Panasonic
ideas for life

Relaiskatalog 2005

Teil 1: Elektromechanische Relais

Teil 2: PhotoMOS- und Halbleiter-Relais

07/2005

Richtlinien und Hinweise

Panasonic ist Teil einer weltweiten Unternehmensgruppe, die in verschiedenen Ländern unter verschiedenen Markennamen Relais und die zugehörigen Komponenten vertreibt. In einigen Ländern können sich die Einsatzbedingungen von den in Europa üblichen Voraussetzungen unterscheiden. Insbesondere betrifft dies die nationalen und internationalen Spezifikationen wie UL, CSA, VDE, SEV, ÖVE, SEMKO usw. Deshalb ist zu beachten, dass zum Beispiel die in diesem Katalog aufgeführten Werte für Kontaktlasten, (z.B. 10 A, 30 VDC für das SP-Relais) keine absoluten Maximalwerte darstellen, sondern auf geprüften Bemessungswerten basieren. Die angegebene Lebensdauer basiert ebenfalls auf Tests durch den Hersteller oder entsprechende Testlabors. In der Praxis kann die für eine bestimmte Last angegebene Lebensdauer unter anderen Bedingungen durchaus überschritten werden.

Folgende Werte sollten sorgsam für jede einzelne Anwendung bedacht werden:

- Größe und Art der Last
- Schaltspiele pro Sekunde (oder Minute)
- Umgebungsbedingungen

In den Relaisdatenblättern und -broschüren sind Hinweise auf die Übereinstimmung mit industriellen Standards, Zulassungen oder Zertifizierungen zu finden. Doch aufgrund der Vielzahl verfügbarer Relaistypen müssen nicht alle Typen innerhalb einer Produktfamilie dem genannten Standard im gleichen Ausmaß entsprechen. Möchten Sie zu einem bestimmten Produkt und dessen Übereinstimmung mit dem Standard genaue Informationen einholen, wenden Sie sich bitte an Panasonic.

Treten Fragen zur Lebensdauer eines Relais in einer spezifischen Anwendung auf, sollten Sie das zuständige Vertriebsbüro von Panasonic kontaktieren. Es soll auch darauf hingewiesen werden, dass die in diesem Katalog, und in Abweichung von der Norm EN/ IEC 61810-1, angegebene Lebensdauer auf einer durchschnittlichen Umgebungstemperatur von ungefähr 25°C beruht.

Die angegebenen Funktionen und Spezifikationen sind sorgfältig mit modernen Methoden getestet worden. Die zugehörigen Werte beziehen sich auf ein Produkt im Neuzustand bei Raumtemperatur. Sie sind keine zugesicherten Eigenschaften, denn sie können sich während der Produktlebensdauer oder durch Umwelteinflüsse verändern. Auf Anfrage stehen für die wichtigsten Betriebsverhalten statistische Auswertungen zur Verfügung. Panasonic behält sich das Recht auf Änderungen an den technischen Spezifikationen ohne vorherige Ankündigung vor.

Anwendung der EU-Richtlinien auf Schaltrelais

Zum jetzigen Zeitpunkt verlangt keine Richtlinie die CE-Kennzeichnung für Schaltrelais[1]. Im Einzelnen gilt bezüglich der drei u.U. für Schaltrelais in Frage kommenden EU-Richtlinien folgendes:

1 EMV-Richtlinie

Schaltrelais - elektromechanische als auch Halbleiterrelais - sind weder mit einer CE-Kennzeichnung zu versehen, noch ist eine Konformitätserklärung unter der EMV-Richtlinie auszustellen.

Die EMV-Richtlinie betrifft in erster Linie gebrauchsfertige Geräte. Bei ihrer Anwendung auf Komponenten ist nach dem Leitfaden[2] zu prüfen, ob die zu betrachtende Komponente eine “eigenständige Funktion“ besitzt. Komponenten mit einer eigenständigen Funktion sind zum Beispiel elektrische Motoren, Stromversorgungseinheiten oder Temperaturregler. Diese Bauteile sind mit einer CE-Kennzeichnung zu versehen.

Bauteile, die in Geräte eingebaut werden, wie z.B. Relais, können ihre Funktion nicht eigenständig ausüben. Das gleiche Relais kann in unterschiedlichen Geräten unterschiedliche Funktionen haben. Deshalb sind Schaltrelais Bauteile ohne eigenständige Funktion, die nicht unter die EMV-Richtlinie fallen.

2 Niederspannungsrichtlinie

Relais mit Anschlüssen für Leiterplatten/Steckanschlüssen fallen nicht unter den Geltungsbereich der Niederspannungsrichtlinie.

Die Niederspannungsrichtlinie betrifft sowohl elektrische Betriebsmittel, die in Geräte eingebaut werden, als auch Geräte zum unmittelbaren Gebrauch. Bei elektrischen Betriebsmitteln, die als elementare Komponenten oder Grundbauteile für den Einbau in Geräte bestimmt sind, sind Geräteeigenschaften und Sicherheit des Endprodukts großenteils davon abhängig, wie der Einbau erfolgt; sie fallen deshalb nicht unter die Niederspannungsrichtlinie und dürfen nicht CE-gekennzeichnet werden. Als Beispiel hierfür sind im Leitfaden[3] elektromechanische Grundbauteile wie Steckverbinder, Relais mit Leiterplattenanschlüssen und Mikroschalter genannt.

Wenn man von größeren Relais absieht, die zum Beispiel in Schaltschränken eingesetzt werden, gelten für gewöhnliche Relais mit Steckanschlüssen, die wahlweise auch mit Leiterplattenanschlüssen verfügbar sind, die gleichen Überlegungen. Auch hier hängt die Sicherheit vom speziellen Einzelfall ab. Bei der Beurteilung ihres Verhaltens aus der Sicht der Niederspannungsrichtlinie kommt man deshalb zum gleichen Ergebnis wie bei Leiterplattenrelais. Somit besteht auch für derartige Relais keine Verpflichtung zur CE-Kennzeichnung.

3 Maschinenrichtlinie

In der Maschinenrichtlinie wird unterschieden zwischen Maschinen, Maschinenteilen und Sicherheitsbauteilen. Relais fallen in keine dieser Merkmalsgruppen. Die Liste der Sicherheitsbauteile in Anhang IV der Maschinenrichtlinie ist abschließend und enthält keine Relais.

Daher ist weder eine CE-Kennzeichnung anzubringen, noch eine Konformitäts- oder Herstellererklärung unter der Maschinenrichtlinie abzugeben.

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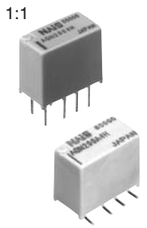
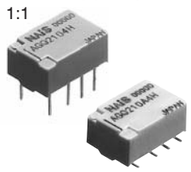
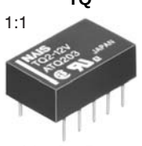
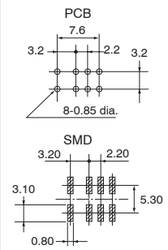
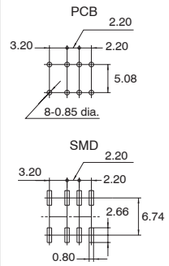
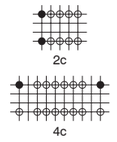
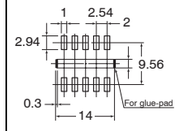
1. Dieses Dokument befasst sich ausschließlich mit "Schaltrelais ohne festgelegtes Zeitverhalten". Der Einfachheit halber wird hier die abgekürzte Bezeichnung "Schaltrelais" gewählt. Elektronische Schaltrelais sind eingeschlossen.
2. Leitfaden (Fassung vom 26. Mai 1997) zur Anwendung der Ratsrichtlinie 89/336/EWG.
3. Leitfaden (Fassung vom Juli 1997) zur Anwendung der Ratsrichtlinie 73/23/EWG.

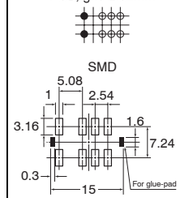
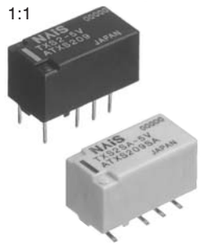
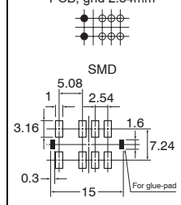
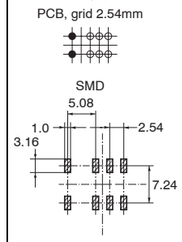
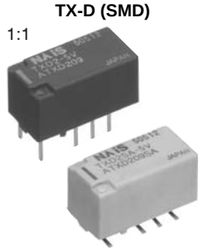
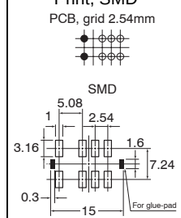
Inhaltsverzeichnis

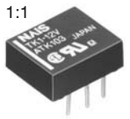
Zur Übersicht

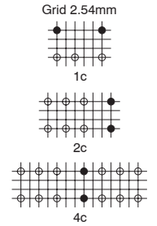
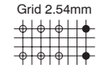
Mit Hilfe dieser Übersicht finden Sie die für Ihre Anforderungen notwendigen Relais auf einfache Weise. Wichtiger Hinweis: Die Werte für den Schaltstrom und die Schaltspannung geben keine Standard-Betriebsbedingungen an. Bitte entnehmen Sie die Werte für die Nennschaltkapazität und andere wichtige Werte dem jeweiligen Relais-Datenblatt. In Zweifelsfällen nehmen Sie bitte Kontakt zu Ihrem Panasonic-Vertriebsbüro auf.

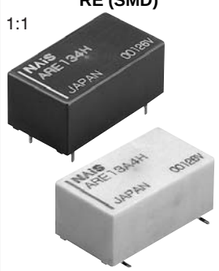
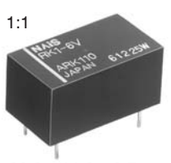
Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung
✪GN (SMD) 1:1  10.6 x 5.7 x 9.0mm	• Extrem kompaktes Ultraminiaturrelais • Sehr hohe Stoßspannungsfestigkeit 2,5kV, erfüllt die Bellcore-Norm • RoHS konform	**Max:** 1A **Min:** 10µA	• 110V DC • 125V AC	2c	(DC) 1,5; 3; 4,5; 6; 9; 12; 24V
✪GQ (SMD) 1:1  10.6 x 7.2 x 5.2/5.4mm	• Extrem kompaktes Ultraminiaturrelais • Sehr hohe Stoßspannungsfestigkeit 2,5kV, erfüllt die Bellcore-Norm • RoHS konform	**Max:** 1A **Min:** 10µA	• 110V DC • 125V AC	2c	(DC) 1,5; 3; 4,5; 6; 9; 12; 24V
✪TQ 1:1  14 x 9 x 5mm	• Universelles Leistungs-Profil für den Einsatz in der Telekommunikation und der Mess- und Regeltechnik • RoHS konform	**Max:** 1A **Min:** 10µA	• 110V DC • 125V AC	2c	(DC) 3; 4,5; 5; 6; 9; 12; 24; 48V
✪TQ (SMD) 1:1  14 x 9 x 5.6mm	• 2A Schaltstrom • Sehr hohe Stoßspannungsfestigkeit 2,5kV, erfüllt damit Bellcore-Norm • RoHS konform	**Max:** 2A **Min:** 10µA	• 220V DC • 125V AC	2c	(DC) 1,5; 3; 4,5; 5; 6; 9; 12; 24; 48V

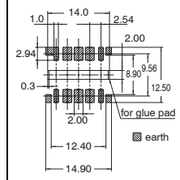
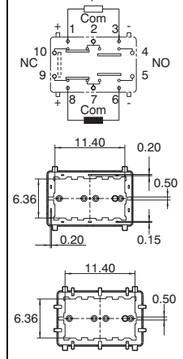
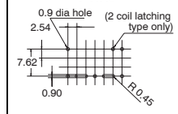
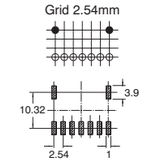
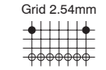
Spulenleistung	Spannungsfestigkeit: offener Kontakt	Spannungsfestigkeit: zwischen Kontaktsätzen	Spannungsfestigkeit: Spule/Kontakt	Stoßspannungsfestigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
Monostabil: 140mW (1,5 - 12V DC) 230mW (24V DC) **Bistabil 1 Spule:** 100mW (1,5V - 12V DC) 120mW (24V DC)	750Vrms	1000Vrms	1500Vrms	1.500V FCC 2.500V Bellcore	Print, SMD 	47 UL, CSA, BSI
Monostabil: 140mW (1,5 - 12V DC) 230mW (24V DC) **Bistabil 1 Spule:** 100mW (1,5V - 12V DC) 120mW (24V DC)	750Vrms	1000Vrms	1500Vrms	1.500V FCC 2.500V Bellcore	Print, SMD 	51 UL, CSA, BSI
Monostabil: 140mW (3 - 12V DC) 200mW (24V DC) 300mW (48V DC) **Bistabil 1 Spule:** 100mW (3 - 12V DC) 150mW (24V DC) **Bistabil 2 Spulen:** 200mW (3 - 12V DC) 300mW (24V DC)	750Vrms	1000Vrms	1000Vrms	1.500V FCC	Print Grid 2.54mm 	72 UL, CSA, BSI
Monostabil: 140mW (bis 12V DC) 200mW (24V DC) 300mW (48V DC) **Bistabil 1 Spule:** 70mW (bis 12V DC) 100mW (24V DC) **Bistabil 2 Spulen:** 140mW (bis 12V DC) 200mW (24V DC)	1000Vrms	1500Vrms	1500Vrms	1.500V FCC 2.500V Bellcore	SMD 	79 UL, CSA

Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung	Spulenleistung	Spannungsfestigkeit offener Kontakt	Spannungsfestigkeit zwischen Kontaktsätzen	Spannungsfestigkeit Spule/Kontakt	Stoßspannungs-festigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
✪TX (SMD) 1:1  15 x 7.4 x 8.2mm	• Hochempfindliches Relais (140mW) • Geringe Thermospannung • RoHS konform	**Max:** 2A **Min:** 10µA	• 220V DC • 220V AC	2c	(DC) 1,5; 3; 4,5; 5; 6; 9; 12; 24; 48V	**Monostabil:** 140mW (bis 24V DC) 270mW (48V DC) **Bistabil 1 Spule:** 100mW **Bistabil 2 Spulen:** 300mW	1000Vrms	1000Vrms	2000Vrms	1.500V FCC 2.500V Bellcore	Print, SMD PCB, grid 2.54mm  	84 UL, CSA, BSI
TX-S (SMD) 1:1  15 x 7.4 x 8.2/8.4mm	• Hochempfindliches Relais (50mW) • Geringe Thermospannung • RoHS konform	**Max:** 1A **Min:** 10µA	• 110V DC • 125V AC	2c	(DC)1,5; 3; 4,5; 5; 6; 9;12;24V	**Monostabil:** 50mW (1,5 - 12V DC) 70mW (24V DC) **Bistabil 1 Spule:** 35mW (1,5 - 12V DC) 50mW (24V DC) **Bistabil 2 Spulen:** 70mW (1,5 - 12V DC) 150mW (24V DC)	750Vrms	1000Vrms	1800Vrms	1.500VFCC 2.500V Bellcore	Print, SMD PCB, grid 2.54mm  	98 UL, CSA, BSI
SX (SMD) 1:1  15 x 7.4 x 8.2/10mm	• Spulenleistungsaufnahme 50mW • Durchgangswiderstand max. 100mΩ/5 Mio. Schaltungen • Thermospannung max. 3µV • Isolationswiderstand min. 10GΩ • RoHS konform	**Max:** 0,01A **Min:** 10µA	• 10V DC	2c	(DC) 1,5; 3; 4,5; 6; 9; 12; 24V	**Monostabil:** 50mW (1,5 - 12V DC) 230mW (24V DC) **Bistabil 1 Spule:** 35mW (1,5 - 12V DC) 50mW (24V DC) **Bistabil 2 Spulen:** 70mW (1,5 - 12V DC) 150mW (24V DC)	750Vrms	1000Vrms	1500Vrms	-	Print, SMD PCB, grid 2.54mm  	58 UL, CSA, BSI
TX-D (SMD) 1:1  15 x 7.4 x 8.2/8.4mm	• Speziell für Telekom-Bereich • Erfüllt Bellcore-Norm und Isolationsanforderungen nach EN41003-Standard • Hohe Spannungs- und Stoßspannungsfestigkeit • Folge-Umschaltkontakte möglich • RoHS konform	**Max:** 2A **Min:** 10µA	Break Before Make: • 220V DC • 250V AC Make Before Break: • 125V DC • 125V AC	2c	(DC) 1,5; 3; 4,5; 5; 6; 9; 12; 24V	**Monostabil:** 200mW (1,5 - 12V DC) 230mW (24V DC) **Bistabil 1 Spule:** 150mW (1,5 - 12V DC) 170mW (24V DC)	1000Vrms	1000Vrms	2000Vrms	1.500V FCC 2.500V Bellcore	Print, SMD PCB, grid 2.54mm  	91 UL, CSA, BSI
TN 1:1  14 x 5.6 x 9.8mm	• Stehende Ausführung zum TQ • Hohe Packungsdichte durch extrem kleine Grundfläche möglich • RoHS konform	**Max:** 1A **Min:** 10µA	• 110V DC • 125V AC	2c	(DC) 3; 4,5; 5; 6; 9; 12; 24; 48V	**Monostabil:** 140mW (bis 12V DC) 200mW (24V DC) 300mW (48V DC) **Bistabil 1 Spule:** 100mW (3 - 12V DC) 150mW (24V DC) **Bistabil 2 Spulen:** 200mW (3 - 12V DC) 300mW (24V DC)	750Vrms	1000Vrms	1000Vrms	1.500V FCC	Print Grid 2.54mm 	68 UL, CSA

Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung
TK 1:1  10.6 x 9 x 4mm	• Kleinstes Relais mit 2A Leistung • Sehr hohe Stoßspannungsfestigkeit 2,5kV erfüllt damit Bellcore-Norm • RoHS konform	**Max:** 2A **Min:** 10µA	• 220V DC • 220V AC	1c	(DC) 1,5; 3; 4,5; 5; 6; 9; 12; 24V
DS 1:1  20 x 9.9 x 9.8mm	• Universelles Kartenrelais mit großem Schaltleistungsbereich • M = 400mW, S = 200mW Ausführung • RoHS konform	**Max:** 2A **Min:** 10µA	• 220V DC • 250V AC	1c, 2c, 4c	(DC) 1,5; 3; 5; 6; 9; 12; 24; 48V
✪ **DS2Y** 1:1  20 x 9.9 x 9.3mm	• Universelles Kartenrelais mit großem Schaltleistungsbereich • RoHS konform	**Max:** 2A **Min:** 10µA	• 220V DC • 250V AC	2c	(DC) 1,5; 3; 5; 6; 9; 12; 24; 48V
HY 1:1  12 x 7.4 x 10.1mm	• Kleines, sensitives Relais • RoHS konform	**Max:** 1A 30V DC **Min:** 1mA 1V DC	• 60V DC	1c	(DC) 1,5; 3; 4,5; 5; 6; 9; 12; 24V

Spulenleistung	Spannungsfestigkeit offener Kontakt	Spannungsfestigkeit zwischen Kontaktsätzen	Spannungsfestigkeit Spule/Kontakt	Stoßspannungs-festigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
Monostabil: 140mW (bis 12V DC) 270mW (24V DC) **Bistabil 1 Spule:** 100mW (3 - 12V DC) 150mW (24V DC) **Bistabil 2 Spulen:** 200mW (1,5 - 9V DC) 250mW (12V DC) 400mW (24V DC)	750Vrms	1000Vrms	1500Vrms	1.500V FCC 2.500V Bellcore	Print Grid 2.54mm 	63 UL, CSA
Typ M: **Monostabil:** 400mW **Bistabil 1 Spule:** 180mW **Bistabil 2 Spulen:** 360mW **Typ S:** **Monostabil:** 200mW **Bistabil 1 Spule:** 90mW **Bistabil 2 Spulen:** 180mW	1000Vrms (DS1-S: 500Vrms)	1000Vrms	1500Vrms (1000Vrms bei DS1-S)	1.500V FCC	Print Grid 2.54mm  1c 2c 4c	38 UL, CSA
Monostabil: 200mW (300mW: 48V) **Bistabil 2 Spulen:** 180mW (360mW: 48V)	750Vrms	1000Vrms	1000Vrms	1.500V FCC	Print Grid 2.54mm 	44 UL, CSA
Standard: 200mW **Sensitiv:** 150mW	500Vrms	-	1000Vrms	-	Print Grid 2.54mm 	55 UL, CSA

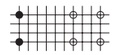
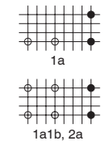
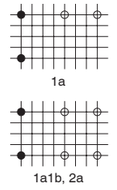
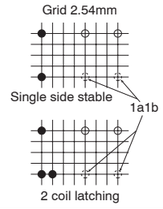
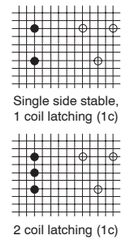
Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung
RA 1:1  14.7 x 9.7 x 5.9mm	• HF-Relais in SMT-Version • Bis 1GHz • Impedanz: 50ΩHF • RoHS konform HF-Charakteristika bei 1GHz: • Isolation: min. 20dB • Insertion loss: max 0,3dB • V.S.W.R.: max. 1,2	**DC:** 1A **HF:** 3W (1GHz)	• 30V DC	2c	(DC) 1,5; 3; 4,5; 5; 6; 9; 12; 24; 48V
✪**RJ** 1:1  14 x 9 x 8.2mm	• Geschirmtes HF-Relais • Bis 5GHz • Impedanz: 50Ω • RoHS konform HF-Charakteristika bei 5GHz: • Isolation: min. 35dB • Insertion loss: max. 0,5dB • V.S.W.R.: max. 1,25 • SMT und PCB Version erhältlich	**DC:** 0,3A **HF:** 1W (5GHz)	• 30V DC	2c	(DC) 3; 4,5; 12; 24V
RX 1:1  20.5 x 12.4 x 9.4mm	• Geschirmtes HF-Relais • Bis 3GHz • Impedanz 50Ω • RoHS konform HF-Charakteristika bei 2,5GHz: • Isolation: min. 60dB • Insertion loss: max. 0,2dB • V.S.W.R.: max. 1,2	**DC:** 0,5A **HF:** 10W (2,5GHz)	• 30 V DC	1c	(DC) 3; 4,5; 6; 9; 12; 24V
✪**RE (SMD)** 1:1  20.2 x 11.2 x 8.9/9.6mm	• HF-Relais für Broadcasting • Bis 2,6GHz • Impedanz: 50/75Ω • RoHS konform HF-Charakteristika bei 2,6GHz: • Isolation: min 30dB • Insertion loss: max. 0,7dB • V.S.W.R.: max. 1,7 • SMT und PCB Version erhältlich •	**DC:** 0,5A **HF:** 10W (2,6GHz)	• 30V DC	1c	(DC) 3; 4,5; 6; 9; 12; 24V
RK 1:1  20.2 x 11.2 x 9.7mm	• HF-Relais für Broadcasting • Bis 1,5GHz • Impedanz: 50/75Ω • RoHS konform HF-Charakteristika: • Isolation: min. 60dB (bei 1,5GHz) • Insertion loss: max. 0,3dB (bei 900MHz) • V.S.W.R.: max. 1,5dB (bei 900MHz) • Bistabile Version erhältlich	**DC:** 0,5A **HF:** 10W (1,2GHz)	• 30V DC	1c	(DC) 3; 4,5; 5; 6; 9; 12; 24V

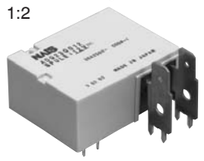
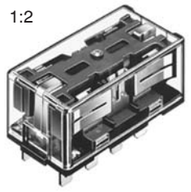
Spulenleistung	Spannungsfestigkeit offener Kontakt	Spannungsfestigkeit zwischen Kontaktsätzen	Spannungsfestigkeit Spule/Kontakt	Stoßspannungs-festigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
Monostabil: 140mW (1,5 - 12V) 200mW (24V) 300mW (48V) **Bistabil 1 Spule:** 70mW (1,5 - 12V) 100mW (24V) **Bistabil 2 Spulen:** 140mW (1,5 - 12V) 200mW (24V)	750Vrms	1000Vrms	1000Vrms	-	SMD Suggested mounting pads (Top view)  	106 -
Monostabil: 200mW **Bistabil 2 Spulen:** 150mW	500Vrms	500Vrms	500Vrms	-	Print, SMD  	124 -
Monostabil: 200mW **Bistabil 1 Spule:** 200mW **Bistabil 2 Spulen:** 400mW	500Vrms	-	1000Vrms	-	Print  	137 -
Monostabil: 200mW	500Vrms	-	1000Vrms	-	Print, SMD Grid 2.54mm  	120 -
Monostabil: 200mW **Bistabil 1 Spule:** 200mW **Bistabil 2 Spulen:** 400mW	500Vrms	-	1000Vrms	-	Print Grid 2.54mm  Single side stable 1 coil latching	128 -

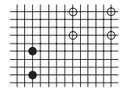
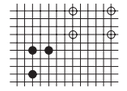
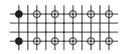
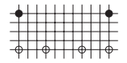
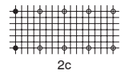
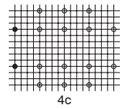
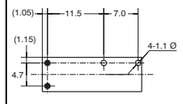
Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung
✪ **RD SPDT** 1:2  34 x 13.2 x 39mm	• Koaxial-Relais • Bis 26,5GHz (18GHz) • Impedanz: 50Ω • RoHS konform HF-Charakteristika bei 18GHz: • Isolation: min. 60dB • Insertion loss: max. 0,5dB • V.S.W.R.: max. 1,5 • TTL Version erhältlich	**DC:** 100mA **HF:** 120W (3GHz)	• 30V DC	SPDT	(DC) 4,5; 12; 24V
✪ **RD TRANSFER** 1:2  32 x 32 x 39mm	• Koaxial-Relais • Bis 26,5GHz (18GHz) • Impedanz: 50Ω • RoHS konform HF-Charakteristika bei 18GHz: • Isolation: min. 60dB • Insertion loss: max. 0,5dB • V.S.W.R.: max. 1,5 • TTL Version erhältlich	**DC:** 100mA **HF:** 120W (3GHz)	• 5V DC	DPDT	(DC) 5; 12; 24V
RP 1:1  10.6 x 9 x 4mm	• HF-Relais mit geringer Bauhöhe • Bis 1,8GHz • Impedanz: 50Ω • RoHS konform HF-Charakteristika bei 1,8GHz: • Isolation: min. 10dB • Insertion loss: max. 1dB • V.S.W.R.: max. 1,3	**DC:** 0,1A **HF:** 1W (1,8GHz)	• 30V DC	1c	(DC) 1,5; 3; 4,5; 5; 6; 9; 12;24V

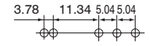
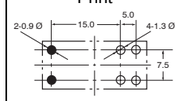
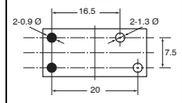
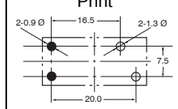
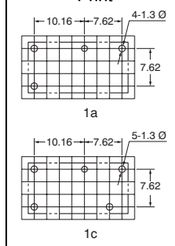
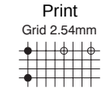
Spulenleistung	Spannungsfestigkeit			Stoßspannungs-festigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
	offener Kontakt	zwischen Kontaktsätzen	Spule/Kontakt			
Monostabil: 840-970mW (4,5; 12; 24V) **Bistabil 2 Spulen:** 700-900mW (4,5; 12; 24V) **Bistabil TTL-Version (with self cut-off function):** 5; 12; 24V	500Vrms	500Vrms	500Vrms	-	Koax -	110 -
Monostabil: 1540-1670mW (4,5; 12; 24V) **Bistabil 2 Spulen:** 1200-1400mW (4,5; 12; 24V) **Bistabil TTL-Version (with self cut-off function):** 5; 12; 24V	500Vrms	500Vrms	500Vrms	-	Koax -	110 -
Monostabil: 140mW (1,5 - 12V) 270mW (24V)	750Vrms	-	1500Vrms	-	Print Grid 2.54mm 	133 -

Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung
Gepolte Leistungsrelais					
✪ **DE** 1:2  25 x 12.5 x 12.5mm	• Großes Schaltvermögen (16A = 25.000, 10A = 100.000 Schaltungen) • Min. 8mm Luft- und Kriechstrecke • RoHS konform	**Max:** • 8A (1a1b, 2a) • 10/16A (1a)	• 230V DC • 440V AC	1a, 1a1b, 2a	(DC) 1,5; 3; 4,5; 5; 6; 9; 12; 24; 48V
DSP 1:2  20.2 x 11 x 10.5mm	• Miniatur-Starkstromrelais • DIL-Bauweise • Luftstrecke min. 2,5mm • Kriechstrecke min. 7mm • RoHS konforme Type verfügbar	**Max:** • 8A (1a) • 5A (1a1b, 2a)	• 220V DC • 400V AC	1a, 1a1b, 2a	(DC) 3; 5; 6; 9; 12; 24V
DK 1:2  20 x 15 x 10mm	• Abmessungen für 1a = 12,5mm, für 02a, 1a1b = 15mm • Gepoltes Miniatur-Lastrelais • Min. 8mm Luft- und Kriechstrecke: DK2A-L2, -6,8mm DK1A1B-L2, -6,8mm • Nicht für Neuentwicklungen • RoHS konforme Type verfügbar	**Max:** • 10A (1a) • 8A (1a1b, 2a)	• 125V DC • 400V AC	1a, 1a1b, 2a	(DC) 3; 5; 6; 9; 12; 24V
DY 1:2  20 x 15 x 9.7mm	• Preiswertes, gepoltes Leistungsrelais • 1a1b - Kontaktversion pingleich zum DK1a1b • Luft- und Kriechstrecke min. 6mm • RoHS konform	**Max:** • 10A (1a) • 8A (1a,1b)	• 125V DC • 380V AC	1a, 1a1b	(DC) 3; 5; 6; 12; 24V
✪ **DJ** 1:2  29 x 13 x 16/16.5mm	• Min. 8mm Luft- und Kriechstrecke • Geringe Spulenleistung • Wahlweise mit Handbetätiger lieferbar • RoHS konform	**Max:** 16A	• 125V DC • 400V AC	1a, 1b, 1c, 1a1b, 2a, 2b, 2c	(DC) 5; 6; 12; 24; 48V

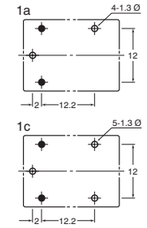
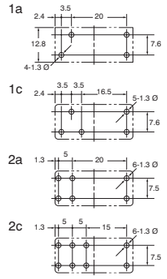
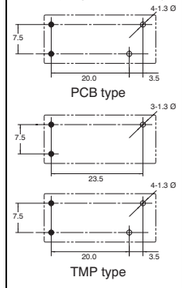
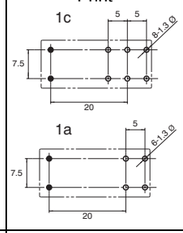
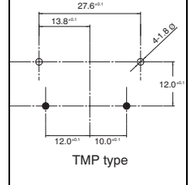
Spulenleistung	Spannungsfestigkeit: offener Kontakt	Spannungsfestigkeit: zwischen Kontaktsätzen	Spannungsfestigkeit: Spule/Kontakt	Stoßspannungs-festigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
Monostabil: 200mW **Bistabil 1 Spule:** 100mW **Bistabil 2 Spulen:** 200mW	1000Vrms	4000Vrms (1a1b, 2a)	5000Vrms	12.000V	Print Grid 2.54mm 	142 UL, CSA, VDE, TÜV
Monostabil: 300mW **Bistabil 1 Spule:** 150mW **Bistabil 2 Spulen:** 300mW	1000Vrms	2000Vrms (1a1b, 2a)	3000Vrms	5.000V	Print Grid 2.54mm  1a 1a1b, 2a	162 TÜV, UL, CSA, SEV
Monostabil: 200mW **Bistabil 2 Spulen:** 200mW	1000Vrms	4000Vrms	4000Vrms	10.000V	Print Grid 2.54mm  1a 1a1b, 2a	155 VDE, TÜV, UL, CSA, SEV
Monostabil: 200mW **Bistabil 2 Spulen:** 200mW	1000Vrms	4000Vrms	4000Vrms	10.000V	Print Grid 2.54mm  Single side stable 1a1b 2 coil latching	168 -
Monostabil: 250mW **Bistabil 1 Spule:** 150mW **Bistabil 2 Spulen:** 250mW	1000Vrms	-	4000Vrms	10.000V	Print Grid 2.54mm  Single side stable, 1 coil latching (1c) 2 coil latching (1c)	146 VDE, TÜV, UL, CSA, SEV

Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung
DQ 1:2  38 x 29 x 17.3mm	• Bistabiles Leistungsrelais • Kontaktmaterial cadmium frei • 8mm Luft-und Kriechstrecke • RoHS konform	**Max:** 30A	• 250V DC • 250V AC	1a	(DC) 4,5; 6; 9; 12; 24V
S 1:2  28 x 12 x 10.4mm	• Hoher Schaltleistungsbereich durch 5-Lagen-Kontakt • Gute HF-Eigenschaften • Geringe Thermospannung • Sockel lieferbar • Nicht für Neuentwicklungen • RoHS konform	**Max:** 4A **Min:** 100µA	• 200V DC • 250V AC	2a2b, 3a1b, 4a	(DC) 3; 5; 6; 12; 24; 48V
ST 1:2  31 x 14 x 11.3mm	• Reibungsfrei gelagerter Drehanker • Luft- und Kriechstrecke > 4mm • Hohe Spannungsfestigkeit • Sockel lieferbar • Nicht für Neuentwicklungen • RoHS konforme Type verfügbar	**Max:** 8A **Min:** 1mA	• 250V DC • 400V AC	1a1b, 2a	(DC) 3; 5; 6; 9; 12; 24; 48V
SP 1:2  2c: 50 x 25.6 x 22mm 4c: 50 x 36.8 x 22mm	• Gepoltes Lastrelais mit Drehanker • VS-kompatibel • Sockel lieferbar • RoHS konform	**Max:** 15A	• 110V DC • 250V AC	2c, 4c	(DC) 3; 5; 6; 12; 24; 48V
Ungepolte Leistungsrelais					
✪**LD** 1:2  20.3 x 7 x 15mm	• Schmales Relais mit 7mm Breite • 200mW Spulenleistung • Luft-und Kriechstrecke min. 6mm • RoHS konform	**Max:** 3A	• 30V DC • 277V AC	1a	(DC) 4,5; 5; 6; 9; 12; 18; 24V
PA 1:2  20 x 5 x 12.5mm	• Extrem kleines und schmales Leistungs-Relais • Hartvergoldete Kontakte • Pingleich zum PhotoMOS-Relais AQZ • PAD mit min. 3,1mm Luft-, min. 3,6mm Kriechstrecke • RoHS konform	**Max:** 5A	• 110V DC • 250V AC	1a	(DC) 5; 6; 9; 12; 18; 24V

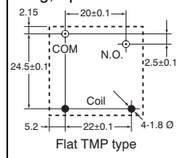
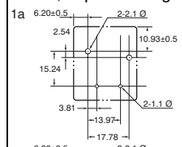
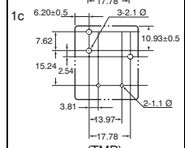
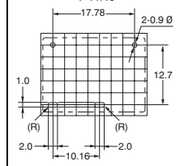
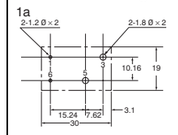
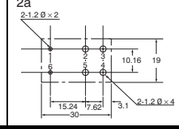
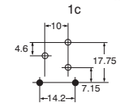
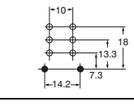
Spulenleistung	Spannungsfestigkeit			Stoßspannungs-festigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
	offener Kontakt	zwischen Kontaktsätzen	Spule/Kontakt			
Bistabil 1 Spule: 500mW **Bistabil 2 Spulen:** 1000mW	1500Vrms	-	4000Vrms	10.000V	Print Grid 2.54mm  1 coil latching  2 coil latching	160 UL, CSA
Monostabil: 80 - 355mW **Bistabil 1 Spule:** 100mW **Bistabil 2 Spulen:** 200mW	750Vrms	1000Vrms	1500Vrms	-	Print Grid 2.54mm 	171 UL, CSA
Monostabil: 240mW **Bistabil 1 Spule:** 130mW **Bistabil 2 Spulen:** 240mW	1200Vrms	2000Vrms	3750Vrms	6.000V	Print Grid 2.54mm  (Single side stable)	182 UL, CSA, SEV, VDE, TV rating
Monostabil: 300mW **Bistabil 2 Spulen:** 300mW	1500Vrms	3000Vrms	3000Vrms	-	Print, Flachstecker Grid 2.54mm  2c  4c	176 UL, CSA, TÜV
200mW	750Vrms	-	4000Vrms	10.000V	Print 	270 TÜV, UL, CSA, VDE
120mW (5 - 18V) 180mW (24V)	1000Vrms	-	2000Vrms	4.000V	Print Grid 2.54mm 	296 TÜV, UL, CSA

Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung	Spulenleistung	Spannungsfestigkeit offener Kontakt	Spannungsfestigkeit zwischen Kontaktsätzen	Spannungsfestigkeit Spule/Kontakt	Stoßspannungs- festigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
✪ **PE** 1:2  28 x 5 x 15mm	• Schmales Relais für Netzanwendung • Isolationsaufbau konform zu VDE0700 • 8mm Luft- und Kriechstrecke • Hauch- oder hartvergoldete Kontakte • Printsockel lieferbar • RoHS konform	**Max:** 6A	• 300V DC • 400V AC	1a, 1b, 1c	(DC) 4,5; 5; 6; 12; 18; 24; 48; 60V	170mW (5 - 24V) 217mW (48V) 175mW (60V)	1000Vrms	-	4000Vrms	6.000V	Print 	299 UL, CSA, VDE
LA 1:2  24 x 12 x 25mm	• 3A-Version mit goldplattierten Kontakten lieferbar (ideal als Lautsprecher-Schalter) • Preiswertes Leistungsrelais mit 2 Schließern • 6mm Luft-u. Kriechstrecke • Stoßspannungsfestigkeit von 10kV • RoHS konform	**Standard:** Max: 3A (3A rated) **Power-Typ:** Max: 5A (5A, TV-4 rated)	• 30V DC • 277V AC	2a	(DC) 12; 24V	530mW	1000Vrms	1000Vrms	4000Vrms	10.000V	Print 	267 TÜV, UL, CSA, SEV, SEMKO
LK 1:2  24 x 11 x 25mm	• Stoßspannungsfestigkeit von 10kV • Schmales Leistungsrelais für DC und AC • Hoher Einschaltstrom (100A) • RoHS konform	**Max:** 5A	• 30V DC • 277V AC	1a	(DC) 5; 9; 12; 24V	530mW	1000Vrms	-	4000Vrms	10.000V	Print 	280 UL, CSA, TÜV, SEV, SEMKO, VDE, TV rating
LK-P 1:2 24 x 11 x 25mm	• Großes Schaltvermögen • Hohe Isolationswerte: Luft und Kriechstrecke zwischen Spule und Kontakt: Min. 6mm • Hohes Einschaltstromvermögen 1) 11A Einschaltstrom 2) UL/CSA TV-5 rating • RoHS konform	**Max.:** 10A	• 30V DC • 277V AC	1a	(DC) 12; 24V	530mW	1000Vrms	-	4000Vrms	10.000V	Print 	283 UL, CSA, TÜV, SEV, SEMKO, VDE, TV rating
LK-S 1:2  24 x 11 x 25mm	• Sensitiv-Ausführung • Hohe Isolationswerte: Luft- und Kriechstrecke zwischen Spule und Kontak: Min. 6mm • RoHS konform	**Max.:** 5A	• 30V DC • 277V AC	1a	(DC) 5; 9; 12; 24V	250mW	1000Vrms	-	4000Vrms	10.000V	Print 	286 UL, CSA, TÜV, SEV, SEMKO, VDE, TV-rating
✪ **JQ** 1:2  20 x 10 x 15.6mm	• Geringe Leistungsaufnahme • Äußerst preiswert • Hohe Stoßspannungsfestigkeit • Luft- und Kriechstrecke >4mm • RoHS konforme Type verfügbar	**Max:** 10A	• 110V DC • 277V AC	1a, 1c	(DC) 3; 5; 6; 9; 12;18; 24; 48V	200mW (1a) 400mW (1c)	• 1000Vrms (1a) • 750Vrms (1c)	-	4000Vrms	8.000V	Print 	249 UL, CSA, TÜV, VDE, SEMKO
PQ 1:2  20 x 10 x 15.6mm	• Hohe Schaltleistung • Hohe Stoßspannungsfestigkeit • Sensitiv • Pingleich JQ 1a • RoHS konform	**Max:** 5A	• 110V DC • 250V AC	1a	(DC) 3; 5; 6; 9; 12; 18; 24V	200mW	1000Vrms	-	4000Vrms	8.000V	Print 	302 UL, CSA, TÜV, SEV, SEMKO, VDE

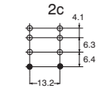
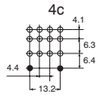
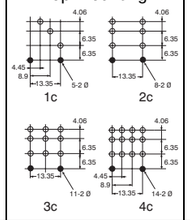
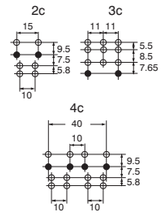
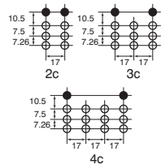
Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung
✪ **JS** 1:2  22 x 16 x 16mm	• Universelles Miniatur-Leistungsrelais • Spezialtype für hohe Umgebungstemperatur • Äußerst preiswert • Hohe Schaltleistung • RoHS konforme Type verfügbar	**Max:** 10A	• 100V DC • 277V AC	1a, 1c	(DC) 5; 6; 9; 12; 18; 24; 48V
✪ **JW** 1:2  28.6 x 12.8 x 20mm	• Kompaktes Netzrelais • Luft- und Kriechstrecke >8mm zwischen Kontakten und Spule (bei zwei Wechselkontakten, min. 7,5mm) • RoHS konforme Type verfügbar	**Standard:** **Max:** 5A (2a, 2c) **10A-Typ:** **Max:** 10A (1a, 1c)	• 100V DC • 440V AC	1a, 1c, 2a, 2c	(DC) 5; 6; 9; 12; 18; 24; 48V
✪ **LE** 1:2  28.6 x 12.4 x 24.9mm	• Für Haushaltsanwendung • Für hohe Umgebungs- temperaturen geeignet • 4,8mm Fast-on-Anschlüsse • Auch als sensitive Type (200mW) erhältlich • Luft- und Kriechstrecke min. 8mm • RoHS konform	**Max:** 16A	• 277/400V AC	1a	(DC) 5; 6; 9; 12; 18; 24; 48V
✪ **LZ** 1:2  28.8 x 12.5 x 15.7mm	• Geringe Bauhöhe • Min.10mm Luft- und Kriechstrecke • Bis 105°C Umgebungstemperatur • RoHS konform	**Max:** 16A	• 250V DC • 440V AC	1a, 1c	(DC) 5; 9; 12; 18; 24; 48V
✪ **LF** 1:2  30.1 x 15.7 x 23.3mm	• Einschaltstrom: 102A/200VAC 224A/100VAC • Luft- und Kriechstrecke min. 8mm • Hohe Stoßspannungsfestigkeit • RoHS konform	**Max:** 25A	• 250V AC	1a	(DC) 5; 6; 9; 12; 18; 24V

Spulenleistung	Spannungsfestigkeit			Stoßspannungs-festigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
	offener Kontakt	zwischen Kontaktsätzen	Spule/Kontakt			
360mW	750Vrms	-	1500Vrms	-	Print 	254 TÜV, VDE, UL, CSA, erfüllt TV5
530mW	1000Vrms	3000Vrms (2a, 2c)	5000Vrms	10.000V	Print 	262 TÜV, VDE, UL, CSA, SEV, erfüllt TV5, SEMKO
Standard: 400mW **Sensitiv:** 200mW	1000Vrms	-	4000Vrms	10.000V	Print,Top-mounting 	273 TÜV, UL, CSA, VDE
400mW	1000Vrms	-	5000Vrms	10.000V	Print 	289 VDE, UL, CSA
900mW	1000Vrms	-	5000Vrms	10.000V	Print, Top-mounting 	277 UL, CSA, TÜV, VDE, SEMKO

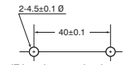
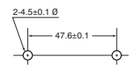
Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung
JM 1:2  Slim: 30.4 x 16 x 26.5mm Flat: 31 x 28.5 x 17.2mm	• Relais für hohe Motorlasten • Für hohe Einschaltströme geeignet • Hohe Stoßspannungsfestigkeit • Pingleich zum LF-Relais • RoHS konforme Type verfügbar	**Max:** 20A	• 100V DC • 250V AC	1a	(DC) 5; 6; 9; 12; 24; 48V
JT-V 1:2  PCB: 31.9 x 26.9 x 20.2mm TMP: 32.2 x 27.4 x 27.9mm	• Erhöhter Isolationsaufbau als das JTN • Luftstrecke Kontakt-Spule: min. 6,4mm • Kriechstrecke Kontakt-Spule: min. 9,5mm • Hohe Spannungs- und Stoßspannungsfestigkeit • Hohe Schaltleistung bei kleinen Abmessungen und geringer Höhe • RoHS konform	**Max:** 30A	• 30V DC • 277V AC	1a, 1c	(DC) 12; 18, 24; 48V
JV-N 1:2  22 x 16 x 10.9mm	• Kompaktes Leistungsrelais mit geringer Bauhöhe • Sensitive Spule • Geringe Erwärmung der Anschlüsse durch breitere Pins • RoHS konforme Type verfügbar	**Max:** 16A	• 110V DC • 277V AC	1a	(DC) 4,5; 6; 9; 12; 24; 48; 100V
JC 1:2  30 x 19 x 30.4mm	• 8mm Luft- und Kriechstrecke • 2a-Sondertyp mit Blasmagnet für 250V DC/5A • Hohe Einschaltströme • Sockel lieferbar • RoHS konforme Type verfügbar	**Max:** 15A	• 250V AC **Blasmagnettyp:** • 250V DC	1a, 2a	(DC) 5; 6; 12; 24; 48V
HL 1:2  27.2 x 20.8 x 35.4mm	• Kompaktes Lastrelais • Hohe Lebensdauer • Großer Schaltlastbereich • Sockel lieferbar • RoHS konforme Type verfügbar	**Max:** 15A **Min:** 1mA	• 30V DC • 250V AC	1c, 2c	(DC) 6; 12; 24; 48; 110V (AC) 6; 12; 24; 48; 120V; 240V

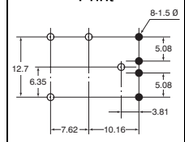
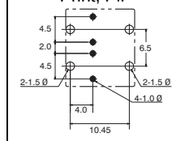
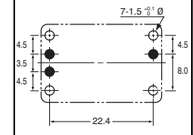
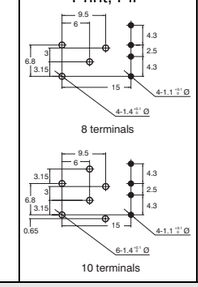
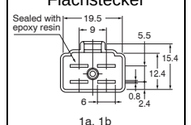
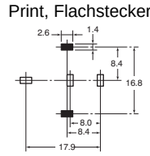
Spulenleistung	Spannungsfestigkeit			Stoßspannungs-festigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
	offener Kontakt	zwischen Kontaktsätzen	Spule/Kontakt			
900mW	1000Vrms	-	5000Vrms	10.000V	Print, Top-mounting, Spule an Print  Flat TMP type	245 TÜV, UL, CSA, VDE
1000mW	-	1200Vrms	3500Vrms	6.000V	Print, Top-mounting 1a  1c  (TMP)	257 UL, C-UL
200mW 600mW (100V-Spule)	1000Vrms	-	2500Vrms	4.500V	Print 	260 UL, CSA, TÜV
900mW (1a) 1000mW (2a)	2000Vrms	2000Vrms (2a)	4000Vrms	10.000V	Print, Flachstecker, Top-mounting 1a  2a 	233 UL, VDE, SEV, SEMKO CSA, erfüllt TV5
(DC) 900 - 1W (AC) 1,2 - 1,3VA	1000Vrms	1500Vrms	2000Vrms	-	Print, Flachstecker, Top-mounting 1c  2c 	218 UL, CSA, erfüllt TV5

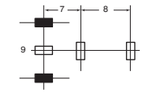
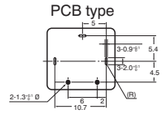
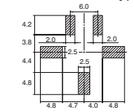
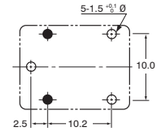
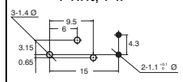
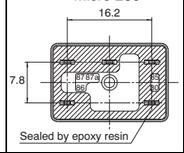
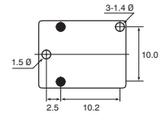
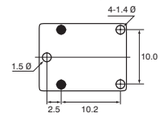
Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung
HJ 1:2  28 x 21.5 x 35/38mm	• Kompaktes Starkstrom-Relais • Mit Gleich- oder Wechsel-spannungsspule • Sockel lieferbar • Fehlermeldungsanzeige durch eine LED (nur AC Typen) • Auch mit Handbetätiger erhältlich • Pingleich zum HC Relais • RoHS konform	**Max:** 7A	• 30V DC • 250V AC	2c, 4c	(DC) 12; 24; 48; 110V (AC) 12; 24; 48; 100; 120; 200; 220/240V
HC 1:2  27.2 x 20.8 x 35.2mm	• Kompaktes Starkstromrelais • Mit Gleich- und Wechselspan-nungsspule • Sockel lieferbar • Pingleich zum HJ-Relais • RoHS konforme Type verfüg-bar	**Max:** 10A **Min:** 1mA	• 30V DC • 250V AC	1c, 2c, 3c, 4c	(DC) 6; 12; 24; 48; 110V (AC) 6; 12; 24; 48; 120; 240V
HN 1:2  29 x 13 x 28mm	• Schmales (13mm) Relais mit Lötanschluss • Schraubsockel mit 17,5mm Breite • Auch mit LED-Schaltanzeige • Gleich- oder Wechelspan-nungsspule • RoHS konform	**Max:** 5A	• 30V DC • 250V AC	1c, 2c	(DC) 5; 6; 12; 24; 48V (AC) 100; 120; 240V
HP 1:2  36 x 25 x 44.5mm	• Lastrelais mit hoher Lebens-dauer • RoHS konforme Type verfüg-bar	**Max:** 10A	• 125V DC • 250V AC	2c, 3c, 4c	(DC) 6; 12; 24; 48; 110V (AC) 6; 12; 24; 48; 115; 220; 240V
HG 1:3  2c: 44 x 36 x 56mm 3c: 36 x 36 x 56mm 4c: 68 x 36 x 56mm	• Kompaktes Starkstromrelais • Sockel lieferbar • RoHS konforme Type verfüg-bar	**Max:** 20A	• 125V DC • 250V AC	2c, 3c, 4c	(DC) 6; 12; 24; 48; 110V (AC) 6; 12; 24; 48; 115; 220; 240V

Spulenleistung	Spannungsfestigkeit			Stoßspannungs-festigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
	offener Kontakt	zwischen Kontaktsätzen	Spule/Kontakt			
(DC) 900mW (AC) 1,2 - 1,5VA	1000Vrms	2000 Vrms	2000Vrms	-	Flachstecker 2c  4c 	211 VDE, UL, CSA, SEV, TV rating
(DC) 900mW (AC) 1,2VA	700Vrms	700Vrms	2000Vrms	-	Print, Flachstecker, Top-mounting  1c 2c 3c 4c	188 VDE, UL, CSA, SEV, TV rating
(DC) 530mW (AC) 0,9VA	1000Vrms	3000Vrms	5000Vrms	-	Flachstecker, Schraubfassung -	239 UL, C-UL, (VDE)
(DC) 1500mW (AC) 1,9 - 4,9VA	2000Vrms	2000Vrms	2000Vrms	-	Flachstecker  2c 3c 4c	222 VDE, UL, CSA, SEV
(DC) 1400 - 2100mW (AC) 3,6 - 7,6VA	2000Vrms	2000Vrms	2000Vrms	-	Flachstecker  2c 3c 4c	206 UL, CSA

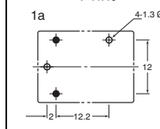
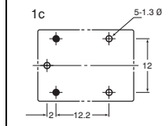
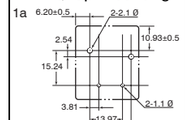
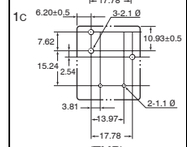
Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	**Besonderheiten**	**Schaltstrom (min, max)**	**Max. Schaltspannung**	**Kontaktart**	**Spulenspannung**
HE 1:3  50 x 33 x 35.8mm	• Kompaktes Netztrennrelais für Gleich- bzw. Wechselspannung • 8mm Luft- und Kriechstrecke • 3mm Kontaktöffnung • Sockel lieferbar • RoHS konform	**Max:** 30A	• 100V DC • 277V AC	1a, 2a	(DC) 6; 12; 24; 48; 110V (AC) 12; 24; 48;120; 240V
MC 1:3  45.2 x 40 x 45.5mm	• Minischütz zur Steuerung von Motoren, Klima- und Heizgeräten • Energiesparend • Auch in Printausführung lieferbar • 3mm Kontaktöffnung	**Max:** 16A	• 440V DC • 400V AC	4a, 3a1b, 2a2b	(DC) 3; 5; 6; 12; 24; 48V (AC) 24; 42; 60;110; 125, 200, 220, 240, 380V

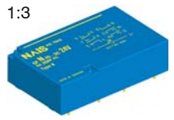
Spulenleistung	**Spannungsfestigkeit**			**Stoßspannungs-festigkeit**	**Anschlüsse** (von unten gesehen)	**Seite Zulassungen**
	offener Kontakt	zwischen Kontaktsätzen	Spule/Kontakt			
(DC) 1920mW (AC) 1,7 - 2,7VA	2000Vrms	4000Vrms	5000Vrms	10.000V	Top-mounting Panel cutout  (Plug-in terminal type) (Screw terminal type)  (NEMA terminal type) (Screw terminal type, wide pitch)	200 TÜV, UL, CSA, VDE, TV rating
(DC) 500mW (AC) 1VA	2500Vrms	2500Vrms	2500Vrms	-	Print, Schraub, Steck, DIN-Schiene -	292 UL, CSA

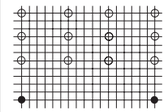
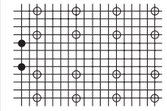
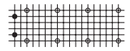
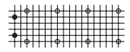
Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung	Spulenleistung	Spannungsfestigkeit offener Kontakt	Spannungsfestigkeit zwischen Kontaktsätzen	Spannungsfestigkeit Spule/Kontakt	Stoßspannungs-festigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
Twin												
CF 1:2  22.5 x 16.5 x 16.5mm	• Für hohe DC-Ströme • Twin Relais (H-Brücke) • 24V Spule auf Anfrage • Geräuscharm < 50dB auf Anfrage • RoHS konform	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1c x 2	(DC) 12V	640mW	1000Vrms	-	1000Vrms	-	Print 	320 -
✪**CJ** 1:2  13.7 x 12.2 x 13.5mm	• Kleine Bauform (13,7(L) x 12,2(W) x 13,5(H)) • Hoher Schaltstrom (25A) im kleinen Gehäuse • Pin-in-Paste-Version verfügbar • Twin Relais (H-Brücke) • RoHS konform	**Max:** • 20A (N.O.) • 10A (N.C.)	• 14V DC	1c x 2	(DC) 12V	**Standard:** 800mW **Sensitiv:** 640mW	500Vrms	-	500Vrms	-	Print, PiP 	323 -
CR 1:2  24.6 x 17 x 18.5mm	• Print-Anschlüsse • IP 67 • Leise schaltendes KFZ-Relais • Twin Relais (2 x 1 Form C) • RoHS konform	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1c x 2	(DC) 12V	640mW	500Vrms	-	500Vrms		Print 	340 -
✪**CT** 1:2  17.4 x 14 x 13.5mm	• Als Doppelspulen- oder Einzelrelais lieferbar • Pin-in-Paste-Version verfügbar • Layout ACT512 = Layout von 2 ACT112 • Twin Relais (H-Brücke) • RoHS konform	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1c, 1c x 2	(DC) 12V	800mW	500Vrms	-	500Vrms	-	Print, PiP 	344 -
Single												
CA 1:2  21.5 x 14.4 x 37mm	• Kleines, leichtes KFZ-Relais • Steckbar • RoHS konform	**Max:** • 20A (1a, 1.4W Typ) • 30A (1a, 1.8W Typ) • 20A (1b, 1c)	• 15V DC (1c; 12V DC Typ) • 16V DC (1a, 1b; 12V DC Typ) • 30V DC (1c; 24V DC Typ)	1a, 1b, 1c	(DC) 12; 24V	1800mW 1400mW (S-Typ)	500Vrms	-	500Vrms	-	Flachstecker 	306 -
CB 1:2  26 x 22 x 25mm	• Hohe Schockfestigkeit • Geringe Kontaktverluste • 1A Ausführung mit 70A lieferbar • RoHS konform	**Max:** • 70A (H type) • 40A (1a, 1c N.O.) • 30A (1c)	• 16V DC (12V DC Typ) • 32V DC (24V DC Typ)	1a, 1c	(DC) 12; 24V	1400mW (12V DC Typ) 1800mW (24V DC Typ) 1800mW (12V DC, Power-Typ)	500Vrms	-	500Vrms	-	Print, Flachstecker 	312 -

Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung	Spulenleistung	Spannungsfestigkeit offener Kontakt	Spannungsfestigkeit zwischen Kontaktsätzen	Spannungsfestigkeit Spule/Kontakt	Stoßspannungs-festigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
✪ **CM** 1:2  20 x 15 x 22mm	• Hohe Schockfestigkeit • Geringe Kontaktverluste • Als Printrelais oder in Flach-stecker-Ausführung lieferbar • RoHS konform	**Max:** • 35A (N.O.) • 20A (N.C.)	• 16V DC (12V DC Typ) • 32V DC (24V DC Typ)	1a, 1c	(DC) 12; 24V	1500mW (12V DC Typ) 1800mW (24V DC Typ)	500Vrms	-	500Vrms	-	Print, Flachstecker 	327 -
✪ **CP (SMD)** 1:2  14 x 13 x 9.5mm	• Stromtragfähigkeit: 125°C - 40A/2 min. 125°C - 30A/1h • Einschaltstrom 40A - Lampen-last • 24V Spule auf Anfrage • RoHS konform	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1a, 1c	(DC) 12V; 24V	640mW	500Vrms	-	500Vrms	-	Print, SMD PCB type  Surface mount type 	332 -
CQ 1:2  17 x 13 x 16.6mm	• Geräuscharm • Ausführung wie JJM • RoHS konform	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1c	(DC) 12V	640mW	500Vrms	-	500Vrms	-	Print 	336 -
✪ **CT** 1:2  17.4 x 7.2 x 13.5mm	• Als Doppelspulen- oder Einzelrelais lieferbar • Pin-in-Paste-Version verfügbar • Layout ACT512 = Layout von 2 ACT112 • Twin Relais (H-Brücke) • RoHS konform	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1c, 1c x 2	(DC) 12V	800mW	500Vrms	-	500Vrms	-	Print, PiP 	344 -
CV 1:2  22.5 x 15 x 15.7mm	• 20A Micro ISO-Relais • Flache Bauform Spulenleis-tung 800mW • Als Printrelais oder in Flach-stecker-Ausführung lieferbar • Geräuscharm • RoHS konform	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1a, 1c	(DC) 12V	800mW	500Vrms	-	500Vrms	-	Print, Flachstecker Micro 280  Sealed by epoxy resin	349 -
✪ **JJM** 1:2  15.5 x 12 x 13.9mm	• Typische Applikationen: Klimaanlagen, Fensterheber, Zentralverriegelung • 24V Spule auf Anfrage • Einschaltstrom 40A-Lampen-last • RoHS konform	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1a, 1c	(DC) 12V	640mW	500Vrms	-	500Vrms	-	Print 	360 -
JJM-DM 1:2  15.5 x 12 x 13.9mm	• Doppelschließer für Auto-Alarm-Anwendungen • Einschaltstrom 40A - Lampen-last • RoHS konform	**Max:** 2 x 6A	• 16V DC	Doppel-schließer	(DC) 12V	1000mW	500Vrms	-	500Vrms	-	Print 	364 -

Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung
JS-M 1:2  22 x 16 x 16.4mm	• Hochleistungs-Ausführung JSM-5 mit max. Einschalt-strom 50A • Standard-Ausführung JSM-4 mit max. Einschaltstrom 25A • RoHS konform	**Standard:** **Max:** 10A **15A-Typ:** **Max:** 15A	• 16V DC	1a, 1c	(DC) 9; 12V
JT-N 1:2  PCB: 31.9 x 26.9 x 20.2mm TMP: 32.2 x 27.4 x 27.9mm	• Hohe Schaltleistung • Bis 30A Lampenlast • RoHS konform	**Max:** • 30A (1a) • 20A (1c N.O.) • 10A (1c N.C.)	• 30V DC • 277V AC	1a, 1c	(DC) 5; 6; 9; 12; 15; 18; 24V
Sondertypen					
EV 1:4  88 x 87 x 87mm  80 x 38 x 71mm	• Gekapseltes DC-Schütz für Elektro- und Hybridfahrzeuge • Kompakte Bauform • RoHS konforme Type verfüg-bar	**Max:** • 150A (1a, 2a) • 60A (1a) • 30A (1a)	• 400V DC	1a (30A/60A/ 150A) 2a (150A)	(DC) 12; 24V

Spulenleistung	Spannungsfestigkeit offener Kontakt	Spannungsfestigkeit zwischen Kontaktsätzen	Spannungsfestigkeit Spule/Kontakt	Stoßspannungs-festigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
640mW	750Vrms	-	1500Vrms	-	Print 1a  1c 	367 -
800mW	1200Vrms	-	2500Vrms	-	Print,Top-mounting 1a  1C  (TMP)	370 UL, CSA
5W (Dauerbetrieb) 35W (Einschaltstrom bei 150A-Typ)	2500Vrms	-	2500Vrms	-	Schraubfassung -	354 -

Typ ✪ = Vorzugstyp (Bildskalierung: DIN A4)	Besonderheiten	Schaltstrom (min, max)	Max. Schaltspannung	Kontaktart	Spulenspannung
SFN4D 1:3  53.3 x 33 x 14.5mm	• Zwangsgeführte Sicherheits-doppelkontakte nach EN 50205 • Spulenleistung: 390mW • Bauhöhe: 14,5mm • Verstärkte Isolation (5,5mm Luft- und Kriechstrecke) • RoHS konform	**Max:** 8A **Min:** 10mA	• 500V DC • 500V AC	4a2b	(DC) 5; 9; 12; 16; 18; 21; 24; 36; 48; 60V
SF4D 1:3  53.3 x 33 x 16.5mm	• Gepoltes Relais mit zwangs-geführten Kontakten nach EN 50205 • Min. 10V/10mA • Doppelkontakt • RoHS konform	**Max:** 8A **Min:** 10mA	• 400V DC • 400V AC	4a4b	(DC) 5; 9; 12; 18; 21; 24; 36; 48; 60V
SF2D 1:3  53.3 x 25 x 16.5mm	• Gepoltes Relais mit zwangs-geführten Kontakten nach EN 50205 • Min. 10V/10mA • D=Doppelkontakt • RoHS konform	**Max:** 8A **Min:** 10mA	• 400V DC • 400V AC	2a2b	(DC) 5; 9; 12; 18; 21; 24; 36; 48; 60V
SF3 1:3  53.3 x 25 x 16.5mm	• Gepoltes Relais mit zwangs-geführten Kontakten nach EN 50205 • Min. 10V / 10mA • RoHS konform	**Max:** 8A **Min:** 10mA	• 400V DC • 400V AC	3a1b	(DC) 5; 9; 12; 18; 21; 24; 36; 48; 60V

Spulenleistung	Spannungsfestigkeit			Stoßspannungs-festigkeit	Anschlüsse (von unten gesehen)	Seite Zulassungen
	offener Kontakt	zwischen Kontaktsätzen	Spule/Kontakt			
390mW (5 - 24V) 420mW (36 - 60V)	2500Vrms	4000Vrms	5000Vrms	-	Print Grid 2.5mm  4a2b	383 UL, CSA, SEV, TÜV
500mW	2500Vrms	2500Vrms	2500Vrms	-	Print Grid 2.54mm  4a4b	380 UL, CSA, SEV, TÜV
500mW	2500Vrms	2500Vrms	2500Vrms	-	Print Grid 2.54mm  2a2b	374 UL, CSA, SEV, TÜV
500mW	2500Vrms	2500Vrms	2500Vrms	-	Print Grid 2.54mm  3a1b	377 UL, CSA, SEV, TÜV

Signalrelais

Panasonic
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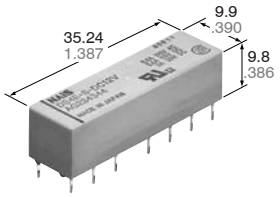
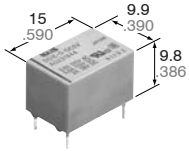
HIGHLY SENSITIVE 1500 V FCC SURGE WITHSTANDING MINIATURE RELAY

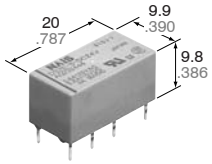
DS RELAYS



DS4E



DS1E



DS2E

mm inch

FEATURES

- **High sensitivity: 200 mW pick-up power**
  100 mW pick-up power types available
- **Latching types available**
- **High switching capacity: 60 W, 125 V A**
- **High breakdown voltage: 1,500 V FCC surge between open contacts**
  1,000 V AC between open contacts
- **DIP-1C type can be used with 14 pin IC socket**
  2C type can be used with 16 pin IC socket,
  4C type can be used with 2 sets of 14 pin IC sockets
- **Gold-cap silver palladium types available for 2 Form C type**
- **Bifurcated contacts are standard**

SPECIFICATIONS

Contact

Arrangement		1 Form C, 2 Form C, 4 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		50 mΩ
Contact material		Gold-clad silver
Rating (resistive)	Max. switching power	60 W, 125 VA
	Max. switching voltage	220 V DC, 250 V AC
	Max. switching current	2 A DC, AC
	Max. carrying current	3 A DC, AC
Expected life (min. operations)	Mechanical (at 600 cpm)	10^8 (10^7 for 1 Form C 2 coil latching type)
	Electrical 2 A 30 VDC resistive	5×10^5

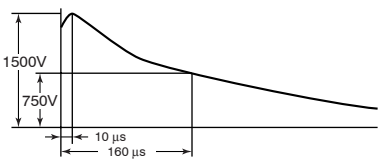
* Gold capped silver-palladium contact also available for 2 Form C 10^7 operations at 0.1 A 50 V DC resistive

Coil (polarized) (at 20°C 68°F)

M type	Single side stable	Minimum operating power	Approx. 200 mW
		Nominal operating power	Approx. 400 mW
	1 coil latching	Minimum set and reset power	Approx. 90 mW
		Nominal set and reset power	Approx. 180 mW
	2 coil latching	Minimum set and reset power	Approx. 180 mW
		Nominal set and reset power	Approx. 360 mW
S type	Single side stable	Minimum operating power	Approx. 100 mW (128 mW)*
		Nominal operating power	Approx. 200 mW
	1 coil latching	Minimum set and reset power	Approx. 45 mW (58 mW)*
		Nominal set and reset power	Approx. 90 mW
	2 coil latching	Minimum set and reset power	Approx. 90 mW (115 mW)*
		Nominal set and reset power	Approx. 180 mW

* For 1 Form C high sensitive types.

FCC (Federal Communication Commission) requests following standard as Breakdown Voltage specification.



Characteristics (at 20°C 68°F)

Max. operating speed		20 cpm at rated load 50 cps at low level load	
Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)	
Initial breakdown voltage*2	Type of relay	(DS1-S type)	(Other types)
	Between open contacts	500 Vrms	1,000 Vrms
	Between contacts sets	—	1,000 Vrms
	Between contacts and coil	1,000 Vrms	1,500 Vrms
FCC surge voltage between contacts and coil		1,500 V (Expect DS1-S type)	
Operate time*3 (at nominal voltage)		Approx. 3 ms	
Release time (without diode)*3 (at nominal voltage)		Approx. 2 ms	
Set time*3 (at nominal voltage)		Approx. 3 ms	
Reset time*3 (at nominal voltage)		Approx. 3 ms	
Temperature rise (at nominal voltage, Contact current: 2A)		Max. 65°C	
Shock resistance	Functional*4	1C, 2C:Min. 490 m/s² {50 G} 4C:Min. 294 m/s² {30 G}	
	Destructive*5	Min. 980 m/s² {100 G}	
Vibration resistance	Functional*6	10 to 55 Hz at double amplitude of 3.3 mm	
	Destructive	10 to 55 Hz at double amplitude of 5 mm	
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F	
	Humidity	5 to 85% R.H.	
Unit weight	1 Form C	Approx. 3.2g .11oz	
	2 Form C	Approx. 4g .14oz	
	4 Form C	Approx. 7g .25oz	

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10µs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10µs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

TYPICAL APPLICATIONS

- Telecommunication equipment
- Office equipment
- Computer peripherals
- Security equipment
- Measuring instrumentation

ORDERING INFORMATION

Ex DS [2] [E] — [M] [L2] – [DC 48 V] — [R] *

Contact arrangement	Classification of type	Sensitivity	Operating function	Coil voltage
1: 1 Form C 2: 2 Form C 4: 4 Form C	E: Amber sealed type	M: 400 mW nominal operating power S: 200 mW nominal operating power	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	DC 1.5, 3, 5, 6, 9, 12, 24, 48 V

*Reverse polarity types available (add suffix-R). Standard packing: Carton: 50 pcs.; Case: 500 pcs.

TYPES

Single side stable

	Nominal Voltage, V DC	Part No.		
		1 Form C	2 Form C	4 Form C
M (400 mW) type	1.5	DS1E-M-DC1.5V	DS2E-M-DC1.5V	DS4E-M-DC1.5V
	3	DS1E-M-DC3V	DS2E-M-DC3V	DS4E-M-DC3V
	5	DS1E-M-DC5V	DS2E-M-DC5V	DS4E-M-DC5V
	6	DS1E-M-DC6V	DS2E-M-DC6V	DS4E-M-DC6V
	9	DS1E-M-DC9V	DS2E-M-DC9V	DS4E-M-DC9V
	12	DS1E-M-DC12V	DS2E-M-DC12V	DS4E-M-DC12V
	24	DS1E-M-DC24V	DS2E-M-DC24V	DS4E-M-DC24V
	48	DS1E-M-DC48V	DS2E-M-DC48V	DS4E-M-DC48V
S (200 mW) type	1.5	DS1E-S-DC1.5V	DS2E-S-DC1.5V	DS4E-S-DC1.5V
	3	DS1E-S-DC3V	DS2E-S-DC3V	DS4E-S-DC3V
	5	DS1E-S-DC5V	DS2E-S-DC5V	DS4E-S-DC5V
	6	DS1E-S-DC6V	DS2E-S-DC6V	DS4E-S-DC6V
	9	DS1E-S-DC9V	DS2E-S-DC9V	DS4E-S-DC9V
	12	DS1E-S-DC12V	DS2E-S-DC12V	DS4E-S-DC12V
	24	DS1E-S-DC24V	DS2E-S-DC24V	DS4E-S-DC24V
	48	DS1E-S-DC48V	DS2E-S-DC48V	DS4E-S-DC48V

1 coil latching

	Nominal Voltage, V DC	Part No.		
		1 Form C	2 Form C	4 Form C
M (180 mW) type	1.5	DS1E-ML-DC1.5V	DS2E-ML-DC1.5V	DS4E-ML-DC1.5V
	3	DS1E-ML-DC3V	DS2E-ML-DC3V	DS4E-ML-DC3V
	5	DS1E-ML-DC5V	DS2E-ML-DC5V	DS4E-ML-DC5V
	6	DS1E-ML-DC6V	DS2E-ML-DC6V	DS4E-ML-DC6V
	9	DS1E-ML-DC9V	DS2E-ML-DC9V	DS4E-ML-DC9V
	12	DS1E-ML-DC12V	DS2E-ML-DC12V	DS4E-ML-DC12V
	24	DS1E-ML-DC24V	DS2E-ML-DC24V	DS4E-ML-DC24V
	48	DS1E-ML-DC48V	DS2E-ML-DC48V	DS4E-ML-DC48V
S (90 mW) type	1.5	DS1E-SL-DC1.5V	DS2E-SL-DC1.5V	DS4E-SL-DC1.5V
	3	DS1E-SL-DC3V	DS2E-SL-DC3V	DS4E-SL-DC3V
	5	DS1E-SL-DC5V	DS2E-SL-DC5V	DS4E-SL-DC5V
	6	DS1E-SL-DC6V	DS2E-SL-DC6V	DS4E-SL-DC6V
	9	DS1E-SL-DC9V	DS2E-SL-DC9V	DS4E-SL-DC9V
	12	DS1E-SL-DC12V	DS2E-SL-DC12V	DS4E-SL-DC12V
	24	DS1E-SL-DC24V	DS2E-SL-DC24V	DS4E-SL-DC24V
	48	DS1E-SL-DC48V	DS2E-SL-DC48V	DS4E-SL-DC48V

2 coil latching

	Nominal Voltage, V DC	Part No.		
		1 Form C	2 Form C	4 Form C
M (360 mW) type	1.5	DS1E-ML2-DC1.5V	DS2E-ML2-DC1.5V	DS4E-ML2-DC1.5V
	3	DS1E-ML2-DC3V	DS2E-ML2-DC3V	DS4E-ML2-DC3V
	5	DS1E-ML2-DC5V	DS2E-ML2-DC5V	DS4E-ML2-DC5V
	6	DS1E-ML2-DC6V	DS2E-ML2-DC6V	DS4E-ML2-DC6V
	9	DS1E-ML2-DC9V	DS2E-ML2-DC9V	DS4E-ML2-DC9V
	12	DS1E-ML2-DC12V	DS2E-ML2-DC12V	DS4E-ML2-DC12V
	24	DS1E-ML2-DC24V	DS2E-ML2-DC24V	DS4E-ML2-DC24V
	48	DS1E-ML2-DC48V	DS2E-ML2-DC48V	DS4E-ML2-DC48V
S (180 mW) type	1.5	DS1E-SL2-DC1.5V	DS2E-SL2-DC1.5V	DS4E-SL2-DC1.5V
	3	DS1E-SL2-DC3V	DS2E-SL2-DC3V	DS4E-SL2-DC3V
	5	DS1E-SL2-DC5V	DS2E-SL2-DC5V	DS4E-SL2-DC5V
	6	DS1E-SL2-DC6V	DS2E-SL2-DC6V	DS4E-SL2-DC6V
	9	DS1E-SL2-DC9V	DS2E-SL2-DC9V	DS4E-SL2-DC9V
	12	DS1E-SL2-DC12V	DS2E-SL2-DC12V	DS4E-SL2-DC12V
	24	DS1E-SL2-DC24V	DS2E-SL2-DC24V	DS4E-SL2-DC24V
	48	DS1E-SL2-DC48V	DS2E-SL2-DC48V	DS4E-SL2-DC48V

Notes: 1. Reverse polarity types available (add suffix-R).
2. Standard packing: carton: 50 pcs.; case: 500 pcs.

COIL DATA (at 20°C 68°F)

Single side stable

	Nominal voltage, V DC	Pick-up voltage, V DC (max.)		Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Maximum allowable, V DC (at 50°C 122°F)	
		1 Form C	2, 4 Form C			1 Form C	2, 4 Form C
M type	1.5	1.05	1.05	0.15	5.63	1.8	2.25
	3	2.1	2.1	0.3	22.5	3.6	4.5
	5	3.5	3.5	0.5	62.5	6	7.5
	6	4.2	4.2	0.6	90	7.2	9
	9	6.3	6.3	0.9	203	10.8	13.5
	12	8.4	8.4	1.2	360	14.4	18
	24	16.8	16.8	2.4	1440	28.8	36
	48	33.6	33.6	4.8	5760	57.6	72
S type	1.5	1.2	1.05	0.15	11.3	2.4	3
	3	2.4	2.1	0.3	45	4.8	6
	5	4.0	3.5	0.5	125	8.0	10
	6	4.8	4.2	0.6	180	9.6	12
	9	7.2	6.3	0.9	405	14.4	18
	12	9.6	8.4	1.2	720	19.2	24
	24	19.2	16.8	2.4	2880	38.4	48
	48	38.4	33.6	4.8	11520	76.8	96

1 coil latching

	Nominal voltage, V DC	Reset Set, V DC (max.)		Coil resistance, Ω (±10%)	Maximum allowable, V DC (at 50°C 122°F)	
		1 Form C	2, 4 Form C		1 Form C	2, 4 Form C
M type	1.5	1.05	1.05	12.5	1.8	2.25
	3	2.1	2.1	50	3.6	4.5
	5	3.5	3.5	139	6	7.5
	6	4.2	4.2	200	7.2	9
	9	6.3	6.3	450	10.8	13.5
	12	8.4	8.4	800	14.4	18
	24	16.8	16.8	3200	28.8	36
	48	33.6	33.6	12800	57.6	72
S type	1.5	1.2	1.05	25	2.4	3
	3	2.4	2.1	100	4.8	6
	5	4.0	3.5	278	8.0	10
	6	4.8	4.2	400	9.6	12
	9	7.2	6.3	900	14.4	18
	12	9.6	8.4	1600	19.2	24
	24	19.2	16.8	6400	38.4	48
	48	38.4	33.6	25600	76.8	96

2 coil latching

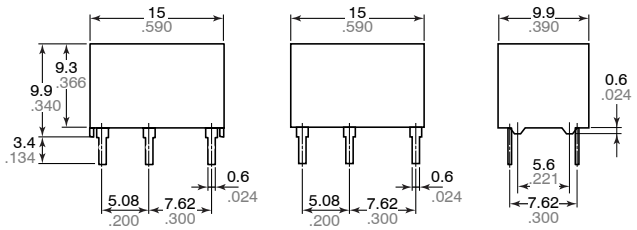
	Nominal voltage, V DC	Reset Set, V DC (max.)		Coil resistance, Ω (±10%)		Maximum allowable, V DC (at 50°C 122°F)	
		1 Form C	2,4 Form C	Coil I	Coil II	1 Form C	2,4 Form C
M type	1.5	1.05	1.05	6.25		1.8	2.25
	3	2.1	2.1	25		3.6	4.5
	5	3.5	3.5	69.4		6	7.5
	6	4.2	4.2	100		7.2	9
	9	6.3	6.3	225		10.8	13.5
	12	8.4	8.4	400		14.4	18
	24	16.8	16.8	1600		28.8	36
	48	33.6	33.6	6400		57.6	72
S type	1.5	1.2	1.05	12.5		2.4	3
	3	2.4	2.1	50		4.8	6
	5	4.0	3.5	139		8.0	10
	6	4.8	4.2	200		9.6	12
	9	7.2	6.3	450		14.4	18
	12	9.6	8.4	800		19.2	24
	24	19.2	16.8	3200		38.4	48
	48	38.4	33.6	12800		76.8	96

DIMENSIONS

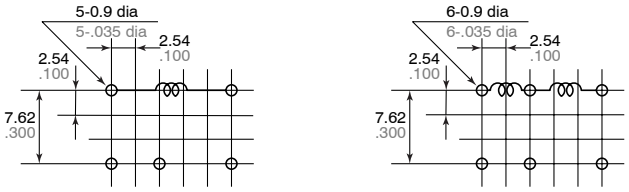
mm inch

1 Form C

Single side stable, 1 coil latching, 2 coil latching



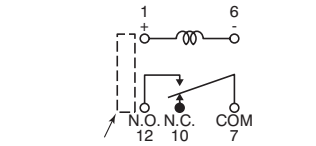
PC board pattern (Copper-side view)
Single side stable, 1 coil latching 2 coil latching



Tolerance: ±0.1 ±.004

General tolerance: ±0.3 ±.012

Schematic (Bottom view)
Single side stable
Deenergized condition



• A polarity bar showing the relay direction can replace the schematic.

1 coil latching

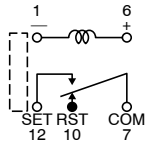


Diagram shows the “reset” position when terminals 1 and 6 are energized.
Energize with reverse polarity to transfer contacts.

2 coil latching

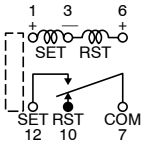
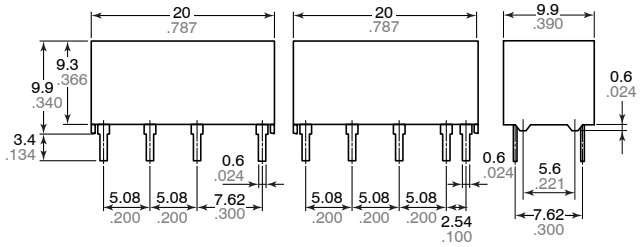


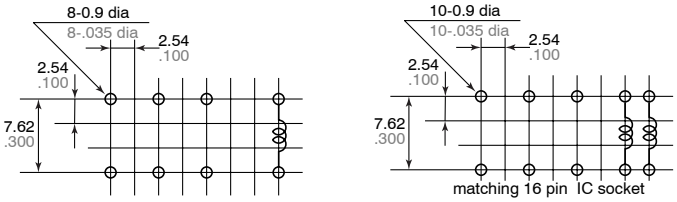
Diagram shows the “reset” position when terminals 3 and 6 are energized.
Energize terminals 1 and 3 to transfer contacts.

2 Form C

Single side stable, 1 coil latching, 2 coil latching



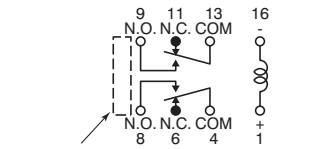
PC board pattern (Copper-side view)
Single side stable, 1 coil latching 2 coil latching



Tolerance: ±0.1 ±.004

General tolerance: ±0.3 ±.012

Schematic (Bottom view)
Single side stable
Deenergized condition



• A polarity bar showing the relay direction can replace the schematic.

1 coil latching

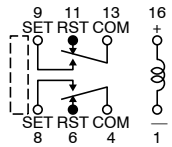


Diagram shows the “reset” position when terminals 1 and 16 are energized.
Energize with reverse polarity to transfer contacts.

2 coil latching

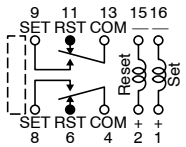
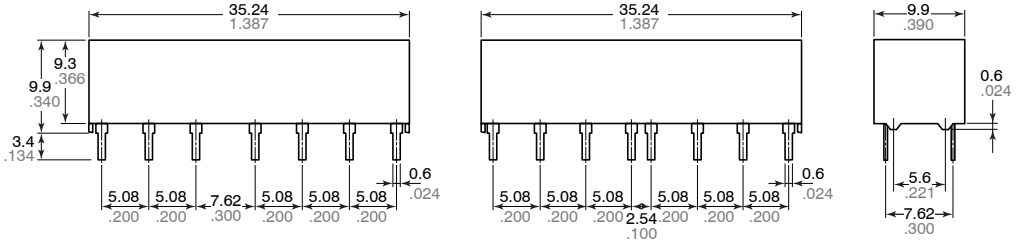


Diagram shows the “reset” position when terminals 2 and 15 are energized.
Energize terminals 1 and 16 to transfer contacts.

4 Form C

mm inch

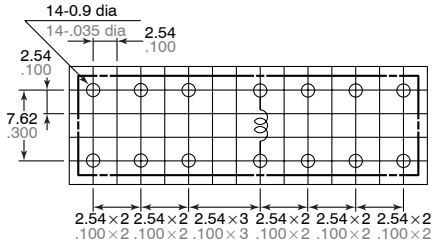
Single side stable, 1 coil latching, 2 coil latching



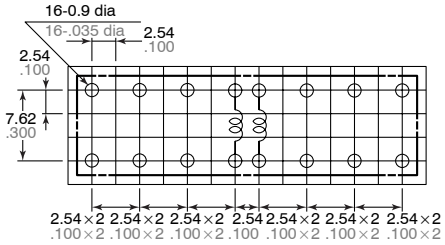
General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)

Single side stable, 1 coil latching



2 coil latching

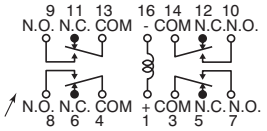


Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Single side stable

Deenergized condition



• A polarity bar showing the relay direction can replace the schematic.

1 coil latching

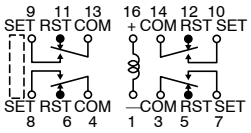


Diagram shows the “reset” position when terminals 1 and 16 are energized.
Energize with reverse polarity to transfer contacts.

2 coil latching

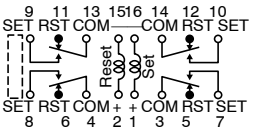
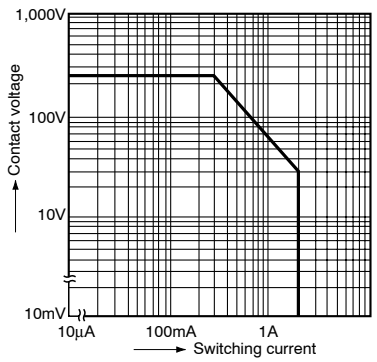


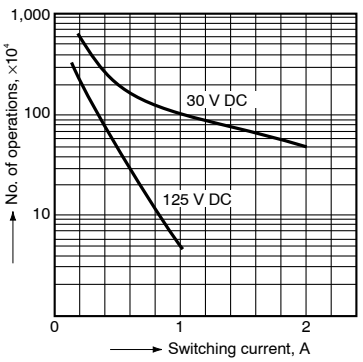
Diagram shows the “reset” position when terminals 2 and 15 are energized.
Energize terminals 1 and 16 to transfer contacts.

REFERENCE DATA

1. Maximum switching capacity

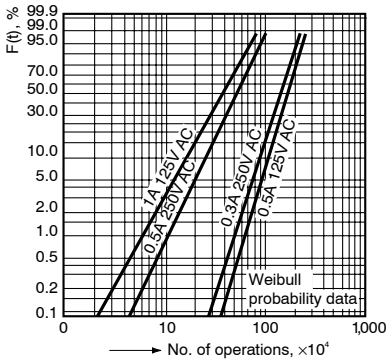


2. Life curve (Resistive load)

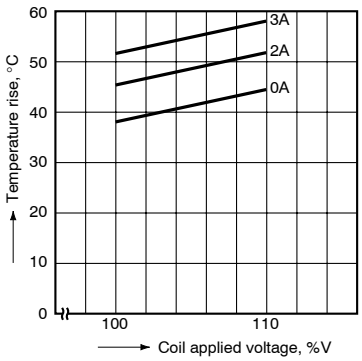


3. Contact reliability for AC loads

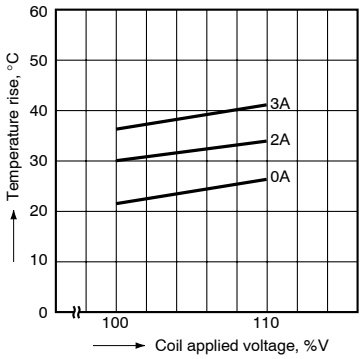
Sample: DS2E-M-DC24V 10 pcs.
Cycle rate: 20 cpm.
Detection level: 200 mΩ



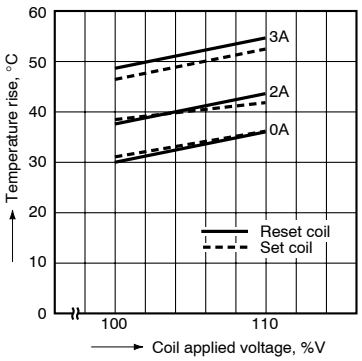
4-(1). Coil temperature rise
(2 Form C single side stable type)
Point measured: Inside the coil
Ambient temperature: 18° to 19°C 64° to 66°F



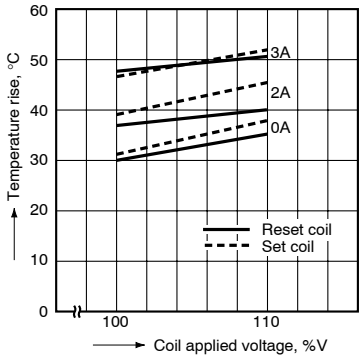
4-(2). Coil temperature rise
(4 Form C single side stable type)
Point measured: Inside the coil
Ambient temperature: 17° to 18°C 63° to 64°F



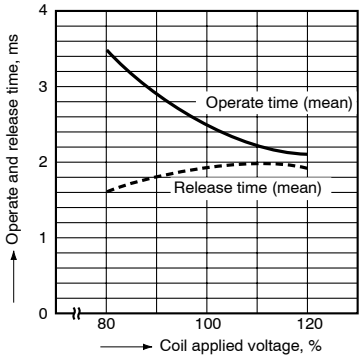
4-(3). Coil temperature rise
(2 Form C 2 coil latching type)
Point measured: Inside the coil
Ambient temperature: 20° to 21°C 68° to 70°F



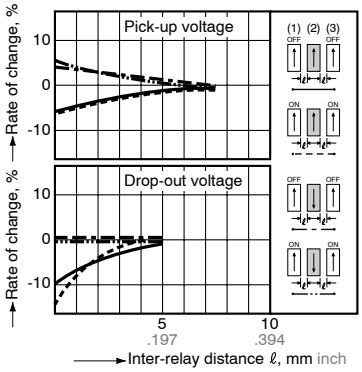
4-(4). Coil temperature rise
(4 Form C 2 coil latching type)
Point measured: Inside the coil
Ambient temperature: 20°C 68°F



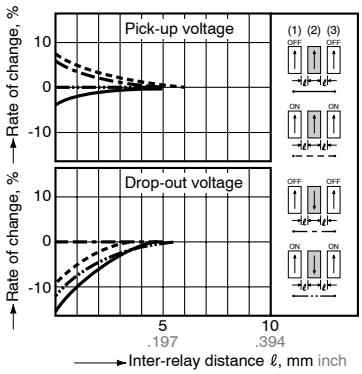
5. Operate and release time characteristics
(2 Form C single side stable type)
Test condition: Without diode connected to coil in parallel



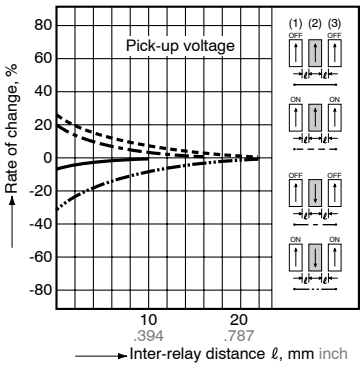
6-(1). Influence of adjacent mounting
(1 Form C)

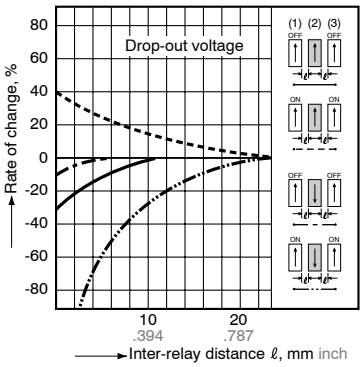


6-(2). Influence of adjacent mounting
(2 Form C)



6-(3). Influence of adjacent mounting
(4 Form C)



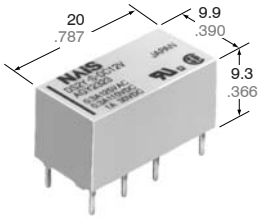


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

MINIATURE RELAY

DS2Y RELAYS



mm inch

FEATURES

- **2 Form C contact**
- **High sensitivity-200 mW nominal operating power**
- **High breakdown voltage**
  1500 V FCC surge between open contacts
- **DIP-2C type matching 16 pin IC socket**
- **Sealed construction**

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			50 mΩ
Contact material			Gold-clad sliver
Rating (resistive)	Max. switching power		60 W, 62.5 VA
	Max. switching voltage		220 V DC, 250 V AC
	Max. switching current		2 A
	Max. carrying current		3 A
Expected life (min. operations)	Mechanical		1×10^8
	Electrical	1 A 30 V DC	5×10^5
		2 A 30 V DC	1×10^5

Coil (polarized) (at 20°C 68°F)

Single side stable	Minimum operating power	Approx. 98 mW (147 mW: 48 V)
	Nominal operating power	Approx. 200 mW (300 mW: 48 V)
2 coil latching	Minimum set and reset power	Approx. 88 mW (177 mW: 48 V)
	Nominal set and reset power	Approx. 180 mW (360 mW: 48 V)

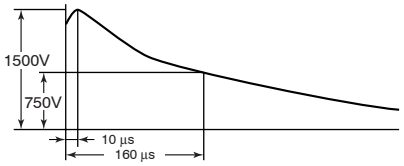
Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms, detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics (at 20°C 68°F)

Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	750 Vrms
	Between contact sets	1,000 Vrms
	Between contact and coil	1,000 Vrms
FCC surge voltage between contacts and coil		1,500 V
Operate time*3 (at nominal voltage)		Approx. 4 ms
Release time*3 (at nominal voltage)		Approx. 3 ms
Set time*3 (latching) (at nominal voltage)		Approx. 3 ms
Reset time*3 (latching) (at nominal voltage)		Approx. 3 ms
Temperature rise		Max. 65°C with nominal voltage across coil and at nominal switching capacity
Shock resistance	Functional*4	Min. 490 m/s² {50 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 4 g 14 oz.

FCC (Federal Communication Commission) requests following standard as Breakdown Voltage specification.



TYPICAL APPLICATIONS

- Telecommunication equipment
- Office equipment
- Computer peripherals
- Security alarm systems
- Medical equipment

ORDERING INFORMATION

Ex DS2Y-S | L2 | DC12 V | R

Operating function	Coil voltage	Polarity
Nil: Single side stable L2: 2 coil latching	DC 1.5, 3, 5, 6, 9, 12, 24, 48 V	Nil: Standard polarity R: Reverse polarity

(Notes) 1. Standard packing: Carton: 50 pcs. Case: 500 pcs.
2. 1 coil latching type available.

TYPES AND COIL DATA (at 20°C 68°F)

Single side stable

Nominal voltage, V DC	Part No.	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power mW	Maximum allowable voltage, V DC (at 50°C 122°F)
1.5	DS2Y-S-DC1.5V	1.05	0.15	132.7	11.3	200	3
3	DS2Y-S-DC3V	2.10	0.3	66.7	45	200	6
5	DS2Y-S-DC5V	3.5	0.5	40	125	200	10
6	DS2Y-S-DC6V	4.2	0.6	33.3	180	200	12
9	DS2Y-S-DC9V	6.3	0.9	22.2	405	200	18
12	DS2Y-S-DC12V	8.4	1.2	16.7	720	200	24
24	DS2Y-S-DC24V	16.8	2.4	8.3	2,880	200	48
48	DS2Y-S-DC48V	33.6	4.8	6.3	7,680	300	86

(Note) Standard packing: Carton: 50 pcs. Case: 500 pcs.

2 coil latching

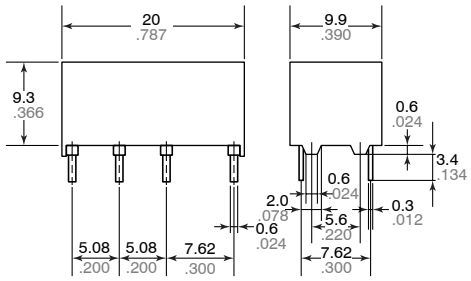
Nominal voltage, V DC	Part No.	Reset set, V DC (max.)	Nominal operating current mA (±10%)		Coil resistance, Ω (±10%)		Nominal operating power, mW		Maximum allowable voltage, V DC (at 50°C 122°F)
			Set	Reset	Set	Reset	Set	Reset	
1.5	DS2Y-SL2-DC1.5V	1.05	120	120	12.5	12.5	180	180	3
3	DS2Y-SL2-DC3V	2.1	60	60	50	50	180	180	6
5	DS2Y-SL2-DC5V	3.5	36	36	139	139	180	180	10
6	DS2Y-SL2-DC6V	4.2	30	30	200	200	180	180	12
9	DS2Y-SL2-DC9V	6.3	20	20	450	450	180	180	18
12	DS2Y-SL2-DC12V	8.4	15	15	800	800	180	180	24
24	DS2Y-SL2-DC24V	16.8	7.5	7.5	3,200	3,200	180	180	48
48	DS2Y-SL2-DC48V	33.6	7.5	7.5	6,400	6,400	360	360	72

(Note) Standard packing: Carton: 50 pcs. Case: 500 pcs.

DIMENSIONS

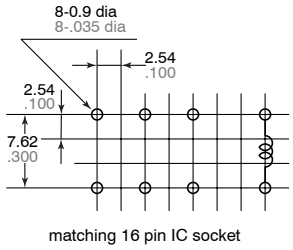
mm inch

Single side stable



General tolerance: ±0.3 ±.012

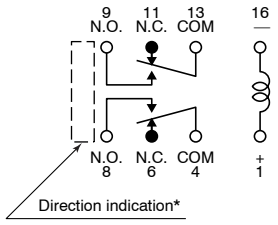
PC board pattern (Copper-side view)



matching 16 pin IC socket

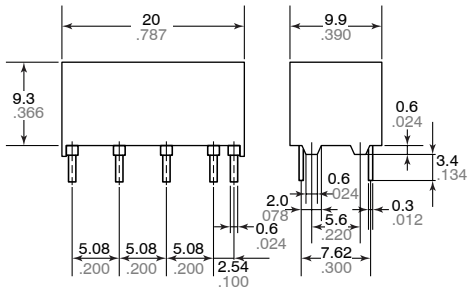
Tolerance: ±0.1 ±.004

Schematic (Bottom view)
(Deenergized position)



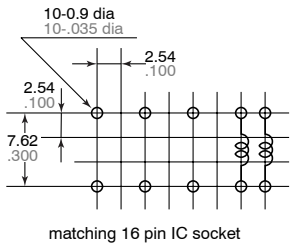
*A polarity bar shows the relay direction.

2 coil latching



General tolerance: ±0.3 ±.012

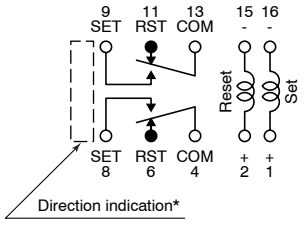
PC board pattern (Copper-side view)



matching 16 pin IC socket

Tolerance: ±0.1 ±.004

Schematic (Bottom view)
(Reset position)

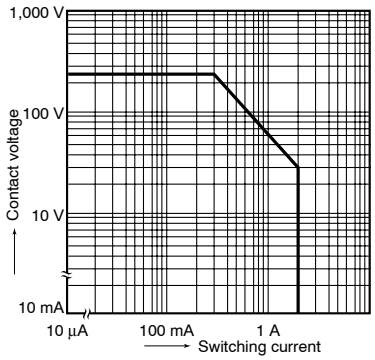


*A polarity bar shows the relay direction.

Diagram shows the "reset" position when terminals 2 and 15 are energized. Energize terminals 1 and 16 to transfer contacts.

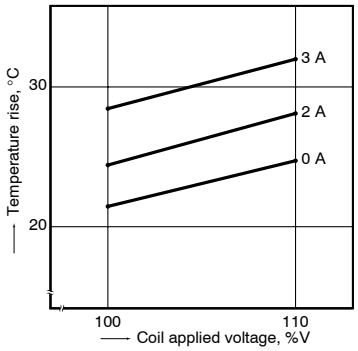
REFERENCE DATA

1. Maximum switching capacity



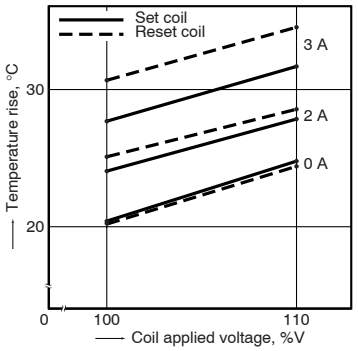
2-(1) Coil temperature rise (Single side stable)

Tested sample: DS2Y-S-DC12V, 5 pcs.
Measured portion: Inside the coil
Ambient temperature: 21°C to 25°C 70°F to 77°F



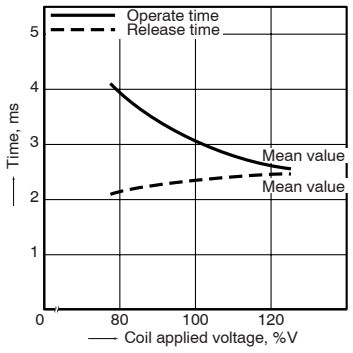
2-(2) Coil temperature rise 2 coil latching

Tested sample: DS2Y-SL2-DC12V, 5 pcs.
Measured portion: Inside the coil
Ambient temperature: 21°C to 25°C 70°F to 77°F



3. Operate/release time for single side stable (Without diode)

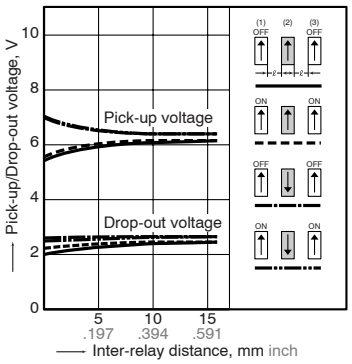
Tested sample: DS2Y-S-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F



4-(1) Influence of adjacent mounting

Tested sample: DS2Y-S-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F

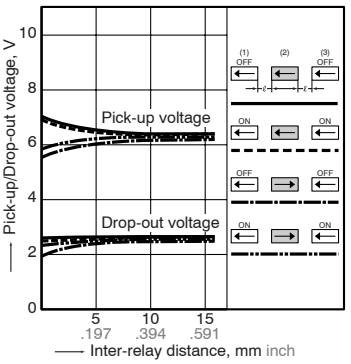
TEST METHOD
1. Apply nominal voltage to No. (1) and (3) DS2Y relays.
2. Measure pick-up voltage and drop-out voltage of No. (2) relay when inter-relay distance (ℓ) changes.



4-(2) Influence of adjacent mounting

Tested sample: DS2Y-S-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F

TEST METHOD
1. Apply nominal voltage to No. (1) and (3) DS2Y relays.
2. Measure pick-up voltage and drop-out voltage of No. (2) relay when inter-relay distance (ℓ) changes.



For Cautions for Use, see Relay Technical Information (page 392).

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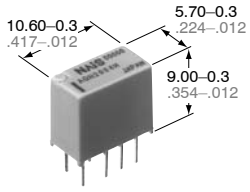
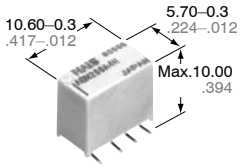
ULTRA-SMALL PACKAGE SLIM POLARIZED RELAY

GN RELAYS (AGN)





mm inch

FEATURES

• Compact slim body saves space
Thanks to the small surface area of 5.7 mm × 10.6 mm .224 inch × .417 inch and low height of 9.0 mm .354 inch, the packaging density can be increased to allow for much smaller designs.

• Outstanding surge resistance.
Surge withstand between open contacts: 1,500 V 10×160 μs (FCC part 68)
Surge withstand between contacts and coil: 2,500 V 2×10 μs (Telcordia)

• The use of twin crossbar contacts ensures high contact reliability.
AgPd contact is used because of its good sulfide resistance. Adopting low-gas molding material. Coil assembly molding technology which avoids generating volatile gas from coil.

• Increased packaging density
Due to highly efficient magnetic circuit design, leakage flux is reduced and changes in electrical characteristics from components being mounted close-together are minimized. This all means a packaging density higher than ever before.

• Nominal operating power: 140 mW

• Outstanding vibration and shock resistance.
Functional shock resistance:
750 m/s² {75G}
Destructive shock resistance:
1,000 m/s² {100G}
Functional vibration resistance:
10 to 55 Hz (at double amplitude of 3.3 mm .130 inch)
Destructive vibration resistance:
10 to 55 Hz (at double amplitude of 5 mm .197 inch)

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1A)			100 mΩ
Contact material			Stationary: AgPd+Au clad Movable: AgPd
Rating	Nominal switching capacity (resistive load)		1 A 30 V DC 0.3 A 125 V AC
	Max. switching power (resistive load)		30 W, 37.5 V A
	Max. switching voltage		110 V DC, 125 V AC
	Max. switching current		1 A
	Min. switching capacity ❋1		10 μA 10 mV DC
Nominal operating power	Single side stable		140mW (1.5 to 12 V DC) 230mW (24 V DC)
	1 coil latching		100mW (1.5 to 12 V DC) 120mW (24 V DC)
Expected life (min. operations)	Mechanical (at 180 cpm)		5×10^7
	Electrical (at 20 cpm)	1 A 30 V DC resistive	10^5
		0.3 A 125 V AC resistive	10^5

Remarks:
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA.
*3 Nominal voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil; contact carrying current: 1 A.
*5 Half-wave pulse of sine wave: 6 ms; detection time: 10μs.
*6 Half-wave pulse of sine wave: 6 ms.
*7 Detection time: 10μs.
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Initial insulation resistance*1		Min. 1,000MΩ (at 500V DC)
Initial breakdown voltage*2	Between open contacts	750 Vrms for 1min.
	Between contact sets	1,000 Vrms for 1min.
	Between contacts and coil	1,500 Vrms for 1min.
Initial surge voltage	Between open contacts (10×160 μs)	1,500 V (FCC Part 68)
	Between contacts and coil (2×10 μs)	2,500 V (Telcordia)
Operate time [Set time]*3 (at 20°C)		Max. 4 ms (Approx. 2 ms) [Max. 4 ms (Approx. 2 ms)]
Release time (without diode) [Reset time]*3 (at 20°C)		Max. 4 ms (Approx. 1 ms) [Max. 4 ms (Approx. 2 ms)]
Temperature rise*4 (at 20°C)		Max. 50°C
Shock resistance	Functional*5	Min. 750 m/s²{75G]
	Destructive*6	Min. 1,000 m/s²{100G]
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temperature ❋2	–40°C to 85°C –40°F to 185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 1 g .035 oz

Notes:
❋1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
❋2 The upper limit for the ambient temperature is the maximum temperature that can satisfy the coil temperature rise. Under the packing condition, allowable temperature range is from –40 to +70°C –40° to +158°F.

TYPICAL APPLICATIONS

- **Communications (XDSL, Transmission)**
- **Measurement**
- **Security**
- **Home appliances, and audio/visual equipment**
- **Automotive equipment**
- **Medical equipment**

ORDERING INFORMATION

Ex. AGN [2] [0] [0] [A] [1] [H] [Z]

Contact arrangement	Operating function	Type of operation	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	0: Single side stable 1: 1 coil latching	0: Standard type (B.B.M.)	Nil: Standard PC board terminal A: Surface-mount terminal A type S: Surface-mount terminal S type	1H: 1.5V 09 : 9V 03 : 3V 12 : 12V 4H: 4.5V 24 : 24V 06 : 6V	Nil: Tube packing Z: Tape and reel packing (picked from 5/6/7/8 pin side)

Note: Tape and reel packing symbol "-Z" is not marked on the relay. "X" type tape and reel packing (picked from 1/2/3/4-pin side) is also available. Suffix "X" instead of "Z".

TYPES AND COIL DATA (at 20°C 68°F)

(1) Standard PC board terminal

Operating Function	Part No. Standard PC board terminal	Coil Rating, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	AGN2001H	1.5	1.13	0.15	93.8	16	140	2.25
	AGN20003	3	2.25	0.3	46.7	64.2	140	4.5
	AGN2004H	4.5	3.38	0.45	31	145	140	6.75
	AGN20006	6	4.5	0.6	23.3	257	140	9
	AGN20009	9	6.75	0.9	15.5	579	140	13.5
	AGN20012	12	9	1.2	11.7	1,028	140	18
	AGN20024	24	18	2.4	9.6	2,504	230	28.8

Operating Function	Part No. Standard PC board terminal	Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
1 coil latching	AGN2101H	1.5	1.13	1.13	66.7	22.5	100	2.25
	AGN21003	3	2.25	2.25	33.3	90	100	4.5
	AGN2104H	4.5	3.38	3.38	22.2	202.5	100	6.75
	AGN21006	6	4.5	4.5	16.7	360	100	9
	AGN21009	9	6.75	6.75	11.1	810	100	13.5
	AGN21012	12	9	9	8.3	1,440	100	18
	AGN21024	24	18	18	5.0	4,800	120	36

1) Standard packing: 50 pcs. in an inner package (tube); 1,000 pcs. in an outer package
2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

(2) Surface-mount terminal

Operating Function	Part No. Tube packing	Part No. Tape and reel packing	Coil Rating, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	AGN200❍1H	AGN200❍1HZ	1.5	1.13	0.15	93.8	16	140	2.25
	AGN200❍03	AGN200❍03Z	3	2.25	0.3	46.7	64.2	140	4.5
	AGN200❍4H	AGN200❍4HZ	4.5	3.38	0.45	31	145	140	6.75
	AGN200❍06	AGN200❍06Z	6	4.5	0.6	23.3	257	140	9
	AGN200❍09	AGN200❍09Z	9	6.75	0.9	15.5	579	140	13.5
	AGN200❍12	AGN200❍12Z	12	9	1.2	11.7	1,028	140	18
	AGN200❍24	AGN200❍24Z	24	18	2.4	9.6	2,504	230	28.8

❍: For each surface-mounted terminal variation, input the following letter.
A type: A, S type: S
1) Standard packing: 50 pcs.(tube), 500pcs. (tape and reel)in an inner package; 1,000 pcs. in an outer package
2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

Operating Function	Part No.		Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Tube packing	Tape and reel packing							
1 coil latching	AGN210❍1H	AGN210❍1HZ	1.5	1.13	1.13	66.7	22.5	100	2.25
	AGN210❍03	AGN210❍03Z	3	2.25	2.25	33.3	90	100	4.5
	AGN210❍4H	AGN210❍4HZ	4.5	3.38	3.38	22.2	202.5	100	6.75
	AGN210❍06	AGN210❍06Z	6	4.5	4.5	16.7	360	100	9
	AGN210❍09	AGN210❍09Z	9	6.75	6.75	11.1	810	100	13.5
	AGN210❍12	AGN210❍12Z	12	9	9	8.3	1,440	100	18
	AGN210❍24	AGN210❍24Z	24	18	18	5.0	4,800	120	36

❍: For each surface-mounted terminal variation, input the following letter.
A type: A, S type: S

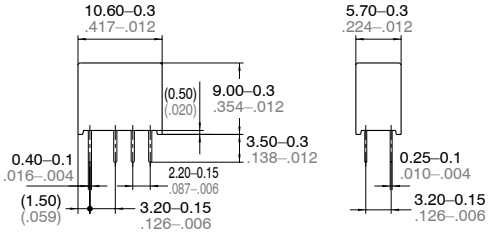
1) Standard packing: 50 pcs.(tube), 500pcs. (tape and reel)in an inner package; 1,000 pcs. in an outer package

2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

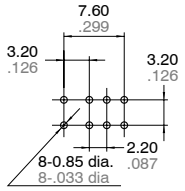
DIMENSIONS

mm inch

1. PC board terminal



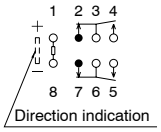
PC board pattern



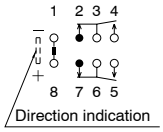
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Single side stable (Deenergized condition)

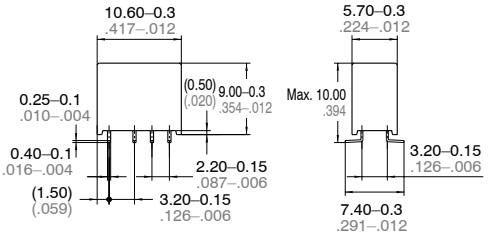


1 coil latching (Reset condition)

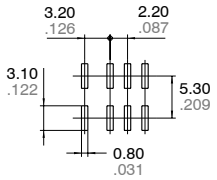


2. Surface-mount terminal

1) A type



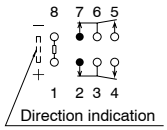
Suggested mounting pad



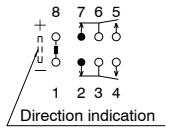
Tolerance: ±0.1 ±.004

Schematic (Top view)

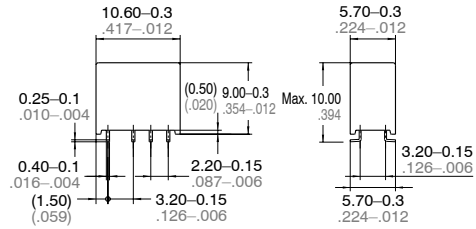
Single side stable (Deenergized condition)



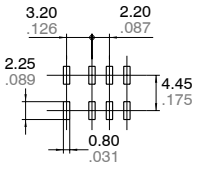
1 coil latching (Reset condition)



1) S type



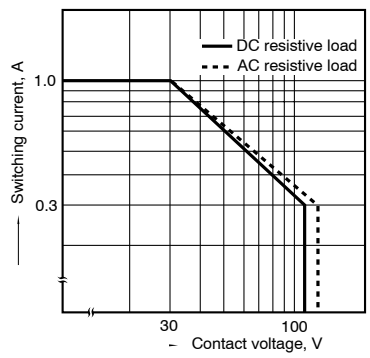
Suggested mounting pad



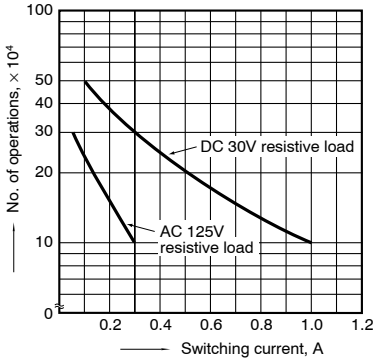
Tolerance: ±0.1 ±.004

REFERENCE DATA

1. Max. switching capacity



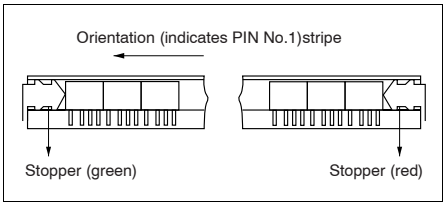
2. Life curve



NOTES

1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

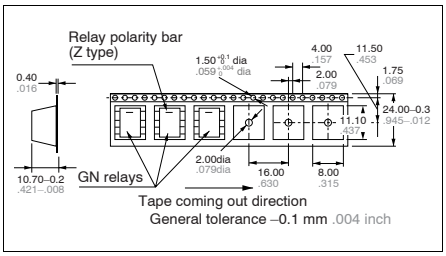


2) Tape and reel packing

(A type)

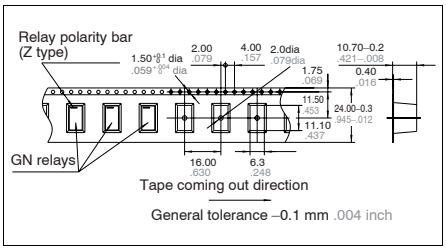
(1)-1 Tape dimensions

mm inch



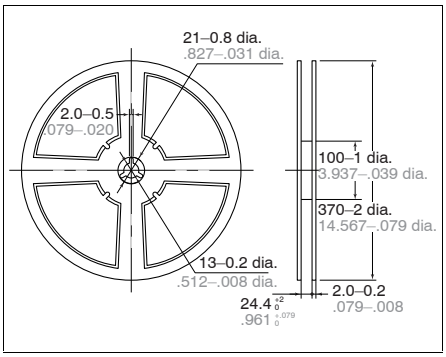
(S type)

(1)-2 Tape dimensions



(2) Dimensions of plastic peel

mm inch



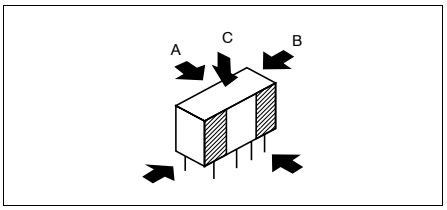
2. Automatic insertion

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.

Chucking pressure in the direction A:
4.9 N {500gf} or less

Chucking pressure in the direction B:
9.8 N {1 kgf} or less

Chucking pressure in the direction C:
9.8 N {1 kgf} or less



Please chuck the ▨ portion.

Avoid chucking the center of the relay.

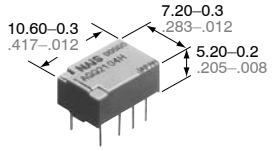
In addition, excessive chucking pressure to the pinpoint of the relay should be avoided.

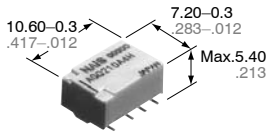
For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

ULTRA-SMALL PACKAGE FLAT POLARIZED RELAY

GQ RELAYS (AGQ)





mm inch

FEATURES

• Compact flat body saves space
With a small footprint of 10.6 mm (L) × 7.2 mm (W) .417 inch (L) × .283 inch (W) for space savings, it also has a very short height of 5.2 mm .205 inch. (Standard PC board type.)

• Outstanding surge resistance.
Surge withstand between open contacts: 1,500 V 10×160 μs (FCC part 68)
Surge withstand between contacts and coil: 2,500 V 2×10 μs (Telcordia)

• The use of twin crossbar contacts ensures high contact reliability.
AgPd contact is used because of its good sulfide resistance. Adopting low-gas molding material. Coil assembly molding technology which avoids generating volatile gas from coil.

• Increased packaging density
Due to highly efficient magnetic circuit design, leakage flux is reduced and changes in electrical characteristics from components being mounted close-together are minimized. This all means a packaging density higher than ever before.

• Nominal operating power: 140 mW

• Outstanding vibration and shock resistance.
Functional shock resistance:
750 m/s² {75G}
Destructive shock resistance:
1,000 m/s² {100G}
Functional vibration resistance:
10 to 55 Hz (at double amplitude of 3.3 mm .130 inch)
Destructive vibration resistance:
10 to 55 Hz (at double amplitude of 5 mm .197 inch)

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1A)			100 mΩ
Contact material			Stationary: AgPd+Au clad Movable: AgPd
Rating	Nominal switching capacity (resistive load)		1 A 30 V DC 0.3 A 125 V AC
	Max. switching power (resistive load)		30 W, 37.5 V A
	Max. switching voltage		110 V DC, 125 V AC
	Max. switching current		1 A
	Min. switching capacity ❋1		10 μA 10 mV DC
Nominal operating power	Single side stable		140mW (1.5 to 12 V DC) 230mW (24 V DC)
	1 coil latching		100mW (1.5 to 12 V DC) 120mW (24 V DC)
Expected life (min. operations)	Mechanical (at 180 cpm)		5×10^7
	Electrical (at 20 cpm)	1 A 30 V DC resistive	10^5
		0.3 A 125 V AC resistive	10^5

Remarks:
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA.
*3 Nominal voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil; contact carrying current: 1 A.
*5 Half-wave pulse of sine wave: 6 ms;detection time: 10μs.
*6 Half-wave pulse of sine wave: 6 ms.
*7 Detection time: 10μs.
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Initial insulation resistance*1		Min. 1,000MΩ (at 500V DC)
Initial breakdown voltage*2	Between open contacts	750 Vrms for 1min.
	Between contact sets	1,000 Vrms for 1min.
	Between contacts and coil	1,500 Vrms for 1min.
Initial surge voltage	Between open contacts (10×160 μs)	1,500 V(FCC Part 68)
	Between contacts and coil (2×10 μs)	2,500 V(Telcordia)
Operate time [Set time]*3 (at 20°C)		Max. 4 ms (Approx. 2 ms) [Max. 4 ms (Approx. 2 ms)]
Release time (without diode) [Reset time]*3 (at 20°C)		Max. 4 ms (Approx. 1 ms) [Max. 4 ms (Approx. 2 ms)]
Temperature rise*4 (at 20°C)		Max. 50°C
Shock resistance	Functional*5	Min. 750 m/s²{75G]
	Destructive*6	Min. 1,000 m/s²{100G]
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temperature ❋2	–40°C to 85°C –40°F to 185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 1 g .035 oz

Notes:
❋1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
❋2 The upper limit for the ambient temperature is the maximum temperature that can satisfy the coil temperature rise. Under the packing condition, allowable temperature range is from –40 to +70°C –40° to +158°F.

TYPICAL APPLICATIONS

- **Communications (XDSL, Transmission)**
- **Measurement**
- **Security**
- **Home appliances, and audio/visual equipment**
- **Automotive equipment**
- **Medical equipment**

ORDERING INFORMATION

Ex. AGQ 2 0 0 A 1 H Z

Contact arrangement	Operating function	Type of operation	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	0: Single side stable 1: 1 coil latching	0: Standard type (B.B.M.)	Nil: Standard PC board terminal A: Surface-mount terminal A type S: Surface-mount terminal S type	1H: 1.5V 09 : 9V 03 : 3V 12 : 12V 4H: 4.5V 24 : 24V 06 : 6V	Nil: Tube packing Z: Tape and reel packing (picked from 5/6/7/8 pin side)

Note: Tape and reel packing symbol "-Z" is not marked on the relay. "X" type tape and reel packing (picked from 1/2/3/4-pin side) is also available. Suffix "X" instead of "Z".

TYPES AND COIL DATA (at 20°C 68°F)

(1) Standard PC board terminal

Operating Function	Part No. Standard PC board terminal	Coil Rating, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	AGQ2001H	1.5	1.13	0.15	93.8	16	140	2.25
	AGQ20003	3	2.25	0.3	46.7	64.2	140	4.5
	AGQ2004H	4.5	3.38	0.45	31	145	140	6.75
	AGQ20006	6	4.5	0.6	23.3	257	140	9
	AGQ20009	9	6.75	0.9	15.5	579	140	13.5
	AGQ20012	12	9	1.2	11.7	1,028	140	18
	AGQ20024	24	18	2.4	9.6	2,504	230	28.8

Operating Function	Part No. Standard PC board terminal	Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
1 coil latching	AGQ2101H	1.5	1.13	1.13	66.7	22.5	100	2.25
	AGQ21003	3	2.25	2.25	33.3	90	100	4.5
	AGQ2104H	4.5	3.38	3.38	22.2	202.5	100	6.75
	AGQ21006	6	4.5	4.5	16.7	360	100	9
	AGQ21009	9	6.75	6.75	11.1	810	100	13.5
	AGQ21012	12	9	9	8.3	1,440	100	18
	AGQ21024	24	18	18	5.0	4,800	120	36

1) Standard packing: 50 pcs. in an inner package (tube); 1,000 pcs. in an outer package
2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

(2) Surface-mount terminal

Operating Function	Part No. Tube packing	Part No. Tape and reel packing	Coil Rating, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	AGQ200❍1H	AGQ200❍1HZ	1.5	1.13	0.15	93.8	16	140	2.25
	AGQ200❍03	AGQ200❍03Z	3	2.25	0.3	46.7	64.2	140	4.5
	AGQ200❍4H	AGQ200❍4HZ	4.5	3.38	0.45	31	145	140	6.75
	AGQ200❍06	AGQ200❍06Z	6	4.5	0.6	23.3	257	140	9
	AGQ200❍09	AGQ200❍09Z	9	6.75	0.9	15.5	579	140	13.5
	AGQ200❍12	AGQ200❍12Z	12	9	1.2	11.7	1,028	140	18
	AGQ200❍24	AGQ200❍24Z	24	18	2.4	9.6	2,504	230	28.8

❍: For each surface-mounted terminal variation, input the following letter.
A type: A, S type: S
1) Standard packing: 50 pcs.(tube), 900pcs. (tape and reel)in an inner package; 1,000 pcs.(tube), 1,800pcs. (tape and reel) in an outer package
2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

Operating Function	Part No.		Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Tube packing	Tape and reel packing							
1 coil latching	AGQ210❍1H	AGQ210❍1HZ	1.5	1.13	1.13	66.7	22.5	100	2.25
	AGQ210❍03	AGQ210❍03Z	3	2.25	2.25	33.3	90	100	4.5
	AGQ210❍4H	AGQ210❍4HZ	4.5	3.38	3.38	22.2	202.5	100	6.75
	AGQ210❍06	AGQ210❍06Z	6	4.5	4.5	16.7	360	100	9
	AGQ210❍09	AGQ210❍09Z	9	6.75	6.75	11.1	810	100	13.5
	AGQ210❍12	AGQ210❍12Z	12	9	9	8.3	1,440	100	18
	AGQ210❍24	AGQ210❍24Z	24	18	18	5.0	4,800	120	36

❍: For each surface-mounted terminal variation, input the following letter.
A type: A, S type: S

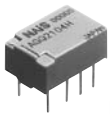
1) Standard packing: 50 pcs.(tube), 900pcs. (tape and reel)in an inner package; 1,000 pcs.(tube), 1,800pcs. (tape and reel) in an outer package

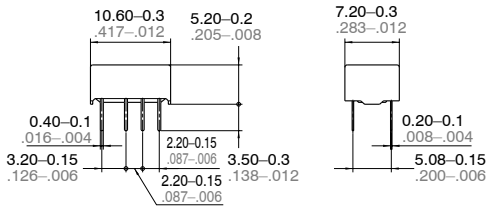
2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

DIMENSIONS

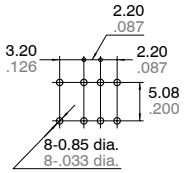
mm inch

1. PC board terminal



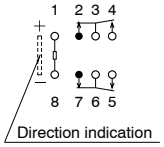


PC board pattern

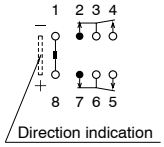


Schematic (Bottom view)

Single side stable (Deenergized condition)



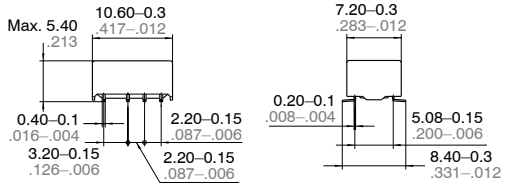
1 coil latching (Reset condition)



Tolerance: ±0.1 ±.004

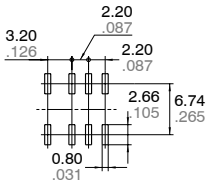
2. Surface-mount terminal

1) A type



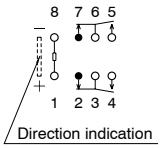
Suggested mounting pad

Single side stable/ 1 coil latching

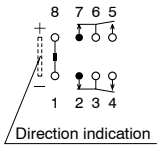


Schematic (Top view)

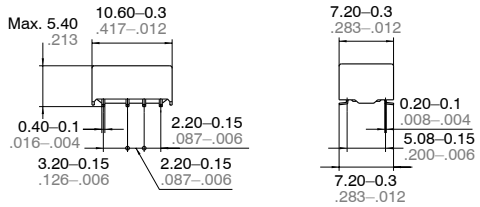
Single side stable (Deenergized condition)



1 coil latcing (Reset condition)

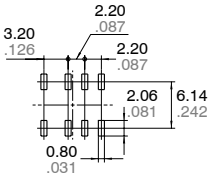


1) S type



Suggested mounting pad

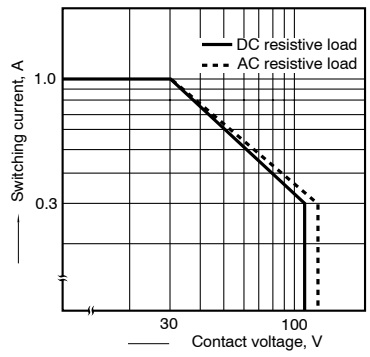
Single side stable/ 1 coil latching



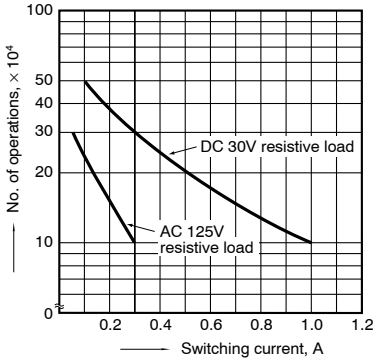
Tolerance: ±0.1 ±.004

REFERENCE DATA

1. Max. switching capacity



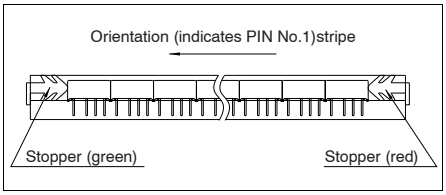
2. Life curve

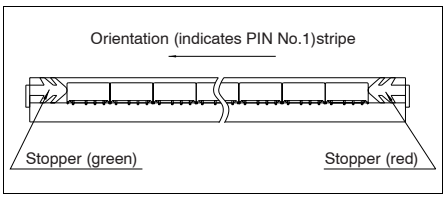


NOTES

1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.



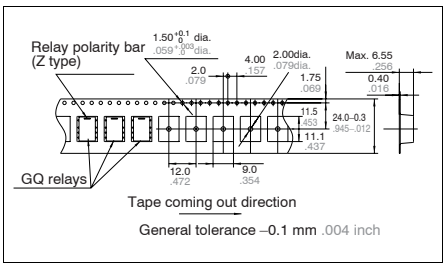


2) Tape and reel packing

(A type)

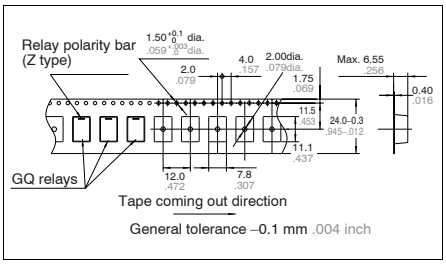
(1)-1 Tape dimensions

mm inch



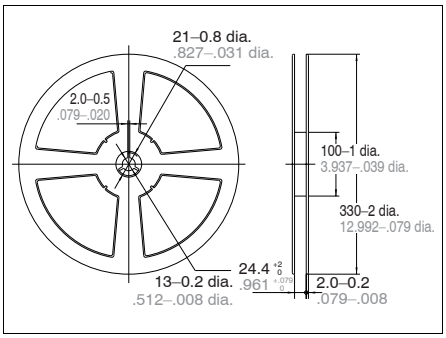
(S type)

(1)-2 Tape dimensions



(2) Dimensions of plastic peel

mm inch



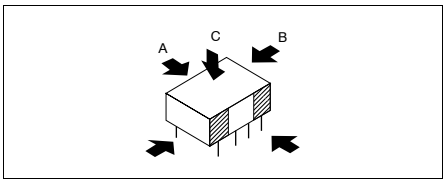
2. Automatic insertion

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.

Chucking pressure in the direction A : 9.8 N {1 kgf} or less

Chucking pressure in the direction B : 9.8 N {1 kgf} or less

Chucking pressure in the direction C : 9.8 N {1 kgf} or less



Please chuck the ▨ portion.

Avoid chucking the center of the relay.

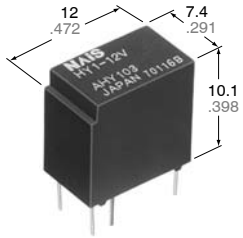
In addition, excessive chucking pressure to the pinpoint of the relay should be also avoided.

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

Non-polarized
1 Form C Relay

HY RELAYS



mm inch

FEATURES

- **High sensitivity: 150 mW/200 mW**
- **A wide range of ambient temperature: –40°C to +70°C –40°F to +158°F**
- **Sealed construction**
- **Rating: 1 A 30 V DC**

SPECIFICATIONS

Contact

Arrangement		1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ
Contact material		Gold-clad silver
Rating (resistive)	Nominal switching capacity	1 A 30 V DC
	Max. switching power	30 W
	Max. switching voltage	60 V DC
	Max. switching current	1 A
	Max. carrying current	2 A
Expected life (min. operations)	Mechanical (at 180 cpm)	10^7
	Electrical (at 20 cpm) 1 A 30 V DC	10^5

Coil

Nominal operating power	Standard type	200 mW
	High sensitivity type	150 mW

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics (at 25°C 77°F, 50% Relative humidity)

Max. operating speed		20 cpm (at nominal voltage)
Initial insulation resistance*1	Between contacts	Min. 100 MΩ at 500 V DC
	Between contact and coil	Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	500 Vrms
	Between contacts and coil	1,000 Vrms
Operate time*3 (at nominal voltage)		Max. 5 ms (approx. 2 ms)
Release time (without diode)*3 (at nominal voltage)		Max. 4 ms (approx. 1 ms)
Temperature rise at nominal voltage Contact carrying current 1 A at 20°C		Max. 50°C
Shock resistance	Functional*4	Min. 98 m/s² (10 G)
	Destructive*5	Min. 980 m/s² (100 G)
Vibration resistance	Functional*6	58.8 m/s² {6 G}, 10 to 55 Hz at double amplitude of 1 mm
	Destructive	117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		1.8 g .063 oz

TYPICAL APPLICATIONS

- Automotive: Switching to small motor
  1) Automirrow controller
  2)Retractable head light controller
- Push button device: Dial pulsing
- Low-voltage signal switching and motor control of small home appliances such as portable video tape recorders and audio devices.
- Operating of dish-control motors for PCs and word processors

ORDERING INFORMATION

Ex. HY [1] [Z] — [3V]

Contact arrangement	Sensitivity	Coil voltage (DC)
1: 1 Form C	Nil: High sensitivity 150 mW Z: Standard 200 mW	1.5, 3, 4.5, 5, 6, 9, 12, 24 V

Standard packing: Carton: 100 pcs. Case 500 pcs.

TYPES AND COIL DATA (at 20°C 68°F)

Standard packing: Carton: 50 pcs. Case: 2,000 pcs.

200 mW Standard type

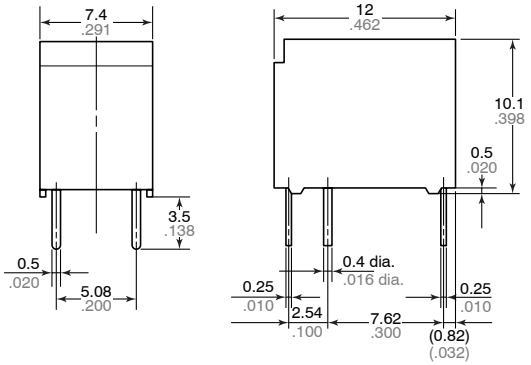
Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
HY1Z-1.5V	1.5	1.125	0.15	11.25	133.3	200	1.8
HY1Z-3V	3	2.25	0.3	45	66.7	200	3.6
HY1Z-4.5V	4.5	3.375	0.45	101.2	44.5	200	5.4
HY1Z-5V	5	3.75	0.5	125	40	200	6
HY1Z-6V	6	4.5	0.6	180	33.3	200	7.2
HY1Z-9V	9	6.75	0.9	405	22.2	200	10.8
HY1Z-12V	12	9	1.2	720	16.7	200	14.4
HY1Z-24V	24	18	2.4	2,880	8.3	200	28.8

150 mW High sensitivity type

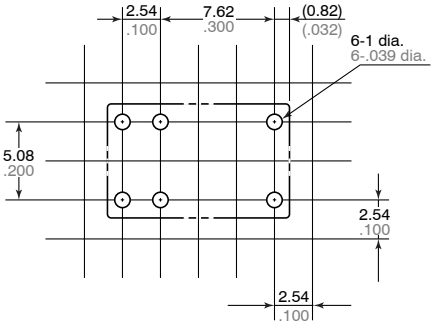
Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
HY1-1.5V	1.5	1.125	0.15	15	100	150	2.1
HY1-3V	3	2.25	0.3	60	50	150	4.2
HY1-4.5V	4.5	3.375	0.45	135	33.3	150	6.3
HY1-5V	5	3.75	0.5	166	30.1	150	7
HY1-6V	6	4.5	0.6	240	25	150	8.4
HY1-9V	9	6.75	0.9	540	16.7	150	12.6
HY1-12V	12	9	1.2	960	12.5	150	16.8
HY1-24V	24	18	2.4	3,840	6.25	150	33.6

DIMENSIONS

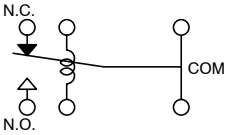
mm inch



PC board pattern (Copper-side view)



Schematic (Bottom view)

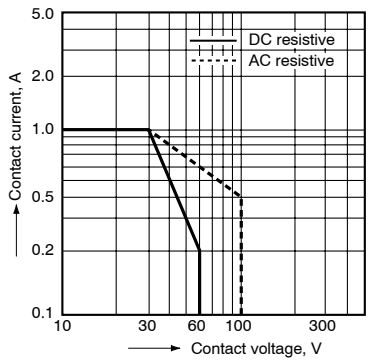


General tolerance: ±0.3 ±.012

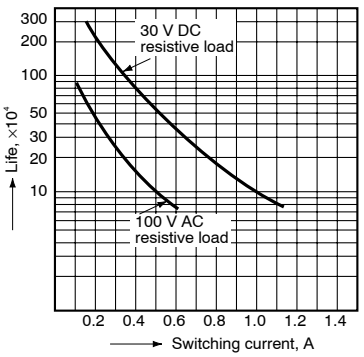
Tolerance: ±0.1 ±.004

REFERENCE DATA

1. Maximum switching power



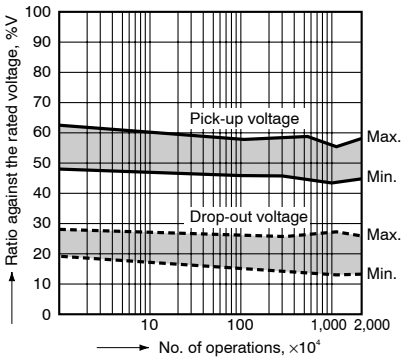
2. Life curve



3. Mechanical life

Tested sample: HY1Z-12V, 10 pcs.

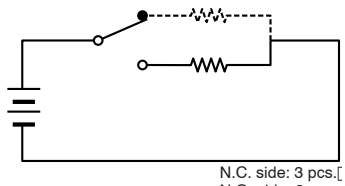
Ambient temperature: 20°C to 25°C 68°F to 77°F



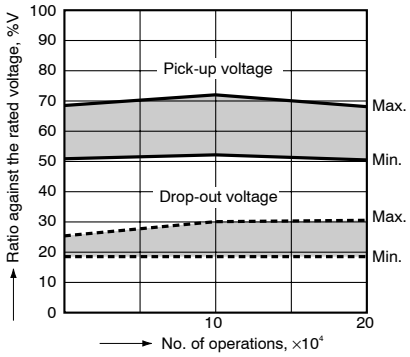
4. Electrical life

Tested sample: HY1-12V, 6 pcs.
Condition: 1 A 30 V DC resistive load, 30 cpm

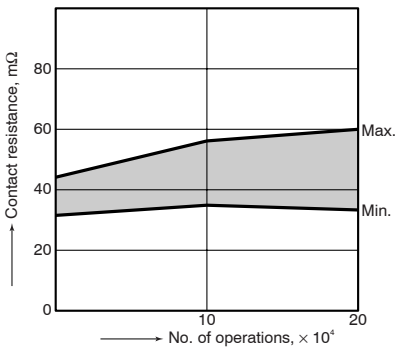
Circuit:



Change of pick-up and drop-out voltage

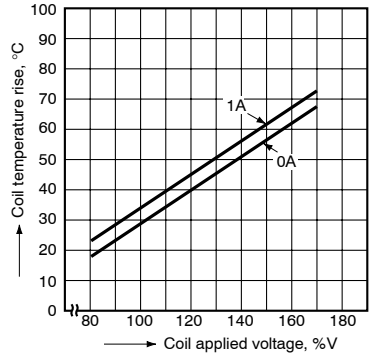


Change of contact resistance



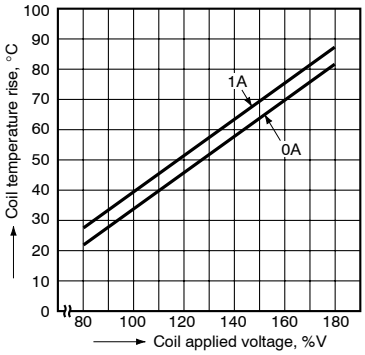
5-(1). Coil temperature rise
(150 mW high sensitivity type)

Tested sample: HY1-9V, 5 pcs.
Ambient temperature:24°C 75°F



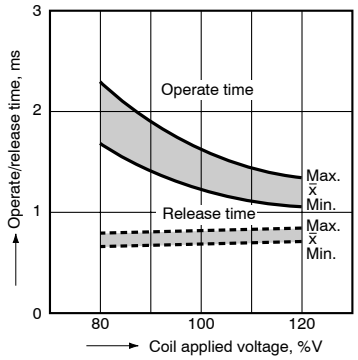
5-(2). Coil temperature rise
(200 mW Standard type)

Tested sample: HY1Z-12V, 5 pcs.
Ambient temperature: 23°C 74°F



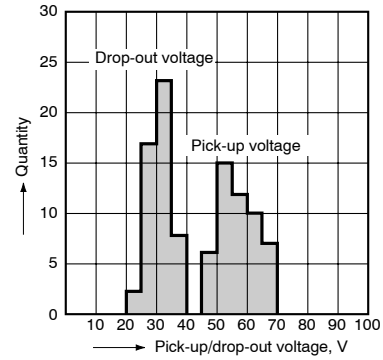
6. Operate/release time characteristics

Tested sample: HY1Z-12V, 5 pcs.
Ambient temperature: 25°C 77°F



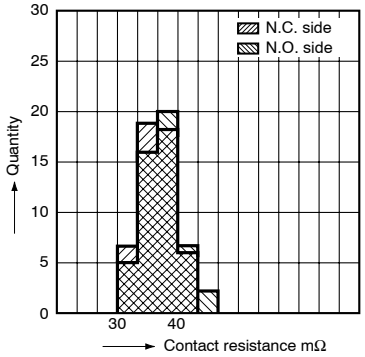
7. Distribution of pick-up and drop-out voltages

Tested sample: HY1-12V, 50 pcs.
Ambient temperature: 23°C 74°F



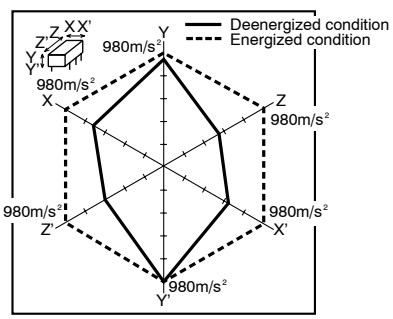
8. Distribution of contact resistance

Tested sample: HY1-12V, 50 pcs.
N.C. side N.O. side



9. Malfunction shock

Tested sample: HY1Z-12V, 6 pcs.



NOTE

Soldering and cleaning

HY relays have the sealed construction. It is possible to do automatic soldering and automatic cleaning, but avoid the ultrasonic cleaning.

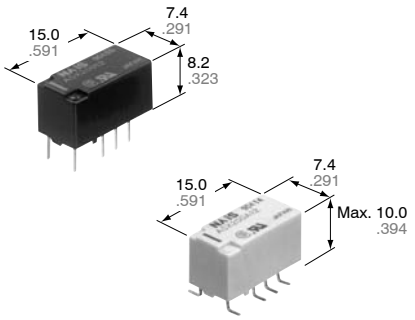
For cleaning, it is recommended that a fluorinated hydrocarbon or other alcoholic solvent be used.

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

HIGH SENSITIVITY RELAY WITH GUARANTEED LOW LEVEL SWITCHING CAPACITY

SX RELAYS (ASX)



mm inch

FEATURES

1. High contact reliability over a long life has been made possible for low level loads.
Using a low level load (1 mV 10μA to 10 V 10 mA) 10^7 operations were achieved with a static contact resistance of Max. 100 mΩ (voltage drop of 20 mV, 1 mA, 1 kHz) and a dynamic contact resistance of Max. 1 Ω (Measurement delay 10 ms, voltage drop of 20 mV, 1 mA, 1 kHz).

2. High sensitivity of 50 mW
By using the highly efficient polar magnetic circuit “seesaw balance armature mechanism”, a rated power consumption of 50 mW (for single side stable type) has been achieved.

3. Low thermal electromotive force
Reducing the heat from the coil enables a thermal electromotive force of 3 μV or less.

SPECIFICATIONS

Contact

Arrangement		2 Form C
Static contact resistance (During initial and electric life tests)*1 (By voltage drop of 20 mV 1 mA [1kHz])		Max. 100 mΩ
Dynamic contact resistance (During initial and electric life tests)*1 (By voltage drop of 20 mV 1 mA[1 kHz], Measurement delay 10 ms after applying nominal coil voltage)		Max. 1 Ω
Contact material		Gold-clad silver alloy
Rating	Nominal switching capacity (resistive load)	10 mA 10 VDC
	Max. switching power	0.1 W
	Max. switching voltage	10 VDC
	Max. switching current	10 mA DC
	Min. switching capacity**1	10 μA 1 mVDC
Nominal operating power	Single side stable	50mW (1.5 to 12 V DC) 70mW (24 V DC)
	1 coil latching	35mW (1.5 to 12 V DC) 50mW (24 V DC)
	2 coil latching	70mW (1.5 to 12 V DC) 150mW (24 V DC)
Thermal electromotive force, max. (at nominal voltage applied to the coil**2)		3 μV
Expected life (min. operations)	Mechanical (at 750 cpm)	5×10^7
	Electrical (at 750 cpm) (10 mA 10 V DC resistive load)	10^7

Notes:
**1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
**2 For single side stable only.

Characteristics

Initial insulation resistance*2		Min. 10,000MΩ (at 500V DC)
Initial breakdown voltage*3	Between open contacts	750 Vrms for 1min.
	Between contact sets	1,000 Vrms for 1min.
	Between contact and coil	1,800 Vrms for 1min.
Operate time [Set time]*4 (at 20°C)		Max. 5 ms (Approx. 3 ms) [Max. 5 ms (Approx. 3 ms)]
Release time (without diode) [Reset time]*4 (at 20°C)		Max. 5 ms (Approx. 1.5 ms) [Max. 5 ms (Approx. 3 ms)]
Temperature rise*5 (at 20°C)		Max. 50°C
Shock resistance	Functional*6	Min. 750 m/s²{75G]
	Destructive*7	Min. 1,000 m/s²{100G]
Vibration resistance	Functional*8	10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to 70°C –40°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 2 g .071 oz

Remarks:
* Specifications will vary with foreign standards certification ratings.
*1 By nominal switching capacity: No. of operations: 10^7
*2 Measurement at same location as "Initial breakdown voltage" section.
*3 Detection current: 10mA.
*4 Nominal voltage applied to the coil, excluding contact bounce time.
*5 By resistive method, nominal voltage applied to the coil; contact carrying current: 10mA.
*6 Half-wave pulse of sine wave: 6 ms; detection time: 10μs.
*7 Half-wave pulse of sine wave: 6 ms.
*8 Detection time: 10μs.
*9 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

TYPICAL APPLICATIONS

This relay will be used for the small load for measuring instruments or others where a stable contact resistance is required.

07/2005

ORDERING INFORMATION

Ex. ASX 2 0 0 A 1 H Z

Contact arrangement	Operating function	Type of operation	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	0: Single side stable 1: 1 coil latching 2: 2 coil latching	0: Standard type (B.B.M.)	Nil: Standard PC board terminal A: Surface-mount terminal	1H: 1.5V 09 : 9V 03 : 3V 12 : 12V 4H: 4.5V 24 : 24V 06 : 6V	Nil: Tube packing Z: Tape and reel packing (piked from 8/9/10/12 pin side)

Note: Tape and reel packing symbol "-Z" is not marked on the relay. "X" type tape and reel packing (picked from 1/3/4/5-pin side) is also available. Suffix "X" instead of "Z".

TYPES AND COIL DATA (at 20°C 68°F)

(1) Standard PC board terminal

1) Standard packing: 40 pcs. in an inner package (tube); 1,000 pcs. in an outer package

2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

Single side stable

Part No. Standard PC board terminal	Coil Rating, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
ASX2001H	1.5	1.2	0.15	33.3	45	50	2.25
ASX20003	3	2.4	0.3	16.7	180	50	4.5
ASX2004H	4.5	3.6	0.45	11.1	405	50	6.75
ASX20006	6	4.8	0.6	8.3	720	50	9
ASX20009	9	7.2	0.9	5.6	1,620	50	13.5
ASX20012	12	9.6	1.2	4.2	2,880	50	18
ASX20024	24	19.2	2.4	2.9	8,229	70	36

1 coil latching

Part No. Standard PC board terminal	Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
ASX2101H	1.5	1.2	1.2	23.3	64.3	35	2.25
ASX21003	3	2.4	2.4	11.7	257	35	4.5
ASX2104H	4.5	3.6	3.6	7.8	579	35	6.75
ASX21006	6	4.8	4.8	5.8	1,029	35	9
ASX21009	9	7.2	7.2	3.9	2,314	35	13.5
ASX21012	12	9.6	9.6	2.9	4,114	35	18
ASX21024	24	19.2	19.2	2.1	11,520	50	36

2 coil latching

Part No. Standard PC board terminal	Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)		Coil resistance, Ω (±10%)		Nominal operating power, mW		Max. allowable voltage, V DC
				Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
ASX2201H	1.5	1.2	1.2	46.7	46.7	32.1	32.1	70	70	2.25
ASX22003	3	2.4	2.4	23.3	23.3	129	129	70	70	4.5
ASX2204H	4.5	3.6	3.6	15.6	15.6	289	289	70	70	6.75
ASX22006	6	4.8	4.8	11.7	11.7	514	514	70	70	9
ASX22009	9	7.2	7.2	7.8	7.8	1,157	1,157	70	70	13.5
ASX22012	12	9.6	9.6	5.8	5.8	2,057	2,057	70	70	18
ASX22024	24	19.2	19.2	6.3	6.3	3,840	3,840	150	150	36

(2) Surface-mount terminal

1) Standard packing: 40 pcs.(tube), 1,000pcs. (tape and reel)in an inner package; 500 pcs.(tube), 1,000pcs. (tape and reel)in an outer package

2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

Single side stable

Part No.		Coil Rating, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Tube packing	Tape and reel packing							
ASX200A1H	ASX200A1HZ	1.5	1.2	0.15	33.3	45	50	2.25
ASX200A03	ASX200A03Z	3	2.4	0.3	16.7	180	50	4.5
ASX200A4H	ASX200A4HZ	4.5	3.6	0.45	11.1	405	50	6.75
ASX200A06	ASX200A06Z	6	4.8	0.6	8.3	720	50	9
ASX200A09	ASX200A09Z	9	7.2	0.9	5.6	1,620	50	13.5
ASX200A12	ASX200A12Z	12	9.6	1.2	4.2	2,880	50	18
ASX200A24	ASX200A24Z	24	19.2	2.4	2.9	8,229	70	36

1 coil latching type

Part No.		Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Tube packing	Tape and reel packing							
ASX210A1H	ASX210A1HZ	1.5	1.2	1.2	23.3	64.3	35	2.25
ASX210A03	ASX210A03Z	3	2.4	2.4	11.7	257	35	4.5
ASX210A4H	ASX210A4HZ	4.5	3.6	3.6	7.8	579	35	6.75
ASX210A06	ASX210A06Z	6	4.8	4.8	5.8	1,029	35	9
ASX210A09	ASX210A09Z	9	7.2	7.2	3.9	2,314	35	13.5
ASX210A12	ASX210A12Z	12	9.6	9.6	2.9	4,114	35	18
ASX210A24	ASX210A24Z	24	19.2	19.2	2.1	11,520	50	36

2 coil latching type

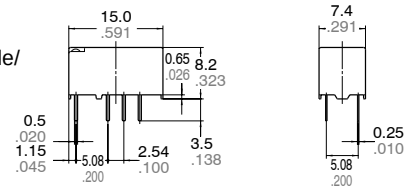
Part No.		Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)		Coil resistance, Ω (±10%)		Nominal operating power, mW		Max. allowable voltage, V DC
Tube packing	Tape and reel packing				Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
ASX220A1H	ASX220A1HZ	1.5	1.2	1.2	46.7	46.7	32.1	32.1	70	70	2.25
ASX220A03	ASX220A03Z	3	2.4	2.4	23.3	23.3	129	129	70	70	4.5
ASX220A4H	ASX220A4HZ	4.5	3.6	3.6	15.6	15.6	289	289	70	70	6.75
ASX220A06	ASX220A06Z	6	4.8	4.8	11.7	11.7	514	514	70	70	9
ASX220A09	ASX220A09Z	9	7.2	7.2	7.8	7.8	1,157	1,157	70	70	13.5
ASX220A12	ASX220A12Z	12	9.6	9.6	5.8	5.8	2,057	2,057	70	70	18
ASX220A24	ASX220A24Z	24	19.2	19.2	6.3	6.3	3,840	3,840	150	150	36

DIMENSIONS

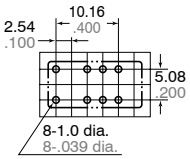
mm inch

1. PC board terminal

Single side stable/
1 coil latching

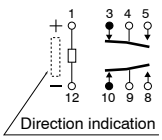


PC board pattern

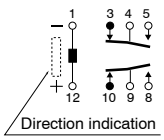


Schematic (Bottom view)

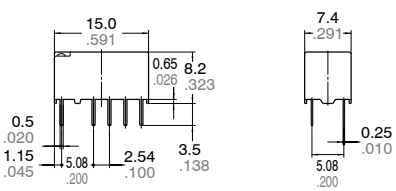
Single side stable
(Deenergized condition)

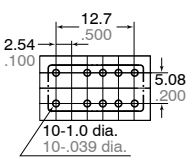


1 coil latching
(Reset condition)

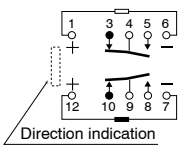


2 coil latching





2 coil latching
(Reset condition)

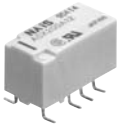


General tolerance: ±0.3 ±.012

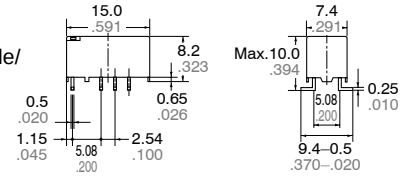
Tolerance: ±0.1 ±.004

2. Surface-mount terminal

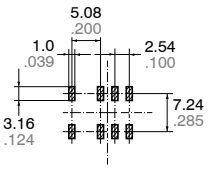
mm inch



Single side stable/
1 coil latching

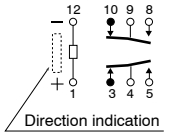


Suggested mounting pad

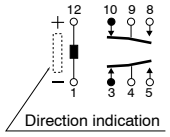


Schematic (Top view)

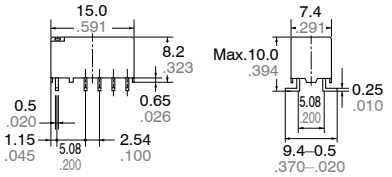
Single side stable (Deenergized condition)



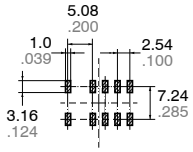
1 coil latching (Reset condition)



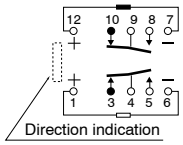
2 coil latching



Suggested mounting pad



2 coil latching (Reset condition)

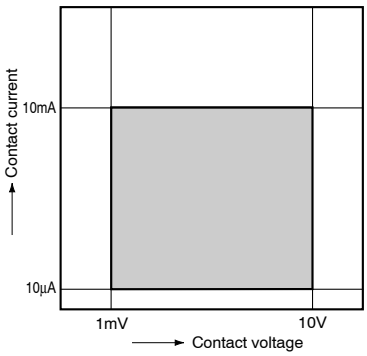


General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.004

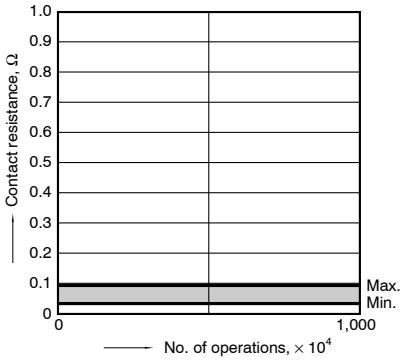
REFERENCE DATA

1. Switching capacity range



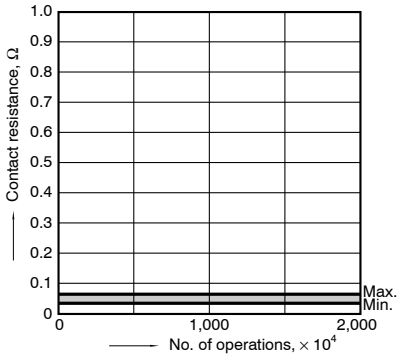
2-(1). Change in dynamic contact resistance (10 mA 10 V DC resistive load)

Tested: ASX20012, Quantity: n=10
Operating frequency: 750 cpm
Measured condition: 10 ms after applying nominal coil voltage, using voltage drop of 20 mV, 1 mA, 1 kHz.



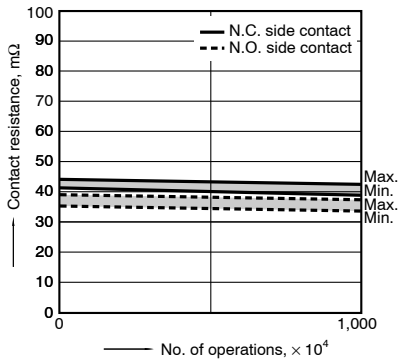
2-(2). Change in dynamic contact resistance (10 μA 1 mV DC resistive load)

Tested: ASX20012, Quantity: n=10
Operating frequency: 750 cpm
Measured condition: 10 ms after applying nominal coil voltage, using voltage drop of 20 mV, 1 mA, 1 kHz.



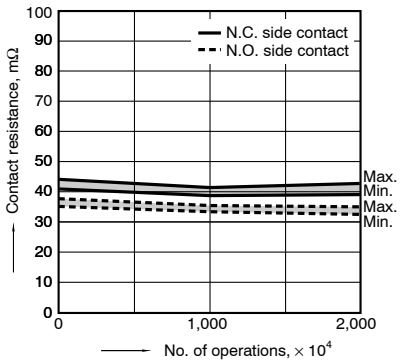
3-(1). Change in static contact resistance (10 mA 10 V DC resistive load)

Tested: ASX20012, Quantity: n=10
Operating frequency: 750 cpm



3-(2). Change in static contact resistance (10 μA 1 mV DC resistive load)

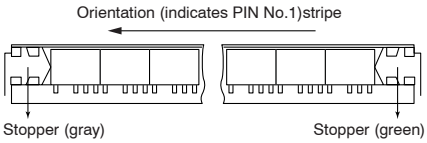
Tested: ASX20012, Quantity: n=10
Operating frequency: 750 cpm



NOTES

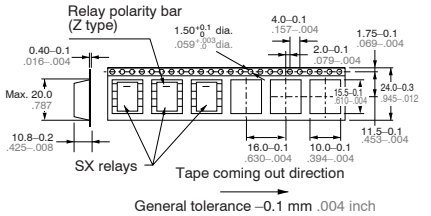
1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

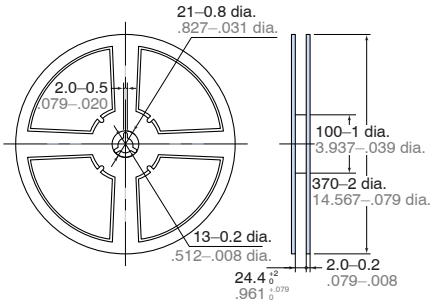


2) Tape and reel packing

(1) Tape dimensions mm inch



(2) Dimensions of plastic reel mm inch

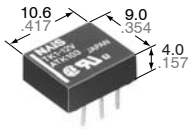


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

ULTRA LOW PROFILE 2 A POLARIZED RELAY

TK RELAYS



mm inch

FEATURES

- **Low profile 4 mm .157 inch height**
- **High contact capacity: 2 A**
- **Surge withstand voltage between contact and coil: 2,500 V (Telcordia)**

SPECIFICATIONS

Contact

Arrangement			1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			50 mΩ
Contact material			Gold-clad silver alloy
Rating	Nominal switching capacity (resistive load)		2 A 30 V DC
	Max. Switching power (resistive load)		60 W
	Max. switching voltage		220 V DC
	Max. switching current		2 A
	Min. switching capacity ※1		10 μA 10 mV DC
Nominal operating power	Single side stable		140 mW (1.5 to 12 V DC) 270 mW (24 V DC)
	1 coil latching		100 mW (1.5 to 12 V DC) 150 mW (24 V DC)
	2 coil latching		200 mW (1.5 to 9 V DC) 250 mW (12 V DC) 400 mW (24 V DC)
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8 (Single side stable)
			5×10^7 (1 or 2 coil latching)
	Electrical (at 20 cpm)	2 A 30 V DC resistive	10^5

Note:

※1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10 μA 1 mV DC – 10 mA 10 V DC])

Characteristics

Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage	Between open contacts	750 Vrms for 1 min. (Detection current: 10 mA)
	Between contact and coil	1,500 Vrms for 1 min. (Detection current: 10 mA)
FCC surge voltage between open contacts (10×160 μs)		1,500 V
Surge voltage between contacts and coil (2×10 μs) [Telcordia]		2,500 V
Temperature rise*2 (at 20°C)		Max. 50°C
Operate time [Set time]*3 (at 20°C)		Max. 3 ms (Approx. 1.5 ms) [Max. 3 ms (Approx. 1 ms)]
Release time [Reset time]*4 (at 20°C)		Max. 2 ms (Approx. 1 ms) [Max. 3 ms (Approx. 1 ms)]
Shock resistance	Functional*5	Min. 750 m/s² {75 G}
	Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*7	196 m/s² {20G}, 10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	294 m/s² {30G}, 10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low	Ambient temperature*9	–40°C to +85°C –40°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 1 g .035 oz.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 By resistive method, nominal voltage applied to the coil; contact carrying current: 2 A.
*3 Nominal voltage applied to the coil, excluding contact bounce time.
*4 Nominal voltage applied to the coil, excluding contact bounce time without diode.
*5 Half-wave pulse of sine wave: 6 ms; detection time: 10 μs.
*6 Half-wave pulse of sine wave: 6 ms.
*7 Detection time: 10 μs.
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).
*9 The maximum ambient temperature allows for coil temperature rise at maximum allowable coil voltage.
As for the applicable range of continuous carrying current against temperature, please refer to "Maximum value of continuous carrying current" chart. (Page 65)

ORDERING INFORMATION

EX. TK [1] — [L2] — [H] — [12V]

Contact arrangement	Operating function	Terminal shape	Coil voltage (DC)
1: 1 Form C	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	Nil: Standard PC board terminal H: Self-clinching terminal	1.5, 3, 4.5, 5, 6, 9, 12, 24V

TYPES AND COIL DATA (at 20°C 68°F)

1. Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TK1-1.5 V	TK1-H-1.5 V	1.5	1.125	0.15	93.8	16	140	2.25
TK1-3 V	TK1-H-3 V	3	2.25	0.3	46.7	64.3	140	4.5
TK1-4.5 V	TK1-H-4.5 V	4.5	3.38	0.45	31.1	145	140	6.7
TK1-5 V	TK1-H-5 V	5	3.75	0.5	28.1	178	140	7.5
TK1-6 V	TK1-H-6 V	6	4.5	0.6	23.3	257	140	9
TK1-9 V	TK1-H-9 V	9	6.75	0.9	15.5	579	140	13.5
TK1-12 V	TK1-H-12 V	12	9	1.2	11.7	1,028	140	18
TK1-24 V	TK1-H-24 V	24	18	2.4	11.3	2,133	270	28.8

2. 1 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TK1-L-1.5 V	TK1-L-H-1.5 V	1.5	1.125	1.125	66.7	22.5	100	2.25
TK1-L-3 V	TK1-L-H-3 V	3	2.25	2.25	33.3	90	100	4.5
TK1-L-4.5 V	TK1-L-H-4.5 V	4.5	3.38	3.38	22.2	202.5	100	6.7
TK1-L-5 V	TK1-L-H-5 V	5	3.75	3.75	20	250	100	7.5
TK1-L-6 V	TK1-L-H-6 V	6	4.5	4.5	16.7	360	100	9
TK1-L-9 V	TK1-L-H-9 V	9	6.75	6.75	11.1	810	100	13.5
TK1-L-12 V	TK1-L-H-12 V	12	9	9	8.3	1,440	100	18
TK1-L-24 V	TK1-L-H-24 V	24	18	18	6.3	3,840	150	28.8

3. 2 Coil latching

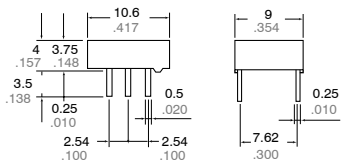
Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TK1-L2-1.5 V	TK1-L2-H-1.5 V	1.5	1.125	1.125	133.9	11.2	200	2.25
TK1-L2-3 V	TK1-L2-H-3 V	3	2.25	2.25	66.7	45	200	4.5
TK1-L2-4.5 V	TK1-L2-H-4.5 V	4.5	3.38	3.38	44.5	101.2	200	6.7
TK1-L2-5 V	TK1-L2-H-5 V	5	3.75	3.75	40	125	200	7.5
TK1-L2-6 V	TK1-L2-H-6 V	6	4.5	4.5	33.3	180	200	9
TK1-L2-9 V	TK1-L2-H-9 V	9	6.75	6.75	22.2	405	200	13.5
TK1-L2-12 V	TK1-L2-H-12 V	12	9	9	20.8	576	250	14.4
TK1-L2-24 V	TK1-L2-H-24 V	24	18	18	16.7	1,440	400	26.4

Notes:
1. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 50 pcs.; Case; 1,000 pcs.
3. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

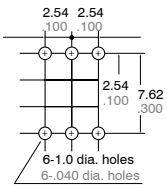
DIMENSIONS

mm inch

Standard PC board terminal

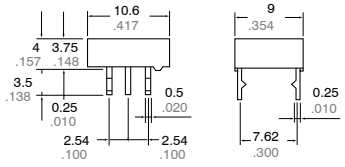


PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

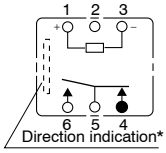
Self-clinching terminal



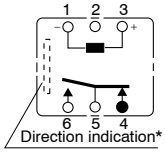
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

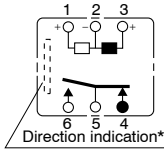
• Single side stable (Deenergized condition)



• 1-coil latching (Reset condition)



• 2-coil latching (Reset condition)

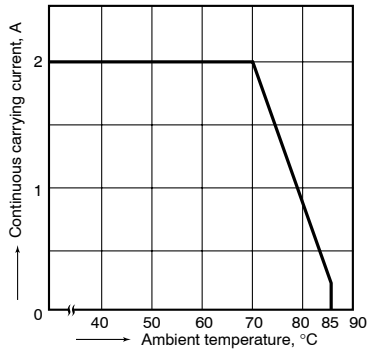


*Orientation stripe located on top of relay.

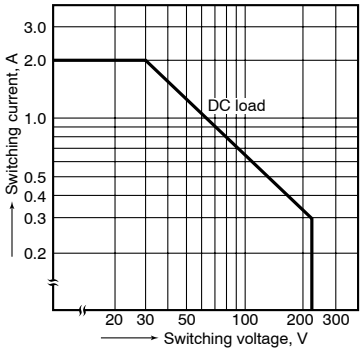
REFERENCE DATA

1. Maximum value of continuous carrying current

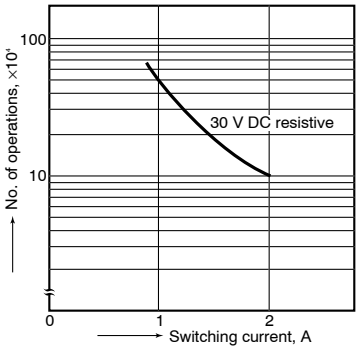
Test conditions:
Coil applied voltage: 110% of rated voltage
Continuous carrying current: 1,000 hours



2. Maximum switching capacity

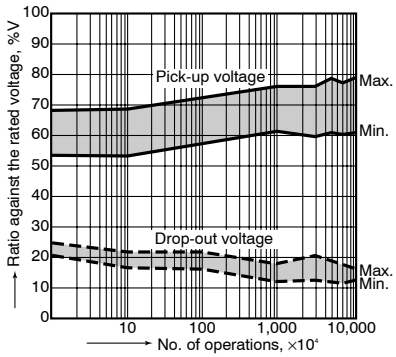


3. Life curve



4. Mechanical life

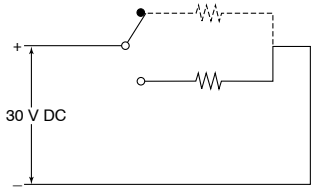
Tested sample: TK1-12V, 8 pcs.
Switching frequency: 30 Hz



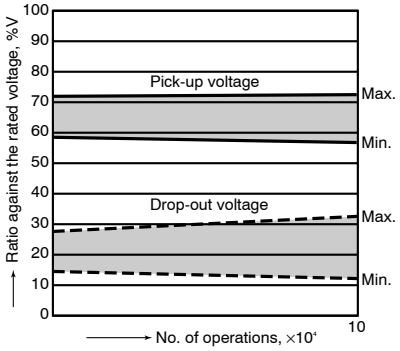
5. Electrical life (DC load)

Tested sample: TK1-12V, 10 pcs.
Condition: 2 A 30 V DC resistive load, 20 cpm

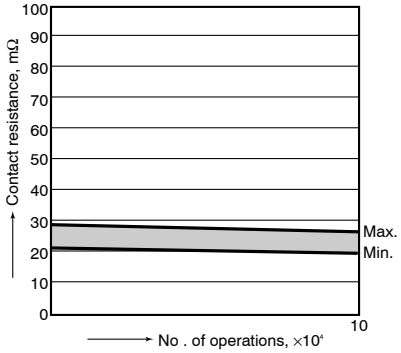
Circuit



Change of pick-up and drop-out voltage

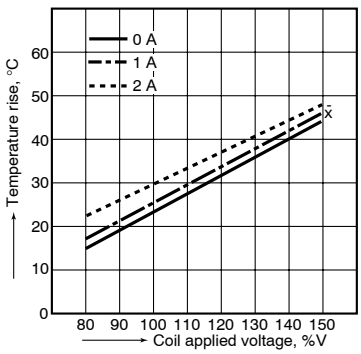


Change of contact resistance

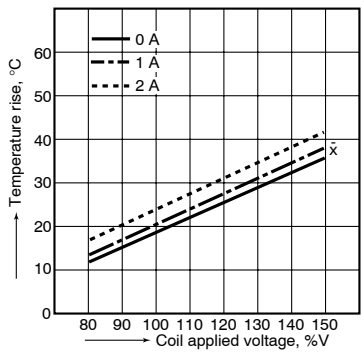


6. Coil temperature rise

Tested sample: TK1-12V, 6 pcs.
Measured portion: Inside the coil
Carrying current: 0 A, 1 A, 2 A
Ambient temperature: 25°C 77°F



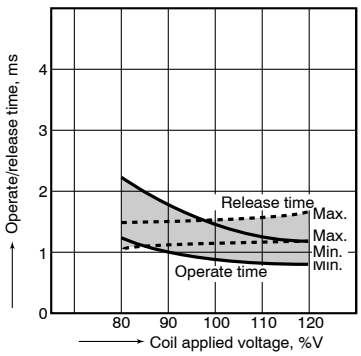
Ambient temperature: 70°C 158°F



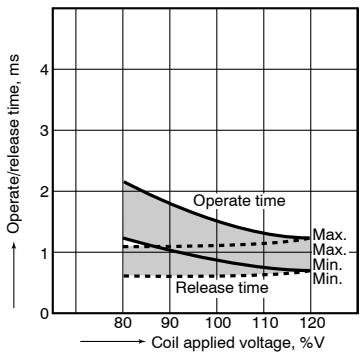
7. Operate/release time characteristics

Tested sample: TK1-5 V, 50 pcs.

<With diode>

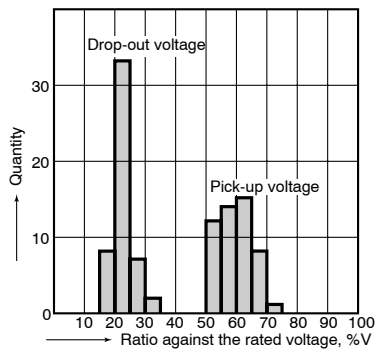


<Without diode>

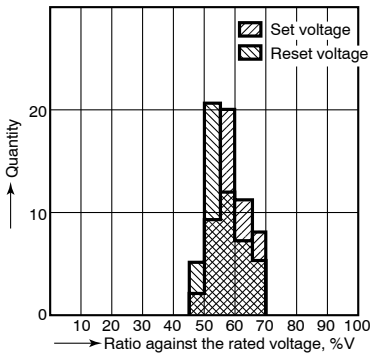


8. Distribution of pick-up and drop-out voltage

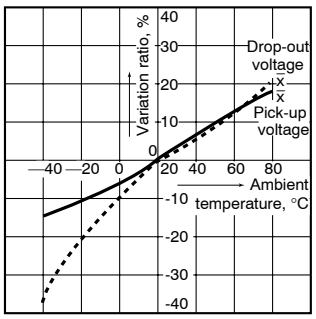
Tested sample: TK1-5V, 50 pcs.



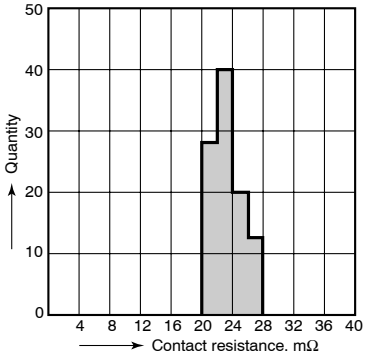
9. Distribution of set and reset voltage
Tested sample: TK1-L2-12V, 50 pcs.



10. Ambient temperature characteristics
Tested sample: TK1-12V, 5 pcs.

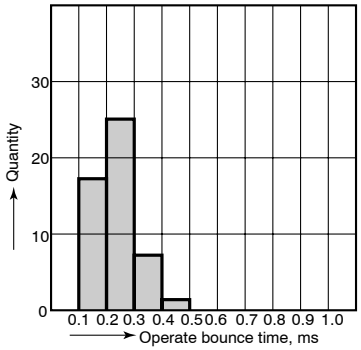


11. Distribution of contact resistance
Tested sample TK1-5V, 50 pcs. (50×2 contacts)

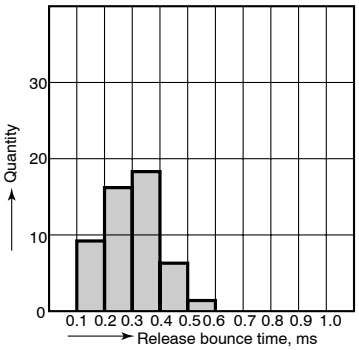


12. Distribution of operate/release bounce time
Tested sample: TK1-5V, 50 pcs.

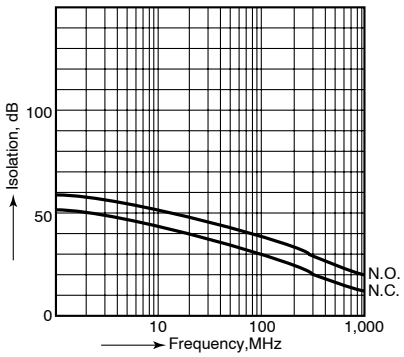
<Operate bounce time>



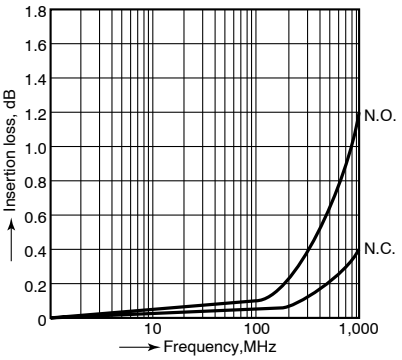
<Release bounce time>



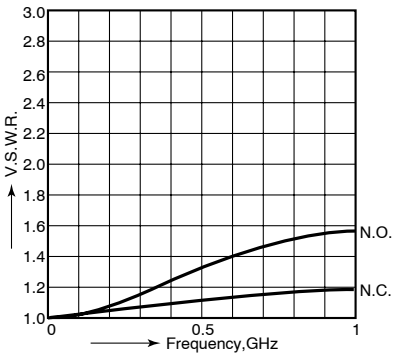
13.-(1) High-frequency characteristics
Isolation characteristics



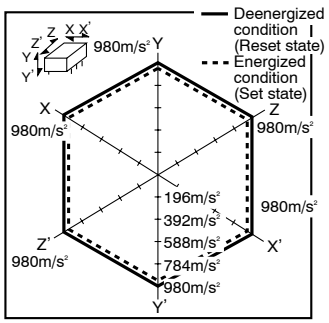
13.-(2) High-frequency characteristics
Insertion loss characteristics



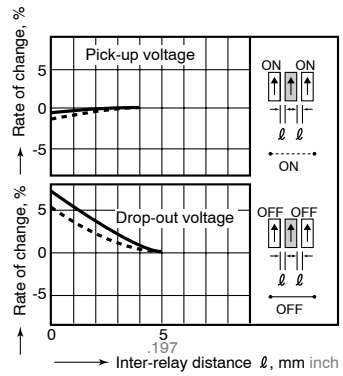
13.-(3) High-frequency characteristics
V.S.W.R.



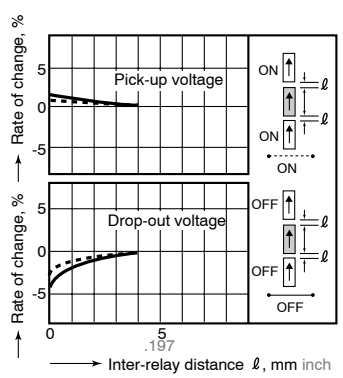
14. Malfunctional shock
Tested sample: TK1-12V, 6 pcs. (single side stable);
TK1-L2-12V, 6 pcs. (latching)



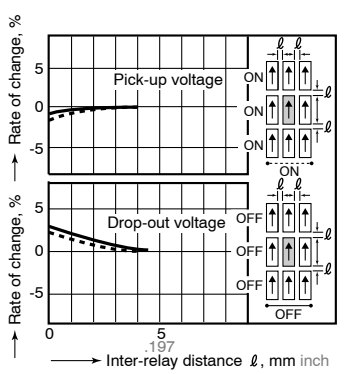
15.-(1) Influence of adjacent mounting



15.-(2) Influence of adjacent mounting

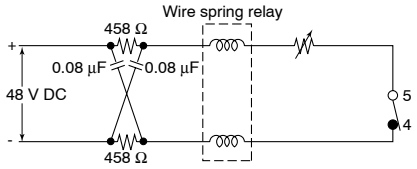


15.-(3) Influence of adjacent mounting

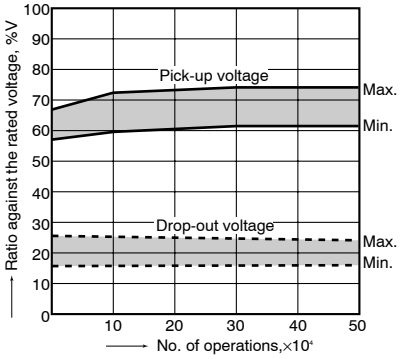


16. Actual load test (35 mA 48 V DC wire spring relay load)

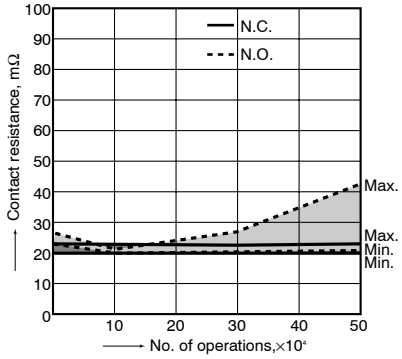
Circuit



Change of pick-up and drop-out voltage



Change of contact resistance

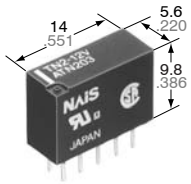


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

SLIM POLARIZED RELAY

TN RELAYS



mm inch

FEATURES

- **Small header area makes higher density mounting possible**
- **High sensitivity: 140 mW nominal operating power (single side stable 3-12 V type)**
- **Surge voltage withstand: 1500 V FCC Part 68**
- **Self-clinching terminal also available**

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1A)			60 mΩ
Contact material			Gold-clad silver
Rating	Nominal switching capacity (resistive load)		1 A 30 V DC, 0.5 A 125 V AC
	Max. switching power (resistive load)		30 W, 62.5 VA
	Max. switching voltage		110 V DC,125 V AC
	Max. switching current		1 A
	Min. switching capacity ※1		10 μA 10 mV DC
Nominal operating power	Single side stable		140 mW (3 to 12 V DC) 200 mW (24 V DC) 300 mW (48 V DC)
	1 coil latching		100 mW (3 to 12 V DC) 150 mW (24 V DC)
	2 coil latching		200 mW (3 to 12 V DC) 300 mW (24 V DC)
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8
	Electrical (at 20 cpm)	1 A 30 V DC resistive load	2×10^5
		0.5 A 125 V AC resistive load	10^5

Note:

※1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10 μA 1 mV DC – 10 mA 10 V DC])

Characteristics

Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage	Between open contacts	750 Vrms for 1 min. (Detection current: 10 mA)
	Between contact and coil	1,000 Vrms for 1 min. (Detection current: 10 mA)
	Between contact sets	1,000 Vrms for 1 min. (Detection current: 10 mA)
FCC surge voltage between open contacts		1,500 V
Temperature rise*2 (at 20°C)		Max. 50°C
Operate time [Set time]*3 (at 20°C)		Max. 3 ms (Approx. 2 ms) [Max. 3 ms (Approx. 2 ms)]
Release time [Reset time]*4 (at 20°C)		Max. 3 ms (Approx. 1 ms) [Max. 3 ms (Approx. 2 ms)]
Shock resistance	Functional*5	Min. 490 m/s² {50G}
	Destructive*6	Min. 980 m/s² {100G}
Vibration resistance	Functional*7	176.4 m/s² {18G}, 10 to 55 Hz at double amplitude of 3 mm
	Destructive	294 m/s² {30G}, 10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 1.5 g .053 oz

Remarks

* Specifications will vary with foreign standards certification ratings.

*1 Measurement at same location as "Initial breakdown voltage" section.

*2 By resistive method, nominal voltage applied to the coil; contact carrying current: 1 A.

*3 Nominal voltage applied to the coil, excluding contact bounce time.

*4 Nominal voltage applied to the coil, excluding contact bounce time without diode.

*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs.

*6 Half-wave pulse of sine wave: 6 ms.

*7 Detection time: 10 μs.

*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

ORDERING INFORMATION

Ex. TN | 2 | — | L2 | — | H | — | 12V

Contact arrangement	Operating function	Terminal shape	Coil voltage(DC)
2: 2 Form C	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	Nil: Standard PC board terminal H: Self-clinching terminal	3,4.5,5,6,9,12, 24,48*V

*48 V coil type: Single side stable only

Note: AgPd stationary contact types available for high resistance against contact sticking. When ordering, please add suffix "-3" like TN2-12V-3.

TYPES AND COIL DATA (at 20°C 68°F)

1. Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TN2-3 V	TN2-H-3 V	3	2.25	0.3	46.7	64.3	140	4.5
TN2-4.5 V	TN2-H-4.5 V	4.5	3.38	0.45	31.1	145	140	6.7
TN2-5 V	TN2-H-5 V	5	3.75	0.5	28.1	178	140	7.5
TN2-6 V	TN2-H-6 V	6	4.5	0.6	23.3	257	140	9
TN2-9 V	TN2-H-9 V	9	6.75	0.9	15.5	579	140	13.5
TN2-12 V	TN2-H-12 V	12	9	1.2	11.7	1,028	140	18
TN2-24 V	TN2-H-24 V	24	18	2.4	8.3	2,880	200	36
TN2-48 V	TN2-H-48 V	48	36	4.8	6.25	7,680	300	57.6

2. 1 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TN2-L-3 V	TN2-L-H-3 V	3	2.25	2.25	33.3	90	100	4.5
TN2-L-4.5 V	TN2-L-H-4.5 V	4.5	3.38	3.38	22.2	202.5	100	6.7
TN2-L-5 V	TN2-L-H-5 V	5	3.75	3.75	20	250	100	7.5
TN2-L-6 V	TN2-L-H-6 V	6	4.5	4.5	16.7	360	100	9
TN2-L-9 V	TN2-L-H-9 V	9	6.75	6.75	11.1	810	100	13.5
TN2-L-12 V	TN2-L-H-12 V	12	9	9	8.3	1,440	100	18
TN2-L-24 V	TN2-L-H-24 V	24	18	18	6.3	3,840	150	36

3. 2 Coil latching

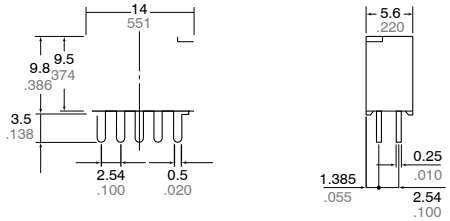
Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TN2-L2-3 V	TN2-L2-H-3 V	3	2.25	2.25	66.7	45	200	4.5
TN2-L2-4.5 V	TN2-L2-H-4.5 V	4.5	3.38	3.38	44.4	101.2	200	6.7
TN2-L2-5 V	TN2-L2-H-5 V	5	3.75	3.75	40	125	200	7.5
TN2-L2-6 V	TN2-L2-H-6 V	6	4.5	4.5	33.3	180	200	9
TN2-L2-9 V	TN2-L2-H-9 V	9	6.75	6.75	22.2	405	200	13.5
TN2-L2-12 V	TN2-L2-H-12 V	12	9	9	16.7	720	200	18
TN2-L2-24 V	TN2-L2-H-24 V	24	18	18	12.5	1,920	300	28.8

Notes:
1. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.
3. In case of 5 V drive circuit, it is recommended to use 4.5 V type relay.
4. AgPd stationary contact types available for high resistance against contact sticking. When ordering, please add suffix "–3" like TN2-12V-3.

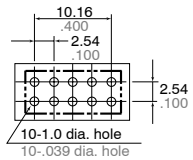
DIMENSIONS

mm inch

Standard PC board terminal

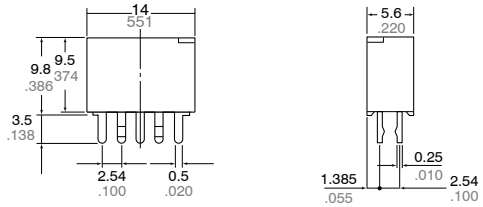


PC board pattern (Copper-side view)



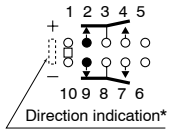
Tolerance: ±0.1 ±.004

Self-clinching terminal

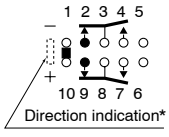


Schematic (Bottom view)

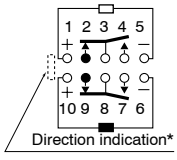
• Single side stable (Deenergized condition)



• 1-coil latching (Reset condition)



• 2-coil latching (Reset condition)

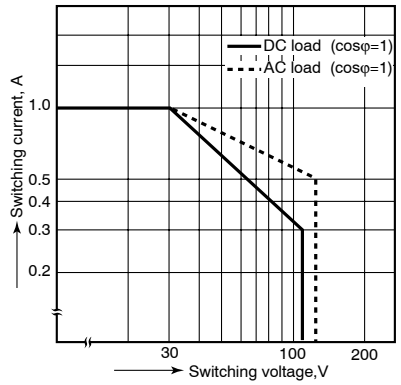


*Orientation stripe located on top of relay

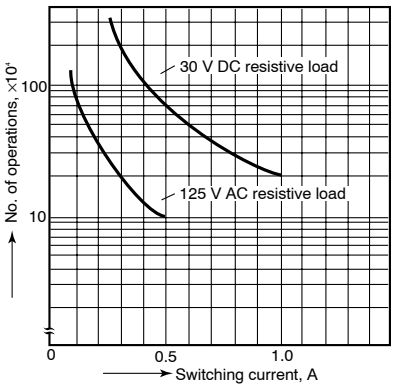
General tolerance: ±0.3 ±.012

REFERENCE DATA

1. Maximum switching capacity

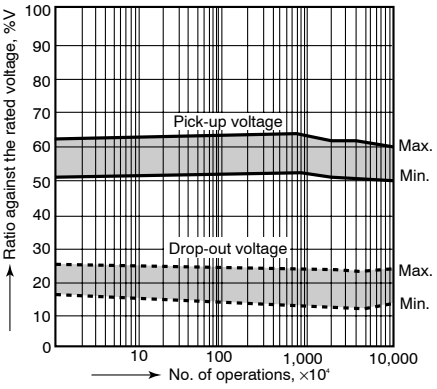


2. Life curve



3. Mechanical life

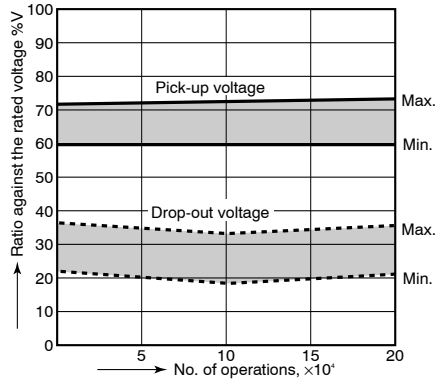
Tested sample: TN2-12V, 10 pcs.



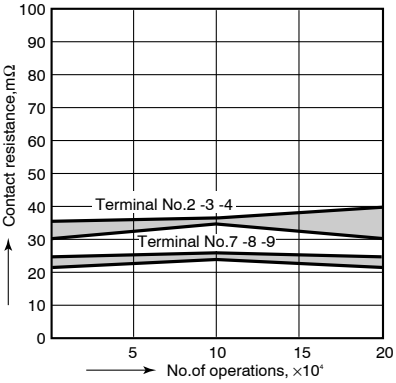
4. Electrical life (DC load)

Tested sample: TN2-12V, 10 pcs.
Condition: 1 A 30 V DC resistive load, 20 cpm

Change of pick-up and drop-out voltage

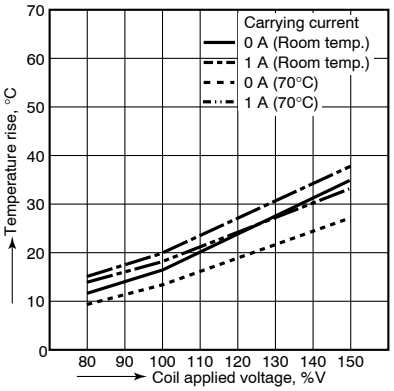


Change of contact resistance



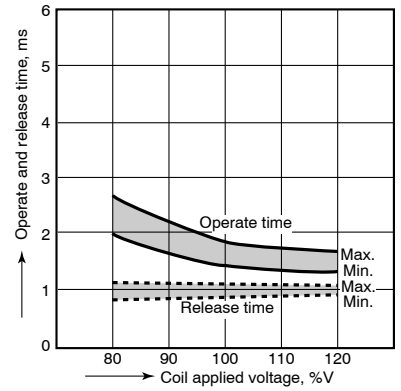
5. Coil temperature rise

Tested sample: TN2-12V
Point measured: Inside the coil
Ambient temperature: Room temperature (25° to 26°C), 70°C (77° to 79°F), 158°F



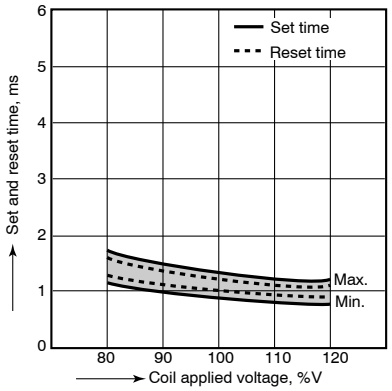
6. Operate/release time characteristics

Tested sample: TN2-12V, 5 pcs.



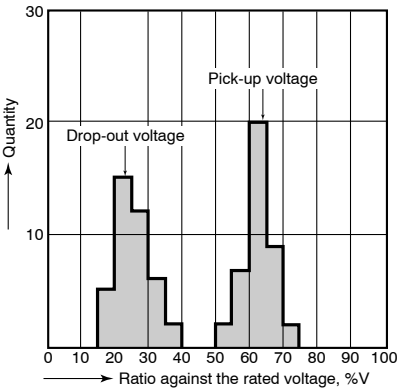
7. Set/reset time characteristics

Tested sample: TN2-L2-12V, 5 pcs.



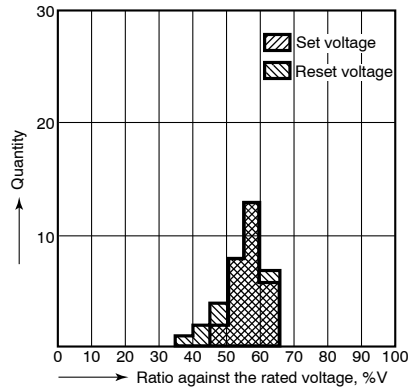
8. Distribution of pick-up and drop-out voltages

Tested sample: TN2-12V, 40 pcs.



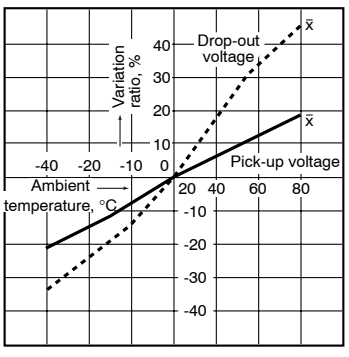
9. Distribution of set and reset voltage

Tested sample: TN2-L2-12V, 32 pcs.



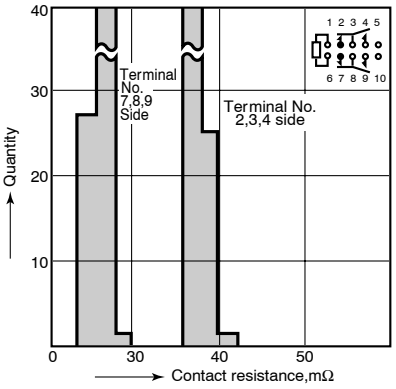
10. Ambient temperature characteristics

Tested sample: TN2-12V, 5 pcs.

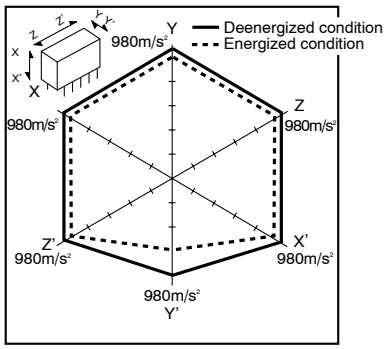


11. Distribution of contact resistance

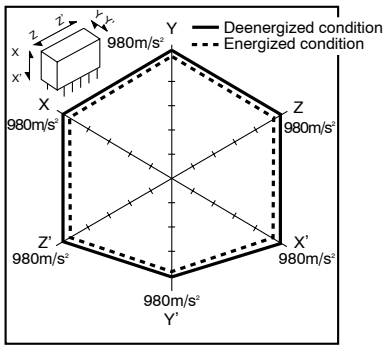
Tested sample: TN2-12V, 38 pcs. (38×4 contacts)



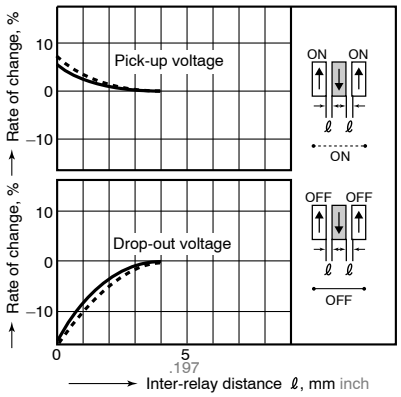
12-(1). Malfunctional shock (single side stable)
Tested sample: TN2-12V, 6 pcs.



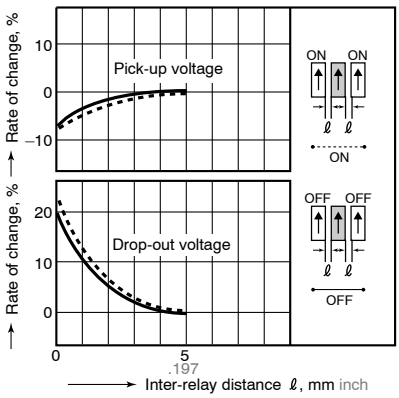
12-(2). Malfunctional shock (latching)
Tested sample: TN2-L2-12V, 6 pcs.



13-(1). Influence of adjacent mounting

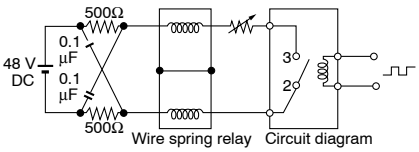


13-(2). Influence of adjacent mounting

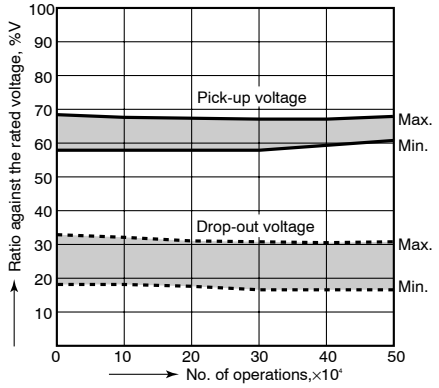


14. Actual load test
(35 mA 48 V DC wire spring relay load)

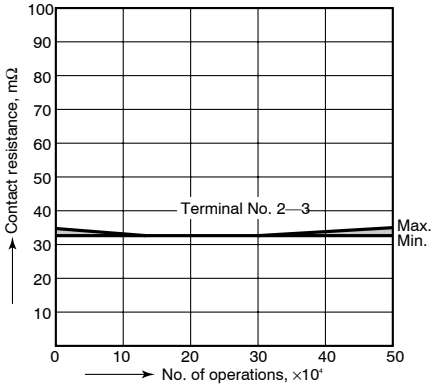
Circuit



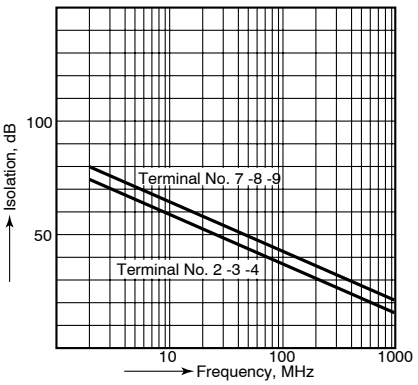
Change of pick-up and drop-out voltage



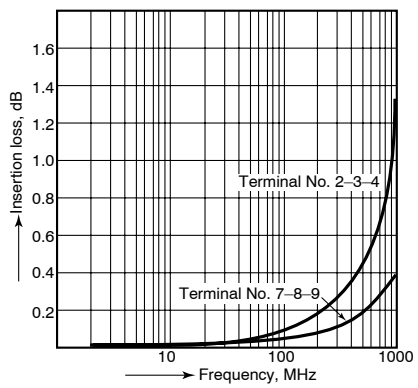
Change of contact resistance



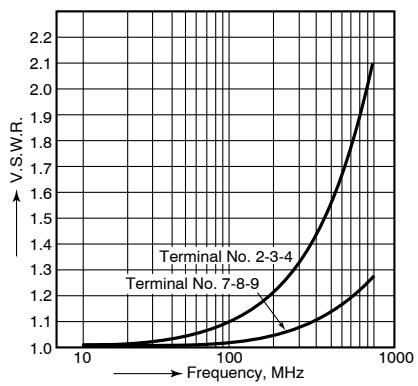
15-(1). High-frequency characteristics
Tested sample: TN2-xxV
Isolation characteristics



15-(2). High-frequency characteristics
Tested sample: TN2-xxV
Insertion loss characteristics



15-(3). High-frequency characteristics
Tested sample: TN2-xxV
V.S.W.R.

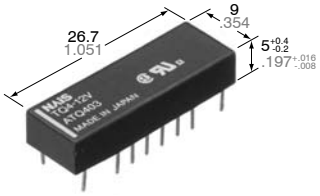


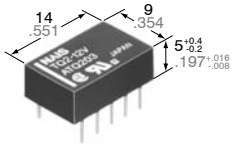
For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

LOW PROFILE
2 FORM C RELAY

TQ RELAYS





mm inch

FEATURES

- **High sensitivity:**
  2 Form C: 140 mW power consumption (single side stable type)
  4 Form C: 280 mW power consumption (single side stable type)
- **Surge voltage withstand: 1500 V FCC Part 68**
- **Sealed construction allows automatic washing**
- **Self-clinching terminal also available**
- **M.B.B. contact types available**

SPECIFICATIONS

Contact

			Standard (B.B.M) type		M.B.B.type
Arrangement			2 Form C	4 Form C	2 Form D
Initial contact resistance, max. (By voltage drop 6 V DC 1A)			50 mΩ		
Contact material			Gold-clad silver		
Rating	Nominal switching capacity (resistive load)		1 A 30 V DC 0.5 A 125 V AC		1 A 30 V DC
	Max. switching power (resistive load)		30 W, 62.5 V A		30 W
	Max. switching voltage		110 V DC, 125 V AC		110 V DC
	Max. switching current		1 A		
	Min. switching capacity ※1		10 μA 10 mV DC		
Nominal operating power	Single side stable		140 mW (3 to 12 V DC) 200 mW (24 V DC) 300 mW (48 V DC)	280 mW (3 to 24 V DC) 400 mW (48 V DC)	200 mW
	1 coil latching		100 mW (3 to 12 V DC) 150 mW (24 V DC)	200 mW	—
	2 coil latching		200 mW (3 to 12 V DC) 300 mW (24 V DC)	400 mW	—
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8		10^7
	Electrical (at 20 cpm) (1 A 30 V DC resistive)	1 A 30 V DC resistive	2×10^5		10^5
		0.5 A 125 V AC resistive	10^5		—

Note:

※1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10 μA 1 mV DC – 10 mA 10 V DC])

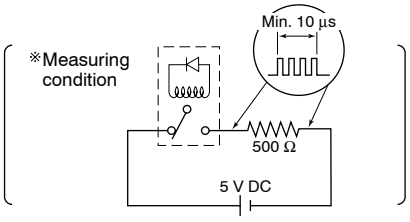
Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 By resistive method, nominal voltage applied to the coil; contact carrying current: 1 A.
*3 Nominal voltage applied to the coil, excluding contact bounce time.
*4 Nominal voltage applied to the coil, excluding contact bounce time without diode.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs.
*6 Half-wave pulse of sine wave: 6 ms.
*7 Detection time: 10 μs.

Characteristics

		Standard (B.B.M) type	M.B.B.type
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)	
Initial breakdown voltage	Between open contacts	750 Vrms for 1 min. (Detection current: 10 mA)	300 Vrms for 1 min. (Detection current: 10 mA)
	Between contact and coil	1,000 Vrms for 1 min. (Detection current: 10 mA)	
	Between contact sets	1,000 Vrms for 1 min. (Detection current: 10 mA)	
FCC surge voltage between open contacts		1,500 V	
Operate time [Set time]*3 (at 20°C)		Max. 3 ms (Approx. 2 ms) [Max. 3 ms (Approx. 2 ms)]	
Release time [Reset time]*4 (at 20°C)		Max. 3 ms (Approx. 1 ms) [Max. 3 ms (Approx. 2 ms)]	
M.B.B. time*8		—	Min. 10 μs.
Temperature rise*2 (at 20°C)		Max. 50°C	
Shock resistance	Functional*5	Min. 490 m/s² {50G}	
	Destructive*6	Min. 980 m/s² {100G}	
Vibration resistance	Functional*7	176.4 m/s² {18G}, 10 to 55 Hz at double amplitude of 3 mm	
	Destructive	294 m/s² {30G}, 10 to 55 Hz at double amplitude of 5 mm	
Conditions for operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +70°C –40°F to +158°F	–40°C to +50°C –40°F to +122°F
	Humidity	5 to 85% R.H.	
Unit weight	2 Form C:	Approx. 1.5 g .053 oz	
	4 Form C:	Approx. 3 g .106 oz.	—

*8 M.B.B. time:



*9 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

ORDERING INFORMATION

EX. TQ [2] [H] — [L2] — [2M] — [3V]

Contact arrangement	Terminal shape	Operating function	MBB function	Coil voltage (DC)
2: 2 Form C 4: 4 Form C	Nil: Standard PC board terminal H: Self-clinching terminal	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	Nil: Standard (B.B.M.) type 2M: 2M.B.B. type	3, 4.5, 5, 6, 9, 12, 24, 48* V

*48 V coil type: Single side stable only

Notes: 1. AgPd stationary contact types available for high resistance against contact sticking. When ordering, please add suffix "-3" like TQ2-12V-3.
2. M.B.B. contact types are available only for TQ2 type.

TYPES AND COIL DATA (at 20°C 68°F)

1. Standard (B.B.M.) type

2 Form C type

1. Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TQ2-3 V	TQ2H-3 V	3	2.25	0.3	46.7	64.3	140	4.5
TQ2-4.5 V	TQ2H-4.5 V	4.5	3.38	0.45	31.1	144.6	140	6.7
TQ2-5 V	TQ2H-5 V	5	3.75	0.5	28.1	178	140	7.5
TQ2-6 V	TQ2H-6 V	6	4.5	0.6	23.3	257	140	9
TQ2-9 V	TQ2H-9 V	9	6.75	0.9	15.5	579	140	13.5
TQ2-12 V	TQ2H-12 V	12	9	1.2	11.7	1,028	140	18
TQ2-24 V	TQ2H-24 V	24	18	2.4	8.3	2,880	200	36
TQ2-48 V	TQ2H-48 V	48	36	4.8	6.25	7,680	300	57.6

2. 1 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TQ2-L-3 V	TQ2H-L-3 V	3	2.25	2.25	33.3	90	100	4.5
TQ2-L-4.5 V	TQ2H-L-4.5 V	4.5	3.38	3.38	22.2	202.5	100	6.7
TQ2-L-5 V	TQ2H-L-5 V	5	3.75	3.75	20	250	100	7.5
TQ2-L-6 V	TQ2H-L-6 V	6	4.5	4.5	16.7	360	100	9
TQ2-L-9 V	TQ2H-L-9 V	9	6.75	6.75	11.1	810	100	13.5
TQ2-L-12 V	TQ2H-L-12 V	12	9	9	8.3	1,440	100	18
TQ2-L-24 V	TQ2H-L-24 V	24	18	18	6.3	3,840	150	36

3. 2 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TQ2-L2-3 V	TQ2H-L2-3 V	3	2.25	2.25	66.7	45	200	4.5
TQ2-L2-4.5 V	TQ2H-L2-4.5 V	4.5	3.38	3.38	44.4	101.2	200	6.7
TQ2-L2-5 V	TQ2H-L2-5 V	5	3.75	3.75	40	125	200	7.5
TQ2-L2-6 V	TQ2H-L2-6 V	6	4.5	4.5	33.3	180	200	9
TQ2-L2-9 V	TQ2H-L2-9 V	9	6.75	6.75	22.2	405	200	13.5
TQ2-L2-12 V	TQ2H-L2-12 V	12	9	9	16.7	720	200	18
TQ2-L2-24 V	TQ2H-L2-24 V	24	18	18	12.5	1,920	300	28.8

Notes: 1. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.
3. In case of 5 V transistor drive circuit, it is recommend to use 4.5 V type relay.
4. AgPd stationary contact types available for high resistance against contact sticking. When ordering, please add suffix “–3” like TQ2-12V-3.

4 Form C type

1. Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TQ4-3 V	TQ4H-3 V	3	2.25	0.3	93.8	32	280	4.5
TQ4-4.5 V	TQ4H-4.5 V	4.5	3.38	0.45	62.2	72.3	280	6.7
TQ4-5 V	TQ4H-5 V	5	3.75	0.5	56.2	89	280	7.5
TQ4-6 V	TQ4H-6 V	6	4.5	0.6	46.5	129	280	9
TQ4-9 V	TQ4H-9 V	9	6.75	0.9	31.1	289	280	13.5
TQ4-12 V	TQ4H-12 V	12	9	1.2	23.3	514	280	18
TQ4-24 V	TQ4H-24 V	24	18	2.4	11.7	2,056	280	36
TQ4-48 V	TQ4H-48 V	48	36	4.8	8.3	5,760	400	57.6

2. 1 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TQ4-L-3 V	TQ4H-L-3 V	3	2.25	2.25	66.6	45	200	4.5
TQ4-L-4.5 V	TQ4H-L-4.5 V	4.5	3.38	3.38	44.4	101.2	200	6.7
TQ4-L-5 V	TQ4H-L-5 V	5	3.75	3.75	40	125	200	7.5
TQ4-L-6 V	TQ4H-L-6 V	6	4.5	4.5	33.3	180	200	9
TQ4-L-9 V	TQ4H-L-9 V	9	6.75	6.75	22.2	405	200	13.5
TQ4-L-12 V	TQ4H-L-12 V	12	9	9	16.7	720	200	18
TQ4-L-24 V	TQ4H-L-24 V	24	18	18	8.3	2,880	200	36

3. 2 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TQ4-L2-3 V	TQ4H-L2-3 V	3	2.25	2.25	133	22.5	400	4.5
TQ4-L2-4.5 V	TQ4H-L2-4.5 V	4.5	3.38	3.38	88.9	50.6	400	6.7
TQ4-L2-5 V	TQ4H-L2-5 V	5	3.75	3.75	80	62.5	400	7.5
TQ4-L2-6 V	TQ4H-L2-6 V	6	4.5	4.5	66.6	90	400	9
TQ4-L2-9 V	TQ4H-L2-9 V	9	6.75	6.75	44.4	202.5	400	13.5
TQ4-L2-12 V	TQ4H-L2-12 V	12	9	9	33.3	360	400	18
TQ4-L2-24 V	TQ4H-L2-24 V	24	18	18	16.7	1,440	400	36

Notes: 1. Specified value of the pick-up, drop-out, voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.
3. In case of 5 V transistor drive circuit, it is recommend to use 4.5 V type relay.
4. 1 coil latching and 2 coil latching types are also available by request. Please consult us for details.
5. AgPd stationary contact types available for high resistance against contact sticking. When ordering, please add suffix “–3” like TQ2-12V-3.

2. M.B.B. type

Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TQ2-2M-3 V	TQ2H-2M-3 V	3	2.4	0.3	66.7	45	200	4.5
TQ2-2M-4.5 V	TQ2H-2M-4.5 V	4.5	3.6	0.45	44.4	101	200	6.7
TQ2-2M-5 V	TQ2H-2M-5 V	5	4	0.5	40	125	200	7.5
TQ2-2M-6 V	TQ2H-2M-6 V	6	4.8	0.6	33.3	180	200	9
TQ2-2M-9 V	TQ2H-2M-9 V	9	7.2	0.9	22.2	405	200	13.5
TQ2-2M-12 V	TQ2H-2M-12 V	12	9.6	1.2	16.7	720	200	18
TQ2-2M-24 V	TQ2H-2M-24 V	24	19.2	2.4	8.3	2,880	200	36

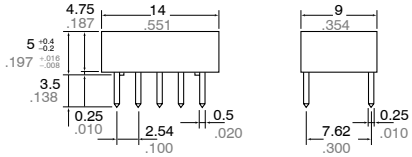
Notes: 1. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.
3. In case of 5 V transistor drive circuit, it is recommend to use 4.5 V type relay.
4. AgPd stationary contact types available for high resistance against contact sticking. When ordering, please add suffix “–3” like TQ2-12V-3.

DIMENSIONS

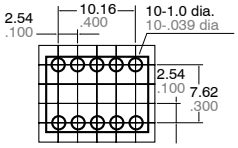
mm inch

1) 2 Form C, 2 Form D

Standard PC board terminal

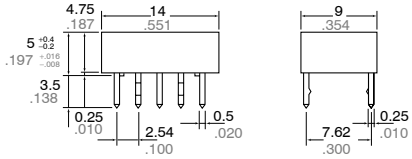


PC board pattern (Copper-side view)



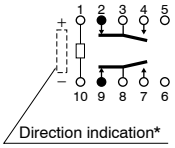
Tolerance: ±0.1 ±.004

Self-clinching terminal

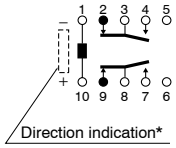


Schematic (Bottom view)

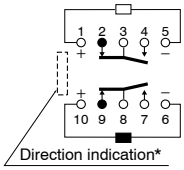
• Single side stable (Deenergized condition)



• 1-coil latching (Reset condition)



• 2-coil latching (Reset condition)

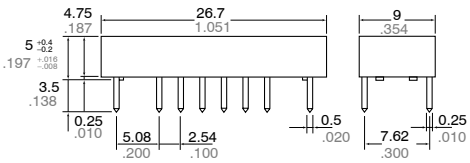


*Orientation stripe typical-located on top of relay

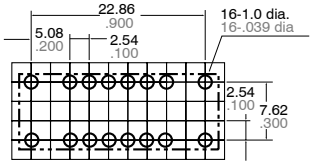
General tolerance: ±0.3 ±.012

2) 4 Form C

Standard PC board terminal

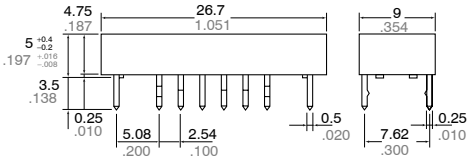


PC board pattern (Copper-side view)



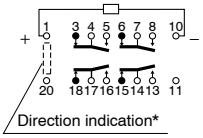
Tolerance: ±0.1 ±.004

Self-clinching terminal

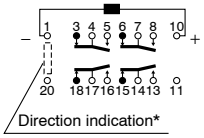


Schematic (Bottom view)

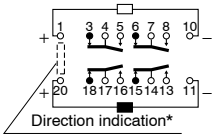
• Single side stable (Deenergized condition)



• 1-coil latching (Reset condition)



• 2-coil latching (Reset condition)

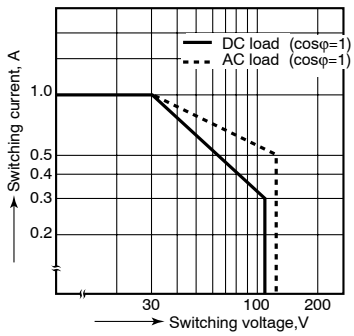


*Orientation stripe typical-located on top of relay

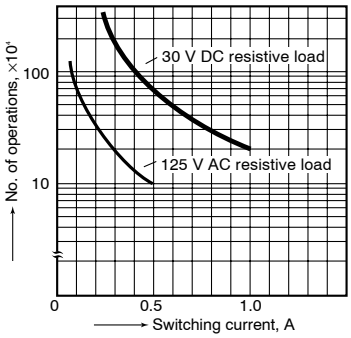
General tolerance: ±0.3 ±.012

REFERENCE DATA

1. Maximum switching capacity

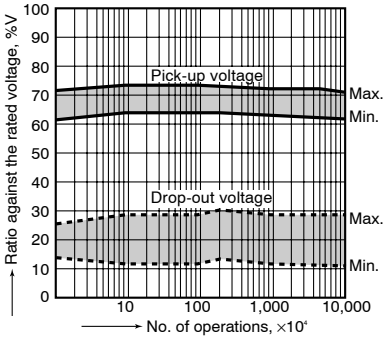


2. Life curve

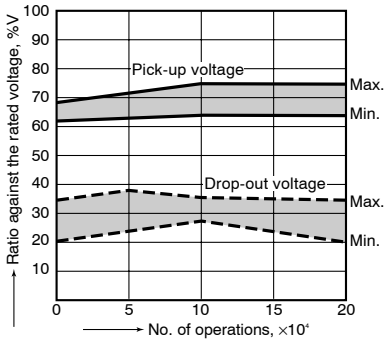


3. Mechanical life

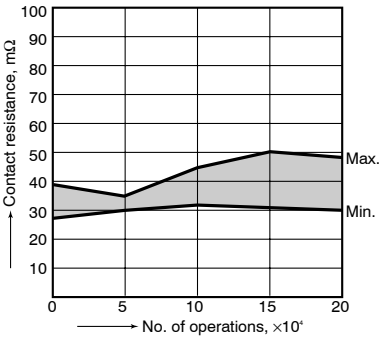
Tested sample: TQ2-12V, 10 pcs.



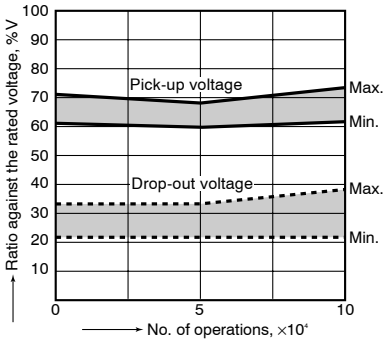
4.-(1) Electrical life (DC load)
Tested sample: TQ2-12V, 6 pcs.
Condition: 1 A 30 V DC resistive load, 20 cpm
Change of pick-up and drop-out voltage



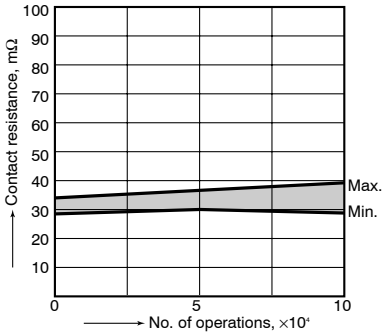
Change of contact resistance



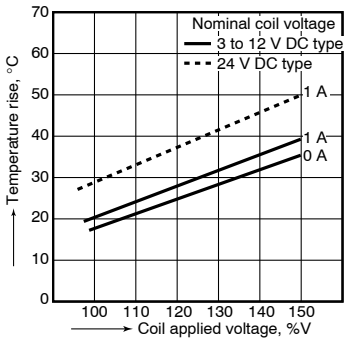
4.-(2) Electrical life (AC load)
Tested sample: TQ2-12V, 6 pcs.
Condition: 0.5 A 125 V AC resistive load, 20 cpm
Change of pick-up and drop-out voltage



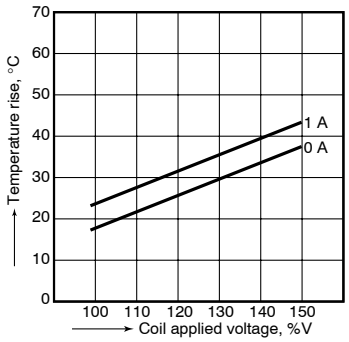
Change of contact resistance



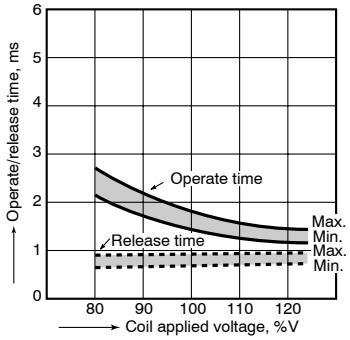
5.-(1) Coil temperature rise (2C)
Tested sample: TQ2-12V
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



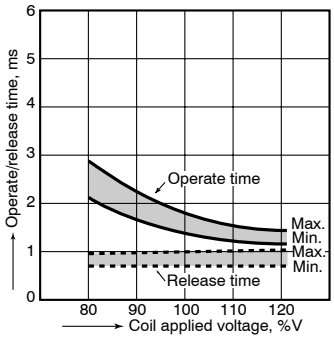
5.-(2) Coil temperature rise (4C)
Tested sample: TQ4-12V
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



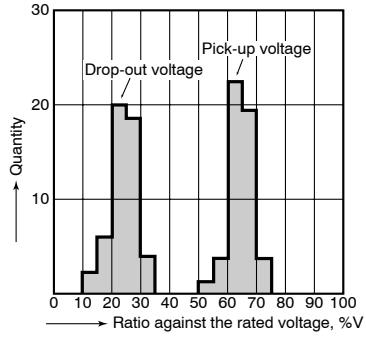
6.-(1) Operate/release time characteristics
Tested sample: TQ2-12V, 10 pcs.



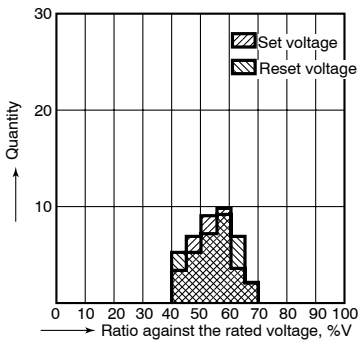
6.-(2) Operate/release time characteristics
Tested sample: TQ4-12V, 10 pcs.



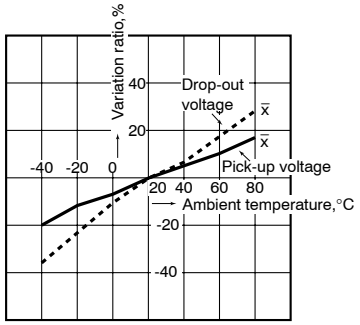
7. Distribution of pick-up and drop-out voltages
Tested sample: TQ2-12V, 50 pcs.



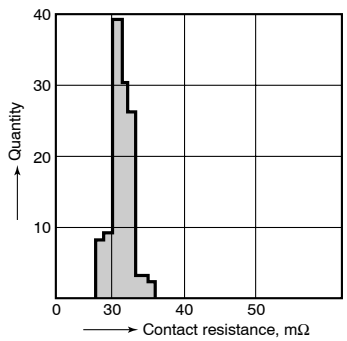
8. Distribution of set and reset voltage
Tested sample: TQ2-L2-12V, 35 pcs.



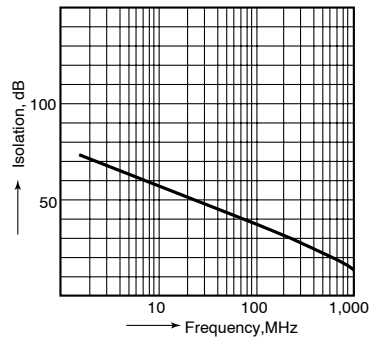
9. Ambient temperature characteristics
Tested sample: TQ2-12V, 5 pcs.



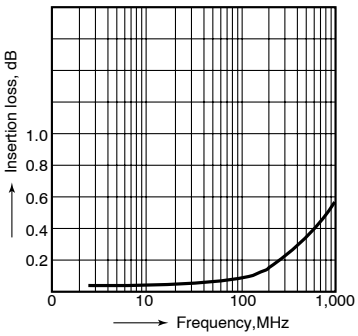
10. Distribution of contact resistance
Tested sample: TQ2-12V, 30 pcs. (30×4 contacts)



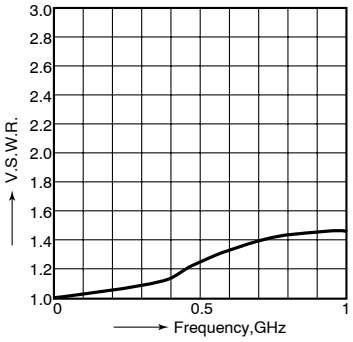
11.-(1) High-frequency characteristics
Isolation characteristics



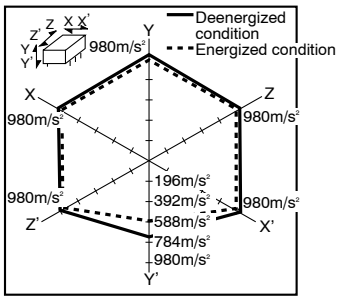
11.-(2) High-frequency characteristics
Insertion loss characteristics



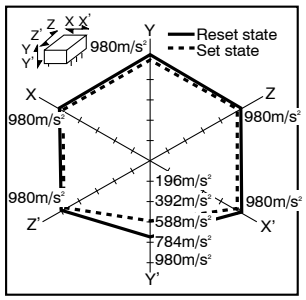
11.-(3) High-frequency characteristics
V.S.W.R.



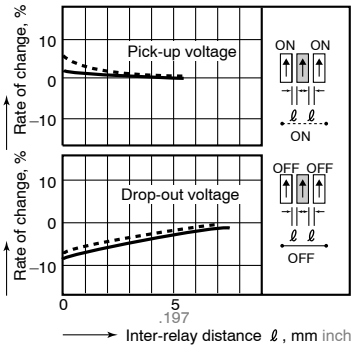
12.-(1) Malfunctional shock (single side stable)
Tested sample: TQ2-12V, 6 pcs.



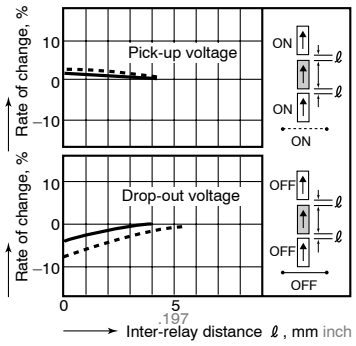
12.-(2) Malfunctional shock (latching)
Tested sample: TQ2-L-12V, 6 pcs.



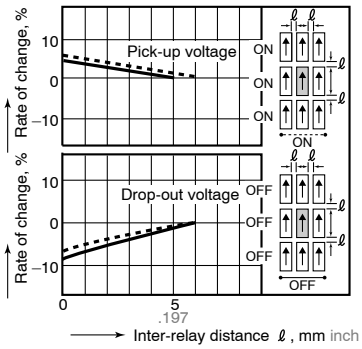
13.-(1) Influence of adjacent mounting



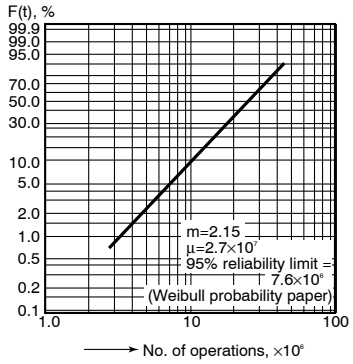
13.-(2) Influence of adjacent mounting



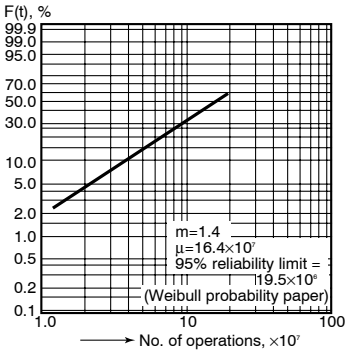
13.-(3) Influence of adjacent mounting



14.-(1) Contact reliability
(1 mA 5 V DC resistive load)
Tested sample: TQ2-12V
Condition: Detection level 10 W

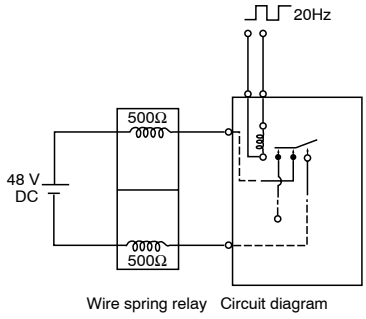


14.-(2) Contact reliability
(100 μA 5 V DC resistive load)
Tested sample: TQ2-12V
Condition: Detection level 100 Ω



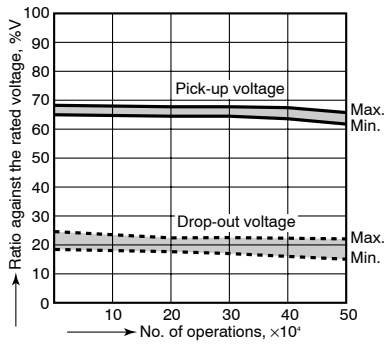
15. Actual load test (35 mA 48 V DC wire spring relay load)

Circuit

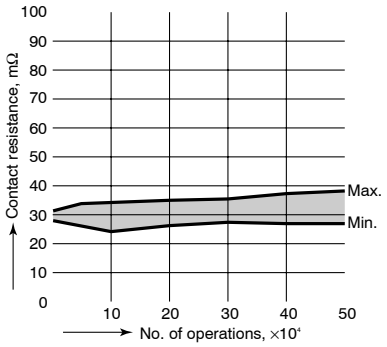


Wire spring relay Circuit diagram

Change of pick-up and drop-out voltage

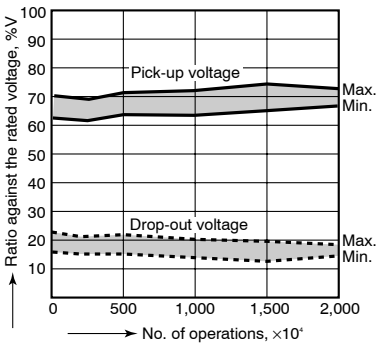


Change of contact resistance

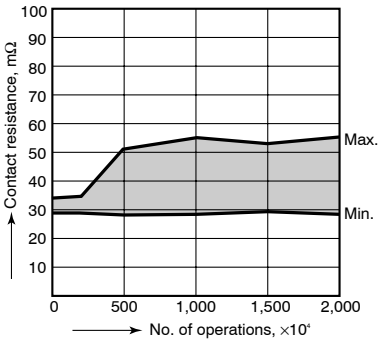


16. 0.1 A 53 V DC resistive load test

Change of pick-up and drop-out voltage



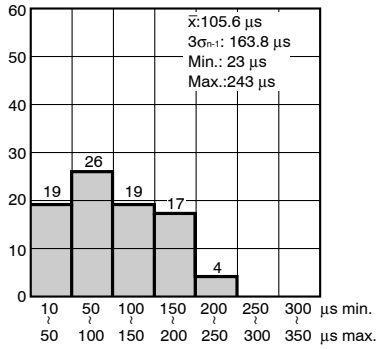
Change of contact resistance



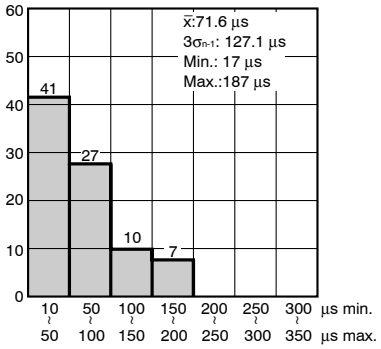
17.-(1) Distribution of M.B.B. time

Sample: TQ2-2M-5V, 85 pcs.

Terminal Nos. 2-3-4: ON



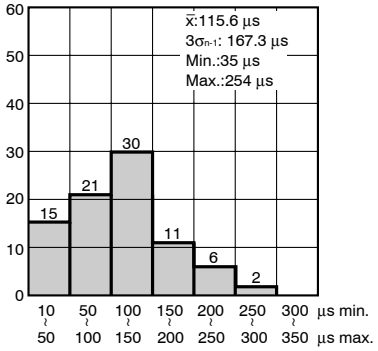
Terminal Nos. 2-3-4: OFF



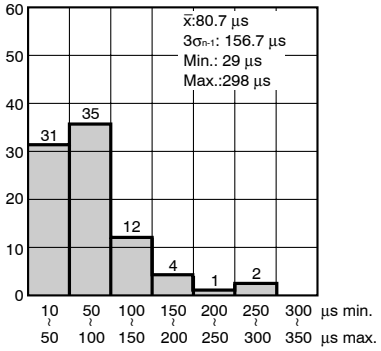
17.-(2) Distribution of M.B.B. time

Sample: TQ2-2M-5V, 85 pcs.

Terminal Nos. 7-8-9: ON



Terminal Nos. 7-8-9: OFF

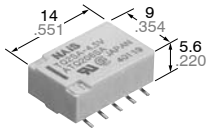


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

LOW-PROFILE SURFACE-MOUNT RELAY

TQ SMD RELAYS



mm inch

FEATURES

- **Low-profile: 6 mm .236 inch (Tape height: max. 6.5 mm .256 inch)**
- **Tape and reel package is available as standard packing style**
- **Surge withstand between contacts and coil: 2,500 V**
- **Breakdown voltage between contacts and coil: 1,500 V**
- **Capacity: 2 A**
- **High sensitivity:**
  2 Form C; 140 mW power consumption (Single side stable type)

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			75 mΩ
Contact material			Gold-clad silver alloy
Rating	Nominal switching capacity (resistive load)		2 A 30 V DC, 0.5 A 125 V AC
	Max. switching power (resistive load)		60 W, 62.5 VA
	Max. switching voltage		220 V DC, 125 V AC
	Max. switching current		2 A
	Min. switching capacity ※1		10 μA 10 mV DC
Nominal operating power	Single side stable		140 mW (1.5 to 12 V DC) 200 mW (24 V DC) 300 mW (48 V DC)
	1 coil latching		70 mW (1.5 to 12 V DC) 100 mW (24 V DC)
	2 coil latching		140 mW (1.5 to 12 V DC) 200 mW (24 V DC)
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8
	Electrical (at 20 cpm)	2 A 30 V DC resistive	10^5
		1 A 30 V DC resistive	2×10^5
		0.5 A 125 V AC resistive	10^5

Note:

※1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10 μA 1 mV DC – 10 mA 10 V DC])

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 By resistive method, nominal voltage applied to the coil; contact carrying current: 2 A.
*3 Nominal voltage applied to the coil, excluding contact bounce time.
*4 Nominal voltage applied to the coil, excluding contact bounce time without diode.
*5 Half-wave pulse of sine wave: 6 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Initial insulation resistance*1			Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage	Between open contacts		1,000 Vrms for 1 min. (Detection current: 10 mA)
	Between contact sets		1,500 Vrms for 1 min. (Detection current: 10 mA)
	Between contact and coil		1,500 Vrms for 1 min. (Detection current: 10 mA)
Initial surge voltage	Between open contacts (10×160 μs)		1,500 V (FCC Part 68)
	Between contacts and coil (2×10 μs)		2,500 V (Telcordia)
Temperature rise*2 (at 20°C)			Max. 50°C
Operate time [Set time]*3 (at 20°C)			Max. 4 ms (Approx. 2 ms) [Max. 4 ms (Approx. 2 ms)]
Release time [Reset time]*4 (at 20°C)			Max. 4 ms (Approx. 1 ms) [Max. 4 ms (Approx. 2 ms)]
Shock resistance		Functional*5	Min. 750 m/s² {75 G}
		Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance		Functional*7	200 m/s² {20G}, 10 to 55 Hz at double amplitude of 3.3 mm
		Destructive	294 m/s² {30G}, 10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)		Ambient temperature	–40°C to +85°C*3 –40°F to +185°F
		Humidity	5 to 85% R.H.
Unit weight			Approx. 2 g .071 oz

ORDERING INFORMATION

Ex. TQ | 2 | SA | - | L | - | 3V | - | Z

Contact arrangement	Surface-mount availability	Operating function	Coil voltage (DC)	Packing style
2: 2 Form C	SA: Standard surface-mount terminal type SL: High connection reliability surface-mount terminal type SS: Space saving surface-mount terminal type	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48* V	Nil: Tube packing Z: Tape and reel packing (picked from the 6/7/8/9/10-pin side)

*48 V coil type: Single side stable only

Notes: 1. Tape and reel (picked from 1/2/3/4/5-pin side) is also available by request.
Part No. suffix "-X" is needed when ordering. (ex.) TQ2SA-3V-X
2. Tape and reel packing symbol "-Z" or "-X" are not marked on the relay.

TYPES

1. Single side stable

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
TQ2S❍-1.5 V	1.5	1.13	0.15	93.8	16	140	2.2
TQ2S❍-3 V	3	2.25	0.3	46.7	64.3	140	4.5
TQ2S❍-4.5 V	4.5	3.38	0.45	31	145	140	6.7
TQ2S❍-5 V	5	3.75	0.5	28.1	178	140	7.5
TQ2S❍-6 V	6	4.5	0.6	23.3	257	140	9
TQ2S❍-9 V	9	6.75	0.9	15.5	579	140	13.5
TQ2S❍-12 V	12	9	1.2	11.7	1,028	140	18
TQ2S❍-24 V	24	18	2.4	8.3	2,880	200	36
TQ2S❍-48 V	48	36	4.8	6.3	7,680	300	57.6

2. 1 coil latching

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
TQ2S❍-L-1.5 V	1.5	1.13	1.13	46.9	32	70	2.2
TQ2S❍-L-3 V	3	2.25	2.25	23.3	128.6	70	4.5
TQ2S❍-L-4.5 V	4.5	3.38	3.38	15.6	289.3	70	6.7
TQ2S❍-L-5 V	5	3.75	3.75	14	357	70	7.5
TQ2S❍-L-6 V	6	4.5	4.5	11.7	514	70	9
TQ2S❍-L-9 V	9	6.75	6.75	7.8	1,157	70	13.5
TQ2S❍-L-12 V	12	9	9	5.8	2,057	70	18
TQ2S❍-L-24 V	24	18	18	4.2	5,760	100	36

3. 2 coil latching

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
TQ2S❍-L2-1.5 V	1.5	1.13	1.13	93.8	16	140	2.2
TQ2S❍-L2-3 V	3	2.25	2.25	46.7	64.3	140	4.5
TQ2S❍-L2-4.5 V	4.5	3.38	3.38	31	145	140	6.7
TQ2S❍-L2-5 V	5	3.75	3.75	28.1	178	140	7.5
TQ2S❍-L2-6 V	6	4.5	4.5	23.3	257	140	9
TQ2S❍-L2-9 V	9	6.75	6.75	15.5	579	140	13.5
TQ2S❍-L2-12 V	12	9	9	11.7	1,028	140	18
TQ2S❍-L2-24 V	24	18	18	8.3	2,880	200	36

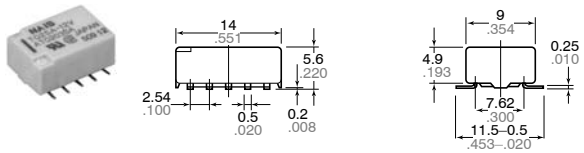
❍: For each surface-mounted terminal variation, input the following letter.
SA type: A, SL type: L, SS type: S

Notes: 1. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 50 pcs.; Case; 1,000 pcs.; Tape and reel: 500 pcs./reel
3. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

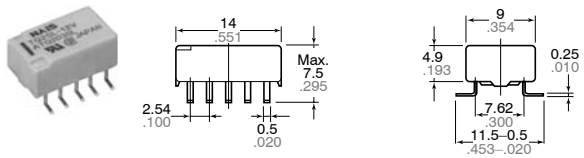
DIMENSIONS

mm inch

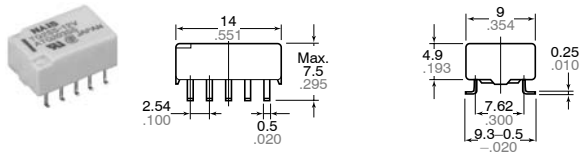
SA type



SL type



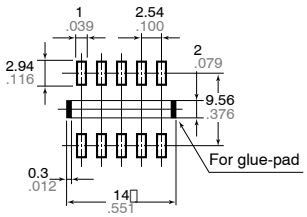
SS type



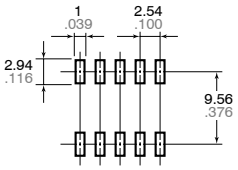
General tolerance: ±0.3 ±.012

Recommendable mounting pad (Top view)

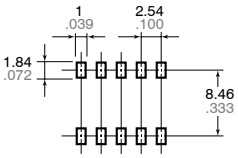
SA type



SL type



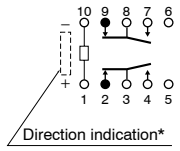
SS type



Tolerance: ±0.1 ±.004

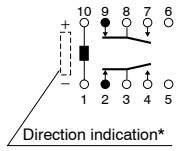
Schematic (Top view)

•Single side stable (Deenergized condition)



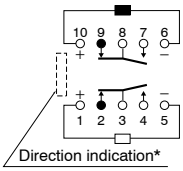
*Orientation stripe located on top of relay.

•1-coil latching (Reset condition)



*Orientation stripe located on top of relay.

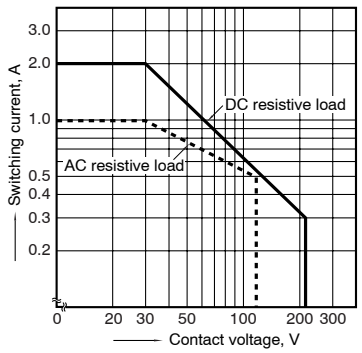
•2-coil latching (Reset condition)



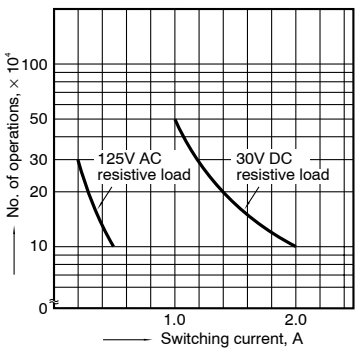
*Orientation stripe located on top of relay.

REFERENCE DATA

1. Maximum switching capacity

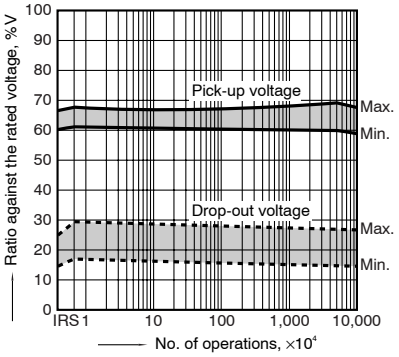


2. Life curve



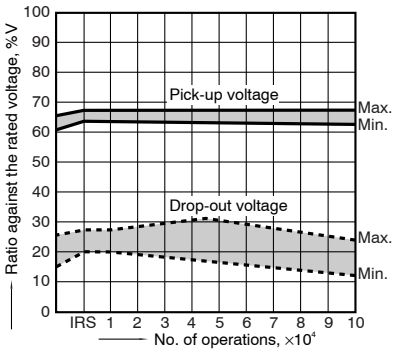
3. Mechanical life (mounting by IRS method)

Tested sample: TQ2SA-12V, 10 pcs.

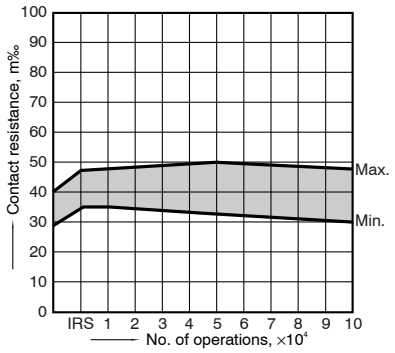


4.-(1) Electrical life (2 A 30 V DC resistive load)

Tested sample: TQ2SA-12V, 6 pcs.
Operating frequency: 20 cpm
Change of pick-up and drop-out voltage (mounting by IRS method)

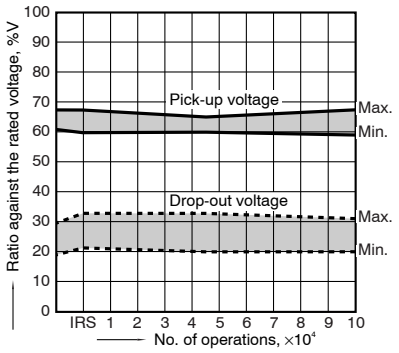


Change of contact resistance (mounting by IRS method)

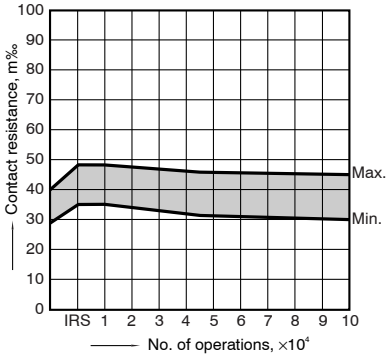


4.-(2) Electrical life (0.5 A 125 V AC resistive load)

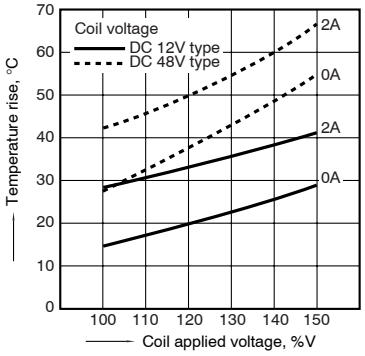
Tested sample: TQ2SA-12V, 6 pcs
Operating frequency: 20 cpm
Change of pick-up and drop-out voltage (mounting by IRS method)



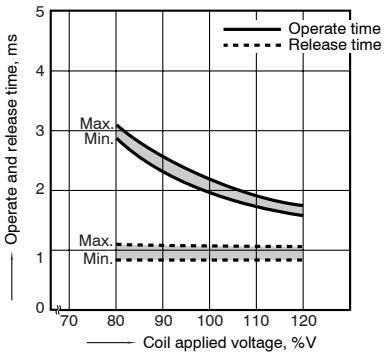
Change of contact resistance
(mounting by IRS method)



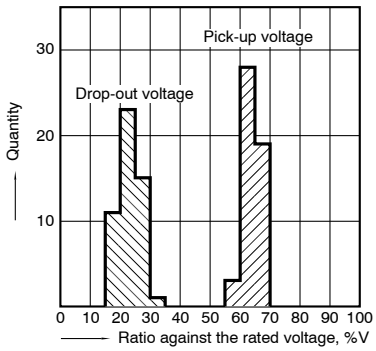
5. Coil temperature rise
Tested sample: TQ2SA-12V, 6 pcs.
Point measured: Inside the coil
Ambient temperature: 25°C 77°F



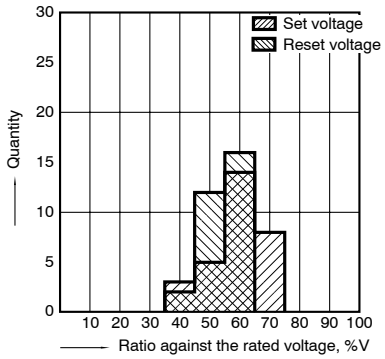
6. Operate/release time
Tested sample: TQ2SA-12V, 6 pcs.



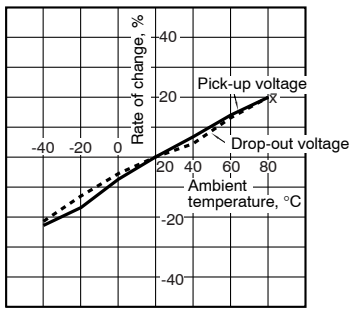
7. Distribution of pick-up and drop out voltage
Tested sample: TQ2SA-12V, 50 pcs.



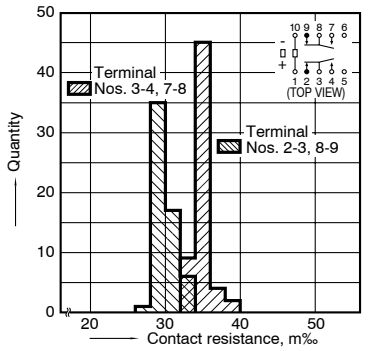
8. Distribution of set and reset voltage
Tested sample: TQ2SA-L-12V, 30 pcs.



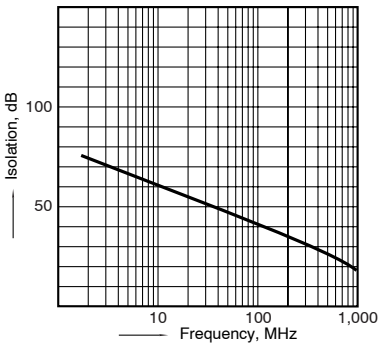
9. Ambient temperature characteristics
Tested sample: TQ2SA-12V, 5 pcs.



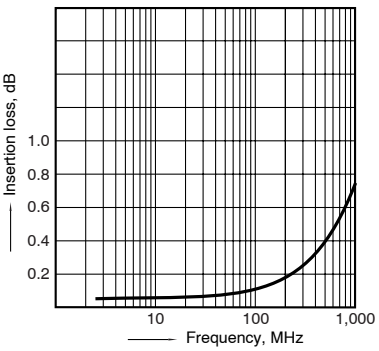
10. Distribution of contact resistance
Tested sample: TQ2SA-5V, 30 pcs. (30 × 4 contacts)



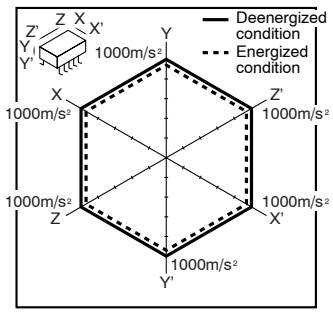
11.-(1) High-frequency characteristics
Isolation characteristics



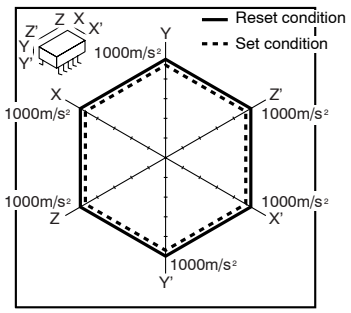
11.-(2) High-frequency characteristics
Insertion loss characteristics



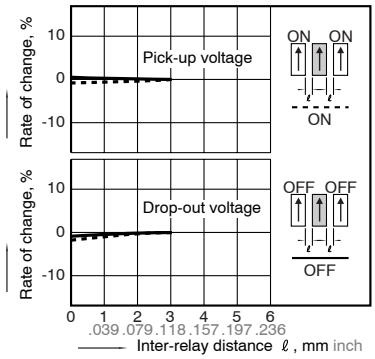
12.-(1) Malfunctional shock (single side stable)
Tested sample: TQ2SA-12V, 6 pcs



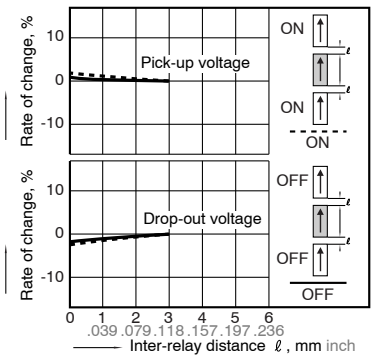
12.-(2) Malfunctional shock (latching)
Tested sample: TQ2SA-L2-12V, 6 pcs.



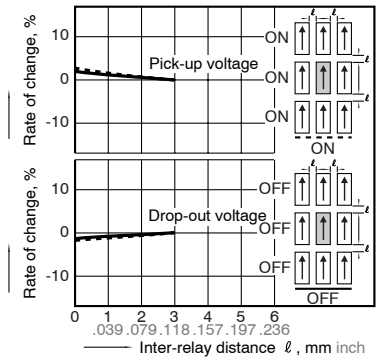
13.-(1) Influence of adjacent mounting
Tested sample: TQ2SA-12V, 5 pcs.



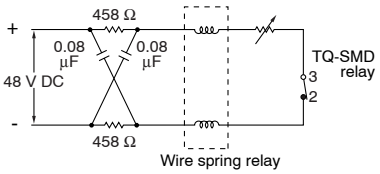
13.-(2) Influence of adjacent mounting
Tested sample: TQ2SA-12V, 6 pcs.



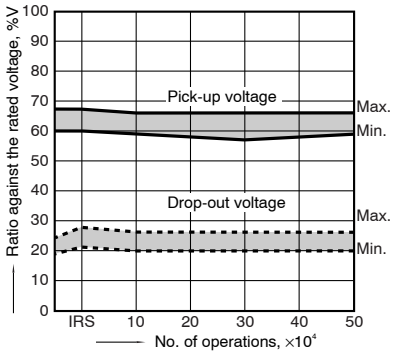
13.-(3) Influence of adjacent mounting
Tested sample: TQ2SA-12V, 6 pcs.



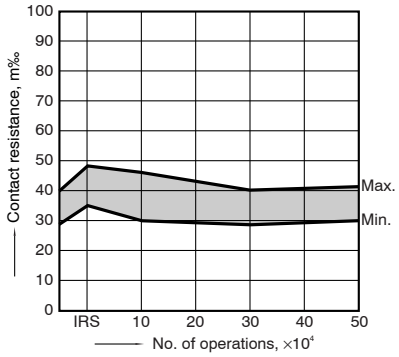
14. Pulse dialing test
Tested sample: TQ2SA-12V, 6 pcs.
(35 mA 48 V DC wire spring relay load)
Circuit



Change of pick-up and drop-out voltage
(mounting by IRS method)



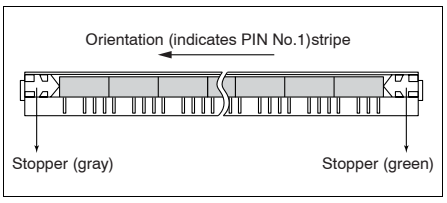
Change of contact resistance
(mounting by IRS method)



NOTES

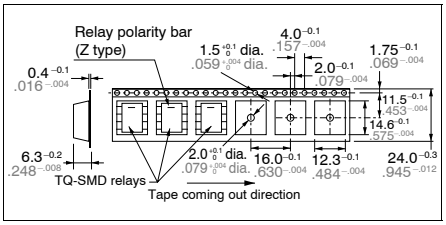
1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.



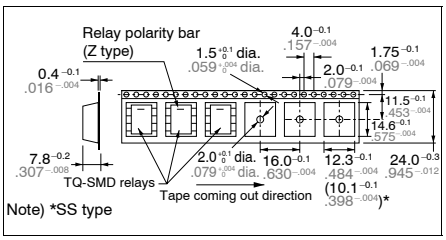
2) Tape and reel packing (surface-mount terminal type)
(1) Tape dimensions
(i) SA type

mm inch



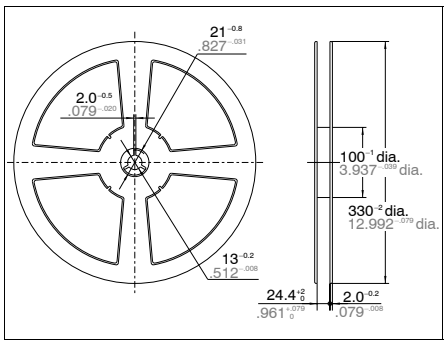
(ii) SL, SS type

mm inch



(2) Dimensions of plastic reel

mm inch

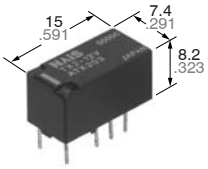


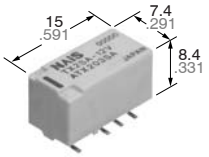
For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

2 A CAPACITY RELAY WITH HIGH SURGE VOLTAGE & HIGH BREAKDOWN VOLTAGE

TX RELAYS





mm inch

FEATURES

- **Breakdown voltage between contacts and coil: 2,000 V**
- **Surge withstand between contacts and coil: 2,500 V**
- **High contact capacity: 2 A 30 V DC**
- **Surface-mount type available**

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			100 mΩ
Contact material			Gold-clad silver alloy
Rating	Nominal switching capacity (resistive load)		2 A 30 V DC
	Max. switching power (resistive load)		60 W
	Max. switching voltage		220 V DC
	Max. switching current		2 A
	Min. switching capacity ※1		10 μA 10 mV DC
Nominal operating power	Single side stable		140 mW (1.5 to 24 V DC) 270 mW (48 V DC)
	1 coil latching		100 mW (1.5 to 24 V DC)
	2 coil latching		200 mW (1.5 to 24 V DC)
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8
	Electrical (at 20 cpm)	2 A 30 V DC resistive	10^5
		1 A 30 V DC resistive	5×10^5

Notes:

※1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10 μA 1 mV DC – 10 mA 10 V DC])

※2 The upper limit for the ambient temperature is the maximum temperature that can satisfy the coil temperature rise. Under the packing condition, allowable temperature range is from –40 to +70°C –40°C to +158°F.

Remarks

* Specifications will vary with foreign standards certification ratings.

*1 Measurement at same location as "Initial breakdown voltage" section.

*2 By resistive method, nominal voltage applied to the coil; contact carrying current: 2 A.

*3 Nominal voltage applied to the coil, excluding contact bounce time.

*4 Nominal voltage applied to the coil, excluding contact bounce time without diode.

*5 Half-wave pulse of sine wave: 6 ms; detection time: 10 μs.

*6 Half-wave pulse of sine wave: 6 ms.

*7 Detection time: 10 μs.

*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Initial insulation resistance*1			Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage	Between open contacts		1,000 Vrms for 1 min. (Detection current: 10 mA)
	Between contact sets		1,000 Vrms for 1 min. (Detection current: 10 mA)
	Between contact and coil		2,000 Vrms for 1 min. (Detection current: 10 mA)
Initial surge voltage	Between open contacts (10×160 μs)		1,500 V (FCC Part 68)
	Between contacts and coil (2×10 μs)		2,500 V (Telcordia)
Temperature rise*2 (at 20°C)			Max. 50°C
Operate time [Set time]*3 (at 20°C)			Max. 4 ms (Approx. 2 ms) [Max. 4 ms (Approx. 2 ms)]
Release time [Reset time]*4 (at 20°C)			Max. 4 ms (Approx. 1 ms) [Max. 4 ms (Approx. 2 ms)]
Shock resistance		Functional*5	Min. 750 m/s² {75 G}
		Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance		Functional*7	196 m/s² {20 G}, 10 to 55 Hz at double amplitude of 3.3 mm
		Destructive	294 m/s² {30G}, 10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)		Ambient temperature ※2	–40°C to +85°C (up to 24 V coil) –40°F to +185°F (up to 24 V coil) –40°C to +70°C (48 V coil) –40°F to +158°F (48 V coil)
		Humidity	5 to 85% R.H.
Unit weight			Approx. 2 g .071 oz

07/2005

ORDERING INFORMATION

Ex. TX [2] [SA] — [L] — [H] — [3V] — [Z]

Contact arrangement	Surface-mount availability	Operating function	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	Nil: Standard PC board terminal type or self-clinching terminal type SA: Standard surface-mount terminal type SL: High connection reliability surface-mount terminal type SS: Space saving surface-mount terminal type	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	Nil: Standard PC board terminal or surface-mount terminal H: Self-clinching terminal	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48* V	Nil: Tube packing Z: Tape and reel packing(picked from the 8/9/10/12 -pin side

Notes: 1. Tape and reel (picked from 1/3/4/5-pin side) is also available by request. Part number suffix "-X" is needed when ordering.
(ex.) TX2SA-3 V-X
2. Tape and reel packing symbol "-Z" or "-X" are not marked on the relay.

*48 V coil type: Single side stable only

TYPES AND COIL DATA (at 20°C 68°F)

1) Standard PC board terminal type and self-clinching terminal type

1. Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TX2-1.5 V	TX2-H-1.5 V	1.5	1.13	0.15	93.8	16	140	2.2
TX2-3 V	TX2-H-3 V	3	2.25	0.3	46.7	64.3	140	4.5
TX2-4.5 V	TX2-H-4.5 V	4.5	3.38	0.45	31	145	140	6.7
TX2-5 V	TX2-H-5 V	5	3.75	0.5	28.1	178	140	7.5
TX2-6 V	TX2-H-6 V	6	4.5	0.6	23.3	257	140	9
TX2-9 V	TX2-H-9 V	9	6.75	0.9	15.5	579	140	13.5
TX2-12 V	TX2-H-12 V	12	9	1.2	11.7	1,028	140	18
TX2-24 V	TX2-H-24 V	24	18	2.4	5.8	4,114	140	36
TX2-48 V	TX2-H-48 V	48	36	4.8	5.6	8,533	270	57.6

2. 1 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TX2-L-1.5 V	TX2-L-H-1.5 V	1.5	1.13	1.13	66.7	22.5	100	2.2
TX2-L-3 V	TX2-L-H-3 V	3	2.25	2.25	33.3	90	100	4.5
TX2-L-4.5 V	TX2-L-H-4.5 V	4.5	3.38	3.38	22.2	202.5	100	6.7
TX2-L-5 V	TX2-L-H-5 V	5	3.75	3.75	20	250	100	7.5
TX2-L-6 V	TX2-L-H-6 V	6	4.5	4.5	16.7	360	100	9
TX2-L-9 V	TX2-L-H-9 V	9	6.75	6.75	11.1	810	100	13.5
TX2-L-12 V	TX2-L-H-12 V	12	9	9	8.3	1,440	100	18
TX2-L-24 V	TX2-L-H-24 V	24	18	18	4.2	5,760	100	36

3. 2 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TX2-L2-1.5 V	TX2-L2-H-1.5 V	1.5	1.13	1.13	133.9	11.2	200	2.2
TX2-L2-3 V	TX2-L2-H-3 V	3	2.25	2.25	66.7	45	200	4.5
TX2-L2-4.5 V	TX2-L2-H-4.5 V	4.5	3.38	3.38	44.5	101.2	200	6.7
TX2-L2-5 V	TX2-L2-H-5 V	5	3.75	3.75	40	125	200	7.5
TX2-L2-6 V	TX2-L2-H-6 V	6	4.5	4.5	33.3	180	200	9
TX2-L2-9 V	TX2-L2-H-9 V	9	6.75	6.75	22.2	405	200	13.5
TX2-L2-12 V	TX2-L2-H-12 V	12	9	9	16.7	720	200	18
TX2-L2-24 V	TX2-L2-H-24 V	24	18	18	8.3	2,880	200	36

Notes:
1. Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
3. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

2) Surface-mount terminal type

1. Single side stable

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
TX2S❍-1.5 V	1.5	1.13	0.15	93.8	16	140	2.2
TX2S❍-3 V	3	2.25	0.3	46.7	64.3	140	4.5
TX2S❍-4.5 V	4.5	3.38	0.45	31	145	140	6.7
TX2S❍-5 V	5	3.75	0.5	28.1	178	140	7.5
TX2S❍-6 V	6	4.5	0.6	23.3	257	140	9
TX2S❍-9 V	9	6.75	0.9	15.5	579	140	13.5
TX2S❍-12 V	12	9	1.2	11.7	1,028	140	18
TX2S❍-24 V	24	18	2.4	5.8	4,114	140	36
TX2S❍-48 V	48	36	4.8	5.6	8,533	270	57.6

2. 1 coil latching

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
TX2S❍-L-1.5 V	1.5	1.13	1.13	66.7	22.5	100	2.2
TX2S❍-L-3 V	3	2.25	2.25	33.3	90	100	4.5
TX2S❍-L-4.5 V	4.5	3.38	3.38	22.2	202.5	100	6.7
TX2S❍-L-5 V	5	3.75	3.75	20	250	100	7.5
TX2S❍-L-6 V	6	4.5	4.5	16.7	360	100	9
TX2S❍-L-9 V	9	6.75	6.75	11.1	810	100	13.5
TX2S❍-L-12 V	12	9	9	8.3	1,440	100	18
TX2S❍-L-24 V	24	18	18	4.2	5,760	100	36

3. 2 coil latching

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
TX2S❍-L2-1.5 V	1.5	1.13	1.13	133.9	11.2	200	2.2
TX2S❍-L2-3 V	3	2.25	2.25	66.7	45	200	4.5
TX2S❍-L2-4.5 V	4.5	3.38	3.38	44.5	101.2	200	6.7
TX2S❍-L2-5 V	5	3.75	3.75	40	125	200	7.5
TX2S❍-L2-6 V	6	4.5	4.5	33.3	180	200	9
TX2S❍-L2-9 V	9	6.75	6.75	22.2	405	200	13.5
TX2S❍-L2-12 V	12	9	9	16.7	720	200	18
TX2S❍-L2-24 V	24	18	18	8.3	2,880	200	36

❍: For each surface-mounted terminal variation, input the following letter.

SA type: A , SL type: L , SS type: S

Notes:

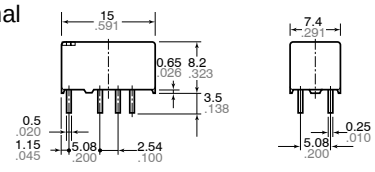
1. Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
3. Tape and reel packing is also available for surface-mount type by request. Part number suffix “-X” or “-Z” is needed when ordering.
   In this case, “X” or “Z” are not marked on the relay.
   Quantity in tape and reel: 500 pcs.
   (ex.) • TX2SA-3V-X
   └Picked from the 1/3/4/5-pin side
   • TX2SA-L-3V-Z
   └Picked from the 8/9/10/12-pin side
4. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

DIMENSIONS

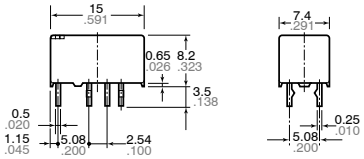
mm inch

1. Single side stable and 1 coil latching type

Standard PC board terminal

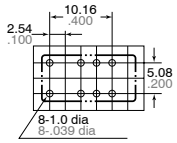


Self clinching terminal



General tolerance: ±0.3 ±.012

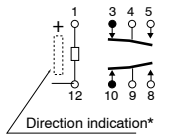
PC board pattern (Copper-side view)



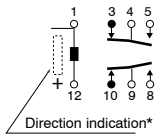
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Single side stable (Deenergized condition)

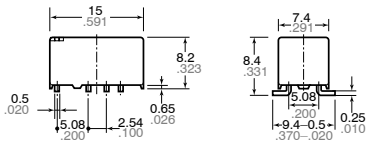


1 coil latching (Reset condition)

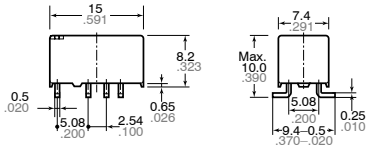


*Orientation stripe located on top of relay.

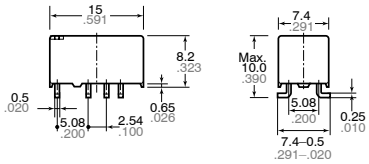
Surface-mount terminal
SA type



SL type

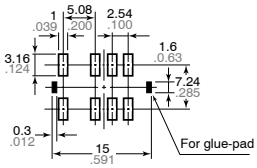


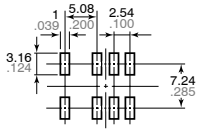
SS type

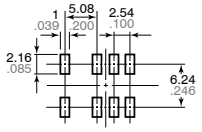


General tolerance: ±0.3 ±.012

Suggested mounting pad (Top view)



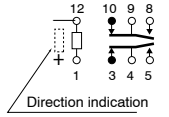




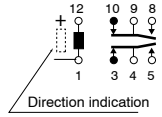
Tolerance: ±0.1 ±.004

Schematic (Top view)

Single side stable (Deenergized condition)

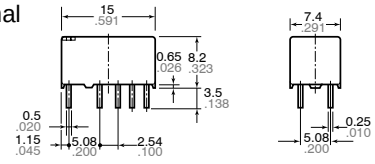


1 coil latching (Reset condition)

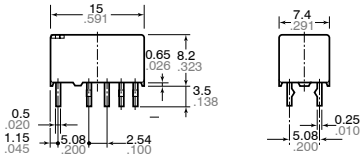


2. Coil latching type

Standard PC board terminal

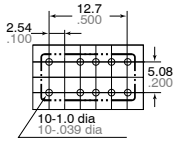


Self clinching terminal



General tolerance: ±0.3 ±.012

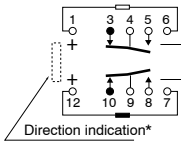
PC board pattern (Copper side view)



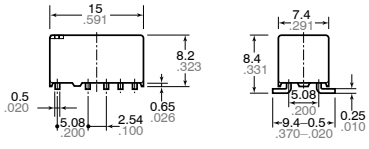
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

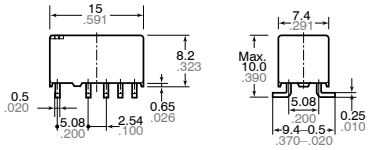
2 coil latching (Reset condition)



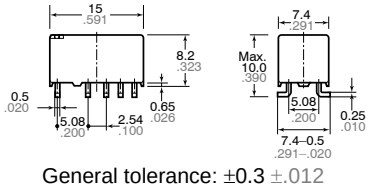
Surface-mount terminal
SA type



SL type

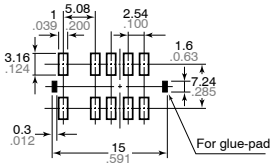


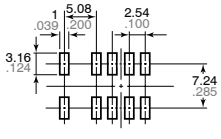
SS type

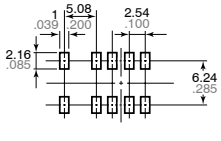


General tolerance: ±0.3 ±.012

Suggested mounting pad (Top view)



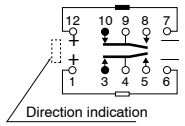




Tolerance: ±0.1 ±.004

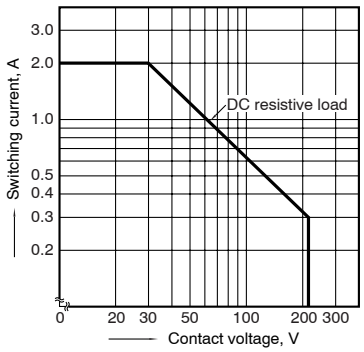
Schematic (Top view)

2 coil latching (Reset condition)

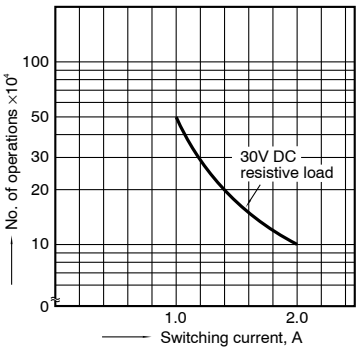


REFERENCE DATA

1. Maximum switching capacity

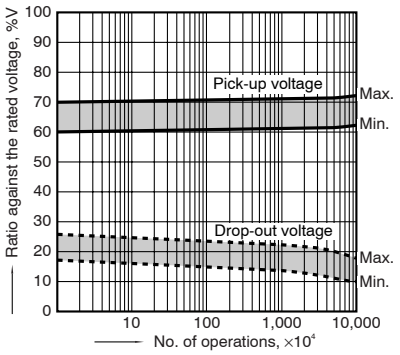


2. Life curve



3. Mechanical life

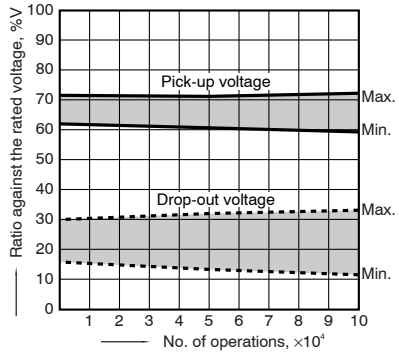
Tested sample: TX2-5V, 10 pcs.
Operating frequency: 180 cpm



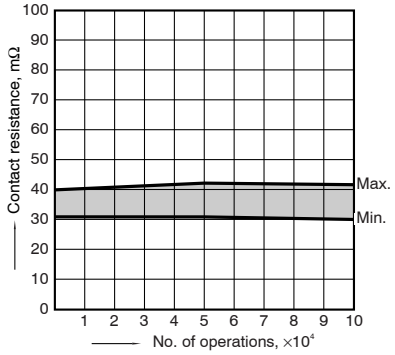
4. Electrical life

Tested sample: TX2-5V, 6 pcs.
Operating frequency: 20 cpm

Change of pick-up and drop-out voltage

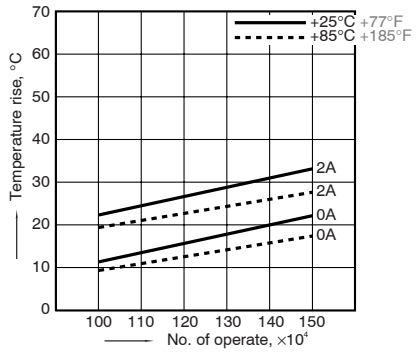


Change of contact resistance



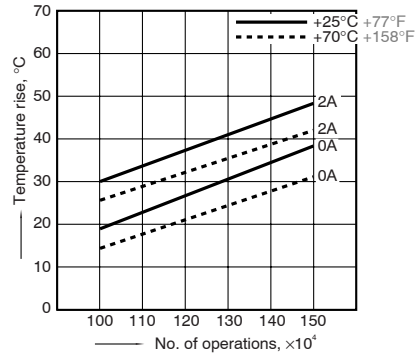
5-(1). Coil temperature rise

Tested sample: TX2-5V, 6 pcs.
Point measured: Inside the coil
Ambient temperature: 25°C 77°F, 85°C 185°F



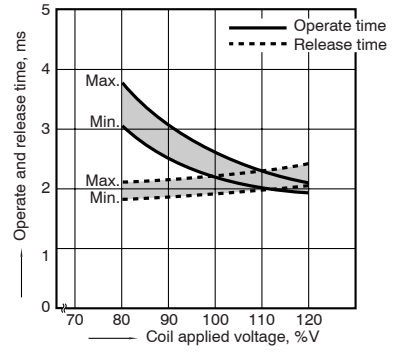
5-(2). Coil temperature rise

Tested sample: TX2-48V, 6 pcs.
Point measured: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F

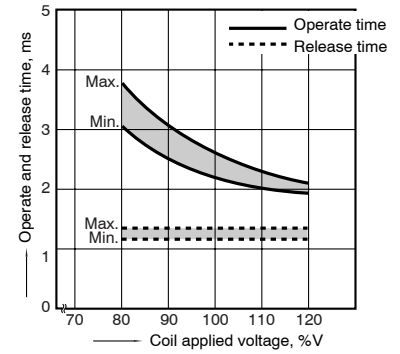


6-(1). Operate and release time (with diode)

Tested sample: TX2-5V, 10 pcs.

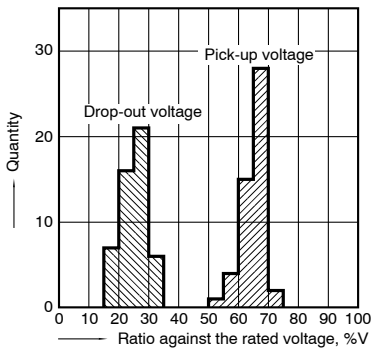


6-(2). Operate and release time (without diode)



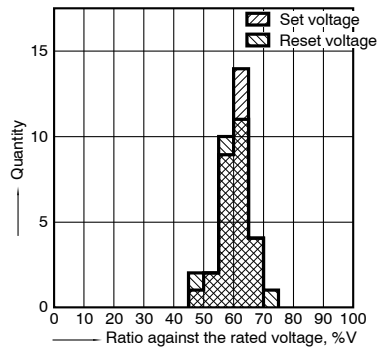
7. Distribution of pick-up and drop-out voltage

Tested sample: TX2-5V, 50 pcs.



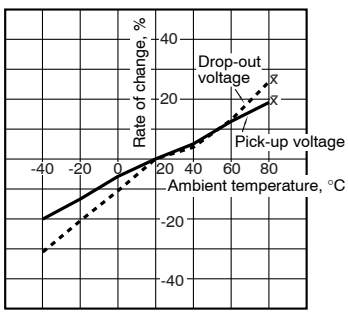
8. Distribution of set and reset voltage

Tested sample: TX2-L2-12V, 30 pcs.

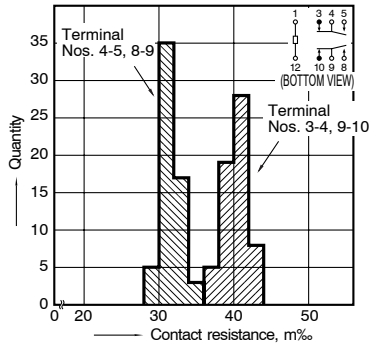


9. Ambient temperature characteristics

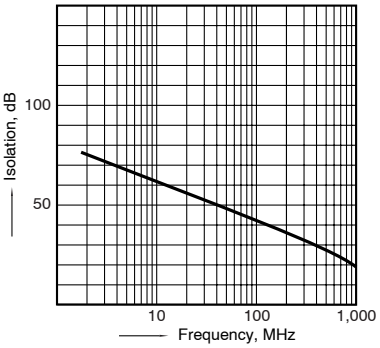
Tested sample: TX2-5V, 5 pcs.



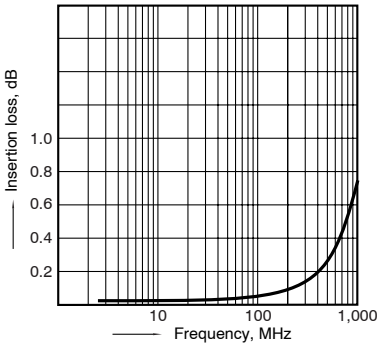
10. Distribution of contact resistance
Tested sample: TX2-5V, 30 pcs. (30 × 4 contacts)



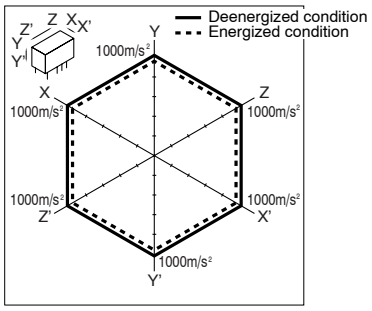
11-(1). High frequency characteristics
Tested sample: TX2-12V, 2 pcs.
Isolation characteristics



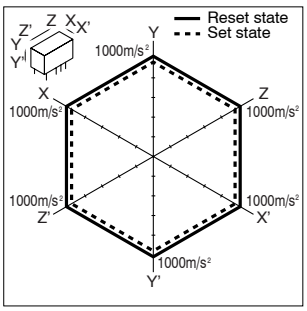
11-(2). High frequency characteristics
Tested sample: TX2-12V, 2 pcs.
Insertion loss characteristics



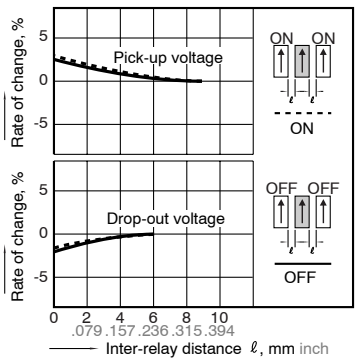
12-(1). Malfunctional shock (single side stable)
Tested sample: TX2-5V, 6 pcs



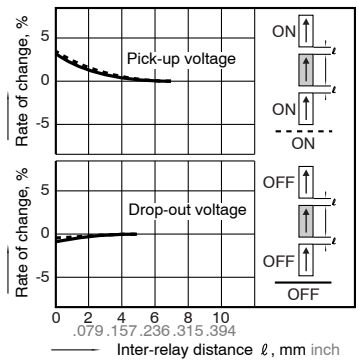
12-(2). Malfunctional shock (latching)
Tested sample: TX2-L2-12V, 6 pcs.



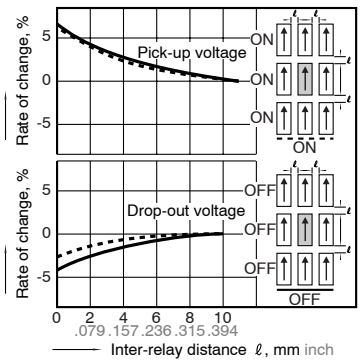
13-(1). Influence of adjacent mounting



13-(2). Influence of adjacent mounting

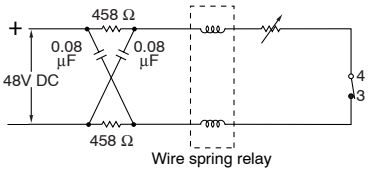


13-(3). Influence of adjacent mounting

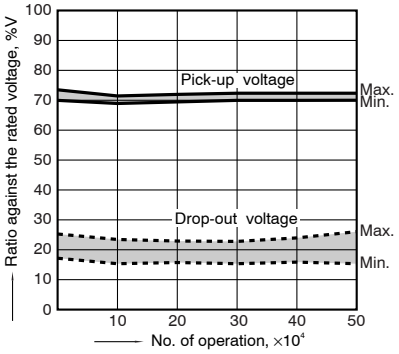


14. Pulse dialing test
Tested sample: TX2-5V, 6 pcs.
(35 mA 48 V DC wire spring relay load)

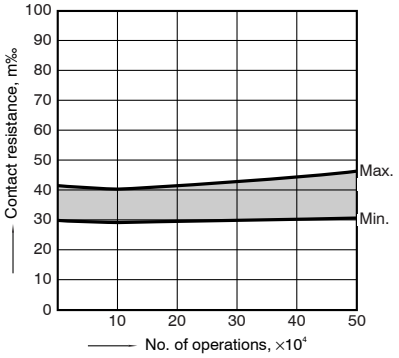
Circuit



Change of pick-up and drop-out voltage



Change of contact resistance

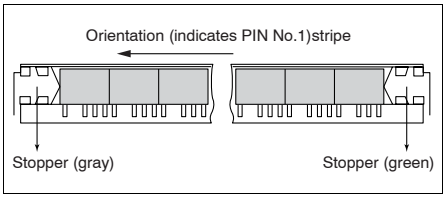


Note: Data of surface-mount type are the same as those of PC board terminal type.

NOTES

1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

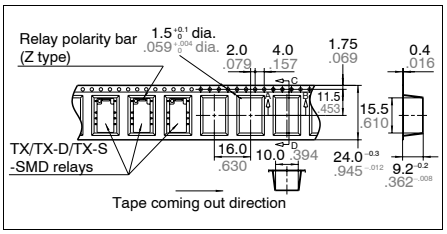


2) Tape and reel packing (surface-mount terminal type)

(1) Tape dimensions

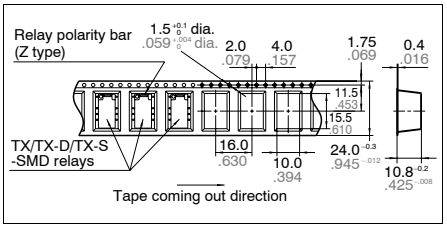
(i) SA type

mm inch



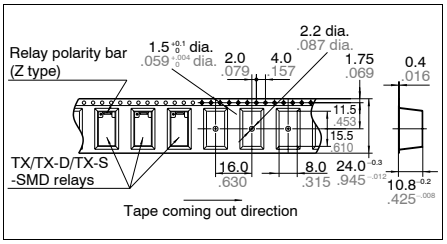
(ii) SL type

mm inch



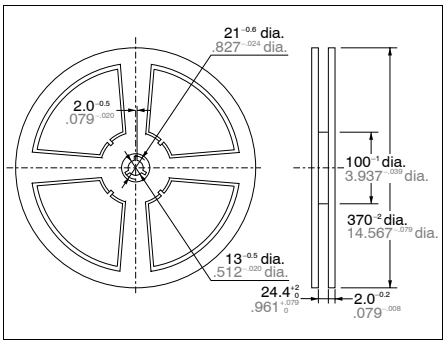
(iii) SS type

mm inch



(2) Dimensions of plastic reel

mm inch



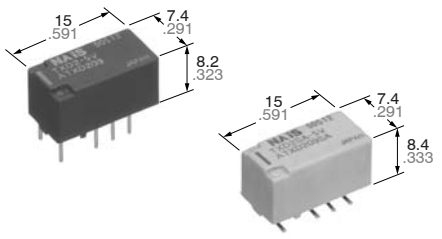
For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

HIGH INSULATION RELAYS (Conforming to the supplementary insulation class of EN Standards (EN41003))

TX-D RELAYS

Signal



mm inch

FEATURES

• Approved to the supplementary insulation class in the EN standards (EN41003).
The insulation distance between the contact and coil meet the supplementary insulation class of the EN41003 standards as required for equipment connected to the telephone lines in Europe.
Satisfies the following conditions:
• Clearances: 2.0 mm .079 inch or more
• Creepage distance: 2.5 mm .098 inch or more

• 2,000 V breakdown voltage between contact and coil.
• Outstanding surge resistance.
Surge withstand between open contacts: 1,500 V 10×160 μsec. (FCC part 68)
Surge withstand between contact and coil: 2,500 V 2×10 μsec. (Telcordia)
• High contact capacity: 2 A 30 V DC (Standard type)
• M.B.B. type available
• The use of gold-clad twin crossbar contacts ensures high contact reliability.

SPECIFICATIONS

Contact

			Standard (B.B.M) type	M.B.B.type
Arrangement			2 Form C	2 Form D
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			100 mΩ	
Contact material			Gold-clad silver	
Rating	Nominal switching capacity (resistive load)		2 A 30 V DC	1 A 30 V DC
	Max. switching power (resistive load)		60 W	30 W
	Max. switching voltage		220 V DC	110 V DC
	Max. switching current		2 A	1 A
	Min. switching capacity ※1		10 μA 10 mV DC	
	Nominal operating power	Single side stable	200 mW (1.5 to 12 V DC) 230 mW (24 V DC)	250 mW (1.5 to 12 V DC) 270 mW (24 V DC)
		1 coil latching	150 mW (1.5 to 12 V DC) 170 mW (24 V DC)	—
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8	10^7
	Electrical (at 20 cpm)		10^5 (2 A 30 V DC resistive), 5 ×10^5 (1 A 30 V DC resistive)	10^5 (1 A 30 V DC resistive)

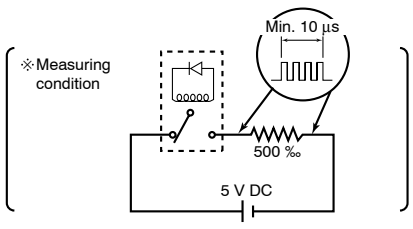
Notes:
※1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10 μA 1 mV DC – 10 mA 10 V DC])
※2 The upper limit for the ambient temperature is the maximum temperature that can satisfy the coil temperature rise. Under the packing condition, allowable temperature range is from –40 to +70°C –40°C to +158°F.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10 mA
*3 By resistive method; nominal voltage applied to the coil; contact carrying current: 2 A.
*4 By resistive method; nominal voltage applied to the coil; contact carrying current: 1 A.
*5 Nominal voltage applied to the coil, excluding contact bounce time.
*6 Nominal voltage applied to the coil, excluding contact bounce time without diode.
*7 Half-wave pulse of sine wave: 6 ms.; detection time: 10 μs.
*8 Half-wave pulse of sine wave: 11 ms.; detection time: 10 μs.
*9 Half-wave pulse of sine wave: 6 ms.
*10 Detection time: 10 μs.
*11 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

		Standard (B.B.M) type	M.B.B.type
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)	
Initial break-down voltage*2	Between open contacts	1,000 Vrms for 1 min.	500 Vrms for 1 min.
	Between contact and coil	2,000 Vrms for 1 min.	
	Between contact sets	1,000 Vrms for 1 min.	
Initial surge voltage	Between contacts, 10 ×160 μs	1,500 V [FCC Part 68]	–
	Between contact and coil, 2×10 μs	2,500 V [Telcordia]	
Temperature rise (at 20°C)		Max. 50°C*3	Max. 50°C*4
Operate time [Set time]*5 (at 20°C)		Max. 4 ms (Approx. 2 ms) [Max. 4 ms (Approx. 2 ms)]	Max. 4 ms (Approx. 2 ms)
Release time [Reset time]*6 (at 20°C)		Max. 4 ms (Approx. 1 ms) [Max. 4 ms (Approx. 2 ms)]	Max. 4 ms (Approx. 1 ms)
M.B.B. time*12		—	Min. 10 μs
Shock resistance	Functional	Min. 750 m/s² {75 G}*7	Min. 500 m/s² {50 G}*8
	Destructive*9	Min. 1,000 m/s² {100 G}	
Vibration resistance	Functional*10	10 to 55 Hz at double amplitude of 3.3 mm	
	Destructive	10 to 55 Hz at double amplitude of 5 mm	
Conditions for operation, transport and storage*11 (Not freezing and condensing at low temperature)	Ambient temp. ※2	–40°C to +85°C –40°F to +185°F	
	Humidity	5 to 85%R.H.	
Unit weight		Approx. 2 g .071 oz.	

*12 M.B.B. time:



TYPICAL APPLICATIONS

- **Communications (XDSL, Transmission)**
- **Measurement**
- **Security**
- **Home appliances, and audio/visual equipment**
- **Automotive equipment**
- **Medical equipment**

ORDERING INFORMATION

1) Standard (B.B.M.)type

Ex. TXD [2] [SA] — [L] — [ ] — [4.5V] — [Z]

Contact arrangement	Surface-mount availability	Operating function	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	Nil: Standard PC board terminal or self-clinching terminal SA: Standard surface-mount terminal SL: High connection reliability surface-mount terminal type SS: Space saving surface-mount terminal type	Nil: Single side stable L: 1 coil latching	Nil: Standard PC board terminal or surface-mount type H: Self-clinching terminal	1.5, 3, 4.5, 5, 6, 9, 12, 24 V	Nil: Tube packing Z: Tape and reel packing (Picked from the 8/9/10/12-pin side)

2) M.B.B.type

Ex. TXD [2] [SA] — [2M] — [ ] — [4.5V] — [Z]

Contact arrangement	Surface-mount availability	Operating function	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form D	Nil: Standard PC board terminal or self-clinching terminal SA: Standard surface-mount terminal SL: High connection reliability surface-mount terminal type SS: Space saving surface-mount terminal type	2M: 2 M.B.B. type	Nil: Standard PC board terminal or surface-mount type H: Self- clinching terminal	1.5, 3, 4.5, 5, 6, 9, 12, 24 V	Nil: Tube packing Z: Tape and reel packing (Picked from the 8/9/10/12-pin side)

Notes: 1. Tape and reel (picked from 1/3/4/5-pin side) is also available by request. Part number: suffix "-X" is needed when ordering.
(ex.) TXD2SA-3V-X
2. Tape and reel packing symbol "-Z" or "-X" are not marked on the relay.

TYPES AND COIL DATA (at 20°C 68°F)

1. Standard (B.B.M.) type

(1) Standard PC board terminal and self-clinching terminal

1. Single side stable

Coil Rating, V DC	Part No. V DC		Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Standard PC board terminal	Self-clinching terminal						
1.5	TXD2-1.5V	TXD2-H-1.5V	1.13	0.15	132.7	11	200	1.8
3	TXD2-3V	TXD2-H-3V	2.25	0.3	66.7	45	200	3.6
4.5	TXD2-4.5V	TXD2-H-4.5V	3.38	0.45	44.4	101	200	5.4
5	TXD2-5V	TXD2-H-5V	3.75	0.5	40.0	125	200	6
6	TXD2-6V	TXD2-H-6V	4.5	0.6	33.3	180	200	7.2
9	TXD2-9V	TXD2-H-9V	6.75	0.9	22.2	405	200	10.8
12	TXD2-12V	TXD2-H-12V	9	1.2	16.7	720	200	14.4
24	TXD2-24V	TXD2-H-24V	18	2.4	9.6	2,504	230	28.8

2. 1 coil latching

Coil Rating, V DC	Part No.		Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Standard PC board terminal	Self-clinching terminal						
1.5	TXD2-L-1.5V	TXD2-L-H-1.5V	1.13	1.13	100.0	15	150	1.8
3	TXD2-L-3V	TXD2-L-H-3V	2.25	2.25	50.0	60	150	3.6
4.5	TXD2-L-4.5V	TXD2-L-H-4.5V	3.38	3.38	33.3	135	150	5.4
5	TXD2-L-5V	TXD2-L-H-5V	3.75	3.75	30.0	166	150	6
6	TXD2-L-6V	TXD2-L-H-6V	4.5	4.5	25.0	240	150	7.2
9	TXD2-L-9V	TXD2-L-H-9V	6.75	6.75	16.7	540	150	10.8
12	TXD2-L-12V	TXD2-L-H-12V	9	9	12.5	960	150	14.4
24	TXD2-L-24V	TXD2-L-H-24V	18	18	7.1	3,388	170	28.8

Standard packing: 40 pcs. in an inner package (tube); 1,000 pcs. in an outer package.
Note: In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

(2) Surface-mount terminal

1. Single side stable

Coil Rating, V DC	Part No.		Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Tube packing	Tape and reel packing						
1.5	TXD2S❍-1.5V	TXD2S❍-1.5V-Z	1.13	0.15	132.7	11	200	1.8
3	TXD2S❍-3V	TXD2S❍-3V-Z	2.25	0.3	66.7	45	200	3.6
4.5	TXD2S❍-4.5V	TXD2S❍-4.5V-Z	3.38	0.45	44.4	101	200	5.4
5	TXD2S❍-5V	TXD2S❍-5V-Z	3.75	0.5	40.0	125	200	6
6	TXD2S❍-6V	TXD2S❍-6V-Z	4.5	0.6	33.3	180	200	7.2
9	TXD2S❍-9V	TXD2S❍-9V-Z	6.75	0.9	22.2	405	200	10.8
12	TXD2S❍-12V	TXD2S❍-12V-Z	9	1.2	16.7	720	200	14.4
24	TXD2S❍-24V	TXD2S❍-24V-Z	18	2.4	9.6	2,504	230	28.8

2. 1 coil latching

Coil Rating, V DC	Part No.		Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Tube packing	Tape and reel packing						
1.5	TXD2S❍-L-1.5V	TXD2S❍-L-1.5V-Z	1.13	1.13	100.0	15	150	1.8
3	TXD2S❍-L-3V	TXD2S❍-L-3V-Z	2.25	2.25	50.0	60	150	3.6
4.5	TXD2S❍-L-4.5V	TXD2S❍-L-4.5V-Z	3.38	3.38	33.3	135	150	5.4
5	TXD2S❍-L-5V	TXD2S❍-L-5V-Z	3.75	3.75	30.0	166	150	6
6	TXD2S❍-L-6V	TXD2S❍-L-6V-Z	4.5	4.5	25.0	240	150	7.2
9	TXD2S❍-L-9V	TXD2S❍-L-9V-Z	6.75	6.75	16.7	540	150	10.8
12	TXD2S❍-L-12V	TXD2S❍-L-12V-Z	9	9	12.5	960	150	14.4
24	TXD2S❍-L-24V	TXD2S❍-L-24V-Z	18	18	7.1	3,388	170	28.8

❍: For each surface-mounted terminal variation, input the following letter.
SA type: A , SL type: L , SS type: S
Standard packing:40 pcs. (tube), 500 pcs. (tape and reel) in an inner package; 1,000 pcs. in an outer package
Notes:
1. Tape and reel packing symbol “-Z” is not marked on the relay. “X” type tape and reel packing (picked from 1/3/4/5-pin side) is also available.
2. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

2. M.B.B. Type

(1) Standard PC board terminal and self-clinching terminal

Single side stable

Coil Rating, V DC	Part No.		Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Standard PC board terminal	Self-clinching terminal						
1.5	TXD2-2M-1.5V	TXD2-2M-H-1.5V	1.13	0.15	166.7	9	250	1.8
3	TXD2-2M-3V	TXD2-2M-H-3V	2.25	0.3	83.3	36	250	3.6
4.5	TXD2-2M-4.5V	TXD2-2M-H-4.5V	3.38	0.45	55.6	81	250	5.4
5	TXD2-2M-5V	TXD2-2M-H-5V	3.75	0.5	50.0	100	250	6
6	TXD2-2M-6V	TXD2-2M-H-6V	4.5	0.6	41.7	144	250	7.2
9	TXD2-2M-9V	TXD2-2M-H-9V	6.75	0.9	27.8	324	250	10.8
12	TXD2-2M-12V	TXD2-2M-H-12V	9	1.2	20.8	576	250	14.4
24	TXD2-2M-24V	TXD2-2M-H-24V	18	2.4	11.3	2,133	270	28.8

Standard packing: 40 pcs. in an inner package (tube); 1,000 pcs. in an outer package

(2) Surface-mount terminal

Single side stable

Coil Rating, V DC	Part No.		Set voltage, V DC (max.)	Reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Tube packing	Tape and reel packing						
1.5	TXD2S❍-2M-1.5V	TXD2S❍-2M-1.5V-Z	1.13	0.15	166.7	9	250	1.8
3	TXD2S❍-2M-3V	TXD2S❍-2M-3V-Z	2.25	0.3	83.3	36	250	3.6
4.5	TXD2S❍-2M-4.5V	TXD2S❍-2M-4.5V-Z	3.38	0.45	55.6	81	250	5.4
5	TXD2S❍-2M-5V	TXD2S❍-2M-5V-Z	3.75	0.5	50.0	100	250	6
6	TXD2S❍-2M-6	TXD2S❍-2M-6V-Z	4.5	0.6	41.7	144	250	7.2
9	TXD2S❍-2M-9	TXD2S❍-2M-9V-Z	6.75	0.9	27.8	324	250	10.8
12	TXD2S❍-2M-12	TXD2S❍-2M-12V-Z	9	1.2	20.8	576	250	14.4
24	TXD2S❍-2M-24	TXD2S❍-2M-24V-Z	18	2.4	11.3	2,133	270	28.8

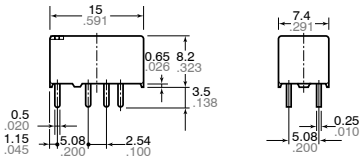
❍: For each surface-mounted terminal variation, input the following letter.
SA type: A , SL type: L , SS type: S
Standard packing: 40 pcs. (tube), 500 pcs. (tape and reel) in an inner package; 1,000 pcs. in an outer package
Notes:
1. Tape and reel packing symbol “-Z” is not marked on the relay. “X” type tape and reel packing (picked from 1/3/4/5-pin side) is also available.
2. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

DIMENSIONS

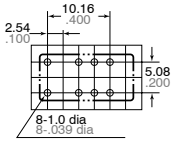
mm inch

1. Standard PC board terminal and self-clinching terminal

Standard PC board terminal



PC board pattern (Copper side view)

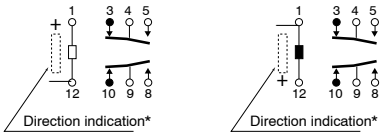


Tolerance: ±0.1 ±.004

Schematic (Bottom view)

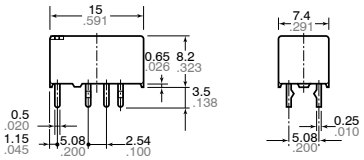
Single side stable (Deenergized condition)

1 coil latching (Reset condition)



*Orientation stride located on top of relay.

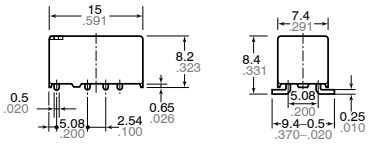
Self clinching terminal



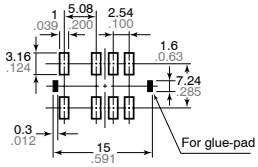
General tolerance: ±0.3 ±.012

2. Surface-mount terminal

SA type



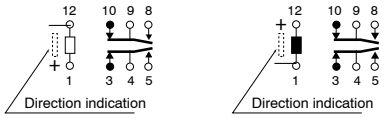
Suggested mounting pad (Top view)



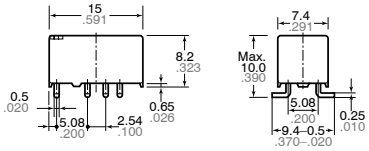
Schematic (Top view)

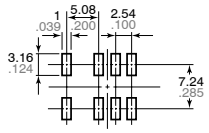
Single side stable (Deenergized condition)

1 coil latching (Reset condition)

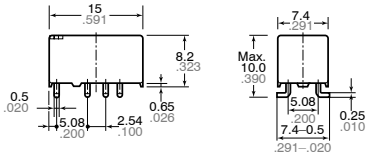


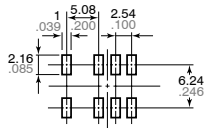
SL type





SS type



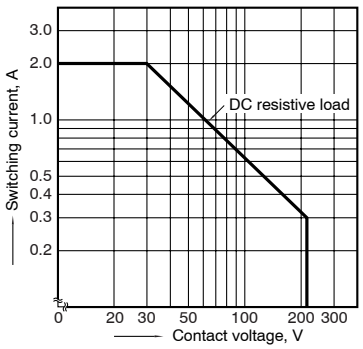


General tolerance: ±0.3 ±.012

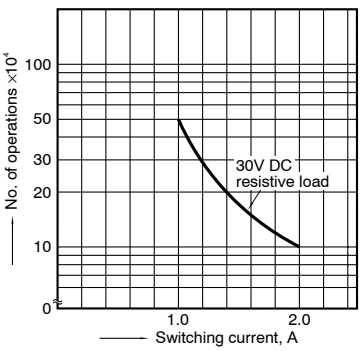
Tolerance: ±0.1 ±.004

REFERENCE DATA

1. Maximum switching capacity

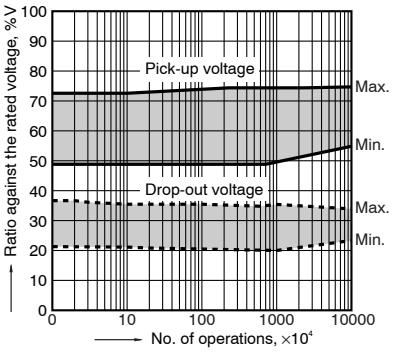


2. Life curve



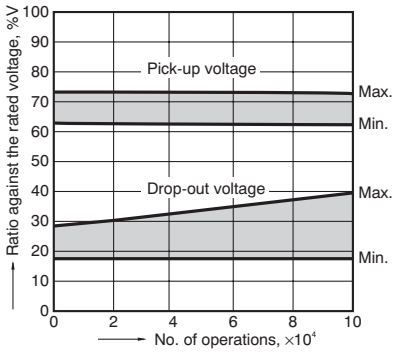
3. Mechanical life

Tested sample: TXD2-5V, 10 pcs.
Operating frequency: 180 cpm

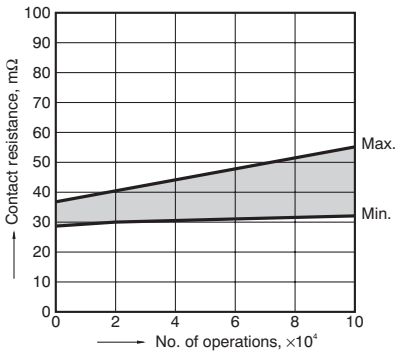


4. Electrical life (2 A 30 V DC resistive load)
Tested sample: TXD2-5V, 6 pcs.
Operating frequency: 20 cpm

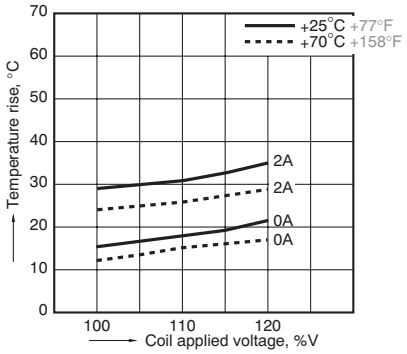
Change of pick-up and drop-out voltage



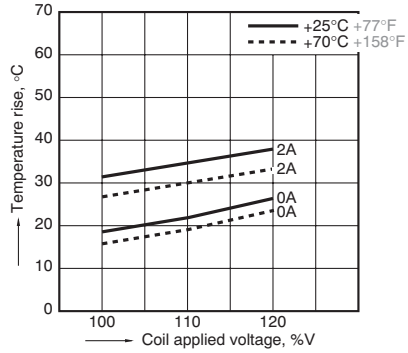
Change of contact resistance



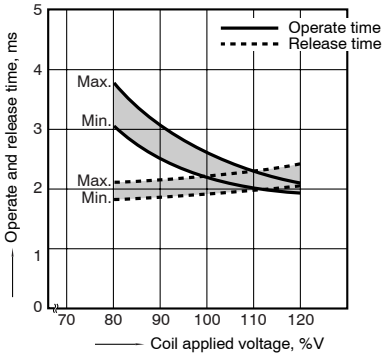
5-(1). Coil temperature rise
Tested sample: TXD2-5V, 6 pcs.
Measured portion: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F



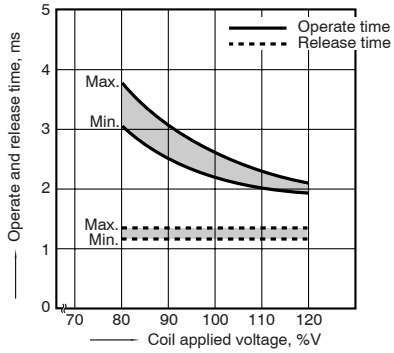
5-(2). Coil temperature rise
Tested sample: TXD2-24V, 6 pcs.
Measured portion: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F



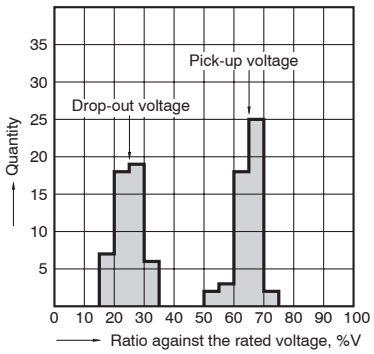
6-(1). Operate/release time characteristics (with diode)
Tested sample: TXD2-5V, 10 pcs.



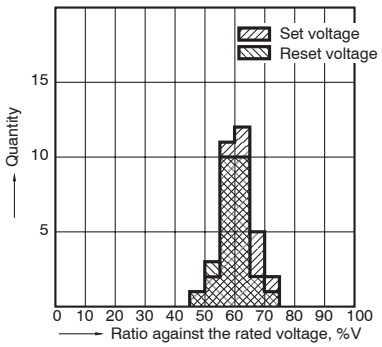
6-(2). Operate/release time characteristics (without diode)
Tested sample: TXD2-5V, 10 pcs.



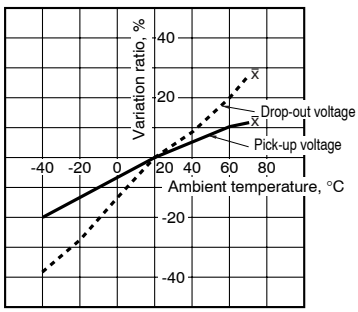
7. Distribution of pick-up and drop-out voltage
Tested sample: TXD2-5V, 50 pcs.



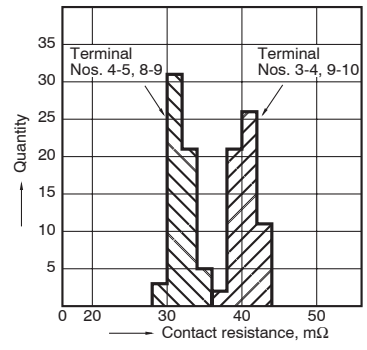
8. Distribution of set and reset voltage
Tested sample: TXD2-L-12V, 30 pcs.



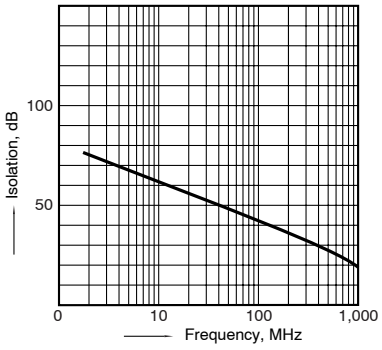
9. Ambient temperature characteristics
Tested sample: TXD2-5V, 5 pcs.



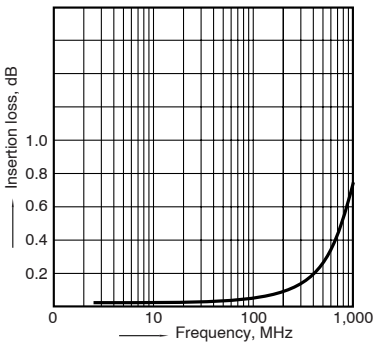
10. Distribution of contact resistance
Tested sample: TXD2-5V, 30 pcs. (30 × 4 contacts)



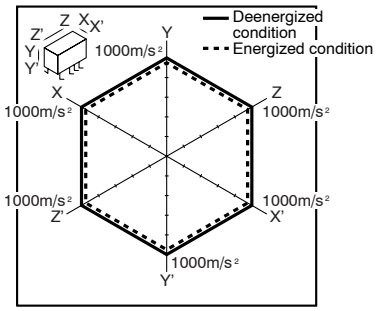
11-(1). High-frequency characteristics
Isolation characteristics
Tested sample: TXD2-12V, 2 pcs.



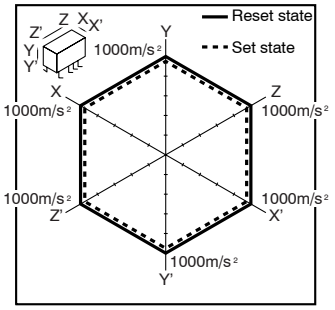
11-(2). High-frequency characteristics
Insertion loss characteristics
Tested sample: TXD2-12V, 2 pcs.



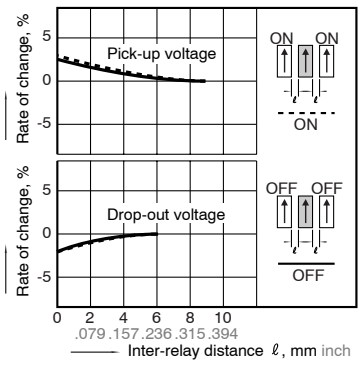
12-(1). Malfunctional shock (single side stable)
Tested sample: TXD2-5V, 6 pcs



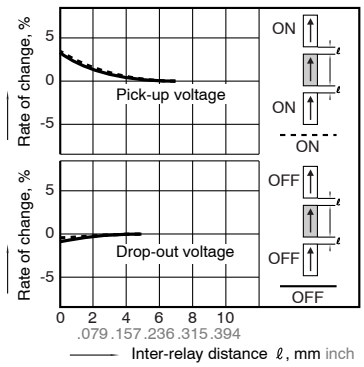
12-(2). Malfunctional shock (latching)
Tested sample: TXD2-L-12V, 6 pcs.



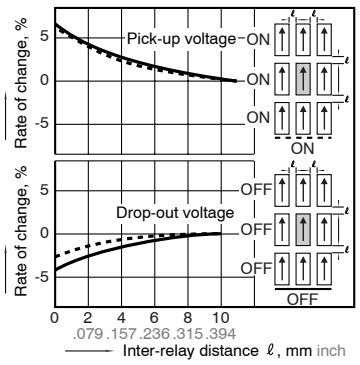
13-(1). Influence of adjacent mounting
Tested sample: TXD2-12V, 6 pcs.



13-(2). Influence of adjacent mounting
Tested sample: TXD2-12V, 6 pcs.

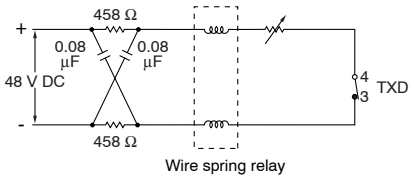


13-(3). Influence of adjacent mounting
Tested sample: TXD2-12V, 6 pcs.

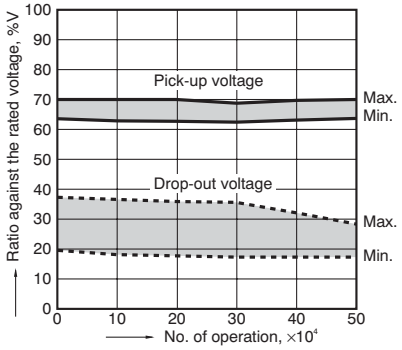


14. Actual load test (35 mA 48 V DC wire spring relay load)
Tested sample: TXD2-5V, 6 pcs.

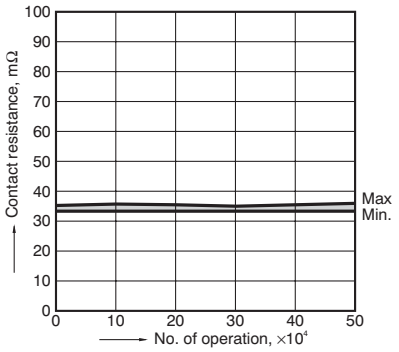
Circuit



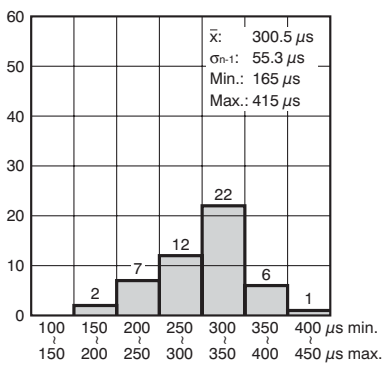
Change of pick-up and drop-out voltage



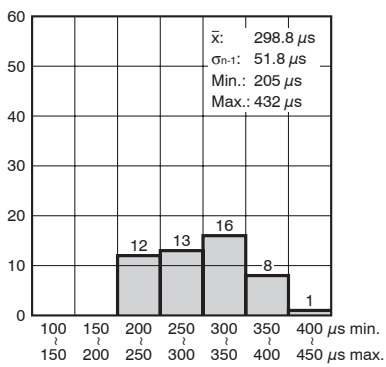
Change of contact resistance



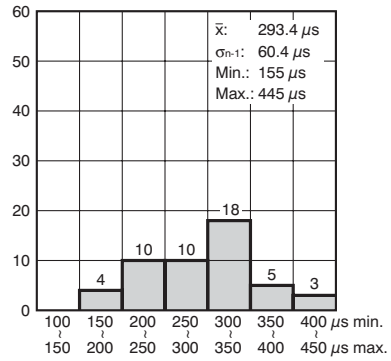
15-(1). Distribution of M.B.B. time
Tested sample: TXD2-2M-5V, 50 pcs.
Terminal No. 3-4-5: ON



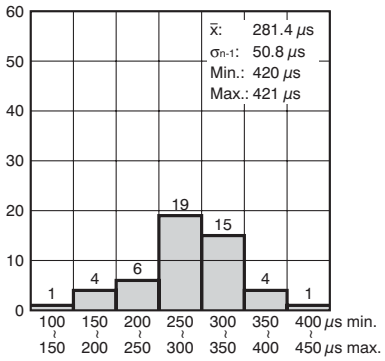
Terminal No. 3-4-5: OFF



15-(2). Distribution of M.B.B. time
Tested sample: TXD2-2M-5V, 50 pcs.
Terminal No. 8-9-10: ON



Terminal No. 8-9-10: OFF

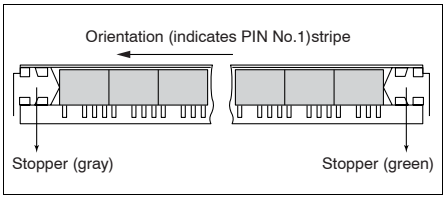


Signal

NOTES

1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

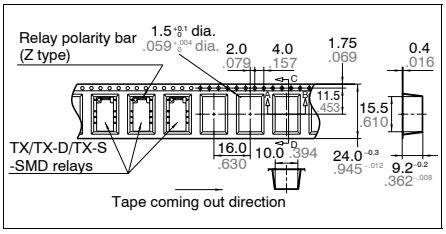


2) Tape and reel packing (surface-mount terminal type)

(1) Tape dimensions

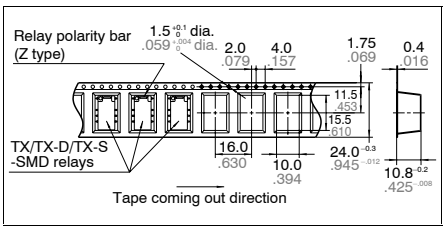
(i) SA type

mm inch



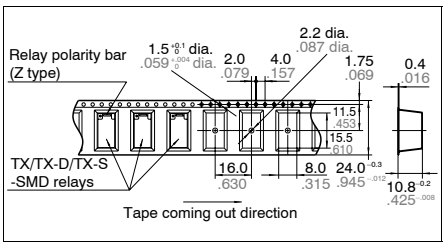
(ii) SL type

mm inch



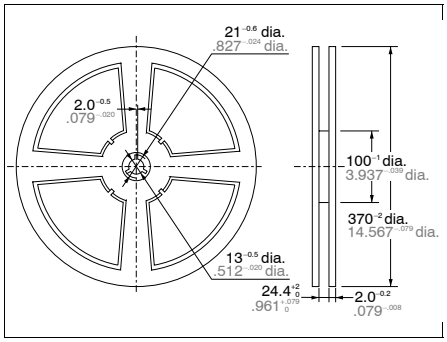
(iii) SS type

mm inch



(2) Dimensions of plastic reel

mm inch

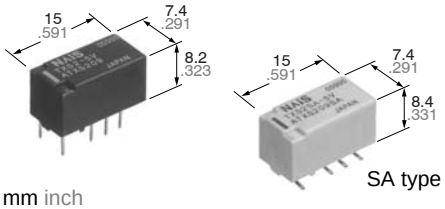


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

SMALL POLARIZED RELAY WITH HIGH SENSITIVITY 50mW

TX-S RELAYS



mm inch

SA type

FEATURES

High sensitivity

• 50mW nominal operating power (single side stable 1.5-12V)

• Useful for electric-power-saving

Approx. 0.3μV low thermal electromotive force

Outstanding surge resistance

Surge withstand between open contacts:
1,500V 10×160μs (FCC part 68)

Surge withstand between contacts and coil:
2,500V 2×10μs (Telcordia)

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			100 mΩ
Contact material			Gold-clad silver alloy
Rating	Nominal switching capacity (resistive load)		1 A 30 V DC
	Max. switching power (resistive load)		30 W (DC)
	Max. switching voltage		110 V DC
	Max. switching current		1 A
	Min. switching capacity ※1		10 μA 10 mV DC
Nominal operating power	Single side stable		50 mW (1.5 to 12 V DC) 70 mW (24 V DC)
	1 coil latching		35 mW (1.5 to 12 V DC) 50 mW (24 V DC)
	2 coil latching		70 mW (1.5 to 12 V DC) 150 mW (24 V DC)
Expected life (min. operations)	Mechanical (at 180 cpm)		5×10^7
	Electrical (at 20 cpm)	1 A 30 V DC resistive	2×10^5

Note:

※1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10 μA 1 mV DC – 10 mA 10 V DC])

Remarks

* Specifications will vary with foreign standards certification ratings.

*1 Measurement at same location as "Initial breakdown voltage" section.

*2 Detection current: 10mA

*3 Excluding contact bounce time.

*4 By resistive method; nominal voltage applied to the coil; contact carrying current: 1 A.

Characteristics

Initial insulation resistance*1		Min. 1,000 MW (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	750 Vrms for 1min.
	Between contact sets	1,000 Vrms for 1min.
	Between contacts and coil	1,800 Vrms for 1min.
Initial surge voltage	Between open contacts (10 × 160μs)	1,500V (FCC Part 68)
	Between contacts and coil (2 × 10 μs)	2,500V (Telcordia)
Operate time [Set time]*3 (at 20°C)(at nominal voltage)		Max. 5 ms (Approx. 3 ms) [Max. 5 ms (Approx. 3 ms)]
Release time (without diode) [Reset time]*3 (at 20°C)(at nominal voltage)		Max. 5 ms (Approx. 1.5 ms) [Max. 5 ms (Approx. 3 ms)]
Temperature rise*4 (at 20°C)		Max. 50°C
Shock resistance	Functional*5	Min. 750 m/s² {75 G}
	Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 2 g .071 oz

*5 Half-wave pulse of sine wave: 6 ms; detection time: 10 μs

*6 Half-wave pulse of sine wave: 6 ms

*7 Detection time: 10 μs

*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

TYPICAL APPLICATIONS

- **Communications (XDSL, Transmission)**
- **Measurement**
- **Security**
- **Home appliances, and audio/visual equipment**
- **Automotive equipment**
- **Medical equipment**

ORDERING INFORMATION

Ex. TXS | 2 | SA | — | L | — | H | — | 3V | — | Z |

Contact arrangement	Surface-mount availability	Operating function	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	Nil: Standard PC board terminal type or self-clinching terminal type SA: Standard surface-mount terminal type SL: High connection reliability surface-mount terminal type SS: Space saving surface-mount terminal type	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	Nil: Standard PC board terminal or surface-mount terminal H: Self-clinching terminal	1.5, 3, 4.5, 6, 9, 12, 24 V	Nil: Tube packing Z: Tape and reel packing(piked from the 8/9/10/12 -pin side

Notes: 1. Tape and reel (picked from 1/3/4/5-pin side) is also available by request. Part number suffix □-X□ is needed when ordering. (ex.) TXS2SA-3 V-X

2. Tape and reel packing symbol "-Z" or "-X" are not marked on the relay.

TYPES AND COIL DATA (at 20°C 68°F)

1) Standard PC board terminal type and self-clinching terminal type

Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. Allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TXS2-1.5V	TXS2-H-1.5V	1.5	1.2	0.15	33.3	45	50	2.2
TXS2-3V	TXS2-H-3V	3	2.4	0.3	16.7	180	50	4.5
TXS2-4.5V	TXS2-H-4.5V	4.5	3.6	0.45	11.1	405	50	6.7
TXS2-6V	TXS2-H-6V	6	4.8	0.6	8.3	720	50	9
TXS2-9V	TXS2-H-9V	9	7.2	0.9	5.6	1,620	50	13.5
TXS2-12V	TXS2-H-12V	12	9.6	1.2	4.2	2,880	50	18
TXS2-24V	TXS2-H-24V	24	19.2	2.4	2.9	8,229	70	36

1 coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (Max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. Allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TXS2-L-1.5V	TXS2-L-H-1.5V	1.5	1.2	1.2	23.3	64.3	35	2.2
TXS2-L-3V	TXS2-L-H-3V	3	2.4	2.4	11.7	257	35	4.5
TXS2-L-4.5V	TXS2-L-H-4.5V	4.5	3.6	3.6	7.8	579	35	6.7
TXS2-L-6V	TXS2-L-H-6V	6	4.8	4.8	5.8	1,029	35	9
TXS2-L-9V	TXS2-L-H-9V	9	7.2	7.2	3.9	2,314	35	13.5
TXS2-L-12V	TXS2-L-H-12V	12	9.6	9.6	2.9	4,114	35	18
TXS2-L-24V	TXS2-L-H-24V	24	19.2	19.2	2.1	11,520	50	36

2 coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (Max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. Allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TXS2-L2-1.5V	TXS2-L2-H-1.5V	1.5	1.2	1.2	46.7	32.1	70	2.2
TXS2-L2-3V	TXS2-L2-H-3V	3	2.4	2.4	23.3	129	70	4.5
TXS2-L2-4.5V	TXS2-L2-H-4.5V	4.5	3.6	3.6	15.6	289	70	6.7
TXS2-L2-6V	TXS2-L2-H-6V	6	4.8	4.8	11.7	514	70	9
TXS2-L2-9V	TXS2-L2-H-9V	9	7.2	7.2	7.8	1,157	70	13.5
TXS2-L2-12V	TXS2-L2-H-12V	12	9.6	9.6	5.8	2,057	70	18
TXS2-L2-24V	TXS2-L2-H-24V	24	19.2	19.2	6.3	3,840	150	36

Notes:
1. Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.

2) Surface-mount terminal type

Single side stable

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. Allowable voltage, V DC
TXS2S❍-1.5 V	1.5	1.2	0.15	33.3	45	50	2.2
TXS2S❍-3 V	3	2.4	0.3	16.7	180	50	4.5
TXS2S❍-4.5 V	4.5	3.6	0.45	11.1	405	50	6.7
TXS2S❍-6 V	6	4.8	0.6	8.3	720	50	9
TXS2S❍-9 V	9	7.2	0.9	5.6	1,620	50	13.5
TXS2S❍-12 V	12	9.6	1.2	4.2	2,880	50	18
TXS2S❍-24 V	24	19.2	2.4	2.9	8,229	70	36

1 coil latching

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. Allowable voltage, V DC
TXS2S❍-L-1.5 V	1.5	1.2	1.2	23.3	64.3	35	2.2
TXS2S❍-L-3 V	3	2.4	2.4	11.7	257	35	4.5
TXS2S❍-L-4.5 V	4.5	3.6	3.6	7.8	579	35	6.7
TXS2S❍-L-6 V	6	4.8	4.8	5.8	1,029	35	9
TXS2S❍-L-9 V	9	7.2	7.2	3.9	2,314	35	13.5
TXS2S❍-L-12 V	12	9.6	9.6	2.9	4,114	35	18
TXS2S❍-L-24 V	24	19.2	19.2	2.1	11,520	50	36

2 coil latching

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. Allowable voltage, V DC
TXS2S❍-L2-1.5 V	1.5	1.2	1.2	46.7	32.1	70	2.2
TXS2S❍-L2-3 V	3	2.4	2.4	23.3	129	70	4.5
TXS2S❍-L2-4.5 V	4.5	3.6	3.6	15.6	289	70	6.7
TXS2S❍-L2-6 V	6	4.8	4.8	11.7	514	70	9
TXS2S❍-L2-9 V	9	7.2	7.2	7.8	1,157	70	13.5
TXS2S❍-L2-12 V	12	9.6	9.6	5.8	2,057	70	18
TXS2S❍-L2-24 V	24	19.2	19.2	6.3	3,840	150	36

❍: For each surface-mounted terminal variation, input the following letter.
SA type: A, SL type: L, SS type: S

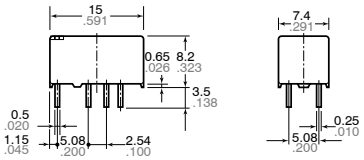
Notes:
1. Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 40 pcs. ; Case: 1,000 pcs.
3. Tape and reel packing is also available for surface-mount type by request. Part number suffix "-X" or "-Z" is needed when ordering.
In this case, "X" or "Z" are not marked on the relay.
Quantity in tape and reel: 500 pcs.
(ex.) • TXS2SA-3V-X
└Picked from the 1/3/4/5-pin side
• TXS2SA-L-3V-Z
└Picked from the 8/9/10/12-pin side

DIMENSIONS

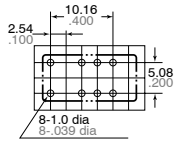
mm inch

1. Single side stable and 1 coil latching type

Standard PC board terminal



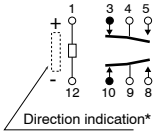
PC board pattern (Copper-side view)



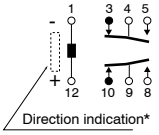
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Single side stable (Deenergized condition)

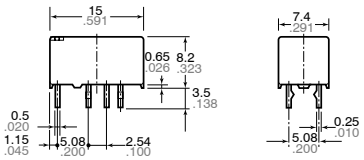


1 coil latching (Reset condition)



*Orientation stripe located on top of relay.

Self clinching terminal



General tolerance: ±0.3 ±.012

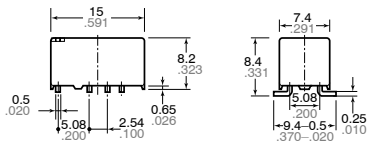
Surface-mount terminal
SA type

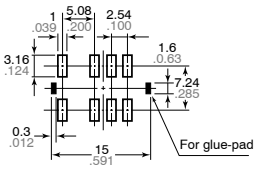
mm inch

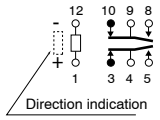
Suggested mounting pad
(Top view)

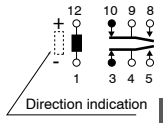
Schematic (Top view)
Single side stable
(Deenergized condition)

1 coil latching
(Reset condition)

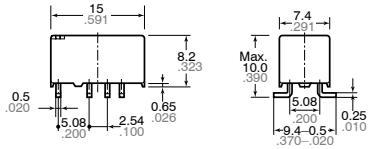


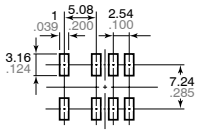




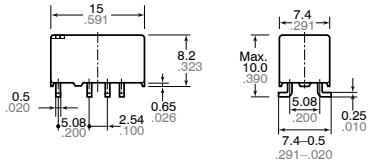


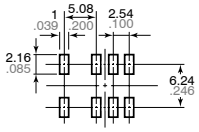
SL type





SS type





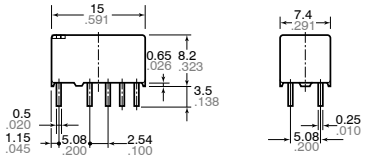
General tolerance: ±0.3 ±.012

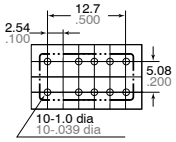
Tolerance: ±0.1 ±.004

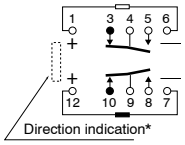
2. Coil latching type
Standard PC board terminal

PC board pattern
(Copper side view)

Schematic (Bottom view)
2 coil latching
(Reset condition)

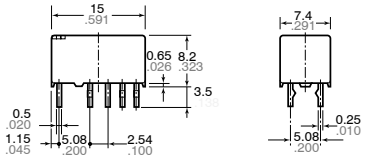






Tolerance: ±0.1 ±.004

Self clinching terminal

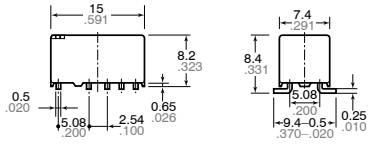


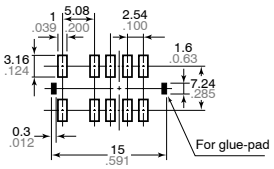
General tolerance: ±0.3 ±.012

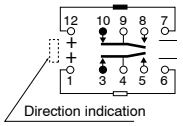
Surface-mount terminal
SA type

Suggested mounting pad
(Top view)

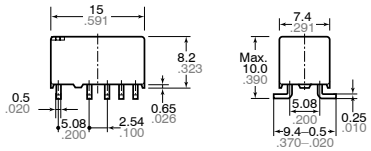
Schematic (Top view)
2 coil latching
(Reset condition)

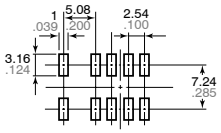




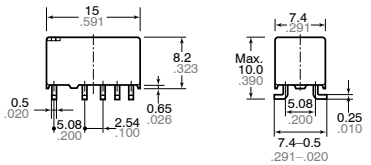


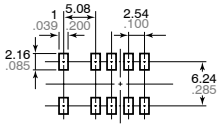
SL type





SS type



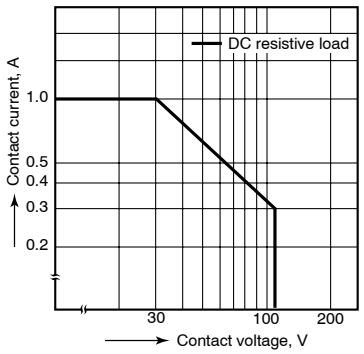


General tolerance: ±0.3 ±.012

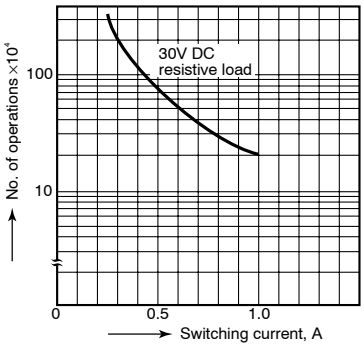
Tolerance: ±0.1 ±.004

REFERENCE DATA

1. Maximum switching capacity

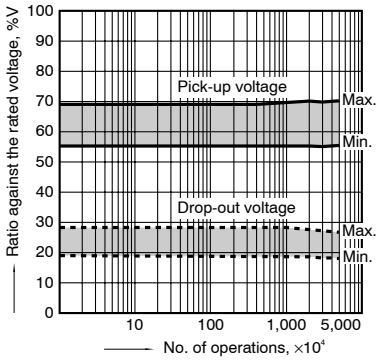


2. Life curve



3. Mechanical life

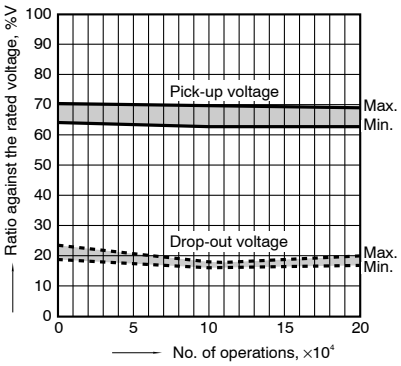
Tested sample: TXS2-4.5V, 10 pcs.
Operating frequency: 180 cpm



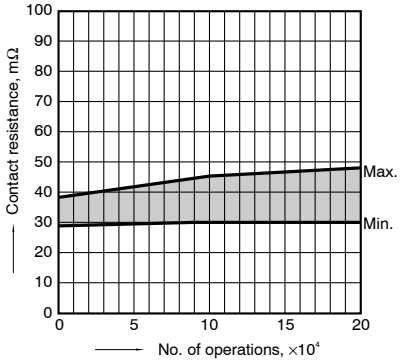
4. Electrical life (1 A 30 V DC resistive load)

Tested sample: TXS2-4.5V, 6 pcs.
Operating frequency: 20 cpm

Change of pick-up and drop-out voltage

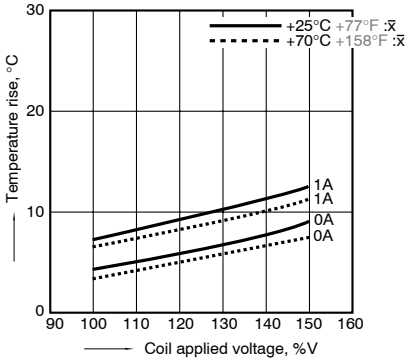


Change of contact resistance



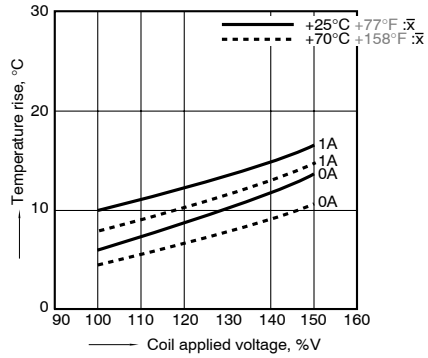
5-(1). Coil temperature rise

Tested sample: TXS2-4.5V, 6 pcs.
Point measured: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F



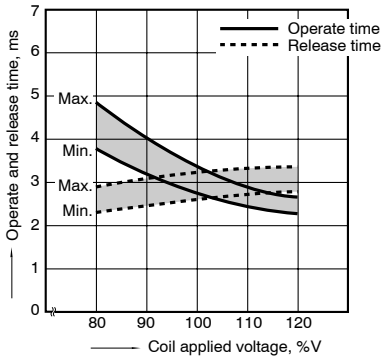
5-(2). Coil temperature rise

Tested sample: TXS2-24V, 6 pcs.
Point measured: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F



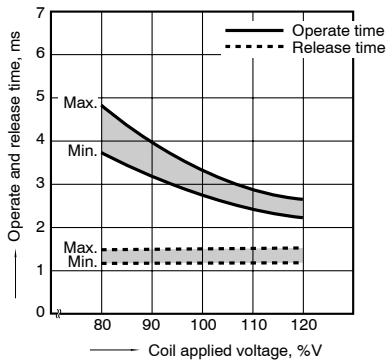
6-(1). Operate and release time (with diode)

Tested sample: TXS2-4.5V, 10 pcs.



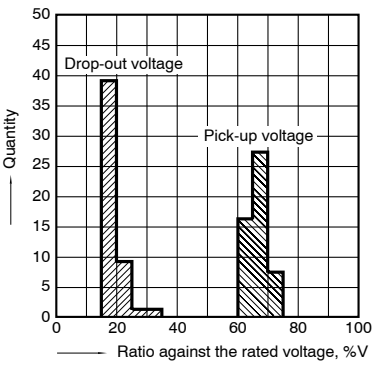
6-(2). Operate and release time (without diode)

Tested sample: TXS2-4.5V, 10 pcs.



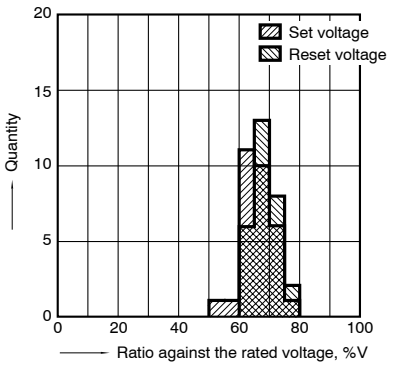
7. Distribution of pick-up and drop-out voltage

Tested sample: TXS2-4.5V, 50 pcs.



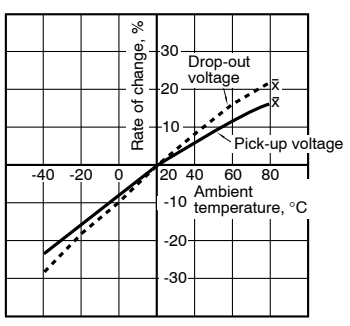
8. Distribution of set and reset voltage

Tested sample: TXS2-4.5V 30 pcs.

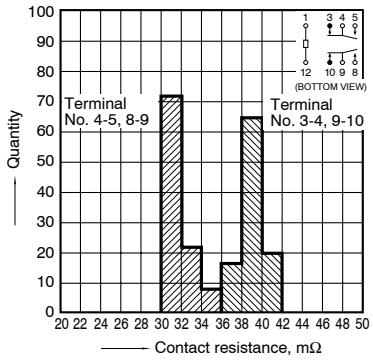


9. Ambient temperature characteristics

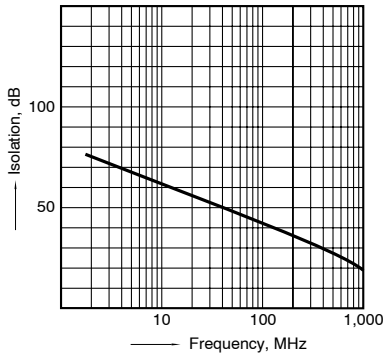
Tested sample: TXS2-4.5V 5 pcs.



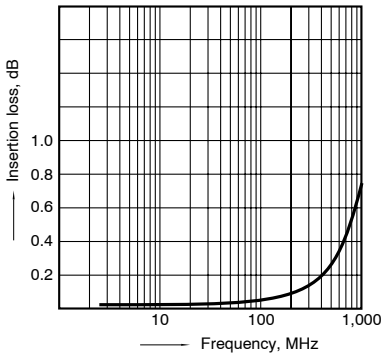
10. Distribution of contact resistance
Tested sample: TXS2-4.5V, 50 pcs. (50x4 contacts)



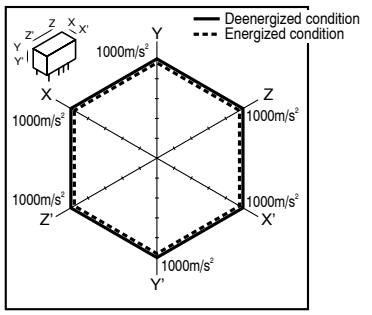
11-(1). High frequency characteristics
Tested sample: TXS2-4.5V, 2 pcs.
Isolation characteristics



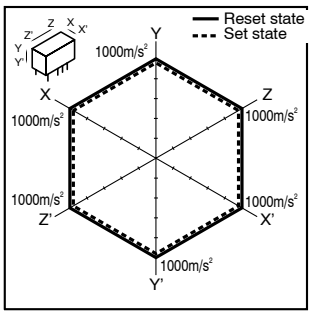
11-(2). High frequency characteristics
Tested sample: TXS2-4.5V, 2 pcs.
Insertion loss characteristics



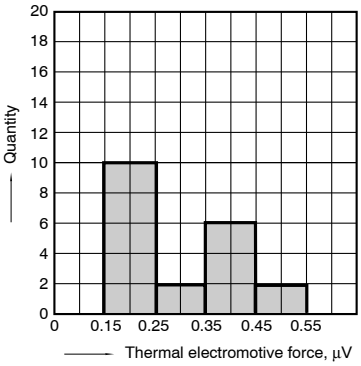
12-(1). Malfunctional shock (single side stable)
Tested sample: TXS2-4.5V, 6 pcs.



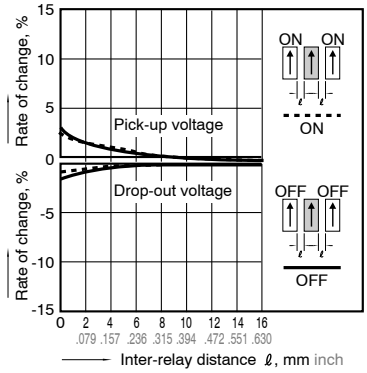
12-(2). Malfunctional shock (latching)
Tested sample: TXS2-L2-4.5V, 6 pcs.



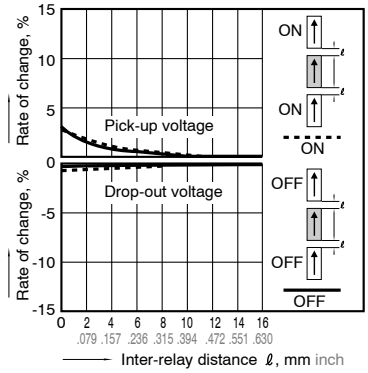
13. Thermal electromotive force
Tested sample: TXS2-4.5V, 10 pcs.



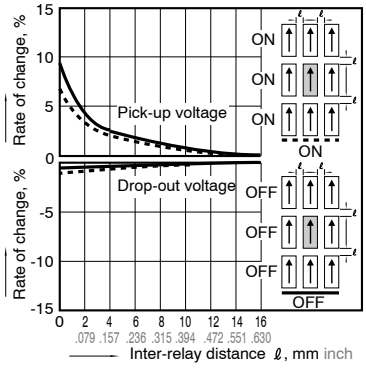
14-(1). Influence of adjacent mounting
Tested sample: TXS2-4.5V, 6 pcs.



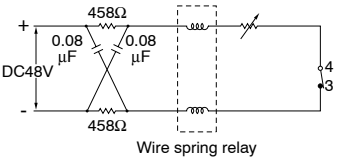
14-(2). Influence of adjacent mounting
Tested sample: TXS2-4.5V, 6 pcs.



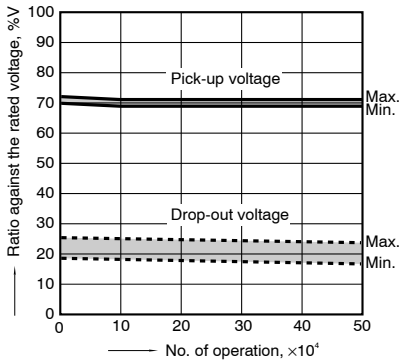
14-(3). Influence of adjacent mounting
Tested sample: TXS2-4.5V, 6 pcs.



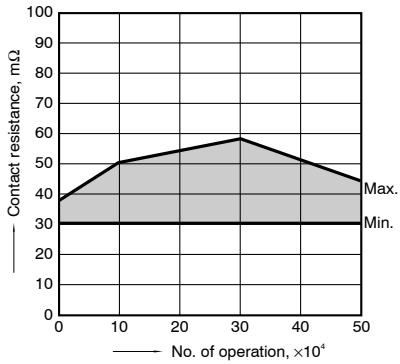
15. Pulse dialing test
Tested sample: TXS2-4.5V, 6 pcs.
(35 mA 48V DC wire spring relay load)



Change of pick-up and drop-out voltage



Change of contact resistance

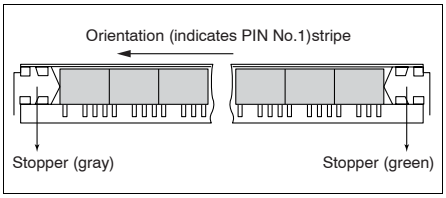


Note: Data of surface-mount type are the same as those of PC board terminal type.

NOTES

1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

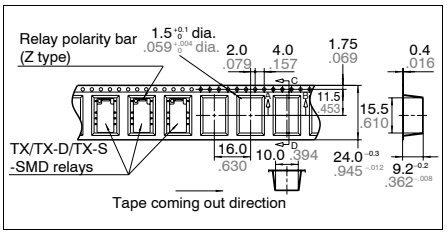


2) Tape and reel packing (surface-mount terminal type)

(1) Tape dimensions

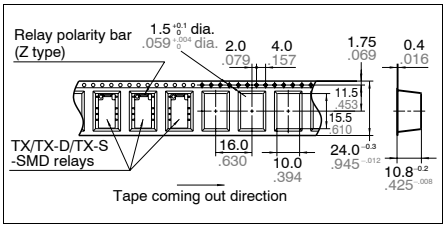
(i) SA type

mm inch



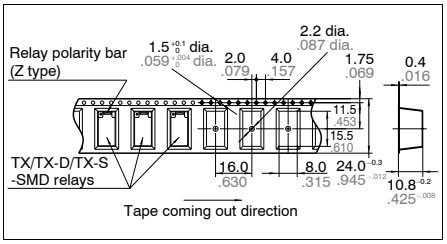
(ii) SL type

mm inch



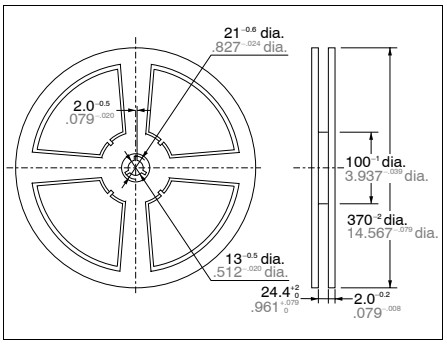
(iii) SS type

mm inch



(2) Dimensions of plastic reel

mm inch



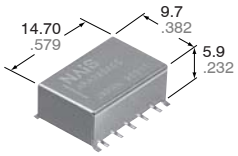
For Cautions for Use, see Relay Technical Information (page 392).

Hochfrequenzrelais

Panasonic
ideas for life

2.6 GHz SMALL MICROWAVE RELAYS

RA RELAYS (ARA)



mm inch

FEATURES

1. High frequency characteristics (Impedance 50Ω, ~1.0GHz)

- Insertion loss; Max. 0.3dB
- Isolation; Min. 20dB (Between open contacts)
  Min. 30dB (Between contact sets)
- V.S.W.R.; Max. 1.2

2. Surface mount terminal

This relay is a surface-mounted model with excellent high-frequency properties. In addition, it can use a microstrip line in the base circuit design which spares the labor of machining the base.

3. Low profile small type

9.7(W)×14.7(L)×5.9(H) mm
.382(W)×.579(L)×.232(H) inch

4. High sensitivity: 140 mW nominal operating power

5. High contact reliability

Electrical life: Min. 10^7 (10mA 10V DC)

TYPICAL APPLICATIONS

- **Measurement instruments**
  Oscilloscope attenuator circuit

SPECIFICATIONS

Contact

Arrangement			2 Form C
Contact material			Gold-clad silver alloy
Initial contact resistance			Max. 75mΩ
Rating	Contact rating (resistive)		10mA 10 V DC 1A 30 V DC
	Contact carrying power		Max. 3W (at 1.0GHz, impedance 50Ω, V.S.W.R. max.1.2)
	Max. switching voltage		30 V DC
	Max. switching current		1A
High frequency characteristics (~1GHz, Impedance 50Ω)	Isolation	Between open contacts	Min. 20dB
		Between contact sets	Min. 30dB
	Insertion loss		Max. 0.3dB
	V.S.W.R.		Max. 1.2
	Input power		Max. 3W (at 1.0GHz, impedance 50Ω, V.S.W.R. max.1.2)
Nominal operating power	Single side stable		140mW (1.5 to 12V) 200mW (24V) 300mW (48V)
	1 coil latching		70 mW (1.5 to 12V) 100mW (24V)
	2 coil latching		140mW (1.5 to 12V) 200mW (24V)
Expected life (min. operation)	Mechanical (at 180 cpm)		10^8
	Electrical (at 20 cpm)	10mA 10 V DC (resistive load)	10^7
		1A 30 V DC (resistive load)	10^5

Characteristics

Initial insulation resistance *1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage *2	Between open contacts	750 Vrms for 1 min.
	Between contact sets	1,000 Vrms for 1 min.
	Between contact and coil	1,000 Vrms for 1 min.
	Between contact and earth terminal	1,000 Vrms for 1 min.
Operate time [Set time] *3 (at 20°C)		Max. 4ms (Approx. 2ms) [Max. 4ms (Approx. 2ms)]
Release time (without diode) [Reset time] *3 (at 20°C)		Max. 4ms (Approx. 1ms) [Max. 4ms (Approx. 2ms)]
Temperature rise (at 20°C) *4		Max. 60°C
Shock resistance	Functional *5	Min. 500 m/s²
	Destructive *6	Min. 1,000 m/s²
Vibration resistance	Functional *7	10 to 55 Hz at double amplitude of 3mm
	Destructive	10 to 55 Hz at double amplitude of 5mm
Conditions for operation, transport and storage *8 (Not freezing and condensing at low temperature)	Ambient temp	–40°C to +85°C –40°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 2g .07oz

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Nominal operating voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil: 3W contact carrying power: at 1.0GHz, Impedance 50Ω, V.S.W.R. Max.1.2
*5 Half-wave pulse of sine wave: 11ms, detection time: 10μs.
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

ORDERING INFORMATION

Ex. A | RA | 2 | 0 | 0 | A | 03 | [ ]

Product name	Contact arrangement	Operating function	Type of operation	Terminal shape	Coil voltage, V DC	Packing style
RA	2: 2 Form C	0: Single side stable 1: 1 coil latching 2: 2 coil latching	0: Standard type (B.B.M)	A: Surface-mount terminal	1H: 1.5 09: 9 03: 3 12: 12 4H: 4.5 24: 24 05: 5 48: 48 06: 6	Nil: Tube packing X: Tape and reel packing (picked from 1/2/3 pin side) Z: Tape and reel packing (picked from 8/9/10 pin side)

Note: Packing style; Nil: Tube packing 40 pcs. in an inner package, 1,000 pcs. in an outer package
Z: Tape and reel packing 500 pcs. in an inner package, 1,000 pcs. in an outer package

TYPES ANE COIL DATA (at 20°C 68°F)

• Single side stable type

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
ARA200A1H(Z)	1.5	1.125	0.15	16	93.8	140	2.25
ARA200A03(Z)	3	2.25	0.3	64.3	46.7	140	4.5
ARA200A4H(Z)	4.5	3.375	0.45	145	31	140	6.75
ARA200A05(Z)	5	3.75	0.5	178	28.1	140	7.5
ARA200A06(Z)	6	4.5	0.6	257	23.3	140	9
ARA200A09(Z)	9	6.75	0.9	579	15.5	140	13.5
ARA200A12(Z)	12	9	1.2	1,028	11.7	140	18
ARA200A24(Z)	24	18	2.4	2,880	8.3	200	36
ARA200A48(Z)	48	36	4.8	7,680	6.3	300	57.6

• 1 coil latching type

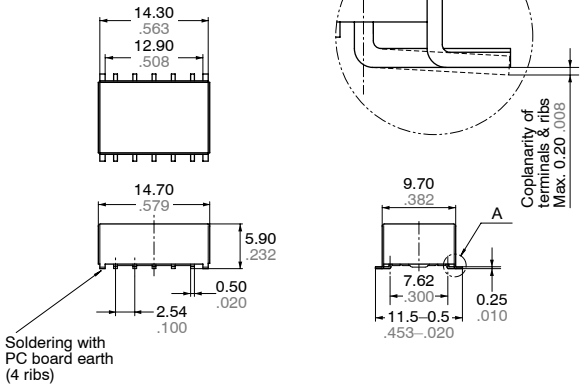
Part No.	Nominal voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
ARA210A1H(Z)	1.5	1.125	1.125	32	46.9	70	2.25
ARA210A03(Z)	3	2.25	2.25	128.6	23.3	70	4.5
ARA210A4H(Z)	4.5	3.375	3.375	289.3	15.6	70	6.75
ARA210A05(Z)	5	3.75	3.75	357	14	70	7.5
ARA210A06(Z)	6	4.5	4.5	514	11.7	70	9
ARA210A09(Z)	9	6.75	6.75	1,157	7.8	70	13.5
ARA210A12(Z)	12	9	9	2,057	5.8	70	18
ARA210A24(Z)	24	18	18	5,760	4.2	100	36

• 2 coil latching type

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
ARA220A1H(Z)	1.5	1.125	1.125	16	93.8	140	2.25
ARA220A03(Z)	3	2.25	2.25	64.3	46.7	140	4.5
ARA220A4H(Z)	4.5	3.375	3.375	145	31	140	6.75
ARA220A05(Z)	5	3.75	3.75	178	28.1	140	7.5
ARA220A06(Z)	6	4.5	4.5	257	23.3	140	9
ARA220A09(Z)	9	6.75	6.75	579	15.5	140	13.5
ARA220A12(Z)	12	9	9	1,028	11.7	140	18
ARA220A24(Z)	24	18	18	2,880	8.3	200	36

DIMENSIONS

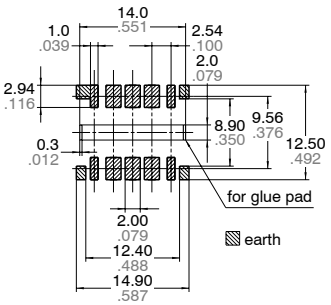
mm inch



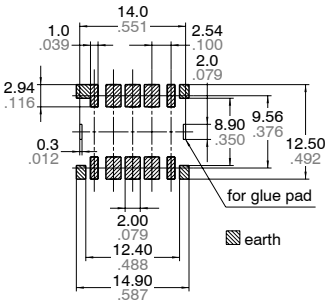
Tolerance: ±0.3 ±.012

Suggested Mounting Pads (Top view)

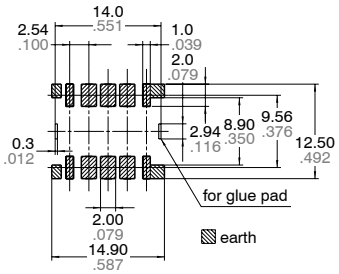
Single side stable



1 coil latching



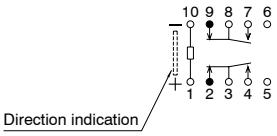
2 coil latching



Tolerance: ±0.1 ±.004

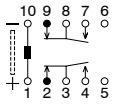
Schematic (Top view)

Single side stable



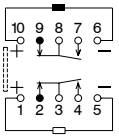
(Deenergized condition)

1 coil latching



(Reset condition)

2 coil latching



(Reset condition)

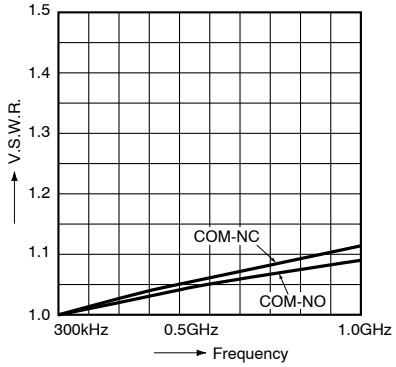
REFERENCE DATA

1-(1). High frequency characteristics (Impedance 50Ω)

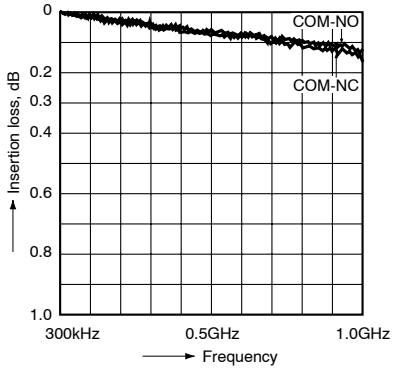
Sample: ARA200A12

Measuring method: Measured with HP network analyzer (HP8753C).

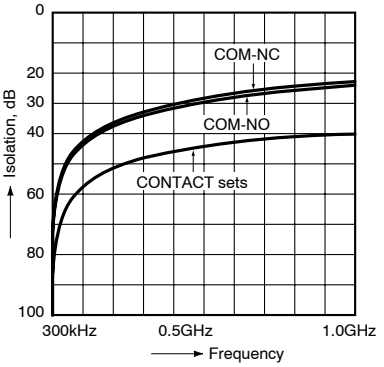
• V.S.W.R.



• Insertion loss

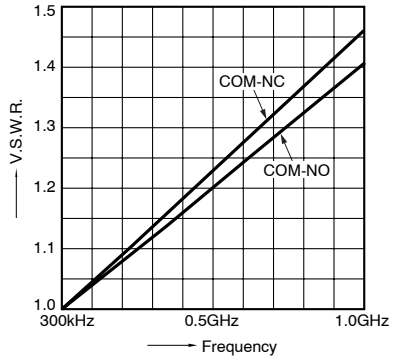


• Isolation

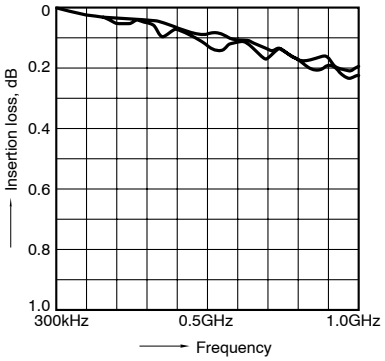


1-(2). High frequency characteristics (Impedance 75Ω)
Sample: ARA200A12
Measuring method: Measured with HP network analyzer (HP8753C).

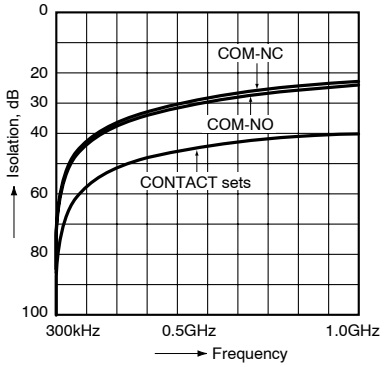
• V.S.W.R.



• Insertion loss



• Isolation



For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

26.5GHz, 18GHz COAXIAL SWITCH

RD COAXIAL SWITCHES (ARD)

FEATURES

1. Excellent high frequency characteristics (SPDT, transfer) up to 26.5 GHz.

2. SPDT, transfer and SPST type is available

3. High sensitivity
Nominal operating power:
840 mW (SPDT, Failsafe type)
1540 mW (Transfer, Failsafe type)

4. Long life: 5×10^6 (SPDT, transfer)

5. Latching type is also available

TYPICAL APPLICATIONS

Wireless and mobile communication
- Cellular phone base stations
- Amplifier switching

Digital broadcasting
- Broadcasting equipment

Measurement instruments
- All types of inspection equipment

SPECIFICATIONS

Contact

Arrangement		SPDT			Transfer			SPST
Contact material		Gold plating						
Initial contact resistance		Max. 100mΩ						
Rating	Contact input power*1	120W 3GHz (V.S.W.R. 1.15 or less, no contact switching, ambient temperature 40°C [SPDT], 25°C [Transfer])#1						120W 2.2GHz (V.S.W.R. 1.2 or less, no contact switching) 150W 2.2GHz (V.S.W.R. 1.2 or less, no contact switching when cooling fan is used)
Indicator rating	Contact rating	Max. 30V 100mA			Max. 5V 100mA			—
	Initial contact resistance (Measured by 5V 100mA)	Max. 1Ω						—
High frequency characteristics (Impedance 50Ω)		to 1 GHz	1 to 4	4 to 8	8 to12.4	12.4 to 18	18 to 26.5#2	—
	V.S.W.R. (max.)	1.1	1.15	1.25	1.35	1.5	1.7	See “REFERENCE DATA”
	Insertion loss (dB, max.)	0.2		0.3	0.4	0.5	0.8	
	Isolation (dB, min.)	85	80	70	65	60	55	
Expected life (min. operation)	Mechanical (at 180 cpm)	5×10^6						10^4
	Electrical (at 20 cpm)	5×10^6 (5W, to 3GHz, impedance 50Ω, V.S.W.R.; max. 1.2)						10^4 (80W, to 2.2GHz, impedance 50Ω, V.S.W.R.; max. 1.2, ambient temperature; max. 40°C 104°F)

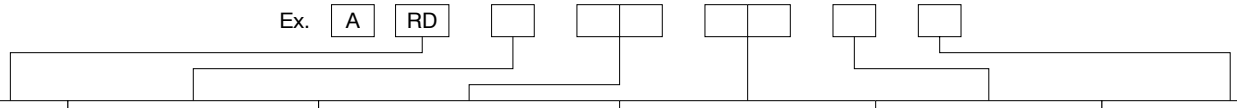
#1 Factors such as heating of the connected connector influence the high frequency characteristics; therefore, please verify under actual conditions of use.
#2 18 to 26.5 GHz characteristics apply to the 26.5 GHz type only.

Characteristics

			SPDT	Transfer	SPST
Initial insulation resistance*2			Min. 1,000 MΩ (at 500 V DC)		
Initial breakdown voltage*3	Between open contacts		500 Vrms for 1 min.		
	Between contact and coil		500 Vrms for 1 min.		
	Between contact and earth terminal		500 Vrms for 1 min.		
	Between coil and earth terminal		500 Vrms for 1 min.		
Operate time*4 (at 20°C)			Max. 15ms	Max. 20ms	Max. 15ms
Shock resistance		Functional*5	Min. 500 m/s² {50G}		Min. 200 m/s² {20G}
		Destructive*6	Min. 1,000 m/s² {100G}		
Vibration resistance		Functional*7	10 to 55 Hz at double amplitude of 3mm		
		Destructive	10 to 55 Hz at double amplitude of 5mm		
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)		Ambient temp	–55°C to +85°C –67°F to +185°F		
		Humidity	5 to 85% R.H.		
Unit weight (Approx.)			50g 1.76oz	110g 3.88oz	20g .71oz

Remarks
*1 Please verify the usability of input power under actual conditions because heat generated from connectors can influence connection.
*2 Measurement at same location as “Initial breakdown voltage” section.
*3 Detection current: 10mA
*4 Nominal operating voltage applied to the coil, excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11ms, detection time: 10μs.
*6 Half-wave pulse of sine wave: 11ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

ORDERING INFORMATION



Product name	Frequency	Operating function	Nominal operating voltage, V DC	Operation terminal	HF data attached (SPDT, Transfer)
RD	0: to 3GHz (SPST) 1: to 18GHz (SPDT) 2: to 18GHz (Transfer) 5: to 26.5GHz (SPDT) 6: to 26.5GHz (Transfer)	00: Failsafe 10: Latching (SPST) 20: Latching (SPDT, Transfer) 51: Latching with TTL driver (with self cut-off function) (SPDT, Transfer)	4H: 4.5V (Failsafe, Latching type only) 05: 5V (Latching with TTL driver type only) 12: 12V 24: 24V	Nil: Solder terminal (SPDT, Transfer), Lead wire (SPST) C: Connector cable (SPDT type only)	Nil: No HF test data attached Q: HF test data attached

Note: Sealed types are also available. (SPDT type only)

TYPES

1. SPDT

1) Solder terminal

Operating function	Nominal operating voltage, V DC	18GHz type		26.5GHz type	
		No HF datasheet attached	HF datasheet attached	No HF datasheet attached	HF datasheet attached
Failsafe	4.5	ARD1004H	ARD1004HQ	ARD5004H	ARD5004HQ
	12	ARD10012	ARD10012Q	ARD50012	ARD50012Q
	24	ARD10024	ARD10024Q	ARD50024	ARD50024Q
Latching	4.5	ARD1204H	ARD1204HQ	ARD5204H	ARD5204HQ
	12	ARD12012	ARD12012Q	ARD52012	ARD52012Q
	24	ARD12024	ARD12024Q	ARD52024	ARD52024Q
Latching with TTL driver (with self cut-off function)	5	ARD15105	ARD15105Q	ARD55105	ARD55105Q
	12	ARD15112	ARD15112Q	ARD55112	ARD55112Q
	24	ARD15124	ARD15124Q	ARD55124	ARD55124Q

Note: Standard packing; Carton: 1 pc. Case: 20 pcs.

2) Connector cable

Operating function	Nominal operating voltage, V DC	18GHz type		26.5GHz type	
		No HF datasheet attached	HF datasheet attached	No HF datasheet attached	HF datasheet attached
Failsafe	4.5	ARD1004HC	ARD1004HCQ	ARD5004HC	ARD5004HCQ
	12	ARD10012C	ARD10012CQ	ARD50012C	ARD50012CQ
	24	ARD10024C	ARD10024CQ	ARD50024C	ARD50024CQ
Latching	4.5	ARD1204HC	ARD1204HCQ	ARD5204HC	ARD5204HCQ
	12	ARD12012C	ARD12012CQ	ARD52012C	ARD52012CQ
	24	ARD12024C	ARD12024CQ	ARD52024C	ARD52024CQ
Latching with TTL driver (with self cut-off function)	5	ARD15105C	ARD15105CQ	ARD55105C	ARD55105CQ
	12	ARD15112C	ARD15112CQ	ARD55112C	ARD55112CQ
	24	ARD15124C	ARD15124CQ	ARD55124C	ARD55124CQ

Note: Standard packing; Carton: 1 pc. Case: 10 pcs.

2. Transfer

1) Solder terminal

Operating function	Nominal operating voltage, V DC	18GHz type		26.5GHz type	
		No HF datasheet attached	HF datasheet attached	No HF datasheet attached	HF datasheet attached
Failsafe	4.5	ARD2004H	ARD2004HQ	ARD6004H	ARD6004HQ
	12	ARD20012	ARD20012Q	ARD60012	ARD60012Q
	24	ARD20024	ARD20024Q	ARD60024	ARD60024Q
Latching	4.5	ARD2204H	ARD2204HQ	ARD6204H	ARD6204HQ
	12	ARD22012	ARD22012Q	ARD62012	ARD62012Q
	24	ARD22024	ARD22024Q	ARD62024	ARD62024Q
Latching with TTL driver (with self cut-off function)	5	ARD25105	ARD25105Q	ARD65105	ARD65105Q
	12	ARD25112	ARD25112Q	ARD65112	ARD65112Q
	24	ARD25124	ARD25124Q	ARD65124	ARD65124Q

Note: Standard packing; Carton: 1 pc. Case: 10 pcs.

3. SPST

Operating function	Nominal operating voltage, V DC	Part No.
Failsafe	4.5	ARD0004H
	12	ARD00012
	24	ARD00024
Latching	4.5	ARD0104H
	12	ARD01012
	24	ARD01024

Note: Standard packing; Carton: 1 pc. Case: 20 pcs.

COIL DATA (at 20°C 68°F)

1. SPDT

1) Failsafe type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%)	Nominal power consumption, mW
4.5	186.7	840
12	70.0	840
24	40.4	970

2) Latching type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%)	Nominal power consumption, mW
4.5	155.6	700
12	62.5	750
24	37.5	900

3) Latching with TTL driver type (with self cut-off function)

Nominal operating voltage, V DC	TTL logic level (see TTL logic level range)		Switching frequency
	ON	OFF	
5	2.4 to 5.5V	0 to 0.5V	Max. 180 cpm (ON time : OFF time = 1 : 1)
12			
24			

2. Transfer

1) Failsafe type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%)	Nominal power consumption, mW
4.5	342.2	1540
12	128.3	1540
24	69.6	1670

2) Latching type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%)	Nominal power consumption, mW
4.5	266.7	1200
12	104.2	1250
24	58.3	1400

3) Latching with TTL driver type (with self cut-off function)

Nominal operating voltage, V DC	TTL logic level (see TTL logic level range)		Switching frequency
	ON	OFF	
5	2.4 to 5.5V	0 to 0.5V	Max. 180 cpm (ON time : OFF time = 1 : 1)
12			
24			

3. SPST

1) Failsafe type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%)	Nominal power consumption, mW
4.5	400	1800
12	150	
24	75	

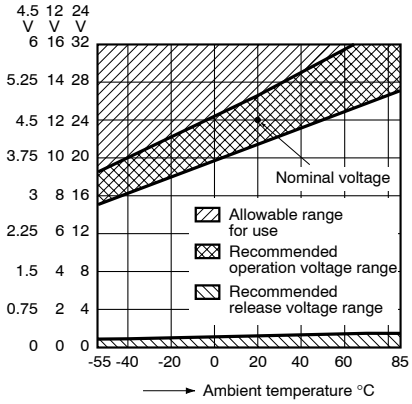
2) Latching type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%)	Nominal power consumption, mW
4.5	400	1800
12	150	
24	75	

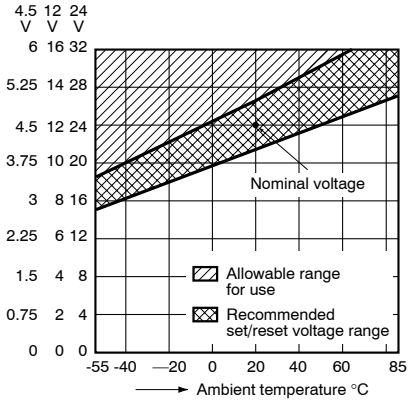
• Operating voltage range

(1) SPDT, Transfer type

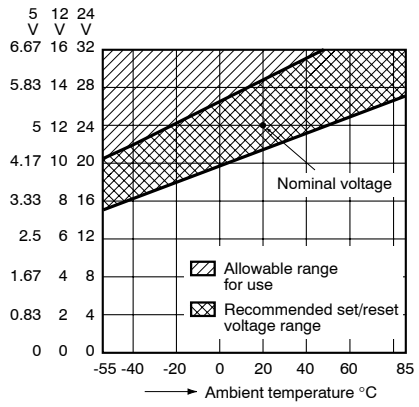
1) Failsafe type



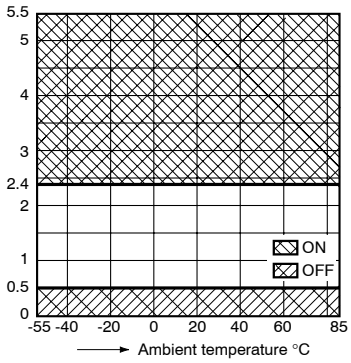
2) Latching type



3) Latching with TTL driver type (with self cut-off function)



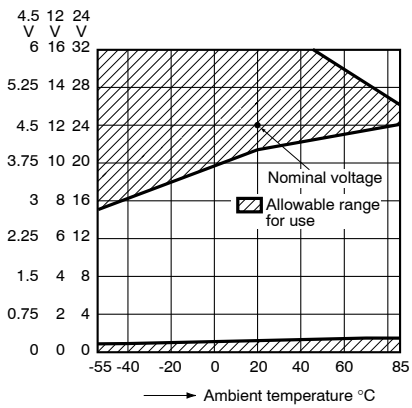
4) TTL Logic level range



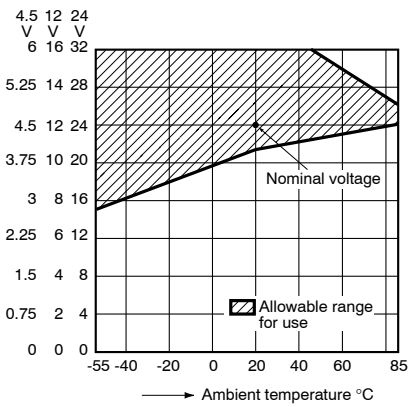
Note) Please consult us for use that is outside this range.

(2) SPST type

1) Failsafe type



2) Latching type

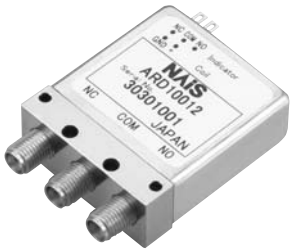


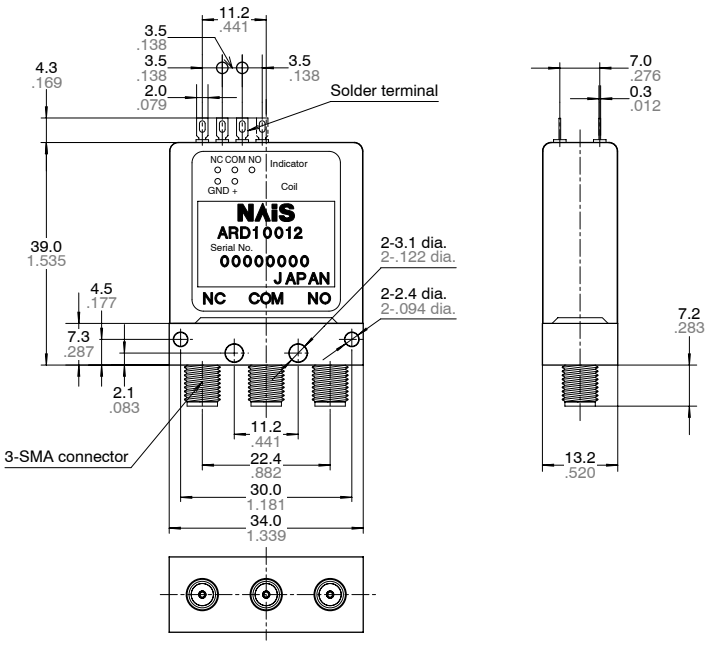
DIMENSIONS

mm inch

1. SPDT

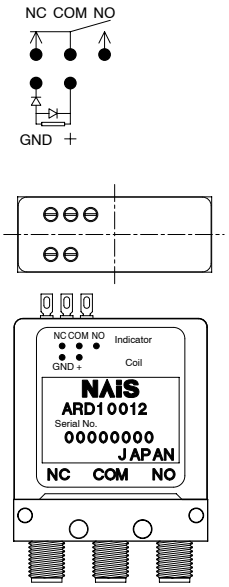
1) Solder terminal



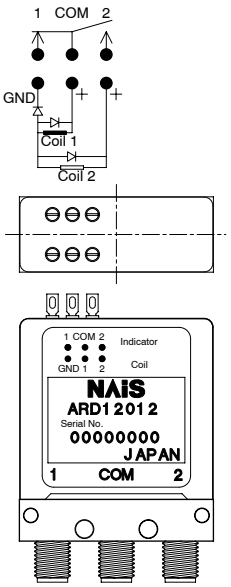


Tolerance: ±0.3 ±.012

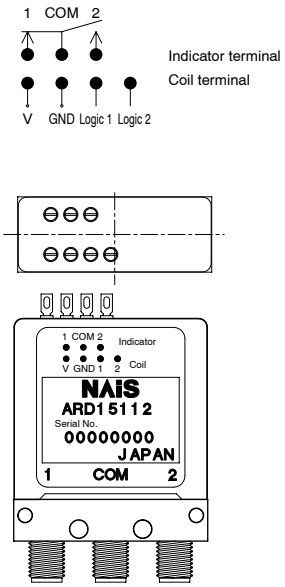
Failsafe



Latching



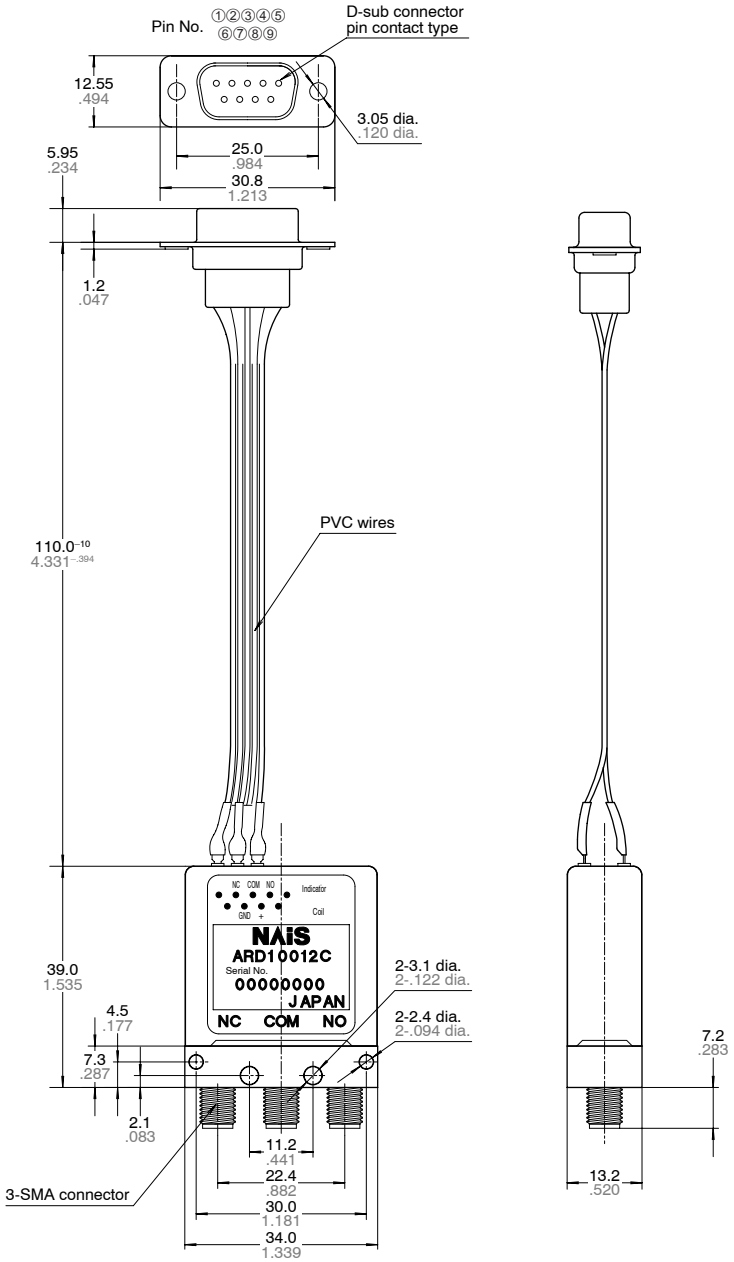
Latching with TTL driver
(with self cut-off function)



2) Connector cable

mm inch

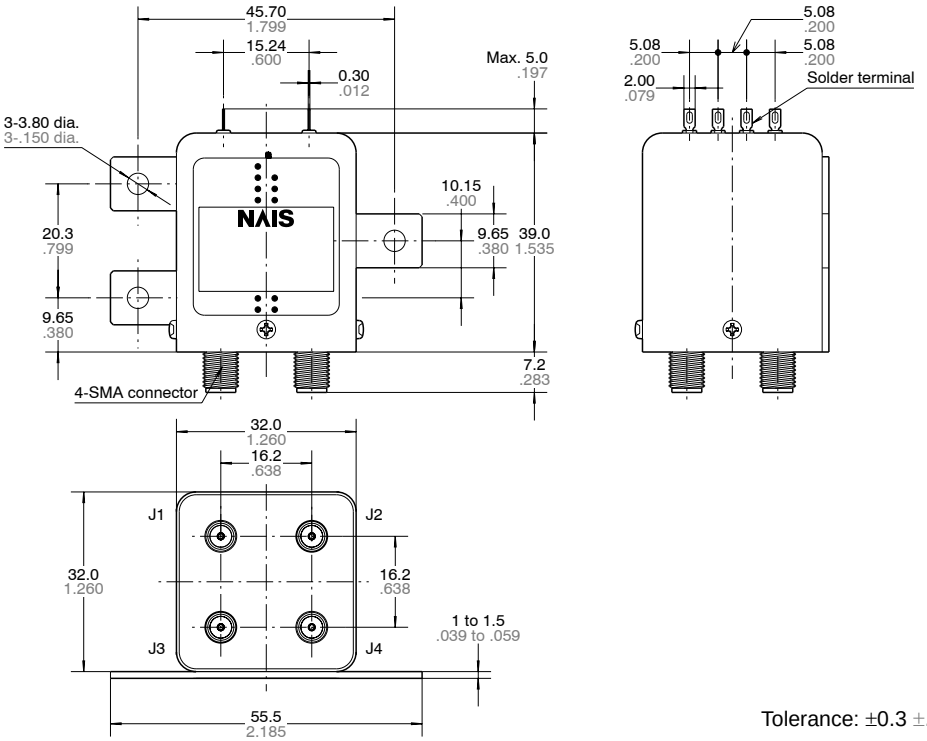
	Indicator					Coil			
Pin No.	①	②	③	④	⑤	⑥	⑦	⑧	⑨
Fail safe	–	NC	COM	NO	–	–	GND	+	–
Latching	–	1	COM	2	–	–	GND	1	2
Latching with TTL driver	–	1	COM	2	–	V	GND	Logic 1	Logic 2



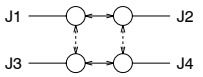
Tolerance: ±0.3 ±.012

2. Transfer

mm inch

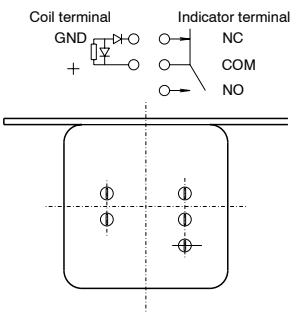


Tolerance: ±0.3 ±.012

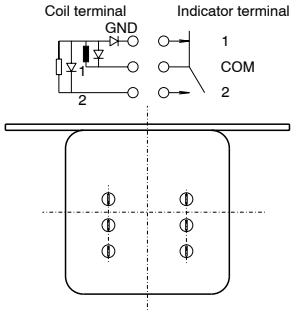


Fail safe	NC: J1-J2, J3-J4 NO: J1-J3, J2-J4
Latching	POS1: J1-J2, J3-J4 POS2: J1-J3, J2-J4
Latching with TTL driver	POS1: J1-J2, J3-J4 POS2: J1-J3, J2-J4

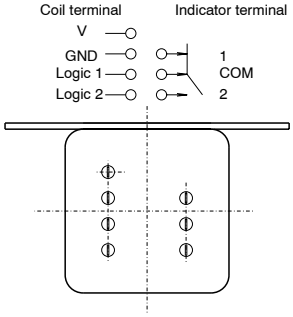
Failsafe



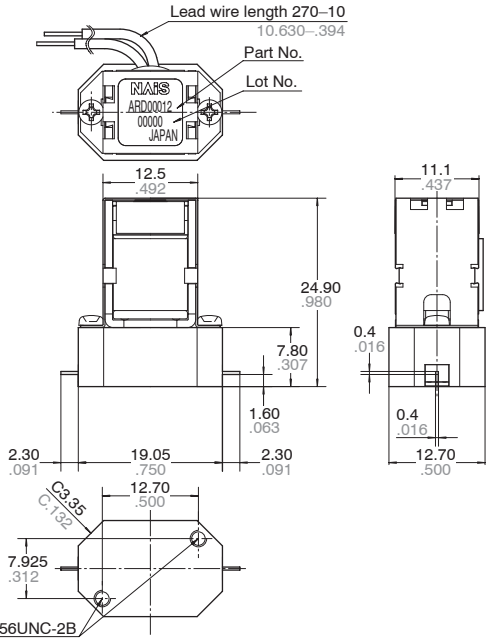
Latching



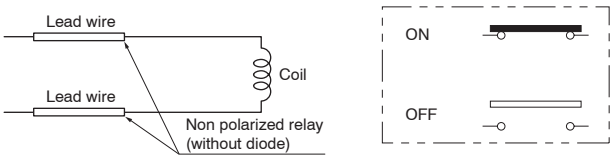
Latching with TTL driver
(with self cut-off function)



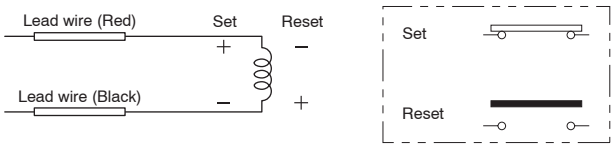
3. SPST



Fail safe type



Latching type

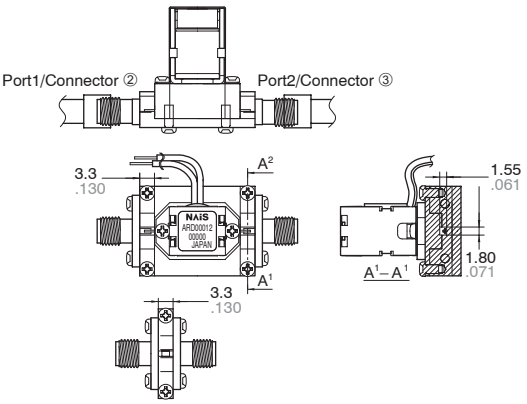


Tolerance: ±0.3 ±.012

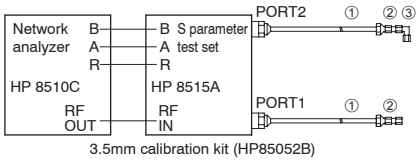
High-Frequency

• Measuring method (Impedance 50Ω)

(V.S.W.R.) The contact must be ON.
(Insertion loss) The contact must be ON.
(without DUT board's loss)
(Isolation) The contact must be OFF.
At that time, conduct measurement with an averaging of 64 times and 1% smoothing.



• Measuring equipment



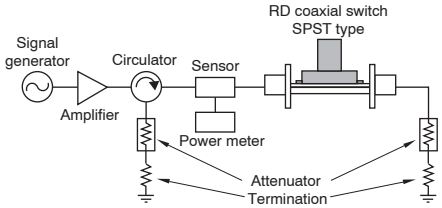
3.5mm calibration kit (HP85052B)

• Connector

No.	Contents	Product name
①	3.5 mm testport, Extention cable	HP85131-60013
②	3.5 mm coaxial adaptor	HP83059
③	SMA adaptor	HP125.771.000

• Input power test

Sample: ARD01024, Quantity: n = 5
Frequency: 2.2 GHz, Ambient temperature: Room temperature
Test circuit:



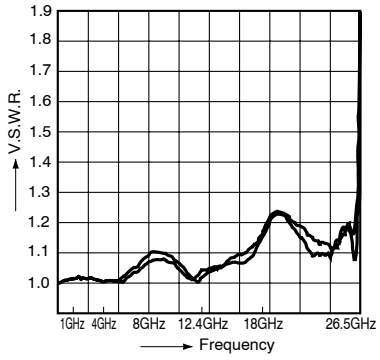
Sample	Cooling fan	Input power, W												
		80	90	100	110	120	130	140	150	160	170	180	190	200
No. 1	Without		○	○	→	→	→	→	○					
No. 2				○	→	○	→	→	○					
No. 3						○	○	→	○					
No. 4	With			○	→	○	→	→	○	→	○	○	→	○
No. 5									○	→	○	○	○	○

○: No abnormality for high frequency and operating characteristics were observed after 30 min. power carrying. (→; Test sequence)

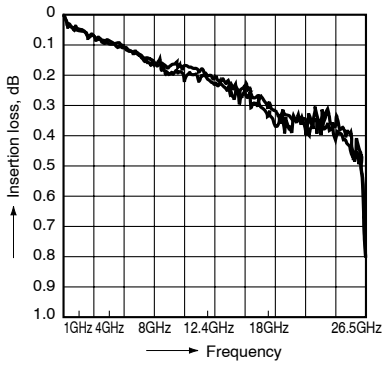
REFERENCE DATA

1-(1). High frequency characteristics (SPDT)
Sample: ARD10012
Measuring method: Measured with HP network analyzer (HP8510).

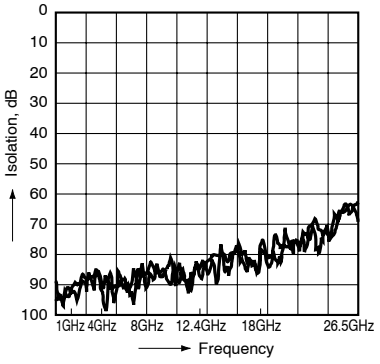
• V.S.W.R.



• Insertion loss

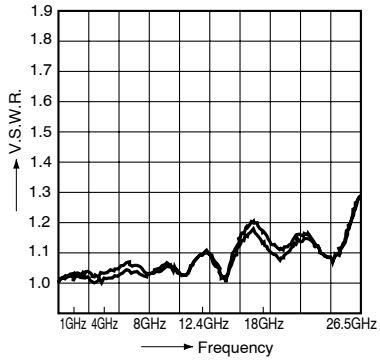


• Isolation

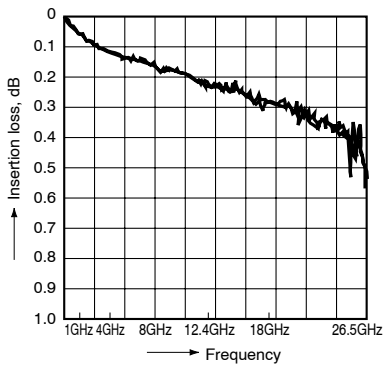


1-(2). High frequency characteristics (Transfer)
Sample: ARD60012
Measuring method: Measured with HP network analyzer (HP8510).

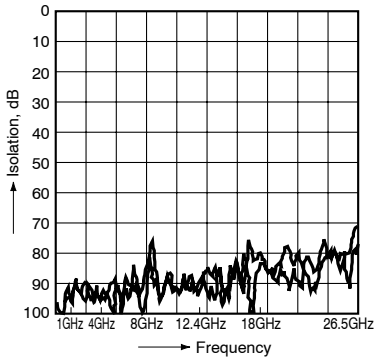
• V.S.W.R.



• Insertion loss

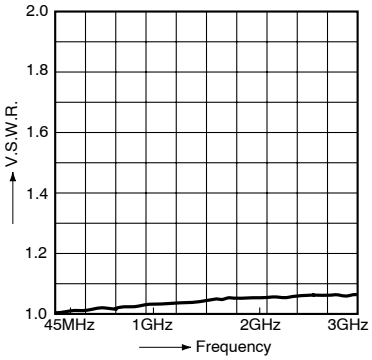


• Isolation

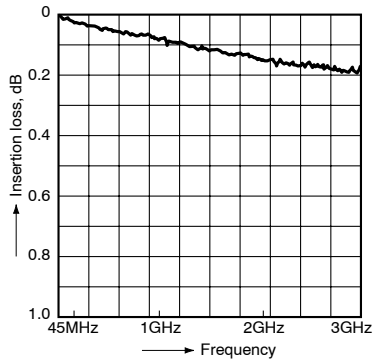


1-(3). High frequency characteristics (SPST)
Measuring method: Measured with HP network analyzer (HP8510).

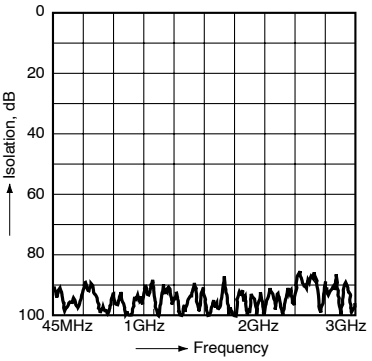
• V.S.W.R.



• Insertion loss



• Isolation



NOTES

1. Coil connection
When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction. (Only SPST failsafe type is non polarized relay)

2. Connection of coil indicator and washing conditions (SPDT, Transfer)
1) The connection of coil indicator terminal shall be done by soldering.
Soldering conditions
Max. 260°C 500°F (solder temp) within 10sec (soldering time)
Max. 350°C 662°F (solder temp) within 3sec (soldering time)
2) This product is not sealed type, therefore washing is not allowed.

3. Other handling precautions.
For SMA connectors, we recommend a torque of 0.90±0.1 N·m for installation, which falls within the prescribed torque of MIL-C-39012. Please be aware that conditions might be different depending on the connector materials and how it interacts with surrounding materials.

For Cautions for Use, see Relay Technical Information (page 392).

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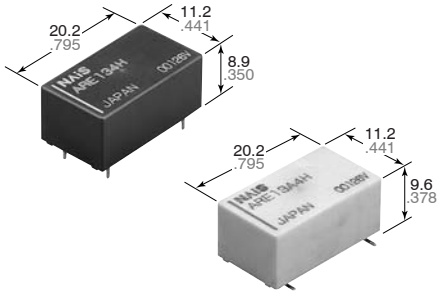
2.6 GHz SMALL MICROWAVE RELAYS

RE RELAYS (ARE)



mm inch

FEATURES

• Excellent high frequency characteristics (to 2.6GHz)

Type	Frequency	900MHz	2.6GHz
Impedance 50Ω	V.S.W.R. (Max.)	1.3	1.7
	Insertion loss (dB, Max.)	0.2	0.7
	Isolation (dB, Min.)	60	30
Impedance 75Ω	V.S.W.R. (Max.)	1.2	1.5
	Insertion loss (dB, Max.)	0.2	0.5
	Isolation (dB, Min.)	60	30

• Surface-mount type also available

• Compact and slim size
Size: 20.2(L) × 11.2(W) × 8.9(H)* mm
.795(L) × .441(W) × .350(H) inch
*Surface-mount terminal is 9.6 mm .378 inch size.

TYPICAL APPLICATIONS

1. Broadcasting and video markets.
• Digital broadcasting market
• STB/tuner market, etc.

2. Communications market
• Antennae switching
• All types of wireless devices

SPECIFICATIONS

Contact

Arrangement			1 Form C
Contact material			Gold
Initial contact resistance			Max. 100mΩ
Rating	Contact rating		1W (at 2.6 GHz [Impedance 75 Ω, V.S.W.R. Max.1.5] [Impedance 50 Ω, V.S.W.R. Max.1.7]) 10mA 24V DC (resistive load)
	Contact carrying power		10W (at 2.6GHz [Impedance 75 Ω, V.S.W.R. Max.1.5] [Impedance 50 Ω, V.S.W.R. Max.1.7])
	Max. switching voltage		30 V DC
	Max. switching current		0.5 A DC
High frequency characteristics (Impedance 75Ω)	V.S.W.R.		Max. 1.2 (to 900MHz) Max. 1.5 (to 2.6GHz)
	Insertion loss		Max. 0.2dB (to 900MHz) Max. 0.5dB (to 2.6GHz)
	Isolation		Min. 60dB (to 900MHz) Min. 30dB (to 2.6GHz)
High frequency characteristics (Impedance 50Ω)	V.S.W.R.		Max. 1.3 (to 900MHz) Max. 1.7 (to 2.6GHz)
	Insertion loss		Max. 0.2dB (to 900MHz) Max. 0.7dB (to 2.6GHz)
	Isolation		Min. 60dB (to 900MHz) Min. 30dB (to 2.6GHz)
Expected life (min. operations)	Mechanical (at 180 cpm)		10^6
	Electrical	1W, 2.6GHz, [Impedance 75Ω, V.S.W.R. & 1.5] [Impedance 50Ω, V.S.W.R. & 1.7]	3×10^5
		10mA 24V DC (resistive load) (at 20cpm)	3×10^5

Coil (at 20°C, 68°F)

Nominal operating power	200 mW

Characteristics

Initial insulation resistance*1			Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts		500 Vrms
	Between contact and coil		1,000 Vrms
	Between contact and ground terminal		500 Vrms
Operate time*3 (at 20°C)			Max. 10ms
Release time (without diode)*3 (at 20°C)			Max. 5ms
Temperature rise (at 20°C)*4			Max. 60°C
Shock resistance	Functional*5		Min. 500 m/s²{50 G}
	Destructive*6		Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*7		10 to 55 Hz at double amplitude of 3 mm
	Destructive		10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)		Ambient temp.	–40°C to 70°C –40°F to 158°F
		Humidity	5 to 85% R.H.
Unit weight			Approx. 5 g .18 oz

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Nominal operating voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil: Contact carrying power: 10W, at 2.6GHz, [Impedance 75Ω, V.S.W.R. & 1.5] [Impedance 50Ω, V.S.W.R. & 1.7]
*5 Half-wave pulse of sine wave: 11ms, detection time: 10μs.
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

07/2005

ORDERING INFORMATION

Ex. ARE 1 ☐ ☐ ☐ ☐

Contact arrangement	Operating function	Terminal shape	Coil voltage (DC)	Packing style
1: 1 Form C	0: Single side stable type (Impedance 50Ω) 3: Single side stable type (Impedance 75Ω)	Nil: Standard PC board terminal A: Surface-mount terminal	03: 3 V 4H: 4.5 V 06: 6 V 09: 9 V 12: 12 V 24: 24 V	Nil: Carton packing (Standard PC board terminal only) Tube packing (Surface-mount terminal only) Z: Tape and reel packing (picked from 12/13/14 pin side)

Note: Tape and reel packing symbol "-Z" is not marked on the relay.
"X" type tape and reel packing (picked from 8/9/10/11/12/13/14-pin side) is also available.
Suffix "X" instead of "Z".

TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type (Impedance 50Ω)
• Packing of standard PC board terminal: 50 pcs. in an inner package (carton); 500 pcs. in an outer package.
• Packing of surface-mount terminal: 25 pcs. in an inner package (tube); 200 pcs. in an outer package.
• Packing of surface-mount terminal: 400 pcs. in an inner package (tape and reel); 800 pcs. in an outer package.

Standard PC board terminal	Surface-mount terminal	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C)
ARE1003	ARE10A03	3	2.25	0.3	45	66.7	200	3.3
ARE104H	ARE10A4H	4.5	3.375	0.45	101	44.4	200	4.95
ARE1006	ARE10A06	6	4.5	0.6	180	33.3	200	6.6
ARE1009	ARE10A09	9	6.75	0.9	405	22.2	200	9.9
ARE1012	ARE10A12	12	9	1.2	720	16.7	200	13.2
ARE1024	ARE10A24	24	18	2.4	2,880	8.3	200	26.4

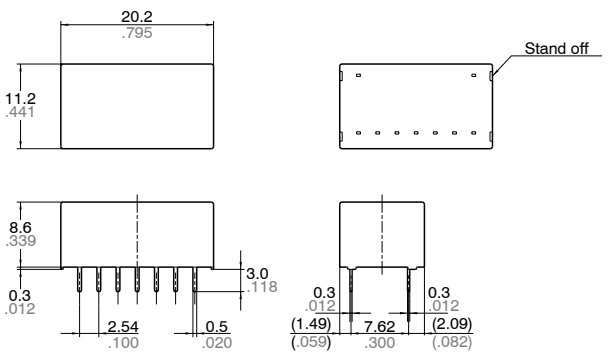
• Single side stable type (Impedance 75Ω)
• Packing of standard PC board terminal: 50 pcs. in an inner package (carton); 500 pcs. in an outer package.
• Packing of surface-mount terminal: 25 pcs. in an inner package (tube); 200 pcs. in an outer package.
• Packing of surface-mount terminal: 400 pcs. in an inner package (tape and reel); 800 pcs. in an outer package.

Standard PC board terminal	Surface-mount terminal	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C)
ARE1303	ARE13A03	3	2.25	0.3	45	66.7	200	3.3
ARE134H	ARE13A4H	4.5	3.375	0.45	101	44.4	200	4.95
ARE1306	ARE13A06	6	4.5	0.6	180	33.3	200	6.6
ARE1309	ARE13A09	9	6.75	0.9	405	22.2	200	9.9
ARE1312	ARE13A12	12	9	1.2	720	16.7	200	13.2
ARE1324	ARE13A24	24	18	2.4	2,880	8.3	200	26.4

DIMENSIONS

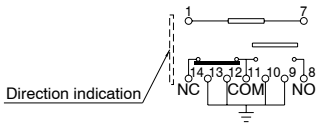
mm inch

1. Standard PC board terminal (75Ω, 50Ω type)



General tolerance: ±0.3 ±.012

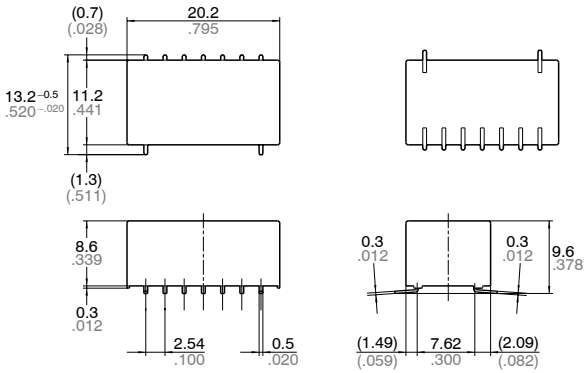
Schematic (Bottom view)



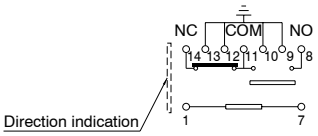
(Deenergized condition)

2. Surface mount terminal mm inch

• 75Ω type



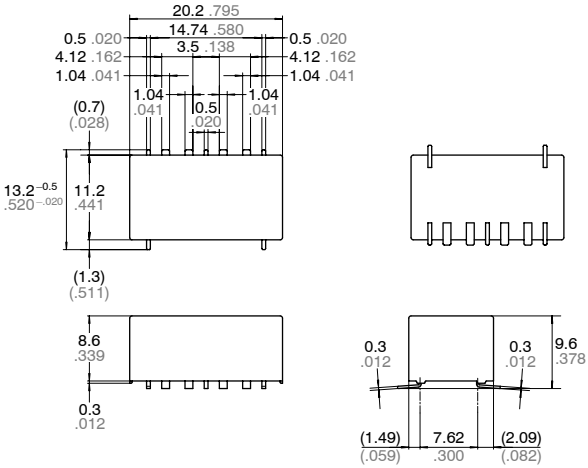
Schematic (Top view)



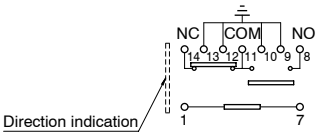
(Deenergized condition)

General tolerance: ±0.3 ±.012

• 50Ω type



Schematic (Top view)



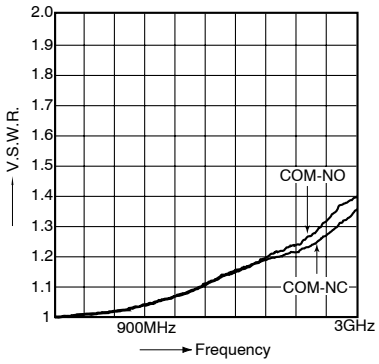
(Deenergized condition)

General tolerance: ±0.3 ±.012

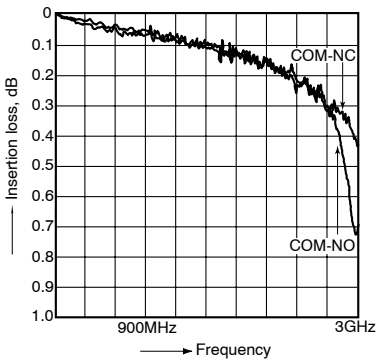
REFERENCE DATA

1-(1). High frequency characteristics (75Ω type) (Standard PC board terminal)

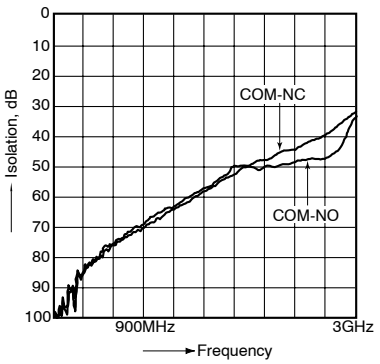
• V.S.W.R. characteristics



• Insertion loss characteristics

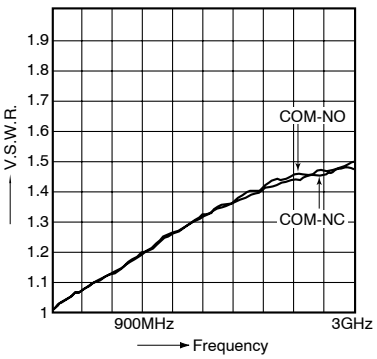


• Isolation characteristics

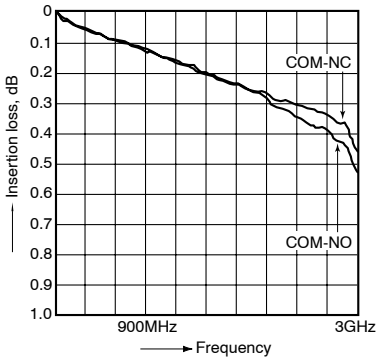


1-(2). High frequency characteristics (50Ω type) (Standard PC board terminal)

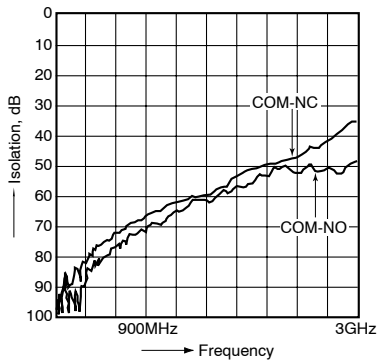
• V.S.W.R. characteristics



• Insertion loss characteristics



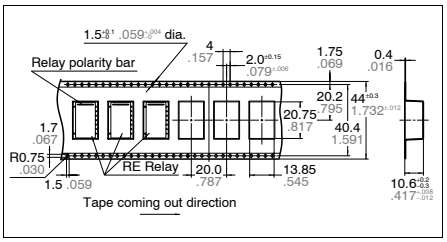
• Isolation characteristics



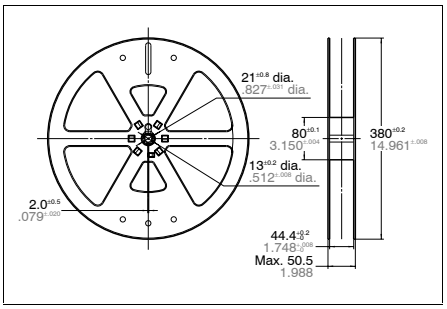
NOTES

1. Packing style

1) Tape dimensions



2) Dimensions of plastic reel



For Cautions for Use, see Relay Technical Information (page 392).

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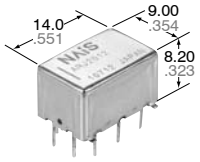
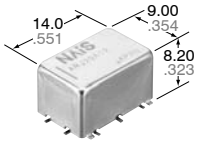
SMD RELAYS WITH 8GHz CAPABILITIES

RJ RELAYS (ARJ)





FEATURES

• Excellent high frequency characteristics (50Ω, at 5GHz)
V.S.W.R.: Max. 1.25
Insertion loss: Max. 0.5dB
Isolation: Min. 35dB
(Between open contacts)
Min. 30dB
(Between contact sets)

• Surface mount terminal
Surface mount terminals are now standard so there is much less work in designing PC boards.

• Small size
Size: 14.00 (L)×9.00 (W)×8.20 (H) mm
.551 (L)×.354 (W)×.323 (H) inch

TYPICAL APPLICATIONS

Measurement equipment market
Attenuator circuits, spectrum analyzer, oscilloscope, mobile equipment, tester

Mobile telecommunication market
IMT2000, microwave communication

Medical instruments market

SPECIFICATIONS

Contact

Arrangement			2 Form C
Contact material			Gold alloy
Initial contact resistance			Max. 150mΩ
Rating	Contact rating		1W (at 5 GHz, Impedance 50Ω, V.S.W.R. &1.25) 10mA 10V DC (resistive load)
	Contact carrying power		1W (at 5 GHz, Impedance 50Ω, V.S.W.R. &1.25)
	Max. switching voltage		30 V DC
	Max. switching current		0.3 A DC
High frequency characteristics (Initial) (~5GHz, Impedance 50Ω)	V.S.W.R.		Max. 1.25
	Insertion loss (without D.U.T. board's loss)		Max. 0.5dB
	Isolation	Between open contacts	Min. 35dB
		Between contact sets	Min. 30dB
	Input power		1W (at 5GHz, impedance 50Ω, V.S.W.R. &1.25, at 20°C)
Expected life (min. operations)	Mechanical (at 180 cpm)		10^7
	Electrical (at 20cpm)	1W, at 5GHz, V.S.W.R. & 1.25	10^6
		10mA 10V DC (resistive load)	10^6

Coil (at 20°C, 68°F)

	Nominal operating power
Single side stable	200 mW
2 coil latching	150 mW

Characteristics

Initial insulation resistance*1		Min. 500 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	500 Vrms
	Between contact sets	500 Vrms
	Between contact and coil	500 Vrms
	Between coil and earth terminal	500 Vrms
	Between contact and earth terminal	500 Vrms
Operate time [Set time]*3 (at 20°C)		Max. 5ms
Release time (without diode)[Reset time]*3 (at 20°C)		Max. 5ms
Temperature rise (at 20°C)*4		Max. 50°C
Shock resistance	Functional*5	Min. 500 m/s²
	Destructive*6	Min. 1,000 m/s²
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–30°C to 70°C –22°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 3 g .11 oz

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Nominal operating voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil, 5GHz, V.S.W.R. & 1.25
*5 Half-wave pulse of sine wave: 6ms, detection time: 10μs.
*6 Pulse of sine wave: 11ms.
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

ORDERING INFORMATION

Ex. ARJ [2] [ ] [ ] [ ] [ ]

Contact arrangement	Operating function	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	0: Single side stable 2: 2 coil latching	Nil: Standard PC board terminal A: Surface-mount terminal	03 : 3V 4H: 4.5V 12 : 12V 24 : 24V	Nil: Carton packing X: Tape end reel packing (picked from 1/2/3-pin side) Z: Tape and reel packing (picked from 6/7/8-pin side)

Note: Tape and reel packing symbol "-Z" is not marked on the relay. "X" type tape and reel packing (picked from 1/2/3-pin side) is also available. Suffix "X" instead of "Z".

TYPES AND COIL DATA (at 20°C 68°F)

1. Standard PC board terminal

• Packing of standard PC board terminal: 50 pcs. in an inner package (carton); 500 pcs. in an outer package

Operating function	Coil Rating, V DC	Part No. Standard PC board terminal	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	3	ARJ2003	2.25	0.3	66.6	45	200	3.3
	4.5	ARJ204H	3.375	0.45	44.4	101.2	200	4.95
	12	ARJ2012	9	1.2	16.6	720	200	13.2
	24	ARJ2024	18	2.4	8.3	2,880	200	26.4

Operating function	Coil Rating, V DC	Part No. Standard PC board terminal	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
2 coil latching	3	ARJ2203	2.25	2.25	50	60	150	3.3
	4.5	ARJ224H	3.375	3.375	33.3	135	150	4.95
	12	ARJ2212	9	9	12.5	960	150	13.2
	24	ARJ2224	18	18	6.3	3,840	150	26.4

2. Surface-mount terminal

• Packing of surface-mount terminal: 50 pcs. in an inner package (carton); 500 pcs. in an outer package

• Packing of surface-mount terminal: 500 pcs. in an inner package (tape and reel); 500 pcs. in an outer package

Operating function	Coil Rating, V DC	Part No. Carton packing	Part No. Tape and reel packing	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	3	ARJ20A03	ARJ20A03Z	2.25	0.3	66.6	45	200	3.3
	4.5	ARJ20A4H	ARJ20A4HZ	3.375	0.45	44.4	101.2	200	4.95
	12	ARJ20A12	ARJ20A12Z	9	1.2	16.6	720	200	13.2
	24	ARJ20A24	ARJ20A24Z	18	2.4	8.3	2,880	200	26.4

Operating function	Coil Rating, V DC	Part No. Carton packing	Part No. Tape and reel packing	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
2 coil latching	3	ARJ22A03	ARJ22A03Z	2.25	2.25	50	60	150	3.3
	4.5	ARJ22A4H	ARJ22A4HZ	3.375	3.375	33.3	135	150	4.95
	12	ARJ22A12	ARJ22A12Z	9	9	12.5	960	150	13.2
	24	ARJ22A24	ARJ22A24Z	18	18	6.3	3,840	150	26.4

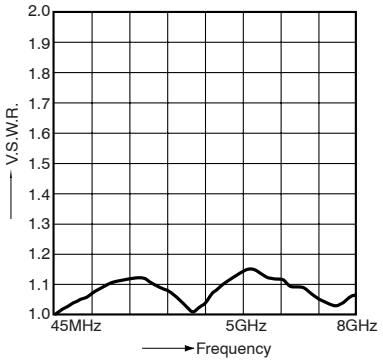
REFERENCE DATA

1. High frequency characteristics

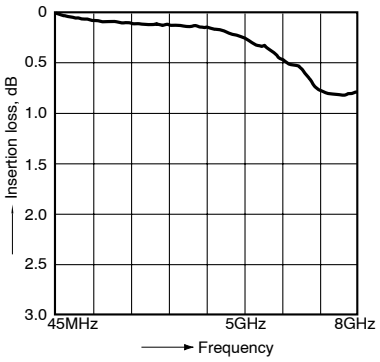
Sample: ARJ20A12

Measuring method: Measured with MEW PC board by HP network analyzer (HP8510C).

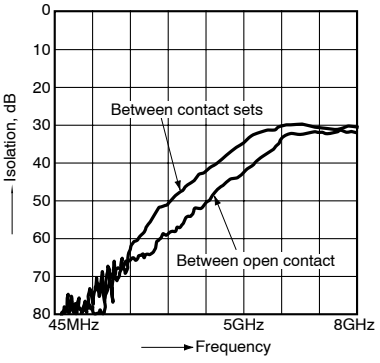
• V.S.W.R. characteristics



• Insertion loss characteristics (without D.U.T. board's loss)



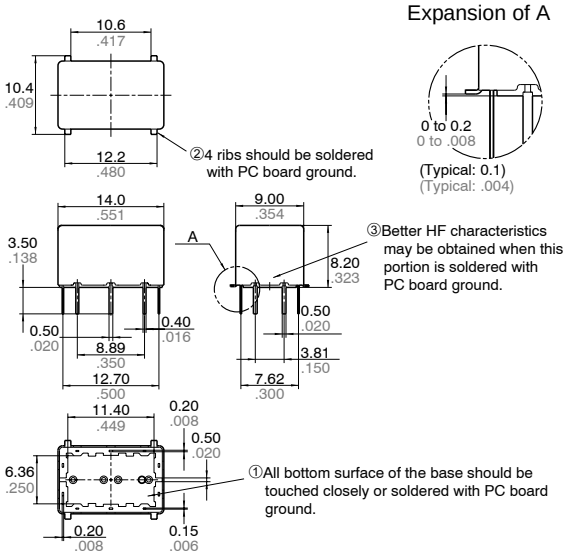
• Isolation characteristics



DIMENSIONS

mm inch

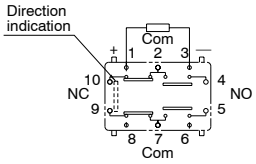
1. Standard PC board terminal



Expansion of A

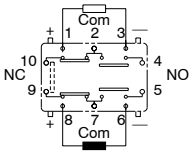
Schematic (Bottom view)

Single side stable



(Deenergized condition)

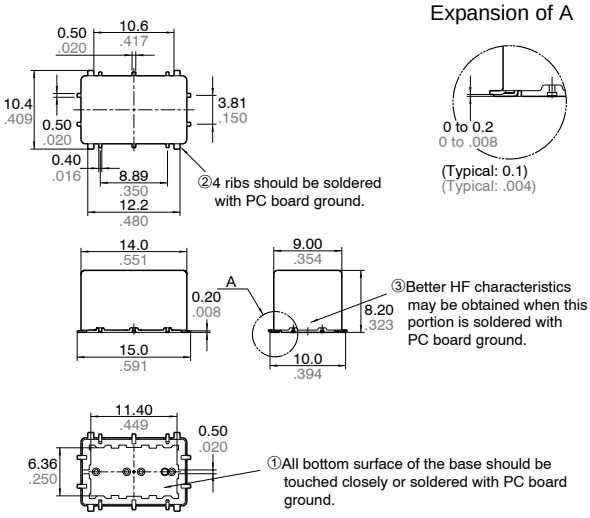
2 coil latching



(Reset condition)

General tolerance: ±0.3 ±.012

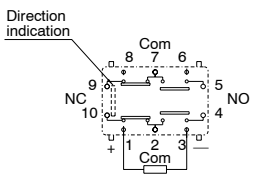
2. Surface mount terminal



Expansion of A

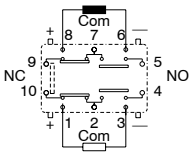
Schematic (Top view)

Single side stable



(Deenergized condition)

2 coil latching



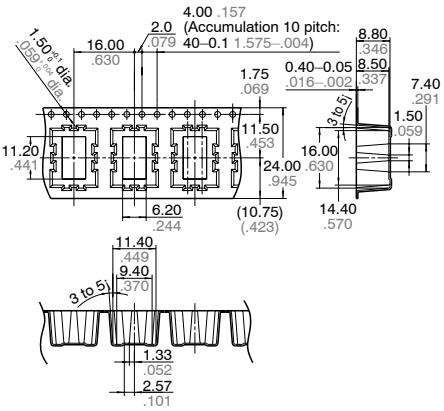
(Reset condition)

General tolerance: ±0.3 ±.012

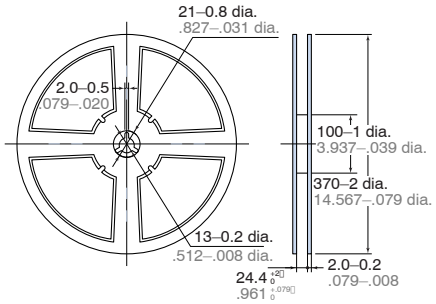
NOTES

1. Tape and reel packing

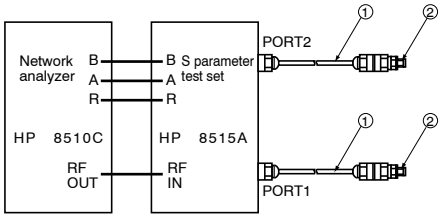
1) Tape dimensions



2) Dimensions of plastic reel



2. Measuring method (Impedance 50Ω)



Connector

No.	Product name	Contents
1	HP 85131-60013	3.5 mm testport, Extension cable
2	HP 83059	3.5 mm coaxial adaptor

(Step 1) Calibrate the test system with HP calibration kit [HP85052B]

(Step 2) After calibration, connect the D.U.T. board and measure. Connect 50 Ω terminals on connectors other than those for measurement.

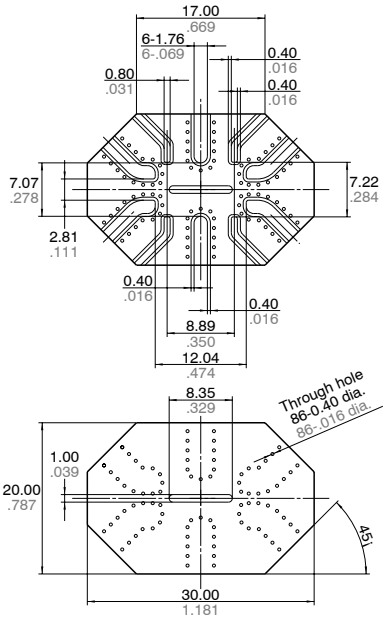
Notes)

1. All bottom surface of the base should be touched closely or soldered with PC board ground.
2. 4 ribs should be soldered with PC board ground.

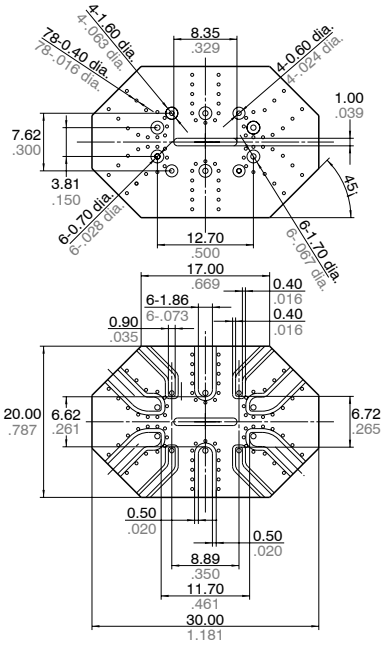
Measuring board

1) Dimensions

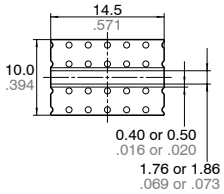
<Surface mount terminal>



<Standard PC board terminal>



<Calibration board>



2) Material: Glass PTFE double-sided through hole PC board R-4737 (Matsushita Electric Works)

3) Board thickness: t = 0.8 mm

4) Copper plating: 18μm

• Connector (SMA type receptacle)
Product name: R125 510 (RADIALL)

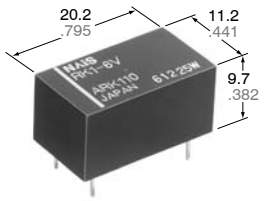
Insertion loss compensation

The insertion loss of relay itself is given by subtracting the insertion loss of short-circuit the Com and the NC (or NO). (signal path and two connectors)

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

1.5 GHz MICROWAVE RELAY RK RELAYS



mm inch

- **Excellent high frequency characteristics**
  Isolation: Min. 60dB (at 1.5 GHz)
  Insertion loss: Max. 0.3dB (at 900 MHz)
- **V.S.W.R.: Max. 1.5 (at 900MHz)**
- **High sensitivity in small size**
  Size: 20.2 × 11.2 × 9.7 mm .795 × .441 × .382 inch
  Nominal power consumption: 200 mW (single side stable type)
- **Sealed construction for automatic cleaning**
- **Latching types are also available**

SPECIFICATIONS

Contact

Arrangement			1 Form C
Contact material			Gold-clad
Initial contact resistance, max. (By HP4328A)			100 mΩ
Rating	Max. switching power		10 W
	Max. switching voltage		30 V DC
	Max. switching current		0.5 A
	Nominal switching capacity		0.01 A 24 V DC 10 W (at 1.2 GHz, Impedance 50Ω)
High frequency characteristics (Impedance 50Ω)	V.S.W.R.		Max. 1.5 (at 900 MHz)
	Insertion loss		Max. 0.3 dB (at 900 MHz)
	Isolation		Min. 60 dB (at 1.5 GHz)
Expected life (min. operations)	Mechanical		5×10^6
	Electrical	0.01 A 24 V DC	3×10^5
		10 W 1.2 GHz	10^5

Coil (at 25°C, 68°F)

	Nominal operating power
Single side stable	200 mW
1 coil latching	200 mW
2 coil latching	400 mW

Characteristics

Initial insulation resistance*1		Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	500 Vrms
	Between contact and coil	1,000 Vrms
	Between contact and earth terminal	500 Vrms
Operate time [Set time]*3 (at nominal voltage)		Approx. 6 ms [Approx. 5ms]
Release time (without diode) [Reset time]*3 (at nominal voltage)		Approx. 3 ms [Approx. 5ms]
Temperature rise		Max. 60°C with nominal coil voltage across coil and at nominal switching capacity
Shock resistance	Functional*4	Min. 196 m/s² {20 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	10 to 55 Hz at double amplitude of 3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage (Not freezing and condensing at low temperature)	Ambient temp.	-40°C to 70°C -40°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 4.4 g .155 oz

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms, detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs

TYPICAL APPLICATIONS

- **Audio visual equipment broadcast satellite tuners VCRs, CATVs, TVs**
- **Communication equipment automobile telephones maritime telephones emergency and disaster prevention communications, PCM switches**
- **Instrumentation test equipment measuring equipment**

ORDERING INFORMATION

Ex. RK [1] — [L2] — [24V]

Contact arrangement	Operating function	Coil voltage, DC
1: Standard type 1R: R type (See Schematic on next page.)	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	3, 4.5, 5, 6, 9, 12, 24 V

Note: Standard packing; Carton: 50 pcs. Case 500 pcs.

TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type

Part No.		Nominal voltage, V DC	Pick-up voltage, max. V DC	Drop-out voltage, min. V DC	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Maximum. allowable voltage, V DC (at 60°C 140°F)
RK1-3V	RK1R-3V	3	2.25	0.3	45	66.7	200	3.3
RK1-4.5V	RK1R-4.5V	4.5	3.38	0.45	101	44.4	200	4.95
RK1-5V	RK1R-5V	5	3.75	0.5	125	40.7	200	5.5
RK1-6V	RK1R-6V	6	4.5	0.6	180	33.3	200	6.6
RK1-9V	RK1R-9V	9	6.75	0.9	405	22.2	200	9.9
RK1-12V	RK1R-12V	12	9	1.2	720	16.7	200	13.2
RK1-24V	RK1R-24V	24	18	2.4	2,880	8.3	200	26.4

• 1 coil latching type

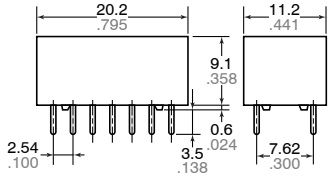
Part No.		Nominal voltage, V DC	Set voltage, max. V DC	Reset voltage, max. V DC	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Maximum. allowable voltage, V DC (at 60°C 140°F)
RK1-L-3V	RK1R-L-3V	3	2.25	2.25	45	66.7	200	3.3
RK1-L-4.5V	RK1R-L-4.5V	4.5	3.38	3.38	101	44.4	200	4.95
RK1-L-5V	RK1R-L-5V	5	3.75	3.75	125	40	200	5.5
RK1-L-6V	RK1R-L-6V	6	4.5	4.5	180	33.3	200	6.6
RK1-L-9V	RK1R-L-9V	9	6.75	6.75	405	22.2	200	9.9
RK1-L-12V	RK1R-L-12V	12	9	9	720	16.7	200	13.2
RK1-L-24V	RK1R-L-24V	24	18	18	2,880	8.3	200	26.4

• 2 coil latching type

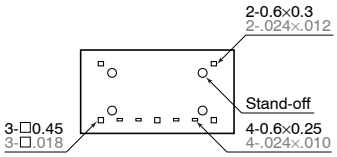
Part No.		Nominal voltage, V DC	Set voltage, max. V DC	Reset voltage, max. V DC	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Maximum. allowable voltage, V DC (at 60°C 140°F)
RK1-L2-3V	RK1R-L2-3V	3	2.25	2.25	22.5	133.3	400	3.3
RK1-L2-4.5V	RK1R-L2-4.5V	4.5	3.38	3.38	50.6	88.9	400	4.95
RK1-L2-5V	RK1R-L2-5V	5	3.75	3.75	62.5	80	400	5.5
RK1-L2-6V	RK1R-L2-6V	6	4.5	4.5	90	66.7	400	6.6
RK1-L2-9V	RK1R-L2-9V	9	6.75	6.75	202.5	44.4	400	9.9
RK1-L2-12V	RK1R-L2-12V	12	9	9	360	33.3	400	13.2
RK1-L2-24V	RK1R-L2-24V	24	18	18	1,440	16.7	400	26.4

DIMENSIONS

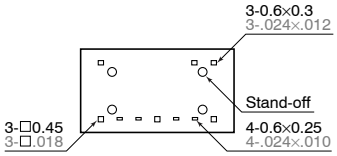
mm inch



Single side stable and
1 coil latching



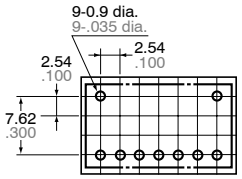
2 coil latching



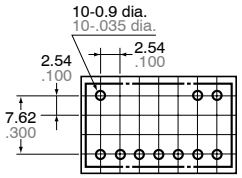
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

Single side stable and
1 coil latching



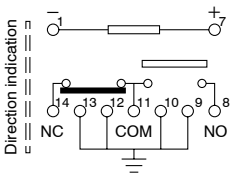
2 coil latching



Tolerance: ±0.1 ±.003

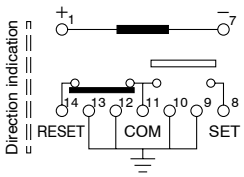
Schematic (Bottom view)

Single side stable



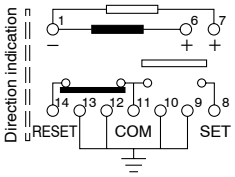
(Deenergized condition)

1 coil latching



(Reset condition)

2 coil latching

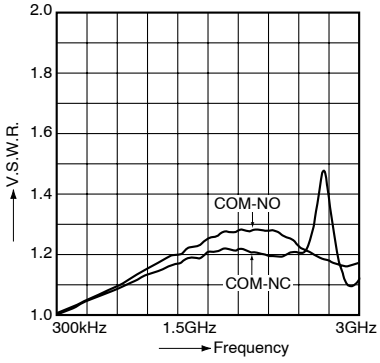


(Reset condition)

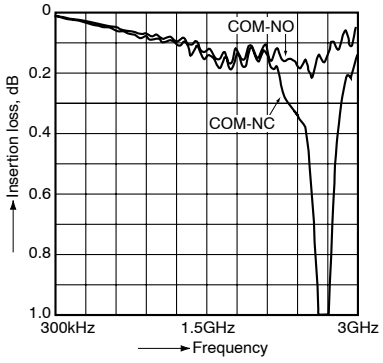
REFERENCE DATA

1.-(1) High frequency characteristics (Impedance 75Ω)
Sample: RK1-12V
Measuring method: Measured with HP network analyzer (HP8753C)

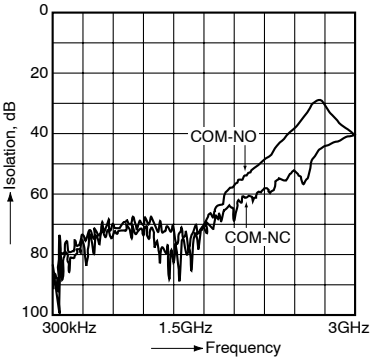
• V.S.W.R. characteristics



• Insertion loss characteristics

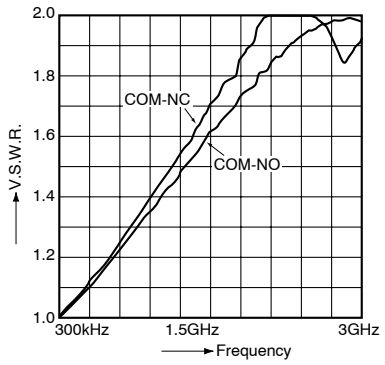


• Isolation characteristics

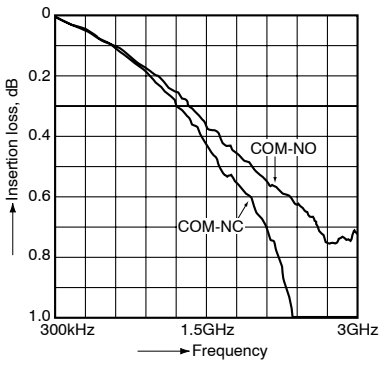


1.-(2) High frequency characteristics (Impedance 50Ω)
Sample: RK1-5V
Measuring method: Measured with HP network analyzer (HP8753C)

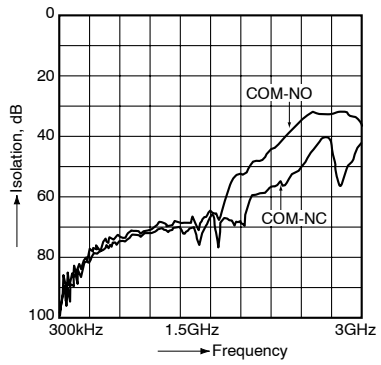
• V.S.W.R. characteristics



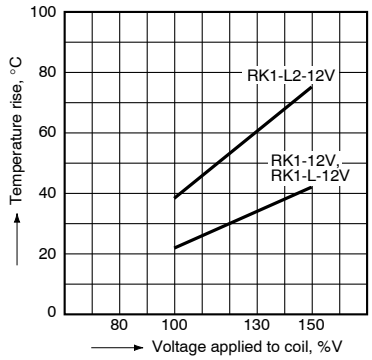
• Insertion loss characteristics



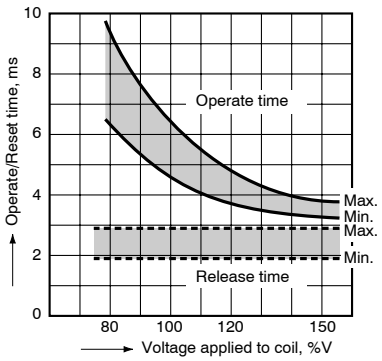
• Isolation characteristics



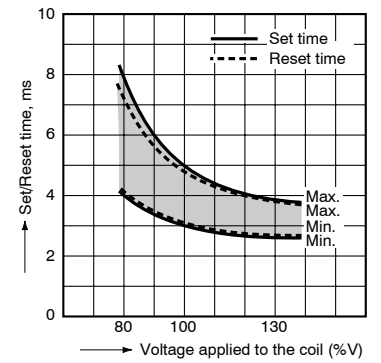
2. Coil temperature rise
Sample: RK1-12V, RK1-L-12V, RK1-L2-12V
No. of samples: n = 6
Carrying current: 10 mA
Ambient temperature: 25°C 77°F



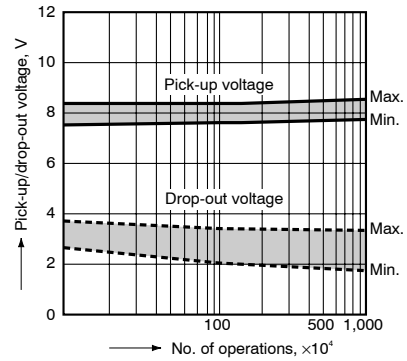
3.-(1) Operate/Release time
(Single side stable)
Sample: RK1-12V; No. of samples: n = 6



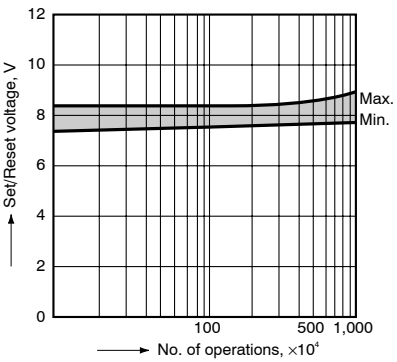
3.-(2) Set/Reset time (Latching)
Sample: RK1-L-12V, RK1-L2-12V
No. of samples: n = 12



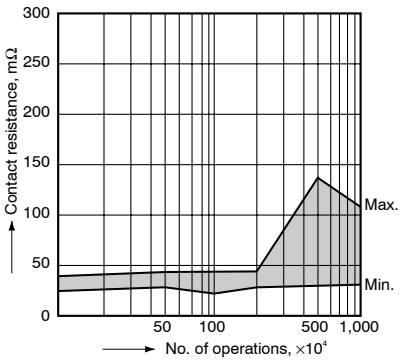
4.-(1) Mechanical life test (Single side stable)
Sample: RK1-12V; No. of samples: n = 12



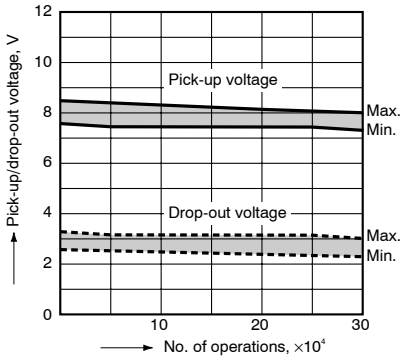
4.-(2) Mechanical life test (Latching)
Sample: RK1-L2-12V
No. of samples: n = 12



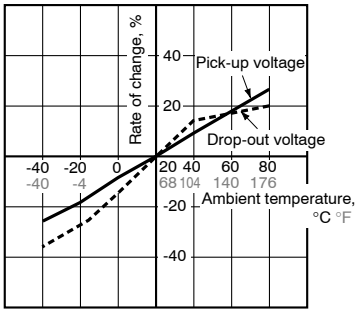
4.-(3) Mechanical life test
Sample: RK1-12V
No. of samples: n = 20 (20 × 2 contacts)



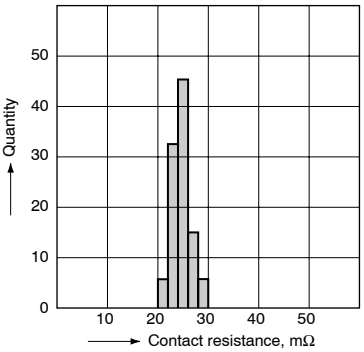
5. Electrical life test (0.01 A 24 V DC)
Sample: RK1-12V; No. of samples: n = 6



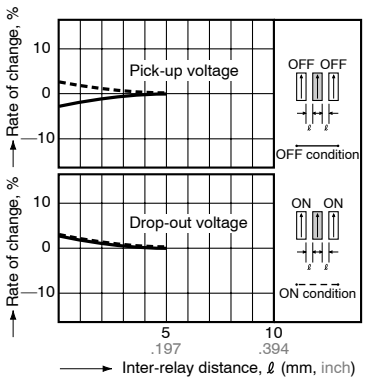
6. Ambient temperature characteristics
Sample: RK1-12V; No. of samples: n = 6



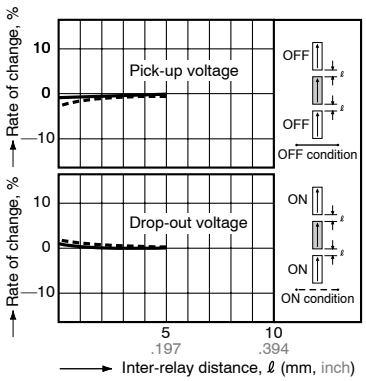
7. Contact resistance distribution (initial)
Sample: RK1-12V
No. of samples: n = 50 (50 × 2 contacts)



8.-(1) Influence of adjacent mounting
Sample: RK1-12V; No. of sample: n = 10



8.-(2) Influence of adjacent mounting
Sample: RK1-12V; No. of samples: n = 10

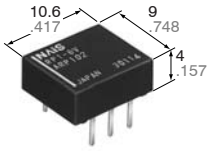


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

LOW PROFILE HIGH FREQUENCY RELAY

RP RELAYS



mm inch

- **High frequency relay with the low profile of 4 mm .157 inch**
- **Excellent high frequency characteristics**
  Isolation: Min. 10dB (at 1.8 GHz)
  Insertion loss: Max. 1.0dB (at 1.8 GHz)
  V.S.W.R.: Max. 1.3 (at 1.8 GHz)
- **High sensitivity in small size**
  Size: 10.6 × 9 × 4 mm .417 × .354 × .157 inch
  Nominal operating power: 140 mW
- **Utilizes tube package for automatic mounting.**
- **Self-clinching terminal also available**

SPECIFICATIONS

Contact

Arrangement		1 Form C
Contact material	Movable	Silver alloy
	Stationary	Gold-clad silver
Initial contact resistance, max. (By voltage drop 6 V DC 0.1 A)		50 mΩ
Rating	Nominal switching capacity	0.1 A 30 V DC Contact switching power: 1 W (Max. 1.8 GHz); Contact carrying power: 3 W (Max. 1.2 GHz) 1 W (Max. 1.8 GHz)
High frequency characteristics (Impedance 50Ω)	V.S.W.R.	Max. 1.2 (at 1 GHz) Max. 1.3 (at 1.8 GHz)
	Insertion loss	Max. 0.5 dB (at 1 GHz) Max. 1 dB (at 1.8 GHz)
	Isolation	Min. 15 dB (at 1 GHz) Min. 10 dB (at 1.8 GHz)
Expected life (min. operations)	Mechanical (at 180 cpm)	5×10^6
	Electrical (at 20 cpm)	10^5 (0.1 A 30 V DC resistive load)
		10^5 (1 W at 1.8 GHz; V.S.W.R.: max. 1.3)

Coil (at 25°C, 68°F)

Voltage type	Nominal operating power
1.5 to 12 V DC	140 mW
24 V DC	270 mW

Characteristics

Max. operating speed (at rated load)		20 cpm
Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	750 Vrms for 1 min.
	Between contacts and coil	1,500 Vrms for 1 min.
Operate time*3 (at nominal voltage)		Max. 3 ms (Approx. 1.5 ms)
Release time(without diode)*3 (at nominal voltage)		Max. 2 ms (Approx. 1 ms)
Temperature rise		Max. 50°C with nominal coil voltage across coil and at nominal switching capacity
Shock resistance	Functional*4	Min. 500 m/s² {50 G}
	Destructive*5	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*6	10 to 55 Hz at double amplitude of 3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage (Not freezing and condensing at low temperature)	Ambient temp.	-40°C to 70°C -40°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 1 g .04 oz

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms, detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs

TYPICAL APPLICATIONS

- Antenna switching of mobile phone
- Switching signal of measuring equipment
- All types of compact wireless devices

ORDERING INFORMATION

Ex. RP 1 □ □ □

Contact arrangement	Operating function	Terminal shape	Coil voltage (DC)
1: 1 Form C	Nil: Single side stable	Nil: Standard PC board terminal H: Self-clinching terminal	1.5, 3, 4.5, 5, 6, 9, 12, 24 V

Note: Standard packing; Carton: 50 pcs. Case 1,000 pcs.

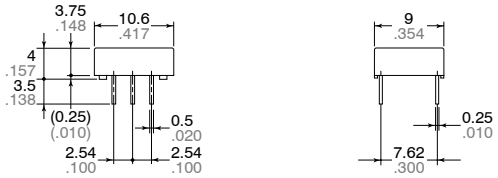
TYPES ANE COIL DATA (at 20°C 68°F)

Part No.		Nominal voltage, V DC	Pick-up voltage, max. V DC	Drop-out voltage, min. V DC	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
RP1-1.5V	RP1-H-1.5V	1.5	1.125	0.15	16	93.8	140	2.25
RP1-3V	RP1-H-3V	3	2.25	0.3	64.3	46.7	140	4.5
RP1-4.5V	RP1-H-4.5V	4.5	3.375	0.45	145	31.1	140	6.75
RP1-5V	RP1-H-5V	5	3.75	0.5	178	28	140	7.5
RP1-6V	RP1-H-6V	6	4.5	0.6	257	23.3	140	9
RP1-9V	RP1-H-9V	9	6.75	0.9	579	15.6	140	13.5
RP1-12V	RP1-H-12V	12	9	1.2	1,028	11.7	140	18
RP1-24V	RP1-H-24V	24	18	2.4	2,133	11.3	270	28.8

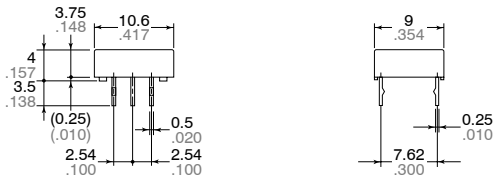
DIMENSIONS

mm inch

Standard PC board terminal

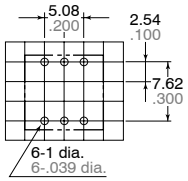


Self-clinching terminal



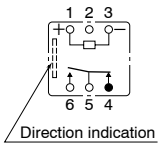
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



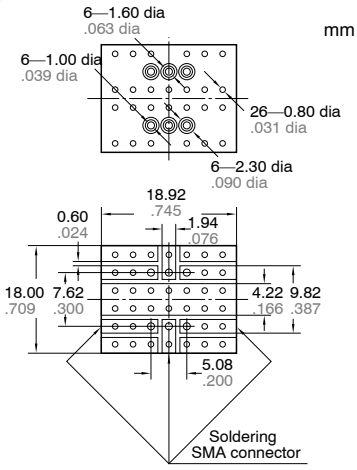
Deenergized condition

REFERENCE DATA

1. High frequency characteristics

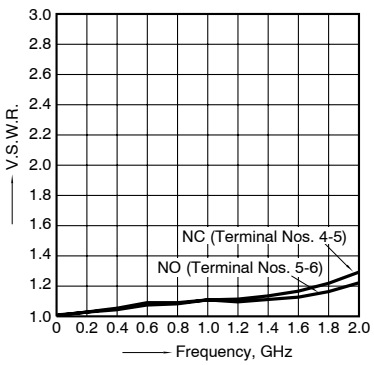
Sample: RP1-6V
Measuring method: Impedance 50Ω
Measuring tool:

mm inch

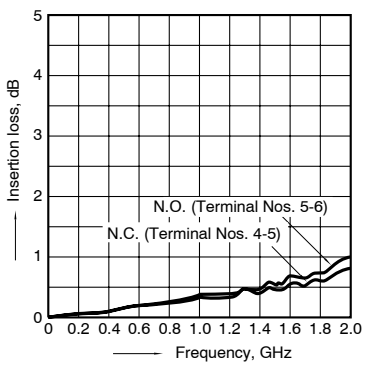


PC board
- Double-sided through hole
- Material: Glass-epoxy resin
- t = 1.0mm .039 inch
- Copper plated thickness: 35 μm

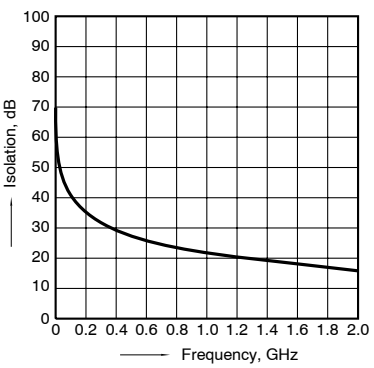
• V.S.W.R



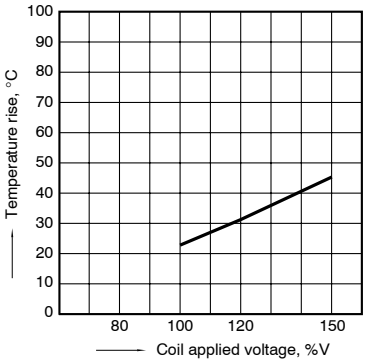
• Insertion loss



• Isolation

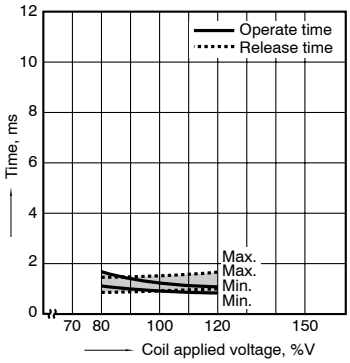


2. Coil temperature rise
Sample: RP1-6V; No. of samples: n = 5
Carrying current: 0.1 A
Ambient temperature: 25°C 77°F

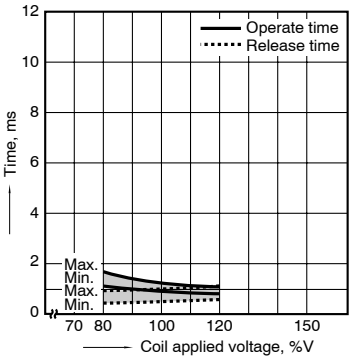


3. Operate/release time
Sample: RP1-9V; No. of samples: n = 50

• With diode

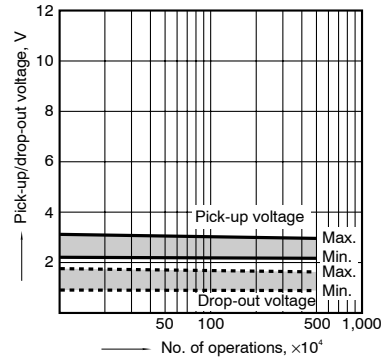


• Without diode



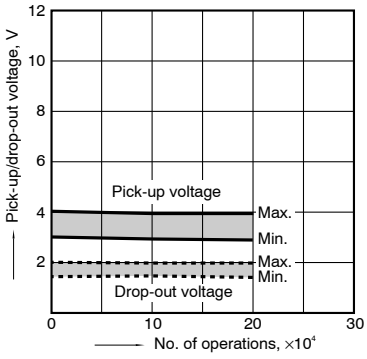
4. Mechanical life
Sample: RP1-5V; No. of samples: n = 8

• Change of pick-up, drop-out voltage

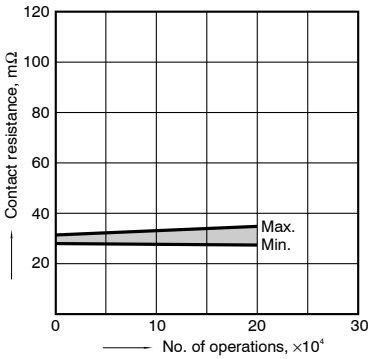


5. Electrical life (0.1 A 30 V DC)
Sample: RP1-6V; No. of samples: n = 6

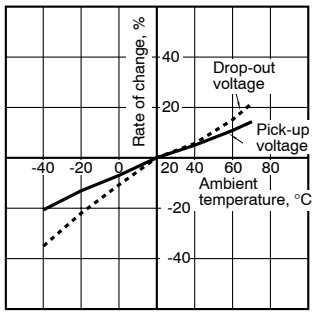
• Change of pick-up/drop-out voltage



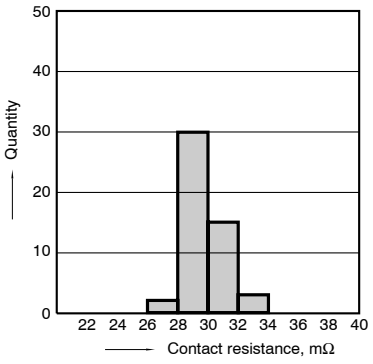
• Change of contact resistance



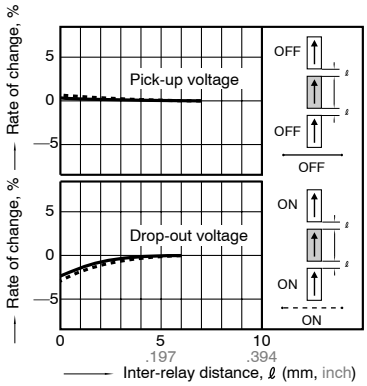
6. Ambient temperature characteristics
Sample: RP1-6V; No. of samples: n = 5



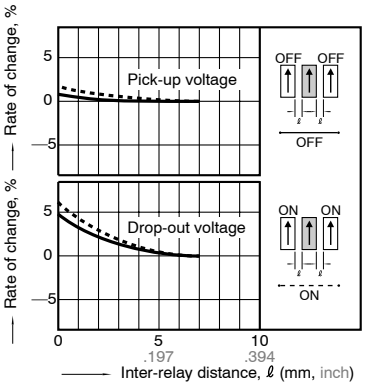
7. Contact resistance distribution (initial)
Sample: RP1-12V; No. of samples: n = 25



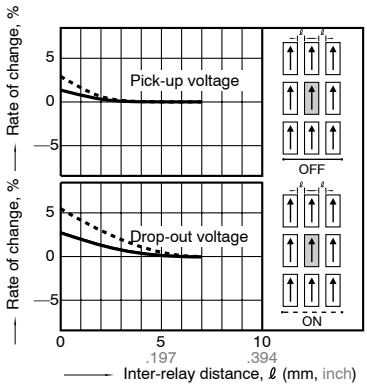
8.-(1) Influence of adjacent mounting
Sample: RP1-12V; No. of samples: n = 6



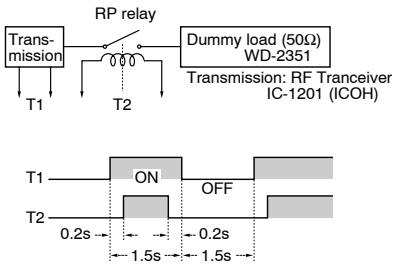
8.-(2) Influence of adjacent mounting
Sample: RP1-12V; No. of samples: n = 6



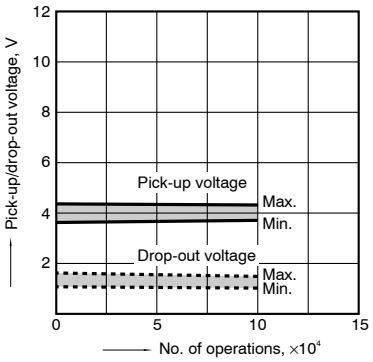
8.-(3) Influence of adjacent mounting
Sample: RP1-12V; No. of samples: n = 6



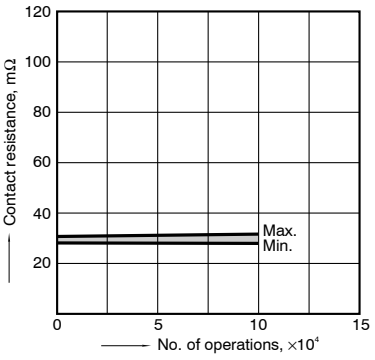
9. High frequency switching test (1.2 GHz, 1 W)
Sample: RP1-6V; No. of samples: n = 6
Ambient temperature: 20°C 68°F



• Change of pick-up/drop-out voltage



• Change of contact resistance

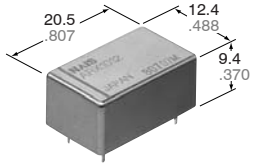


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

3 GHz SMALL MICROWAVE RELAY

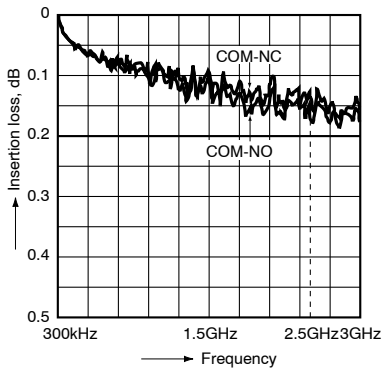
RX RELAYS (ARX)



mm inch

1. Excellent high frequency characteristics (~2.5GHz, Impedance 50Ω)
- Insertion loss: 0.2 dB or less
- Isolation: 60 dB or more

- Insertion loss



- V.S.W.R./ Return loss: 1.2dB or less/ 20.8dB or more

2. High sensitivity
- Nominal operating power: 200 mW

3. Small size
- Size: 20.5(L) × 12.4(W) × 9.4(H) mm .807(L) × .488(W) × .370(H) inch

*Also available for unit support (contact us for more details).

High-Frequency

SPECIFICATIONS

Contact

Arrangement			1 Form C
Contact material			Gold
Initial contact resistance			Max. 100 mΩ
Rating	Contact rating		10W (2.5 GHz, Impedance 50Ω, V.S.W.R.&1.2) 10mA 24V DC (resistive load)
	Contact carrying power		Max. 20W (at 40°C, V.S.W.R.&1.2, Average)
	Max. switching voltage		30 V DC
	Max. switching current		0.5 A DC
High frequency characteristics (~2.5GHz, Impedance 50Ω)	V.S.W.R. (Return loss)		Max. 1.2 (Min. 20.8dB)
	Insertion loss		Max. 0.2 dB
	Isolation		Min. 60 dB
	Input power		Max. 20W (at 40°C, V.S.W.R.&1.2, Average)
Expected life (min. operations)	Mechanical (at 180 cpm)		5×10^6
	Electrical	10mA 24 V DC (resistive load)	3×10^5
		10W 2.5 GHz, Impedance 50Ω, V.S.W.R.&1.2	10^5

Coil (at 20°C, 68°F)

	Nominal operating power
Single side stable	200 mW
1 coil latching	200 mW
2 coil latching	400 mW

Characteristics

Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	500 Vrms
	Between contact and coil	1,000 Vrms
	Between contact and earth terminal	500 Vrms
Operate time [Set time]*3 (at 20°C)		Max. 10ms (Approx. 6ms) [Max. 10ms (Approx. 5ms)]
Release time (without diode) [Reset time]*3		Max. 6ms (Approx. 3ms) [Max. 10ms (Approx. 5ms)]
Temperature rise (at 20°C)*4		Max. 60°C
Shock resistance	Functional*5	Min. 200 m/s² {20 G}
	Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to 70°C –40°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 5 g .18 oz

Remarks
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Nominal operating voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil: Contact carrying power: 20W, at 2.5GHz, Impedance 50Ω, V.S.W.R.&1.2
*5 Half-wave pulse of sine wave: 11ms, detection time: 10μs.
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

TYPICAL APPLICATIONS

- Cellular phone base station (W-CDMA, FPLMTS, IMT-2000, PCS, DCS)
- Cellular phone-related measurement devices (SP3T/SP4T switches, etc)
- Wireless LAN
- Wireless Local Loop

ORDERING INFORMATION

Ex. A | RX | 1 | 0 | 12

Product name	Contact arrangement	Operating function	Coil voltage, V DC	
RX	1: 1 Form C	0: Single side stable 1: 1 coil latching 2: 2 coil latching	03: 3 4H: 4.5 06: 6	09: 9 12: 12 24: 24

Note: Standard packing; Carton: 50 pcs. Case 500 pcs.

TYPES ANE COIL DATA (at 20°C 68°F)

• Single side stable type

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)(initial)	Drop-out voltage, V DC (min.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C)
ARX1003	3	2.25	0.3	45	66.7	200	3.3
ARX104H	4.5	3.375	0.45	101	44.4	200	4.95
ARX1006	6	4.5	0.6	180	33.3	200	6.6
ARX1009	9	6.75	0.9	405	22.2	200	9.9
ARX1012	12	9	1.2	720	16.7	200	13.2
ARX1024	24	18	2.4	2,880	8.3	200	26.4

• 1 coil latching type

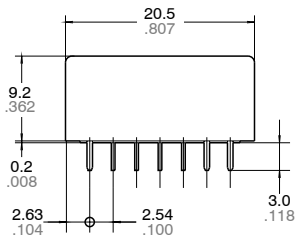
Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)(initial)	Reset voltage, V DC (max.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C)
ARX1103	3	2.25	2.25	45	66.7	200	3.3
ARX114H	4.5	3.375	3.375	101	44.4	200	4.95
ARX1106	6	4.5	4.5	180	33.3	200	6.6
ARX1109	9	6.75	6.75	405	22.2	200	9.9
ARX1112	12	9	9	720	16.7	200	13.2
ARX1124	24	18	18	2,880	8.3	200	26.4

• 2 coil latching type

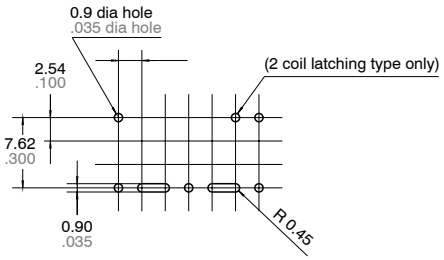
Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)(initial)	Reset voltage, V DC (max.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C)
ARX1203	3	2.25	2.25	22.5	133.3	400	3.3
ARX124H	4.5	3.375	3.375	50.6	88.9	400	4.95
ARX1206	6	4.5	4.5	90	66.7	400	6.6
ARX1209	9	6.75	6.75	202.5	44.4	400	9.9
ARX1212	12	9	9	360	33.3	400	13.2
ARX1224	24	18	18	1,440	16.7	400	26.4

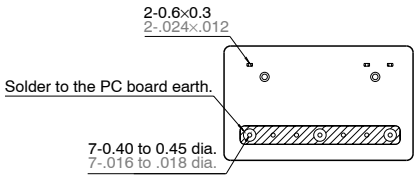
DIMENSIONS

mm inch



PC board pattern (Bottom view)

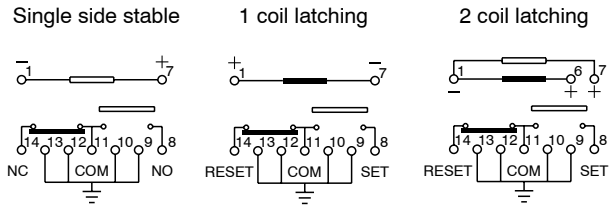




Tolerance: –0.1 –.004

General tolerance: –0.3 –.012

Schematic (Bottom view)



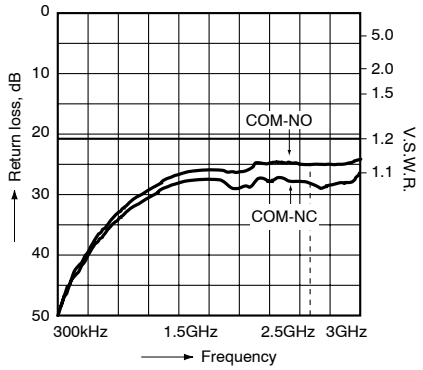
(Deenergized condition) (Reset condition) (Reset condition)

REFERENCE DATA

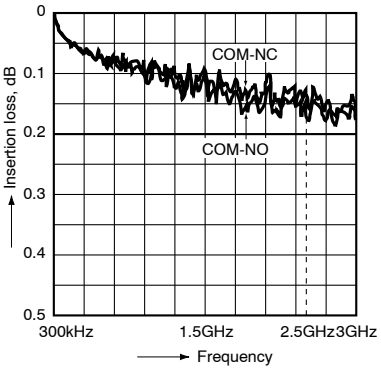
1. High frequency characteristics
Sample: ARX1012
Measuring method: Measured with HP network analyzer (HP8753C).

The details for the high frequency characteristics and the measurement procedures and conditions are listed in the RX relay test report.

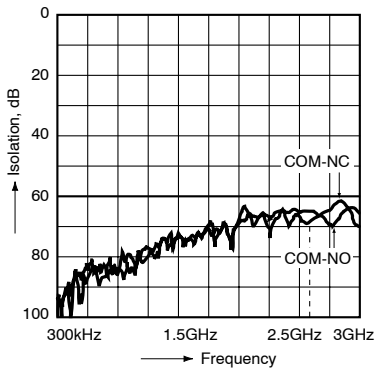
• V.S.W.R. (Return loss)



• Insertion loss



• Isolation



For Cautions for Use, see Relay Technical Information (page 392).

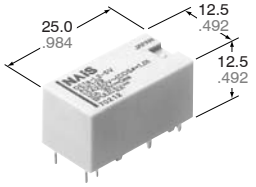
RX (ARX)

Gepolte Leistungsrelais

Panasonic
ideas for life

COMPACT HIGH-INSULATION POLARIZED POWER RELAY

DE RELAYS (ADE)



mm inch

FEATURES

- **Conforms to VDE0631.**
  Insulating distance between coil and contacts:
  Clearance Min. 8mm .315 inch
  Creepage distance Min. 8mm .315 inch
- **Extensive product line-up.**
- **Surge voltage between contact and coil 12 kV**
- **Low operating power**
  Nominal operating power at 200 mW (Single side stable, 2 coil latching)
- **Compact body saves space**
  Size: 12.5(W) × 25.0(L) × 12.5(H) mm
  .492(W) × .984(L) × .492(H) inch
  UL/CSA, VDE approved

SPECIFICATIONS

Contact

Arrangement		1 Form A	1 Form A 1 Form B	2 Form A
Contact material		Silver alloy		
Initial contact resistance, max. (By voltage drop 6V DC 1A)		30mΩ		
Rating (resistive load)	Nominal switching capacity	10A 250V AC, 10A 30V DC	8A 250V AC, 8A 30V DC	8A 250V AC, 8A 30V DC
	Max. switching power	2,500 VA*, 300W	2,000 VA*, 240W	2,000 VA*, 240W
	Max. switching voltage	440V AC, 230V DC	440V AC, 230V DC	440V AC, 230V DC
	Max. switching current	10A (16A)*	8A (16A)*	8A (16A)*
	Min. switching capacity#1	100 mA, 5 V DC		
Expected life (min. operations)	Mechanical (at 300cpm)	10^7		
	Electrical (at 20 cpm) (resistive load)	10^5	10^5(AC) 5×10^4(DC)	
	Electrical (16A / 230 V AC resistive)*	25000	20000	

Coil (at 20°C, 68°F)

	Nominal operating power
Single side stable	200 mW
1 coil latching	100 mW
2 coil latching	200 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* 16A possible for one contact set only with max. 4000 VA switching power.

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms
	Between contact sets	4,000 Vrms (2 Form A, 1 Form A 1 Form B)
	Between contact and coil	5,000 Vrms
Surge voltage between contact and coil*3		Min. 12,000 V (initial)
Operate time [Set time]*4		Max. 10ms (typ. 5ms) [Max. 10ms (typ. 4ms)] (at 20°C 68°F)
Release time (without diode) [Reset time]*4		Max. 5ms (typ. 2ms) [Max. 10ms (typ. 4ms)] (at 20°C 68°F)
Temperature rise (at 70°C)*5		Max. 50°C
Shock resistance	Functional*6	Min. 196 m/s²{20 G}
	Destructive*7	Min. 980 m/s²{100 G}
Vibration resistance	Functional*8	10 to 55 Hz at double amplitude of 2 mm
	Destructive	10 to 55 Hz at double amplitude of 3 mm
Conditions for operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to 70°C –40°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 7 g .25 oz

*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Nominal operating voltage applied to the coil, excluding contact bounce time.
*5 By resistive method
*6 Half-wave pulse of sine wave: 11ms, detection time: 10ms.
*7 Half-wave pulse of sine wave: 6ms
*8 Detection time: 10ms
*9 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410)

TYPICAL APPLICATIONS

- **Temperature controller**
- **Automatic meter reading**
- **OA equipment**
- **FA equipment**

ORDERING INFORMATION

Ex. DE — 1a — L — 3 V

Product name	Contact arrangement	Operating function	Coil voltage, V DC
DE	1a: 1 Form A 1a1b: 1 Form A 1 Form B 2a: 2 Form A	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48**

Notes: 1) Standard packing; Carton (tube package) 20 pcs. Case 500 pcs.

2) UL/CSA, VDE approved type is standard.

**just for single side stable

TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type

1 Form A, 1 Form A 1 Form B, 2 Form A

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
DE❑-1.5V	1.5	1.05	0.15	11.3	132.7	200	1.95
DE❑-3V	3	2.1	0.3	45	66.6	200	3.9
DE❑-4.5V	4.5	3.15	0.45	101	44.5	200	5.85
DE❑-5V	5	3.5	0.5	125	40	200	6.5
DE❑-6V	6	4.2	0.6	180	33.3	200	7.8
DE❑-9V	9	6.3	0.9	405	22.2	200	11.7
DE❑-12V	12	8.4	1.2	720	16.6	200	15.6
DE❑-24V	24	16.8	2.4	2,880	8.3	200	31.2
DE❑-48V	48	33.6	4.8	11,520	4.2	200	62.4

• 1 coil latching type

1 Form A

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (min.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
DE❑-L-1.5V	1.5	1.05	1.05	22.5	66.6	100	1.95
DE❑-L-3V	3	2.1	2.1	90	33.3	100	3.9
DE❑-L-4.5V	4.5	3.15	3.15	202	22.3	100	5.85
DE❑-L-5V	5	3.5	3.5	250	20	100	6.5
DE❑-L-6V	6	4.2	4.2	360	16.7	100	7.8
DE❑-L-9V	9	6.3	6.3	812	11.1	100	11.7
DE❑-L-12V	12	8.4	8.4	1,440	8.3	100	15.6
DE❑-L-24V	24	16.8	16.8	5,760	4.2	100	31.2

• 2 coil latching type

1 Form A

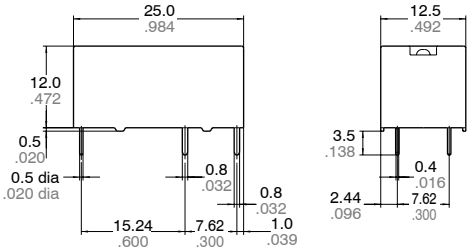
Part No.	Nominal voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (min.) (initial)	Coil resistance, Ω (±10%)		Nominal operating current, mA (±10%)		Nominal operating power, mW		Max. allowable voltage, V DC
				Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
DE❑-L-1.5V	1.5	1.05	1.05	11.3	11.3	66.6	66.6	200	200	1.95
DE❑-L2-3V	3	2.1	2.1	45	45	66.6	66.6	200	200	3.9
DE❑-L2-4.5V	4.5	3.15	3.15	101	101	44.5	44.5	200	200	5.85
DE❑-L2-5V	5	3.5	3.5	125	125	40	40	200	200	6.5
DE❑-L2-6V	6	4.2	4.2	180	180	33.3	33.3	200	200	7.8
DE❑-L2-9V	9	6.3	6.3	405	405	22.2	22.2	200	200	11.7
DE❑-L2-12V	12	8.4	8.4	720	720	16.6	16.6	200	200	15.6
DE❑-L2-24V	24	16.8	16.8	2,880	2,880	8.3	8.3	200	200	31.2

Note: Insert contact arrangement, e.g.1a, 1a1b, 2a, in ❑ for contact form required.

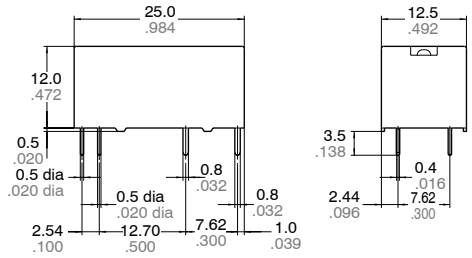
DIMENSIONS

mm inch

Single side stable
1 coil latching type



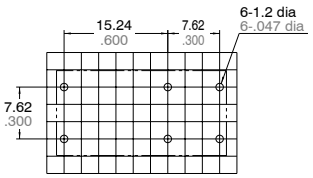
2 coil latching type



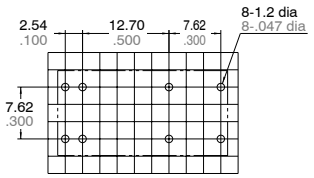
Tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

Single side stable
1 coil latching type



2 coil latching type

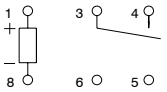


Tolerance : ±0.1 ±.004

Schematic (Bottom view)

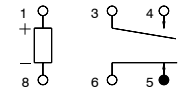
Single side stable

(1 Form A)



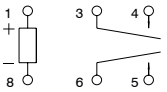
(5,6: dummy terminal)

(1 Form A 1 Form B)



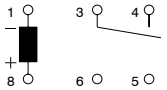
(Deenergized condition)

(2 Form A)



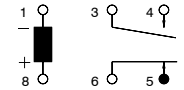
1coil latching type

(1 Form A)



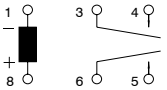
(5,6: dummy terminal)

(1 Form A 1 Form B)



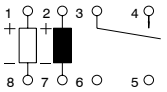
(Reset condition)

(2 Form A)



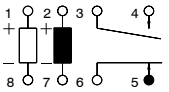
2coil latching type

(1 Form A)



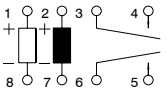
(5,6: dummy terminal)

(1 Form A 1 Form B)



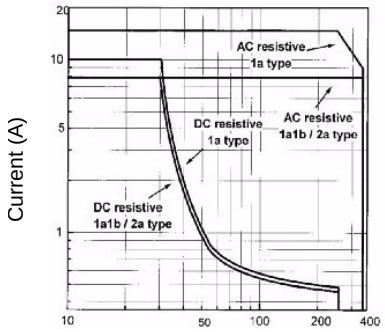
(Reset condition)

(2 Form A)



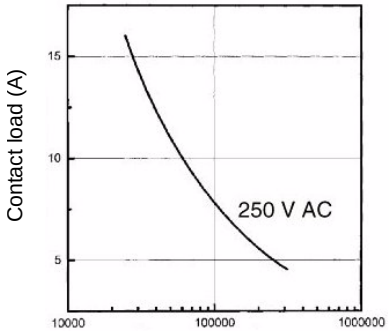
REFERENCE DATA

1. Max. switching power



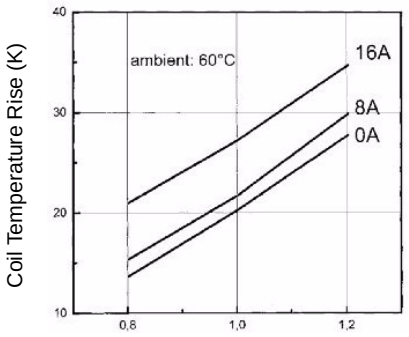
Contact voltage

2. Life curve



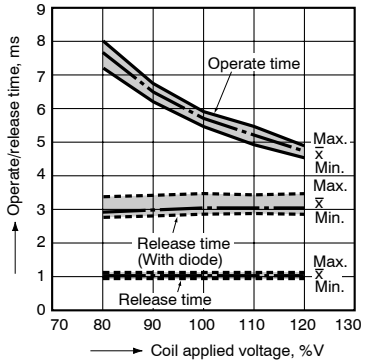
No. of operations

3. Coil Temperature Rise

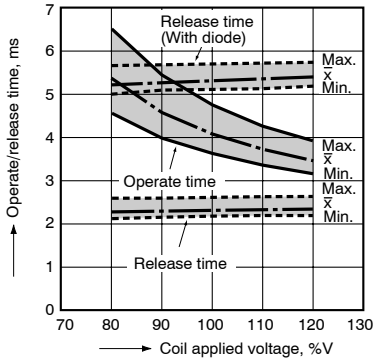


Coil Temperature Rise (% of nominal)

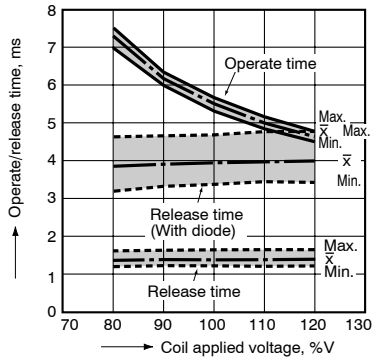
4-1. Operate/release time (1 Form A)
Tested sample: DE1a-5V
Quantity: n=5



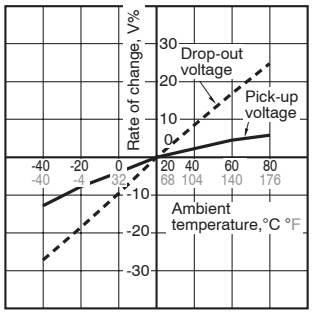
4-2. Operate/release time (1 Form A 1 Form B)
Tested sample: DE1a1b-5V, Quantity: n=5



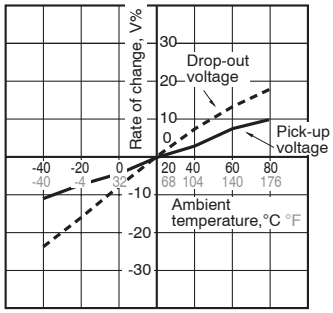
4-3. Operate/release time (2 Form A)
Tested sample: DE2a-5V, Quantity: n=5



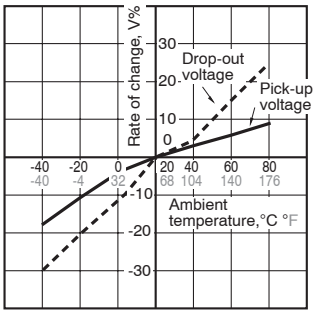
5-1. Ambient temperature characteristics (1 Form A)
Tested sample: DE1a-5V, Ambient temperature: –40°C to 80°C –40°F to 176°F, Quantity: n=6



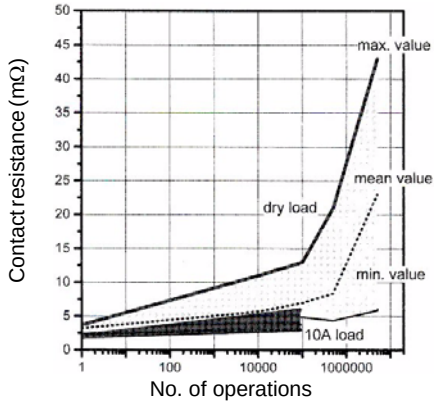
5-2. Ambient temperature characteristics (1 Form A 1 Form B)
Tested sample: DE1a1b-5V, Ambient temperature: –40°C to 80°C –40°F to 176°F, Quantity: n=6



5-3. Ambient temperature characteristics (2 Form A)
Tested sample: DE2a-5V, Ambient temperature: –40°C to 80°C –40°F to 176°F, Quantity: n=6



6. Change of contact resistance



For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

16A, COMPACT AND HIGH INSULATION POWER LATCHING RELAY

DJ RELAYS (ADJ)


Without test button


With test button

FEATURES

1. Variety of contact arrangements
Wide lineup of 1 Form C, 1 Form A, 1 Form B, 2 Form C, 2 Form A, 2 Form B, 1 Form A 1 Form B.

2. Latching operation
Latching via a polarized magnetic circuit structure allows remote operation and lower energy consumption

3. Compact with high capacity
16A (1-pole type) contact rating in a compact 29×13×16.5 mm (L×W×H) size.

4. Low power consumption
1 coil latching: 150mW
2 coil latching, single side stable: 250mW

5. High insulation
Both clearance and creepage distance between coil and contact are at 8 mm min.

6. With operation verification function
A test button (manual lever) type to facilitate circuit checks is also available (1 Form C, 1 Form A, 1 Form B types only).

TYPICAL APPLICATIONS

- FA equipment (brake circuits of industrial machine and robots, etc.)
- Electric power devices (remote surveillance devices, etc.)
- Household appliance networks (Motor control and lighting control, etc.)
- Time switches

SPECIFICATIONS

Contact

Arrangement		1 Form C, 1 Form A, 1 Form B, 1 Form A 1 Form B, 2 Form C, 2 Form A, 2 Form B
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	16 A 250V AC (1 Form C, 1 Form A, 1 Form B) 10 A 250V AC (2 Form C, 2 Form A, 2 Form B, 1 Form A 1 Form B)
	Max. switching power	4,000 V A
	Max. switching voltage	250V AC
	Max. switching current	16 A
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	5×10^6
	Electrical (Resistive load)*1 (at 20 cpm)	1 Form C, 1 Form A, 1 Form B: 10^5 (at 16A 250V AC) 2 Form C, 2 Form A, 2 Form B, 1 Form A 1 Form B: : 10^5 (at 10A 250V AC)

Coil

Nominal operating power	1 coil latching	150mW
	Single side stable, 2 coil latching	250mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
*1 With breathing holes open
*2 Measurement at same location as "Initial breakdown voltage" section.
*3 Detection current: 10mA
*4 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*5 Excluding contact bounce time.
*6 By resistive method, max. switching current
*7 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*8 Half-wave pulse of sine wave: 6 ms
*9 Detection time: 10 μs
*10 Refer to 5. Conditions for operation, transport and storage mentioned in NOTES (page 154).

Characteristics

Initial insulation resistance*2		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*3	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	4,000 Vrms for 1 min.
Surge voltage between contact and coil*4		Min. 10,000 V (initial)
Operate time [Set time]*5 (at nominal voltage)		Approx. 10ms
Release time [Reset time]*5 (at nominal voltage)		Approx. 10ms
Temperature rise (at 70°C)*6		Max. 55°C
Shock resistance	Functional*7	Min. 200 m/s²{20 G}
	Destructive*8	Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*9	10 to 55Hz at double amplitude of 2.0mm
	Destructive	10 to 55Hz at double amplitude of 3.0mm
Conditions for operation, transport and storage*10 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 14 g .49 oz

ORDERING INFORMATION

Ex. ADJ □ □ □ □ □

Contact arrangement	Operating function and protective construction	Auxiliary function	Coil voltage (DC)
1: 1 Form C 2: 1 Form A 3: 1 Form B 4: 1 Form A 1 Form B 5: 2 Form C 6: 2 Form A 7: 2 Form B	1: 1 coil latching, Flux-resistant type* 2: 1 coil latching, Sealed type 3: 2 coil latching, Flux-resistant type* 4: 2 coil latching, Sealed type 5: Single side stable, Flux-resistant type* 6: Single side stable, Sealed type	0: Without test button 1: With test button	05: 5 V 12: 12 V 06: 6 V 24: 24 V 48: 48 V

Notes: Standard packing: Carton: 100 pcs, Case: 500 pcs
*Only available with test button

TYPES

1. Without test button
Sealed type

Contact arrangement	Coil voltage, V DC	Single side stable type	1 coil latching type	2 coil latching type
		Part No.	Part No.	Part No.
1 Form C	5	ADJ16005	ADJ12005	ADJ14005
	6	ADJ16006	ADJ12006	ADJ14006
	12	ADJ16012	ADJ12012	ADJ14012
	24	ADJ16024	ADJ12024	ADJ14024
	48	ADJ16048	ADJ12048	ADJ14048
1 Form A	5	ADJ26005	ADJ22005	ADJ24005
	6	ADJ26006	ADJ22006	ADJ24006
	12	ADJ26012	ADJ22012	ADJ24012
	24	ADJ26024	ADJ22024	ADJ24024
	48	ADJ26048	ADJ22048	ADJ24048
1 Form B	5	ADJ36005	Please use 1 Form A.	Please use 1 Form A.
	6	ADJ36006		
	12	ADJ36012		
	24	ADJ36024		
	48	ADJ36048		
1 Form A 1 Form B	5	ADJ46005	ADJ42005	ADJ44005
	6	ADJ46006	ADJ42006	ADJ44006
	12	ADJ46012	ADJ42012	ADJ44012
	24	ADJ46024	ADJ42024	ADJ44024
	48	ADJ46048	ADJ42048	ADJ44048
2 Form C	5	ADJ56005	ADJ52005	ADJ54005
	6	ADJ56006	ADJ52006	ADJ54006
	12	ADJ56012	ADJ52012	ADJ54012
	24	ADJ56024	ADJ52024	ADJ54024
	48	ADJ56048	ADJ52048	ADJ54048
2 Form A	5	ADJ66005	ADJ62005	ADJ64005
	6	ADJ66006	ADJ62006	ADJ64006
	12	ADJ66012	ADJ62012	ADJ64012
	24	ADJ66024	ADJ62024	ADJ64024
	48	ADJ66048	ADJ62048	ADJ64048
2 Form B	5	ADJ76005	Please use 2 Form A.	Please use 2 Form A.
	6	ADJ76006		
	12	ADJ76012		
	24	ADJ76024		
	48	ADJ76048		

2. With test button
Flux-resistant type

Contact arrangement	Coil voltage, V DC	Single side stable type	1 coil latching type	2 coil latching type
		Part No.	Part No.	Part No.
1 Form C	5	ADJ15105	ADJ11105	ADJ13105
	6	ADJ15106	ADJ11106	ADJ13106
	12	ADJ15112	ADJ11112	ADJ13112
	24	ADJ15124	ADJ11124	ADJ13124
	48	ADJ15148	ADJ11148	ADJ13148
1 Form A	5	ADJ25105	ADJ21105	ADJ23105
	6	ADJ25106	ADJ21106	ADJ23106
	12	ADJ25112	ADJ21112	ADJ23112
	24	ADJ25124	ADJ21124	ADJ23124
	48	ADJ25148	ADJ21148	ADJ23148
1 Form B	5	ADJ35105	Please use 1 Form A.	Please use 1 Form A.
	6	ADJ35106		
	12	ADJ35112		
	24	ADJ35124		
	48	ADJ35148		

COIL DATA (at 20°C 68°F)

• Single side stable type

Nominal voltage, V DC	Set voltage, max. V DC (initial)	Reset voltage, max. V DC (initial)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
5	3.75	0.5	100	250	6.5
6	4.5	0.6	144		7.8
12	9	1.2	576		15.6
24	18	2.4	2,304		31.2
48	36	4.8	9,216		62.4

• 1 coil latching type

Nominal voltage, V DC	Set voltage, max. V DC (initial)	Reset voltage, max. V DC (initial)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
5	3.5	3.5	167	150	6.5
6	4.2	4.2	240		7.8
12	8.4	8.4	960		15.6
24	16.8	16.8	3,840		31.2
48	33.6	33.6	15,360		62.4

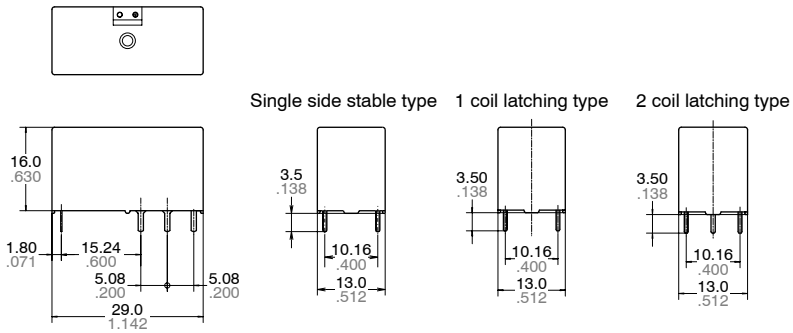
• 2 coil latching type

Nominal voltage, V DC	Set voltage, max. V DC (initial)	Reset voltage, max. V DC (initial)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
5	3.5	3.5	100	250	6.5
6	4.2	4.2	144		7.8
12	8.4	8.4	576		15.6
24	16.8	16.8	2,304		31.2
48	33.6	33.6	9,216		62.4

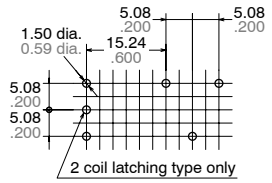
DIMENSIONS

mm inch

1. 1 Form C, without test button



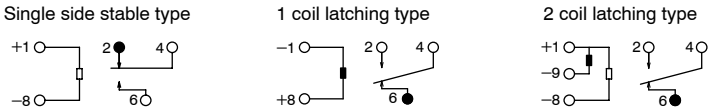
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

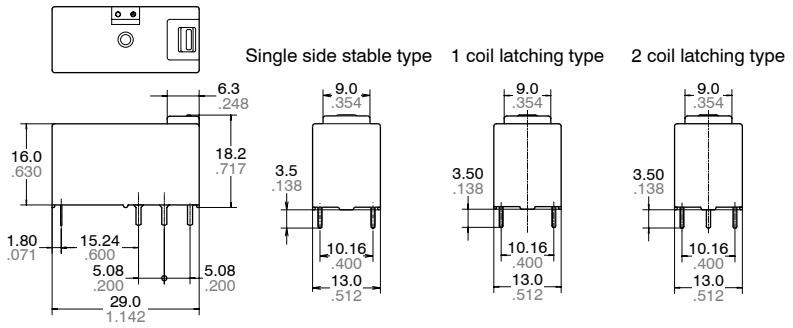
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

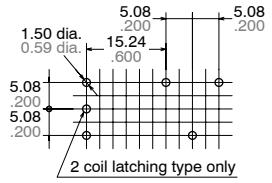


2. 1 Form C, with test button

mm inch



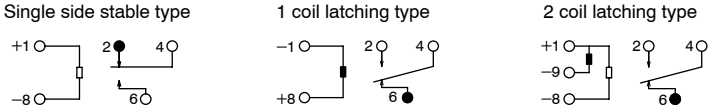
PC board pattern (Bottom view)



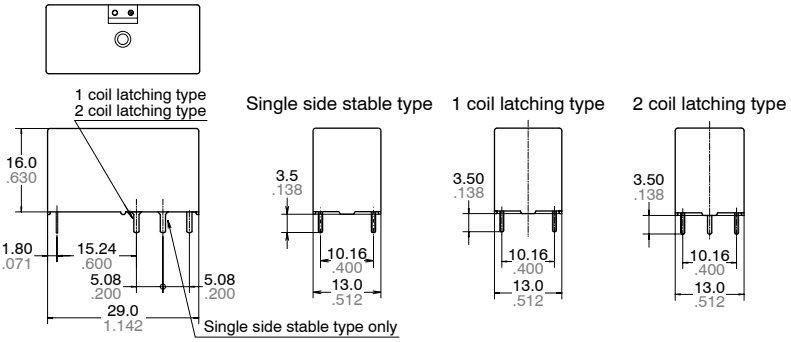
Tolerance: ±0.1 ±.004

General tolerance: ±0.3 ±.012

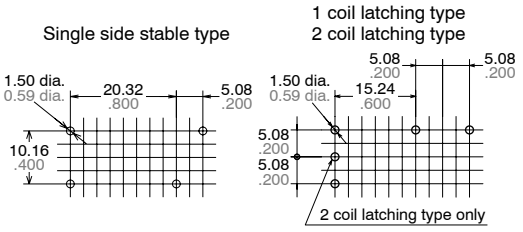
Schematic (Bottom view)



3. 1 Form A, without test button



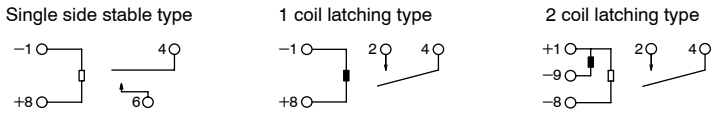
PC board pattern (Bottom view)



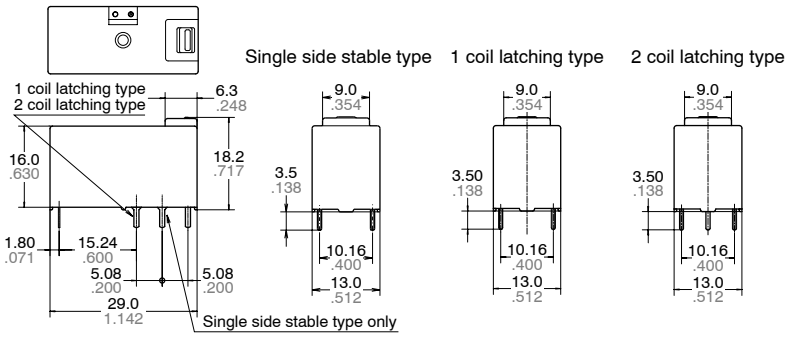
Tolerance: ±0.1 ±.004

General tolerance: ±0.3 ±.012

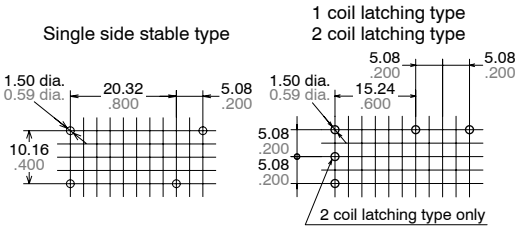
Schematic (Bottom view)



4. 1 Form A, with test button



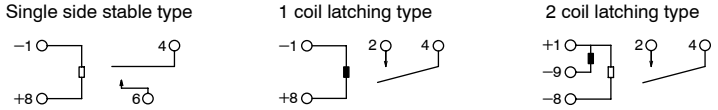
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

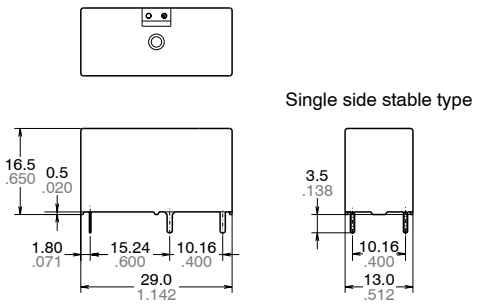
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

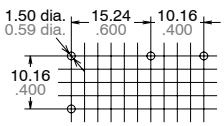


5. 1 Form B, without test button

mm inch



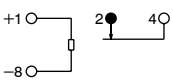
PC board pattern (Bottom view)



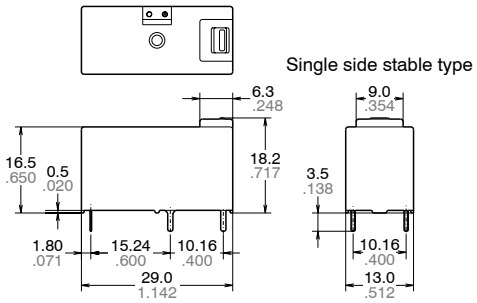
Tolerance: ±0.1 ±.004

General tolerance: ±0.3 ±.012

Schematic (Bottom view)

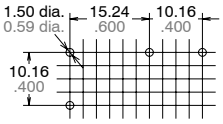


6. 1 Form B, with test button



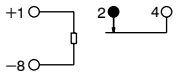
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

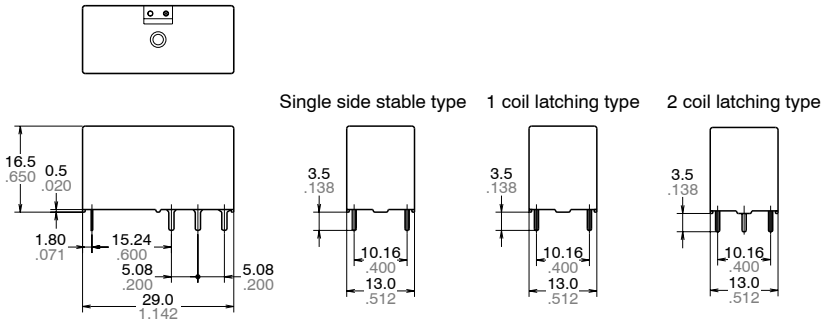


Tolerance: ±0.1 ±.004

Schematic (Bottom view)

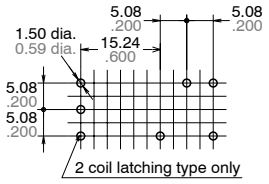


7. 1 Form A 1 Form B, without test button



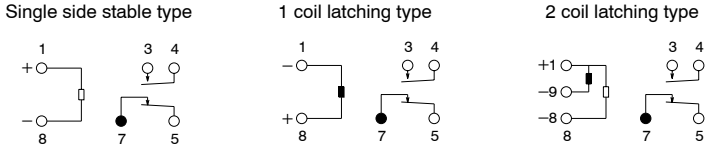
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



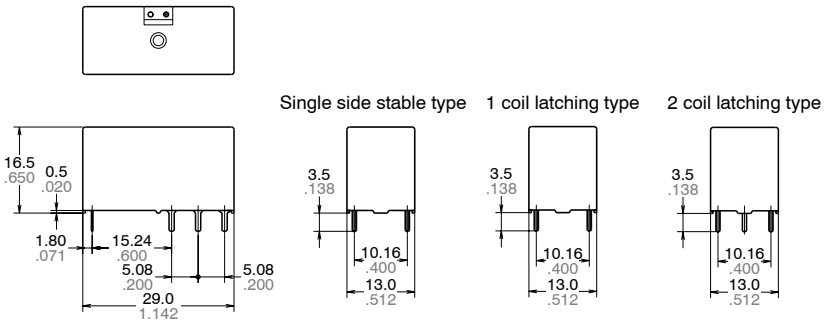
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

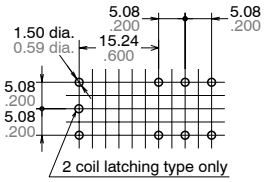


8. 2 Form C, without test button

mm inch



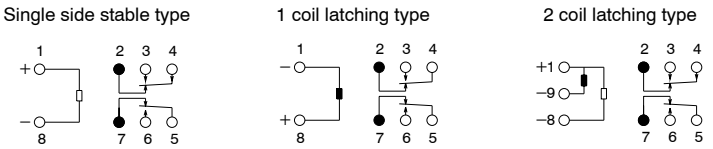
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

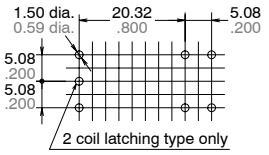
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

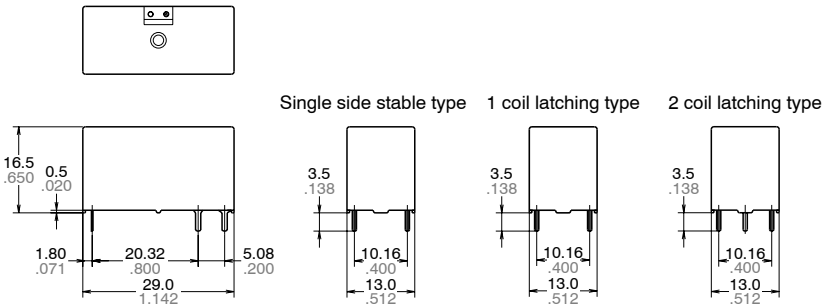


9. 2 Form A, without test button

PC board pattern (Bottom view)

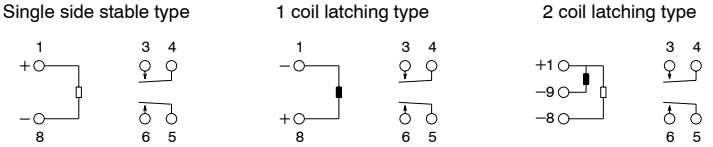


Tolerance: ±0.1 ±.004



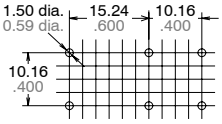
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

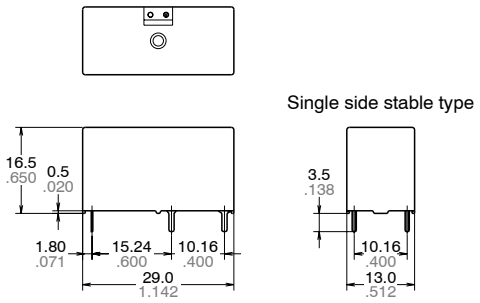


10. 2 Form B, without test button

PC board pattern (Bottom view)

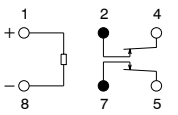


Tolerance: ±0.1 ±.004



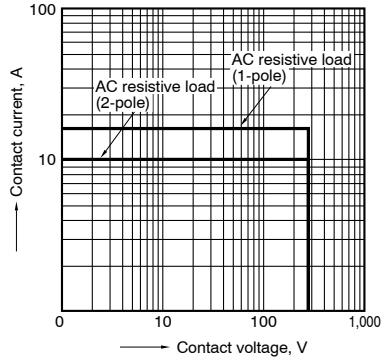
General tolerance: ±0.3 ±.012

Schematic (Bottom view)



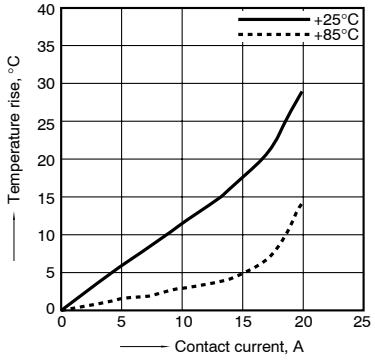
REFERENCE DATA

1. Max. switching capacity



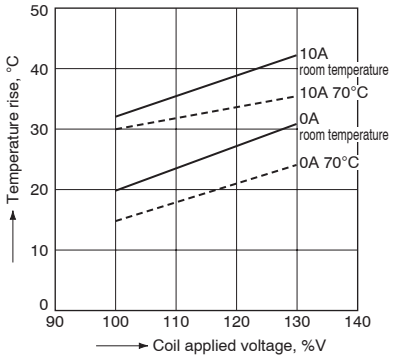
2. Temperature rise

Sample: ADJ12024, 6 pcs.
Coil applied voltage: 0 %V, Contact current: 16 A, 20 A
Measured portion: Contact, Ambient temperature: 25°C 77°F, 85°C 185°F



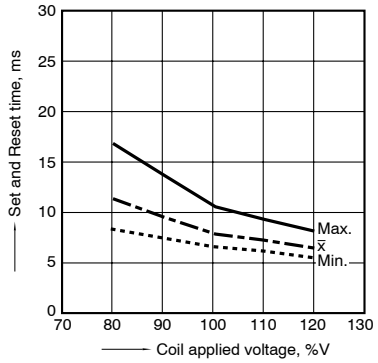
3. Coil temperature rise

Sample: ADJ56024, 6 pcs.
Coil applied voltage: 100 %V, 130 %V of rating
Contact current: 0 A, 10 A
Measured portion: Inside the coil, Ambient temperature: Room temperature, 70°C 158°F



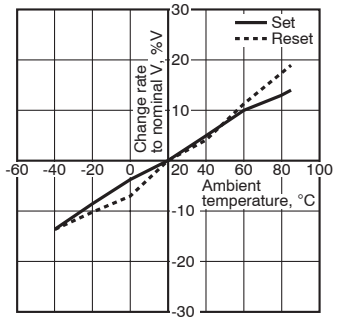
4. Set and Reset time

Sample: ADJ12024, 10 pcs
Coil applied voltage: 80 %V, 100 %V, 120 %V of rating



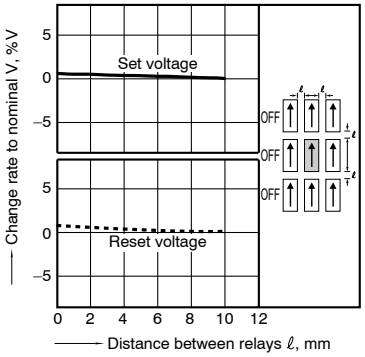
5. Ambient temperature characteristics

Sample: ADJ12024, 6pcs
Ambient temperature: –40°C to 85°C –40°F to 185°F



6. Influence of adjacent mounting

Sample: ADJ12024, 6pcs
Ambient temperature: Room temperature



NOTES

1. Coil operating power

Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%. However, check it with the actual circuit since the characteristics may be slightly different.

2. Coil connection

When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

3. Soldering

We recommend the following soldering conditions

Soldering: 250°C 482°F, max. 5 s

4. Others

1) If the relay has been dropped, the appearance and characteristics should always be checked before use.

2) The cycle lifetime is defined under the standard test condition specified in the JIS* C 5442-1996 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 85%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase,ambient conditions and other factors.

Also, be especially careful of loads such as those listed below.

• When used for AC load-operating and the operating phase is synchronous. Rocking and fusing can easily occur due to contact shifting.

• High-frequency load-operating

When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.

Three countermeasures for these are listed here.

• Incorporate an arc-extinguishing circuit.

• Lower the operating frequency

• Lower the ambient humidity

3) For secure operations, the voltage applied to the coil should be nominal voltage. In addition, please note that pick-up and drop-out voltage will vary according to the ambient temperature and operation conditions.

4) Heat, smoke, and even a fire may occur if the relay is used in conditions outside of the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded. Also, make sure that the relay is wired correctly.

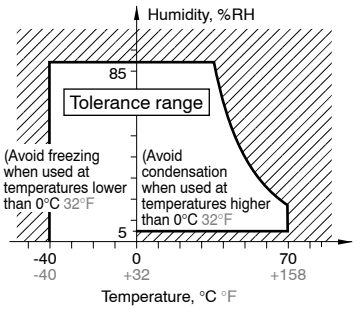
5) Incorrect wiring may cause unexpected events or the generation of heat or flames.

6) Check the ambient conditions when storing or transporting the relays and devices containing the relays. Freezing or condensation may occur in the relay, causing functional damage. Avoid subjecting the relays to heavy loads, or strong vibration and shocks.

5. Usage, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:

- Temperature:
  –40 to +70°C –40 to +158°F
- Humidity: 5 to 85% RH
  (Avoid freezing and condensation.)
  The humidity range varies with the temperature. Use within the range indicated in the graph below.



- Atmospheric pressure: 86 to 106 kPa
  Temperature and humidity range for usage, transport, and storage

2) Condensation

Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.

3) Freezing

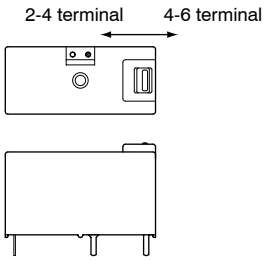
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.

4) Low temperature, low humidity environments

The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

6. Test button (manual lever) operation

The relay contacts switch over as follows:

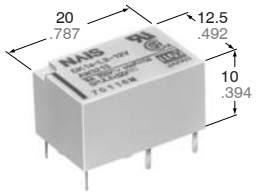


For Cautions for Use, see Relay Technical Information (page 392).

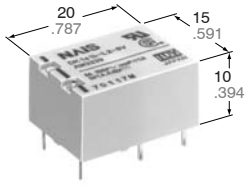
Panasonic
ideas for life

10 A MINIATURE POWER RELAY

DK RELAYS



1a



1a1b

mm inch

FEATURES

- **Large capacity in small size: 10 A 250 V AC (1a)**
- **High sensitivity: 200 mW nominal operating power**
- **High breakdown voltage 4,000 Vrms between contacts and coil 1,000 Vrms between open contacts Meeting FCC Part 68**
- **Sealed construction**
- **Latching types available**

SPECIFICATIONS

Contact

Arrangement		1 Form A	2 Form A, 1 Form A 1 Form B
Initial contact resistance, max. (By voltage drop 6 V DC 1A)		30 mΩ	
Contact material		Gold flash over silver alloy	
Rating (resistive)	Nominal switching capacity	10 A 250 V AC 10 A 30 V DC	8 A 250 V AC 8 A 30 V DC
	Max. switching power	300 W, 2,500 VA	240 W, 2,000 VA
	Max. switching voltage	250 V AC, 30 V DC	250 V AC, 30 V DC
	Max. switching current	10 A	8 A
	Min. switching capacity#1	10 mA, 5 V DC	
Expected life (min. operations)	Mechanical	5×10^7	
	Electrical (resistive)	10^5 (10 A 250 V AC, 10 A 30 V DC)	10^5 (8 A 250 V AC, 8 A 30 V DC)

Coil

Nominal operating power	200 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 mΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms
	Between contacts and coil	4,000 Vrms
Surge voltage between coil and contact*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Max. 10 ms (Approx. 5 ms)
Release time (without diode)*4 (at nominal voltage)		Max. 8 ms (Approx. 3 ms)
Temperature rise (at nominal voltage)		Max. 40°C with nominal coil voltage and at 10 A switching current
Shock resistance	Functional*5	Min. 98 m/s² {10 G}
	Destructive*6	Min. 980 m/s² {100 G}
Vibration resistance	Functional*7	88.2 m/s² {9 G}, 10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	176.4 m/s² {18 G}, 10 to 55 Hz at double amplitude of 3.0 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +65°C –40°F to +149°F
	Humidity	5 to 85% R.H.
Unit weight	1 Form A	Approx. 5.6 g .20 oz
	1 Form A 1 Form B, 2 Form A	Approx. 6 g .21 oz

TYPICAL APPLICATIONS

- Switching power supply
- Power switching for various OA equipment
- Control or driving relays for industrial machines (robotics, numerical control machines, etc.)
- Output relays for programmable logic controllers, temperature controllers, timers and so on.
- Home appliances

ORDERING INFORMATION

Ex. DK [1a] — [L2] — [12V] — [F]

Contact arrangement	Operating function	Coil voltage	Environmental support
1a: 1 Form A 2a: 2 Form A 1a1b: 1 Form A 1 Form B	Nil: Single side stable L2: 2 coil latching	3, 5, 6, 9, 12, 24V	• RoHS Directive conforming type ($AgSnO_2$ type) F: 1a Nil: 2a, 1a1b • RoHS Directive non-conforming type (AgCdO type) Nil: 1a

Notes: 1. Standard packing Carton: 50 pcs.; Case: 500 pcs.
UL/CSA, TÜV approved type is standard.
2. 1 coil latching type available.

Polarized Power

TYPES AND COIL DATA (at 20°C 68°F)

Single side stable

	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Maximum allowable voltage, V DC (at 65°C 149°F)
1 Form A	DK1a-3V (-F)	3	2.1	0.3	66.6	45	200	3.9
	DK1a-5V (-F)	5	3.5	0.5	40	125	200	6.5
	DK1a-6V (-F)	6	4.2	0.6	33.3	180	200	7.8
	DK1a-9V (-F)	9	6.3	0.9	22.2	405	200	11.7
	DK1a-12V (-F)	12	8.4	1.2	16.6	720	200	15.6
	DK1a-24V (-F)	24	16.8	2.4	8.3	2,880	200	31.2
1 Form A 1 Form B	DK1a1b-3V	3	2.1	0.3	66.6	45	200	3.9
	DK1a1b-5V	5	3.5	0.5	40	125	200	6.5
	DK1a1b-6V	6	4.2	0.6	33.3	180	200	7.8
	DK1a1b-9V	9	6.3	0.9	22.2	405	200	11.7
	DK1a1b-12V	12	8.4	1.2	16.6	720	200	15.6
	DK1a1b-24V	24	16.8	2.4	8.3	2,880	200	31.2
2 Form A	DK2a-3V	3	2.1	0.3	66.6	45	200	3.9
	DK2a-5V	5	3.5	0.5	40	125	200	6.5
	DK2a-6V	6	4.2	0.6	33.3	180	200	7.8
	DK2a-9V	9	6.3	0.9	22.2	405	200	11.7
	DK2a-12V	12	8.4	1.2	16.6	720	200	15.6
	DK2a-24V	24	16.8	2.4	8.3	2,880	200	31.2

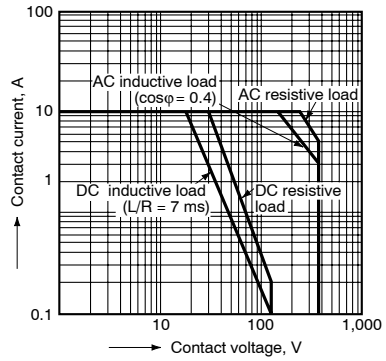
2 coil latching

	Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)		Coil resistance, Ω (±10%)		Nominal operating power, mW		Maximum allowable voltage, V DC (at 65°C 149°F)
					Set	Reset	Set	Reset	Set	Reset	
1 Form A	DK1a-L2-3V (-F)	3	2.1	2.1	66.6	66.6	45	45	200	200	3.9
	DK1a-L2-5V (-F)	5	3.5	3.5	40	40	125	125	200	200	6.5
	DK1a-L2-6V (-F)	6	4.2	4.2	33.3	33.3	180	180	200	200	7.8
	DK1a-L2-9V (-F)	9	6.3	6.3	22.2	22.2	405	405	200	200	11.7
	DK1a-L2-12V (-F)	12	8.4	8.4	16.6	16.6	720	720	200	200	15.6
	DK1a-L2-24V (-F)	24	16.8	16.8	8.3	8.3	2,880	2,880	200	200	31.2
1 Form A 1 Form B	DK1a1b-L2-3V	3	2.1	2.1	66.6	66.6	45	45	200	200	3.9
	DK1a1b-L2-5V	5	3.5	3.5	40	40	125	125	200	200	6.5
	DK1a1b-L2-6V	6	4.2	4.2	33.3	33.3	180	180	200	200	7.8
	DK1a1b-L2-9V	9	6.3	6.3	22.2	22.2	405	405	200	200	11.7
	DK1a1b-L2-12V	12	8.4	8.4	16.6	16.6	720	720	200	200	15.6
	DK1a1b-L2-24V	24	16.8	16.8	8.3	8.3	2,880	2,880	200	200	31.2
2 Form A	DK2a-L2-3V	3	2.1	2.1	66.6	66.6	45	45	200	200	3.9
	DK2a-L2-5V	5	3.5	3.5	40	40	125	125	200	200	6.5
	DK2a-L2-6V	6	4.2	4.2	33.3	33.3	180	180	200	200	7.8
	DK2a-L2-9V	9	6.3	6.3	22.2	22.2	405	405	200	200	11.7
	DK2a-L2-12V	12	8.4	8.4	16.6	16.6	720	720	200	200	15.6
	DK2a-L2-24V	24	16.8	16.8	8.3	8.3	2,880	2,880	200	200	31.2

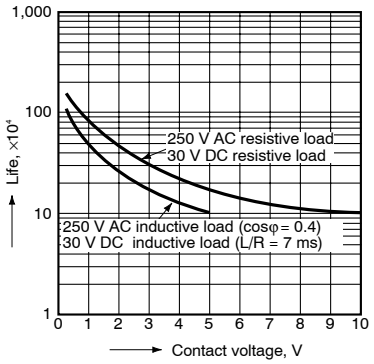
REFERENCE DATA

1. 1 Form A type

1. Maximum operating power

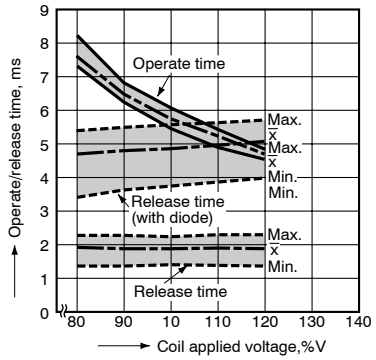


2. Life curve



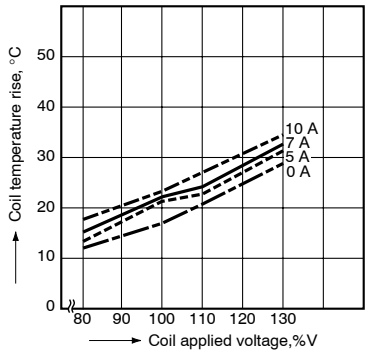
3. Operate/Release time

Sample: DK1a-24V, 5 pcs.



4. Coil temperature rise (at 30°C 68°F)

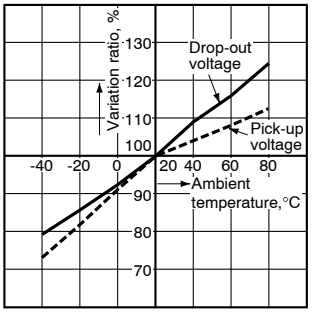
Sample: DK1a-12V, 5 pcs.



5. Ambient temperature characteristics

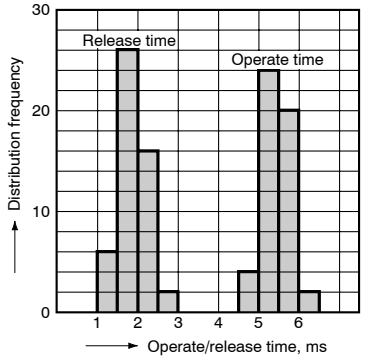
Sample: DK1a-24V, 6 pcs

Ambient temperature: –40°C to +80°C
–40°F to +176°F



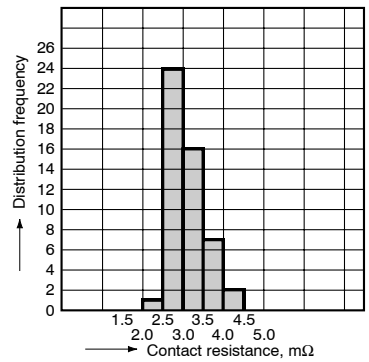
6. Operate/Release time (at 20°C 68°F)

Sample: DK1a-24V (50 pcs.)



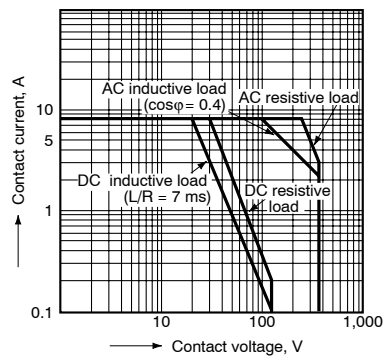
7. Contact resistance (at 20°C 68°F)

Sample: DK1a-24V (50 pcs.)

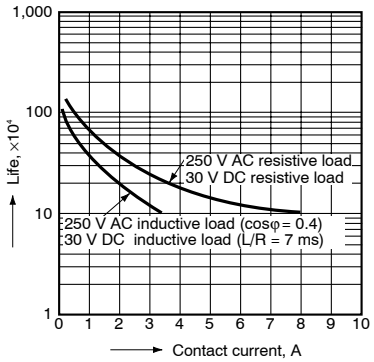


2. 1 Form A 1 Form B type, 2 Form A type1. 1 Form A type

1. Maximum operating power

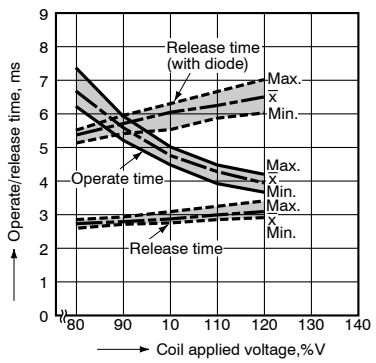


2. Life curve



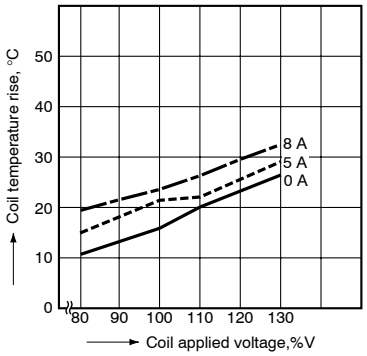
3. Operate/Release time (at 20°C 68°F)

Sample: DK1a1b-12V, 5 pcs.

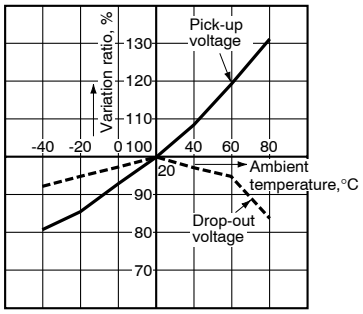


4. Coil temperature rise

Sample: DK1a1b-12V, 5 pcs.
Ambient temperature: 20°C 68°F



5. Ambient temperature characteristics

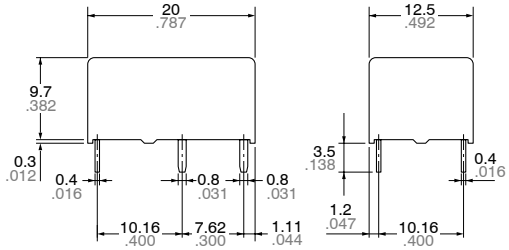


DIMENSIONS

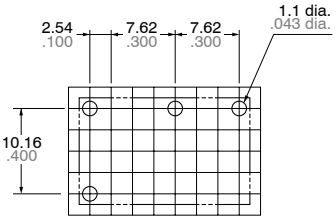
mm inch

1. 1 Form A type

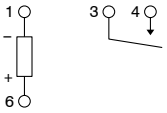
Single side stable type



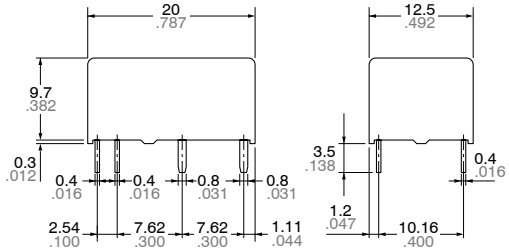
PC board pattern (Copper-side view)

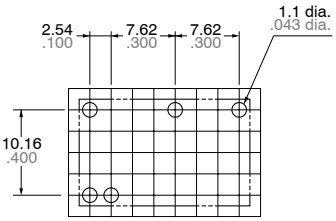


Schematic (Bottom view)
Single side stable
(Deenergized condition)



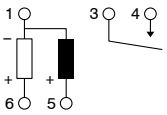
2 coil latching type





The above shows 2 coil latching type. No.5 terminal is eliminated on single side stable type.

2 coil latching
(Reset condition)



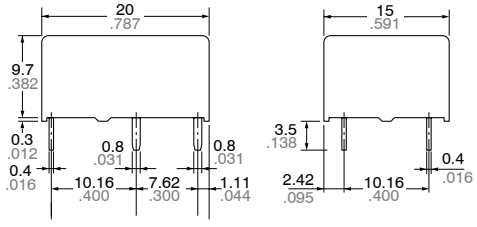
Since this is a polarized relay, the connection to the coil should be done according to the above schematic.

General tolerance: ±0.3 ±.012

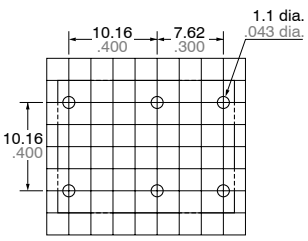
Tolerance: ±0.1 ±.004

2. 1 Form A 1 Form B type, 2 Form A type

Single side stable type

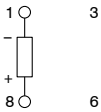


PC board pattern (Copper-side view)

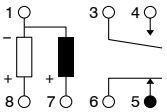


Schematic (Bottom view)
<1 Form A 1 Form B type>

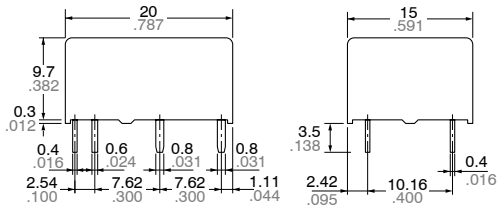
Single side stable (Deenergized condition)

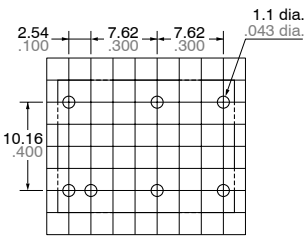


2 coil latching (Reset condition)



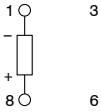
2 coil latching type



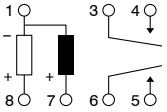


<2 Form A>

Single side stable (Deenergized condition)



2 coil latching (Reset condition)



Since this is a polarized relay, the connection to the coil should be done according to the above schematic.

Note:
Relay out-line and PC board pattern are common for both 1 Form A 1 Form B type and 2 Form A type.

General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.004

DK relay socket

TYPES AND RELAY COMPATIBILITY

Relay \ Socket		1 Form A		1 Form A 1 Form B, 2 Form A	
		Single side stable type	2 coil latching type	Single side stable type	2 coil latching type
1 Form A	Single side stable type	DK1a-PS	DK1a-PSL2	—	—
	2 coil latching type	—	DK1a-PSL2	—	—
1 Form A 1 Form B 2 Form A	Single side stable type	—	—	DK2a-PS	DK2a-PSL2
	2 coil latching type	—	—	—	DK2a-PSL2

SPECIFICATIONS

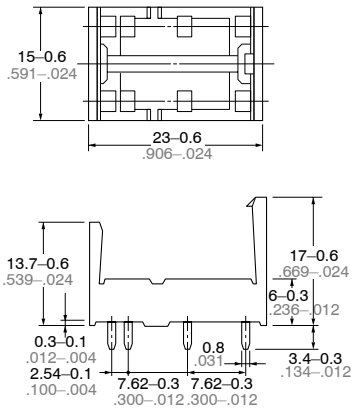
Breakdown voltage*1	4,000 Vrms (Except the portion between coil terminals)
Insulation resistance	Min. 1,000 mΩ (at 500 V DC)
Heat resistance	150°C (for 1 hour)
Max. continuous current	10 A (DK1a-PS, DK1a-PSL2), 8 A (DK2a-PS, DK2a-PSL2)

Remarks
*1 Detection current: 10 mA

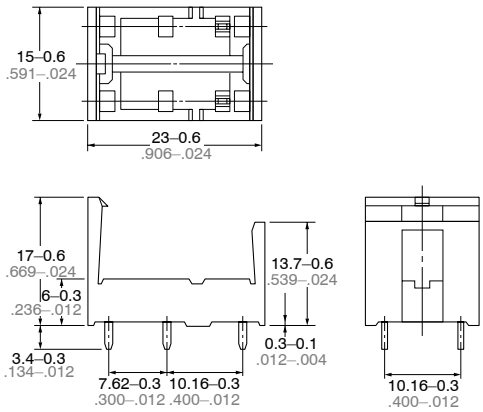
DIMENSIONS

mm inch

1 Form A type

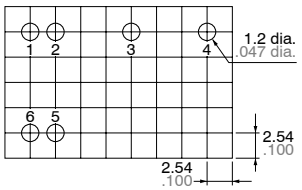


1 Form A 1 Form B type, 2 Form A type

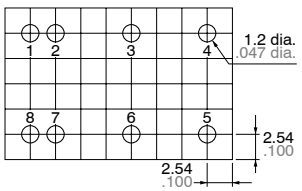


PC board pattern (Copper-side view)

1 Form A



1 Form A 1 Form B



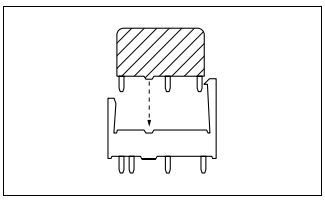
The above shows 2 coil latching type. No.2 and 5 terminal are eliminated on single side stable type.

General tolerance: ±0.3 ±.012

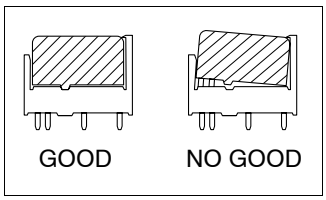
Tolerance: ±0.1 ±.004

FIXING AND REMOVAL METHOD

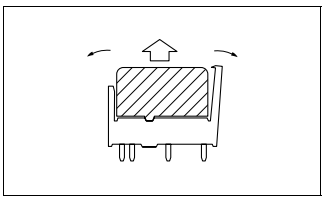
1. Match the direction of relay and socket.



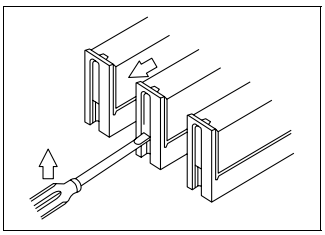
2. Both ends of the relay are to be secured firmly so that the socket hooks on the top surface of the relay.



3. Remove the relay, applying force in the direction shown below.

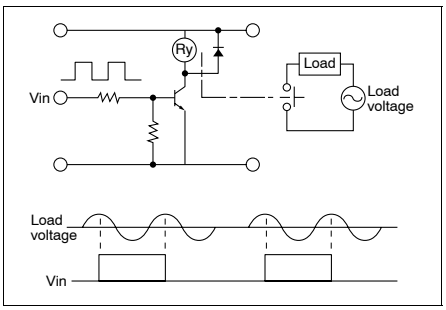


4. In case there is not enough space to grasp relay with fingers, use screwdrivers in the way shown below.



NOTES

1. Phase synchronization of AC-load switching
In case of switching the contact synchronized with phase of load voltage, the life of contact might be shorter or contact failure might be caused. Please confirm this matter in the actual system in this case. If necessary, the phase control would be recommended.



2. Soldering should be done under the following conditions:
250°C 482°F within 10s
300°C 572°F within 5s
350°C 662°F within 3s

For Cautions for Use, see Relay Technical Information (page 392).

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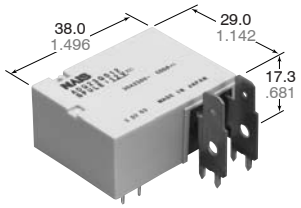
30A POWER LATCHING RELAY

DQ RELAYS (ADQ)



FEATURES

1. 30A capacity in small size

2. Latching type

3. High insulation
4,000V AC (between contacts and coil)
Surge 10,000V (between contacts and coil)

4. Sealed construction

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		30 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	30 A 250V AC
	Max. switching power	7,500 V A
	Max. switching voltage	250V AC
	Max. switching current	30 A
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	10^6
	Electrical (Resistive load)	10^{4*1}

Coil

	Nominal operating power
1 coil latching	500 mW
2 coil latching	1,000 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at rated load)		10 cpm
Initial insulation resistance*2		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*3	Between open contacts	1,500 Vrms for 1 min.
	Between contacts and coil	4,000 Vrms for 1 min.
Surge voltage between contact and coil*4		Min. 10,000 V (initial)
Set time*5 (at 20°C) (at nominal voltage)		Max. 20ms
Reset time*5 (at 20°C) (at nominal voltage)		Max. 20ms
Temperature rise (at 65°C)*6		Max. 50°C (Coil; de-energized)
Shock resistance	Functional*7	Min. 200 m/s²{20 G}
	Destructive*8	Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*9	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 2.0mm
Conditions for operation, transport and storage*10 (Not freezing and condensing at low temperature)	Ambient temperature*11	–40°C to +65°C –40°F to +149°F
	Humidity	5 to 75% R.H.
Unit weight		Approx. 35 g 1.23 oz

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 At nominal switching capacity, operating frequency: 3s ON, 3s OFF
*2 Measurement at same location as "Initial breakdown voltage" section.
*3 Detection current: 10mA
*4 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*5 Excluding contact bounce time.
*6 By resistive method, max. switching current
*7 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*8 Half-wave pulse of sine wave: 6 ms
*9 Detection time: 10 μs
*10 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).
*11 Under the packing condition, allowable temperature range is from –40 to +65°C –40° to +149°F.

TYPICAL APPLICATIONS

- Time switches
- Electric water heaters
- Remote control of electric power meters

ORDERING INFORMATION

ADQ [ ] [3] [Q] [0] [ ]

Operating function	Contact capacity	Terminal shape	Contact characteristics	Coil voltage (DC)
1: 1 coil latching 2: 2 coil latching	3: 30 A	Q: 250 Faston terminal	0: Standard contact	4H: 4.5 V 12: 12 V 06: 6 V 24: 24 V 09: 9 V

TYPES AND COIL DATA (at 20°C 68°F)

• 1 coil latching type

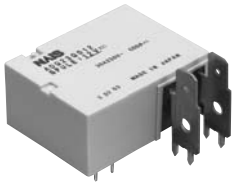
Contact arrangement	Part No.	Nominal voltage, V DC	Set voltage, max. V DC (initial)	Reset voltage, max. V DC (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
1 Form A	ADQ13Q04H	4.5	3.15	3.15	40.5	111.1	500	5.85
	ADQ13Q006	6	4.2	4.2	72	83.3	500	7.8
	ADQ13Q009	9	6.3	6.3	162	55.6	500	11.7
	ADQ13Q012	12	8.4	8.4	288	41.7	500	15.6
	ADQ13Q024	24	16.8	16.8	1,152	20.8	500	31.2

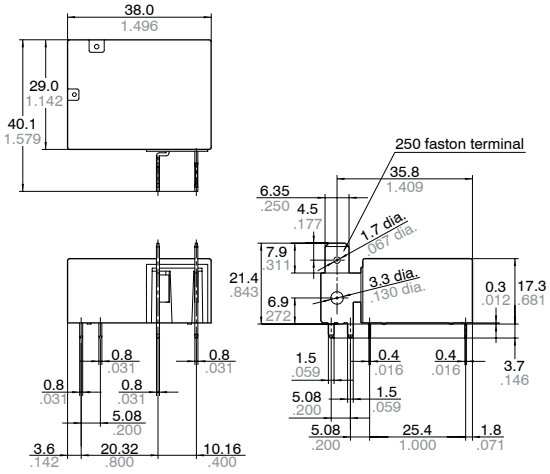
• 2 coil latching type

Contact arrangement	Part No.	Nominal voltage, V DC	Set voltage, max. V DC (initial)	Reset voltage, max. V DC (initial)	Coil resistance, Ω (±10%)		Nominal operating current, mA (±10%)		Nominal operating power, mW		Max. allowable voltage, V DC
					Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
1 Form A	ADQ23Q04H	4.5	3.15	3.15	20.3	20.3	221.7	221.7	1,000	1,000	5.85
	ADQ23Q006	6	4.2	4.2	36	36	166.7	166.7	1,000	1,000	7.8
	ADQ23Q009	9	6.3	6.3	81	81	111.1	111.1	1,000	1,000	11.7
	ADQ23Q012	12	8.4	8.4	144	144	83.3	83.3	1,000	1,000	15.6
	ADQ23Q024	24	16.8	16.8	576	576	41.7	41.7	1,000	1,000	31.2

DIMENSIONS

mm inch

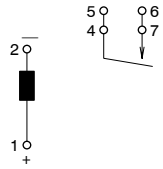




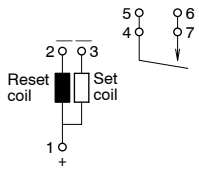
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

1 coil latching type (Reset condition)

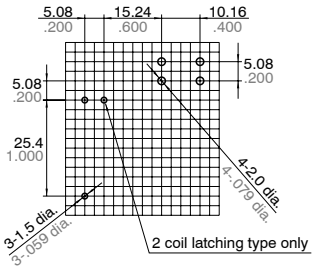


2 coil latching type (Reset condition)



Note) Terminal No.3 is only for 2 coil latching type.

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

NOTES

If the relay is used over 20A current through plug-in terminal, plug-in terminal should be soldered on receptacle terminal for preventing the loose contact during long time using.

For Cautions for Use, see Relay Technical Information (page 392).

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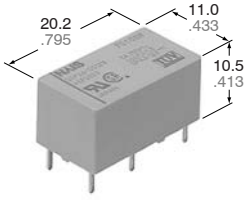
8 A MINIATURE POWER RELAY IN DS RELAY SERIES

DSP RELAYS

DSP1a

DSP1



DSP2a

mm inch

FEATURES

- **Power types added to DS relay series**
- **High switching capacity: 1a: 8 A 250 V AC / 1a1b, 2a: 5 A 250 V AC**
- **High sensitivity: 190 mW pick-up power**
- **High contact welding resistance**
- **Latching types available**
- **High breakdown voltage 3,000 Vrms between contacts and coil 1,000 Vrms between open contacts Meeting FCC Part 68**
- **Sealed types are standard**

SPECIFICATIONS (at 20°C 68°F)

Contact

Arrangement		1a	1a1b	2a
Contact material		Gold flash over silver alloy		
Initial contact resistance, max. (By voltage drop 6 V DC 1A)		30 mΩ		
Nominal switching capacity		8A 250 VAC 5A 30 VDC	5A 250 VAC 5A 30 VDC	
Rating (resistive)	Max. switching power	2,000 VA 150 W	1,250 VA 150 W	
	Max. switching voltage	250 V AC, 30 V DC		
	Max. switching current	8 A	5 A	
	Min. switching capacity#1	10 mA, 5 V DC		
Expected life (min. operations)	Mechanical (at 180 cpm)	5×10^7		
	Electrical	10^5		

Coil (polarized) (at 20°C 68°F)

Minimum operating power	Single side stable	192 mW
	1 coil latching	96 mW
	2 coil latching	192 mW
Nominal operating power	Single side stable	300 mW
	1 coil latching	150 mW
	2 coil latching	300 mW

Note: All specifications are based on the condition of 25°C 77°F, 50% R.H. unless otherwise specified.

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed		30 cps. at rated load
Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	1,000 Vrms
	Between contact sets	2,000 Vrms (1a1b, 2a)
	Between contacts and coil	3,000 Vrms
Surge voltage between contacts and coil		Min. 5,000 V
Set time*3 (at nominal voltage)		Max. 10 ms (Approx. 5 ms)
Reset time*3 (at nominal voltage)		Max. 10 ms (Approx. 4 ms)
Operate time*3 (at nominal voltage)		Max. 10 ms (Approx. 5 ms)
Release time(without diode)*3 (at nominal voltage)		Max. 5 ms (Approx. 4 ms)
Temperature rise		Max. 40°C (1a1b type) Max. 55°C (1a, 2a types)
Soldering temperature		250°C (10 s) 300°C (5 s), 350°C (3 s)
Shock resistance	Functional*4	Min. 196 m/s² {20 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm
	Destructive	205.8 m/s² {21 G}, 10 to 55 Hz at double amplitude of 3.5 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)		–40°C to +65°C – 40°F 149°F
Unit weight		Approx. 4.3 g .15 oz

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

TYPICAL APPLICATIONS

Office and industrial electronic devices
• Terminal devices of information processing equipment, such as printer, data recorder.
• Office equipment (copier, facsimile)
• Measuring instruments
• NC machines, temperature controllers and programmable logic controllers.

ORDERING INFORMATION

Ex. DSP [1] —— [L] —— [DC12V] —— [R]

Contact arrangement	Operating function	Coil voltage	Polarity
1: 1a1b 1a: 1a 2a: 2a	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	DC: 3, 5, 6, 9, 12, 24 V	Nil: Standard polarity R: Reverse polarity

Note: Standard packing: Carton: 50 pcs.; Case: 500 pcs.
UL/CSA, VDE approved type is standard.

TYPES AND COIL DATA (at 20°C 68°F)

Single side stable

Type	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, at 50°C, V DC
Single side stable	DSP❑-DC3V	3	2.4	0.3	100	300	30	3.9
	DSP❑-DC5V	5	4.0	0.5	60	300	83	6.5
	DSP❑-DC6V	6	4.8	0.6	50	300	120	7.8
	DSP❑-DC9V	9	7.2	0.9	33.3	300	270	11.7
	DSP❑-DC12V	12	9.6	1.2	25	300	480	15.6
	DSP❑-DC24V	24	19.2	2.4	12.5	300	1,920	31.2

1 coil latching

Type	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, at 50°C, V DC
1 coil latching	DSP❑-L-DC3V	3	2.4	2.4	50	150	60	3.9
	DSP❑-L-DC5V	5	4.0	4.0	30	150	167	6.5
	DSP❑-L-DC6V	6	4.8	4.8	25	150	240	7.8
	DSP❑-L-DC9V	9	7.2	7.2	16.7	150	540	11.7
	DSP❑-L-DC12V	12	9.6	9.6	12.5	150	960	15.6
	DSP❑-L-DC24V	24	19.2	19.2	6.3	150	3,840	31.2

2 coil latching

Type	Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, at 50°C, V DC
2 coil latching	DSP❑-L2-DC3V	3	2.4	2.4	100	300	30	3.9
	DSP❑-L2-DC5V	5	4.0	4.0	60	300	83	6.5
	DSP❑-L2-DC6V	6	4.8	4.8	50	300	120	7.8
	DSP❑-L2-DC9V	9	7.2	7.2	33.3	300	270	11.7
	DSP❑-L2-DC12V	12	9.6	9.6	25.5	300	480	15.6
	DSP❑-L2-DC24V	24	19.2	19.2	12.5	300	1,920	31.2

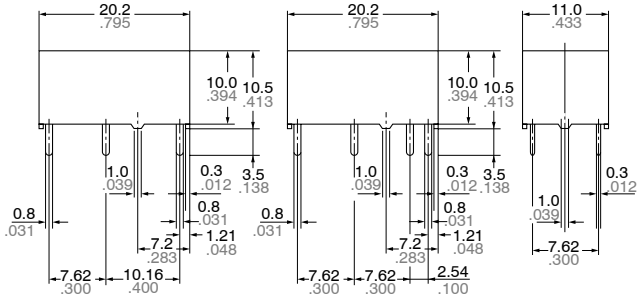
Note: Insert 1a, 1 or 2a in, 2 ❑ for contact form required.

DIMENSIONS

mm inch

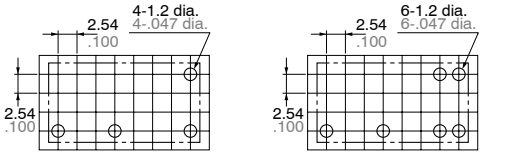
1a type (DSP1a)

Single side stable
1 coil latching 2 coil latching



General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)
Single side stable 2 coil latching



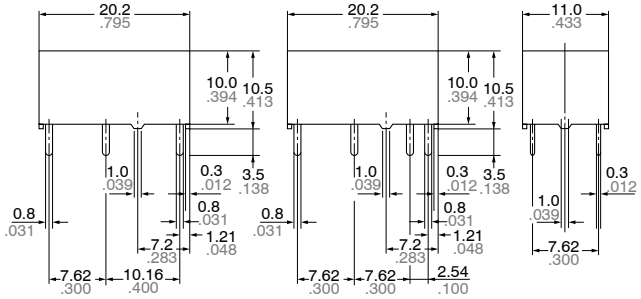
Tolerance: ±0.1 ±.004

Schematic (Bottom view)
Single side stable 2 coil latching

(Deenergized condition) (Reset condition)

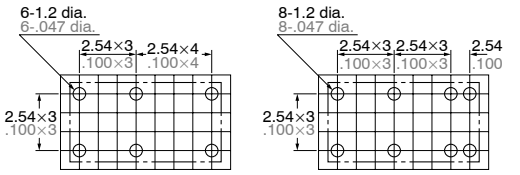
1a1b type (DSP1)

Single side stable
1 coil latching 2 coil latching



General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)
Single side stable 2 coil latching



Tolerance: ±0.1 ±.004

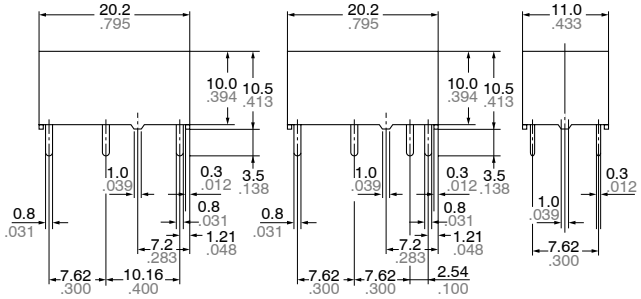
Schematic (Bottom view)
Single side stable 2 coil latching

(Deenergized condition) (Reset condition)

2a type (DSP2a)

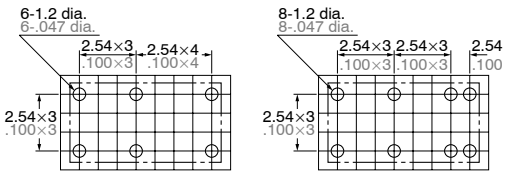
mm inch

Single side stable
1 coil latching 2 coil latching



General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)
Single side stable 2 coil latching



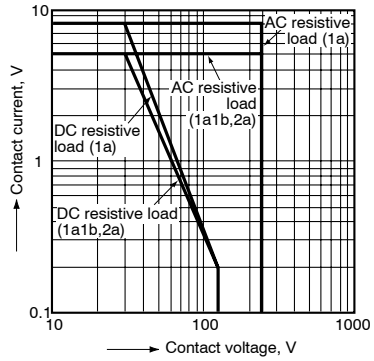
Tolerance: ±0.1 ±.004

Schematic (Bottom view)
Single side stable 2 coil latching

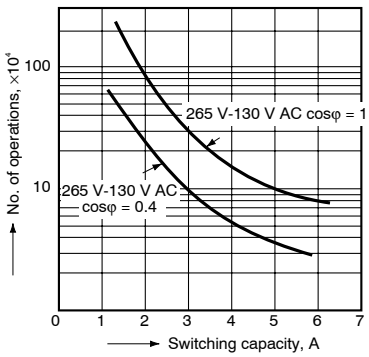
(Deenergized condition) (Reset condition)

REFERENCE DATA

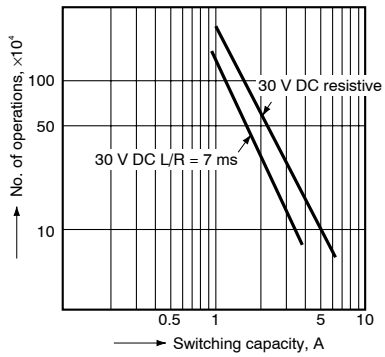
1. Max. switching capacity



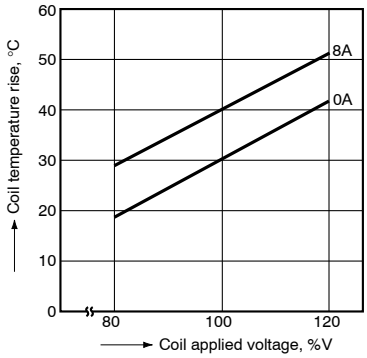
2.-(1) Life curve (1a1b type)



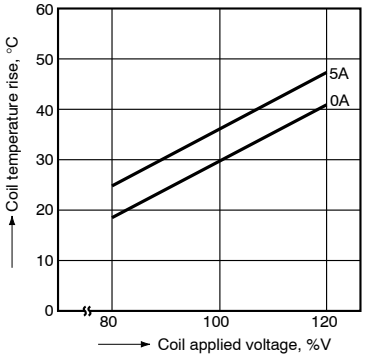
2.-(2) Life curve (1a1b type)



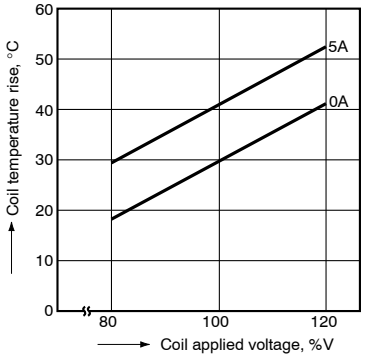
3.-(1) Coil temperature rise (1a type)
Sample: DSP1a-DC12V, 5 pcs.



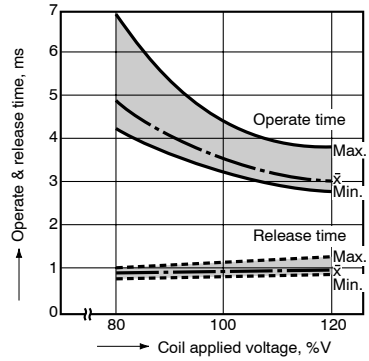
3.-(2) Coil temperature rise (1a1b type)
Sample: DSP1-DC12V, 5 pcs.



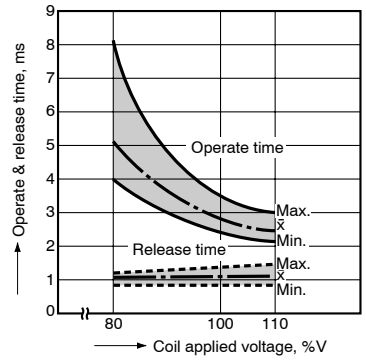
3.-(3) Coil temperature rise (2a type)
Sample: DSP2a-DC12V, 5 pcs.



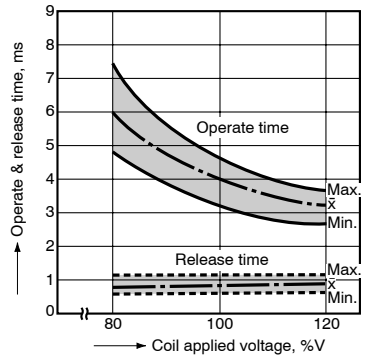
4.-(1) Operate & release time
(without diode, 1a type)
Sample: DSP1a-DC12V, 5 pcs.



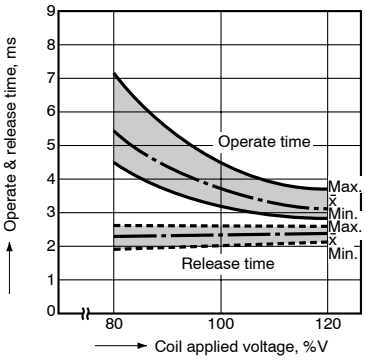
4.-(2) Operate & release time
(without diode, 1a1b type)
Sample: DSP1-DC12V, 5 pcs.



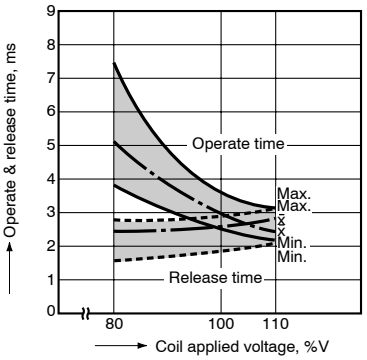
4.-(3) Operate & release time
(without diode, 2a type)
Sample: DSP2a-DC12V, 5 pcs.)



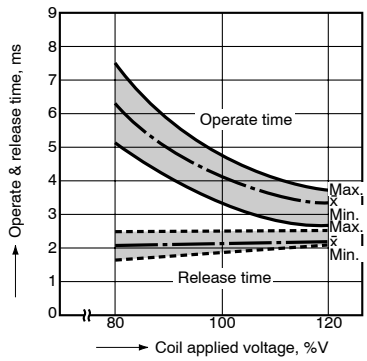
4.-(4) Operate & release time
(with diode, 1a type)
Sample: DSP1a-DC12V, 5 pcs.



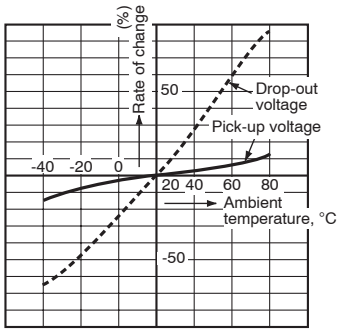
4.-(5) Operate & release time
(with diode, 1a1b type)
Sample: DSP1-DC12V, 5 pcs.



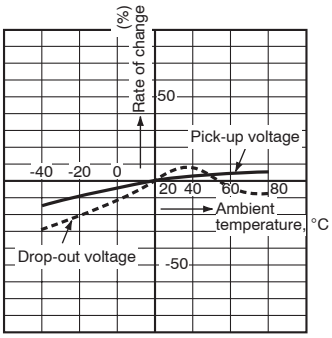
4.-(6) Operate & release time
(with diode, 2a type)
Sample: DSP2a-DC12V, 5 pcs.



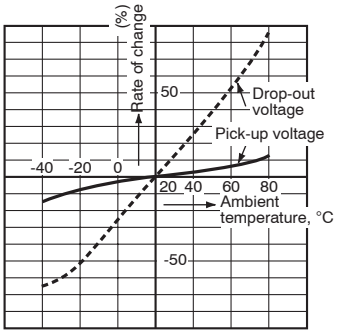
5.-(1) Change of pick-up and drop-out voltage (1a type)
Sample: DSP1a-DC12V, 5 pcs.



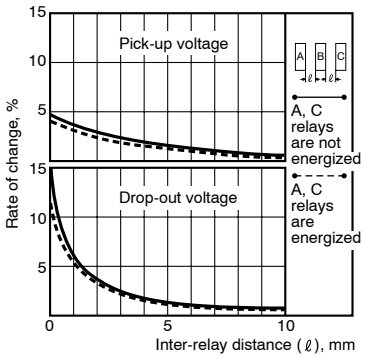
5.-(2) Change of pick-up and drop-out voltage (1a1b type)
Sample: DSP1-DC12V, 5 pcs.



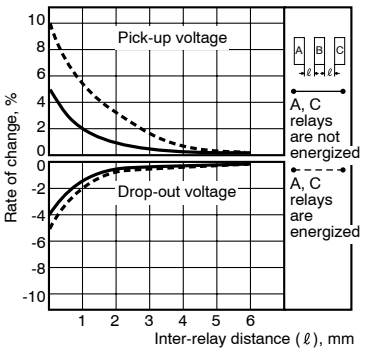
5.-(3) Change of pick-up and drop-out voltage (2a type)
Sample: DSP2a-DC12V, 5 pcs.



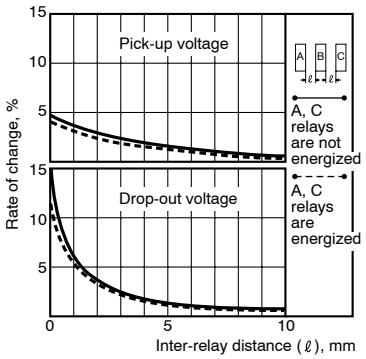
6.-(1) Influence of adjacent mounting (1a type)
Sample: DSP1a-DC12V, 5 pcs.



6.-(2) Influence of adjacent mounting (1a1b type)
Sample: DSP1-DC12V, 5 pcs.



6.-(3) Influence of adjacent mounting (2a type)
Sample: DSP2a-DC12V, 5 pcs.

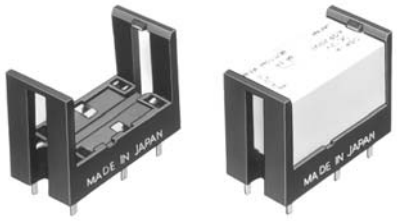


NOTES

Soldering should be done under the following conditions:
250°C 482°F within 10 s
300°C 572°F within 5 s
350°C 662°F within 3 s

For Cautions for Use, see Relay Technical Information (page 392).

SOCKETS FOR DSP RELAYS



TYPES AND APPLICABLE RELAYS

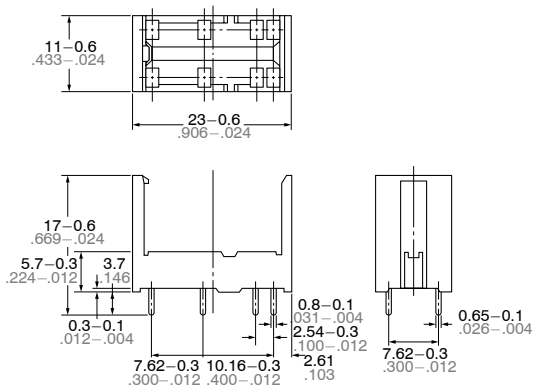
Applicable relays \ Type No.	For DSP1a		For DSP1a, DSP1, DSP2a	
	DSP1a-PS	DSP1a-PSL2	DSP2a-PS	DSP2a-PSL2
DSP1a relays	OK	OK	OK	OK
DSP1a-L2 relays		OK		OK
DSP1 relays			OK	OK
DSP1-L2 relays				OK
DSP2a relays			OK	OK
DSP2a-L2 relays				OK

SPECIFICATIONS

Item	Specifications
Breakdown voltage	3,000 Vrms between terminals (Except for the portion between coil terminals)
Insulation resistance	1,000 MΩ between terminals at 500 V
Heat resistance	150°C for 1 hour
Max. continuous current	1a: 8 A 2a: 5 A

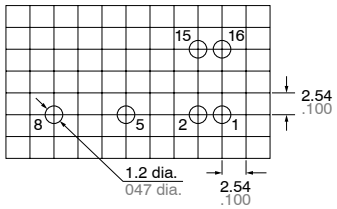
DIMENSIONS

mm inch



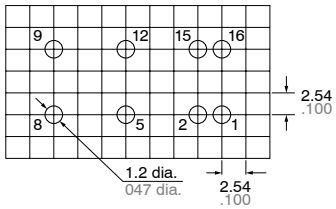
PC board pattern (Copper-side view)

DSP1a-PS, DSP1a-PSL2



Terminal No.2 and 15 are for DSP1a-PSL2 only.

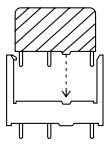
DSP2a-PS, DSP2a-PSL2



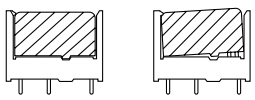
Terminal No.2 and 15 are for DSP2a-PSL2 only.

FIXING AND REMOVAL METHOD

1. Match the direction of relay and socket.

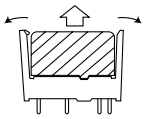


2. Both ends of relays are fixed so surely that the socket hooks on the top surface of relays.

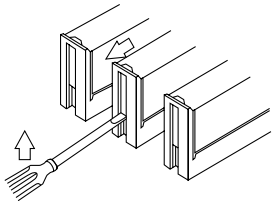


Good No good

3. Remove the relay, applying force in the direction shown below.



4. In case there is not enough space for finger to pick relay up, use screw drivers in the way shown below.



Panasonic
ideas for life

10A MINIATURE POWER RELAY

DY RELAYS (ADY)

FEATURES

- **Latching types available**
- **Electrical life of Min. 2 × 10^5 times (1 Form A type) realized with inductive load (cosφ=0.4, L/R=7ms, 5A 250V AC)**
- **Lead- and cadmium-free.**
- **Socket also available.**

	Part No.
Single side stable type	DK2a-PS
2 coil latching type	DK2a-PSL2

TYPICAL APPLICATIONS

- Control for industrial machines (machine tools, robotics)
- Output relays for temperature controllers, PLCs, timers, sensors.
- Measuring equipment
- Security equipment

SPECIFICATIONS

Contact

			1 Form A	1 Form A 1 Form B
Arrangement				
Initial contact resistance, max. (By voltage drop 6 V DC 1A)			30 mΩ	
Contact material			Gold-flashed silver alloy	
Rating	Nominal switching capacity	Resistive load	10A 250V AC 10A 30V DC	8A 250V AC 8A 30V DC
		Inductive load (cosφ = 0.4, L/R = 7ms)	5A 250V AC	3.5A 250V AC
	Max. switching capacity (Reference)	Resistive load	2,500V A, 300W	2,000V A, 240W
		Inductive load (cosφ = 0.4, L/R = 7ms)	1,250V A	875V A
	Max. switching voltage		380V AC, 125V DC	
	Max. switching current		10 A	8 A
	Min. switching capacity#1		5V 10mA	
Expected life (min. operations)	Mechanical (at 300cpm)		5×10^7	
	Electrical (at 20cpm)	1 Form A inductive load	2×10^5	
		1 Form A resistive load 1 Form A 1 Form B resistive load 1 Form A 1 Form B inductive load	10^5	

Coil

Nominal operating power	200 mW

Characteristics

		1 Form A	1 Form A 1 Form B
Max. operating speed		20 cpm (at rated load)	
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)	
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.	
	Between contacts and coil	4,000 Vrms for 1 min.	
Surge voltage between coil and contact*3		Min. 10,000 V (initial)	
Operate time [Set time]*4 (at nominal voltage) (at 20°C)		Max. 10ms (Approx. 5ms) [Max. 10ms (Approx. 5ms)]	
Release time [Reset time] (without diode)*4 (at nominal voltage) (at 20°C)		Max. 8ms (Approx. 3ms) [Max. 10ms (Approx. 3ms)]	
Temperature rise (at 70°C)*5		Max. 40°C	
Shock resistance	Functional*6	Min. 98 m/s² {10 G}	
	Destructive*7	Min. 980 m/s² {100 G}	
Vibration resistance	Functional*8	10 to 55 Hz at double amplitude of 1.5 mm	
	Destructive	10 to 55 Hz at double amplitude of 3.0 mm	
Conditions for operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F	
	Humidity	5 to 85% R.H.	
Unit weight		Approx. 6g .21oz	

Remarks

#1 This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 By resistive method, nominal voltage applied to the coil, max. switching current
*6 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*7 Half-wave pulse of sine wave: 6ms
*8 Detection time: 10μs
*9 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

ORDERING INFORMATION

ADY □ □ 0 □

Contact arrangement	Operating function	Contact characteristics	Coil voltage (DC)
1: 1 Form A 3: 1 Form A, 1 Form B	0: Single side stable 2: 2 coil latching	0: Standard contact	03: 3 V 12: 12 V 05: 5 V 24: 24 V 06: 6 V

Notes: 1) Standard packing-Carton: 50 pcs.; Case: 500 pcs.
2) UL/CSA approved type is standard.

TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type

Contact arrangement	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
1 Form A	ADY10003	3	2.1	0.3	66.6	45	200	3.9
	ADY10005	5	3.5	0.5	40	125	200	6.5
	ADY10006	6	4.2	0.6	33.3	180	200	7.8
	ADY10012	12	8.4	1.2	16.6	720	200	15.6
	ADY10024	24	16.8	2.4	8.3	2,880	200	31.2
1 Form A 1 Form B	ADY30003	3	2.1	0.3	66.6	45	200	3.9
	ADY30005	5	3.5	0.5	40	125	200	6.5
	ADY30006	6	4.2	0.6	33.3	180	200	7.8
	ADY30012	12	8.4	1.2	16.6	720	200	15.6
	ADY30024	24	16.8	2.4	8.3	2,880	200	31.2

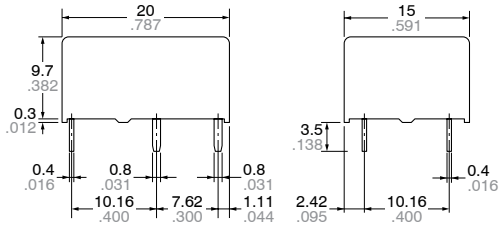
• 2 coil latching type

Contact arrangement	Part No.	Nominal voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)		Coil resistance, Ω (±10%)		Nominal operating power, mW		Max. allowable voltage, V DC
					Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
1 Form A	ADY12003	3	2.1	2.1	66.6	66.6	45	45	200	200	3.9
	ADY12005	5	3.5	3.5	40	40	125	125	200	200	6.5
	ADY12006	6	4.2	4.2	33.3	33.3	180	180	200	200	7.8
	ADY12012	12	8.4	8.4	16.6	16.6	720	720	200	200	15.6
	ADY12024	24	16.8	16.8	8.3	8.3	2,880	2,880	200	200	31.2
1 Form A 1 Form B	ADY32003	3	2.1	2.1	66.6	66.6	45	45	200	200	3.9
	ADY32005	5	3.5	3.5	40	40	125	125	200	200	6.5
	ADY32006	6	4.2	4.2	33.3	33.3	180	180	200	200	7.8
	ADY32012	12	8.4	8.4	16.6	16.6	720	720	200	200	15.6
	ADY32024	24	16.8	16.8	8.3	8.3	2,880	2,880	200	200	31.2

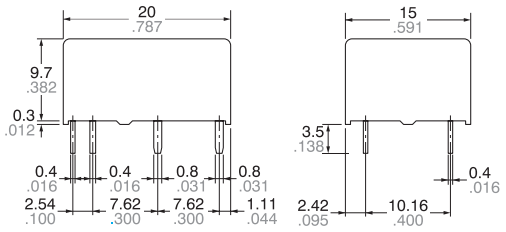
DIMENSIONS

mm inch

Single side stable type

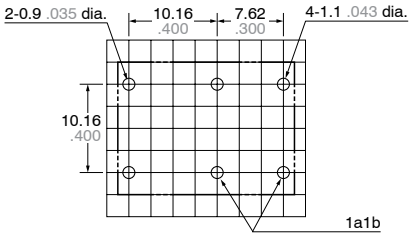


2 coil latching type

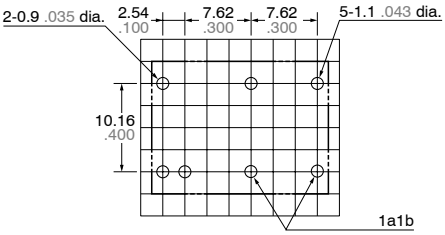


PC board pattern (BOTTOM VIEW)

Single side stable type



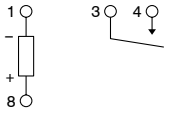
2 coil latching type



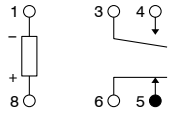
Tolerance: ±0.1 ±.004

Schematic (BOTTOM VIEW)

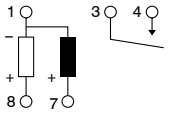
Single side stable (1 Form A)



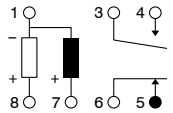
Single side stable (1 Form A 1 Form B)



2 coil latching type (Reset condition)



2 coil latching type (Reset condition)



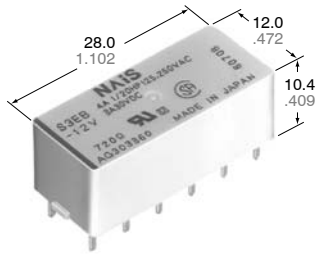
General tolerance: ±0.3 ±.012

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

4 A CAPACITY, THE VARIETY OF CONTACT ARRANGEMENTS

S RELAYS



mm inch

FEATURES

- **The variety of contact arrangements 2 Form A 2 Form B, 3 Form A 1 Form B, 4 Form A**
- **Latching types available**
- **High sensitivity in small size 100 mW pick-up and 200 mW nominal operating power**
- **High shock and vibration resistance Shock: 50 G Vibration: 10 to 55 Hz at double amplitude of 3 mm .118 inch**
- **Wide switching range From 100μA 100 mV DC to 4 A 250 V AC**
- **Low thermal electromotive force Approx. 3 μV**
- **Dual-In-Line packaging arrangement**

Polarized Power

SPECIFICATIONS

Contacts

Arrangement			2 Form A 2 Form B, 3 Form A 1 Form B, 4 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			50 mΩ
Initial contact pressure			Approx. 12 g .42 oz
Contact material			Gold clad silver alloy
Electrostatic capacitance			Approx. 3pF
Thermal electromotive force (at nominal coil voltage)			Approx. 3μV
Rating (resistive)	Nominal switching capacity		4 A 250 V AC, 3 A 30 V DC
	Maximum switching power		1,000 VA, 90 W
	Maximum switching voltage		250 V AC, 30 V DC (48 VDC at less than 0.5 A)
	Max. switching current		4 A (AC), 3 A (DC)
	Min. switching capacity#1		100μA 100 m V DC
Expected life (min. operations)	Mechanical (at 50 cps)		10^8
	Electrical (at 20 cpm)	4 A 250 V AC	10^5
		3 A 30 V DC	2×10^5

Coil (polarized) (at 20°C 68°F)

Single side stable	Minimum operating power	Approx. 100 mW
	Nominal operating power	Approx. 200 mW
Latching	Minimum set and reset	Approx. 100 mW
	Nominal set and reset	Approx. 200 mW

Notes:

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics (at 25°C 77°F 50% Relative humidity)

Max. operating speed			20 cpm for maximum load, 50 cps for low-level load (1 mA 1 V DC)
Initial insulation resistance*1			10,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts		750 Vrms
	Between contact sets		1,000 Vrms
	Between contacts and coil		1,500 Vrms
Operate time*3 (at nominal voltage)(at 20°C)			Max. 15 ms (Approx. 8 ms)
Release time (without diode)*3 (at nominal voltage)(at 20°C)			Max. 10 ms (Approx. 5 ms)
Set time*3 (latching) (at nominal voltage)(at 20°C)			Max. 15 ms (Approx. 8 ms)
Reset time*3 (latching) (at nominal voltage)(at 20°C)			Max. 15 ms (Approx. 8 ms)
Initial contact bounce, max.			1 ms
Temperature rise (at nominal voltage)(at 20°C)			Max. 35°C with nominal coil voltage and at maximum switching current
Shock resistance	Functional*4		Min. 490 m/s² {50 G}
	Destructive*5		Min. 980 m/s² {100 G}
Vibration resistance	Functional*6		176.4 m/s² {18 G}, 10 to 55 Hz at double amplitude of 3 mm
	Destructive		235.2 m/s² {24 G}, 10 to 55 Hz at double amplitude of 4 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)		Ambient temp.	–40°C to +65°C –40°F to +149°F
		Humidity	5 to 85% R.H.
Unit weight			Approx. 8 g .28 oz

TYPICAL APPLICATIONS

Telecommunications equipment, data processing equipment, facsimiles, alarm equipment, measuring equipment.

ORDERING INFORMATION

Ex. S — 2 — L2 — 48 V

Product name	Contact arrangement	Operating function	Coil voltage, V DC
S	2: 2 Form A 2 Form B 3: 3 Form A 1 Form B 4: 4 Form A	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	3, 5, 6,12, 24, 48

Notes: 1) Standard packing; Carton 50 pcs. Case 500 pcs.
2) UL/CSA approved type is standard.

TYPES AND COIL DATA at 20°C 68°F

Single side stable

Type	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA	Coil resistance, Ω (±10%)	Inductance, mH	Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
S❑-3V	3	2.1	0.3	66.7	45	23	200	5.5
S❑-5V	5	3.5	0.5	38.5	130	65	192	9.0
S❑-6V	6	4.2	0.6	33.3	180	93	200	11.0
S❑-12V	12	8.4	1.2	16.7	720	370	200	22.0
S❑-24V	24	16.8	2.4	8.4	2,850	1,427	202	44.0
S❑-48V	48	33.6	4.8	5.6	8,500	3,410	271	75.0

1 coil latching

Type	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage V DC (min.)	Nominal operating current, mA	Coil resistance, Ω (±10%)	Inductance, mH	Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
S❑-L1-3V	3	2.1	0.3	33	90	0.04	99	8.4
S❑-L1-5V	5	3.5	0.5	16	300	0.14	80	15.3
S❑-L1-6V	6	4.2	0.6	16	360	0.14	96	16.8
S❑-L1-12V	12	8.4	1.2	8	1450	0.6	96	33.7
S❑-L1-24V	24	16.8	2.4	4	5700	2.05	96	66.7
S❑-L1-48V	48	33.6	4.8	3	16,000	8.9	144	111

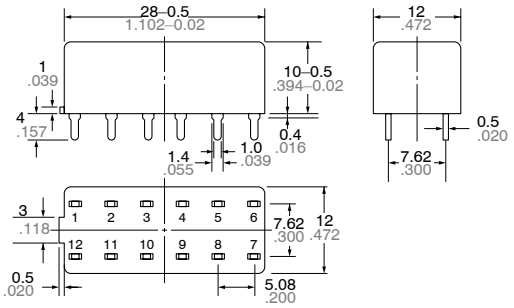
2 coil latching

Type	Nominal voltage, V DC	Set and reset voltage, V DC (max.)	Nominal operating current, mA	Coil resistance, Ω (±10%)		Inductance, mH		Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
				Coil I	Coil II	Coil I	Coil II		
S❑-L2-3V	3	2.1	66.7	45	45	10	10	200	5.5
S❑-L2-5V	5	3.5	38.5	130	130	31	31	192	9.0
S❑-L2-6V	6	4.2	33.7	180	180	40	40	200	11.0
S❑-L2-12V	12	8.4	16.7	720	720	170	170	200	22.0
S❑-L2-24V	24	16.8	8.4	2,850	2,850	680	680	202	44.0
S❑-L2-48V	48	33.6	7.4	6,500	6,500	1,250	1,250	355	65.0

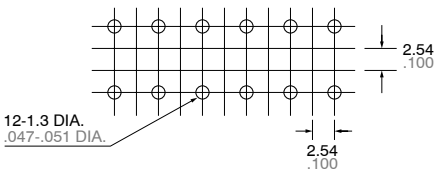
Note: Insert 2, 3 or 4 in ❑ for contact form required.

DIMENSIONS

mm inch



PC board pattern (Copper-side view)



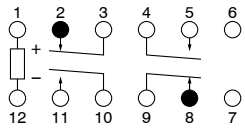
General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.003

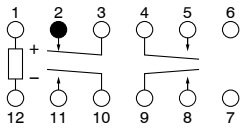
Schematic (Bottom view)

Single side stable
Deenergized position

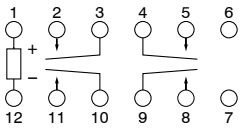
2a2b



3a1b

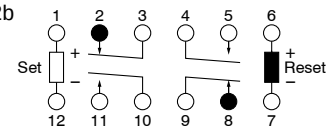


4a

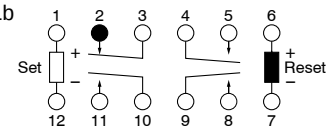


2 coil latching
Diagram shows the "reset" position when terminals 6 and 7 are energized. Energize terminals 1 and 12 to transfer contacts.

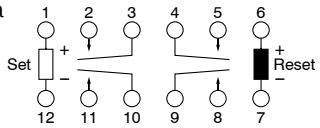
2a2b



3a1b

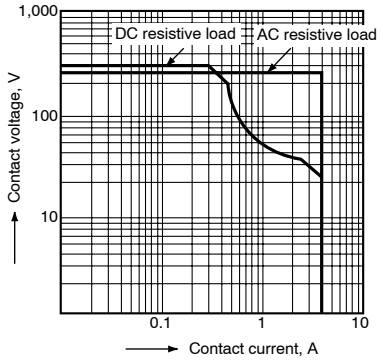


4a

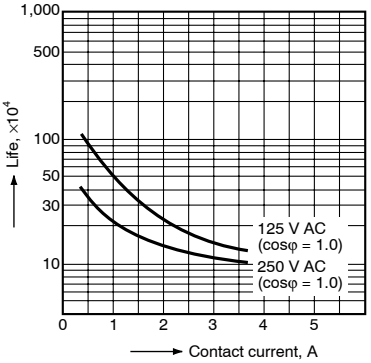


REFERENCE DATA

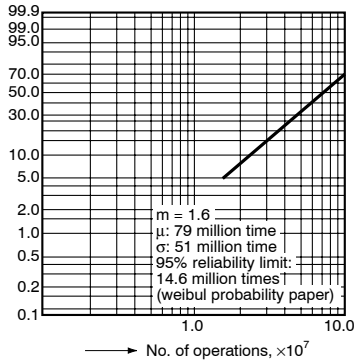
1. Maximum switching power



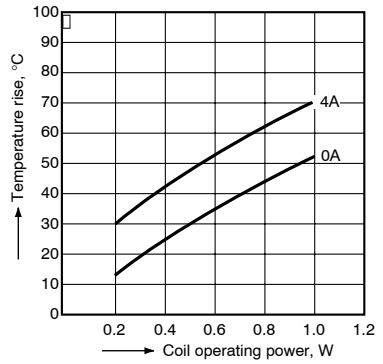
2. Life curve



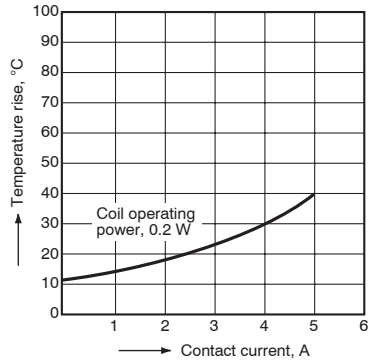
3. Contact reliability
Condition: 1V DC, 1mA
Detection level 10 Ω
Tasted Sample: S4-24V, 10pcs



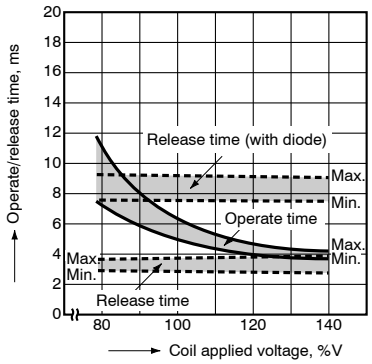
4.-(1) Coil temperature rise
Tested Sample: S4-24V, 4 Form A



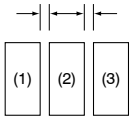
4.-(2) Coil temperature rise
Tested Sample: S4-24V, 4 Form A



5. Operate and release time
(Single side stable type)
Tested Sample: S4-24V, 10pcs

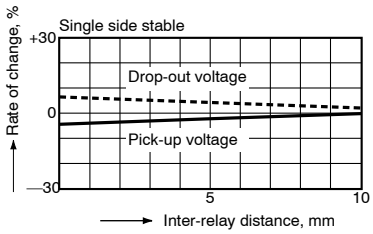


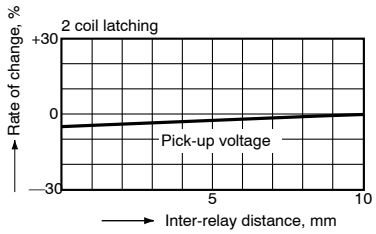
6. Influence of adjacent mounting



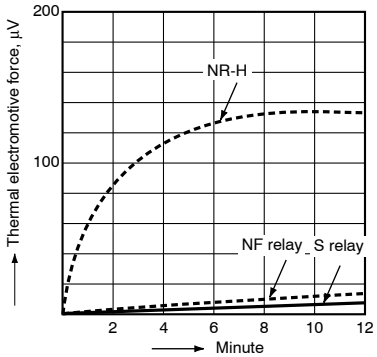
(1) & (3) relays are energized

Note: When installing an S-relay near another, and there is no effect from an external magnetic field, be sure to leave at least 10 mm .394 inch between relays in order to achieve the performance listed in the catalog.

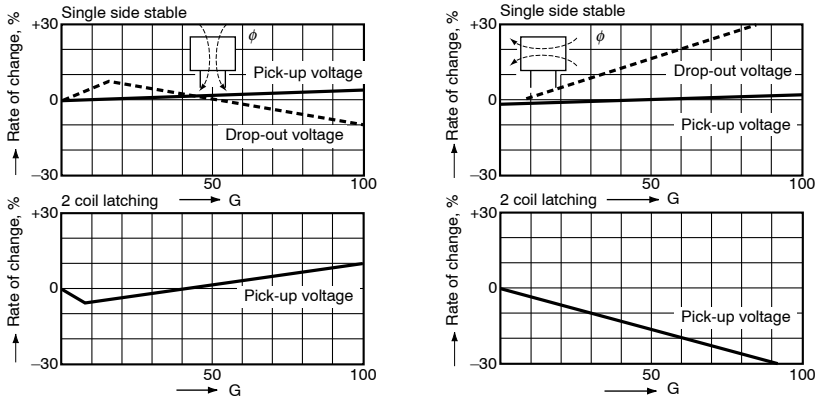




7. Thermal electromotive force



8. Effect from an external magnetic field



ACCESSORIES

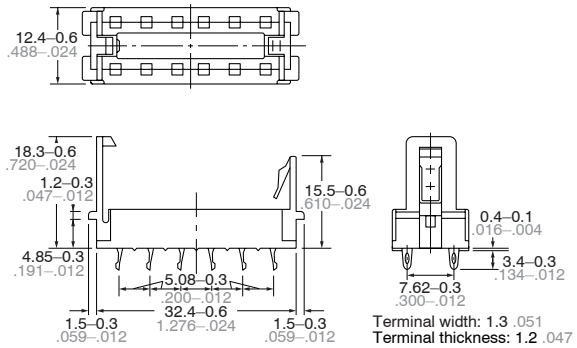
S Relay Socket, S-PS

Specifications

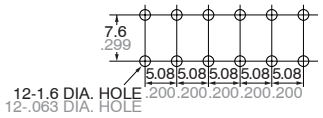
Breakdown voltage	1,500 Vrms between terminals
Insulation resistance	More than 100 MΩ between terminals at 500 V DC Mega
Heat resistance	150 ±3°C (302 ±5.4°F) for 1 hour.
Maximum continuous current	4 A

(Note: Don't insert or remove relays while in the energized condition.)

Dimensions mm inch



PC board pattern (Copper-side view)



Inserting and removing method

Inserting method: Insert the relay as shown in Fig. 1 unit the rib of the relay snaps into the clip of the socket.

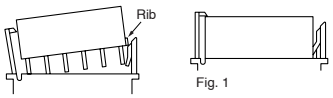


Fig. 1

Removing method:
(1) Remove the relay straight from the socket holding the shaded portion of the relay as shown in Fig. 2.

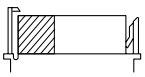


Fig. 2

(2) When sockets are mounted in close proximity, use a slotted screw driver as shown in Fig. 3.

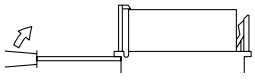
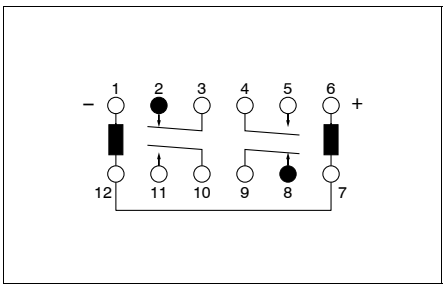


Fig. 3

NOTES

1. Special use of 2 coil latching types: 2 ways can be considered if 2 coil latching types are used as 1 coil latching types.
(A) Reverse polarity is applied to the set coil of 2 coil latching type.
(B) By shorting terminals 12 and 7, apply plus to 1, minus to 6 at set and plus to 6, minus to 1 at reset. Applied coil voltage should be the same as the nominal. Operating power will be reduced to one-half.

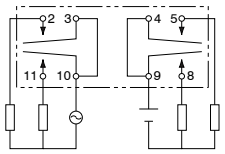
Reset position of 2a2b type



2. Soldering operations should be accomplished as quick as possible; within 10 seconds at 250°C 482°F solder temperature or 3 seconds at 350°C 662°F. The header portion being sealed with epoxy resin, undue subjection to heat may cause loss of seal. Solder should not be permitted to remain on the header.

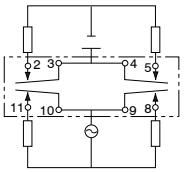
CAUTIONS FOR USE

Based on regulations regarding insulation distance, there is a restriction on same-channel load connections between terminals No. 2, 3 and 4, 5, as well as between No. 8, 9 and 10, 11. See the figure below for an example.



● Between 2, 3 and 4, 5: different channels, therefore not possible
● Between 10, 11 and 8, 9: different channels, therefore not possible

No good



● Between 2, 3 and 4, 5: same channels, therefore possible
● Between 10, 11 and 8, 9: same channels, therefore possible

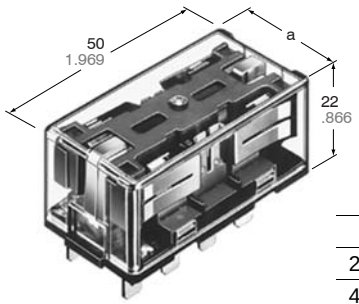
Good

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

15A (2C), 10A (4C) COMPACT POWER RELAYS WITH HIGH SENSITIVITY

SP RELAYS



mm inch

	a
2C	25.6 1.008
4C	36.8 1.449

FEATURES

- **High Vibration/Shock Resistance**
  Vibration resistance: 18 G, amplitude 3 mm (10 to 55 Hz)
  Shock resistance: 40 G (11 ms)
- **Latching types available**
- **High Sensitivity in Small Size 150 mW pick-up, 300 mW nominal operating power**
- **Wide Switching Range**
  From 1 mA to 15 A (2C) and 10 A (4C)

SPECIFICATIONS

Contacts

Arrangement				2 Form C, 4 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)				30 mΩ
Initial contact pressure				2C: Approx. 0.392 N (40 g 1.41 oz) 4C: Approx. 0.196 N (20 g 0.71 oz)
Contact material				Stationary contact: Gold flashed silver alloy
				Movable contact: Silver alloy
Rating (resistive load)	Nominal switching capacity			2C: 15 A 250 V AC, 10 A 30 V DC 4C: 10 A 250 V AC, 10 A 30 V DC
	Max. switching power			2C: 3,750 VA, 300 W 4C: 2,500 VA, 300 W
	Max. switching voltage			2C, 4C: 250 V AC, 30 V DC
	Max. switching current			2C: 15 A (AC) 10 A (DC), 4C: 10 A
	Min. switching capacity#1			100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)			5×10^7
	Electrical (at 20 cpm) (resistive load)	2C	15 A 250 V AC	10^5
			10 A 30 V DC	10^5
		4C	10 A 250 V AC	10^5
			10 A 30 V DC	10^5

Coil (polarized) at 20°C 68°F

Single side stable	Nominal operating power	300 mW
Latching	Minimum set and reset power	150 mW
	Nominal set and reset power	300 mW

Characteristics (at 25°C 77°F 50% Relative humidity)

Max. operating speed (at rated load)		20 cpm
Initial insulation resistance*1		1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	1,500 Vrms
	Between contact sets	3,000 Vrms
	Between contact and coil	3,000 Vrms
Operate time*3(at nominal voltage)		Max. 30 ms (Approx. 25 ms)
Release time(without diode)*3 (at nominal voltage)		Max. 20 ms (Approx. 15 ms)
Temperature rise (at nominal voltage)		Max. 40°C with nominal coil voltage and at nominal switching capacity
Shock resistance	Functional*4	Min. 392 m/s² {40 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	176.4 m/s² {18 G}, 10 to 55 Hz at double amplitude of 3 mm
	Destructive	176.4 m/s² {18 G}, 10 to 55 Hz at double amplitude of 3 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–50°C to +60°C –58°F to +140°F
	Humidity	5 to 85% R.H.
Unit weight		2C: 50 g 1.76 oz ; 4C: 65 g 2.29 oz

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

TYPICAL APPLICATIONS

NC machines, remote control panels, sophisticated business equipment.

ORDERING INFORMATION

Ex. SP 2 — P — L2 — DC24V

Contact arrangement	Mounting classification	Operating function	Coil voltage
2: 2 Form C 4: 4 Form C	NIL: standard type with FASTON terminals P: PC board type Standard - 1.4 mm x 0.5 mm (without UL/CSA marking) Optional - 2.0 x 0.5 mm (with UL/CSA marking)	Nil: Single side stable L2: 2 coil latching	DC 3, 5, 6, 12, 24, 48 V

(Notes) 1. For PC board terminal types, please consult us for details.
2. 2 Form C: Carton: 20 pcs., Case: 200 pcs.
4 Form C: Carton: 10 pcs., Case: 100 pcs.
3. UL/CSA, TÜV approved type is standard.
4. 1 coil latching type available.

TYPES AND COIL DATA (at 20°C 68°F)

Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA	Coil resistance, Ω (±10%) 20°C	Inductance, H (at 120 Hz)	Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
2 Form C	4 Form C								
SP2-DC3V	SP4-DC3V	3	2.1	0.3	100.0	30	Approx. 0.05	300	4.5
SP2-DC5V	SP4-DC5V	5	3.5	0.5	60.2	83	0.1	300	7.5
SP2-DC6V	SP4-DC6V	6	4.2	0.6	50.0	120	0.2	300	9
SP2-DC12V	SP4-DC12V	12	8.4	1.2	25.0	480	0.7	300	18
SP2-DC24V	SP4-DC24V	24	16.8	2.4	12.5	1,920	3.0	300	36
SP2-DC48V	SP4-DC48V	48	33.6	4.8	6.2	7,700	11.2	300	72

2-coil latching

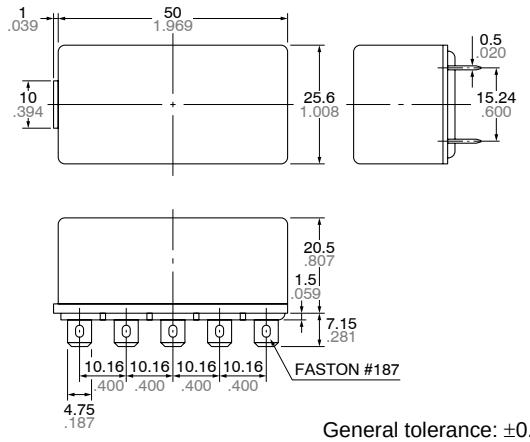
Part No.		Nominal voltage, V DC	Set and reset voltage, V DC (max.)	Nominal operating current, mA	Coil resistance, Ω (±10%)		Inductance, H (at 120 Hz)		Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
2 Form C	4 Form C				Coil I	Coil II	Coil I	Coil II		
SP2-L2-DC3V	SP4-L2-DC3V	3	2.1	100.0	30	30	Approx. 0.03	Approx. 0.03	300	4.5
SP2-L2-DC5V	SP4-L2-DC5V	5	3.5	60.2	83	83	0.07	0.07	300	7.5
SP2-L2-DC6V	SP4-L2-DC6V	6	4.2	50.0	120	120	0.1	0.1	300	9
SP2-L2-DC12V	SP4-L2-DC12V	12	8.4	25.0	480	480	0.4	0.4	300	18
SP2-L2-DC24V	SP4-L2-DC24V	24	16.8	12.5	1,920	1,920	1.4	1.4	300	36
SP2-L2-DC48V	SP4-L2-DC48V	48	33.6	6.2	7,680	7,680	5.6	5.6	300	72

DIMENSIONS

mm inch

2 Form C

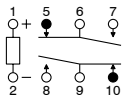
Plug-in terminal



General tolerance: ±0.3 ±.012

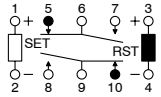
Schematic (Bottom view)

Single side stable



(Deenergized condition)

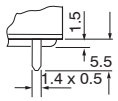
2 coil latching



(Reset condition)

Diagram shows the “reset” position when terminals 3 and 4 are energized. Energize terminals 1 and 2 to transfer contacts.

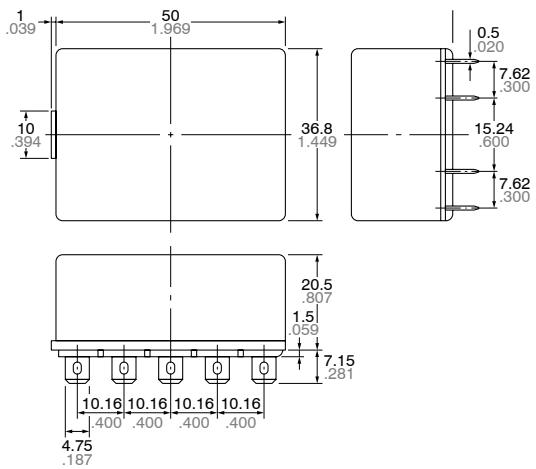
PC board terminal



With UL/CSA approval:
pin 2 mm x 0.5 mm
standard type:
pin 1.4 mm x 0.5 mm

4 Form C

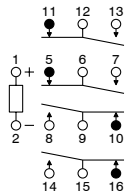
Plug-in terminal



General tolerance: ±0.3 ±.012

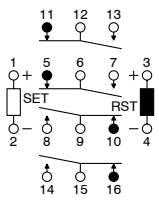
Schematic (Bottom view)

Single side stable



(Deenergized condition)

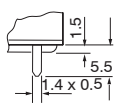
2 coil latching



(Reset condition)

Diagram shows the “reset” position when terminals 3 and 4 are energized. Energize terminals 1 and 2 to transfer contacts.

PC board terminal

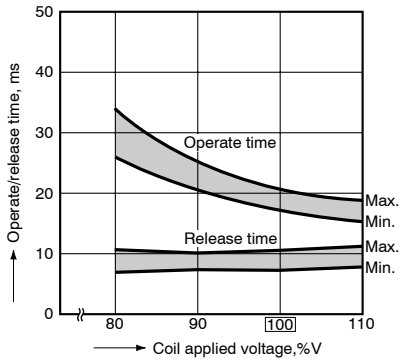


With UL/CSA approval:
pin 2 mm x 0.5 mm
standard type:
pin 1.4 mm x 0.5 mm

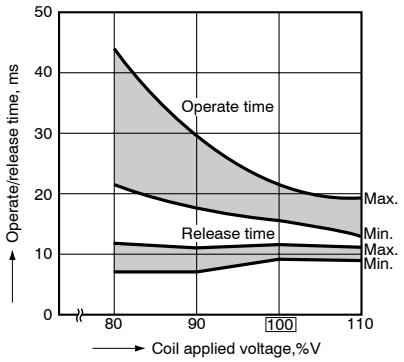
REFERENCE DATA

Operate and release time (Single side stable)

SP2



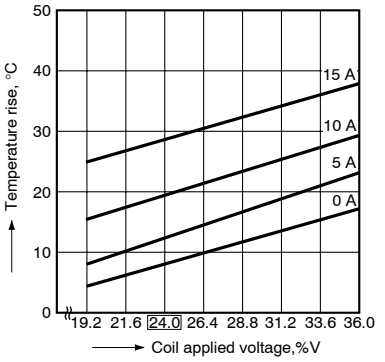
SP4



Coil temperature rise

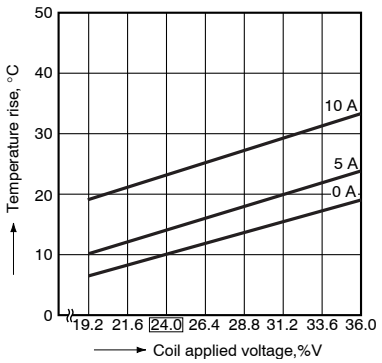
Sample: SP2-DC24V

Ambient temperature: 20 to 22°C 68 to 72°F

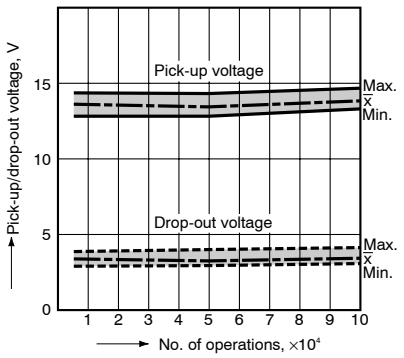


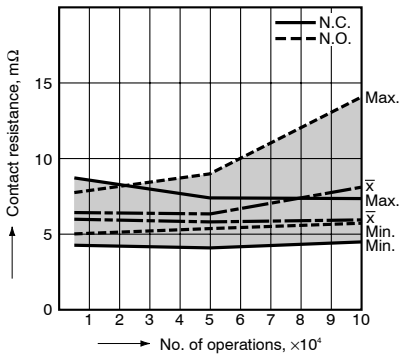
Sample: SP4-DC24V

Ambient temperature: 27 to 29°C 81 to 84°F

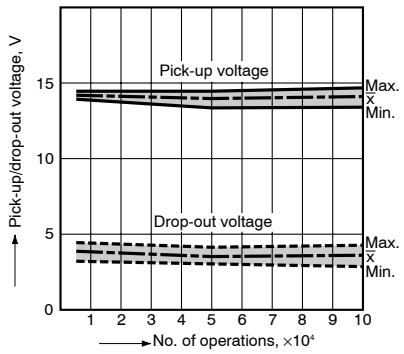


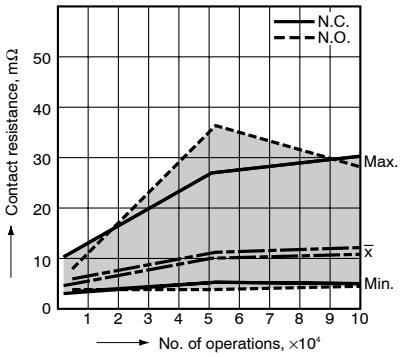
Electrical life (SP2, 15 A 250 V AC resistive load)





Electrical life (SP4, 10 A 250 V AC resistive load)



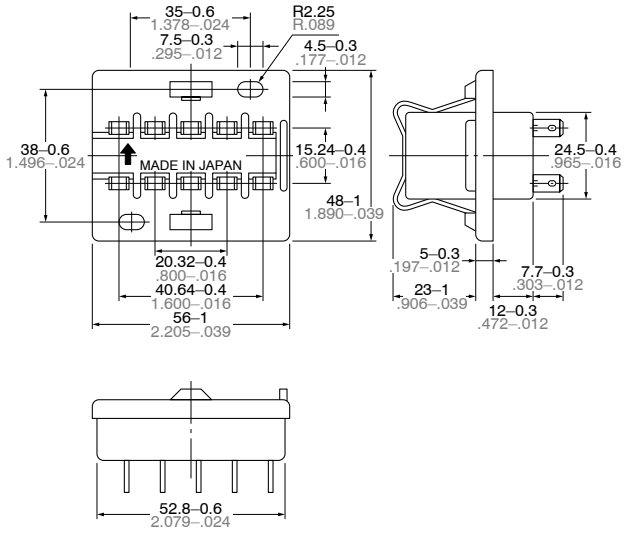


ACCESSORIES

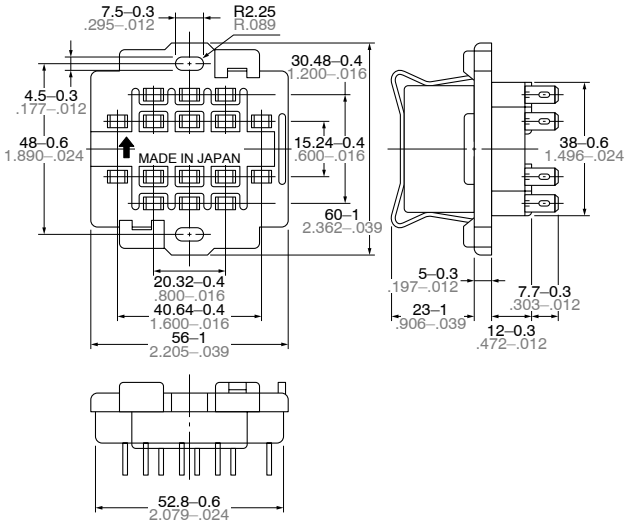
mm inch

Soldering socket

SP2-SS

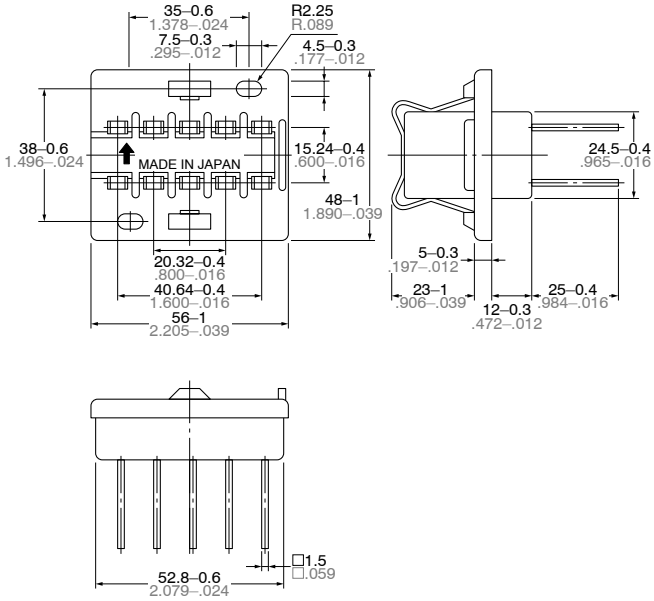


SP4-SS

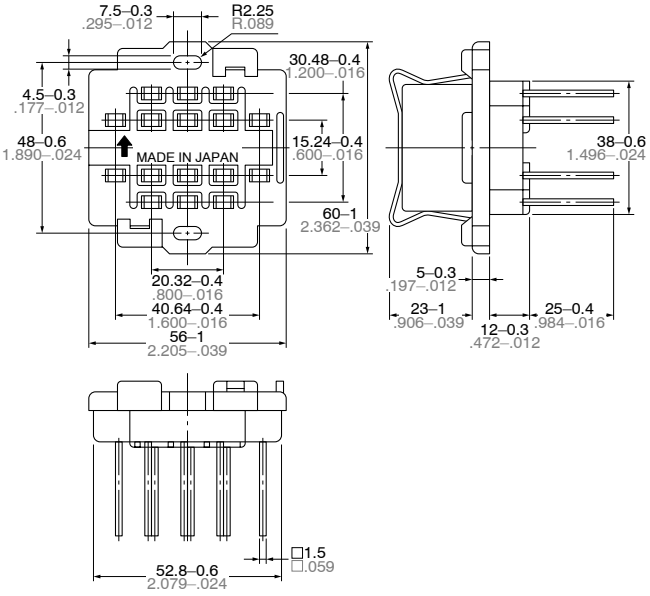


Wrapping socket

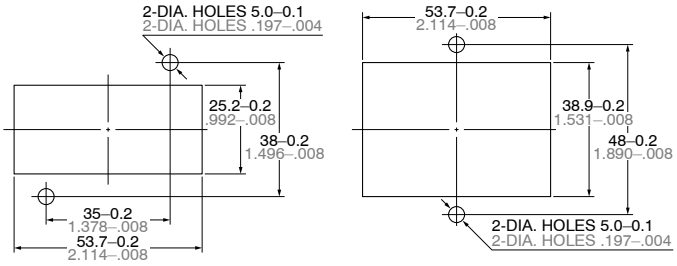
SP2-WS



SP4-WS



Mounting hole drilling diagram



Performance profile

Item	SP2, socket with solder	SP4, socket with solder	SP2, wrapping socket	SP4, wrapping socket
Withstand voltage	AC 3,000V, 1 min., between each terminal			
Insulation resistance	1,000 MΩ min			
Ambient working temperature	–50 to +60°C –58 to +140°F			
Maximum current, ON current	15 A	10 A	12 A	10 A

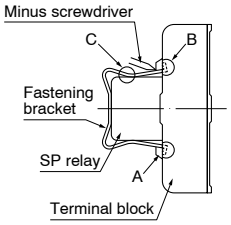
Note: Do not remove the relay while it is ON.

Notes:
(1) Mounting screws and the fastening bracket are included in the package.
(2) Mount the relay with the proper mounting direction — i.e. with the direction of the NAiS mark on top of the relay case matching the direction of the NAiS mark on the terminal block. (The ; direction of the terminal block is the upward direction of the relay.)

Mounting and removal of fastening bracket

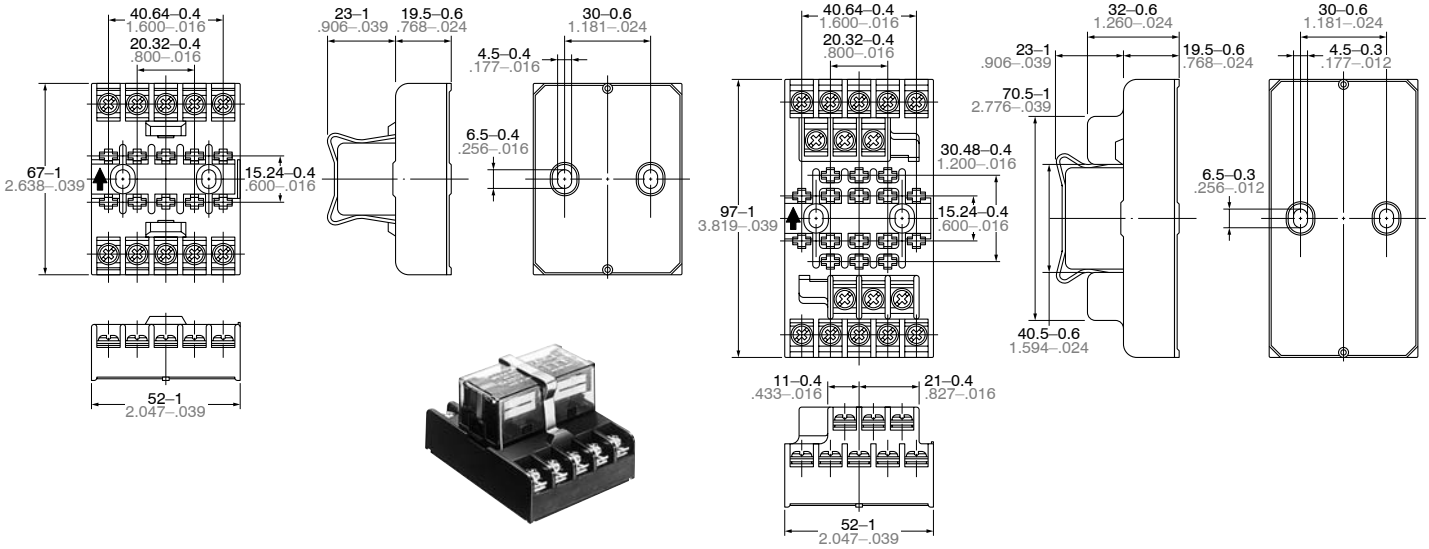
1. Mounting
Insert the A part of the fastening bracket into the mounting groove of the socket, and then fit the B part into groove, while pressing with the tip of a minus screwdriver.

2. Removal
Slide the B part of the fastening bracket from the groove in the socket, while pressing with the tip of a minus screwdriver. While the bracket is in this position, keep pressing the C part of the bracket to the relay side with your finger, and lift up to the left side and remove from the groove, as in the diagram at right.

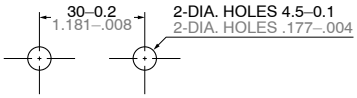


Screw terminal socket

mm inch



Mounting hole drilling diagram

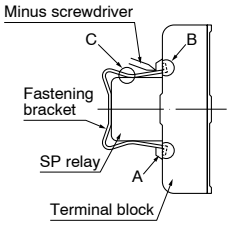


Notes:
(1) Mounting screws and the fastening bracket are included in the package.
(2) Mount the relay with the proper mounting direction — i.e. with the direction of the NAIS mark on top of the relay case matching the direction of the NAIS mark on the terminal block. (The ; direction of the terminal block is the upward direction of the relay.)

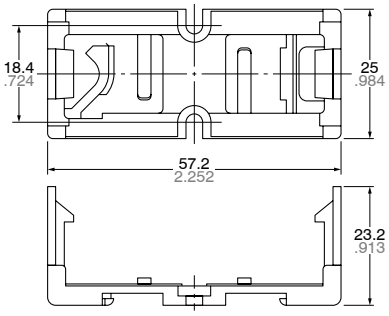
Fastening bracket mounting and removal

1. Mounting
Insert the A part of the fastening bracket into the mounting groove of the terminal block, and then fit the B part into groove, while pressing with the tip of a minus screwdriver.

2. Removal
Slide the B part of the fastening bracket from the groove in the terminal block, while pressing with the tip of a minus screwdriver. While the bracket is in this position, keep pressing the C part of the bracket to the relay side with your finger, and lift up to the left side and remove from the groove, as in the diagram at right.

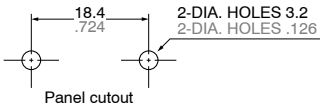


Mounting plate



SP-MA

The SP-Relay with SP-MA attached



Tolerance: ±0.1 ±.004

Direct chassis mounting possible, and applicable to DIN rail.
[DIN 46277 (35 mm width) is applicable.]

Use method

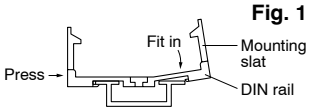
1. Both the SP relay 2c and 4c can be mounted to the mounting slats.
2. Use the mounting slats either by attaching them directly to the chassis, or by mounting with a DIN rail.

(A) When attaching directly to chassis
Use two M3 screws.
For the mounting pitch, refer to the specification diagram.

(B) When mounting on a DIN rail
Use a 35mm 1.378inch wide DIN rail (DIN46277).
The mounting method should be as indicated in the diagram at right.

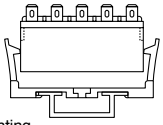
Method for mounting on DIN rail

Fig. 1



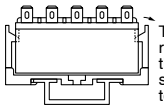
Press relay in

Fig. 2



Fit into mounting grooves.

Fig. 3



To remove the relay, press down the mounting slats so the claws move to the outside.

(1) First fit the arc shaped claw of the mounting slat into the DIN rail.
(2) Press on the side as shown in the diagram below.
(3) Fit in the claw part on the opposite side.

Precautions for use

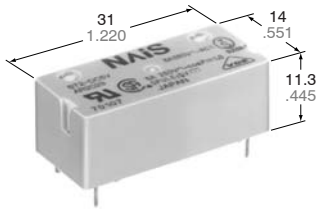
When mounting to a DIN rail, use a commercially available fastening bracket if there is a need to stop sliding of the mounting slat in the rail direction.

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

IC DRIVABLE PC BOARD RELAY FOR FIELD LOAD SWITCHING

ST RELAYS



mm inch

FEATURES

- **Sealed to meet the combination process of automatic wave soldering and cleaning needs**
- **Latching types available**
- **High switching capacity and high sensitivity in subminiature size 150 mW pick-up, 8 A inrush capacity: 51 A for 1a1b, 35 A for 2a**
- **High shock and vibration resistance Shock: 20 G, Vibration: 10 to 55 Hz at double amplitude of 2 mm**

SPECIFICATIONS

Contacts

Arrangement			1 Form A 1 Form B	2 Form A
Contact material			Gold flash over silver alloy	
Initial contact resistance, max.			30 mΩ	
Rating (resistive)	Max. switching power		2,000 VA, 150 W	
	Max. switching voltage		380 V AC, 250 V DC	
	Max. switching current		8 A	
	Min. switching capacity#1		100 mA, 5 V DC	
HP rating			1/4 HP 125, 250 V AC	
Inrush current capability			51 A (TV-3 equivalence) for 1a1b 35 A (TV-1 equivalence) for 2a	
Expected life (min. operations)	Mechanical (at 180 cpm)		10^7	
	Electrical	8 A 250 V AC (resistive)	10^5	
		5 A 30 V DC (resistive)	2×10^5	
		3 A 100 V AC (lamp)	3×10^4	—
		1 A 100 V AC (lamp)	—	3×10^4

Coil (polarized) (at 25°C 77°F)

Single side stable	Nominal operating power	Approx. 240 mW
Latching	Nominal set and reset power	Approx. 240 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

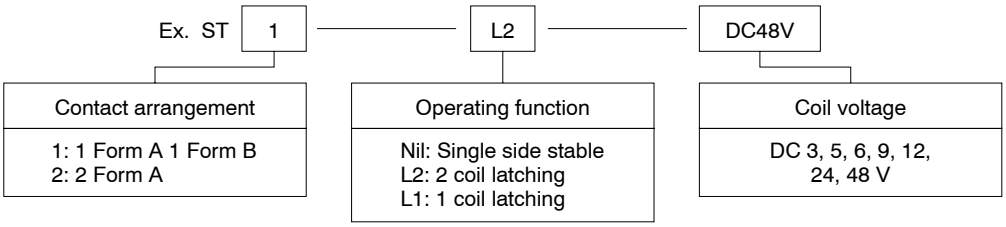
Characteristics (at 25°C 77°F 50% Relative humidity)

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between contact sets	2,000 Vrms
	Between open contacts	1,200 Vrms
	Between contacts and coil	3,750 Vrms
Surge voltage between coil and contact*3		Min. 6,000 V
Operate time*4 (at nominal voltage)		Max. 15 ms (Approx. 10 ms)
Release time (without diode)*4 (at nominal voltage)		Max. 10 ms (Approx. 8 ms)
Set time*4 (latching) (at nominal voltage)		Max. 10 ms (Approx. 8 ms)
Reset time*4 (latching) (at nominal voltage)		Max. 10 ms (Approx. 8 ms)
Temperature rise (at 60°C)		Max. 55°C with nominal coil voltage and at 8 A switching current
Shock resistance	Functional*5	Min. 196 m/s² {20 G}
	Destructive*6	Min. 980 m/s² {100 G}
Vibration resistance	Functional*7	117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm
	Destructive	176.4 m/s² {18 G}, 10 to 55 Hz at double amplitude of 3 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +60°C –40°Fto +140°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 10g .353 oz

TYPICAL APPLICATIONS

Sequence controllers, facsimiles, telephone controls, remote control security devices and security equipment.

ORDERING INFORMATION



(Note) Standard packing: Carton; 50 pcs., Case; 500 pcs.

TYPES AND COIL DATA (at 20°C 68°F)

Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Maximum allowable voltage, V DC (60°C 140°F)	Coil resistance, Ω (±10%)	Nominal operating current, mA
1 Form A 1 Form B	2 Form A						
ST1-DC3V	ST2-DC3V	3	2.4	0.3	4.5	38	78.9
ST1-DC5V	ST2-DC5V	5	4.0	0.5	7.5	105	47.6
ST1-DC6V	ST2-DC6V	6	4.8	0.6	9.0	150	40
ST1-DC9V	ST2-DC9V	9	7.2	0.9	13.5	360	25
ST1-DC12V	ST2-DC12V	12	9.6	1.2	18.0	600	20
ST1-DC24V	ST2-DC24V	24	19.2	2.4	36.0	2,400	10
ST1-DC48V	ST2-DC48V	48	38.4	4.8	72.0	9,000	5.3

1 coil latching

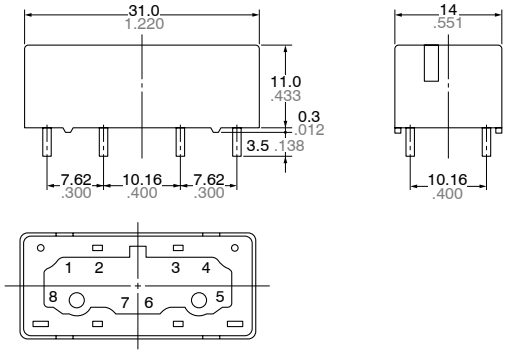
Part No.		Nominal voltage, V DC	Set and reset voltage, V DC (max.)	Maximum allowable voltage, V DC (60°C 140°F)	Coil resistance, Ω (±10%)	Nominal operating current, mA
1 Form A 1 Form B	2 Form A					
ST1-L1-DC3V	ST2-L1-DC3V	3	2.4	4.5	80	37.5
ST1-L1-DC5V	ST2-L1-DC5V	5	4.0	7.5	230	21.7
ST1-L1-DC6V	ST2-L1-DC6V	6	4.8	9.0	330	18.2
ST1-L1-DC9V	ST2-L1-DC9V	9	7.2	13.5	730	12.3
ST1-L1-DC12V	ST2-L1-DC12V	12	9.6	18.0	1,300	9.2
ST1-L1-DC24V	ST2-L1-DC24V	24	19.2	36.0	5,000	4.8
ST1-L1-DC48V	ST2-L1-DC48V	48	38.4	72.0	18,000	2.7

2 coil latching

Part No.		Nominal voltage, V DC	Set and reset voltage, V DC (max.)	Maximum allowable voltage, V DC (60°C 140°F)	Coil resistance, Ω (±10%)	Nominal operating current, mA
1 Form A 1 Form B	2 Form A					
ST1-L2-DC3V	ST2-L2-DC3V	3	2.4	4.5	40	75
ST1-L2-DC5V	ST2-L2-DC5V	5	4.0	7.5	110	45.5
ST1-L2-DC6V	ST2-L2-DC6V	6	4.8	9.0	155	38.7
ST1-L2-DC9V	ST2-L2-DC9V	9	7.2	13.5	360	25
ST1-L2-DC12V	ST2-L2-DC12V	12	9.6	18.0	640	18.8
ST1-L2-DC24V	ST2-L2-DC24V	24	19.2	36.0	2,400	10
ST1-L2-DC48V	ST2-L2-DC48V	48	38.4	72.0	10,200	4.7

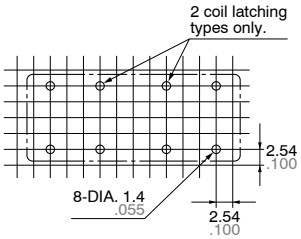
DIMENSIONS

mm inch



General tolerance: ±0.2 ±.008

PC board pattern
(Copper-side view)

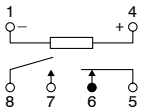


Tolerance: ±0.1 ±.004

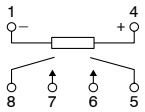
Schematics (Bottom view)

Single side stable

1a1b



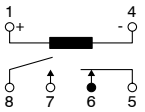
2a



(Deenergized condition)

1 coil latching

1a1b



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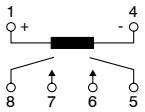
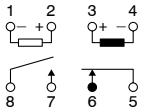


(Reset condition)

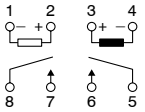
Diagrams show the "reset" position when terminals 1 and 4 are energized.

2 coil latching

1a1b



2a

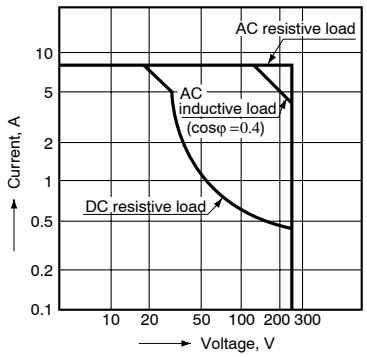


(Reset condition)

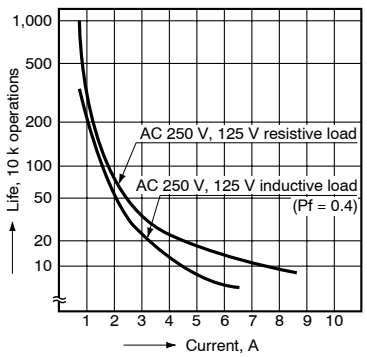
Diagram shows the “reset” position when terminals 3 and 4 are energized. Energize terminals 1 and 2 to transfer contacts.

REFERENCE DATA

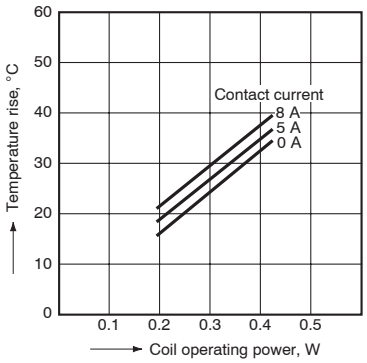
1. Max. switching power



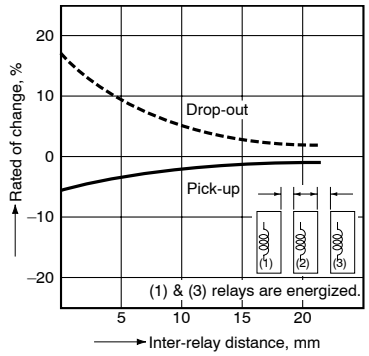
2. Life curve



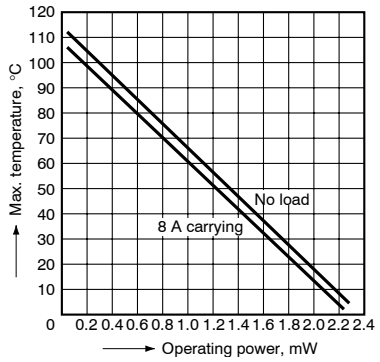
3. Coil temperature rise
Sample: ST1-DC24V



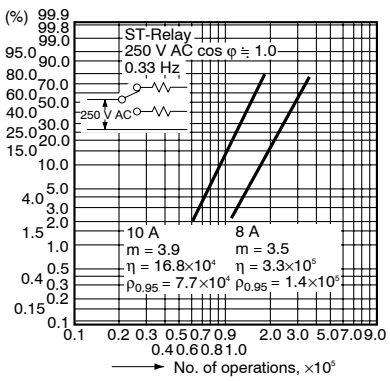
4. Influence of adjacent mounting
Sample: ST1-DC24V



5. Max. ambient temperature by operating power



6. Contact reliability



ST relay socket

ST-SS
Solder terminal socket

ST-PS
PC board terminal socket

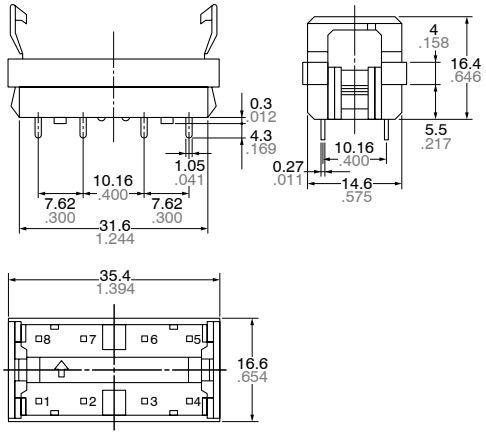
Specifications

Breakdown voltage	4,000 Vrms Coil/Contacts 2,000 Vrms Contacts/Contacts
Insulation resistance	More than 1,000 MΩ between terminals
Heat resistance	150°C (302°F) for 1 hr
Max. continuous current	10 A
Relay insertion life	15 times

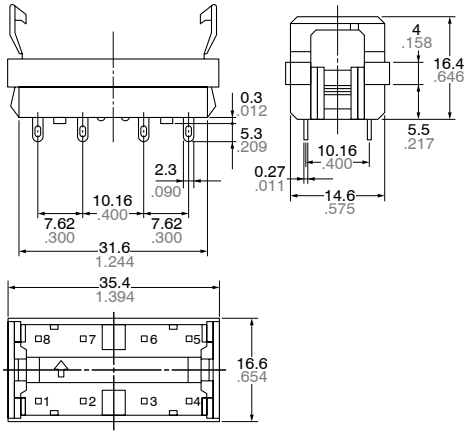
DIMENSIONS

mm inch

ST-PS



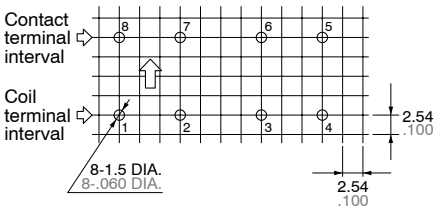
ST-SS



Precautions for use (socket)

1. PC board mounting method

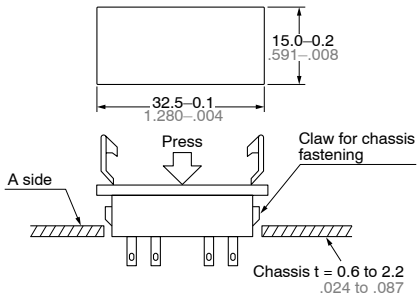
PC board pattern



The terminal configuration is symmetrical on the left and right, so an arrow mark ; is stamped on the socket to prevent mis-insertion. We recommend printing the same arrow mark ; on the component mounting side (side opposite from pattern) of the PC board. In this case, the terminal configuration becomes the terminal nos. noted near the drilling holes.

2. Chassis cutout

Chassis cutting dimensions

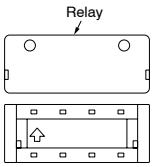


If the chassis hole is punched with a press, set so the release R on the front side (A side).

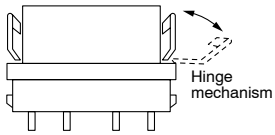
The range for chassis thickness is 0.6 to 2.2 mm .024 to .087 inch.

3. Relay mounting and removal

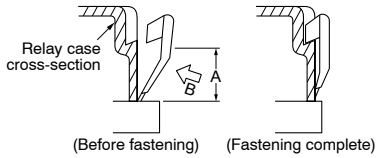
(1) Align the directions of the relay and socket.



(2) Insert the relay all the way in, so it is securely in place.



(3) Press the part indicated by A in the B direction, and fasten by placing the hook on the relay.



(4). When removing the relay, completely release the hooks on both sides and pull the relay out.

For Cautions for Use, see Relay Technical Information (page 392).

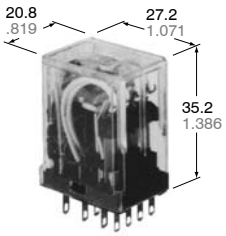
Ungepolte Leistungsrelais

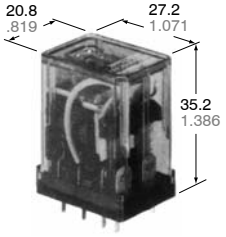
VDE
1c, 2c, 4c

Panasonic
ideas for life

MINIATURE RELAY FOR WIDER APPLICATIONS

HC RELAYS





mm inch

HCE Amber Relays

FEATURES

- **Extra long life — Min. 10^8 mechanical operations (DC type)**
- **4 contact arrangements**

4 Form C (for 5 A 250 V AC),
3 Form C (for 7 A 250 V AC),
2 Form C (for 7 A 250 V AC),
1 Form C (for 10 A 250 V AC)

- **Applicable to low to high level loads (100μA to 10A)**
- **Amber sealed types available**
- **Bifurcated contact types available as HC4D**

SPECIFICATIONS

Contacts

Arrangement		1 Form C	2 Form C	3 Form C	4 Form C
Initial current resistance, max. (By voltage drop 6 V DC 1 A)		30 mΩ			
Contact material		Gold-flashed silver alloy			Gold-clad silver nickel
Rating (resistive)	Nominal switching capacity	10 A 250 V AC	7 A 250 V AC	7 A 250 V AC	5 A 250 V AC
	Max. switching power	2,500 VA	1,750 VA	1,750 VA	1,250 VA
	Max. switching voltage	250 V AC			
	Max. switching current	10 A	7 A	7 A	5 A
	Min. switching capacity#1	1 mA, 1 V DC			

Coil

Nominal operating power	AC (50Hz): 1.3VA, AC (60Hz): 1.2 VA DC:0.9 to 1.1W

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Detection current: 10 mA
*2 Excluding contact bounce time
*3 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*4 Half-wave pulse of sine wave: 6ms

Characteristics

Max. operating speed		20 cpm (at max. rating)
Initial insulation resistance		Min. 1,000 MW at 500 V DC
Initial breakdown voltage*1	Between open contacts	700 Vrms for 1 min.
	Between contact sets	700 Vrms for 1 min.
	Between contact and coil	2,000 Vrms for 1 min.
Operate time*2 (at nominal voltage) (at 20°C)		Max. 20 ms (DC, AC type)
Release time (without diode)*2 (at nominal voltage) (at 20°C)		Max. 20 ms (DC, AC type)
Temperature rise, max. (at 70°C) (at nominal voltage)		80°C
Shock resistance	Functional*3	Min. 196 m/s² {20 G}
	Destructive*4	Min. 980 m/s² {100 G}
Vibration resistance	Functional*5	10 to 55 Hz at double amplitude of 1 mm
	Destructive	10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*6 (Not freezing and condensing at low temperature)	Ambient temp.	–50°C to +70°C –58°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 30g 1.06 oz

*5 Detection time: 10μs
*6 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Expected life (min. operations)

Electrical (at 20 cpm)

Voltage		125 V AC		250 V AC		30 V DC		Expected life
Load		Resistive (cos φ = 1)	Inductive (cos φ ≅ 0.4)	Resistive (cos φ = 1)	Inductive (cos φ ≅ 0.4)	Resistive	Inductive	
HC1 (1 Form C)	Current	10A	5A	10A	3A	—	—	2×10^5
		7A	3A	7A	2.5A	3A	1A	5×10^5
		5A	2A	5A	1.5A	—	—	1×10^6
HC2 (2 Form C)	Current	7A	3.5A	7A	2A	—	—	2×10^5
		5A	2.5A	5A	1.5A	3A	0.6A	5×10^5
		3A	1.5A	3A	1A	—	—	1×10^6
HC3 (3 Form C)	Current	7A	—	7A	—	—	—	1×10^5
		—	3.5A	—	2A	—	—	2×10^5
		5A	—	5A	—	3A	0.4A	5×10^5
HC4 (4 Form C)	Current	5A	2A	5A	1A	—	—	2×10^5
		3A	1A	3A	0.8A	3A	0.4A	5×10^5
		2A	0.5A	2A	0.4A	—	—	1×10^6

Mechanical life (at 180 cpm)	DC type: 10^8 , AC type: 5×10^7

TYPICAL APPLICATIONS

Transportation, power station control equipment, refrigerators, building control equipment, office machines, coin operated machines, amusement devices, medical equipment, etc.

ORDERING INFORMATION

EX. HC [4] [D] — [H] — [AC 240V] — [F]

Contact arrangement

1: 1 Form C
2: 2 Form C
3: 3 Form C
4: 4 Form C

Type classifications

Nil: Standard type
D: Bifurcated contact type (HC4D only. See Page 302.)
K: Latching relay type (HC2K only. See Page 303.)

Terminal arrangement

H: Plug-in
HP: PC board terminal
HTM: Top mounting
HL: Light emitting diode wired, plug-in
HPL: Light emitting diode wired, PC board

Coil voltage

AC 6, 12, 24, 48, 120/240 V
DC 6, 12, 24, 48, 110 V

Contact Material

	$AgSnO_2$ type	AgNi type	AgCdO type
1 Form C	F		Nil
2 Form C	F		Nil
3 Form C	F		Nil
4 Form C		Nil	
4 Form C Bifurcated		Nil	

Notes:
1. When ordering VDE recognized types, add suffix VDE.
2. HC3 (3 Form C) series are not approved by VDE.
3. AC 48 V type is not available for LED wiring.
4. Standard packing Carton: 20 pcs.; Case: 200 pcs.
5. UL/CSA approved type is standard.

COIL DATA (Common for Standard, Amber sealed and Bifurcated contact types)

DC Type at 20°C 68°F

Coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable voltage, V DC	Coil resistance, Ω (±10%)	Nominal coil current, mA (±10%)	Operating power, W	
						Nominal	Minimum
6	4.8	0.6	6.6	40	150	0.9	0.58
12	9.6	1.2	13.2	160	75	0.9	0.58
24	19.2	2.4	26.4	650	37	0.9	0.58
48	38.4	4.8	52.8	2,600	18.5	0.9	0.58
110	88.0	11.0	121.0	10,000	10	1.0	0.64

AC Types (50/60 Hz) at 60 Hz, 20°C 68°F

Coil voltage, V AC	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Max. allowable voltage, V AC	Nominal coil current, mA (±20%)	Operating power, VA	
					Nominal	Minimum
6	4.8	1.8	6.6	200	1.20	0.77
12	9.6	3.6	13.2	100		
24	19.2	7.2	26.4	50		
48	38.4	14.4	52.8	25		
110/120	96	36	132	10.9/11.9		
220/240	176.0	66.0	264.0	6.0/6.5		

NOTES:

1. The range of coil current is ±15% for AC (60 Hz), and ±10% for DC, at 20°C.
2. The relay is applicable to the range of 80 % to 110% of the nominal coil voltage. However, it is recommended that the relay be used in the range of 85% to 110% to take temporary voltage variations into consideration.
3. The coil resistance of DC types is the measured value at a coil temperature of 20°C. Please compensate coil resistance by ±0.4% for each degree centigrade coil temperature change.
4. All AC 240 V types are rated for double coil voltages, both AC 220 V and AC 240 V.
5. For use with 220 V or 240 V DC, connect a resistor as suggested in the chart below, in series with the 110 V DC relay.

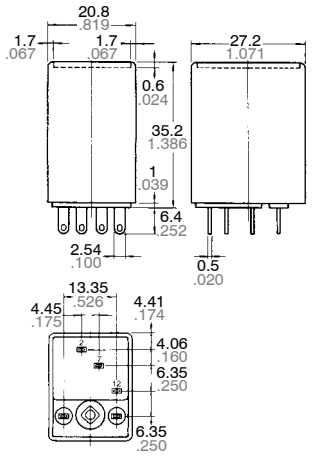
Voltage	1 Form C, 2 Form C, 3 Form C, 4 Form C
220 V DC	11 kΩ (5 W)
240 V DC	13 kΩ (5 W)

DIMENSIONS (Common for standard, Amber sealed and Bifurcated contact (4C only) types)

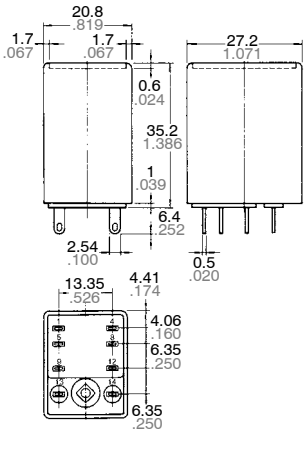
mm inch

Plug-in type

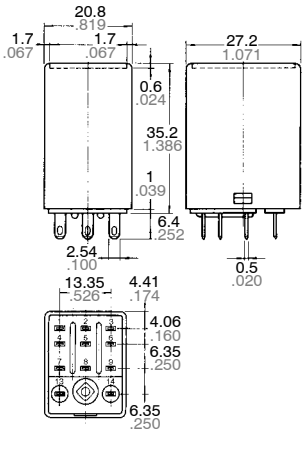
HC1-H (1 Form C)



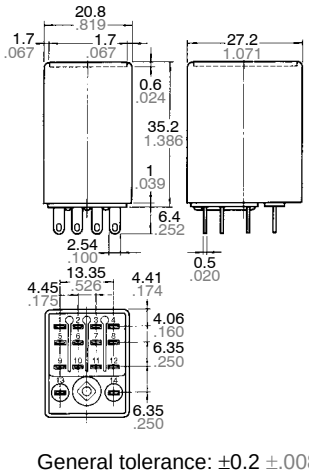
HC2-H (2 Form C)



HC3-H (3 Form C)



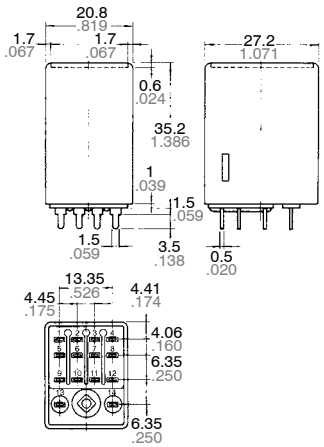
HC4-H (4 Form C)



General tolerance: ±0.2 ±.008

PC board type

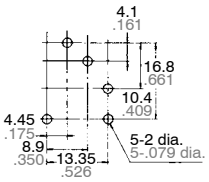
HC4-H (4 Form C)



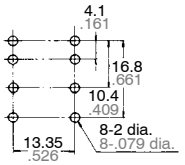
Dimensions of HC1-HP, HC2-HP, HC3-HP are the same as those of plug-in type except shapes of terminals.

PC board pattern (Copper-side view)

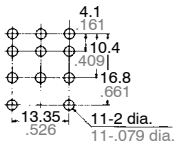
1c



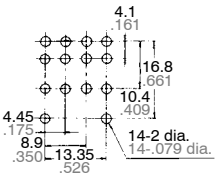
2c



3c



4c

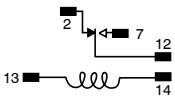


Tolerance: ±0.1 ±.004

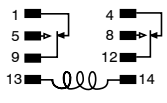
Note: Special PC terminal with 0.9 mm (.035 inch) width available with suffix “-31”.

Schematic (bottom view)

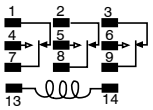
HC1-H, HC1-HP (1 Form C)



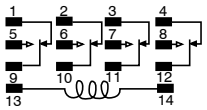
HC2-H, HC2-HP (2 Form C)



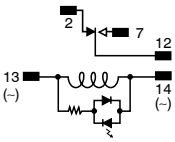
HC3-H, HC3-HP (3 Form C)



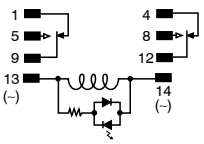
HC4-H, HC4-HP (4 Form C)



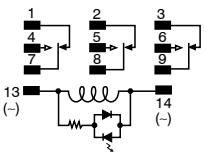
LED AC type



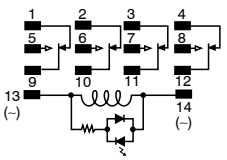
LED AC type



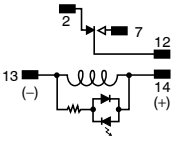
LED AC type



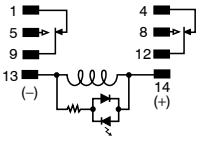
LED AC type



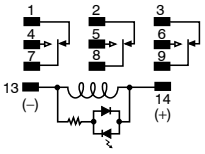
LED DC type



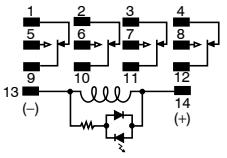
LED DC type



LED DC type



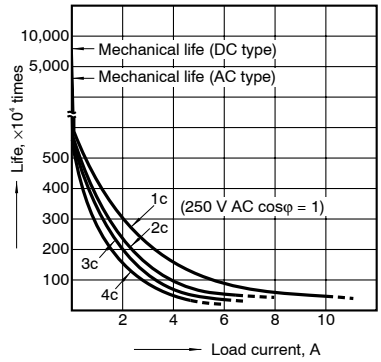
LED DC type



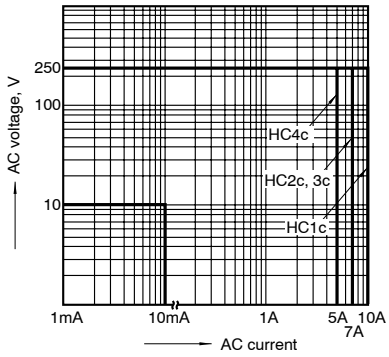
REFERENCE DATA

1. Life curve

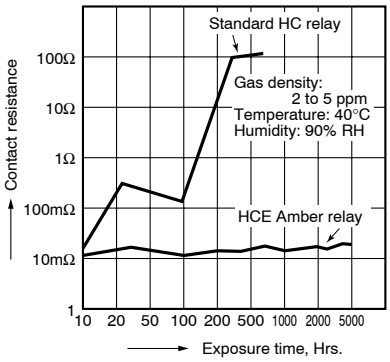
Load: 250 V AC resistive load



2. Switching capacity range



3. H2S gas test

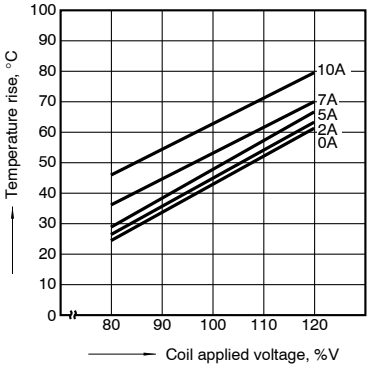


4. Coil temperature rise

Measured portion: Inside the coil Note: When the nominal voltage is applied to AC 120 or 240 V coil types respectively, the figures of coil temperature rise increase by approx. 10 degrees to the ones shown on each graph.

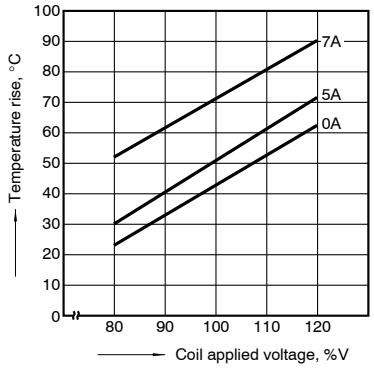
HC1 AC coil

Ambient temperature: 25°C 77°F



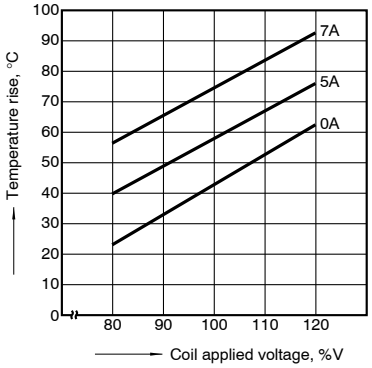
HC2 AC coil

Ambient temperature: 30°C 86°F



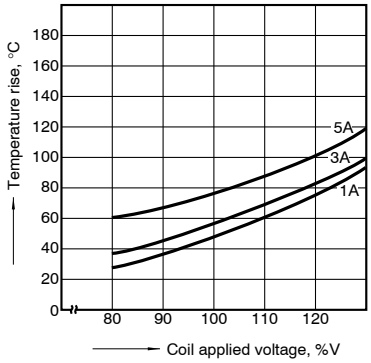
HC3 AC coil

Ambient temperature: 18°C 64°F



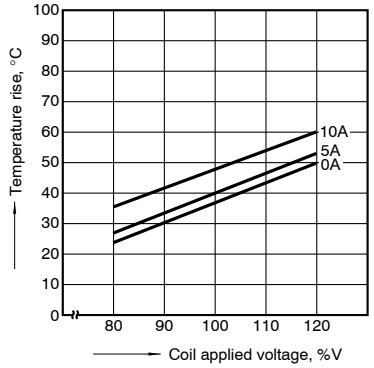
HC4 AC coil

Ambient temperature: 15 to 21°C 59 to 70°F



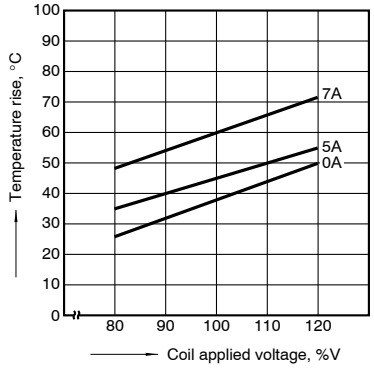
HC1 DC coil

Ambient temperature: 29°C 84°F



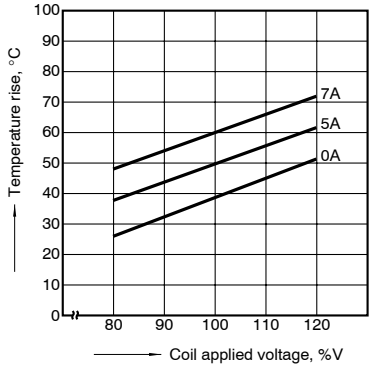
HC2 DC coil

Ambient temperature: 29°C 84°F



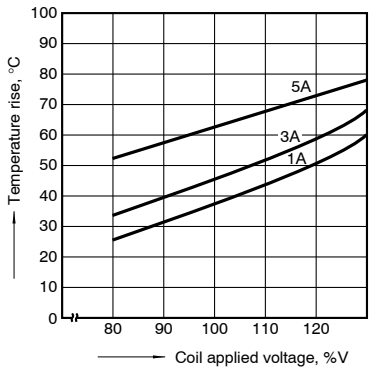
HC3 DC coil

Ambient temperature: 29°C 84°F



HC4 DC coil

Ambient temperature: 17 to 18°C 62 to 64°F



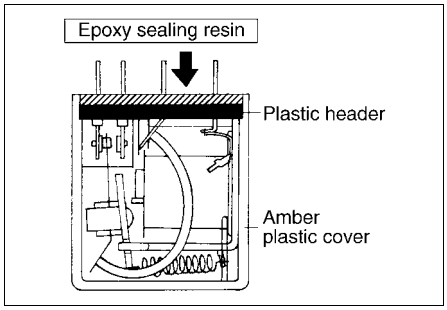
Amber Relays HCE

HC sealed relays are version of the HC relays and are recommended for use in switching medium loads under adverse ambient conditions. They show highly stable contact resistance even after long use, due to their sealed construction and reliable gold plated contacts. Amber relays also make the combined process of automatic wave soldering and cleaning process possible with their resultant savings in cost and labor. Contact arrangements of 1 Form C, 2C, and 4C are available for plug-in, PC board and top-mount.

Construction

The diagram at right shows a cross-section of the plastic sealed relay. All the plastic parts are annealed and out-gassed to ensure fully the stability of both chemical and physical characteristics.

Sealed construction



SPECIFICATIONS

Contacts

Contact arrangement		1 Form C	2 Form C	4 Form C
Rating (resistive)	Nominal switching capacity	5 A 250 V AC	3 A 250 V AC	2 A 250 V AC
	Max. switching power	1,250 VA	700 VA	500 VA
	Max. switching voltage	250 V AC		
	Max. switching current	5 A	3 A	2 A
	Min. switching capacity#1	1 mA, 100 mV DC		
Conditions for operation, transport and storage (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +60°C –40°F to +140°F		
	Humidity	5 to 85% R.H.		
Ambient air pressure		760 mmHg +20% (1.013 mb +20%)		

Expected life (min. operations)

	Voltage		125 V AC	250 V AC	30 V DC		Expected life
	Load		Resistive (cos φ = 1)	Resistive (cos φ = 1)	Resistive	Inductive	
Electrical (at 20 cpm)	HC1E (1 Form C)	Current	5 A	5 A	3 A	1 A	2×10^5
	HC2E (2 Form C)	Current	3 A	3 A	2 A	1.7 A	
	HC4E (4 Form C)	Current	2 A	2 A	2 A	0.6 A	
Mechanical life (at 180 cpm)	DC type: 10^8 , AC type: 5×10^7						

Characteristics

Operate time	Max. 20 ms
Release time	Max. 20 ms

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

ORDERING INFORMATION

EX. HC | 4 | E | D | — | HP | — | AC 240V | — | F

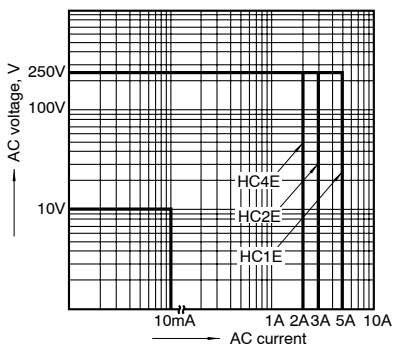
Contact arrangement	Type classifications	Terminal arrangement	Coil voltage	Contact Material
1: 1 Form C 2: 2 Form C 4: 4 Form C	Nil: Standard type D: Bifurcated contact type (HC4D only. See Page 302.)	H: Plug-in HP: PC board terminal HTM: Top mounting L: Light emitting diode wired, plug-in PL: Light emitting diode wired, PC board	AC 6, 12, 24, 48, 120, 240 V DC 6, 12, 24, 48, 110 V	

	$AgSnO_2$ type	AgNi type	AgCdO type
1 Form C	F		Nil
2 Form C	F		Nil
4 Form C		Nil	
4 Form C Bifurcated		Nil	

UL/CSA approved type is standard.

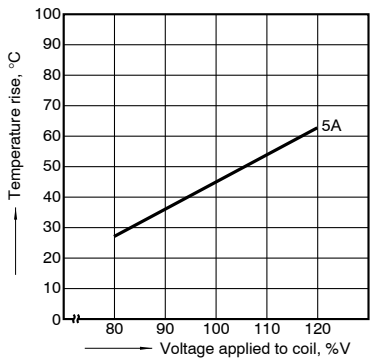
REFERENCE DATA (HC Amber Relays)

1. Switching capacity range



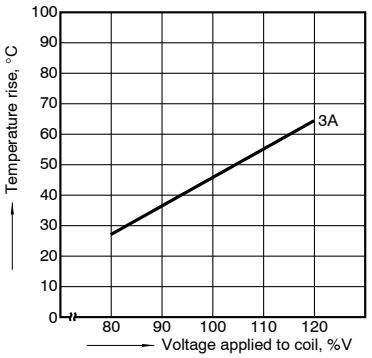
2.-(1) Coil temperature rise (1c AC type)

Measured portion: Inside the coil
Ambient temperature 30°C 86°F

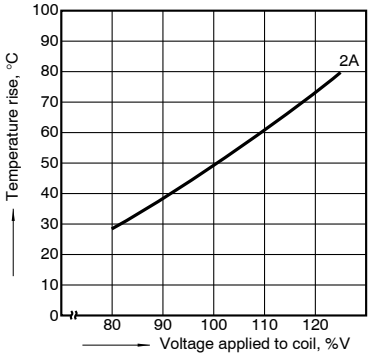


2.-(2) Coil temperature rise (2c AC type)

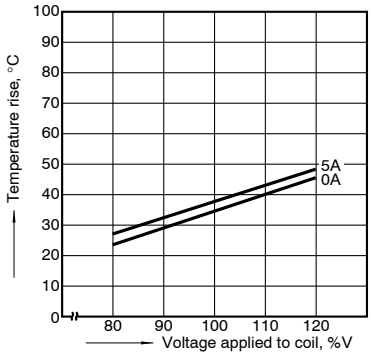
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



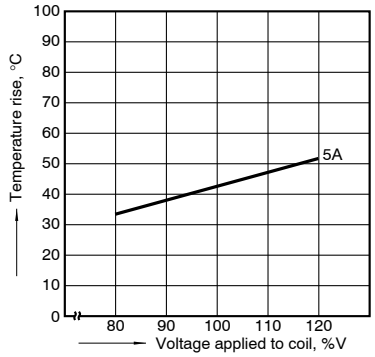
2.-(3) Coil temperature rise (4c AC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



2.-(4) Coil temperature rise (1c DC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F

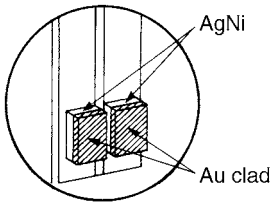


2.-(5) Coil temperature rise (2c DC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



Bifurcated contact types HC4D

Extremely high contact reliability has been made possible by adoption of gold-clad bifurcated contacts for both movable and stationary contacts.
HC4D type can be used from the dry circuit 100 μA at 10 V DC to the power circuit 3 A at 250 V AC resistive load. Therefore, with HC4D type such a usage is possible that one contact switches 100 μA and another contact switches 3 A load. Also Amber sealed types are available as HC4ED relays.



SPECIFICATIONS

Contacts

Contact arrangement		4 Form C only
Contact material		Gold-clad silver nickel
Rating (resistive)	Nominal switching capacity	3 A 250 V AC
	Max. switching power	750 VA
	Max. switching current	3A
	Min. switching capacity#1	(HC4D) 100 μA, 1 V DC (HC4ED) 100 μA, 100 mV DC

Characteristics

Operate time (Approx.)	Max. 20 ms
Release time (Approx.)	Max. 20 ms

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Expected life (min. operations)

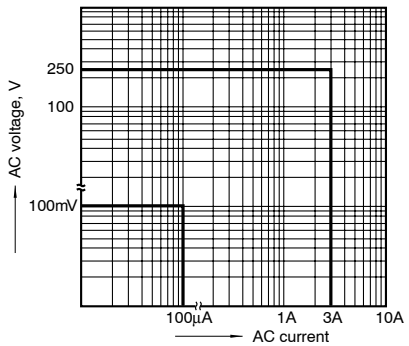
Electrical (at 20 cpm)

Voltage	125 V AC		250 V AC		30 V DC	Expected life
Load	Resistive (cos φ = 1)	Inductive (cos φ ≅ 0.4)	Resistive (cos φ = 1)	Inductive (cos φ ≅ 0.4)	Resistive	
HC4D	3 A	1 A	3 A	0.8 A	3 A	2×10^5
HC4ED	1 A	—	1 A	—	—	

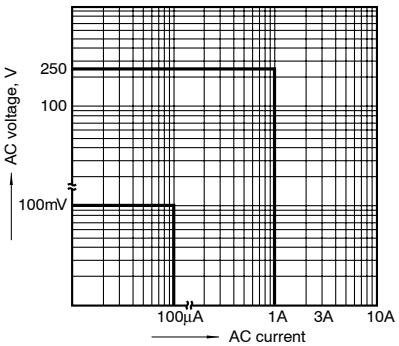
REFERENCE DATA

1. Switching capacity range

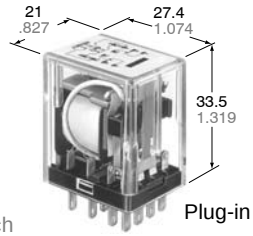
Standard type



Amber type



Latching relay types: HC2K



mm inch

Plug-in

HC magnetic latching relays are particularly suitable for various vending machines, remote control devices, parking meters, conveyor, NC machinery, etc.

TYPES AND COIL DATA

DC coils at 20°C 68°F

UL, CSA recognized

Part No.		Nominal coil current (mA)		Nominal operating power (VA)		Coil voltage	
Plug-in	PC board terminal	set	reset	set	reset	Pick-up	Max. allowable
HC2K-DC6V (-F)	HC2K-P-DC6V (-F)	207	107	1.24	0.64	80% of Nominal voltage	110% of Nominal voltage
HC2K-DC12V (-F)	HC2K-P-DC12V (-F)	100	52.2	1.20	0.63		
HC2K-DC24V (-F)	HC2K-P-DC24V (-F)	51.1	25.5	1.23	0.61		
HC2K-DC48V (-F)	HC2K-P-DC48V (-F)	25.3	13.7	1.21	0.66		
HC2K-DC100V (-F)	HC2K-P-DC100V (-F)	15.6	5.8	1.56	0.58		

Plug-in

AC coils

Part No.		Nominal coil current (mA)		Nominal operating power (VA)		Coil voltage	
Plug-in	PC board terminal	set	reset	set	reset	Pick-up	Max. allowable
HC2K-AC6V (-F)	HC2K-P-AC6V (-F)	206	103	1.23	0.62	80% of Nominal voltage	110% of Nominal voltage
HC2K-AC12V (-F)	HC2K-P-AC12V (-F)	100	52	1.20	0.62		
HC2K-AC24V (-F)	HC2K-P-AC24V (-F)	51	21.4	1.22	0.51		
HC2K-AC48V (-F)	HC2K-P-AC48V (-F)	25.2	18.5	1.2	0.88		
HC2K-AC115V (-F)	HC2K-P-AC115V (-F)	10.4	5.4	1.20	0.621		

PC board terminal

HC2K AC types are not recognized by UL, CSA.

Notes: 1. The coil current range is ±10% of the nominal coil current.
2. The relay is suitable to the range of 80% — 110% of the nominal coil voltage. However, it is recommended that the relay be used in the range of 85% — 110% of the nominal coil voltage, with the temporary voltage variation taken into consideration.
3. UL/CSA approved type is standard.

SPECIFICATIONS

Contacts

Arrangement		2 Form C only
Initial contact resistance max. (By voltage drop 6 V DC 1 A)		50 mΩ
Rating (resistive)	Nominal switching capacity	3 A 250 V AC
	Max. switching power	750 VA
	Max. switching current	3A
	Min. switching capacity#1	1 mA, 1 V DC

Coil

Nominal operating power	Set coil	1.2 VA to 1.33 VA
	Reset coil	0.51 VA to 0.88 VA

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

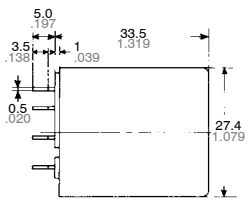
Characteristics

Initial breakdown voltage	Between contact and coil	1,500 Vrms for 1 min.
Set time (at nominal voltage) (at 20°C)		AC, DC: Approx. 20 ms
Reset time (at nominal voltage)		AC: Approx. 30 ms DC: Approx. 50 ms
Temperature rise (at nominal voltage)	Set coil	Max. 80°C
	Reset coil	Max. 50°C
Shock/vibration resistance		Min. 98 m/s² {10 G}
Expected life (min. operations)	Mechanical (at 180 cpm)	10^7
	Electrical (resistive) (at 20 cpm)	2×10^5
Ambient temperature		–40°C to +50°C –40°F to +122°F (Not freezing and condensing at low temperature)

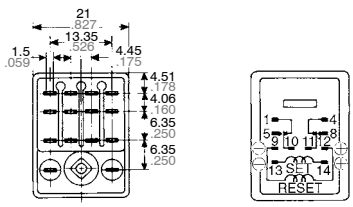
DIMENSIONS AND CIRCUIT DIAGRAM

mm inch

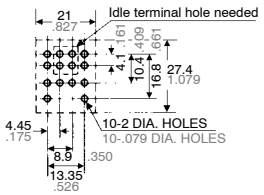
Dimensions



Circuit diagram



PC board pattern (Copper-side)



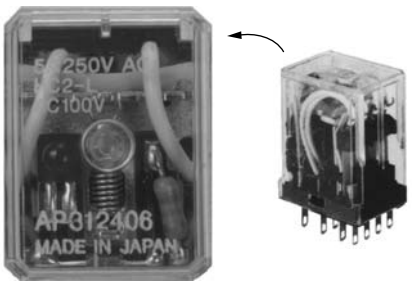
General tolerance: ±0.5 ±.020

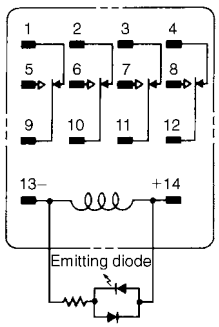
Tolerance: ±0.1 ±.004

Notes:
1. Configuration and dimensions of HC2K types are the same as those of standard HC4 types. Standard sockets and screw terminal sockets of HC4 can be used: HC4-SS-K, HC4-PS-K, HC4-WS-K, and HC4-HSF-K.
2. Please note that circuit diagram of HC2K is different from HC4.
3. Avoid operation by capacitor since latching force varies according to input pulse voltage.

LED wired types: HC-L

The built-in indication LED (Light emitting diode) Series are suitable for instant indication of operate function in applications where numerous relays are to be used. The HC-L relays are supplied with LED wired in parallel with the coil for visual indication that the relay is functioning. A Red LED is used for AC type and green one for DC.





Protection diode
(BOTTOM VIEW)

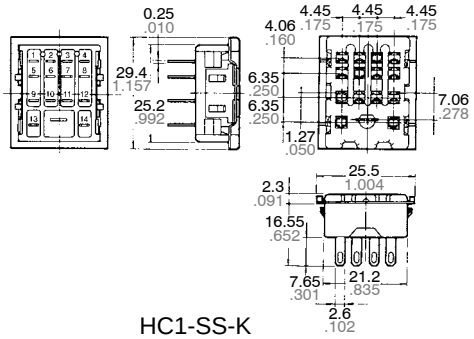
ACCESSORIES

Socket \ Relay	HC1 (1 Form C)	HC2 (2 Form C)	HC3 (3 Form C)	HC4 (4 Form C)
Socket with solder tab (with hold-down clip)	 HC1-SS-K	 HC2-SS-K	 HC3-SS-K	 HC4-SS-K
PC board socket (with hold-down clip)	 HC1-PS-K	 HC2-PS-K	 HC3-PS-K	 HC4-PS-K
Socket for wrap wiring (with hold-down clip)	—	—	—	 HC4-WS-K
Screw terminal socket for front wiring (with hold-down clip)	—	 HC2-SF-K Exclusively for HC2-H	 HC3-HSF-K For HC2-H, HC3-H	 HC4-HSF-K For HC1-H, HC2-H, HC4-H
Screw terminal socket for DIN rail assembly (with hold-down clip)		 HC2-SFD-S HC2-SFD-K Exclusively for HC2-H	 HC3-SFD-K For HC2-H, HC3-H	 HC4-SFD-K For HC1-H, HC2-H, HC4-H

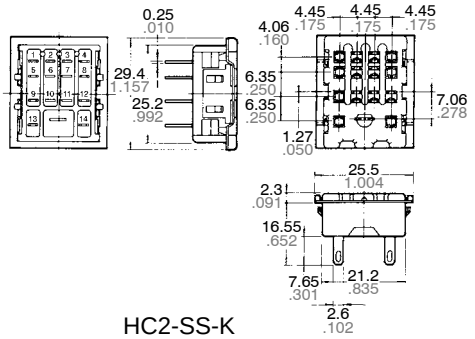
DIMENSIONS

mm inch

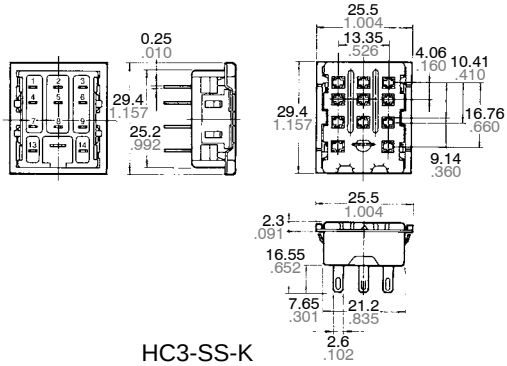
Socket with solder tab (with hold-down clip)



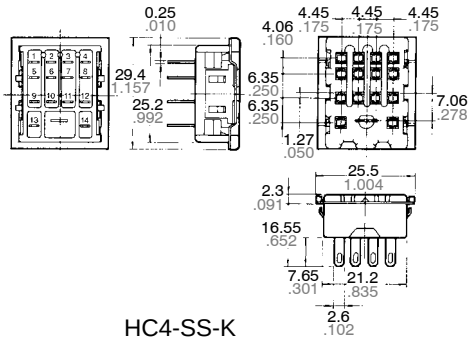
HC1-SS-K



HC2-SS-K

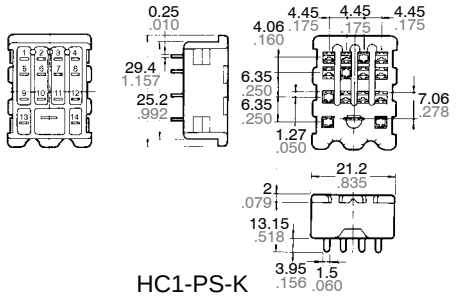


HC3-SS-K

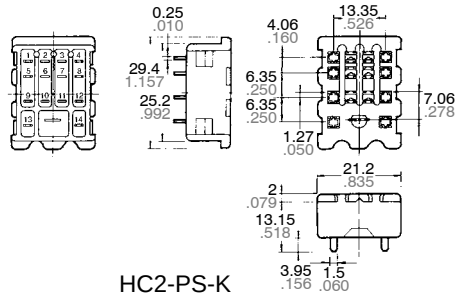


HC4-SS-K

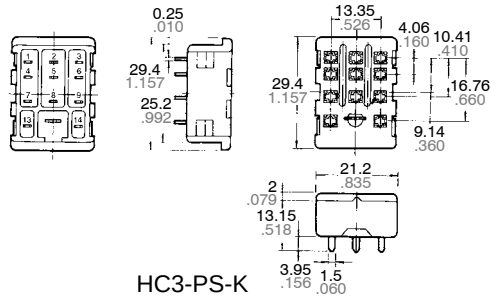
PC board socket (with hold-down clip)



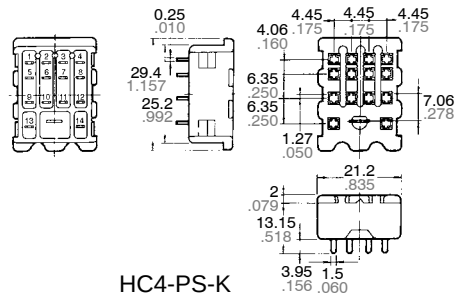
HC1-PS-K



HC2-PS-K

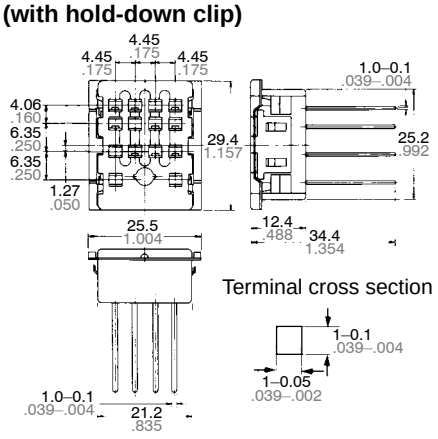


HC3-PS-K



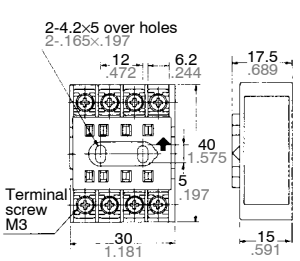
HC4-PS-K

Socket for wrapping (with hold-down clip)

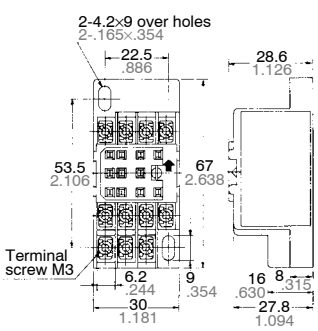


HC4-WS-K

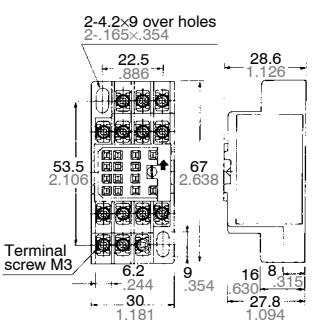
Screw terminal socket for front wiring (with hold-down clip)



HC2-SF-K



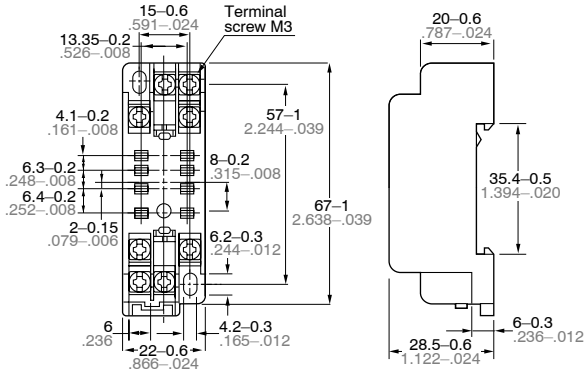
HC3-HSF-K



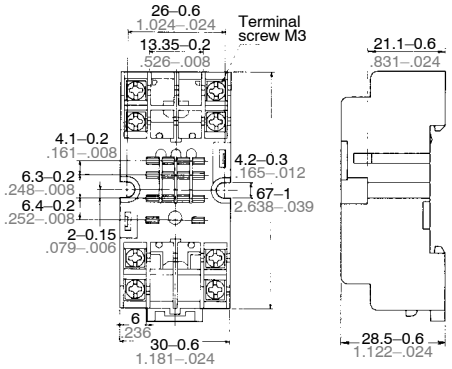
HC4-HSF-K

Screw terminal socket for DIN rail assembly (with hold-down clip)

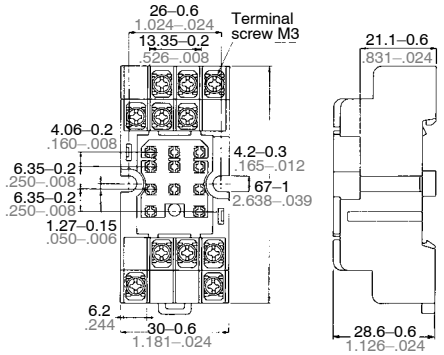
mm inch



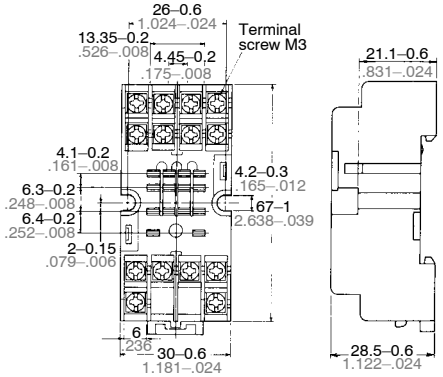
HC2-SFD-S



HC2-SFD-K



HC3-SFD-K

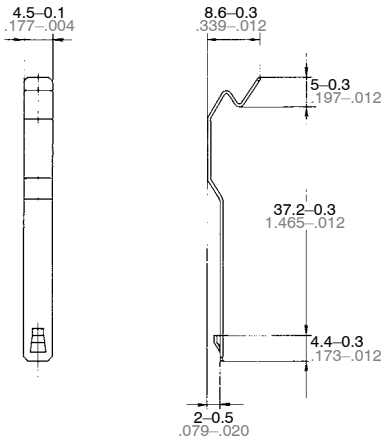


HC4-SFD-K

Hold-down clip

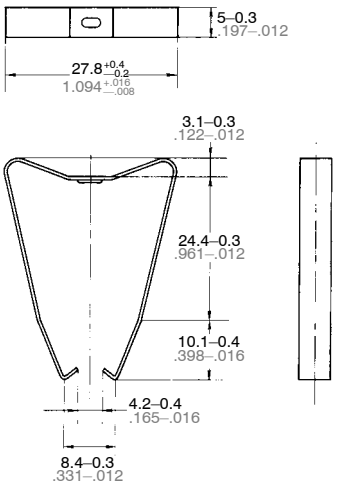
(1) Leaf spring: Applied to HC1-SS-K, HC2-SS-K, HC3-SS-K, HC4-SS-K, HC1-PS-K, HC2-PS-K, HC3-PS-K, HC4-PS-K, HC2-SF-K, HC3-HSF-K, HC4-HSF-K

Part No.: HC/HL-LEAF-SPRING-K



(2) “M shape” leaf spring: Applied to HC4-WS-K

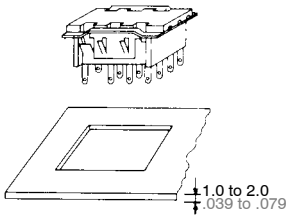
Part No.: HC/HL-LEAF-SPRING-MK



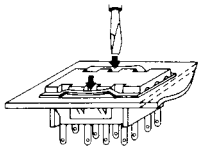
MOUNTING DIMENSIONS AND METHOD

mm inch

Solder and wrapping socket mount

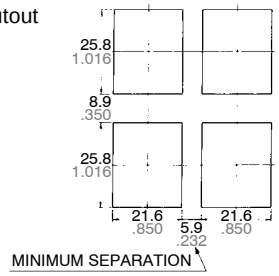


Chassis thickness



Quick mounting

Chassis cutout

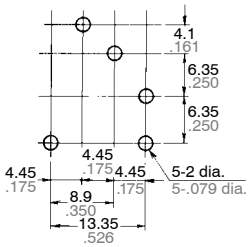


Tolerance: ±0.1 ±.004

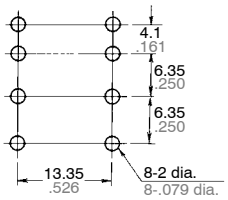
PC board pattern for PC board socket (Copper-side view)

For socket-mount

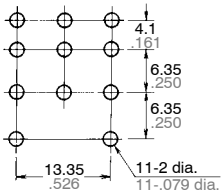
HC1-PS-K



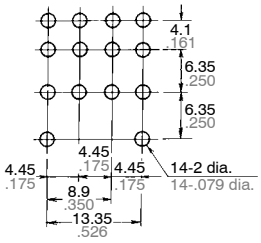
HC2-PS-K



HC3-PS-K



HC4-PS-K

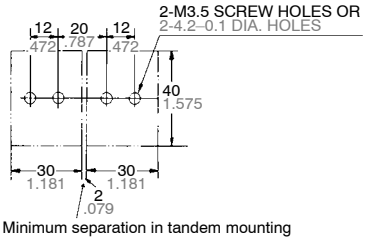


General tolerance: ±0.5 ±.020

Screw socket mounts (Top view)

HC2-SF-K

Chassis cutout

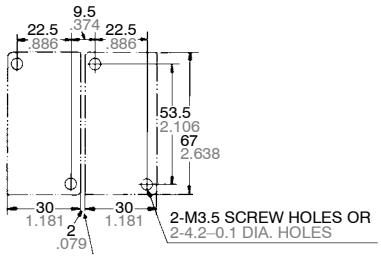


Minimum separation in tandem mounting

Schematic

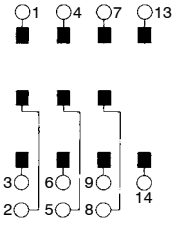
HC3-HSF-K

Chassis cutout



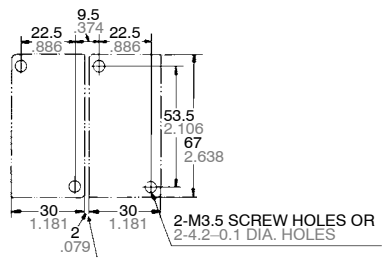
Minimum separation in tandem mounting

Schematic



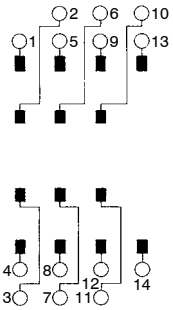
HC4-HSF-K

Chassis cutout



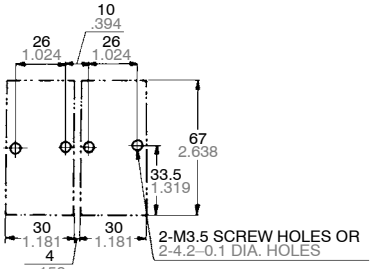
Minimum separation in tandem mounting

Schematic



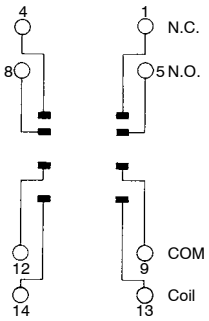
HC2-SFD-K

Chassis cutout



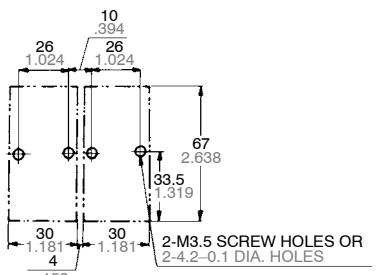
Minimum separation in tandem mounting

Schematic



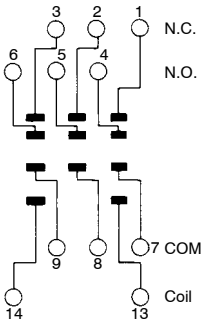
HC3-SFD-K

Chassis cutout



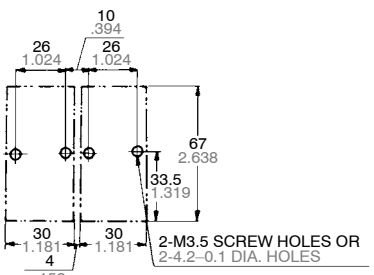
Minimum separation in tandem mounting

Schematic



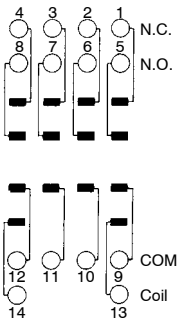
HC4-SFD-K

Chassis cutout



Minimum separation in tandem mounting

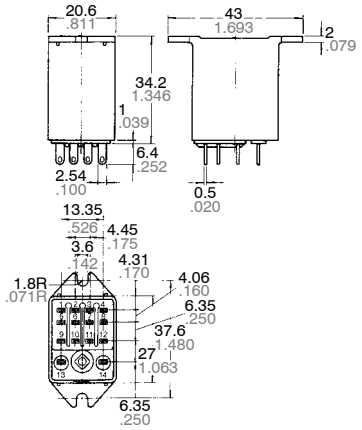
Schematic



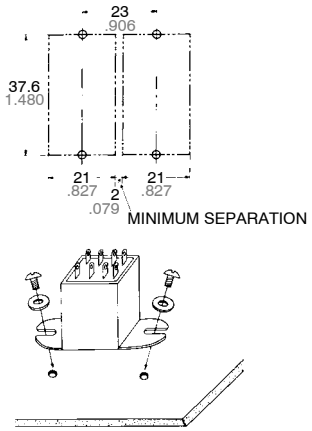
Direct mount for HC-TM relay siries

HC-HTM

4 Form C



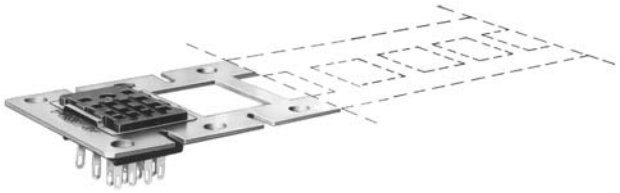
CHASSIS CUTOUT
IN TANDEM MOUNTING



Notes:
1. HC 1-HTM, HC2-HTM, HC3-HTM, HC4-HTM types all have dimensions in common except for the number of terminals.
2. For the specifications, please refer to page 188.
3. In mounting, use M3 screw and M3 washer.

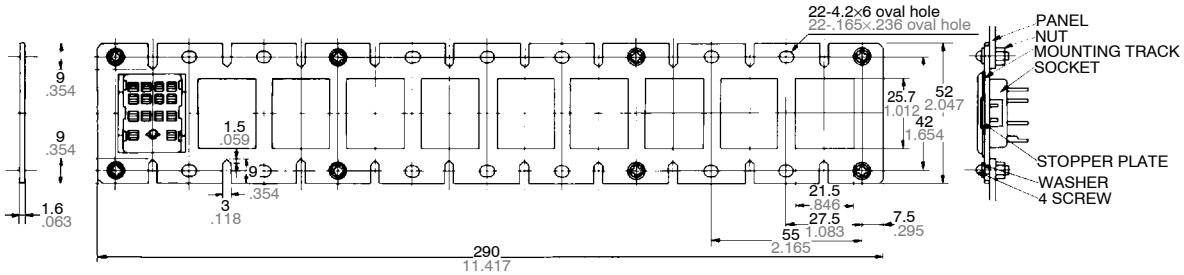
Tolerance: ±0.1 ±.004

Mounting track for solder socket



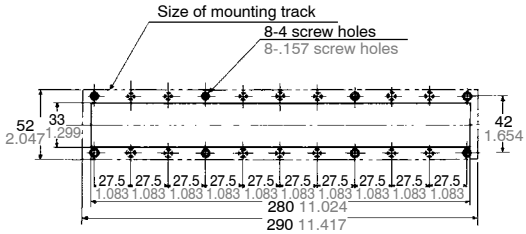
Up to 10 sockets per track.
Cut at notch for desired track length.

Track-mounted solder log sockets
HC-MOUNTING TRACK

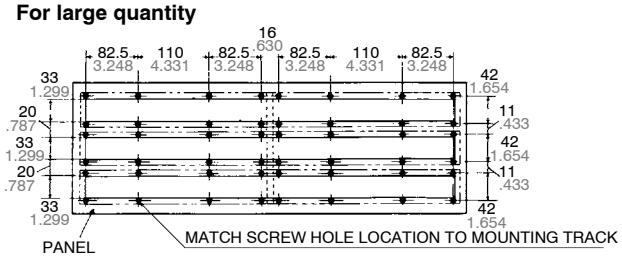


Chassis

For small quantity



For large quantity



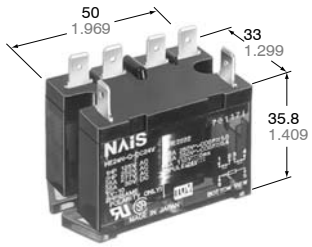
Tolerance: ±0.1 ±.004

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

TV-15, 30 AMP (1 Form A) Power Relay

HE RELAYS



mm inch

FEATURES

- **High contact capacity with superior inrush current characteristics;**

	1 Form A	2 Form A
Rating	30 A 277 V AC	25 A 277 V AC
TV rating	TV-15	TV-10

- **Excellent high heat-resistance;**
- **High dielectric strength: 10,000 V surge Conforming to VDE0806 (Insulation gap: 8 mm .315 inch) VDE, TÜV also approved**

SPECIFICATIONS

Contacts

Type		DC coil type		AC coil type	
Arrangement		1a	2a	1a	2a
Contact material		Silver alloy			
Initial contact resistance, max. (By voltage drop 6 V DC 1A)		100 mΩ			
Rating (resistive)	Nominal switching capacity	30 A 277 V AC	25 A 277 V AC	30 A 277 V AC	25 A 277 V AC
	Max. switching power	8,310 VA	6,925 VA	8,310 VA	6,925 VA
	Max. switching voltage	277 V AC, 30 V DC			
	Max. switching current	30 A	25 A	30 A	25 A
	Min. switching capacity#1	100 mA, 5 V DC			
Expected life (min. operations)	Mechanical (at 180 cpm)	10^7		5×10^6	
	Electrical (at 20 cpm)	10^5 (1a: 30 A 277 V AC, 2a: 25 A 277 V AC) 2×10^5 (1a: 30 A 250 V AC, 2a: 20 A 250 V AC)			

Coil (at 20°C 68°F)

	DC coil type	AC coil type
Nominal operating power	1.92 W	See Coil data (next page)

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

		DC coil type	AC coil type
Maximum operating speed		20 cpm	
Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC	
Initial breakdown voltage*2	Between open contacts	2,000 Vrms for 1 min.	
	Between contacts and coil	5,000 Vrms for 1 min.	
	Between contact sets (2a)	4,000 Vrms for 1 min.	
Surge voltage between coil and contact*3		Min. 10,000 V	
Operate time*4 (at nominal voltage)		Max. 30 ms	
Release time*4 (at nominal voltage)		Max. 10 ms	Max. 30 ms
Temperature rise, max. (resistive load)(at 55°C)		60°C	65°C
Shock resistance	Functional*5	98 m/s² {10 G}	
	Destructive*6	980 m/s² {100 G}	
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 1 mm	
	Destructive	10 to 55 Hz at double amplitude of 1.5 mm	
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–50°C to +55°C –58°F to +131°F	
	Humidity	5 to 85% R.H.	
	Air pressure	86 to 106 kPa	
Unit weight		Approx. 90 g 3.17 oz (Plug-in type)	

TYPICAL APPLICATIONS

1. Home appliances
   - Air conditioners
   - Microwave ovens
   - TV sets
   - Heaters
   - Stereo
2. Office equipment
   - Copiers
   - Vending machines

ORDERING INFORMATION

HE [1a] [N] — [S] — [DC12] V

Contact arrangement	Pick-up voltage	Terminals	Coil voltage
1a: 1 Form A 2a: 2 Form A	N: 70% of nominal voltage	Nil: Plug-in terminal type S: Screw terminal type SW: Screw terminal type (wide pitch) Q: NEMA terminal type P: PC board terminal type*	DC: 6, 12, 24, 48, 110 V AC: 12, 24, 48, 120, 240 V

Standard packing: Carton: 20 pcs.; Case: 100 pcs.
* PC board terminal are available only for 1 Form A type of DC coil voltage.
UL/CSA, TÜV approved type is standard.

TYPES

	Terminal shape	Contact arrangement	
		1 Form A	2 Form A
DC type	Plug-in terminal	HE1aN-DC6V	HE2aN-DC6V
		HE1aN-DC12V	HE2aN-DC12V
		HE1aN-DC24V	HE2aN-DC24V
		HE1aN-DC48V	HE2aN-DC48V
		HE1aN-DC110V	HE2aN-DC110V
	Screw terminal	HE1aN-S-DC6V	HE2aN-S-DC6V
		HE1aN-S-DC12V	HE2aN-S-DC12V
		HE1aN-S-DC24V	HE2aN-S-DC24V
		HE1aN-S-DC48V	HE2aN-S-DC48V
		HE1aN-S-DC110V	HE2aN-S-DC110V
	Screw terminal (wide pitch)	HE1aN-SW-DC6V	HE2aN-SW-DC6V
		HE1aN-SW-DC12V	HE2aN-SW-DC12V
		HE1aN-SW-DC24V	HE2aN-SW-DC24V
		HE1aN-SW-DC48V	HE2aN-SW-DC48V
		HE1aN-SW-DC110V	HE2aN-SW-DC110V
	NEMA terminal	HE1aN-Q-DC6V	HE2aN-Q-DC6V
		HE1aN-Q-DC12V	HE2aN-Q-DC12V
		HE1aN-Q-DC24V	HE2aN-Q-DC24V
		HE1aN-Q-DC48V	HE2aN-Q-DC48V
		HE1aN-Q-DC110V	HE2aN-Q-DC110V
	PC board terminal	HE1aN-P-DC6V	—
		HE1aN-P-DC12V	—
		HE1aN-P-DC24V	—
		HE1aN-P-DC48V	—
		HE1aN-P-DC110V	—

	Terminal shape	Contact arrangement	
		1 Form A	2 Form A
AC type	Plug-in terminal	HE1aN-AC12V	HE2aN-AC12V
		HE1aN-AC24V	HE2aN-AC24V
		HE1aN-AC48V	HE2aN-AC48V
		HE1aN-AC120V	HE2aN-AC120V
		HE1aN-AC240V	HE2aN-AC240V
	Screw terminal	HE1aN-S-AC12V	HE2aN-S-AC12V
		HE1aN-S-AC24V	HE2aN-S-AC24V
		HE1aN-S-AC48V	HE2aN-S-AC48V
		HE1aN-S-AC120V	HE2aN-S-AC120V
		HE1aN-S-AC240V	HE2aN-S-AC240V
	Screw terminal (wide pitch)	HE1aN-SW-AC12V	HE2aN-SW-AC12V
		HE1aN-SW-AC24V	HE2aN-SW-AC24V
		HE1aN-SW-AC48V	HE2aN-SW-AC48V
		HE1aN-SW-AC120V	HE2aN-SW-AC120V
		HE1aN-SW-AC240V	HE2aN-SW-AC240V
	NEMA terminal	HE1aN-Q-AC12V	HE2aN-Q-AC12V
		HE1aN-Q-AC24V	HE2aN-Q-AC24V
		HE1aN-Q-AC48V	HE2aN-Q-AC48V
		HE1aN-Q-AC120V	HE2aN-Q-AC120V
		HE1aN-Q-AC240V	HE2aN-Q-AC240V

COIL DATA at 20°C 68°F

	Nominal voltage	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal coil current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, W	Max. allowable voltage (at 50°C 122°F), V DC
DC coil type	6 V DC	4.2	0.6	320.9	18.8	1.92	6.6
	12 V DC	8.4	1.2	160	75	1.92	13.2
	24 V DC	16.8	2.4	80	300	1.92	26.4
	48 V DC	33.6	4.8	40	1200	1.92	52.8
	110 V DC	77.0	11.0	17.5	6300	1.92	121.0

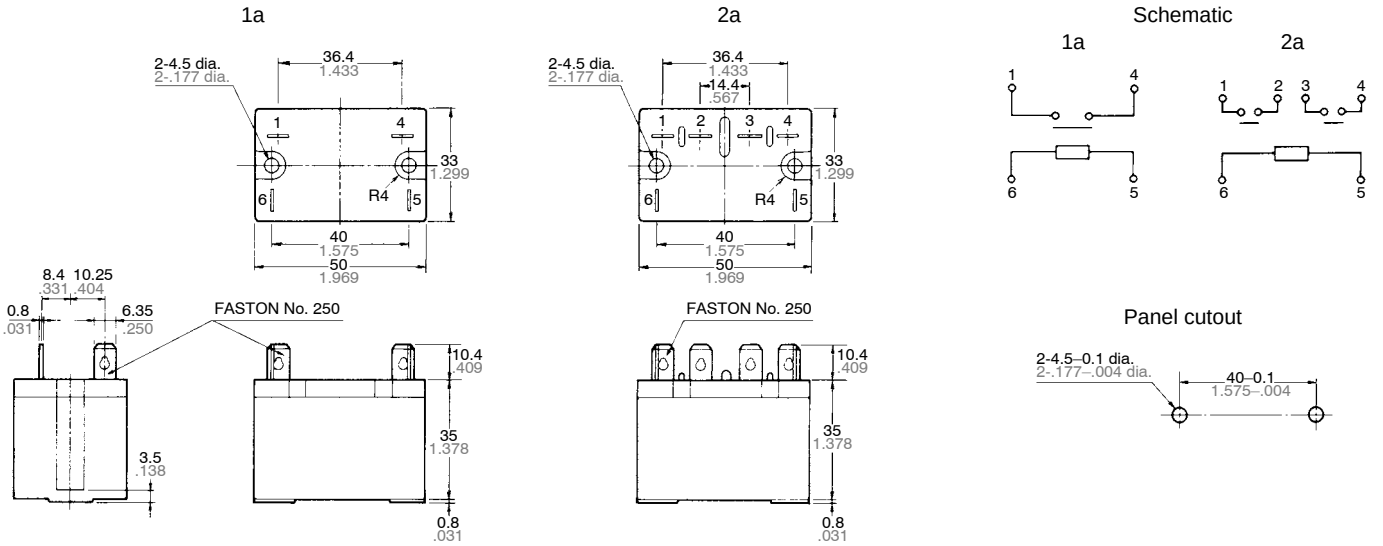
	Nominal voltage	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Nominal coil current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, VA	Max. allowable voltage (at 50°C 122°F), V AC
AC coil type	12 V AC	8.4	1.8	138*	75	1.7	13.2
	24 V AC	16.8	3.6	74*	300	1.8	26.4
	48 V AC	33.6	7.2	39*	1200	1.9	52.8
	120 V AC	70.0	18.0	22.1*	5200	2.7	132.0
	240 V AC	140.0	36.0	10.8*	20800	2.6	264.0

*Value at 60 Hz

DIMENSIONS

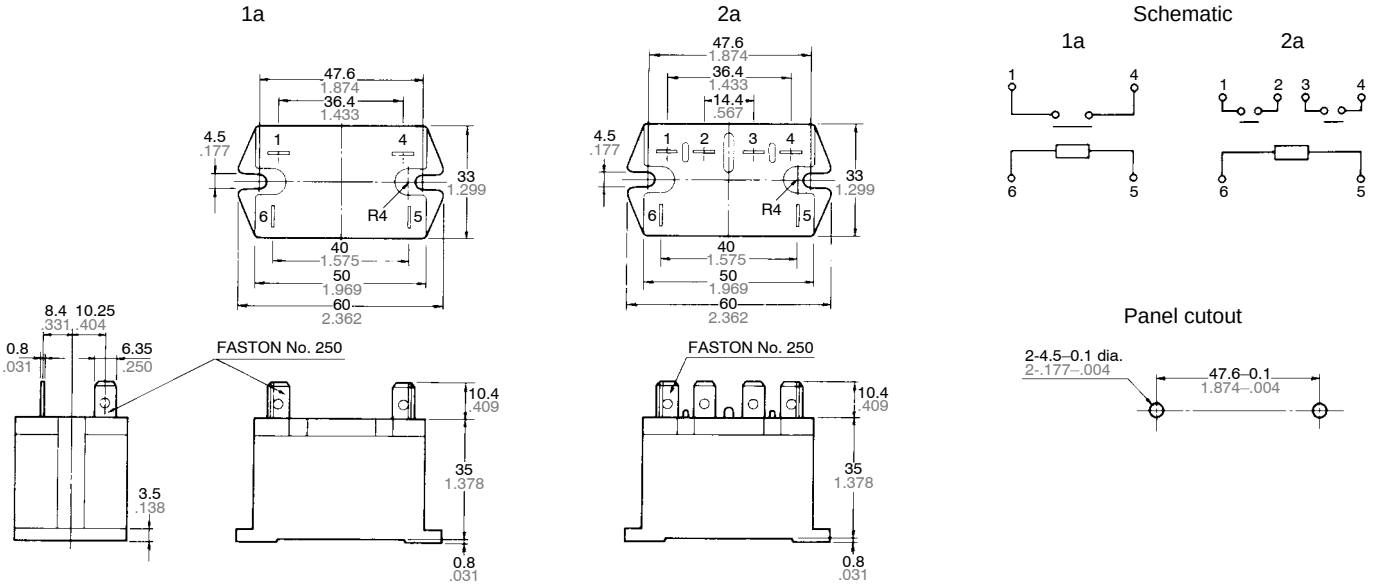
mm inch

1. Plug-in terminal type



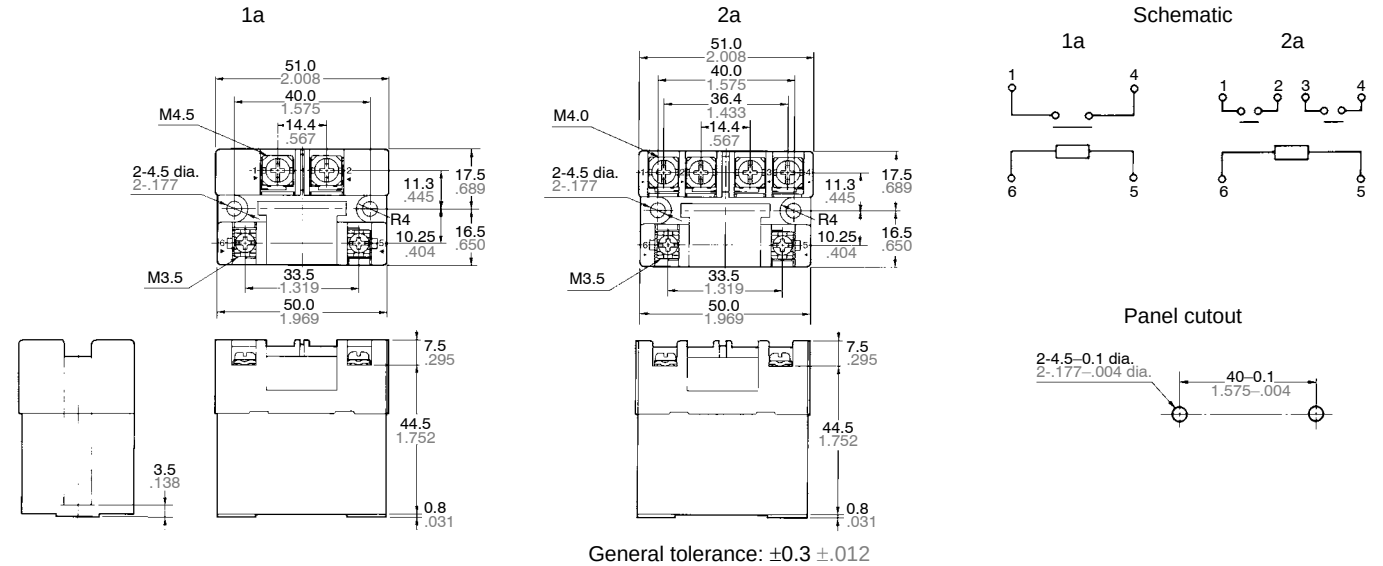
General tolerance: ±0.3 ±.012

2. NEMA terminal type



General tolerance: ±0.3 ±.012

3. Screw terminal type

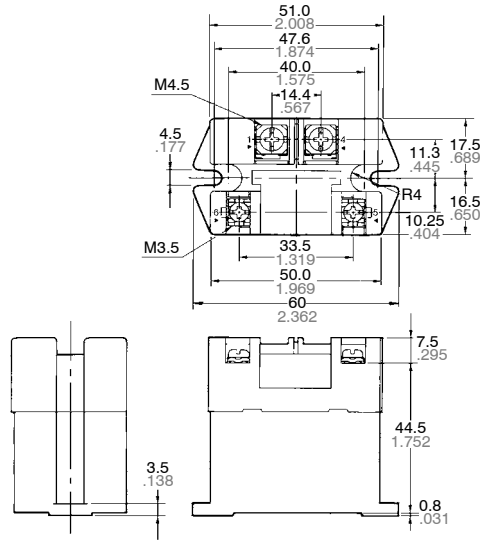


General tolerance: ±0.3 ±.012

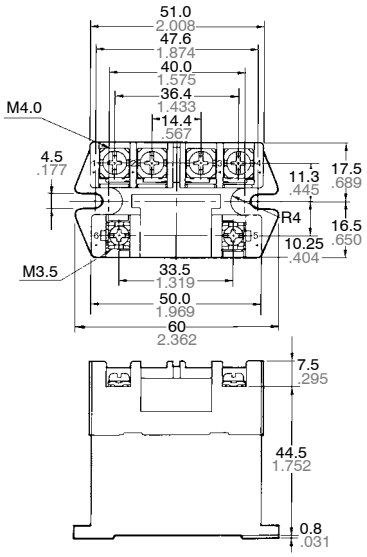
4. Screw terminal type (wide pitch)

mm inch

1a

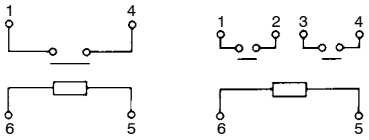


2a

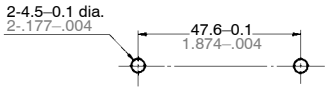


Schematic

1a 2a

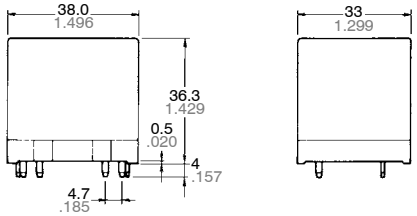


Panel cutout

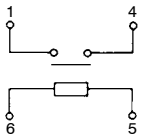


General tolerance: ±0.3 ±.012

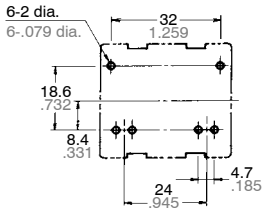
5. PC board terminal type



Schematic (Bottom view)



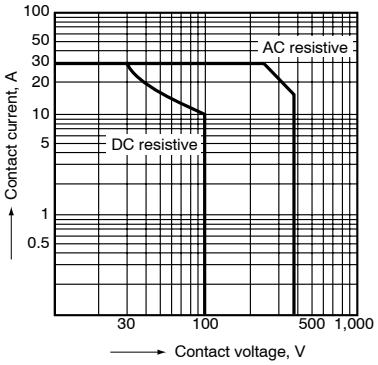
PC board pattern (Copper-side view)



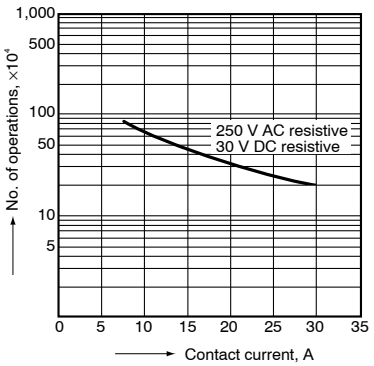
REFERENCE DATA

1 Form A Type

1. Maximum switching power

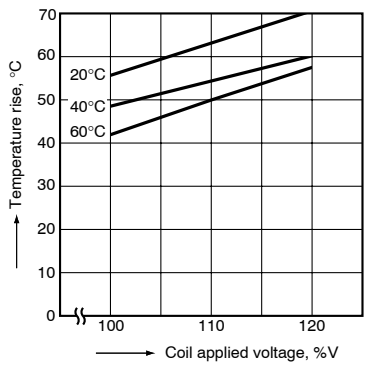


2. Life curve



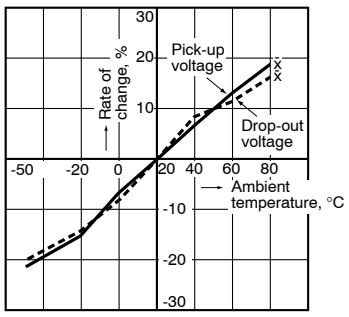
3. Contact temperature rise (DC type)

Measured portion: Inside the coil
Contact current: 30 A



4. Ambient temperature characteristics

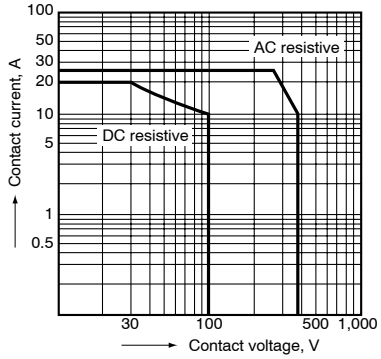
Sample: HE1aN-AC120V, 6 pcs.



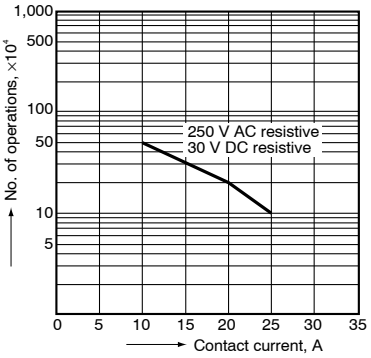
Power

1 Form A Type

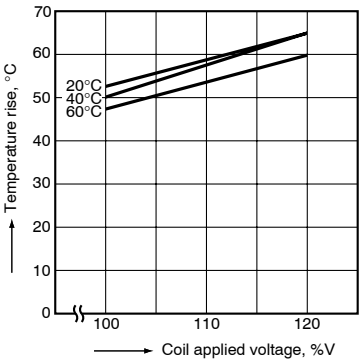
1. Maximum switching power



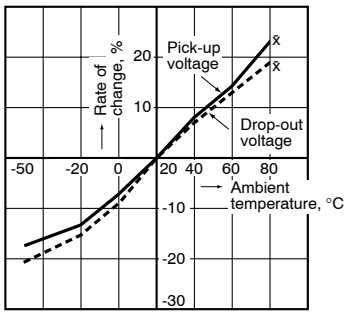
2. Life curve



3. Contact temperature rise (DC type)
Measured portion: Inside the coil
Contact current: 30 A

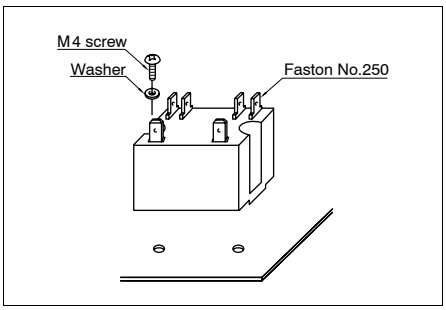


4. Ambient temperature characteristics
Sample: HE2aN-AC120V, 6 pcs.

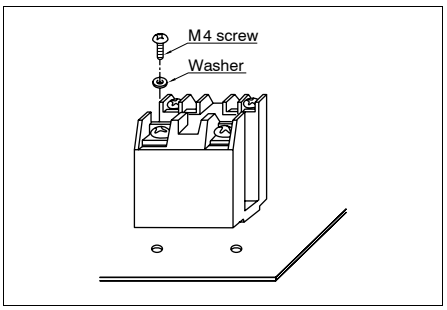


MOUNTING METHOD

1. Plug-in terminal type



2. Screw terminal type



3. Allowable installation wiring size for screw terminal types and terminal blocks

1a type	2.6 mm or 5.5 mm²
2a type	2.0 mm or 3.5 mm²

Due to the UP terminals, it is possible to either directly connect the wires or use crimped terminal

NOTES

1. The dust cover should not be removed since doing so may alter the characteristics.
2. Avoid use under severe environmental conditions, such as high humidity, organic gas or in dust, oily locations and locations subjected to extremely frequent shock or vibrations.
3. When mounting, use spring washers. Optimum fastening torque ranges from 5 kg to 7 kg·cm 4.5 to 6 pounds·inch.
4. Firmly insert the receptacles so that there is no slack or looseness. To remove a receptacle, 2 to 4 kg of pulling strength is required. Do not remove more than one receptacle at one time.Always remove one receptacle at a time and pull it straight outwards.
5. Install the relay so that it lies in direction A (up-down direction). (Pick-up voltage and drop-out voltage values are those when installed in direction A.)
6. When using the AC type, the operate time due to the in-rush phase is 20 ms or more. Therefore, it is necessary for you to verify the characteristics for your actual circuit. Moreover, the release time for the NC side of the 2a1b type requires the same verification.
7. When using the push-on blocks for the screw terminal type, use crimped terminals and tighten the screw-down terminals to the torque's listed below.

M4.5 screw	147 N-cm to 166.6 N-cm (15 to 17 kg·cm)
M4 screw	117.6 N-cm to 137 N-cm (12 to 14 kg·cm)
M3.5 screw	78.4 N-m to 98 N-cm (8 to 10 kg·cm)

8. All AC240V types are rated for double coil voltage, both AC 220V AC 240V.

For Cautions for Use, see Relay Technical Information (page 392).

HE RELAY ACCESSORIES

Terminal socket instantly attachable to DIN rail

TYPES

Part No.	Applicable relays
JH1-SF	HE1a/JH1a
JH2-SF	HE2a/JH2a

SPECIFICATIONS

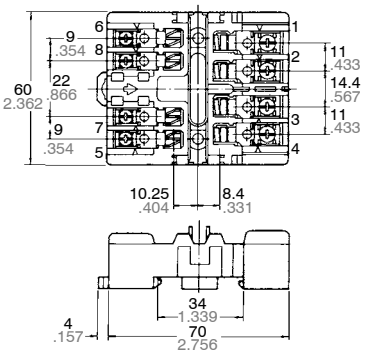
Part No.	JH1, JH2
Maximum continuous current*	20 A 250 V AC (1a: 30 A 250 V AC)
Breakdown voltage	2,000 Vrms between terminals
Insulation resistance	More than 1,000 MΩ between poles
Heat resistance	150°C ±3°C for 1 hour

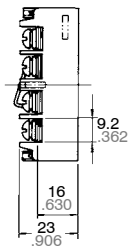
* Don't insert or remove relays while in the energized condition.

DIMENSIONS

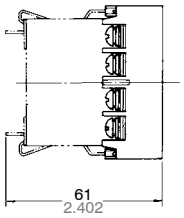
mm inch

1 Form A, 2 Form A

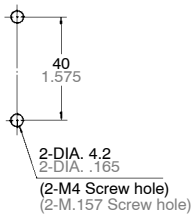




Relay mounting diagram



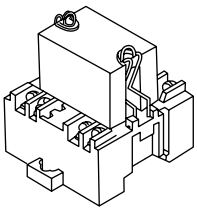
Panel cutout



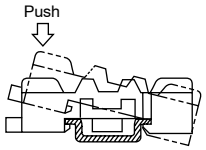
Note:
JH1-SF does not have receptacles (tooth rests) for numbers 2, 3, 7, and 8.
JH2-SF does not have receptacles (tooth rests) for numbers 7 and 8.

MOUNTING METHOD

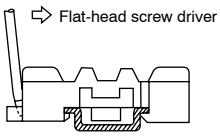
1. Relay mounting



2. Installing to a DIN rail



3. Removing from a DIN rail



NOTE

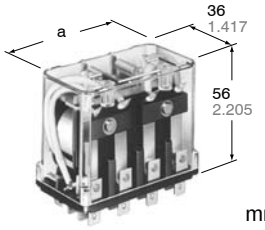
1. Be careful not to drop the relay. It is made of heat-hardened resin and may break.

2. Be sure to tighten the screw- down terminals firmly. Loose terminals may lead to the generation of heat.

Panasonic
ideas for life

20 AMP POWER RELAY

HG RELAYS



mm inch

	a
HG2	34.0 1.339
HG3	50.0 1.969
HG4	68.0 2.667

FEATURES

- **Large capacity — 20 A 250 V AC resistive and 1.5 kW 3 phase 220 V AC motor loads**
- **High contact reliability after long use**
- **Usable with direct soldering, quick-connect and plug-in terminals. (.250)**

SPECIFICATIONS

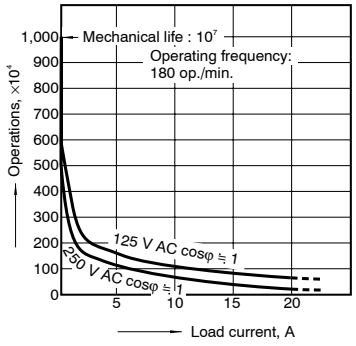
Contacts

Arrangement	2 Form C, 3 Form C, 4 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1A)	15 mΩ
Contact material	Silver alloy
Nominal switching capacity	20 A 250 V AC (resistive)
Min. switching capacity#1	100 mA, 5 V DC

Expected life (min. operations)

Mechanical (at 180 cpm)	AC type: 10^7, DC type: 10^6

Life curve for AC types



#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section

Characteristics (at 60 Hz, 20°C 68°F)

Maximum operating speed		20 cpm
Initial insulation resistance*1		Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	2,000 Vrms for 1 min.
	Between contacts sets	2,000 Vrms for 1 min.
	Between contacts and coil	2,000 Vrms for 1 min.
Operate time*3 (approx.) (at nominal voltage)	2 Form C type	Max. 30 ms
	3 Form C & 4 Form C type	Max. 40 ms
Release time (without diode)*3 (approx.) (at nominal voltage)	2 Form C type	Max. 30 ms
	3 Form C & 4 Form C type	Max. 40 ms
Shock resistance	Functional*4	98 m/s² {10 G} (except for the contact moving direction)
	Destructive*5	980 m/s² {100 G}
Vibration resistance	Functional*6	10 to 55 Hz at 1 mm double amplitude
	Destructive	10 to 55 Hz at 2 mm double amplitude
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–50°C to +40°C –58°F to +104°F
	Humidity	5 to 85% R.H.
Unit weight	2 Form C type	Approx. 130 g 4.59 oz
	3 Form C type	Approx. 185 g 6.53 oz
	4 Form C type	Approx. 240 g 8.47 oz

*2 Detection current: 10 mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Electrical life with AC load

AC load	Voltage, V AC	Current, A	Expected life (min. operations)
Resistive (cos φ ≅ 1)	125	20	5×10^5
		15	7.5×10^5
	250	20	2×10^5
		15	5×10^5
		10	7.5×10^5
Inductive (cos φ ≅ 0.4)	125	15	2×10^5
		10	5×10^5
	250	10	2×10^5
		7.5	5×10^5

AC load		Voltage, V AC	Capacity, kW	Expected life (min. operations)
Lamp		125	0.5	2×10^5
			0.3	5×10^5
Motor	Single phase	125	0.75	2×10^5
			0.4	5×10^5
		250	0.75	2×10^5
			0.4	5×10^5
	Three phase	250	1.5	2×10^5
			0.75	5×10^5

Note: In case of an electromagnet or exiting coil load (solenoid, etc.), the value of the motor or lamp load is applicable.

Electrical life with DC load

DC load	Voltage, V DC	Current, A	Expected life (min. operations)
Resistive	24	15	5×10^5
	125	0.8	5×10^5
Inductive (L/R ≅ 7 ms)	24	10	5×10^5
	125	0.4	5×10^5

Note: For DC inductive load, use of an arc extinguishing circuit is recommended.

TYPICAL APPLICATIONS

Industrial machinery, machine tools, food processing and packing machines, office machines, transportation equipment and amusement devices.

ORDERING INFORMATION

Ex. HG 2 — AC 240 V

Contact arrangement	Coil voltage
2: 2 Form C 3: 3 Form C 4: 4 Form C	AC 6, 12, 24, 48, 115, 220, 240 V DC 6, 12, 24, 48, 110, 200 V

(Note) Standard packing Carton: HG2 20 pcs. Case: HG2 100 pcs.
HG3, HG4 10 pcs. HG3, HG4 50 pcs.
UL/CSA approved type is standard.

TYPES AND COIL DATA

DC TYPES at 20°C 68°F

Type	Part No.	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable, V DC voltage	Coil resistance, Ω (±10%)	Nominal coil current, mA	Operating power, W
HG2 (2 Form C)	HG2-DC6V	6	4.8	0.9	6.6	26.4	230	(approx.) 1.4
	HG2-DC12V	12	9.6	1.8	13.2	100	119.6	(approx.) 1.4
	HG2-DC24V	24	19.2	3.6	26.4	416	57.6	(approx.) 1.4
	HG2-DC48V	48	38.4	7.2	52.8	1585	30.3	(approx.) 1.4
	HG2-DC110V	110	88	16.5	121	7650	14.4	(approx.) 1.4
	HG2-DC200V	200	160	20	220	27,800	7.2	(approx.) 1.4
HG3 (3 Form C)	HG3-DC6V	6	4.8	0.9	6.6	22.7	264	(approx.) 1.6
	HG3-DC12V	12	9.6	1.8	13.2	89.5	134	(approx.) 1.6
	HG3-DC24V	24	19.2	3.6	26.4	364	66	(approx.) 1.6
	HG3-DC48V	48	38.4	7.2	52.8	1450	33.1	(approx.) 1.6
	HG3-DC110V	110	88	16.5	121	6670	16.5	(approx.) 1.6
	HG3-DC200V	200	160	20	220	23,800	8.4	(approx.) 1.6
HG4 (4 Form C)	HG4-DC6V	6	4.8	0.9	6.6	18.5	325	(approx.) 2.1
	HG4-DC12V	12	9.6	1.8	13.2	71.4	168	(approx.) 2.1
	HG4-DC24V	24	19.2	3.6	26.4	296	81.2	(approx.) 2.1
	HG4-DC48V	48	38.4	7.2	52.8	1050	45.7	(approx.) 2.1
	HG4-DC110V	110	88	16.5	121	5420	20.3	(approx.) 2.1
	HG4-DC200V	200	160	20	220	15,500	12.9	(approx.) 2.1

AC TYPES (50/60 Hz) at 60 HZ, 20°C 68°F

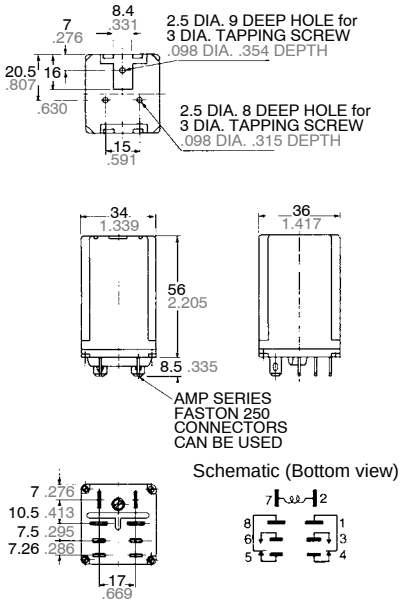
Type	Part No.	Nominal coil voltage, V AC	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Max. allowable, V AC voltage	Inductance, H	Nominal coil current, mA	Operating power, VA
HG2 (2 Form C)	HG2-AC6V	6	4.8	1.8	6.6	0.026	600	(approx.) 3.6
	HG2-AC12V	12	9.6	3.6	13.2	0.104	300	(approx.) 3.6
	HG2-AC24V	24	19.2	7.2	26.4	0.416	150	(approx.) 3.6
	HG2-AC48V	48	38.4	14.4	52.8	1.660	75	(approx.) 3.6
	HG2-AC115V	115	92	34.5	126.5	9.531	31.3	(approx.) 3.6
	HG2-AC220V	220	176	66	242	34.96	16.4	(approx.) 3.6
	HG2-AC240V	240	192	72	264	41.68	15	(approx.) 3.6
HG3 (3 Form C)	HG3-AC6V	6	4.8	1.8	6.6	0.018	864	(approx.) 5.2
	HG3-AC12V	12	9.6	3.6	13.2	0.073	432	(approx.) 5.2
	HG3-AC24V	24	19.2	7.2	26.4	0.290	216	(approx.) 5.2
	HG3-AC48V	48	38.4	14.4	52.8	1.163	108	(approx.) 5.2
	HG3-AC115V	115	92	34.5	126.5	6.648	45.2	(approx.) 5.2
	HG3-AC220V	220	176	66	242	24.26	23.6	(approx.) 5.2
	HG3-AC240V	240	192	72	264	29.06	21.6	(approx.) 5.2
HG4 (4 Form C)	HG4-AC6V	6	4.8	1.8	6.6	0.012	1264	(approx.) 7.6
	HG4-AC12V	12	9.6	3.6	13.2	0.050	632	(approx.) 7.6
	HG4-AC24V	24	19.2	7.2	26.4	0.199	316	(approx.) 7.6
	HG4-AC48V	48	38.4	14.4	52.8	0.795	158	(approx.) 7.6
	HG4-AC115V	115	92	34.5	126.5	4.557	66.1	(approx.) 7.6
	HG4-AC220V	220	176	66	242	16.89	34	(approx.) 7.6
	HG4-AC240V	240	192	72	264	19.87	31.6	(approx.) 7.6

Notes:
1. The coil current ranges is ±15% for AC (60 Hz), ±10% for DC (20°C 68°F).
2. These relays are applicable to a range of 80% to 110% of the nominal coil voltage. However, it is recommended that the relay be used in a range of 85% to 110% of the nominal coil voltage, taking the temporary voltage variation into consideration. For AC types, when operating voltage is 70% of nominal coil voltage, "buzzing" will occur, and a large amount of current will flow, burning the coil.
3. Each coil resistance of DC types is the measured value at coil temperature of 20°C 68°F. Please compensate the coil resistance by ±0.4%, each time the coil temperature changes by ±1°C.

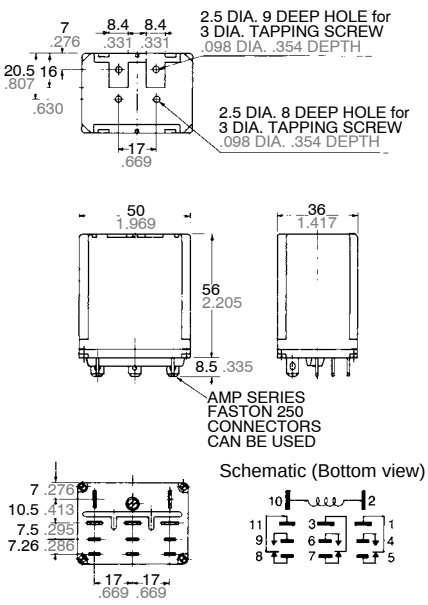
DIMENSIONS

mm inch

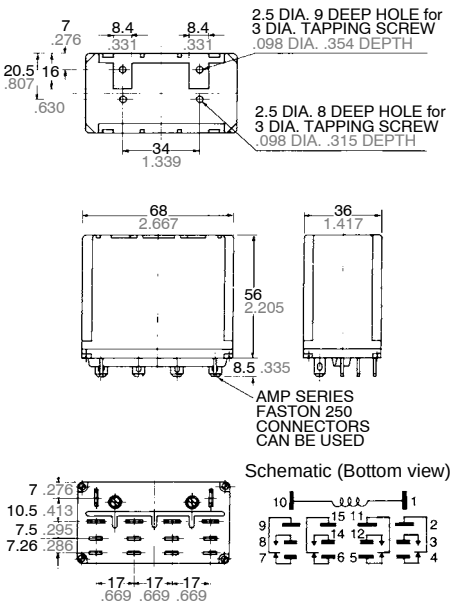
HG2 (2 Form C)



HG3 (3 Form C)



HG4 (4 Form C)



General tolerance: ±0.5 ±.020

ACCESSORIES

Please refer to “MOUNTING METHOD” for further information.

HG	Relay	Screw terminal socket for DIN rail assembly (with hold-down clip)	Solder terminal socket for rectangular hole (with hold-down clip)	Bracket for direct mounting
HG2 (2 Form C)		HG2-SFD 	HG2-SS 	HP-BRACKET  1 pc.
HG3 (3 Form C)		HG3-SFD 	HG3-SS 	HP-BRACKET  2 pcs.
HG4 (4 Form C)		No screw terminal socket for HG4 use 2 screw terminal sockets (HG2-SFD)	HG4-SS 	HP-BRACKET  2 pcs.

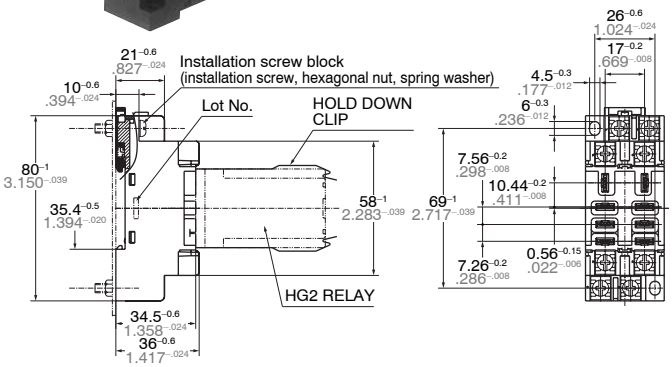
Note: Tapping-screw holes are provided on the cover top for direct mounting.

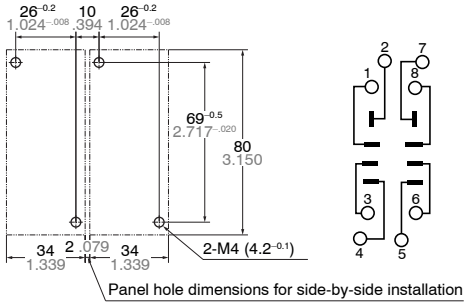
MOUNTING METHOD AND DIMENSIONS

mm inch

Screw terminal socket (Hold-down clips included)

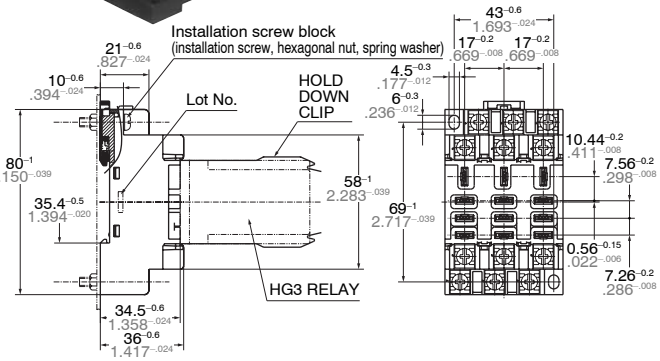
HG2-SFD

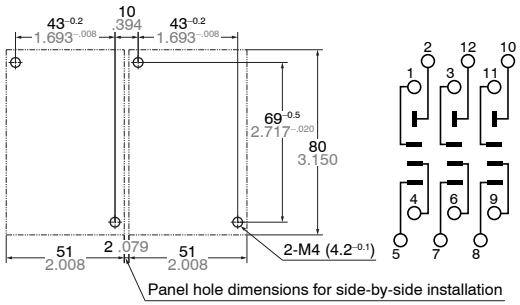




Note: Hold down clip and installation screw block are included in package.

HG3-SFD

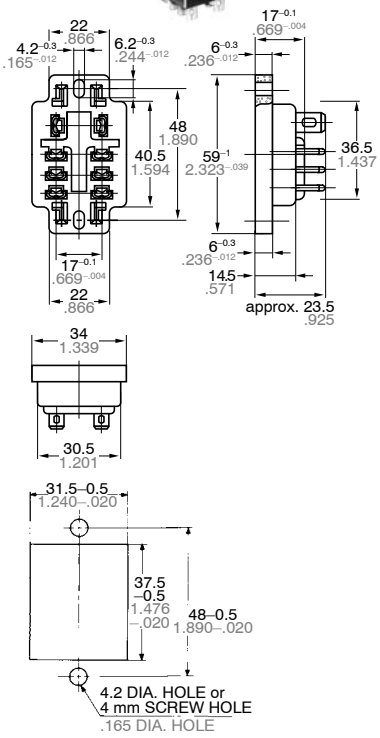




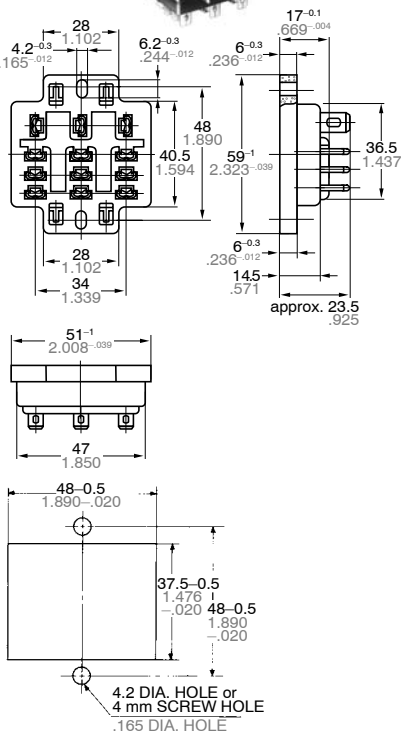
Note: Hold down clip and installation screw block are included in package.

Solder terminal socket (Hold-down clips included)

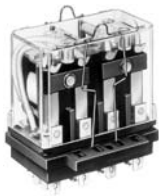
HG2-SS

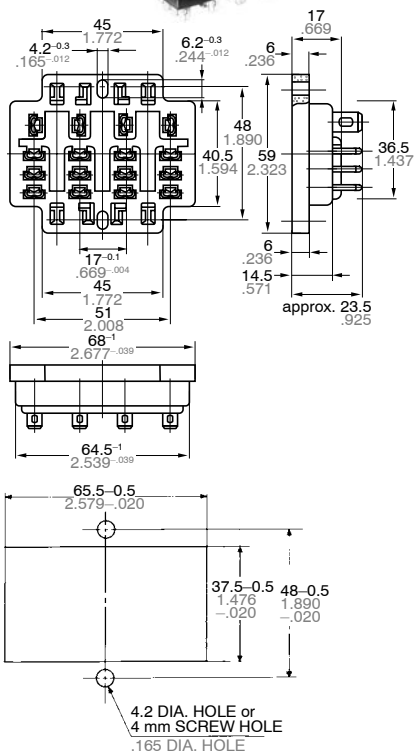


HG3-SS



HG4-SS



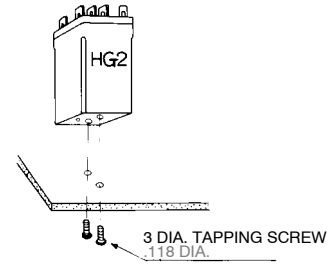


Note: HG sockets accept Faston 250.

General tolerance: ±0.6 ±.024

Direct mounting

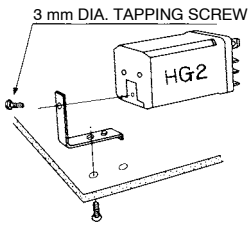
Faston 250 series quick-connectors can be used.

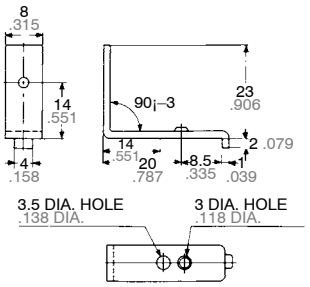


A: HG 2: 15mm .591
HG 3: 17mm .669
HG 4: 34mm 1.339

Direct mounting with HP-BRACKET

Faston 250 series quick-connectors can be used.

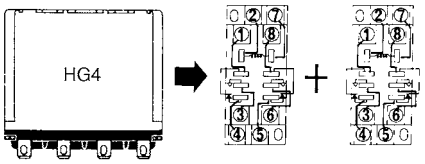




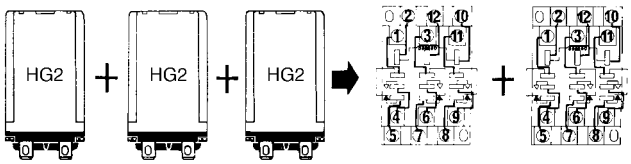
Use two brackets for HG3 and HG4

Notes:
1. This bracket is unavailable for UL, CSA and VDE applications.
2. When using any other non-standard bracket mounting-screw length should not exceed bracket thickness plus 7 mm .276 inch to avoid damage to relay coils.

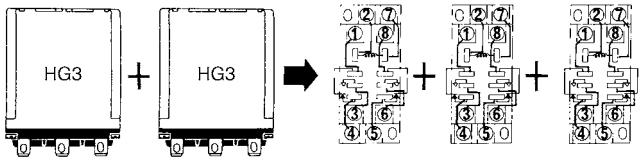
Socket Combinations



HG2-SFD+HG2-SFD



HG3-SFD+HG3-SFD



HG2-SFD+HG2-SFD+HG2-SFD

NOTES

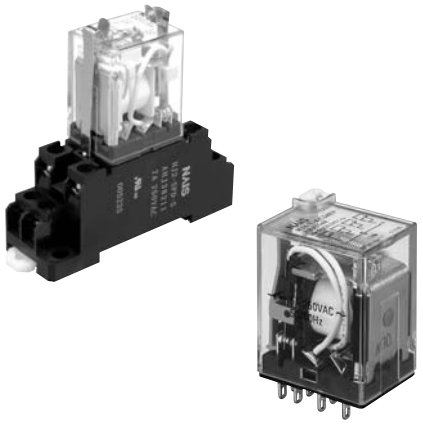
Please use the hold-down clip whenever HG relays will be used in applications where strong vibrating or shock force occurs. When used in such applications, mount the relay so that this force does not parallel the direction of contact movement.

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

MINIATURE RELAY FOR WIDER APPLICATIONS

HJ RELAYS



FEATURES

- **2 contact arrangements**
  4 Form C (for 5 A 250 V AC),
  2 Form C (for 7 A 250 V AC)
- **Excellent contact reliability by Au plating**
- **Environmentally friendly Cd-free contacts**
- **Coil breakdown detection function (AC type with LED only)**
- **Convenient Screw terminal sockets with finger protection also available**
- **Test button type available**
- **Built-in diode and CR for surge suppression type available**

TYPICAL APPLICATIONS

Control panels
Power supply units
Molding machines
Machine tools
Welding equipment
Agricultural equipment
Office equipment
Vending machines
Communications equipment
Amusement machines

ORDERING INFORMATION

Ex. HJ □ – □ – □ – □ – □ – □

Contact arrangement	Operation indication	Test button	Coil voltage	Surge suppression	Contact surface
2: 2 Form C 4: 4 Form C	Nil: Without LED indication L: With LED indication	Nil: Without test button T: With test button	AC 12, 24, 48, 100/110, 110/120, 200/220, 220/240 V DC 12, 24, 48, 100/110 V	Nil: Without D: With diode R: With CR	Nil: Without 6: With Au plating

Power

SPECIFICATIONS

Contacts

Arrangement		2 Form C	4 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		50mΩ	
Contact material		Au plating Silver alloy (Au plating type) Silver alloy (without Au plating type)	
Rating (resistive load)	Nominal switching capacity	7A 250V AC	5A 250V AC
	Max. switching power	1,750 VA	1,250 VA
	Max. switching voltage	250 V AC	
	Max. switching current	7 A	5 A
	Min. switching current*9	1 V 1 mA (Au plating type only)	
Expected life (min. operations)	Mechanical (at 180 cpm)	2×10^7	
	Electrical (at 20 cpm) (resistive load)	10^5 (7A 250 V AC) 5×10^5 (5A 250 V AC)	10^5 (5A 250 V AC) 2×10^5 (3A 250 V AC)

Coil

Nominal operating power	0.9W 1.2V A

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 For the AC coil types, the operate/release time will differ depending on the phase.
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).
*9 This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

		2 Form C	4 Form C
Max. operating speed		20 cpm (at max. rating)	
Initial insulation resistance*1		Min. 100 MΩ at 500 V DC	
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.	
	Between contact sets	2,000 Vrms for 1 min.	
	Between contact and coil	2,000 Vrms for 1 min.	
Operate time*3 (at nominal voltage)		Max. 20 ms*4	
Release time (without diode)*3 (at nominal voltage)		Max. 20 ms*4	
Temperature rise, max. (at 70°C) (at nominal voltage)		60°C	
Shock resistance	Functional*5	Min. 100 m/s² {10 G}	
	Destructive*6	Min. 1,000 m/s² {100 G}	
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 1.0 mm	
	Destructive	10 to 55 Hz at double amplitude of 1.0 mm	
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F	
	Humidity	5 to 85% R.H.	
Unit weight	Without test button	Approx. 31g 1.09 oz	Approx. 32g 1.13 oz
	Test button	Approx. 34g 1.20 oz	Approx. 34g 1.20 oz

TYPES

[Au plating type]

1. Plug-in type

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V-6	HJ4-DC 12V-6
24V DC	HJ2-DC 24V-6	HJ4-DC 24V-6
48V DC	HJ2-DC 48V-6	HJ4-DC 48V-6
100/110V DC	HJ2-DC110V-6	HJ4-DC110V-6
12V AC	HJ2-AC 12V-6	HJ4-AC 12V-6
24V AC	HJ2-AC 24V-6	HJ4-AC 24V-6
48V AC	HJ2-AC 48V-6	HJ4-AC 48V-6
100/110V AC	HJ2-AC100V-6	HJ4-AC100V-6
110/120V AC	HJ2-AC120V-6	HJ4-AC120V-6
200/220V AC	HJ2-AC200V-6	HJ4-AC200V-6
220/240V AC	HJ2-AC220/240V-6	HJ4-AC220/240V-6

2. Plug-in type (with LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V-6	HJ4-L-DC 12V-6
24V DC	HJ2-L-DC 24V-6	HJ4-L-DC 24V-6
48V DC	HJ2-L-DC 48V-6	HJ4-L-DC 48V-6
100/110V DC	HJ2-L-DC110V-6	HJ4-L-DC110V-6
12V AC	HJ2-L-AC 12V-6	HJ4-L-AC 12V-6
24V AC	HJ2-L-AC 24V-6	HJ4-L-AC 24V-6
48V AC	HJ2-L-AC 48V-6	HJ4-L-AC 48V-6
100/110V AC	HJ2-L-AC100V-6	HJ4-L-AC100V-6
110/120V AC	HJ2-L-AC120V-6	HJ4-L-AC120V-6
200/220V AC	HJ2-L-AC200V-6	HJ4-L-AC200V-6
220/240V AC	HJ2-L-AC220/240V-6	HJ4-L-AC220/240V-6

3. Plug-in type (with diode)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V-D-6	HJ4-DC 12V-D-6
24V DC	HJ2-DC 24V-D-6	HJ4-DC 24V-D-6
48V DC	HJ2-DC 48V-D-6	HJ4-DC 48V-D-6
100/110V DC	HJ2-DC110V-D-6	HJ4-DC110V-D-6

4. Plug-in type (with diode and LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V-D-6	HJ4-L-DC 12V-D-6
24V DC	HJ2-L-DC 24V-D-6	HJ4-L-DC 24V-D-6
48V DC	HJ2-L-DC 48V-D-6	HJ4-L-DC 48V-D-6
100/110V DC	HJ2-L-DC110V-D-6	HJ4-L-DC110V-D-6

5. Plug-in type (with CR)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-AC100V-R-6	HJ4-AC100V-R-6
110/120V AC	HJ2-AC120V-R-6	HJ4-AC120V-R-6
200/220V AC	HJ2-AC200V-R-6	HJ4-AC200V-R-6
220/240V AC	HJ2-AC220/240V-R-6	HJ4-AC220/240V-R-6

6. Plug-in type (with CR and LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-L-AC100V-R-6	HJ4-L-AC100V-R-6
110/120V AC	HJ2-L-AC120V-R-6	HJ4-L-AC120V-R-6
200/220V AC	HJ2-L-AC200V-R-6	HJ4-L-AC200V-R-6
220/240V AC	HJ2-L-AC220/240V-R-6	HJ4-L-AC220/240V-R-6

Note) Packing quantity: 20pcs. (Inner carton), 200pcs. (Outer carton)

[Without Au plating type]

1. Plug-in type

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V	HJ4-DC 12V
24V DC	HJ2-DC 24V	HJ4-DC 24V
48V DC	HJ2-DC 48V	HJ4-DC 48V
100/110V DC	HJ2-DC110V	HJ4-DC110V
12V AC	HJ2-AC 12V	HJ4-AC 12V
24V AC	HJ2-AC 24V	HJ4-AC 24V
48V AC	HJ2-AC 48V	HJ4-AC 48V
100/110V AC	HJ2-AC100V	HJ4-AC100V
110/120V AC	HJ2-AC120V	HJ4-AC120V
200/220V AC	HJ2-AC200V	HJ4-AC200V
220/240V AC	HJ2-AC220/240V	HJ4-AC220/240V

2. Plug-in type (with LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V	HJ4-L-DC 12V
24V DC	HJ2-L-DC 24V	HJ4-L-DC 24V
48V DC	HJ2-L-DC 48V	HJ4-L-DC 48V
100/110V DC	HJ2-L-DC110V	HJ4-L-DC110V
12V AC	HJ2-L-AC 12V	HJ4-L-AC 12V
24V AC	HJ2-L-AC 24V	HJ4-L-AC 24V
48V AC	HJ2-L-AC 48V	HJ4-L-AC 48V
100/110V AC	HJ2-L-AC100V	HJ4-L-AC100V
110/120V AC	HJ2-L-AC120V	HJ4-L-AC120V
200/220V AC	HJ2-L-AC200V	HJ4-L-AC200V
220/240V AC	HJ2-L-AC220/240V	HJ4-L-AC220/240V

3. Plug-in type (with test button)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-T-DC 12V	HJ4-T-DC 12V
24V DC	HJ2-T-DC 24V	HJ4-T-DC 24V
48V DC	HJ2-T-DC 48V	HJ4-T-DC 48V
100/110V DC	HJ2-T-DC110V	HJ4-T-DC110V
12V AC	HJ2-T-AC 12V	HJ4-T-AC 12V
24V AC	HJ2-T-AC 24V	HJ4-T-AC 24V
48V AC	HJ2-T-AC 48V	HJ4-T-AC 48V
100/110V AC	HJ2-T-AC100V	HJ4-T-AC100V
110/120V AC	HJ2-T-AC120V	HJ4-T-AC120V
200/220V AC	HJ2-T-AC200V	HJ4-T-AC200V
220/240V AC	HJ2-T-AC220/240V	HJ4-T-AC220/240V

4. Plug-in type (with LED indication and test button)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-T-DC 12V	HJ4-L-T-DC 12V
24V DC	HJ2-L-T-DC 24V	HJ4-L-T-DC 24V
48V DC	HJ2-L-T-DC 48V	HJ4-L-T-DC 48V
100/110V DC	HJ2-L-T-DC110V	HJ4-L-T-DC110V
12V AC	HJ2-L-T-AC 12V	HJ4-L-T-AC 12V
24V AC	HJ2-L-T-AC 24V	HJ4-L-T-AC 24V
48V AC	HJ2-L-T-AC 48V	HJ4-L-T-AC 48V
100/110V AC	HJ2-L-T-AC100V	HJ4-L-T-AC100V
110/120V AC	HJ2-L-T-AC120V	HJ4-L-T-AC120V
200/220V AC	HJ2-L-T-AC200V	HJ4-L-T-AC200V
220/240V AC	HJ2-L-T-AC220/240V	HJ4-L-T-AC220/240V

5. Plug-in type (with diode)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V-D	HJ4-DC 12V-D
24V DC	HJ2-DC 24V-D	HJ4-DC 24V-D
48V DC	HJ2-DC 48V-D	HJ4-DC 48V-D
100/110V DC	HJ2-DC110V-D	HJ4-DC110V-D

6. Plug-in type (with diode and LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V-D	HJ4-L-DC 12V-D
24V DC	HJ2-L-DC 24V-D	HJ4-L-DC 24V-D
48V DC	HJ2-L-DC 48V-D	HJ4-L-DC 48V-D
100/110V DC	HJ2-L-DC110V-D	HJ4-L-DC110V-D

7. Plug-in type (with CR)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-AC100V-R	HJ4-AC100V-R
110/120V AC	HJ2-AC120V-R	HJ4-AC120V-R
200/220V AC	HJ2-AC200V-R	HJ4-AC200V-R
220/240V AC	HJ2-AC220/240V-R	HJ4-AC220/240V-R

Note) Packing quantity: 20pcs. (Inner carton), 200pcs. (Outer carton)

8. Plug-in type (with CR and LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-L-AC100V-R	HJ4-L-AC100V-R
110/120V AC	HJ2-L-AC120V-R	HJ4-L-AC120V-R
200/220V AC	HJ2-L-AC200V-R	HJ4-L-AC200V-R
220/240V AC	HJ2-L-AC220/240V-R	HJ4-L-AC220/240V-R

[Accessories]

Type	No. of channels	Item	Part No.
Terminal socket	2 channels	HJ2 terminal socket	HJ2-SFD
		HJ2 terminal socket (Finger protect type)	HJ2-SFD-S
	2/4 channels (common)	HJ4 terminal socket	HJ4-SFD
		HJ4 terminal socket (Finger protect type)	HJ4-SFD-S

Notes) 1. Packing quantity: 10pcs. (Inner carton), 100pcs. (Outer carton)
2. Use the retainer that is shipped with the terminal socket.
3. Products conform to UL, CSA and TÜV, as standard.
4. In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.5 to 0.8 N•m.
5. When attaching directly to a chassis, please use an M3.5 × 0.6 metric coarse screw thread, a spring washer, and a hexagonal nut.
6. For S1DX timer, use the retainer (Part No. ADX18012).

COIL DATA

DC coils

Coil voltage V DC	Pick-up voltage, V DC (max.) (at 20°C 68°F) (Initial)	Drop-out voltage, V DC (max.) (at 20°C 68°F) (Initial)	Nominal coil current, mA (±20%)	Coil resistance, Ω (at 20°C 68°F) (±20%)	Nominal operating power, W (±20%)	Max. allowable voltage, V DC (at 70°C 158°F)
12	9.6	1.2	75	160 (±10%)	0.9	13.2
24	19.2	2.4	37	650 (±10%)	0.9	26.4
48	38.4	4.8	18	2,600 (±15%)	0.9	52.8
100/110	80	11	9.1/10	11,000 (±15%)	1.1	121

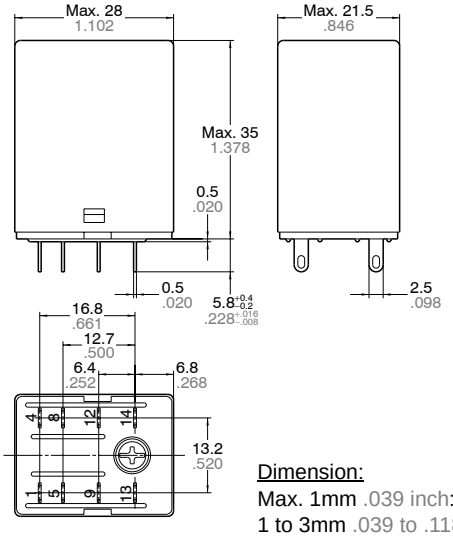
AC coils (50/60Hz)

Coil voltage V AC	Pick-up voltage, V AC (max.) (at 20°C 68°F) (Initial)	Drop-out voltage, V AC (max.) (at 20°C 68°F) (Initial)	Nominal coil current, mA (±20%)		Nominal operating power, V A (±20%)		Max. allowable voltage, V AC (at 70°C 158°F)
			50Hz	60Hz	50Hz	60Hz	
12	9.6	3.6	102.9	85.4	Approx. 1.2 to 1.5	Approx. 1.0 to 1.3	13.2
24	19.2	7.2	54.5	45.6			26.4
48	38.4	14.4	30.7	25.9			52.8
100/110	80	33	11.8/13.9	10.0/11.6			121
110/120	88	36	10.9/12.5	9.1/10.3			132
200/220	160	66	6.8/8.1	5.7/6.7			242
220/240	176	72	6.8/7.8	5.6/6.4			264

DIMENSIONS

mm inch

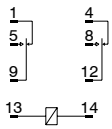
1. Plug-in type 2 Form C (including diode/CR)



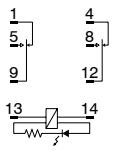
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

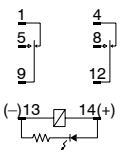
Standard type



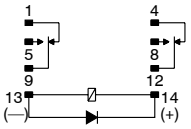
LED AC type



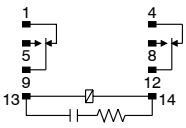
LED DC type



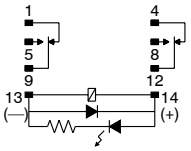
Diode DC type



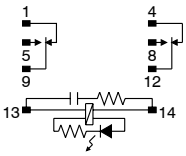
CR AC type



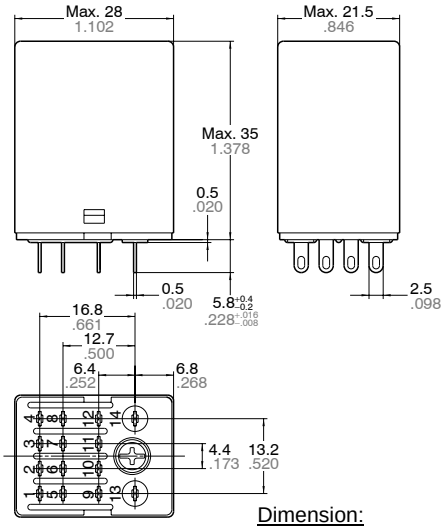
Diode/LED DC type



CR/LED AC type



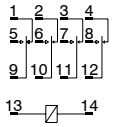
2. Plug-in type 4 Form C (including diode/CR)



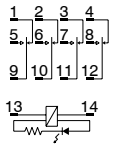
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

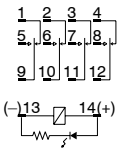
Standard type



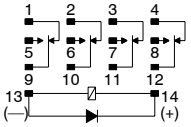
LED AC type



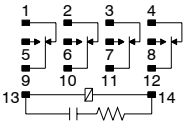
LED DC type



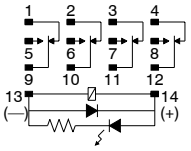
Diode DC type



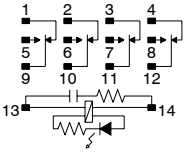
CR AC type



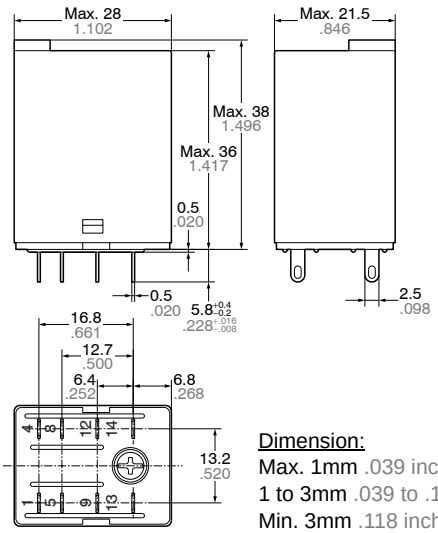
Diode/LED DC type



CR/LED AC type



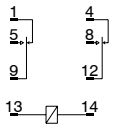
3. Plug-in type with test button 2 Form C



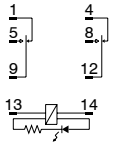
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

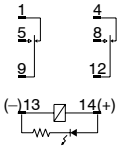
Standard type



LED AC type

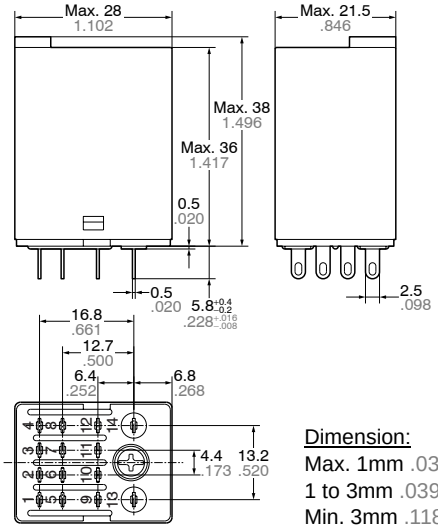


LED DC type

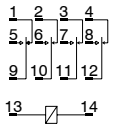


4. Plug-in type with test button 4 Form C

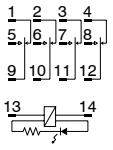
mm inch



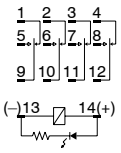
Schematic (Bottom view)
Standard type



LED AC type



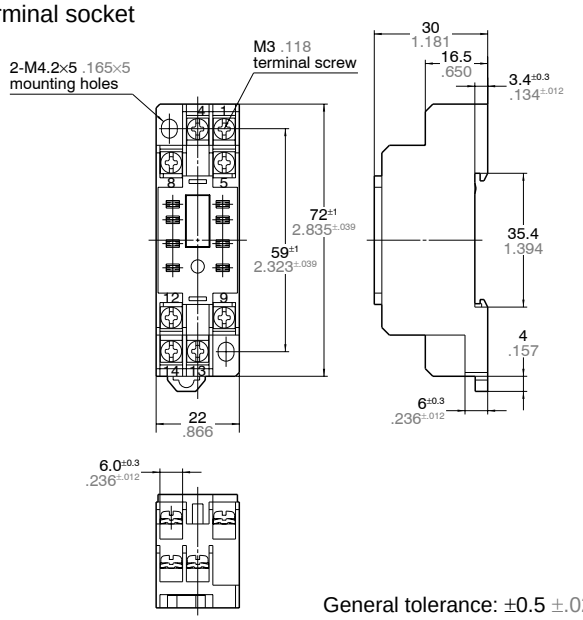
LED DC type



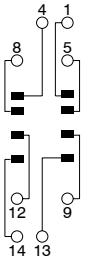
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

5. Terminal socket

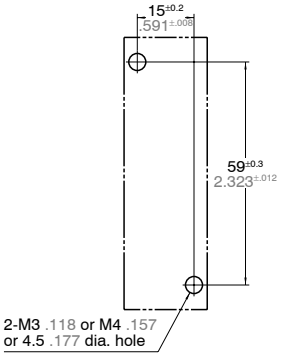
HJ2 terminal socket



Schematic (Bottom view)

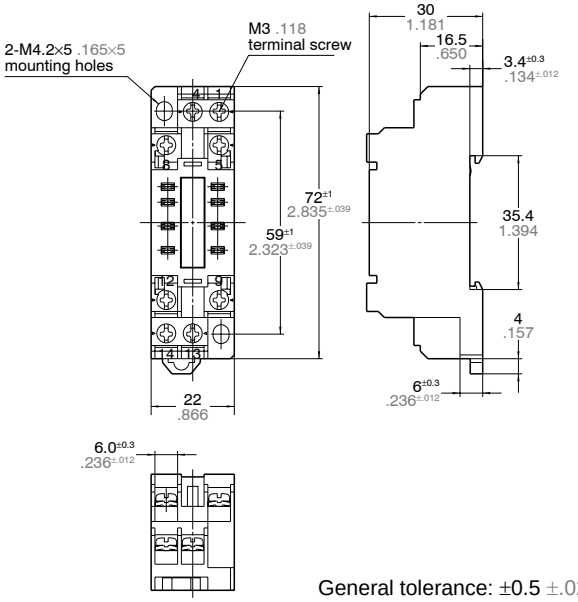


Mounting hole dimensions

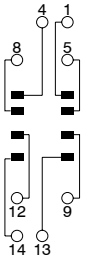


General tolerance: ±0.5 ±.020

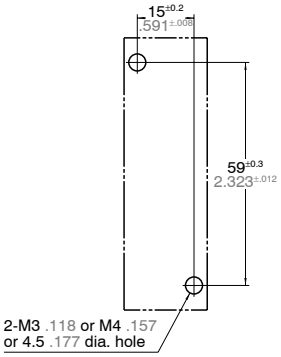
HJ2 terminal socket (Finger protect type)



Schematic (Bottom view)



Mounting hole dimensions

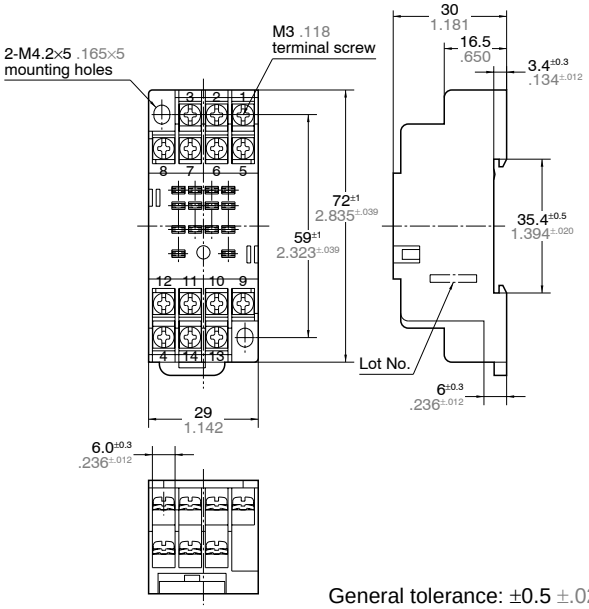


General tolerance: ±0.5 ±.020

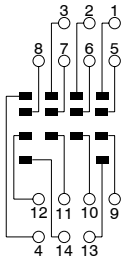
Note) Round type terminal is unable to attach.

HJ4 terminal socket

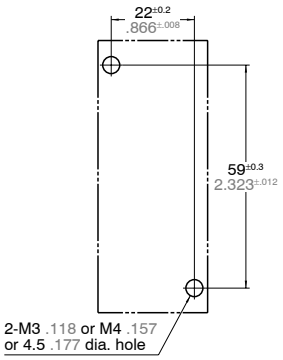
mm inch



Schematic (Bottom view)



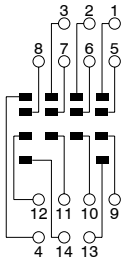
Mounting hole dimensions



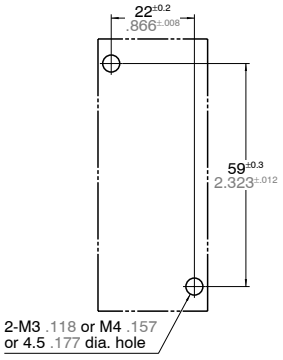
General tolerance: ±0.5 ±.020

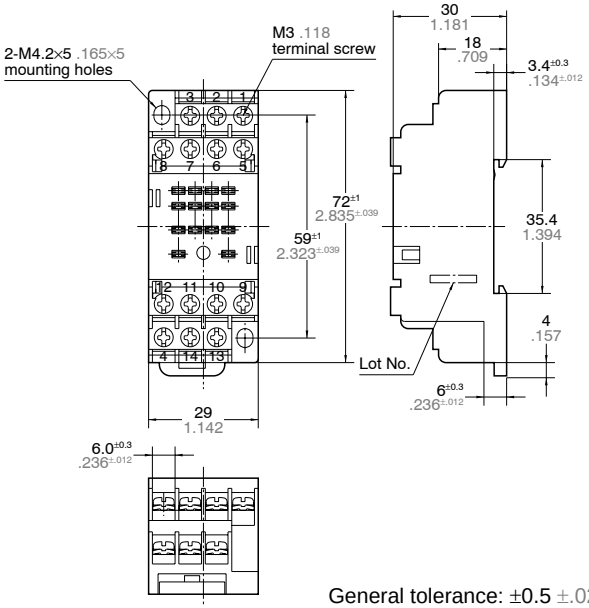
HJ4 terminal socket (Finger protect type)

Schematic (Bottom view)



Mounting hole dimensions



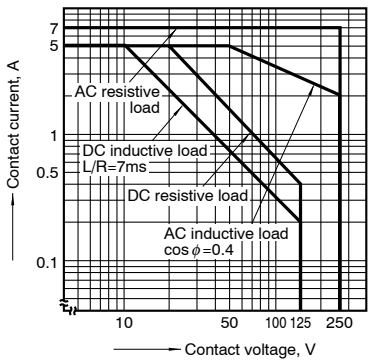


General tolerance: ±0.5 ±.020

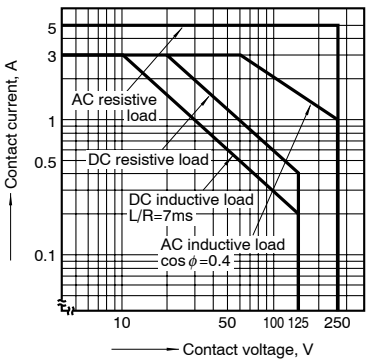
Note) Round type terminal is unable to attach.

REFERENCE DATA

1-(1). Max. switching capacity (2 Form C type)

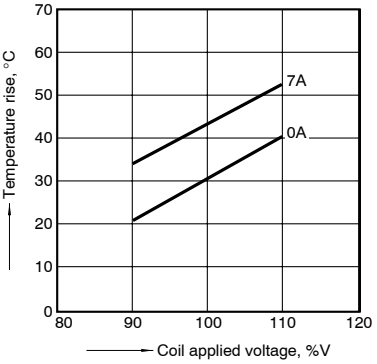


1-(2). Max. switching capacity (4 Form C type)

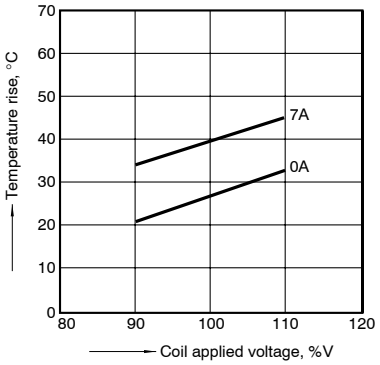


2-(1). Coil temperature rise (2 Form C/AC type)

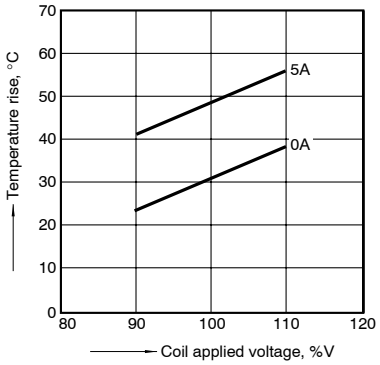
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



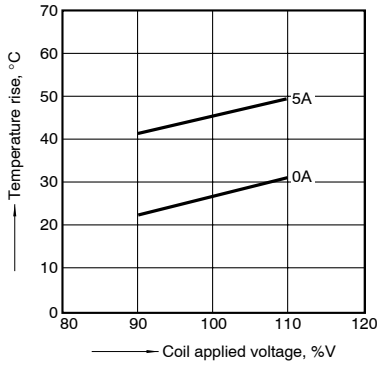
2-(2). Coil temperature rise (2 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



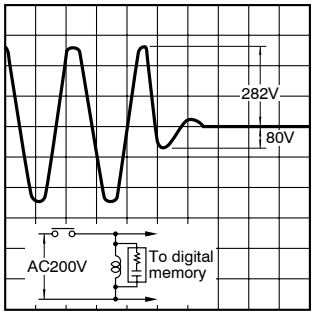
2-(3). Coil temperature rise (4 Form C/AC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



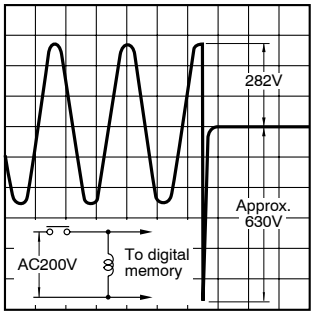
2-(4). Coil temperature rise (4 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



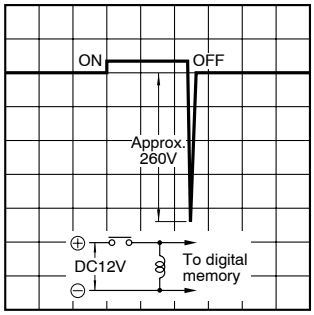
3-(1). AC coil surge voltage waveform (With CR)
Tested sample: HJ4-AC200V-R



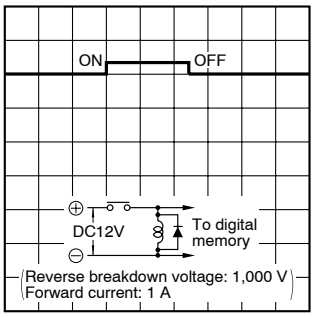
3-(2). AC coil surge voltage waveform (Without CR)
Tested sample: HJ4-AC200V



4-(1). DC coil surge voltage waveform (Without diode)



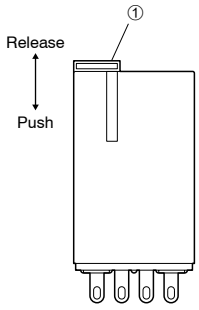
4-(2). DC coil surge voltage waveform (With diode)
Diode characteristics:
Reverse breakdown voltage: 1,000 V
Forward current: 1 A



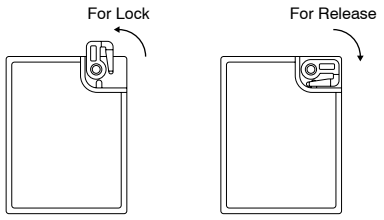
NOTES

1. Operation method for test button

1) Push and release ① gently to confirm relay switching.



2) To lock to one side turn 90° counter-clockwise while pushing lock and turn 90° clockwise to release.



2. Rating

Standard	File No.	Ratings	
		2 Form C	4 Form C
UL	E43149	7A 250 V AC 7A 30V DC	5A 250 V AC 5A 30V DC
TÜV	Std. type R 2024382	7A 250 V~ (cosϕ=1) 7A 30V⎓ (0ms)	5A 250 V~ (cosϕ=1) 5A 30V⎓ (0ms)
	Test button R 2-50006950		
	CR, Diode Au plating R 50006950		

(CSA: C-UL approved)

3. Diode characteristics

1) Reverse breakdown voltage: 1,000 V
2) Forward current: 1 A

4. Diode and CR built-in type

Since the diode and CR inside the relay coil are designed to absorb the counter emf, the element may be damaged if a large surge, etc., is applied to the diode and CR. If there is the possibility of a large surge voltage from the outside, please implement measures to absorb it.

Power

For Cautions for Use, see Relay Technical Information (page 392).

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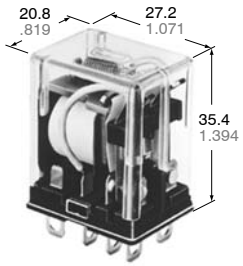
ideas for life

15A (1C), 10 A (2C) SPACE SAVING POWER RELAY

HL RELAYS



mm inch

FEATURES

- **High switching capacity in a compact size**

1 Form C (15 A 125 V AC), 2 Form C (10 A 250 V AC)

- **Rugged construction for tough applications**
- **Long life**

Mechanical: Min. 10^8 operations (DC),
Min. 5×10^7 operations (AC)
Electrical: Min. 5×10^5 operations

SPECIFICATIONS

Contacts

Arrangement			1 Form C	2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			50 mΩ	
Contact material			Silver alloy	
Rating (resistive)	Nominal switching capacity		15 A 125 V AC, 10 A 250 V AC	10 A 250 V AC
	Max. switching power		AC: 2,500 VA DC: 90 W	AC: 2,500 VA DC: 90 W
	Max. switching voltage		250 V AC 30 V DC	250 V AC 30 V DC
	Max. switching current		15 A	10 A
	Min. switching capacity#1		100 mA, 5 V DC	
Expected life	Mechanical (at 180 cpm)		5×10^7 (AC), 10^6 (DC)	
	Electrical (resistive)	15 A 125 V AC	5×10^5	—
		10 A 250 V AC	5×10^5	5×10^5
		3 A 30 V DC	5×10^5	5×10^5

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics (at 25°C 77°F, 50% Relative humidity)

Max. operating speed		20 cpm
Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between contact sets	1,500 Vrms for 1 min.
	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	2,000 Vrms for 1 min.
Operate time (at nominal voltage)		Max. 25 ms (DC type) Max. 25 ms (AC type)
Release time*3 (without diode) (at nominal voltage)		Max. 25 ms (DC type) Max. 25 ms (AC type)
Temperature rise, max. (at nominal voltage)		Max. 80°C
Shock resistance	Functional*4	Min. 196 m/s² {20 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	10 to 55 Hz at double amplitude of 1 mm
	Destructive	10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temperature	–50°C to +70°C –58°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 35 g 1.25 oz

TYPICAL APPLICATIONS

Power station control equipment, refrigerators, building control equipment, office machines, and medical equipment.

ORDERING INFORMATION

Ex. HL 2 — H — AC240V

Contact arrangement	Terminal arrangement	Coil voltage
1: 1 Form C 2: 2 Form C	H: Plug-in HP: PC board HTM: Top mounting L: Light emitting diode wired, plug-in PL: Light emitting diode wired, PC board	AC 6, 12, 24, 48, 120, 240 V DC 6, 12, 24, 48, 110 V

Note: Standard packing Carton: 20 pcs., Case: 200 pcs.
UL/CSA approved type is standard.

COIL DATA (at 20°C 68°F)

DC coils

Coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable voltage, V DC	Coil resistance, Ω (±10%)	Nominal coil current, mA	Operating power, W	
						Nominal	Minimum
6	4.8	0.6	6.6	40	150	0.90	0.58
12	9.6	1.2	13.2	160	75		
24	19.2	2.4	26.4	650	37		
48	38.4	4.8	52.8	2,600	18.5		
110	88.0	11.0	121.0	10,000	10	1.0	0.64

AC coils at 60 Hz

Coil voltage, V DC	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Max. allowable voltage, V AC	Nominal coil current, mA	Operating power, VA	
					Nominal	Minimum
6	4.8	1.8	6.6	200	1.20	0.77
12	9.6	3.6	13.2	100		
24	19.2	7.2	26.4	50		
48	38.4	14.4	52.8	25		
110/120	88	36	132	10.9/11.9		
220/240	176	72	264	6.0/6.5		

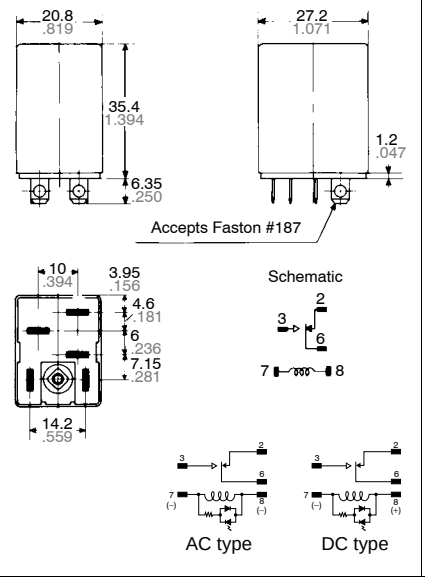
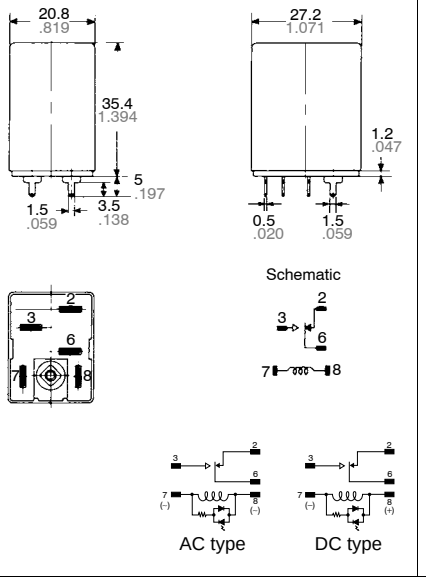
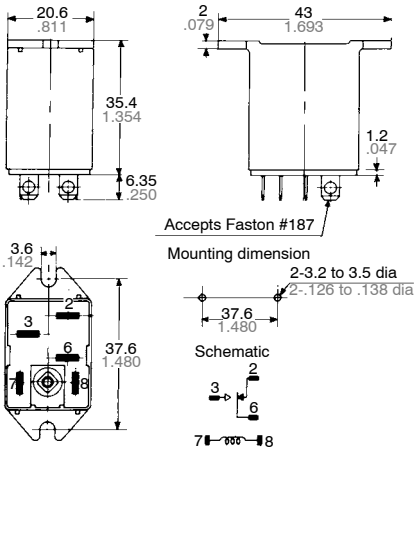
Notes:

1. The range of coil current is ±15% for AC (60 Hz), ±10% for DC, at 20°C.
2. The relay may be used in the range of 80% to 110% of the nominal coil voltage. However, it is recommended that the relay be used at 85% to 110% nominal voltage to take temporary voltage variations into consideration.
3. Each coil resistance of DC types is the measured value at a coil temperature of 20°C. Please allow a compensation of ±0.4% resistance for each coil temperature change of ±1°C.
4. All AC 240 V types are rated for double coil voltages, both AC 220 V and AC 240 V.
5. For use with 220 or 240 V DC, connect a resistor, as suggested below, in series with the 110 V DC relay.

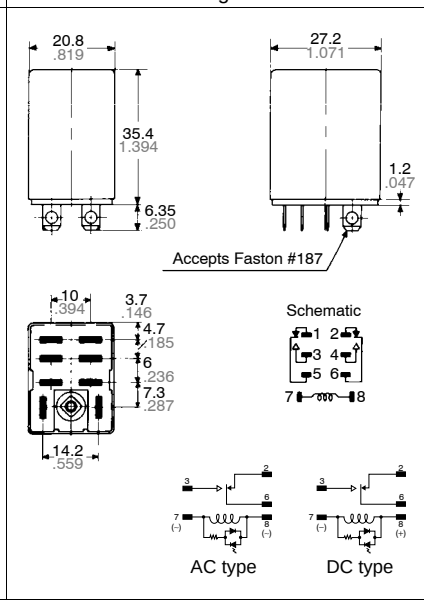
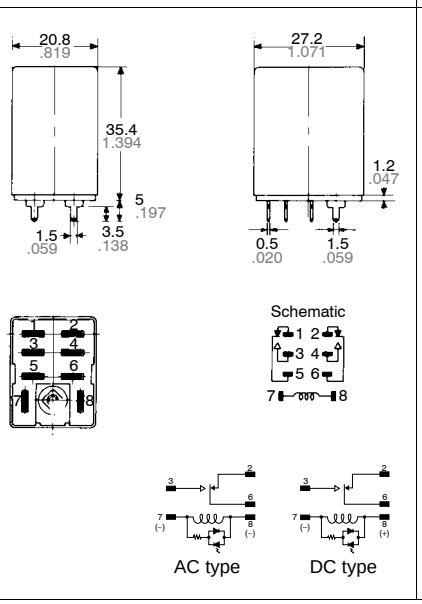
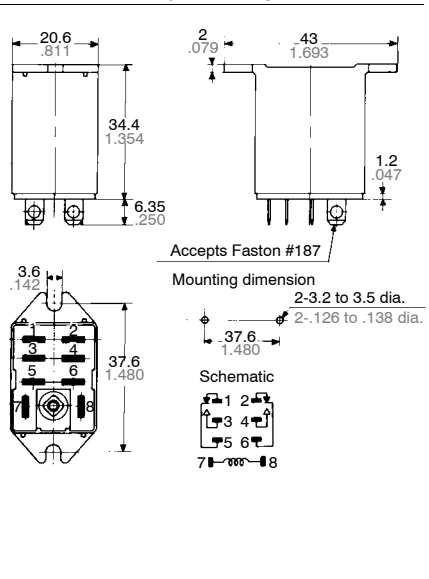
Voltage	1 Form C, 2 Form C
220 V DC 240 V DC	11 kW (5 W) 13 kW (5 W)

DIMENSIONS

mm inch

	Plug-in	PC board*1	Top mounting
HL1 (1 Form C)			

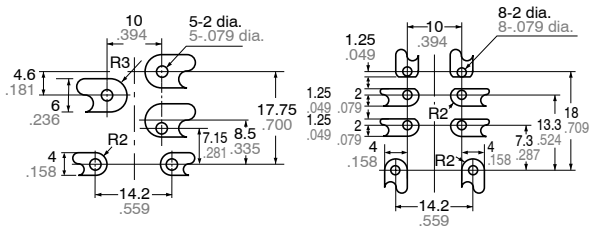
mm inch

	Plug-in	PC board*1	Top mounting
HL2 (2 Form C)			

Tolerance: ±0.5 ±.020

*1 PC board pattern

Copper-side view



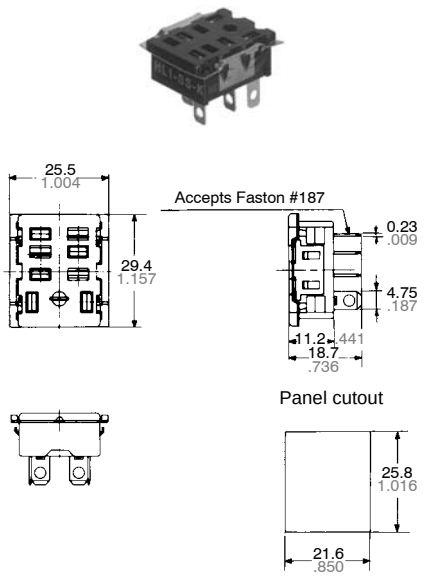
(HL1) (HL2)

Tolerance: ±0.1 ±.004

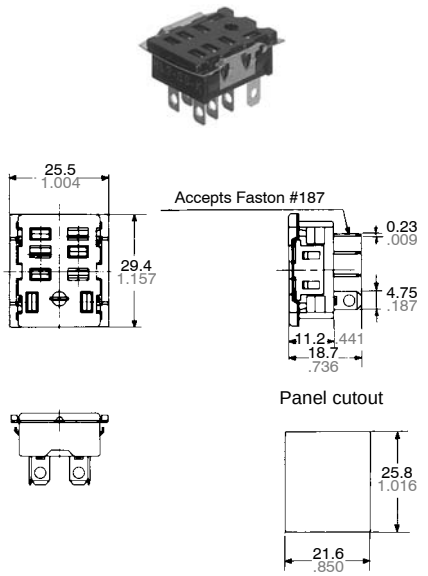
ACCESSORIES

mm inch

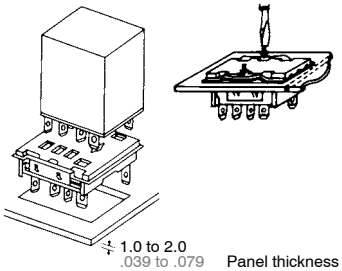
HL1-SS-K (with hold-down clip)



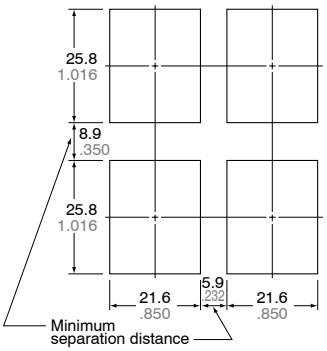
HL2-SS-K (with hold-down clip)



Plug-in terminal socket mount
Simply insert socket into panel hole and push down as indicated to lock socket in place.



Panel cutout for tandem mounting

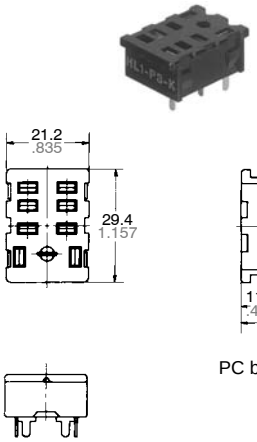


Tolerance: ±0.1 ±.004

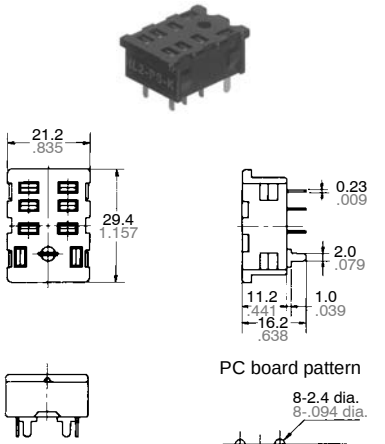
2. PC board terminal socket

mm inch

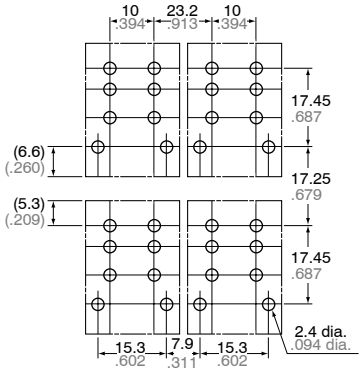
HL1-PS-K



HL2-PS-K



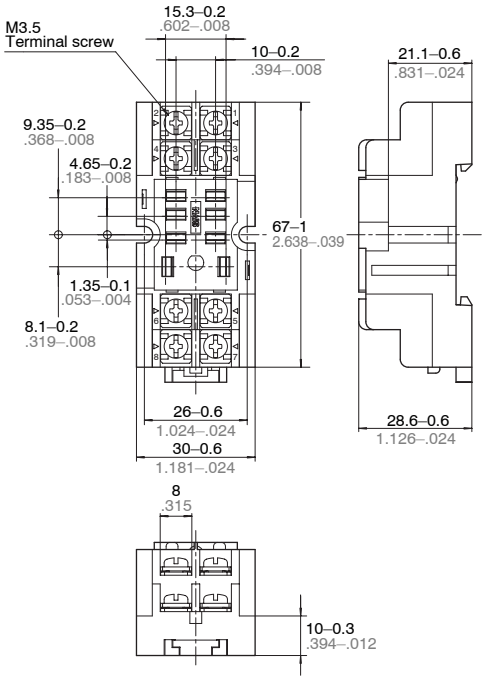
Layout for tandem mounting
(2 Form C)



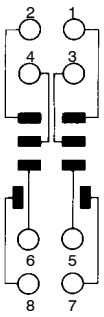
Tolerance: ±0.1 ±.004

3. Screw terminal socket for DIN rail assembly

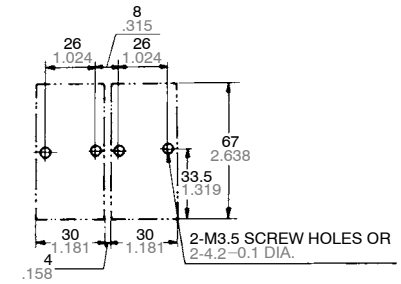
HL2-SFD-K (with hold-down clip)



Schematic



Layout for tandem mounting



Minimum separation in tandem mounting

Tolerance: ±0.1 ±.004

(Remark) Max. continuous current of all HL sockets is 10 A.

For Cautions for Use, see Relay Technical Information (page 392).

VDE 2c, 3c

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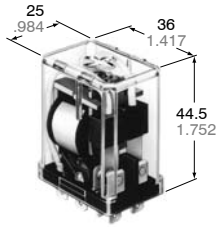
10 AMP POWER RELAY

HP RELAYS



mm inch

FEATURES

- **Interchangeable with existing models**
- **Long life and high reliability**
- **High contact capacity up to 10 A 250 V AC**
- **Available with plug-in/solder and quick-connect terminals**

SPECIFICATIONS (at 20°C 68°F)

Contacts

Arrangement		2 Form C	3 Form C	4 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		15 mΩ		
Contact material		Silver		Silver alloy
Rating	Nominal switching capacity	10 A 250 V AC (resistive)		
	Min. switching capacity#1	100 mA, 5 V DC		

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "initial breakdown voltage" section
*2 Detection current; 10 mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics (at 60 Hz, 20°C 68°F)

		2 Form C	3 Form C	4 Form C
Maximum operating speed		20 cpm		
Initial insulation resistance*1		more than 100 MΩ at 500 V DC		
Breakdown voltage*2	Between open contacts	1,000 Vrms	2,000 Vrms	1,000 Vrms
	Between contact sets	1,500 Vrms	2,000 Vrms	1,500 Vrms
	Between contact and coil	1,500 Vrms	2,000 Vrms	1,500 Vrms
Operate time*3 (at nominal voltage)		Max. 25 ms	Max. 30 ms	
Release time (without diode)*3 (at nominal voltage)		Max. 25 ms	Max. 30 ms	
Temperature rise		Max. 65°C		
Shock resistance	Functional*4	98 m/s² {10 G}		
	Destructive*5	980 m/s² {100 G}		
Vibration resistance	Functional*6	10 to 55 Hz at 1 mm double amplitude		
	Destructive	10 to 55 Hz at 2 mm double amplitude		
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–50°C to +40°C –58°F to +104°F		
	Humidity	5 to 85% R.H.		
Unit weight		Approx. 60g 2.12 oz	Approx. 100g 3.53 oz	Approx. 125g 4.41 oz

LIFE DATA

Contact rating and expected life For AC load type

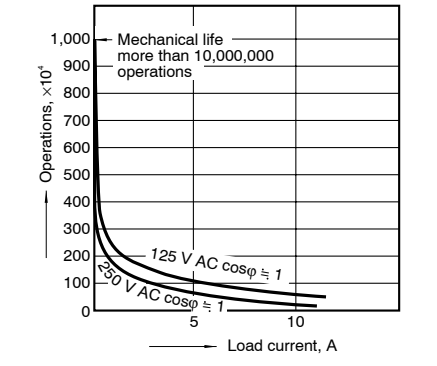
	Voltage	125 V AC		250 V AC		Expected life (min. operations)
	Load	Resistive (cos φ ≅ 1)	Inductive (cos φ ≅ 0.4)	Resistive (cos φ ≅ 1)	Inductive (cos φ ≅ 0.4)	
Electrical life	Current	—	—	10 A	7.5 A	2×10^5
		10 A	7.5 A	7.5 A	5 A	5×10^5
		5 A	3 A	3 A	2 A	1×10^6
		1A	0.7 A	0.6 A	0.4 A	2×10^6
Mechanical life						1×10^7

Note: When the electromagnet or exciting coil (Solenoid, etc.) is the load, the value of motor or lamp load is applicable.

Contact rating and expected life For DC load type

	Voltage	24 V DC		125 V DC		Expected life (min. operations)
	Load	Resistive (cos φ ≅ 1)	Inductive (cos φ ≅ 0.4)	Resistive (cosφ ≅ 1)	Inductive (cos φ ≅ 0.4)	
Electrical life	Current	—	7 A	—	—	2×10^5
		7.5 A	5 A	0.5 A	0.4 A	5×10^5
		5 A	3 A	0.3 A	0.2 A	1×10^6
		1A	0.6 A	0.1 A	0.06 A	2×10^6
Mechanical life						1×10^7

Life curve



Notes:
1. For DC inductive loads, use an arc suppressing circuit.
2. When used under a DC load operating at high repetition rate with considerable arcing, corrosion of the contacts and/or the contact blades is likely to occur. When using the relay under conditions of high temperature, humidity or high repetition rate, it is suggested that the relay cover be removed to facilitate extended operation.

TYPICAL APPLICATIONS

HP relays enjoy wide use in various applications, particularly in automation controls and remote controls.
Applications include:
Industrial machinery
Machine tool
Food processing packing machines
Office equipment
Coin operate devices
Home appliances
Transportation
Communication and measuring devices
Amusement devices

ORDERING INFORMATION

Ex. HP [3] — [M] — [AC240V]

Contact arrangement	Terminal	Coil voltage
2: 2 Form C 3: 3 Form C 4: 4 Form C	Nil: Standard plug-in terminal M: Direct mounting (3 Form C only) TM: Top mounting (2 Form C only) L: Lamp wired, standard plug-in terminal	AC 6, 12, 24, 48, 115, 220, 240 V DC 6, 12, 24, 48, 110 V

(Notes) 1. For UL/CSA or VDE recognized types, add suffix UL/CSA or VDE (HP2-TM type VDE application under way)
2. Standard packing Carton: 50 pcs. Case: 200 pcs.
3. UL/CSA approved type is standard.

TYPES AND COIL DATA

1. Standard plug-in terminal type (without lamp wired)

DC TYPES at 20°C 68°F

Type	Part No.	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable voltage, V DC	Coil resistance, Ω (±10%)	Nominal coil current, mA	Nominal operating power, W
2 Form C	HP2-DC6V	6	4.8	0.9	6.6	25	240	1.5
	HP2-DC12V	12	9.6	1.8	13.2	110	109	1.3
	HP2-DC24V	24	19.2	3.6	26.4	440	54.5	1.3
	HP2-DC48V	48	38.4	7.2	52.8	1,800	26.7	1.3
	HP2-DC110V	110	88	16.5	121	7,300	15.0	1.7
3 Form C	HP3-DC6V	6	4.8	0.9	6.6	24	250	1.5
	HP3-DC12V	12	9.6	1.8	13.2	100	120	1.4
	HP3-DC24V	24	19.2	3.6	26.4	400	60	1.4
	HP3-DC48V	48	38.4	7.2	52.8	1,560	31	1.5
	HP3-DC110V	110	88	16.5	121	7,450	14.9	1.6
4 Form C	HP4-DC6V	6	4.8	0.9	6.6	22	273	1.6
	HP4-DC12V	12	9.6	1.8	13.2	95	127	1.5
	HP4-DC24V	24	19.2	3.6	26.4	380	63	1.5
	HP4-DC48V	48	38.4	7.2	52.8	1,500	32	1.5
	HP4-DC110V	110	88	16.5	121	7,000	15.7	1.7

AC TYPE (50/60 Hz) at 60 Hz, 20°C 68°F

Type	Part No.	Nominal coil voltage, V AC	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Max. allowable voltage, V AC	Inductance, H	Nominal coil current, mA	Nominal operating power, VA
2 Form C	HP2-AC6V	6	4.8	1.8	6.6	0.049	310	1.9
	HP2-AC12V	12	9.6	3.6	13.2	0.190	160	1.9
	HP2-AC24V	24	19.2	7.2	26.4	0.776	78	1.9
	HP2-AC48V	48	38.4	14.4	52.8	3.106	39	1.9
	HP2-AC115V	115	92	34.5	126.5	15.83	18	2.1
	HP2-AC220V	220	176	66	242	57.90	9.5	2.1
	HP2-AC240V	240	192	72	264	66.26	9.0	2.2
3 Form C	HP3-AC6V	6	4.8	1.8	6.6	0.030	520	3.1
	HP3-AC12V	12	9.6	3.6	13.2	0.119	260	3.1
	HP3-AC24V	24	19.2	7.2	26.4	0.475	130	3.1
	HP3-AC48V	48	38.4	14.4	52.8	1.899	65	3.1
	HP3-AC115V	115	92	34.5	126.5	10.36	28.5	3.3
	HP3-AC220V	220	176	66	242	39.32	14.2	3.1
	HP3-AC240V	240	192	72	264	44.05	13.9	3.3
4 Form C	HP4-AC6V	6	4.8	1.8	6.6	0.019	800	4.8
	HP4-AC12V	12	9.6	3.6	13.2	0.077	400	4.8
	HP4-AC24V	24	19.2	7.2	26.4	0.309	200	4.8
	HP4-AC48V	48	38.4	14.4	52.8	1.292	95	4.6
	HP4-AC115V	115	92	34.5	126.5	6.953	42	4.8
	HP4-AC220V	220	176	66	242	26.57	21	4.6
	HP4-AC240V	240	192	72	264	29.75	20.5	4.9

NOTES

1. The range of coil current for AC relays is ±15% (60 Hz). For DC relays it is ±10% at 20°C, 68°F.
2. The HP relay will operate in a range from 80% to 110% of the nominal coil voltage. It is, however, recommended that the relay be used in the range of 85% to 110% of the nominal coil voltage, with the temporary voltage variation taken into consideration.
3. When the operating voltage of AC relays drops below 80% of the nominal coil voltage, the relay will generate a considerable amount of heat which is not recommended for maximum efficiency.
4. The coil resistance of DC types is the measured value of the coil at a temperature of 20°C 68°F. If the coil temperature changes by ±1°C, the measured value of the coil resistance should be increased or decreased by 0.4%.
5. For applications from 220 V to 240 V DC, connect a resistor in series with the relay coil. See chart for resistor values.

Voltage	2 Form C	3 Form C	4 Form C
220 V DC	7.3 kΩ (5 W)	7.45 kΩ (5 W)	7 kΩ (5 W)
240 V DC	8.7 kΩ (5 W)	8.8 kΩ (5 W)	8.3 kΩ (5 W)

2. Standard plug-in terminal type (with lamp wired)

DC TYPES at 20°C 68°F

Type		Part No.	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable voltage, V DC	Coil resistance, Ω (±10%)	Nominal coil current, mA	Nominal operating power, W
2 Form C	LED	HP2-L-DC6V	6	4.8	0.9	6.6	25	240	1.5
		HP2-L-DC12V	12	9.6	1.8	13.2	110	109	1.3
		HP2-L-DC24V	24	19.2	3.6	26.4	440	54.5	1.3
		HP2-L-DC48V	48	38.4	7.2	52.8	1,800	26.7	1.3
	Neon lamp	HP2-L-DC110V	110	88	16.5	121	7,300	15.0	1.7
3 Form C	LED	HP3-L-DC6V	6	4.8	0.9	6.6	24	250	1.5
		HP3-L-DC12V	12	9.6	1.8	13.2	100	120	1.4
		HP3-L-DC24V	24	19.2	3.6	26.4	400	60	1.4
		HP3-L-DC48V	48	38.4	7.2	52.8	1,560	31	1.5
	Neon lamp	HP3-L-DC110V	110	88	16.5	121	7,450	14.9	1.6
4 Form C	LED	HP4-L-DC6V	6	4.8	0.9	6.6	22	273	1.6
		HP4-L-DC12V	12	9.6	1.8	13.2	95	127	1.5
		HP4-L-DC24V	24	19.2	3.6	26.4	380	63	1.5
		HP4-L-DC48V	48	38.4	7.2	52.8	1,500	32	1.5
	Neon lamp	HP4-L-DC110V	110	88	16.5	121	7,000	15.7	1.7

AC TYPE (50/60 Hz) at 60 Hz, 20°C 68°F

Type		Part No.	Nominal coil voltage, V AC	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Max. allowable voltage, V AC	Inductance, H	Nominal coil current, mA	Nominal operating power, VA
2 Form C	LED	HP2-L-AC6V	6	4.8	1.8	6.6	0.049	310	1.9
		HP2-L-AC12V	12	9.6	3.6	13.2	0.190	160	1.9
		HP2-L-AC24V	24	19.2	7.2	26.4	0.776	78	1.9
	Neon lamp	HP2-L-AC115V	115	92	34.5	126.5	15.83	18	2.1
		HP2-L-AC220V	220	176	66	242	57.90	9.5	2.1
		HP2-L-AC240V	240	192	72	264	66.26	9.0	2.2
3 Form C	LED	HP3-L-AC6V	6	4.8	1.8	6.6	0.030	520	3.1
		HP3-L-AC12V	12	9.6	3.6	13.2	0.119	260	3.1
		HP3-L-AC24V	24	19.2	7.2	26.4	0.475	130	3.1
	Neon lamp	HP3-L-AC115V	115	92	34.5	126.5	10.36	28.5	3.3
		HP3-L-AC220V	220	176	66	242	39.32	14.2	3.1
		HP3-L-AC240V	240	192	72	264	44.05	13.9	3.3
4 Form C	LED	HP4-L-AC6V	6	4.8	1.8	6.6	0.019	800	4.8
		HP4-L-AC12V	12	9.6	3.6	13.2	0.077	400	4.8
		HP4-L-AC24V	24	19.2	7.2	26.4	0.309	200	4.8
	Neon lamp	HP4-L-AC115V	115	92	34.5	126.5	6.953	42	4.8
		HP4-L-AC220V	220	176	66	242	26.57	21	4.6
		HP4-L-AC240V	240	192	72	264	29.75	20.5	4.9

3. Top Mounting (TM) and direct mounting (M) type

DC TYPES at 20°C 68°F

Type	Part No.	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable voltage, V DC	Coil resistance, Ω (±10%)	Nominal coil current, mA	Nominal operating power, W
2 Form C Top Mounting Type (TM)	HP2-TM-DC6V	6	4.8	0.9	6.6	25	240	1.5
	HP2-TM-DC12V	12	9.6	1.8	13.2	110	109	1.3
	HP2-TM-DC24V	24	19.2	3.6	26.4	440	54.5	1.3
	HP2-TM-DC48V	48	38.4	7.2	52.8	1,800	26.7	1.3
	HP2-TM-DC110V	110	88	16.5	121	7,300	15.0	1.7
3 Form C Direct Mounting Type (TM)	HP3-M-DC6V	6	4.8	0.9	6.6	24	250	1.5
	HP3-M-DC12V	12	9.6	1.8	13.2	100	120	1.4
	HP3-M-DC24V	24	19.2	3.6	26.4	400	60	1.4
	HP3-M-DC48V	48	38.4	7.2	52.8	1,560	31	1.5
	HP3-M-DC110V	110	88	16.5	121	7,450	14.9	1.6

AC TYPE (50/60 Hz) at 60 Hz, 20°C 68°F

Type	Part No.	Nominal coil voltage, V AC	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Max. allowable voltage, V AC	Inductance, H	Nominal coil current, mA	Nominal operating power, VA
2 Form C Top Mounting Type (TM)	HP2-TM-AC6V	6	4.8	1.8	6.6	0.049	310	1.9
	HP2-TM-AC12V	12	9.6	3.6	13.2	0.190	160	1.9
	HP2-TM-AC24V	24	19.2	7.2	26.4	0.776	78	1.9
	HP2-TM-AC48V	48	38.4	14.4	52.8	3.106	39	1.9
	HP2-TM-AC115V	115	92	34.5	126.5	15.83	18	2.1
	HP2-TM-AC220V	220	176	66	242	57.90	9.5	2.1
	HP2-TM-AC240V	240	192	72	264	66.26	9.0	2.2
3 Form C Direct Mounting Type (M)	HP3-M-AC6V	6	4.8	1.8	6.6	0.030	520	3.1
	HP3-M-AC12V	12	9.6	3.6	13.2	0.119	260	3.1
	HP3-M-AC24V	24	19.2	7.2	26.4	0.475	130	3.1
	HP3-M-AC48V	48	38.4	14.4	52.8	1.899	65	3.1
	HP3-M-AC115V	115	92	34.5	126.5	10.36	28.5	3.3
	HP3-M-AC220V	220	176	66	242	39.32	14.2	3.1
	HP3-M-AC240V	240	192	72	264	44.05	13.9	3.3

4. Direct mounting (with lamp wired) type

DC TYPES

Type	Part No.	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable voltage, V DC	Coil resistance, Ω (±10%)	Nominal coil current, mA	Nominal operating power, W
3 Form C Neon lamp	HP3-ML-DC110V	110	88	16.5	121	7,450	14.9	1.6

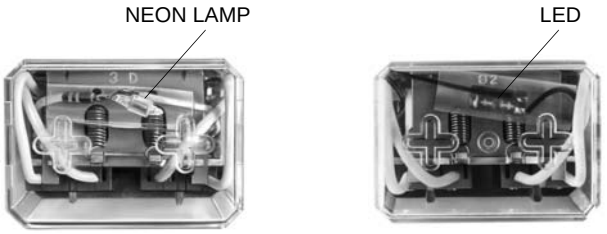
AC TYPE (50/60 Hz) at 60 Hz, 20°C 68°F

Type	Part No.	Nominal coil voltage, V AC	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Max. allowable voltage, V AC	Inductance, H	Nominal coil current, mA	Nominal operating power, VA
3 Form C Neon lamp	HP3-ML-AC115V	115 V	92	34.5	126.5	10.36	28.5	3.3
	HP3-ML-AC220V	220 V	176	66	242	39.32	14.2	3.1
	HP3-ML-AC240V	240 V	192	72	264	44.05	13.9	3.3

LAMP-WIRED RELAYS

Specifications

Life of neon lamp....continuous: more than 25,000 hours (more than 3 years)
on/off = 1: more than 6 years
Life of LED .....continuous: more than 50,000 hours (more than 5.5 years)
on/off = 1: more than 100,000 hours (more than 11 years)

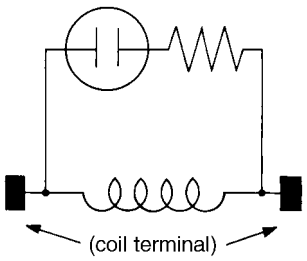
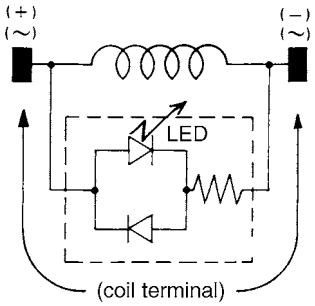


Variation

Type	Coil Voltage		
	AC	DC	
HP2-L HP3-L HP3-ML HP4-L	6 V	6 V	LED (Light emitting diode)
	12 V	12 V	
	24 V	24 V	
	—	48 V	
	115 V	110 V	Neon lamp
	220 V	—	
	240 V	—	

Notes:
1. AC 48 V type is not available for lamp wiring.

Circuit diagrams

Neon lamp type	LED type
	

Terminal No. (DC type)

Polarity \ Type	HP2-L	HP3-L HP3-ML	HP4-L
(+)	7	10	10
(–)	2	2	1

Notes:
1. Pay attention to the polarity of coil See circuit diagram (LED type only).

Operating current of LED

Coil Voltage	Operating current of LED
DC 6V	DC 6.4 mA
DC 12V	DC 5.7 mA
DC 24V	DC 4.7 mA
DC 48V	DC 4.5 mA
AC 6V	AC 10.5 mA
AC 12V	AC 9.0 mA
AC 24V	AC 7.7 mA

Notes:
1. Operating current of relays should be increased by the value of LED operating current. Please refer the table. Operating current of neon lamp is approx. 0.3 mA to 0.4 mA.
2. To use the HP relay in the inductive load circuit, the contact protection circuit is recommended.

ACCESSORIES

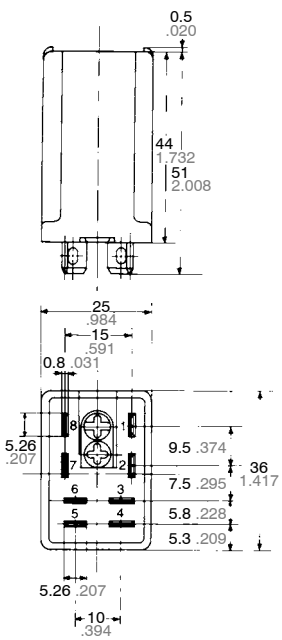
Please refer to “MOUNTING METHODS” for further information.
UL, CSA recognized except BRACKET and INSERTING PLATE.

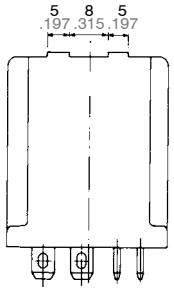
HP	Relay	Solder terminal socket for rectangular hold boring (with hold-down clip)	Screw terminal socket for DIN rail assembly (with hold-down clip)	For HP2, HP4
HP2		HP2-SRS  (UL, CSA, VDE)	HP2-SFD  (UL, CSA)	HP-BRACKET for direct mounting 
HP3		HP3-SRS  (UL, CSA, VDE)	HP3-SFD  (UL, CSA)	HP INSERTION PLATE for P/C board mounting 
HP4		HP4-SRS  (UL, CSA)	HP4-SFD  (UL, CSA)	

DIMENSIONS AND WIRING DIAGRAM

mm inch

HP2 (2 Form C) Plug-in terminal types





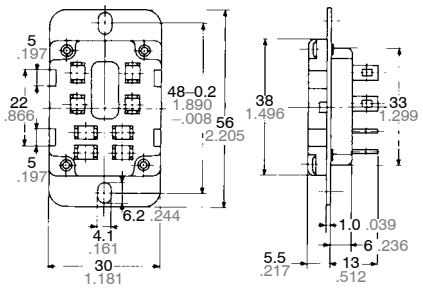
Circuit diagram

Accepts
Faston 205

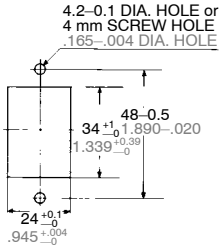
Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

HP2-SRS (with hold-down clip)

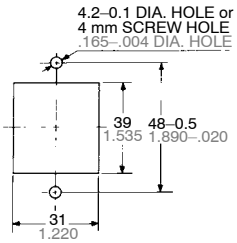
Optimum space-saving panel cut-out.
Can be mounted from either the front or the rear of the panel.



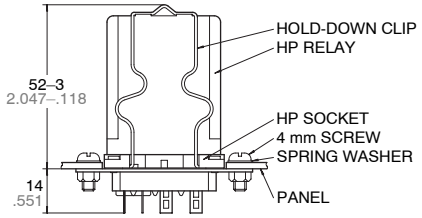
Front surface-mounting

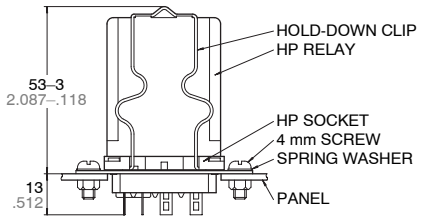


Rear surface-mounting



mm inch

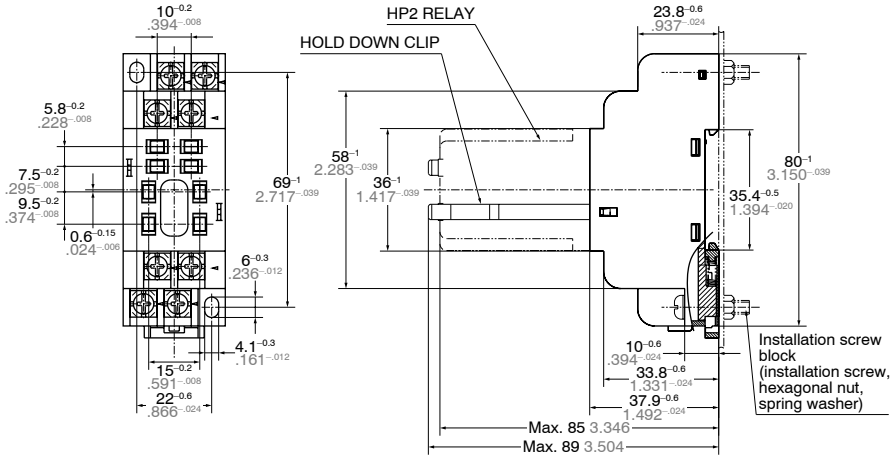




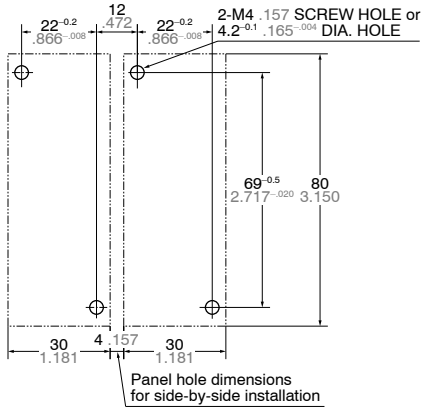
Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

HP2-SFD (with hold-down clip)

Front wiring in restricted space



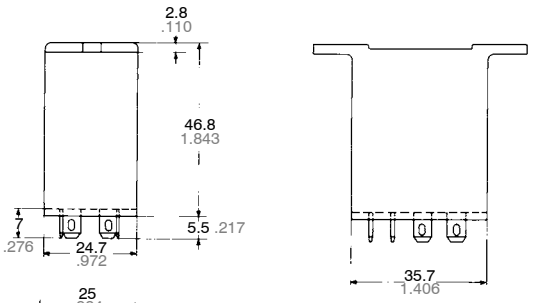
Mounting dimensions



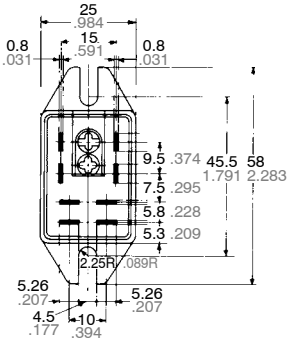
Note: Hold down clip and installation screw block are included in package.

Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

HP2-TM (2 Form C) Top mounting types

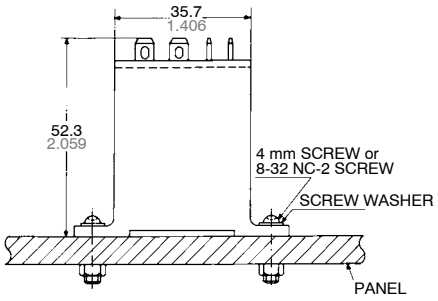


Circuit diagram

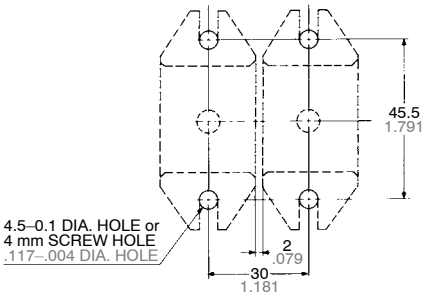


Accepts Faston 205

Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

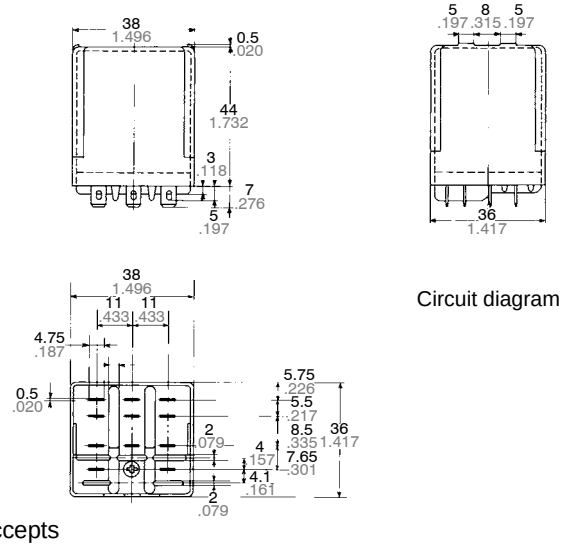


Mounting dimensions



HP3 (3 Form C) Plug-in terminal types

mm inch



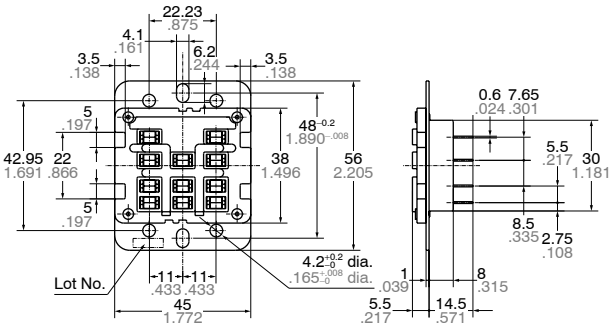
Circuit diagram

Accepts
Faston 187

Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

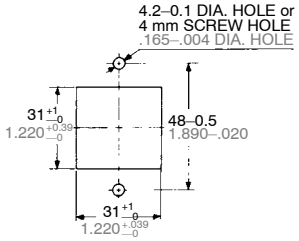
HP3-SRS (with hold-down clip)

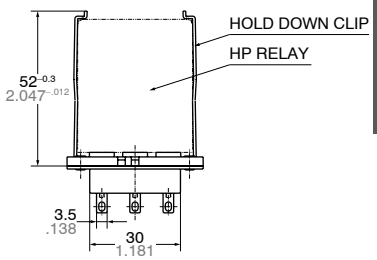
Optimum space-saving panel cut-out.
Can be mounted from either the front or the rear of the panel.



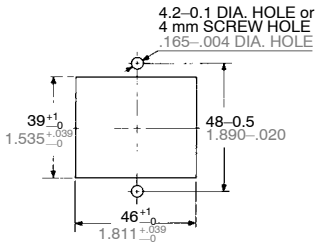
Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

Front surface-mounting



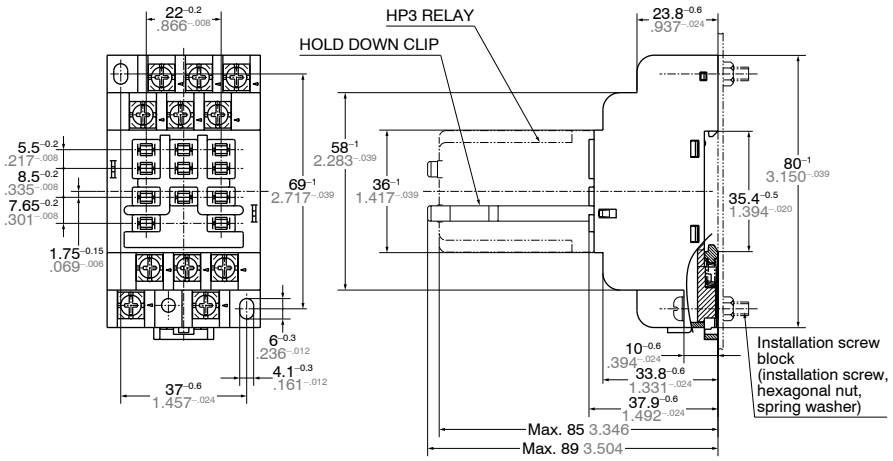


Rear surface-mounting



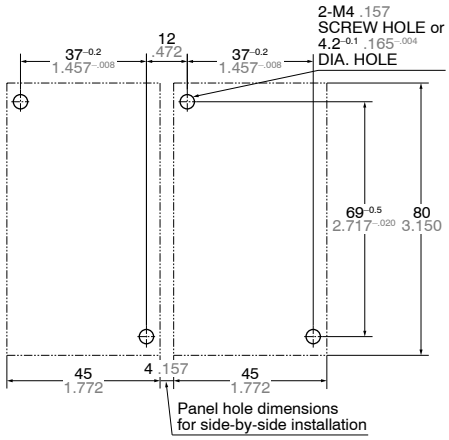
HP3-SFD (with hold-down clip)

Front wiring in restricted space



Note: Hold down clip and installation screw block are included in package.

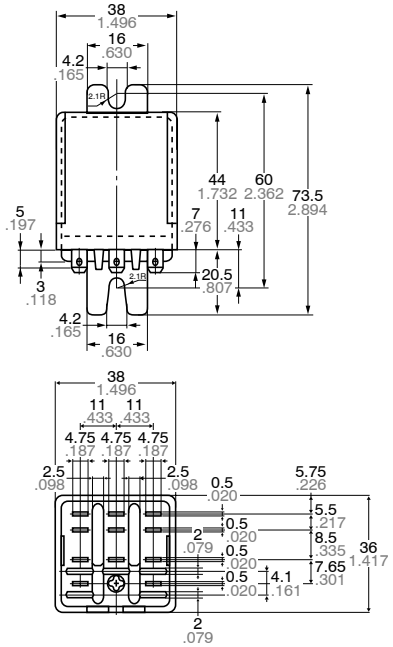
Mounting dimensions

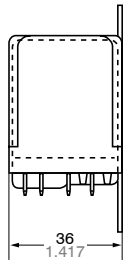


Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

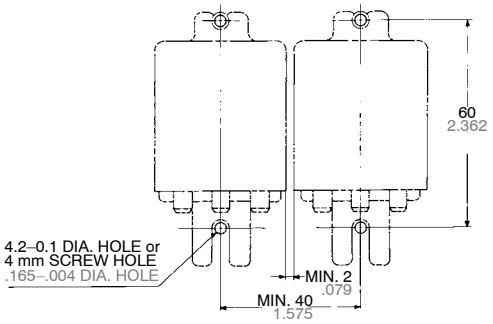
HP3-M (3 Form C) Direct mounting types

mm inch

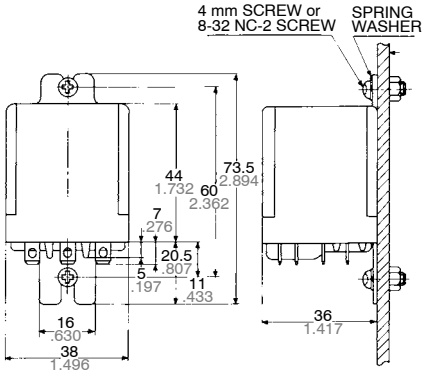




Mounting dimension



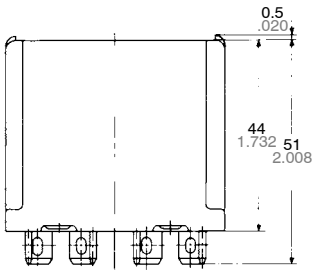
Circuit diagram

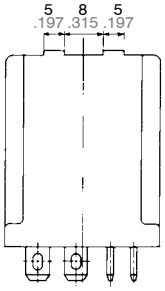


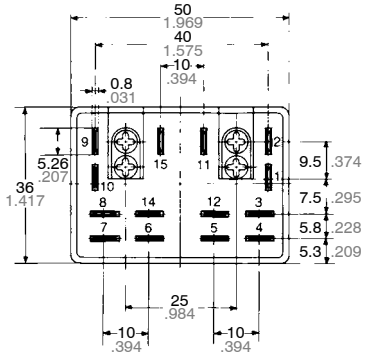
Accepts
Faston 187

Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

HP4 (4 Form C) Plug-in terminal types







Circuit diagram

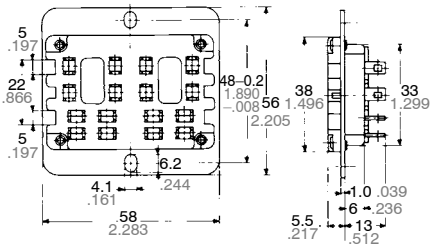
Accepts
Faston 187

Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

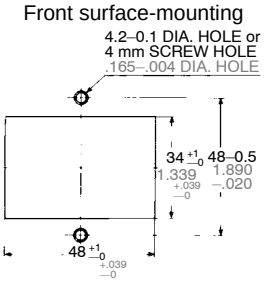
HP4-SRS (with hold-down clip)

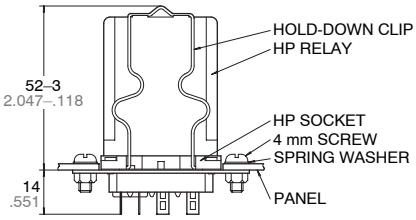
mm inch

Optimum space-saving panel cut-out.
Can be mounted from either the front or the rear of the panel.

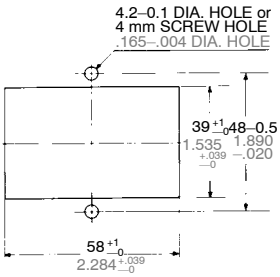


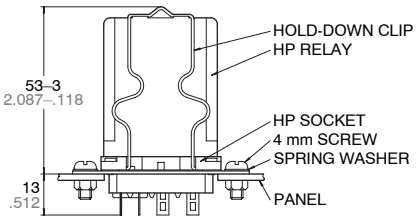
Front surface-mounting





Rear surface-mounting

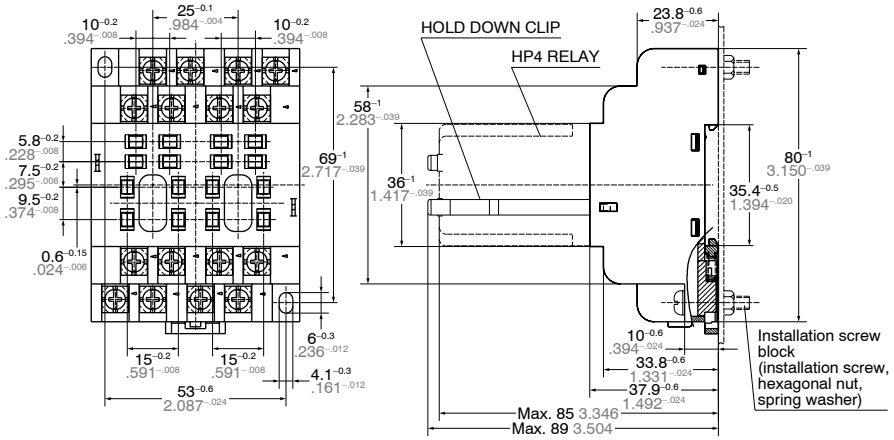




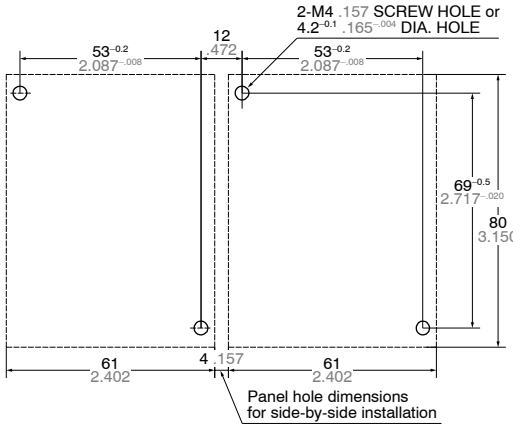
Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

HP4-SFD (with hold-down clip)

Front wiring in restricted space.
Two HP2 relays can be mounted in one socket.



Mounting dimensions



Note: Hold down clip and installation screw block are included in package.

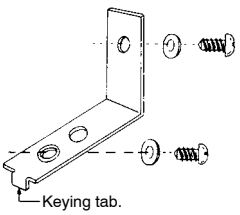
Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

ACCESSORIES for HP2 and HP4 types

HP Bracket (with 2 screws, 2 washers)
The HP Bracket is used for mounting HP2 relays and HP4 relays directly to the panel. It facilitates soldering or quick connections with Faston 205 tab 0.8 mm .031 inch.

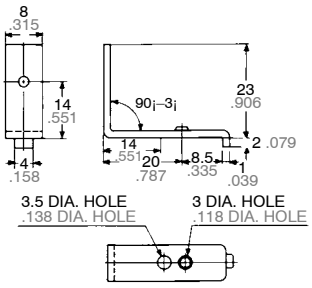
Notes:
1. This bracket is unavailable for UL, CSA and VDE applications.
2. When using the special bracket, it is recommended to use the screws and washers called out in the chart in the next page in order to eliminate any possible damage to the relay coil.

Mounting methods
(a) Remove the M3 × 7 screw (red colored) fixed to the relay, and place the bracket on the relay with the attaching M3 × 7 screw (blue colored) and the spring washer.



(b) Use the additional M3 × 7 screw and washer for attaching the bracket to the panel.

For the HP4 type relay two brackets are used



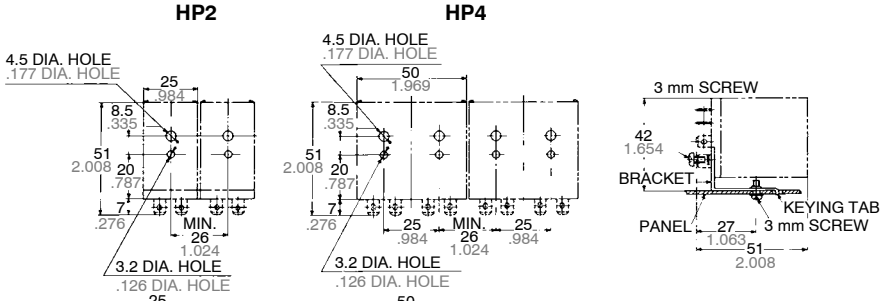
Thickness of a special bracket	1.0 mm (.039 inch)	1.6 mm (.063 inch)	2.0 mm (.079 inch)
A suitable screw	M3 × 7-M3 × 8	M3 × 8	M3 × 8-M3 × 10
A suitable washer	for M3	for M3	for M3

Screw M 3 × 7

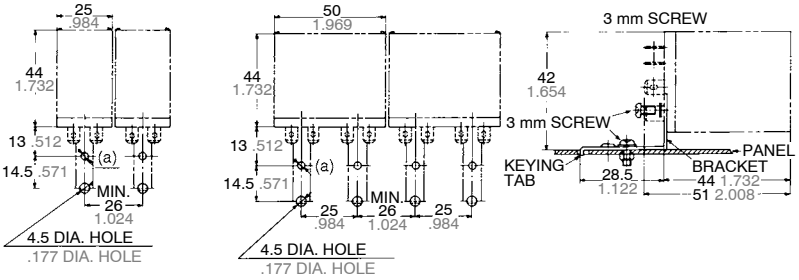
- Millimeter
- 3mm .118inch diameter
- 7mm .276inch length

Dimensions and mounting method mm inch

1. Rear-surface mounting



2. Front-surface mounting



HP Inserting Plate for HP2 and HP4 types

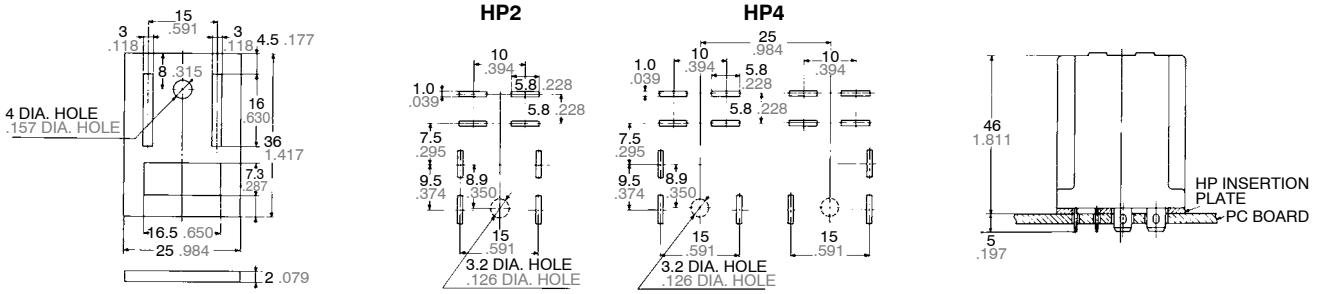
1. HP inserting plate is used for mounting HP2 and HP4 relays on a printed board to adjust the length of the terminals.

2. If adjustment by soldering is not suitable, bore 1/8" diameter hole on the printed circuit board and mount the relay with a M3 × 10 screw. The chart to the right suggests the proper screws for different printed circuit boards.

3. Two plates are used for the HP4 type relay.

Thickness of P/C board	Suitable screw
1.0 mm .039 inch	M3 × 10
1.2 mm .047 inch	M3 × 10

PC board pattern



Please refer to the above second instruction.

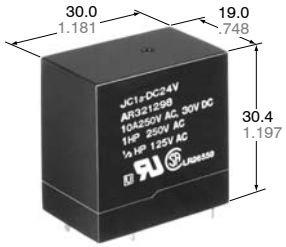
Tolerance: ±0.1 ±.004

For Cautions for Use, see Relay Technical Information (page 392).

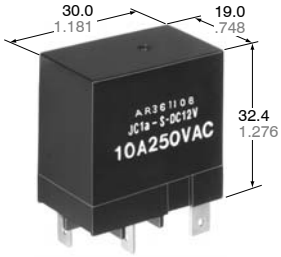
Panasonic
ideas for life

COMPACT POWER RELAYS

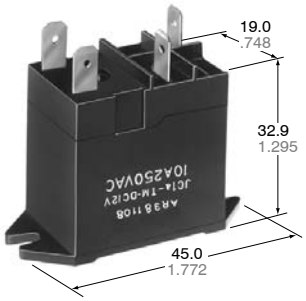
JC RELAYS



PC board type



Plug-in type



TM type

mm inch

FEATURES

- **High inrush current capability**
  1 Form A: 163 A inrush (TV-8)
  2 Form A: 111 A inrush (TV-5)
- **High dielectric withstanding for transient protection:**
  JC can withstand 10,000 V surge in μs between coil and contact.
- **Electrical life:**
  1 Form A: 10^5 ope. at 15 A 250 V AC resistive load
  2 Form A: 10^5 ope. at 10 A 250 V AC resistive load
- **UL/CSA, VDE, TÜV, SEMKO also approved.**

SPECIFICATIONS

Contact

Arrangement			1 Form A	2 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			30 mΩ (Cd free type: 100 mΩ)	
Contact material			Silver alloy	
Contact force, min.			30 g	
Rating (resistive load)	Maximum switching power		3,750 VA	2,500 VA
	Maximum switching voltage		250 V AC	250 V AC
	Max. switching current		15 A	10 A
	Min. switching capacity#1		100 mA, 5 V DC	
Expected life (min. operation)	Mechanical		5×10^6	
	Electrical (resistive)	10 A 250 V AC	10^5	—
		5A 250 V AC	—	10^5

Coil

Nominal operating power	900 mW	1,000 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement of same location as "Intial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Maximum operating speed			20 cpm.
Initial insulation resistance*1			Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts		2,000 V rms for 1 min.
	Between contacts sets		2,000 Vrms for 1 min.
	Between contacts and coil		4,000 Vrms for 1 min.
Operate time*3 (at nominal voltage)			Max. 30 ms
Release time(without diode)*3 (at nominal voltage)			Max. 10 ms
Temperature rise (at nominal voltage)			Max. 55°C
Shock resistance	Functional*4		196 m/s² {20 G}
	Destructive*5		980 m/s² {100 G}
Vibration resistance	Functional*6		98 m/s² {10 G}, 10 to 55 Hz at double amplitude of 1.6 mm
	Destructive		117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)		Ambient temp.	–50°C to +60°C –58°F to +140°F
		Humidity	5 to 85%R.H.
Unit weight			Approx. 31 g 1.09 oz

TYPICAL APPLICATIONS

Automatic garage door openers
Microwave ovens
Dryers
Vending machines
Copiers
Air conditioners
Stereo equipment
TV sets

ORDERING INFORMATION

Ex. JC [1a] F — [TM] — [DC12V] — [F]

Contact arrangement	Mounting classification	Coil voltage	Environmental support
1a: 1 Form A 2a: 2 Form A	Nil: PC board terminal S: Plug-in terminal TM: Top mounting	DC 5, 6, 12, 24, 48 V	F: RoHS Directive conforming type ($AgSnO_2$ type) Nil: RoHS Directive non-conforming type (AgCdO type)

(Notes) 1. TV rated types available 1 Form A: TV-8; 2 Form A: TV-5.
2. Standard packing Carton: 50 pcs.; Case: 200 pcs.
3. UL/CSA, VDE, TÜV, and SEMKO certified products can also be supported. Please consult us.

COIL DATA (at 20°C 68°F)

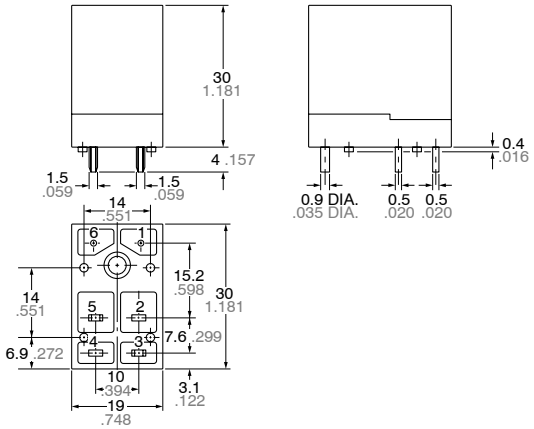
Contact arrangement	Nominal voltage. V DC	Pick-up voltage. V DC (max.)	Drop-out voltage. V DC (min.)	Coil resistance, Ω(±10%)	Nominal operating current, mA	Nominal operating power, W	Maximum allowable voltage, V DC (at 60°C)
1 Form A	6	4.8	0.6	40	150	0.9	6.6
	12	9.6	1.2	160	75	0.9	13.2
	24	19.2	2.4	640	37.5	0.9	26.4
	48	38.4	4.8	2,560	18.8	0.9	52.8
2 Form A	6	4.8	0.6	36	166.6	1.0	6.6
	12	9.6	1.2	144	83.3	1.0	13.2
	24	19.2	2.4	576	41.6	1.0	26.4
	48	38.4	4.8	2,304	20.8	1.0	52.8

DIMENSIONS

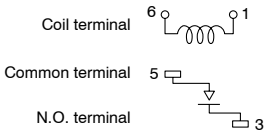
mm inch

PC board type

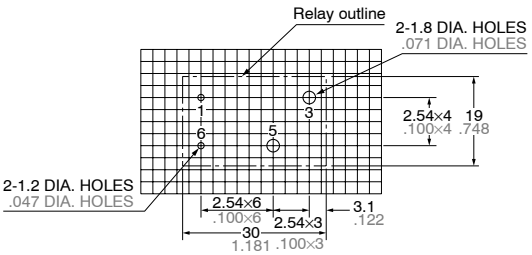
JC1a



Schematic

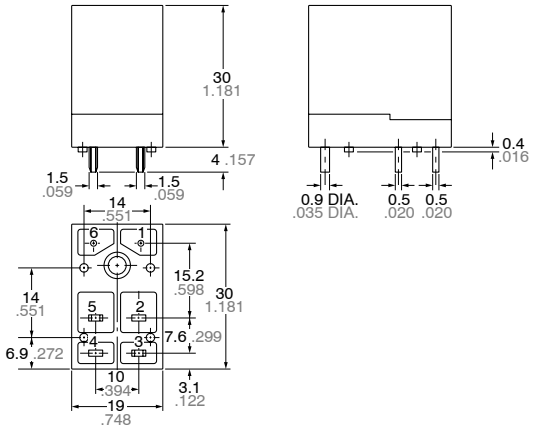


PC board pattern (Bottom view)

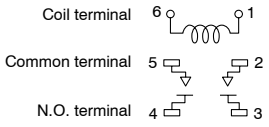


PC board type

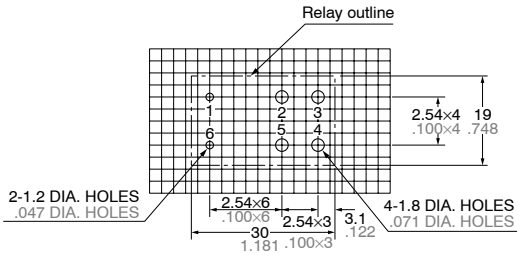
JC2a



Schematic



PC board pattern (Bottom view)



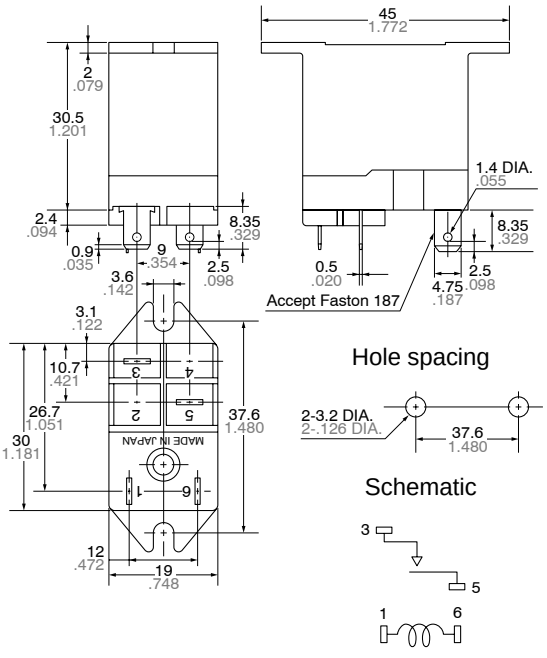
General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.004

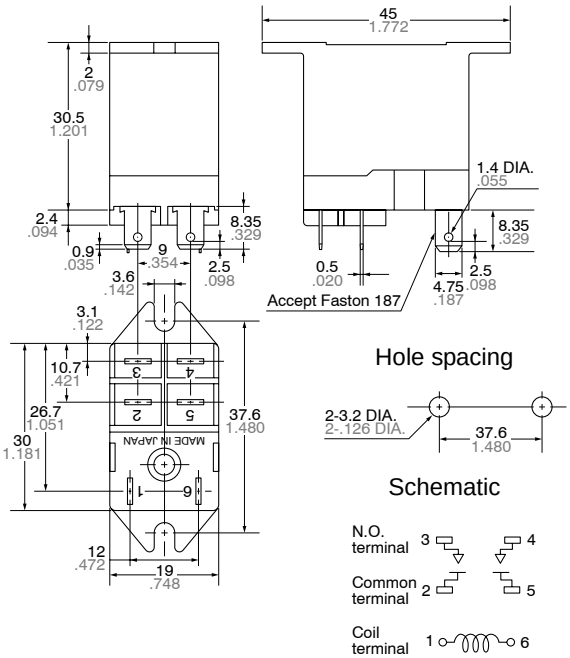
Top mount type

mm inch

1a

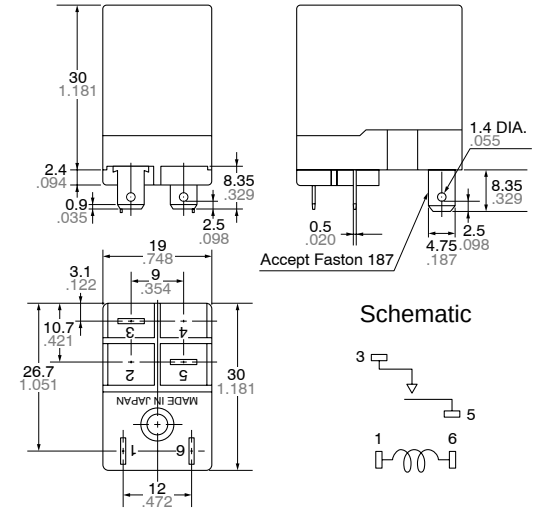


2a

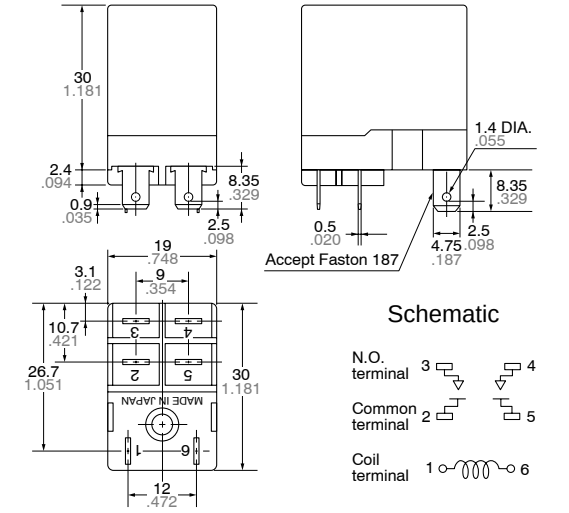


Plug-in type

1a



2a

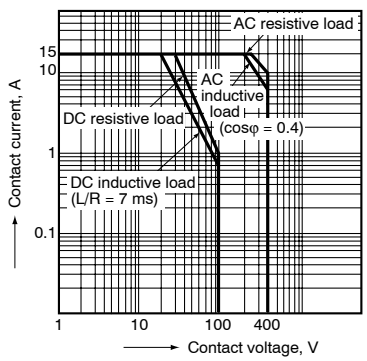


General tolerance: ±0.3 ±.012

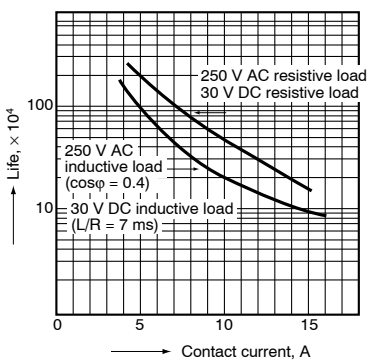
REFERENCE DATA

JC1a type

1. Maximum value for switching capacity

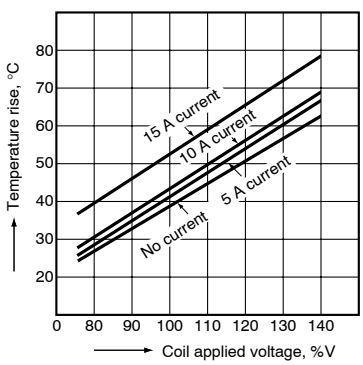


2. Life curve

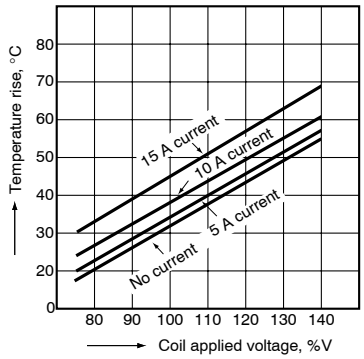


3.-(1) Coil temperature rise

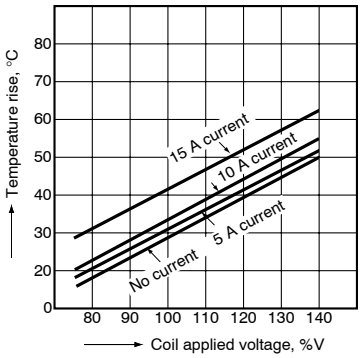
Point measured: Inside the coil
Ambient temperature: 26°C 79°F



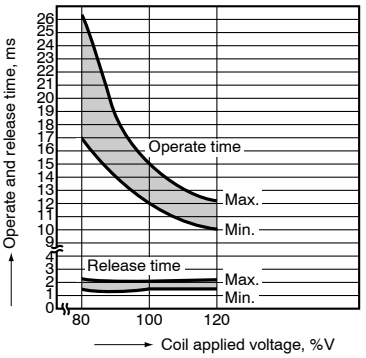
3.-(2) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 40°C 104°F



3.-(3) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 60°C 140°F

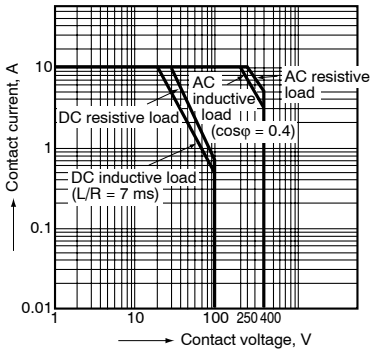


4. Operate / release time

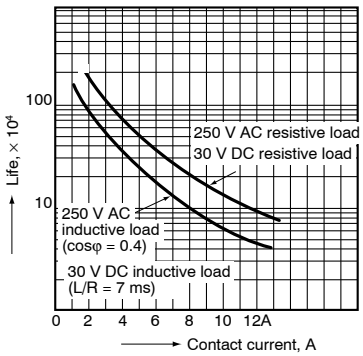


JC2a type

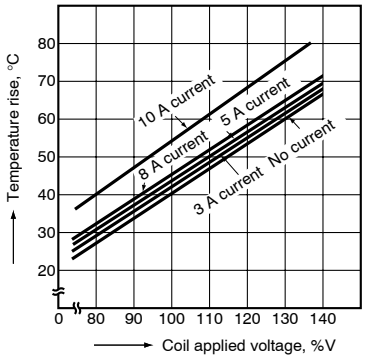
1. Maximum value for switching capacity



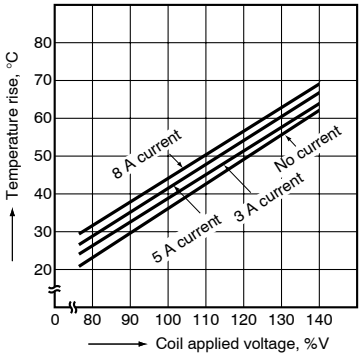
2. Life curve



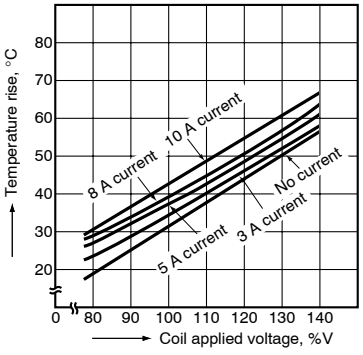
3.-(1) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 26°C 79°F



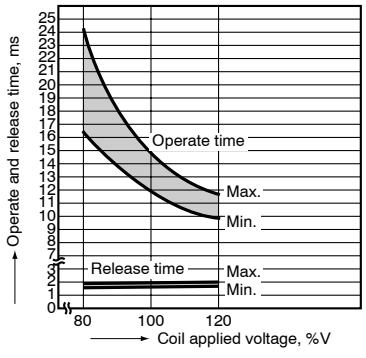
3.-(2) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 40°C 104°F



3.-(3) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 60°C 140°F



4. Operate / release time



ACCESSORIES

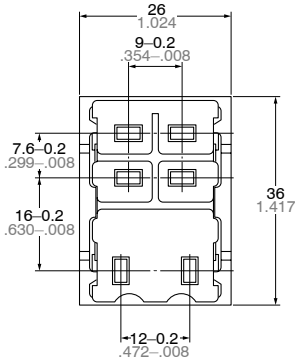
JC1-SS

JC2-SS

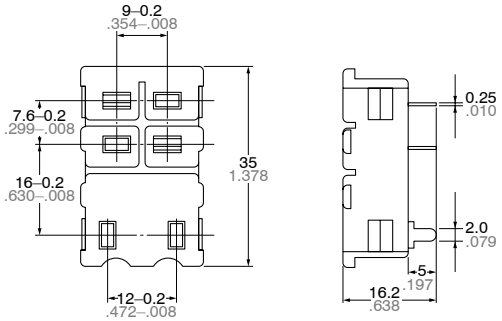
JC1-PS

JC2-PS

JC2-SS

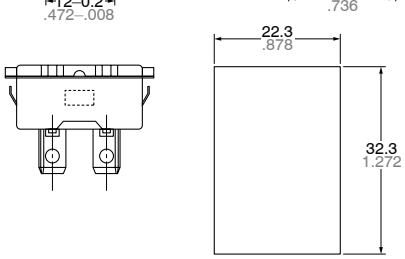


JC2-PS



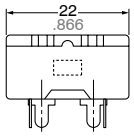
mm inch

Tolerance: ±0.5 ±.020

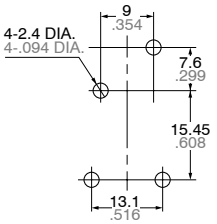


Panel cutout

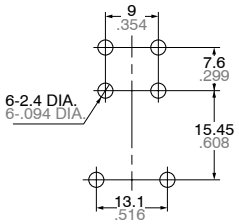
Tolerance: ±0.1 ±.004



JC1-PS



JC2-PS



PC board Pattern

Tolerance: ±0.1 ±.004

(Note)
Outward dimensions and chassis cutout dimensions for JC1-SS and JC1-PS are same as those of JC2-SS and JC2-PS respectively.
UL/CSA approved type is standard.

For Cautions for Use, see Relay Technical Information (page 392).

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COMPACT POWER RELAYS FOR HIGH DC LOADS

JC RELAY (Special Type)

Data sheet addition for JC Relay

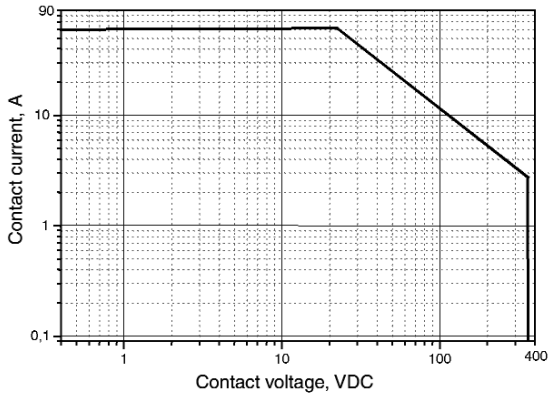
- **Integrated arc-blowing magnet for high DC loads [H73 type]**
- **High switching capacity: 20A / 60V DC**
- **Clearance and creepage distance contact / coil: 8 mm**
- **Two contacts connected in series ensures even higher life expectancy**

APPLICATIONS:

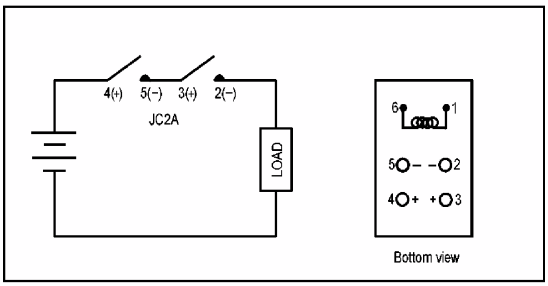
Switching of DC loads in devices such as
- Control of Industrial DC motors
- Emergency power-off for DC loads

Arrangement		**2 Form A**	
Contact material		**AgCdO, AgNi**	
Contact connection		one contact	two contacts in series
Rating (resistive) load	250VDC / 5A	1×10^4 ops.	2×10^4 ops.
	250VDC / 4A	3×10^4 ops.	4×10^4 ops.
Special loads test data (min. operations at 20°C)	220VDC / 1,6A; L/R = 14.6ms (1s On, 4s Off)	2×10^4	3×10^4
	220VDC / 1A; L/R = 17.4ms (1s On, 4s Off)	2×10^4	3×10^4
	60VDC / 20A; resistive load (30s On, 30s Off)	1×10^4	2×10^4
Mechanical, endurance and coil data according to JC-datasheet			

Load limit curve for connection in series



Connection diagram



Attention: For the Blow-out effect, the polarity must be defined as: (-) at contacts: 2, 5
(+) at contacts: 3, 4

ORDERING AND TYPE INFORMATION (values at 20°C)

Type	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating power, W	Coil resistance, Ω (±10%)
JC2aF-DC5V-Y1-H73	5	4.0	0.5	1	25
JC2aF-DC6V-Y1-H73	6	4.8	0.6	1	36
JC2aF-DC12V-Y1-H73	12	9.6	1.2	1	144
JC2aF-DC24V-Y1-H73	24	19.2	2.4	1	576
JC2aF-DC48V-Y1-H73	48	38.4	4.8	1	2304

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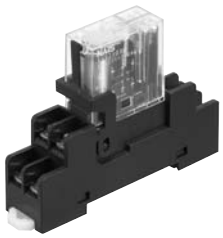
SLIM AND COMPACT RELAY FOR WIDER APPLICATIONS

HN RELAYS (AHN)



FEATURES

• Slim and compact size
20% more compact (width and height) than existing model* (with the condition of screw terminal socket for DIN rail)
*Compared with our HC/HJ relay.

• High-capacity and high reliability
Max. switching current:
16 A (for 1 Form C type at AC load)
Uses gold-flashed contacts for highly reliable contact (for 2 Form C type).

• Environmentally friendly
Compliance with RoHS Directive (2002/95/EC)
(Note: HN2 screw terminal socket only conformable from April, 2005.)

• Slim screw terminal socket
Utilizes relay-securing hook for easy relay removal.

TYPICAL APPLICATIONS

Control panels
Power supply units
Molding machines
Machine tools
Welding equipment
Agricultural equipment
Office equipment
Vending machines
Communications equipment
Amusement machines, etc.

SPECIFICATIONS

Contacts

Contact arrangement		1 Form C	2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100mΩ	50mΩ
Contact material		Silver alloy	Gold-flashed silver alloy
Rating (resistive load)	Nominal switching capacity	10A 250V AC, 10A 30V DC	5A 250V AC, 5A 30V DC
	Max. switching power	4,000 VA, 300W	1,250 VA, 150W
	Max. switching voltage	250V AC, 30V DC	250V AC, 30V DC
	Max. switching current	16 A (at AC load), 10 A (at DC load)	5 A
	Min. switching current*9	5V 100mA DC	1V 1 mA DC
Expected life (min. operations)	Mechanical (at 300 cpm)	AC: 10^7 DC: 2×10^7	
	Electrical (at 20 cpm) (at rated load)	10^5	

Coil

Nominal operating power	0.53W 0.9VA

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as “Initial breakdown voltage” section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 For the AC coil types, the operate/release time will differ depending on the phase.
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).
*9 This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed		20 cpm (at max. rating)
Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.
	Between contact sets	3,000 Vrms for 1 min. (2 Form C type only)
	Between contact and coil	5,000 Vrms for 1 min.
Operate time*3 (at nominal voltage)		Max. 15 ms*4
Release time (without diode)*3 (at nominal voltage)		Max. 10 ms*4
Temperature rise, max. (at 70°C) (at nominal voltage)		60°C
Shock resistance	Functional*5	Min. 100 m/s² {10 G}
	Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	10 to 55 Hz at double amplitude of 1.5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 19g .67 oz

ORDERING INFORMATION

Ex. AHN □ □ □ □

Contact arrangement	Terminal arrangement	Type classification	Coil voltage
1: 1 Form C 2: 2 Form C	1: AC plug-in type 2: DC plug-in type	0: Standard 1: With LED indication 2: With diode 3: With diode and LED indication	05: 5 V, 06: 6 V, 12: 12 V, 24: 24 V, 48: 48 V X0: 100/110 V AC, 100 V DC X1: 110/120 V AC, 110 V DC Y0: 200/220 V AC, Y2: 220/240 V AC

Note: Products conform to UL/C-UL and VDE, as standard (VDE pending: 1 Form C type).

TYPES

1. Plug-in type

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12005	AHN22005
6V DC	AHN12006	AHN22006
12V DC	AHN12012	AHN22012
24V DC	AHN12024	AHN22024
48V DC	AHN12048	AHN22048
100V DC	AHN120X0	AHN220X0
110V DC	AHN120X1	AHN220X1
12V AC	AHN11012	AHN21012
24V AC	AHN11024	AHN21024
100/110V AC	AHN110X0	AHN210X0
110/120V AC	AHN110X1	AHN210X1
200/220V AC	AHN110Y0	AHN210Y0
220/240V AC	AHN110Y2	AHN210Y2

Note: Packing quantity; Inner carton: 50 pcs, Outer carton: 500 pcs.

2. Plug-in with LED indication type

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12105	AHN22105
6V DC	AHN12106	AHN22106
12V DC	AHN12112	AHN22112
24V DC	AHN12124	AHN22124
48V DC	AHN12148	AHN22148
100V DC	AHN121X0	AHN221X0
110V DC	AHN121X1	AHN221X1
12V AC	AHN11112	AHN21112
24V AC	AHN11124	AHN21124
100/110V AC	AHN111X0	AHN211X0
110/120V AC	AHN111X1	AHN211X1
200/220V AC	AHN111Y0	AHN211Y0
220/240V AC	AHN111Y2	AHN211Y2

Note: Packing quantity; Inner carton: 50 pcs, Outer carton: 500 pcs.

3. Plug-in with diode type

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12205	AHN22205
6V DC	AHN12206	AHN22206
12V DC	AHN12212	AHN22212
24V DC	AHN12224	AHN22224
48V DC	AHN12248	AHN22248
100V DC	AHN122X0	AHN222X0
110V DC	AHN122X1	AHN222X1

Note: Packing quantity; Inner carton: 50 pcs, Outer carton: 500 pcs.

4. Plug-in with diode and LED indication type

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12305	AHN22305
6V DC	AHN12306	AHN22306
12V DC	AHN12312	AHN22312
24V DC	AHN12324	AHN22324
48V DC	AHN12348	AHN22348
100V DC	AHN123X0	AHN223X0
110V DC	AHN123X1	AHN223X1

Note: Packing quantity; Inner carton: 50 pcs, Outer carton: 500 pcs.

5. Screw terminal socket

Type	No. of channels	Item	Part No.
For DIN rail assembly	1 channel	HN1 screw terminal socket	AHNA11
	2 channels	HN2 screw terminal socket	AHNA21

Notes) 1. Packing quantity: 10pcs. (Inner carton), 100pcs. (Outer carton)
2. Products conform to UL, C-UL, as standard.
3. In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.5 to 0.8 N•m.
4. When attaching directly to a chassis, please use an M3 × 16 metric coarse screw thread.
5. To prevent damage and deformity, please use the relay-securing hook at 10 N or less.
6. When using with current of 16 A (for HN1 screw terminal socket), the maximum ambient temperature is 50°C. When using in an ambient temperature of 70°C, the maximum current is 14 A.

COIL DATA (at 20°C 68°F)

DC coils

Coil voltage V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Nominal coil current, mA (±20%)	Coil resistance, Ω (±10%)	Nominal operating power, W	Max. allowable voltage, V DC
5	3.5	0.5	105.9	47	0.53	8.5
6	4.2	0.6	88.4	68		10.2
12	8.4	1.2	44.2	270		20.4
24	16.8	2.4	22.1	1,090		40.8
48	33.6	4.8	11	4,350		81.6
100	70	10	5.3	18,870		170
110	77	11	4.8	22,830		187

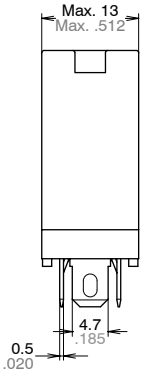
AC coils (50/60Hz)

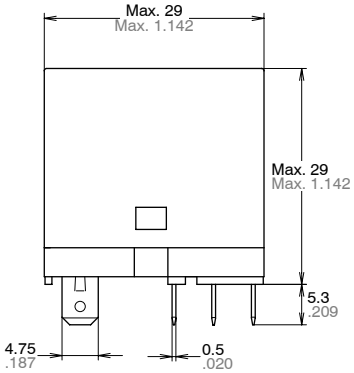
Coil voltage V AC	Pick-up voltage, V AC (max.) (Initial)	Drop-out voltage, V AC (min.) (Initial)	Nominal coil current, mA (±20%)		Nominal operating power, VA		Max. allowable voltage, V AC
			50Hz	60Hz	50Hz	60Hz	
12	9.6	3.6	93	75	Approx. 1.1 to 1.4	Approx. 0.9 to 1.2	16.8
24	19.2	7.2	46.5	37.5			33.6
100/110	80/88	30/33	11.0/13.0	9.0/10.6			140/154
110/120	88/96	33/36	10.0/11.8	8.2/9.7			154/168
200/220	160/176	60/66	5.5/6.5	4.5/5.3			280/308
220/240	176/192	66/72	5.0/5.9	4.1/4.8			308/336

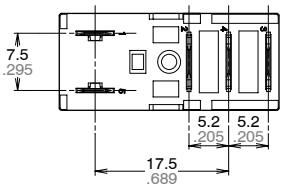
DIMENSIONS

mm inch

1. Plug-in type 1 Form C

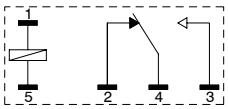




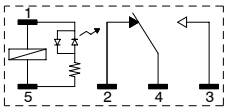


Schematic (Bottom view)

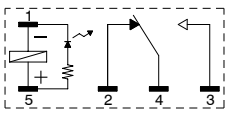
Standard type



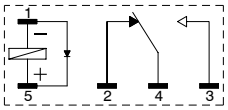
With LED AC type



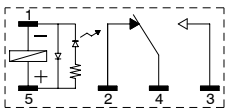
With LED DC type



With Diode type

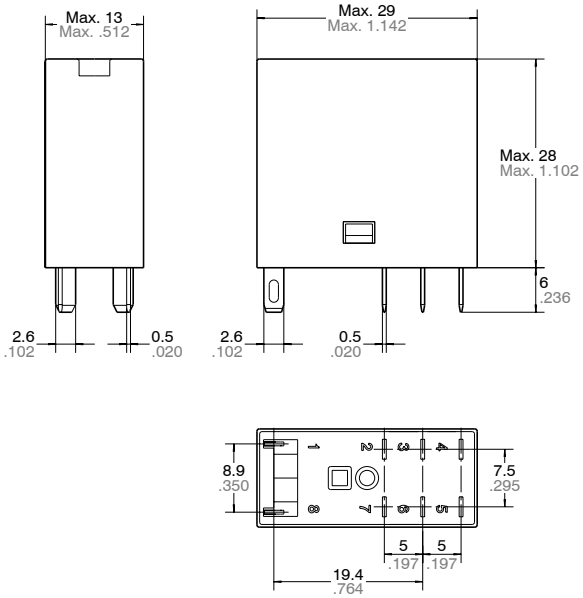


With Diode and LED type



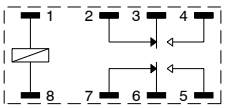
Dimension :	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

2. Plug-in type 2 Form C

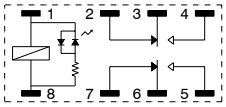


Schematic (Bottom view)

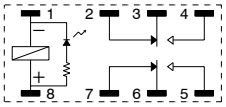
Standard type



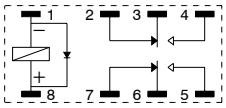
With LED AC type



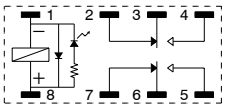
With LED DC type



With Diode type

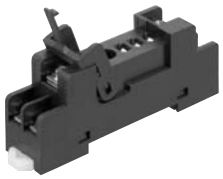


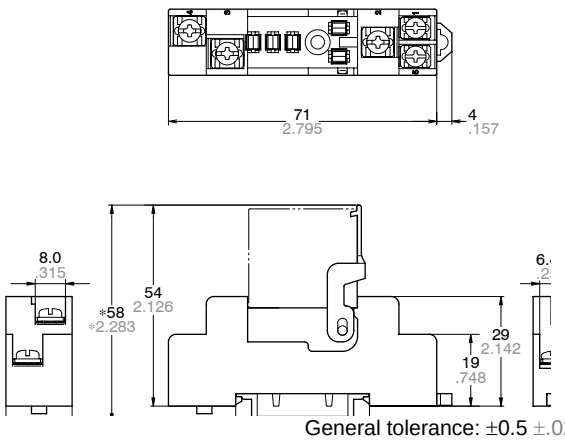
With Diode and LED type



Dimension :	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

3. HN1 Screw terminal socket

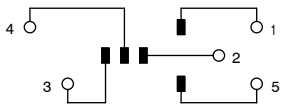




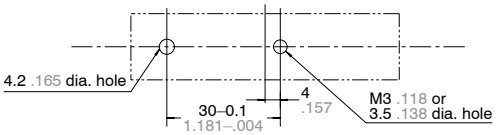
General tolerance: ±0.5 ±.020

∗ Reference in case of using DIN rail (ATA48011)

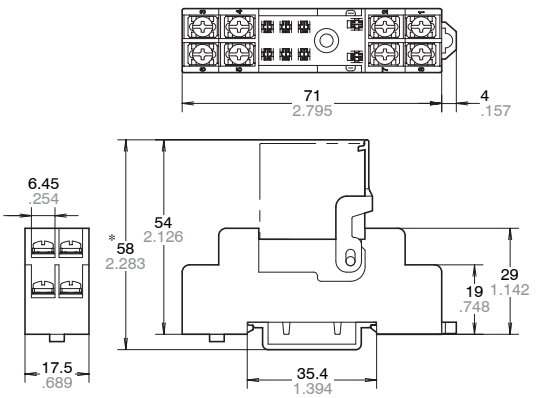
Schematic (Top view)



Mounting hole dimensions



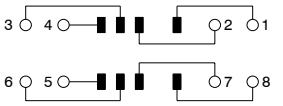
4. HN2 Screw terminal socket



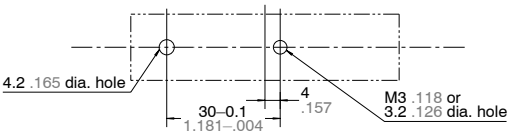
General tolerance: ±0.5 ±.020

∗ Reference in case of using DIN rail (ATA48011)

Schematic (Top view)

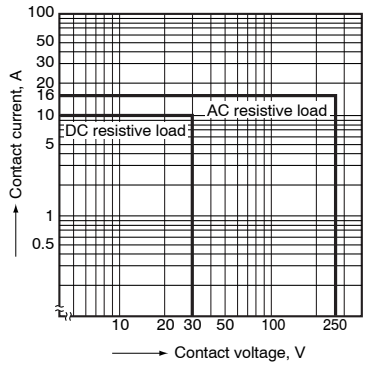


Mounting hole dimensions

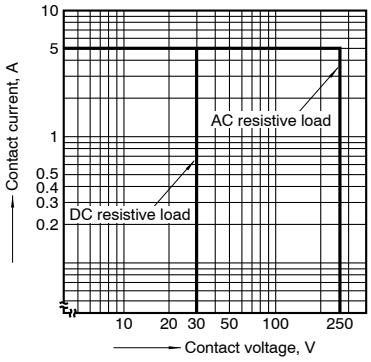


REFERENCE DATA

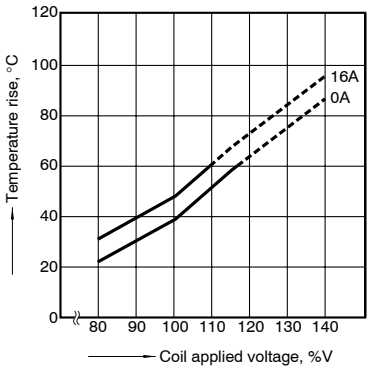
1-(1). Max. switching capacity (1 Form C)



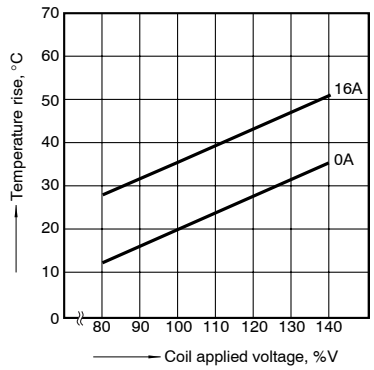
1-(2). Max. switching capacity (2 Form C)



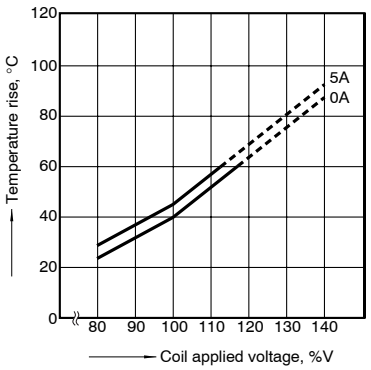
2-(1). Coil temperature rise (1 Form C/AC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



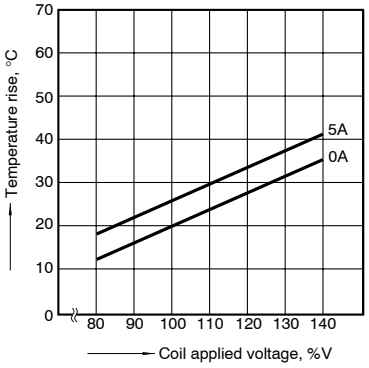
2-(2). Coil temperature rise (1 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



2-(3). Coil temperature rise (2 Form C/AC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



2-(4). Coil temperature rise (2 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



NOTES

1. Coil operating power

To ensure proper operation, the voltage applied to both terminals of the coil should be ±5% (at 20°C 68°F) the rated operating voltage of the coil.

Also, be aware that the pick-up and drop-out voltages will fluctuate depending on the ambient temperature and operating conditions.

2. LED indications

The light of the light emitting diode is what displays operation. If voltage remains after relay dropout, the LED might illuminate briefly.

3. Switching lifetime

The switching lifetime is defined under the standard test condition specified in the JIS C 5442-1996 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase,ambient conditions and other factors.

Also, be especially careful of loads such as those listed below.

(1) When used for AC load-operating and the operating phase is synchronous. Rocking and fusing can easily occur due to contact shifting.

(2) High-frequency load-operating

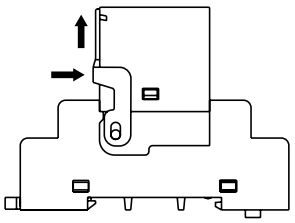
When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.

Three countermeasures for these are listed here.

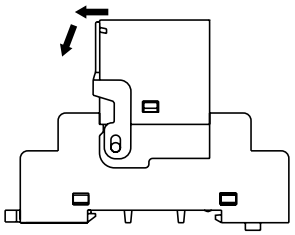
1. Incorporate an arc-extinguishing circuit.
2. Lower the operating frequency
3. Lower the ambient humidity

4. About the relay-securing hook

1) Installation of the securing hook is easily performed by pressing upward in the direction of the arrows.



2) Removal of the securing hook is easily performed by releasing the hook and pressing down, as shown in the figure.



5. Diode characteristics

1) Reverse breakdown voltage:
90V (5 to 48V DC type)
250V (100, 110V DC type)

6. Diode type

Since the diode inside the relay coil are designed to absorb the counter emf, the element may be damaged if a large surge, etc., is applied to the diode.

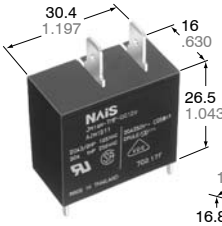
If there is the possibility of a large surge voltage from the outside, please implement measures to absorb it.

For Cautions for Use, see Relay Technical Information (page 392).

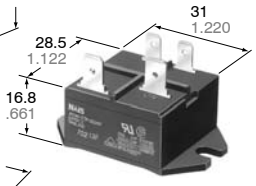
Panasonic
ideas for life

COMPACT POWER RELAY FOR INDUCTIVE LOAD

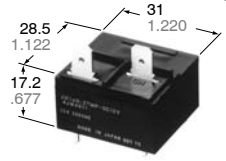
JM RELAYS



Slim TMP type



Flat TM type



Flat TMP type

mm inch

FEATURES

• Compact, high-capacity, and resistant to inductive loads
The relay is a compact 16×30.4×26.5 mm .630×1.197×1.043 inch. It can control an inductive load (cosφ = 0.7) with inrush current of 70 A and steady state current of 20 A.

• Excellent contact welding resistance
High contact pressure, a forced opening mechanism, and a forced wiping mechanism realizes an excellent contact welding resistance.

• High breakdown voltage and surge resistant relay
More than 6.4 mm .252 inch maintained for the insulation distance between contacts and coil, and the breakdown voltage between contacts and coil is 5,000 V for 1 minute. In addition, the surge resistance between contacts and coil is greater than 10,000 V.

• Resistant to external force
An absorber mechanism is used on the load terminals, giving a large improvement in characteristics variations caused by the external force during FASTON placement/removal.

• Flux resistance mechanism
The terminal area is plugged with resin to prevent flux seepage during PCB mounting. (TMP type)

• Conforms to the various safety standards
UL, CSA approved.
TÜV, VDE under application.

• The line up can support economical mounting methods.
The relay are equipped with a drive terminal (coil terminal) on one side for PCBs, and a load terminal (tab terminal #250) on the reverse side. The line up includes the TM type which can be attached directly to the PCB composing a drive circuit, and the TMP type which supports economical wiring. The TMP type can also be directly attached, and a high capacity load can be wired to the tab terminal.

Power

SPECIFICATIONS

Contact

Arrangement				1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)				30 mΩ (Cd free type: 100 mΩ)
Contact material				Silver alloy
Rating (resistive load)	Nominal switching capacity			20 A 250 V AC
	Max. switching power			5,000 VA
	Max. switching voltage			250 V AC
	Max. switching current			20 A
	Min. switching capacity#1			100 mA, 5 V DC
Expected life (min. ope.)	Mechanical (at 180 cpm)			10^6
	Electrical Life (at 20 cpm)	Resistive load 20 A, 250 V AC (cosφ = 1)		10^5
		Inductive load	Inrush 70 A, Steady 20 A (250 V AC cosφ = 0.7)	10^5
			Inrush 80 A, Cut-off 80 A (When the motor is locked) (250 V AC cosφ = 0.7)	1.5×10^3

Coil

Nominal operating power	900 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Max. operating speed			180 cpm
Initial insulation resistance*1			Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts		1,000 Vrms for 1 min.
	Between contacts and coil		5,000 Vrms for 1 min.
Surge voltage between contact and coil*3			Min. 10,000 V
Operate time*4 (at nominal voltage)(at 20°C)			Max. 20ms (Approx. 8 ms)
Release time (without diode)*4 (at nominal voltage)(at 20°C)			Max. 10ms (Approx. 3 ms)
Temperature rise (at 60°C)			Max. 55°C (Contact switching current: 20 A/voltage applied to coil: 100%V)
Shock resistance	Functional*5		Min. 98 m/s² {10 G}
	Destructive*6		Min. 980 m/s² {100 G}
Vibration resistance	Functional*7		10 to 55 Hz at double amplitude of 1.6 mm
	Destructive		10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)		Ambient temp.	–40°C to +60°C –40°F to +140°F
		Humidity	5 to 85% R.H.
Unit weight	Slim TMP		Approx. 28 g .99 oz
	Flat TMP		Approx. 32 g 1.13 oz
	Flat TM		Approx. 33 g 1.16 oz

TYPICAL APPLICATIONS

- Compressor and heater control in air conditioners
- Power control in hot air type heaters
- Magnetron control in microwave ovens
- Lamp and motor control in OA equipment such as copiers and facsimiles.

ORDERING INFORMATION

Ex. JM [1a] [N] — [Z] [TMP] — [DC 24V] — [F]

Contact arrangement	Pickup voltage	Classification of type	Mounting classification	Coil voltage	Environmental support
1a: 1 Form A	N: 70% of nominal voltage	Nil: Slim type Z: Flat type	TMP: TMP type TM: TM type (Flat type) P: PCB type(Slim type)	DC 5, 6, 9, 12, 24, 48 V	F: RoHS Directive conforming type ($AgSnO_2$ type) Nil: RoHS Directive non-conforming type (AgCdO type)

(Note) 1. Standard packing: Carton: 50pcs. Case: 200pcs.
UL/CSA, VDE approved type is standard.

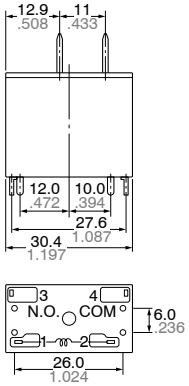
TYPES AND COIL DATA (at 20°C 68°F)

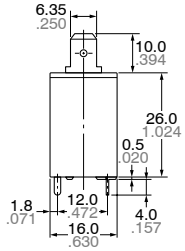
Part No.				Nominal voltage, V DC	Pick-up voltage	Drop-out voltage,	Nominal operating current, mA	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Slim		Flat								
TMP	PCB	TMP	TM							
JM1aN-TMP-DC5V (-F)	JM1aN-P-DC5V (-F)	JM1aN-ZTMP-DC5V (-F)	JM1aN-ZTM-DC5V (-F)	5	3.5	0.5	180	27.8	900	5.5
JM1aN-TMP-DC6V (-F)	JM1aN-P-DC6V (-F)	JM1aN-ZTMP-DC6V (-F)	JM1aN-ZTM-DC6V (-F)	6	4.2	0.6	150	40	900	6.6
JM1aN-TMP-DC9V (-F)	JM1aN-P-DC9V (-F)	JM1aN-ZTMP-DC9V (-F)	JM1aN-ZTM-DC9V (-F)	9	6.3	0.9	100	90	900	9.9
JM1aN-TMP-DC12V (-F)	JM1aN-P-DC12V (-F)	JM1aN-ZTMP-DC12V (-F)	JM1aN-ZTM-DC12V (-F)	12	8.4	1.2	75	160	900	13.2
JM1aN-TMP-DC24V (-F)	JM1aN-P-DC24V (-F)	JM1aN-ZTMP-DC24V (-F)	JM1aN-ZTM-DC24V (-F)	24	16.8	2.4	37.5	640	900	26.4
JM1aN-TMP-DC48V (-F)	JM1aN-P-DC48V (-F)	JM1aN-ZTMP-DC48V (-F)	JM1aN-ZTM-DC48V (-F)	48	33.6	4.8	18.75	2,560	900	52.8

DIMENSIONS

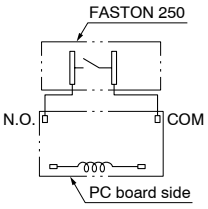
mm inch

Slim TMP type



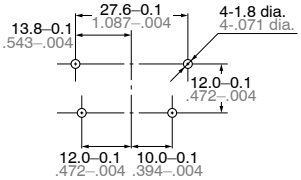


Schematic



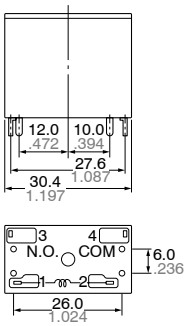
PC board pattern

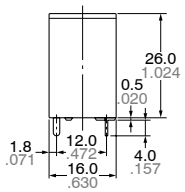
(Copper-side view)



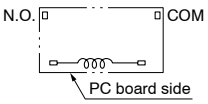
General tolerance: ±0.4 ±.016

Slim PCB type



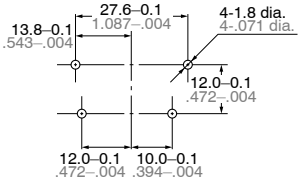


Schematic



PC board pattern

(Copper-side view)

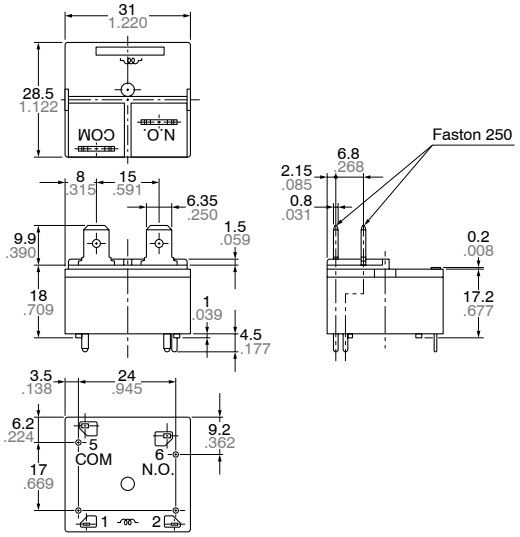


General tolerance: ±0.4 ±.016

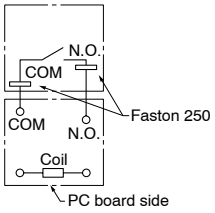
Tolerance: ±0.1 ±.004

Flat TMP type

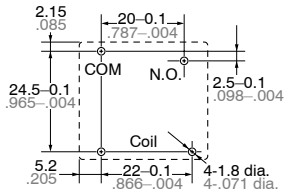
mm inch



Schematic



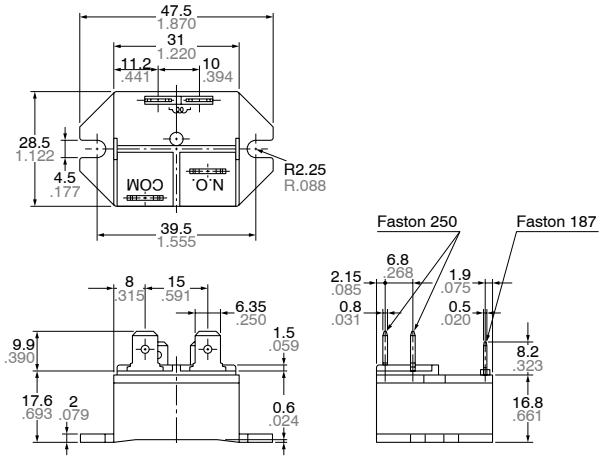
PC board pattern (Bottom view)



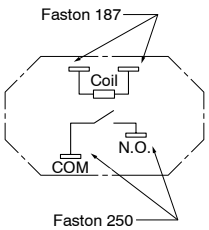
General tolerance: ±0.4 ±.016

Tolerance: ±0.1 ±.004

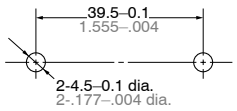
Flat TM type



Schematic



Panel cutout

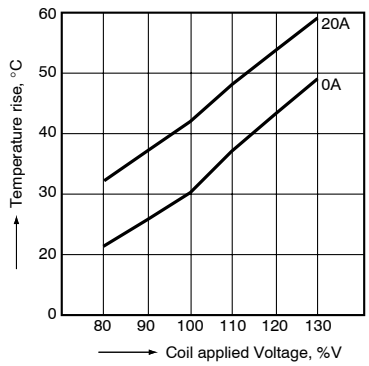


General tolerance: ±0.4 ±.016

REFERENCE DATA

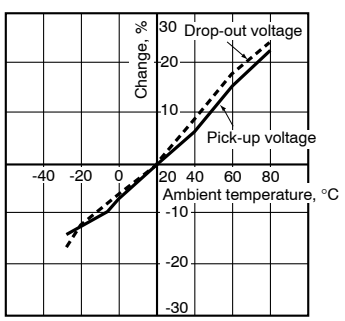
1. Coil temperature rise

Place to be measured: Inside of coil
Ambient temperature: 25°C 77°F



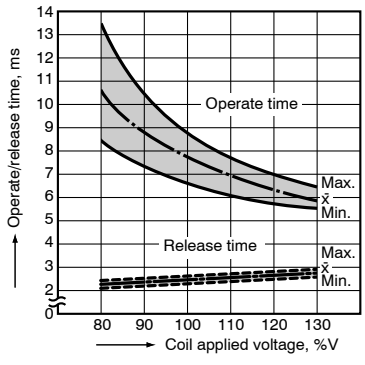
2. Ambient temperature characteristics

Sample: JM1aN-TMP-DC24V, 5 pcs.

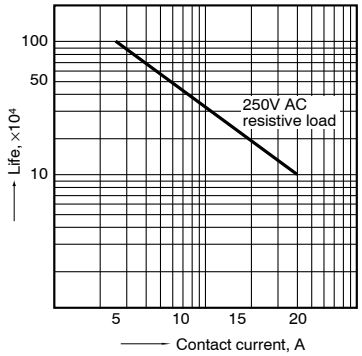


3. Operate/release time

Sample: JM1aN-TMP-DC24V, 5 pcs.

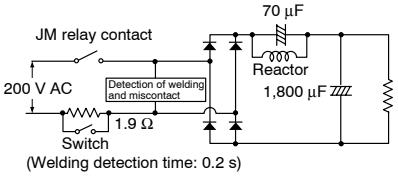


4. Life curve

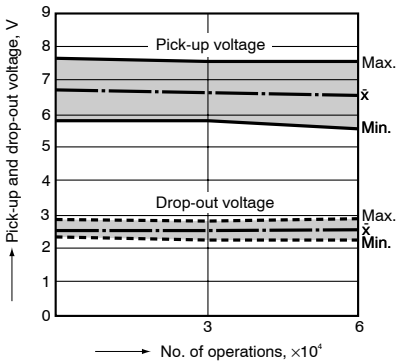


5-(1). 200 V AC electrical life test (200 V AC inverter dummy load)

Sample: JM1aN-TMP-DC12V, 6 pcs.
Load: Inrush 108 A, Steady 15 A,
Inverter dummy 200 V AC
Switching frequency: ON 5 s, OFF 5 s
Circuit



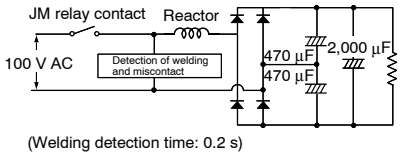
Change of pick-up and drop-out voltage



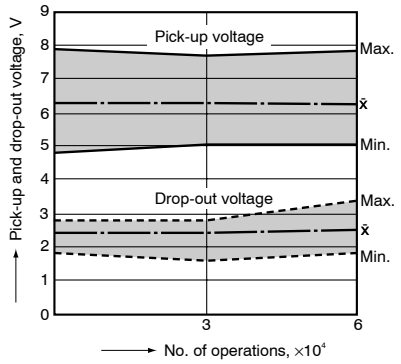
Contact welding: 0 time
Miscontact: 0 time

5-(2). 100 V AC electrical life test (100 V AC inverter dummy load)

Sample: JM1aN-TMP-DC12V, 20 pcs.
Load: Inrush 224 A, Steady 20A,
Inverter dummy 100 V AC
Switching frequency: ON 10 s, OFF 10 s
Circuit



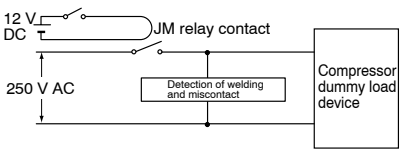
Change of pick-up and drop-out voltage



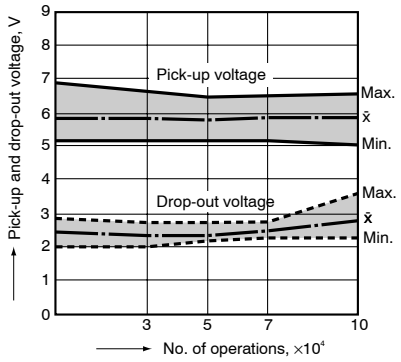
Contact welding: 0 time
Miscontact: 0 time

5-(3). Inrush 70 A, Steady 20 A, 250 V AC compressor dummy load

Sample: JM1aN-TMP-DC12V, 6 pcs.
Load: (Endurance) inrush 70 A cosφ = 0.7 (0.3 s),
steady 20A pf = 0.9,
250V AC compressor dummy
(Overload) 80A cosφ = 0.7, 250 V AC
No. of operations: (Endurance) 10^5 times
(Overload) 1,000 times (after endurance test)
Switching frequency: (Endurance) ON 1.5 s,
OFF 1.5 s
(Overload) ON 3 s,
OFF 2 min., 57 s
Circuit (endurance)



Change of pick-up and drop-out voltage



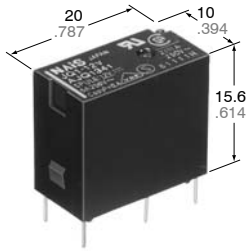
Contact welding: 0 time
Miscontact: 0 time

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

HIGH ELECTRICAL & MECHANICAL NOISE IMMUNITY RELAY

JQ RELAYS



mm inch

FEATURES

- **High electrical noise immunity**
- **High switching capacity in a compact package**
- **High sensitivity: 200 mW (1a), 400 mW (1c)**
- **High surge voltage: 8,000 V between contacts and coil**
- **UL, CSA, VDE, TÜV, SEMKO approved**
- **Class B coil insulation type available**

SPECIFICATIONS

Contact

				Standard type	High capacity type
Arrangement				1 Form A, 1 Form C	
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)				100 mΩ	
Contact material				Silver alloy	
Rating (resistive)	Nominal switching capacity	1a		5 A 125 V AC 2 A 250 V AC 5 A 30 V DC	10 A 125 V AC 5 A 250 V AC 5 A 30 V DC
		1c	N.O.	5 A 125 V AC 2 A 250 V AC 3 A 30 V AC	10 A 125 V AC 5 A 250 V AC 5 A 30 V DC
			N.C.	2 A 125 V AC 1 A 250 V AC 1 A 30 V DC	3 A 125 V AC 2 A 250 V AC 1 A 30 V DC
	Max. switching power	1a		625 VA, 150 W	1,250 VA, 150 W
		1c	N.O.	625 VA, 90 W	1,250 V AC, 150 W
			N.C.	250 VA, 30 W	500 V AC, 30 W
	Max. switching voltage			250 V AC, 110 V DC (0.3A)	
	Max. switching current			N.O.: 5 A N.C.: 2 A	N.O.: 10 A N.C.: 3 A
	Min. switching capacity#1			100 mA, 5 V DC	
Expected mechanical life (at 180 cpm)(min. operations)				10^7	

Expected electrical life (min. operations)

Type			Switching capacity	No. of operations
Standard type	1a		5 A 125 V AC 3 A 125 V AC 2 A 250 V AC 5 A 30 V DC	5×10^4 2×10^5 2×10^5 10^5
	1c	N.O.	5 A 125 V AC 2 A 250 V AC 3 A 30 V DC	5×10^4 2×10^5 10^5
		N.C.	2 A 125 V AC 1 A 250 V AC 1 A 30 V DC	2×10^5 2×10^5 10^5
High capacity type	1a		10 A 125 V AC 5 A 250 V AC 5 A 30 V DC	5×10^4 5×10^4 10^5
	1c	N.O.	10 A 125 V AC 5 A 250 V AC 5 A 30 V DC	5×10^4 5×10^4 10^5
		N.C.	3 A 125 V AC 2 A 250 V AC 1 A 30 V DC	2×10^5 2×10^5 10^5

Coil (at 20°C 68°F)

Nominal operating power	1a: 200 mW	1c: 400 mW

Characteristics

Max. operating speed			20 cpm
Initial insulation resistance*1			Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts		1a: 1,000 Vrms for 1 min. 1c: 750 Vrms for 1 min.
	Between contacts and coil		4,000 Vrms for 1 min.
Surge voltage between contact and coil*3			8,000 V
Operate time*4 (at nominal voltage)			Approx. 5 ms
Release time*4 (at nominal voltage)(without diode)			Approx. 2 ms
Temperature rise*5			Max. 45°C
Shock resistance	Functional*6		Min. 294 m/s² {30 G}
	Destructive*7		Min. 980 m/s² {100 G}
Vibration resistance	Functional*8		98 m/s² {10 G}, 10 to 55 Hz at double amplitude of 1.6 mm
	Destructive		117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2.0 mm
Conditions for operation, transport and storage*9 (Not freezing and condensing at low temperature)		Ambient temp.*10	–40°C to +85°C –40°F to +185°F
		Humidity	5 to 85% R.H.
Unit weight			Approx. 7 g .25 oz

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Measured conditions

Standard type	Resistive, nominal voltage applied to the coil. Contact carrying current: 5 A, at 70°C 158°F
High capacity type	Resistive, nominal voltage applied to the coil. Contact carrying current: 10 A, at 70°C 158°F

*6 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*7 Half-wave pulse of sine wave: 6ms
*8 Detection time: 10μs
*9 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).
*10 When using relays in a high ambient temperature, consider the pick-up voltage rise due to the high temperature (a rise of approx. 0.4% V for each 1°C 33.8°F with 20°C 68°F as a reference) and use a coil impressed voltage that is within the maximum allowable voltage range.

Power

TYPICAL APPLICATIONS

- Air conditioners
- Refrigerators
- Microwave ovens
- Heaters

ORDERING INFORMATION

Ex. JQ [1a] [P] — [B] — [12] V — [F]

Contact arrangement	Contact capacity	Coil insulation class	Coil voltage (DC)	Environmental support
1a: 1 Form A 1: 1 Form C	Nil: Standard P: High capacity	Nil: Class E coil insulation B: Class B coil insulation	5, 6, 9, 12, 18, 24, 48* V	F: RoHS Directive conforming type ($AgSnO_2$ type) Nil: RoHS Directive non-conforming type (AgCdO type)

UL/CSA, VDE, SEMKO approved type is standard.
* Available only for 1 Form C type

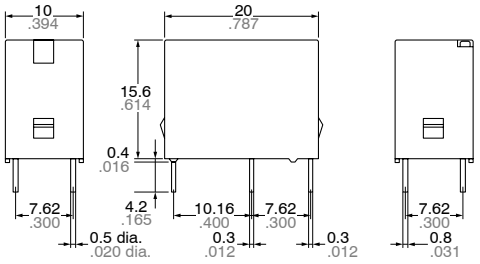
TYPES AND COIL DATA at 20°C 68°F

		Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (min.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, V DC
1 Form A	Standard type	JQ1a-5V (-F)	5	3.75	0.25	40	200	125	180% of nominal voltage (at 20°C 68°F)
		JQ1a-6V (-F)	6	4.5	0.3	33.3		180	
		JQ1a-9V (-F)	9	6.75	0.45	22.2		405	
		JQ1a-12V (-F)	12	9	0.6	16.7		720	
		JQ1a-18V (-F)	18	13.5	0.9	11.1		1,620	
		JQ1a-24V (-F)	24	18	1.2	8.3		2,880	
	High capacity type	JQ1aP-5V (-F)	5	4	0.25	40	200	125	130% of nominal voltage (at 85°C 185°F)
		JQ1aP-6V (-F)	6	4.8	0.3	33.3		180	
		JQ1aP-9V (-F)	9	7.2	0.45	22.2		405	
		JQ1aP-12V (-F)	12	9.6	0.6	16.7		720	
		JQ1aP-18V (-F)	18	14.4	0.9	11.1		1,620	
		JQ1aP-24V (-F)	24	19.2	1.2	8.3		2,880	
1 Form C	Standard type	JQ1-5V (-F)	5	3.75	0.25	80	400	62.5	150% of nominal voltage (at 20°C 68°F)
		JQ1-6V (-F)	6	4.5	0.3	66.7		90	
		JQ1-9V (-F)	9	6.75	0.45	44.4		202.5	
		JQ1-12V (-F)	12	9	0.6	33.3		360	
		JQ1-18V (-F)	18	13.5	0.9	22.2		810	
		JQ1-24V (-F)	24	18	1.2	16.7		1,440	
		JQ1-48V (-F)	48	36	2.4	8.3		5,760	
	High capacity type	JQ1P-5V (-F)	5	4	0.25	80	400	62.5	110% of nominal voltage (at 85°C 185°F)
		JQ1P-6V (-F)	6	4.8	0.3	66.7		90	
		JQ1P-9V (-F)	9	7.2	0.45	44.4		202.5	
		JQ1P-12V (-F)	12	9.6	0.6	33.3		360	
		JQ1P-18V (-F)	18	14.4	0.9	22.2		810	
		JQ1P-24V (-F)	24	19.2	1.2	16.7		1,440	
		JQ1P-48V (-F)	48	38.4	2.4	8.3		5,760	

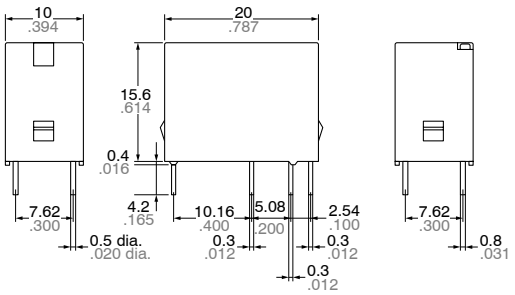
DIMENSIONS

mm inch

1 Form A

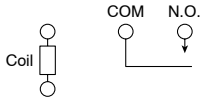


1 Form C

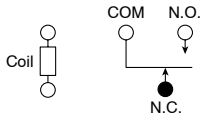


Schematic (Bottom view)

1 Form A

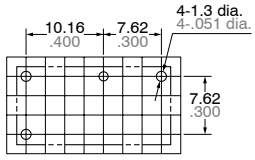


1 Form C

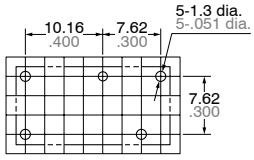


PC board pattern (Bottom view)

1 Form A



1FormC



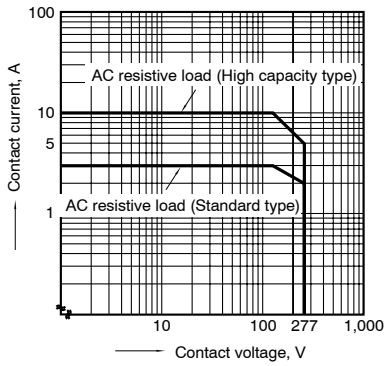
Tolerance: ±0.1 ±.004

Dimension :	General tolerance
Max. 1mm .039 inch	±0.2 ±.008
1 to 5mm .039 to .118 inch	±0.3 ±.012
Min. 5mm .118 inch	±0.4 ±.016

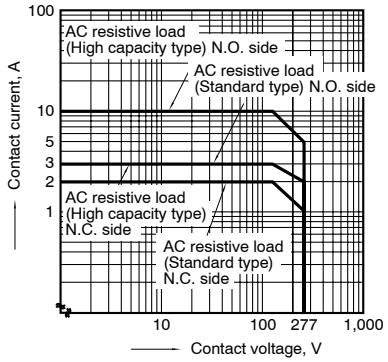
Power

REFERENCE DATA

Max. switching capacity (1 Form A type)

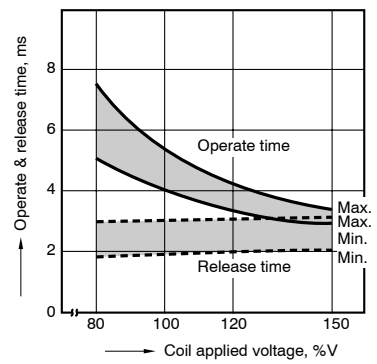


Max. switching capacity (1 Form C type)

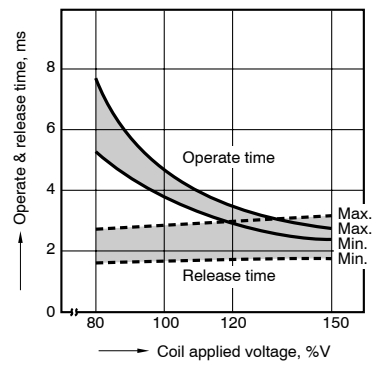


Standard type

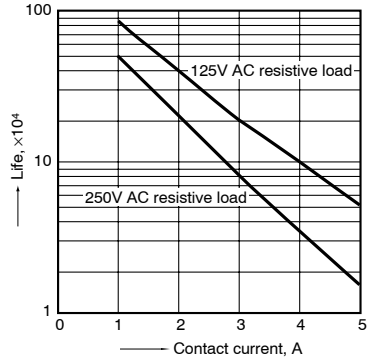
1-(1). Operate & release time (1 Form A type)
Tested sample: JQ1a-12V, 25 pcs.



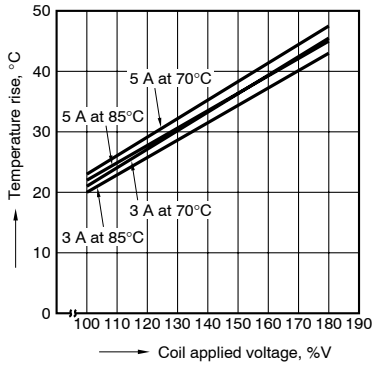
1-(2). Operate & release time (1 Form C type)
Tested sample: JQ1-24V, 25 pcs.



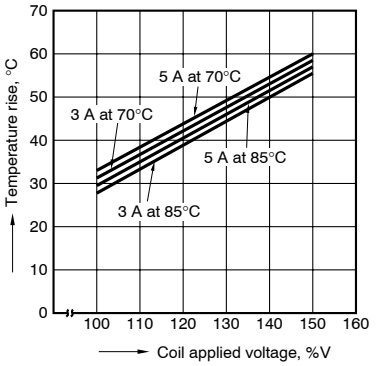
2. Life curve
Ambient temperature: room temperature



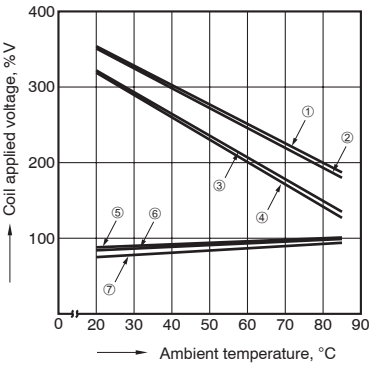
3-(1). Coil temperature rise (1 Form A type)
Contact carrying current: 3 A, 5 A
Measured portion: Inside the coil



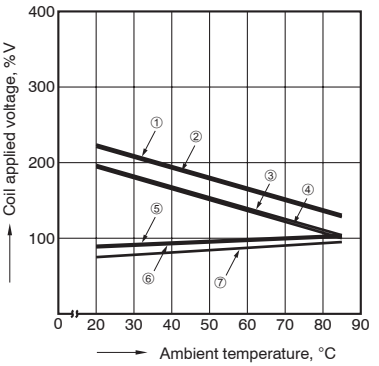
3-(2). Coil temperature rise (1 Form C type)
Contact carrying current: 3 A, 5 A
Measured portion: Inside the coil



4-(1). Ambient temperature characteristics (1 Form A type)
Tested sample: JQ1a-24V
Contact carrying current: 3 A, 5 A



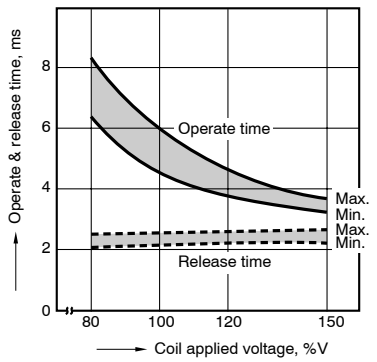
4-(2). Ambient temperature characteristics (1 Form C type)
Tested sample: JQ1-24V
Contact carrying current: 3 A, 5 A



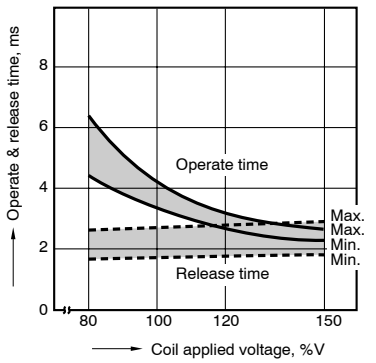
① Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 130°C 266°F) (Carrying current: 3 A)
② Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 130°C 266°F) (Carrying current: 5 A)
③ Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 115°C 239°F) (Carrying current: 3 A)
④ Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 115°C 239°F) (Carrying current: 5 A)
⑤ Pick-up voltage with a hot-start condition of 100%V on the coil (Carrying current: 5 A)
⑥ Pick-up voltage with a hot-start condition of 100%V on the coil (Carrying current: 3 A)
⑦ Pick-up voltage

High capacity type

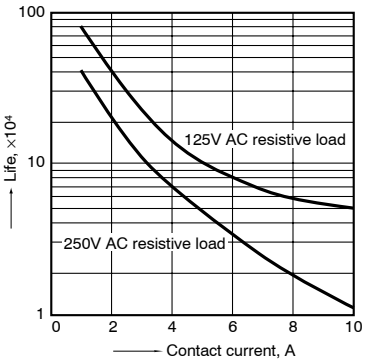
1-(1). Operate & release time (1 Form A type)
Tested sample: JQ1aP-12V, 25 pcs.



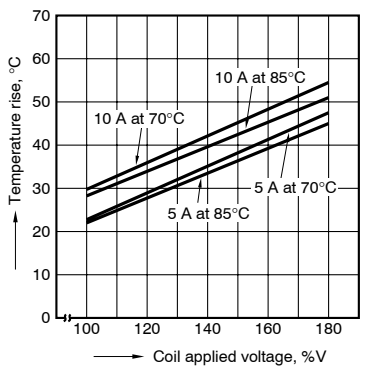
1-(2). Operate & release time (1 Form C type)
Tested sample: JQ1P-12V, 25 pcs.



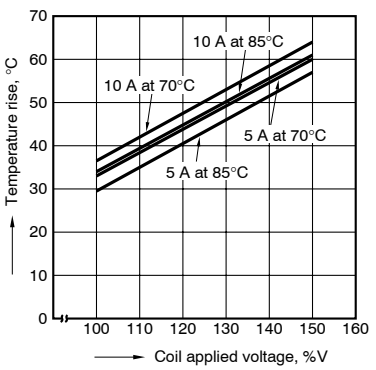
2. Life curve
Ambient temperature: room temperature



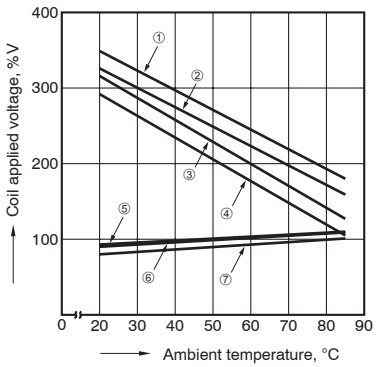
3-(1). Coil temperature rise (1 Form A type)
Contact carrying current: 5 A, 10 A
Measured portion: Inside the coil



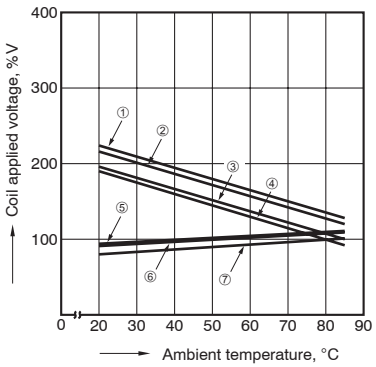
3-(2). Coil temperature rise (1 Form C type)
Contact carrying current: 5 A, 10 A
Measured portion: Inside the coil



4-(1). Ambient temperature characteristics (1 Form A type)
Tested sample: JQ1aP-24V
Contact carrying current: 5 A, 10 A



4-(2). Ambient temperature characteristics (1 Form C type)
Tested sample: JQ1P-24V
Contact carrying current: 5 A, 10 A



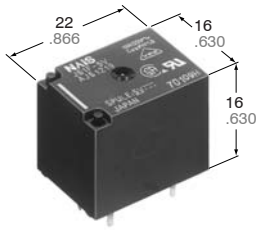
① Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 130°C 266°F) (Carrying current: 5 A)
② Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 130°C 266°F) (Carrying current: 10 A)
③ Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 115°C 239°F) (Carrying current: 5 A)
④ Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 115°C 239°F) (Carrying current: 10 A)
⑤ Pick-up voltage with a hot-start condition of 100%V on the coil (Carrying current: 10 A)
⑥ Pick-up voltage with a hot-start condition of 100%V on the coil (Carrying current: 5 A)
⑦ Pick-up voltage

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

MINIATURE PC BOARD TYPE POWER RELAY

JS RELAYS



mm inch

FEATURES

- **Miniature size with universal terminal footprint**
- **High contact capacity: 10 A**
- **Class B coil insulation type available**
- **TV-5 type available (Standard type)**
  1 Form A type → TV-5
  1 Form C type → TV-5 (N.O. side only)
- **VDE, TÜV also approved**
- **Sealed construction for automatic cleaning (Standard type)**

SPECIFICATIONS

Contact

Types		Standard type	High power type
Arrangement		1 Form A, 1 Form C	1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ	
Contact material		Silver alloy	
Rating (resistive load)	Nominal switching capacity	10 A 250 V AC 10 A 125 V AC 6 A 277 V AC	10 A 250 V AC 10 A 125 V AC 10 A 277 V AC
	Max. switching power	2,500 VA	
	Max. switching voltage	250 V AC, 100 V DC	
	Max. switching current	10 A (AC), 5 A (DC)	
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life (min. ope.)	Mechanical (at 180 cpm)	10^7	
	Electrical at 10 A 125 V AC, 6 A 277 V AC resistive (standard) 10 A 277 V AC resistive (High power)	10^5	2×10^5
	10 A 250 V AC resistive (Standard: at 20 cpm) (High power: at 20 cpm, 105°C 221°F)**	5×10^4 (No contact only)	1.5×10^5

** Holding voltage should be 60% V of nominal voltage

Coil

Nominal operating power	360 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

*1 Detection current: 10mA
*2 Excluding contact bounce time
*3 Half-wave pulse of sine wave: 11ms; detection time: 10μs

Characteristics

		Standard type	High power type
Max. operating speed		20 cpm	
Types			
Initial insulation resistance		Min. 100 MΩ (at 500 V DC)	
Initial breakdown voltage*1	Between open contacts	750 Vrms for 1 min.	
	Between contacts and coil	1,500 Vrms for 1 min.	
Operate time*2 (at nominal voltage)		Approx. 10 ms	
Release time(without diode)*2 (at nominal voltage)		Approx. 10 ms	
Temperature rise (at nominal voltage)		Max. 35°C, resistive, nominal voltage applied to coil. Contact carrying current: 10A, at 85°C 185°F	
Shock resistance	Functional*3	Min. 98 m/s² {10 G}	
	Destructive*4	Min. 980 m/s² {100 G}	
Vibration resistance	Functional*5	Approx. 98 m/s² {10 G}, 10 to 55 Hz at double amplitude of 1.6 mm	
	Destructive	Approx. 117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm	
Conditions for operation, transport and storage*6 (Not freezing and condensing at low temperature)	Ambient temp.*7	–40°C to +85°C –40°F to +185°F	–40°C to +105°C –40°F to +221°F
	Humidity	5 to 85% R.H.	
Unit weight		Approx.12 g .423 oz	

*4 Half-wave pulse of sine wave: 6ms
*5 Detection time: 10μs
*6 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).
*7 When using relays in a high ambient temperature, consider the pick-up voltage rise due to the high temperature (a rise of approx. 0.4% V for each 1°C 33.8°F with 20°C 68°F as a reference) and use a coil impressed voltage that is within the maximum allowable voltage range.

TYPICAL APPLICATIONS

1. Home appliances
   Air conditioner, heater, etc.
2. Automotive
   Power-window, car antenna, door-lock, etc.
3. Office machines
   PPC, facsimile, etc.
4. Vending machines

ORDERING INFORMATION

Ex. JS [1a] [F] — [B] — [12V] — [F]

Contact arrangement	Protective construction	Coil insulation class	Coil voltage (DC)	Environmental support
1: 1 Form C (Standard) 1a: 1 Form A (Standard) 1aP: 1 Form A (High Power)	Nil: Sealed type F: Flux-resistant type	Nil: Class E insulation B: Class B insulation	5, 6, 9, 12, 18, 24, 48 V	F: RoHS Directive conforming type ($AgSnO_2$ type) Nil: RoHS Directive non-conforming type (AgCdO type)

UL/CSA, VDE, TÜV (Standard type only) approved type is standard.

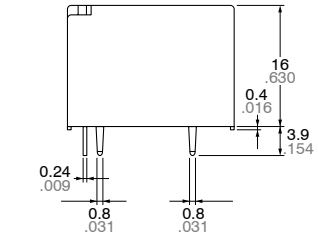
Notes: 1. Standard packing: Carton: 100 pcs. Case: 500 pcs.
2. When ordering TV rated (TV-5) types, add suffix -TV.
3. Contact arrangement 1aP type is Flux-resistant type only (class B or class F insulation). Please consult us for coil insulation class F.

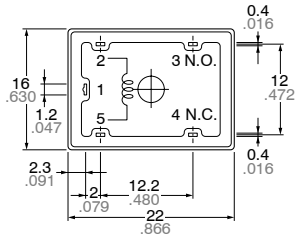
COIL DATA

Part No.					Nominal voltage, V DC	Pick-up voltage, V DC (max.) (at 20°C 68°F)	Drop-out voltage, V DC (min.) (at 20°C 68°F)	Coil resistance, Ω (±10%) (at 20°C 68°F)	Nominal operating current, mA (±10%) (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Max. allowable voltage (at 85°C 185°F)
Standard type				High Power type							
Sealed type		Flux-resistant type		Flux-resistant type							
1 Form A	1 Form C	1 Form A	1 Form C	1 Form A							
JS1a-5V (-F)	JS1-5V (-F)	JS1aF-5V (-F)	JS1F-5V (-F)	JS1aPF-B-5V (-F)	5	3.5	0.5	69.4	72	360	130%V of nominal voltage
JS1a-6V (-F)	JS1-6V (-F)	JS1aF-6V (-F)	JS1F-6V (-F)	JS1aPF-B-6V (-F)	6	4.2	0.6	100	60		
JS1a-9V (-F)	JS1-9V (-F)	JS1aF-9V (-F)	JS1F-9V (-F)	JS1aPF-B-9V (-F)	9	6.3	0.9	225	40		
JS1a-12V (-F)	JS1-12V (-F)	JS1aF-12V (-F)	JS1F-12V (-F)	JS1aPF-B-12V (-F)	12	8.4	1.2	400	30		
JS1a-18V (-F)	JS1-18V (-F)	JS1aF-18V (-F)	JS1F-18V (-F)	JS1aPF-B-18V (-F)	18	12.6	1.8	900	20		
JS1a-24V (-F)	JS1-24V (-F)	JS1aF-24V (-F)	JS1F-24V (-F)	JS1aPF-B-24V (-F)	24	16.8	2.4	1,600	15		
JS1a-48V (-F)	JS1-48V (-F)	JS1aF-48V (-F)	JS1F-48V (-F)	JS1aPF-B-48V (-F)	48	33.6	4.8	6,400	7.5		

DIMENSIONS

mm inch



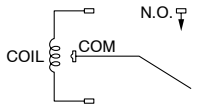


Note: Terminal No. 4 is only for Standard 1 Form C type

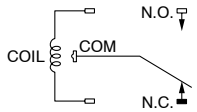
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

1a



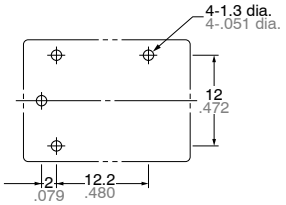
1c



PC board pattern (Bottom view)

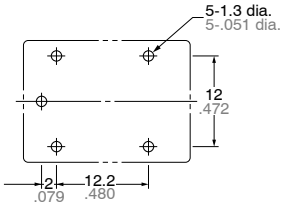
1a

(Standard, High Power)



1c

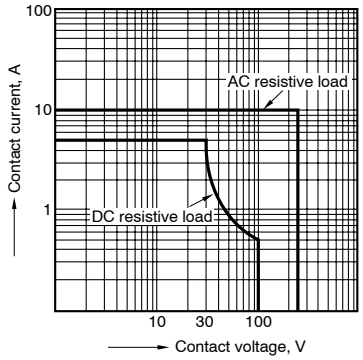
(Standard)



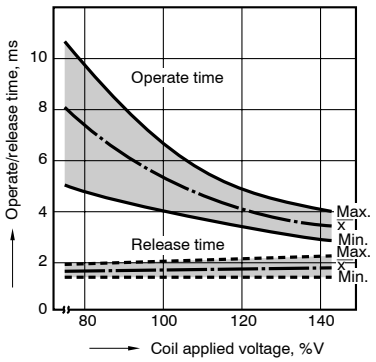
Tolerance: ±0.1 ±.004

REFERENCE DATA

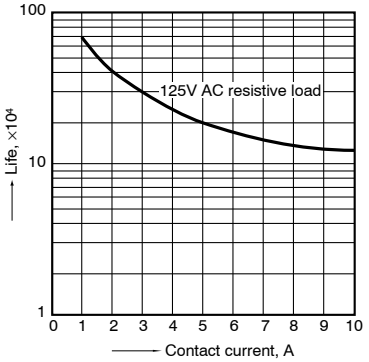
1. Maximum value for switching capacity



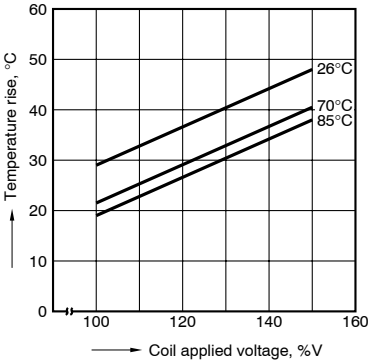
2. Operate/release time
Sample: 25 pcs., JS1-12V



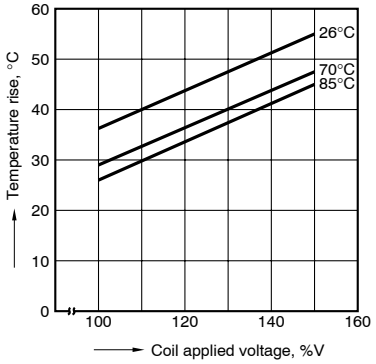
3. Life curve
Ambient temperature: Room temperature



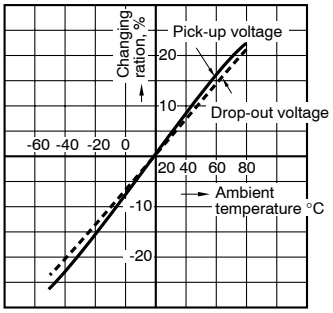
4-(1). Coil temperature rise
Sample: 5 pcs., JS1a-24V
Measured portion: Inside the coil
Contact current: 5 A



4-(2). Coil temperature rise
Sample: 5 pcs., JS1a-24V
Measured portion: Inside the coil
Contact current: 10 A

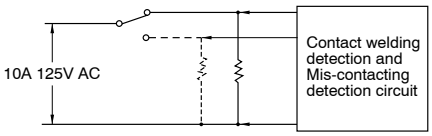


5. Ambient temperature characteristics
Sample: 6 pcs., JS1-12V

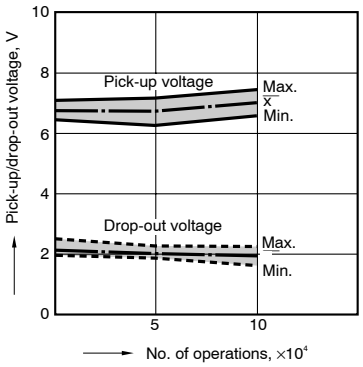


6. Electrical life test
(10 A 125 V AC, resistive load)
Sample: 6 pcs., JS1-12V
Operating speed: 20 cpm
Ambient temperature: room temperature

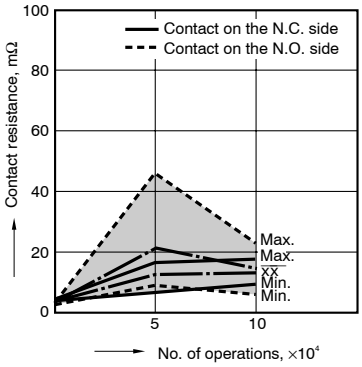
(Circuit)



Change of pick-up and drop-out voltage



Change of contact resistance



For Cautions for Use, see Relay Technical Information (page 392).

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SURGE VOLTAGE 6,000 V
30 AMP. RELAY

JT-V RELAYS

PCB type

TMP type

FEATURES

- **Surge withstand voltage: Min. 6,000 V**
- **High switching capacity — 30 A for 1 Form A**
- **2 contact arrangements — 1 Form A or 1 Form C**
- **"TMP" types available**
- **UL/C-UL recognized**
- **Class F types standard**

SPECIFICATIONS

Contacts

		PCB & TMP type	
Arrangement		1 Form A	1 Form C
Initial contact resistance, max. (By voltage drop method, 6 V DC 1 A)		50 mΩ	
Contact material		Silver alloy	
Rating	Max. switching power	8310 VA	N.C.: 2770 VA N.O.: 5540 VA
	Max. switching voltage	277 V AC	
	Max. switching current	30 A	N.C.: 10 A N.O.: 20 A
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life	Mechanical	Min. 1×10^7	
	Electrical (Resistive load)	20 A 277 V AC Min. 1×10^5*	N.O.: 20 A 277 V AC Min. 1×10^5* N.C.: 10 A 277 V AC Min. 1×10^5*

* The life is for open venting-hole condition.

Coil at 20°C 68°F

	PCB & TMP type
Nominal operating power	Approx. 1,000 mW

Characteristics

		PCB & TMP type
Initial insulation resistance*1		Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between contacts	1,200 Vrms
	Between contacts and coil	3,500 Vrms
Initial surge voltage between contact and coil		Min. 6,000 V*3
Operate time*4 (at nominal voltage)		Max. 15 ms
Release time (without diode)*4 (at nominal voltage)		Max. 10 ms
Shock resistance	Functional*5	Min. 98 m/s² {10 G}
	Destructive*6	Min. 980 m/s² {100 G}
Vibration resistance	Functional*7	Max. 88.2 m/s² {9 G}, 10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	Max. 117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–55°C to +85°C –67°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		PCB type: Approx. 25 g (.88 oz) TMP type: Approx. 30 g (1.06 oz)

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Intial breakdown voltage" section
*2 Detection current: 10 mA
*3 Ware is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981.
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

TYPICAL APPLICATIONS

- Oven
- Heating & ventilation
- Home appliance

ORDERING INFORMATION

JT-V Relays (PCB and TMP type)

JTV | 1a | S | TMP | 12V

Contact arrangement	Protective construction	Mounting classification	Coil voltage
1a: 1 Form A 1: 1 Form C	S: Sealed type G: Dust cover type	PA: PCB type TMP: TMP type	DC 12, 18, 24, 48 V

Notes: 1. UL/C-UL approved type is standard.
2. 5 V, 6 V, 9 V DC types are also available. Please contact us for details.
3. Standard packing: PCB type: Carton: 50 pcs. Case: 500 pcs.
TMP type: Carton: 50 pcs. Case: 300 pcs.

COIL DATA (at 20°C 68°F)

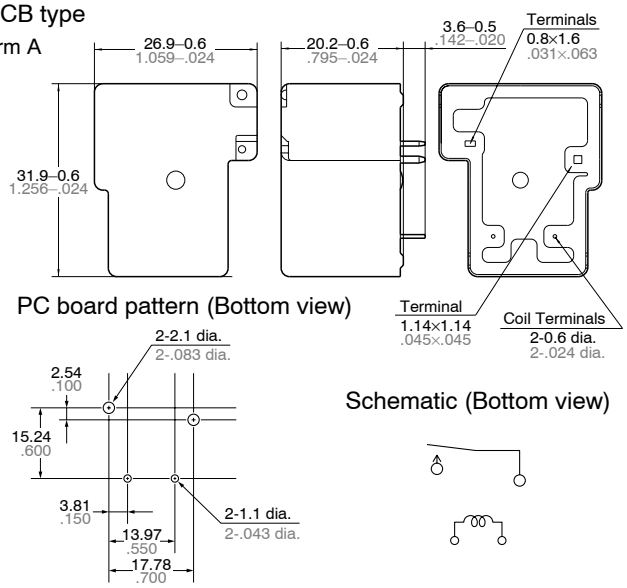
Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
			PCB & TMP	PCB & TMP	
12	9.0	1.2	144	1000	14.4
18	13.5	1.8	324	1000	21.6
24	18.0	2.4	576	1000	28.8
48	36.0	4.8	2304	1000	57.6

DIMENSIONS

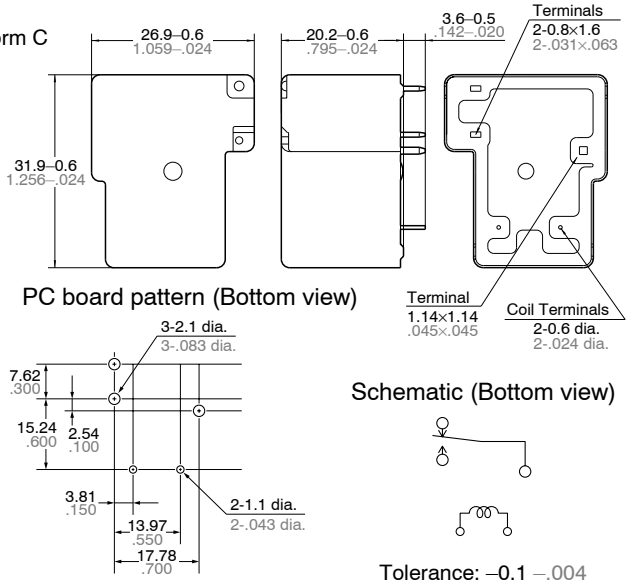
mm inch

1. PCB type

1 Form A



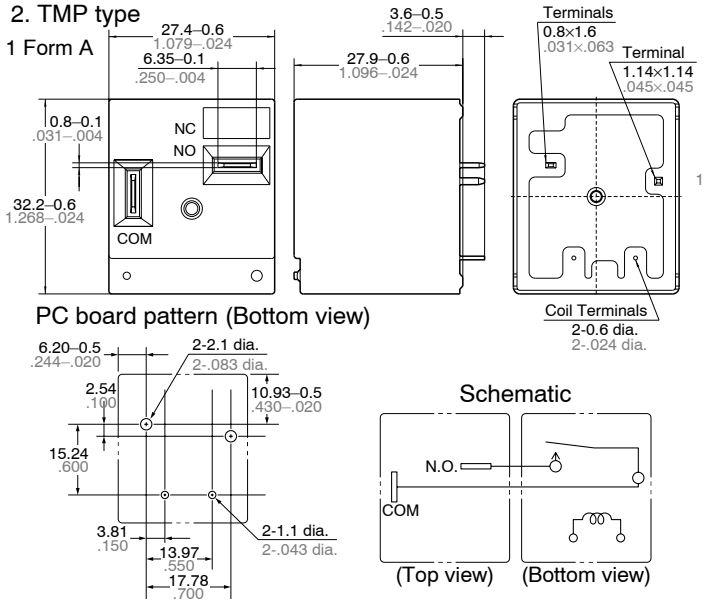
1 Form C



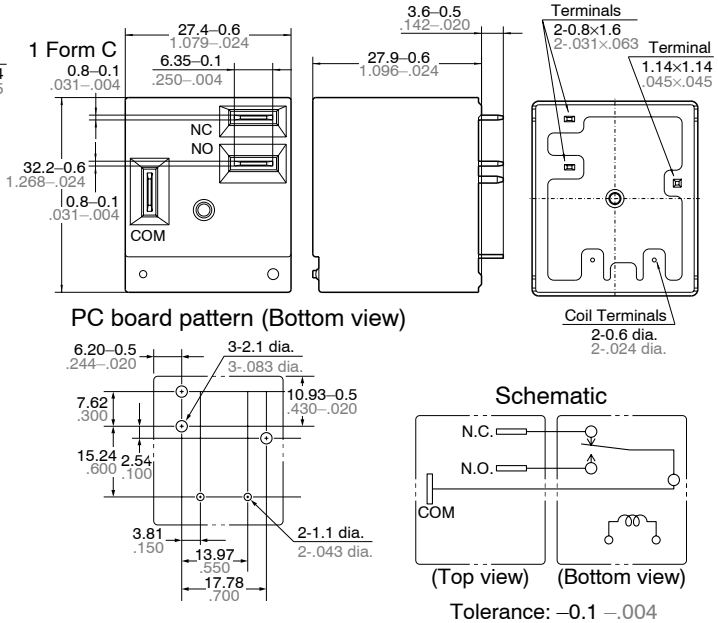
Tolerance: –0.1 –.004

2. TMP type

1 Form A



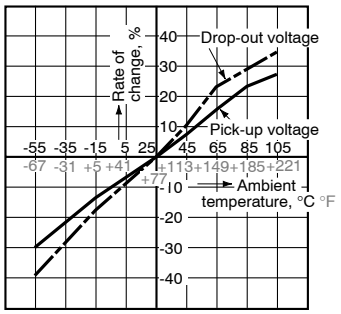
1 Form C



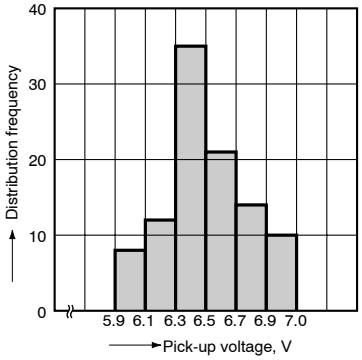
Tolerance: –0.1 –.004

REFERENCE DATA

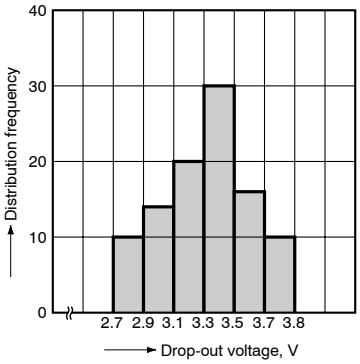
1. Change of rate of pick-up and drop-out voltage (at 20°C 68°F)
Sample: JTV1S-TMP-24V (6 pcs.)



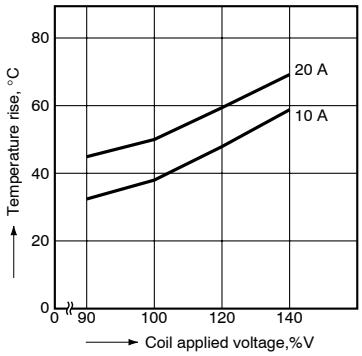
2. Distribution frequency of pick-up voltage (at 20°C 68°F)
Sample: JTV1S-TMP-12V (100 pcs.)



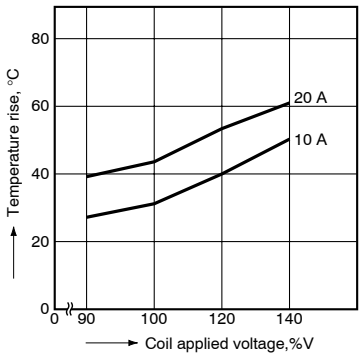
3. Distribution frequency of drop-out voltage (at 20°C 68°F)
Sample: JTV1S-TMP-12V (100 pcs.)



4.-(1) Coil temperature rise (TMP type)*
Ambient temperature: 25°C 77°F
Sample: JTV1aS-TMP-12V (6 pcs.)



Ambient temperature: 85°C 185°F
Sample: JTV1aS-TMP-12V (6 pcs.)



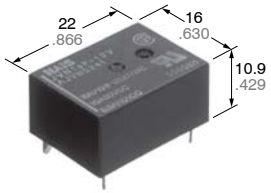
* Coil temperature rise of sealed types are same as data of the dust cover type.

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

COMPACT FLAT POWER RELAY FOR HEATER LOADS

JV-N RELAYS



FEATURES

• High 16 A capacity
The contacts are high capacity 16A, 125 V AC.

• Compact, flat type with low 10.9 mm .429 inch height
Compact flat type with low surface area of 16 × 22 mm .630 × .866 inch and height of 10.9 mm .429 inch.

• High sensitivity at 200 mW
High sensitivity at 200 mW coil power consumption.

• Represses contact terminal heat
The contact terminals are larger and thicker compared to the existing JV relay. This limits the rise in temperature of the terminals when there is a large current flowing to approx. 28°C 62°F (normal current of 16 A).

• Conforms to the various safety standards
UL/CSA, TÜV approved.

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 30 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	16 A 125 V AC, 10 A 277 V AC 10 A 30 V DC, 10 A 125 V AC
	Max. switching power	2,770 VA, 300 W
	Max. switching voltage	277 V AC, 30 V DC
	Max. switching current	16 A (AC 125 V), 10 A (DC)
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. ope.) Mechanical (at 180 cpm)		2×10^7
Electrical at resistive load (at 20 cpm)	Sealed type 16 A 125 V AC, 10 A 30 V DC	10^5
	Flux-resistant type 10 A 125 V AC	3×10^5

Coil

Nominal operating power	200 mW (DC 4.5 to 48 V) 600 mW (DC 100 V)

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed		20 cpm
Operate time*1 (at nominal voltage)		Max. 12 ms (DC 4.5 V to 48 V) Max. 8 ms (DC 100 V)
Release time*2 (at nominal voltage)		Max. 5 ms
Initial insulation resistance		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage (Detection current: 10 mA	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	2,500 Vrms for 1 min.
Surge voltage between contact and coil		Min. 4,500 V
Temperature rise		Max. 45°C (DC 4.5 V to 48 V) *3 Max. 55°C (DC 100 V)*4
Conditions in case of operation, transport and storage*8		Ambient temperature –40 to 70°C –40 to 158°F (DC 4.5 to 48 V) –40 to 60°C –40 to 140°F (DC 100V) Humidity: 5 to 85 % R.H. (Note freezing and condensing at low temperature) Air pressure: 86 to 106 kPa
Shock resistance	Functional	Min. 200 m/s²{20G}*5
	Destructive	Min. 1,000 m/s²{100G}*6
Vibration resistance	Functional	10 to 55 Hz *7 at double amplitude of 1.6 mm
	Destructive	10 to 55 Hz at double amplitude of 2 mm
Unit weight		Approx. 8g .28 oz

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Excluding contact bounce time
*2 Excluding contact bounce time, without diode
*3 By resistive method; nominal voltage applied to the coil; contact carrying current: 16A, at 70°C 158°F
*4 Nominal voltage applied to the coil, at 60°C 140°F
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

TYPICAL APPLICATIONS

- AV equipment: TV's, VTR's, etc.
- OA equipment
- HA equipment

ORDERING INFORMATIONS

Ex. JVN [1a] [F] – [4.5 V]

Contact arrangement	Protective construction	Coil voltage (DC)
1a: 1 Form A	Nil: Sealed type F: Flux-resistant type	4.5, 6, 9, 12, 18, 24, 48, 100 V

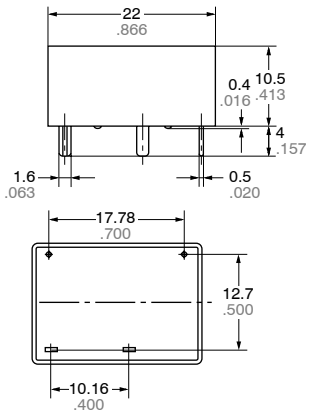
UL/CSA, TÜV approved type is standard.

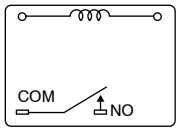
TYPES AND COIL DATA (at 20°C 68°F)

Part No.		Nominal voltage, V DC	Pick-up voltage V DC (max.)	Drop-out voltage V DC (min.)	Coil resistance, W (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Sealed type	Flux-resistant type							
JVN1a-4.5V	JVN1aF-4.5V	4.5	3.375	0.23	101	44.4	200	6.75
JVN1a-6V	JVN1aF-6V	6	4.5	0.3	180	33.3	200	9
JVN1a-9V	JVN1aF-9V	9	6.75	0.45	405	22.2	200	13.5
JVN1a-12V	JVN1aF-12V	12	9	0.6	720	16.7	200	18
JVN1a-18V	JVN1aF-18V	18	13.5	0.9	1,620	11.1	200	27
JVN1a-24V	JVN1aF-24V	24	18	1.2	2,880	8.3	200	36
JVN1a-48V	JVN1aF-48V	48	36	2.4	11,520	4.2	200	72
JVN1a-100V	JVN1aF-100V	100	60	4	16,600	6	600	110

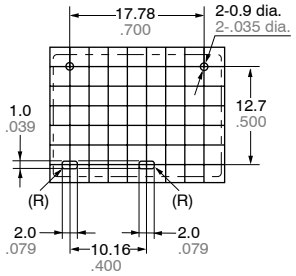
DIMENSIONS

mm inch





PC board pattern

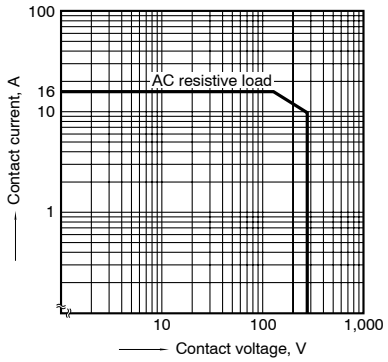


Dimension:

	General tolerance
Max. 1mm .039 inch:	±0.2 ±.008
1 to 5mm .039 to .197 inch:	±0.3 ±.012
Min. 5mm .197 inch:	±0.4 ±.016

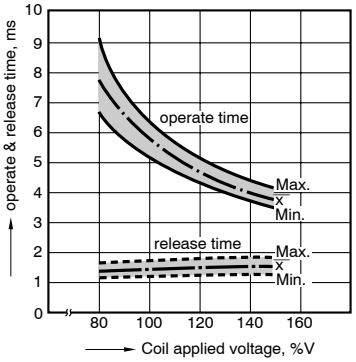
REFERENCE DATA

1. Max. switching power



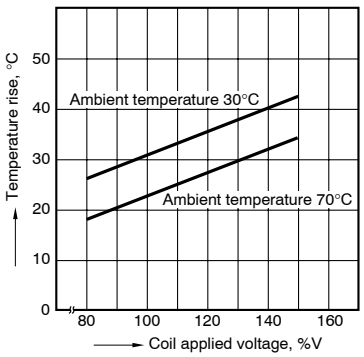
2. Operate/release time

Sample: JVN1aF-12 V, 6 pcs.



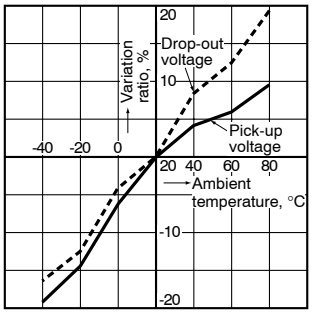
3. Coil temperature rise

Sample: JVN1aF-12 V, 6 pcs.
point measured: coil inside
Contact current: 16 A



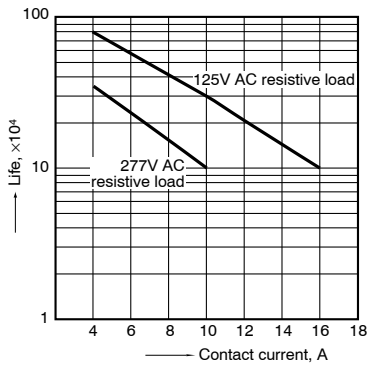
4. Ambient temperature characteristics

Sample: JVN1aF-12 V, 6 pcs.



5. Life curve

Operation frequency: 20 times/min.
Ambient temperature: room temperature



Power

For Cautions for Use, see Relay Technical Information (page 392).

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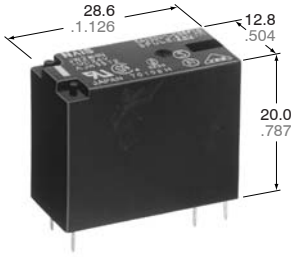
COMPACT PC BOARD POWER RELAY

JW RELAYS



mm inch

FEATURES

- **Miniature package with universal terminal footprint**
- **High dielectric withstanding for transient protection: 10,000 V surge in μs between coil and contact**
- **Sealed construction**
- **Class B coil insulation types available**
- **TV rated (TV-5) types available (only for 1 Form A type)**
- **VDE, TÜV, SEMKO, SEV, FIMKO, TV-5 also approved**

SPECIFICATIONS

Contact

		Standard type	High capacity type
Arrangement		1 Form A, 1 Form C, 2 Form A, 2 Form C	1 Form A, 1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ	
Contact material		Silver alloy	
Rating (resistive load)	Nominal switching capacity	5 A 250 V AC, 5 A 30 V DC	10 A 250 V AC, 10 A 30 V DC
	Max. switching power	1,250 VA, 150 W	2,500 VA, 300 W
	Max. switching voltage	250 V AC, 30 V DC	
	Max. switching current	5 A	10 A
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life (min. ope.)	Mechanical (at 180 cpm)	5×10^6	
	Electrical (at 6 cpm) (Resistive load)	10^5	

Coil

Nominal operating power	530 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Detection current: 10mA
*2 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).
*8 When using relays in a high ambient temperature, consider the pick-up voltage rise due to the high temperature (a rise of approx. 0.4% V for each 1°C 33.8°F with 20°C 68°F as a reference) and use a coil impressed voltage that is within the maximum allowable voltage range.

Characteristics

			Standard type	High capacity type
Max. operating speed (at rated load)			6 cpm	
Initial insulation resistance			Min. 1,000 MΩ at 500 V DC	
Initial breakdown voltage*1	Between open contacts		1,000 Vrms for 1 min.	
	Between contacts and coil		5,000 Vrms for 1 min.	
	Between contact sets		3,000 Vrms for 1 min. (2 Form A, 2 Form C)	
Initial surge voltage between contacts and coil*2			Min. 10,000 V	
Operate time*3 (at nominal voltage)			Max. 15 ms	
Release time (without diode)*3 (at nominal voltage)			Max. 5 ms	
Temperature rise (at 20°C) (at nominal voltage) (with nominal coil voltage and at nominal switching capacity)			1a: max. 39°C 1c, 2a, 2c: max. 55°C (resistance method)	1a: max. 45°C 1c: max. 55°C (resistance method)
Shock resistance	Functional*4		Min. 98 m/s² {10 G}	
	Destructive*5		Min. 980 m/s² {100 G}	
Vibration resistance	Functional*6		Approx. 98 m/s² {10 G}, 10 to 55 Hz at double amplitude of 1.6 mm	
	Destructive		Approx. 117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2.0 mm	
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)		Ambient temp.*8	–40°C to +85°C –40°F to +185°F	
		Humidity	5 to 85% R.H.	
Unit weight			Approx. 13 g .46 oz	

TYPICAL APPLICATIONS

1. Home appliances
   TV sets, VCR, Microwave ovens
2. Office machines
   Photocopiers, Vending machines
3. Industrial equipment
   NC machines, Robots, Temperature controllers

ORDERING INFORMATION

Ex. JW [1] [F] [S] [N] [B] [DC5V] — [ ]

Contact arrangement	Contact capacity	Protective construction	Pick-up voltage	Coil insulation class	Coil voltage	Environmental support
1: 1 Form C 1a: 1 Form A 2: 2 Form C 2a: 2 Form A	Nil: Standard (5 A) F: High capacity (10 A)*	S: Sealed type	N: 70% of nominal voltage	Nil: Class E insulation B: Class B insulation	DC 5, 6, 9, 12, 18, 24, 48 V	• RoHS Directive conforming type ($AgSnO_2$ type) F: 1a (Standard/High capacity) Nil: 1c (Standard/High capacity), 2a (Standard), 2c (Standard) • RoHS Directive non-conforming type (AgCdO type) Nil: 1a (Standard/High capacity)

*Only for 1 Form A and 1 Form C type
UL/CSA, VDE, SEMKO, FIMKO, SEV approved type is standard.
Notes: 1. When ordering TV rated (TV-5) types, add suffix-TV (available only for 1 Form A type).
2. Standard packing: Carton: 100 pcs. Case: 500 pcs.

TYPES

Standard (5A) types

Contact arrangement	Coil voltage, V DC	Part No.	Contact arrangement	Coil voltage, V DC	Part No.
1 Form A	5	JW1aSN-DC5V (-F)	2 Form A	5	JW2aSN-DC5V
	6	JW1aSN-DC6V (-F)		6	JW2aSN-DC6V
	9	JW1aSN-DC9V (-F)		9	JW2aSN-DC9V
	12	JW1aSN-DC12V (-F)		12	JW2aSN-DC12V
	18	JW1aSN-DC18V (-F)		18	JW2aSN-DC18V
	24	JW1aSN-DC24V (-F)		24	JW2aSN-DC24V
	48	JW1aSN-DC48V (-F)		48	JW2aSN-DC48V
1 Form C	5	JW1SN-DC5V	2 Form C	5	JW2SN-DC5V
	6	JW1SN-DC6V		6	JW2SN-DC6V
	9	JW1SN-DC9V		9	JW2SN-DC9V
	12	JW1SN-DC12V		12	JW2SN-DC12V
	18	JW1SN-DC18V		18	JW2SN-DC18V
	24	JW1SN-DC24V		24	JW2SN-DC24V
	48	JW1SN-DC48V		48	JW2SN-DC48V

High capacity (10 A) types

Contact arrangement	Coil voltage, V DC	Part No.	Contact arrangement	Coil voltage, V DC	Part No.
1 Form A	5	JW1aFSN-DC5V (-F)	1 Form C	5	JW1FSN-DC5V
	6	JW1aFSN-DC6V (-F)		6	JW1FSN-DC6V
	9	JW1aFSN-DC9V (-F)		9	JW1FSN-DC9V
	12	JW1aFSN-DC12V (-F)		12	JW1FSN-DC12V
	18	JW1aFSN-DC18V (-F)		18	JW1FSN-DC18V
	24	JW1aFSN-DC24V (-F)		24	JW1FSN-DC24V
	48	JW1aFSN-DC48V (-F)		48	JW1FSN-DC48V

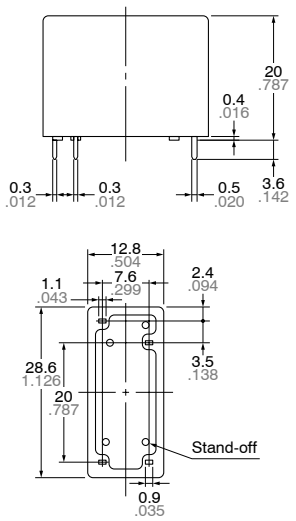
COIL DATA (at 20°C 68°F)

Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Nominal operating current, mA (±10%)	Coil resistance, W (±10%)	Nominal operating power, mW	Max. allowable voltage
5	3.5	0.5	106	47	530	130% V of Nominal Voltage (at 60°C 140°F) 120% V of Nominal Voltage (at 85°C 185°F)
6	4.2	0.6	88	68		
9	6.3	0.9	58	155		
12	8.4	1.2	44	270		
18	12.6	1.8	29	611		
24	16.8	2.4	22	1,100		
48	33.6	4.8	11	4,400		

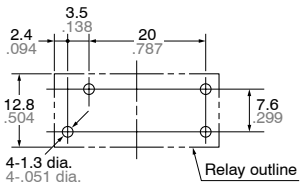
DIMENSIONS

mm inch

1 Form A

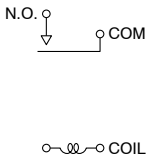


PC board pattern (Copper-side view)

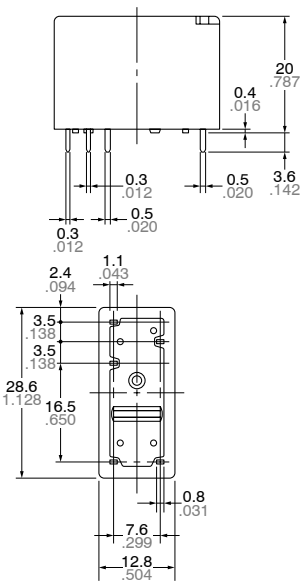


Tolerance: ±0.1 ±.004

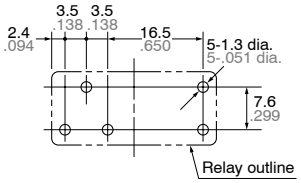
Wiring diagram (Bottom view)



1 Form C

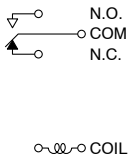


PC board pattern (Copper-side view)



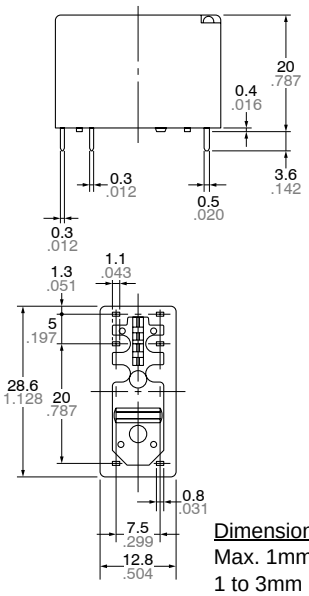
Tolerance: ±0.1 ±.004

Wiring diagram (Bottom view)

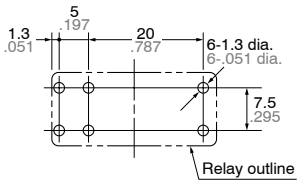


Dimension :	General tolerance
Max. 1mm .039 inch	±0.1 ±.004
1 to 3mm .039 to .118 inch	±0.2 ±.008
Min. 3mm .118 inch	±0.3 ±.012

2 Form A

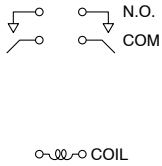


PC board pattern (Copper-side view)

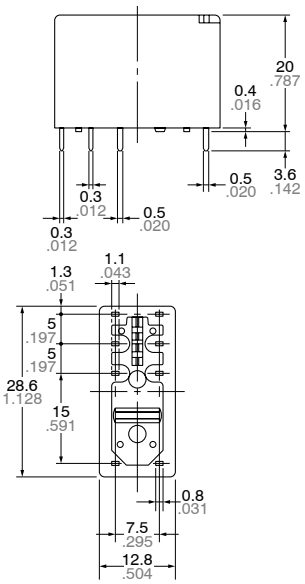


Tolerance: ±0.1 ±.004

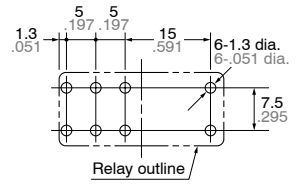
Wiring diagram (Bottom view)



2 Form C

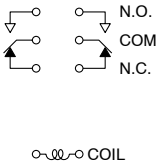


PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

Wiring diagram (Bottom view)

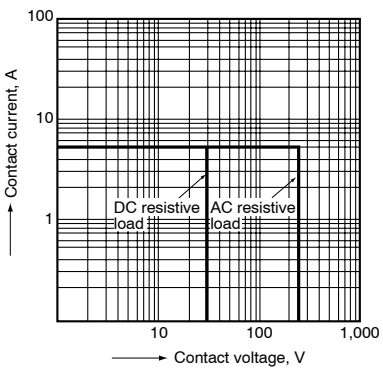


Dimension :	General tolerance
Max. 1mm .039 inch	±0.1 ±.004
1 to 3mm .039 to .118 inch	±0.2 ±.008
Min. 3mm .118 inch	±0.3 ±.012

REFERENCE DATA

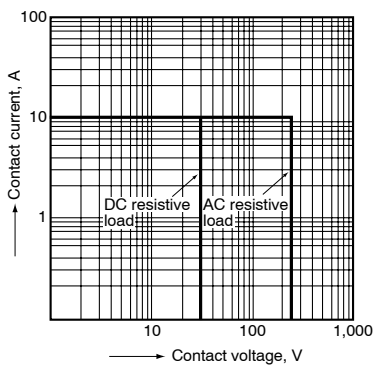
1-(1). Maximum operating power

1 Form A Standard (5 A) type



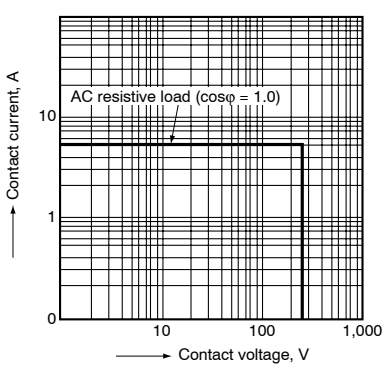
1-(2). Maximum operating power

1 Form A High Capacity (10 A) type

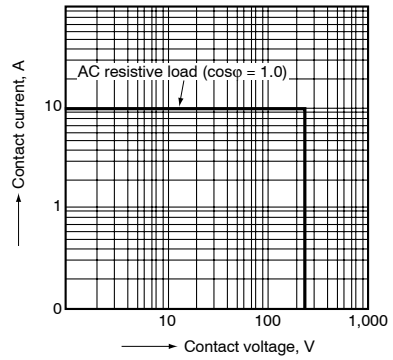


1-(3). Maximum operating power

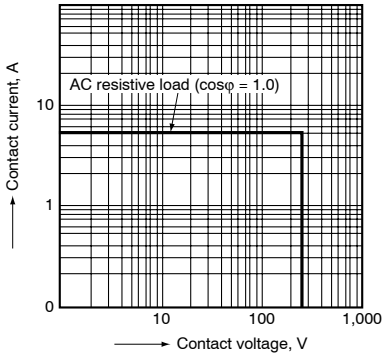
1 Form C Standard (5 A) type



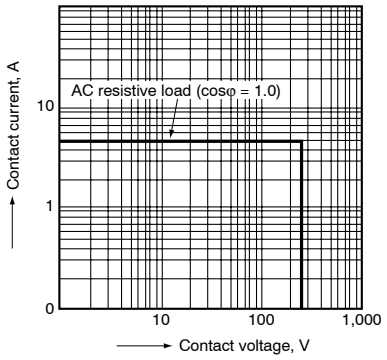
1-(4). Maximum operating power
1 Form C High Capacity (10 A) type



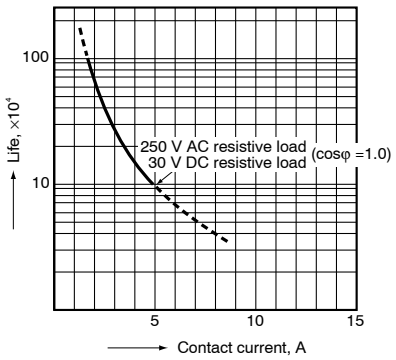
1-(5). Maximum operating power
2 Form A Standard (5 A) type



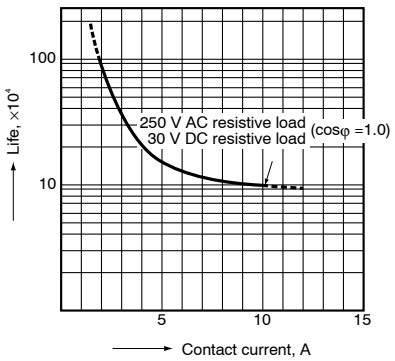
1-(6). Maximum operating power
2 Form C Standard (5 A) type



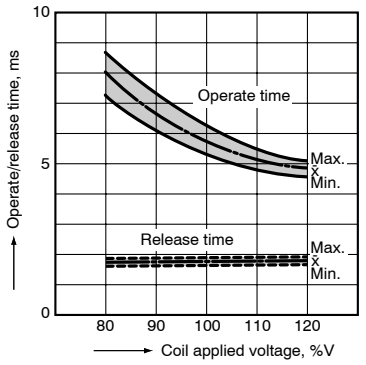
2-(1). Life curve
1 Form A Standard (5 A) type



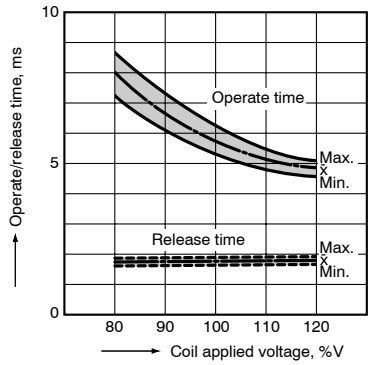
2-(2). Life curve
1 Form A High Capacity (10 A) type



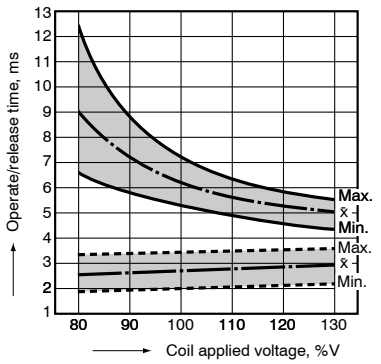
3-(1). Operate/release time
Sample: JW1aSN-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F



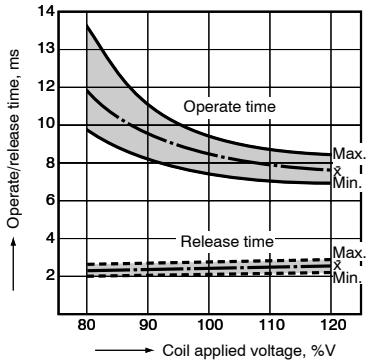
3-(2). Operate/release time
Sample: JW1aFSN-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F



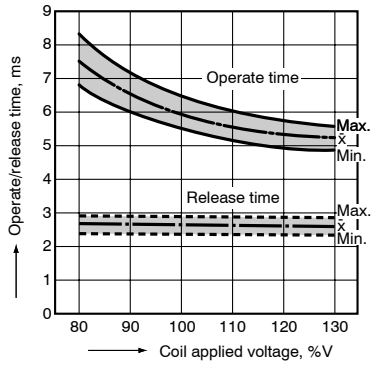
3-(3). Operate/release time
Sample: JW1SN-DC12V, 6 pcs.
Ambient temperature: 20°C 68°F



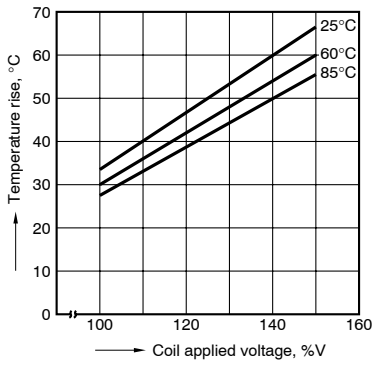
3-(4). Operate/release time
Sample: JW2aSN-DC24V, 6 pcs.
Ambient temperature: 20°C 68°F



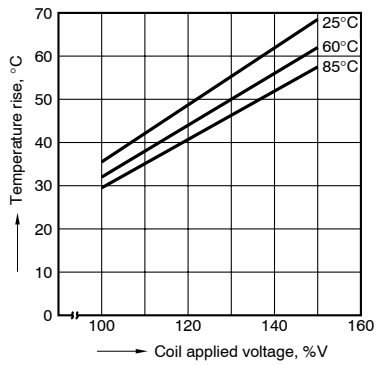
3-(5). Operate/release time
Sample: JW2SN-DC12V, 6 pcs.
Ambient temperature: 20°C 68°F



4-(1). Coil temperature rise
(Contact carrying current: 5A)
Sample JW1aFSN-DC12V, 6 pcs.
Point measured: Inside the coil



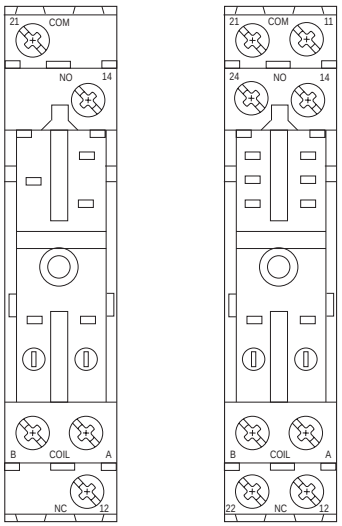
4-(2). Coil temperature rise
(Contact carrying current: 10 A)
Sample: JW1aFSN-DC12V, 6 pcs.
Point measured: Inside the coil



ACCESSORIES

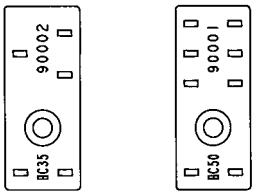
DIN terminal sockets

JW1SI **JW2SI**



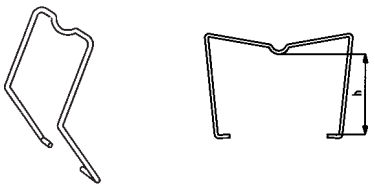
Plug-in sockets

JW1PI **JW2PI**



Retaining springs

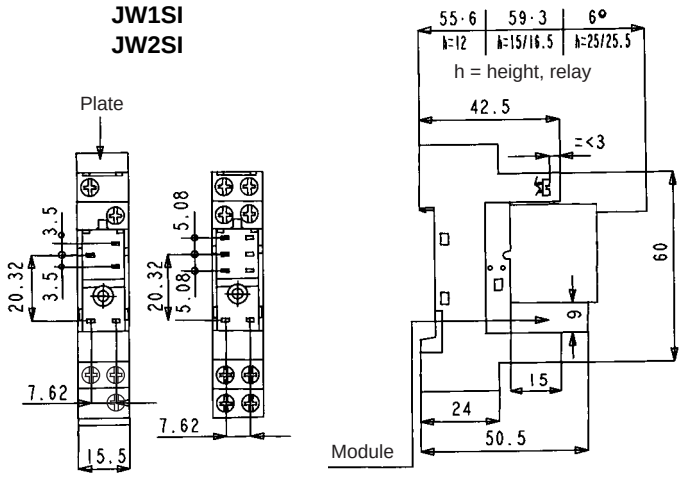
JWHFSI **JWHFI**



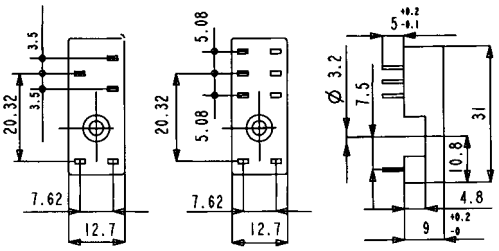
h (relay height) = 20.4 mm

DIMENSIONS

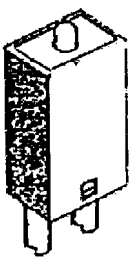
JW1SI
JW2SI

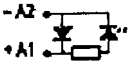
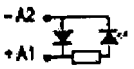
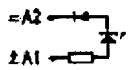
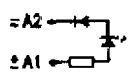


JW1PI **JW2PI**



MODULES supporting the JW relay



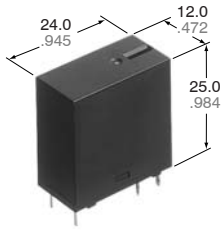
Description	Voltage	Schematic	LED color	Type
Module with diode and LED. Protection against inverting polarity plus illuminated signal.	6 / 24 V DC		LED red	42
	24 / 60 V DC		LED red	42 B
Module with signal LED. No protection against inverting polarity. AC or DC power supply possible.	6 / 24 V AC/DC		LED red	62
	24 / 60 V AC/DC		LED red	62B

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

2 Form A slim power relay

LA RELAYS (ALA)



mm inch

FEATURES

1. 2 Form A slim type
24(L) × 12(W) × 25(H) mm
.945(L)×.472(W)×.984(H) inch

2. 3A type and 5A TV type
3A type: Contact reliability and break performance best suited for protecting and switching speakers.
5A TV type: Tough against inrush current and optimal for turning on and off the power supply. Rated TV-4 (UL/CSA).

3. High insulation resistance
• Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
• Surge withstand voltage between contact and coil: 10,000 V or more.

4. High noise immunity realized by the card separation structure between contact and coil

5. Conforms to the various safety standards
• UL/CSA, VDE, TÜV, SEMKO, SEV approved

SPECIFICATIONS

Contact

Type		3A rated	5A TV rated
Arrangement		2 Form A	
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 50 mΩ	Max. 100 mΩ
Contact material		Gold-clad silver alloy	Silver alloy
Rating (resistive load)	Nominal switching capacity	3 A 125 V AC	5 A 277 V AC
	Max. switching power	625 VA	1,385 V A
	Max. switching voltage	125 V AC	277 V AC
	Max. switching current	5 A (AC)	
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life (min. operations)	Mechanical (at 180 cpm)	10^6	
	Electrical (at 20 cpm) (at rated load)	5×10^4 (ON: OFF=1.5s: 1.5s)	

Coil

Nominal operating power	530 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50ms according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Type		3A rated	5A TV rated
Max. operating speed		20 cpm	
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)	
Initial *2 breakdown voltage	Between contact sets	1,000 Vrms for 1 min.	
	Between open contacts	1,000 Vrms for 1 min.	
	Between contact and coil	4,000 Vrms for 1 min.	
Surge voltage between contact and coil*3		Min. 10,000 V	
Operate time*4 (at nominal voltage)		Max. 15ms (at 20°C 68°F)	
Release time (with diode)*4 (at nominal voltage)		Max. 15ms (at 20°C 68°F)	
Temperature rise (at 70°C)		Max. 45°C with nominal coil voltage and at 3 A contact carrying current	Max. 45°C with nominal coil voltage and at 5 A contact carrying current
Shock resistance	Functional*5	Min. 200 m/s²{approx. 20 G}	
	Destructive*6	Min. 1,000 m/s²{approx. 100 G}	
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm	
	Destructive	10 to 55Hz at double amplitude of 1.5mm	
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F	
	Humidity	5 to 85% R.H.	
	Air pressure	86 to 106 kPa	
Unit weight		Approx. 13 g .46 oz	

ORDERING INFORMATION

Ex. A | LA | 2 | P | F | 12

Product name	Contact arrangement	Contact capacity	Protective construction	Coil voltage(V DC)
LA	2: 2 Form A	Nil: 3A P: 5A TV-4	F: Flux-resistant type	12, 24

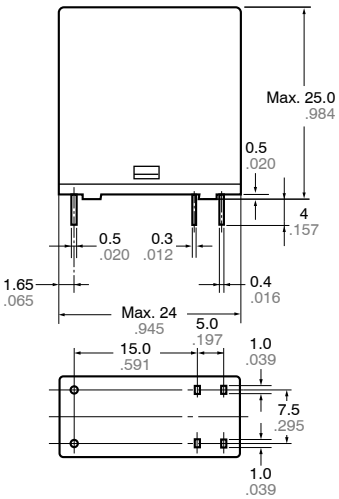
UL/CSA, VDE, TÜV, SEMKO, TV-4 approved type is standard.
Notes: 1. Standard packing Carton: 100 pcs. Case: 500 pcs.
2. 4.5V, 5V, 9V and 18V DC types are also available. Please consult us for details.

TYPES AND COIL DATA (at 20°C 68°F)

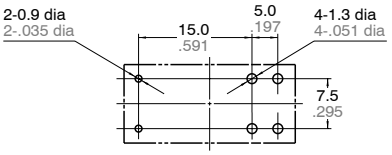
Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum allowable voltage, V DC
3 A type	5A TV type							
ALA2F12	ALA2PF12	12	(Initial) 9	(Initial) 0.6	272	44.2	530	15.6
ALA2F24	ALA2PF24	24	(Initial) 18	(Initial) 1.2	1,087	22.1	530	31.2

DIMENSIONS

mm inch



PC board pattern (Bottom view)



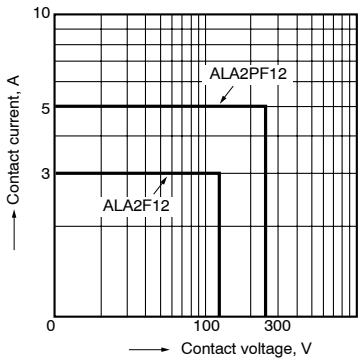
Tolerance : ±0.1 ±.004

Schematic (Bottom view)

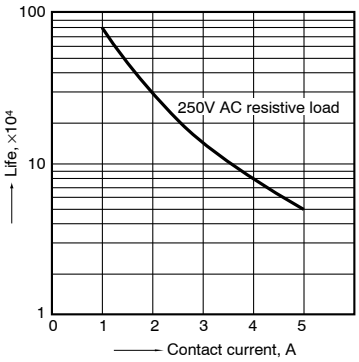
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

REFERENCE DATA

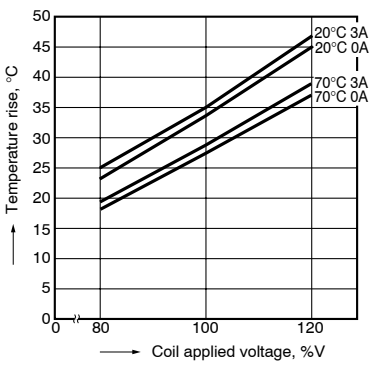
1. Max. switching power (AC resistive load)



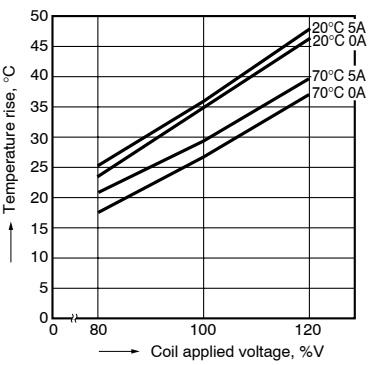
2. Life curve (250 V AC resistive load)



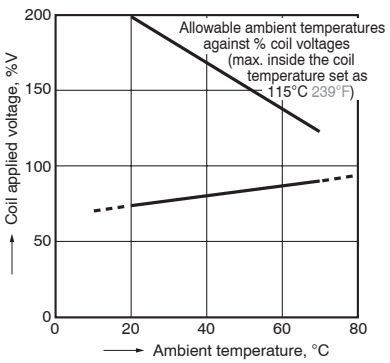
3-(1). Coil temperature rise
Sample: ALA2F12, 6 pcs.
Measured portion: coil inside
Contact current: 0 A, 3A



3-(2). Coil temperature rise
Sample: ALA2PF12, 6 pcs.
Measured portion: coil inside
Contact current: 0 A, 5A

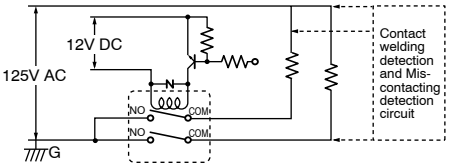


4. Ambient temperature characteristics and coil applied voltage
Contact current: ALA2F=3A
ALA2PF=5A

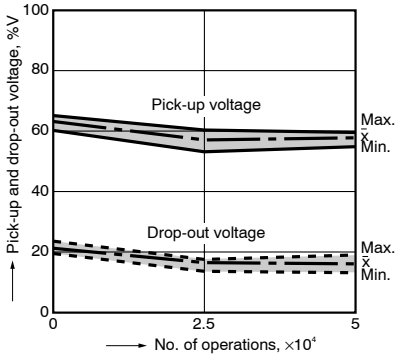


5-(1). Electrical life test
(3 A 125 V AC, resistive load)
Sample: ALA2F12, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

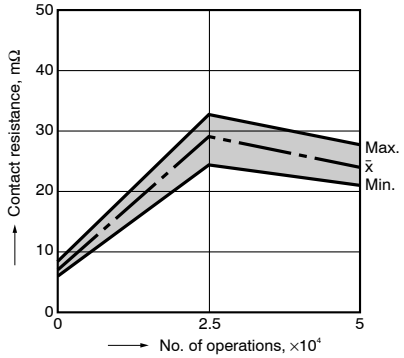
Circuit:



Change of pick-up and drop-out voltage

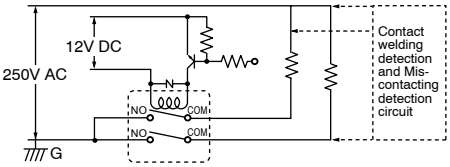


Change of contact resistance

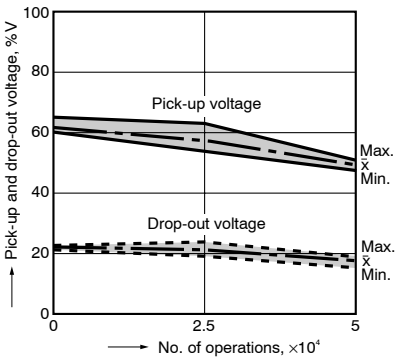


5-(2). Electrical life test
(5 A 250 V AC, resistive load)
Sample: ALA2PF12, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

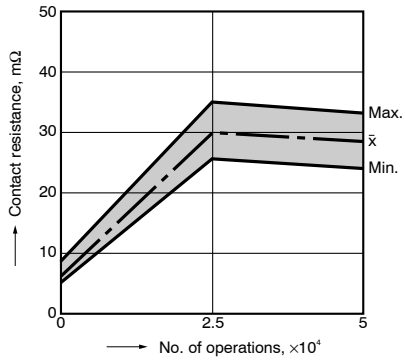
Circuit:



Change of pick-up and drop-out voltage

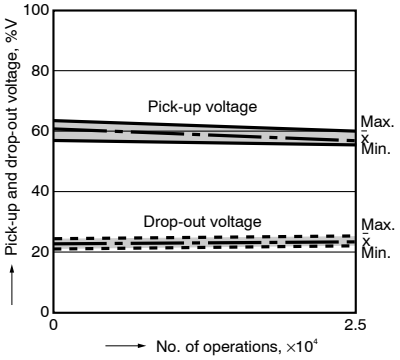


Change of contact resistance

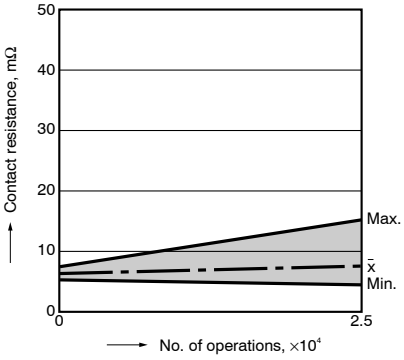


5-(3). Electrical life test
(UL lamp load test TV-4)
Tested sample: ALA2PF12, 6 pcs.
• Overload test
Load: 6.0 A 120 V AC (60 Hz),
Inrush: 91 A
Operation frequency: 10 times/min
(ON: OFF = 1 s: 5 s)
No. of operations: 50 ope.
• Endurance test
Load: 4A 120 V AC (60 Hz),
Inrush: 65 A
Operation frequency: 10 times/min
(ON: OFF = 1 s: 5 s)
No. of operations: 25,000 ope.

Change of pick-up and drop-out voltage



Change of contact resistance

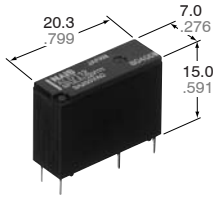


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

1 Form A Slim Power Relay

LD RELAYS (ALD)



mm inch

FEATURES

1. Slim type: Width 7 mm .276 inch.
20.3(L)×7.0(W)×15.0(H) mm
.799(L)×.276(W)×.591(H) inch

2. Perfect for small load switching of home appliances
10^5 switching operations possible with a 3A 250V AC resistive load.

3. Low operating power
Compact size, nominal operating power as low as 200mW.

4. High shock resistance
The relay withstands a functional shock resistance of 300m/s² [approx. 30 G more]

5. High insulation resistance
• Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
• Surge withstand voltage between contact and coil: 10,000 V or more.

6. UL/CSA, VDE, TÜV approved.

SPECIFICATIONS

Contact

Arrangement			1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			Max. 100 mΩ
Contact material			Silver alloy
Rating (resistive load)	Nominal switching capacity		3 A 277 V AC, 3 A 30V DC
	Max. switching power		831 V A (AC), 90W (DC)
	Max. switching voltage		277 V AC, 30 V DC
	Max. switching current		3 A
	Min. switching capacity#1		100 mA, 5 V DC
Expected life (min.operations)	Mechanical (at 180 cpm)		5×10^6
	Electrical (at 20 cpm) (at rated load)	3A 125V AC, 3A 30V DC	2×10^5
		3A 250V AC	10^5
		5A 250V AC	5×10^4

Coil

Nominal operating power	200 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2×50ms according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial*2 breakdown voltage	Between open contacts	750 Vrms for 1 min.
	Between contact and coil	4,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Max. 10ms (at 20°C 68°F)
Release time (with diode)*4 (at nominal voltage)		Max. 10ms (at 20°C 68°F)
Temperature rise (at 70°C 158°F)		Max. 45°C with nominal coil voltage and at 3 A contact carrying current (resistance method)
Shock resistance	Functional*5	Min. 300 m/s²{approx. 30 G}
	Destructive*6	Min. 1,000 m/s²{approx. 100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 4 g .14 oz

TYPICAL APPLICATIONS

- **Air conditioner**
- **Refrigerator**
- **Hot water units**
- **Microwave ovens**
- **Fan heaters**

ORDERING INFORMATION

Ex. A | LD | 1 | 12 | W

Product name	Contact arrangement	Coil voltage (V DC)	Packing style
LD	1: 1 Form A	4H: 4.5, 09: 9, 24: 24 05: 5, 12: 12 06: 6, 18: 18	Nil: Tube packing W: Carton packing

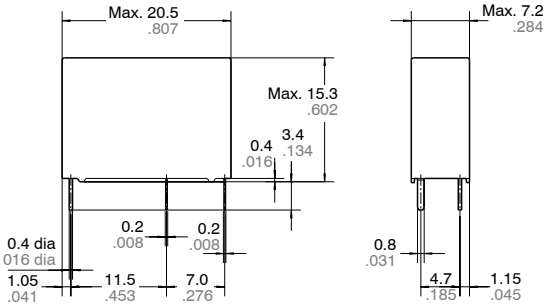
UL/CSA, TÜV, VDE approved type is standard.
Note: Tube packing: Tube: 50pcs, Case: 1,000pcs
Carton packing: Carton: 100pcs, Case: 500pcs

TYPES AND COIL DATA (at 20°C 68°F)

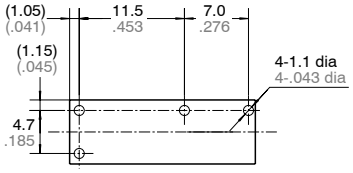
Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum allowable voltage, V DC (at 20°C 68°F)
ALD14H	4.5	3.38	0.22	101	44.6	200	5.85
ALD105	5	3.75	0.25	125	40.0	200	6.5
ALD106	6	4.5	0.3	180	33.3	200	7.8
ALD109	9	6.75	0.45	405	22.2	200	11.7
ALD112	12	9	0.6	720	16.7	200	15.6
ALD118	18	13.5	0.9	1,620	11.1	200	23.4
ALD124	24	18	1.2	2,880	8.3	200	31.2

DIMENSIONS

mm inch

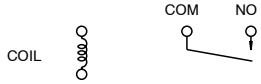


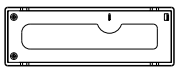
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

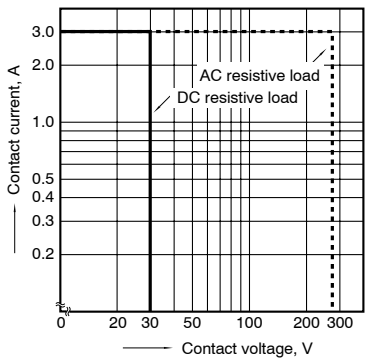




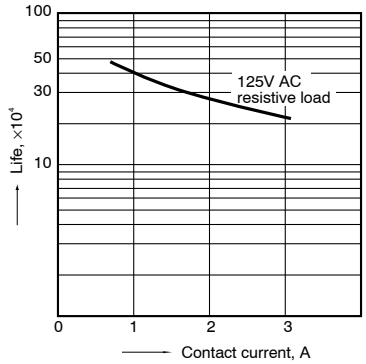
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

REFERENCE DATA

1. Max. switching power

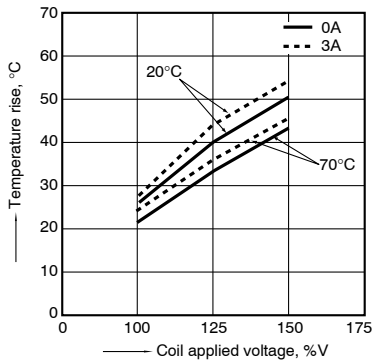


2. Life curve



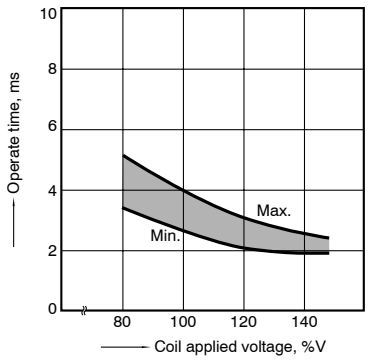
3. Coil temperature rise

Sample: ALD112, 6 pcs.
Point measured: inside the coil
Contact current: 0 A, 3 A



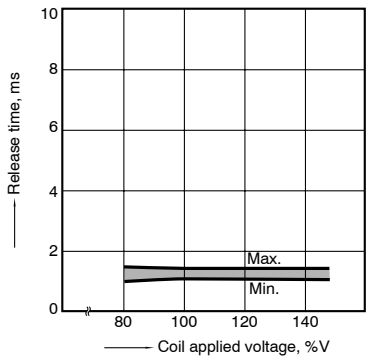
4-(1). Operate time

Sample: ALD112, 6 pcs.



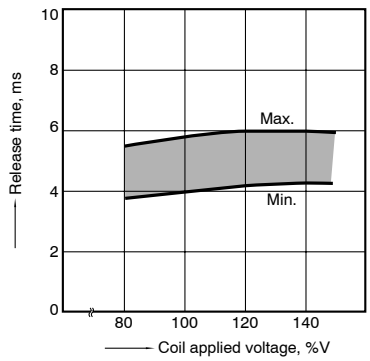
4-(2). Release time (without diode)

Sample: ALD112, 6 pcs.

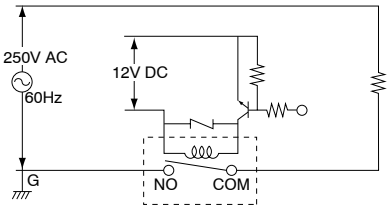


4-(3). Release time (with diode)

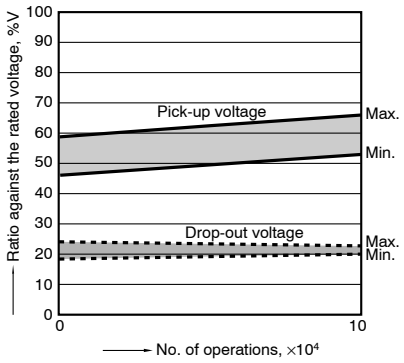
Sample: ALD112, 6 pcs.



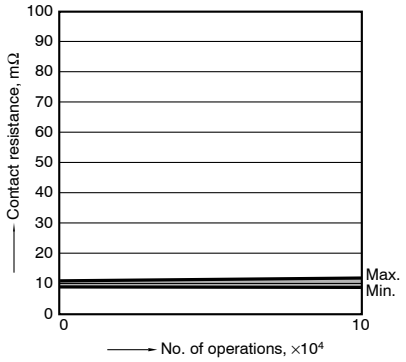
5-(1). Electrical life test
(3 A 250 V AC, resistive load)
Sample: ALD112, 6 pcs.
Operating speed: 20 cpm
Ambient temperature: room temperature
circuit:



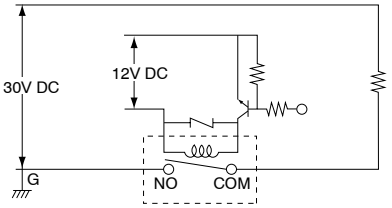
Change of pick-up and drop-out voltage



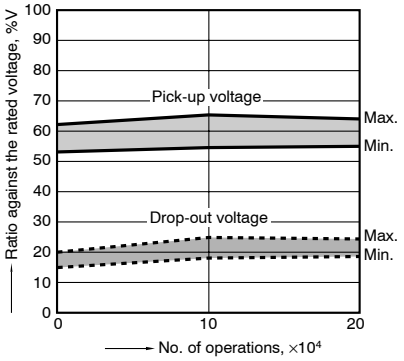
Change of contact resistance



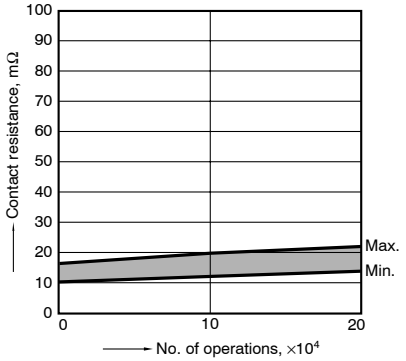
5-(2). Electrical life test
(3 A 30 V DC, resistive load)
Sample: ALD112, 6 pcs.
Operating speed: 20 cpm
Ambient temperature: room temperature
circuit:



Change of pick-up and drop-out voltage



Change of contact resistance

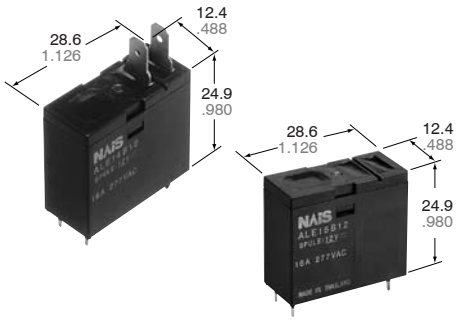


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

16A Power Relay For Micro wave oven

LE RELAYS (ALE)



mm inch

FEATURES

1. Ideal for magnetron and heater loads

2. Excellent heat resistance
- This satisfies UL coil insulation class B/ class F available

3. High insulation resistance
- Creepage distance and clearances between contact and coil: Min. 8 mm .315 inch
- Surge withstand voltage: Min. 10,000V

4. Low operating power
- Nominal operating power: 400mW/ 200mW (High sensitive type)

5. A wide variety of types
- Product line consists of 4 types with different shapes and pins

6. Conforms to the various safety standards:
- UL/CSA, TÜV, VDE approved and SEMKO available

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	16 A 277 V AC
	Max. switching power	4,432 V A
	Max. switching voltage	277 V AC
	Max. switching current	16 A
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	2×10^6
	Electrical (at 20 cpm) (Resistive load)	10^5

Coil

Type	Standard	High sensitive
Nominal operating power	400 mW	200 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Max. operating speed (at rated load)		20 cpm
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	4,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage) (at 20°C 68°F)		Max. 20ms
Release time (with diode)*4 (at nominal voltage) (at 20°C 68°F)		Max. 20ms Max. 25ms (200 mW type)
Temperature rise (at nominal voltage) (resistance method, contact current 16 A, 20°C 68°F)		Max. 55°C Max. 45°C (200 mW type)
Shock resistance	Functional*5	Min. 200 m/s²{20 G}
	Destructive*6	Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 17 g .60 oz

Power

TYPICAL APPLICATIONS

- **Microwave ovens**
- **Refrigerators**
- **OA equipment**

ORDERING INFORMATION

Ex. A | LE | 1 | 2 | B | 12

Product name	Contact arrangement	Terminal shape	Coil insulation class	Coil voltage, V DC
LE	1: 1 Form A 7: 1 Form A (200 mW)	2: TMP type/PCB side three terminals (includes one dummy terminal) 3: TMP type/PCB side three terminals 4: TMP type/PCB side four terminals 5: PCB type (No tab terminals)	B: Class B insulation F: Class F insulation	05: 5 18: 18 06: 6 24: 24 09: 9 48: 48 12: 12

UL/CSA, TÜV, VDE approved type is standard.
Note: Standard packing; Carton: 100 pcs. Case 500 pcs.

TYPES

1. Standard type

Contact arrangement	Coil voltage, V DC	TMP type/PCB side three terminals (includes one dummy terminal)	TMP type/PCB side three terminals	TMP type/PCB side four terminals	PCB type (No tab terminals)
		Part No.	Part No.	Part No.	Part No.
1 Form A	5	ALE12❍05	ALE13❍05	ALE14❍05	ALE15❍05
	6	ALE12❍06	ALE13❍06	ALE14❍06	ALE15❍06
	9	ALE12❍09	ALE13❍09	ALE14❍09	ALE15❍09
	12	ALE12❍12	ALE13❍12	ALE14❍12	ALE15❍12
	18	ALE12❍18	ALE13❍18	ALE14❍18	ALE15❍18
	24	ALE12❍24	ALE13❍24	ALE14❍24	ALE15❍24
	48	ALE12❍48	ALE13❍48	ALE14❍48	ALE15❍48

❍: Input the following letter. Class B: B, Class F: F

2. High sensitive type

Contact arrangement	Coil voltage, V DC	TMP type/PCB side three terminals (includes one dummy terminal)	TMP type/PCB side three terminals	TMP type/PCB side four terminals	PCB type (No tab terminals)
		Part No.	Part No.	Part No.	Part No.
1 Form A (High sensitivity: 200mW)	5	ALE72❍05	ALE73❍05	ALE74❍05	ALE75❍05
	6	ALE72❍06	ALE73❍06	ALE74❍06	ALE75❍06
	9	ALE72❍09	ALE73❍09	ALE74❍09	ALE75❍09
	12	ALE72❍12	ALE73❍12	ALE74❍12	ALE75❍12
	18	ALE72❍18	ALE73❍18	ALE74❍18	ALE75❍18
	24	ALE72❍24	ALE73❍24	ALE74❍24	ALE75❍24
	48	ALE72❍48	ALE73❍48	ALE74❍48	ALE75❍48

❍: Input the following letter. Class B: B, Class F: F

COIL DATA (at 20°C 68°F)

1. Standard type

Nominal voltage, V DC	Pick-up voltage, V DC (max.) (at 20°C 68°F)	Drop-out voltage, V DC (min.) (at 20°C 68°F)	Coil resistance, Ω (±10%) (at 20°C 68°F)	Nominal operating current, mA (±10%) (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Maximum allowable voltage, V DC (at 20°C 68°F)
5	3.75	0.25	63	80	400	7.25
6	4.5	0.3	90	66.7		8.7
9	6.75	0.45	203	44.4		13.05
12	9	0.6	360	33.3		17.4
18	13.5	0.9	810	22.2		26.1
24	18	1.2	1,440	16.7		34.8
48	36	2.4	5,760	8.3		69.6

2. High sensitive type

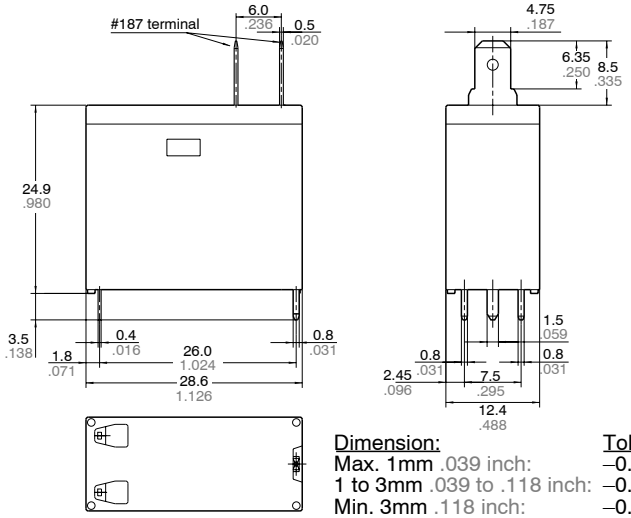
Nominal voltage, V DC	Pick-up voltage, V DC (max.) (at 20°C 68°F)	Drop-out voltage, V DC (min.) (at 20°C 68°F)	Coil resistance, Ω (±10%) (at 20°C 68°F)	Nominal operating current, mA (±10%) (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Maximum allowable voltage, V DC (at 20°C 68°F)
5	3.75	0.25	125	40	200	7.25
6	4.5	0.3	180	33.3		8.7
9	6.75	0.45	405	22.2		13.05
12	9	0.6	720	16.7		17.4
18	13.5	0.9	1,620	11.1		26.1
24	18	1.2	2,880	8.3		34.8
48	36	2.4	11,520	4.2		69.6

DIMENSIONS

mm inch

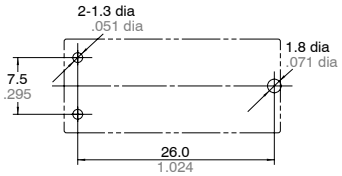
1. TMP type

PCB side three terminals
(includes one dummy terminal)



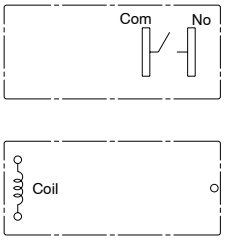
Dimension:	Tolerance
Max. 1mm .039 inch:	–0.1 –.004
1 to 3mm .039 to .118 inch:	–0.2 –.008
Min. 3mm .118 inch:	–0.3 –.012

PC board pattern (Bottom view)

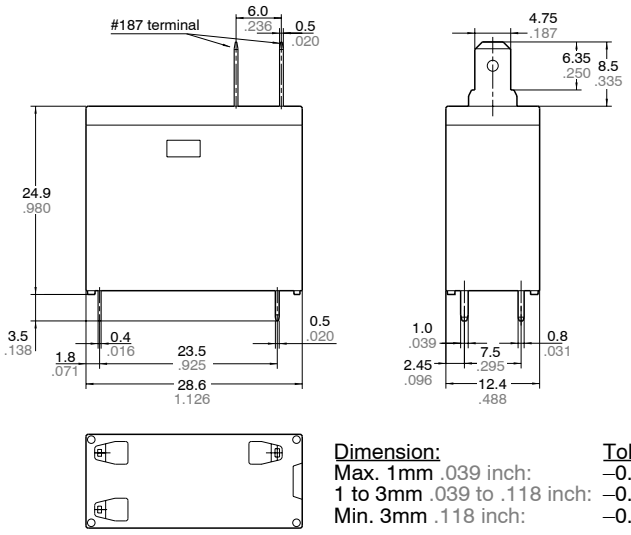


Tolerance : –0.1 –.004

Schematic (Bottom view)

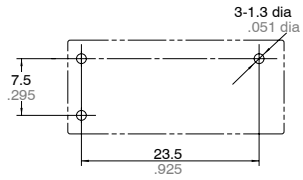


PCB side three terminals



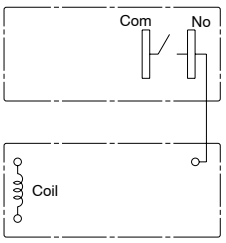
Dimension:	Tolerance
Max. 1mm .039 inch:	–0.1 –.004
1 to 3mm .039 to .118 inch:	–0.2 –.008
Min. 3mm .118 inch:	–0.3 –.012

PC board pattern (Bottom view)

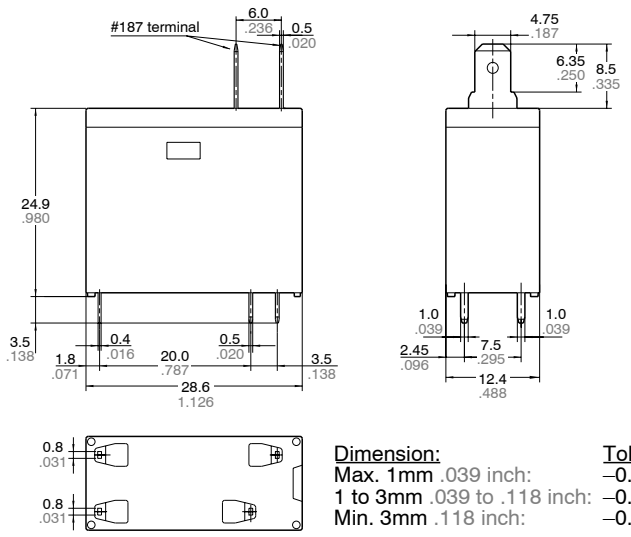


Tolerance : –0.1 –.004

Schematic (Bottom view)

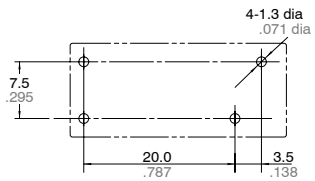


PCB side four terminals



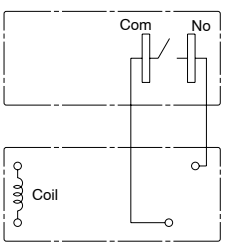
Dimension:	Tolerance
Max. 1mm .039 inch:	–0.1 –.004
1 to 3mm .039 to .118 inch:	–0.2 –.008
Min. 3mm .118 inch:	–0.3 –.012

PC board pattern (Bottom view)



Tolerance : –0.1 –.004

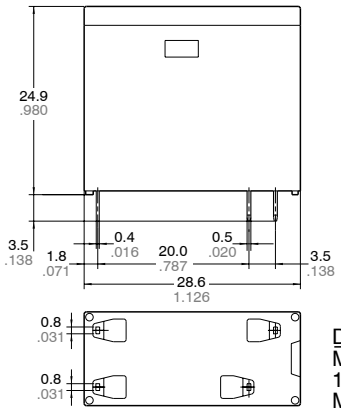
Schematic (Bottom view)

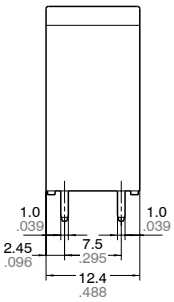


2. PCB type

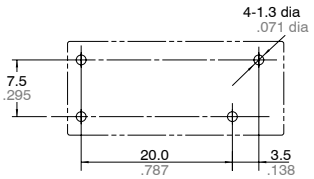
PCB side four terminals
(No tab terminals)

mm inch





PC board pattern (Bottom view)



Tolerance : –0.1 –.004

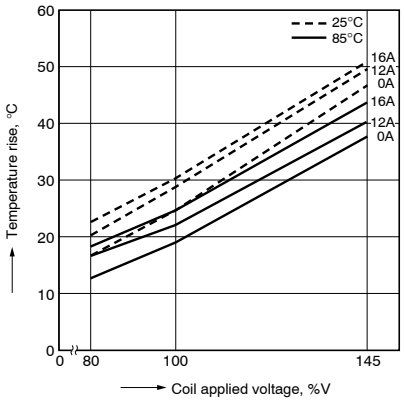
Dimension:	Tolerance
Max. 1mm .039 inch:	–0.1 –.004
1 to 3mm .039 to .118 inch:	–0.2 –.008
Min. 3mm .118 inch:	–0.3 –.012

Schematic (Bottom view)

REFERENCE DATA

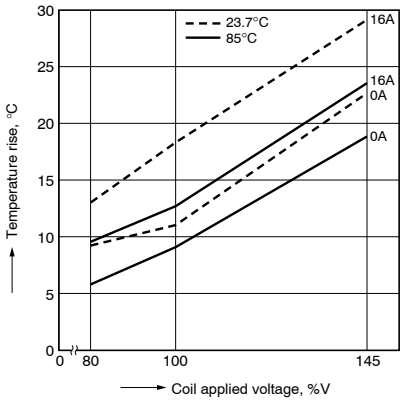
1-1. Coil temperature rise (400mW type)

Sample: ALE15B12, 6 pcs.
Point measured: coil inside
Ambient temperature: 25°C 77°F, 85°C 185°F

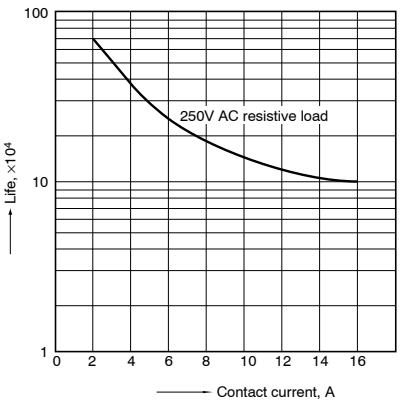


1-2. Coil temperature rise (200mW type)

Sample: ALE75B12, 6 pcs.
Point measured: coil inside
Ambient temperature: 23.7°C 74.66°F, 85°C 185°F

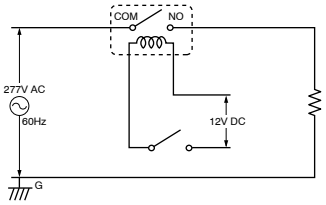


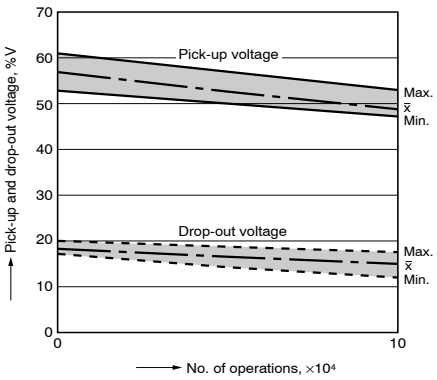
2. Life curve



3. Electrical life test (16 A 277 V AC, resistive load)

Sample: ALE15B12, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: Room temperature
Circuit:



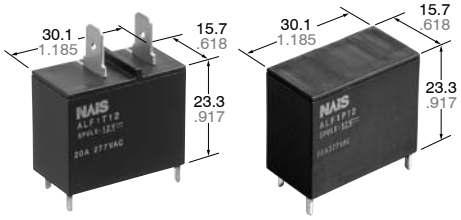


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

20A Power Relay For Home appliances

LF RELAYS (ALF)



TMP type PCB type

mm inch

FEATURES

1. Ideal for compressor and inverter loads

1) Compressor load: 20A 250V AC
2) Inverter load: 20A 100V AC,
10A 200V AC

2. High insulation resistance

- Creepage distance and clearances between contact and coil;
  Creepage Min. 9.5mm .374inch/
  Clearance Min. 8mm .315inch
- Surge withstand voltage: Min. 10,000V

3. "PCB" and "TMP" types available

4. Conforms to the various safety standards:

UL/CSA, TÜV, VDE approved

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	20 A 250V AC
	Max. switching power	6,250 V A
	Max. switching voltage	250V AC
	Max. switching current	25 A
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	2×10^6
	Electrical (at 20 cpm) (Resistive load)	10^5

Coil

Nominal operating power	900 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Max. operating speed (at rated load)		20 cpm
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	5,000 Vrms for 1 min.
Surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Approx. 15ms
Release time (without diode)*4 (at nominal voltage)		Approx. 15ms
Temperature rise (at nominal voltage)		Max. 45°C (resistance method, contact current 20 A, rated coil voltage, 60°C 140°F)
Shock resistance	Functional*5	Min. 100 m/s²{10 G}
	Destructive*6	Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +60°C –40°F to +140°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 23 g .81 oz

Power

TYPICAL APPLICATIONS

- **Air conditioner**
- **Refrigerators**
- **OA equipment**

ORDERING INFORMATION

Ex. A LF 1 T 12

Product Name	Contact arrangement	Terminal shape	Coil voltage, V DC
LF	1: 1 Form A	T: TMP type P: PCB type	05: 5 12: 12 06: 6 18: 18 09: 9 24: 24

Note: Standard packing; Carton: 50 pcs. Case 200 pcs.
UL/CSA,VDE, TÜV approved type is standard.

TYPES

Contact arrangement	Coil voltage, V DC	TMP type	PCB type
1 Form A	5	ALF1T05	ALF1P05
	6	ALF1T06	ALF1P06
	9	ALF1T09	ALF1P09
	12	ALF1T12	ALF1P12
	18	ALF1T18	ALF1P18
	24	ALF1T24	ALF1P24

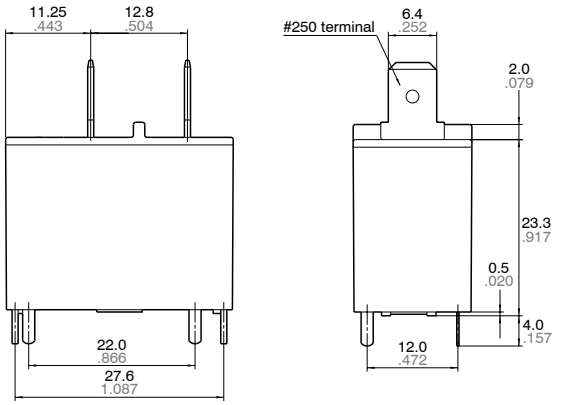
COIL DATA

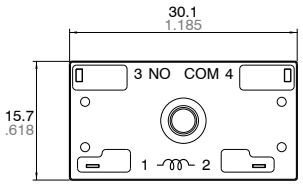
Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω(±10%)	Nominal operating current, mA (±10%)	Nominal operating power, W	Maximum allowable voltage, V DC
5	3.5	0.5	27.8	180	0.9	5.5
6	4.2	0.6	40	150		6.6
9	6.3	0.9	90	100		9.9
12	8.4	1.2	160	75		13.2
18	12.6	1.8	360	50		19.8
24	16.8	2.4	640	37.5		26.4

DIMENSIONS

mm inch

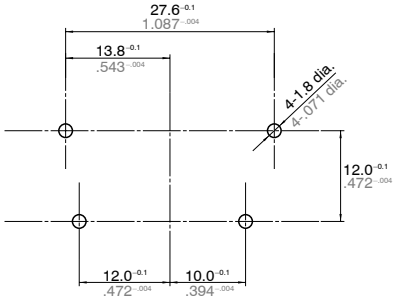
1. TMP type





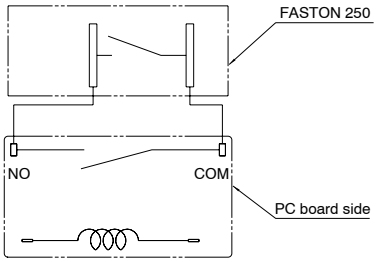
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)

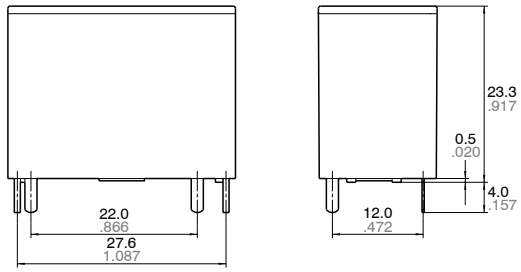


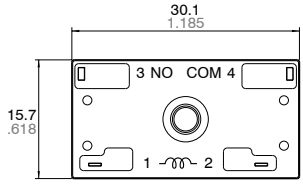
Tolerance: ±0.1 ±.004

Schematic (Bottom view)



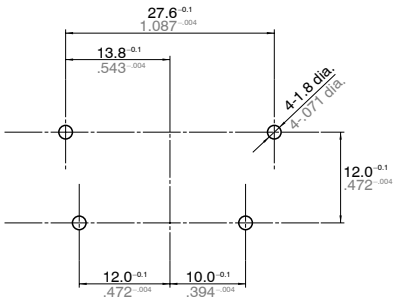
2. PCB type





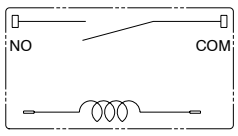
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

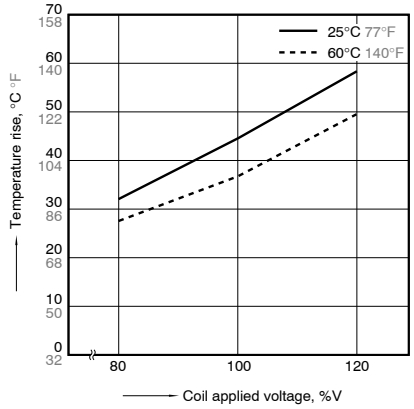
Schematic (Bottom view)



REFERENCE DATA

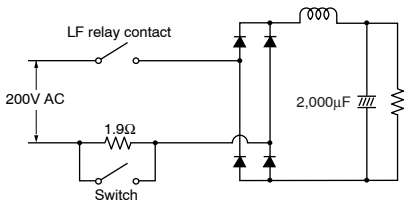
1. Coil temperature rise

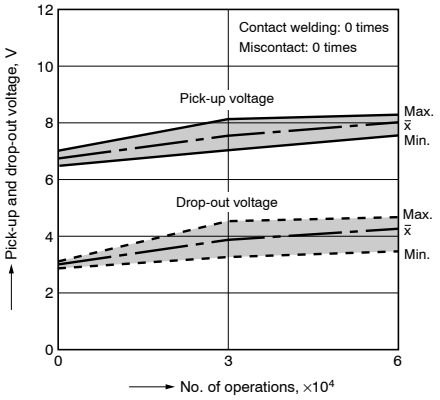
Sample: ALF1T12, 6 pcs.
Point measured: coil inside
Contact current: 20A
Ambient temperature: 25°C 77°F, 60°C 140°F



2-(1). 200V AC electrical life test (200V AC, inverter load)

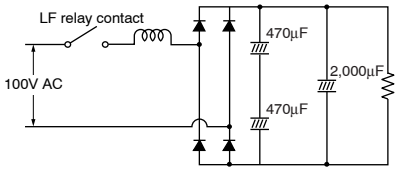
Sample: ALF1T12, 6 pcs.
Load: Inrush 102A (wave peak value),
Steady 14.4A (wave peak value)
Inverter dummy 200V AC
Switching frequency: ON 1s, OFF 5s
Circuit:

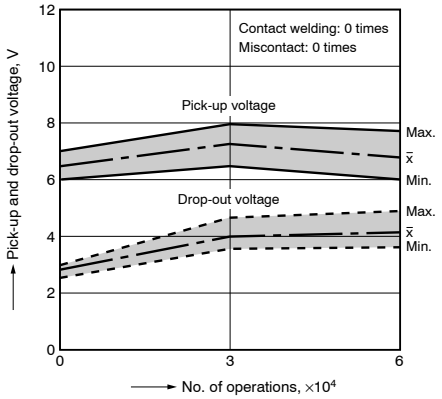




2-(2). 100V AC electrical life test (100V AC, inverter load)

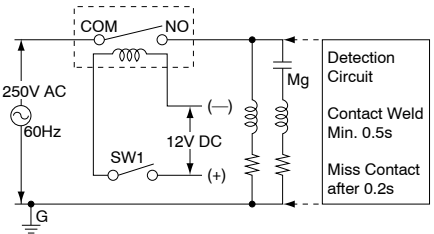
Sample: ALF1T12, 6 pcs.
Load: Inrush 224A (wave peak value),
Steady 30.5A (wave peak value)
Inverter dummy 100V AC
Switching frequency: ON 1s, OFF 5s
Circuit:

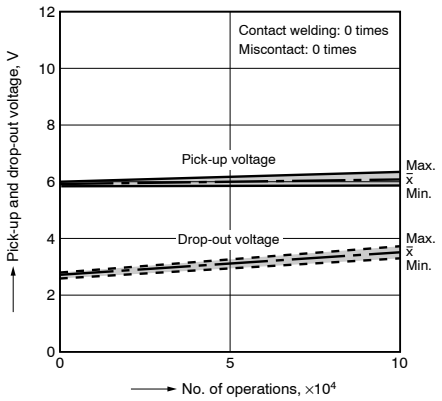




2-(3). Inrush 70.7A, Steady 20A, 250V AC electrical life test (Compressor dummy load)

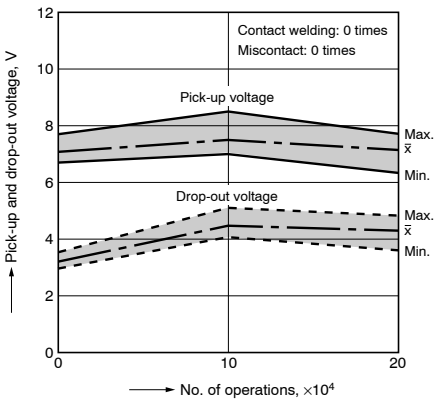
Sample: ALF1T12, 3 pcs.
Load: Inrush 70.7A, cosϕ = 0.7
Steady 20A, cosϕ 0.9
250V AC compressor dummy
Switching frequency: ON 1.5s, OFF 1.5s
Circuit:





2-(4). Electrical life test (20A 250V AC, resistive load)

Sample: ALF1T12, 6 pcs.
Switching frequency: ON 1.5s, OFF 1.5s

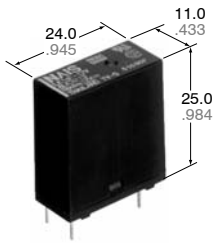


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

SLIM POWER RELAY WITH HIGH INRUSH CURRENT CAPABILITY

LK RELAYS



mm inch

FEATURES

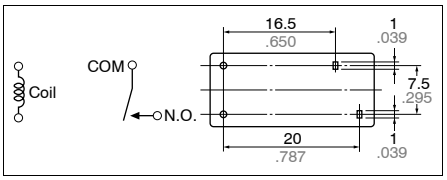
1. High inrush current capability
1) Operating load capability:
inrush 100 A, steady 5 A
2) UL/CSA, TV-5

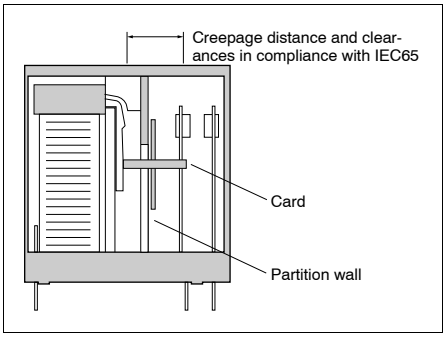
2. High insulation resistance between contact and coil
1) Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
2) Surge withstand voltage between contact and coil: 10,000 V or more

3. High noise immunity realized by the card separation structure between contact and coil

4. Popular terminal pitch in AV equipment field

mm inch





5. Space-saving slim type
Base area: Width 11 × Length 24 mm
Width .433 × Length .945 inch

6. Conforms to the various safety standards
UL, CSA, VDE, TÜV, SEMKO, SEV, BSI approved

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 100 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	5 A 277 V AC, 5 A 30 V DC
	Max. switching power	1,385 VA, 150 W
	Max. switching voltage	277 V AC, 30 V DC
	Max. switching current	5A (AC), 5 A (DC)
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. ope.)	Mechanical (at 180 cpm)	2×10^6
	Electrical (at 20 cpm) (at rated load)	10^5

Coil

Nominal operating power	530 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Max. operating speed		20 cpm
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min
	Between contacts and coil	4,000 Vrms for 1 min
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Approx. 7 ms (at 20°C 68°F)
Release time (without diode)*4 (at nominal voltage)		Approx. 2 ms (at 20°C 68°F)
Temperature rise (at 70°C)		Max. 35°C with nominal coil voltage at 5A contact carrying current (resistance method)
Shock resistance	Functional*5	Min. 200 m/s²
	Destructive*6	Min. 1,000 m/s²
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	10 to 55 Hz at double amplitude of 1.5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40 to +70°C –40 to +158°F
	Humidity	5 to 85%R.H.
	Air pressure	86 to 106 kPa
Unit weight		Approx. 12 g .42 oz

TYPICAL APPLICATIONS

- AV equipment: TV's, VTR's, etc.
- OA equipment
- HA equipment

ORDERING INFORMATION

Ex. LK [1a] [F] —— [24V]

Contact arrangement	Protective construction	Coil voltage (DC)
1a: 1 Form A	F: Flux-resistant type	5, 6, 9, 12, 18, 24 V

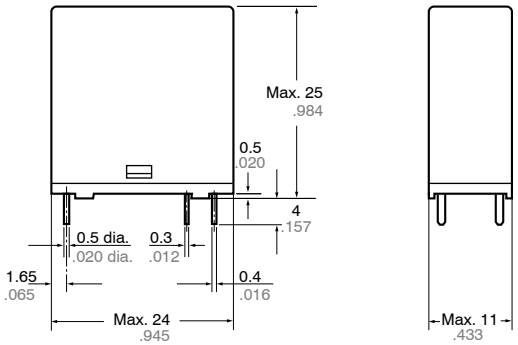
UL/CSA, TÜV, SEMKO, TV-5 approved type is standard.
(Note) Standard packing Carton: 100 pcs. Case: 500 pcs.

TYPES AND COIL DATA (at 20°C 68°F)

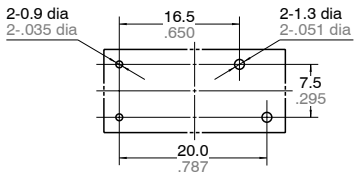
Part No.	Nominal voltage, V DC	Pick-up voltage V DC (max.) (Initial)	Drop-out voltage V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 20°C 68°F)
LK1aF-5V	5	3.5	0.5	47	106.4	530	6.5
LK1aF-6V	6	4.2	0.6	68	88.3	530	7.8
LK1aF-9V	9	6.3	0.9	153	58.8	530	11.7
LK1aF-12V	12	8.4	1.2	272	44.2	530	15.6
LK1aF-18V	18	12.6	1.8	611	29.5	530	23.4
LK1aF-24V	24	16.8	2.4	1,087	22.1	530	31.2

DIMENSIONS

mm inch

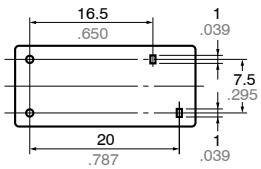


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



Dimension : General tolerance

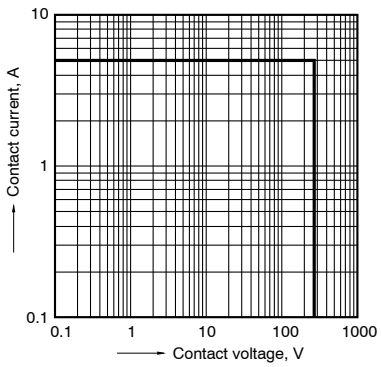
Max. 1mm .039 inch: ±0.1 ±.004

1 to 3mm .039 to .118 inch: ±0.2 ±.008

Min. 3mm .118 inch: ±0.3 ±.012

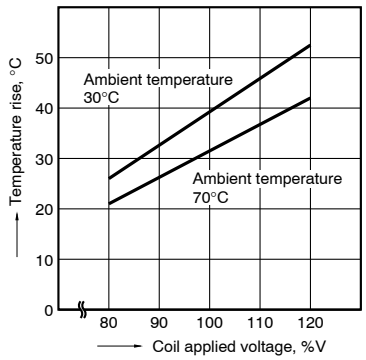
REFERENCE DATA

1. Max. switching power (AC resistive load)



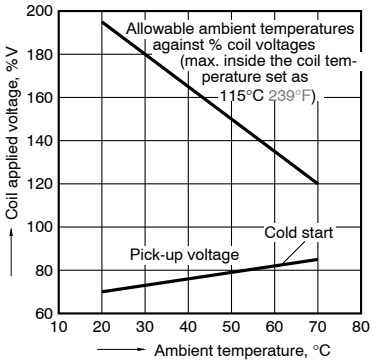
2. Coil temperature rise

Sample: LK1aF-12V, 6 pcs.
Point measured: coil inside
Contact current: 5 A



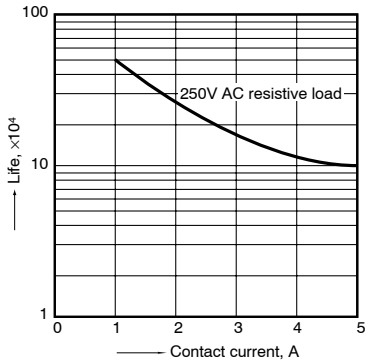
3. Ambient temperature characteristics

Contact current: 5 A



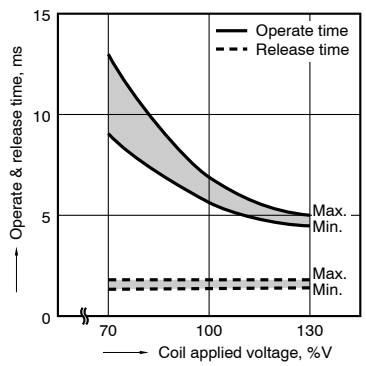
4. Life curve

Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: room temperature



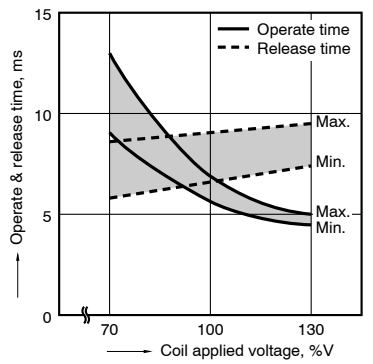
5-1. Operate & release time (without diode)

Sample: LK1aF-12V, 20 pcs.



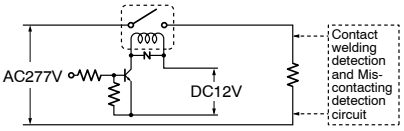
5-2. Operate & release time (with diode)

Sample: LK1aF-12V, 20 pcs.

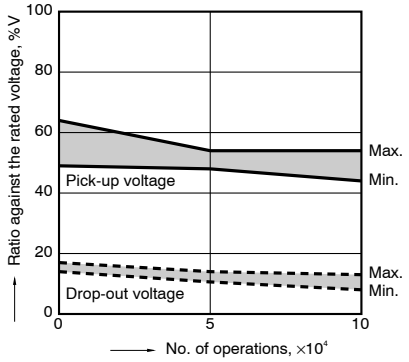


6-1. Electrical life test
(5 A 277 V AC, resistive load)
Sample: LK1aF-12V, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 26°C 79°F

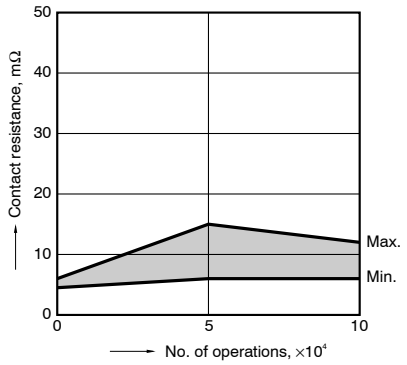
Circuit:



Change of pick-up and drop-out voltage

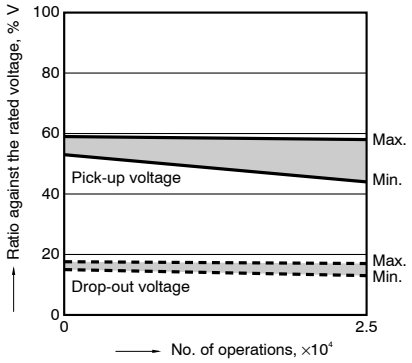


Change of contact resistance

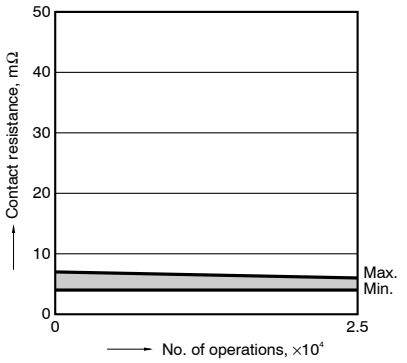


6-2. Electrical life test
(UL lamp load test TV-5)
Tested sample: LK1aF-12V, 6 pcs.
• Overload test
Load: 7.5 A 120 V AC (60 Hz),
Inrush: 111 A
Operation frequency: 10 times/min
(ON: OFF = 1 s: 5 s)
No. of operations: 50 ope.
• Endurance test
Load: 5A 120 V AC (60 Hz),
Inrush: 78 A
Operation frequency: 10 times/min
(ON: OFF = 1 s: 5 s)
No. of operations: 25,000 ope.

Change of pick-up and drop-out voltage



Change of contact resistance



NOTES

1. Cleaning
This relay is not the sealed type, so it cannot be immersion cleaned. Be careful that flux does not overflow onto the PC board or penetrate inside the relay.

2. Soldering
We recommend the following soldering conditions.
1) Automatic soldering
* Preheating: 100°C 212°F, within 2 mins (PC board solder surface)
* Soldering: 260°C 500°F, within 5 s

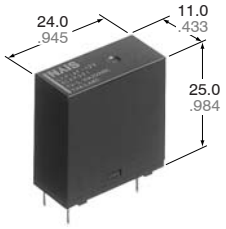
2) Hand soldering
* Iron tip temperature: 280 to 300°C 536 to 571°F
* Soldering iron: 30 to 60W
* Soldering time: Within 3 s

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

10 A Slim Power Relay

LK-P RELAYS



mm inch

FEATURES

1. High switching capacity: 10 A 277V AC

2. High insulation resistance between contact and coil

1) Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)

2) Surge withstand voltage between contact and coil: 10,000 V or more

3. High noise immunity realized by the card separation structure between contact and coil

4. Popular terminal pitch in AV equipment field

5. Space-saving slim type

Base area: Width 11 × Length 24 mm
Width .433 × Length .945 inch

6. Conforms to the various safety standards

UL/CSA, VDE, TÜV and SEMKO, SEV approved

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 100 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	10 A 277 V AC, 5 A 30V DC
	Max. switching power	2,770 V A, 150W
	Max. switching voltage	277 V AC, 30 V DC
	Max. switching current	10 A (AC), 5A (DC)
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	2×10^6
	Electrical (at 20 cpm) (at rated load)	10^5

Coil

Nominal operating power	530 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial *2 breakdown voltage	Between open contacts	1,000 Vrms for 1 min.
	Between contact and coil	4,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Approx. 7 ms (at 20°C 68°F)
Release time (without diode)*4 (at nominal voltage)		Approx. 2 ms (at 20°C 68°F)
Temperature rise (at 70°C)		Max. 45°C with nominal coil voltage and at 10 A contact carrying current (resistance method)
Shock resistance	Functional*5	Min. 200 m/s²{approx. 20 G}
	Destructive*6	Min. 1,000 m/s²{approx. 100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
	Air pressure	86 to 106 kPa
Unit weight		Approx. 12 g .42 oz

Power

TYPICAL APPLICATIONS

- Audio visual equipment
  TVs, VTRs
- Office equipment
  LBP, CRT
- Home appliances
  Refrigerator, Air conditioner

ORDERING INFORMATION

Ex. LKP [1a] [F] — [12V]

Contact arrangement	Protective construction	Coil voltage(DC)
1a: 1 Form A	F: Flux-resistant type	5, 6, 9, 12, 18, 24V

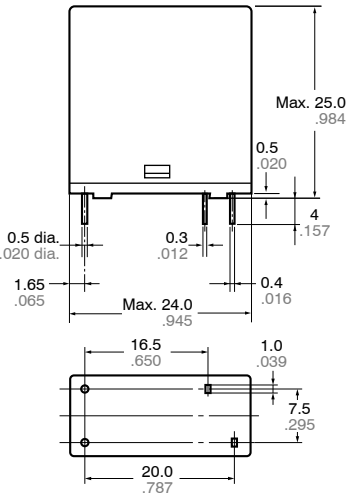
UL/CSA, TÜV, SEMKO, TV-5 approved type is standard.
Notes 1. Standard packing Carton: 100 pcs. Case: 500 pcs.
2. 5 V, 9 V, 18 V DC types are also available. Please consult us for details.

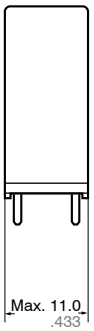
TYPES AND COIL DATA (at 20°C 68°F)

Part No.	Nominal voltage, V DC	Pick-up voltage V DC (max.) (Initial)	Drop-out voltage V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 20°C 68°F)
LKP1aF-5V	5	3.5	0.5	47	106.4	530	6.5
LKP1aF-6V	6	4.2	0.6	68	88.3	530	7.8
LKP1aF-9V	9	6.3	0.9	153	58.8	530	11.7
LKP1aF-12V	12	8.4	1.2	272	44.2	530	15.6
LKP1aF-18V	18	12.6	1.8	611	29.5	530	23.4
LKP1aF-24V	24	16.8	2.4	1,087	22.1	530	31.2

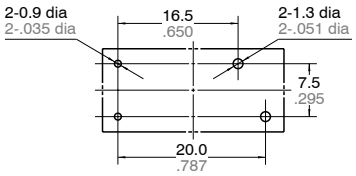
DIMENSIONS

mm inch





PC board pattern (Bottom view)



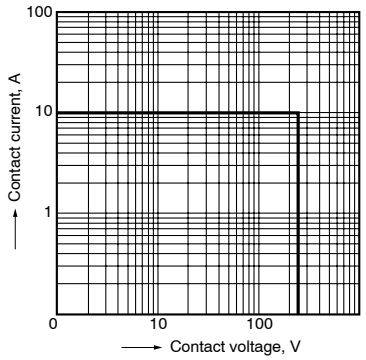
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

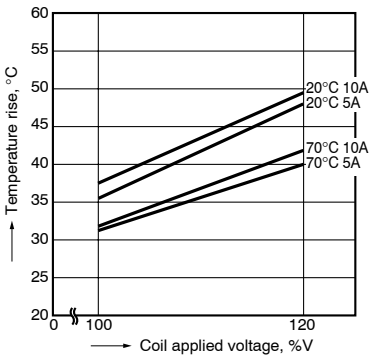
REFERENCE DATA

1. Max. switching power



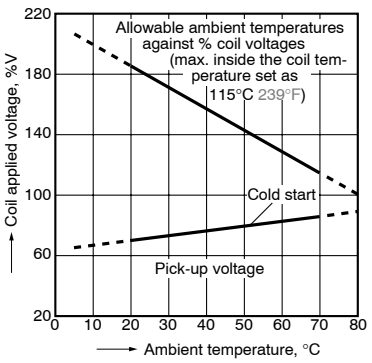
2. Coil temperature rise

Sample: LKP1aF-12V, 6 pcs.
Point measured: coil inside
Contact current: 5 A, 10 A



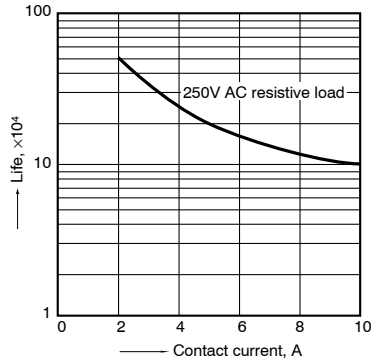
3. Ambient temperature characteristics and coil applied voltage

Contact current: 10 A



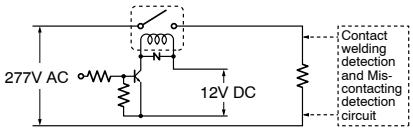
4. Life curve

Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: room temperature

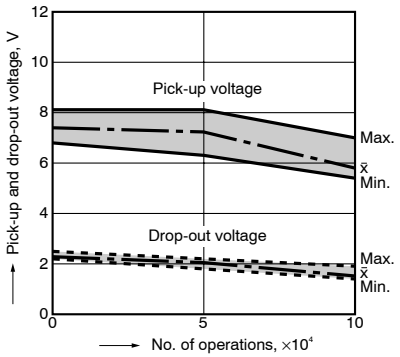


5. Electrical life test
(10 A 277 V AC, resistive load)
Sample: LKP1aF-12V, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

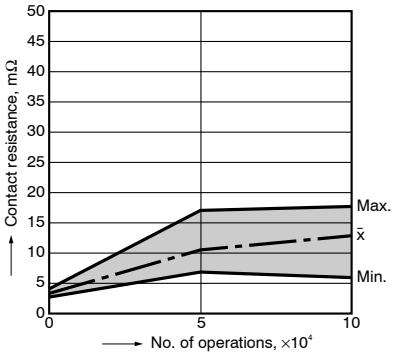
Circuit:



Change of pick-up and drop-out voltage



Change of contact resistance

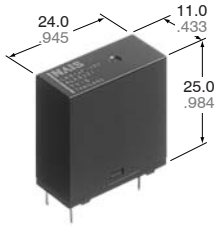


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

250 mW Slim Power Relay

LK-S RELAYS



mm inch

FEATURES

1. High sensitivity: 250mW
The power-saving relay is highly sensitive at the nominal operating power of 250 mW (530 mW power consumption on LK relays).

2. High insulation resistance between contact and coil
1) Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
2) Surge withstand voltage between contact and coil: 10,000 V or more

3. High noise immunity realized by the card separation structure between contact and coil

4. Popular terminal pitch in AV equipment field

5. Space-saving slim type
Base area: Width 11 × Length 24 mm
Width .433 × Length .945 inch

6. Conforms to the various safety standards
UL/CSA, VDE, TÜV and SEMKO SEV approved

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 100 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	5 A 277 V AC
	Max. switching power	1,385 V A
	Max. switching voltage	277 V AC
	Max. switching current	5 A (AC)
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	10^6
	Electrical (at 20 cpm) (at rated load)	10^5

Coil

Nominal operating power	250 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial *2 breakdown voltage	Between open contacts	1,000 Vrms for 1 min.
	Between contact and coil	4,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Approx. 7 ms (at 20°C 68°F)
Release time (without diode)*4 (at nominal voltage)		Approx. 2 ms (at 20°C 68°F)
Temperature rise (at 70°C)		Max. 35°C with nominal coil voltage and at 5 A contact carrying current (resistance method)
Shock resistance	Functional*5	Min. 200 m/s²{approx. 20 G}
	Destructive*6	Min. 1,000 m/s²{approx. 100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
	Air pressure	86 to 106 kPa
Unit weight		Approx. 12 g .42 oz

TYPICAL APPLICATIONS

- Audio visual equipment
- Office equipment
- Home appliances

ORDERING INFORMATION

Ex. LKS [1a] [F] — [12V]

Contact arrangement	Protective construction	Coil voltage(DC)
1a: 1 Form A	F: Flux-resistant type	5, 6, 9, 12, 18, 24V

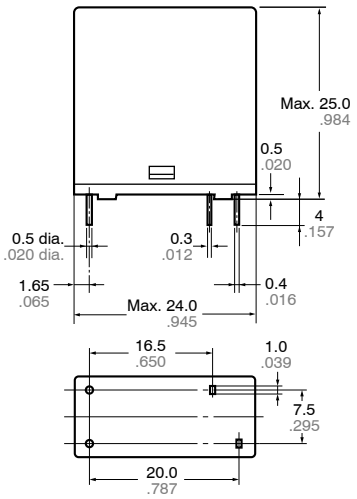
UL/CSA, TÜV, SEMKO, TV-5 approved type is standard.
Notes 1. Standard packing Carton: 100 pcs. Case: 500 pcs.
2. 6 V, 18 V DC types are also available. Please consult us for details.

TYPES AND COIL DATA (at 20°C 68°F)

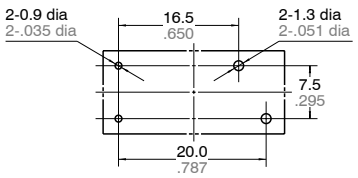
Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum allowable voltage, V DC (at 20°C 68°F)
LKS1aF-5V	5	3.5	0.5	100	50	250	6.5
LKS1aF-6V	6	4.2	0.6	144	41.7	250	7.8
LKS1aF-9V	9	6.3	0.9	324	27.8	250	11.7
LKS1aF-12V	12	8.4	1.2	576	20.8	250	15.6
LKS1aF-18V	18	12.6	1.8	1,296	13.9	250	23.4
LKS1aF-24V	24	16.8	2.4	2,304	10.4	250	31.2

DIMENSIONS

mm inch



PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

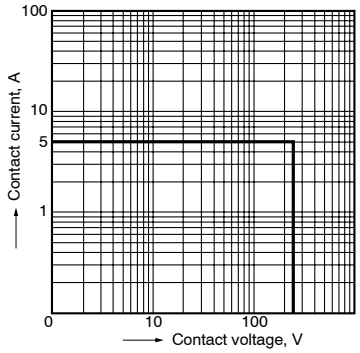
Schematic (Bottom view)

Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Power

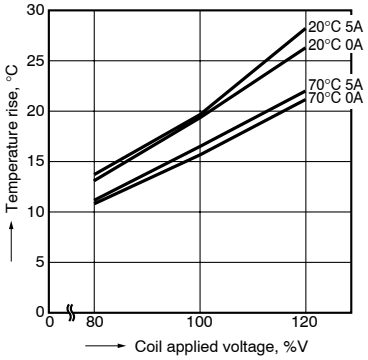
REFERENCE DATA

1. Max. switching power (AC resistive load)



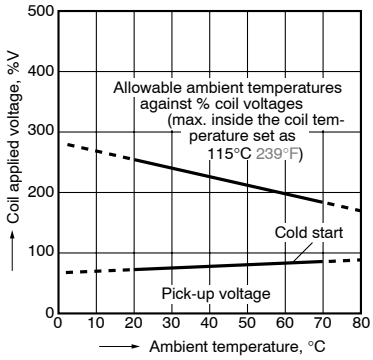
2. Coil temperature rise

Sample: LKS1aF-12V, 6 pcs.
Point measured: coil inside
Contact current: 0 A, 5A



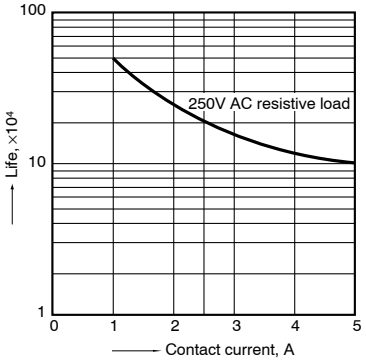
3. Ambient temperature characteristics and coil applied voltage

Contact current: 5 A



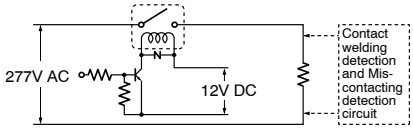
4. Life curve

Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: Room temperature

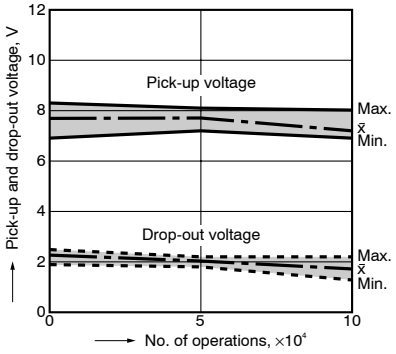


5-(1). Electrical life test
(5 A 277 V AC, resistive load)
Sample: LKS1aF-12V, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

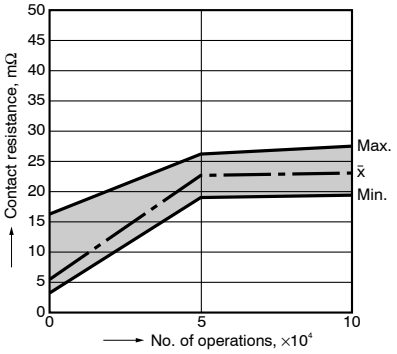
Circuit:



Change of pick-up and drop-out voltage

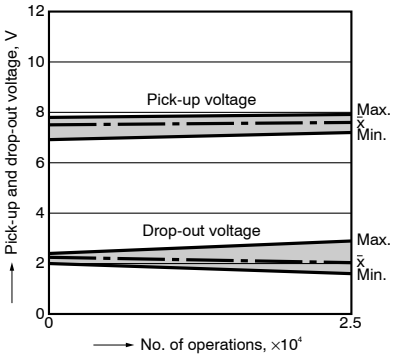


Change of contact resistance

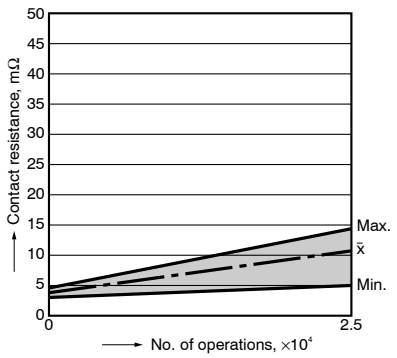


5-(2). Electrical life test
(UL lamp load test TV-5)
Tested sample: LKS1aF-12V, 6 pcs.
• Overload test
Load: 7.5 A 120 V AC (60 Hz),
Inrush: 111 A
Operation frequency: 10 times/min
(ON: OFF = 1 s: 5 s)
No. of operations: 50 ope.
• Endurance test
Load: 5A 120 V AC (60 Hz),
Inrush: 78 A
Operation frequency: 10 times/min
(ON: OFF = 1 s: 5 s)
No. of operations: 25,000 ope.

Change of pick-up and drop-out voltage



Change of contact resistance

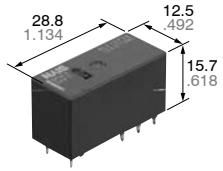


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

16A Low Profile Power Relay

LZ RELAYS (ALZ)



mm inch

FEATURES

1. Low profile size: Height 15.7 mm
28.8 (L)×12.5 (W)×15.7(H) mm
1.134 (L)×.492 (W)×.618(H) inch

2. High insulation resistance
Creepage distance and clearances between contact and coil: Min. 10 mm

3. UL coil insulation class B (85°C 185°F) or class F (105°C 221°F).

4. Pb free and Cd free

5. Low operating power
• Nominal operating power: 400mW

6. Conforms to the various safety standards:
• UL/CSA, VDE approved.

SPECIFICATIONS

Contact

Arrangement		1 Form A, 1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	16 A 250 V AC
	Max. switching power	4,000 V A
	Max. switching voltage	440 V AC
	Max. switching current	16 A
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	1×10^7
	Electrical (at 20 cpm)*10 (Rated load)	N.O.: 10^5 N.C.: 5×10^4

Coil

Nominal operating power	400 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).
*9 Class F type is ambient temperature 105°C 221°F.
*10 Electrical life was evaluated with the breathing hole open.

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	5,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Max. 15ms (at 20°C 68°F)
Release time (with diode)*4 (at nominal voltage)		Max. 5ms (at 20°C 68°F)
Temperature rise (20°C 68°C)		Max. 55°C with nominal coil voltage and at 16 A contact carrying current (resistance method)
Shock resistance	Functional*5	Min. 100 m/s²{approx. 10 G}
	Destructive*6	Min. 1,000 m/s²{approx. 100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm (NO), 0.82mm (NC)
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F (Class B)*9
	Humidity	5 to 85% R.H.
Unit weight		Approx. 12 g .42 oz

TYPICAL APPLICATIONS

• HVAC
• Oven ranges
• Refrigerators

ORDERING INFORMATION

Ex. A LZ 1 1 B 12 W

Product name	Contact arrangement	Protective construction	Coil insulation class	Coil voltage, V DC	Packing style
LZ	1: 1 Form C 2: 1 Form A	1: Flux-resistant type 2: Sealed type	B: Class B insulation F: Class F insulation	05: 5 18: 18 09: 9 24: 24 12: 12 48: 48	Nil: Tube packing W: Carton packing

UL/CSA VDE approved type is standard.

Notes: 1. Tube packing: Inner carton: 20pcs.; Case: 800pcs.
2. Carton packing: Inner carton: 100pcs.; Case: 500pcs.
3. Carton packing symbol "W" is not marked on the relay.

TYPES

Contact arrangement	Coil voltage, V DC	Flux-resistant type		Sealed type	
		Class B	Class F	Class B	Class F
1 Form A	5	ALZ21B05	ALZ21F05	ALZ22B05	ALZ22F05
	9	ALZ21B09	ALZ21F09	ALZ22B09	ALZ22F09
	12	ALZ21B12	ALZ21F12	ALZ22B12	ALZ22F12
	18	ALZ21B18	ALZ21F18	ALZ22B18	ALZ22F18
	24	ALZ21B24	ALZ21F24	ALZ22B24	ALZ22F24
	48	ALZ21B48	ALZ21F48	ALZ22B48	ALZ22F48
1 Form C	5	ALZ11B05	ALZ11F05	ALZ12B05	ALZ12F05
	9	ALZ11B09	ALZ11F09	ALZ12B09	ALZ12F09
	12	ALZ11B12	ALZ11F12	ALZ12B12	ALZ12F12
	18	ALZ11B18	ALZ11F18	ALZ12B18	ALZ12F18
	24	ALZ11B24	ALZ11F24	ALZ12B24	ALZ12F24
	48	ALZ11B48	ALZ11F48	ALZ12B48	ALZ12F48

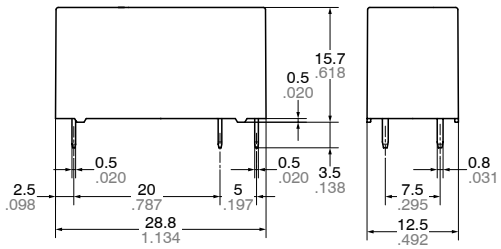
COIL DATA

Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum allowable voltage, V DC
5	3.5	0.5	63	80	400	6.5
9	6.3	0.9	203	44.4	400	11.7
12	8.4	1.2	360	33.3	400	15.6
18	12.6	1.8	810	22.2	400	23.4
24	16.8	2.4	1,440	16.7	400	31.2
48	33.6	4.8	5,760	8.3	400	62.4

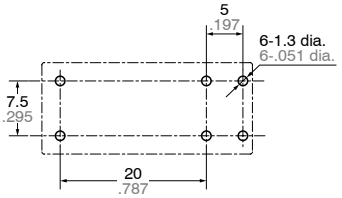
DIMENSIONS

mm inch

1. 1 Form A type

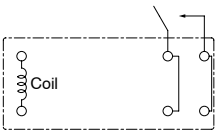


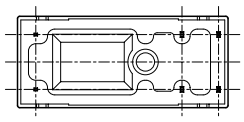
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

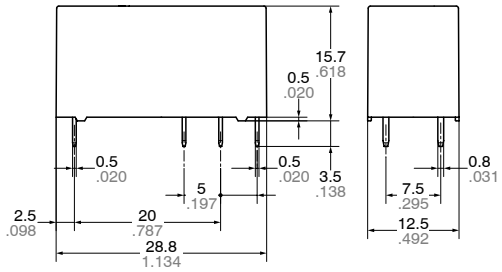
Schematic (Bottom view)

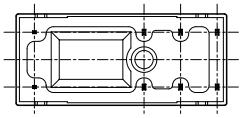




Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

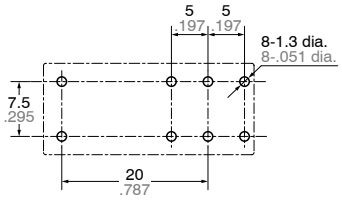
2. 1 Form C type





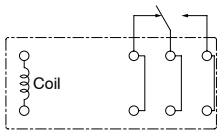
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



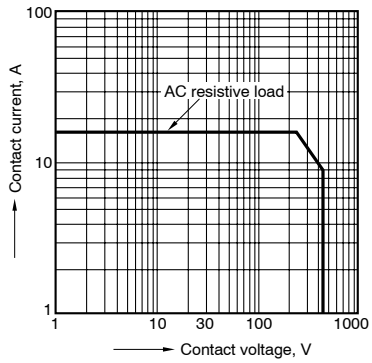
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

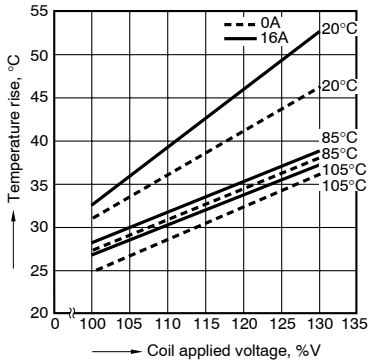


REFERENCE DATA

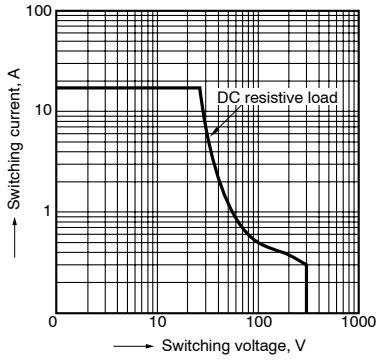
1. Max. switching power



2. Coil temperature rise



3. DC breaking capacity



Power

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

Polarized motor contactor monostable or latching

MC Mini-Contactor

Screw terminal (4a)

Fasten terminal type

PCB terminal type

FEATURES

- **Suitable for AC3 and AC11 loads**
- **Low noise**
- **Forced operation contacts**
- **Low power consumption, hence ideal as interface module**
- **Mono- or bistable**

TÜV, UL, C-UL RATINGS

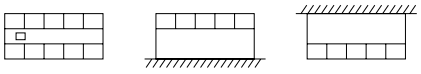
Type No.		DC coil type		**MC-SM, MC-SA**	**MC-SMF, MC-SAF**	**MC-SMP, MC-SAP**
		AC coil type		**MC-NM, MC-NA**	**MC-NMF, MC-NAF**	**MC-NMP, MC-NAP**
Terminal form				Screw terminal	Fasten terminal	PCB terminal
TÜV rating	Rated switching voltage			400 VAC		
	Rated current			15 A		8 A
	Motor load (IEC AC3)	Single phase	120 VAC	0.4 kW 9.5 A		0.37 kW 8 A
			240 VAC	0.75 kW 8 A		0.75 kW 8 A
		Three phase	240 VAC	2.5 kW 11 A		2.2 kW 8 A
			400 VAC	4.0 kW 9 A		3.8 kW 8 A
	Auxiliary contact rating	AC15		6A 120 VAC , 6 A 240 VAC, 4A 380 VAC		
		AC12		10A 120 VAC , 10 A 240 VAC, 10A 380 VAC		

UL / C-UL rating	"a" contact	Motor load	Single phase	120 VAC	F.L.A.* 10 A, L.R.A.** 60 A
				240 VAC	F.L.A. 10 A, L.R.A. 60 A
			Three phase	240 VAC	F.L.A. 10 A, L.R.A. 60 A
		General use			15 A, 120 VAC, 10 A 240 VAC
		Tungsten lamp			6 A 240 VAC
	"b" contact	General use			10 A 240 VAC
		Pilot duty			A300

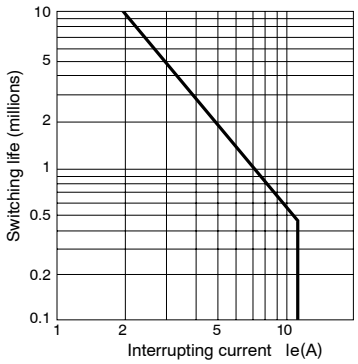
*F.L.A. = Full load amperage

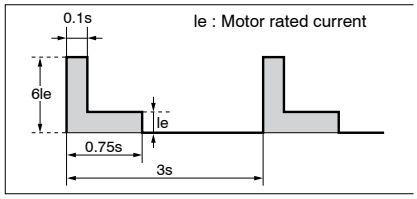
**L.R.A. = Locked rotor amperage

SPECIFICATIONS

	DC coil type	AC coil type
Mechanical life	> 10^7	> 5 x 10^6
Insulation resistance	More than 10Ω by 500 VDC megger (initial)	
Dielectric strength	2,500 VAC for more than 1 minute (initial)	
Coil surge voltage	< 50 V	--
Impulse resistance of surge absorption circuit	> 500 V	--
Usable range of coil voltage	80% to 120% V (cold) 85% to 120% V (hot)	80% to 110% V (cold) 85% to 110% V (hot)
Usable temp. & humidity	-10°C to + 60°C 14°F to + 140°F, < 85% R.H.	
Permissible mounting direction		
Weight	Screw: 150g, Fasten/PCB: 140g	Screw: 130g, Fasten/PCB: 120g

AC3 220 V LIFE CURVE (Average) for Screw and Fasten Types





3 ϕ 220V 60Hz COS ϕ = 0.35
Switching frequency : 20 cycles/minute

COIL SPECIFICATIONS

Rated coil voltage	Pick-up voltage (at 20°C)	Drop-out voltage (at 20°C)	Rated energized current (at 20°C)	Rated power consumption	Operating speed	
					Making	Breaking
12 VDC	Max. 9.6 VDC	Min. 1.2 VDC	42 mA	500 mW	< 100 ms	< 30 ms
24 VDC	Max. 19.2 VDC	Min. 2.4 VDC	21 mA	500 mW	< 100 ms	< 30 ms

Coil voltage	Frequency	Pick-up voltage (at 20°C)	Drop-out voltage (at 20°C)	Power capacity		Operating speed	
				Inrush	Sealed	Making	Breaking
120 VAC	60 Hz	Max. 96 VAC	Min. 24 VAC	Max. 22 VA	Max. 5 VA	< 30 ms	< 30 ms
240 VAC	50 Hz	Max. 176 VAC	Min. 44 VAC	Max. 24 VA	Max. 7 VA	< 30 ms	< 30 ms

ORDERING INFORMATION

Ex. MC — S M P — 3a1b — 24VDC

	Screw terminal
F	Fasten terminal
P	PCB terminal

S	DC coil type*
N	AC coil type

M	AC3 Motor loads
A	AC15 Electro-magnetic loads

Contact Configuration
4a or 3a1b
2a2b

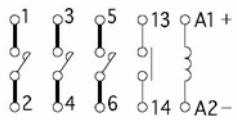
Coil Voltage

(DC coil)
5VDC
6VDC
12VDC
24VDC
48VDC
(AC coil)50/60Hz
24VAC
120VAC
220VAC
240VAC

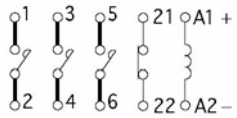
*As for DC coil types, latch versions are available. (but no approval of TUV, UL, C-UL nor CE marking) Please add the ordering code of "L" after Terminal Form code like an example of MC-SML-4a-12VDC.

COIL CONFIGURATION

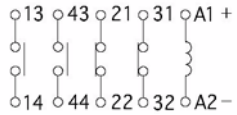
4a



3a1b

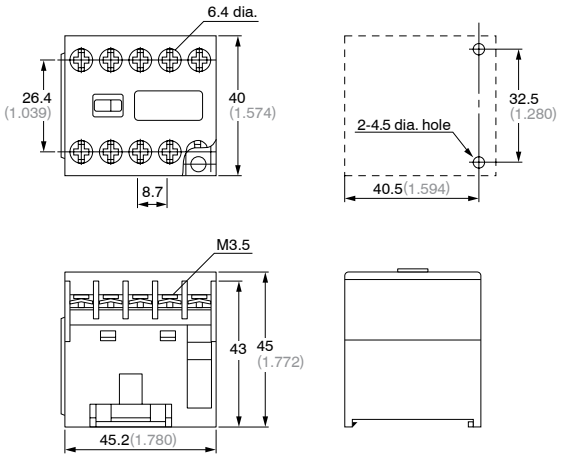


2a2b

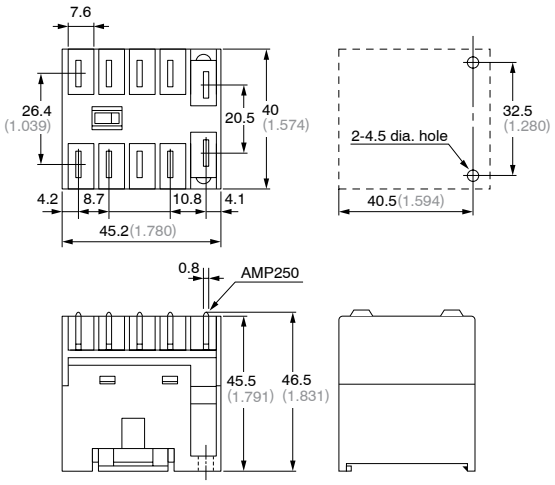


DIMENSIONS

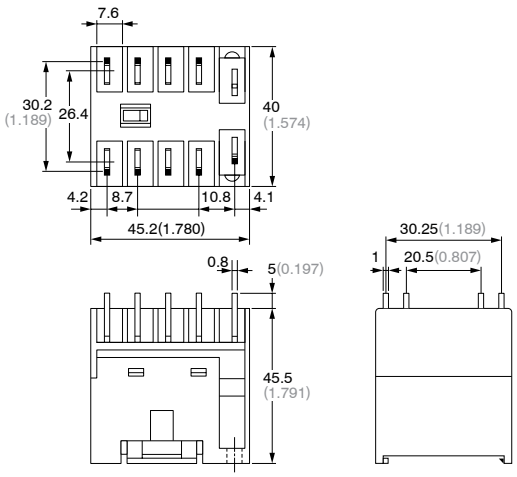
(1) Screw type

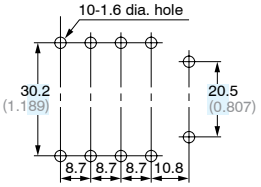


(2) Fasten type



(3) PCB type





WIRING

1) Connection to Screw terminals

Terminal screw	Wire size, max.	Compatible solderless terminal	Standard tightening torque N/m
M3.5	diameter 1.6, 2mm² AWG14	2-3.5 2Y-3.5	approx. 0.8 - 1.2 N•m

2) Connection to Fasten terminals

- **Applicable receptacles are AMP 250 Series (Straight type, Flag type) and AMP's positive lock (17207).**
- **Firmly insert the receptacles so that they cannot be easily pulled out. Do not attempt to pull out two or more receptacles at one time.**

3) Connection to PCB terminals

- **Hand soldering is recommended to avoid flux penetration. Especiallythe use of rosin-flux is recommended since this type of flux makes cleaning unnecessary.**
- **Since the materials of cover is polycarbonate resin, use an alcohol solvent for cleaning.**
- **SinceMC is not a sealed contactor, be careful thecleaning solvent does not get inside.**

INSTALLATION ENVIRONMENT

- **Handle the device with care. Excessive physical impact may cause malfunction.**
- **Do not install the device in a location where it will be exposed to extreme temperatures or humidity, excessive dust, corrosive gases, vibration, physical impact, direct sunlight or water.**
- **Please avoid using in an area where external magnetic field is large.**
- **For the DC coil type, the contactor will not move when coil connection plus and minus is incorrect, because the device is polarized.**

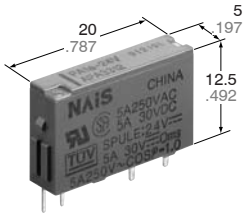
TIPS FOR SAFE OPERATION

- **The life of the contactor may be reduced under extreme operating conditions (high temperature or humidity, exposure to oil vapor, etc.). Choose a model with sufficient operating margin to withstand such conditions.**
- **The MC contactor is not suitable for applications involving jogging (inching) or plug breaking (plugging).**
- **The MC contactor is factory-adjusted and should not be disassembled. Do not attempt to replace the contacts or the coil.**

Panasonic
ideas for life

THE SLIM POWER RELAY

PA RELAYS



mm inch

FEATURES

- **Slim size (width 5 mm .197 inch, height 12.5 mm .492 inch) permits higher density mounting**
- **Wide switching capacity: Control from 100μA 100 mV to 5 A 250 V AC, 30 V DC**
- **High sensitivity: 120 mW (Nominal) (5 to 18 V DC type)**
- **High surge voltage (4000 V) and high breakdown voltage (2000 V)**
- **Shock & vibration resistance (functional): Min. 147m/s² {15 G}**
- **SIL (single in line) terminal layout**
- **Reinforced according to IEC1131-2 (TÜV)**
  PAD type: 3.1 mm clearance
  3.6 mm creepage distance

SPECIFICATIONS (at 20°C 68°F)

Contacts

Arrangement		1a
Contact material		Gold-clad silver alloy
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		30 mΩ
Rating (resistive)	Nominal switching capacity	5 A 250 V AC, 5 A 30 V DC
	Maximum switching power	1250 VA, 150 W
	Maximum switching voltage	250 V AC, 110 V DC
	Max. switching current	5 A
	Min. switching capacity#1	100μA, 100 mV DC
Expected life (min. operations)	Mechanical	2×10^7
	Electrical (at 20 cpm)	3 A 250 V AC, 3 A 30 V DC, 10^5 5 A 250 V AC, 5 A 30 V DC, 5×10^4

Coil (at 25°C 77°F, 50% R.H.)

Nominal operating power	5 to 18 V DC	120 mW
	24 V DC	180 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Intial breakdown voltage" section
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Max. operating speed		20 cpm at rated load
Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	1,000 Vrms
	Between contacts and coil	2,000 Vrms
Surge voltage between contacts and coil*3		4,000 V
Operate time*4 (at nominal voltage)		Max. 10 ms
Release time (without diode)*4 (at nominal voltage)		Max. 5 ms
Temperature rise		Max. 45°C with nominal coil voltage across coil and at nominal switching capacity
Shock resistance	Functional*5	Min. 147 m/s² {15 G}
	Destructive*6	Min. 980 m/s² {100 G}
Vibration resistance	Functional*7	Min. 147 m/s² {15 G}, 10 to 55 Hz at double amplitude of 2.5 mm
	Destructive	Min. 205.8 m/s² {21 G}, 10 to 55 Hz at double amplitude of 3.5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85%R.H.
Unit weight		Approx. 3 g .15 oz

TYPICAL APPLICATIONS

- Interface relays for programmable controllers
- Output relays for measuring equipment, timers, counters and temperature controllers
- Industrial equipment, office equipment

ORDERING INFORMATION

Ex. PA(D) [1a] —— [12V]

Contact arrangement	Coil voltage (DC)
1a: 1 Form A	5, 6, 9, 12, 18, 24V

Notes: 1) The PAD type offers slightly higher clearance (3.1 mm) and creepage distance (3.6 mm).
2) Standard packing: Tube: 25 pcs.; Case: 1,000 pcs.
UL/CSA, TÜV approved type is standard.

TYPES AND COIL DATA (at 20°C 68°F)

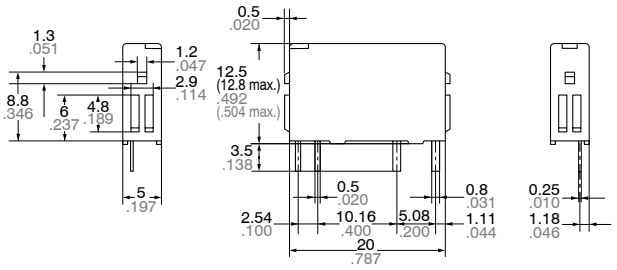
Part No.	Nominal voltage, V DC	Pick-up voltage,* V DC (max.)	Drop-out voltage,* V DC (min.)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, V DC
PA(D)1a-5V	5	3.5	0.25	24	120	208	6
PA(D)1a-6V	6	4.2	0.3	20	120	300	7.2
PA(D)1a-9V	9	6.3	0.45	13.3	120	675	10.8
PA(D)1a-12V	12	8.4	0.6	10	120	1,200	14.4
PA(D)1a-18V	18	12.6	0.9	6.7	120	2,700	21.6
PA(D)1a-24V	24	16.8	1.2	7.5	180	3,200	28.8

*1 Pulse driving

DIMENSIONS

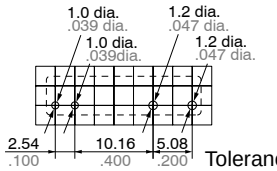
mm inch

1. PA relay



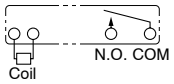
General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

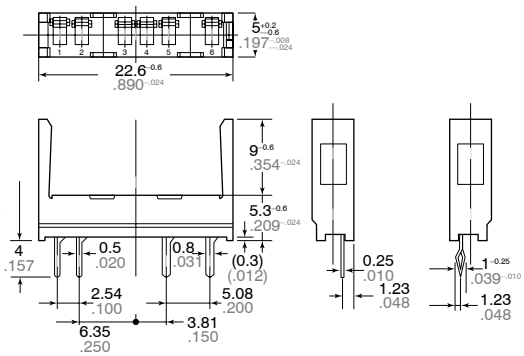
Schematic (Bottom view)



2. Socket

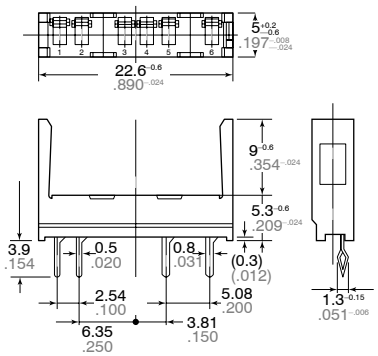
Standard type

PA1a-PS



PA1a-PS

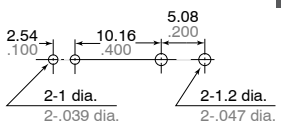
Self clinching type



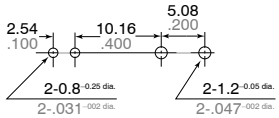
PA1a-PS-H

PC board pattern (Copper-side view)

Standard type



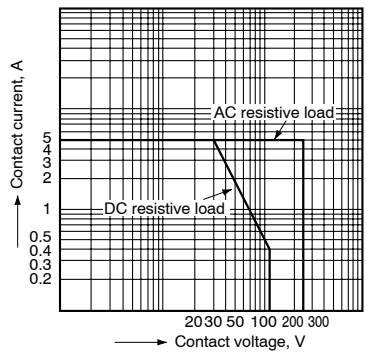
Self clinching type



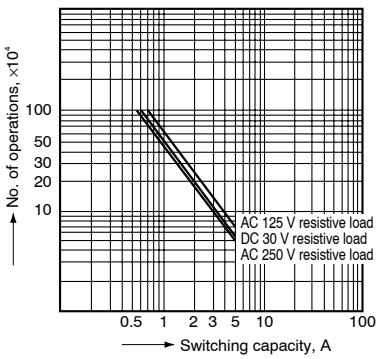
Tolerance: ±0.1 ±.004

REFERENCE DATA

1. Max. switching capacity

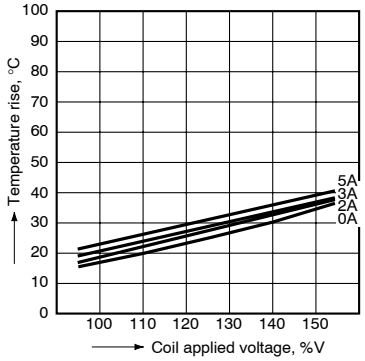


2. Life curve

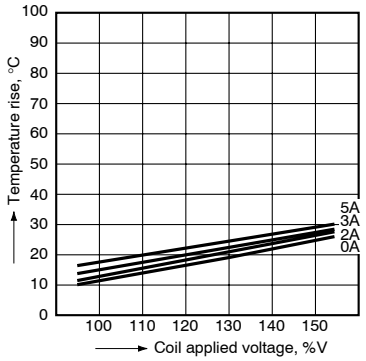


3.-(1) Coil temperature rise (120 mW)

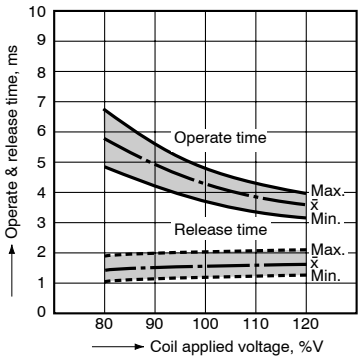
Sample: PA1a-12V
Ambient temperature: 20°C 68°F
Measured portion: Inside the coil



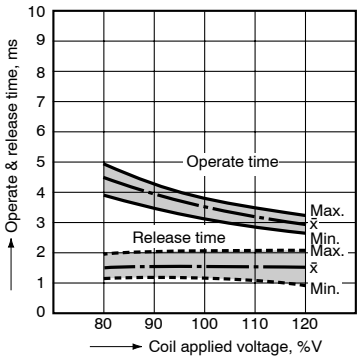
3.-(2) Coil temperature rise (180 mW)
Sample: PA1a-24V
Ambient temperature: 20°C 68°F
Measured portion: Inside the coil



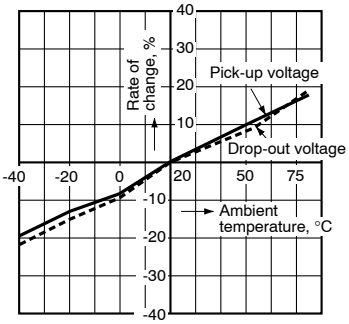
4.-(1) Operate & release time (120 mW)
Sample: PA1a-12V
No. of samples: n = 20



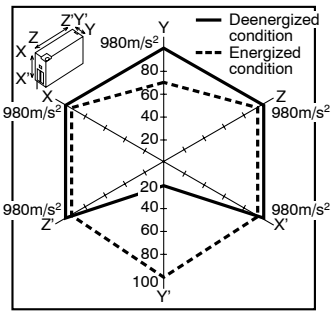
4.-(2) Operate & release time (180 mW)
Sample: PA1a-24V
No. of samples: n = 20



5. Ambient temperature characteristics
Sample: PA1a-12V
No. of samples: n = 6

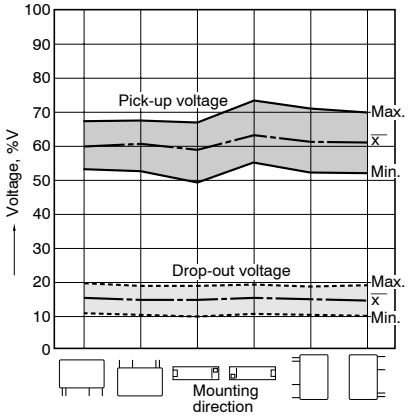


6. Malfunctional shock
Sample: PA1a-12V
No. of samples: n = 6

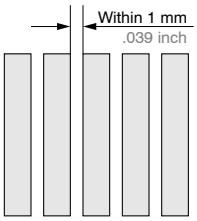


NOTES

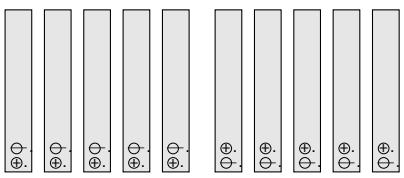
1. Specification values for pick-up and drop-out voltages are for the relay mounting with its terminals below.



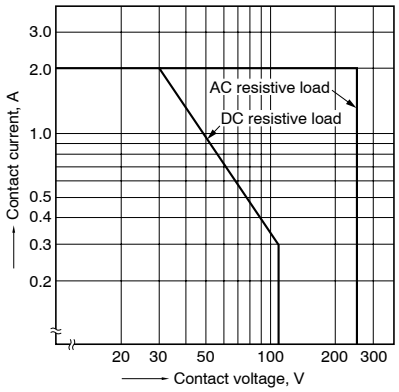
2. When mounting the relays within 1 mm .039 inch, please notice the condition below.
1) Mount the relays in the same direction.

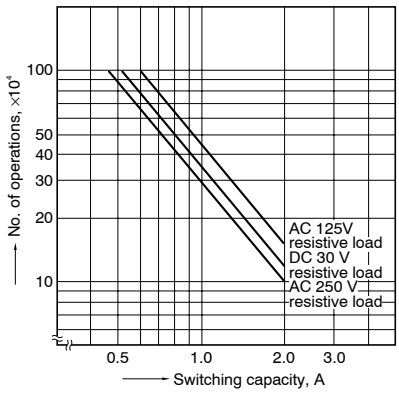


2) Coil terminals (Terminal No. 1 & 2) polarity should be arranged in the same direction.



3) Allowable contact current is 2 A.
4) About the electrical life for close mounting, please refer to data below.



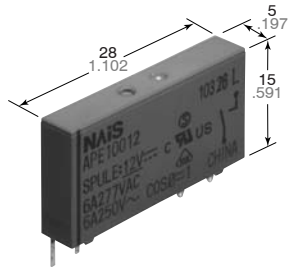


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

THE SLIM POWER RELAY

PE RELAYS (APE)



FEATURES

- **Slim size**
  28 mm (L)×5 mm (W)×15 mm (H)
  1.102 inch (L)×.197 inch (W)×.591 inch (H)
  permits high density mounting
- **Wide switching capacity:**
  100 mA/12 V DC-6A/250 V AC
- **High sensitivity: 170mW**
- **High breakdown (4,000 V) and surge (6,000 V) voltage between contacts and coil**
- **Clearance/creepage distance: 8/8 mm**
- **1 Form A/1 Form C contact.**

Insulation complying to following standards:

EN 60255 General specification for electrical relays
EN 60335 For use in house-hold appliances
EN 60730 For use in temperature sensing appliances
EN 60950 For use in electrical business equipment
EN 60065 For use in entertainment electronics (radio, HiFi-sets)
EN 50178 For use in industrial range

Notes / Rating

Standard	File No.	Rating
UL	E43149	6 A 277 V AC
VDE	122402ÜG	6 A 250 V AC ($\cos\phi$ = 1) 1 A 250 V AC ($\cos\phi$ = 0.4)
SEV	CH-99.1 10483.2A1	6 A 250 V AC ($\cos\phi$ = 1)

SPECIFICATIONS

Contacts

Arrangement		1 Form A, 1 Form C	
Contact material		Silver alloy	Au-plated silver alloy
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ	30 mΩ
Rating (resistive)	Nominal switching capacity	6 A 250 V AC	
	Maximum switching power	1,500 VA	
	Maximum switching voltage	250V AC	
	Max. switching current	6 A (AC)	
	Min. switching capacity#1	100 mA, 5 V DC	1 mA, 1 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	5×10^6	
	Electrical (at 6 cpm) (at rated load)	N.O.: 5×10^4 N.C.: 3×10^4	

Coil (at 25°C 77°F, 50% R.H.)

Nominal operating power	170 mW (4.5 to 24 V DC) 217 mW (48 V DC) 175 mW (60 V DC)

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Intial breakdown voltage" section
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 50ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 11ms

Characteristics

Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	1,000 Vrms
	Between contacts and coil	4,000 Vrms
Surge voltage between contacts and coil*3		Min. 6,000 V (Initial)
Operate time*4 (at nominal voltage)		Max. 8 ms (approx. 5 ms)
Release time (without diode)*4 (at nominal voltage)		Max. 4 ms (approx. 2.5 ms)
Temperature rise		Max. 30°C with nominal coil voltage across coil and at nominal switching capacity
Shock resistance	Functional*5	1 Form C: Min. 49 m/s²{5 G} 1 Form A: Min. 98 m/s²{10 G}
	Destructive*6	Min. 980 m/s² {100 G}
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 1.0 mm/6 G
	Destructive	10 to 55 Hz at double amplitude of 1.5 mm/9 G
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F
	Humidity	5 to 85%R.H.
Unit weight		Approx. 4 g .14 oz

*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

TYPICAL APPLICATIONS

- Interface relays for programmable controllers
- Output relays for measuring equipment, timers, counters and temperature controllers
- Industrial equipment, office equipment
- House-hold appliances for Europe

ORDERING INFORMATION

Ex. APE [1] [0] [1] [4H]

Contact arrangement	Contact type	Contact material	Coil voltage, V DC	
1: 1 Form A 3: 1 Form C	0: Single contact	0: Silver alloy 1: Au–plated silver alloy	4H: 4.5 V 05: 5 V 06: 6 V 12: 12V	18: 18 V 24: 24 V 48: 48 V 60: 60 V

Notes: 1. Standard packing: Tube: 20 pcs.; Case: 1,000 pcs.
2. 1 Form B is also available.

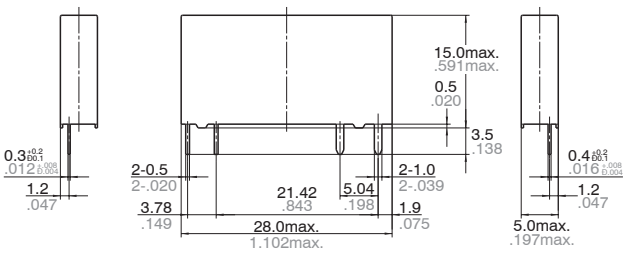
TYPES AND COIL DATA (at 20°C 68°F)

Part No.	Contact arrangement	Nominal voltage, V DC	Pick-up voltage, (Initial) V DC (max.)	Drop-out voltage, (Initial) V DC (min.)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, V DC
APE1004H	1 Form A (without Au-plated)	4.5	2.97	0.225	38	170	119	5.4
APE10005		5	3.3	0.25	34		148	6
APE10006		6	3.96	0.3	28		212	7.2
APE10012		12	7.92	0.6	14		847	14.4
APE10018		18	11.88	0.9	9		1,906	21.6
APE10024		24	15.84	1.2	7		3,388	28.8
APE10048		48	31.68	2.4	5	217	10,618	57.6
APE10060		60	39.6	3	3	175	20,572	72
APE1014H	1 Form A (with Au-plated)	4.5	2.97	0.225	38	170	119	5.4
APE10105		5	3.3	0.25	34		148	6
APE10106		6	3.96	0.3	28		212	7.2
APE10112		12	7.92	0.6	14		847	14.4
APE10118		18	11.88	0.9	9		1,906	21.6
APE10124		24	15.84	1.2	7		3,388	28.8
APE10148		48	31.68	2.4	5	217	10,618	57.6
APE10160		60	39.6	3	3	175	20,572	72
APE3004H	1 Form C (without Au-plated)	4.5	2.97	0.225	38	170	119	5.4
APE30005		5	3.3	0.25	34		148	6
APE30006		6	3.96	0.3	28		212	7.2
APE30012		12	7.92	0.6	14		847	14.4
APE30018		18	11.88	0.9	9		1,906	21.6
APE30024		24	15.84	1.2	7		3,388	28.8
APE30048		48	31.68	2.4	5	217	10,618	57.6
APE30060		60	39.6	3	3	175	20,572	72
APE3014H	1 Form C (with Au-plated)	4.5	2.97	0.225	38	170	119	5.4
APE30105		5	3.3	0.25	34		148	6
APE30106		6	3.96	0.3	28		212	7.2
APE30112		12	7.92	0.6	14		847	14.4
APE30118		18	11.88	0.9	9		1,906	21.6
APE30124		24	15.84	1.2	7		3,388	28.8
APE30148		48	31.68	2.4	5	217	10,618	57.6
APE30160		60	39.6	3	3	175	20,570	72

DIMENSIONS

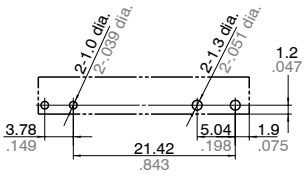
mm inch

1. 1 Form A type



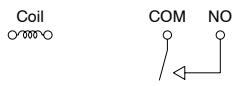
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

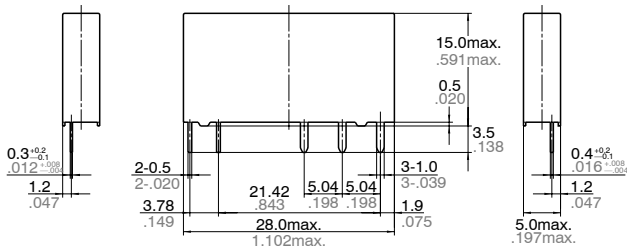


Tolerance: ±0.1 ±.004

Schematic (Bottom view)

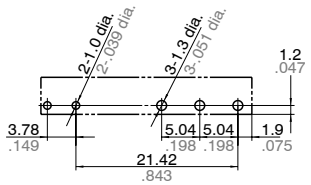


2. 1 Form C type



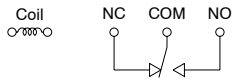
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



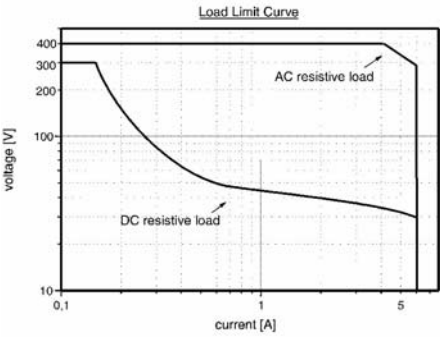
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

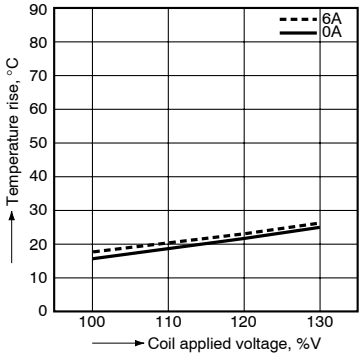


REFERENCE DATA

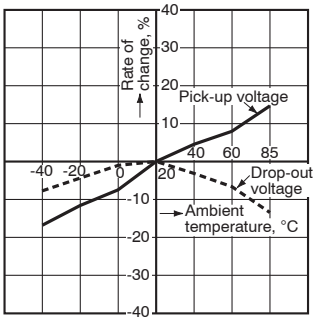
1. Max. switching capacity



2. Coil temperature rise
Sample: APE30012
Measured portion: Inside the coil
Ambient temperature: 28°C 82°F

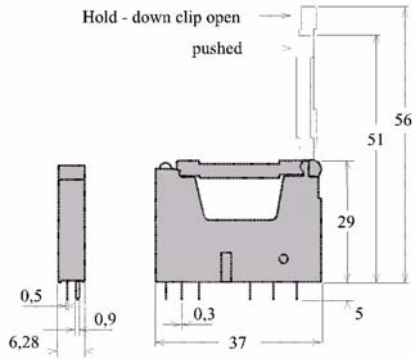


3. Ambient temperature characteristics
Sample: APE30012
No. of samples: n = 6

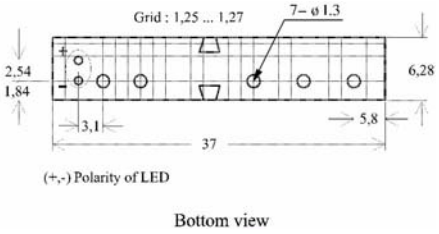


PE RELAY SOCKET

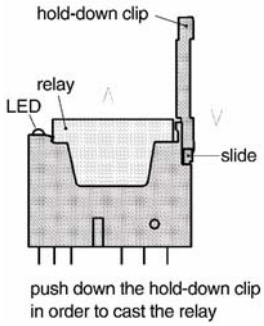
1. Dimensions

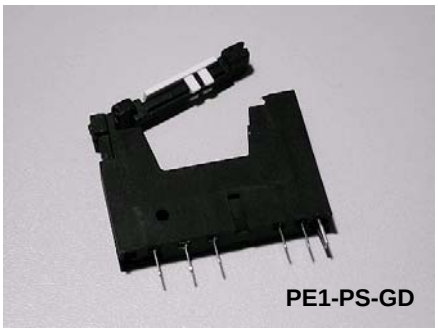


2. Pin Layout



3. Handling





Specifications

LED		Pins rating
nominal voltage	24 V DC	see above
nominal current	appr. 4.2 mA	
diameter	3 mm	
colour	green*	

*other LED-colours on request

Socket incorporates LED-indication, hold-down clip and an integrated casting mechanism; PCB-mounting.

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
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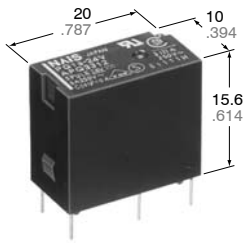
HIGH ELECTRICAL & MECHANICAL NOISE IMMUNITY RELAY

PQ RELAYS



mm inch

FEATURES

- **High electrical noise immunity**
- **Bifurcated contact type with higher contact reliability**
- **High switching capacity: 5 A 250 V AC**
- **High sensitivity: 200 mW (Nominal)**
- **High surge voltage between contacts and coil: 8,000 V**
- **Compatible with DS-P relay terminal layout**

SPECIFICATIONS

Contacts

Arrangement			1 Form A (Bifurcated)
Contact material			Silver alloy
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			50 mΩ
Rating (resistive)	Nominal switching capacity		5 A 250 V AC, 5 A 30 V DC
	Max. switching power		1,250 VA, 150 W
	Max. switching voltage		250 V AC, 110 V (0.3 A)
	Min. switching capacity#1		100 μA, 100 mV DC
Expected life (min. ope.)	Mechanical (at 180 cpm)		2×10^7
	Electrical (at 20 cpm)	5 A 125 V AC	2×10^5
		5 A 250 V AC	10^5

Coil (at 20°C 68°F)

Nominal operating power	200 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ± 1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Max. operating speed		20 cpm at rated load
Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	1,000 Vrms
	Between contacts and coil	4,000 Vrms
Surge voltage between contacts and coil*3		8,000 V
Operate time*4 (at nominal voltage)		Max. 20 ms
Release time (without diode)*4 (at nominal voltage)		Max. 10 ms
Coil temperature rise (Resistive at nominal voltage, contact carrying current: 5 A, at 70°C)		Max. 45°C
Shock resistance	Functional*5	294 m/s² {30 G}
	Destructive*6	980 m/s² {100 G}
Vibration resistance	Functional*7	117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2.0 mm
	Destructive	205.8 m/s² {21 G}, 10 to 55 Hz at double amplitude of 3.5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85%R.H.
Unit weight		Approx. 7 g .25 oz

TYPICAL APPLICATIONS

- Programmable controllers
- Interface relays for Factory Automation and Communication equipment
- Output relays for measuring equipment, timers, counters and temperature controllers

ORDERING INFORMATION

Ex. PQ [1a] — [12V]

Contact arrangement	Coil voltage (DC)
1a: 1 Form A (Bifurcated)	3, 5, 6, 9, 12, 18, 24 V

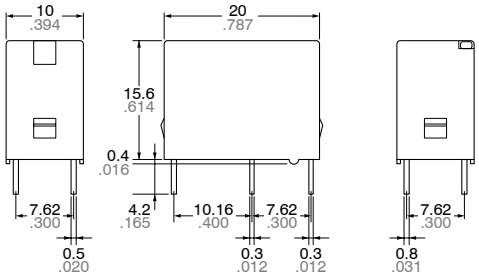
Note: Standard packing: Carton: 100 pcs.; Case: 500 pcs.
UL/CSA, VDE, SEMKO approved type is standard.

TYPES AND COIL DATA (at 20°C 68°F)

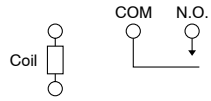
Part No.	Nominal voltage, V DC	Pick-up voltage, (max.)	Drop-out voltage, (min.)	Nominal operating current, mA	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, V DC
PQ1a-3V	3	2.25	0.15	66.7	200	45	180% V of nominal voltage (at 20°C 68°F) 130% V of the nominal voltage (at 70°C 158°F)
PQ1a-5V	5	3.75	0.25	40	200	125	
PQ1a-6V	6	4.5	0.3	33.3	200	180	
PQ1a-9V	9	6.75	0.45	22.2	200	405	
PQ1a-12V	12	9	0.6	16.7	200	720	
PQ1a-18V	18	13.5	0.9	11.1	200	1,620	
PQ1a-24V	24	18	1.2	8.3	200	2,880	

DIMENSIONS

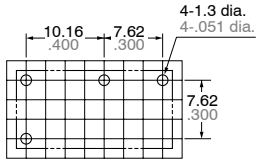
mm inch



Schematic (Bottom view)



PC board pattern
(Copper-side view)

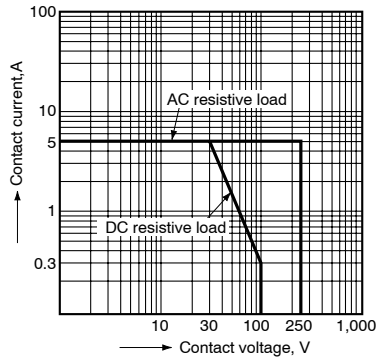


Dimension :	General tolerance
Max. 1mm .039 inch	±0.2 ±.008
1 to 5mm .039 to .118 inch	±0.3 ±.012
Min. 5mm .118 inch	±0.4 ±.016

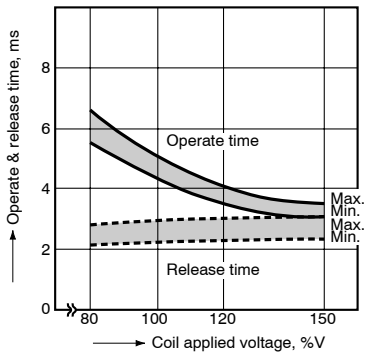
Tolerance: ±0.1 ±.004

REFERENCE DATA

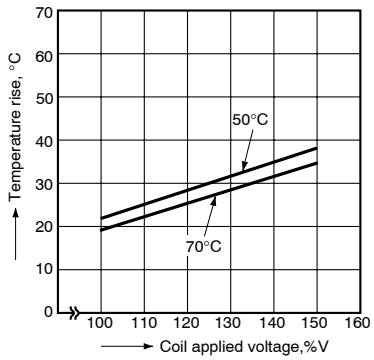
1. Max. switching capacity



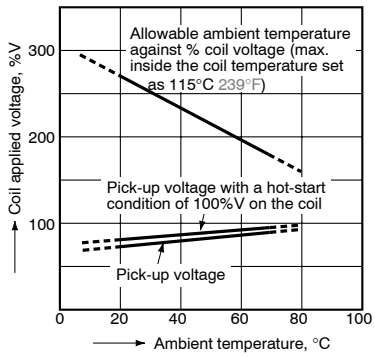
2. Operate & release time
Tested sample: PQ1a-24V, 25 pcs.



3. Coil temperature rise
Measured portion: Inside the coil
Contact carrying current: 5 A



4. Ambient temperature characteristics
Tested sample: PQ1a-24V
Contact carrying current: 5 A



For Cautions for Use, see Relay Technical Information (page 392).

PQ

KFZ-Relais

Panasonic
ideas for life

AUTOMOTIVE POWER RELAYS — SMALL SIZE, LIGHT WEIGHT

CA RELAYS

FEATURES

1. Small size and light weight
For space saving, the outside dimensions of the main body are reduced to be 21.5 mm (length) × 14.4 mm (width) × 37 mm (height) (.846 × .567 × 1.457 inch), and the weight is also reduced to be approx. 19 g .67 oz (direct coupling 1 Form A, 1 Form B type).

2. Low operating power (1.4W) type is available (1 Form A, 1 Form B)

3. Since the terminal arrangement complies with JIS D5011 B4-M1, commercial connectors are available for these types of relays.

SPECIFICATIONS

Contact

Type			12 V DC			24 V DC
Arrangement			1 Form A	1 Form B	1 Form C	1 Form C
Initial contact resistance (By voltage drop 6 V DC 1A)			Max. 50 mΩ			
Contact material			Silver alloy			
Contact voltage drop			Max. 0.3 V After electrical life test, by voltage drop 12 V DC 20 A (1.4 W type), 12 V DC 30 A (1.8 W type)	Max. 0.3 V After electrical life test, by voltage drop 12 V DC 20 A	Max. 0.4 V After electrical life test, by voltage drop 12 V DC 20 A	Max. 0.4 V After electrical life test, by voltage drop 24 V DC 10 A
Rating	Nominal switching capacity (resistive load)		20 A 12 V DC (1.4 W type) 30 A 12 V DC (1.8 W type)	20 A 12 V DC		10 A 24 V DC (ON: 2s, OFF: 2s)
	Max. switching voltage		16 V		15 V	30 V
	Max. switching current		120 A (1.4 W type) 150 A (1.8 W type)	120 A	100 A	50 A (Inrush current)
	Max. carrying current		20 A continuous (1.4 W type) 30 A for 1 min (1.8 W type)	20 A continuous	20 A continuous	10 A continuous
	Min. switching capacity#1		1 A 12 V DC			1 A 24 V DC
Nominal operating power			1.4 W / 1.8 W		1.8 W	
Expected life (min. operations)	Mechanical (at 120 cpm)		10^6		5×10^5	
	Electrical	20 A (1.4 W, 1.8 W type)	10^5 (ON: 2s, OFF: 2s)	10^5 (ON 2s, OFF 2s)		10^5 (ON 2s, OFF 2s)
		30 A (1.8 W type)	2×10^4 (ON: 3s, OFF: 15s)			

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics (at 20°C 68°F)

Type			12 V DC		24 V DC
Max. operating speed			15 cpm (1.4 W type: at nominal load; 1.8 W type: at 20 A)	15 cpm (at nominal load)	
Initial insulation resistance			Min. 10 MΩ at 500 V DC		
Initial breakdown voltage*1	Between open contacts		500 V rms for 1 min.		
	Between contacts and coil		500 V rms for 1 min.		
Operate time*2 (at nominal voltage)			Max. 10 ms at 20°C (initial)		Max. 10 ms (initial)
Release time (without diode)*2 (at nominal voltage)			Max. 10 ms at 20°C (initial)		Max. 10 ms (initial)
Shock resistance		Functional*3	Min. 200 m/s² {20 G}	Min. 100 m/s² {10 G}	Min. 100 m/s² {10 G}
		Destructive*4	Min. 1,000 m/s² {100 G}		
Vibration resistance		Functional*5	Rubber bracket A type: Min. 100 m/s² {10 G}, 50 Hz to 500 Hz Direct coupling type or Screw-mounting type: Min. 44.1 m/s² {4.5 G}, 33Hz		Min. 44.1 m/s² {4.5 G}, 33 Hz
		Destructive*6	Rubber bracket A type: Min. 100m/s² {10 G}, 50 Hz to 500 Hz Direct coupling type or Screw-mounting type: Min. 44.1 m/s² {4.5 G}, 33Hz		Min. 44.1 m/s² {4.5 G}, 33 Hz
Conditions for operation, transport and storage*7 (Not freezing and condensing low temperature)		Ambient temp.	–30°C to +80°C –22°F to +176°F		
		Humidity	5% R.H. to 85% R.H.		
Water-proof standard			Plastic sealed type: JIS DO203S2, Dust cover type: JIS DO203R2		JIS DO203S2
Mass			Rubber bracket A type: 23 g .81 oz Direct coupling type or Screw-mounting type: 19 g .67 oz	31 g 1.09 oz	

Electrical life (min. operation)

	Nominal coil voltage, V DC	Motor load (operating frequency ON: 2 s, OFF: 2 s)	Halogen lamp load (operating frequency ON: 1 s, OFF: 14 s)
1 Form A, 1 Form B	12	10^5, 20 A 12 V DC	10^5, 20 A 12 V DC
1 Form C	12	10^5, 20 A 12 V DC	10^5, 20 A 12 V DC
	24	10^5, 10 A 24 V DC	10^5, 6 A 24 V DC

Remarks

*1 Detection current: 10 mA
*2 Excluding contact bounce time
*3 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*4 Half-wave pulse of sine wave: 6ms
*5 Detection time: 10μs
*6 Time of vibration for each direction; X, Y, direction: 2 hours, Z direction: 4 hours
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT(page 410).

ORDERING INFORMATION

CA [1a] [F] [S] — [12 V] — [A] — [5]

Contact arrangement	Protective construction	Nominal operating power	Coil voltage (DC)	Mounting method	Classification by type
1a: 1 Form A 1b: 1 Form B 1 : 1 Form C	Nil: Plastic sealed type F: Dust cover type	Nil: Standard type (1.8 W) S: Low operating power type (1.4 W) (1 Form A, 1 Form B)	12 V 24 V (1 Form C only)	A: Rubber bracket A type (1 Form A, 1 Form B) N: Screw mounting type C: Direct coupling type	Nil: 1 Form C 5: 1 Form A or 1 Form B

Notes: 1. Type with resistor/diode inside are available as options. Please consult our sales office.
2. Standard packing: Carton: 20 pcs. Case: 200 pcs.

COIL DATA

1) Standard type

Contact arrangement	Mounting type	Plastic sealed type	Dust cover type	Nominal voltage, V DC	Pick-up voltage, V DC (at 20°C 68°F)	Drop-out voltage, V DC (at 20°C 68°F)	Nominal operating current, mA (at 20°C 68°F)	Coil resistance, Ω (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Usable voltage range, V DC
1 Form A	Rubber bracket A	CA1a-12V-A-5	CA1aF-12V-A-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
	Screw-mounting	CA1a-12V-N-5	CA1aF-12V-N-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
	Direct coupling	CA1a-12V-C-5	CA1aF-12V-C-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
1 Form B	Rubber bracket A	CA1b-12V-A-5	CA1bF-12V-A-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
	Screw-mounting	CA1b-12V-N-5	CA1bF-12V-N-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
	Direct coupling	CA1b-12V-C-5	CA1bF-12V-C-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
1 Form C	Screw-mounting	CA1-DC12V-N	–	12	Max. 8	Min. 0.6	150±10%	80±10%	1.8	10 to 15
	Direct coupling	CA1-DC12V-C	–	12	Max. 8	Min. 0.6	150±10%	80±10%	1.8	10 to 15
	Screw-mounting	CA1-DC24V-N	–	24	Max. 16	Min. 1.2	75±10%	320±10%	1.8	20 to 30
	Direct coupling	CA1-DC24V-C	–	24	Max. 16	Min. 1.2	75±10%	320±10%	1.8	20 to 30

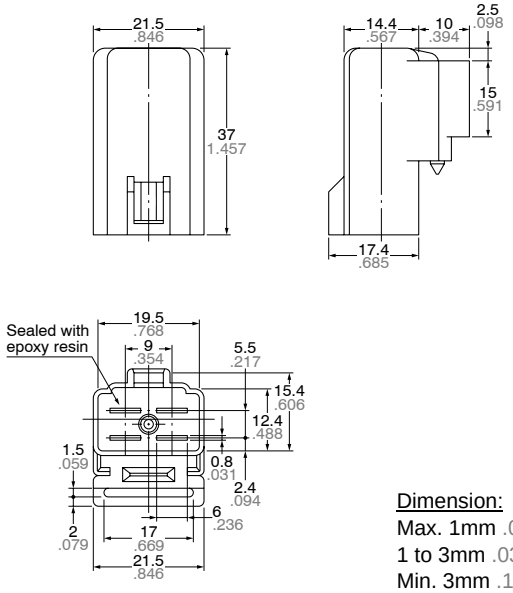
2) Low operating power type

Contact arrangement	Mounting type	Plastic sealed type	Dust cover type	Nominal voltage, V DC	Pick-up voltage, V DC (at 20°C 68°F)	Drop-out voltage, V DC (at 20°C 68°F)	Nominal operating current, mA (at 20°C 68°F)	Coil resistance, Ω (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Usable voltage range, V DC
1 Form A	Rubber bracket A	CA1aS-12V-A-5	CA1aFS-12V-A-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
	Screw-mounting	CA1aS-12V-N-5	CA1aFS-12V-N-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
	Direct coupling	CA1aS-12V-C-5	CA1aFS-12V-C-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
1 Form B	Rubber bracket A	CA1bS-12V-A-5	CA1bFS-12V-A-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
	Screw-mounting	CA1bS-12V-N-5	CA1bFS-12V-N-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
	Direct coupling	CA1bS-12V-C-5	CA1bFS-12V-C-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16

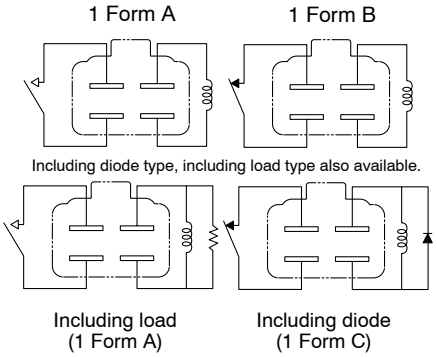
DIMENSIONS

mm inch

1. 1 Form A/1 Form B
Rubber bracket A type

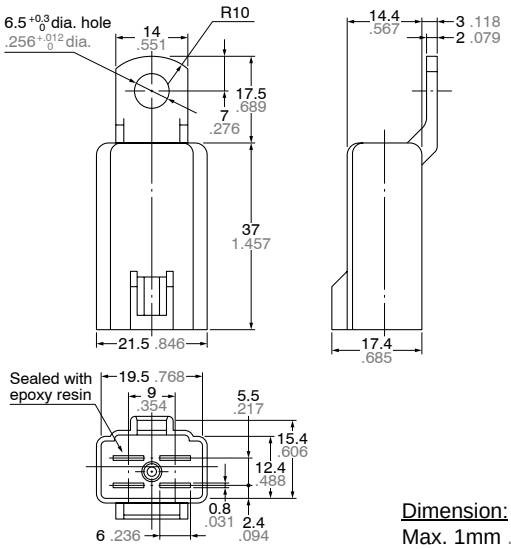


SCHEMATIC (Bottom View)

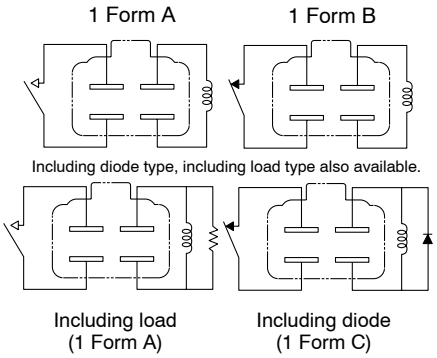


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

2. 1 Form A/1 Form B
Screw-mounting type



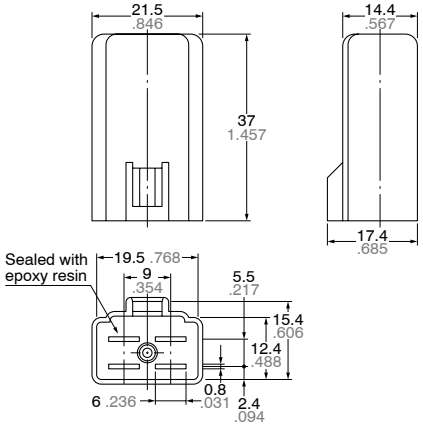
SCHEMATIC (Bottom View)



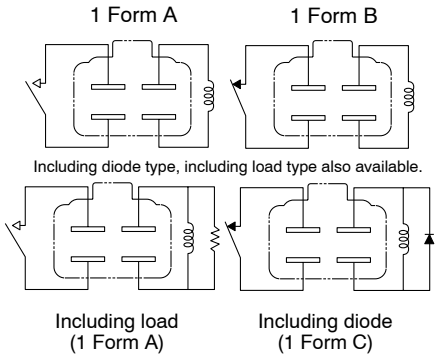
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

3. 1 Form A/1 Form B
Direct coupling type

mm inch

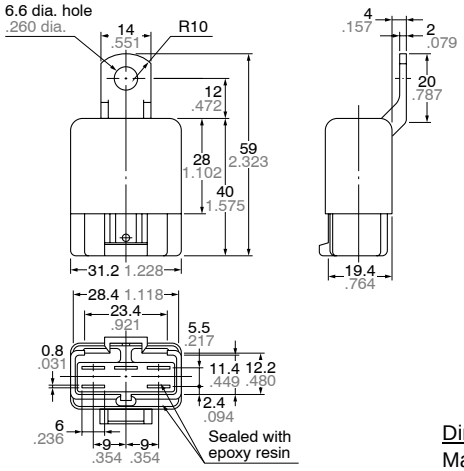


SCHEMATIC (Bottom View)

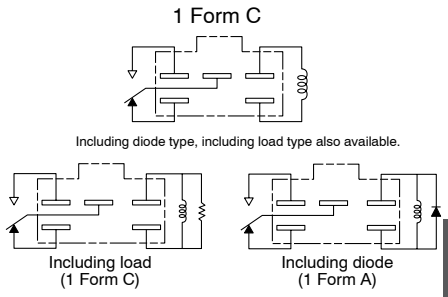


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

4. 1 Form C
Screw-mounting type

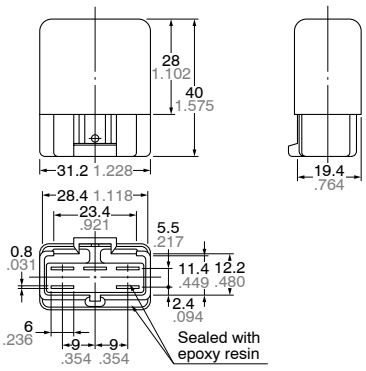


SCHEMATIC (Bottom View)

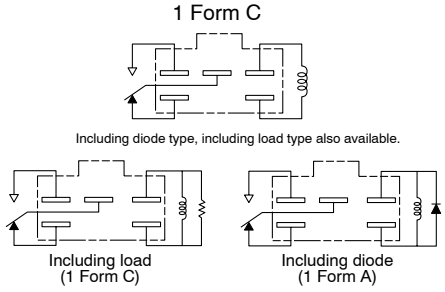


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

5. 1 Form C
Direct coupling type



SCHEMATIC (Bottom View)

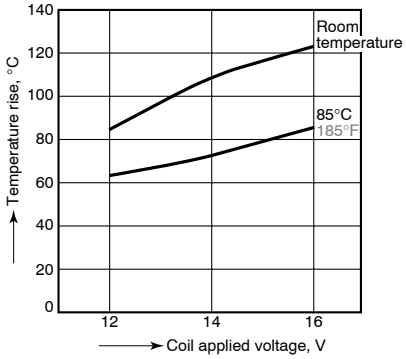


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

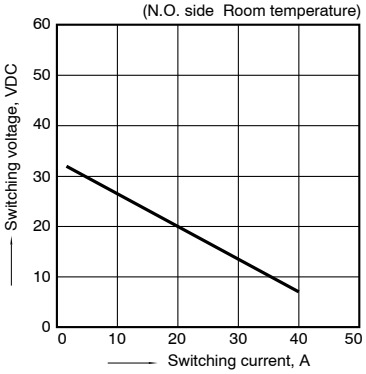
REFERENCE DATA

1. Coil temperature rise

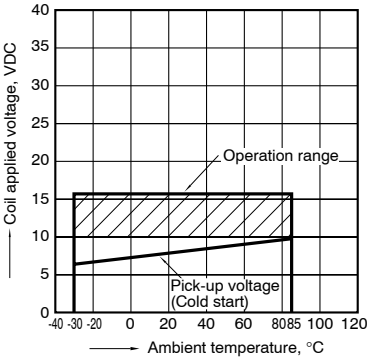
Samples: CA1aS-12V-N-5, 5pcs.
Measured portion: Inside the coil
Contact carrying current: 20A
Ambient temperature: Room temperature, 85°C
185°F



2. Max. switching capability (Resistive load)

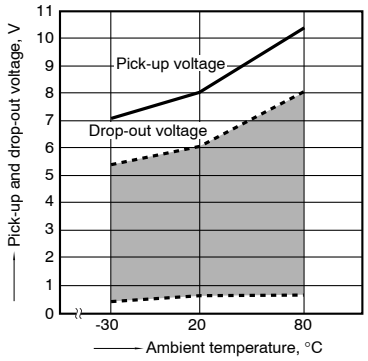


3. Ambient temperature and operating temperature range



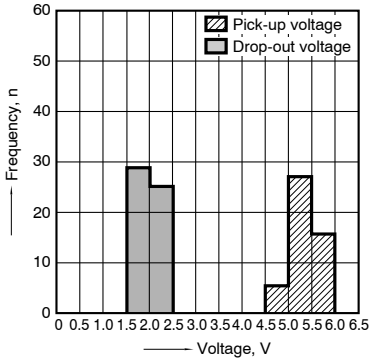
4. Ambient temperature characteristics (Cold start)

Samples: CA1bS-12V-N-5



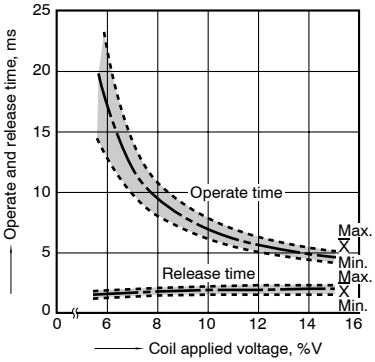
5. Distribution of pick-up and drop-out voltage

Quantity: 50pcs.



6. Distribution of operate and release time

Sample: CA1a-12V-N-5, 10pcs.

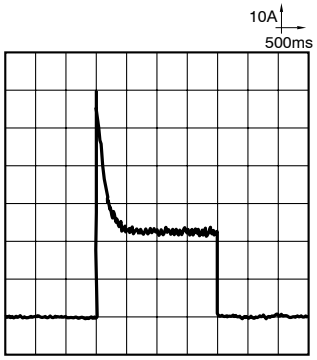


7-(1). Electrical life test (Motor load)

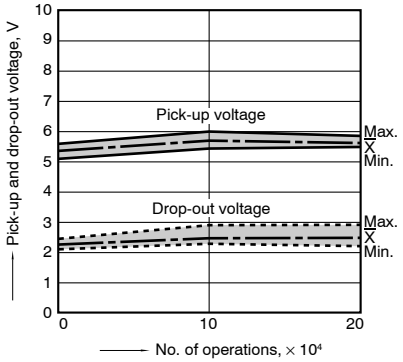
Sample: CA1a-12V-C, 3pcs.
Load: Inrush current: 63A, steady current: 23A
Blower fan motor actual load (motor free)
Switching frequency: (ON:OFF = 2s:2s)
Ambient temperature: Room temperature

Load current waveform

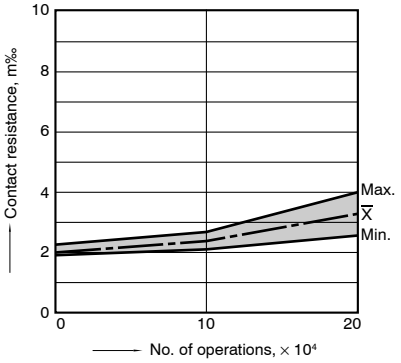
Load: Inrush current: 63A, steady current: 23A,



Change of pick-up and drop-out voltage

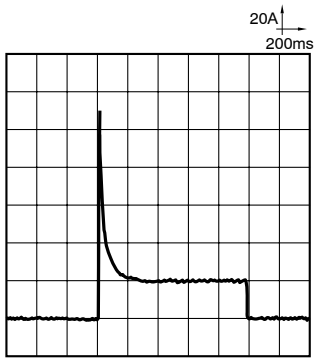


Change of contact resistance

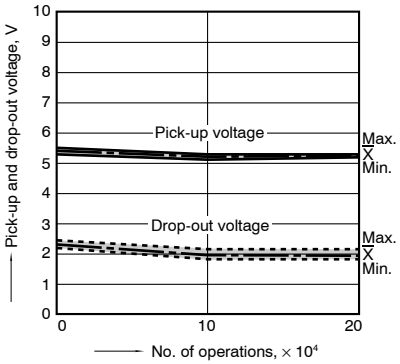


7-(2). Electrical life test (Lamp load)
Sample: CA1a-12V-C, 3pcs.
Load: 60Wx4, Inrush current: 110A, steady current: 20A
Halogen lamp actual load
Switching frequency: (ON:OFF = 1s:14s)
Ambient temperature: Room temperature

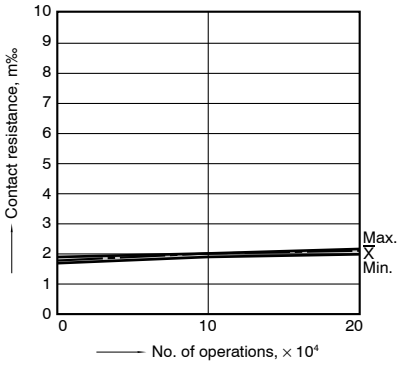
Load current waveform
Load: Inrush current: 110A, steady current: 20A,



Change of pick-up and drop-out voltage



Change of contact resistance



Cautions regarding the protection element

1. Part numbers without protection elements

1) 12 V models

When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 24 V or higher, or a resistor (680Ω to 1,000Ω). When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2) 24 V models

When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 48 V or higher, or a resistor (2,800Ω to 4,700Ω).

When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2. Part numbers with diodes

These relays use a diode in the coil surge protection element. Therefore, the release time is slower and the working life might be shorter compared to part numbers without protection elements and part numbers with resistors.

Be sure to use only after evaluating under actual load conditions.

3. Part numbers with resistors

This part number employs a resistor in the coil surge protection circuit; therefore, an external surge protection element is not required. In particular, when a diode is connected in parallel with a coil, the revert time becomes slower which could adversely affect working life. Please check the circuit and make sure that a diode is not connected in parallel with the coil drive circuit.

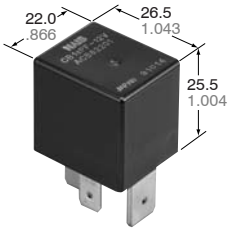
Automotive

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

HIGH POWER AUTOMOTIVE RELAY

CB RELAYS



mm inch

FEATURES

- **40 A rating at 85°C 185°F**
- **ISO type terminals**
- **High shock resistance for drop test requirements (2 meters 6.6 feet)**
- **Low temperature rise — all current carrying material is copper.**
- **Plug-in and PC board type**

SPECIFICATIONS

Contact

(1) Standard type (12V coil voltage)

Arrangement		1 Form A	1 Form C	High contact capacity (1 Form A)
Rating	Nominal switching capacity	40 A 14 V DC	N.O.: 40 A 14 V DC N.C.: 30 A 14 V DC	70 A 14 V DC (at 20°C 68°F) 50 A 14 V DC (at 85°C 185°F)
	Max. switching current (at 85°C 185°F)	N.O.: 40 A 14 V DC	N.O.: 40 A 14 V DC N.C.: 30 A 14 V DC	N.O.: 40 A 14 V DC
Initial contact resistance (By voltage drop 6 V DC 1 A)		Max. 15mΩ		
Contact material		Silver alloy		
Min. switching capacity#1		1 A 12 V DC (12 V DC), 1 A 24 V DC (24 V DC),		
Expected life	Mechanical (at 120 cpm)	Min. 10^6		
	Electrical (at rated load)	Flux-resistant type: Min. 10^{5}*1 Sealed type: Min. 5×10^4		

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

(2) Standard type (24V coil voltage)

Arrangement		1 Form A	1 Form C	High contact capacity (1 Form A)
Rating	Nominal switching capacity	20 A 28V DC	N.O.: 20 A 28 V DC N.C.: 10 A 28 V DC	20 A 28V DC
	Max. switching current (at 85°C 185°F)	20 A 28 V DC	N.O.: 20 A 28 V DC N.C.: 10 A 28 V DC	20 A 28 V DC

*1 All other specifications are the same as those of standard type (12V coil voltage)

(3) Heat resistant type (12V, 24V coil voltage)

Type		12V coil voltage		24V coil voltage	
Arrangement		1 Form A	1 Form C	1 Form A	1 Form C
Rating	Nominal switching capacity	40 A 14V DC	N.O.: 40 A 14 V DC N.C.: 30 A 14 V DC	20 A 28 V DC	N.O.: 20 A 28 V DC N.C.: 10 A 28 V DC
	Max. switching current (at 85°C 185°F)	40 A 14 V DC	N.O.: 40 A 14 V DC N.C.: 30 A 14 V DC	20 A 28V DC	N.O.: 20 A 28 V DC N.C.: 10 A 28 V DC

*1 All other specifications are the same as those of standard type (12V coil voltage)

Coil

Arrangement	Coil voltage	Nominal operating power
1 Form A, 1 Form C	12V DC	1.4W
	24V DC	1.8W
High contact capacity (1 Form A)	12V DC	1.8W
	24V DC	1.8W

Characteristics

Max. operating speed (at rated load)			15 cpm
Initial insulation resistance*2			Min. 20 MΩ (at 500 V DC)
Initial breakdown voltage*3	Between open contacts		500 Vrms for 1 min.
	Between contacts and coil		500 Vrms for 1 min.
Operate time*4 (at nominal voltage)			Max. 15 ms (Initial)
Release time (without diode)*4 (at nominal voltage)			Max. 15 ms (Initial)
Shock resistance		Functional	Min. 200 m/s² {20 G}
		Destructive	Min. 1,000 m/s² {100 G}
Vibration resistance		Functional	10 Hz to 500 Hz, Min. 44.1m/s² {4.5G}
		Functional*5	10 Hz to 2,000 Hz, Min. 44.1m/s² {4.5G}
Conditions for operation, transport and storage*6 (Not freezing and condensing at low temperature)		Ambient temp.	–40°C to +85°C –40°F to +185°F (Heat resistant type: –40°C to +125°C –40°F to +257°F)
		Humidity	5% R.H. to 85% R.H.
Mass			Approx. 33 g 1.16 oz

Remarks

*1 At nominal switching capacity, operating frequency: 2s ON, 2s OFF
*2 Measurement at same location as "Initial breakdown voltage" section
*3 Detection current: 10 mA
*4 Excluding contact bounce time
*5 Time of vibration for each direction; X, Y, Z direction: 4 hours

*6 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT(page 410).

TYPICAL APPLICATIONS

- **Head lights**
- **Head Lamp**
- **Starters**
- **Air conditioner**
- **ABS**
- **Tracter, Combine**

ORDERING INFORMATION

CB | 1 | F | — | T | — | M | — | 12 V

Contact arrangement	Protective construction	Heat resistant of types	Mounting classification	Coil voltage (DC)
1a: 1 Form A 1: 1 Form C 1aH: High contact capacity (1 Form A)	Nil: Sealed type F: Flux-resistant type	Nil: Standard type T: Heat resistant type*1 D: Diode R: Resistor	Nil: Plug-in type P: PC board type M: Bracket type	12, 24 V

Note: Bulk package: 50 pcs.; Case: 200 pcs.

*1 Heat resistant type with high contact capacity is not available. (See "2. Heat resistant type" in "TYPES" below.

TYPES

1. Standard type

Contact arrangement	Mounting classification	Coil voltage, V DC	Part No.	
			Sealed type	Flux-resistant type
1 Form A	PC board type	12V	CB1a-P-12V	CB1aF-P-12V
		24V	CB1a-P-24V	CB1aF-P-24V
	Plug-in type	12V	CB1a-12V	CB1aF-12V
		24V	CB1a-24V	CB1aF-24V
	Bracket type	12V	CB1a-M-12V	CB1aF-M-12V
		24V	CB1a-M-24V	CB1aF-M-24V
1 Form C	PC board type	12V	CB1-P-12V	CB1F-P-12V
		24V	CB1-P-24V	CB1F-P-24V
	Plug-in type	12V	CB1-12V	CB1F-12V
		24V	CB1-24V	CB1F-24V
	Bracket type	12V	CB1-M-12V	CB1F-M-12V
		24V	CB1-M-24V	CB1F-M-24V
High contact capacity (1 Form A)	Plug-in type	12V	CB1aH-12V	CB1aHF-12V
		24V	CB1aH-24V	CB1aHF-24V

* High contact capacity PC board type is also available. Please contact us for details.

2. Heat resistant type

Contact arrangement	Mounting classification	Coil voltage, V DC	Part No.	
			Sealed type	Flux-resistant type
1 Form A	PC board type	12V	CB1a-T-P-12V	CB1aF-T-P-12V
		24V	CB1a-T-P-24V	CB1aF-T-P-24V
	Plug-in type	12V	CB1a-T-12V	CB1aF-T-12V
		24V	CB1a-T-24V	CB1aF-T-24V
	Bracket type	12V	CB1a-T-M-12V	CB1aF-T-M-12V
		24V	CB1a-T-M-24V	CB1aF-T-M-24V
1 Form C	PC board type	12V	CB1-T-P-12V	CB1F-T-P-12V
		24V	CB1-T-P-24V	CB1F-T-P-24V
	Plug-in type	12V	CB1-T-12V	CB1F-T-12V
		24V	CB1-T-24V	CB1F-T-24V
	Bracket type	12V	CB1-T-M-12V	CB1F-T-M-12V
		24V	CB1-T-M-24V	CB1F-T-M-24V

COIL DATA (at 20°C 68°F)

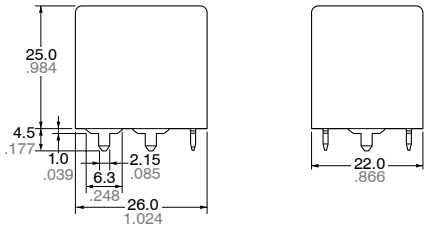
Contact arrangement	Nominal voltage, V DC	Pick-up voltage, V DC*	Drop-out voltage, V DC	Nominal current, mA	Coil resistance, Ω	Nominal operating power, W	Usable voltage range, V DC
1 Form A 1 Form C	12	Max. 3 to 7	Min. 1.2 to 4.2	117±10%	103±10%	1.4	10 to 16
	24	Max. 6 to 14	Min. 2.4 to 8.4	75±10%	320±10%	1.8	20 to 32
High contact capacity (1 Form A)	12	Max. 3 to 7	Min. 1.2 to 4.2	150±10%	80±10%	1.8	10 to 16

* Other pick-up voltage types are also available. Please contact us for details.

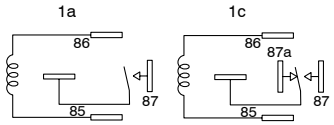
DIMENSIONS

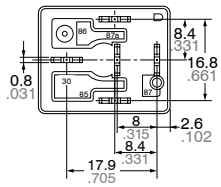
mm inch

1. PC board type



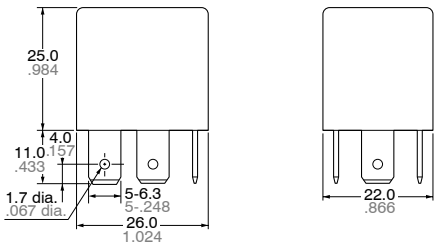
Schematic (Bottom view)



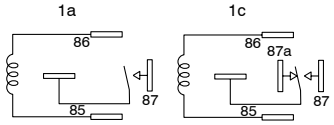


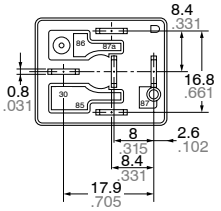
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

2. Plug-in type



Schematic (Bottom view)

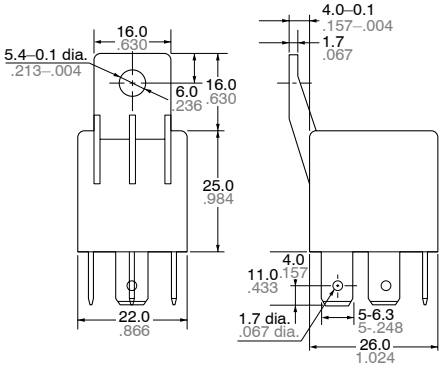




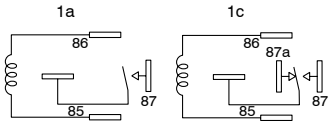
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

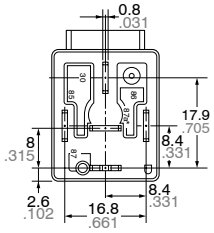
3. Bracket type

mm inch



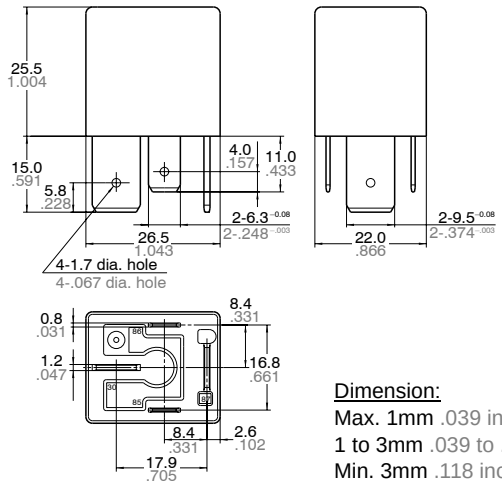
Schematic (Bottom view)



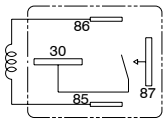


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

4. High contact capacity type (Plug-in terminal type)

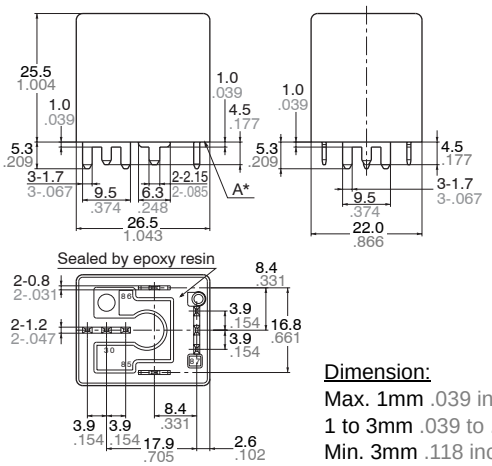


Schematic (Bottom view)

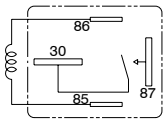


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

High contact capacity type (PC board terminal type)



Schematic (Bottom view)



Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

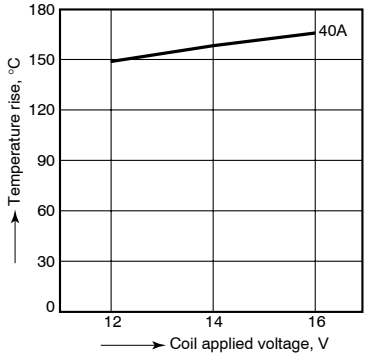
* Intervals between terminals is measured at A surface level.

REFERENCE DATA

CB (Standard type)

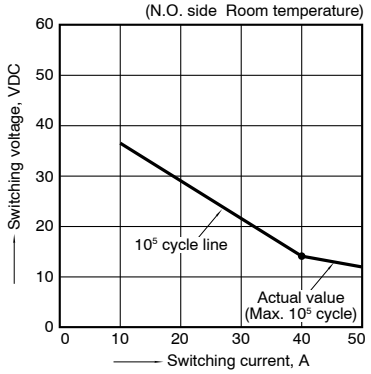
1. Coil temperature rise

Sample: CB1aF-P-12V, 3pcs.
Measured potion: Inside the coil
Contact carrying current: 40A
Ambient temperature: 85°C 185°F



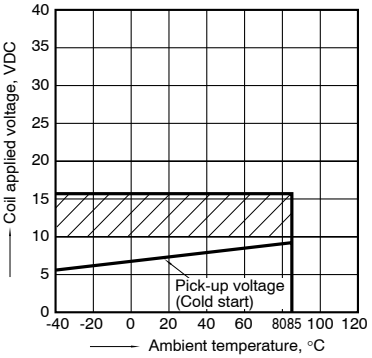
2. Max. switching capability (Resistive load)

(Standard type)



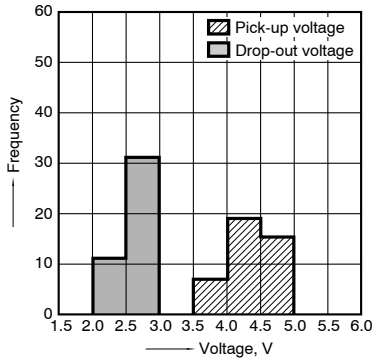
3. Ambient temperature and operating temperature range

(Standard type)



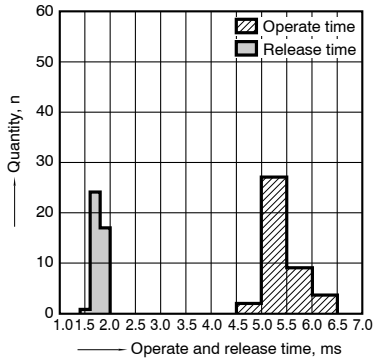
4. Distribution of pick-up and drop-out voltage

Sample: CB1-P-12V, 42pcs.



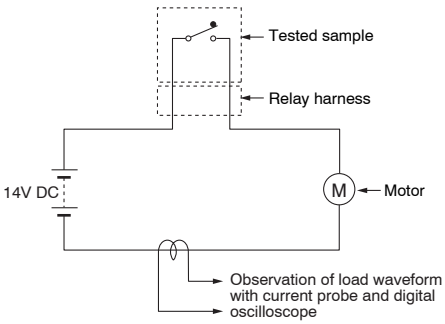
5. Distribution of operate and release time

Sample: CB1-P-24V, 42pcs.
* Without diode



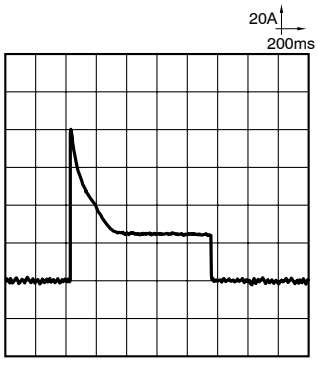
6-(1). Electrical life test (Motor free)

Sample: CB1F-12V, 5pcs.
Load: 25A 14V DC, motor free actual load
Switching frequency: (ON:OFF = 1s:9s)
Ambient temperature: Room temperature
Circuit

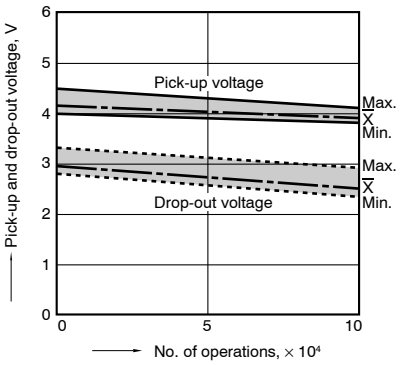


Load current waveform

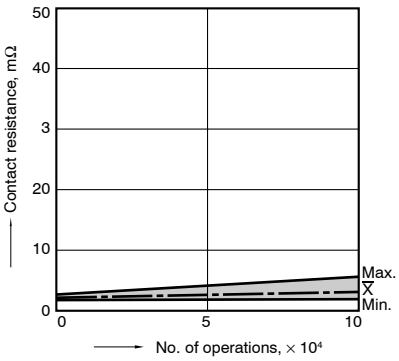
Inrush current: 80A, Steady current: 25A,



Change of pick-up and drop-out voltage



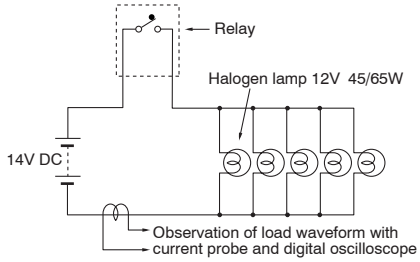
Change of contact resistance



6-(2). Electrical life test (Lamp load)

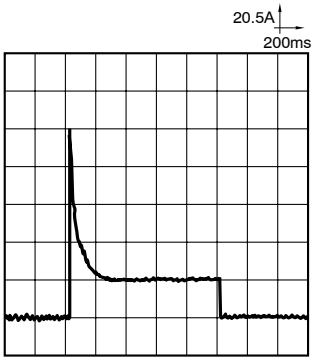
Sample: CB1F-12V, 5pcs.
Load: 45/65Wx5 parallel, 14V DC, halogen lamp actual load
Switching frequency: (ON:OFF = 1s:8s)
Ambient temperature: Room temperature

Circuit

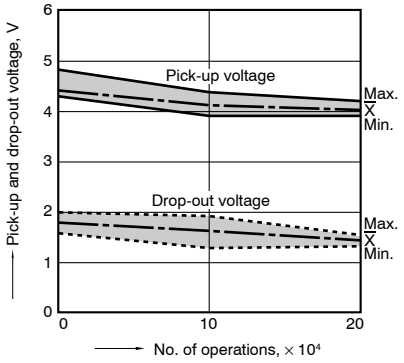


Load current waveform

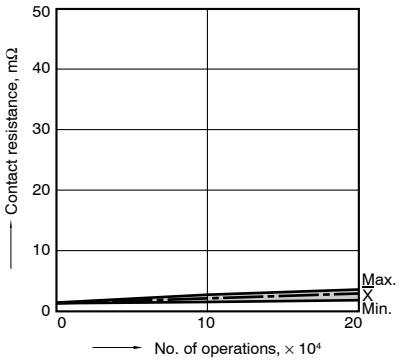
Inrush current: 100A, Steady current: 20A,



Change of pick-up and drop-out voltage



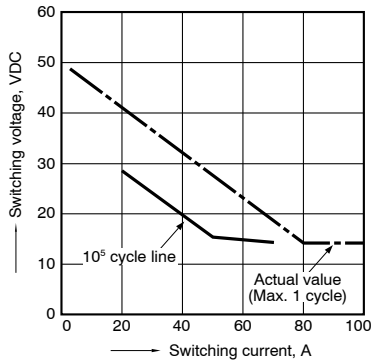
Change of contact resistance



CB (High capacity type)

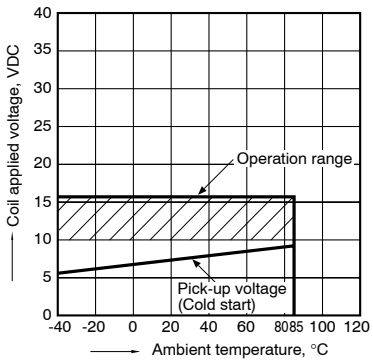
1. Max. switching capability

(High capacity type)



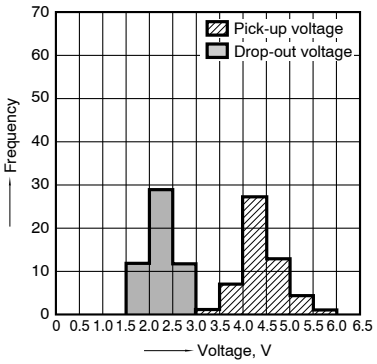
2. Ambient temperature and operating temperature range

(High capacity type)



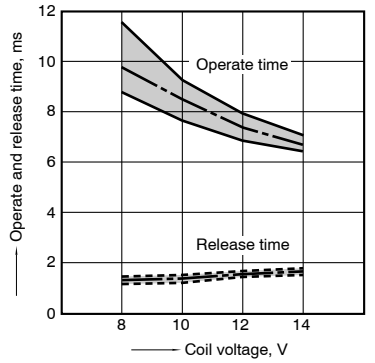
3. Distribution of pick-up and drop-out voltage

Sample: CB1aHF-12V, 53pcs.



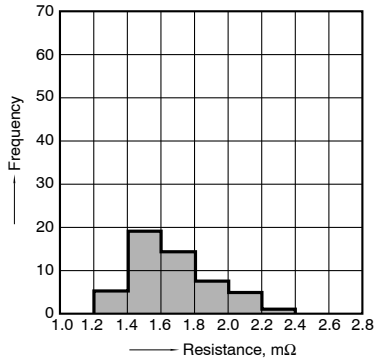
4. Distribution of operate and release time

Sample: CB1aHF-12V, 53pcs.



5. Contact resistance

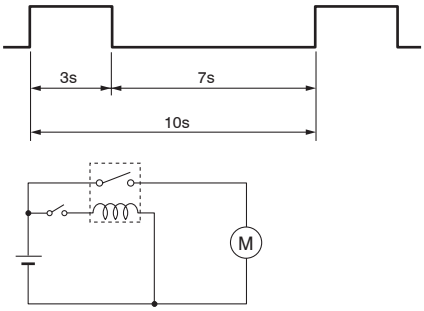
Sample: CB1aHF-12V, 53pcs.
(By voltage drop 6V DC 1A)



6-(1). Electrical life test (Motor free)

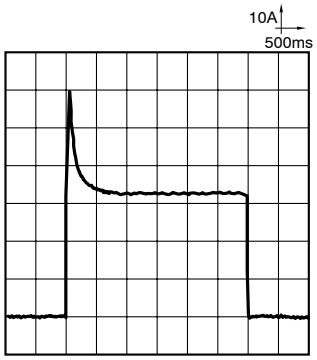
Sample: CB1aH-12V, 3pcs.
Load: Inrush current: 64A/Steady current: 35A
Fan motor actual load (motor free) 12V DC
Switching frequency: (ON:OFF = 3s:7s)
Ambient temperature: Room temperature

Circuit

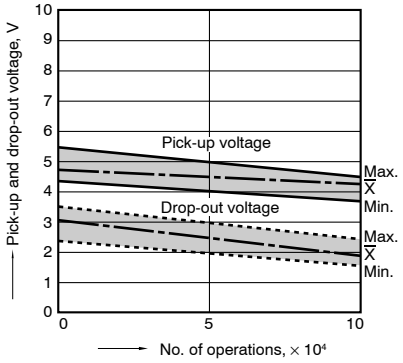


Load current waveform

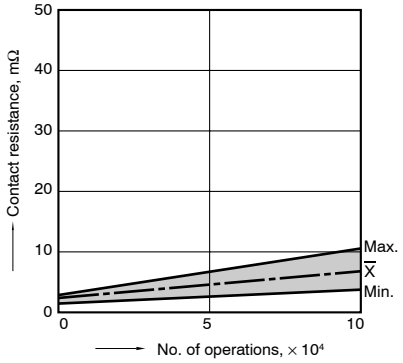
Inrush current: 64A, Steady current: 35A,



Change of pick-up and drop-out voltage



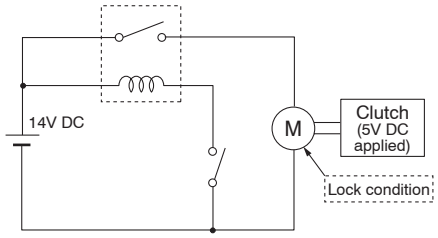
Change of contact resistance



6-(2). Electrical life test (Motor lock)

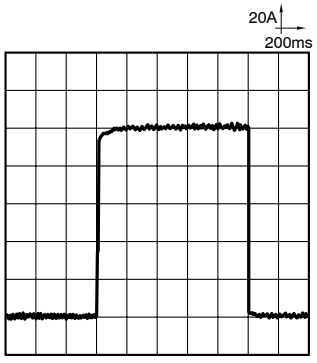
Sample: CB1aH-12V, 5pcs.
Load: 100A 14V DC
Magnet clutch actual load (lock condition)
Switching frequency: (ON:OFF = 1s:9s)
Ambient temperature: Room temperature

Circuit

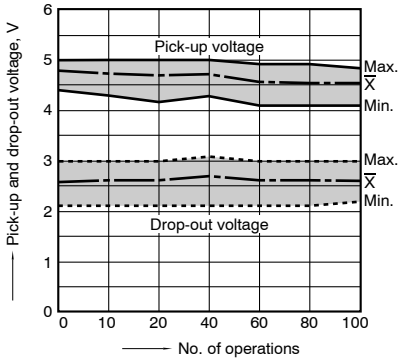


Load current waveform

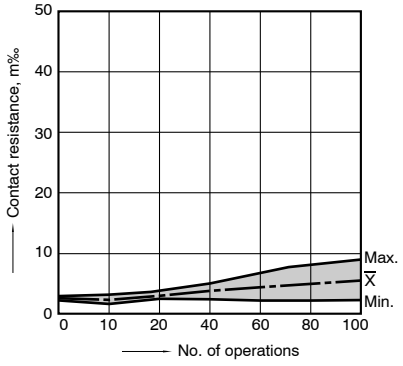
100A 14V DC



Change of pick-up and drop-out voltage



Change of contact resistance



Cautions regarding the protection element

1. Part numbers without protection elements

1) 12 V models

When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 24 V or higher, or a resistor (680Ω to 1,000Ω). When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2) 24 V models

When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 48 V or higher, or a resistor (2,800Ω to 4,700Ω). When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2. Part numbers with diodes

These relays use a diode in the coil surge protection element. Therefore, the release time is slower and the working life might be shorter compared to part numbers without protection elements and part numbers with resistors.
Be sure to use only after evaluating under actual load conditions.

3. Part numbers with resistors

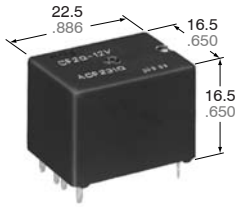
This part number employs a resistor in the coil surge protection circuit; therefore, an external surge protection element is not required. In particular, when a diode is connected in parallel with a coil, the revert time becomes slower which could adversely affect working life. Please check the circuit and make sure that a diode is not connected in parallel with the coil drive circuit.

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

TWIN POWER AUTOMOTIVE RELAY

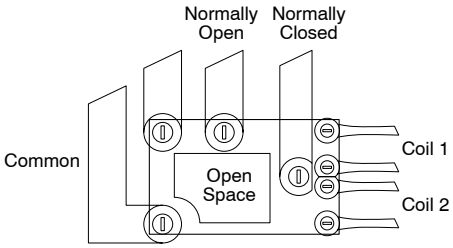
CF RELAYS



mm inch

FEATURES

- **7 Amp Steady/30 Amp Inrush current capability**
- **Simple footprint enables ease of PC board layout**



SPECIFICATIONS

Contact

Arrangement			1 Form C×2 (H bridge)
Contact material			Silver alloy
Initial contact resistance (By voltage drop 6 V DC 1 A)			Max. 50 mΩ
Initial contact voltage drop			Max. 0.2 V (at 20 A)
Rating	Nominal switching capacity		N.O.: 20A 14 V DC N.C.: 10A 14 V DC
	Max. switching power		140 W
	Max. switching voltage		16 V DC
	Max. make current		10 A (Continuous), 30 A (within 1 min.; coil applied voltage: 12 V, at 20°C)
	Max. carrying current		30 A (2 minutes), 20 A (1 hour) (coil applied voltage: 12 V, at 20°C) 25 A (2 minutes), 15 A (1 hour) (coil applied voltage: 12 V, at 85°C)
	Min. switching capacity#1		1 A 12 V DC
Expected life (min. ope.)	Mechanical (at 120 cpm)		10^6
	Electrical	resistive load	Min.10^5
		7 A 14 V DC, Inrush 30 A (Motor load)	2×10^5
		20 A 14 V DC (Motor lock)	Min.5×10^4

Coil

Nominal operating power	640 mW

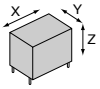
#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at rated load)		6 cpm
Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	1,000 Vrms for 1 min.
Operate time*3 (at nominal voltage)		Max. 10 ms
Release time*3 (at nominal voltage)		Max. 10 ms
Shock resistance	Functional*4	Min. 100 m/s² {10 G}
	Destructive*5	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*6	Approx. 44.1 m/s2 {4.5 G}, 10 Hz to 100 Hz
	Destructive*7	Approx. 44.1 m/s² {4.5 G}, 10 Hz to 500 Hz
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to + 85°C –40°F to +185°F
	Humidity	5%R.H. to 85%R.H.
Mass	Standard type	Approx. 15 g .529 oz

Remarks

*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Time of vibration for each direction;
X, Y, direction: 2 hours
Z direction: 4 hours



*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

TYPICAL APPLICATIONS

- Power windows
- Auto door lock
- Electrically powered sunroof
- Electrically powered mirrors
- Powered seats
- Lift gates
- Slide door closers, etc. (for DC motor forward/ reverse control circuits)

ORDERING INFORMATION

Ex. CF [2] – [12 V]

Contact arrangement	Coil voltage (DC)
1 Form C × 2	12 V

Standard packing: Tube: 35pcs.; Outer carton: 700pcs.

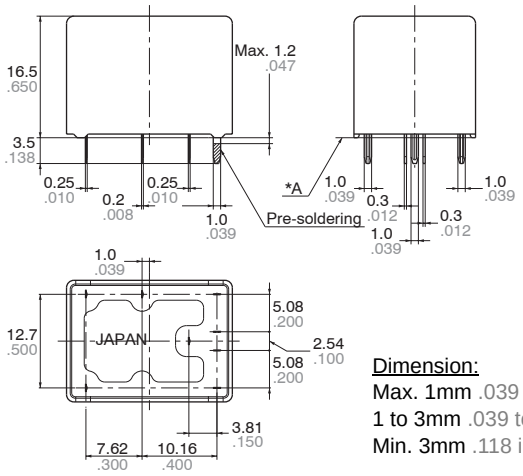
TYPES AND COIL DATA (at 20°C 68°F)

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance, Ω	Nominal operating current, mA	Nominal operating Power, mW	Usable voltage range, VDC
CF2-12V	12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16

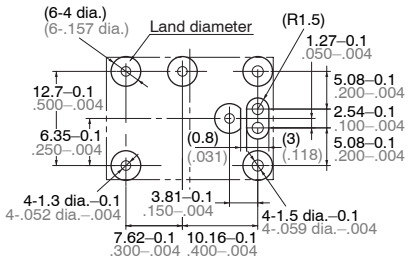
* Other pick-up voltage types are also available. Please contact us for details.

DIMENSIONS

mm inch

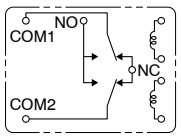


Recommended PC board pattern



Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

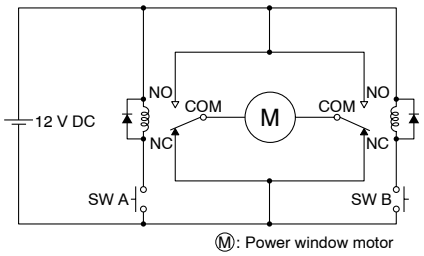
Schematic



* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUITS

Forward/reverse control circuits of DC motor for power window



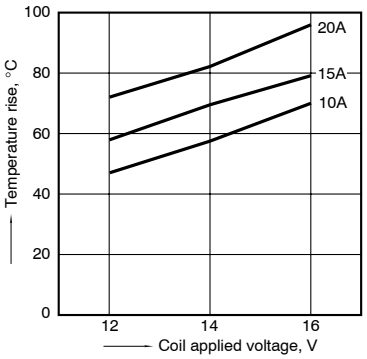
Ⓜ: Power window motor

SW A	SW B	Motor
OFF	OFF	Stop
ON	OFF	Forward
OFF	ON	Reverse

REFERENCE DATA

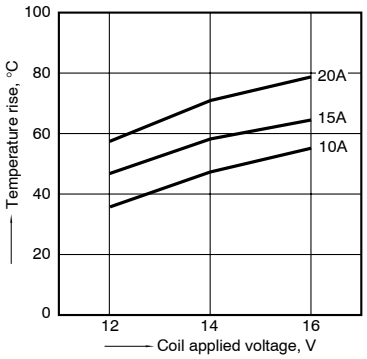
1-(1). Coil temperature rise (at room temperature)

Sample: CF2-12V, 6pcs.
Measured potion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: Room temperature

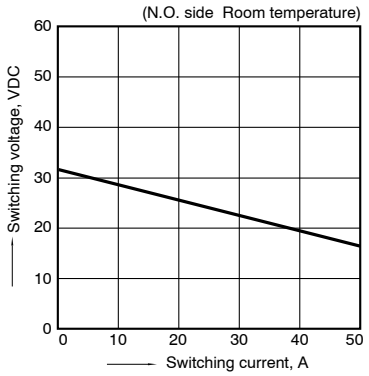


1-(2). Coil temperature rise (at 85°C 185°F)

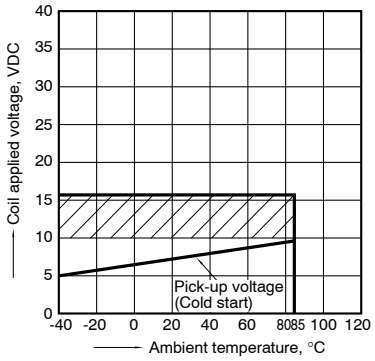
Sample: CF2-12V, 6pcs.
Measured potion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 85°C 185°F



2. Max. switching capability (Resistive load)

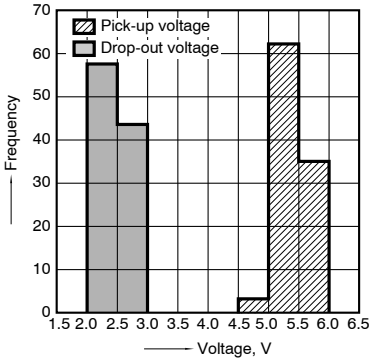


3. Ambient temperature and operating temperature range



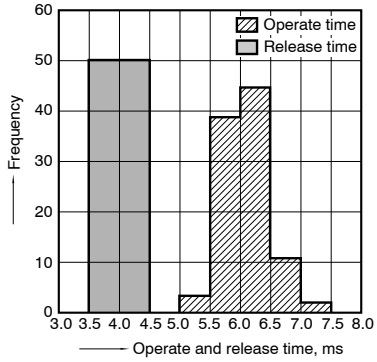
4. Distribution of pick-up and drop-out voltage

Sample: CF2-12V, 100pcs.



5. Distribution of operate and release time

Sample: CF2-12V, 100pcs.
* With diode

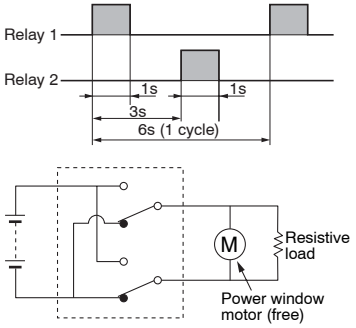


Automotive

6-(1). Electrical life test (Motor free)

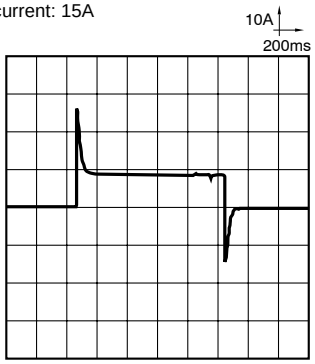
Sample: CF2-12V, 3pcs.
Load: Inrush current: 30A, Steady current: 7A,
Power window motor actual load (free condition)
Switching frequency: (ON:OFF = 1s:5s)
Ambient temperature: Room temperature

Circuit

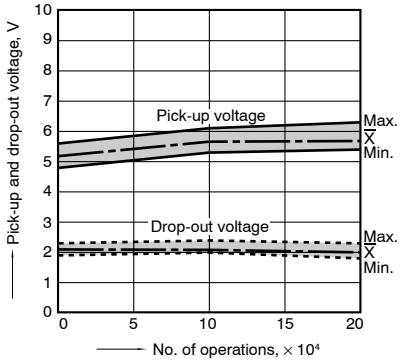


Load current waveform

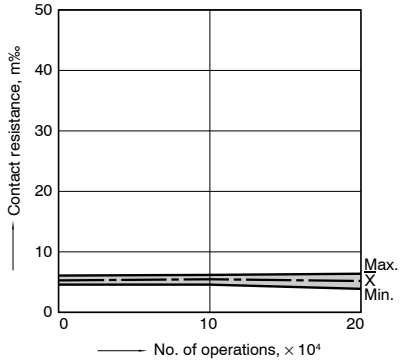
Inrush current: 27A, Steady current: 8.4A
Brake current: 15A



Change of pick-up and drop-out voltage



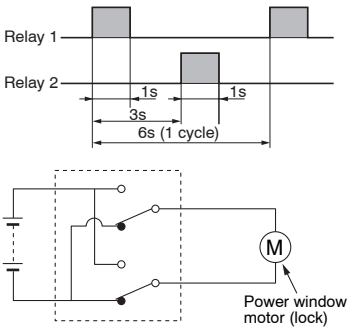
Change of contact resistance



6-(2). Electrical life test (Motor lock)

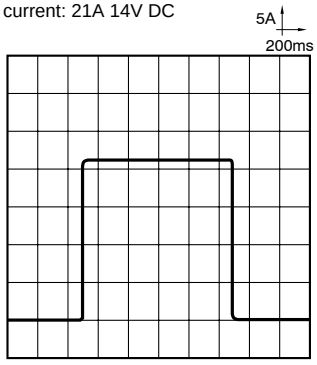
Sample: CF2-12V, 3pcs.
Load: 20A 14V DC,
Power window motor actual load (lock condition)
Switching frequency: (ON:OFF = 1s:5s)
Ambient temperature: Room temperature

Circuit

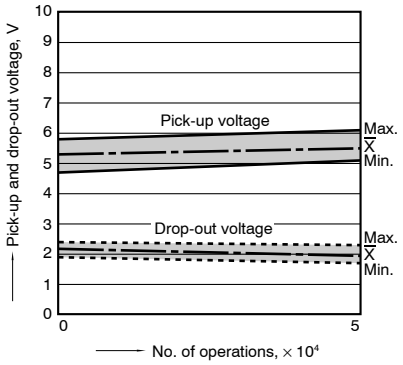


Load current waveform

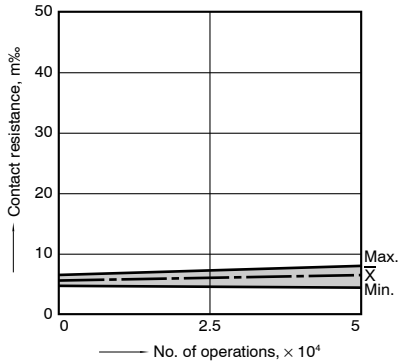
Steady current: 21A 14V DC



Change of pick-up and drop-out voltage



Change of contact resistance



For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

SUPER MINIATURE TWIN TYPE AUTOMOTIVE RELAY

CJ RELAYS (ACJ)

FEATURES

• Smallest in its class, it is extremely compact at approximately 2/3 the size of previous products.
It takes up only about two thirds the space and volume of our previous twin type CT compact relay. It is perfect for making compact relay units.

• Compact and high-capacity 25 A load switching.
High capacity control is possible while being compact and capable of motor lock load switching at 25 A, 14 V DC.

Sealed type
Sealed type makes automatic cleaning possible.

TYPICAL APPLICATIONS

- Powered windows
- Automatic door locks
- Electrically powered mirrors
- Powered sun roofs
- Powered seats
- Lift gates
- Slide door closers, etc.
  (for DC motor forward/reverse control circuits)

SPECIFICATIONS

Contact

Arrangement			1 Form C×2
Contact material			Silver alloy
Initial contact resistance (By voltage drop 6 V DC 1 A)			Max. 100mΩ
Rating	Nominal switching capacity		N.O.: 20 A 14 V DC N.C.: 10 A 14 V DC
	Max. carrying current		30 A for 2 minutes, 20 A for 1 hour (14 V, at 20°C 68°F)
	Min. switching capacity**[1]		1A 12V DC
Expected life (min. operation)	Mechanical (at 120 cpm)		Min. 10^7
	Electrical	Resistive load*[1]	Min. 10^5
		Motor load*[2]	N.O.; 5A 14V DC, Inrush 25A (motor load): Min. 2×10^5
			N.O.; 25A 14V DC (motor lock): Min. 10^5
			N.C.; 20A (brake) 14V DC: Min. 2×10^5

Coil

Nominal operating power	640mW (ACJ2212) 800mW (ACJ2112)

Remarks

**[1] This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*[1] At nominal switching capacity, operating frequency: 1s ON, 9s OFF
*[2] At operating frequency: 0.5s ON, 9.5s OFF
*[3] Measurement at same location as “Initial breakdown voltage” section
*[4] Detection current: 10mA
*[5] Excluding contact bounce time
*[6] Half-wave pulse of sine wave: 11ms; detection time: 10μs
*[7] Half-wave pulse of sine wave: 6ms
*[8] Detection time: 10μs
*[9] Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Max. operating speed (at nominal switching capacity)		6 cpm
Initial insulation resistance *[3]		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage *[4]	Between open contacts	500 Vrms for 1 min.
	Between contacts and coil	500 Vrms for 1 min.
Operate time *[5] (at nominal voltage) (at 20°C 68° F)		Max. 10ms (Initial)
Release time (without diode)*[5] (at nominal voltage) (at 20°C 68° F)		Max. 10ms (Initial)
Shock resistance	Functional *[6]	Min. 100 m/s²{10G}
	Destructive *[7]	Min. 1,000 m/s²{100G}
Vibration resistance	Functional *[8]	10 Hz to 100 Hz, Min. 44.1m/s²{4.5G}
	Destructive	10 Hz to 500 Hz, Min. 44.1m/s²{4.5G}
Conditions for operation, transport and storage *[9] (Not freezing and condensing at low temperature)	Ambient temp	–40°C to +85°C – 40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 6.5g .23oz

Automotive

ORDERING INFORMATION

ACJ [2] [ ] [12]

Contact arrangement	Nominal operating power	Coil voltage (V DC)
2: 1 Form C × 2	2: 640 mW 1: 800 mW	12: 12

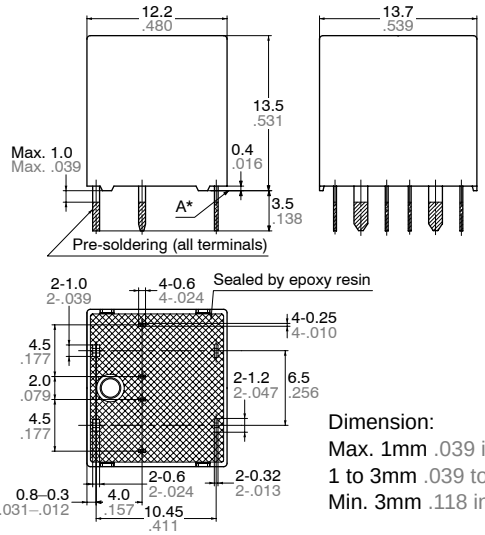
Standard packing: Carton(tube package) 40 pcs; Case 1,000 pcs.

TYPES AND COIL DATA (at 20°C 68°F).

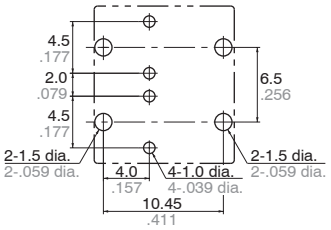
Contact arrangement	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance, Ω	Nominal operating current, mA	Nominal operating power, mW	Usable voltage range, V DC
1 Form C ×2	ACJ2212	12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16
	ACJ2112	12	Max. 6.5	Min. 0.8	180±10%	66.7±10%	800	10 to 16

DIMENSIONS

mm inch

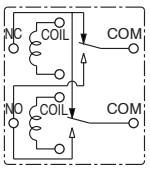


PC board pattern (Bottom view)



Tolerance: ±0.1±.004

Schematic (Bottom view)

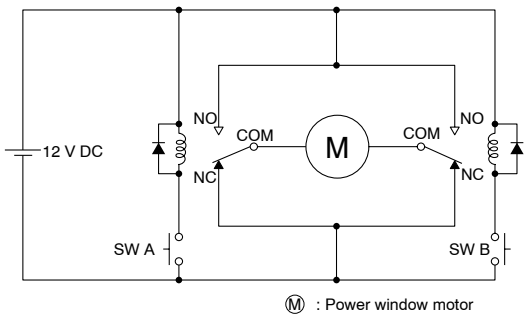


Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

Forward/reverse control circuits of DC motor

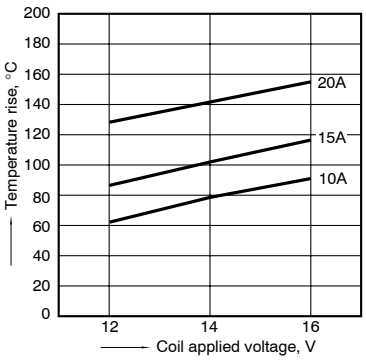


Ⓜ : Power window motor

REFERENCE DATA

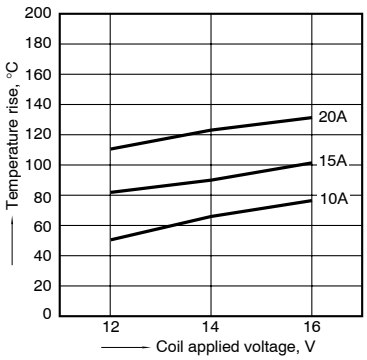
1-(1). Coil temperature rise (at room temperature)

Sample: ACJ2212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 25°C 77°F



1-(2). Coil temperature rise (at 85°C 185°F)

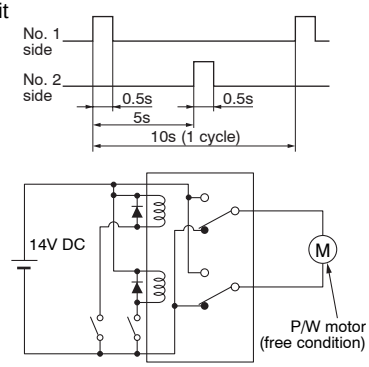
Sample: ACJ2212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 85°C 185°F



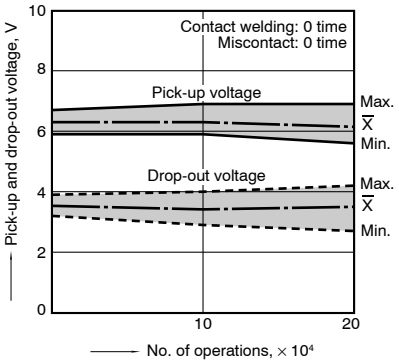
2-(1). Electrical life test (Motor free)

Sample: ACJ2212, 3pcs; Load: Inrush current: 25A/ Steady current: 5A, Power window motor actual load (free condition); Tested voltage: 14V DC; Switching frequency: (ON:OFF = 0.5s:9.5s); Switching cycle: 2×10^5; Ambient temperature: Room temperature

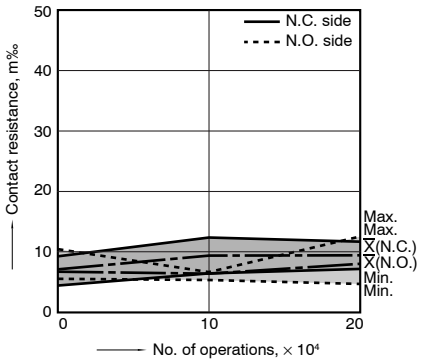
Circuit



Change of pick-up and drop-out voltage

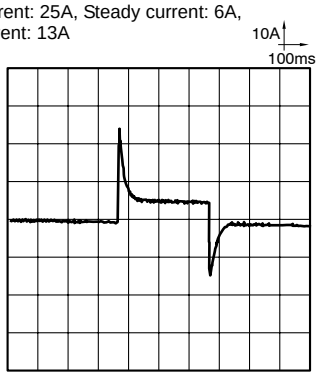


Change of contact resistance



Load current waveform

Inrush current: 25A, Steady current: 6A, Brake current: 13A

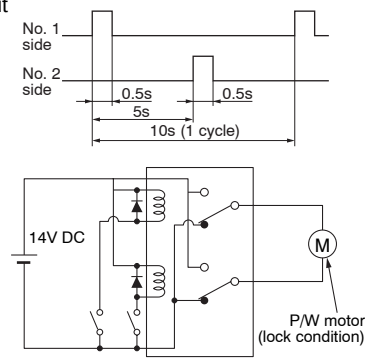


Automotive

2-(2). Electrical life test (Motor lock)

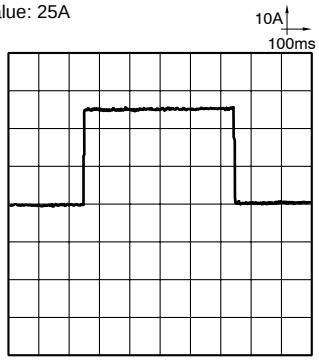
Sample: ACJ2212, 3pcs; Load: Steady current: 25A, Power window motor actual load (lock condition); Tested voltage: 14V DC; Switching frequency: (ON:OFF = 0.5s:9.5s); Switching cycle: 10^5; Ambient temperature: Room temperature

Circuit

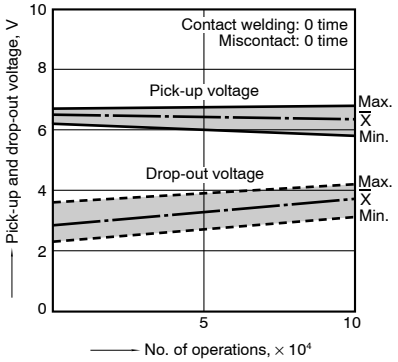


Load current waveform

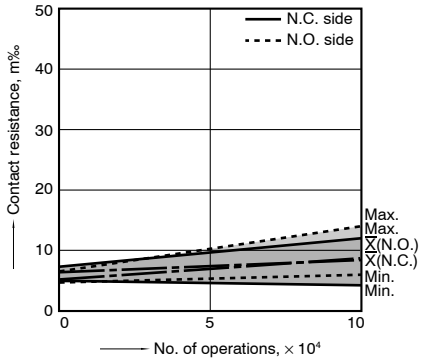
Current value: 25A



Change of pick-up and drop-out voltage



Change of contact resistance

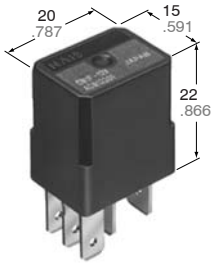


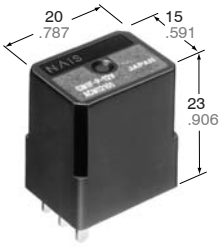
For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

AUTOMOTIVE MICRO-ISO RELAY

CM RELAYS





mm inch

FEATURES

• Small size:
20 mm(L)×15 mm(W)×22 mm(H)
.787 inch(L)×.591 inch(L)×.866 inch(H)

• Wide line-up
PC board and Plug-in type, Resistor and diode inside type.
24V DC type is also available.

• Compact and high-capacity 35A load switching
N.O.: 35A 14V DC, N.C.: 20A 14V DC (Sealed type)
Min. 5×10^4
N.O.: 35A 14V DC, N.C.: 20A 14V DC (Flux-resistant type)
Min. 10^5 *12V DC type

• Micro-ISO type terminals

TYPICAL APPLICATIONS

- Fan motor
- Heater
- Head lump
- Air Compressor
- EPS
- ABS
- Blower fan
- Defogger, etc.

SPECIFICATIONS

Contact

Type		12 V coil voltage	24 V coil voltage
Arrangement		1 Form A, 1 Form C	
Contact material		Silver alloy	
Initial contact resistance (By voltage drop 6 V DC 1 A)		Max. 15mΩ	
Contact voltage drop		Max. N.O.: 0.5 V (at 35 A 14 V DC) Max. N.C.: 0.3 V (at 20 A 14 V DC)	Max. N.O.: 0.3 V (at 15 A 28 V DC) Max. N.C.: 0.2 V (at 8 A 28 V DC)
Rating (resistive load)	Nominal switching capacity	N.O.: 35 A 14 V DC N.C.: 20 A 14 V DC	N.O.: 15 A 28 V DC N.C.: 8 A 28 V DC
	Max. carrying current	N.O.: 20 A (14 V DC, at 85°C 185°F) N.C.: 10 A (14 V DC, at 85°C 185°F)	N.O.: 15 A (28 V DC, at 85°C 185°F) N.C.: 8 A (28 V DC, at 85°C 185°F)
	Min. switching capacity#1	1 A 12 V DC	1 A 24 V DC
Expected life	Mechanical (at 120 cpm)	Min. 10^6	
	Electrical (at rated load)	Flux-resistant type: Min. 10^5*1 Sealed type: Min. 5×10^4	

Coil

Nominal operating power	1.5 W 1.7 W (Internal resistor type)	1.8 W 2.0 W (Internal resistor type)

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Type		24V coil type	12V coil type
Max. operating speed (at nominal switching capacity)		15 cpm	
Initial insulation resistance*2		Min. 20 MΩ (at 500 V DC)	
Initial breakdown voltage*3	Between open contacts	500 Vrms for 1 min.	
	Between contacts and coil	500 Vrms for 1 min.	
Operate time*4 (at nominal voltage) (at 20°C 85°F)		Max. 10 ms	
Release time*4 (at nominal voltage) (at 20°C 85°F)		Max. 10 ms Max. 15 ms (with diode)	
Shock resistance	Functional*5	Min. 200 m/s² {20G}	
	Destructive*6	Min. 1,000m/s² {100G}	
Vibration resistance	Functional	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5 G}	
	Destructive*7	10 Hz to 2,000 Hz, Min. 44.1 m/s² {4.5 G}	
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.*9	–40°C to + 85°C –40°F to + 185°F	
	Humidity	5% R.H. to 85% R.H.	
Mass		Approx. 20g .71oz	

Remarks
*1 At nominal switching capacity, operating frequency: 2s ON, 2s OFF
*2 Measurement at same location as "Initial breakdown voltage" section.
*3 Detection current: 10mA
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Time of vibration for each direction; X, Y, Z direction: 4 hours

*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).
*9 Ambient temperature 125°C 257°F type is also available. Please contact us for details.

Automotive

ORDERING INFORMATION

CM [1] [F] — [R] — [P] — [12V]

Contact arrangement	Protective construction	Classification of types	Mounting classification	Coil voltage (DC)
1a: 1 Form A 1: 1 Form C	Nil: Sealed type F: Flux-resistant type	Nil: Standard type D: with diode inside R: with resistor inside	Nil: Plug-in type P: PC board type	12 V 24 V

Note: Bulk package: 50 pcs.; Case: 200 pcs.

TYPES

Packing quantity: Inner 50pcs, Outer 200pcs.

Contact arrangement	Part No.	Coil voltage	Mounting classification	Protective construction
1 Form A	CM1a-12V	12 V DC	Plug-in type	Sealed type
	CM1aF-12V			Flux-resistant type
	CM1a-P-12V		PC board type	Sealed type
	CM1aF-P-12V			Flux-resistant type
1 Form C	CM1-12V		Plug-in type	Sealed type
	CM1F-12V			Flux-resistant type
	CM1-P-12V		PC board type	Sealed type
	CM1F-P-12V			Flux-resistant type

Contact arrangement	Part No.	Coil voltage	Mounting classification	Protective construction
1 Form A	CM1a-24V	24 V DC	Plug-in type	Sealed type
	CM1aF-24V			Flux-resistant type
	CM1a-P-24V		PC board type	Sealed type
	CM1aF-P-24V			Flux-resistant type
1 Form C	CM1-24V		Plug-in type	Sealed type
	CM1F-24V			Flux-resistant type
	CM1-P-24V		PC board type	Sealed type
	CM1F-P-24V			Flux-resistant type

COIL DATA (at 20°C 68°F)

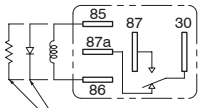
Nominal voltage, V DC	Pick-up voltage, V DC	Drop-out voltage, V DC	Nominal current, mA	Coil resistance, ohm	Nominal operating power, W	Usable voltage range, V DC
12	3 to 7	1.2 to 4.2	125±10%	96±10%	1.5	10 to 16
24	6 to 14	2.4 to 8.4	75±10%	320±10%	1.8	20 to 32

DIMENSIONS

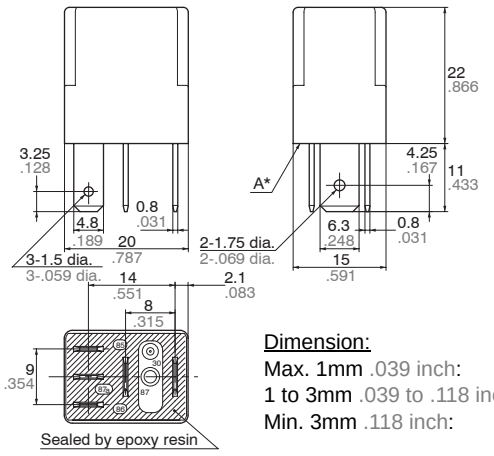
mm inch

1. Micro-ISO Plug-in type (1 Form C)

Schematic (Bottom view)



Including diode type,
including resistor type also available

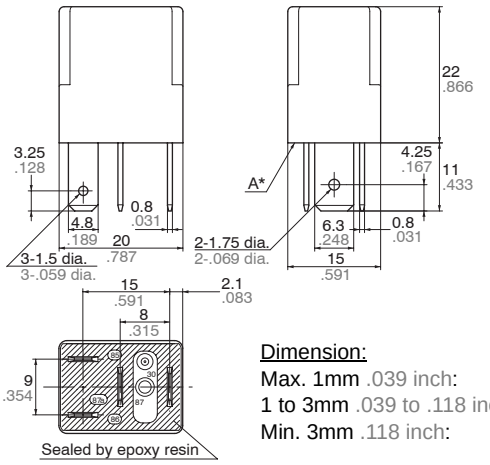


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

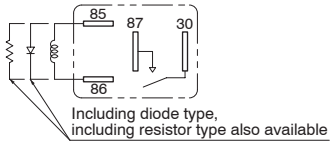
* Intervals between terminals is measured at A surface level.

2. Micro-ISO Plug-in type (1 Form A)

mm inch



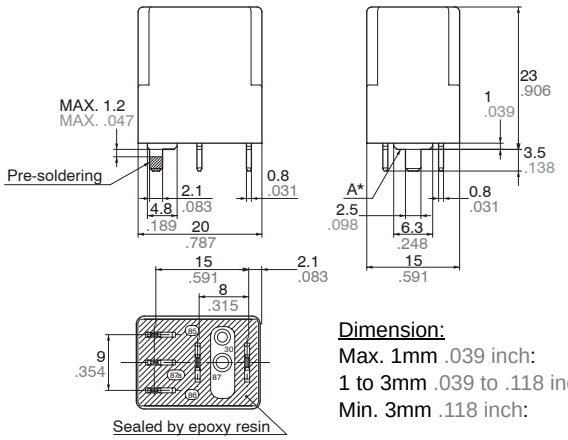
Schematic (Bottom view)



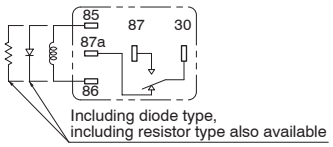
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Intervals between terminals is measured at A surface level.

3. Micro-ISO PC board type (1 Form C)



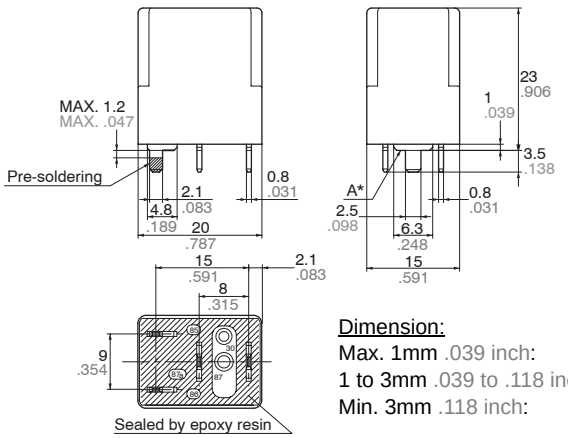
Schematic (Bottom view)



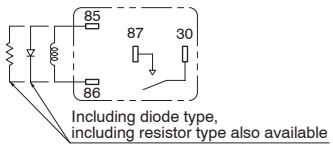
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

4. Micro-ISO PC board type (1 Form A)



Schematic (Bottom view)

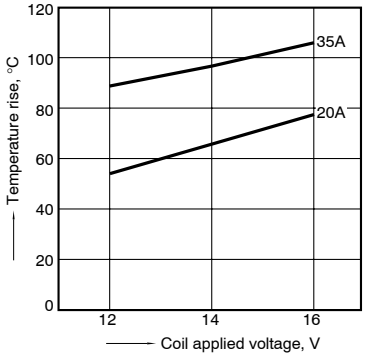


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

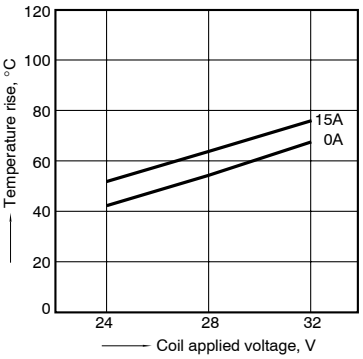
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

REFERENCE DATA

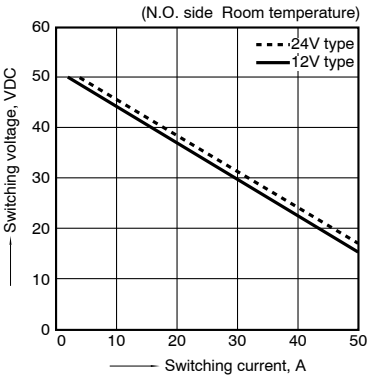
1-(1). Coil temperature rise (12V type)
Sample: CM1F-12V, 3 pcs.
Measured portion: Inside the coil
Contact carrying current: 20A, 35A
Ambient temperature: 85°C 185°F



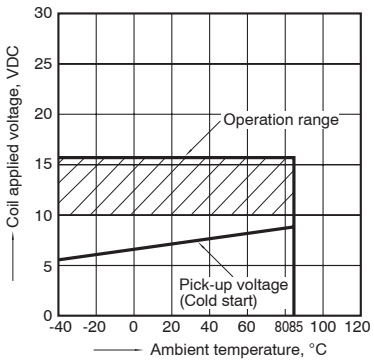
1-(2). Coil temperature rise (24V type)
Sample: CM1F-24V, 4 pcs.
Measured portion: Inside the coil
Contact carrying current: 0A, 15A
Ambient temperature: 85°C 185°F



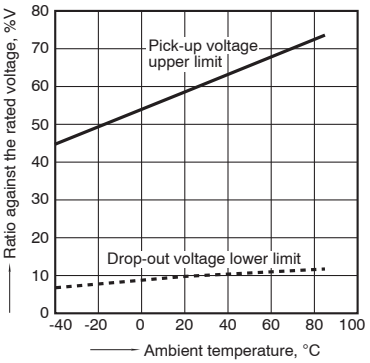
2. Max. switching capability (Resistive load)



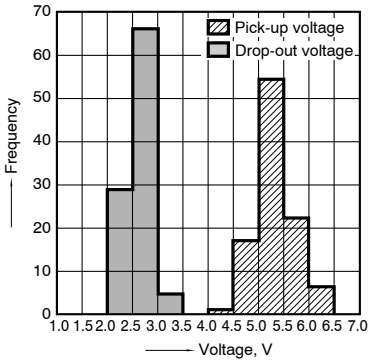
3. Ambient temperature and operating temperature range (12V type)



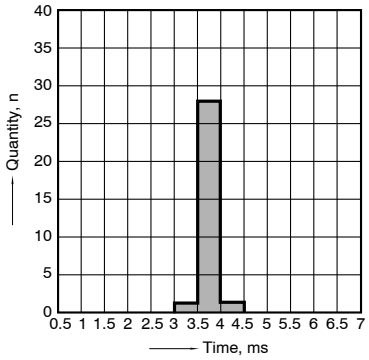
4. Ambient temperature characteristics (Cold/initial)



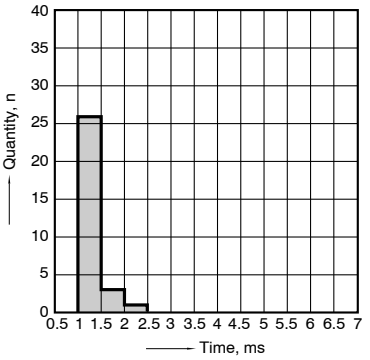
5. Distribution of pick-up and drop-out voltage
Sample: CM1F-12V, 100pcs.



6. Distribution of operate time
Sample: CM1F-12V, 30pcs.
* Max. 10ms standard (excluding contact bounce)

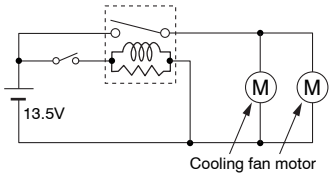


7. Distribution of release time
Sample: CM1F-12V, 30pcs.
* Max. 10ms standard (excluding contact bounce)
Without diode

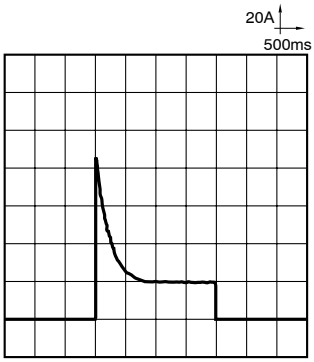


8-(1). Electrical life test (Motor free)
Sample: CM1aF-R-12V, 6pcs.
Load: Cooling fan motor actual load (free condition)
Switching frequency: (ON:OFF = 2s:6s)
Ambient temperature: Room temperature

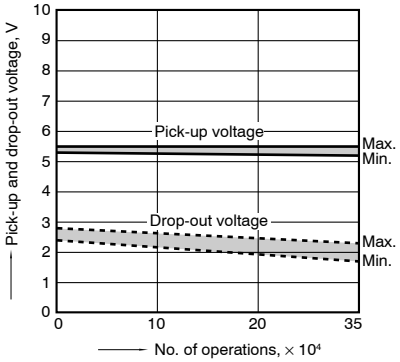
Circuit



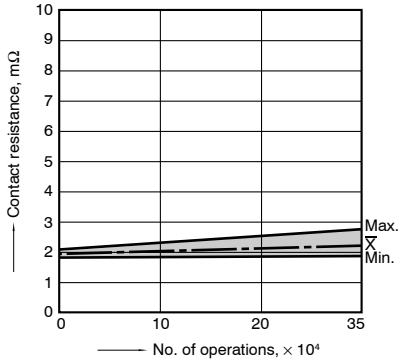
Load current waveform
Inrush current: 85A, Steady current: 18A,



Change of pick-up and drop-out voltage

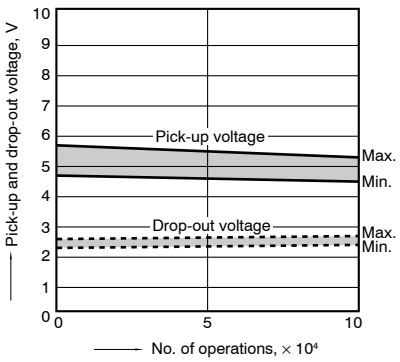


Change of contact resistance

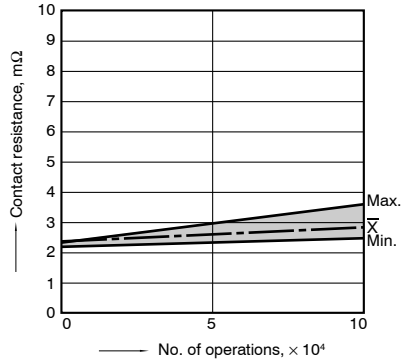


8-(2). Electrical life test (Halogen lamp load)
Sample: CM1aF-R-12V, 6pcs.
Load: 20A 13.5V DC
Switching frequency: (ON:OFF = 1s:14s)
Ambient temperature: Room temperature

Change of pick-up and drop-out voltage



Change of contact resistance



Cautions regarding the protection element

1. Part numbers without protection elements

1) 12 V models
When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 24 V or higher, or a resistor (680Ω to 1,000Ω). When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2) 24 V models
When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 48 V or higher, or a resistor (2,800Ω to 4,700Ω).
When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2. Part numbers with diodes

These relays use a diode in the coil surge protection element. Therefore, the release time is slower and the working life might be shorter compared to part numbers without protection elements and part numbers with resistors.
Be sure to use only after evaluating under actual load conditions.

3. Part numbers with resistors

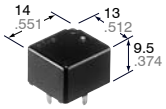
This part number employs a resistor in the coil surge protection circuit; therefore, an external surge protection element is not required. In particular, when a diode is connected in parallel with a coil, the revert time becomes slower which could adversely affect working life. Please check the circuit and make sure that a diode is not connected in parallel with the coil drive circuit.

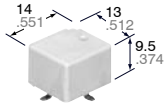
For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

MINIATURE, LOW PROFILE AUTOMOTIVE RELAY

CP RELAYS





mm inch

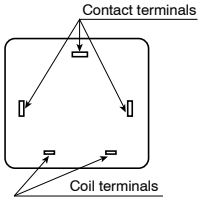
FEATURES

• Low profile
<Height>
PC board terminal type:
9.5 mm .374 inch
Surface-mount terminal type:
10.5mm .413inch

• High capacity
CP Relay provides low profile spacesaving advantages while offering high continuous current of 25 A(1 hour).

• Sealed construction suitable for harsh environments

• Simple footprint pattern enables ease of PC board layout



• "PC board terminal" and "Surface mount terminal" types available
SMD automatic mounting is possible for surface mount terminal types because tube packaging is used.

TYPICAL APPLICATIONS

- Power windows
- Auto door lock
- Power sunroof
- Memory sheet
- Wiper
- Defogger
- Blower fan
- EPS
- ABS etc.

SPECIFICATIONS

Contact

Arrangement			1 Form A	1 Form C
Contact material			Silver alloy	
Initial contact resistance (By voltage drop 6V DC 1A)			Max. 100 mΩ	
Rating	Nominal switching capacity		20 A 14 V DC	20 A 14 V DC (N.O.) 10 A 14 V DC (N.C.)
	Max. switching voltage		16 V DC	
	Max. carrying current		40 A for 2 minutes 30 A for 1 hour (12 V at 20°C 68°F) 35 A for 2 minutes 25 A for 1 hour (12 V at 85°C 185°F)	
	Min. switching capacity#1		1 A 12 V DC	
Expected life (min. operations)	Mechanical (at 120cpm)		10^7	
	Electrical (at 6cpm)	Resistive load	Min. 10^5*1	
		Motor load	Min. 2×10^5*2	
			Min. 10^5*3	
		Lamp load	Min. 10^5*4	

Coil

Nominal operating power	640 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at rated load)		6cpm
Initial insulation resistance*5		Min. 100MΩ (at 500 V DC)
Initial breakdown voltage*6	Between open contacts	500 Vrms for 1min.
	Between contact and coil	500 Vrms for 1min.
Operate time*7		Max. 10ms (at 20°C 68°F)
Release time (without diode)*7 (at nominal voltage)		Max. 10ms (at 20°C 68°F)
Shock resistance	Functional*8	Min. 100 m/s² {10 G}
	Destructive*9	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*10	10 Hz to 100 Hz, Min.44.1 m/s² {4.5 G}
	Destructive	10 Hz to 500 Hz, Min.44.1 m/s² {4.5 G}
Conditions in case of operation, transport and storage*11 (Not freezing and condensing at low temperature)	Ambient temp	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 4g .14 oz

Remarks
*1 At nominal switching capacity, operating frequency: 1s ON, 9s OFF
*2 N.O.: at 5A (steady), 25A (inrush)/N.C.: at 20A (brake) 14V DC, operating frequency: 0.5s ON, 9.5s OFF
*3 At 20A 14V DC (Motor lock), operating frequency: 0.5s ON, 9.5s OFF
*4 N.O.: at 5A (steady), 40A (inrush)14V DC, operating frequency: 1s ON, 14s OFF
*5 Measurement at same location as "Initial breakdown voltage" section
*6 Detection current: 10mA
*7 Excluding contact bounce time
*8 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*9 Half-wave pulse of sine wave: 6ms
*10 Detection time: 10μs
*11 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

ORDERING INFORMATION

Ex. CP [1a] [SA] — [12V] — [X]

Contact arrangement	Mounting classification	Coil voltage (DC)	Packing style
1a: 1 Form A 1: 1 Form C	Nil: PC board terminal SA: Surface-mount terminal	12 V	Nil: Tube packing X: Tape and reel packing (picked from the NC terminal side) Z: Tape and reel packing (picked from the coil terminal side)

Notes: 1. Tube packing: Carton (Tube): 40 pcs.; Case: 1,000 pcs. * PC board terminal type only.
2. Tape and reel packing: Carton (Tape and reel): 300 pcs.; Case: 900 pcs. * Surface-mount terminal type only.
3. Surface-mount terminal type is available only for 1 form C contact arrangement.

TYPES

1. PC board terminal type

Contact arrangement	Coil voltage	Part No.
1 Form A	12V DC	CP1a-12V
1 Form C	12V DC	CP1-12V

2. Surface mount terminal type

Contact arrangement	Coil voltage*1	Part No.
1 Form C	12V DC	CP1SA-12V-X
1 Form C	12V DC	CP1SA-12V-Z

Notes:
1. *1 24V DC type is also available by request. Please contact us for details.
2. Tape and reel packing symbol "-z" or "-x" are not marked on the relay.

COIL DATA (at 20°C 68°F)

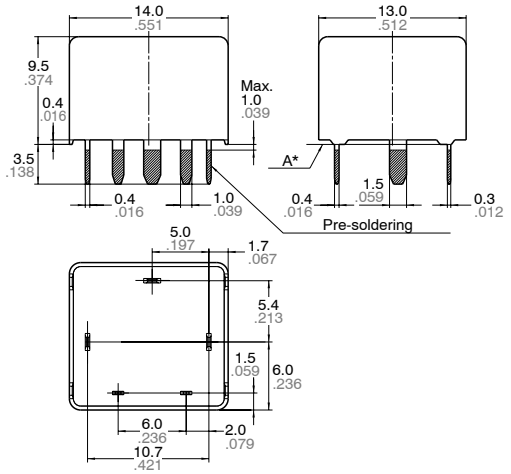
Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance Ω	Nominal operating current mA	Nominal operating power mW	Usable voltage range, V DC
12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16

* Other pick-up voltage types are also available. Please contact us for details.

DIMENSIONS

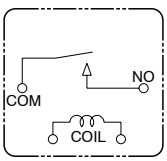
mm inch

1. PC board terminal type

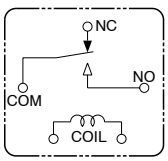


Schematic (Bottom view)

1a

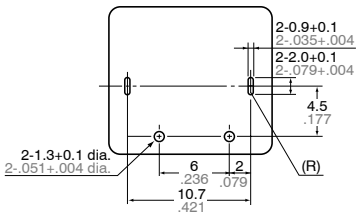


1c

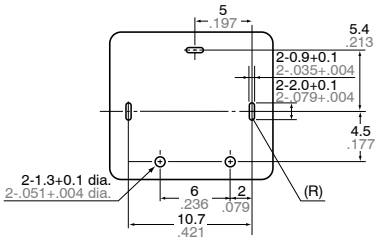


PC board pattern (Bottom view)

1a



1c

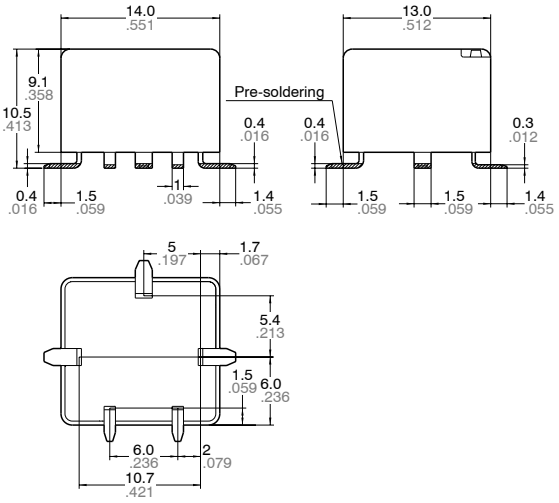


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

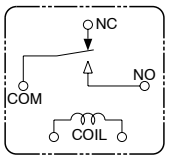
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

2. Surface mount terminal type

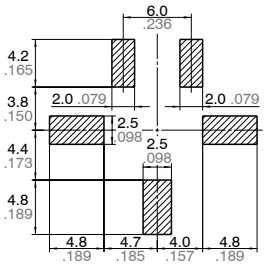
mm inch



Schematic



Recommended mounting pad (Top view)

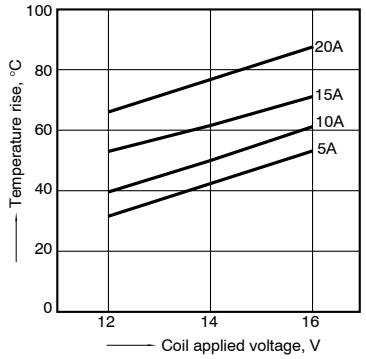


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

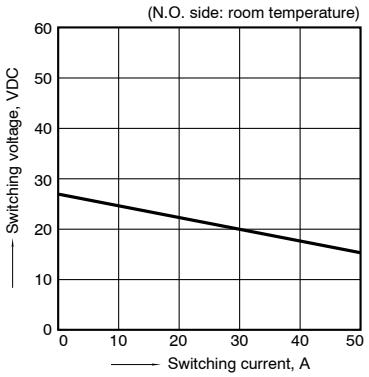
REFERENCE DATA

1. Coil temperature rise

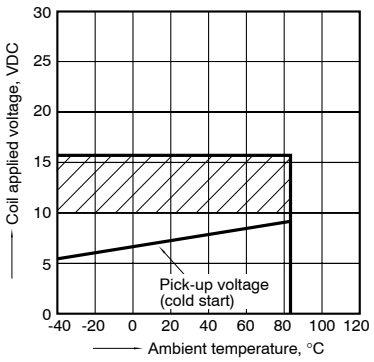
Sample : CP1-12V, 6pcs
Point measured : Inside the coil
Contact carrying current, 5A, 10A, 15A, 20A
Resistance method, ambient temperature 85°C 185°F



2. Max. switching capability (Resistive load)

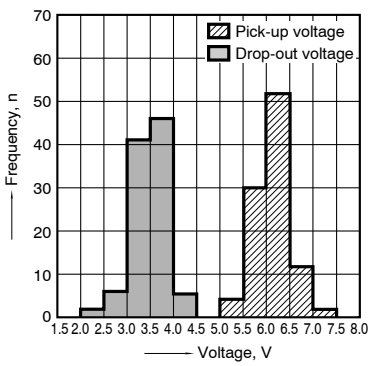


3. Ambient temperature and operating voltage range



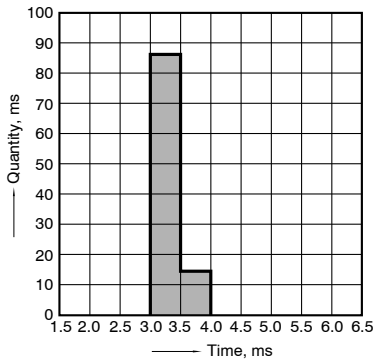
4. Distribution of pick-up and drop-out voltage

Sample : CP1-12V, 100pcs
Ambient temperature : 20°C 68°F



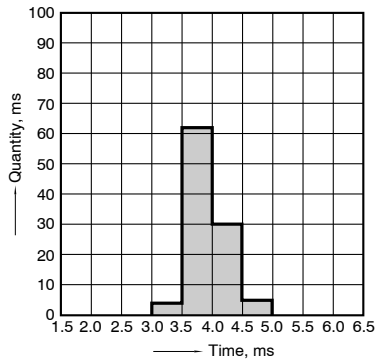
5. Distribution of operate time

Sample : CP1-12V, 100pcs
Ambient temperature : 20°C 68°F



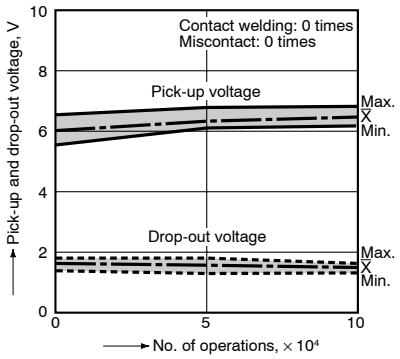
6. Distribution of release time

Sample : CP1-12V, 100pcs
Ambient temperature : 20°C 68°F
* With diode



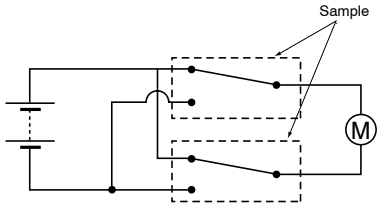
7-(1). Electrical life test (at rated load)
Sample : CP1-12V
Quantity : n = 4 (NC = 2, NO = 2)
Load : Resistive load (NC side : 10A 14 V DC, NO side : 20 A 14 V DC)
Operating frequency : ON 1s, OFF 9s

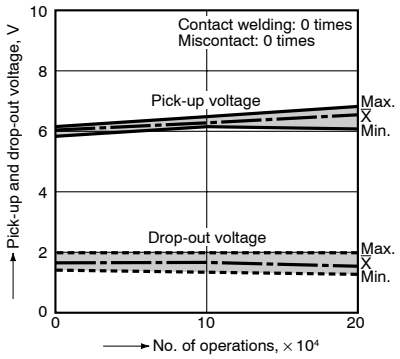
Ambient temperature : Room temperature



7-(2). Electrical life test (Motor free)
Sample : CP1-12V, 3pcs.
Load : 5A, Inrush 25A, Brake current 15A,
Power window motor load (Free condition).
Operating frequency : (ON : OFF = 0.5s : 9.5s)
Ambient temperature : Room temperature

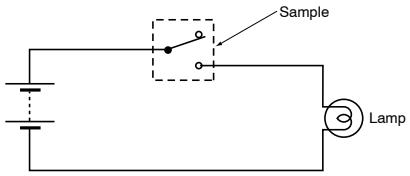
Circuit :

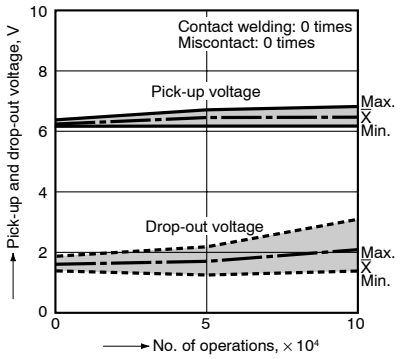




7-(3). Electrical life test (Lamp load)
Sample : CP1-12V, 3pcs.
Load : 5A, Inrush 40A, 14VDC lamp load
Operating frequency : (ON : OFF = 1s : 14s)
Ambient temperature : Room temperature

Circuit :





For Cautions for Use, see Relay Technical Information (page 392).

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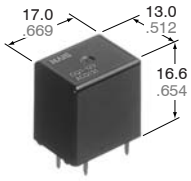
ideas for life

1 FORM C AUTOMOTIVE SILENT RELAY

CQ RELAYS



mm inch

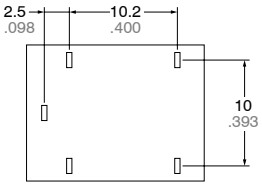
FEATURES

• Silent
Noise has been reduced by approximately 20 dB, using our own silencing design.

• Less space required
Measuring only 17(L)×13(W)mm (.669(L)×.512(W) inches), this product ranks first among automotive quiet relays in terms of saving space.

• Sealed construction

• Next-generation standard terminal pitch employed
The terminal array used is identical to that used in JJM relays.



SPECIFICATIONS

Contact

Arrangement			1 Form C
Contact material			Silver alloy
Initial contact resistance (By voltage drop 6 V DC 1A)			Max. 100 mΩ
Contact voltage drop			Max. 0.2V (at 10 A)
Rating	Nominal switching capacity		N.O.: 20 A 14 V DC N.C.: 10 A 14 V DC
	Max. carrying current		35 A for 2 minutes, 25 A for 1 hour (12 V, at 20°C 68°F) 30 A for 2 minutes, 20 A for 1 hour (12 V, at 85°C 185°F)
	Min. switching capacity#1		1 A 12 V DC
Expected life (min. operations)	Mechanical (at 120 cpm)		Min. 10^7
	Electrical	Resistive load	Min.10^5*1
		Motor load	Min. 3×10^5*2

Coil

Nominal operating power	640 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

*1 At nominal switching capacity, operating frequency: 1s ON, 9s OFF
*2 N.O.: at 5 A (steady), 30 A (inrush)/N.C.: at 20 A (brake) 14 V DC, operating frequency: 1s ON, 2s OFF
*3 Measurement at same location as “Initial breakdown voltage” section
*4 Detection current: 10mA
*5 Excluding contact bounce time
*6 Half-wave pulse of sine wave: 11ms; detection: 10μs
*7 Half-wave pulse of sine wave: 6ms
*8 Detection time: 10μs

Characteristics

Max. operating speed (at nominal switching capacity)		6 cpm
Initial insulation resistance*3		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*4	Between open contacts	500 Vrms for 1 min.
	Between contacts and coil	500 Vrms for 1 min.
Operate time*5 (at nominal voltage)(at 20°C68°F)		Max. 10 ms (initial)
Release time*5 (at nominal voltage)(at 20°C68°F)		Max. 10 ms (initial)
Shock resistance	Functional*6	Min. 100 m/s² {10G}
	Destructive*7	Min. 1,000 m/s² {100G}
Vibration resistance	Functional*8	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G}
	Destructive*9	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}
Conditions for operation, transport and storage*10 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 6.5g .23 oz

*9 Time of vibration for each direction;


X, Y, direction: 2 hours
Z direction: 4 hours

*10 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

TYPICAL APPLICATIONS

- Intermittent wiper
- Cruise control
- Power windows
- Auto door lock
- Car stereo
- Car air-conditioner
- Electrically powered seats
- Electrically powered sunroof, etc.

ORDERING INFORMATION

Ex. CQ [1] — [12 V]

Contact arrangement	Coil voltage(DC)
1 Form C	12 V

Standard packing: Carton(tube package) 40pcs. Case: 800pcs.

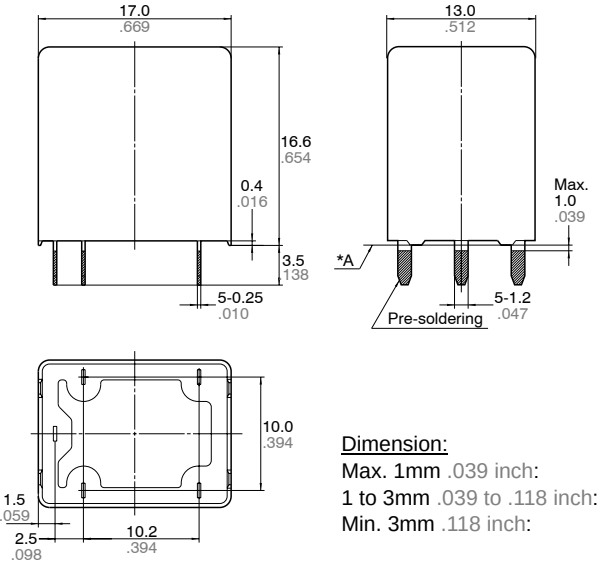
TYPES AND COIL DATA (at 20°C 68°F)

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)*	Drop-out voltage, V DC (Initial)	Coil resistance, Ω	Nominal operating current, mA	Nominal operating power, mW	Usable voltage range, V DC
CQ1-12V	12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16

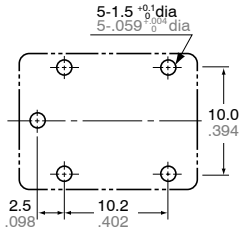
* Other pick-up voltage types are also available. Please contact us for details.

DIMENSIONS

mm inch



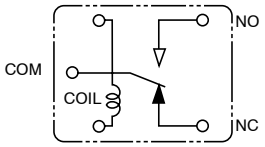
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

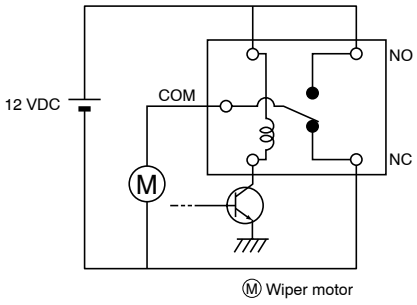
Schematic (Bottom view)



* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

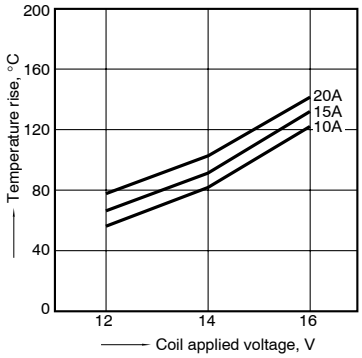
EXAMPLE OF CIRCUIT

Control circuit for intermittent wiper motor

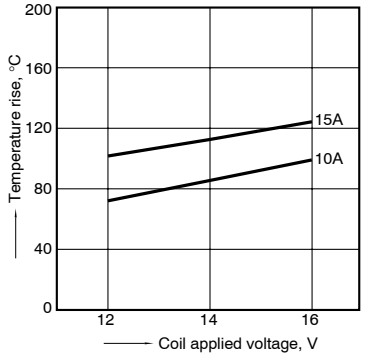


REFERENCE DATA

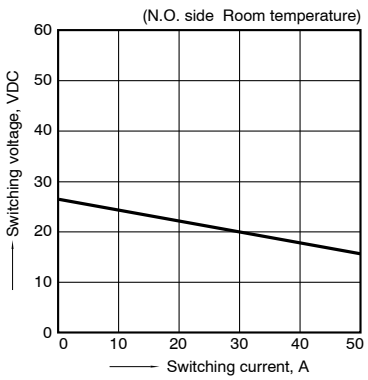
1-(1). Coil temperature rise (at room temperature)
Sample: CQ1-12V, 5pcs
Contact carrying current: 10A, 15A, 20A
Ambient temperature: Room temperature



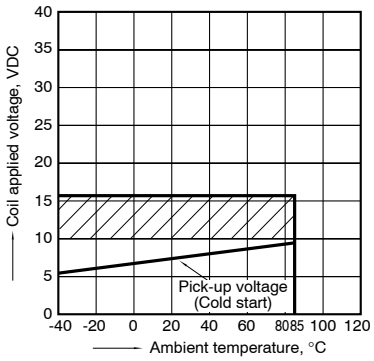
1-(2). Coil temperature rise (at 85°C 185°F)
Sample: CQ1-12V, 5pcs
Contact carrying current: 10A, 15A
Ambient temperature: 85°C 185°F



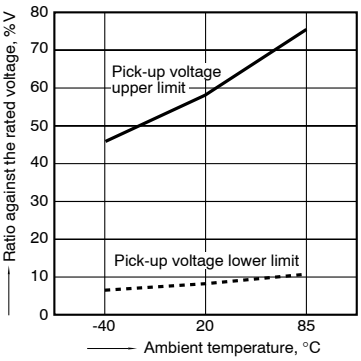
2. Max. switching capability (Resistive load)



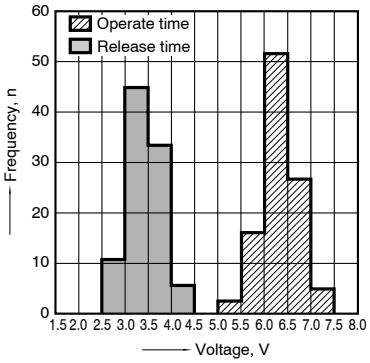
3. Ambient temperature and operating temperature range



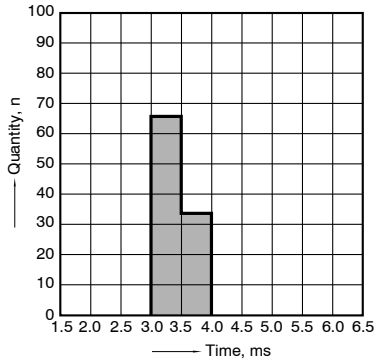
4. Ambient temperature characteristics



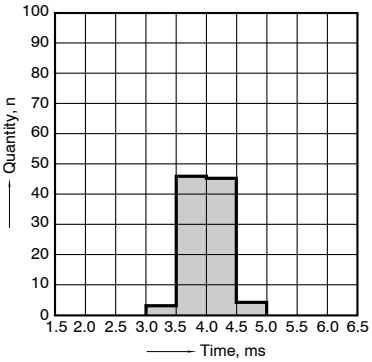
5. Distribution of pick-up and drop-out voltage
Sample: CQ1-12V, 100pcs



6. Distribution of operate time
Sample: CQ1-12V, 100pcs

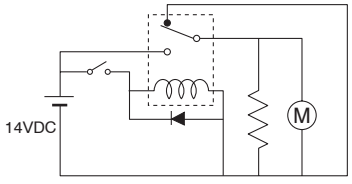


7. Distribution of release time
Sample: CQ1-12V, 100pcs
* With diode

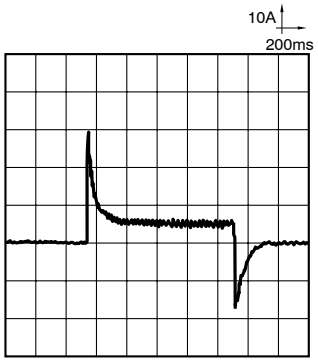


8. Electrical life test (Motor free)
Sample: CQ1-12V, 3pcs
Load: Inrush current: 30A, Steady current: 5A,
Brake current: 17A,
wiper motor actual load (free condition)
Tested voltage: 14V DC
Switching frequency: (ON:OFF = 1s:2s)
Ambient temperature: Room temperature

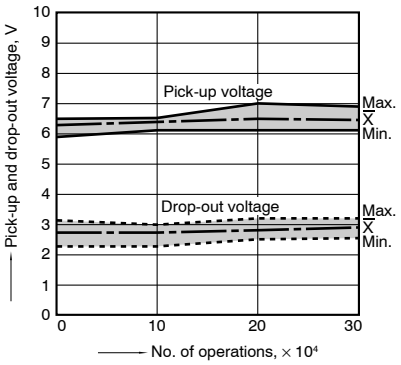
Circuit



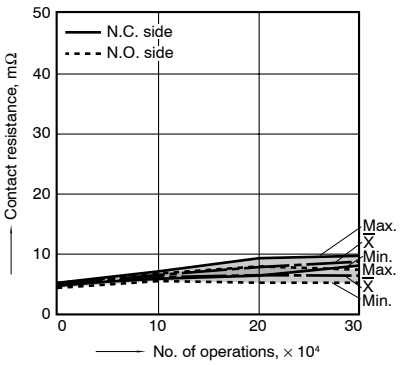
Load current waveform
Inrush current: 30A, Steady current: 5A,
Brake current: 17A



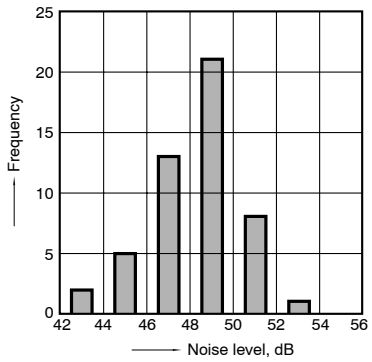
Change of pick-up and drop-out voltage



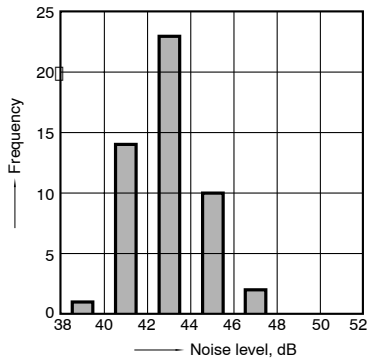
Change of contact resistance



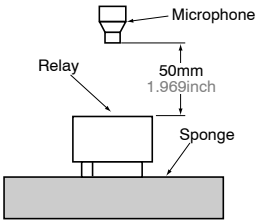
9-(1). Operation noise distribution
When actuated



9-(2). Operation noise distribution
When released



Measuring conditions
Sample: CQ1-12 V, 50 pcs.
Equipment setting: “A” weighted, Fast, Max. hold
Coil voltage: 12V DC
Coil connection device: Diode
Background noise: Approx. 20dB

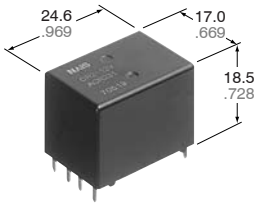


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

TWIN POWER SILENT AUTOMOTIVE RELAY

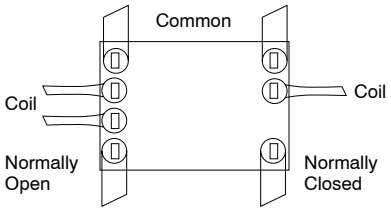
CR RELAYS



mm inch

FEATURES

- **Silent**
Noise has been reduced by approximately 20 dB, using our own silencing design.
- **Twin (1 Form C × 2)**
Forward/reverse motor control is possible with a single relay.
- **Sealed construction**
- Simple footprint enable ease of PC board layout



SPECIFICATIONS

Contact

Arrangement			1 Form C × 2 (H bridge)
Contact material			Silver alloy
Initial contact resistance (By voltage drop 6 V DC 1A)			Max. 100 mΩ
Contact voltage drop			Max. 0.2V (at 10 A)
Rating	Nominal switching capacity		N.O.: 20 A 14 V DC N.C.: 10 A 14 V DC
	Max. carrying current		35 A for 2 minutes, 25 A for 1 hour (12 V, at 20°C68°F) 30 A for 2 minutes, 20 A for 1 hour (12 V, at 85°C185°F)
	Min. switching capacity#1		1 A 12 V DC
Expected life (min. operations)	Mechanical (at 120 cpm)		Min. 10^7
	Electrical	Resistive load	Min. 10^5*1
		Motor load	Min. 2×10^5*2
			Min. 10^5*3

Coil

Nominal operating power	640 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

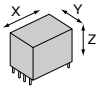
Remarks

*1 At nominal switching capacity, operating frequency: 1s ON, 9s OFF
*2 N.O.: at 5 A (steady), 25 A (inrush)/N.C.: at 20 A (brake) 14 V DC, operating frequency: 0.5s ON, 9.5s OFF
*3 At 20A 14 V DC (Motor lock), operating frequency: 0.5s ON, 9.5s OFF
*4 Measurement at same location as "Initial breakdown voltage" section
*5 Detection current: 10mA
*6 Excluding contact bounce time
*7 Half-wave pulse of sine wave: 11ms; detection: 10μs
*8 Half-wave pulse of sine wave: 6ms

Characteristics

Max. operating speed (at nominal switching capacity)		6 cpm
Initial insulation resistance*4		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*5	Between open contacts	500 Vrms for 1 min.
	Between contacts and coil	500 Vrms for 1 min.
Operate time*6 (at nominal voltage)(at 20°C68°F)		Max. 10 ms (initial)
Release time*6 (at nominal voltage)(at 20°C68°F)		Max. 10 ms (initial)
Shock resistance	Functional*7	Min. 100 m/s² {10G}
	Destructive*8	Min. 1,000 m/s² {100G}
Vibration resistance	Functional*9	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G}
	Destructive*10	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}
Conditions for operation, transport and storage*11 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 12.5g.44 oz

*9 Detection time: 10μs
*10 Time of vibration for each direction;



X, Y, direction: 2 hours
Z direction: 4 hours

*11 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

TYPICAL APPLICATIONS

- Power windows
- Auto door lock
- Electrically powered sunroof
- Electrically powered mirror, etc.

ORDERING INFORMATION

Ex. CR [2] — [12 V]

Contact arrangement	Coil voltage(DC)
1 Form C × 2	12 V

Standard packing: Carton(tube package) 32pcs. Case: 800pcs.

07/2005

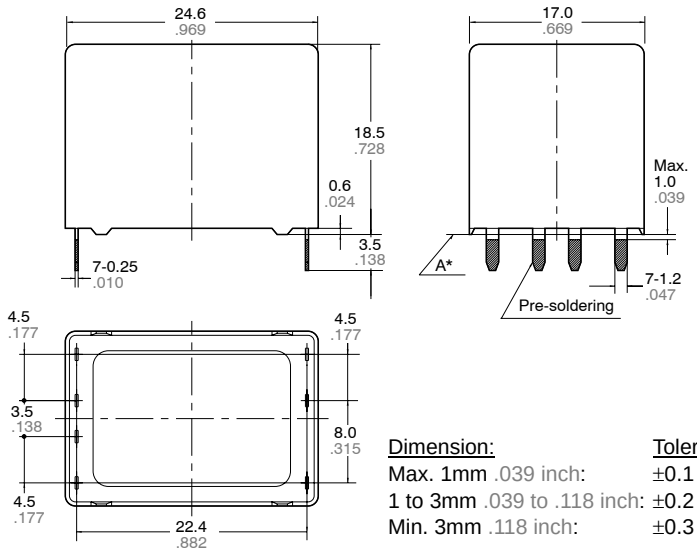
TYPES AND COIL DATA (at 20°C 68°F)

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)*	Drop-out voltage, V DC (Initial)	Coil resistance, Ω	Nominal operating current, mA	Nominal operating power, mW	Usable voltage range, V DC
CR2-12V	12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16

* Other pick-up voltage types are also available. Please contact us for details.

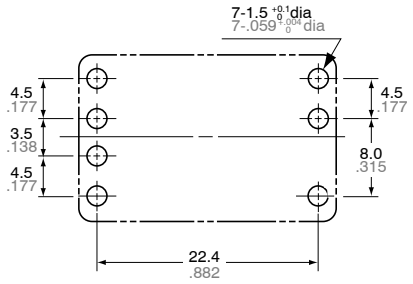
DIMENSIONS

mm inch



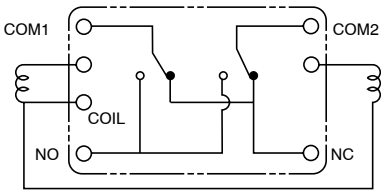
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

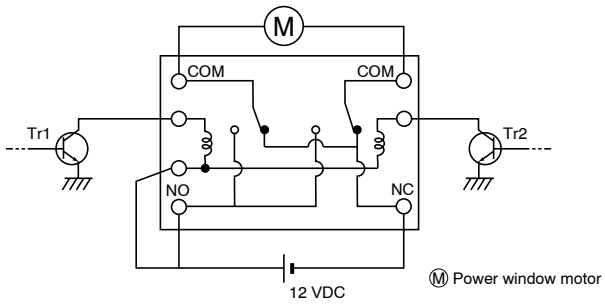
Schematic (Bottom view)



* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

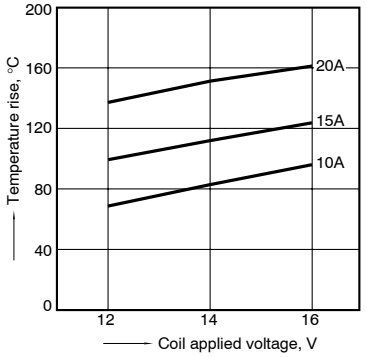
Forward/reverse control circuits of DC motor for power window



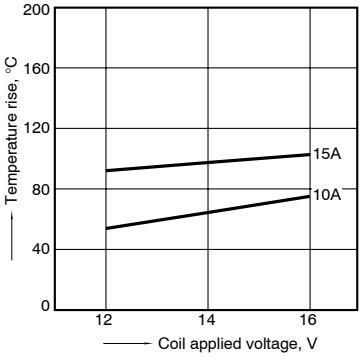
Tr1	Tr2	Motor
OFF	OFF	Stop
ON	OFF	Forward
OFF	ON	Reverse

REFERENCE DATA

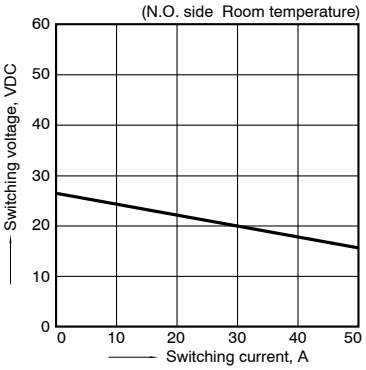
1-(1). Coil temperature rise (at room temperature)
Sample: CR2-12V, 5pcs
Contact carrying current: 10A, 15A, 20A
Ambient temperature: Room temperature



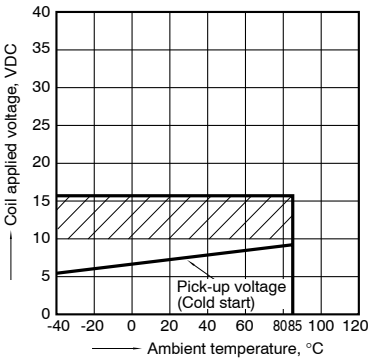
1-(2). Coil temperature rise (at 85°C 185°F)
Sample: CR2-12V, 5pcs
Contact carrying current: 10A, 15A
Ambient temperature: 85°C 185°F



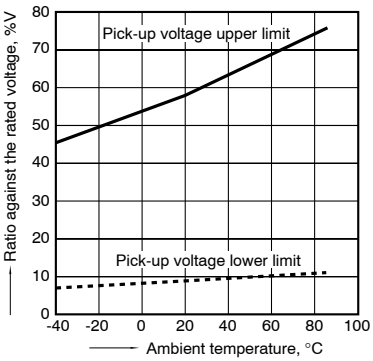
2. Max. switching capability (Resistive load)



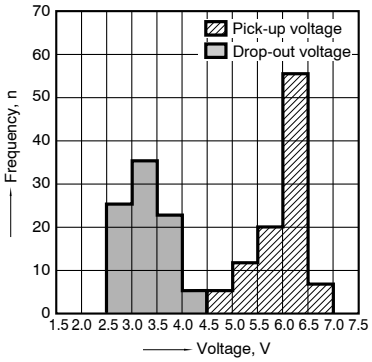
3. Ambient temperature and operating temperature range



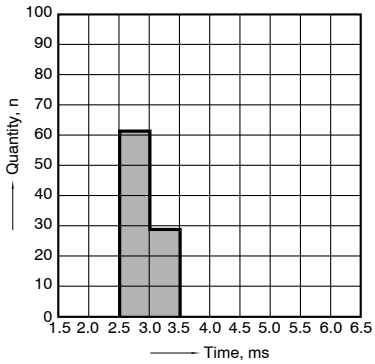
4. Ambient temperature characteristics



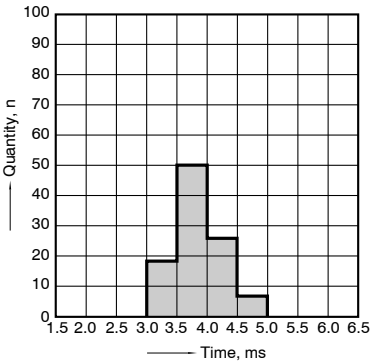
5. Distribution of pick-up and drop-out voltage
Sample: CR2-12V, 100pcs



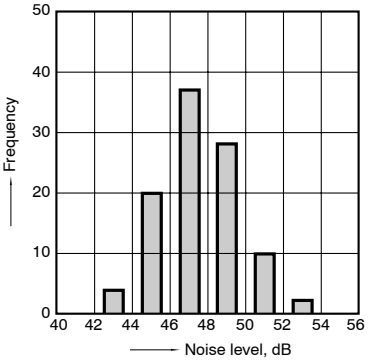
6. Distribution of operate time
Sample: CR2-12V, 100pcs



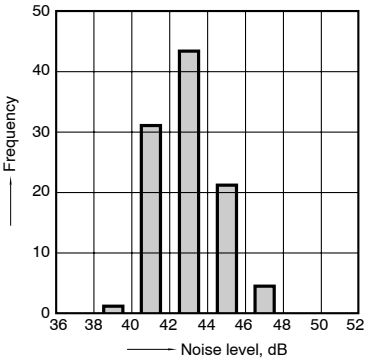
7. Distribution of release time
Sample: CR2-12V, 100pcs
* With diode



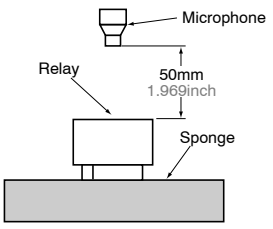
8-(1). Operation noise distribution
When actuated



8-(2). Operation noise distribution
When released



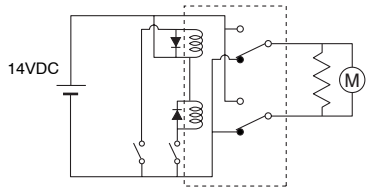
Measuring conditions
Sample: CR2-12 V, 50 pcs.
Equipment setting: “A” weighted, Fast, Max. hold
Coil voltage: 12V DC
Coil connection device: Diode
Background noise: Approx. 20dB



9-(1). Electrical life test (Motor free)

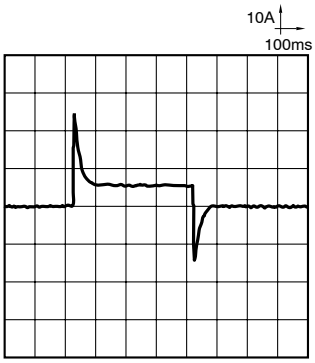
Sample: CR2-12V, 3pcs
Load: Inrush current: 25A, Steady current: 6A,
Brake current: 15A,
power window motor actual load (free condition)
Tested voltage: 14V DC
Ambient temperature: Room temperature

Circuit

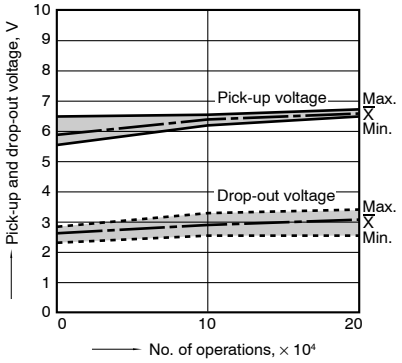


Load current waveform

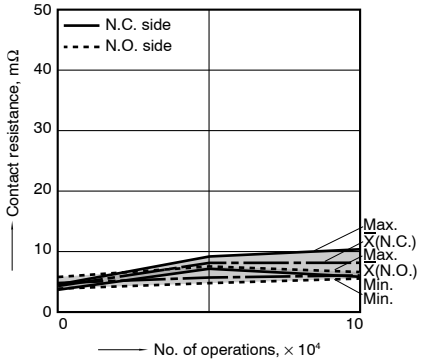
Inrush current: 25A, Steady current: 6A,
Brake current: 15A
Tested voltage: 14V DC



Change of pick-up and drop-out voltage



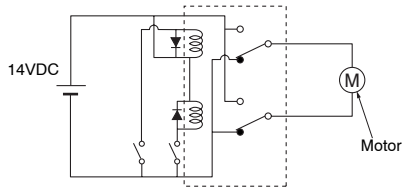
Change of contact resistance



9-(2). Electrical life test (Motor lock)

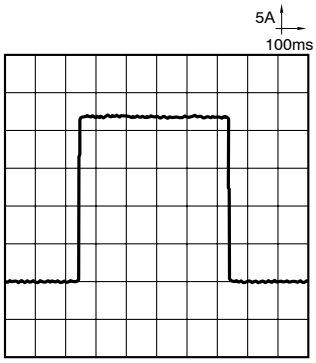
Sample: CR2-12V, 3pcs
Brake current: 22A,
power window motor actual load (lock condition)
Tested voltage: 14V DC
Switching frequency: (ON:OFF = 0.5s:9.5s)
Ambient temperature: Room temperature

Circuit

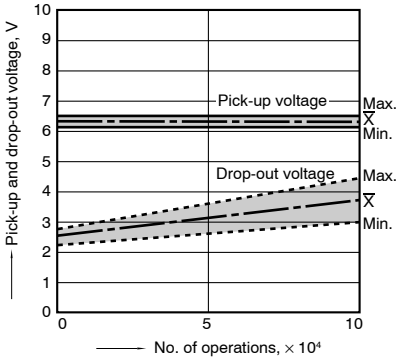


Load current waveform

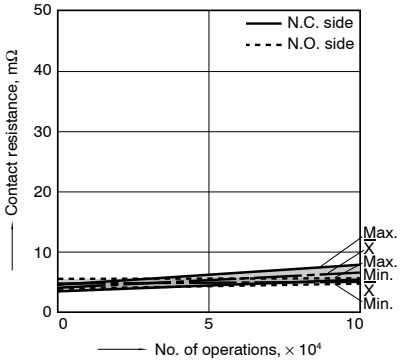
Brake current: 22A
Tested voltage: 14V DC



Change of pick-up and drop-out voltage



Change of contact resistance

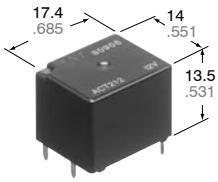


For Cautions for Use, see Relay Technical Information (page 392).

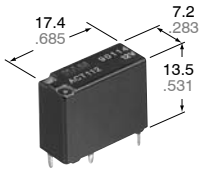
Panasonic
ideas for life

SUPER MINIATURE TWIN TYPE AUTOMOTIVE RELAY

CT RELAYS (ACT)



Twin type (8 terminals)



mm inch

Slim 1c type

FEATURES

• Small & slim size

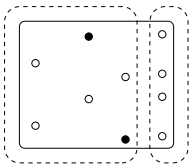
Twin type: 17.4(L)×14.0(W)×13.5(H)mm
.685(L)×.551(W)×.531(H)inch
Slim 1c type: 17.4(L)×7.2(W)×13.5(H)mm
.685(L)×.283(W)×.531(H)inch

• Twin (1 Form C × 2)

Forward/reverse motor control is possible with a single relay.

• Simple footprint enables ease of PC board layout

※10 terminals layout



○ = 8 terminals

TYPICAL APPLICATIONS

- Power windows
- Auto door lock
- Power sunroof
- Electrically powered mirrors
- Powered seats
- Lift gates
- Slide door closers, etc.
  (for DC motor forward/reverse control circuits)

SPECIFICATIONS

Contact

Arrangement			1 Form C×2, 1 Form C
Contact material			Silver alloy
Initial contact resistance (By voltage drop 6 V DC 1 A)			Max. 100mΩ
Initial contact voltage drop			Max. 0.2 V (at 10 A)
Rating	Nominal switching capacity		N.O.: 20 A 14 V DC N.C.: 10 A 14 V DC
	Max. carrying current		35 A for 2 minutes, 25 A for 1 hour (14 V, at 20°C 68°F) 30 A for 2 minutes, 20 A for 1 hour (14 V, at 85°C 185°F)
	Min. switching capacity#1		1 A 12 V DC
Expected life (min. operation)	Mechanical (at 120 cpm)		Min. 10^7
	Electrical	Resistive load	Min. 10^{5}*1
		Motor load	Min. 2×10^{5}*2 (free)
			Min. 10^{5}*3 (lock)

Coil

Nominal operating power	800 mW

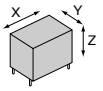
#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at nominal switching capacity)		6 cpm
Initial insulation resistance*4		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*5	Between open contacts	500 Vrms for 1 min.
	Between contacts and coil	500 Vrms for 1 min.
Operate time*6 (at nominal voltage) (at 20°C 68° F)		Max. 10ms (Initial)
Release time*6 (at nominal voltage) (at 20°C 68° F)		Max. 10ms (Initial)
Shock resistance	Functional*7	Min. 100 m/s² {10G}
	Destructive*8	Min. 1,000 m/s² {100G}
Vibration resistance	Functional*9	10 Hz to 100 Hz, Min. 44.1m/s² {4.5G}
	Destructive*10	10 Hz to 500 Hz, Min. 44.1m/s² {4.5G}
Conditions for operation, transport and storage*11 (Not freezing and condensing at low temperature)	Ambient temp	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 8.0g .28oz (Twin type) Approx. 4.0g .14oz (Slim 1c type)

Remarks

*1 At nominal switching capacity, operating frequency: 1s ON, 9s OFF
*2 N.O.: at 5 A (steady), 25 A (inrush)/N.C.: at 20 A (brake) 14 V DC, operating frequency: 0.5s ON, 9.5s OFF
*3 At 25A 14 V DC (Motor lock), operating frequency: 0.5s ON, 9.5s OFF
*4 Measurement at same location as "Initial breakdown voltage" section
*5 Detection current: 10mA
*6 Excluding contact bounce time
*7 Half-wave pulse of sine wave: 11ms; detection: 10μs
*8 Half-wave pulse of sine wave: 6ms
*9 Detection time: 10μs
*10 Time of vibration for each direction;



X, Y, direction: 2 hours
Z direction: 4 hours

*11 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

ORDERING INFORMATION

Ex. A CT 1 12

Product name	Contact arrangement	Coil voltage (V DC)
CT	1: 1 Form C 2: 1 Form C × 2 (8 terminals type) 5: 1 Form C × 2 (10 terminals type)	12: 12

Standard packing; 1 Form C: Carton(tube package) 30pcs. Case 1,500pcs.
1 Form C × 2: Carton(tube package) 30pcs. Case 900pcs.

TYPES AND COIL DATA (at 20°C 68°F)

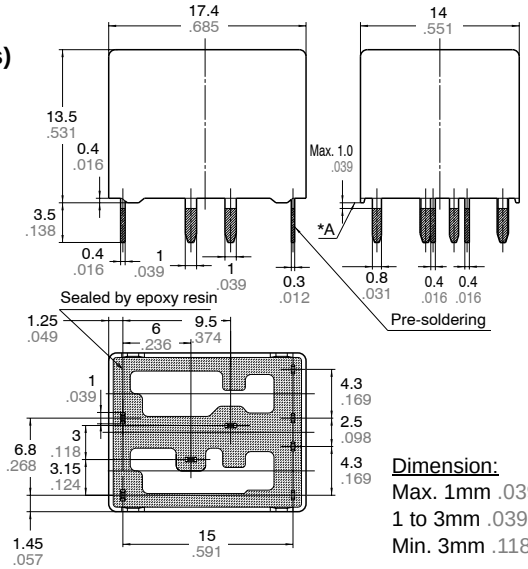
Contact arrangement	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance, Ω	Nominal operating current, mA	Nominal operating power, mW	Usable voltage range, V DC
1c	ACT112	12	Max. 7.2	Min. 1.0	180±10%	66.7±10%	800	10 to 16
1c × 2 (8 terminals type)	ACT212	12	Max. 7.2	Min. 1.0	180±10%	66.7±10%	800	10 to 16
1c × 2 (10 terminals type)	ACT512	12	Max. 7.2	Min. 1.0	180±10%	66.7±10%	800	10 to 16

* Other pick-up voltage types are also available. Please contact us for details.

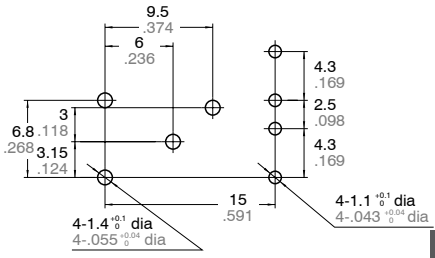
DIMENSIONS

mm inch

1. Twin type (8 terminals)

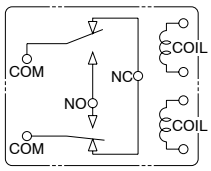


PC board pattern (Bottom view)



Tolerance: ±0.1±.004

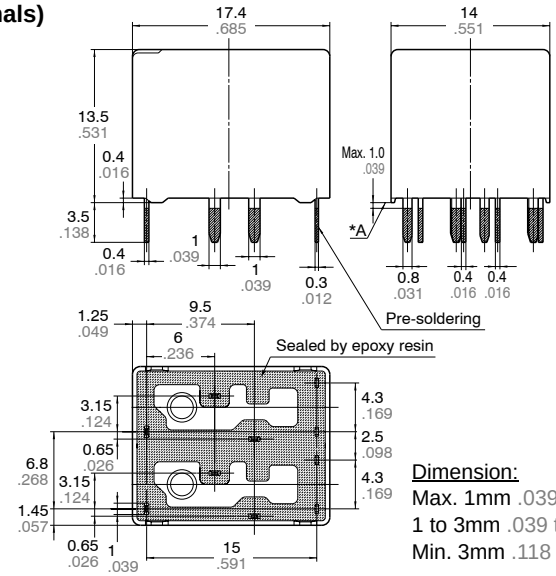
Schematic (Bottom view)



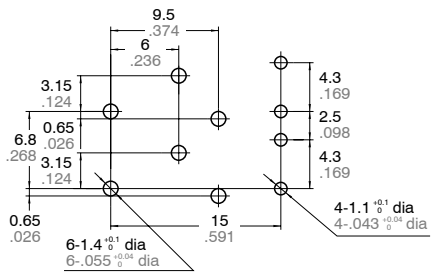
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

2. Twin type (10 terminals)

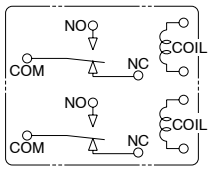


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



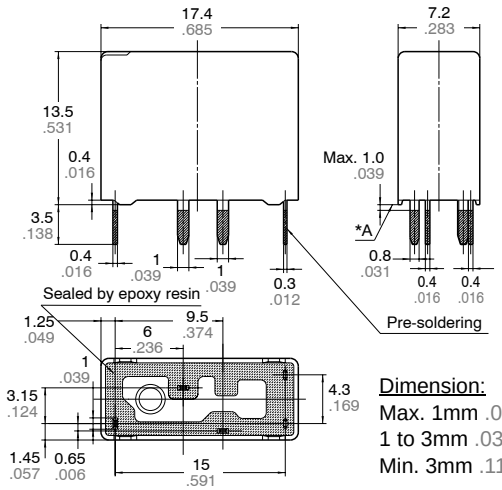
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

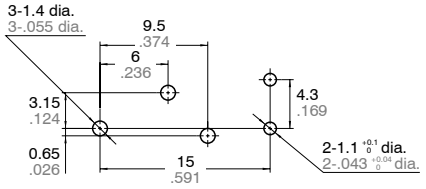
Automotive

3. Slim 1c type

mm inch



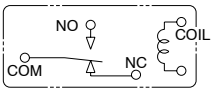
PC board pattern (Bottom view)



Tolerance: ±0.1±.004

Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

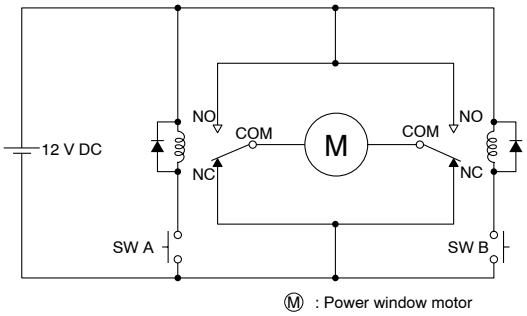
Schematic (Bottom view)



* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

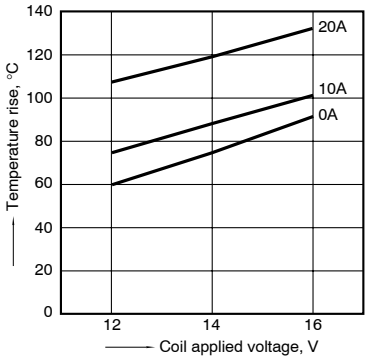
Forward/reverse control circuits of DC motor for power windows



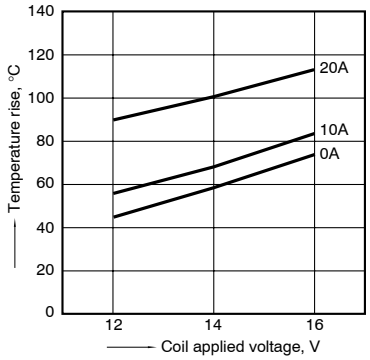
Ⓜ : Power window motor

REFERENCE DATA

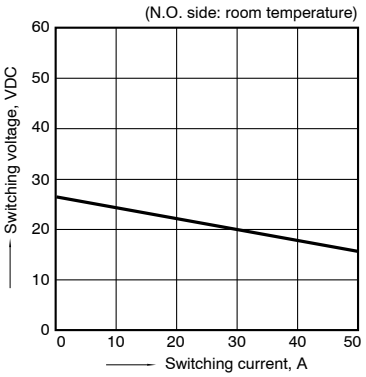
1-(1). Coil temperature rise (at room temperature)
Sample: ACT212, 3pcs.
Contact carrying current: 0A, 10A, 20A



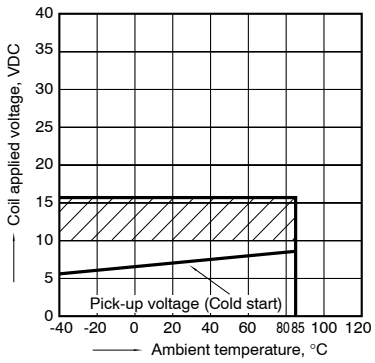
1-(2). Coil temperature rise (at 85°C 185°F)
Sample: ACT212, 3pcs.
Contact carrying current: 0A, 10A, 20A



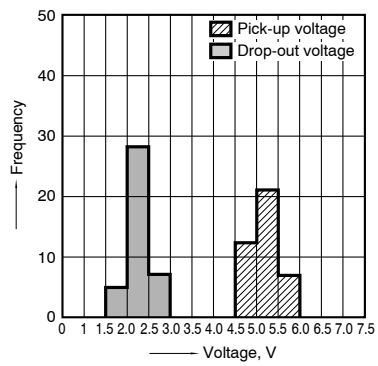
2. Max. switching capability (Resistive load)



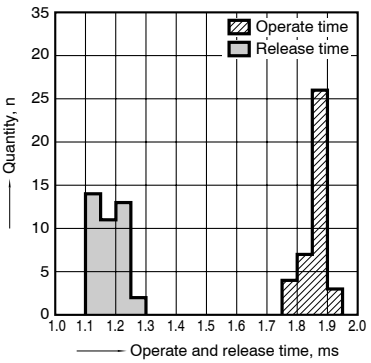
3. Ambient temperature and operating voltage range



4. Distribution of pick-up and drop-out voltage
Sample: ACT212, 40pcs.



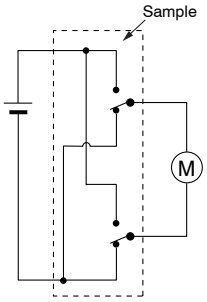
5. Distribution of operate and release time
Sample: ACT212, 40pcs.
* Without diode



6-(1). Electrical life test (Motor free)

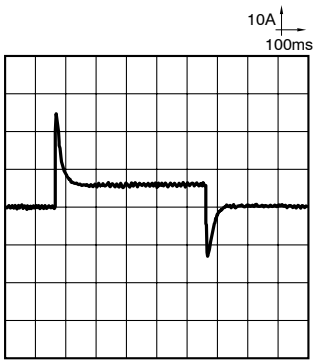
Sample: ACT212, 3pcs.
Load: 5A steady, Inrush 25A, 14V DC
Brake current: 13A 14V DC,
Power window motor actual load (free condition)
Operating frequency: (ON : OFF = 0.5s : 9.5s)
Ambient temperature: Room temperature

Circuit:

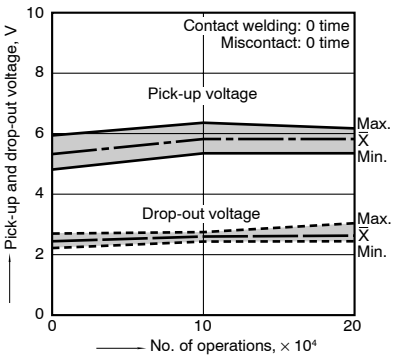


Load current waveform

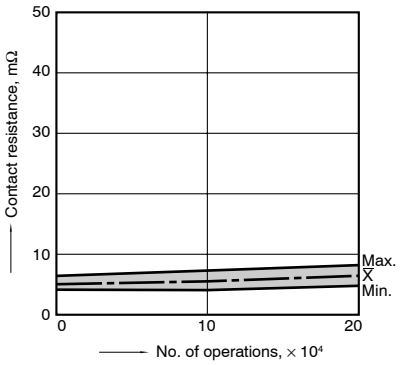
Inrush current: 25A, Steady current: 6A
Brake current: 13A



Change of pick-up and drop-out voltage



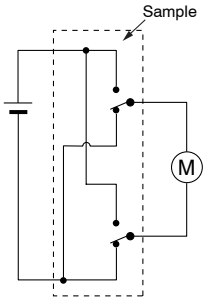
Change of contact resistance



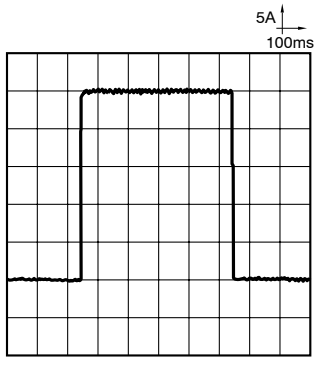
6-(2). Electrical life test (Motor lock)

Sample: ACT212, 3pcs.
Load: 25A 14V DC
Switching frequency: (ON : OFF = 0.5s : 9.5s)
Ambient temperature: Room temperature

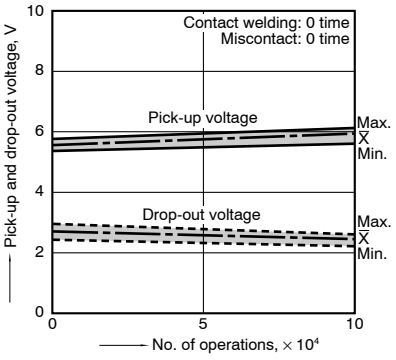
Circuit:



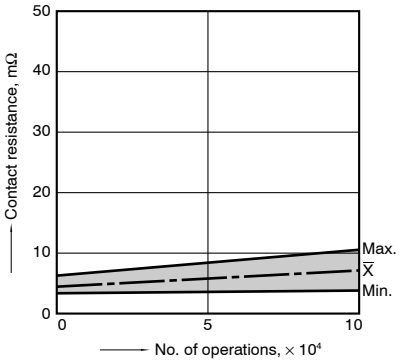
Load current waveform



Change of pick-up and drop-out voltage



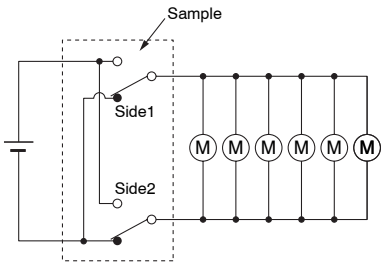
Change of contact resistance

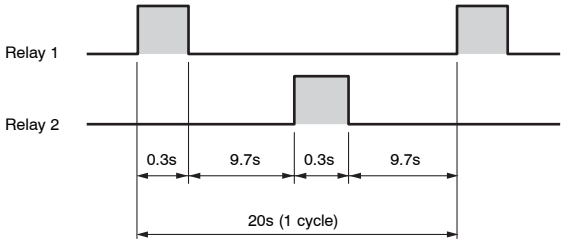


6-(3). Electrical life test (Motor lock)

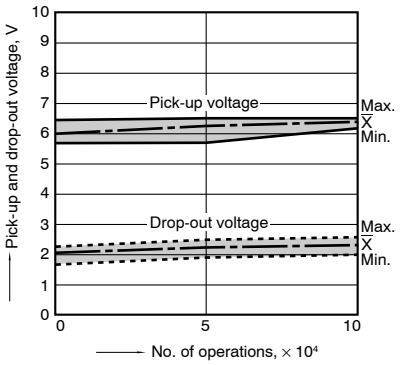
Sample: ACT212, 3pcs.
Load: 20A 14V DC,
door lock motor actual load (Lock condition)
Switching frequency: (ON : OFF = 0.3s : 19.7s)
Ambient temperature: Room temperature

Circuit:

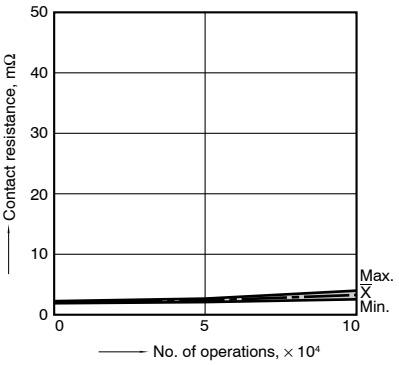




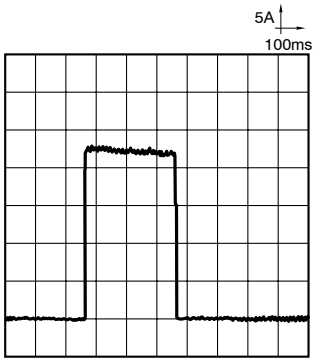
Change of pick-up and drop-out voltage



Change of contact resistance



Load current waveform



For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

AUTOMOTIVE LOW PROFILE MICRO-ISO/MICRO-280 RELAY

CV RELAYS (ACV)

Micro ISO 1c type

Micro ISO 1a type

Micro 280 plug-in type

Micro 280 PCB type

FEATURES

• Low profile:
22.5 mm(L)×15 mm(W)×15.7 mm(H)
.886 inch(L)×.591 inch(W)×.618 inch(H)

• Low temperature rise
Terminal temperature has been reduced compared with using our conventional product

• Low sound pressure level
Noise level has been reduced approx.10dB compared with using our conventional product.

• Wide line-up
Micro ISO/Micro 280 terminal types and resistor and diode inside type, PCB terminal type (Micro 280 only).

• Plastic sealed type
Plastically sealed for automatic cleaning.

• Compact and high-capacity 20A load switching
N.O.: 20A 14V DC, N.C.: 10A 14V DC
(Max. carrying current: at 85°C 185°F)

TYPICAL APPLICATIONS

- Headlights
- Magnetic clutches
- Radiator fans
- Blowers
- Fog lamps
- Tail lights
- Heaters
- Defoggers
- Horns
- Condenser fans, etc.

SPECIFICATIONS

Contact

Arrangement		1 Form A	1 Form C
Contact material		Silver alloy	
Initial contact resistance (By voltage drop 6 V DC 1 A)		Max. 50mΩ	
Contact voltage drop		Max. N.O.: 0.2 V (at 20 A)	Max. N.O.: 0.2 V (at 20 A switching) Max. N.C.: 0.5 V (at 10 A switching)
Rating	Nominal switching capacity	N.O.: 20 A 14 V DC	N.O.: 20 A 14 V DC N.C.: 10 A 14 V DC
	Max. carrying current	N.O.: 20 A (Continuous, at 85°C 185°F) 50 A for 2 minutes, 40 A for 1 hour (at 20°C 68°F) 40 A for 2 minutes, 30 A for 1 hour (at 85°C 185°F)	<N.O.> N.O.: 20 A (Continuous, at 85°C 185°F) 50 A for 2 minutes, 40 A for 1 hour (at 20°C 68°F) <N.C.> N.C.: 10 A (Continuous, at 85°C 185°F) 40 A for 2 minutes, 30 A for 1 hour (at 85°C 185°F)
	Min. switching capacity#1	1 A 12 V DC	
Expected life (min. operation)	Mechanical (at 120 cpm)	Min. 10^6	
	Electrical (at rated load)	Min. 10^5*1	

Coil

Nominal operating power	0.8 W, 1.0 W (with resister inside type)

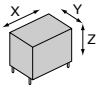
#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at nominal switching capacity)		15cpm
Initial insulation resistance*2		Min. 20MΩ (at 500 V DC)
Initial breakdown voltage*3	Between open contacts	500 Vrms for 1min.
	Between contacts and coil	500 Vrms for 1min.
Operate time*4 (at nominal voltage) (at 20°C 68°F) (initial)		Max. 10ms
Release time*4 (at nominal voltage) (at 20°C 68°F) (initial)		Max. 10ms Max. 15ms (with diode inside type)
Shock resistance	Functional*5	Min. 100 m/s²{10 G}
	Destructive*6	Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*7	10 Hz to 100 Hz, Min.44.1 m/s² {4.5 G}
	Destructive*8	10 Hz to 500 Hz, Min.44.1 m/s² {4.5 G}
Conditions in case of operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temp*10	–40°C to +85°C –40°F to +185°F
	Humidity	25% R.H. to 85% R.H.
Mass		Approx. 15.0g .53 oz

Remarks

*1 At nominal switching capacity, operating frequency: 2s ON, 2s OFF
*2 Measurement at same location as "Initial breakdown voltage" section.
*3 Detection current: 10mA
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Time of vibration for each direction;
X, Y, Z direction: 4 hours



*9 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).
*10 Ambient temperature 125°C 257°F type is also available. Please contact us for details.

Automotive

ORDERING INFORMATION

Ex. A CV 1 2 0 12

Product name	Contact arrangement	Mounting classification	Type classification	Coil voltage, V DC
CV	1: 1 Form C 3: 1 Form A	1: Micro ISO plug-in type 2: Micro 280 plug-in type 3: Micro 280 PC board type	0: Standard type 1: With diode inside 2: With resistor inside	12: 12

Note: Standard packing; Carton (Tube): 50 pcs.; Case: 200 pcs.

TYPES

1. Micro ISO terminal type

Coil voltage (DC)	Contact arrangement	Mounting classification	Type classification	Part No.
12 V	1 Form A	Plug-in terminal	Standard type	ACV31012
			With diode inside type	ACV31112
			With resistor inside type	ACV31212
	1 Form C		Standard type	ACV11012
			With diode inside type	ACV11112
			With resistor inside type	ACV11212

2. Micro 280 terminal type

Coil voltage (DC)	Contact arrangement	Mounting classification	Type classification	Part No.
12 V	1 Form A	Plug-in terminal	Standard type	ACV32012
			With diode inside type	ACV32112
			With resistor inside type	ACV32212
		PC board terminal	Standard type	ACV33012
			With diode inside type	ACV33112
			With resistor inside type	ACV33212
	1 Form C	Plug-in terminal	Standard type	ACV12012
			With diode inside type	ACV12112
			With resistor inside type	ACV12212
		PC board terminal	Standard type	ACV13012
			With diode inside type	ACV13112
			With resistor inside type	ACV13212

COIL DATA (at 20°C 68°F)

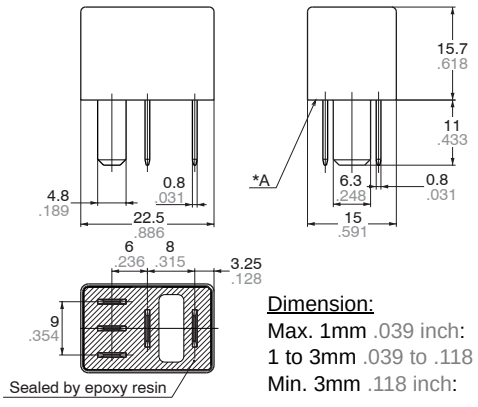
Nominal voltage, V DC	Pick-up voltage, * V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance, W	Nominal operating current, mA	Nominal operating power, W	Usable voltage range, V DC
12	Max. 7.0	Min. 0.6	180±10% 142.3±10% (with resistor)	67±10% 84±10% (with resistor)	0.8 1.0 (with resistor)	10 to 16

* Other pick-up voltage types are also available. Please contact us for details.

DIMENSIONS

mm inch

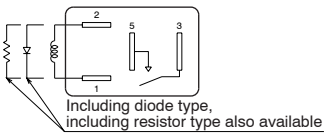
1. Micro ISO terminal type



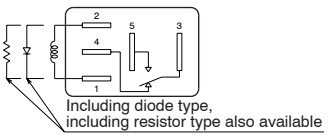
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

1 Form A



1 Form C

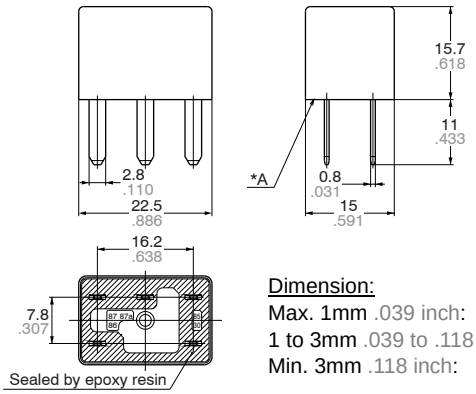


* Intervals between terminals is measured at A surface level.

2. Micro 280 terminal type

mm inch

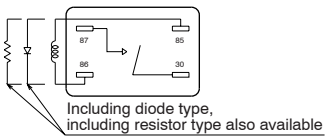
1). Plug-in type



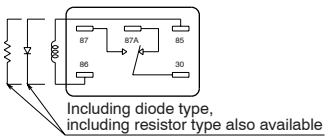
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

1 Form A

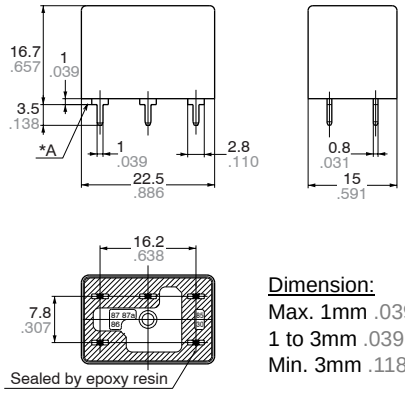


1 Form C



* Intervals between terminals is measured at A surface level.

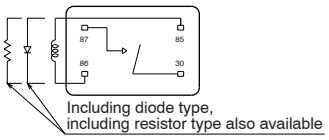
2). PC board type



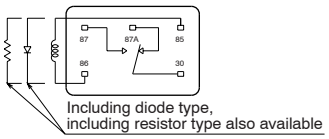
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

1 Form A



1 Form C



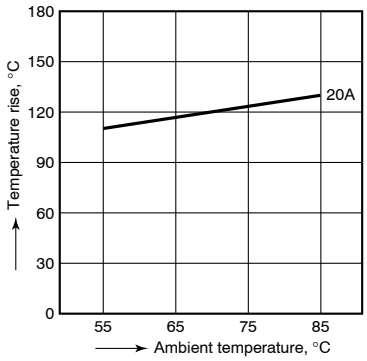
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

Automotive

REFERENCE DATA

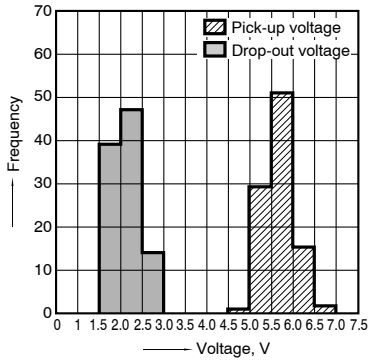
1. Coil temperature rise (20A)

Point measured: Inside the coil
Contact carrying current: 20A
Coli applied voltage: 13.5V



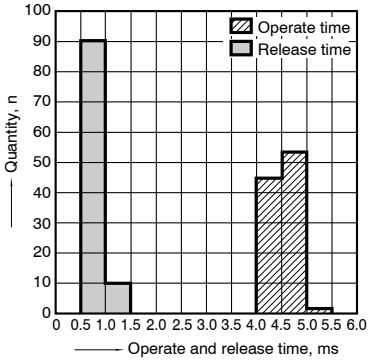
2. Distribution of pick-up and drop-out voltage

Sample: ACV11012, 100pcs



3. Distribution of operate and release time

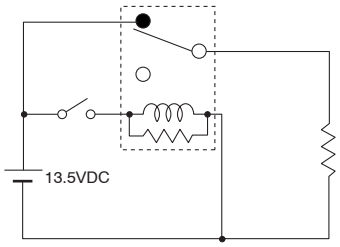
Sample: ACV11012, 100pcs.



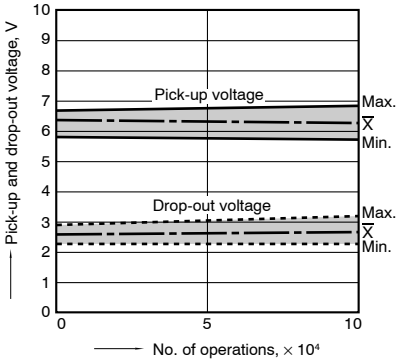
4-(1). Electrical life test (Resistive load)

Sample: ACV12212, 3pcs.
Load: Resistive load (NC switching) 11A
Switching frequency: (ON : OFF = 1s : 1s)
Ambient temperature: Room temperature

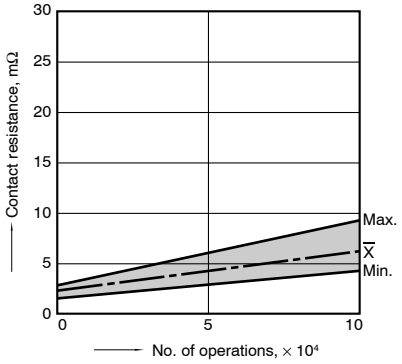
Circuit



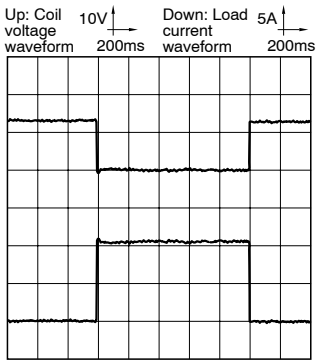
Change of pick-up and drop-out voltage



Change of contact resistance



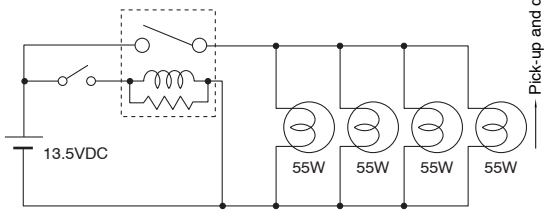
Load current waveform



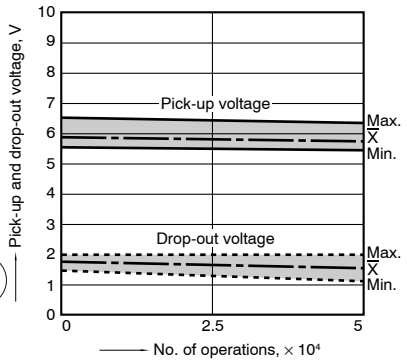
4-(2). Electrical life test (Lamp load)

Sample: ACV12212, 3pcs.
Load: 55Wx4, inrush: 90A/steady: 20A,
lamp actual load
Switching frequency: (ON : OFF = 1s : 14s)
Ambient temperature: Room temperature

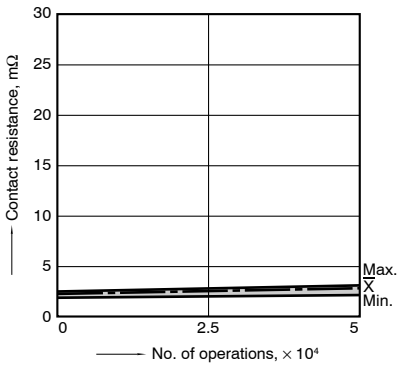
Circuit



Change of pick-up and drop-out voltage

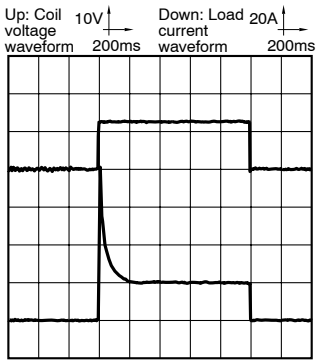


Change of contact resistance



Load current waveform

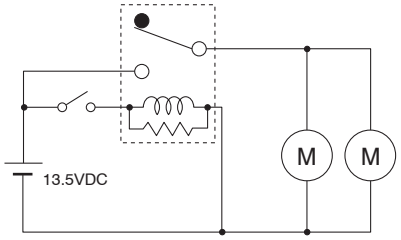
Inrush current: 90A, steady current: 20A



4-(3). Electrical life test (Motor load)

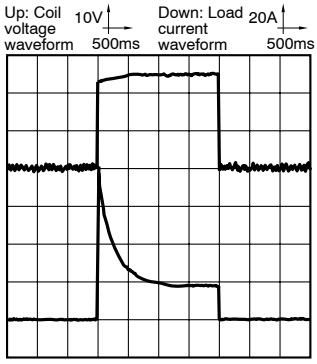
Sample: ACV12212, 3pcs.
Load: inrush: 80A/steady: 18A,
radiator fan actual load (motor free)
Switching frequency: (ON : OFF = 2s : 6s)
Ambient temperature: Room temperature

Circuit

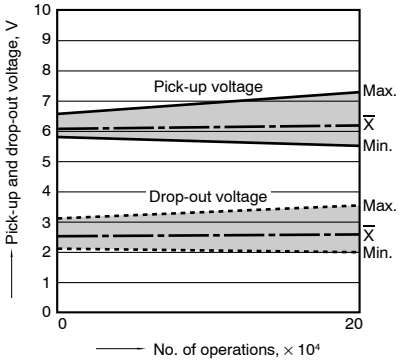


Load current waveform

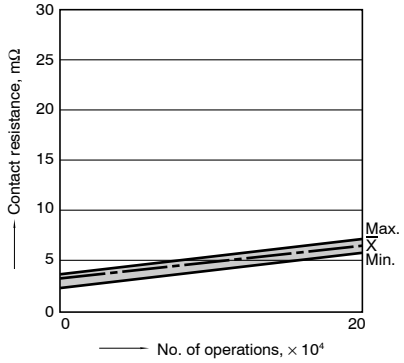
Inrush current: 80A, steady current: 18A



Change of pick-up and drop-out voltage



Change of contact resistance



Cautions regarding the protection element

1. Part numbers without protection elements

• 12 V models

When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 24 V or higher, or a resistor (680Ω to 1,000Ω). When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2. Part numbers with diodes

These relays use a diode in the coil surge protection element. Therefore, the release time is slower and the working life might be shorter compared to part numbers without protection elements and part numbers with resistors.
Be sure to use only after evaluating under actual load conditions.

3. Part numbers with resistors

This part number employs a resistor in the coil surge protection circuit; therefore, an external surge protection element is not required. In particular, when a diode is connected in parallel with a coil, the revert time becomes slower which could adversely affect working life. Please check the circuit and make sure that a diode is not connected in parallel with the coil drive circuit.

Automotive

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

COMPACT BUT CUT OFF DC POWER CURRENT, POWER CAPSULE CONTACT RELAY.

EV RELAYS (AEV)


150A 2a


150A 1a


60a


30a

FEATURES

• Small size & light weight: size 1/4, weight 1/2 (compared to conventional contactors)

• No arc space is required: size including arc space 1/9 (compared to conventional contactors)

The arc is not exposed to the outside, therefore, no arc space is not required.

• Safety construction

The arc is not exposed, therefore, the contactor is explosion proof and intrinsically safe.

• Quiet: operation noise 1/4 (compared to conventional contactors).

Along with the above-mentioned miniaturization, the operation noise has been reduced to 70dB, and, in addition, the operation noise remains unchanged when a current of 1000A or more is interrupted.

• High contact reliability

The contact part is hermetically sealed with H_2 mixed gas, hence the contact resistance remains stable regardless of the ambient conditions.

• Mounting direction is not specified

The weight of the movable parts is light, and also the restoring force is large, hence the contactor is relatively unaffected by gravity.

• Line-up of indicator Type (150A Type only)

A line-up of relays with indicator that can monitor the relay operation.

• Coil voltage 24V DC type is also available

SPECIFICATIONS

Contact

Type		150A type	60A type	30A type
Arrangement		1 Form A, 2 Form A	1 Form A	1 Form A
Rating	Nominal switching capacity (resistive load)	150A 400V DC	60A 400V DC	30A 400V DC
	Short term current	300A (10min) ($40mm^2$)	120A (15min) ($15mm^2$)	60A (5min) ($5.5mm^2$)
	Max. cut-off current	2,500A 300V DC (3 cycles)#1	600A 300V DC (5 cycles)#3	—
	Overload opening/ closing rating	600A 300V DC (25 cycles)	120A 400V DC (50 cycles)#3	120A 400V DC (50 cycles)#3
	Reverse direction cut-off	–300A 200V DC (25 cycles)	–120A 200V DC (50 cycles)#3	–60A 200V DC (50 cycles)#3
	Contact voltage drop	Max. 0.1V When current (is 150A per 1) contact set	Max. 0.1V When current (is 60A per 1) contact set	Max. 0.2V When current (is 30A per 1) contact set
Nominal operating power		35W (Inrush, approx 0.1s) 5W (Stable)	Max. 5W	Max. 5W
Expected life (min. operations)	Mechanical	1 Form A: 10^5 2 Form A: 5×10^4	10^5	
	Electrical	150A 400V DC 10^3 L/R q 1ms	60A 400V DC 10^3 L/R q 1ms#3	30A 400V DC 3×10^4 L/R q 1ms#3

Characteristics

Initial insulation resistance		Min. 100 MΩ (at 500 V DC)*1
Initial breakdown voltage	Between open contacts	AC 2,500 Vrms for 1 min.*2
	Between contact and coil	AC 2,500 Vrms for 1 min.*2
Operate time (at 20°C) (at nominal voltage)		Max. 50ms*3
Reset time (without diode) (at 20°C) (at nominal voltage)		Max. 30ms*4
Shock resistance	Functional	Min. 196 m/s² {20 G}*5
	Destructive	Min. 490 m/s² {50 G}*6
Vibration resistance	Functional	43 m/s² {4.4 G} 10 Hz to 200 Hz*7
	Destructive	43 m/s² {4.4 G} 10 Hz to 200 Hz*8
Conditions for operation, transport and storage (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +80°C*9 –40°F to +176°F
	Humidity	5% R.H. to 85% R.H.
Mass		150 A 1 Form A: 600 g 21.16oz 150 A 2 Form A: 1,100 g 38.80oz 60 A: 330 g 11.64oz 30 A: 310 g 10.93oz

Remarks

*1 Measurement at same location as “Initial breakdown voltage” section.
*2 Detection current: 10mA.
*3 Nominal voltage applied to the coil,excluding bounce time.
*4 Nominal voltage applied to the coil.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10μs.
*6 Half-wave pulse of sine wave: 6 ms.
*7 Detection time: 10 μs.
*8 3 directions, each 4 hours.
*9 Storage: Max.85°C 185°F.

Notes

* Same specifications as the 12 V type.
#1 Condition: Nominal switching 100 cycles,each cut off 2,500 A.
#2 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).
#3 The electrical load performance value for the 60 A and 30 A types applies when a varistor is connected in parallel to the coil. Please be warned that working life will be reduced when a diode is used.

Indicator ratings

Arrangement	1 Form A	1 Form B
Material	Gold-clad	
Rating (resistive load)	0.1 A 30 V DC (Low level load = min. 1 mA)	
Contact resistance	Max. 100 mΩ	

Note:
Indicator type is only available for the 150 A type.

TYPICAL APPLICATIONS

- Electric Vehicle
- Hybrid Electric Vehicle

ORDERING INFORMATION

Ex. A EV 1 5 0 12

Product Name	Contact arrangement	Contact rating	Indicator contact arrangement	Coil voltage
EV	1: 1 Form A 2: 2 Form A (150A type)	3: 30A 5: 150A 6: 60A	0: without indicator contact 1: a contact (150A type only) 3: b contact (150A type only)	12: 12V DC 24: 24V DC

Packing quantity

Types	Inner	Outer
150A 2 Form A	1pc.	5pcs.
150A 1 Form A	1pc.	10pcs.
60A 1 Form A	1pc.	20pcs.
30A 1 Form A	1pc.	20pcs.

SPARE PARTS

Installing parts	Part No.	Packing Quantity
M8 nut with washer for 150A type	AEV801	2pcs.
M5 screw for 60A type	AEV802	2pcs.
M4 screw for 30A type	AEV803	2pcs.
Bus bar for 60A type	AEV804	2pcs.

TYPES AND COIL DATA (at 20°C 68°F)

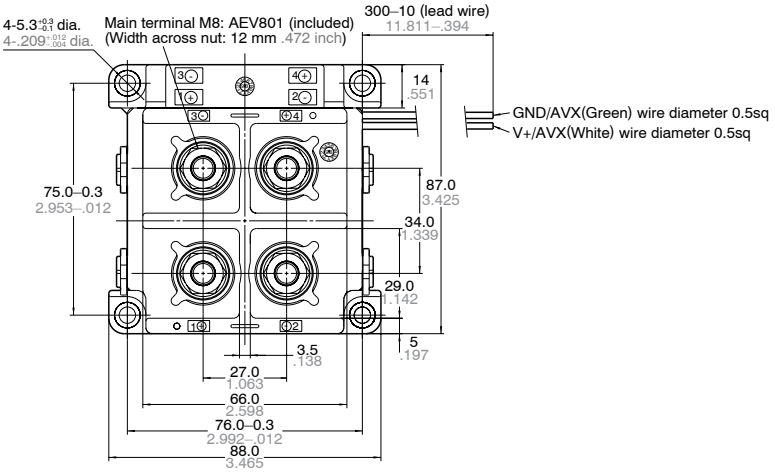
Part No.	Coil voltage, V DC	Pick-up voltage, V DC	Drop-out voltage, V DC	Nominal coil current	Operating power, W (12 V DC)	Max. allowable voltage, V DC
AEV25012*	12 V DC	Max. 9 V DC	Min. 1 V DC	2.8 A ±10% (at peak)*	35W (Inrush, approx. 0.1S) 5W (Stable)	16 V DC
AEV15012*						
AEV16012				0.415 A ±10%	Max. 5W	
AEV13012						
AEV25024*	24 V DC	Max. 18 V DC	Min. 2 V DC	1.9 A ±10% (at peak)*	35W (Inrush, approx. 0.1S) Max. 5W (1 Form A) Max. 6W (2 Form A)	32 V DC
AEV15024*				2.2 A ±10% (at peak)*		
AEV16024				0.208 A ±10%	Max. 5W	
AEV13024						

Note:
* Same coil data as Indicator type.

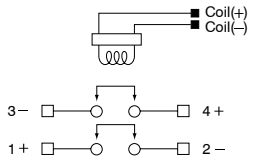
DIMENSIONS

mm inch

150A 2a

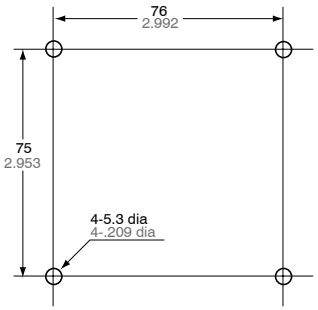


Schematic (TOP VIEW)



output side has polarities (+) and (-)

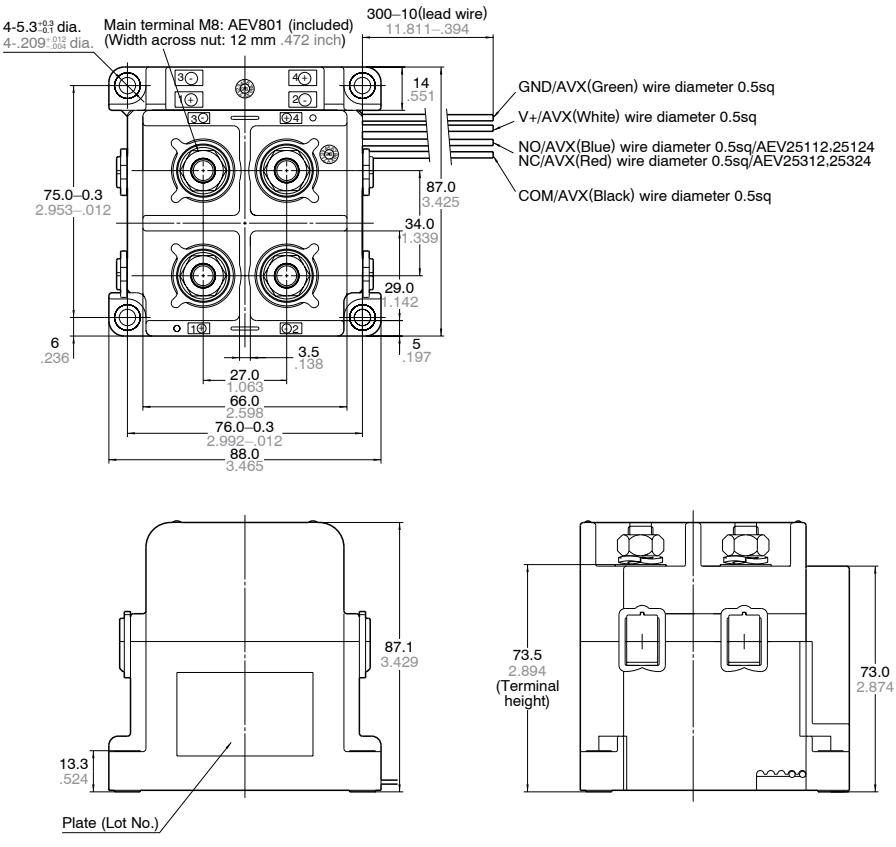
Mounting dimensions



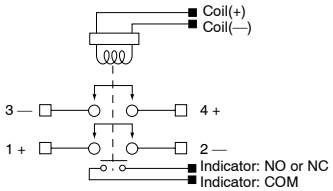
General tolerance:

less than 10 (.394)	±0.3 (±.012)
10 (.394) to 50 (1.969)	±0.6 (±.024)
more than 50 (1.969)	±1.0 (±.039)

150A 2a Indicator Type

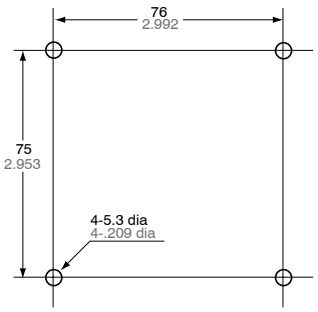


Schematic (TOP VIEW)



output side has polarities (+) and (-)

Mounting dimensions

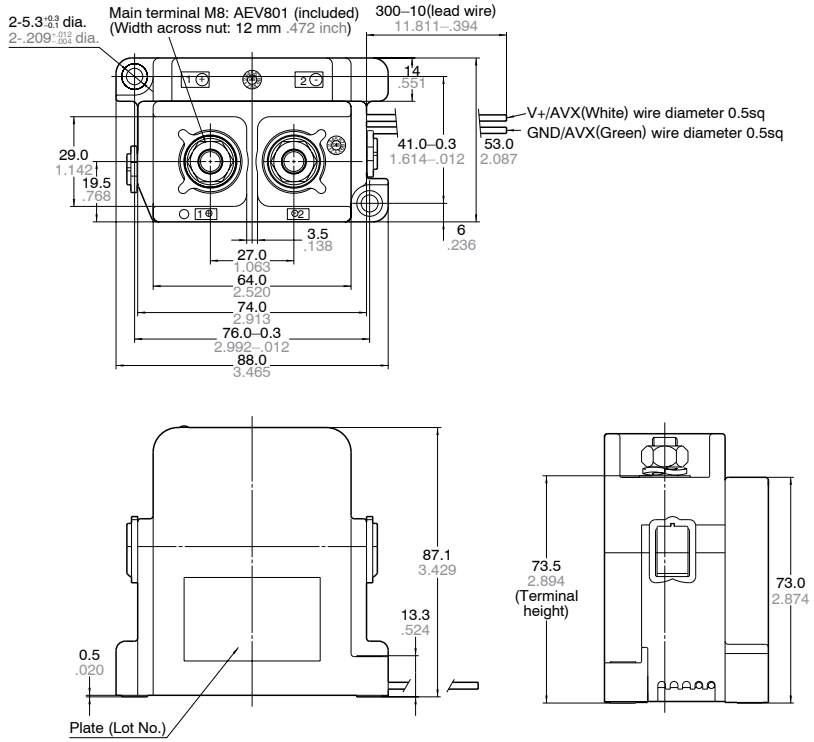


General tolerance:

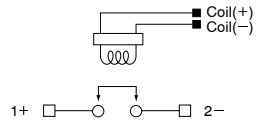
less than 10 (.394)	±0.3 (±.012)
10 (.394) to 50 (1.969)	±0.6 (±.024)
more than 50 (1.969)	±1.0 (±.039)

150A 1a

mm inch

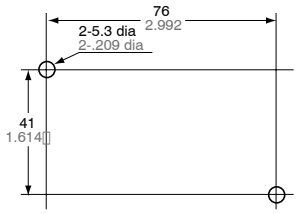


Schematic (TOP VIEW)



output side has polarities (+) and (-)

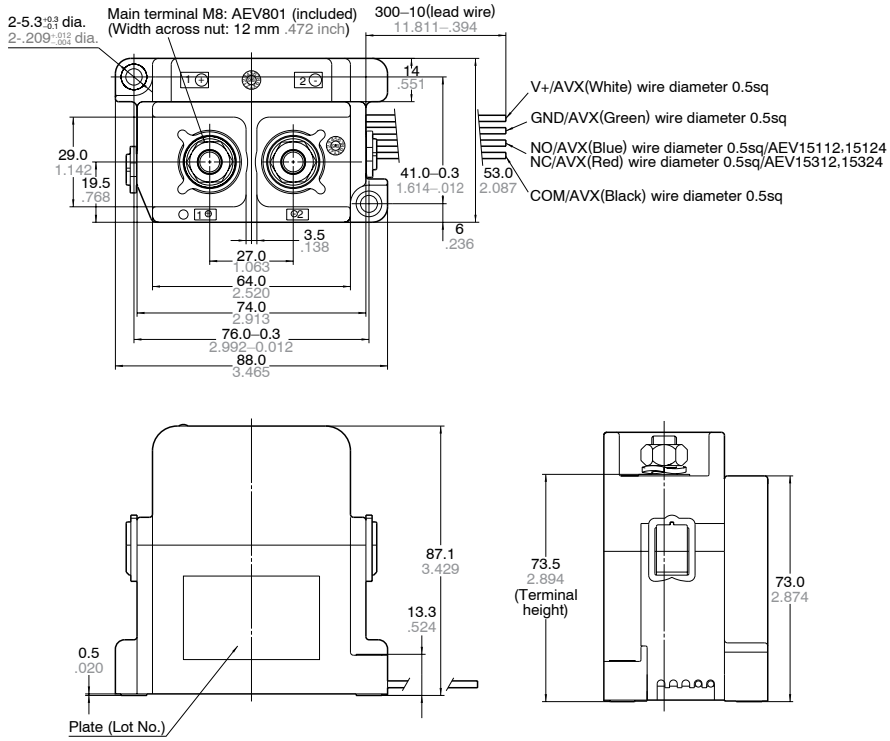
Mounting dimensions



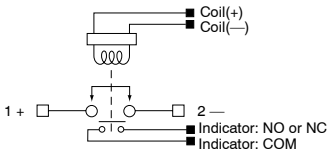
General tolerance:

less than 10 (.394)	±0.3 (±.012)
10 (.394) to 50 (1.969)	±0.6 (±.024)
more than 50 (1.969)	±1.0 (±.039)

150A 1a Indicator Type

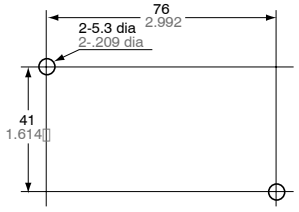


Schematic (TOP VIEW)



output side has polarities (+) and (-)

Mounting dimensions

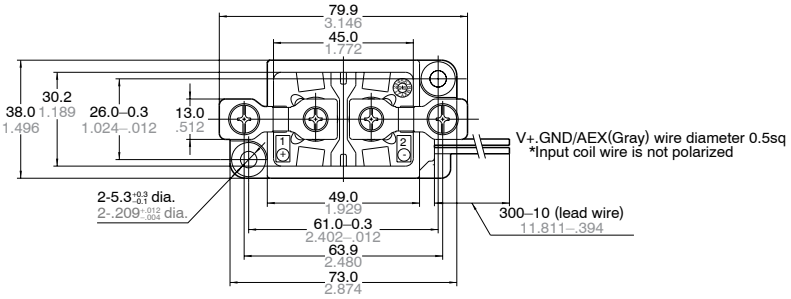


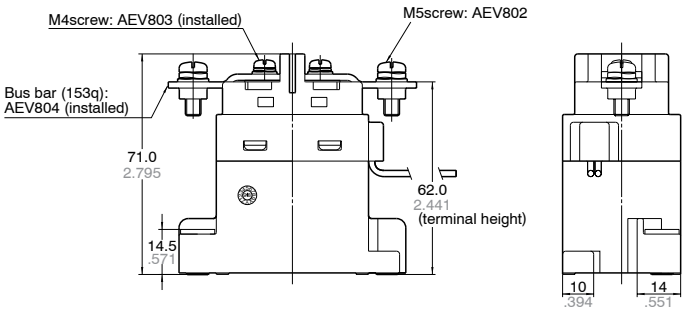
General tolerance:

less than 10 (.394)	±0.3 (±.012)
10 (.394) to 50 (1.969)	±0.6 (±.024)
more than 50 (1.969)	±1.0 (±.039)

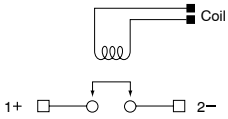
60A

mm inch



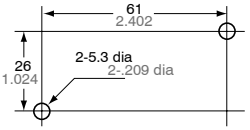


Schematic (TOP VIEW)



output side has polarities (+) and (-)

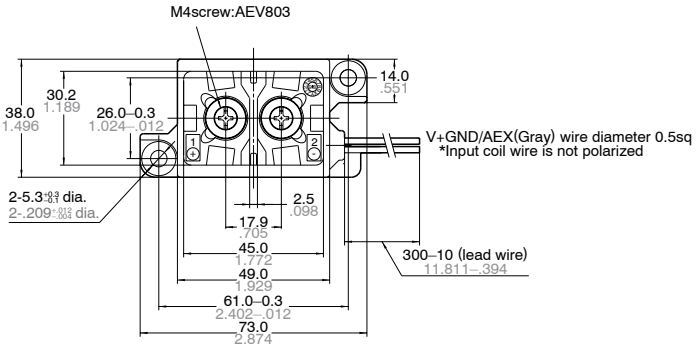
Mounting dimension

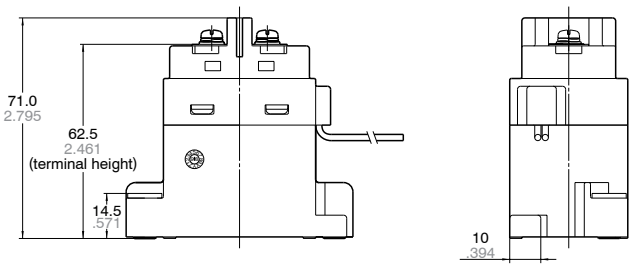


General tolerance:

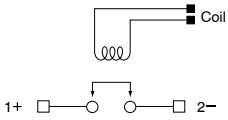
less than 10 (.394)	±0.3 (±.012)
10 (.394) to 50 (1.969)	±0.6 (±.024)
more than 50 (1.969)	±1.0 (±.039)

30A



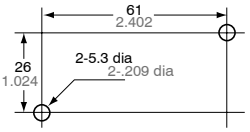


Schematic (TOP VIEW)



output side has polarities (+) and (-)

Mounting dimension

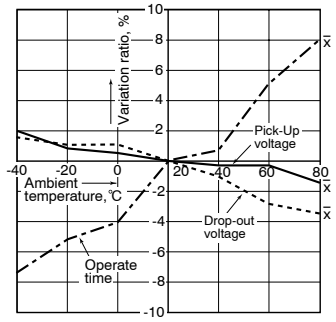


General tolerance:

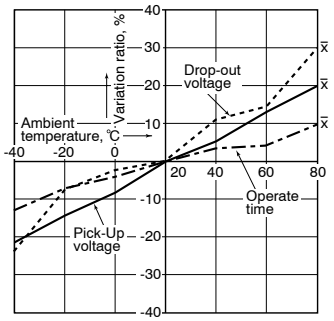
less than 10 (.394)	±0.3 (±.012)
10 (.394) to 50 (1.969)	±0.6 (±.024)
more than 50 (1.969)	±1.0 (±.039)

REFERENCE DATA

1-(1) Ambient temperature characteristics (150A type)
Sample: AEV15012,3pcs



1-(2) Ambient temperature characteristics (60A type)
Sample: AEV16012,3pcs



NOTES

1. When installing the relay, always use washers to prevent loosening of the screws.
Tighten each of the screws within the rated ranges given below. Exceeding the maximum torque may result in breakage. Mounting is possible in either direction.
• M8 screw (for 150 A main terminal): 8 to 10 N·m
• M5 screw (150 A, 60 A, 30 A main unit mounting section)
(60 A main terminal): 2.5 to 3.6 N·m
• M4 screw (30 A terminal): 1.8 to 2.7 N·m

2. The coils (150 A type) and contacts (30 A, 60 A, 150 A) of the relay are polarized, so follow the instructions in the connection schematic when connecting the coils and contacts.
Type 150 A has contains a reverse surge voltage absorption circuit;
therefore a surge protector is not needed. We recommend installing a surge protector varistor (ZNR) for the 30 A and 60 A types. Avoid using a diode as this may result in decreased cut-off capability.

3. As a general rule, do not use a relay if it has been dropped.

4. Avoid mounting the relay in strong magnetic fields (near a transformer or magnet) or close to an object that radiates heat.

5. Electrical life
This relay is a high-voltage direct-current switch. In its final breakdown mode, it may lose the ability to provide the proper cut-off. Therefore, do not exceed the indicated switching capacity and life. (Please treat the relay as a product with limited life and replace it when necessary.)
In the event that the relay loses cut-off ability, there is a possibility that burning may spread to surrounding parts, so configure the layout so that the power is turned off within one second.
When using the 30 A type, to prevent increases in the contact resistance, do not allow switching without any load.

6. Permeation life of internal gas
This relay uses a hermetically encased contact (capsule contact) with gas inside. The gas has a permeation life that is affected by the temperature inside the capsule contact (ambient temperature + temperature rise due to flow of electrical current). For this reason, make sure the ambient operating temperature is between –40 and 80°C –40 and +176°F, and the ambient storage temperature is between –40 and 85°C –40 and +185°F.

7. If the power is turned off and then immediately on after applying the rated voltage (current) continuously to the relay's coil and contact, the resistance of the coil will increase due to a rise in the coil temperature.
This causes the pick-up voltage to rise, and possibly exceed the rated pick-up voltage. In these circumstances, take measures such as reducing the load current, limiting the duration of current flow, and applying a coil voltage higher than the rated operating voltage (quick start).

8. Main contact ratings in the ratings apply to when there is a resistive load.
If you are using an inductive load (L load) such that L/R > 1 ms, add surge protection in parallel with the inductive load.
If this is not done, the electrical life will decrease and cut-off failure may occur.

9. When using the 150 A type, mount it as far away as possible from amateur wireless transmitters or devices that may generate large surges.
To prevent malfunctioning due to high emission levels, it may be necessary to take measures for E.M.I., such as adding a line noise filter or an electromagnetic shield.

10. Since coil current control is performed, a slight amount of superimposed line noise may be generated in the input line system. If this noise must be removed, install a line noise filter.

11. Be careful that foreign matter and oils and fats kind doesn't stick to the main terminal part because it is likely to cause a terminal part to give off unusual heat.

12. Avoid excessive load applied to the terminal in case of installing such as a bus bar etc., because it might give bad influence to the opening and closing performance.
• M8 screw terminal (150A main terminal part)
Terminal pulling up strength; Max.100N per terminal
The up-down rotation torque applied to the terminal; Max.15N·m

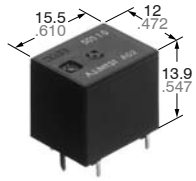
13. When the 150 A type is driven, sufficient current capacity is required when power is applied. When stabilized DC voltage is used, please verify that nominal coil current during peeks has a capacity of 150% or more for each relay.

For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

COMPACT SIZE AUTOMOTIVE RELAY

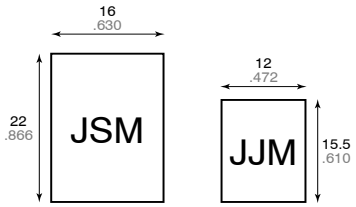
JJ-M RELAYS



mm inch

FEATURES

• Compact (half-size).
The base area is approximately half the size of conventional (JS-M) relays. The controller unit can be made more compact.
Base area has been reduced by one half



• Perfect for automobile electrical systems.
Over 2 × 10^5 openings possible with a 14 V DC motor load, an inrush current of 25 A, and steady state current of 5 A. (N.O. side)

• Standard terminal pitch employed
The terminal array used is identical to that used in small automotive relays.

• Plastic sealed type.
Plastically sealed for automatic cleaning.

• Line-up of 1 Form A and 1 Form C.

TYPICAL APPLICATIONS

- Power windows
- Auto door lock
- Electrically powered sun roof
- Electrically powered mirror
- Cornerring lamp, etc.

SPECIFICATIONS

Contact

Arrangement			1 Form A	1 Form C
Contact material			Silver alloy	
Initial contact resistance (By voltage drop 6V DC 1A)			Max. 100 mΩ	
Rating (resistive load)	Nominal switching capacity		20 A 14 V DC	20 A 14 V DC (N.O.) 10 A 14 V DC (N.C.)
	Min. switching capacity#1		1 A 12 V DC	
	Max. carrying current		35 A (12V, at 20°C 68°F for 2 minutes) 25 A (12V, at 20°C 68°F for 1 hour) 30 A (12V, at 85°C 185°F for 2 minutes) 20 A (12V, at 85°C 185°F for 1 hour)	
Expected life (min. operations)	Mechanical (at 120cpm)		10^7	
	Electrical (at rated load)	Resistive	10^5 *1	10^5 (N.O.)*2 10^5 (N.C.)*3
		Motor load	2×10^5 *4 5×10^4 *5	2×10^5 (N.O.)*6 5×10^4 (N.O.)*7 2×10^5 (N.C.)*8

Coil

Nominal operating power	640 mW

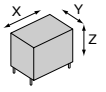
#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
*1 at 20 A 14 V DC, at 20 cpm, operating frequency: 1s ON, 9s OFF
*2 at 20 A 14 V DC, operating frequency: 1s ON, 9s OFF
*3 at 10 A 14 V DC, at 20 cpm, operating frequency: 1s ON, 9s OFF
*4 at 5 A (steady), 25 A (inrush) 14 V DC
*5 at 20 A 14 V DC (Motor lock), operating frequency: 0.5 s ON, 9.5 s OFF
*6 at 5A (steady), 25 A (inrush) 14 V DC

Characteristics

Max. operating speed (at rated load)		6 cpm
Initial insulation resistance*9		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*10	Between open contacts	500 Vrms for 1min.
	Between contact and coil	500 Vrms for 1min.
Operate time*11 (at nominal voltage)		Max. 10 ms (at 20°C 68°F)
Release time (without diode)*11 (at nominal voltage) (Initial)		Max. 10 ms (at 20°C 68°F)
Shock resistance	Functional*12	Min. 100 m/s² {10 G}
	Destructive*13	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*14	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5 G}
	Destructive*15	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5 G}
Conditions in case of operation, transport and storage*16 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 5 g .176 oz

*7 at 20 A 14 V DC (Motor lock)
*8 at peak 20 A 14 V DC (Braking current) operating frequency: 0.5 s ON, 9.5 s OFF
*9 Measurement at same location as “Initial break down voltage” section.
*10 Detection current: 10mA
*11 Excluding contact bounce time.
*12 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*13 Half-wave pulse of sine wave: 6 ms
*14 Detection time: 10 μs
*15 Time of vibration for each direction; X, Y, Z direction: 2 hours



*16 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

ORDERING INFORMATION

Ex. JJM [1a] - [12 V]

Contact arrangement	Coil voltage(DC)
1a: 1 Form A 1: 1 Form C	12 V

(Note) Standard packing: Carton: 50 pcs.; Case: 1,000 pcs.

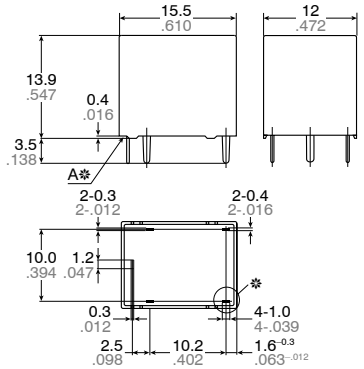
TYPES AND COIL DATA (at 20°C 68°F)

Contact arrangement	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance Ω	Nominal operating current mA	Nominal operating power mW	Usable voltage range, V DC
1 Form A	JJM1a-12 V	12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16
1 Form C	JJM1-12 V	12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16

* Other pick-up voltage types are also available. Please contact us for details.

DIMENSIONS

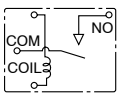
mm inch



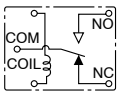
Note: ✻Marked terminal is only for 1Form C type

Schematic (Bottom view)

1a

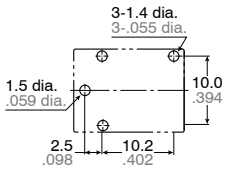


1c

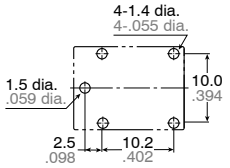


PC board pattern (Bottom view)

1a



1c



* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

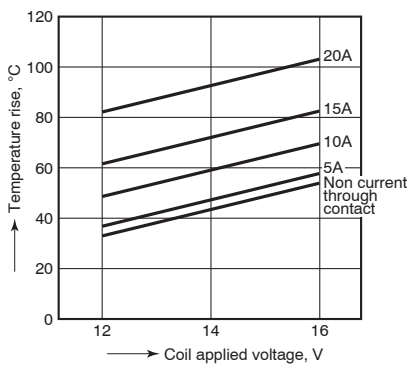
Tolerance: ±0.1 ±.004

Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

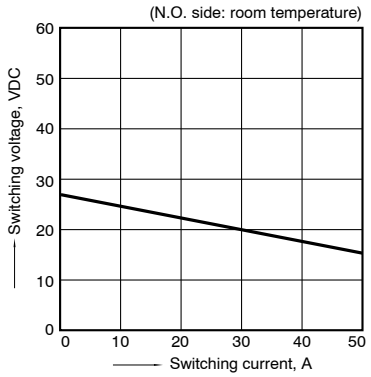
REFERENCE DATA

1. Coil temperature rise

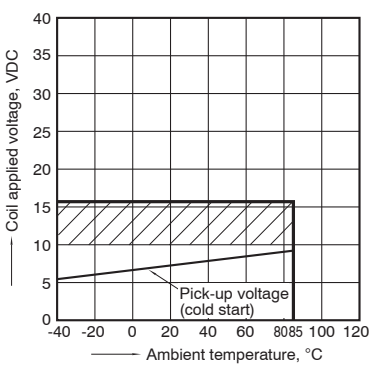
Sample: JJM1-12V, 6pcs
Point measured: Inside the coil
Contact current: Now current through contact, 5A, 10A, 15A, 20A
Resistance method, ambient temperature 85°C 185°F



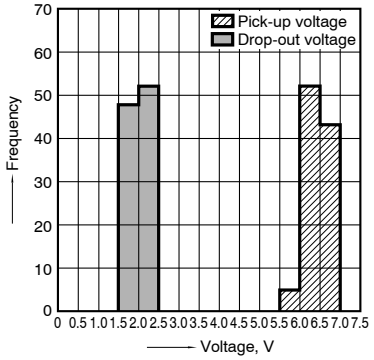
2. Max. switching capability (Resistive load)



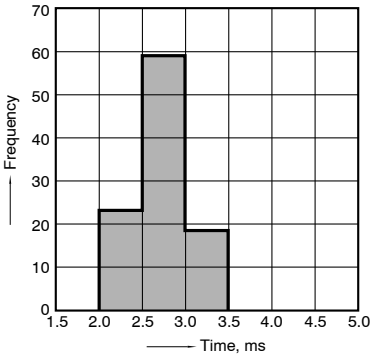
3. Ambient temperature and operating voltage range



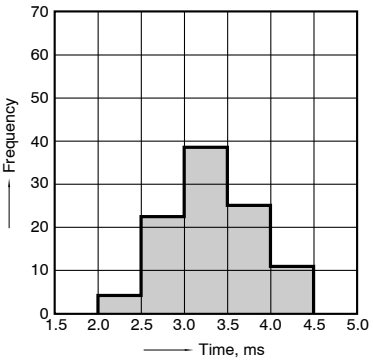
4. Distribution of pick-up and drop-out voltage
Sample: JJM1-12V, 100pcs



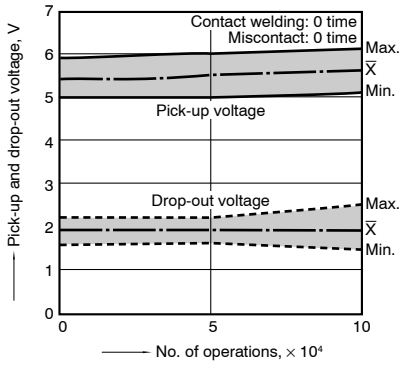
5. Distribution of operate time
Sample: JJM1-12V, 100pcs



6. Distribution of release time
Sample: JJM1-12V, 100pcs
* With diode

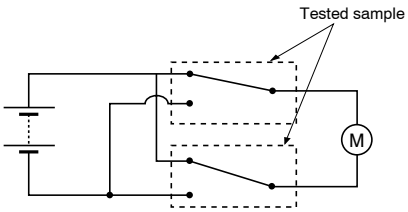


7-(1). Electrical life test (at rated load)
Sample: JJM1-12V
Quantity: n = 6 (NC = 3, NO = 3)
Load: Resistive load (NC side: 10A 14 V DC, NO side: 20 A 14 V DC); Operating frequency: ON 1s, OFF 9s
Ambient temperature: Room temperature

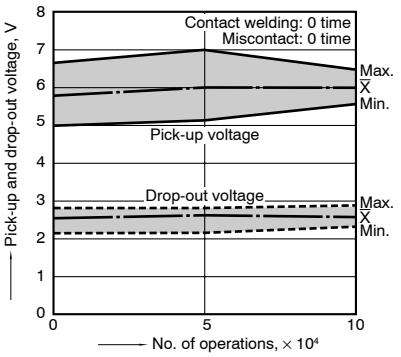


7-(2). Electrical life test (Motor free)
Sample: JJM1-12V, 6pcs.
Load: 5A, Inrush 25A, Brake current 18A 14V DC,
Power window motor load (Free condition).
Operating frequency: (ON : OFF = 0.5s : 9.5s)
Ambient temperature: Room temperature

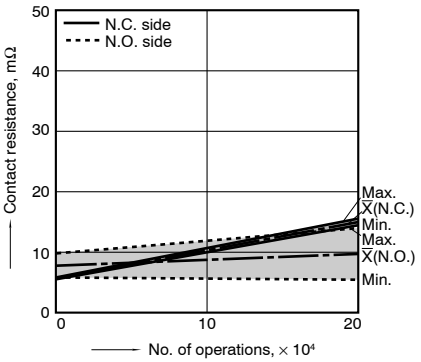
Circuit :



Change of pick-up and drop-out voltage

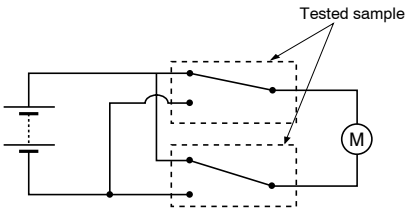


Change of contact resistance

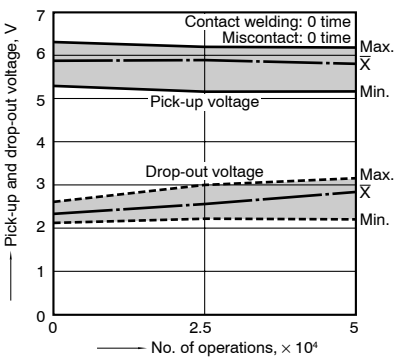


7-(3). Electrical life test (Motor lock)
Sample: JJM1-12V, 6pcs.
Load: 20A, 14VDC,
Power window motor actual load (lock condition).
Operating frequency: (ON : OFF = 1s : 5s)
Ambient temperature: Room temperature

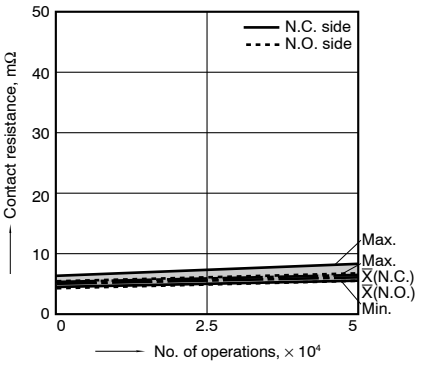
Circuit :



Change of pick-up and drop-out voltage



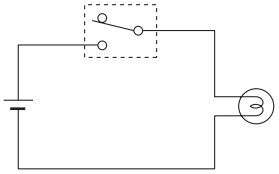
Change of contact resistance



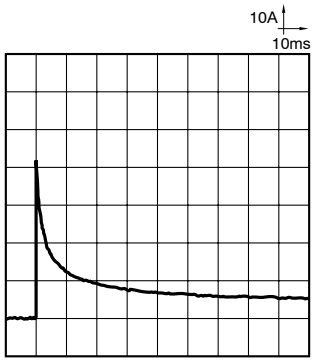
7-(4). Electrical life test (Lamp load)

Sample: JJM1-12V, 6pcs.
Load: 27W+21W, min. 4A (steady), Lamp actual load
Operating frequency: ON 2s, OFF 13s
Ambient temperature: Room temperature

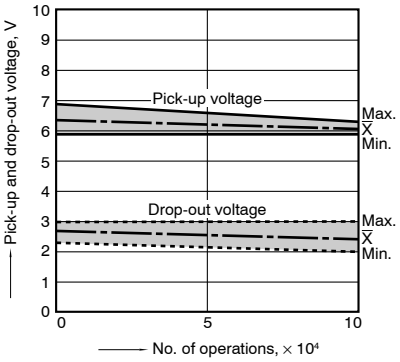
Circuit :



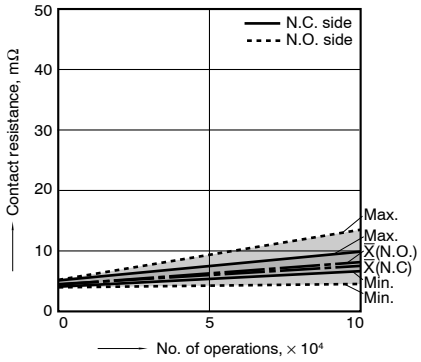
Inrush current: 42A, Steady current: 4.4A



Change of pick-up and drop-out voltage



Change of contact resistance

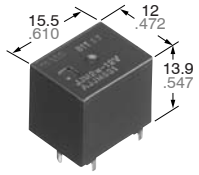


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

DOUBLE MAKE CONTACT AUTOMOTIVE RELAY

JJ-M RELAYS
(Double make type)



mm inch

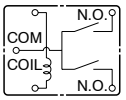
FEATURES

• Small size
The smallest double make type relay 12.0(W)×15.5(L)×13.9(H) mm .472(W)×.610(L)×.547(H) inch

• Pattern design simplification
Simplified pattern design is possible because, while double make construction is employed, the external COM terminal is single.

• Standard terminal pitch employed
The terminal array used is identical to that used in JJM relays(1c type).

• Plastic sealed type
Plastically sealed for automotive cleaning.



<Schematic>

SPECIFICATIONS

Contact

Arrangement		Double make contact
Contact material		Silver alloy
Initial contact resistance (By voltage drop 6V DC 1A)		Max. 100 mΩ
Contact voltage drop		Max. 0.25V (at 2 × 6A)
Rating	Nominal switching capacity	12A 14V DC (at 2 × 6A, lamp load)
	Max. carrying current	2 × 6A (12V, at 20°C 68°F), 2 × 4A (12V, at 85°C 185°F)
	Min. switching capacity#1	1A 12V DC
Expected life (min. operations)	Mechanical (at 120cpm)	Min. 10^7
	Electrical (lamp load)	Min. 10^5*1

Coil

Nominal operating power	1,000 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
*1 At 12A 14V DC (lamp), operating frequency: 1s ON, 14s OFF
*2 Measurement at same location as "initial breakdown voltage" section.
*3 Detection current: 10mA
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Time of vibration for each direction; X, Y direction: 2 hours Z direction: 4 hours

*9 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

Characteristics

Max. operating speed (at nominal switching capacity)		4 cpm
Initial insulation resistance*2		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*3	Between open contacts	500 Vrms for 1min.
	Between contact and coil	500 Vrms for 1min.
Operate time*4 (at nominal voltage)(at 20°C 68°F)		Max. 10 ms (Initial)
Release time (without diode)*4 (at nominal voltage)(at 20°C 68°F)		Max. 10 ms (Initial)
Shock resistance	Functional*5	Min. 100 m/s² {10 G}
	Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*7	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5 G}
	Destructive*8	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5 G}
Conditions in case of operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 5 g .176 oz

TYPICAL APPLICATIONS

Car alarm system flashing lamp etc.

ORDERING INFORMATION

Ex. JJM [2w] [12V]

Contact arrangement	Coil voltage (DC)
Double make contact	12V

Standard packing: Carton(tube package) 50pcs. Case: 1,000pcs.

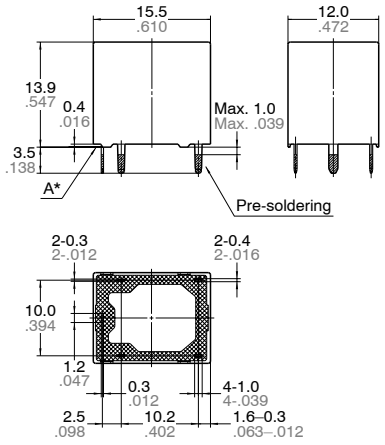
TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type

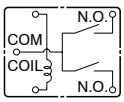
Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance Ω	Nominal operating current, mA	Nominal operating power, mW	Usable voltage range, V DC
JJM2w-12V	12	Max. 6.9	Min. 1.0	144±10%	83.3±10%	1,000	10 to 16

DIMENSIONS

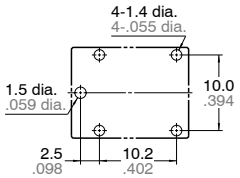
mm inch



Schematic (Bottom view)



PC board pattern (Bottom view)



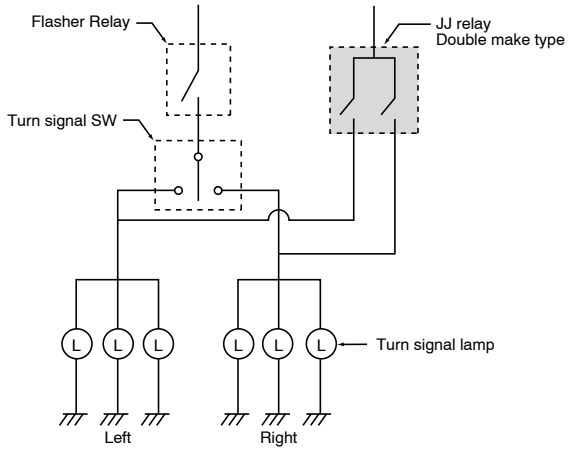
Tolerance: ±0.1 ±.004

Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

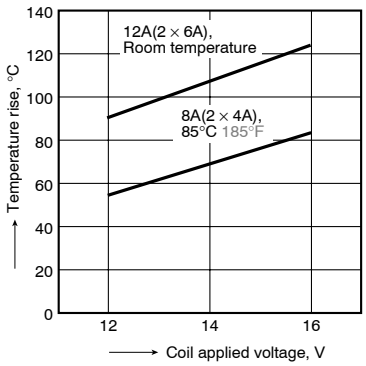
Control circuit for signal lights (security system)



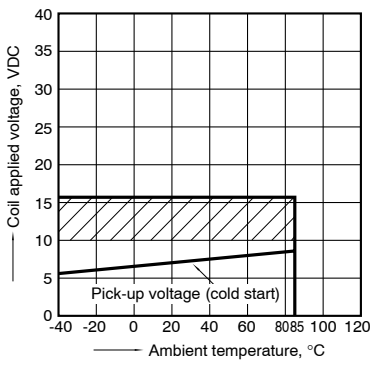
REFERENCE DATA

1. Coil temperature rise

Sample: JJM2w-12V, 6pcs.
Point measured: Inside the coil
Contact carrying current: 2 × 6A, 2 × 4A
Ambient temperature: Room temperature, 85°C 185°F

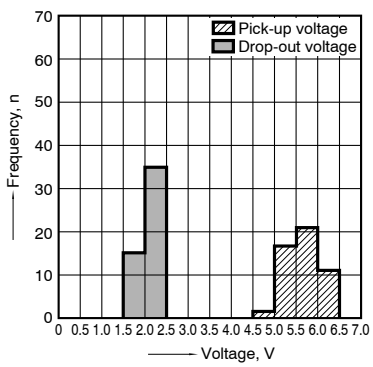


2. Ambient temperature and operating voltage range

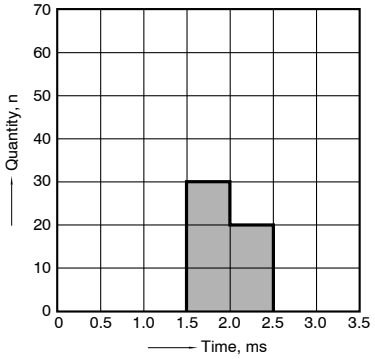


3. Distribution of pick-up and drop-out voltage

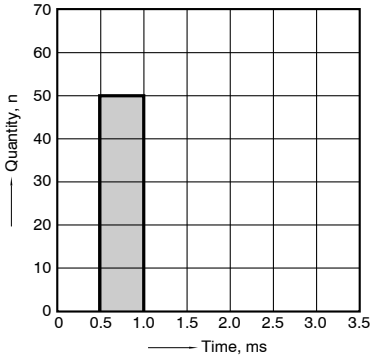
Sample: JJM2W-12V, 50pcs.



4. Distribution of operate time
Sample: JJM2W-12V, 50pcs.

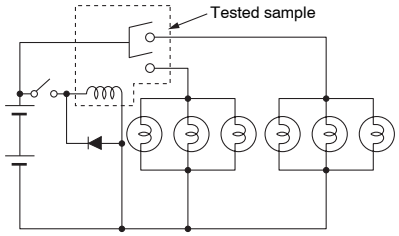


5. Distribution of release time
Sample: JJM2W-12V, 50pcs.
* Without diode

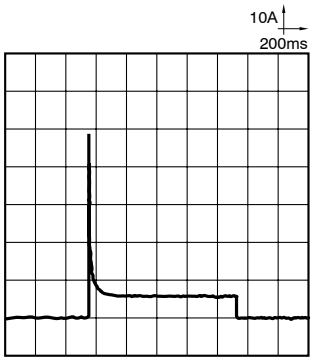


6. Electrical life test (Lamp load)
Sample: JJM2w-12V, 6pcs.
Load: 5.5A, inrush 48A, 6 × 21W
Operating frequency: (ON : OFF = 1s : 14s)
Ambient temperature: Room temperature

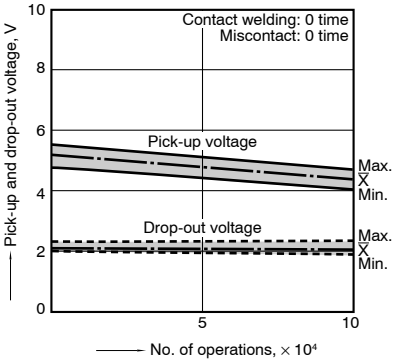
Circuit:



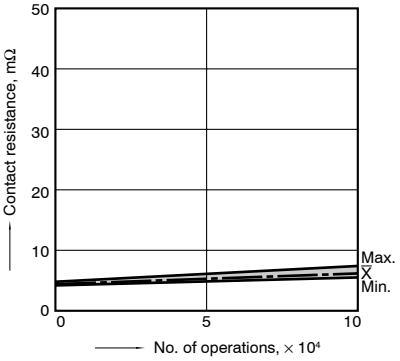
Load current waveform
Current value per contact on one side
Inrush current: 48A, Steady current: 5.5A



Change of pick-up and drop-out voltage



Change of contact resistance

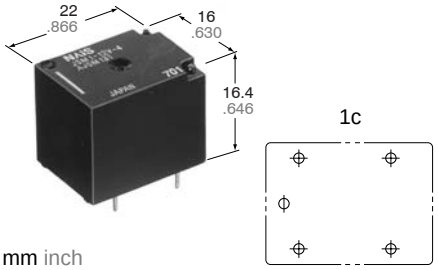


For Cautions for Use, see Relay Technical Information (page 392).

Panasonic
ideas for life

Global Standard Terminal Pitch Automotive Power Relay

JS-M RELAYS



mm inch

FEATURES

- **Low pick-up voltage for high ambient use**
- **Sealed construction**
- **Global standard terminal pitch**
- **Usable at high temperature: 85°C 185°F**

TYPICAL APPLICATIONS

- Power-window
- Car antenna
- Door lock
- Intermittent wiper
- Interior lighting
- Power seat
- Power sunroof
- Car stereo
- Horn
- Lift gate, etc.

SPECIFICATIONS

Contact

			Standard type	High capacity type
Arrangement			1 Form A, 1 Form C	
Contact material			Silver alloy	
Initial contact resistance (By voltage drop 6 V DC 1 A)			*Max. 100 mΩ	*Max. 100 mΩ
Contact voltage drop			Max. 0.2 V (at 10 A 12 V DC)	
Rating	Nominal switching capacity		10 A 16 V DC (resistive)	15 A 16 V DC (resistive)
	Max. carrying current		25 A (at 20°C 68°F for 2 minutes) 15 A (at 20°C 68°F for 1 hour) 20 A (at 85°C 185°F for 2 minutes) 10 A (at 85°C 185°F for 1 hour)	
	Max. switching power		160 W	
	Max. switching voltage		16 V DC	
	Max. switching current		10 A	15 A (10 A max. at 85°C)
	Min. switching capacity#1		1 A 12 V DC	
Expected life (min. ope.)	Mechanical life (at 180 cpm)		10^7	
	Electrical (at 15 cpm)	Resistive	10^5	N.O.: 10^5 N.C.: 5×10^4

* Measured after operating 5 times at the rated load

Coil

Nominal operating power	640 mW

Contact rating

Load	Standard type			High capacity type		
	Form A	Form C		Form A	Form C	
		N.O.	N.C.		N.O.	N.C.
Max. carry current	15 A	15 A	15 A	15 A	15 A	15 A
Max. make current	25 A	25 A	10 A	50 A	50 A	15 A
Max. break current	10 A	10 A	10 A	15 A	15 A	15 A

Characteristics

Max. operating speed (at rated load)			15 cps.
Initial insulation resistance*1			Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts		750 Vrms for 1 min.
	Between contacts and coil		1,500 Vrms for 1 min.
Operate time*3 (at nominal voltage)			Approx. 10 ms
Release time (without diode)*3 (at nominal voltage)			Approx. 10 ms
Shock resistance	Functional*4		Min. 98 m/s² {10 G}
	Destructive*5		Min. 980 m/s² {100 G}
Vibration resistance	Functional*6		10 Hz to 55 Hz at double amplitude of 1.6 mm
	Destructive		10 Hz to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)		Ambient temp.	–40°C to +85°C –40°F to +185°F
		Humidity	5% R.H. to 85% R.H.
Mass			Approx. 12 g .423 oz

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

ORDERING INFORMATION

Ex. JSM [1a] [F] —— [12V] —— [4]

Contact arrangement	Protective construction	Coil voltage (DC)	Contact material
1a: 1 Form A 1: 1 Form C	Nil: Sealed construction F: Flux-resistant type	12 V	4: Standard type (10 A) 5: High capacity type (15 A)

Note: Standard packing: Carton: 100 pcs. Case: 500 pcs.

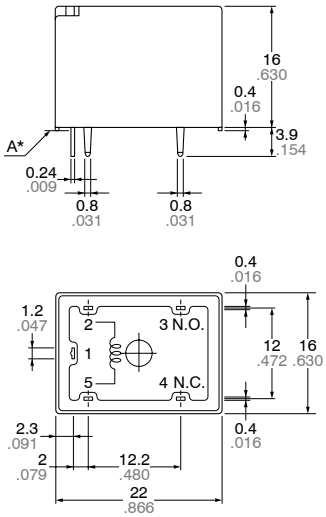
TYPES AND COIL DATA (at 20°C 68°F)

Contact arrange-ment	Coil voltage, V DC	Standard type (10 A)		High capacity type (15 A)		Nominal voltage, V DC	Pick-up voltage, V DC	Drop-out voltage, V DC	Coil resistance Ω	Nominal operating current, mA	Nominal operating power, mW	Max. allowable voltage, V DC (at 80°C 176°F)
		Sealed type	Flux-resistant type	Sealed type	Flux-resistant type							
1 Form A	12	JSM1a-12V-4	JSM1aF-12V-4	JSM1a-12V-5	JSM1aF-12V-5	12	Max. 6.3	Min. 0.9	225±10%	53.3±10%	640	16
1 Form C	12	JSM1-12V-4	JSM1F-12V-4	JSM1-12V-5	JSM1F-12V-5	12	Max. 6.3	Min. 0.9	225±10%	53.3±10%	640	16

* Other pick-up voltage types are also available. Please contact us for details.

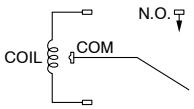
DIMENSIONS

mm inch

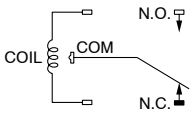


Schematic (Bottom view)

1a

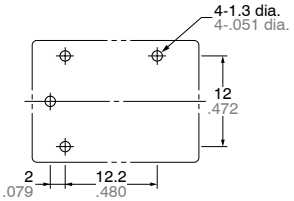


1c

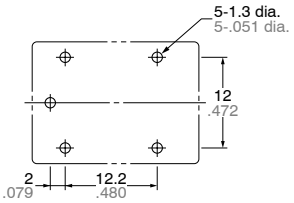


PC board pattern (Bottom view)

1a



1c



Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

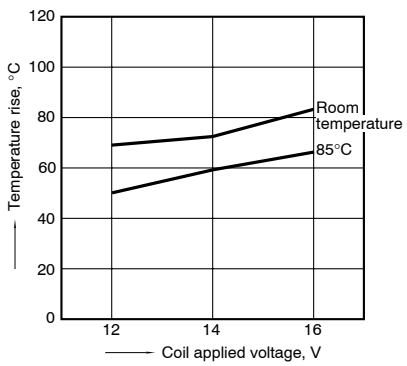
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

Tolerance: ±0.1 ±.004

REFERENCE DATA

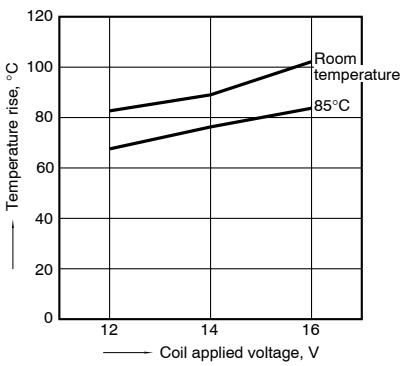
1-(1). Coil temperature rise (10A)

Measured portion: Inside the coil
Contact carrying current, 10A
Ambient temperature: Room temperature, 85°C 185°F

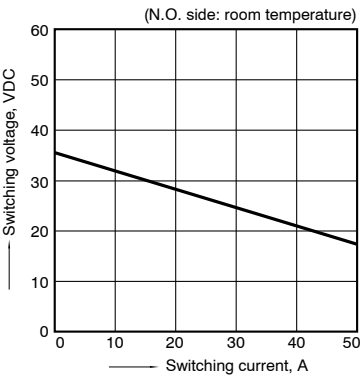


1-(2). Coil temperature rise (15A)

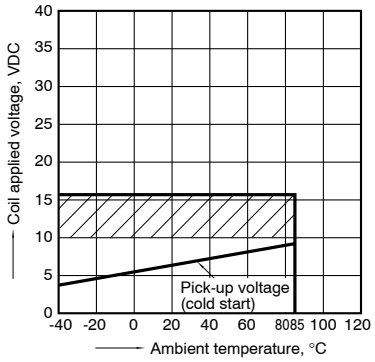
Measured portion: Inside the coil
Contact carrying current, 15A
Ambient temperature: Room temperature, 85°C 185°F



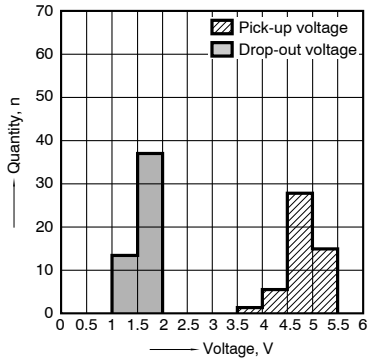
2. Max. switching capability (Resistive load)



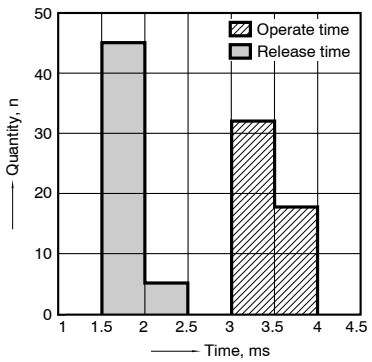
3. Ambient temperature and operating voltage range



4. Distribution of pick-up and drop-out voltage
Sample: JSM1-12V-5, 50pcs.

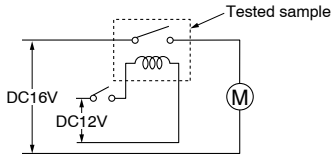


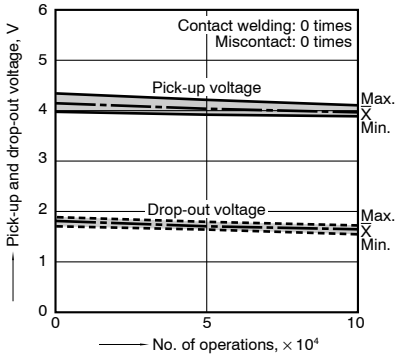
5. Distribution of operate and release time
Sample: JSM1-12V-5, 50pcs.
Coil both side without diode



6-(1). Electrical life test (Motor load)
Sample: JSM1-12V-5, 3pcs.
Load: 50A (Inrush), 10A 16V DC (Steady)
Switching frequency: (ON : OFF = 1s : 9s)

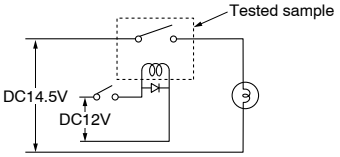
Circuit :

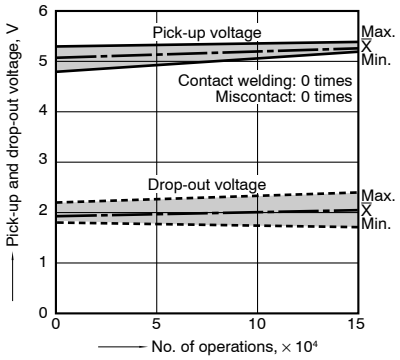




6-(2). Electrical life test (Lamp load)
Sample: JSM1-12V-5, 4pcs.
Load: 55.2A (Inrush), 9.6A 14.5V DC (Steady)
Switching frequency: (ON : OFF = 1s : 3s)

Circuit :





For Cautions for Use, see Relay Technical Information (page 392).

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COMPACT ECONOMICAL 30 AMP. RELAY

JT-N RELAYS

PCB type

TMP type

FEATURES

- **High switching capacity — 30 A for 1 Form A**
- **2 contact arrangements — 1 Form A or 1 Form C**
- **"TMP" types available**
- **UL/CSA recognized**
- **Class F types standard**

SPECIFICATIONS

Contacts

		PCB & TMP type	
Arrangement		1 Form A	1 Form C
Initial contact resistance, max. (By voltage drop method, 6 V DC 1 A)		50 mΩ	
Contact material		Silver alloy	
Rating	Max. switching power	8310 VA	N.C.: 2770 VA N.O.: 5540 VA
	Max. switching voltage	277 V AC	
	Max. switching current	30 A	N.C.: 10 A N.O.: 20 A
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life	Mechanical	Min. 1×10^7	
	Electrical (Resistive load)	20 A 277 V AC Min. 1×10^5*	N.O.: 20 A 277 V AC Min. 1×10^5* N.C.: 10 A 277 V AC Min. 1×10^5*

* The life is for open venting-hole condition.

Coil at 20°C 68°F

Nominal operating power	Approx. 800 mW

Characteristics

		PCB & TMP type
Initial insulation resistance*1		Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between contacts	1,200 Vrms
	Between contacts and coil	2,500 Vrms
Operate time*3 (at nominal voltage)		Max. 20 ms
Release time (without diode)*3 (at nominal voltage)		Max. 10 ms
Shock resistance	Functional*4	Min. 98 m/s² {10 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	Max. 88.2 m/s² {9 G}, 10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	Max. 117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–55°C to +85°C –67°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		PCB type: Approx. 25 g (.88 oz) TMP type: Approx. 30 g (1.06 oz)

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Intial breakdown voltage" section
*2 Detection current: 10 mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 410).

TYPICAL APPLICATIONS

- Automotive
- Air conditioner
- Heating & ventilation
- Home appliance

ORDERING INFORMATION

JT-N Relays (PCB and TMP type)

JTN | 1a | S | TMP | F | DC12V

Contact arrangement	Protective construction	Mounting classification	Coil insulation	Coil voltage
1a: 1 Form A 1: 1 Form C	S: Sealed type	PA: PCB type TMP: TMP type	F: Class F	DC 5, 6, 9, 12, 15, 18, 24 V

Notes: 1. UL/CSA approved type is standard.
2. Standard packing: PCB type: Carton: 50 pcs. Case: 500 pcs.
TMP type: Carton: 50 pcs. Case: 300 pcs.

COIL DATA (at 20°C 68°F)

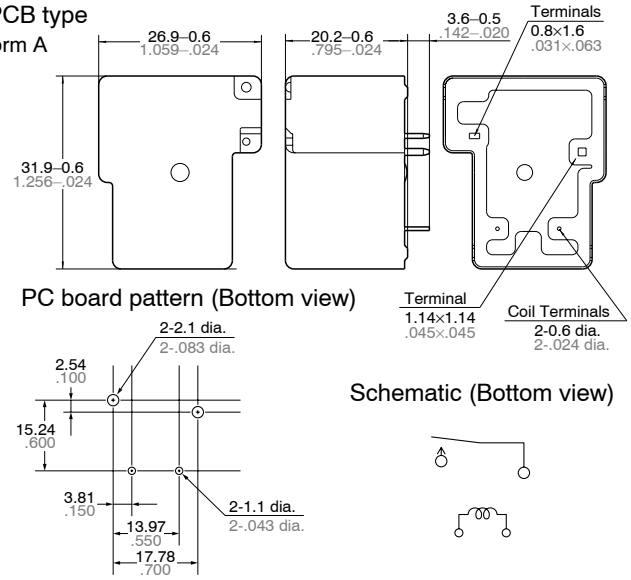
Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
			PCB & TMP	PCB & TMP	
5	3.75	0.5	31	800	6
6	4.5	0.6	45	800	7.2
9	6.75	0.9	101	800	10.8
12	9.0	1.2	180	800	14.4
15	11.25	1.5	281	800	18
18	13.5	1.8	405	800	21.6
24	18.0	2.4	720	800	28.8

DIMENSIONS

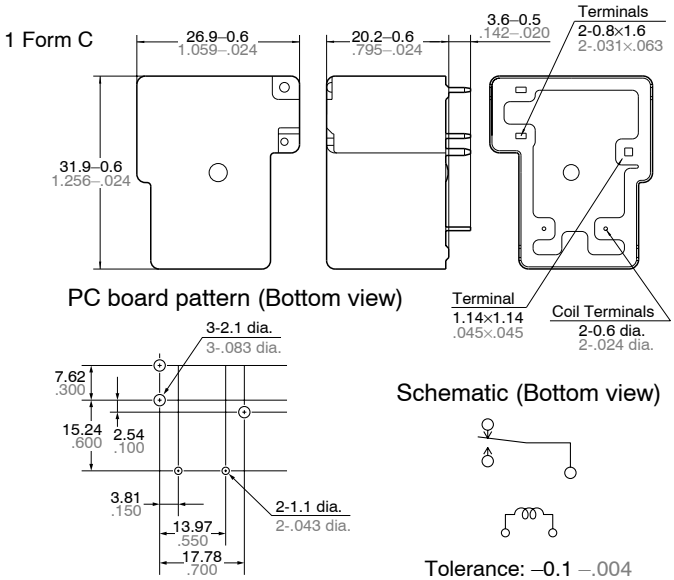
mm inch

1. PCB type

1 Form A



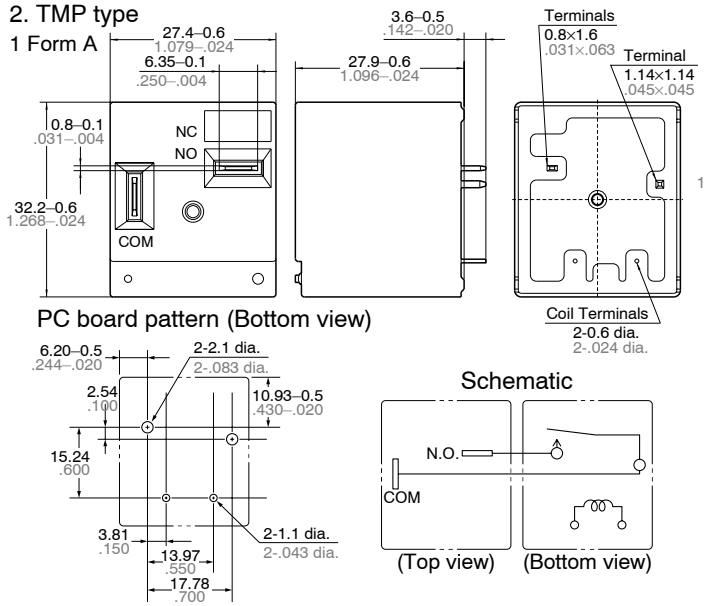
1 Form C



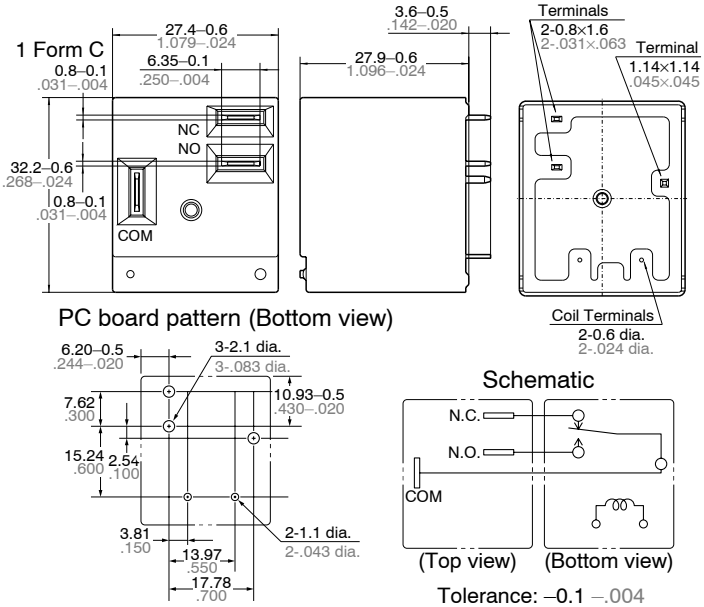
Tolerance: –0.1 –.004

2. TMP type

1 Form A



1 Form C

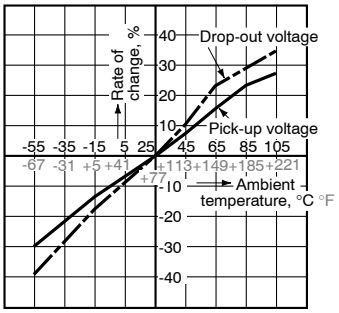


Tolerance: –0.1 –.004

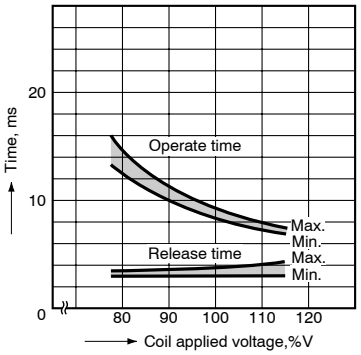
Automotive

REFERENCE DATA

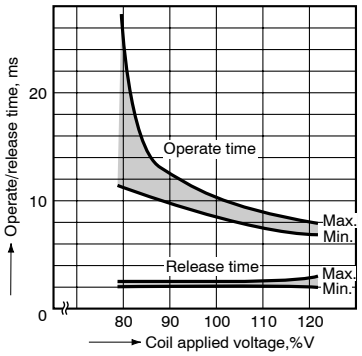
1. Change of rate of pick-up and drop-out voltage (at 20°C 68°F)
Sample: JTN1S-TMP-F-DC24V (6 pcs.)



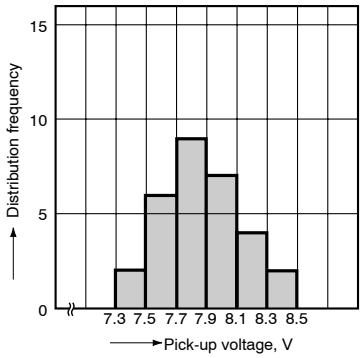
2. Operate & release time (at 20°C 68°F)
Sample: JTN1S-TMP-F-DC24V (6 pcs.)



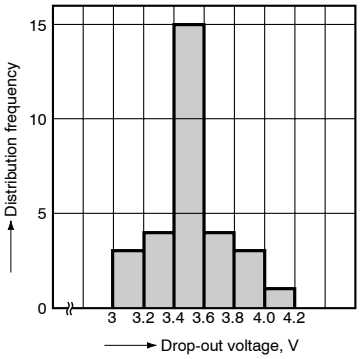
3. Operate & release time (at 20°C 68°F)
Sample: JTN1aS-PA-F-DC24V (6 pcs.)



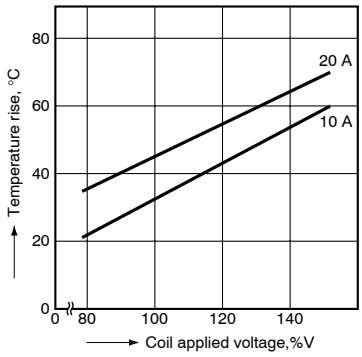
4. Distribution frequency of pick-up voltage (at 20°C 68°F)
Sample: JTN1S-TMP-F-DC12V (30 pcs.)



5. Distribution frequency of drop-out voltage (at 20°C 68°F)
Sample: JTN1S-TMP-F-DC12V (30 pcs.)

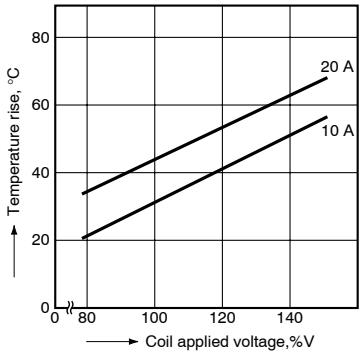


6.-(1) Coil temperature rise (TMP type)*
Ambient temperature: 20°C 68°F
Sample: JTN1aS-TMP-F-DC12V (6 pcs.)

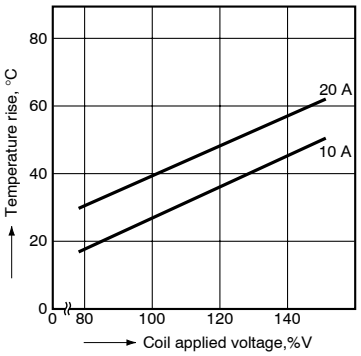


* Coil temperature rise of sealed types are same as data of the dust cover type.

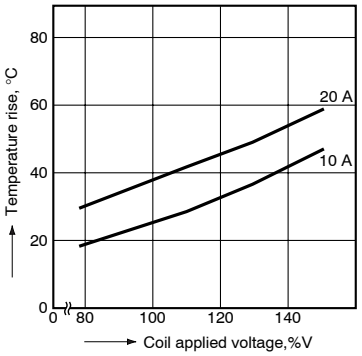
Ambient temperature: 55°C 131°F
Sample: JTN1aS-TMP-F-DC12V (6 pcs.)



Ambient temperature: 85°C 185°F
Sample: JTN1aS-TMP-F-DC12V (6 pcs.)



Ambient temperature: 105°C 221°F
Sample: JTN1aS-TMP-F-DC12V (6 pcs.)



For Cautions for Use, see Relay Technical Information (page 392).

Sicherheitsrelais

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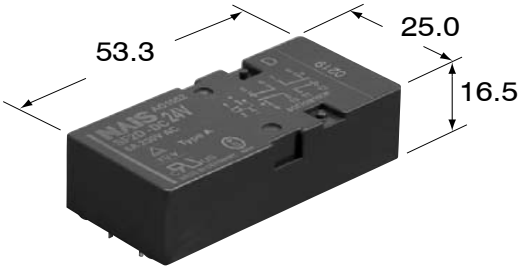
POLARIZED, MONOSTABLE SAFETY RELAY WITH FORCIBLY GUIDED DOUBLE CONTACTS

SF2D RELAY



Tolerance ± 0.3mm
Weight approx. 47g

Features

- **Relay complies with EN 50205, Type A**
- **Overvoltage category as per IEC 60664-1 III / 4kV**
- **Rated voltage as per IEC 60664-1 basic insulation**

	Polution degree		
	2 inside	2 outside	3 inside
Coil-contact	400V	400V	250V
Contact-contact	400V	400V	400V

SPECIFICATIONS

Contact

Contact configuration (a = normally open / NO, b = normally closed / NC)	2a2b
Contact material	$AgSnO_2$, with Au flash
Contact resistance (initial at 6V DC, 1A)	30mΩ
Making and breaking capacities (breathing hole open)*1	6A 250V / 3A 24V
Max. switching voltage	400V
Min. switching voltage / min. switching current	10V / 10mA
Pick-up / drop-out / bounce time (approx. values at $U_{nominal}$)	17.5 / 7 / 2ms
Mechanical life	10^7ops

Coil

Operate / release voltage (% of $U_{nominal}$ at 20°C)	75% / 10%
Pick-up/nominal power consumption at 20°C	280 / 500mW

Remarks

*1 According to EN 60947-5-1: 1997, table 4 AC15 / DC13
*2 Contact interruption <10μs
*3 Breathing hole open

Characteristics

Max. switching frequency (without load)	10Hz
Permissible ambient temperature at nominal power consumption	-40°C to +70°C
Upper temperature limit	105°C
Test voltage: open contact / contact-contact / contact-coil	2500 / 2500 / 2500V_{rms}
Insulation resistance at 500V DC (initial)	10^9Ω
Shock resistance (11ms) NO/NC*2	30G
Vibration resistance 10 – 200 Hz (10 – 55 Hz, amplitude 2 mm)*2	10G
Degree of protection	IP67 / IP30*3

Important: Relay characteristics may be influenced by:

- strong external magnetic fields
- magnetic conductive materials near the relay
- narrow top-to-top mounting (printed surface to printed surface)

Note:

Suitable for most common washing methods except ultrasonic cleaning.

ORDERING INFORMATION

Ex. SF2D — DC12 V

Coil voltage (DC)
5, 9, 12, 18, 21 24, 36, 48, 60

COIL DATA

Part number	Coil nominal voltage V DC	Operate voltage V DC	Release voltage V DC	Coil resistance Ω (±10%, 20°C)	Coil inductance (mH)
SF2D-DC5V	5	3.75	0.5	50	47
SF2D-DC9V	9	6.75	0.9	162	145
SF2D-DC12V	12	9.00	1.2	288	252
SF2D-DC18V	18	13.50	1.8	648	551
SF2D-DC21V	21	15.75	2.1	882	742
SF2D-DC24V	24	18.00	2.4	1152	959
SF2D-DC36V	36	27.00	3.6	2592	2097
SF2D-DC48V	48	36.00	4.8	4608	3654
SF2D-DC60V	60	45.00	6.0	7200	5612

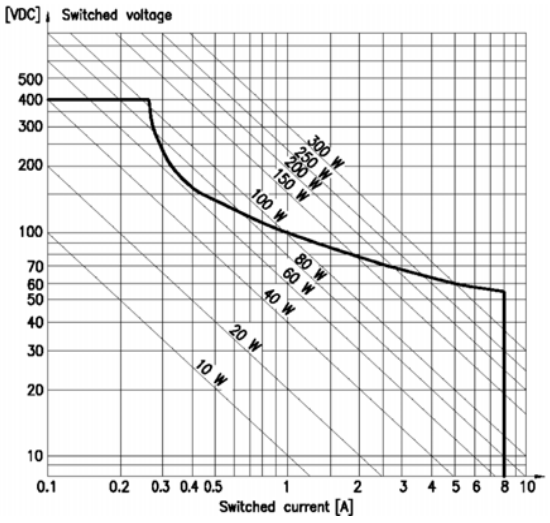
ELECTRICAL LIFE

Voltage	Current	Load type	Frequency	Duty cycle	No. of contacts	No. of ops.
230V AC	8A	AC 1	0.25Hz	25%	2*2	85,000*5
250V AC	6A	AC 1	0.33Hz	50%	4*2	100,000*5
230V AC	6A	AC 1	0.33Hz	10%	2*3	200,000*4,*5
230V AC	30 / 3A	AC 15*1	0.33Hz	10%	1*3	150,000*4,*5
24V DC	8A	DC 1	0.33Hz	10%	2*3	200,000*4,*5
24V DC	3A	DC 13*1	0.33Hz	10%	1*3	50,000*4,*5
24V DC	3A	L/R = 40ms	0.33Hz	10%	1*3	100,000*4,*5

*1 EN 60947-5-1: 1997; table C.1
*2 Breathing hole closed
*3 Breathing hole open
*4 Ambient temperature +70°C
*5 Dielectric strength according to EN61810-1:2004.

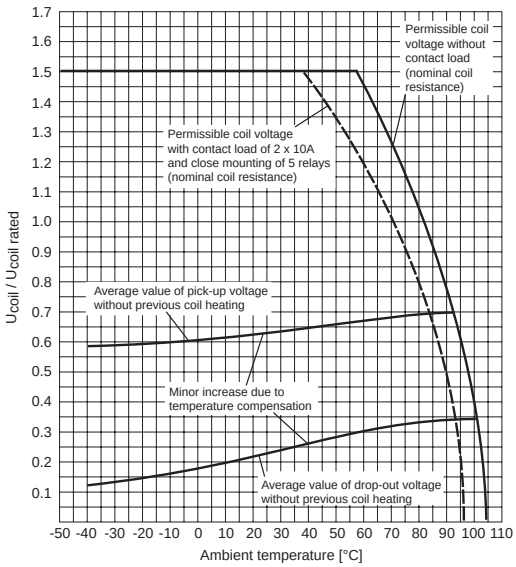
REFERENCE DATA

Load limit curve



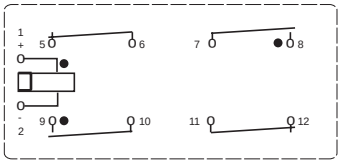
Loads in the range under the curve can be switched safely. The arc will extinguish before the opposite contact makes.

Coil voltage characteristics



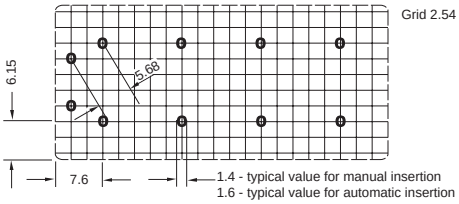
Permissable coil voltages and pick-up and drop-out characteristics at various ambient temperatures.

Connection diagram and pcb bore hole data

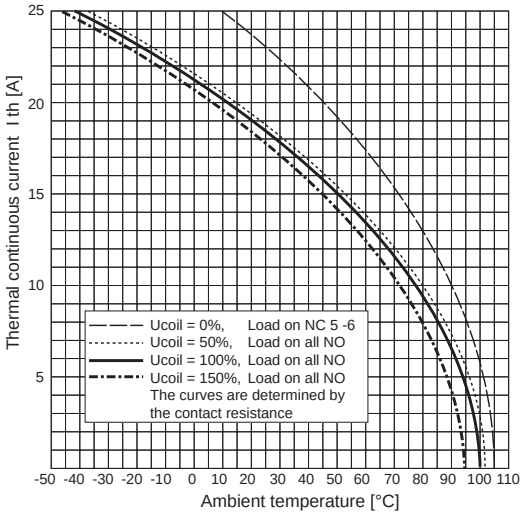


Bottom view

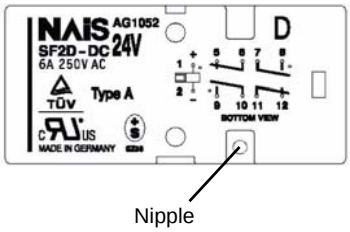
The contacts are shown in the deenergized condition.



Contact current characteristics



APPLICATION NOTES



Nipple

If required a breathing hole can be made in the cover by removing the nipple.
However be aware that the degree of protection will reduce from IP67 to IP30!

For Cautions for Use, see Relay Technical Information (page 392).

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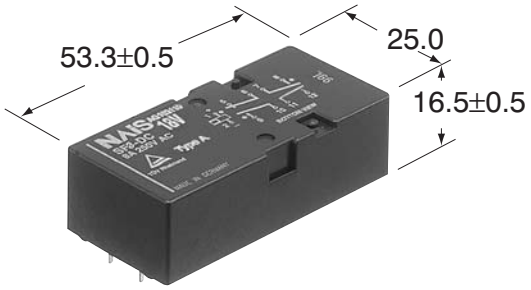
POLARIZED, MONOSTABLE SAFETY RELAY WITH FORCIBLY GUIDED CONTACTS

SF3 RELAY



Tolerance ± 0.3mm
Weight approx. 47g

Features

- **Relay complies with EN 50205, Type A**
- **Overvoltage category as per IEC 60664-1 III / 4kV**
- **Rated voltage as per IEC 60664-1 basic insulation**

	Polution degree		
	2 inside	2 outside	3 outside
Coil-contact	400V	400V	250V
Contact-contact	400V	400V	400V

SPECIFICATIONS

Contact

Contact configuration (a = normally open / NO, b = normally closed / NC)	3a1b
Contact material	$AgSnO_2$, with Au flash
Contact resistance (initial at 6V DC, 1A)	≤30mΩ
Making and breaking capacities (breathing hole open)*1, *3	6A 250V / 3A 24V
Max. switching voltage	400V
Min. switching voltage / min. switching current	10V / 10mA
Pick-up / drop-out / bounce time (approx. values at $U_{nominal}$)	16.5 / 7 / 3ms
Mechanical life	10^7ops

Coil

Operate / release voltage (% of $U_{nominal}$ at 20°C)	75% / 10%
Pick-up/nominal power consumption at 20°C	280 / 500mW

Remarks

*1 According to EN 60947-5-1: 1997, table 4 AC15 / DC13
*2 Contact interruption <10µs
*3 Breathing hole open

Characteristics

Max. switching frequency (without load)	10Hz
Permissible ambient temperature at nominal power consumption	-40°C to +70°C
Upper temperature limit	105°C
Test voltage: open contact / contact-contact / contact-coil	2500 / 2500 / $2500V_{rms}$
Insulation resistance at 500V DC (initial)	$10^9\Omega$
Shock resistance (11ms) NO/NC*2	30G
Vibration resistance 10 – 200 Hz (10 – 55 Hz, amplitude 2 mm)*2	10G
Solder bath temperature, maximum duration	260°C, 5s
Degree of protection	IP67 / IP30*3

Important: Relay characteristics may be influenced by:

- strong external magnetic fields
- magnetic conductive materials near the relay
- narrow top-to-top mounting (printed surface to printed surface)

Note:

Suitable for most common washing methods except ultrasonic cleaning.

Safety

ORDERING INFORMATION

Ex. SF3 — DC12 V

Coil voltage (DC)
5, 9, 12, 18, 21 24, 36, 48, 60

COIL DATA

Part number	Coil nominal voltage V DC	Operate voltage V DC	Release voltage V DC	Coil resistance Ω (±10%, 20°C)	Coil inductance (mH)
SF3-5V	5	3.75	0.5	50	47
SF3-9V	9	6.75	0.9	162	145
SF3-12V	12	9.00	1.2	288	252
SF3-18V	18	13.50	1.8	648	551
SF3-21V	21	15.75	2.1	882	742
SF3-24V	24	18.00	2.4	1152	959
SF3-36V	36	27.00	3.6	2592	2097
SF3-48V	48	36.00	4.8	4608	3654
SF3-60V	60	45.00	6.0	7200	5612

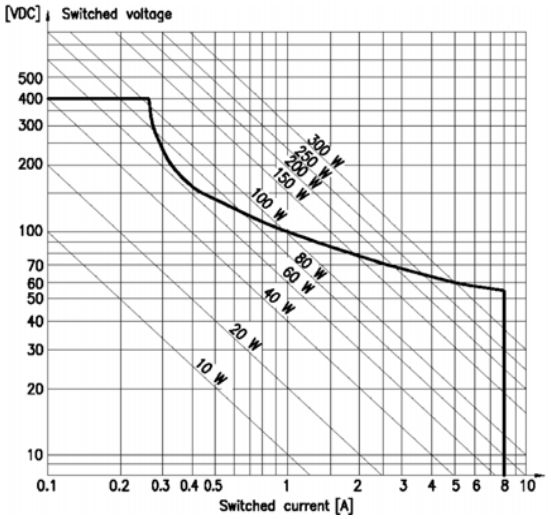
ELECTRICAL LIFE

Voltage	Current	Load type	Frequency	Duty cycle	No. of contacts	No. of ops.
250V AC	8A	cos φ = 1	0.33Hz	50%	2*2,*6	30,000*4,*5
250V AC	6A	cos φ = 1	0.33Hz	50%	4*2	100,000*4,*5
250V AC	2A	cos φ = 1	0.33Hz	50%	4*2	500,000*4,*5
220V AC	30 / 3A	AC 15*1	0.10Hz	10%	1*3	200,000*4,*5
220V AC	5.10A	cos φ = 0.60	0.20Hz	10%	1*3	100,000*4,*5
220V AC	4.43A	cos φ = 0.35	0.20Hz	50%	1*3	100,000*4,*5
220V AC	1.45A	cos φ = 0.35	0.20Hz	50%	1*3	300,000*4,*5
24V DC	6A	resistive	0.33Hz	50%	4*2	400,000*4,*5
24V DC	2A	resistive	0.50Hz	50%	4*2	2,000,000*4,*5
24V DC	3A	DC 13*1	0.33Hz	10%	1*3	50,000*4,*5
24V DC	3A	L/R = 40ms	0.33Hz	10%	1*3	100,000*4,*5

*1 EN 60947-5-1: 1997; table C.1
*2 Breathing hole closed
*3 Breathing hole open
*4 Ambient temperature +70°C
*5 Dielectric strength according to EN61810-1:2004.
*6 Normally open contacts

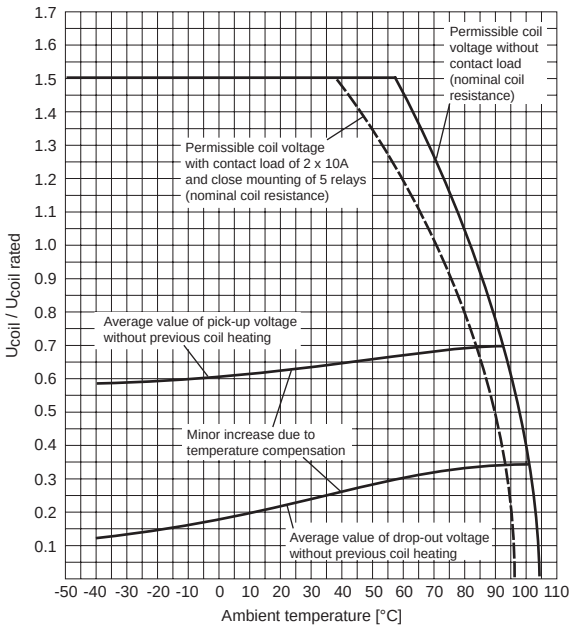
REFERENCE DATA

Load limit curve



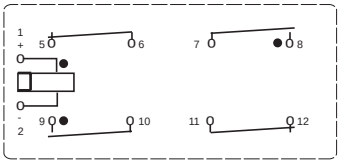
Loads in the range under the curve can be switched safely. The arc will extinguish before the opposite contact makes.

Coil voltage characteristics

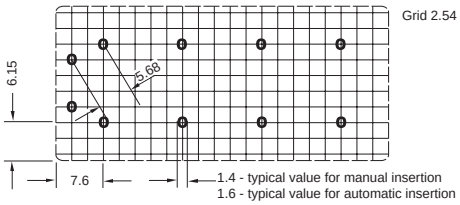


Permissable coil voltages and pick-up and drop-out characteristics at various ambient temperatures.

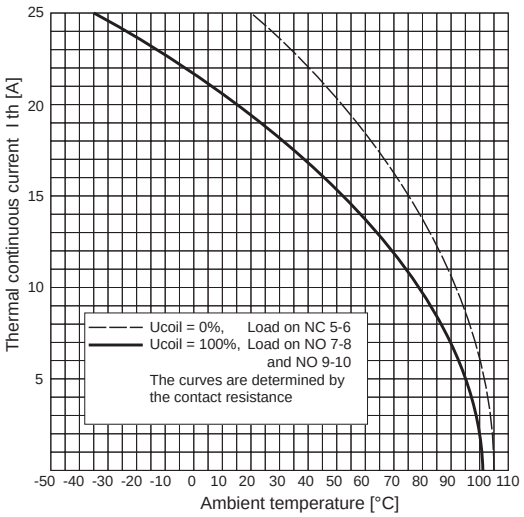
Connection diagram and pcb bore hole data



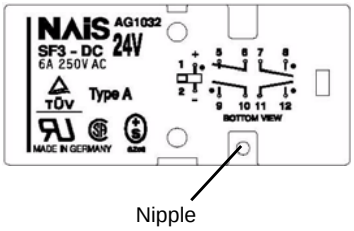
Bottom view
The contacts are shown in the deenergized condition.



Contact current characteristics



APPLICATION NOTES



If required a breathing hole can be made in the cover by removing the nipple.
However be aware that the degree of protection will reduce from IP67 to IP30!

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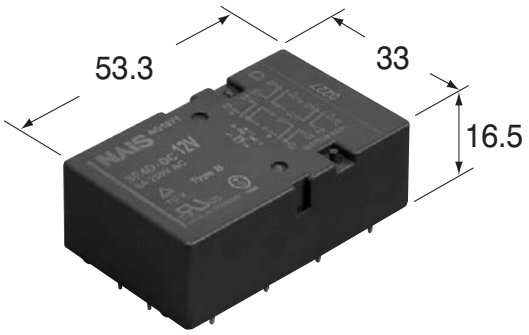
POLARIZED, MONOSTABLE SAFETY RELAY WITH FORCIBLY GUIDED CONTACTS

SF4D RELAY



Tolerance± 0.3mm
Weight approx. 47g

Features

- **Relay complies with EN 50205, Type B**
- **Overvoltage category as per IEC 60664-1 III / 4kV**
- **Rated voltage as per IEC 60664-1 basic insulation**

		Polution degree		
		2 inside	2 outside	3 inside
Coil-contact		400V	400V	250V
Contact-contact	forcibly linked pair only	250V	250V	250V
	all other contacts	400V	400V	400V

SPECIFICATIONS

Contact

Contact configuration (a = normally open / NO, b = normally closed / NC)	4a4b
Contact material	$AgSnO_2$, with Au flash
Contact resistance (initial at 6V DC, 1A)	≤30mΩ
Making and breaking capacities (breathing hole open)*1	6A 250V / 3A 24V
Max. switching voltage	400V
Min. switching voltage / min. switching current	10V / 10mA
Pick-up / drop-out / bounce time (approx. values at $U_{nominal}$)	18.5 / 7.5 / 3ms
Mechanical life	10^7ops

Coil

Operate / release voltage (% of $U_{nominal}$ at 20°C)	75% / 15%
Pick-up/nominal power consumption at 20°C	280 / 500mW

Remarks

*1 According to EN 60947-5-1: 1997, table 4 AC15 / DC13
*2 Contact interruption <10µs
*3 Breathing hole open

Characteristics

Max. switching frequency (without load)	10Hz
Permissible ambient temperature at nominal power consumption	-40°C to +70°C
Upper temperature limit	105°C
Test voltage: open contact / contact-contact / contact-coil	2500 / 2500 / $2500V_{rms}$
Insulation resistance at 500V DC (initial)	$10^9\Omega$
Shock resistance (11ms) NO/NC*2	30G
Vibration resistance 10 – 200 Hz (10 – 55 Hz, amplitude 2 mm)*2	10G
Degree of protection	IP67 / IP30*3

Important: Relay characteristics may be influenced by:

- strong external magnetic fields
- magnetic conductive materials near the relay
- narrow top-to-top mounting (printed surface to printed surface)

Note:

Suitable for most common washing methods except ultrasonic cleaning.

ORDERING INFORMATION

Ex. SF4D — DC12 V

Coil voltage (DC)
5, 9, 12, 18, 21 24, 36, 48, 60

COIL DATA

Part number	Coil nominal voltage V DC	Operate voltage V DC	Release voltage V DC	Coil resistance Ω (±10%, 20°C)	Coil inductance (mH)
SF4D-DC5V	5	3.75	0.75	50	47
SF4D-DC9V	9	6.75	1.35	162	145
SF4D-DC12V	12	9.00	1.80	288	252
SF4D-DC18V	18	13.50	2.70	648	551
SF4D-DC21V	21	15.75	3.15	882	742
SF4D-DC24V	24	18.00	3.60	1152	959
SF4D-DC36V	36	27.00	5.40	2592	2097
SF4D-DC48V	48	36.00	7.20	4608	3654
SF4D-DC60V	60	45.00	9.00	7200	5612

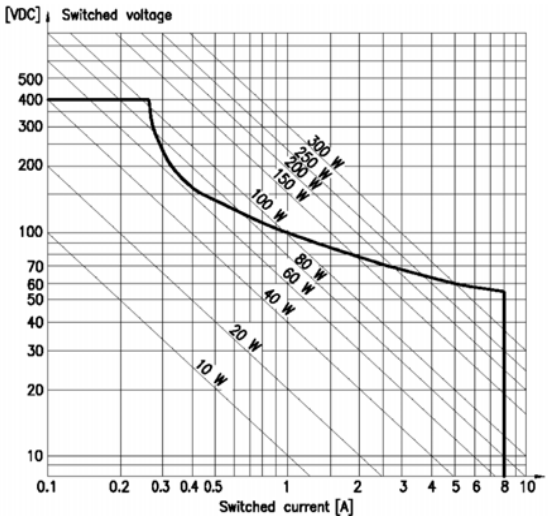
ELECTRICAL LIFE

Voltage	Current	Load type	Frequency	Duty cycle	No. of contacts	No. of ops.
230V AC	8A	AC 1	0.25Hz	25%	4*2	85,000*5
250V AC	6A	AC 1	0.33Hz	50%	4*2 / 8*3	100,000*5
230V AC	6A	AC 1	0.33Hz	10%	2*3	200,000*4,*5
230V AC	30 / 3A	AC 15*1	0.33Hz	10%	1*3	200,000*4,*5
24V DC	8A	DC 1	0.33Hz	10%	2*3	200,000*4,*5
24V DC	3A	DC 13*1	0.33Hz	10%	1*3	50,000*4,*5
24V DC	3A	L/R = 40ms	0.33Hz	10%	1*3	100,000*4,*5

*1 EN 60947-5-1: 1997; table C.1
*2 Breathing hole closed
*3 Breathing hole open
*4 Ambient temperature +70°C
*5 Dielectric strength according to EN61810-1:2004.

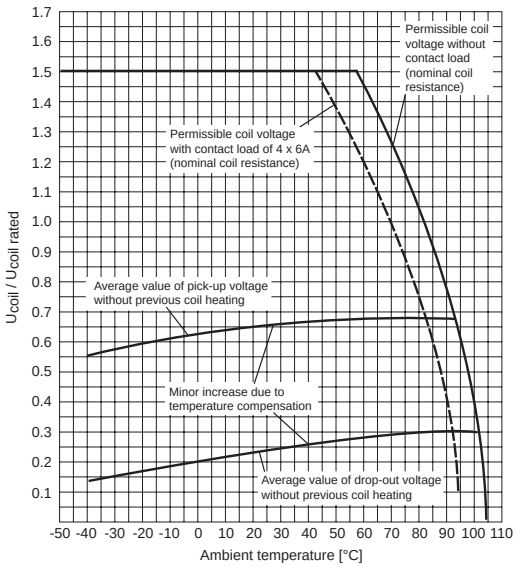
REFERENCE DATA

Load limit curve



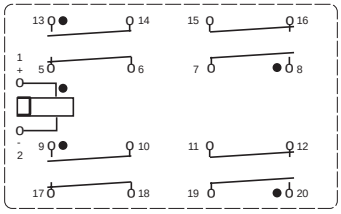
Loads in the range under the curve can be switched safely. The arc will extinguish before the opposite contact makes.

Coil voltage characteristics



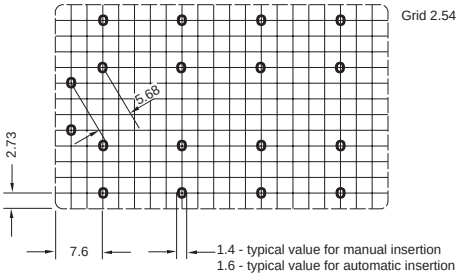
Permissable coil voltages and pick-up and drop-out characteristics at various ambient temperatures.

Connection diagram and pcb bore hole data

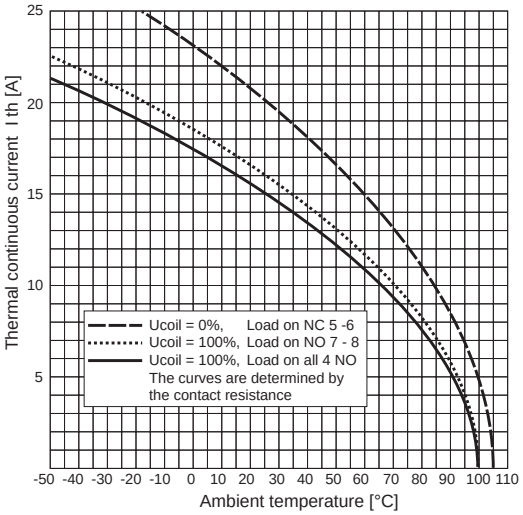


Bottom view

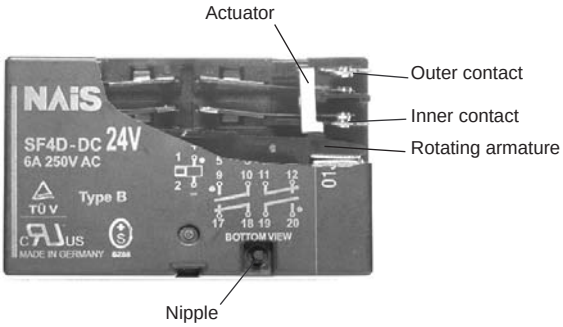
The contacts are shown in the deenergized condition.



Contact current characteristics



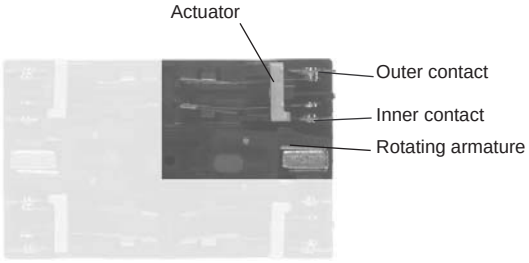
APPLICATION NOTES



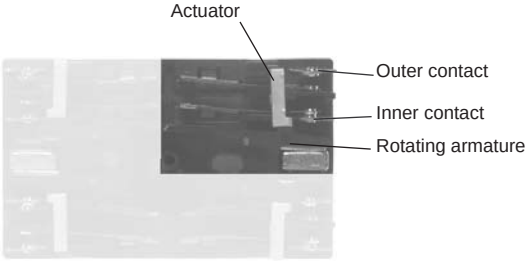
If required a breathing hole can be made in the cover by removing the nipple.
However be aware that the degree of protection will reduce from IP67 to IP30!

Operation of forcibly guided contacts, Type B

If an outer contact should weld, then the forced operated inner contacts driven by the actuator remain open.
The rotating armature remains free to move.
The unaffected contact pairs can operate normally, i.e. their function to make or break remains unaffected.



If an inner contact should weld, then the movement of the rotating armature is blocked via the actuator.
Open contacts of all four contact pairs remain open.
This arrangement corresponds to a conventional forcibly guided contact operation.



For Cautions for Use, see Relay Technical Information (page 392).

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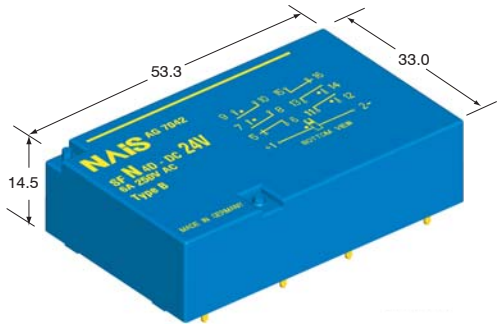
LOW PROFILE SAFETY RELAY WITH FORCIBLY GUIDED CONTACTS

SFN4D RELAY



Tolerance ±0.3 mm
Weight approx. 42 g

Features

- **Relay complies with EN 50205, Type B**
- **Polarized magnet system with snap action function**
- **Extremely small total power loss**
  - Nominal coil power consumption of 390mW
  - Double contacts with low contact resistance,
  e.g. [(6A)^2 × 2.5mΩ] × 4NO = 360mW
- **Relay height, 14.5mm**
- **Reinforced insulation according to EN 50178**
  - between coil-contacts and contacts-contacts
  - rated voltage of the circuits 230 / 400V or 277 / 480Vrms
  - rated impulse voltage of 6kV → clearance ≥ 5.5 mm
  - pollution degree 2 → creepage distance ≥ 5.5mm

SPECIFICATIONS

Contact

Contact configuration (a = normally open / NO, b = normally closed / NC)	4a2b
Contact material	$AgSnO_2$, with Au flash
Contact resistance (initial at 6V DC, 1A) Typical contact resistance	≤30mΩ 2.5mΩ
Max. switching capacity	6A/8A*1 250V AC
Max. switching voltage	500V AC / DC
Min. switching voltage / min. switching current	Reference 10V / 10mA
Pick-up / drop-out / bounce time (approx. values at $U_{nominal}$)	23 / 6*2 / 2ms
Mechanical life	10^7ops

Coil

Operate / release and holding at 20°C (% of $U_{nominal}$)*3	75% / 25% min. 48%
Pick-up/nominal power consumption	219-236 / 390-420mW

Characteristics

Max. switching frequency (without load)	5Hz
Permissible ambient temperature at nominal power consumption*3	-25°C to 92°C
Upper temperature limit	105°C
Test voltage: open contact / contact-contact / contact-coil	2500 / 4000 / 5000V_{rms}
Insulation resistance at 500V DC (initial)	10^9Ω
Shock resistance (11ms) NO/NC*4	20 / 15G
Vibration resistance 10 – 200 Hz (10 – 55 Hz, amplitude 2 mm)*4	10G
Degree of protection	RT III*5

Important: Relay characteristics may be influenced by:

- strong external magnetic fields
- magnetic conductive materials near the relay
- narrow top-to-top mounting (printed surface to printed surface)

*1 See "ELECTRICAL LIFE (Reference Data)*1" on page 384.
*2 Without diode
*3 See also "REFERENCE DATA" on page 385.
*4 Contact interruption <10µs
*5 According to EN 61810-1: 2004, table 2

ORDERING INFORMATION

Ex. SFN4D — DC12 V

Coil voltage (DC)
5, 9, 12, 16, 18, 21 24, 36, 48, 60

Other coil voltage available upon request

COIL DATA (at 20°C)

Part number	Coil nominal voltage V DC	Operate voltage*1 V DC	Release voltage*1 V DC	Coil resistance Ω (±10%, 20°C)
SFN4D-DC5V	5	3.75	1.25	64.1
SFN4D-DC9V	9	6.75	2.25	207.7
SFN4D-DC12V	12	9.00	3.00	369.2
SFN4D-DC16V	16	12.00	4.00	656.4
SFN4D-DC18V	18	13.5	4.50	830.8
SFN4D-DC21V	21	15.75	5.25	1130.8
SFN4D-DC24V	24	18.00	6.00	1476.9
SFN4D-DC36V	36	27.00	9.00	3085.7
SFN4D-DC48V	48	36.00	12.00	5485.7
SFN4D-DC60V	60	45.00	15.00	8571.4

*1 Operate and release voltage at different temperatures, see “REFERENCE DATA” on page 385, coil voltage characteristics.

SWITCHING CAPABILITY

- Making / breaking capacities according to EN 60947-5-1: 2000, table 4 / 5; AC15: 6A 230V AC / DC13: 6A 24V DC
- Endurance / overload test according to UL 508 16 edition, sections 42 / 43; 6A 250V AC / 6A 24V DC; B300 / R300; File E120782

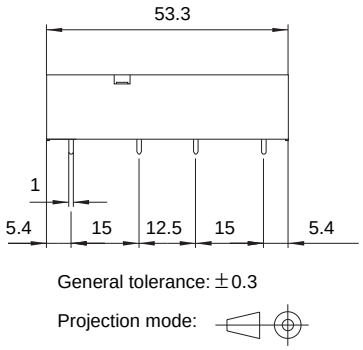
ELECTRICAL LIFE (Reference Data)*1

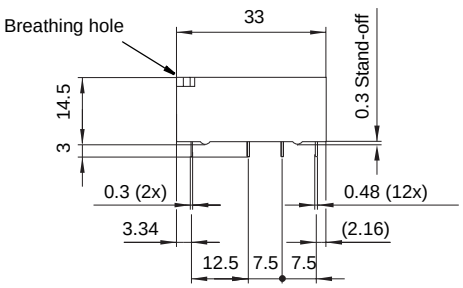
Voltage	Current (A)	Load type	Frequency	Duty cycle	No. of contacts	No. of ops.
230V AC	8	AC 1	0.25Hz	25%	4	85,000
230V AC	6	AC 1	0.25Hz	25%	4	200,000
230V AC	2.5	AC 1	0.25Hz	25%	4	1,500,000
230V AC	60 / 6	AC 15	0.20Hz	20%	3	30,000*2
24V DC	6	DC 1	0.25Hz	25%	4	2,000,000
250V DC	0.27	DC 13	0.10Hz	10%	4	>1,000,000*2

*1 Test conditions: Room temperature, breathing hole closed, dielectric strength according to EN61810-1:2004.
*2 Has to be confirmed
Further data is under preparation.

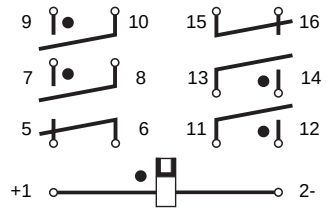
DIMENSIONS

Outer dimensions

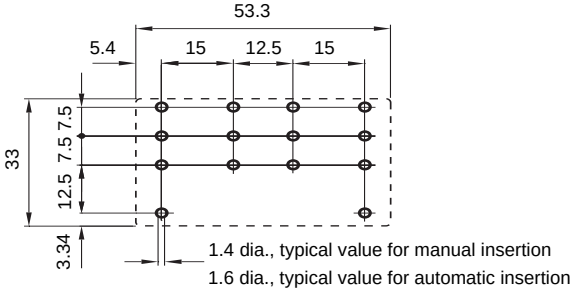




Schematic (Bottom view)

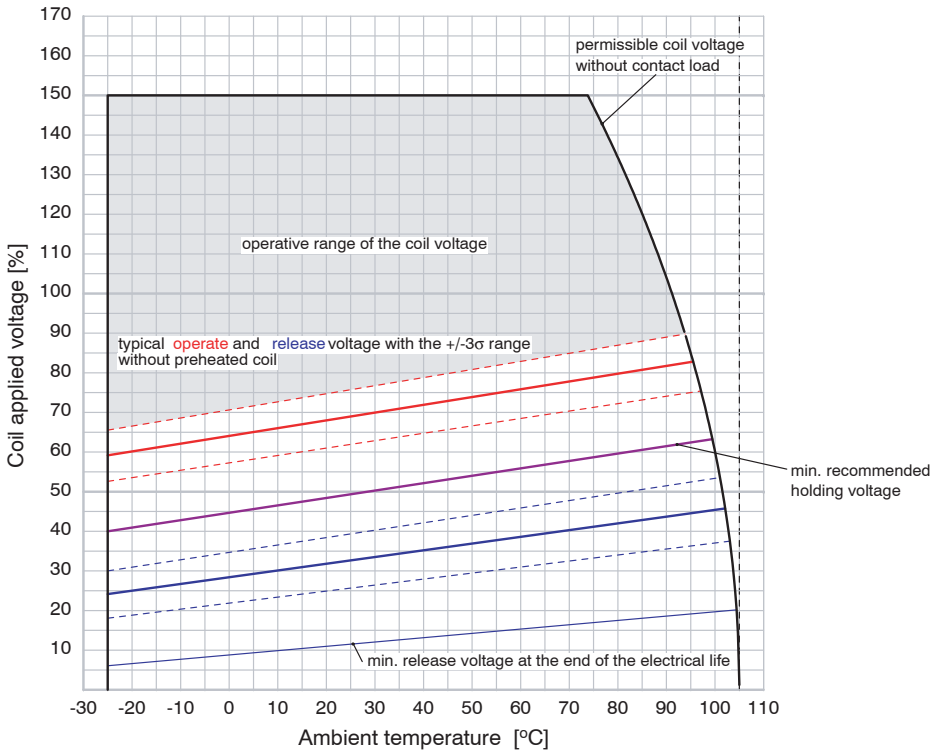


PC board pattern (Bottom view)

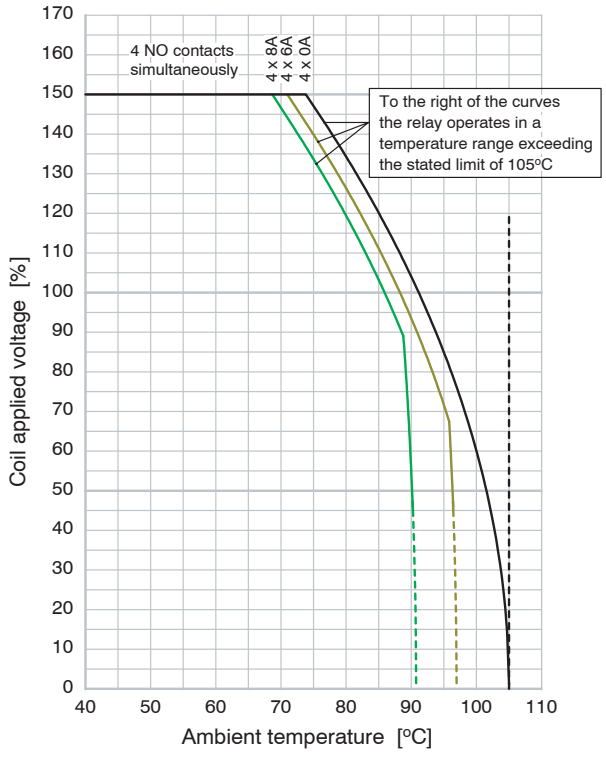


REFERENCE DATA

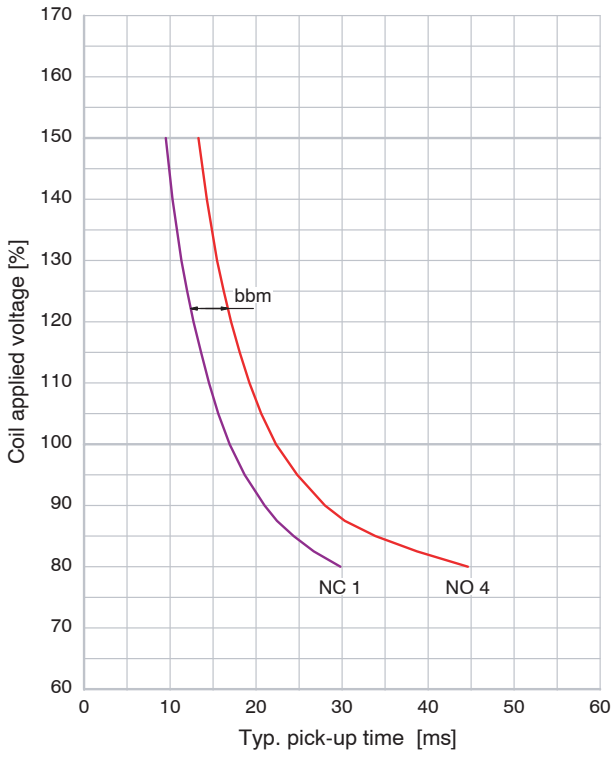
Coil voltage characteristics



Thermic operating range



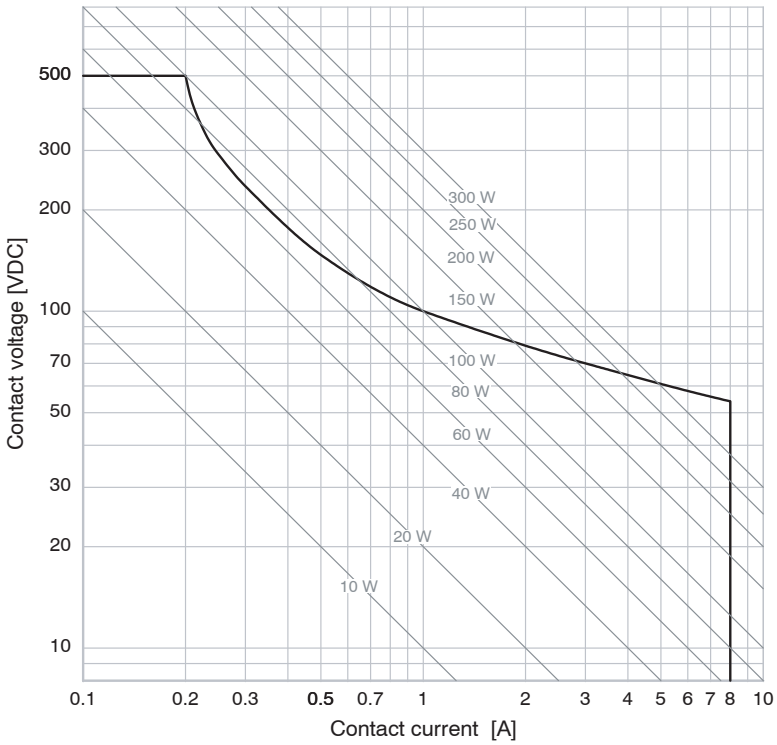
Switching time in relation to coil excitement at 20°C



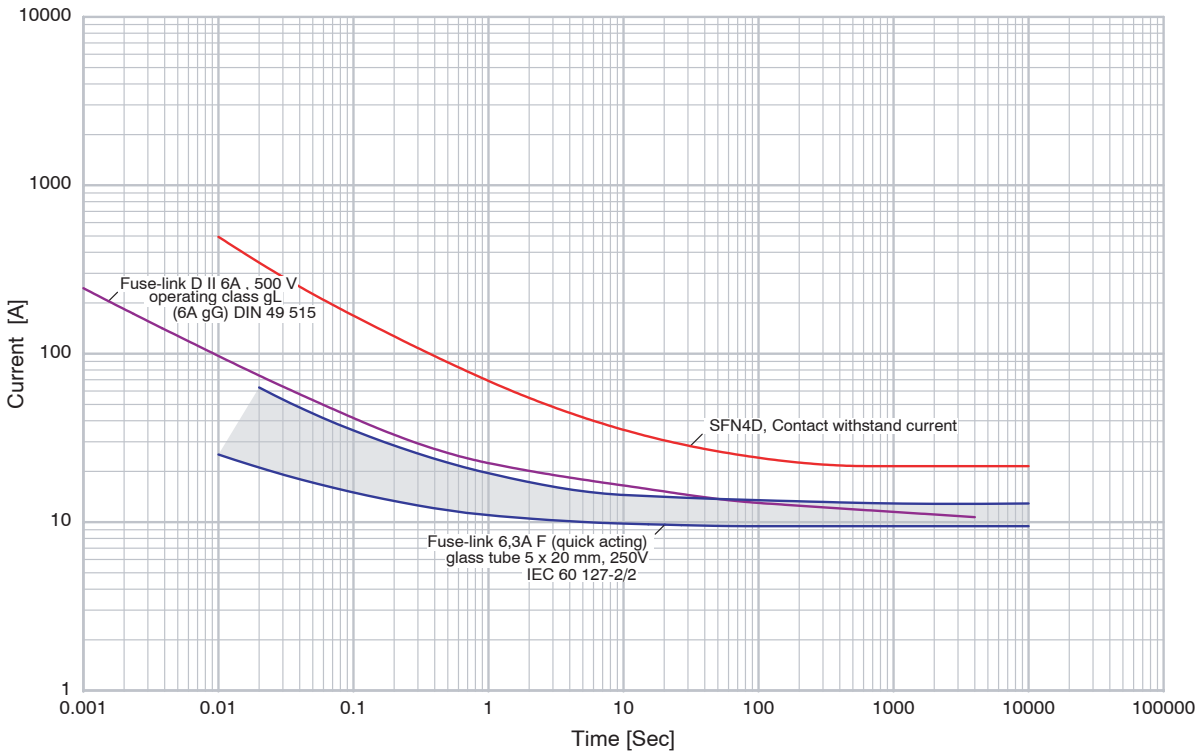
Safety

REFERENCE DATA, continued

Load limit curve

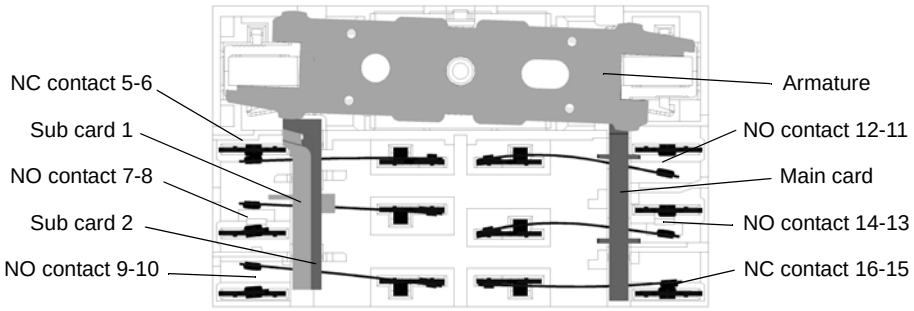


Time / current characteristic

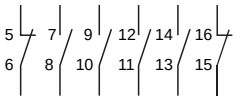


APPLICATION NOTES

The SFN4D Safety Relay



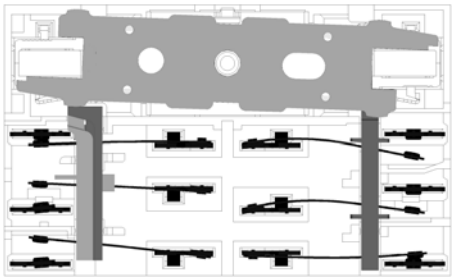
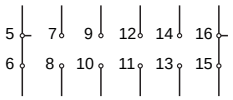
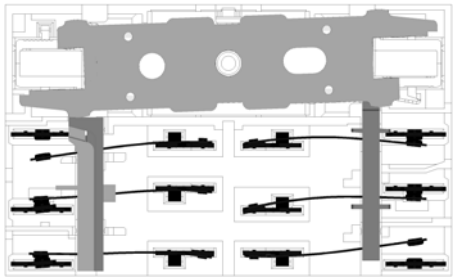
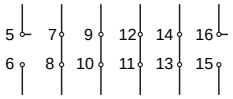
Remark:
Only NC 5-6 monitors all NO contacts!



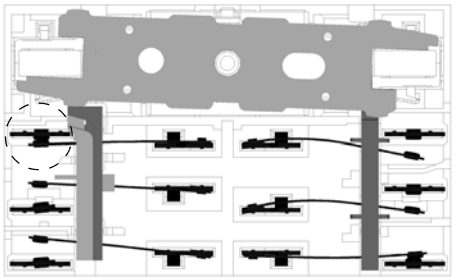
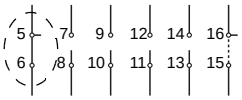
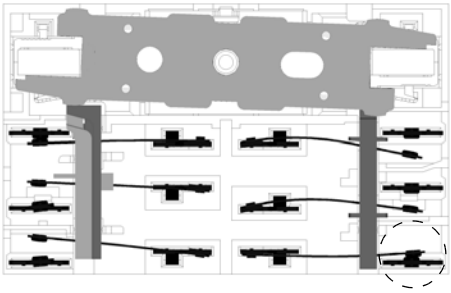
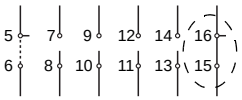
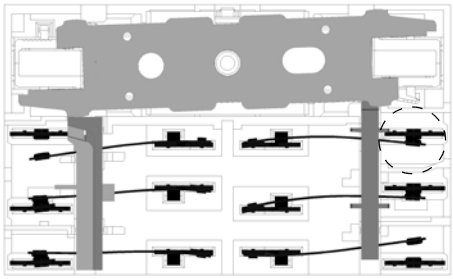
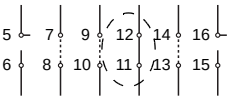
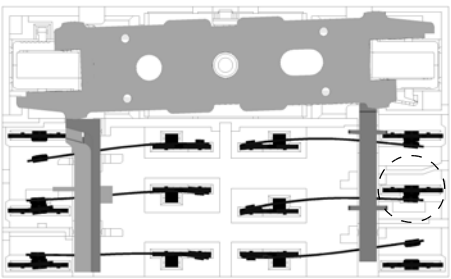
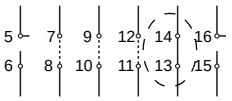
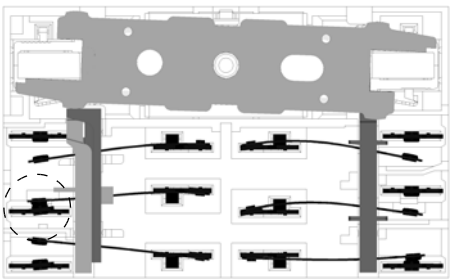
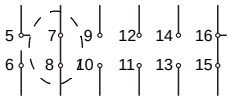
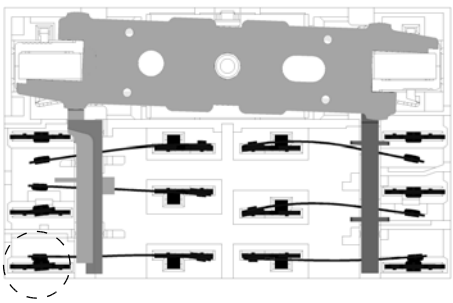
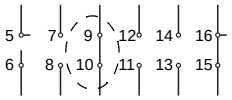
Legend for interpreting contact conditions

Contact	NC (Normally Closed)				NO (Normally Open)			
Condition	Closed	Fully open	Open	Open or closed	Closed	Fully open	Open	Open or closed
Symbol								
Contact gap	0	Maximum (~1.5mm)	>0.5mm (forcibly guided)	Not defined	0	Maximum (~1.5mm)	>0.5mm (forcibly guided)	Not defined

The SFN4D under normal operating conditions

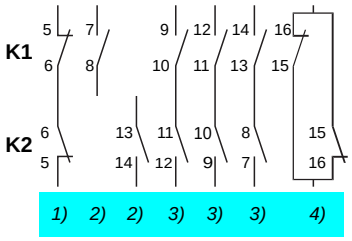
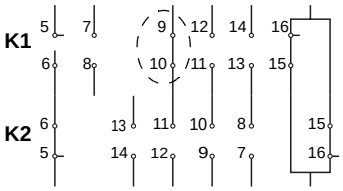
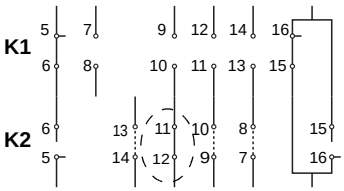
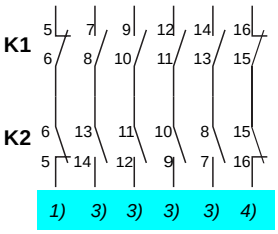
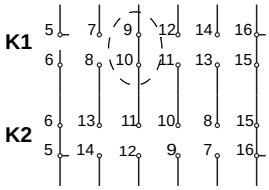
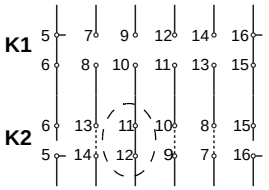
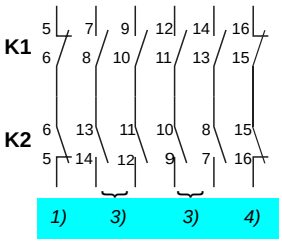
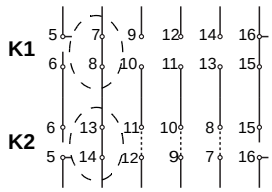
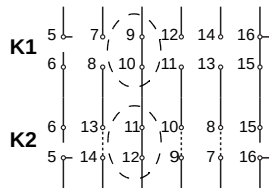
Condition	Illustration of Relay State	Condition of Contacts
- Coil deenergized. - Armature in deenergized position. - NC contacts closed. - NO contacts have a contact gap of approx. 1.5mm.		
- Coil energized. - Armature in energized position. - NO contacts closed. - NC contacts have a contact gap of approx. 1.5mm.		

The SFN4D safety relay with welded contacts

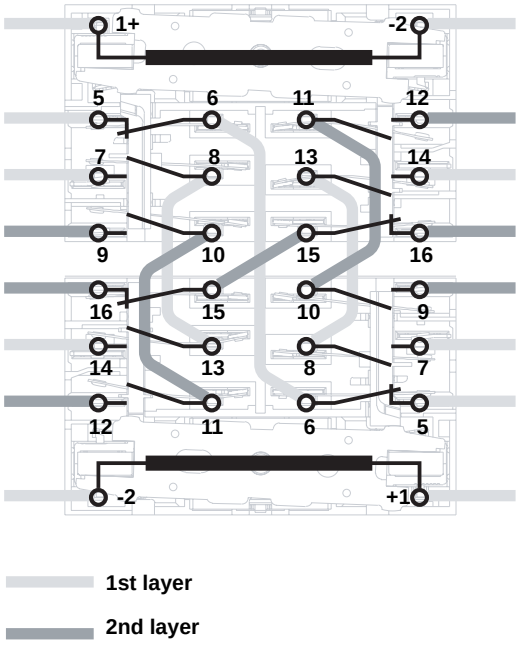
Condition	Illustration of Relay State	Condition of Contacts
- NC 5-6 welded. - Coil energized. - Armature nearly in deenergized position.		 - All NO contacts are forcibly guided. - The NO contact gaps are min. 0.5mm. - For NC 16-15, the contact condition is not defined.
- NC 16-15 welded. - Coil energized. - Armature nearly in deenergized position.		 - All NO contacts are forcibly guided. - The NO contact gaps are min. 0.5mm. - For NC 5-6, the contact condition is not defined.
- NO 12-11 welded. - Coil deenergized. - Armature nearly in energized position.		 - All (both) NC contacts are forcibly guided. - The NC contact gaps are min. 0.5mm. - For all NO contacts, the contact condition is not defined.
- NO 14-13 welded. - Coil deenergized. - Armature in nearly energized position.		 - All (both) NC contacts are forcibly guided. - The NC contact gaps are min. 0.5mm. - For all NO contacts, the contact condition is not defined.
- NO 7-8 welded. - Coil deenergized. - Armature in deenergized position.		 - **NC 16-15 is closed!!** - **All non-welded NO contacts show their max. contact gap.** - NC 5-6 forcibly guided to the welded contact by sub card 1. The contact gap is min. 0.5mm.
- NO 9-10 welded. - Coil deenergized. - Armature in deenergized position.		 - **NC 16-15 is closed!!** - **All non-welded NO contacts show their max. contact gap.** - NC 5-6 forcibly guided to the welded contact by sub card 2. The contact gap is min. 0.5mm.

Failure modes, application examples

1) Feedback loop, 2) Self-holding circuit, 3) Safety circuit, 4) Auxilliary contacts

1. Self-holding circuit, three safety circuits  	One contact welded, e.g. NO 9-10 of K1.	Condition of contacts at deenergized coil 
	One contact welded, e.g. NO 12-11 of K2.	Condition of contacts at deenergized coil 
2.1. Four safety circuits  (see wiring example, p. 390)	One contact welded, e.g. NO 9-10 of K1.	Condition of contacts at deenergized coil 
	One contact welded, e.g. NO 12-11 of K2.	Condition of contacts at deenergized coil 
2.2. Two safety circuits  (see wiring example, p. 390)	Both contacts of one path are welded, e.g. NO 7-8 and NO 14-13. A safety circuit needs two paths in this failure mode. The contacts 9-10, 12-11, and 14-13 of K1 interrupt the load.	Condition of contacts at deenergized coil 
	Both contacts of one path are welded, e.g. NO 9-10 and NO 12-11. A safety circuit needs two paths in this failure mode. The contacts 7-8, 12-11, and 14-13 of K1 interrupt the load.	Condition of contacts at deenergized coil 

Wiring for application examples 2.1 and 2.2



For Cautions for Use, see Relay Technical Information (page 392).

Technische Informationen

Relais-Terminologiedefinition

SPULE (auch als Erregerspule bezeichnet)

• Spulennennspannung
Hierbei handelt es sich um die Spannung, die aufgrund der Konstruktion zur Erregung der Spule vorgesehen ist.

• Ansprechspannung
Hierbei handelt es sich um die Spannung, bei der alle Kontakte in ihre Wirkstellung übergehen (umschalten).

• Abfallspannung
Hierbei handelt es sich um die Spannung, bei der alle Kontakte in ihre Ruhelage zurückkehren.

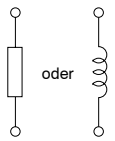
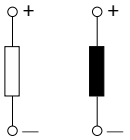
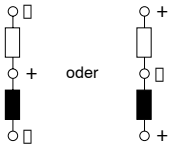
• Maximale Dauerspannung
Hierbei handelt es sich um die Spannung, die ständig an die Spule angelegt werden kann, ohne dass ein Schaden entsteht. Kurzfristige Spitzen einer höheren Spannung können zulässig sein. Dies sollte jedoch vorher mit dem Hersteller abgeklärt werden.

• Nennbetriebsstrom
Hierbei handelt es sich um den Strom, der bei Nennspannung durch die Spule fließt.

• Nennbetriebsleistung
Hierbei handelt es sich um die Leistung, die bei Nennspannung in der Spule verbraucht wird. Bei Gleichstrom wird dieser Wert in Watt und bei Wechselstrom in Voltampere angegeben. Nennleistung (W oder VA) = Nennspannung × Nennstrom.

• Spulenwiderstand
Hierbei handelt es sich um den Widerstand der Spule im Gleichstromrelais bei der im Katalog angegebenen Temperatur. (Bitte beachten Sie, dass der Spulenwiderstand bei einigen Relais abweichend von der üblichen Umgebungstemperatur von 20°C angegeben ist.)

• Schaltverhalten

Monostabiles Relais		Bistabiles Relais mit 1 Spule	Bistabiles Relais mit 2 Spule	
ungepolt	gepolt		4 Anschlüsse	3 Anschlüsse
				

Schwarze Spulen stellen den erregten Zustand dar. Bei bistabilen Relais ist die Spulenpolarität in schematischen Darstellungen generell für den Reset-Zustand angegeben. Dies gilt für beide Spulen.

KONTAKTE

• Kontaktarten
Die Kontaktart bezeichnet den Kontaktmechanismus.

• Kontaktsymbole

Kontakt Form A (Arbeitskontakt)	
Kontakt Form B (Ruhekontakt)	
Kontakt Form C (Umschaltkontakt)	

Kontakte der Form A werden auch N.O.(normally open)-Kontakte oder Arbeits- bzw. Schließkontakte genannt.
Kontakte der Form B werden auch N.C.(normally closed)-Kontakte oder Ruhekontakte bzw. Öffnerkontakte genannt.
Kontakte der Form C werden auch Wechslerkontakte oder Umschaltkontakte genannt.

• MBB-Kontakte
Abkürzung für einen unterbrechungslosen Umschaltkontakt bzw. einen Folgeumschaltkontakt (MBB = make before break). Hierbei handelt es sich um einen Kontaktmechanismus, in dem die Arbeitskontakte schließen, ehe die Ruhekontakte öffnen.

• Nennschaltleistung
Die Nennschaltleistung ist diejenige Leistung in Watt (Gleichstrom) oder Voltampere (Wechselstrom), die konstruktionsbedingt von den Kontakten sicher geschaltet werden kann. Ihr Wert ergibt sich aus dem Produkt von Schaltspannung x Schaltstrom und liegt unter dem Produkt aus maximaler Spannung und maximalem Strom.

• Maximale Schaltspannung
Die maximale Schaltspannung ist die höchste Spannung, die von den Kontakten sicher geschaltet werden kann. Sie ist in den meisten Fällen für Gleich- und Wechselstrom verschieden.

• Maximaler Schaltstrom
Der maximale Schaltstrom ist der größte Strom, der von den Kontakten sicher geschaltet werden kann. Maximaler Wechselstrom und maximaler Gleichstrom können voneinander abweichen.

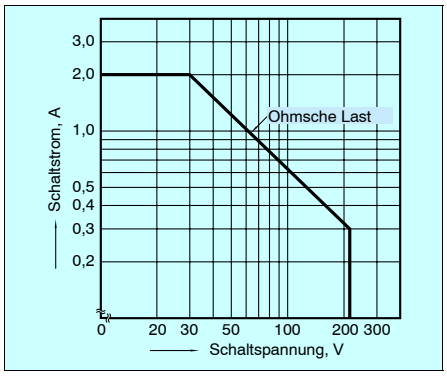
• Maximale Schaltleistung
Die maximale Schaltleistung ist die größte Leistung, die von den Kontakten geschaltet werden kann. Die maximale Schaltleistung sollte nicht überschritten werden.

• Maximaler Dauerstrom
Der maximale Dauerstrom ist derjenige Strom, der nach dem Schließen oder vor dem Öffnen der Kontakte sicher geführt werden kann, ohne dass dabei ein unzulässiger Temperaturanstieg der Kontakte oder anderer temperaturempfindlicher Komponenten im Relais (Spule, Federn, Isolierung usw.) erfolgt. Sein Wert liegt normalerweise über dem maximalen Schaltstrom.

• Minimales Schaltvermögen
Unter minimalem Schaltvermögen versteht man die Mindestwerte von Spannung und Strom, die zuverlässig von den Kontakten geschaltet werden können. Diese Werte unterscheiden sich je nach Relaistyp. Die Mindestwerte werden durch die Schaltfrequenz, Umgebungsbedingungen und den Kontaktreibeweg beeinflusst. Für Low-Level-Lasten oder einen Kontaktwiderstand von maximal 100 mΩ verwenden Sie bitte AgPd-Kontakte.
Es empfiehlt sich, die Verwendung vorab mit unseren Vertriebsbüros abzuklären.

• Maximales Schaltvermögen
Das maximale Schaltvermögen ist für jedes Relais als maximaler Wert der Kontaktkapazität angegeben und stellt eine Wechselbeziehung zwischen der maximalen Schaltleistung, der maximalen Schaltspannung und dem maximalen Schaltstrom dar. Der Schaltstrom und die Schaltspannung können aus einer Grafik entnommen werden, wie Sie z.B. nachfolgend für das DS-Relais angegeben ist. Wenn z.B. die Schaltspannung in einer bestimmten Anwendung festgelegt ist, kann der maximale Schaltstrom über die maximale Schaltleistung auf der Achse entnommen werden.

Maximales Schaltvermögen (TX-Relais)
Beispiel: Bei Verwendung eines TX-Relais bei einer Schaltspannung von 60 V DC beträgt der maximale Schaltstrom 1A.
(Die maximale Schaltkapazität wird als ohmsche Last angegeben. Bitte prüfen Sie die aktuelle Last vor der Verwendung.)



• Kontaktwiderstand
Wird angegeben als Gesamtwiderstand aus dem Widerstand der Kontakte sowie dem Widerstand der Anschlüsse und der Kontaktfeder. Der Kontaktwiderstand wird unter Verwendung der unten dargestellten Spannungsabfall-Methode gemessen. Die Messströme werden in Abb. 1 dargestellt.

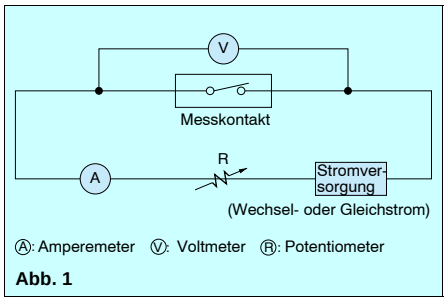


Abb. 1

Messströme

Nennkontaktstrom oder Schaltstrom (A)	Messstrom (mA)
Unter 0,01	1
Zwischen 0,01 und 0,1	10
Zwischen 0,1 und 1	100
Ab 1	1,000

Der Widerstand kann mit einem Milliohmmesser YHP 4328A mit ausreichender Genauigkeit gemessen werden.
Im Allgemeinen werden Relais ab einem Schaltstrom von 1A unter Verwendung der Spannungsabfall-Methode bei 1A, 6V Gleichstrom gemessen.

• Kontaktkapazität
Dieser Wert wird zwischen den Anschlüssen mit einem Messstrom von 1kHz und 20°C gemessen.

RELAISKENNDATEN

• Isolationswiderstand
Der Isolationswiderstand wird zwischen voneinander isolierten, leitenden Teilen des Relais gemessen: zwischen Spule und Kontakten, zwischen geöffneten Kontakten und zwischen Spule oder Kontakten gegenüber Magnetkreis oder Grundkörper mit Erdpotential. Dieser Wert wird normalerweise als “Anfangs-Isolationswiderstand“ bezeichnet und kann mit der Zeit aufgrund von Alterung oder Ablagerung von Kontaktabbrand abnehmen.

• Spannungsfestigkeit
Spannung, die an das Relais ohne Spannungsdurchbruch für eine bestimmte Zeit angelegt werden kann, wird normalerweise an denselben Punkten wie der Isolationswiderstand gemessen. Der angegebene Wert in V_{eff} wird für die Dauer einer Minute angelegt.

• Stoßspannungsfestigkeit
Eigenschaft des Relais, einer externen Stoßspannung, wie einem Blitzschlag oder einem anderen Phänomen, zu widerstehen. Zu Testzwecken wird ein Verlauf verwendet, bei dem die Anstiegszeit, der Spitzenwert und die Abfallzeit festgelegt sind. (Abb. 2)

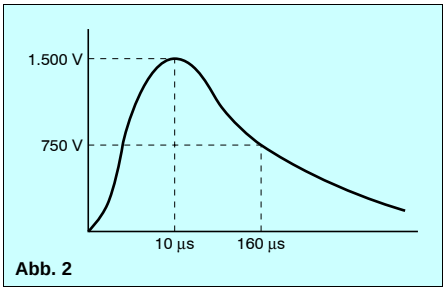


Abb. 2

• Ansprechzeit
Zeit vom Beginn der Spulenerregung bis zum Schließen des Arbeitskontakts. (Bei Relais mit mehreren Kontakten handelt es sich um die Zeit, die bis zum Schließen des letzten Kontaktes vergeht.) Die Ansprechzeit enthält keine Prellzeit.

• Abfallzeit
Zeit vom Ende der Erregung bis zum Wiederverschließen eines Ruhekontaktes. (Bei Relais mit mehreren Kontakten ist es die Zeit, die bis zum Wiederverschließen des letzten Kontaktes vergeht.) Die Abfallzeit enthält keine Prellzeit.

• Set Time
Dieser Begriff steht für die Ansprechzeit eines bistabilen Relais.

• Reset Time
Dieser Begriff beschreibt die Rücksetzzeit eines bistabilen Relais. Bei einem 2-spuligen bistabilen Relais ist es die Zeit vom Beginn der Erregung einer Spule bis zum Wiederschließen der Ruhekontakte. Bei einem 1-spuligen bistabilen Relais ist es die Zeit vom Beginn der Gegenerregung bis zum Wiederverschließen der Ruhekontakte.

• Kontaktprellen
Das Kontaktprellen wird in Millisekunden angegeben. Die Prellzeit erzeugt intermittierende Kontaktabgabe aufgrund der Kollision der bewegten Kontakte beim Ansprechen oder Abfallen der Relais.

• Ansprech-Prellzeit
Zeit, die unmittelbar der Ansprechzeit folgt, während der die Kontakte noch nicht zur Ruhe gekommen sind. Sie endet mit dem Abklingen der letzten Kontaktunterbrechung.

• Abfall-Prellzeit
Zeit, die unmittelbar der Abfallzeit folgt, während der die Kontakte noch nicht zur Ruhe gekommen sind. Sie endet mit dem Abklingen der letzten Kontaktunterbrechung.

• Stoßfestigkeit
Beschleunigung, der das Relais während des Versands oder der Installation ohne Schaden und ohne Veränderung seiner Kenndaten widerstehen kann. Die Stoßfestigkeit wird in ”g” angegeben.

• Funktionale Stoßfestigkeit
Beschleunigung, der das Relais während des Betriebs widersteht, ohne dass sich die geschlossenen Kontakte länger als (z.B. 10µs) öffnen.

• Schwingfestigkeit
Schwingung, der das Relais während des Versands, der Installation oder der Benutzung ohne Beschädigung und ohne Veränderung seiner Kenndaten widersteht. Die Schwingfestigkeit wird als Beschleunigung in "g" oder als Auslenkung mit einem bestimmten Frequenzbereich angegeben.

• Funktionale Schwingfestigkeit
Schwingung, der das Relais während des Betriebs widersteht, ohne dass sich geschlossene Kontakte länger als für die angegebene Zeit öffnen.

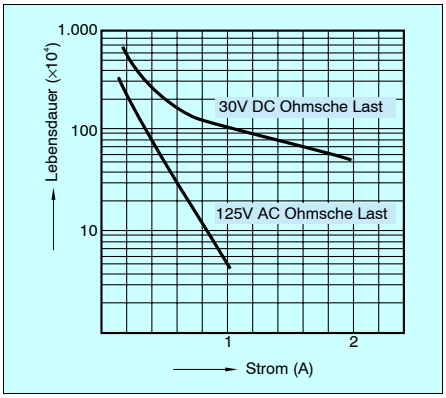
• Mechanische Lebensdauer
Mindestanzahl von Schaltspielen, die das Relais unter Nennbedingungen (Spulenspannung, Temperatur, Luftfeuchtigkeit usw.) ohne Belastung der Kontakte betrieben werden kann.

• Elektrische Lebensdauer
Mindestanzahl von Schaltspielen des Relais unter Nennbedingungen bei angegebener Kontaktlast.

• Maximale Schaltfrequenz
Größtmögliche Schaltfrequenz, bei der die mechanische oder die elektrische Lebensdauer bei Nennerregung der Spule erreicht werden kann.

Lebensdauerkurve
Die Lebensdauerkurve ist für jeden Relais-typ in der Datenspalte angegeben. Die Lebensdauer (Anzahl der Schaltspiele) ergibt sich dabei abhängig von Schaltspannung und Schaltstrom. Für ein DS-Relais mit folgenden Daten:
Schaltspannung = AC 125 V
Schaltstrom = 0,6 A
beträgt die Lebensdauer 300.000 Schaltungen. Dieser Wert bezieht sich auf die ohmsche Last. Bitte prüfen Sie die aktuelle Last vor der Verwendung.

Lebensdauerkurve



HOCHFREQUENZEIGENSCHAFTEN

• Übersprechdämpfung
Hochfrequenzsignale können durch kapazitive Kopplung auch bei geöffneten Kontakten von einem Stromkreis in den benachbarten gelangen. Diese Streuung wird Isolationsverlust genannt. Die Größe des Streusignals wird in DB (Dezibel) angegeben. Dieser Wert drückt das Verhältnis des gestreuten Signals und des Eingangssignals als Logarithmus aus. Je höher der Wert, desto besser die Isolation.

• Einfügungsdämpfung
Im Hochfrequenzbereich erfolgen Störungen durch Selbstinduktion, Widerstand und dialektrische Verluste sowie durch die Reflektion aufgrund einer Impedanz-Fehlanpassung in Schaltkreisen. Verluste aufgrund einer dieser Störungsarten werden Einfügungsdämpfung genannt. Diese ist auf die Verlustgröße des Eingangssignals bezogen. Je geringer diese Größe, desto besser das Relais.

• V.S.W.R. (Spannungs-Stehwellenverhältnis)
Durch die Interferenz zwischen dem Eingangssignal und dem reflektierten Signal wird eine Hochfrequenzresonanz erzeugt.
Der V.S.W.R. bezieht sich dabei auf das Verhältnis zwischen Maximal- und Minimalwert der entstehenden Welle. Der V.S.W.R. ist gleich 1, wenn keine reflektierende Welle vorhanden ist. Normalerweise liegt der V.S.W.R. über 1.

Anmerkungen:
1. Sofern nicht anders angegeben, werden die obigen Hochfrequenzeigenschaften bei Normal-Temperatur und Normal-Luftfeuchtigkeit überprüft (15°C bis 35°C, 25 bis 75%).
2. Die an der Spule angelegte Spannung in den Schalttests besteht aus einem Rechtecksignal mit Nennspannung.
3. Die Phase der Wechselstromlast ist willkürlich.

SCHUTZARTEN

Für die verschiedenen Relaistypen gibt es für den Schutz gegen Staub, das Eindringen von Flussmitteln, verschmutzte Umgebungen und automatische Reinigung usw. verschiedene Schutzarten:

• Ungeschützte Ausführung
Aus Kostengründen werden einige Relais nicht mit einem Gehäuse versehen. Dabei wird davon ausgegangen, dass der Gebrauch des Relais in einem Gehäuse oder einer Schutzumgebung erfolgt.

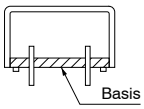
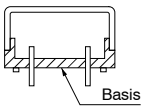
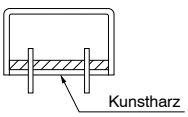
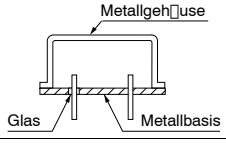
• Ausführung mit Schutzkappe
Die meisten Relais sind mit einer Schutzkappe versehen. Diese schützt das Relais gegen Verschmutzung durch Staubpartikel und gibt dem Benutzer Berührungsschutz.

• Flussmittelresistente Ausführung
Bei diesem Konstruktionstyp wird das Eindringen des Lötflussmittels entweder durch das Einspritzen der Anschlüsse in die Grundplatte oder durch eine einfache Versiegelung während der Herstellung verhindert.

• Mit Kunststoff abgedichtete Ausführung
Dieser Relaistyp schließt das Eindringen von Kontaminanten durch Anwendung einer Kunststoff-Abdichtung an der Grundplatte bzw. der Abdeckung vollkommen aus. Die Komponenten-Bestandteile werden ausgegast, um eine physikalische und chemische Stabilität zu erreichen. Dieser Ausgasungsprozess treibt die flüchtigen Reste in den Kunststoffen aus und stellt innerhalb des Relais eine kontaminanten-freie Umgebung sicher, die zu einem konstanteren Kontaktwiderstand während der gesamten Lebensdauer führt.

• Hermetische Abdichtung
Das mit Kunststoff abgedichtete Relais ist nicht hermetisch dicht, da im Laufe der Zeit ein Austausch von Gasmolekülen durch die Kunststoff-Abdeckung erfolgt. Die einzig wirklich hermetischen Abdichtungen bestehen aus Metall/Metall- und Glas/Metall-Verbindungen. Das gesamte Relais wird vor der Abdichtung mit Trockenstickstoffgas gefüllt, wodurch die Zuverlässigkeit verbessert wird.

KONSTRUKTION UND EIGENSCHAFTEN

Typ	Konstruktion	Eigenschaften	Automatisches Löten	Automatische Reinigung	Schutz vor schädl. Gasen
Ausführung mit Schutzkappe		Einfachste Bauweise, bei der Gehäuse und Basisteil (oder Grundkörper) aneinander montiert sind.	Nein	Nein	Nein
Flussmittelresistente Ausführung		Die Anschlüsse werden eingebettet oder eingeformt. Die Verbindung zwischen dem Gehäuse und der Basis liegt höher als die Oberfläche der Leiterplatte.	Ja	Nein	Nein
Mit Kunststoff abgedichtete Ausführung		Anschlüsse, Gehäuse und Basisteil sind mit Kunstharz vergossen.	Ja	Ja	Ja
Hermetisch abgedichtete Ausführung		Hermetisch durch Metallgehäuse und Metallgrundkörper abgedichtet. Die Anschlüsse sind in Glas eingebettet.	Ja	Ja	Ja

BETRIEBSFUNKTION

• Monostabiles Relais
Relais, das bei Spulenerregung anspricht und bei Unterbrechung der Erregung wieder zurückfällt. (Abb. 3)

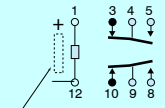


Abb. 3

• Bistabiles Relais (1-spulig)
Relais mit einer Spule und zwei stabilen Schaltzuständen. Dieses Relais wird durch die Anwendung von Signalen entgegengesetzter Polaritäten erregt bzw. zurückgesetzt. (Abb. 4)

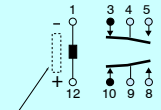


Abb. 4

• Bistabiles Relais (2-spulig)
Relais mit einer bistabilen Konstruktion aus zwei Spulen: Erregungsspule und Rücksetzspule. Das Relais wird durch die abwechselnde Anwendung von Impulsen derselben Polarität erregt bzw. zurückgesetzt. (Abb. 5)

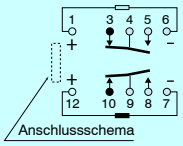
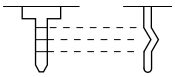


Abb. 5

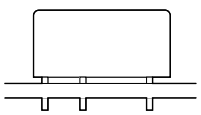
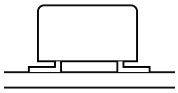
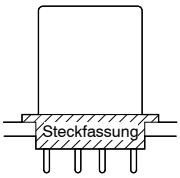
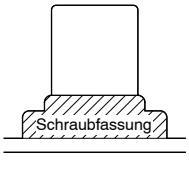
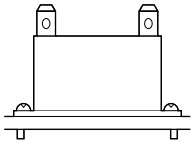
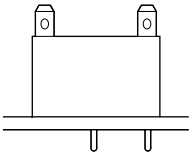
• Betriebsanzeige
Die Betriebsanzeige zeigt den Schaltzustand entweder elektrisch oder mechanisch an. Es werden Relais mit LED-Anzeige (HC-Relais) und Relais mit einer Glimmröhre (HP-Relais) angeboten. (Abb. 6)

HC-Relais mit LED
Abb. 6

ANSCHLUSSKONFIGURATION

Typ	Leiterplatten-Anschluss	Leiterplatten-Leiterplatten-Anschl. Anschluss	Leiterplatten-SMD-Anschluss Anschluss	Steck-Anschluss	Schnellkontakt-Anschluss	Schraub-Anschluss
Relais-Typ						
Anschluss-Konfiguration						
Relais-Typ	GQ-, GN-, TQ-, TN-, TK-, TX-, TX-D-Relais, DS-Relais, DS-BT-Relais, RP-Relais, JS-Relais, JW-Relais, SEB-Relais, JQ-Relais, PQ-Relais	TQ-, TN-, TK-, TX-, TX-D-Relais	GQ-SMD, GN-SMD, TX-SMD, TQ-SMD	HJ-Relais, HC-Relais HP-Relais, HE-Relais HL-Relais, HK-Relais HN-Relais	JC-Relais JR-Relais	HE-Relais EP-Relais EJ-Relais

MONTAGEMETHODE

Typ	Leiterplatten-Montage	Oberflächen-Montage (SMD)	Montage mit Steckfassung	Montage mit Schraubfassung	TM-Typ	TMP-Typ
Montage-Konfiguration						
Relais-Typ	GQ-, GN-, TQ-, TN-, TK-, TX-, TX-D-Relais, DS-Relais, DS-BT-Relais, RP-Relais, SEB-Relais	GQ-SMD, GN-SMD, TX-SMD, TQ-SMD	NC-Relais HC-Relais HL-Relais	HJ-Relais, HC-Relais HP-Relais, HG-Relais HL-Relais, HK-Relais HN-Relais	HC-Relais JR-Relais JC-Relais	JR-Relais LF-Relais JT-N-Relais

Anmerkungen:1.Für bestimmte Leiterplatten-Relais stehen Schraubfassungen zur Verfügung. (SEB-Relais, ST-Relais etc.)
2.Der Typ M (Löttyp) für die direkte Schraubmontage des Gehäuses ist ebenfalls lieferbar. (HG-Relais)

Allgemeine Anwendungsrichtlinien

Ein Relais kann während seiner Anwendung verschiedenen Umgebungsbedingungen ausgesetzt sein, die eventuell zu unerwartetem Ausfall führen. Deshalb ist in vielen Fällen ein Test unter den aktuellen Betriebsbedingungen erforderlich. Die Schaltung muss berücksichtigt werden, um eine korrekte Verwendung des Relais sicherzustellen.

SICHERHEITSHINWEISE

• Stellen Sie unbedingt sicher, dass die Werte aus der Spezifikation, z.B. die Spulendaten, der Schaltstrom und die Lebensdauer nicht überschritten werden. Andernfalls kann es zu übermäßiger Hitze-, Rauch- und Feuerentwicklung kommen.
• Stellen Sie unbedingt sicher, dass der unter Spannung stehende Teil nicht berührt wird, wenn das Relais in Betrieb ist. Andernfalls kann dies zu einem Stromschlag führen. Schalten Sie den Strom ab, wenn Sie das Relais (oder damit verbundene Teile wie die Anschlussklemme und die Fassung) installieren, warten oder reparieren.
• Beachten Sie die internen Verdrahtungsdiagramme im Katalog und stellen Sie dann die richtigen Anschlussschaltungen her. Unsachgemäße Anschlüsse können zu Fehlfunktionen, übermäßiger Hitzeentwicklung, etc. führen.
• Zusätzliche Sicherheitseinrichtungen sollten angebracht werden, wenn Adhäsion, Kontaktausfälle oder Abschaltungen auftreten, die möglicherweise zu Verletzungen oder Sachschäden führen können.

METHODE ZUR AUSWAHL DES RICHTIGEN RELAIS

Ausfallsicher

Vorgaben		Auswahl der Punkte
Spule	a) Nennwert b) Anzugsspannung (Strom) c) Abfallspannung (Strom) d) Maximale Dauerspannung (Strom) e) Spulenwiderstand f) Impedanz g) Temperaturanstieg h) Schaltfrequenz	1) Berücksichtigen Sie die Welligkeit der Erregerspannung. 2) Berücksichtigen Sie Umgebungstemperatur und Temperaturanstieg der Spule. 3) Wird das Relais in Verbindung mit Halbleitern eingesetzt, muss auch die zugehörige Schaltung beachtet werden.
Kontakte	a) Kontaktanordnung b) Kontaktbelastung c) Kontaktmaterial d) Lebensdauer e) Kontaktkraft f) Kontaktwiderstand	1) Es ist empfehlenswert, ein Standardprodukt zu verwenden, das mehr Kontakte als die unbedingt erforderliche Anzahl enthält. 2) Relais müssen die Lebensdauer aufweisen, die im Anwendungsfall erwartet wird. 3) Passt das Kontaktmaterial zum Lasttyp? 4) Dies ist besonders bei Mindestwerten erforderlich. 5) Die Lebensdauer kann bei einer Verwendung unter hohen Temperaturen verkürzt werden. 6) Sie sollte für die aktuelle Umgebung geprüft werden. 7) Je nach Schaltung kann die Relais-Ansteuerung durch die Wechselstromlast synchronisiert sein. Da dies zu einer drastischen Senkung der Lebensdauer führt, sollte der aktuelle Anwendungsfall unbedingt geprüft werden.
Schaltzeit	a) Schaltzeit b) Ansprechzeit c) Abfallzeit d) Schaltfrequenz	1) Es lohnt sich, bei Audio-Schaltungen und ähnlichen Anwendungen eine kurze Prellzeit zu verwenden.
Mechanische Eigenschaften	a) Schwingungsfestigkeit b) Stoßfestigkeit c) Umgebungstemperatur d) Lebensdauer	1) Berücksichtigen Sie die am Einsatzort herrschende Schwingungs- und Stoßbeanspruchung. 2) Besonders bei hohen Umgebungstemperaturen kann ein Relais mit der Spulenisolation der Klasse B oder F erforderlich sein.
Zusatzaspekte	a) Montage-Methode b) Gehäuse c) Größe	1) Es kann zwischen Steck-, Print-, Löt-, Faston- und Schraubanschlüssen gewählt werden. 2) Für den Einsatz in aggressiver Atmosphäre sollten dichte Relais gewählt werden. 3) Sind spezielle Sonderbedingungen gegeben?

GRUNDREGELN IM UMGANG MIT RELAIS

• Vermeiden Sie Stoßbeanspruchungen des Relais.
• Relaisgehäuse sollten nicht entfernt werden, da sich dadurch die Werte ebenfalls verändern können, d.h. die Datenblattangaben gelten nur für das komplette Relais.
• Relais sollten möglichst in einer Umgebung mit normaler Temperatur und Luftfeuchtigkeit, geringem Staub, frei von SO_2, H_2S oder organischen Gasen eingesetzt werden.
• Silikonrückstände in der Nähe des Relais können zu Kontaktausfällen führen. (Dies gilt auch für mit Kunststoff abgedichtete Relais.)
• Beachten Sie bitte, dass bei polarisierten Relais die richtige Polarität (+, –) an die Spule angelegt wird.
• Zum richtigen Einsatz sollte die Nennspannung an die Spule angelegt werden. Verwenden Sie für Gleichstromspulen Rechteckwellen und für Wechselstromspulen Sinuswellen.
• Die Spulenspannung sollte die maximal zulässige Spulenspannung nicht überschreiten.
• Vermeiden Sie Ströme und Spannungen über den zulässigen Grenzwerten.
• Die Schaltlast und Lebensdaueranga-ben stellen nur Richtwerte dar. Die physikalischen Phänomene beim Schalten, und damit die Lebensdauer, hängen stark von der Art der Last und den übrigen Betriebsbedingungen ab. Deshalb sollten Sie vor dem Einsatz alle Parameter überprüfen.
• Setzen Sie das Relais nicht über den im Datenblatt angegebenen Temperaturen ein.
• Verwenden Sie flussmitteldichte oder waschdichte Relais bei automatischem Löten.
• Verwenden Sie alkoholische Reinigungsmittel zum Reinigen der dichten Relais.
• Vermeiden Sie Ultraschallreinigung für alle Arten von Relais.
• Vermeiden Sie es, die Anschlüsse zu verbiegen, denn dies kann zu Fehlfunktionen führen.
• Faston-Stecker sollten eine Steckkraft von 4 bis 7kg haben.
• Zum richtigen Einsatz lesen Sie bitte die detaillierten Hinweise oder Richtlinien.

PROBLEMFÄLLE BEI DER ANWENDUNG

Da beim praktischen Einsatz von Relais nicht alle äußeren Einflüsse schon in der Planung erfasst werden können und weil unvorhersehbare Effekte auftreten können, sind Tests unter den Bedingungen des jeweiligen Einsatzfalles erforderlich. Dabei muss auch die Streuung der Relaisdaten bei den einzelnen Exemplaren berücksichtigt werden. Das Relais ist ein Massenprodukt, und es sollte trotz der fertigungsbedingten Exemplarstreuung ohne Justage oder Abgleich direkt eingesetzt werden können.

RELAISSPULE

• Wechselstromrelais

Wechselstromrelais werden fast immer an einer Spannungsquelle mit einer Frequenz von 50 oder 60 Hz und Standardspannungen von 6, 12, 24, 48, 115, and 240 V betrieben. Deshalb sollten möglichst diese Standardspannungen verwendet werden. In Wechselstromspulen treten außerdem Verluste durch Kurzschlussring, Wirbelstrom- und Hystereseverluste auf. Dazu kommt eine geringere Spuleneffizienz, so dass eine höhere Spulenerwärmung erfolgt als bei Gleichstromrelais.

Darüber hinaus fangen Relais bereits bei Spannungen unterhalb der minimalen Betriebsspannungen zu brummen an. Es ist darauf zu achten, dass die Ausgangsspannung der Spannungsquelle nicht zu sehr schwankt.

Zum Beispiel kann es bei der Ansteuerung eines Motors zu Spannungsabfällen kommen. Wenn ein Relais brummt und dadurch wieder in den Ausgangszustand zurückkehrt, können die Kontakte beschädigt werden.

Wechselstromrelais benötigen zum Einschalten einen höheren Betriebsstrom als den angegebenen, da die Induktivität und damit die Impedanz bei offenem Relaisanker kleiner ist als bei anliegendem Anker. Dies ist vor allem zu berücksichtigen, wenn mehrere Relais parallel betrieben werden.

• Gleichspannungsrelais

Zum Betrieb von Gleichspannungsrelais gibt es Standardspannungen und zwar DC 5, 6, 12, 24, 48 und 100 V. Im Katalog wird der Ansprechstrom angegeben. Dieser Strom reicht jedoch gerade aus, um den Relaisanker zu bewegen. Unter Berücksichtigung von Widerstandstoleranzen und temperaturbedingter Widerstandserhöhung der Spule sollte als Betriebsspannung ein 1,5-facher bis 2-facher Wert der Ansprechspannung gewählt werden. Werden Relais am oberen Limit ihrer Kapazität betrieben oder treten Schwankungen des eingeprägten Spulenstroms auf, kann es zu Verzögerungen in der Kontaktbewegung kommen. Dadurch besteht die Gefahr, dass die angegebenen Schaltkapazitäten nicht erreicht werden. Diese Aspekte sollten sorgfältig berücksichtigt werden. Der Spulenwiderstand erhöht sich um den Faktor 0,4%/°C sowohl bei Eigenerwärmung als auch bei Erhöhung der Umgebungstemperatur. Um denselben Faktor erhöht sich auch die Ansprech- und Abfallspannung.

• Spannungserregung der Wechselstromspule

Um einen stabilen Betrieb zu gewährleisten, sollte die Spulenspannung generell nicht mehr als +10%/-15% von der Nennspannung abweichen. Außerdem ist ein sinusförmiger Wechselstrom nötig. Übliche Wechselspannungen sind unproblematisch, aber bei einer stabilisierenden Wechselspannungsquelle kann es durch eine deformierte Wellenform zur Überhitzung der Spule kommen. Abbildung 1 zeigt zwei Beispiele einer deformierten Wellenform.

Liegt das Relais an derselben Leitung wie die Last (z.B. Motoren, Magneten oder Transformatoren) kann beim Einschalten die Spannung einbrechen. Dies kann vorkommen, wenn ein kleiner Transformator für Relais und Lastkreis benutzt wird. Entstehen Schwierigkeiten, sollte mit Hilfe des Oszillographen Klarheit über den Verlauf der Spannung geschaffen und die nötigen Gegenmaßnahmen ergriffen werden: Ein geeignetes Relais auswählen oder im Fall eines Gleichstromkreises die Spannungsschwankungen durch einen Kondensator ausgleichen (Abb. 2).

Besonders bei der Ansteuerung eines Magnetschalters oder eines Motors sollte, wenn möglich, eine Trennung von Last- und Steuerkreis vorgenommen werden.

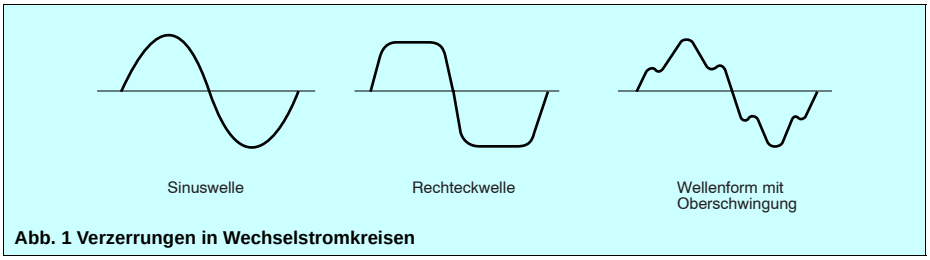


Abb. 1 Verzerrungen in Wechselstromkreisen

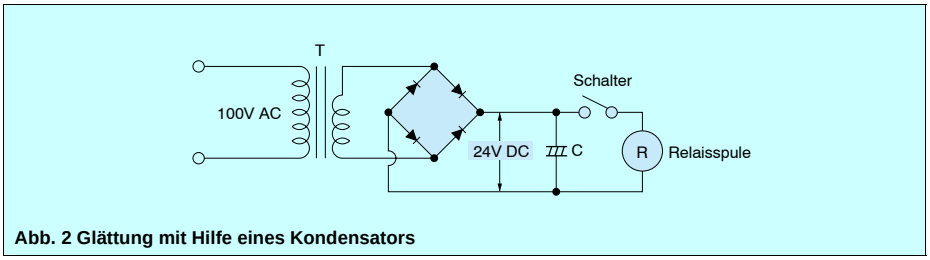


Abb. 2 Glättung mit Hilfe eines Kondensators

• Gleichspannungsquellen

Als Spannungsquelle für das Gleichspannungsrelais lässt sich eine Batterie oder eine einweg- bzw. vollweggleichgerichtete Wechselspannung und ein Glättungskondensator verwenden. Die verschiedenen Spannungsquellen verfügen über verschiedene Eigenschaften. Am besten für einen stabilen Relaisbetrieb ist eine (elektronisch) stabilisierte Gleichspannung.

Falls eine Restwelligkeit an der Spannungsquelle verbleibt, besonders im Fall einer Einweggleichrichtung, kann das Relais brummen. Dies sollte im aktuellen Einzelfall geklärt werden. (Abb. 3)

Für unsere T-Relais (TQ, TN, TK, TX, TX-D, TQ-SMD) und SEB-Relais sollte eine Spannungsquelle mit weniger als 5% Restwelligkeit verwendet werden. Bei den J- und NC-Relais besteht für diesen Betrieb keine Einschränkung. Die Anzugskraft wird jedoch etwas geschwächt und eine gewisse Vorsicht ist notwendig, da die Schwing- und Stoßfestigkeit reduziert ist. Zudem muss Folgendes berücksichtigt werden:

[1] Für Reed-Relais ist eine Restwelligkeit von unter 5% wünschenswert.

[2] Für Klappankerrelais kann ein Halbwellengleichrichter nur unter Zusatz eines Glättungskondensators benutzt werden. Es muss dann jedoch die Restwelligkeit genauer untersucht werden.

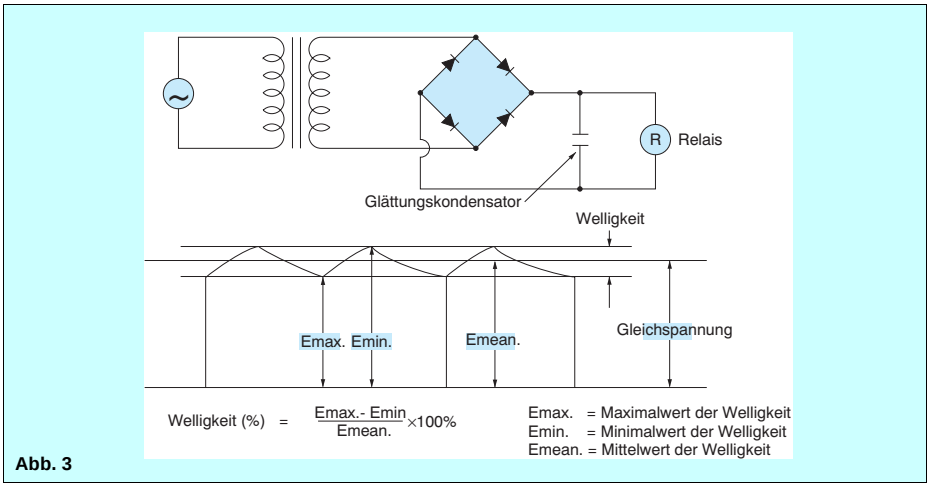


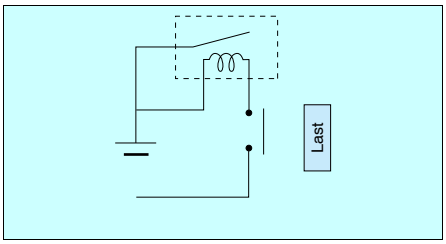
Abb. 3

[3] Für einige Klappankerrelais genügt ein Brückengleichrichter alleine, für andere wiederum nicht. Es wird deshalb empfohlen, die diesbezüglichen Spezifikationen mit dem Hersteller abzuklären. In der Abbildung rechts ist ein Schaltkreis dargestellt, der für Spule und Kontakt dieselbe Spannungsquelle (Batterie etc.) verwendet.

[4] Auf die Spule angelegte Spannung und Spannungsabfall.

Bitte prüfen Sie, dass die aktuell an die Spule angelegte Spannung an der aktuellen Last erfolgt.

Die Lebensdauer wird von einem Spannungsabfall bei Belastung beeinträchtigt.



• Anstieg der Spulentemperatur

Bei ordnungsgemäßem Einsatz müssen Relais mit Nennspannung betrieben werden. Beachten Sie bitte, dass eine Spulenspannung, die größer als die erlaubte maximale Spulenspannung ist, zu übermäßiger Spulenerwärmung und damit zum Windungsschluss und schließlich zum Abbrennen der Spule führen kann.

Bei einer Isolation vom Typ E und einer Umgebungstemperatur von 40°C, ist ein Temperaturanstieg bis 80°C entsprechend der Widerstandstechnik vertretbar. Das "Geräte- und Produktsicherheitsgesetz" (GPSG) definiert hierfür jedoch eine Beschränkung von 75°C.

• Temperaturanstieg bei Impulsbetrieb
Bei Spannungsimpulsen kürzer als 2 Minuten hängt die Spulenerwärmung nicht nur von der Zeit, sondern vom Verhältnis der Ein- zur Abschaltdauer ab. Verglichen mit der Erwärmung bei Dauerbetrieb ist sie relativ gering. Die verschiedenen Relais sind in dieser Hinsicht im wesentlichen gleich. (Abb. 4)

Einschaltdauer	%
Dauerbetrieb	100% Spulenerwärmung
Ein : Aus = 3 : 1	Etwa 80%
Ein : Aus = 1 : 1	Etwa 50%
Ein : Aus = 1 : 3	Etwa 35%

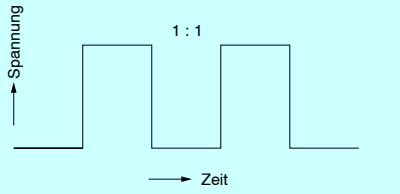


Abb. 4

• Änderung der Anzugsspannung aufgrund des Anstiegs der Spulentemperatur (Warmstart)
Nach einer gewissen gleich bleibenden Spannung in der Spule und anschließendem Ab- und wieder Anschalten des Stroms, steigt bei Gleichstromrelais mit dem Temperaturanstieg auch die Anzugsspannung etwas an. Dies ist mit einer Verwendung in einer höheren Umgebungstemperatur vergleichbar. Das Verhältnis zwischen Widerstands- und Temperaturerhöhung für Kupferdraht liegt bei etwa 0,4% pro 1°C. Um dieses Verhältnis erhöht sich der Spulenwiderstand. Für den Betrieb des Relais ist es deshalb erforderlich, dass die Spannung höher als die Anzugsspannung ist, und die Anzugsspannung entsprechend dem Isolationswiderstand zunimmt. Bei einigen polarisierten Relais ist dieses Änderungsrate jedoch beträchtlich geringer.

• Betriebszeit
Bei Wechselstrombetrieb hängt die Ansprechzeit stark von der momentanen Phasenlage ab, in der die Spule gerade erregt wird. Für Miniaturrelais beträgt sie in den meisten Fällen eine Halbwelle (ca. 10ms). Für die größeren Relais beträgt sie 7 bis 16 ms, die Abfallzeit liegt bei 9 bis 18 ms. Auch bei Gleichstrombetrieb ist die Ansprechzeit bei großen Spulen schnell. Eine zu schnelle Betriebszeit erhöht jedoch auch die Prellzeit von Kontakt "A".

• Streuschaltungen (Nebenschlüsse)
Bei Folgeschaltungen ist darauf zu achten, dass keine Nebenschlüsse erzeugt werden, um falsche oder unregelmäßige Operationen zu vermeiden. Wie in Abb. 5 dargestellt, müssen für die Vorbereitung von Folgeschaltungen zwei Anschlüsse als Stromversorgung vorgesehen werden; der obere Anschluss ist immer ⊕ und der unter ⊖ (bei Wechselstrom-Betrieb gilt dasselbe). Die ⊕-Seite ist also immer jene Seite, an der Kontaktschaltungen (Kontakte für Relais, Zeitschalter, Endschalter etc.) hergestellt werden und die ⊖-Seite ist die Last-Seite (für Relaisspule, Timer-Spule, Magnetspule, Zylinderspule, Motor, Lampe etc.).

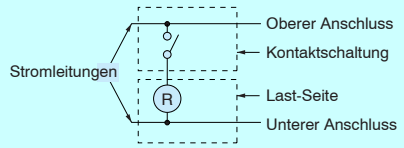


Abb. 5 Beispiel einer vertikalen Folgeschaltung

Abb. 6 zeigt ein Beispiel für Streuschaltungen. Abb. 6 (a) zeigt die geschlossenen Kontakte A, B und C, nach dem Betrieb der Relais R_1, R_2 und R_3. Wenn die Kontakte B und C offen sind, kommt es zu einer Folgeschaltung durch A, R_1, R_2 und R_3, und die Relais können brummen oder ihr Abfall verhindert werden. Die Schaltung aus Abb. 6 (b) ist korrekt ausgeführt. Bei Gleichspannungsbetrieb lassen sich Streuschaltungen durch den Einsatz einer Entkopplungsdiode vermeiden.

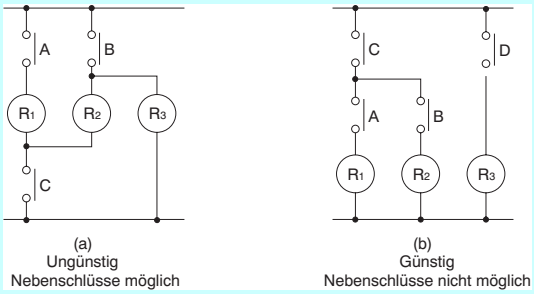


Abb. 6 Streuschaltungen

• Langsamer Anstieg der Spulenspannung und "Selbstmörderschaltung"

Wird die Spulenspannung langsam erhöht, ist der Kontaktumschaltzustand instabil, der Kontaktdruck nimmt ab und das Kontaktprellen erhöht sich. Diese Methode der Spulenerregung sollte nicht angewendet werden, statt dessen sollte die Spannung möglichst schlagartig angelegt werden. Bei bistabilen Relais wird die Methode, den Spulenstrom durch einen relaiseigenen Ruhekontakt zu unterbrechen (Selbstmörderschaltung) nicht empfohlen, da dies zu Störungen, im Extremfall zum Flattern des Relais führen kann.

Die Schaltung in Abb. 7 zeigt eine zeitverzögerte Folgeschaltung mit Reed-Relais. Dabei steigt die Spannung an den Relaispulen verzögert an, im Moment des Umschaltens wird die Spulenspannung unterbrochen. Bei Relais R_1 kann dies zum Flattern führen und die Funktionssicherheit der Schaltung in Frage stellen. Selbst wenn diese Schaltung beim Eingangstest funktioniert, kann nach einiger Zeit durch Abbrand der Kontakte die Zuverlässigkeit und Zeitgenauigkeit der Schaltung reduziert werden.

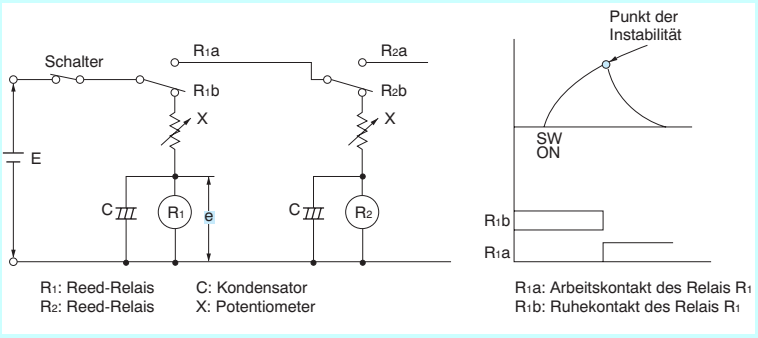


Abb. 7 Zeitverzögerte Folgeschaltung mit Reed-Relais

• Phasensynchronisation beim Schalten von Wechselstromlasten

Schaltet das Relais durch Rückkopplung von der Last zur Ansteuerung immer in der gleichen Phasenlage, kann dies zur Verringerung der elektrischen Lebensdauer und zum Verschweißen oder Verhaken der Kontakte durch Materialwanderung führen. Deshalb sollte das Relais in seinem aktuellen Einzelfall beobachtet werden. Beim Betrieb von Relais mit Timern, Mikrocomputern oder Thyristoren etc. kann es eine Synchronisation mit der Stromversorgung geben. (Abb. 8)

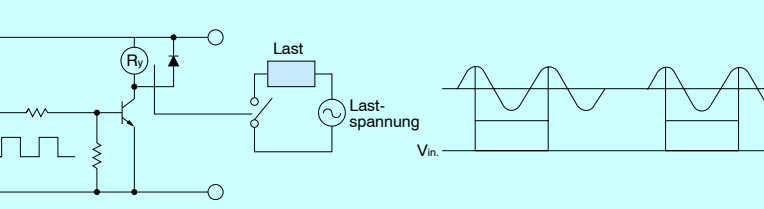


Abb. 8

• Fehlschaltungen durch induktive Kopplung

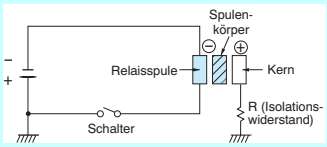
Bei langen Leitungen gilt: Wenn die Last- und die Steuerleitung dieselbe Leitung verwenden, kann dies dazu führen, dass durch die Induktion von der Stromleitung, eine Induktionsspannung an der Spule entsteht. Dabei spielt es keine Rolle, ob das Steuerungssignal an oder aus ist. In diesem Fall werden Relais und Timer nicht zurückgesetzt. Beachten Sie bitte, dass es bei Leitungen, die eine lange Strecke überbrücken, aufgrund von Problemen bei der Kapazitätsverteilung zu Fehlschaltungen der Relais kommen kann. Durch externe Einflüsse, wie Blitzschlag etc., kann es auch zu einem Geräteausfall kommen.

• Langfristiger Stromfluss
In Anwendungen, die lange Schaltzyklen aufweisen (z.B. Notleuchten, Diebstahlsicherungen und Prüfmechanismen) empfiehlt sich vorzugsweise die Verwendung von Ruhekontakten für den Dauerbetrieb.
Dauerhafte und langfristige Spannung auf der Spule kann die Spulenisolation beeinträchtigen, und eine erhöhte Spulenerwärmung zu einer geringen Lebensdauer führen.
Für diese Anwendungen sollten bistabile Relais verwendet werden. Falls Sie ein einzelnes, stabiles Relais verwenden, sollten Sie eine mit Kunststoff abgedichtete Ausführung, die kaum auf die Umgebungsbedingungen reagiert, und eine ausfallsichere Schaltungsanordnung wählen.

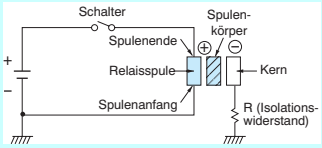
• Seltene Schaltungen
Wenn eine Schaltung nur einmal pro Monat erfolgt, oder die Häufigkeit noch geringer ist, sollten Sie regelmäßige Kontaktprüfungen durchführen. Werden die Kontakte über einen längeren Zeitraum nicht geschaltet, können sich an der Oberfläche Ablagerungen bilden, die zu einer Instabilität der Kontakte führen.

• Elektrolytische Korrosion der Spulen
Beim Einsatz von Relais mit vergleichsweise hoher Spulenspannung (besonders bei 48V Gleichstrom) kann, vor allem bei hoher Luftfeuchtigkeit, elektrolytische Korrosion auftreten. Um das Auftreten offener Stromkreise zu vermeiden, sollten Sie folgende Punkte besonders beachten.
[1] Die ⊕-Seite der Spannungsquelle sollte an der Bodenplatte angeschlossen sein. (siehe Abb. 9 - dies gilt für alle Relais)
[2] In Fällen, in denen die Erdung der ⊖-Seite unvermeidbar ist, oder in Fällen, in denen die Erdung nicht möglich ist:
(1) Setzen Sie bitte die Kontakte (oder den Schalter) in die ⊕-Seite der Spannungsquelle ein und schließen Sie den Beginn der Spulenwicklung an der ⊖-Seite an. (siehe Abb. 10 - dies gilt für alle Relais)
(2) Ist die Erdung nicht erforderlich, schließen Sie den Erdungsanschluss bitte an die ⊕-Seite der Spule an. (siehe Abb. 11 - NF- und R-Relais mit Erdungsanschluss)
[3] Wenn die ⊖-Seite der Stromquelle geerdet ist, vermeiden Sie bitte den Einsatz der Kontakte (und Schalter) an der ⊖-Seite. (siehe Abb. 12 - dies gilt für alle Relais)
[4] Hat das Relais einen Erdungsanschluss, der zum Betrieb nicht benötigt wird, sollte dieser nicht angeschlossen werden, um elektrolytische Korrosion zu verhindern.
Anmerkung: Die Abbildung zeigt, dass der Isolationswiderstand zwischen Eisenkern und Masse eingefügt wurde. In Relais mit Erdungsanschluss ließe sich der Eisenkern direkt an der Masse erden, aber in Anbetracht der elektrolytischen Korrosion sollte diese Verbindung nicht hergestellt werden.

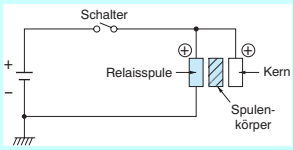
Bewertung: OK (Abb. 9)



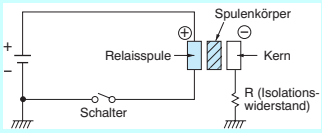
Bewertung: OK (Abb. 10)



Bewertung: OK (Abb. 11)



Bewertung: Nicht OK (Abb. 12)



KONTAKTE

Die Kontakte sind die wichtigsten Teile des Relais. Die Leistungsfähigkeit der Kontakte wird vor allem durch Kontaktmaterial, Schaltspannung und -strom (besonders im Moment des Ein- und Ausschaltens), Art der Last, Schalthäufigkeit, umgebene Atmosphäre, Kontaktform, Schaltgeschwindigkeit und Kontaktprellen bestimmt.
Folgende Punkte sollten beachtet werden, um Materialwanderung, Kontaktschweißen, übermäßigen Abbrand, Erhöhung des Kontaktwiderstands und verschiedene andere Ausfallursachen zu vermeiden:
*Es empfiehlt sich, die Verwendung vorab mit unseren Vertriebsbüros abzuklären.

1. Kontaktspannung, -strom, -last [AC/DC]
Enthält die Last einen induktiven Anteil, wird eine ziemlich hohe Gegen-EMK (Induktionsspannung) erzeugt, die die Abschaltspannung erhöht. Die Energie, die sich an den Kontakten entlädt, verursacht Abbrand und Materialwanderung. Deshalb ist es nicht nötig, den Lichtbogen durch ein geeignetes RC-Glied zu unterdrücken. Bei Gleichspannung gibt es keinen Nulldurchgang, bei dem der Lichtbogen von selbst erlischt. Ist einmal ein Lichtbogen erzeugt worden, ist er schwer zu unterdrücken. Die vergrößerte Lichtbogenverweilzeit stellt das Hauptproblem für die Kontakte dar. Dazu kommt, dass die Richtung des Stroms festgelegt ist, wodurch verstärkte (einseitige) Materialwanderung hervorgerufen wird. Gewöhnlich wird der ungefähre Wert des RC-Gliedes im Katalog oder Datenblatt angegeben, aber dieser Wert alleine reicht meistens nicht aus. Der Kunde wird eine, für seinen Anwendungsfall am besten geeignete Beschaltung vornehmen. Im Allgemeinen empfiehlt es sich, für induktive Lasten Relais einzusetzen, die geeignet sind, 125 VAC zu schalten.
Im Katalog sind die Mindestlasten angegeben, doch diese gelten nur als Richtlinie für das Schaltvermögen des Relais und stellen keine exakten Werte dar. Diese Mindestwerte werden durch die Schaltfrequenz, Umgebungsbedingungen und den Kontaktreibeweg beeinflusst. Für Low-Level-Lasten oder einen Kontaktwiderstand von maximal 100 mΩ (z.B. für Messungen und drahtlose Anwendungen) verwenden Sie bitte AgPd-Kontakte.

[Schaltstrom]
Der Strom ist sowohl beim Schließen als auch beim Öffnen der Kontakte eine wichtige Einflussgröße. Wenn als Last z.B. ein Motor oder eine Lampe geschaltet wird, verursacht der höhere Einschaltstrom einen entsprechend größeren Abbrand und eine größere Materialwanderung. Dadurch entsteht nach einiger Zeit ein Kontaktverhalten oder -verschweißen.

2. Eigenschaften allgemein gebräuchlicher Kontaktmaterialien
Nachstehend sind die Eigenschaften der Kontaktmaterialien aufgelistet. Informieren Sie sich bei der Auswahl eines Relais in dieser Tabelle.

Kontaktmaterial	Ag (Silber)	Die elektrische und thermische Leitfähigkeit ist bei Silber höher als bei allen anderen Metallen. Silber hat einen niedrigen Kontaktwiderstand, ist kostengünstig und weit verbreitet. Ein Nachteil besteht darin, dass Silber in Sulfid-Atmosphäre leicht einen Sulfidfilm entwickelt. Vorsicht ist bei niedriger Spannung und niedrigem Strom geboten.
	AgCd (Silber-Kadmium)	Silber-Kadmium besitzt die Leitfähigkeit und den niedrigen Kontaktwiderstand des Silbers sowie einen ausgezeichneten Widerstand gegenüber Verschweißen. Wie auch bei Silber entwickelt sich in Sulfid-Atmosphäre leicht ein Sulfidfilm.
	AgW (Silber-Wolfram)	Die Härte und der Schmelzpunkt von Silber-Wolfram sind hoch, der Widerstand gegen Lichtbogenbildung ist ausgezeichnet, und die Materialwanderung äußerst gering. Es ist jedoch ein hoher Kontaktdruck erforderlich. Der Kontaktwiderstand ist relativ hoch und der Widerstand gegenüber Korrosion schlecht. Zudem gibt es Einschränkungen bei der Verarbeitung und Montage von Kontaktfedern.
	AgNi (Silber-Nickel)	Silber-Nickel weist eine ähnliche elektrische Leitfähigkeit wie Silber auf. Es verfügt über Lichtbogen löschende Eigenschaften.
	AgPd (Silber-Palladium)	Bei Standardtemperaturen weist Silber-Palladium einen guten Korrosionswiderstand auf und neigt kaum zur Sulfidbildung. In Trocken-Schaltungen haften dem Material jedoch organische Gase an, und es entwickelt leicht Polymere. Zur Vermeidung der Polymer-Bildung wird Gold-Plattierung verwandt. Das Material ist sehr teuer.
Kontakt-Oberflächen	Rh-Auflage (Rhodium)	Die Rhodium-Auflage verbindet perfekten Korrosionswiderstand mit Härte. Kontakte mit Rhodium-Auflagen werden für relativ kleine Lasten benutzt. In einer organischen Gasatmosphäre ist jedoch Vorsicht geboten, da sich Polymere entwickeln können. Deshalb wird das Material in hermetisch dichten Relais (z.B. Reed-Relais) eingesetzt. Das Material ist sehr teuer.
	Au-Plattierung (Goldplattierung)	Gold, das sich durch seine ausgezeichneten Korrosionswiderstand auszeichnet, wird auf ein Basismetall aufgewalzt. Zu den besonderen Eigenschaften gehören eine gleichmäßige Stärke und die Abwesenheit von Poren. Das Material ist besonders bei niedrigen Lasten unter relativ nachteiligen atmosphärischen Bedingungen sehr effektiv. Aufgrund der Konstruktion und der Installation ist es oft schwierig, plattierte Kontakte in vorhandene Relais einzusetzen.
	Au-Auflage (Goldauflage)	Die Goldauflage verfügt über eine ähnliche Wirkung wie die Goldplattierung. Je nach verwendetem Galvanisierungsverfahren ist die Überwachung dieses Verfahrens sehr wichtig, da die Gefahr besteht, dass sich Poren und Risse entwickeln. Das Einsetzen von Kontakten mit Goldauflage in vorhandene Relais ist relativ einfach.
	Hauchvergoldung (Golddünnfilmauflage)	Der Zweck der Vergoldung besteht im Schutz des Kontaktbasismaterials während der Lagerung der Relais oder des Geräts, in das das Relais eingebaut ist. Es kann jedoch beim Schalten von Lasten ein bestimmter Grad der Kontaktstabilität erreicht werden.

3. Kontaktschutz

• Selbstinduktionsspannung

Beim Schalten induktiver Lasten mit einem Relais, wie zum Beispiel bei Relais-Sequenzschaltungen, Gleichstrommotoren, Gleichstromkupplungen und Gleichstrommagneten ist es immer wichtig, Stoßspannungen (z.B. mit einer Diode) zu absorbieren, um die Kontakte zu schützen.

Werden diese induktiven Lasten ausgeschaltet, entwickelt sich eine Selbstinduktionsspannung von mehreren hundert bis tausend Volt, die die Kontakte erheblich schädigen und die Lebensdauer stark verkürzen kann. Wenn der Strom in diesen Lasten relativ gering ist und bei etwa 1A liegt, kann die Selbstinduktionsspannung die Zündung einer Glüh- oder Bogenentladung verursachen. Bei der Entladung zerfällt organisches Material, das in der Luft enthalten ist, und führt zu schwarzen Rückständen (Oxide, Karbide), die sich auf den Kontakten niederschlagen. Dies kann zu Kontaktausfall führen.

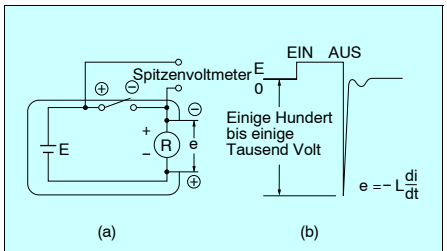


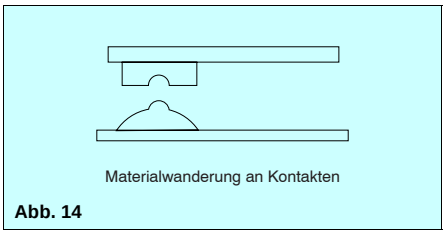
Abb. 13

In der Abbildung 13(a) ist eine Selbstinduktionsspannung (e = –L di/dt) mit einer steilen Wellenform über der Spule erzeugt worden, wobei die in Abbildung 13(b) gezeigte Polarität zum Zeitpunkt der induktiven Last ausgeschaltet wird. Die Selbstinduktionsspannung wird durch die Stromzufuhrleitung geführt und erreicht die beiden Kontakte.

Im Allgemeinen liegt die dielektrische Zündspannung bei Standard-Temperatur und Standard-Luftdruck bei ungefähr 200 bis 300 Volt. Wenn die Selbstinduktionsspannung diesen Wert übersteigt, erfolgt eine Entladung an den Kontakten, die die in der Spule gespeicherte Energie ($(^1/_2 Li^2)$) verbraucht. Aus diesem Grund ist es wünschenswert, die Selbstinduktionsspannung zu absorbieren, so dass sie bei maximal 200V liegt.

• Materialwanderungs-Phänomen

Materialwanderung an Kontakten erfolgt, wenn ein Kontakt schmilzt und das Kontaktmaterial auf andere Kontakte umschlägt. Bei zunehmender Anzahl von Schaltungen entwickeln sich unebene Kontaktoberflächen (Abb. 14). Nach einer gewissen Zeit hängen die unebenen Kontakte so fest zusammen, als wären sie zusammengeschweißt. Dies erfolgt z.B. wenn Entladungen infolge von induktiven oder kapazitiven Lasten auftreten. Als Gegenmaßnahme werden Kontakt-Schaltungen und Kontaktmaterialien benutzt, die gegen Materialwanderung resistent sind, wie z.B. AgSnO, AgW oder AgCu. Im Allgemeinen erscheint auf der Katode eine Konkav- und auf der Anode eine Konvexbildung. Für Gleichstrom-Kapazitivlasten (mehrere Ampere bis mehrere zehn Ampere) ist es immer notwendig, Bestätigungstests unter realen Bedingungen durchzuführen.



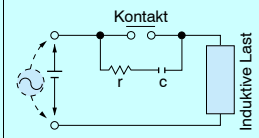
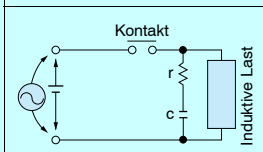
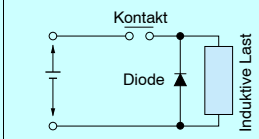
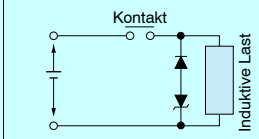
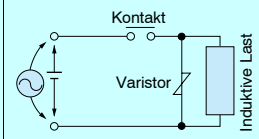
Materialwanderung an Kontakten

Abb. 14

• Kontaktschutzschaltung

Induktionsspannungen können durch Kontaktschutzschaltungen reduziert werden. Beachten Sie jedoch, dass eine unsachgemäße Verwendung die gegenteilige Wirkung haben kann. In der folgenden Tabelle werden typische Schaltungen dieser Art angegeben.

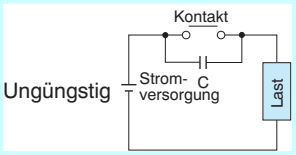
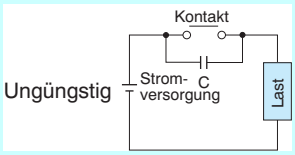
(o = Gut; x = Nicht empfehlenswert)

Schaltung		Anwendung AC	Anwendung DC	Eigenschaften/Anderes	Auswahl der Vorrichtung
RC-Schaltung		*	o	Handelt es sich bei der Last um ein Zeitglied, fließt der Streustrom durch die RC-Schaltung und führt zu einem Fehlbetrieb. * Stellen Sie bei einer Anwendung mit Wechselstromspannung sicher, dass die Impedanz der Last in ausreichendem Maße kleiner als die RC-Schaltung ist.	Als Richtlinie bei der Auswahl von r und c: r: 0,5 bis 1Ω je 1V Schaltspannung c: 0,5 bis 1µF je 1A Schaltstrom Die Werte sind abhängig von der Last und den Abweichungen in den Relais-Eigenschaften. Der Kondensator C unterdrückt die Entladung bei Kontaktöffnung. Der Widerstand begrenzt den Strom, wenn das nächste Mal geschaltet wird. Führen Sie bitte zur Bestätigung Tests durch. Verwenden Sie einen Kondensator mit einer Spannungsfestigkeit von 200 bis 300V. Für Wechselstromschaltungen benötigen Sie einen ungepolten Wechselstromkondensator.
		o	o	Handelt es sich bei der Last um ein Relais oder einen Magneten, verlängert sich die Abfallzeit. Die Schaltung ist wirksam, wenn sie an beiden Kontakten angeschlossen ist, sobald die Leistungszufuhrspannung 24 oder 48V und die Spannung über die Last 100 bis 200V beträgt.	
Diodenschaltung		x	o	Die in Sperrrichtung parallel zur Last eingeschaltete Diode schließt die beim Öffnen der Kontakte entstehende Selbstinduktionsspannung kurz. Dabei wird die in der induktiven Last gespeicherte Energie im ohmschen Anteil der Induktivität in Wärme umgesetzt. Diese Schaltung verzögert die Abfallzeit im Vergleich zur RC-Schaltung weiter (das Zwei- bis Fünffache der im Katalog aufgelisteten Abfallzeit).	Verwenden Sie eine Diode mit einer Durchbruchspannung in Sperrrichtung, die mindestens dem Zehnfachen der Schaltspannung entspricht. In Elektronikschaltungen, in denen die Spannung nicht so hoch ist, kann eine Diode mit einer Durchbruchspannung in Sperrrichtung von ungefähr dem Zwei- bis Dreifachen der Schaltspannung benutzt werden.
Dioden- und Zener-Diodenschaltung		x	o	Die Schaltung ist wirksam, wenn die Abfallzeit in der Diodenschaltung zu lang ist.	Verwenden Sie bitte eine Zener-Diode mit einer Zener-Spannung, die ungefähr der Schaltspannung entspricht.
Varistor-Schaltung		o	o	Unter Verwendung der konstanten Spannungseigenschaften des Varistors verhindert diese Schaltung besonders hohe Spannungen über den Kontakten. Diese Schaltung verzögert zudem leicht die Abfallzeit. Die Schaltung ist wirksam, wenn sie an beiden Kontakten angeschlossen ist, sobald die Leistungszufuhrspannung 24 oder 48V und die Spannung über die Last 100 bis 200V beträgt.	—

• Vermeiden Sie die Benutzung der Schutzschaltungen, die in den Abbildungen rechts gezeigt sind.

Da induktive Gleichstromlasten schwieriger zu schalten sind als ohmsche Lasten, wird die Verwendung einer Schutzschaltung empfohlen. (Abb. 15)

Abb. 15

	
Obwohl sie bei öffnenden Kontakten in der Lichtbogenunterdrückung extrem wirksam sind, unterliegen die Kontakte dem Schweißen, da Energie in C gespeichert wird, wenn die Kontakte sich öffnen und beim Schließen der Kontakte Entladungsstrom von C fließt.	Obwohl sie bei öffnenden Kontakten in der Lichtbogenunterdrückung extrem wirksam sind, unterliegen die Kontakte dem Schweißen, da Energie in C gespeichert wird, wenn die Kontakte sich schließen.

• Montage der Schutzvorrichtung
In der Schaltung ist es notwendig, die Schutzvorrichtung (Diode, Widerstand, Kondensator, Varistor usw.) in der unmittelbaren Nähe der Last oder des Kontakts anzuordnen. Ist die Schutzvorrichtung zu weit entfernt angeordnet, kann ihre Effektivität abnehmen. Als Richtlinie sollte ein Abstand von bis zu 50 cm gelten.

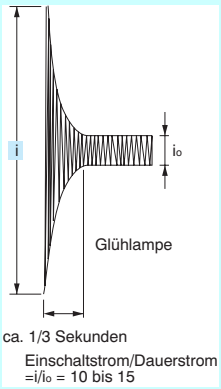
• Anomale Korrosion während des Hochfrequenzschaltens von Gleichstromlasten (Funkenerzeugung)
Wird z.B. ein Gleichstromventil oder eine Gleichstromkupplung bei hoher Frequenz geschaltet, kann sich Korrosion entwickeln. Diese entsteht aus der Reaktion mit dem Stickstoff der Luft, wenn eine Entladung beim Schalten auftritt.

• Lastart und Anlaufstrom
Lastart und Einschaltstrom sind zusammen mit der Schaltfrequenz wichtige Faktoren für die Kontakt-Lebensdauer. Besonders bei Lasten mit Einschaltströmen sollte der Dauerstrom und der Einschaltstrom gemessen werden. Wählen Sie ein Relais mit einem ausreichenden Sicherheitsfaktor. Die rechts abgebildete Tabelle zeigt die Beziehung zwischen typischen Lasten und ihren Einschaltströmen.
Prüfen Sie auch die je nach Relais unterschiedliche aktuelle Polarität, da die Lebensdauer von der Polarität von COM und NO abhängt.

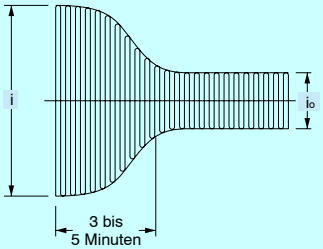
Lastart	Einschaltstrom
Ohmsche Belastung	Dauerstrom
Solenoidlast	Das 10- bis 20-fache des Dauerstroms
Motorlast	Das 5- bis 10-fache des Dauerstroms
Glühlampenlast	Das 10- bis 15-fache des Dauerstroms
Quecksilberlampenlast	Das 3-fache des Dauerstroms
Natriumdampflampenlast	Das 1- bis 3-fache des Dauerstroms
Kapazitive Last	Das 20- bis 40-fache des Dauerstroms
Transformatorlast	Das 5- bis 15-fache des Dauerstroms

Charakteristische Einschaltstromverläufe

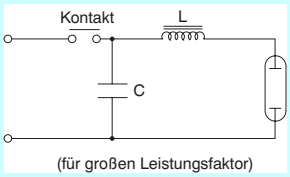
(1) Glühlampelast



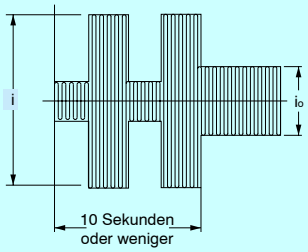
(2) Last der Quecksilberdampflampe
i/io ≅ 3



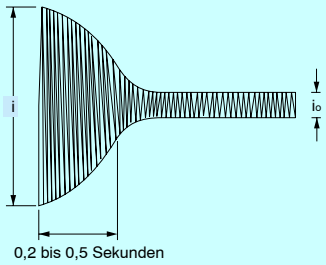
Bitte beachten Sie, dass der Einschaltstrom das 20 bis 40fache des Dauerstroms erreichen kann, insbesondere wenn die Impedanz der Stromquelle niedrig ist.



(3) Last der Leuchtstofflampe
i/io ≅ 5 bis 10

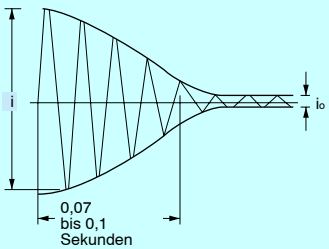


(4) Motorlast i/io ≅ 5 bis 10

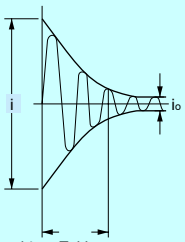


Die Bedingungen werden bei geringer Drehzahl strenger.

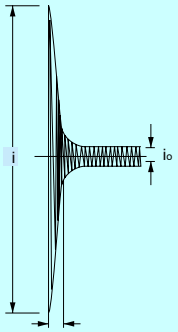
(5) Solenoid-Last
i/io ≅ 10 bis 20



(6) Induktive Last
i/io ≅ 3 bis 10



(7) Kapazitive Last
i/io ≅ 20 bis 40



• Bei Verwendung langer Kabel
Werden in einer Relaiskontaktschaltung lange Kabel (100 bis 300 m) benutzt, kann der Einschaltstrom aufgrund der Streukapazität, die zwischen den Kabeln besteht, zu Problemen führen. Fügen Sie deshalb bitte in Reihe zu den Kontakten einen Widerstand (ungefähr 10 bis 50 Ω ein). (Abb. 16)

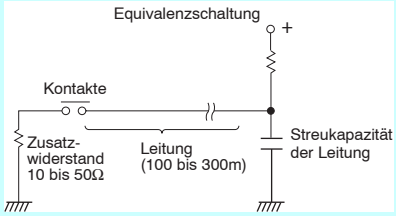


Abb. 16

• Lebensdauer bei hohen Temperaturen
Prüfen Sie unter den aktuellen Gegebenheiten, ob die Lebensdauer durch einen Einsatz bei hohen Temperaturen beeinflusst wird.

• Phasensynchronisation beim Schalten von Wechselstromlasten
Schaltet das Relais durch Rückkopplung von der Last zur Ansteuerung immer in der gleichen Phasenlage, kann dies zur Verringerung der elektrischen Lebensdauer und zum Verschweißen oder Verhaken der Kontakte durch Materialwanderung führen. Deshalb sollte das Relais in seinem aktuellen Einzelfall beobachtet werden. Wenn Probleme auftreten, kontrollieren Sie das Relais jedoch bitte, während es im System betrieben wird. (Abb. 17)

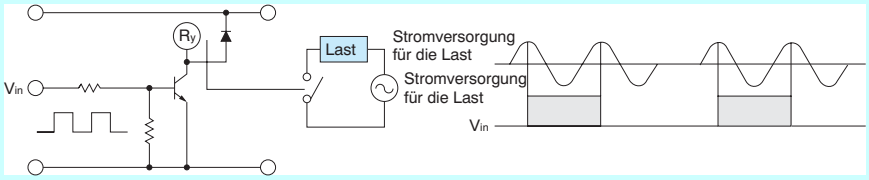


Abb. 17

4. Vorsichtsmaßnahmen beim Schalten von Lasten

• Schaltung von Last und Kontakten
Schalten Sie die Last an der einen Seite der Stromzufuhr; siehe Abb. 18 (a). Und schalten Sie die Kontakte an der anderen Seite. Dies verhindert, dass zwischen den Kontakten hohe Spannungen auftreten. Wenn die Kontakte an beiden Seiten der Stromzufuhr geschaltet sind (Abb. 18 b), besteht das Risiko eines Kurzschlusses, wenn es bei konstruktionsbedingt dicht nebeneinander liegenden Kontakten zu einem Überschlag kommt.

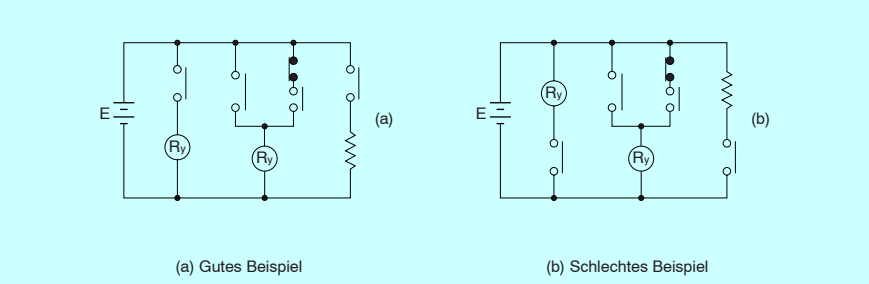


Abb. 18

• Scheinwiderstand
Da der Spannungspegel an Kontakten, die in niedrigen Stromkreisen (Trocken-Schaltungen) verwendet werden, tief ist, führt dies häufig zu einer geringen Leitfähigkeit. Die Stabilität lässt sich verbessern, indem Sie parallel zur Last einen Scheinwiderstand hinzufügen und so absichtlich den Laststrom, der auf die Kontakte trifft, erhöhen.

• Vermeidung von Kurzschlüssen zwischen Arbeits- und Ruhekontakten (Abb. 19)
1) In kompakten Bauteilen kann der Abstand zwischen den Kontakten der Form A und B klein sein. Es muss dabei von Kurzschlüssen durch Überschläge ausgegangen werden.
2) Selbst wenn die drei N.C.- und COM-Kontakte so geschaltet sind, dass sie kurzschließen können, darf keine Möglichkeit des Durchbrennens bestehen.
3) Schaltungen zur Drehrichtungsumkehr von Motoren dürfen nicht mit Ruhe- und Arbeitskontakten desselben Kontaktsatzes aufgebaut werden.

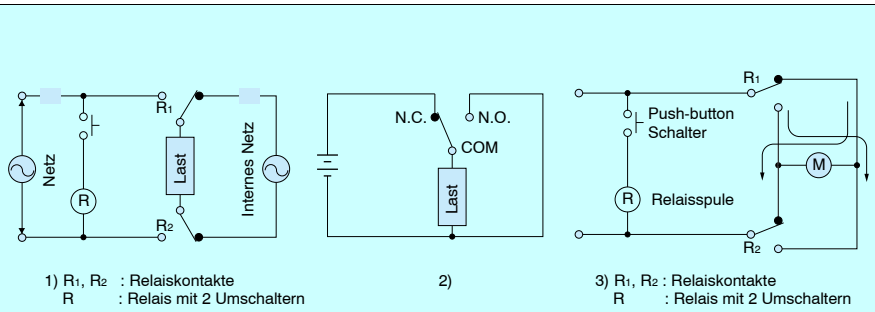


Abb. 19

• Kurzschlüsse zwischen Kontaktsätzen
Obwohl ein eindeutiger Trend zur Miniaturisierung von elektronischen Schaltungen geht, muss der Auswahl der geeigneten Relaistypen besondere Beachtung geschenkt werden. Dies gilt insbesondere für Mehrfachrelais, zwischen denen verschiedene Spannungen geschaltet werden. Dieses Problem lässt sich nicht an Diagrammen für Folgeschaltungen erkennen. Stattdessen muss die gesamte Konstruktion des Bauteils untersucht und im Hinblick auf Luft- und Kriechstrecken, Spannungsfestigkeit, Kontaktabstand etc. für ausreichende Sicherheitsreserven gesorgt werden.

BISTABILE RELAIS

• Bistabile Relais werden werkseitig in zurückgestelltem Zustand ausgeliefert. Eine Schockeinwirkung auf das Relais während des Versands oder bei der Installation kann jedoch den eingestellten Zustand ändern. Bistabile Relais müssen deshalb im praktischen Einsatz generell initialisiert, d.h. in einen definierten Schaltzustand gebracht werden.

• Vermeiden Sie bitte das gleichzeitige Anlegen von Spannungen auf die Setz- und Rücksetzspule.

• Schalten Sie eine Diode, wie in der Abbildung dargestellt, wenn das Relais in den folgenden Schaltungen verwendet wird.

Wenn Setz- oder Rücksetzspulen parallel geschaltet werden, schalten Sie für jede Spule eine Diode in Reihe, siehe Abb. 20 (a), Abb. 20 (b). Auch wenn die Setzspule eines Relais mit der Rücksetzspule eines anderen Relais parallel geschaltet werden, sollten Sie je eine Diode in Reihe schalten, siehe Abb. 20 (c).

Wenn die Setz- oder Rücksetzspule parallel mit einer induktiven Last geschaltet wird (z.B. einer weiteren elektromagnetischen Relais-Spule, einem Motor oder Transformator) sollte eine Diode mit der Setz- und Rücksetzspule in Reihe geschaltet werden, siehe Abb. 20 (d).

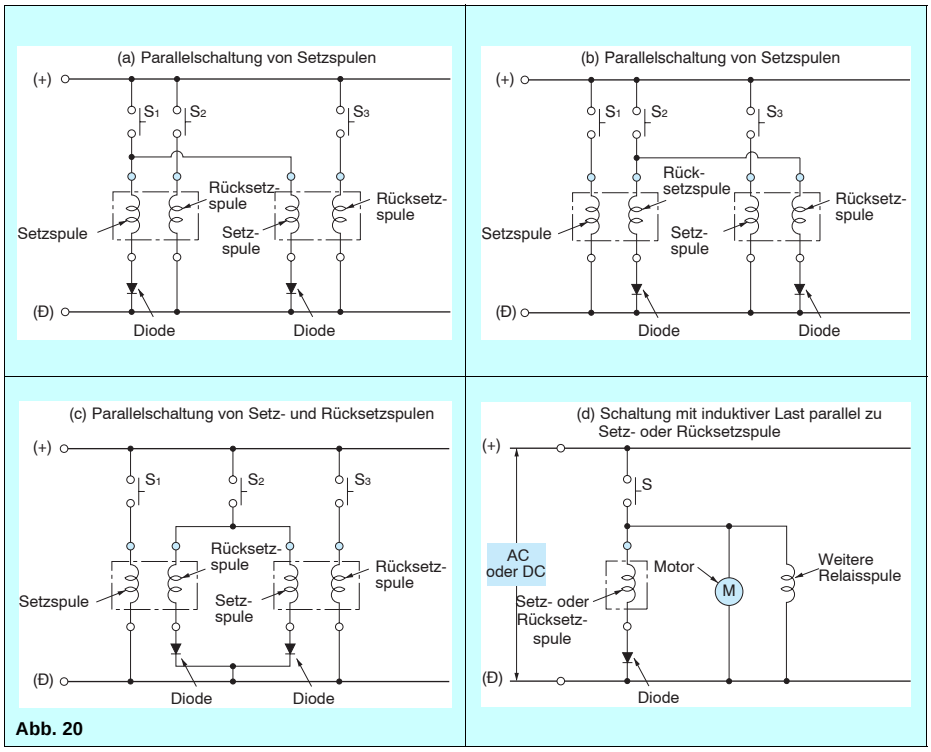


Abb. 20

Verwenden Sie bitte eine Diode, die über eine ausreichende Sperrspannung verfügt. Der zulässige Dauerdurchlaufstrom muss mindestens dem Spulennennstrom entsprechen.

• Vermeiden Sie Anwendungen, bei denen häufig Störspitzen bei der Ansteuerung vorkommen.

• Vermeiden Sie bitte die Benutzung der folgenden Schaltungen, da das Selbstabschalten der Spule den ordnungsgemäßen Schaltzustand der Kontakte verhindern kann. (Abb. 21)

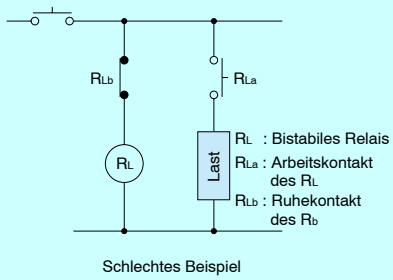


Abb. 21

• Bistabiles Relais mit vier Spulen-Anschlüssen

Bei dem 2-spulig bistabilen Relais in Abb. 22 ist ein Anschluss an einem Ende der Setzspule und ein Anschluss an einem Ende der Rücksetzspule miteinander verbunden. Die Ansteuerung mit gleicher Polarität an der entgegengesetzten Seite bewirkt das Setzen und das Rücksetzen des Relais. In dieser Schaltungsart werden, wie in der nächsten Tabelle angemerkt, zwei Anschlüsse kurzgeschlossen. Die Isolation zwischen den beiden Wicklungen bleibt dabei erhalten.

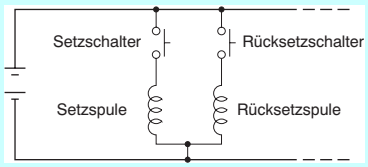


Abb. 22

Relaistyp		Anschluss-Nr.
DS	1c	—
	2c	15 & 16
	4c	*
NC	liegend	5 & 6
	ste-hend	3 & 4
ST		*
SP		2 & 4
DE		1 & 2
JH		6 & 8

Anmerkungen:

1. * Die Konstruktion der DS4c- und ST-Relais gewährleistet einen hohen Isolationswiderstand zwischen der Setz- und Rücksetzspule.
2. Die DSP-, TQ-, TQ-SMD-, TN-, TX- und SEB-Relais sind aufgrund ihrer Polarität für diese Beschaltung nicht anwendbar.

• Induktionsspannung bei bistabilem 2-spuligem Relais

Jede Spule in einem bistabilen, 2-spuligen Relais ist an denselben Eisenkernen mit einer Setz- und einer Rücksetzspule gewickelt. Entsprechend wird die Induktionsspannung an der Rücksetzspule erzeugt, wenn die Spannung auf jede Spule angewendet wird. Die Höhe der Induktionsspannung entspricht zwar etwa der Nennspannung des Relais; dennoch sollten Sie beim Betrieb von Transistoren die Vorspannung in Sperrrichtung beachten.

UMGEBUNGSBEDINGUNGEN

1. Umgebungstemperatur und Atmosphäre

Stellen Sie bitte sicher, dass die Umgebungstemperatur den im Katalog angegebenen Wert nicht überschreitet.
Darüber hinaus sollten für Anwendungen in einer Atmosphäre mit Staub, Schwefelgasen (SO_2, H_2S) oder organischen Gasen, dichte Relais (in Kunststoff abgedichtet oder metallisch hermetisch dicht) in Erwägung gezogen werden.

2. Silikon-Atmosphäre

Auf Silikon basierende Substanzen (Silikongummi, Silikonöl, auf Silikon basierendes Beschichtungsmaterial, Silikon-Dichtungen usw.) geben leicht flüchtiges Silikongas ab. Beachten Sie, dass bei der Verwendung von Silikon in unmittelbarer Nähe von Relais Kontaktstörungen auftreten können, da sich das Silikongas auf den Kontakten festsetzt. Verwenden Sie in einem solchen Fall bitte eine Ersatzsubstanz, die nicht auf Silikon basiert.

3. Umgebungsbedingungen beim Einsatz von abgedichteten Relais (Erzeugung von NOx)

Wenn ein mit Kunststoff abgedichtetes Relais in einer Umgebung mit hoher Luftfeuchtigkeit dazu verwendet wird, eine Last zu schalten, die leicht zu Lichtbogenbildung führt, bildet das durch den Lichtbogen erzeugte NOx mit dem von außen absorbierten Wasser Salpetersäure. Dies führt zur Korrosion der innen liegenden Metallteile und gefährdet eventuell einen fehlerfreien Betrieb.
Verwenden Sie diese Relais nicht in einer Umgebung mit einer Luftfeuchtigkeit von mehr als 85% (bei 20°C). Sollte sich dies nicht vermeiden lassen, setzen Sie sich mit unseren Vertriebsbüros in Verbindung.

4. Vibration und Stoß

Wenn ein Relais und ein Magnetschalter nebeneinander montiert werden, kann es vorkommen, dass sich beim Schaltvorgang des Magnetschalters die Relaiskontakte kurzfristig öffnen und somit Fehlfunktionen eintreten. Als Gegenmaßnahme wird empfohlen, Relais und Magnetschalter nicht gemeinsam auf einer Platine zu montieren, eine Gummidämpfung vorzusehen oder das Relais so zu montieren, dass die Stoßrichtung senkrecht ist.

5. Einfluss externer Magnetfelder

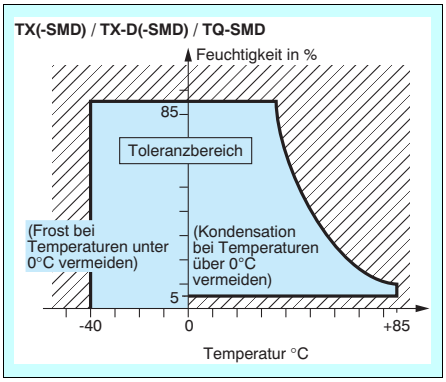
In Reed-Relais und polarisierten Relais (einschließlich NR-Relais) sowie in deren beweglichen Teilen werden Permanentmagnete benutzt. Wenn sich ein Magnet oder Dauermagnet in irgendeinem anderen Relais, Transformator oder Lautsprecher in der Nähe befindet, können sich die Relaiseigenschaften ändern und zu einem fehlerhaften Betrieb führen. Der Einfluss hängt von der Stärke des Magnetfelds ab und sollte bei der Montage berücksichtigt werden.

6. Anwendung, Lagerung und Transportbedingungen

1) Bei der Anwendung, Lagerung und dem Transport von Relais sollte direkte Sonneneinstrahlung vermieden und eine durchschnittliche Temperatur, Luftfeuchtigkeit und Luftdruck eingehalten werden. Nachstehend finden Sie die Spezifikationen für eine angemessene Anwendung, Lagerung und den Transport.

• Temperatur: Je nach Relais unterscheidet sich die zulässige Temperatur, weshalb Sie die jeweiligen Spezifikationen eines Relais berücksichtigen sollten. Zusätzlich kann es beim Transport oder der Lagerung von Relais in Verpackungsstangen zu Abweichungen von den Durchschnittsangaben kommen.
Stellen Sie deshalb sicher, dass Sie die unterschiedlichen Spezifikationen berücksichtigen.

• Feuchtigkeit: 5 bis 85 %



• Luftdruck: 86 bis 106 kPa

Je nach Temperatur unterscheidet sich der zulässige Feuchtigkeitsbereich. Um das Verhältnis von Temperatur und Feuchtigkeit abzulesen, verwenden Sie die nachstehende Grafik.

2) Kondensation

Kondensation entsteht, wenn es bei hoher Temperatur und Luftfeuchtigkeit zu einer plötzlichen Temperaturschwankung kommt.
Die Kondensation beeinträchtigt die Isolierung des Relais.

3) Frost

Kondensationswasser oder andere Feuchtigkeitsansammlungen an einem Relais können unter 0°C gefrieren.
Dies kann zur Blockierung beweglicher Teile oder einer Verzögerung der Funktionszeit führen.

4) Umgebungen mit niedriger Temperatur und geringer Luftfeuchtigkeit

Ist ein Relais über einen längeren Zeitraum niedrigen Temperaturen und geringer Luftfeuchtigkeit ausgesetzt, kann der Kunststoff brüchig werden.

• Beachten Sie, dass Kunststoffe in Umgebungen mit niedrigen Temperaturen und geringer Luftfeuchtigkeit brüchig werden können.
Bei längerer Lagerung oder beim Transport in hohen Temperaturen, hoher Luftfeuchtigkeit und in Umgebungen mit organischen Gasen oder Schwefelgasen können sich an der Kontaktoberfläche Sulfid- und Oxid-Ablagerungen bilden. Dies kann zu einer Instabilität oder Fehlfunktion der Kontakte führen. Stellen Sie bitte sicher, dass die Umgebung für die Lagerung und den Transport von Relais geeignet ist.

• Die Verpackung sollte die Einwirkung von Feuchtigkeit, organischen Gasen und Schwefelgasen soweit wie möglich verhindern.

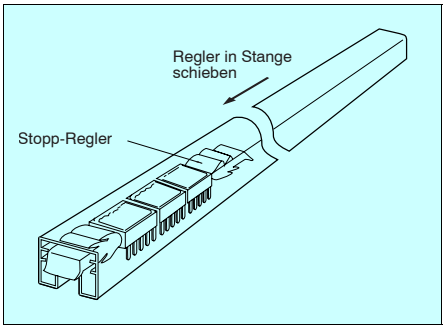
• Da das SMD-Relais besonders schnell auf Feuchtigkeit reagiert, wird es mit einer fest gegen Feuchtigkeit abgedichteten Verpackung ausgeliefert. Beachten Sie deshalb bei der Lagerung folgende Punkte:
(1) Sorgen Sie für eine zügige Verwendung, sobald die Anti-Feuchtigkeitsverpackung einmal geöffnet ist. (Als Richtlinie gilt: Sie sollten diese Relais innerhalb einer Woche verwenden.)
(2) Sollen die Relais nach dem Öffnen der Anti-Feuchtigkeitsverpackung länger gelagert werden, empfiehlt sich ein Lagerplatz, an dem die Feuchtigkeit kontrolliert wird. Alternativ können Sie die Anti-Feuchtigkeitsverpackung zusammen mit einem Silikongel in einer feuchtigkeitsabweisenden Tasche aufbewahren. (Eine Lagerung lässt sich in dieser Form bis ungefähr drei Monate durchführen.)

7. Schwingungen, Erschütterungen und Belastung beim Versand

Wirken beim Versand starke Schwingungen oder Erschütterungen auf ein Gerät ein, in das ein Relais eingebaut ist, oder wirkt ein schweres Gewicht darauf ein, kann es zu Funktionsschäden kommen. Verpacken Sie die Geräte aus diesem Grund in stoßfestem Material, damit der zulässige Erschütterungs- und Stoßbereich nicht überschritten wird.

HINWEISE ZUR VERPACKUNGSSTANGE

Einige Relaisarten werden in Form einer Verpackungsstange ausgeliefert. Wenn Sie der Verpackungsstange einige Relais entnommen haben, schieben Sie den Stopp-Regler anschließend so weit hinein, dass die übrigen Relais fest zusammen geschoben und wieder stoßfest verpackt sind. Andernfalls kann es zu Beschädigungen und/oder Fehlfunktionen kommen.



GEGEN UMWELTEINFLÜSSE ABGEDICHTETE RELAIS

Es sind auch abgedichtete Relaistypen erhältlich. Diese eignen sich z.B. für die Montage an Leiterplatten, an denen automatisches Löten und Reinigen ein Problem darstellen kann. Zudem sind sie resistent gegen Korrosion. Beachten Sie bitte die nachstehenden Hinweise bezüglich der Verwendung von abgedichteten Relais, um umgebungsbedingte Probleme bei deren Einsatz zu verhindern.

1. Umgebungsbedingungen

In Kunststoff abgedichtete Relais eignen sich nicht für Umgebungsbedingungen, bei denen normalerweise hermetisch dichte Relais eingesetzt werden. Obwohl es kein Problem gibt, wenn sie auf Meereshöhe eingesetzt werden, sollte man jedoch atmosphärischen Druck unter 1,013mb ± 20% vermeiden. Desweiteren sollte man die Verwendung dieser Relais in einer Atmosphäre vermeiden, die brennbare oder explosive Gase enthält. Verwenden Sie für diese Anwendungen nur hermetisch dichte Typen.

VERARBEITUNGSHINWEISE

1. Allgemeines

Bei Relais, die dem neuesten Stand der Technik entsprechen, handelt es sich um empfindliche mechanische Präzisionsteile. Während der Produktion werden Vorkehrungen getroffen, um Fehler auszuschließen. Die Relais werden so verpackt, dass sie während des Transports optimal geschützt sind. Dazu gehören die Verwendung von "Eierkarton" ähnlichen Einsätzen, die die Relais schützen und Schäden an den Anschlüssen verhindern, sowie Schaumeinsätze, die eine Beschädigung durch Stoßeinwirkungen verhindern und Verpackungsstangen. Während der Eingangs-Inspektion und der anschließenden Verarbeitung durch den Kunden sollte sorgfältig darauf geachtet werden, dass die Relais beim Auspacken nicht beschädigt werden. Einige wichtige Punkte sind:
(1) Die Anschlüsse sollten nicht berührt werden, um eine Verschmutzung der Oberfläche zu vermeiden. Dies könnte zu Lötproblemen führen.
(2) Die Anschlussbelegung und die Lochung der Leiterplatte müssen zusammenpassen. Jede Nichtübereinstimmung durch nicht passende Leiterplattenbohrungen kann zu Beeinträchtigungen führen und die Leistungsmerkmale sowie die Zuverlässigkeit des Relais nachteilig beeinflussen, insbesondere im Hinblick auf die Dichtigkeit.
(3) Die vorgegebenen Lagertemperaturen sollten nicht überschritten werden.
(4) Die Lagerung und Verarbeitung sollte in möglichst sauberen Räumen erfolgen.

2. Flussmittel

Abhängig vom jeweiligen Relaistyp sollte die Flussmittelverdichtung sorgfältig geprüft werden. Ein nicht abgedichtetes Relais ist durch innere Flussmittel-Verunreinigung gefährdet, die das Kontaktverhalten nachteilig beeinflussen kann. Deshalb sollten diese Relais idealerweise nur von Hand gelötet werden. Es sind "lötdichte" Relais lieferbar, die das Eindringen von Flussmittel durch die Anschlussdurchführungen verhindern. Diese Relais sowie die "abgedichteten" Relais lassen sich bei den meisten Schaum- oder Sprühfluxverfahren einsetzen. Die Verwendung eines nicht aktiven Flussmittels ist in diesem Fall unbedingt ratsam. Da die "lötdichten" Relaistypen nicht vollständig abgedichtet sind, ist ein anschließendes Waschen nicht möglich. Das Vorwärmen der Platine bei der Verarbeitung von lötdichten Relais bewirkt, dass das Flussmittel trocknet und verhindert, dass beim Einlöten Flussmittelreste in das Relaisinnere eindringen können.

3. Einlöten

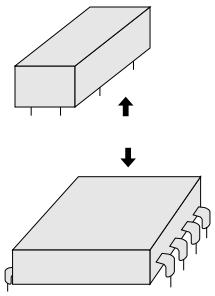
Auch beim automatischen Löten sollten die Relais sorgfältig behandelt werden, um Beschädigungen zu vermeiden. Lötdichte und abgedichtete Relais eignen sich für die üblichen Tauch- oder Wellenlötverfahren. Viele Relais eignen sich für Reflow-Verfahren, wie z.B. Infrarot- oder Dampfphasenlöten. Die Verarbeitungshinweise in Bezug auf maximale Löttemperaturen und -zeiten sind unbedingt zu beachten. Die Anwendung eines I.R.-Lötverfahrens an einem Relais, das nicht speziell für dieses Verfahren konstruiert ist, wird aller Wahrscheinlichkeit nach zum Ausfall führen. Halten Sie in Zweifelsfällen Rücksprache mit Ihrem Matsushita-Vertriebsbüro.

4. Reinigung

Reinigungsverfahren sollten bei nicht abgedichteten Relais vermieden werden. Abgedichtete Relais können durch Eintauchen in eine geeignete Lösung gereinigt werden (siehe Liste mit geeigneten Lösungsmitteln). Das Reinigen in einem Ultraschallbad sollte ebenso vermieden werden. Bedingt durch die Badfrequenz können "Kaltverschweißungen" auftreten, die ein Verhaken der Kontakte bewirken. Im Bedarfsfall kann bei abgedichteten Relais nach dem Reinigen, Trocknen und Abkühlen auf Raumtemperatur durch eine Sollbruchstelle am Nippel eine Belüftungsöffnung hergestellt werden.

MONTAGE-HINWEISE

• Ansicht von oben und von unten
Bei Relais für Leiterplatten sind auf der Ober- und Unterseite die Anschlussbelegungen aufgebracht.



Relais mit Anschlussbelegung auf der Unterseite (die Anschlüsse können von oben nicht gesehen werden)
Relais mit Anschlussbelegung auf der Oberseite (die Anschlüsse können von oben gesehen werden)
Bitte unbedingt beim Erstellen des Leiterplattenlayouts zu beachten!

• Montagerichtung
Die Montagerichtung ist zur Ausnutzung der optimalen Relaiseigenschaften sehr wichtig.

• Stoßfestigkeit
Idealerweise sollte das Relais so montiert werden, dass die Bewegung der Kontakte und der beweglichen Teile senkrecht zur Vibrations- oder Stoßrichtung liegen. Achten Sie bitte besonders darauf, dass die Vibrations- und Stoßfestigkeit der Ruhekontakte in großem Umfang durch die Montagerichtung bei unerregtem Zustand des Relais beeinflusst wird.

• Kontaktzuverlässigkeit
Das Relais sollte so montiert werden, dass die Oberflächen der Kontakte senkrecht angeordnet sind. Somit werden Kontaktstörungen durch Staub, Schmutz, Kontaktabbrand oder Metallstaub weitgehend ausgeschlossen.
Vermeiden Sie Applikationen, bei denen mit nur einem Relais mit einem Kontakt Schwachstrom und mit dem anderen größere Lasten geschaltet werden. Der Abbrand des Starkstrom-Kontakts kann zu Störungen am Schwachstromkontakt führen. Vermeiden Sie es deshalb, das Relais so zu montieren, dass die Schwachstromkontakte unter den Kontakten mit großen Lasten liegen.

• Angrenzende Montage
Wenn viele Relais eng nebeneinander montiert werden, können aus der gemeinsam erzeugten Wärme zu hohe Temperaturen entstehen. Montieren Sie die Relais deshalb bitte mit ausreichenden Abständen, um einen Wärmestau zu verhindern. Dies trifft auch dann zu, wenn eine große Anzahl von Leiterplatten mit Relais installiert wird. Stellen Sie bitte sicher, dass die Umgebungstemperatur den im Katalog angegebenen Wert nicht überschreitet.

• Gegenseitige Beeinflussung bei eng nebeneinander liegender Montage von polarisierten Relais
Wenn polarisierte Relais eng nebeneinander montiert werden, können sich ihre Eigenschaften ändern. Da die Beeinflussung bei nebeneinander liegender Montage je nach Relaistyp unterschiedlich ist, entnehmen Sie die Daten über empfohlene Abstände.

• Montageplatte
-Entfernen Sie die Montageplatte nicht. Sie hat eine besondere Funktion. (Normalerweise löst sich diese nicht ab.)
-Verwenden Sie für die Anbringung Beilagscheiben, um Beschädigungen oder Verformungen zu verhindern. Der Anzugsdrehmoment sollte zwischen 0,49 und 68,6 Nm (5 bis 7 kgf) liegen. Bitte verwenden Sie eine federnde Unterlegscheibe, um eine Ablösung zu vermeiden.

• Steckanschlüsse
Als Richtlinie für Relais mit Steckanschlüssen gilt ein Montagedruck von ca. 4 bis 7kg.

MONTAGE-TECHNIK

• Die Montagerichtung ist grundsätzlich beliebig. Sie sollte jedoch nach Möglichkeit so gewählt werden, dass in Richtung der Kontaktbewegung keine Stoß- oder Vibrationseinwirkungen erfolgen.

Verwendung von Fassungen mit Steckanschlüssen

• Die Fassung sollte so montiert werden, dass ein sicherer Sitz gewährleistet ist. Es sind auch Fassungen zum Anbringen auf DIN-Schienen mit einer Breite von 35 mm lieferbar.

Verwendung von umkehrbaren Fassungen mit Steckanschlüssen

• Die umkehrbaren Fassungen (für HC- und HL-Relais) sind für eine Montage durch Einrasten geeignet. (Die Montageplatte sollte eine Stärke von 1 bis 2mm aufweisen.) (Abb. 23)

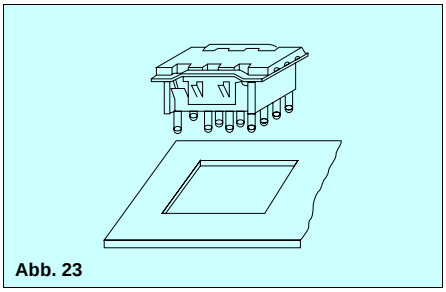


Abb. 23

• Die Fassung sollte durch die Öffnung in der Montageplatte gedrückt werden, bis die Vorsprünge an der Seite der Montagehalterung über die rückseitige Oberfläche hinausragen. (Abb. 24)

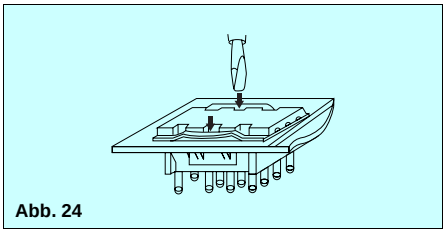


Abb. 24

• Sind alle vier Vorsprünge auf der Rückseite der Montageplatte sichtbar, ist die Fassung richtig befestigt.
• Zum Ausbau der Fassung sollten die Vorsprünge auf der Seite der Montagehalterung nach innen gedrückt und gleichzeitig der Fassungskörper leicht von der Rückseite her angedrückt werden. Danach kann die Fassung aus der Montageplatte entfernt werden.

ANSCHLUSS VON ZULEITUNGEN

• Abhängig von der zu schaltenden Last sollte ein Kabelquerschnitt gemäß der nachfolgenden Tabelle gewählt werden.

Schaltstrom (A)	Kabelquerschnitt (mm^2)
2	0,2
3	0,3
5	0,5
7,5	0,75
12,5	1,25
15	2
20	2
30	3,5

• Wenn die Anschlüsse die Form von Schraubverbindungen haben, verwenden Sie entweder Quetschverbindungen oder andere Techniken, um eine sichere Befestigung zu garantieren.
Bitte verwenden Sie für die Schraubbefestigungen der Anschlussklemme die nachstehenden Angaben zu den Drehmomenten, um Beschädigungen oder Verformungen zu vermeiden.
M4,5-Schraube:
1,47 bis 1,666 Nm (15 bis 17 kgf·cm)
M4-Schraube:
1,176 bis 1,37 Nm (12 bis 14 kgf·cm)
M3,5-Schraube:
0,784 bis 0,98 Nm (8 bis 10 kgf·cm)
M3-Schraube:
0,49 bis 0,69 Nm (5 bis 7 kgf·cm)

BETRIEBSHINWEISE – Checkliste

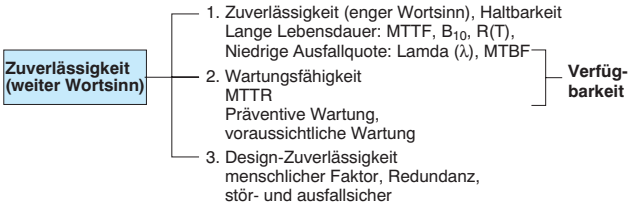
	Prüfpunkte
Spulenspannung	1 Wird die richtige Nennspannung angelegt? 2 Liegt die angelegte Spulenspannung im zulässigen Dauerspannungsbereich? 3 Liegt die Welligkeit der Spulenspannung im zulässigen Bereich? 4 Wird die Polarität der Spannung geprüft, die an eine polarisierte Spule angelegt wurde? 5 Ist im Falle eines Warmstarts der erhöhte Spulenwiderstand aufgrund des Temperaturanstiegs der Spule bei der Bemessung der Spulenspannung berücksichtig worden? 6 Ist die Spulenspannung frei von kurzzeitigen Spannungsabfällen, die durch Laststrom verursacht werden? (Beachten Sie diesen Punkt besonders bei selbsthaltenden Relais.) 7 Wurde die Glättung der Spannungszufuhr bei der Bemessung der Spulennennspannung berücksichtigt? 8 Der Relaisstatus kann instabil werden, wenn die Spulenspannung kontinuierlich ab- oder zunimmt. Wurde das Relais in einer realen Schaltung mit realer Last getestet? 9 Sind die Spannungsabfälle beim Einsatz von Transistoren berücksichtigt worden?
Last (Relais-Kontakte)	1 Ist die Nennlast im Rahmen der Kontaktkapazität? 2 Überschreitet die Last die maximale Schaltkapazität der Kontakte? 3 Besondere Vorsicht ist bei Kontaktschweißen geboten, wenn es sich bei der Last um eine Lampe, einen Motor oder eine Zylinderspule handelt. 4 Wurde das Relais mit einer wirklichen Last getestet? Eine Gleichstromlast kann bei großer Materialwanderung einen Kontaktverschluss verursachen. Wurde das Relais mit einer wirklichen Last getestet? 5 Wird bei einer induktiven Last ein Überspannungsschutz über den Kontakte verwendet? 6 Wenn eine induktive Last eine schwere Bogenentladung über den Relaiskontakten erzeugt, werden die Kontakte eventuell durch eine chemische Reaktion mit Stickstoff korrodiert. Wurde das Relais mit einer wirklichen Last getestet? 7 Platinkontakte können durch Katalysatorseffekte oder Schwingungsenergie braunen Staub erzeugen. Wurde das Relais mit einer wirklichen Last getestet? 8 Liegt die Kontaktschaltfrequenz unter der Spezifikation? 9 Wenn es in einem Relais mehr als zwei Kontaktsets (2T) gibt, kann metallischer Staub, der von einem Kontaktset abgesondert wird, zu einer Fehlfunktion im anderen Set führen (insbesondere bei kleinen Lasten). Wurde das Relais in einer wirklichen Schaltung getestet? 10 Ein Verzögerungskondensator, der über den Relaiskontakten verwendet wird, kann zu Kontaktschweißen führen. Wurde das Relais mit einer wirklichen Last getestet? 11 Bei einem Wechselstrom-Relais kann großes Kontaktprellen zu Kontaktschweißen führen. Wurde das Relais in einer realen Schaltung oder mit realer Last getestet? 12 Eine hohe Spannung kann durch eine Transformatorlast induziert werden. Wurde das Relais mit einer wirklichen Last getestet?
Schaltungsanordnung	1 Berücksichtigt die Schaltungsanordnung die elektrolytische Korrosion der Spule? 2 Sind Transistoren und andere Schaltungselemente vor den gegenläufigen, elektromotorischen Kräfte geschützt, die sich an der Relaisspule entwickeln? 3 Ist die Schaltung so angeordnet, dass die Relaisspule abgeschaltet ist, wenn das Relais für längere Zeit inaktiv ist? 4 Wird das Relais mit den von den internationalen Standards definierten Nennwerten betrieben (sofern eine Einhaltung erforderlich ist)? 5 Ist die Schaltung vor Fehlfunktionen geschützt, wenn die Relais-Aktivierung und/oder Deaktivierungszeit sehr unterschiedlich sind? 6 Ist die Schaltung vor Fehlfunktionen geschützt, die durch das Kontaktprellen der Relais entstehen kann? 7 Ist die Schaltung vor Fehlfunktionen geschützt, wenn ein hoch empfindliches, selbsthaltendes Relais, z.B. vom Typ NR, verwendet werden soll? 8 Wenn es in einem Relais zwei oder mehr Kontaktsets (2T) gibt, kann die Bogenentladung bei induktiver Last Kurzschlüsse an zwei oder mehr Kontaktsets verursachen. Ist die Schaltung so angeordnet, dass solche Bogenentladungen verhindert werden? 9 Der oben angeführte Punkt 8 erfordert auch besondere Beachtung, wenn Lasten aus anderen Stromquellen zugeführt werden. 10 Entspricht der nachträglich eingerichtete Isolationsabstand den Anforderungen der wichtigen internationalen Standards bzw. des Geräte- und Produktsicherheitsgesetzes?

	Prüfpunkte
Schaltungsanordnung	11 Ist die Schaltung vor Fehlfunktionen geschützt, wenn das Relais von Transistoren angesteuert wird? 12 Wird das SCR-Sicherheitsrelais zur Ein- oder Abschaltsteuerung verwendet, kann es bei der Relais-Aktivierung zu einer Synchronisation mit der Zeilenfrequenz und damit zu einer extrem kurzen Lebensdauer kommen. Wurde das Relais in einer realen Schaltung oder mit realer Last getestet? 13 Berücksichtigt das Layout der Leiterplatten die Verwendung eines steckbaren Relais? 14 RF-Signale können an den geöffneten Kontakten streuen. Verwenden Sie für RF-Relais eine geeignete Kontaktisolierung.
Umgebungsbedingungen	1 Liegt die Umgebungstemperatur im zulässigen Bereich für den Betrieb von Relais? 2 Liegt die relative Luftfeuchtigkeit unter 85 Prozent? 3 Ist die Atmosphäre frei von organischen Gasen oder Schwefelgasen? 4 Ist die Umgebungsatmosphäre frei von silikonhaltigen Dämpfen? Je nach Art der Last können silikonhaltige Dämpfe (z.B. von Ölen, Fetten oder Reinigungsmitteln) dazu führen, dass sich an den Kontakten eine schwarze Substanz ablagert, die zu Kontaktausfällen führt. 5 Ist die Luft in der Betriebsumgebung relativ staubfrei? 6 Ist das Relais vor Öl- und Wasserspritzern geschützt? 7 Ist das Relais vor Schwingungen und Erschütterungen geschützt, die zu schlechten Kontakten mit der Fassung führen können? 8 Liegen die Umgebungsschwingungen und -erschütterungen unter dem für das Relais zulässigen Wert? 9 Ist nach der Installation des Relais an seiner Position keine mechanische Resonanz mehr vorhanden? 10 Wurde eine Isolierschicht für das Relais auf die Leiterplatte aufgetragen? Je nach Art der Last kann sich eine schwarze Substanz bilden und zu Kontaktausfällen führen.
Installation und Schaltung	1 Ist das von Hand gelötete Relais vor dem Eindringen von Lötflussmitteln geschützt? 2 Sind die Vorbereitungen für die Flussmittelanwendung und das automatische Einlöten abgeschlossen? 3 Entstehen beim Reinigungsvorgang der Leiterplatte keine negativen Auswirkungen für die Relais? 4 Ist zwischen polarisierten Relais oder Reed-Relais ein ausreichender Abstand vorgesehen, um eine magnetische Kopplung zu verhindern? 5 Ist die Fassung der Relais-Anschlüsse spannungsfrei? 6 Die Eigenschaften polarisierter Relais können durch starke, externe magnetische Felder beeinflusst werden. Sind die Relais in einem erforderlichen Abstand von solchen Feldern installiert? 7 Werden für das Schalten der Last sehr lange Zuleitungen (100 bis 300 Meter) verwendet, kann die Streufähigkeit der Zuleitungen zu Stromspitzen führen. Wurde das Relais mit einer wirklichen Last getestet? 8 Sofern nicht anders angegeben, sollten alle Relais-Anschlüsse bei 250°C in 5 Sekunden oder bei 350°C in 3 Sekunden gelötet werden. 9 Schlecht geformte Leiterplatten können zu Spannungen an den Relais-Anschlüssen und damit zu einer Beeinträchtigung der Relais-Qualität führen. 10 Zum Reinigen der Leiterplatten von Lötflussmitteln sollte keine Glaswolle verwendet werden. Die Glaspartikel können dabei in das Innere des Relais eindringen und zu Fehlfunktionen führen. 11 Relais sollten grundsätzlich nur mit den zugehörigen Kunststoffgehäusen installiert werden. Andernfalls kann die Zuverlässigkeit der Relais-Schaltung beeinträchtigt werden. 12 Trennen Sie nicht benötigte Relais-Anschlüsse nicht ab, da dieser mechanische Stress zu veränderten Eigenschaften des Relais führen kann.
Lagerung und Transport	1 Ist das Relais Frost oder Kondensation (z.B. beim Versand) ausgesetzt? 2 Liegt die Temperatur im zulässigen Bereich für den Betrieb von Relais? 3 Liegt die Luftfeuchtigkeit im zulässigen Bereich für den Betrieb von Relais? 4 Ist die Lagerumgebung frei von organischen Gasen oder Schwefelgasen? 5 Ist die Luft in der Lagerumgebung relativ staubfrei? 6 Ist das Relais vor Öl- und Wasserspritzern geschützt? 7 Wirkt ein schweres Gewicht auf das Relais ein? 8 Überschreiten Schwingungen und Erschütterungen beim Versand den zulässigen Bereich?

Produktzuverlässigkeit

• Was ist Produktzuverlässigkeit?

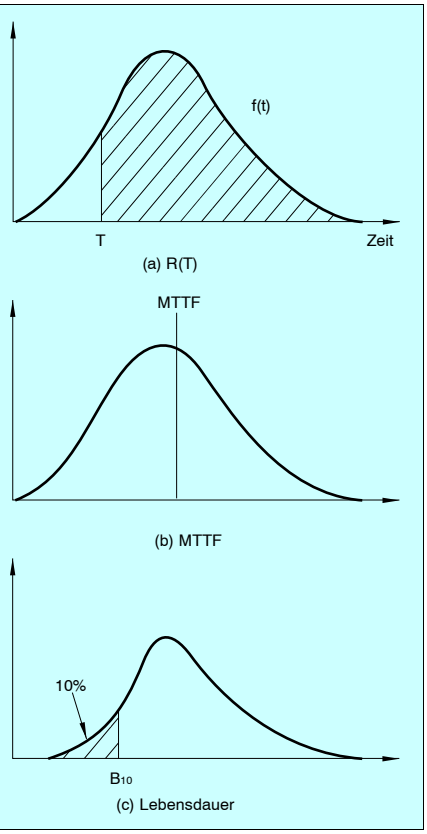
1. Produktzuverlässigkeit im engen Wortsinn
In der Industrie ist die Produktzuverlässigkeit ein Index für die fehlerfreie Funktionsfähigkeit eines Produkts.
2. Produktzuverlässigkeit im weiten Wortsinn
Jedes Produkt hat eine begrenzte Haltbarkeit. Das bedeutet: Ein unendlicher Betrieb ist von keinem Produkt zu leisten. Wenn ein Produkt versagt, kann der Benutzer es wegwerfen oder reparieren. Die Zuverlässigkeit reparierbarer Produkte wird als "Zuverlässigkeit im weiten Wortsinn" bezeichnet. Bei reparierbaren Produkten spielen auch die Wartungsfähigkeit und die Servicefreundlichkeit eine Rolle. Darüber hinaus ist die Zuverlässigkeit des Produktdesigns ein wichtiges Anliegen für die Fertigungsindustrie. Kurz gesagt: der Begriff "Produktzuverlässigkeit" hat drei verschiedene Bedeutungen: die Zuverlässigkeit des Produkts selbst, die Wartungsfähigkeit des Produkts und die Zuverlässigkeit des Produktdesigns.
3. Intrinsische Zuverlässigkeit und Funktionszuverlässigkeit
Es gibt eine Zuverlässigkeit, die in das Produkt "eingebaut" ist. Sie wird als intrinsische Zuverlässigkeit bezeichnet und besteht im Wesentlichen aus der Zuverlässigkeit im engen Wortsinn.
Die Produktzuverlässigkeit für den Benutzer wird als "Funktionszuverlässigkeit" bezeichnet und besteht im Wesentlichen aus der Zuverlässigkeit im weiten Wortsinn. In der Relais-Industrie hat die Funktionszuverlässigkeit den Aspekt von Serviceleistungen.



• Bemessung der Zuverlässigkeit

Die folgende Liste enthält einige der bekanntesten Bemessungsgrundlagen für die Zuverlässigkeit:

Bemessung der Zuverlässigkeit	Beispieldarstellung
Grad der Zuverlässigkeit R(T)	99,9%
MTBF	100 Stunden
MTTF	100 Stunden
Ausfallquote λ	20 FIT, 1%/ Stunde
Lebensdauer B_{10}	50 Stunden



1. Grad der Zuverlässigkeit
Der Grad der Zuverlässigkeit stellt die Zuverlässigkeit in Prozent dar. Zum Beispiel: Wenn von 10 Glühbirnen innerhalb von 100 Stunden keine Glühbirne ausgefallen ist, ergibt sich folgender Grad der Zuverlässigkeit: 100 Stunden ist 10/10 = 100%. Sind nur drei Glühbirnen erhalten geblieben beträgt der Grad der Zuverlässigkeit: 3/10 = 30%.
Der Standard JIS Z8115 definiert den Grad der Zuverlässigkeit wie folgt:
Die Wahrscheinlichkeit, in der ein System, Gerät oder eine Anlage die angegebenen Funktionen über die beabsichtigte Zeitspanne innerhalb der angegebenen Bedingungen ausführt.
2. MTBF
MTBF ist eine Abkürzung für Mean Time Between Failures (durchschnittliche, fehlerfreie Betriebszeit). Sie bezeichnet die mittlere Zeitdauer zwischen zwei Fehlern in einem System, Gerät oder Bauteil. Die MTBF lässt sich nur für reparierbare Produkte verwenden.
Der MTBF-Wert gibt an, wie lange ein Produkt ohne Reparatur verwendet werden kann.
Gelegentlich wird MTBF auch dazu verwendet, die Lebensdauer zwischen den Reparaturen anzugeben.
3. MTTF
MTTF ist eine Abkürzung für Mean Time To Failure (Mittlere Ausfallzeit). Sie bezeichnet die mittlere Zeitdauer bis ein Fehler im Produkt auftritt. Die MTTF wird für irreparable Produkte wie Bauteile und Materialien verwendet.
Bei einem Relais wird meist das Maß MTTF angewendet.
4. Ausfallquote
Die Ausfallquote enthält die durchschnittliche und aktuelle Ausfallquote.
Die durchschnittliche Ausfallquote wird wie folgt definiert:

Durchschnittliche Ausfallquote = Gesamte Ausfälle/Gesamte Betriebszeit

Im Allgemeinen bezeichnet die Ausfallquote die aktuelle Ausfallquote. Sie gibt die Wahrscheinlichkeit an, mit der ein System, Gerät oder eine Anlage, das/die bis zu einem bestimmten Zeitpunkt im Normalbetrieb gelaufen ist, in der Folgezeit defekt wird.
Die Ausfallquote wird meist in der Einheit Prozent/Stunden angegeben. Für Bauteile mit geringen Ausfallquoten wird häufig anstelle der tatsächlichen Quote die Angabe “Failure Unit (FIT) = 10^9 /Stunde” vorgenommen. Bei Relais wird meist Prozent/Anzahl angegeben.
5. Lebensdauer
Die Lebensdauer ist ein Kehrwert für den Grad der Zuverlässigkeit. Sie ist in der folgenden Gleichung als Wert B gegeben:

$1 – R(B) = t$ %

Im Allgemeinen wird häufiger “B[1 – R(B)] = 10%” verwendet. In einigen Fällen ist dieser Wert aussagekräftiger als der MTTF-Wert.

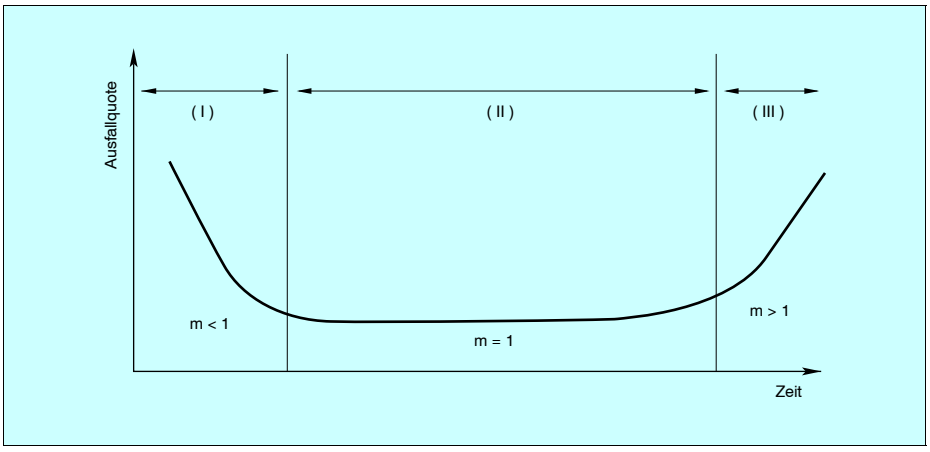
• Ausfall

[1] Was ist ein Ausfall?
Als Ausfall wird der Zustand eines Systems, Geräts oder einer Komponente definiert, in dem/der manche oder alle Funktionen verloren gegangen sind.

[2] Badewannen-Kurve
Die Ausfallquote eines Produkts während des Lebenszyklus lässt sich als Kurve in Badewannenform darstellen (siehe unten). Am Anfang und Ende eines Produktzyklus ist die Ausfallquote hoch.

(I) Anfängliche Ausfallquote
Die hohe Ausfallquote am Anfang lässt sich auf nicht erkannte Design-Fehler, Prozessfehler und andere Ursachen zurückführen. Die anfänglichen Ausfälle werden auf Seite des Herstellers durch Burn-In-Prozesse entdeckt. Dieser Prozess wird als Einlauftest (Aging oder Screening) bezeichnet.

(II) Zufällige Ausfallperiode
Auf die Periode der anfänglichen Ausfallquote folgt eine lange Periode mit niedriger und stabiler Ausfallquote. In diesem Zeitraum, zufällige Ausfallperiode genannt, treten Ausfälle auf der Zeitachse zufällig auf. Auch wenn hier eine Ausfallquote von Null wünschenswert wäre, ist dies im wirklichen Leben meist unrealistisch.



(III) Ausfallquote in der Abnutzungsphase
Die abschließende Phase eines Produktzyklus bildet die Ausfallquote in der Abnutzungsperiode, in der das Produkt aufgrund von Verschleißerscheinungen nicht mehr funktioniert. In diesem Zeitraum können präventive Wartungsmaßnahmen Abhilfe schaffen. Der Ausfall eines Relais aufgrund von Abnutzung lässt sich aus Aufzeichnungen relativ genau vorhersagen. Die Verwendbarkeit eines Relais ist nur in der zufälligen Ausfallperiode vorgesehen, und diese Periode stellt die Lebensdauer eines Relais dar.

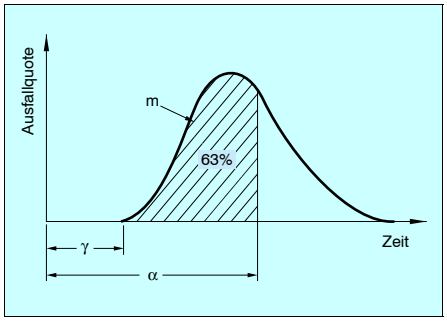
[3] Weibull-Analyse
Die Weibull-Analyse wird zur Klassifizierung der Fehlermuster eines Produkts oder zur Bestimmung der Lebensdauer verwendet. Die Weibull-Verteilung wird durch folgende Gleichung ausgedrückt:

$$f(x) = \frac{m}{\alpha}(\chi-\gamma)^{m-1} e^{-\frac{(\chi-\gamma)^m}{\alpha}}$$

wobei

m : Zahlparameter
α : Maßparameter
γ : Positionsparameter

Werden die drei genannten Variablen berechnet, lässt sich die Weibull-Verteilung für die Berechnung der aktuellen Ausfallquotenverteilung verwenden.



Das Wahrscheinlichkeits-Diagramm von Weibull ist eine einfachere Alternative zur Berechnung komplexer Formeln. Das Diagramm bietet folgende Vorteile:
(1) Die Weibull-Verteilung kommt der aktuellen Verteilung der Ausfallquote am nächsten.
(2) Die Weibull-Wahrscheinlichkeitsdiagramm ist einfach zu verwenden.
(3) In dem Diagramm lassen sich verschiedene Ausfalltypen erkennen.

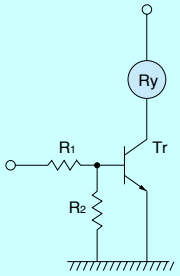
Im folgenden Abschnitt wird der Zusammenhang mit der "Badewannen"-Kurve beschrieben. Der Wert des Parameters "m" stellt die Art des Ausfalls dar.
(1) Wenn $m < 1$: Anfänglicher Ausfall
(2) Wenn $m < 1$: Zufälliger Ausfall
(3) Wenn $m > 1$: Abnutzungsausfall

Anwendungen von Relais in elektronischen Schaltungen

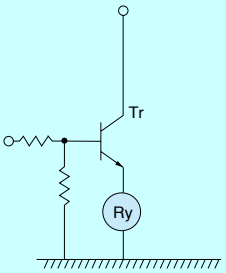
RELAISANSTEUERUNG DURCH EINEN TRANSISTOR

• Anschlussmethode

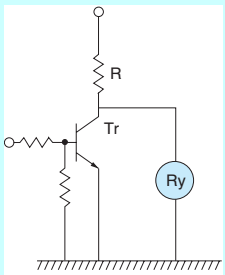
Die auf dem Relais angebrachte Spannungsangabe ist immer die Nennspannung. Im gesperrten Zustand des Transistors sollte die Spannung am Relais Null sein. (Abb. 1)



Kollektor-Anschluss
Bei dieser Ansteuerung ist der Betrieb stabil.



Emitter-Anschluss
Bei dieser Schaltung besteht Gefahr, dass der Transistor nicht durchschaltet und am Relais nicht die volle Nennspannung anliegt.



Parallel-Anschluss
Wenn die Leistung des gesamten Schaltkreises hoch ist, muss die Nennspannung des Relais berücksichtigt werden.

Abb. 1

• Maßnahmen gegen die Zerstörung des Transistors durch Stoßspannungen

Wenn der Spulenstrom plötzlich unterbrochen wird, entsteht in der Spule eine Induktionsspannung. Wenn diese Spannung die Spannungsfestigkeit des Transistors übersteigt, wird der Transistor beschädigt. Es ist unbedingt notwendig, eine Diodenschaltung vorzusehen.
Die Diode sollte so ausgewählt werden, dass der Strom dem Spulenstrom entspricht und die Spitzensperrspannung etwa den dreifachen Wert der Relaisspannung hat. (Abb. 2)

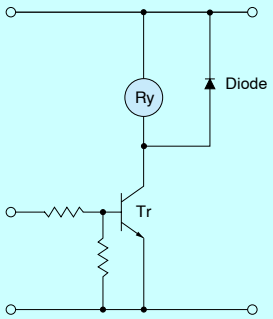


Abb. 2

• Triggerverhalten

(Relaiseigenschaft bei langsamem Spannungsanstieg und -abfall an der Spule)
Undefiniert ist das Relaisverhalten, wenn die Steuerspannung an der Relaisspule rampenförmig angelegt ist. Es ist deshalb notwendig, die Nennspannung mit hoher Anstiegsgeschwindigkeit anzulegen bzw. abfallen zu lassen.
(Abb. 3)
Die Anstiegs- bzw. Abfallzeit sollte 1ms oder weniger betragen.

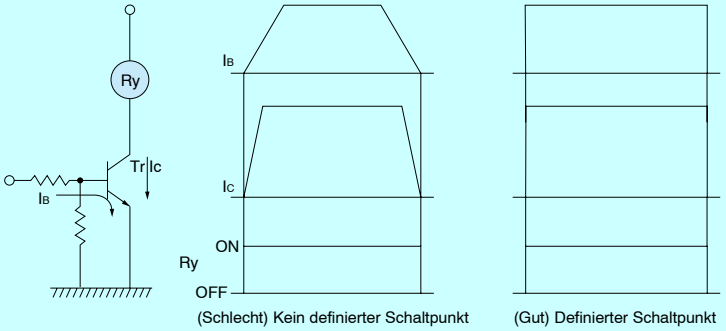


Abb. 3

• Schmitt-Trigger
(Impulsformer-Schaltung)
Wenn das Eingangssignal keine steilen Flanken hat, wird normalerweise zur sicheren Triggerung eine Schmitt-Triggerschaltung benutzt.
Charakteristische Punkte
1. Der gemeinsame Emitter-Widerstand RE_E muss einen Wert aufweisen, der im Vergleich zum Widerstand der Relaisspule ausreichend klein ist. (Die an das Relais angelegte Spannung darf nicht größer als die Nennspannung des Relais sein.)
2. Wenn T_2 oder T_1 leitet, erzeugt der Relaisspulenstrom einen Potentialunterschied am Punkt P der die Schaltspannung des Schmitt-Triggers bestimmt.
3. Wenn das Eingangssignal aufgrund der Welligkeit ein Klappern des Relais erzeugt, sollte vor der Schmitt-Triggerschaltung ein RC-Glied eingesetzt werden. (Dadurch sinkt jedoch die Schaltgeschwindigkeit). (Abb. 4)

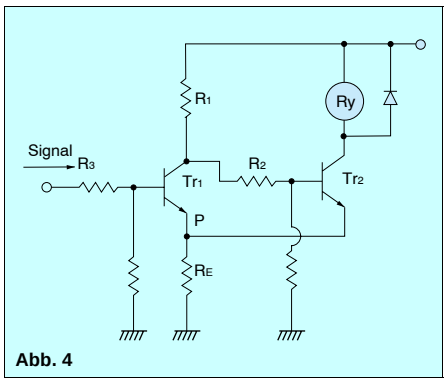


Abb. 4

• Darlington-Schaltungen vermeiden
(hohe Verstärkung)
Diese Schaltungen stellen eine Falle dar, wenn man es mit hoch integrierter Technologie zu tun hat. Dabei muss es nicht zwangsläufig zum Ausfall kommen, aber es besteht die Möglichkeit einer Störung, die nach längerer Betriebszeit bei komplexen Einheiten auftreten kann. (Abb. 5)

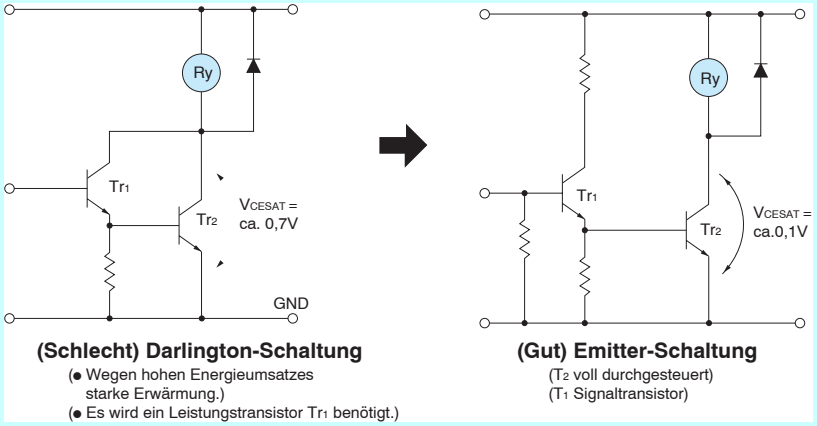


Abb. 5

• Restspannung der Relaisspule
Bei Schaltanwendungen, in denen ein Halbleiter (Transistoren, UJT, etc.) an die Spule angeschlossen wird, bleibt an der Relaisspule eine Restspannung zurück, die zum unvollständigen Abfall des Relais und zu fehlerhaftem Betrieb führen kann. Beim Einsatz von Gleichspannungsspulen kann es zur Reduzierung von Kontaktkraft, Stoß- und Vibrationsfestigkeit kommen. Dies liegt daran, dass die Abfallspannung größer 10% der Nennspannung ist - ein niedriger Wert im Vergleich zur Wechselstromspule. Wenn das Signal vom Kollektor des Transistors zusätzlich zur Steuerung einer anderen Schaltung benutzt wird, fließt kein Strom durch das Relais, selbst wenn der Transistor ausgeschaltet ist. Dies kann zu den oben beschriebenen Problemen führen. (Abb. 6)

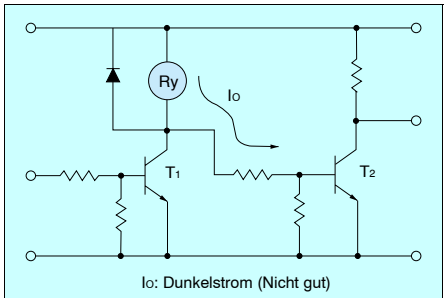
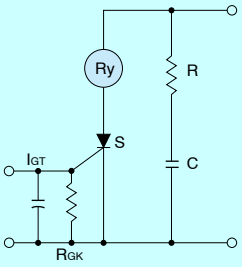


Abb. 6 Kollektorverbindung zur nächsten Stufe Kollektor

RELAISSTEUERUNG MIT THYRISTOR (SCR)

• Normale Ansteuerungsmethode

Bei der Thyristor-Steuerung ist es notwendig, besondere Vorsicht in Bezug auf die hohe Empfindlichkeit des Thyristors und dessen unbeabsichtigten Betrieb aufgrund von Übersprechen walten zu lassen. (Abb. 7)



I_{GT} : Auch mit mehr als dem 3-fachen Nennstrom gibt es kein Problem.
R_{GK} : 1K Ohm Ableitwiederstand.
R,C : Zeitglied zum Schutz vor zu hohem dv/dt

Abb. 7

• Vorsichtsmaßnahmen bei der Ein/ Aus-Schaltung

(Wenn eine Anwendung für Temperatur- oder ähnliche Steuerschaltungen erfolgt) Vorsicht ist geboten, wenn die Relaiskontakte mit dem Maximalwert der Wechselstromphase schließen. Die Lebensdauer des Relais wird dadurch stark vermindert. (Abb. 8)

1. Wenn das Relais unter Verwendung von Thyristoren ein- und ausgeschaltet wird, dient der Thyristor als Halbwellengleichrichter. Es gibt viele Fälle, bei denen es zur Selbstzündung des Thyristors kommt.
2. Dabei können die Ansprechzeiten der Relais mit der Quellenfrequenz synchronisiert werden.
3. Wenn die Last für eine Temperatursteuerung aus einem hohen Laststrom wie z.B. einer Heizung besteht, kann das Schalten nur bei Spitzenwerten oder nur bei Nullphasen-Werten erfolgen - was für diese Art der Ansteuerung typisch ist (abhängig von der Empfindlichkeit und der Reaktionsgeschwindigkeit des Relais).
4. Dementsprechend ergibt sich ein großer Bereich zwischen einer extrem langen und einer extrem kurzen Lebensdauer, und es ist notwendig, das Schaltverhalten entsprechend zu optimieren.

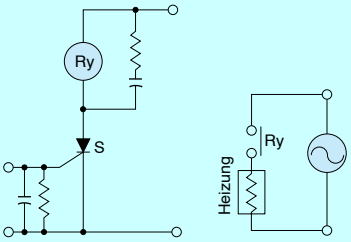


Abb. 8

RELAISSTEUERUNG DURCH EXTERNE KONTAKTE

Leiterplattenrelais sind sehr empfindlich und weisen hohe Schaltgeschwindigkeiten auf. Weil sie zudem auf Welligkeit und Prellen reagieren, ist es notwendig, bei ihrer Ansteuerung sorgfältig vorzugehen.

Wenn die Ansteuerungsfrequenz niedrig und die Verzögerung der Schaltzeit durch einen Kondensator möglich ist, lässt sich damit die Welligkeit der Steuerspannung und das Kontaktprellen verringern. (Abb. 9)

(Es ist jedoch nicht möglich, nur einen Kondensator zu verwenden. Zusammen mit dem Kondensator sollte ein Vorwiderstand zur Vermeidung hoher Einschaltströme eingesetzt werden.)

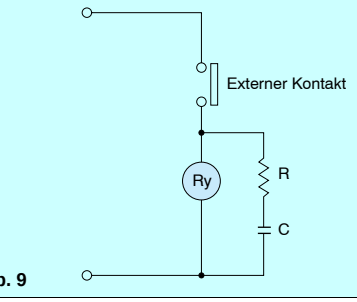
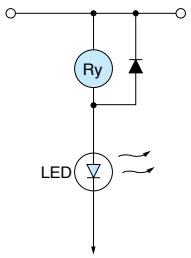


Abb. 9

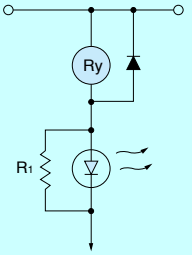
LED IN REIHE UND IN PARALLELBETRIEB ZUR RELAISSPULE

1. In Reihe mit dem Relais



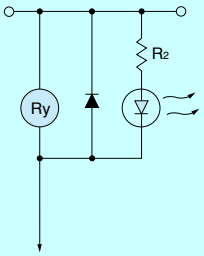
Leistungsverbrauch:
In Verbindung mit dem Relais (Gut)
Defekte LED:
Das Relais funktioniert nicht
Betrieb mit niedriger Betriebsspannung:
Mit LED, 1,5V Spannungsabfall (ungünstig)
Anzahl der Teile: (Gut)

2. R parallel mit LED



Leistungsverbrauch:
Im Zusammenhang mit dem Relais (Gut)
Defekte LED:
Das Relais funktioniert (Gut)
Betrieb mit niedriger Betriebsspannung:
Mit LED, 1,5V Spannungsabfall (ungünstig)
Anzahl der Teile: R_1 (Vorsicht)

3. In Parallelschaltung zum Relais



Leistungsverbrauch:
Strombegrenzungswiderstand R_2 (Vorsicht)
Defekte LED:
Relaisbetrieb stabil (Gut)
Betrieb mit niedriger Betriebsspannung: (Gut)
Anzahl der Teile: R_2 (Vorsicht)

RELAISANSTEUERUNG DURCH EINE ELEKTRONIKSCHALTUNG

• Elektronische Entprellschaltung

Obwohl sich Relais der neuen Generation durch extrem geringe Prellneigung auszeichnen, ist es notwendig, die Signale elektronisch zu entprellen, wenn das Relais z.B. einen Binärzähler ansteuern soll. Durch die dem Relaiskontakt nachgeschaltete FlipFlop-Schaltung werden auftretende Prellsignale am Binärzählereingang unterdrückt. Auch wenn sich auf der einen Seite, entweder am N.O.-Kontakt oder am N.C.-Kontakt Prellungen entwickeln, werden diese durch die Flip-Flop-Schaltung nicht umgekehrt, und Impulse können ohne Verluste in die Binärzählerschaltung gelangen. (Ein Kontaktprellen von der N.O.-Seite zur N.C.-Seite ist jedoch in jedem Fall zu vermeiden). (Abb. 10)

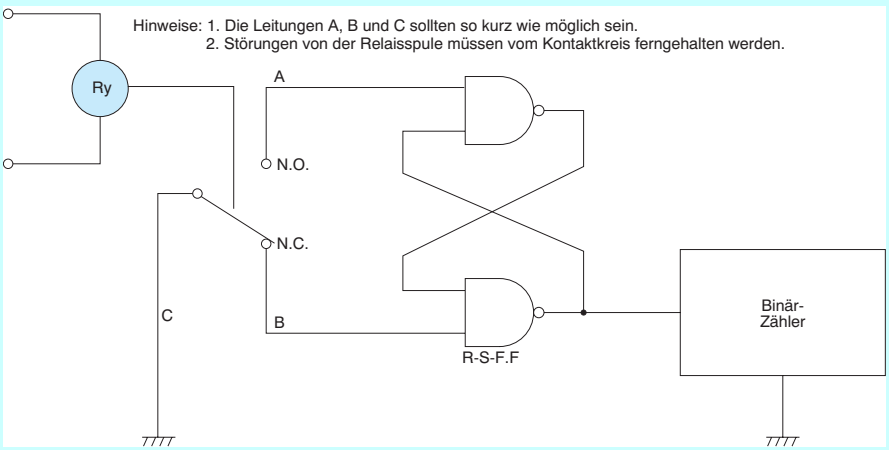


Abb. 10

• Triac-Ansteuerung

Eine Elektronikschaltung wird bei einer direkten Ansteuerung durch einen Triac nicht galvanisch von der Last getrennt. Deswegen können leichte Störungen und Schäden aufgrund eines unvorhergesehenen Betriebs entstehen. Der Einsatz eines Relais bildet dafür eine wirtschaftliche und effektive Lösung. (Optokoppler und Impulstransformator-Schaltungen sind aufwendig.)
Wenn eine Nulldurchgangsschaltung notwendig ist, dann sollte ein Halbleiterrelais (SSR) benutzt werden. (Abb. 11)

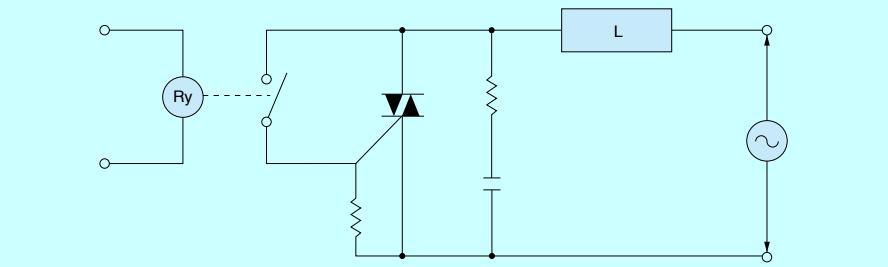


Abb. 11

ELEKTRONISCHE STROMVERSORGUNG FÜR DAS RELAIS UND DIE LAST

• Konstantenspannungsschaltung und deren Dimensionierung

Normalerweise ist eine Spannungsquelle für eine Elektronikschaltung mit Welligkeit und Spannungsschwankungen unerwünscht. Dies trifft natürlich auch für Relaisspannungsquellen zu, jedoch nicht im selben Umfang wie für die Elektronikschaltung. Dementsprechend ist eine Konstantspannungsschaltung für den Betrieb der Elektronikschaltung mit einer ausreichenden Stromreserve wünschenswert. Grob trifft dies auch für das Relais zu, aber vom praktischen Standpunkt aus gesehen, sollte das Relais so ausgewählt werden, dass die gegebene Welligkeit der Spannung und die Spannungsabweichung nicht stören. Dies trifft auch auf die in der Abbildung 12 gezeigten Schaltungen zu. Wichtig ist, dass die Schaltung so dimensioniert wurde, dass sie in der Lage ist, alle Lastschwankungen wie der Ein/Aus-Betrieb des Relais, der Lampe usw. auszugleichen. Dies ist lediglich eine Frage der erforderlichen Technik.

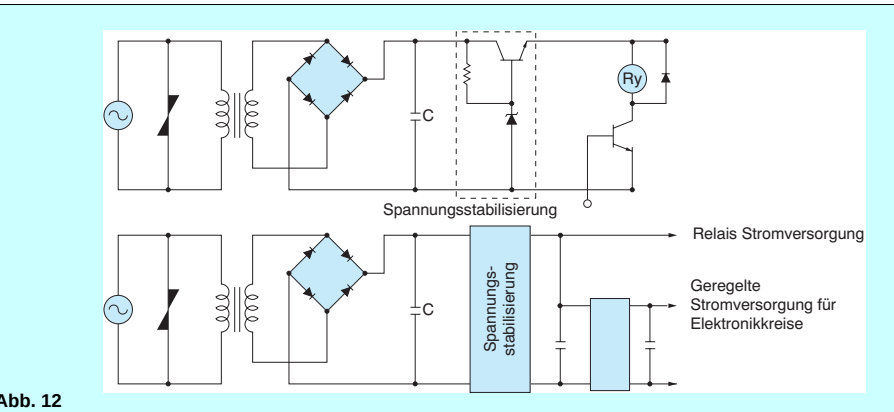


Abb. 12

• Vermeidung von Spannungseinbrüchen aufgrund von Einschaltströmen

In der Schaltung aus Abb. 13 (a) fließt der Einschaltstrom einer Lampe oder eines Kondensators. In dem Moment, in dem die Kontakte schließen, fällt die Spannung ab, und das Relais kann ebenfalls abfallen oder klappern.
In diesem Fall ist es notwendig, die Leistung des Transformators zu erhöhen oder eine Ladeschaltung einzufügen.

Abbildung 13 (b) zeigt ein Beispiel der modifizierten Schaltung.
Die Abbildung 13 (c) zeigt eine batteriebetriebene Version.

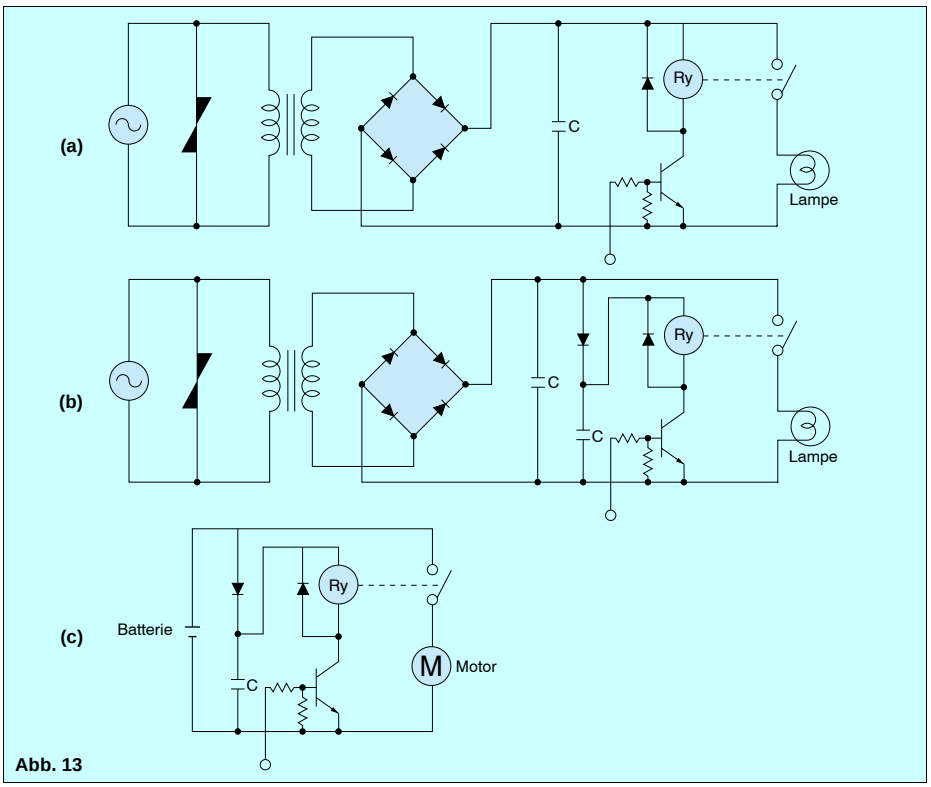


Abb. 13

KONSTRUKTIONSÜBERLEGUNGEN FÜR LEITERPLATTEN

• Muster-Layout für Relais

Relais können die Elektronikschaltungen durch die Erzeugung von Induktionsspannungen beeinflussen.
Beachten Sie deshalb: Konstruieren Sie die Leiterzüge so, dass sie die kürzesten Entfernungen aufweisen. Platzieren Sie den Überspannungsableiter (z.B. die Diode) in der Nähe der Relaisspule. Vermeiden Sie das Verlegen von Leiterzügen, die empfindlich gegen Übersprechen sind (z.B. für Audiosignale) unter dem Relaisspulenbereich. Vermeiden Sie durchgehende Bohrlöcher an Stellen, die von oben nicht eingesehen werden können (z.B. an der Grundfläche des Relais). Das Einfließen von Lötmitteln durch eine solche Bohrung kann zu Schäden, wie z.B. zu einem Leck in der Abdichtung führen. Für ein- und dieselbe Schaltung sind verschiedene Überlegungen notwendig, die den Einfluss des Ein-/Aus-Betriebs der Relaisspule und der Lampe auf andere Elektronikschaltungen minimieren. (Abb. 14)

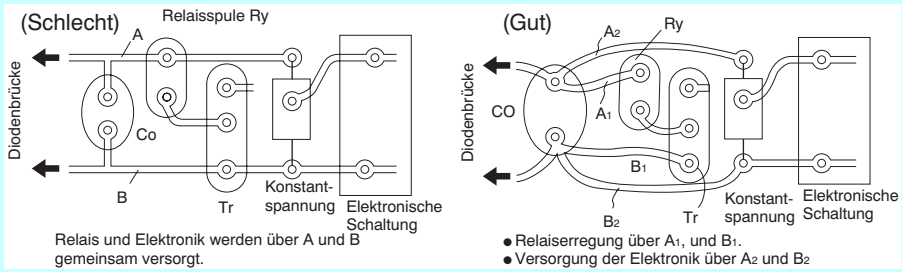


Abb. 14

• Handlötung von Bauelementen nach maschineller Lötung

Durch einen maschinellen Schlitz im runden Teil des Lötauges wird ein Verstopfen der Bohrung mit Lötmittel verhindert. (Abb. 15)

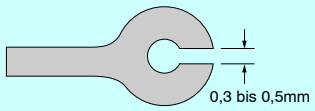


Abb. 15

• Wenn die Leiterplatte selbst als Anschluss genutzt wird

[1] Die Kante sollte abgeschrägt sein. (Dies verhindert ein Ablösen des Leiterzuges, wenn die Platte in die Buchse eingesetzt wird.)

[2] Werden lediglich eine einseitige Leiterplatte und eine Kontaktfeder zum Anschluss benutzt, kann es zu Kontaktausfällen kommen. Hier ist Vorsicht angebracht. (Abb. 16)

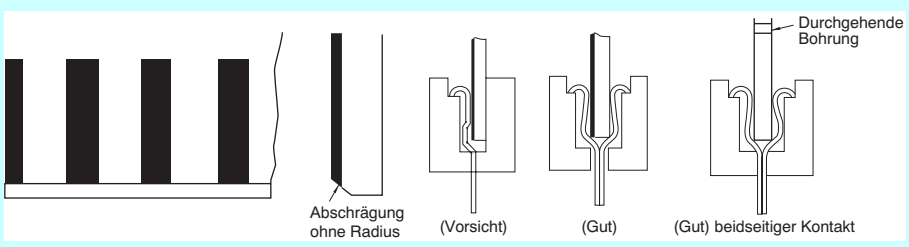


Abb. 16

LEITERPLATTEN-REFERENZDATEN

(Diese Daten stammen von Mustern unserer Firmenprodukte. Bei Ausführung der Schaltungskonstruktion auf der Schaltplatte werden diese Daten als Referenz sehr nützlich sein.)

• Leiterbreite

Die Breite des Leiters wurde im Hinblick auf die Strombelastung, den Temperaturanstieg und die Korrosion sowie mit einem mechanischen Sicherheitsfaktor bestimmt. Zudem steht die Strombelastung in Beziehung zum Temperaturanstieg und zur Umgebungstemperatur. (Je geringer die Leiterbreite und je dünner die Kupferkaschierung, desto größer ist der Temperaturanstieg.) Um einen geringen Temperaturanstieg zu erreichen, muss der Widerstandswert des Leiters niedrig sein. Normalerweise wird der zulässige Strom des Leiters so bestimmt, dass der Temperaturanstieg unter 10 Grad C liegt. Die Leiterbreite sollte auf der Basis dieses zulässigen Leiterstroms konstruiert werden. Die Abbildungen 17, 18 und 19 zeigen den Zusammenhang zwischen dem Strom und der Leiterbreite für jeden Temperaturanstieg bei verschiedenen Kupferkaschierungen. Bedenken Sie auch, dass unregelmäßiger Strom daran gehindert werden sollte, den Zerstörungsstrom des Leiters zu übersteigen. Abb. 21 zeigt den Zusammenhang zwischen der Leiterbreite und dem Zerstörungsstrom.

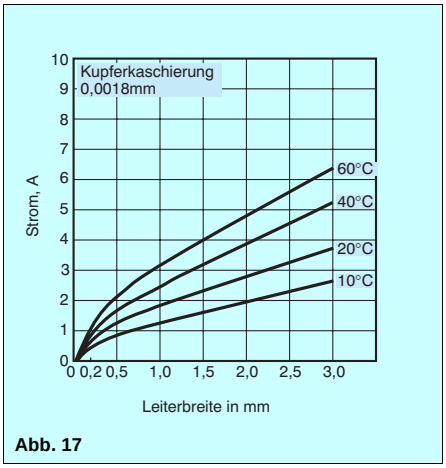


Abb. 17

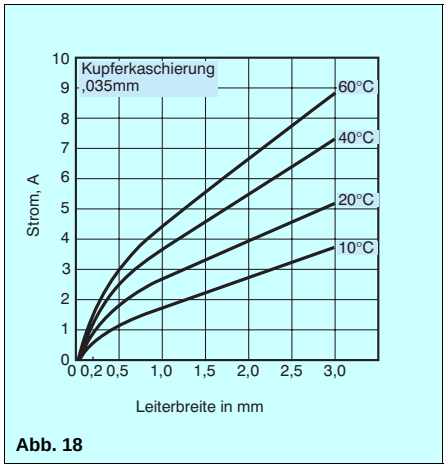


Abb. 18

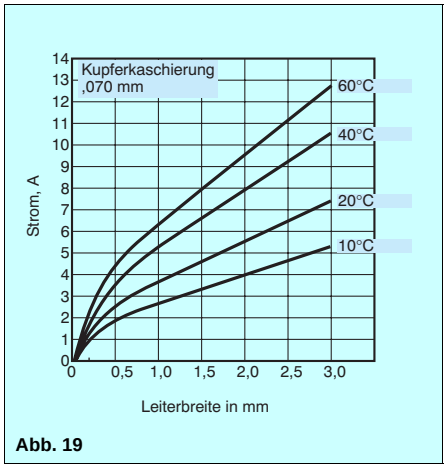
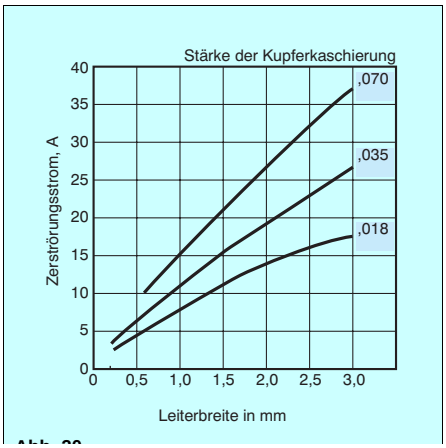
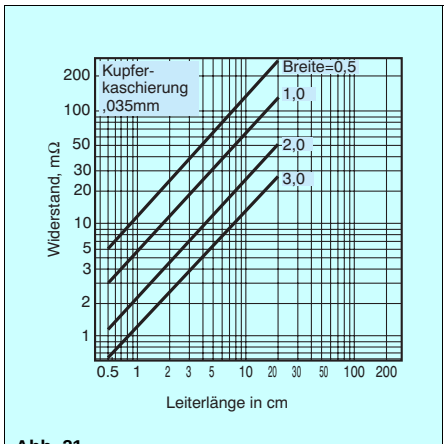


Abb. 19





• Bohrung und Anschlussflächen-Durchmesser

Der Bohrungsdurchmesser und die Anschlussfläche sind zusammen etwas größer als der Zuleitungsdraht. Zudem baut sich beim Löten das Lötmittel am Lötauge auf und erhöht dadurch die Montagestärke.

Die Standardabmessungen für den Bohrungsdurchmesser und die Anschlussfläche können der folgenden Tabelle entnommen werden.

Standardabmessungen für den Bohrungs- und Anschlussflächen-Durchmesser

Standardbohrungsdurchmesser	Toleranz	Anschlussflächen-Durchmesser
0,8	±0.1	2,0 bis 3,0
1,0		
1,2		3,5 bis 4,5
1,6		

Anmerkungen:

1. Der Bohrungsdurchmesser sollte um 0,2 bis 0,5mm größer sein als der Durchmesser der Anschlüsse. Wird jedoch eine automatische Lötmethode (Schwallen) eingesetzt, ist es besser, den Bohrungsdurchmesser in der gleichen Stärke wie den Durchmesser der Anschlüsse plus einer Toleranz von 0,2 mm auszuführen, um zu vermeiden, dass Lötmittel auf die Komponentenseite durchfließt.
2. Der Anschlussdurchmesser sollte das Zwei- bis Dreifache des Bohrungsdurchmessers ausmachen.
3. Eine Bohrung sollte nicht mehrfach belegt werden.

• Ausdehnung und Schrumpfung von kupferbeschichteten Laminaten

Da kupferbeschichtete Laminate über eine Längs- und Seitenrichtung verfügen, müssen Stanzart und Layout sorgfältig erwogen werden. Die Ausdehnung und die Schrumpfung betragen in der Längsrichtung aufgrund der Wärme 1/15 bis 1/2 der Ausdehnung und Schrumpfung in der Seitenrichtung. Dementsprechend macht die Verzerrung der Längsrichtung nach der Stanzung des Materials 1/15 bis 1/2 der Seitenrichtung aus. Die mechanische Belastbarkeit in der Längsrichtung ist um 10 bis 15% größer als in der Seitenrichtung. Aufgrund dieses Unterschieds zwischen Längs- und Querrichtung sollte, bei Produkten mit größerer Ausdehnung, die Längsrichtung für die größerer Ausdehnung gewählt werden. Der Anschlussbereich der Leiterplatte sollte an der Längsseite vorgesehen werden. (Abb. 22)

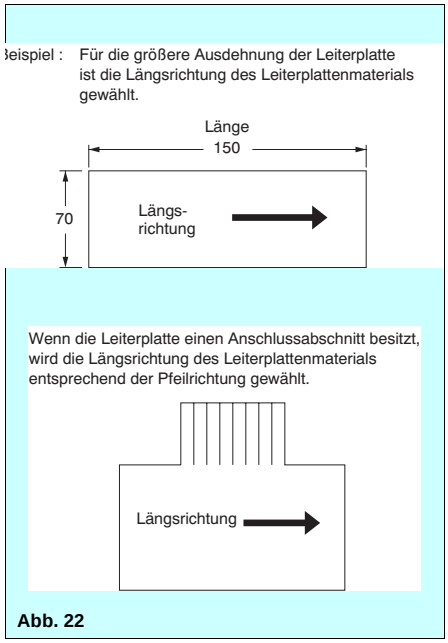


Abb. 22

Abstand zwischen den Leitern

Abb. 23 zeigt den Zusammenhang zwischen dem Abstand zwischen den Leitern und der Zerstörungsspannung. Diese Zerstörungsspannung ist nicht die Zerstörungsspannung des Leiterplatten-Relais; es handelt sich um die Überschlagsspannung (Isolationsdurchbruchsspannung des Abstands zwischen den Schaltungen.) Wird die Leiteroberfläche mit einem Isolierharz beschichtet, z.B. Lötstopplack, steigt die Überschlagsspannung. Aufgrund der Anschlussabstände ist es jedoch notwendig, die Zerstörungsspannung des Leiters ohne Lötstopplack zu berücksichtigen. Es sollte ein großzügiger Sicherheitsfaktor für die Bestimmung des Abstands zwischen den Leitern veranschlagt werden. Tabelle 1 zeigt ein Beispiel für die Konstruktion des Abstands zwischen Leitern (entsprechend den JIS C5010-Standards). Unterliegt das Produkt jedoch den Bestimmungen des Geräte- und Produktsicherheitsgesetzes, sollten diese oder andere Bestimmungen eingehalten werden.

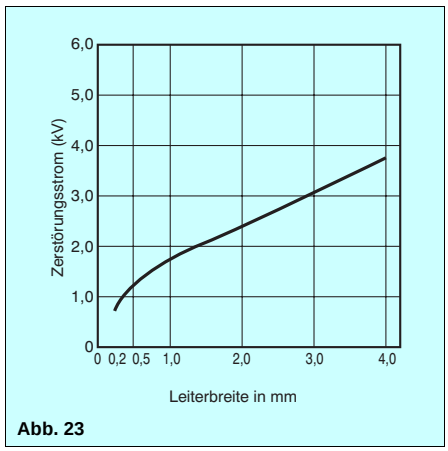


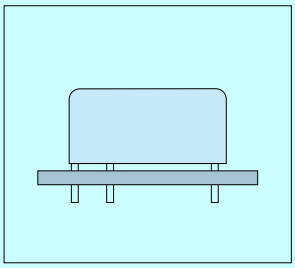
Abb. 23

Tabelle 1. Beispiel für die Konstruktion von Leiterabständen

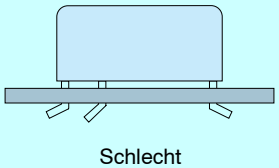
Maximale Gleich- und Wechselstrom-spannung zwischen Leitern (V)	Minimaler Leiterab-stand (mm)
0 bis 50	0,381
51 bis 150	0,635
151 bis 300	1,27
301 bis 500	2,54
Ab 500	Berechnet bei 0,00508 mm/V

Relais Löt- und Reinigungsrichtlinien

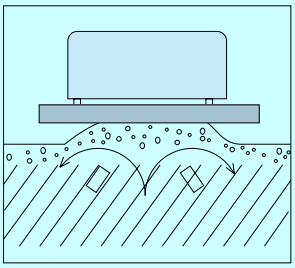
1. Relaismontage



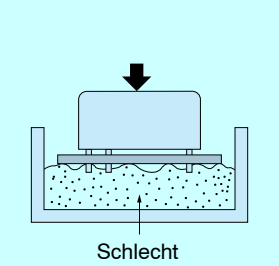
• Vermeiden Sie bitte das Biegen der Anschlüsse, um den Haltemechanismus des Relais nicht zu beschädigen. Die Relaiseigenschaften können sich verändern, wenn die Anschlüsse gebogen werden. Je nach Typ sind Relais mit Haltemechanismus lieferbar.
• Bohren Sie die Leiterplatte entsprechend der Abbildung an.
• Abhängig vom Typ können Relais auch in Steckverpackungen für automatische Bestückung geliefert werden.



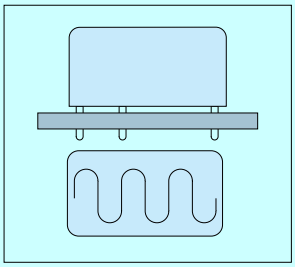
2. Flussmittelanwendung



• Richten Sie die Position der Leiterplatte so aus, dass kein Flussmittel auf die Oberfläche fließen kann. Dies muss besonders bei Relais mit Staubschutzkappen beachtet werden.
• Verwenden Sie auf Harz basierendes, nicht korrodierendes Flussmittel.
• Wenn die Leiterplatte in einen mit Flussmittel voll gesaugten Schwamm gedrückt wird, wie auf der rechten Abbildung gezeigt, kann das Flussmittel leicht in ein mit einer Staubschutzkappe versehenes Relais eindringen. Wenden Sie deshalb bitte niemals diese Methode an. Beachten Sie, dass das Flussmittel selbst in ein flussmittelresistentes Relais eindringen kann, wenn die Leiterplatte fest genug angedrückt wird.



3. Vorwärmen

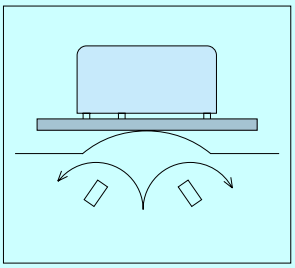


• Wärmen Sie das Relais vor dem automatischen Löten vor. Durch Vorwärmen wird vermieden, dass beim Löten Flussmittel in mit Staubschutzkappen versehene oder flussmittelresistente Relais eindringt. Zudem verbessert sich die Lötfähigkeit.
• Wärmen Sie das Relais unter den folgenden Bedingungen vor.

Temperatur	120°C oder weniger
Zeit	Ungefähr 2 Minuten

• Beachten Sie bitte, dass zu langes Einwirken von hohen Temperaturen die Relais-Eigenschaften nachteilig beeinflussen kann.

4. Löten



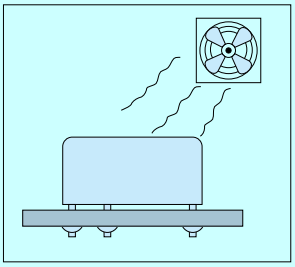
Bitte nehmen Sie bezüglich des bleifreien Lötmittels Kontakt zu uns auf.

Automatisches Löten	Handlöten
• Die optimale Lötmethode besteht aus dem Fließlöten. • Richten Sie die Position der Leiterplatte so aus, dass kein Lötmittel auf die Oberfläche fließen kann. • Sofern nicht anders angegeben, ist das Löten des jeweiligen Relaistyps wie folgt vorgesehen:	• Halten Sie die Spitze des Lötkolbens sauber.

Temperatur der Lötkolbenspitze	Ungefähr 260°C
Lötzeit	Innerhalb von ca. 6 Sekunden

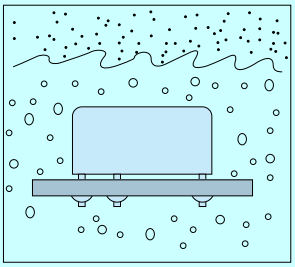
Lötkolben	30W bis 60W
Temperatur der Lötkolbenspitze	Ungefähr 400°C
Lötzeit	Innerhalb von ca. 3 Sekunden

5. Kühlen



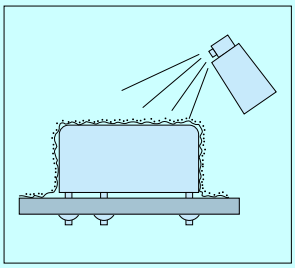
Automatisches Löten	Handlöten
• Es wird eine sofortige Luftkühlung empfohlen, um eine Verschlechterung des Relais und der umliegenden Teile durch die Löthitze zu vermeiden. • Das gegen Umwelteinflüsse abgedichtete Relais kann zwar gereinigt werden, das Eintauchen des Relais in eine kalte Flüssigkeit (z.B. eine Reinigungslösung) unmittelbar nach dem Löten sollte jedoch vermieden werden. Dadurch kann sich die Abdichtung verschlechtern.	—

6. Reinigen



• Reinigen Sie mit Staubschutzkappen versehene Relais und flussmittelresistente Relais bitte nicht durch Eintauchen. Denn selbst wenn nur die untere Oberfläche der Leiterplatte gereinigt wird (zum Beispiel mit einer Bürste) kann Reinigungsflüssigkeit in das Relais eindringen.
• Mit Kunststoff versiegelte Relais können durch Eintauchen gereinigt werden. Verwenden Sie dazu bitte eine auf Freon oder Alkohol basierende Reinigungslösung. Die Verwendung von anderen Lösungsmitteln (z.B. Trichlene, Chlorthene oder Verdünner) kann das Relaisgehäuse beschädigen. Das Material einiger Relaistypen ist jedoch gegen chemische Substanzen resistent. Wählen Sie bitte unter Bezugnahme auf die folgende Reinigungsmittel-Tabelle das geeignete Relais oder die geeignete Lösung aus.
• Es wird die Reinigung durch Abkochen empfohlen. Vermeiden Sie bei Relais die Ultraschallreinigung. Die Ultraschallenergie kann zu Brüchen in der Spule oder zu einem leichten Verkleben der Kontakte führen.

7. Beschichten



• Wenn die Leiterplatte beschichtet werden soll, um die Isolierung der Leiterplatte vor Schäden durch korrosive Gase und hohe Temperaturen zu schützen, dann beachten Sie bitte Folgendes:
• Beschichten Sie bitte keine mit Staubschutzkappen versehenen Relais und flussmittelresistente Relais, da das Beschichtungsmaterial in das Relais eindringen und zu Kontaktausfällen führen kann. Montieren Sie stattdessen die Relais besser nach der Beschichtung.
• Abhängig vom Relaistyp üben manche Beschichtungsmaterialien einen nachteiligen Einfluss auf die Relais aus. Darüber hinaus können Lösungsmittel (z.B. Xylen, Toluen, MEK oder I.P.A.) das Gehäuse beschädigen oder das Harz auflösen und damit die Dichtigkeit gefährden. Wählen Sie die Beschichtungsmaterialien sorgfältig aus.

Typ	Eignung für Relais	Eigenschaften
Auf Epoxydharz basierend	Gut	• Gute elektrische Isolierung. • Obwohl sich die Beschichtung etwas schwierig auftragen lässt, beeinflusst sie die Relaiskontakte nicht nachteilig.
Auf Urethan basierend	Vorsicht	• Gute elektrische Isolierung, einfach anzuwenden. • Die Lösung kann das Gehäuse beschädigen. Vor der Anwendung prüfen.
Auf Silikon basierend	Nicht empfehlenswert	• Silikongas kann Kontaktausfälle verursachen. (auch bei mit Kunststoff abgedichteten Relais) • Verwenden Sie einen Ersatz, der nicht auf Silikon basiert

• Wenn das Relais und alle Komponenten (z.B. ICs) beschichtet werden sollen, kontrollieren Sie die Flexibilität des Beschichtungsmaterials sorgfältig. Durch thermische Belastungen könnte sich die Beschichtung lösen.
• Transport nach der Montage auf Leiterplatten
Ob montiert oder nicht, Relais sind Präzisionsgeräte und sollten keinen Erschütterungen ausgesetzt werden, die die vorgeschriebenen Werte überschreiten. Die bei der Auslieferung vorhandene Leistungsstärke kann aufgrund von Erschütterungen, denen das Relais ausgesetzt wird, beeinträchtigt werden.

SMT-Lötrichtlinien

INSTALLATIONSHINWEISE FÜR OBERFLÄCHENMONTAGE-RELAIS

Um der Nachfrage auf dem Markt nach kleineren, leichteren und schmaleren Produkten gerecht zu werden, hat sich auch bei Leiterplatten die Montagetechnik von einer Einfüge- zu einer Oberflächen-Montage geändert. Um diese Anforderungen zu erfüllen, bieten wir eine Produktlinie für Oberflächenmontage-Relais an. Im Folgenden finden Sie einige Hinweise, die bei der Montage dieser Relais berücksichtigt werden sollten, um Fehlfunktionen auszuschließen.

• Was ist ein Oberflächenmontage-Relais?

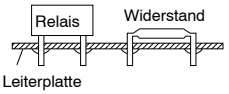
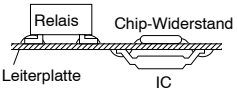
1. Von IMT zu SMT

Die 30 Jahre alte, konventionelle Technologie der Einfügemontage (IMT = Insertion mount technology) wird durch die SMT-Technologie (SMT = surface mount technology) ersetzt.

Halbleiterkomponenten wie Widerstände, ICs und Dioden sind resistent gegen große Hitzebelastungen durch Reflow-Löten, da sie keine mechanischen Teile verwenden. Die konventionellen, elektromechanischen Relais, die aus Magnet- und Ankerspulen sowie Federn bestehen, sind empfindlich gegenüber Wärmebelastung durch Reflow-Lötung.

Auf der Basis unserer Erfahrung mit fortgeschrittenen Relais-Technologien wurden leistungsstarke, elektromagnetische Relais hergestellt, die mit Oberflächenmontage-Technologien wie IRS und VPS kompatibel sind.

• Einfügemontage-Technik vs. Oberflächenmontage-Technik

Einfügemontage-Technik: IMT	Die Bauteilstifte werden in Bohrungen auf der Leiterplatte eingefügt und auf der anderen Seite der Platte durch Fließlöten zu Kupferlötaugen verlötet.	
Oberflächenmontage-Technik (SMT)	Die Bauteile werden auf Kupferlötaugen gesetzt, die vorab mit einer Lötpaste beschichtet wurden. Dann wird die Leiterplattenbestückung erhitzt, um die Bauteile mit den Lötaugen zu verlöten (Reflow-Löten).	

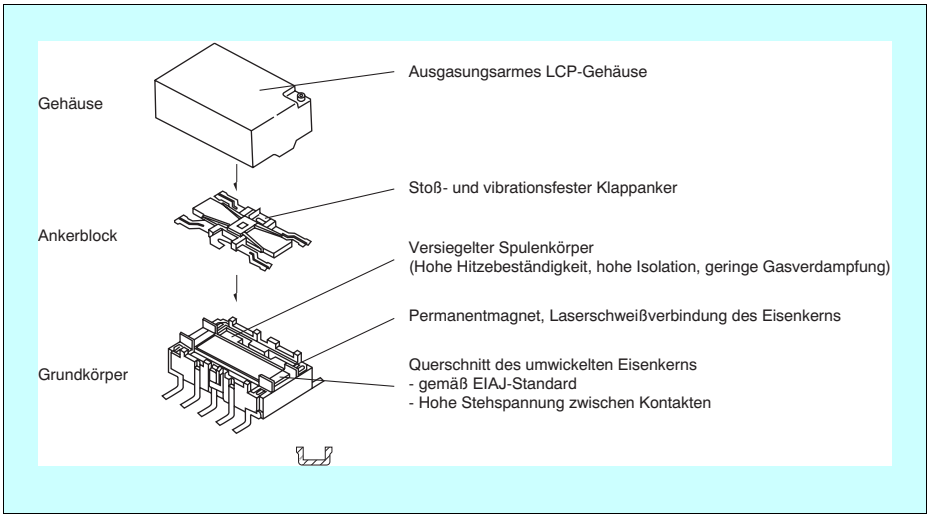
2. Eigenschaften und Vorteile

Eigenschaften	Vorteile
• Hohe Montagedichte • Beidseitige Bauteilinstallation auf der Leiterplatte • Verwendbarkeit von Keramik-Leiterplatten	Minimierung des Systems
• Kompatibel mit automatischer Platzierung durch Roboter • Keine Bohrung für Stifte erforderlich • Kompakte Systemkonstruktion durch hohe Montagedichte	Reduktion der Gesamtkosten
• Hohe Hitzebeständigkeit • Reduzierte Ausgasung	Hohe Zuverlässigkeit

Die Oberflächenmontage-Relais werden mit folgenden, modernen Technologien hergestellt:

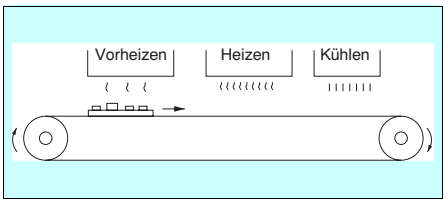
•Hitzebeständige Verkapselungstechnik
•Gas-Analyse
•Bewertung der Zuverlässigkeit
•Präzisions-Presstechnik für hitzebeständige Materialien

• TQ-SMD-Relais

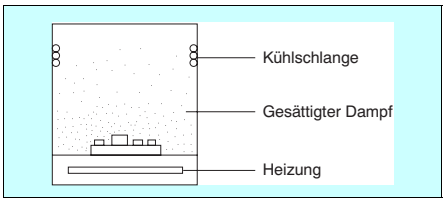


3. Beispiele für SMT-Anwendungen
Im Folgenden werden einige Beispiele für typische SMT-Anwendungen beschrieben:

(1) Infrarot-Reflow-Löten (IRS)
IRS ist die am häufigsten verwendete Löttechnik für die Oberflächenmontage. Als Hitzequelle wird eine Hitzeplatte oder eine Infrarotlampe verwendet. Die Leiterplatten werden auf dem Weg durch einen Tunnelofen nacheinander vorgeheizt, gelötet und gekühlt.



(2) Dampfphasen-Löten (VPS)
Bei der Dampfphasenlötung werden die Leiterplatten durch ein spezielles Lösungsmittel, z.B. Fluorinert FC-70 gezogen, das bis zu einem dampfförmigen Zustand erhitzt ist. Der gesättigte Dampf kondensiert an der Leiterplattenoberfläche, und die Hitze des Dampfes sorgt für die notwendige Energie für das Reflow-Löten.

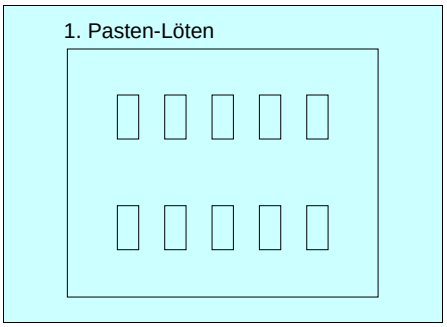


(3) Förderband-Durchlaufofen
Die Leiterplatten werden auf einem dünnen, hitzebeständigen Förderband platziert, und durch die Hitze von Hitzeplatten gelötet, die unter dem Förderband angebracht sind.

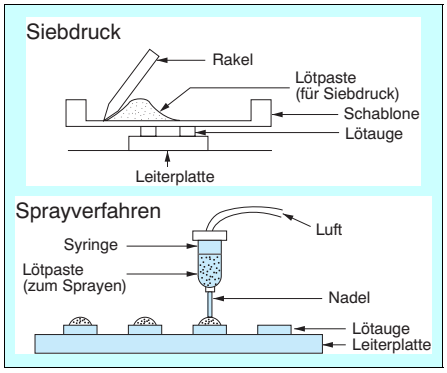
(4) Doppelwellen-Lötverfahren
Die Bauelemente werden auf die Leiterplatten geklebt. Diese werden dann über Kopf durch die Lötwelle gefahren, wodurch die Bauteile mit der Leiterplatte verlötet werden.

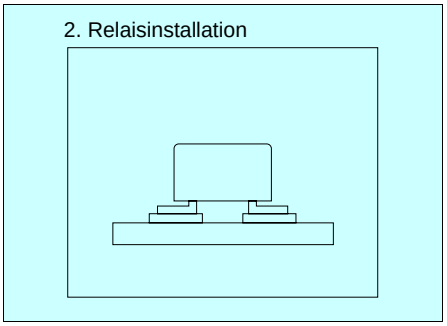
(5) Weitere Techniken
Es gibt auch Reflow-Lötverfahren, die Laser, Heißluft und Impulsheizungen verwenden.

• Installationshinweise

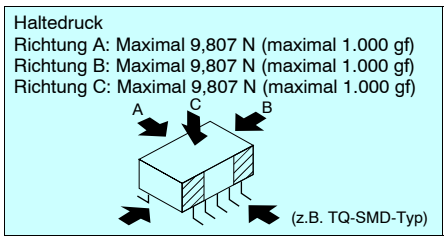


• Die Anordnung der Montage-Lötaugen auf den Leiterplatten sollte Fehlplatzierungen sowie die Lötbarkeit und Isolation berücksichtigen. Verwenden Sie das in den Anwendungsdaten für das betreffende Relais vorgeschlagene Montagelayout.
• Die Lötpaste kann durch Siebdruck oder Sprayverfahren aufgetragen werden. Bei beiden Verfahren muss die Lötpaste in der geeigneten Stärke aufgetragen werden, um eine ausreichende Benetzung und die erforderliche Isolierung zu erreichen.

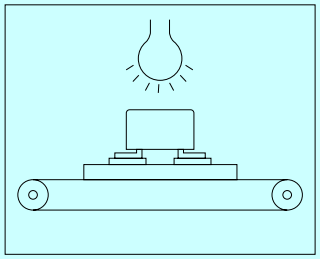




• Für kleine, leichte Bauteile
Wenn kleine Platzierungsfehler auftreten, kann bei Chip-Komponenten von einem Selbstausrichtungseffekt ausgegangen werden. Doch bei elektromechanischen Komponenten wie Relais ist eine präzise Positionierung auf den Lötaugen erforderlich.
• Wenn auf SMT-Relais eine sehr starke mechanische Belastung durch die Platzierungsköpfe einer Maschine einwirkt, kann die Systemleistung nicht mehr garantiert werden.
• Unsere SMT-Relais werden in Steckverpackungen ausgeliefert, die kompatibel mit den automatischen Platzierungsprozessen sind. Auf Nachfrage bieten wir auch Gurtverpackungen an.



3. Reflow



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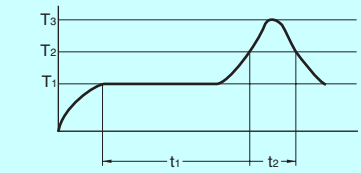
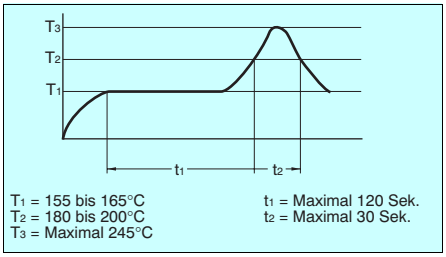
Empfohlene Temperaturprofile während des Rückflusses von bleifreiem Lötmittel. Bitte informieren Sie sich bei den entsprechenden Produkten.



T1 = 150 bis 180°C
T2 = 230°C und höher
T3 = Bis 250°C
t1 = 60 bis 120 Sek.
t2 = Bis 30 Sek.

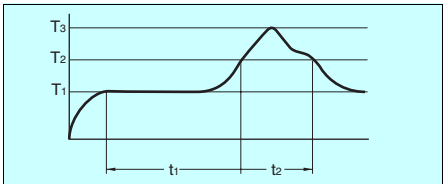
• Wird das Reflow-Löten unter mangelhaften Bedingungen ausgeführt, kann dies zu Unzuverlässigkeiten der Relais-Leistung oder sogar zu physischen Schäden am Relais führen (auch wenn das Relais zum Typ der Oberflächenmontage-Relais mit hoher Hitzebeständigkeit gehört).
Beispiel für empfohlene Lötbedingungen für die Oberflächenmontage-Relais.
(1) IRS-Technik (Infrarot-Reflow-Löten)



T1 = 155 bis 165°C
T2 = 180 bis 200°C
T3 = Maximal 245°C
t1 = Maximal 120 Sek.
t2 = Maximal 30 Sek.

• Es empfiehlt sich, die Lötaugen sofort zu kühlen, um thermische Schäden am Relais und den zugehörigen Bauteilen zu verhindern.
• Die Oberflächenmontage-Relais sind zwar in Lösungsmitteln waschbar, sollten aber nicht unmittelbar nach dem Löten in kalte Reinigungsflüssigkeit getaucht werden.

(2) VPS-Technik (Dampfphasen-Löten)

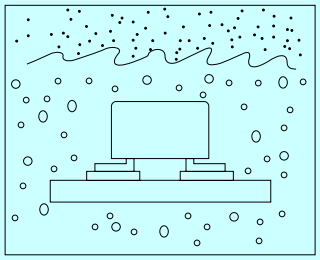


T1 = 90 bis 100°C
T2 = 180 bis 200°C
T3 = Maximal 215°C
t1 = 90 bis 120 Sek.
t2 = Maximal 60 Sek.

(3) Handlöten
Temperatur an der Spitze des Lötkolbens: 280 bis 300°C
Wattleistung des Lötkolbens: 30 bis 60 Watt
Lötzeit Unter 5 Sekunden
(4) Weitere Techniken
Wenn eine Löttechnik verwendet wird, die oben nicht beschrieben wurde (Heißluft, Hitzeplatte oder Impulsheizungen), prüfen Sie die Tauglichkeit dieser Technik sorgfältig.

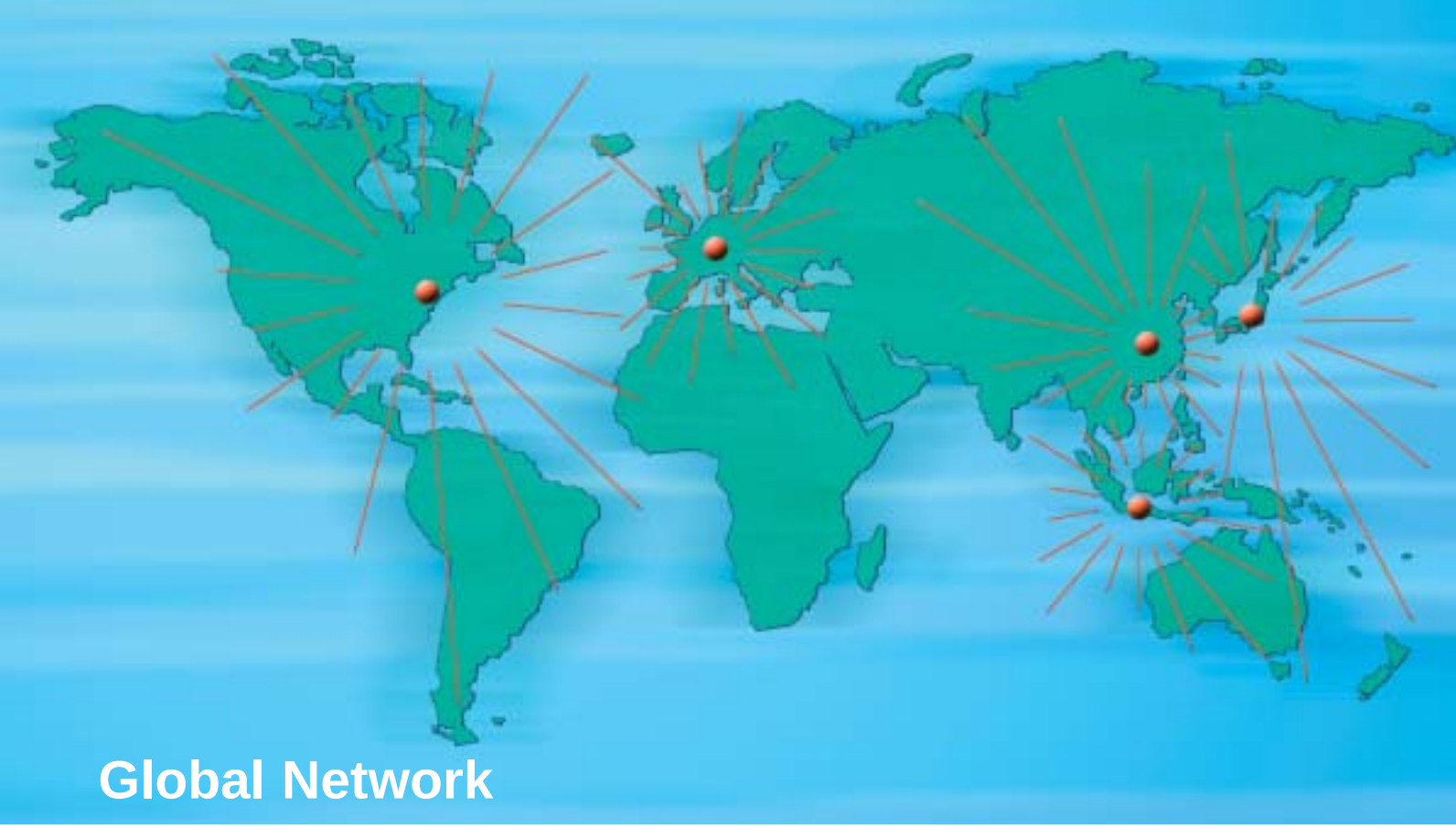
Anmerkungen:
1. Das Profil der Löttemperatur gibt die Temperatur des Lötauges an. In einigen Fällen kann die Umgebungstemperatur deutlich erhöht sein. Beachten Sie die angegebenen Montagebedingungen.
2. Die Vorheiz-Bedingungen für die VPS-Technik sind mit denen der IRS-Technik identisch.

4. Reinigen



• Die Oberflächenmontage-Relais sind in Lösungsmitteln waschbar. Verwenden Sie zur Reinigung Alkohol oder ein entsprechendes Lösungsmittel.
• Oberflächenmontage-Relais können durch Heißwasser gereinigt werden. Eine Reinigung per Ultraschall kann zu Schäden an der Spule oder leichtem Kontaktkleben führen.

* Bitte nehmen Sie bezüglich des bleifreien Lötmittels Kontakt zu uns auf.



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