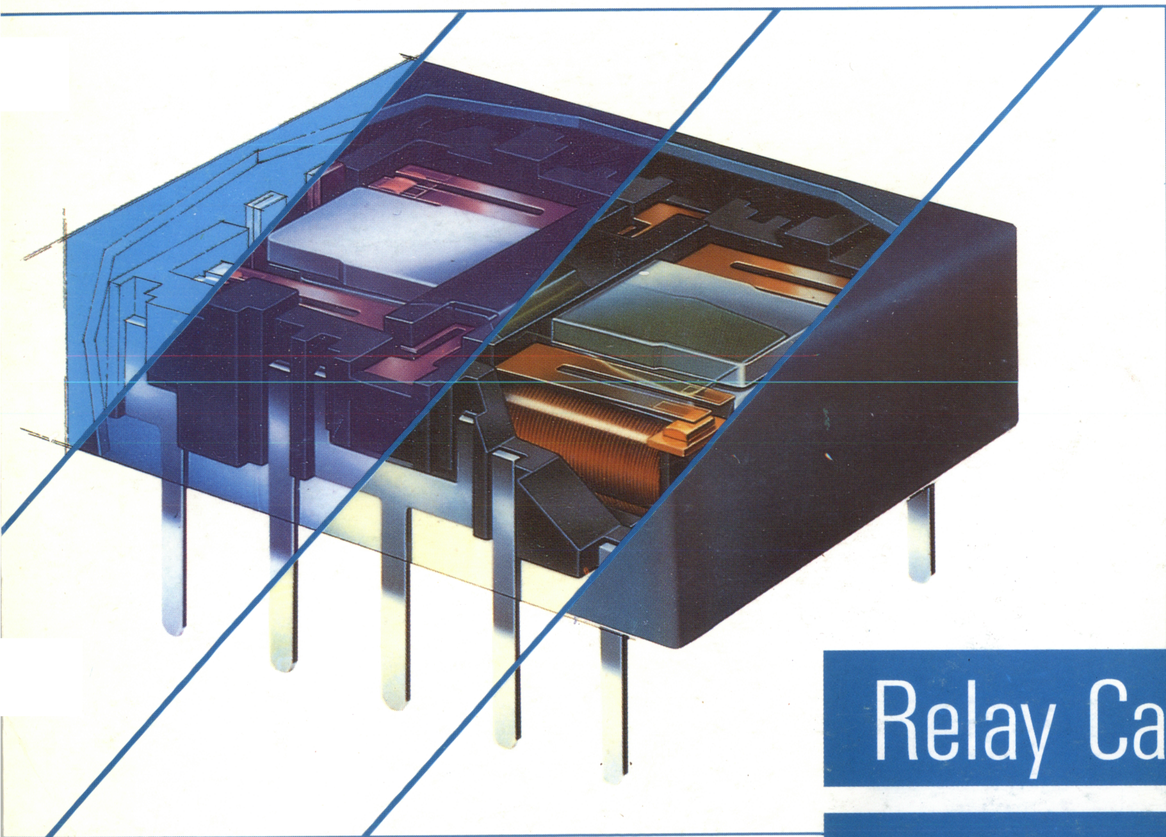
Matsushita
Automation
Controls



Relay Catalogue and Application Guide

Part 1: Electromechanical Relays

Relays for Advanced Technology

General notes and guidelines for users of this Relay Technical Data Book

The SDS-Relais European group of companies was absorbed into the Matsushita Electric Works organisation relatively recently. Originally this relay technical data book was designed primarily for North American and Asian territories where conditions of use, approvals and market conditions often differ from those which are general in Europe. This is especially applicable for requirements defined in national specifications such as UL, CSA, VDE, SEV, OVE, SEMKO etc. and for different mains voltages which are significant when considering factors such as relay contact life.

Whenever UL, CSA or VDE ratings are mentioned when considering contact loadings, (e.g. 10 A, 30 Vdc for the SP-relay), it should be understood that these values are not necessarily an absolute maximum. Very often the stated value has been considered for testing only under consideration of a certain life expectancy as stated by the manufacturer or as required according to the respective specification authority. Thus, under different conditions, the stated "maximum" may in practice be safely exceeded.

Therefore consideration should be given to each specific application for:
- rating and type of load
- switching frequency – cycles per second (or minute)
- environmental conditions

In case of uncertainty contact should be made with Matsushita Automation Controls locally to ascertain the liklihood of the relay meeting the required life expectancy in the particular planned operational circumstances. It is also pointed out that in this book, and different to IEC 255, operational life data is given under a normal ambient temperature of between 20°C and 25°C.

The features and specifications quoted have been carefully tested using modern methods and represent the values which are to be expected with a product in new condition at room temperature. They are not guaranteed values and may change during operational life or due to ambient influences. Test statistical information, covering major operating features, is available on request. Matsushita Automation Controls reserves the right to make alterations and changes to specifications without notice as may be deemed necessary from time to time.

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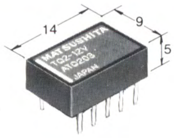
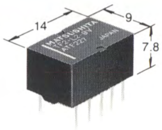
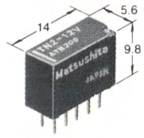
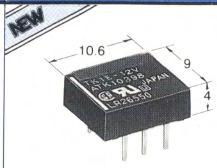
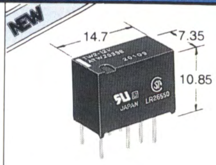
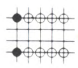
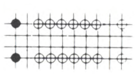
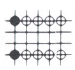
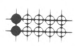
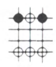
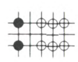
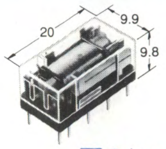
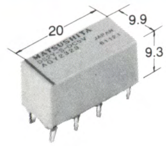
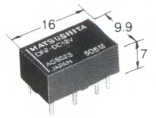
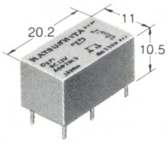
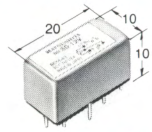
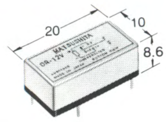
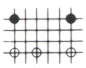
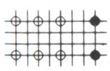
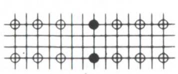
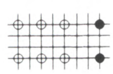
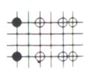
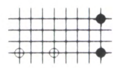
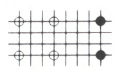
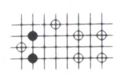
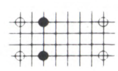
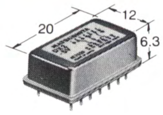
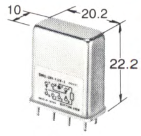
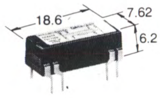
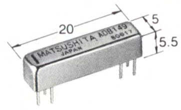
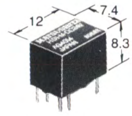
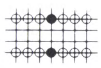
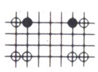
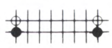
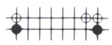
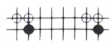
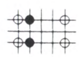
Relay Selector Chart

		NEW T-SERIES				
		TQ-RELAY	**TF-RELAY**	**TN-RELAY**	**TK-RELAY**	**TW-RELAY**
• **Type of relay**	mm					
• **Features**		• Ultra-small size • High sensitivity • 1,500V FCC • 4 pole model available	• Highest sensitivity • Ultra-small size • 1,500V FCC • Surface-mount type available • 48V coil type available	• Ultra-slim size • High sensitivity • 1,500V FCC	• Low profile 4 mm .157 inch • High contact capacity: 2 A • Surge withstand voltage between contact and coil: 2,500 V	• Surge withstand: 2,500 V • High contact capacity: 2 A 30 V DC • Current surge capacity: 4.2 A 700 V AC
• **Sealed types availability**		●	●	●	●	●
• **Latching types availability**		●	●	●	●	●
• **Contact material** (Optional material)		Gold-clad silver	Gold-clad silver	Gold-clad silver	Gold-clad silver nickel	Gold-clad silver nickel
• **Contact rating chart** Maximum ($\cos \varphi = 1$)	15 A 10 A 8 A 5 A 3 A 2 A 1 A	1 A 30 V DC	1 A 30 V DC	1 A 30 V DC	2 A 30 V DC	2 A 30 V DC
Minimum	1 mA 100 µA 10 µA	10 µA 10 mV DC	10 µA 10 mV DC	10 µA 10 mV DC	10 µA 10 mV DC	10 µA 10 mV DC
• **Contact arrangement**		2c, 4c	2c	2c	1c	2c
• **Life** (Min. operation)	**Electrical**	2×10^5	2×10^5	2×10^5	10^5	10^5
	Mechanical	10^8	10^8	10^8	10^8	10^8
• **Breakdown voltage**	Between open contacts	750Vrms	750Vrms	750Vrms	750Vrms	1,000Vrms
	Between contact sets	1,000Vrms	1,000Vrms	1,000Vrms	1,000Vrms	1,000Vrms
	Between contacts and coil	1,000Vrms	1,000Vrms	1,000Vrms	1,500Vrms	1,800Vrms
	Between live parts and ground	—	—	—	—	—
• **Surge withstand voltage**		1,500V FCC	1,500V FCC	1,500V FCC	1,500V FCC	1,500V FCC
• **Coil voltage**		(DC) 3, 4.5, 5, 6, 9, 12, 24 V	(DC) 3, 4.5, 5, 6, 9, 12, 24, 48V	(DC) 3, 4.5, 5, 6, 9, 12, 24V	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24 V	(DC) 3, 4.5, 5, 6, 9, 12, 24, 48 V
• **Nominal operating power**		(Single) (2C) 140mW (4C) 280mW (−L2) 200mW	80mW (DC 3 to 12V) 140mW (DC 24V) 260mW (DC48V)	(Single) 140mW (Up to 12VDC) 200mW (24VDC)	140mW	(Single) 140 mW (Up to 12V DC) 200 mW (24VDC) 260mW (48VDC)
• **Terminal layout** (Bottom View) ●: coil terminal (.100 inch grid)		 2c  4c				
• **Standards**		UL (E43149), CSA (LR26550)	UL (E43149), CSA (LR26550)	UL (E43149), CSA (LR26550)	UL (E43149), CSA (LR26550)	UL (E43149), CSA (LR26550)
• **Mounting method**						
• **Page**		46	51	56	60	64

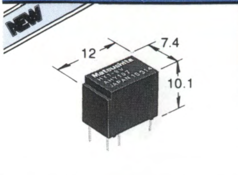
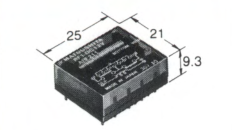
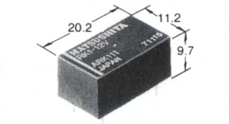
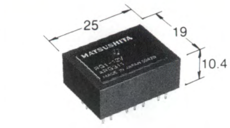
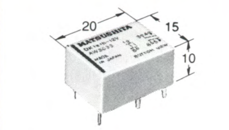
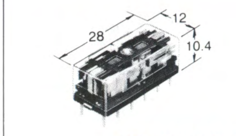
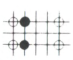
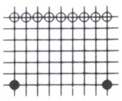
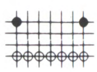
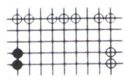
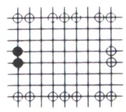
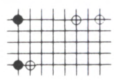
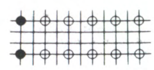
Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals; : Surface-mounting

High Breakdown Voltage Capacity **DS-RELAY**	2C, 200mW Sensitive Miniature Relay **DS2Y-RELAY**	High sensitive DIL Miniature **DF-RELAY**	Miniature DIL Power **DSP-RELAY**	Half-Size **R-RELAY**	Highly Reliable DIL **DR-RELAY**
 IC Relay option				 IC Relay option	
• 1,500V FCC surge satisfied • High sensitivity • High switching power	• High sensitivity • 2 Form C contact • 1,500V FCC • Sealed construction	• Smaller than most 2 form C relays • High sensitivity • DIL	• High switching capacity • High sensitivity • High contact welding resistance • High breakdown voltage	• Magnetically shielded • High sensitivity • High speed operation	• High sensitivity • High contact force • High breakdown voltage • High speed operation
●	●	●	●	●	●
●	●	●	●	●	●
Gold-clad silver (Silver palladium)	Gold-clad silver	Gold-clad silver	Gold-flash over silver alloy	Gold cobalt	Gold cobalt
2 A 30 V DC 10 μA 10 mV DC	1 A 30 V DC 10 μA 10 mV DC	1 A 30 V DC 1 mA 1 V DC	8 A 250 V AC 5 A 30 V DC 1a 5 A 250 V AC 5 A 30 V DC 1a1b, 2a	1 A 20 V DC 10 μA 100 mV DC	1 A 20 V DC 10 μA 100 mV DC
1c, 2c, 4c	2c	2c	1a, 1a1b, 2a	1c	1c
5×10^5	5×10^5	10^5	10^5	10^6	10^6
10^8	10^8	(Single) 5×10^6 (Latching) 10^6	5×10^7	10^9	10^9
1,000Vrms (500 Vrms for DS1-S)	750Vrms	500Vrms	1,000Vrms	350Vrms or 500VDC	750Vrms
1,000Vrms	1,000Vrms	500Vrms	2,000Vrms	—	—
1,500Vrms (1,000 Vrms for DS1-S)	1,000Vrms	1,000Vrms	3,000Vrms	1,000Vrms	1,500Vrms
—	—	—	—	1,000Vrms	1,000Vrms
1,500V FCC	1,500V FCC	1,500V FCC	5,000V surge	—	1,500V FCC
(DC) 1.5, 3, 5, 6, 9, 12, 24, 48V	(DC) 1.5, 3, 5, 6, 9, 12, 24, 48V	(DC) 1.5, 3, 5, 6, 9, 12, 24V	(DC) 3, 5, 6, 9, 12, 24V	(DC) 5, 6, 12, 24, 48V	(DC) 3, 5, 6, 12, 24, 48V
M type (Single) 400mW (−L2) 360mW S type (Single) 200mW (−SL2) 180 mW	(Single) 200mW (300mW: 48V) (−L2) 180mW (360mW: 48V)	(Single) 200mW (−L) 100mW (−L2) 200mW	(Single) 300mW (−L) 150mW (−L2) 300mW	(Single) 150 to 280mW (−L) 70 to 100mW (−L2) 150 to 230mW	(Single) 96 to 209mW (−L) 56 to 109mW (−L2) 111 to 290mW
 1c  2c  4c			 1a  1a1b, 2a		
UL (E43149), CSA (LR26550)	UL (E43149), CSA (LR26550)	UL (E43149), CSA (LR26550)	UL (E43028), TÜV, CSA (LR26550), SEV	UL (E43149), CSA (LR26550)	UL (E43149), CSA (LR26550)
70, 80, 82	88	92	96	72, 101	110

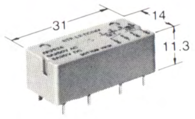
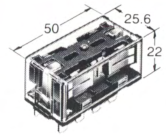
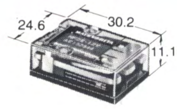
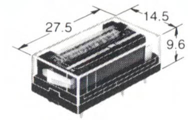
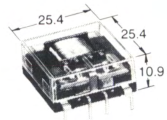
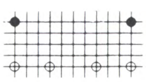
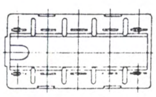
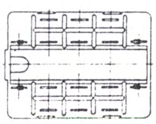
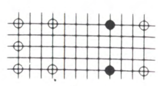
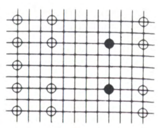
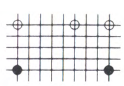
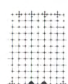
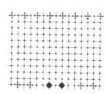
Relay Selector Chart

	Hermetically Sealed DX-RELAY	Full-Size Crystal Can DN-RELAY	Economical Reed DA-RELAY	High Quality Reed DB-RELAY	Ultra-Miniature Single Pole HD-RELAY
• Type of relay (mm)					
• Features	• High radio frequency characteristics • High shock and vibration resistance	• Magnetically shielded • High radio-frequency characteristics • High insulation resistance • DIP terminal	• DIL terminal • Glass encapsulated reed switch	• High insulation resistance • High sensitivity • High speed operation	• Ultra-small type • High sensitivity • Sealed construction
• Sealed types availability	●		●	●	●
• Latching types availability	●				
• Contact material (Optional material)	Gold-clad silver alloy	Gold-clad	Rh-plated nickel-iron alloy	Rhodium	Gold-clad silver
• Contact rating chart Maximum ($\cos\varphi = 1$) (15 A, 10 A, 8 A, 5 A, 3 A, 2 A, 1 A)	1 A 30 V DC	0.5 A 125 V AC 0.5 A 30 V DC	0.2 A 48 V DC	0.4 A 24 V DC	1 A 30 V DC
Minimum (1 mA, 100 μA, 10 μA)	10 μA 30 mV DC		1 mA 100 mV DC	100 μA 5 V DC	1 mA 1 V DC
• Contact arrangement	2c	2c	1a, 2a	1a	1c
• Life (Min. operation) Electrical	2×10^5	10^6	10^6	10^6	10^5
• Life (Min. operation) Mechanical	3×10^7	3×10^7	10^8	2×10^8 (2 shield pin)	5×10^6
• Breakdown voltage Between open contacts	500Vrms	500Vrms	200VDC (1 min.)	200VDC (1 min.)	500Vrms
• Breakdown voltage Between contact sets	500Vrms	—	—	—	—
• Breakdown voltage Between contacts and coil	500Vrms	500Vrms	500VDC (1 min.)	500VDC (1 min.)	500Vrms
• Breakdown voltage Between live parts and ground	500Vrms	—	—	500VDC (1 min.)	—
• Surge withstand voltage	—	—	—	—	—
• Coil voltage	(DC) 3, 5, 6, 12, 24V	(DC) 5, 6, 12, 24, 48 V	(DC) 5, 6, 12, 24V	(DC)1.5, 3, 5, 6, 9, 12, 15, 18, 24V	(DC) 1.5, 3, 5, 6, 9, 12, 24V
• Nominal operating power	(Single) 125 to 144mW (−L) 125 to 144mW (−L2) 250 to 288mW	600mW	(1a) 230mW (2a) 325mW	(Standard) 130mW (High sensitivity for 5V type) 80mW	280 to 300mW
• Terminal layout (Bottom View) ●: coil terminal (.100 inch grid)				 No shield pin  1 shield pin  2 shield pins	
• Standards	—	—	—	—	UL (E43149), CSA (LR26550)
• Mounting method					
• Page	113	115	117	119	122

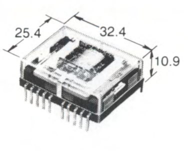
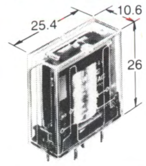
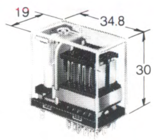
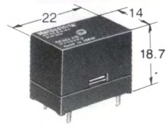
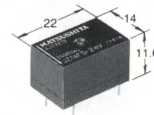
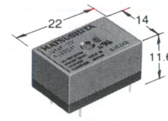
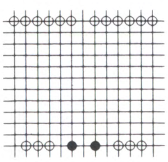
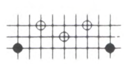
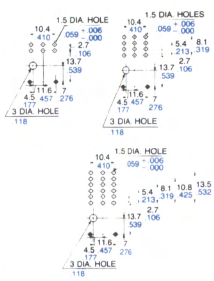
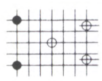
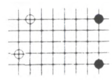
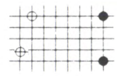
Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals; : Surface-mounting

High Sensitivity 1 Form C Relay **HY-RELAY**	High Frequency **RF-RELAY**	High Frequency **RK-RELAY**	1C and 2C High Frequency **RG-RELAY**	Miniature Power **DK-RELAY**	High Density **S-RELAY**
NEW 					 IC Relay option
• High sensitivity: 150mW/200mW • A wide range of ambient temperature: −40°C to +70°C −40°F to +158°F	• Excellent high frequency • High reliability and long life • Flux-resistant molded construction	• Excellent high frequency characteristics • High sensitivity in small size	• Excellent high frequency • Wide selection • 1A 24VDC	• Large capacity in small size • High sensitivity • High breakdown voltage	• High sensitivity • High vibration and shock resistance • Low thermal electromotive force
●	●	●	●	●	●
		●	●	●	●
Gold-clad silver	(Stationary contact) Gold-plated nickel silver (Movable contact) Gold-clad phosphorus bronze	Gold-clad silver	Gold-clad silver	Gold-flash over silver alloy	Gold-clad silver alloy
1 A 30 V DC 1 mA 1 V DC	0.01 A 24 V DC 30 µA 3 mA DC	0.01A 24VDC	1 A 24 V DC	10A 250VAC 10A 30VDC 1a 8A 250V AC 8A 30V DC 1a1b	5 A 250 V AC 100 µA 100 mV
1c	1c	1c	1c, 2c	1a, 1a1b	2a2b, 4a
10^5	10^5	3×10^5	10^5	10^5	10^5
10^7	5×10^6	5×10^6	5×10^6	5×10^7	10^8
500Vrms	1,000Vrms	500Vrms	1,000Vrms	1,000Vrms	750Vrms
—	—	—	—	4,000Vrms	1,000Vrms
1,000Vrms	2,000Vrms	1,000Vrms	2,000Vrms	4,000Vrms	1,500Vrms
—	Between contacts and ground: 500Vrms; Between ground and coil: 2,000Vrms	500Vrms	500Vrms	—	—
—	—	—	—	—	—
(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24V	(DC) 5, 6, 9, 12, 24, 48V	(DC) 3, 5, 6, 9, 12, 24V	(DC) 3, 5, 6, 9, 12, 24, 48V	(DC) 3, 5, 6, 9, 12, 24V	(DC) 3, 5, 6, 12, 24, 48V
Standard: 200mW High sensitivity: 150mW	450mW	(Single) 200mW (−L) 200mW (−L2) 400mW	(Single) 350 to 400mW (−L) 180 to 200mW (−L2) 350 to 400mW	200mW	192 to 355mW
			 1c  2c	 1a	
UL (E43149), CSA (LR26550)	—	—	—	UL (E43028), SEV, CSA (LR26550)	UL (E43028), CSA (LR26550)
124	128	133	137	144	71, 81, 149

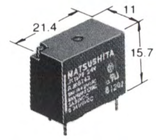
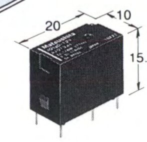
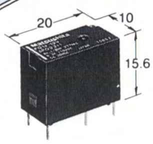
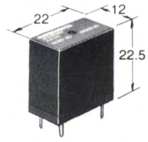
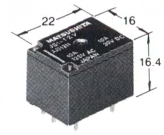
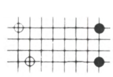
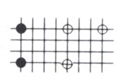
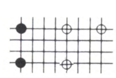
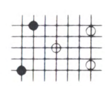
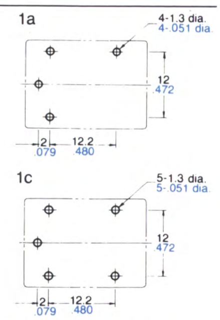
Relay Selector Chart

	Field Switching Power **ST-RELAY**	Compact Power Sensitive **SP-RELAY**	Flatpack **NF-RELAY**	Thin 1 Form C **NB-RELAY**	Flatpack/Vertical type 5 AMP **NC-RELAY**
• Type of relay (mm)					
• Features	• Large capacity in small size • High inrush capability	• High sensitivity • High vibration and shock resistance • Wide switching range	• 1,500V FCC surge satisfied • Low profile • High sensitivity • MBB contact available	• 1500V FCC surge satisfied • Low profile • 5A contact rating	• Flatpack and vertical type • DIL terminal • Bifurcated contacts
• Sealed types availability	●		●	●	●
• Latching types availability	●	●		●	●
• Contact material (Optional material)	Gold-flash over silver alloy	Silver alloy/gold-plated silver alloy	Gold-clad silver (Silver palladium)	(Single) Silver nickel (Bifurcated) Gold-clad silver nickel	Gold-clad Silver nickel
• Contact rating chart Maximum ($\cos\varphi = 1$) (15 A, 10 A, 8 A, 5 A, 3 A, 2 A, 1 A)	8 A 250 V AC	16 A 250 V AC (2c) 10 A 250 V AC (4c)	2 A 30 V DC	(Single contact) 5 A 250 V AC, 30 V DC (Bifurcated contact) 3 A 250 V AC, 30 V DC	5 A max. 250 V AC
Minimum (1 mA, 100 μA, 10 μA)	1 mA 1 V	1 mA 10 V (2c) 1 mA 10 V (4c)	100 μA 100 mV DC	1 mA 1 V (Single) 1 mA 1 V (Bifurcated)	100 μA 1 V
• Contact arrangement	1a1b, 2a	2c, 4c	2c, 4c, 2D, 4D	1c	2c, 4c
• Life (Min. operation) Electrical	10^5	10^5	10^6	2×10^5	(2c) 10^5 (4c) 10^5
• Life (Min. operation) Mechanical	10^7	5×10^7	(2c) 3×10^8 (4c) 10^8	10^7	2×10^7
• Breakdown voltage: Between open contacts	1,200Vrms	1,500Vrms	750Vrms	1,000Vrms	1,000Vrms
Between contact sets	2,000Vrms	3,000Vrms	1,000Vrms	—	1,000Vrms
Between contacts and coil	3,750Vrms	3,000Vrms	1,000Vrms	2,000Vrms	2,000Vrms
Between live parts and ground	—	—	1,000Vrms	—	—
• Surge withstand voltage	6,000V surge	—	1,500V FCC	1,500V FCC	—
• Coil voltage	(DC) 3, 5, 6, 9, 12, 24, 48V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48, 60V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48, 110V
• Nominal operating power	240mW	300mW	(2c) 300mW (4c) 480mW	400mW	(Single) (2c) 360mW (4c) 720mW (−L2) (2c) 800mW (4c) 1,600mW
• Terminal layout (Bottom View) ●: coil terminal (.100 inch grid) mm inch		 SP2  SP4	 2c  4c		 2c (Slim)  2c (Flat)  4c (Slim)  4c (Flat)
• Standards	UL (E43028), VDE, CSA (LR26550), SEV	UL (E43028), VDE, CSA (LR26550)	UL (E43028), VDE, CSA (LR26550)	UL (E43028), CSA (LR26550)	UL (E43028), VDE, CSA (LR26550)
• Mounting method	PC board terminal	Plug-in	PC board terminal	PC board terminal	PC board terminal, Plug-in
• Page	153	157	161	166	170

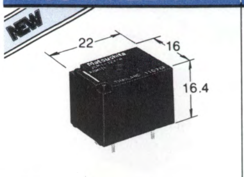
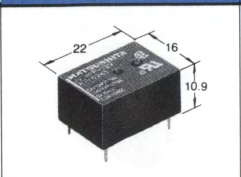
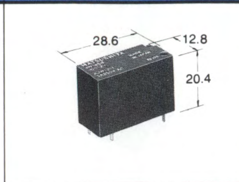
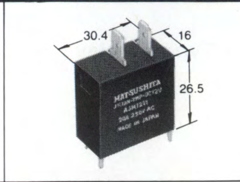
Note: Meaning of symbol marks: PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals; : Surface-mounting

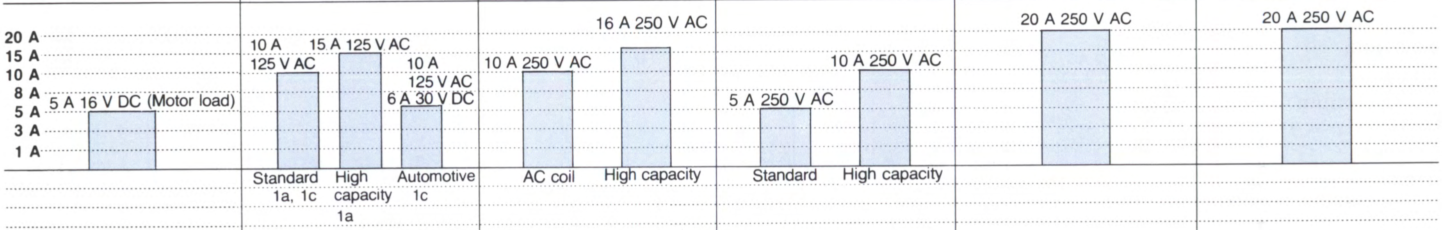
6PDT Flatpack DIL	Vertical type	High Sensitivity	Compact Economical Power	Small Sized Power Relay	8A Power Relay
NL-RELAY	**NT-RELAY**	**K-RELAY**	**JE-X•JE-RELAY**	**JZ-RELAY**	**JG-RELAY**
					
• 6PDT Flat-pack • Low operating power • MBB contact available	• Large capacity 8A • Compact size • AC coils	• Sealed types available • Long life • Bifurcated contact	• Compact size • High contact capacity • Safety-oriented between coil and contact • Flux-resistant type available	• Small sized flat type • High dielectric withstanding • High noise resist-ance	• Compact & flat design • High capacity 8A • High surge resist-ance
●		●			
●					
Gold-clad silver	Gold-clad silver nickel	Gold-clad silver/ silver	Silver alloy	Silver alloy	Silver alloy
2 A 30 V DC 100 μA 100 mV DC	8 A 250 V AC 1 mA 1 V	5 A 125 V AC (K2F) 1 A 50 V AC, 2 A 250 V DC 100 μA 100 mV	3 A 277 V AC 5 A 125 V AC 5 A 30 V DC	5 A 125 V AC, 3 A 125 V AC	8 A 125 V AC
6c, 6D	1c	2c, 4c, 6c	1a, 1c	1a	1a
5×10^5	10^5	10^6	10^5	2×10^5	2×10^5
5×10^7	10^7	10^8	5×10^6	5×10^6	5×10^6
1,000Vrms	1,000Vrms	750Vrms	750Vrms	750Vrms	750Vrms
1,000Vrms	—	750Vrms	—	—	—
2,000Vrms	2,000Vrms	1,500Vrms	1,500Vrms	2,000Vrms	2,000Vrms
—	—	1,250Vrms	—	—	—
—	—	—	5,000V surge	10,000V surge	10,000V surge
(DC) 5, 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48V (AC) 6, 12, 24, 48, 115V	(DC) 3, 6, 12, 24, 42, 48, 60, 110V (AC) 6, 12, 24, 28, 48, 60, 110, 220V	(DC) 5, 6, 9, 12, 24, 48V	(DC) 5, 6, 9, 12, 18, 24V	(DC) 5, 6, 9, 12, 18, 24V
(single) 720mW (−L2) 1,600mW	(DC) 290mW (AC) 0.75VA	(2c) 200 to 400mW (4c) 500 to 700mW (6c) 1,300mW	400mW	(Standard) 400mW (High sensitivity) 200mW	200mW
			 (JE-X)		
UL (E43149), CSA (LR26550)	UL (E43149), VDE, CSA (LR26550), SEV	UL (E43149), VDE, CSA (LR26550)	UL (E43028), TÜV, CSA (LR26550)	UL, TÜV, SEMKO, CSA (LR26550), TVrating	UL (E43028), TÜV, CSA, SEMKO
180	182	185	194	197	201

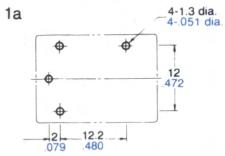
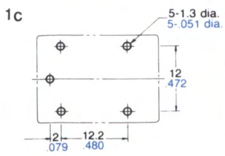
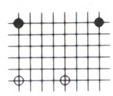
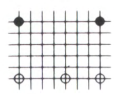
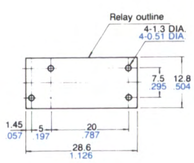
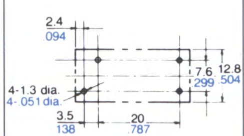
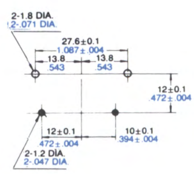
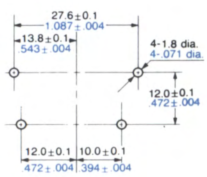
Relay Selector Chart

	Slim Type Power Relay **JK-RELAY**	High Electrical & Mechanical Noise Immunity Relay **JQ-RELAY**	High Electrical & Mechanical Noise Immunity Relay **PQ-RELAY**	Compact Power **JY-RELAY**	Ultra-Miniature PC Board Type Power Relay **JS-RELAY**
• **Type of relay** mm		NEW 	NEW 		
• **Features**	• Compact & slim design • High capacity type (8A) available • Sealed type available	• High electrical noise immunity • High switching capacity • High surge voltage: 8,000V	• High electrical noise immunity • High sensitivity: 200mW • High surge voltage: 8,000V	• 5A, 10A types • Class B coil type available • High dielectric withstanding: 5,000V surge	• Ultra-miniature size with universal terminal footprint • High switching capacity 10A
• **Sealed types availability**	●	●	●	●	●
• **Latching types availability**					
• **Contact material**	Silver alloy	Silver alloy	Silver alloy (Bifurcated)	Silver alloy	Silver alloy
• **Contact rating chart Maximum** ($\cos\varphi = 1$) 15 A / 10 A / 8 A / 5 A / 3 A / 2 A / 1 A	8 A 125 V AC, 3 A 125 V AC	5 A 125 V AC (Standard) 10 A 125 V AC (High capacity)	5 A 277 V AC, 5 A 30 V DC	5 A 125 V AC 10 A 125 V AC	10 A 125 V AC
Minimum 1 mA / 100 μA / 10 μA					
• **Contact arrangement**	1a	1a, 1c	1a	1a, 1c	1a, 1c
• **Life (Min. operation)** — **Electrical**	10^5	5×10^4	10^5	10^5	10^5
• **Life (Min. operation)** — **Mechanical**	5×10^6	10^7	10^7	5×10^6	10^7
• **Breakdown voltage** — Between open contacts	750Vrms	1a: 1,000Vrms 1c: 750Vrms	1,000Vrms	800Vrms	750Vrms
• **Breakdown voltage** — Between contact sets	—	—	—	—	—
• **Breakdown voltage** — Between contacts and coil	2,000Vrms	4,000Vrms	4,000Vrms	2,000Vrms	1,500Vrms
• **Breakdown voltage** — Between live parts and ground	—	—	—	—	—
• **Surge withstand voltage**	8,000V surge	8,000V surge	8,000V surge	5,000V surge	—
• **Coil voltage**	(DC) 3, 5, 6, 9, 12, 18, 24V	(DC) 3, 5, 6, 9, 12, 18, 24, 48 V	(DC) 3, 5, 6, 9, 12, 18, 24 V	(DC) 5, 6, 9, 12, 24, 48 V	(DC) 5, 6, 9, 12, 24, 48V
• **Nominal operating power**	200mW	1a: 200mW 1c: 400mW	200mW	400mW	360mW
• **Terminal layout (Bottom View)** ●: coil terminal (.100 inch grid) mm inch		 1a			1a 1c 
• **Standards**	UL (E43028), TÜV, CSA (LR26550), SEMKO	UL (E43028), SEV, CSA (LR26550)	UL (E43028), SEV, CSA (LR26550)	UL (E43028), TÜV, CSA (LR26550)	UL (E43028), TÜV, CSA (LR26550), TV rating
• **Mounting method**					
• **Page**	204	207	211	214	217

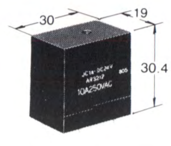
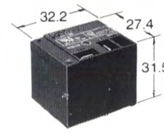
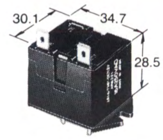
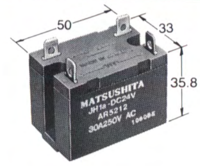
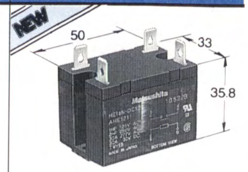
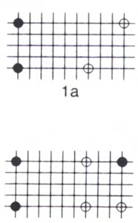
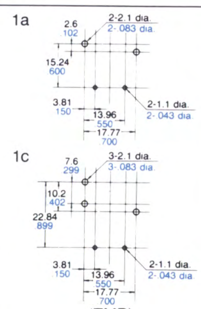
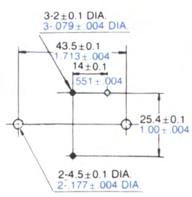
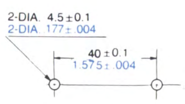
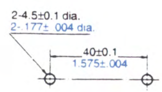
Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals; : Surface-mounting

Automotive Ultra-Miniature Power Relay	Compact Flat Power	Slim Type Power	Compact PC Board Power Relay	Miniature High Power	Compact Power Relay for Inductive Load
JSM-RELAY	**JV-RELAY**	**JR-RELAY**	**JW-RELAY**	**JN-RELAY**	**JM-RELAY**
					
• Dedicated for automotive applications • Contact capacity: 5A 16VDC, Inrush 25A (Motor load)	• High capacity in a compact body • High sensitivity	• 16A type available • Wide insulation distance • High inrush current capability	• High dielectric withstanding for transient protection • Class B coil insulation types available	• High switching capacity 70A inrush 20A steady • High contact welding resistance	• Super welding resistance • High surge resistance • Compact high capacity relay for inductive load
●	●		●		
Silver alloy	Silver alloy	Silver alloy	Silver alloy	Silver alloy	Silver alloy

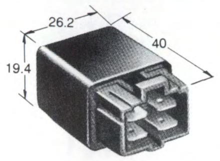
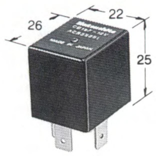
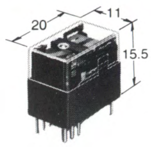
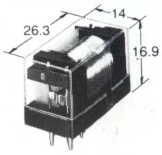
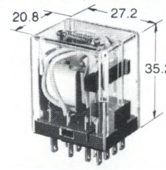
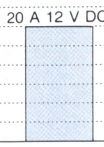
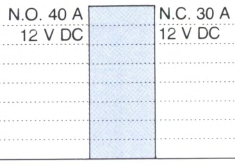
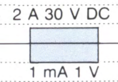
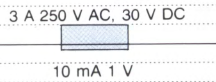
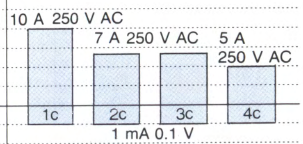
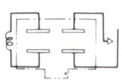
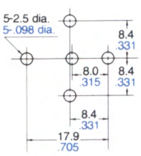
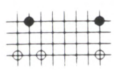
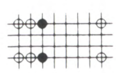
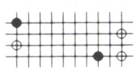
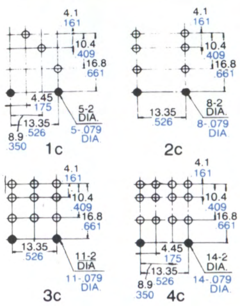
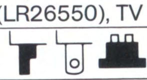


1a, 1c	1a, 1c	1a	Standard: 1a, 1c, 2a, 2c High capacity: 1a, 1c	1a	1a
10^5	(Sealed) 10^5 (Flux-resistant) 10^5 to 3×10^5 (Automotive) 4×10^4	10^5	10^5	10^5	10^5
10^7	(Standard, High capacity) 10^7 (Automotive) 5×10^6	5×10^6	5×10^6	10^6	10^6
750Vrms	(Standard, High capacity) 1,000Vrms (Automative) 750Vrms	1,000Vrms	1,000Vrms	1,000Vrms	1,000Vrms
—	—	3,000Vrms	—	—	—
1,500Vrms	1,500Vrms	5,000Vrms	5,000Vrms	3,000Vrms	5,000Vrms
—	—	—	—	—	—
—	—	10,000V surge	10,000V	5,000V surge	—
(DC) 9, 12, 24V	(DC) 5, 6, 9, 12, 18, 24, 48*, 100V* *Only for Standard, High Capacity type.	(DC) 6, 12, 24, 48 V (AC) 115V	(DC) 5, 6, 9, 12, 24, 48 V	(DC) 5, 6, 9, 12, 24, 48V	(DC) 5, 6, 9, 12, 24, 48V
640mW	(Standard, High capacity) 1a: 200mW 1c: 400mW (Automotive) 450mW	530mW	530mW	0.9W	0.9W
1a  1c 	DIL  1a  1c	 (TMP)	 1a		
—	UL (E43028), CSA (LR26550)	UL (E43028), TÜV, SEV, CSA (LR26550), TV rating	UL, VDE, TÜV, SEMKO, CSA, SEV, TV rating	UL (E43028), CSA (LR26550)	UL (E43028), CSA (LR26550)
220	224	228	232	236	238

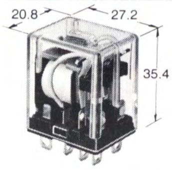
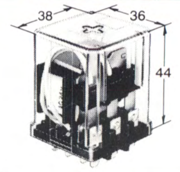
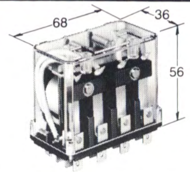
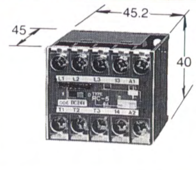
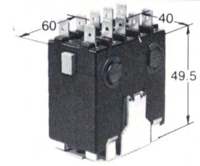
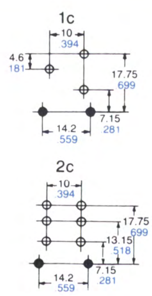
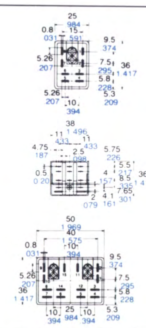
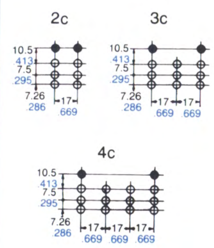
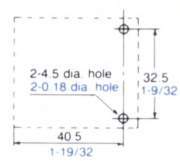
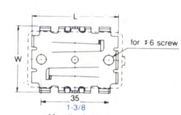
Relay Selector Chart

	Compact High Power **JC-RELAY**	30 A, DC Coil PC Board Relay **JT-RELAY**	1 HP Compact Power **JA-RELAY**	Compact High Power **JH-RELAY**	TV-15, 30 Amp (1 Form A) Power **HE-RELAY**
• Type of relay mm					
• Features	• Class B coil type available • TV-rated type available • High dielectric withstanding: 10,000V surge	• High switching capacity • Open, Dust cover, Sealed types available • Class B coil type available	• High switching capacity 55A inrush, 15A steady • TV-rated type available	• High dielectric withstanding: 10,000V surge • High inrush resistance	• High dielectric withstanding: 10,000V surge • High inrush resistance (TV-15: 1 Form A) (TV-10: 2 Form A)
• Sealed types availability		●			
• Latching types availability				●	
• Contact material (Optional material)	Silver alloy	Silver alloy	Silver alloy	Silver alloy	Silver alloy
• Contact rating chart Maximum (cos $\varphi = 1$) 30 A / 20 A / 15 A / 10 A / 8 A / 5 A / 3 A	15 A 250 V AC 10 A 250 V AC 5 A 250 V AC	30 A 30 V DC (1a) 20 A 30 V DC (1c N.O.) 10 A 30 V DC (1c N.C.)	15 A 250 V AC	30 A 250 V AC (1a) 20 A 250 V AC (2a) 15 A 250 V AC (3a, 2a 1b)	30 A 277 V AC (1a) 20 A 277 V AC (2a)
Minimum 1 mA / 100 μA / 10 μA					
• Contact arrangement	1a / 2a / 1a1b	1a, 1c	1a, 1b, 1c	1a / 2a / 3a, 2a 1b	1a / 2a
• Life (Min. operation) Electrical	10^5	10^5	10^5	10^5	2×10^5
• Life (Min. operation) Mechanical	5×10^6	10^7	5×10^6	5×10^6	10^7
• Breakdown voltage: Between open contacts	2,000Vrms	1,500Vrms	1,000Vrms	2,000Vrms	2,000Vrms
• Breakdown voltage: Between contact sets	2,000Vrms	—	—	2,000Vrms	4,000Vrms
• Breakdown voltage: Between contacts and coil	4,000Vrms	1,500Vrms	2,000Vrms	5,000Vrms	5,000Vrms
• Breakdown voltage: Between live parts and ground	—	—	—	—	—
• Surge withstand voltage	10,000V surge	—	5,000V surge	10,000V surge	10,000V surge
• Coil voltage	(DC) 6, 12, 24, 48V	(DC) 5, 6, 9, 12, 15, 18, 24V	(DC) 6, 12, 24V (AC) 6, 12, 24, 115V	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 120, 220, 240V	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 120, 240V
• Nominal operating power	(1a) 0.9W (2a, 1a1b) 1W	890mW	(DC) 1.2W (AC) 1.3VA	(DC) 1.9W (AC) 3.2VA	(DC) 1.9W (AC) 1.65 to 2.59VA
• Terminal layout (Bottom View) ●: coil terminal (.100 inch grid) mm inch	 1a 2a, 1a1b	1a  1c (TMP)	 (TMP)	 1a	
• Standards	UL, VDE, SEMKO, SEV, CSA(LR26550), TV rating	UL (E43028), CSA (LR26550)	UL (E43028), TÜV, SEV, CSA(LR26550), TV rating	UL (E43028), VDE, TÜV, CSA (LR26550), TV rating	UL (E43028), CSA (LR26550)
• Mounting method					
• Page	241	247	251	256	262

 Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals; : Surface-mounting

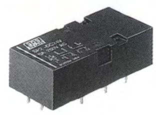
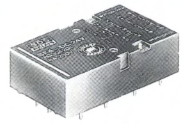
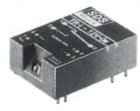
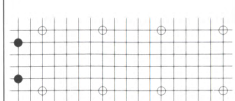
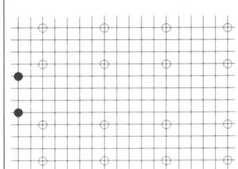
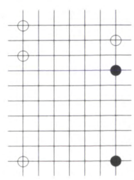
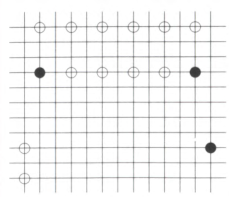
Automotive Power **CA-RELAY**	High Power Automotive Relay **CB-RELAY**	Subminiature DIL **HB-RELAY**	Subminiature **HA-RELAY**	Miniature Power **HC-RELAY**
				
• Small size • Light weight • Completely water tight • Automotive direct plug-in	• 40 A rating at 85°C 185°F • ISO type terminals • High shock resistance for drop test requirements • Low temperature rise	• DIP terminal • Flux-resistant • Ag-Pd contacts type available	• Compact size • AC coils	• Wide applications • Versatile range • Foot print compatible with competitive types
●	●	●	●	●
Silver alloy	Silver alloy	Silver nickel (Silver palladium)	Silver nickel	Gold-flashed silver alloy
				
1a, 1b	1a, 1c	1c, 2c	1c	1c | 2c | 3c | 4c
10^5	10^5	2×10^5	10^5	2×10^5
2×10^5	10^6	10^7	10^7	(DC) 10^8 (AC) 5×10^7
500Vrms	500Vrms	500Vrms	750Vrms	700Vrms
—	—	500Vrms	—	700Vrms
500Vrms	500Vrms	1,000Vrms	1,500Vrms	2,000Vrms
—	—	—	—	—
—	—	—	—	—
(DC) 5, 9, 12, 24V	(DC) 12, 24V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 5, 6, 9, 12, 24, 48V (AC) 6, 12, 24, 48, 115V	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 120, 220/240 V
1.8W	1.4W	(1C) 360mW (2C) 576mW	(DC) 360mW (AC) 0.9VA	(DC) 0.9W (AC) 1.2VA
 (Terminal layout)	 (PCB type)	 1c  2c		
—	—	UL (E43028), CSA (LR26550)	UL (E43028), CSA (LR26550)	UL, VDE, SEV 1c, 2c, 3c, CSA (LR26550), TV rating
				
266	269	273	276	278

Relay Selector Chart

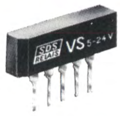
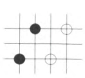
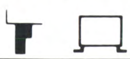
	Compact Power	10 Amp Power	20 Amp Power	Polarized Mini Contactor	Heavy Duty Power
	HL-RELAY	**HP-RELAY**	**HG-RELAY**	**MC-Mini Contactor**	**VC-RELAY**
• Type of relay (mm)					
• Features	• Large capacity • Compact size • Foot print compatible with competitive types	• Long life • Foot print compatible with competitive types	• Large capacity 20A	• Direct motor drive by IC output • Surge suppression circuit incorporated • Screw terminals	• Large capacity with Form X contacts • Screw terminals available
• Sealed types availability					
• Latching types availability					
• Contact material	Silver alloy	Silver alloy	Silver-cadmium-oxide	Silver alloy	Silver-cadmium-oxide
• Contact rating chart — Maximum ($\cos\varphi = 1$) (20 A, 10 A, 8 A, 5 A, 3 A, 2 A, 1 A)	15 A 125 V AC; 10 A 250 V AC	10 A 250 V AC	20 A 250 V AC	15 A 120 V AC X contact; 10 A 240 V AC Y contact	20 A 220 V AC
Minimum (1 mA, 100 μA, 10 μA)	1 mA 1 V; 1 mA 1 V	10 mA 10 V	10 mA 1 V		
• Contact arrangement	1c; 2c	1c, 2c, 3c	2c, 3c, 4c	4X, 3X1Y, 2X2Y	1X, 2X, 3X, 4X, 1X1Y, 2X1Y, 2X2Y, 3X1Y
• Life (Min. operation) — Electrical	5×10^5	2×10^5	2×10^5	25×10^4	2.5×10^5
• Life (Min. operation) — Mechanical	(DC) 10^8 (AC) 5×10^7	10^7	(DC) 10^6 (AC) 10^7	10^7	10^6
• Breakdown voltage — Between open contacts	1,000Vrms	(HP2,4) 1,000Vrms (HP3) 2,000Vrms	2,000Vrms	2,500Vrms	2,500Vrms
• Breakdown voltage — Between contact sets	1,500Vrms	2,000Vrms	2,000Vrms	—	2,500Vrms
• Breakdown voltage — Between contacts and coil	2,000Vrms	2,000Vrms	2,000Vrms	—	2,500Vrms
• Breakdown voltage — Between live parts and ground	—	—	—	—	—
• Surge withstand voltage	—	—	—	—	—
• Coil voltage	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 120, 220/240 V		(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 115, 220, 240V	(DC) 12, 24V	(AC) 24, 48, 110, 120, 220, 240V (DC) 12, 24, 48V
• Nominal operating power	(DC) 0.9 to 1.0W (AC) 1.2 to 1.3VA	(DC) 1.5W (AC) 2.0VA	(2c) 1.4W (DC) 3.6VA (AC) (3c) 1.6W (DC) 5.2VA (AC) (4c) 2.0W (DC) 7.6VA (AC)	500mW	5.0 to 6.6VA
• Terminal layout (Bottom View) •: coil terminal (.100 inch grid) mm inch				Drilling dimensions for mounting screw 	 Mounting bracket Bracket A: L 45 1.772, W 35 1.378 Bracket B: L 50 1.969, W 45 1.772
• Standards	UL (E43028), TV rating, CSA (LR26550)	UL (E43028), VDE, CSA (LR26550), SEV	UL (E43028), CSA (LR26550)	UL (E43028), SEV, CSA (LR52199-6)	UL (43028), VDE, CSA (LR26550), TÜV
• Mounting method				Screw terminal	
• Page	291	294	303	308	309

Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals; : Surface-mounting

Special Relays

	Economical Reed Relay **A-RELAY**	Modern Safety Relay **SF2-RELAY**	Modern Safety Relay **SF4-RELAY**	Time Relay **TR-RELAY**	Time Relay **TS-RELAY**
• Type of relay					
mm	Ø 9.5 x 20	53.3 x 25 x 16.5	53.3 x 33 x 16.5	30.4 x 22.1 x 10.7	34 x 34 x 10,8
• Features	• Single-in-line reed relay. Horizontal mounting possible by bending the pin connections.	• Polarised relay with forced, interlocked contact operation for safety applications.	• Polarised relay with forced, interlocked contact operation for safety applications.	• Universal adustable pcb time-delay relay. Pull-in delay and drop-out delay, wiping or pulse versions available. No auxiliary control voltage required. TR-o may be switched remotely.	• Universal adustable pcb time-delay relay. Pull-in delay and drop-out delay, wiping or pulse versions available. No auxiliary control voltage required. TS-o may be switched remotely.
• Sealed types availability	●	●	●		
• Latching types availability					
• Contact material	Rhodium	Silver-Tin-Oxide	Silver-Tin-Oxide	Gold-Cobald	Gold
• Contact rating chart Maximum ($\cos\varphi = 1$) (20 A, 10 A, 8 A, 5 A, 3 A, 2 A, 1 A)	0.1 A 50 V	6.8 A 220 VAC	6.8 A 220 VAC	1 A 20 VDC	5 A 250 VAC
Minimum (1 mA, 100 µA, 10 µA)	1 mA 100 mV	10 mA 10 V	10 mA 10 V	1 mA 1 V	100 µA 100 mV
• Contact arrangement	1a	2a, 2b	4a, 4b	1c	2a 2b, 3a 1b, 4a
• Life (Min. operation) Electrical	10^6	6.8 A, 220 VAC, 10^5	6.8 A, 220 VAC, 10^5	10^6	10^5
• Life (Min. operation) Mechanical	10^9	10^7	10^7	10^9	10^8
• Breakdown voltage: Between open contacts	250 V_{rms}	2500 V_{rms}	2500 V_{rms}	350 V_{rms}	750 V_{rms}
Between contact sets	–	2500 V_{rms}	2500 V_{rms}	–	1000 V_{rms}
Between contacts and coil	500 V_{rms}	2500 V_{rms}	2500 V_{rms}	1000 V_{rms}	1500 V_{rms}
Between live parts and ground	–	–	–	–	–
• Surge withstand voltage	–	–	–	–	–
• Coil voltage	5, 12, 24	DC 5, 12, 24, 48, 60 V	DC 5, 12, 24, 48, 60 V	DC 5, 12, 24 V	DC 5, 12, 24 V
• Nominal operating power	180 mW	500 mW	500 mW	180 – 420 mW	200 – 300 mW
• Terminal layout (Bottom View) ●: coil terminal (.100 inch grid) mm inch					
• Standards	–	–	SEV, SUVA, TUV	–	–
• Mounting method					
• Page					

Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals; : Surface-mounting

Power Saving Relay Driver **IC-MODULE**	Stepper Module **VS-MODULE**
 5 x 1.8 x 4	 18.5 x 3.3 x 6.3
• Saving of relay power consumption of up to 99.9 % is possible. Low coil inductance. Short pick-up and drop out times. Defined pick-up and drop-out voltages. SM version available for all commen SMT techniques.	• Modern stepper relay using electronic pre-circuit.
The C-switching circuit bestows monostable relay switching characteristics on bistable (latching) relays. It ensures that after the initial switch-on time, only leakage currents of typically 10 to 100 μA flow. Application: To save power consumption. In particular in high density applications or for battery powered devices. Due to the neglible self-heating effect, thermo-voltages at the relay contacts are reduced to a minimum. Following relays are suitable for use with IC module: IF, TFSA, TN, TO, TW, DX, R, DR, TK, DS, DSP, DR, S, NC, ST, DK, SP, RG	The VS-module bestows stepper relay operation in a 2 coil bistable (latching) relay. This means that with unidirectional control pulses, the relay switches alternatively into one or the other stable condition. This is achieved without any mechanical interlocks hence eliminating wear difficulties. The relay and VS module combination can be controlled using only two conductors. 1 relay contact is required for internal switching purposes. In all other respects the relay characteristics remain un-altered. High reliability, short switching times, minimal noise generation, very high mechanical life (up to 10^8 ops). By combining several relays and VS, it is possible to build flip-flop circuits, frequency deviders, counters etc. Following relays are suitable for use with the VS-module: TF, TFSA, TN, TQ, TW, DX, DF, DS-2, DS-4, DSP, S, DKI, SP, RG2, RM
Terminal layout 	**Terminal layout** 
Mounting method 	**Mounting method** 

NAIS Matsushita Automation Controls

Technical Information.

Technical Information

Definition of Relay Terminology

COIL

(also referred to as primary or input)

• **Nominal Coil Voltage** (Rated Coil Voltage)
A single value (or narrow range) of source voltage intended by design to be applied to the coil or input.

• **Pick-Up Voltage** (Pull-In Voltage or Must Operate Voltage)
As the voltage on an unoperated relay is increased, the value at or below which all contacts must function (transfer).

• **Drop-Out Voltage** (Release or Must Release Voltage)
As the voltage on an operated relay is decreased, the value at or above which all contacts must revert to their unoperated position.

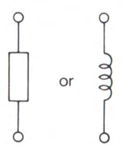
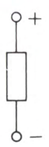
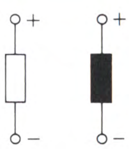
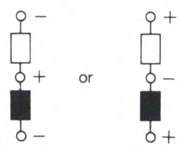
• **Maximum Continuous Voltage**
The maximum voltage that can be applied continuously to the coil without causing damage. Short duration spikes of a higher voltage may be tolerable, but this should not be assumed without first checking with the manufacturer.

• **Nominal Operating Current**
The value of current flow in the coil when nominal voltage is impressed on the coil.

• **Nominal Operating Power**
The value of power used by the coil at nominal voltage. For DC coils expressed in watts; AC expressed as volt amperes. Nominal Power (W or VA) = Nominal Voltage × Nominal Current.

• **Coil Resistance**
This is the DC resistance of the coil in DC type relays for the temperature conditions listed in the catalog. (Note that for certain types of relays, the DC resistance may be for temperatures other than the standard 20°C 68°F.)

• **Coil Designation**

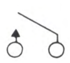
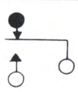
Single side stable type		1 coil latching type	2 coil latching type	
Non-polarized	Polarized		4-terminal	3-terminal
				

A black coil represents the energized state. For latching relays, schematic diagrams generally show the coil in its reset state. Therefore, the coil symbol is also shown for the reset coil in its reset state.

CONTACTS (secondary or output)

• **Contact Forms**
Denotes the contact mechanism and number of contacts in the contact circuit.

• **Contact Symbols**

Form A contacts (normally open contacts)	
Form B contacts (normally closed contacts)	
Form C contacts (changeover contacts)	

Form A contacts are also called N.O. contacts or make contacts.
Form B contacts are also called N.C. contacts or break contacts.
Form C contacts are also called changeover contacts or transfer contacts.

• **MBB Contacts**
Abbreviation for make-before-break contacts. Contact mechanism where Form A contacts (normally open contacts) close before Form B contacts open (normally closed contacts).

• **Rated Switching Power**
The design value in watts (DC) or volt amperes (AC) which can safely be switched by the contacts. This value is the product of switching voltage × switching current, and will be lower than the maximum voltage and maximum current product.

• **Maximum Switching Voltage**
The maximum open circuit voltage which can safely be switched by the contacts. AC and DC voltage maximums will differ in most cases.

• **Maximum Switching Current**
The maximum current which can safely be switched by the contacts. AC and DC current maximums may differ.

• **Maximum Switching Power**
The upper limit of power which can be switched by the contacts. This value will be lower than the maximum voltage × maximum current product and care should be taken not to exceed this value.

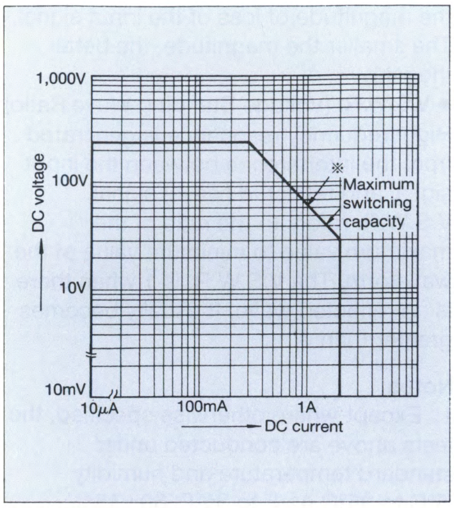
• **Maximum Carrying Current**
The maximum current which **after closing** or **prior to opening**, the contacts can safely pass without being subject to temperature rise in excess of their design limit, or the design limit of other temperature sensitive components in the relay (coil, springs, insulation, etc.). This value is usually in excess of the maximum **switching** current.

• **Minimum Switching Capability**
The minimum value of voltage and current which can be reliably switched by the contacts. These numbers will vary from device type to device type. Factors affecting minimums include contact material, contact pressure, wipe, ambient conditions and type of relay enclosure (sealed vs. non-sealed).

• **Maximum Switching Capacity**
This is listed in the data column for each type of relay as the maximum value of the contact capacity and is an interrelationship of the maximum switching power, maximum switching voltage, and maximum switching current. The switching current and switching voltage can be obtained from this graph. For example, if the switching voltage is fixed in a certain application, the maximum switching current can be obtained from the intersection between the voltage on the axis and the maximum switching power.

Maximum Switching Capacity (DS relay)

Example: Using a DS relay at a switching voltage of 60V DC, the maximum switching current is 1A.
(Maximum switching capacity is given for a resistive load. Be sure to carefully check the actual load before use.)



- **Contact Resistance**

This value is the combined resistance of the resistance when the contacts are touching each other and the resistance of the terminals and contact springs. The contact resistance is measured using the voltage-drop method as shown below. The measuring currents are designated in Fig. 1.

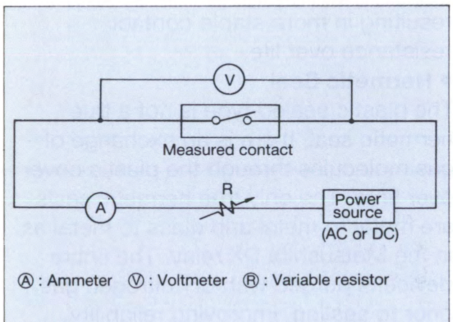


Fig. 1

Test Currents

Rated Contact Current or Switching Current (A)	Test Current (mA)
Less than 0.01	1
0.01 or more and less than 0.1	10
0.1 or more and less than 1	100
1 or more	1,000

The resistance can be measured with reasonable accuracy on a YHP 4328A milliohmmeter.
In general, for relays with a contact rating of 1A or more, measure using the voltage-drop method at 1A 6V DC.

- **Capacitance**

This value is measured between the terminals at 1kHz and 20°C 68°F

PERFORMANCE

- **Insulation Resistance**

The resistance value between all mutually isolated conducting sections of the relay, i.e. between coil and contacts, across open contacts and between coil or contacts to any core or frame at ground potential. This value is usually expressed as "initial insulation resistance" and may decrease with time, due to material degradation and the accumulation of contaminants.

- **Breakdown Voltage** (Hi-Pot or Dielectric Strength)

The maximum voltage which can be tolerated by the relay without damage for a specified period of time, usually measured at the same points as insulation resistance. Usually the stated value is in VAC (RMS) for one minute duration.

- **Surge Withstand Voltage**

The ability of the device to withstand an abnormal externally produced power surge, as in a lightning strike, or other phenomenon. An impulse test waveform is usually specified, indicating rise time, peak value and fall time. (Fig. 2)

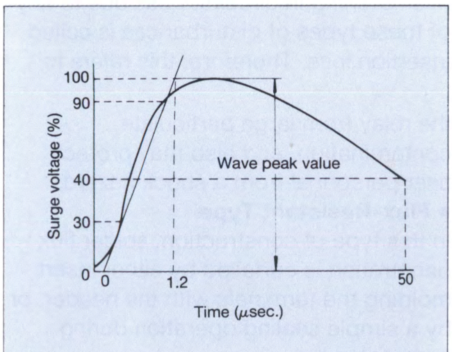


Fig. 2

- **Operate Time** (Pull-In or Pick-Up Time)

The elapsed time from the initial application of power to the coil, until the closure of the normally open contacts. (With multiple pole devices the time until the last contact closes.) This time does **not** include any bounce time.

- **Operate Bounce Time**

The time period immediately following operate time during which the contacts are still dynamic, and ending once all bounce has ceased.

- **Release Time** (Drop-Out Time)

The elapsed time from the initial removal of coil power until the reclosure of the normally closed contacts (last contact with multi-pole) this time does **not** include bounce.

- **Release Bounce Time**

The time period immediately following release time during which the contacts are still dynamic, ending when all bounce has ceased.

- **Set Time**

Term used to describe operate time of a bi-stable or latching relay.

- **Reset Time**

Term used to describe release time of a bi-stable or latching relay. With a 2-coil magnetic latching relay the time is from the first application of power to the reset coil until the reclosure of the reset contacts. With a single coil latching relay, the time is measured from the first application of reverse coil voltage until the reclosure of the reset contacts.

- **Shock Resistance, Destructive**

The acceleration which can be withstood by the relay during shipping or installation without it suffering damage, and without causing a change in its operating characteristics. Usually expressed in "G"s.

- **Shock Resistance, Functional**

The acceleration which can be tolerated by the relay during service without causing the closed contacts to open for more than the specified time.

- **Vibration Resistance, Destructive**

The vibration which can be withstood by the relay during shipping, installation or use, without it suffering damage, and without causing a change in its operating characteristics. Expressed as an acceleration in G's or displacement, and frequency range.

- **Vibration Resistance, Functional**

The vibration which can be tolerated by the relay during service, without causing the closed contacts to open for more than the specified time.

- **Mechanical Life**

The minimum number of times the relay can be operated under nominal conditions (coil voltage, temperature, humidity, etc.) with no load on the contacts.

- **Electrical Life**

The minimum number of times the relay can be operated under nominal conditions with a specific load being switched by the contacts.

- **Contact Bounce** (Time)

Generally expressed in time (msec.), this refers to the intermittent switching phenomenon of the contacts which occurs due to the collision between the movable metal parts or contacts, when the relay is operated or released.

- **Maximum Switching Frequency**

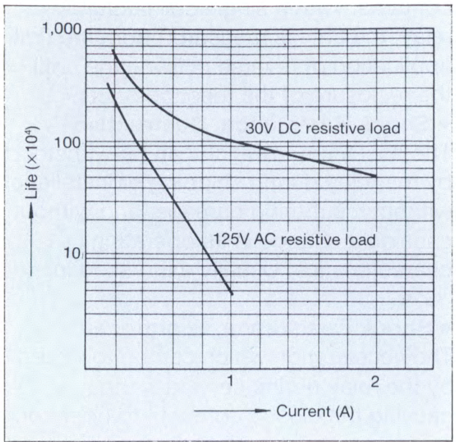
This refers to the maximum switching frequency which satisfies the mechanical life or electrical life under repeated operations by applying a pulse train at the rated voltage to the operating coil.

- **Life Curve**

This is listed in the data column for each type of relay. The life (number of operations) can be estimated from the switching voltage and switching current. For example, for a DS relay operating at:
Switching voltage = 125V AC
Switching current = 0.6A
The life expectancy is 300,000 operations. However, this value is for a resistive load. Be sure to carefully check the actual load before use.

Definition of Relay Terminology

Life Curve



HIGH FREQUENCY CHARACTERISTICS

• Isolation

High frequency signals leak through the stray capacitance across contacts even if the contacts are separated. This leak is called isolation loss. The symbol dB (decibel) is used to express the magnitude of the leak signal. This is expressed as the logarithm of the magnitude ratio of the signal generated by the leak with respect to the input signal. The larger the magnitude, the better the isolation.

• Insertion Loss

At the high frequency region, signal disturbance occurs from self-induction, resistance, and dielectric loss as well as from reflection due to impedance mismatching in circuits. Loss due to any of these types of disturbances is called insertion loss. Therefore, this refers to the magnitude of loss of the input signal. The smaller the magnitude, the better the relay.

• V.S.W.R. (Voltage Standing Wave Ratio)

High frequency resonance is generated from the interference between the input signal and reflected (wave) signal. V.S.W.R. refers to the ratio of the maximum value to minimum value of the waveform. The V.S.W.R. is 1 when there is no reflected wave. It usually becomes greater than 1.

Notes:

1. Except where otherwise specified, the tests above are conducted under standard temperature and humidity (5°C to 35°C 41°F to 95°F, 60±15%).
2. The coil impressed voltage in the switching tests is a rectangular wave at the rated voltage.
3. The phase of the AC load operation is random.

PROTECTIVE CONSTRUCTION

Several different degrees of protection are provided for different relay types, for resistance to dust, flux, contaminating environments, automatic cleaning, etc.

• Open Type

For reasons of cost, some devices are not provided with any enclosure. It is usually assumed that the end application will be in an overall enclosure or protective environment.

• Dust Cover Type

Most standard relays are provided with a dust cover of some type. This protects the relay from large particulate contamination, and also may protect user personnel from a shock hazard.

• Flux-Resistant Type

In this type of construction, solder flux penetration is curtailed by either insert molding the terminals with the header, or by a simple sealing operation during manufacturing.

• Sealed Type

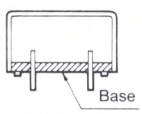
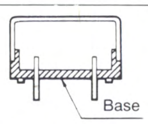
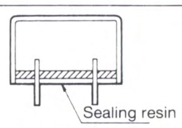
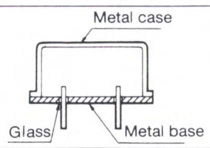
This type of sealed relay totally excludes the ingress of contaminants by way of a sealing compound being applied to the header/cover interface. The constituent components are annealed for physical and chemical stability. This annealing process drives off residual volatiles in the plastics, insuring a contaminant free environment inside the sealed relay, resulting in more stable contact resistance over life.

• Hermetic Seal

The plastic sealed type is not a true hermetic seal, there is an exchange of gas molecules through the plastic cover over time. The only true hermetic seals are metal to metal and glass to metal as in the Matsushita DX relay. The entire device is purged with dry nitrogen gas prior to sealing, improving reliability.

CONSTRUCTION AND CHARACTERISTIC

(○: Yes, ×: No)

Type	Construction	Characteristics	Automatic Soldering	Automatic Cleaning	Harmful Gas Resistance
Dust Cover Type		Most basic construction where the case and base (or body) are fitted together.	×	×	×
Flux-Resistant Type		Terminals are sealed or molded simultaneously. The joint between the case and base is higher than the surface of the PC board.	○	×	×
Sealed Type		Terminals, case, and base are filled with sealing resin.	○	○ *1)	○ *2)
Metallic Hermetic Seal Type		Hermetically sealed with metal case and metal base. Terminals are sealed with glass.	○	○	○

*1) Cleaning solvent
*2) Although absorption by plastic does occur, it is insignificant in actual practice.
Use the metallic hermetic seal type for explosion-proof requirements.

OPERATIONAL FUNCTION

• Single Side Stable Type
Relay which turns on when the coil is energized and turns off when de-energized. (Fig. 3)

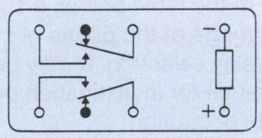


Fig. 3 (Typical schematic for DS relay)

• 1 Coil Latching Type
Relay with a latching construction that can maintain the on or off state with a pulse input. With one coil, the relay is set or reset by applying signals of opposite polarities. (Fig. 4)

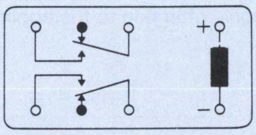


Fig. 4 (Typical schematic for DS relay)

• 2 Coil Latching Type
Relay with a latching construction composed of 2 coils: set coil and reset coil. The relay is set or reset by alternately applying pulse signals of the same polarity. (Fig. 5)

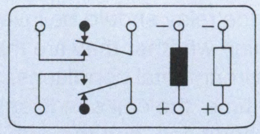
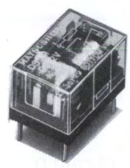
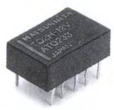
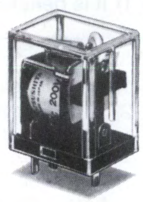
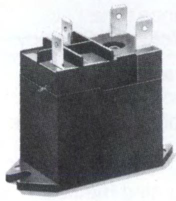
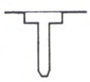
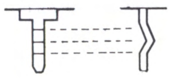


Fig. 5 (Typical schematic for DS relay)

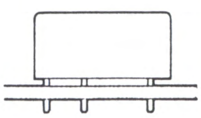
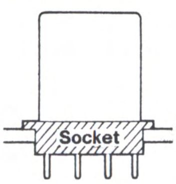
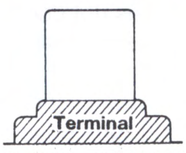
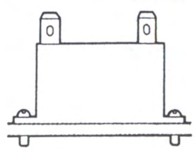
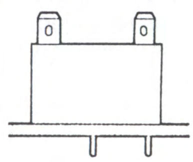
• Operation Indication
Indicates the set and reset states either electrically or mechanically for easy maintenance. An LED wired type (LED wired HC relay), lamp type (lamp wired HP relay) are available. (Fig. 6)

Fig. 6 LED wired HC relay

TERMINAL CONFIGURATION

Type	PC board terminal	PC board self-clinching terminal	Plug-in terminal	Quick connect terminal	Screw terminal
Typical relay type					
Terminal configuration					
Typical relay type	TQ, TF, TN, TK, TW relay NR relay, JS relay, DS relay, JW relay S relay, JQ relay PQ relay	TQ, TF, TN, TK, TW relay	K relay HC relay HP relay HE relay	JC relay JR relay JA relay	JH relay VC relay HE relay

MOUNTING METHOD

Type	PC board mount	Socket mount	Terminal socket mount	TM type	TMP type
Mounting configuration					
Typical relay type	TQ, TF, TN, TK, TW relay NR relay DS relay S relay	K relay NC relay HC relay	HC relay HP relay HG relay	HC relay JR relay JC relay	JR relay JC relay JM relay JT relay

Notes: 1. Sockets are available for certain PC board relays (NR relay, S relay, ST relay, etc.)
2. M type (solder type) for direct screw mounting of case is also available (K relay, HG relay)

General Application Guidelines

A relay may encounter a variety of ambient conditions during actual use resulting in unexpected failure. Therefore, testing over a practical range under actual operating conditions is necessary. Application considerations should be reviewed and determined for proper use of the relay.

METHOD OF DETERMINING SPECIFICATIONS

In order to use the relays properly, the characteristics of the selected relay should be well known, and the conditions of use of the relay should be investigated to determine whether they are matched to the environmental conditions, and at the same time, the coil conditions, contact conditions, and the ambient conditions for the relay that is actually used must be sufficiently known in advance. In the table below, a summary has been made of the points of consideration for relay selection. It may be used as a reference for investigation of items and points of caution.

Specification item		Consideration points regarding selection
Coil	a) Rating b) Pick-up voltage (current) c) Drop-out voltage (current) d) Maximum continuous impressed voltage (current) e) Coil resistance f) Impedance g) Temperature rise h) Input frequency for AC type	1) Select relay with consideration for power source ripple. 2) Give sufficient consideration to ambient temperature and for the coil temperature rise. 3) When used in conjunction with semiconductors, additional attention to the application should be taken.
Contacts	a) Contact arrangement b) Contact rating c) Contact material d) Life e) Contact pressure f) Contact resistance	1) It is desirable to use a standard product with more than the required number of contacts. 2) It is beneficial to have the relay life balanced with the life of the device it is used in. 3) Is the contact material matched to the type of load? It is necessary to take care particularly with low level usage.
Operate time	a) Operate time b) Release time c) Bounce time d) Switching frequency	1) It is beneficial to have the bounce time short for sound circuits and similar applications.
Mechanical characteristics	a) Vibration resistance b) Shock resistance c) Ambient temperature d) Life	1) Give consideration to performance under vibration and shock in the use location. 2) In particular, when used in high temperature applications, relay with class B or class F coil insulation may be required.
Other items	a) Mounting method b) Cover c) Size	1) Selection can be made for connection method with plug-in type, printed circuit board type, soldering, tab terminals, and screw fastening type. 2) For use in an adverse atmosphere, sealed construction type should be selected. 3) Are there any special conditions?

BASICS ON RELAY HANDLING

- To maintain initial performance, care should be taken to avoid dropping or hitting the relay.
- Under normal use, the relay is designed so that the case will not detach. To maintain initial performance, the case should not be removed. Relay characteristics cannot be guaranteed if the case is removed.
- Use of the relay in an atmosphere at standard temperature and humidity with minimal amounts of dust, SO_2, H_2S, or organic gases is recommended.
Also note that use of silicon-based resins near the relay may result in contact failure. For installation in adverse environments, one of the sealed types (plastic sealed type, etc.) should be considered.
- Care should be taken to observe correct coil polarity (+, −) for polarized relays.
- Proper usage requires that the rated voltage be impressed on the coil. Use rectangular waves for DC coils and sine waves for AC coils.
- Be sure the coil impressed voltage does not continuously exceed the maximum allowable voltage.
- Absolutely avoid using switching voltages and currents that exceed the designated values.
- The rated switching power and life are given only as guides. The physical phenomena at the contacts and contact life greatly vary depending on the type of load and the operating conditions. Therefore, be sure to carefully check the type of load and operating conditions before use.
- Do not exceed the usable ambient temperature values listed in the catalog.
- Use the flux-resistant type or sealed type if automatic soldering is to be used.
- Use Freon or alcohol based cleaning solvents when cleaning is to be performed using a sealed type relay.
- Avoid ultrasonic cleaning of all types of relays.
- As a guide, use a Faston mounting pressure of 4 to 7kg or 8.8 to 15.4lbs for relays with tab terminals.
- For proper use, read the main text for details.

PROBLEM POINTS WITH REGARD TO USE

In the actual use of relays, various ambient conditions are encountered, and because unforeseen events occur which can not be thought of on the drawing board, with regard to such conditions, tests are necessary under the possible range of operation. For example, consideration must always be given to variation of performance when relay characteristics are being reviewed. The relay is a mass production item, and as a matter of principle, it must be recognized that the relay is to be used to the extent of such variations without the need for adjustment.

RELAY COIL

• AC operation type

For the operation of AC relays, the power source is almost always a commercial frequency (50 or 60Hz) with standard voltages of 6, 12, 24, 48, 115, and 240V AC. Because of this, when the voltage is other than the standard voltage, the product is a special order item, and the factors of price, delivery, and stability of characteristics may create inconveniences. To the extent that it is possible, the standard voltages should be selected.

Also, in the AC type, shading coil resistance loss, magnetic circuit eddy current loss, and hysteresis loss exit, and because of lower coil efficiency, it is normal for the temperature rise to be greater than that for the DC type.

Furthermore, because humming occurs below the level of pick-up voltage (minimum operating voltage), care is required with regard to power source voltage fluctuations.

For example, in the case of motor starting, if the power source voltage drops, and during the humming of the relay, if it reverts to the restored condition, the contacts suffer a burn damage and welding, with the occurrence of a false operation self-maintaining condition.

For the AC type, there is an inrush current during the operation time (for the separated condition of the armature, the impedance is low and a current greater than rated current flows; for the adhered condition of the armature, the impedance is high and the rated value of current flows), and because of this, for the case of several relays being used in parallel connection, it is necessary to give consideration to power consumption.

• DC operation type

For the operation of DC relays, standards exist for power source voltage and current, with DC voltage standards set at 5, 6, 12, 24, 48, and 100V, but with regard to current, the values as expressed in catalogues in milliamperes of pick-up current.

However, because this value of pick-up current is nothing more than a guarantee of just barely moving the armature, the variation in impressed voltage and resistance values, and the increase in coil resistance due to temperature rise, must be given consideration for the worst possible condition of relay operation, making it necessary to consider the current value as 1.5 to 2 times the pick-up current. Also, because of the extensive use of relays as limit devices in place of meters for both voltage and current, and because of the gradual increase or decrease of current impressed on the coil causing possible delay in movement of the contacts, there is the possibility that the designated control capacity may not be satisfied. Thus it is necessary to exercise care.

The DC type relay coil resistance varies due to ambient temperature as well as to its own heat generation to the extent of about 0.4%/°C, and accordingly, if the temperature increases, because of the increase in pick-up and drop-out voltages, care is required.

• Impressed voltage of AC coil

In order to have stable operation of the relay, the impressed voltage should be basically within the range of $^{+10\%}_{-15\%}$ of the rated voltage. However, it is necessary that the waveform of the voltage impressed on the coil be a sine wave. There is no problem if the power source is commercially provided power, but when a stabilized AC power source is used, there is a waveform distortion due to that equipment, and there is the possibility of abnormal overheating. By means of a shading coil for the AC coil, humming is stopped, but with a distorted waveform, that function is not displayed. Fig. 1 below shows an example of waveform distortion.

If the power source for the relay operating circuit is connected to the same line as motors, solenoids, transformers, and other loads, when these loads operate, the line voltage drops, and because of this the relay contacts suffer the effect of vibration and subsequent burn damage. In particular, if a small type transformer is used and its capacity has no margin of safety, when there is long wiring, or in the case of household used or small sales shop use where the wiring is slender, it is necessary to take precautions because of the normal voltage fluctuations combined with these other factors. When trouble develops, a survey of the voltage situation should be made using a synchroscope or similar means, and the necessary counter-measures should be taken, and together with this determine whether a special relay with suitable excitation characteristics should be used, or make a change in the DC circuit as shown in Fig. 2, in which a capacitor is inserted to absorb the voltage fluctuations.

In particular, when a magnetic switch is being used, because the load becomes like that of a motor, depending upon the application, separation of the operating circuit and power circuit should be tried and investigated.

Fig. 1 Distortion in an AC stabilized power source

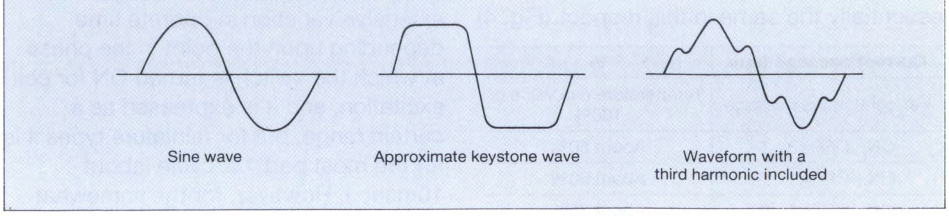
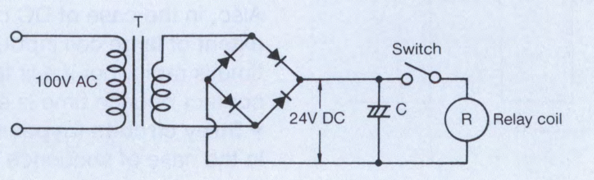


Fig. 2 Voltage fluctuation absorbing circuit using a condenser



General Application Guidelines

• Power source for DC input

As a power source for the DC type relay, a battery or either a half wave or full wave rectifier circuit with a smoothing capacitor is used. The characteristics with regard to the excitation voltage of the relay will change depending upon the type of power source, and because of this, in order to display stable characteristics, the most desirable method is perfect DC.

In the case of ripple included in the DC power source, particularly in the case of half wave rectifier circuit with a smoothing capacitor, if the capacity of the capacitor is too small, due to the influence of the ripple, humming develops and an unsatisfactory condition is produced. With the actual circuit to be used, it is absolutely necessary to confirm the characteristics. (Fig. 3)

With regard to our T-Series (TQ, TF, TN, TK, TW), NF, S, HB, DA, and NR relays, it is necessary to give consideration to the use of a power source with less than a 5% ripple, but for the J series, NC, NT, and NL relays, there is no hindrance to the operation. However, the pull-up force becomes somewhat weakened, and it is necessary to take care since the resistance to vibration and shock is reduced. Also ordinarily the following must be given thought.

[1] It is desirable to have less than a 5% ripple for the reed type relay (including NR relay also).

[2] For the hinge type relay, a half wave rectifier only cannot be used, but with the addition of a smoothing capacitor, it can be used. However, the ripple and the characteristics must be investigated.

[3] For the hinge type relay, there are types which cannot use the full wave rectifier alone and other types which can use the full wave rectifier alone, and it is necessary to discuss this with the maker to determine which is possible.

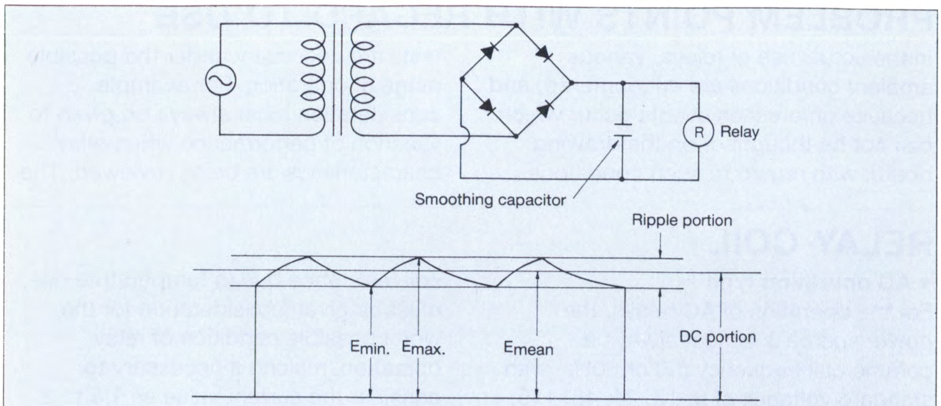


Fig. 3

$$\text{Ripple percentage} = \frac{E_{max.} - E_{min.}}{E_{mean}} \times 100\%$$

$E_{max.}$ = Maximum value of ripple portion
$E_{min.}$ = Minimum value of ripple portion
E_{mean} = Average value of ripple portion

• Coil temperature rise

Proper usage requires that the rated voltage be impressed on the coil. Note, however, that if a voltage greater than or equal to the maximum continuous impressed voltage is impressed on the coil, the coil may burn or its layers short due to the temperature rise. Furthermore, do not exceed the usable ambient temperature range listed in the catalog.

• Temperature rise due to pulse voltage

When a pulse voltage with ON time of less than 2 minutes is used, the coil temperature rise bares no relationship to the ON time. This varies with the ratio of ON time to OFF time, and compared with continuous current passage, it is rather small. The various relays are essentially the same in this respect. (Fig. 4)

Current passage time	%
For continuous passage	Temperature rise value is 100%
ON : OFF=3 : 1	About 80%
ON : OFF=1 : 1	About 50%
ON : OFF=1 : 3	About 35%

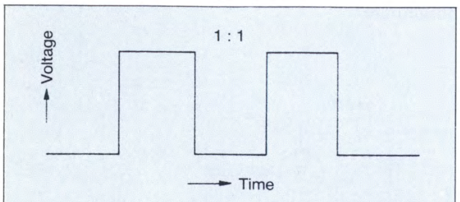


Fig. 4

• Pick-up voltage change due to coil temperature rise (hot start)

In DC relays, after continuous passage of current in the coil, if the current is turned OFF, then immediately turned ON again, due to the temperature rise in the coil, the pick-up voltage will become somewhat higher. Also, it will be the same as using it in a higher temperature atmosphere. The resistance/temperature relationship for copper wire is about 0.4% for 1°C, and with this ratio the coil resistance increases. That is, in order to cause operation of the relay, the current necessary becomes higher than the pick-up current, accompanying the rise in the resistance value.

• Operate time

In the case of AC operation, there is extensive variation in operate time depending upon the point in the phase at which the switch is turned ON for coil excitation, and it is expressed as a certain range, but for miniature types it is for the most part 1/2 cycle (about 10msec.). However, for the somewhat large type relay where bounce is large, the operate time is 7 to 16msec., with release time in the order of 9 to 18msec. Also, in the case of DC operation, to the extent of large coil input, the operating time is rapid, but if it is too rapid, the "A" contact bounce time is extended.

• Stray circuits (bypass circuits)

In the case of sequence circuit construction, because of bypass flow or alternate routing, it is necessary to take care not to have erroneous operation or abnormal operation. To understand this condition while preparing sequence circuits, as shown in Fig. 5, with 2 lines written as the power source lines, the upper line is always ⊕ and the lower line ⊖ (when the circuit is AC, the same thinking applies). Accordingly the ⊕ side is necessarily the side for making contact connections (contacts for relays, timers, limit switches, etc.), and the ⊖ side is the load circuit side (relay coil, timer coil, magnet coil, solenoid coil, motor, lamp, etc.).

Fig. 6 shows an example of stray circuits. In Fig. 6(a), with contacts A, B, and C closed, after relays R_1, R_2, and R_3 operate, if contacts B and C open, there is a series circuit through A, R_1, R_2, and R_3, and the relays will hum and sometimes not be restored to the drop out condition.

The connections shown in Fig. 6(b) are correctly made. In addition, with regard to the DC circuit, because it is simple by means of a diode to prevent stray circuits, proper application should be made.

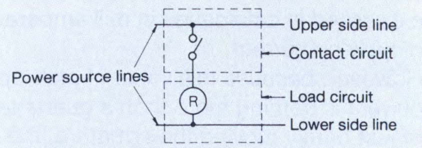


Fig. 5 Example of a vertically written sequence circuit

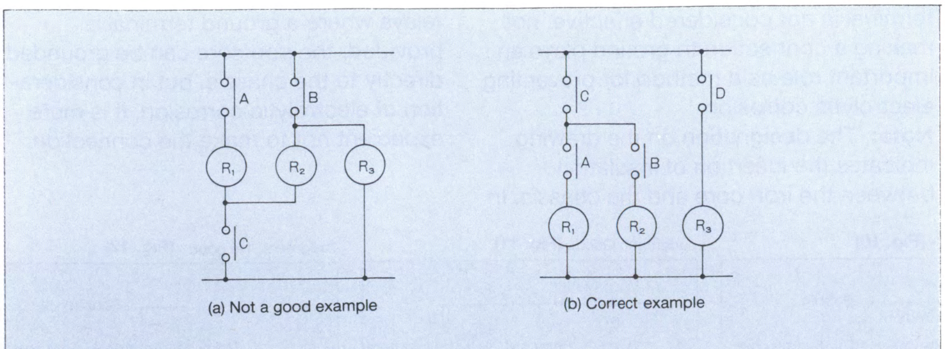


Fig. 6 Stray circuits

• Gradual increase of coil impressed voltage and suicide circuit

When the voltage impressed on the coil is increased slowly, the relay transfering operation is unstable, the contact pressure drops, contact bounce increases, and an unstable condition of contact occurs. This method of applying voltage to the coil should not be used, and consideration should be given to the method of impressing voltage on the coil (use of switching circuit). Also, in the case of latching relays, using self contacts "B", the method of self coil circuit for complete interruption is used, but because of the possibility of trouble developing, care should be taken.

The circuit shown in Fig. 7 causes a timing and sequential operation using a reed type relay, but this is not a good example with mixture of gradual increase of impressed voltage for the coil and a sucide circuit. In the timing portion for relay R_1, when the timing times out, chattering occurs causing trouble. In the initial test (trial production), it shows favorable operation, but as the number of operations increases, contact blackening (carbonization) plus the chattering of the relay creates instability in performance.

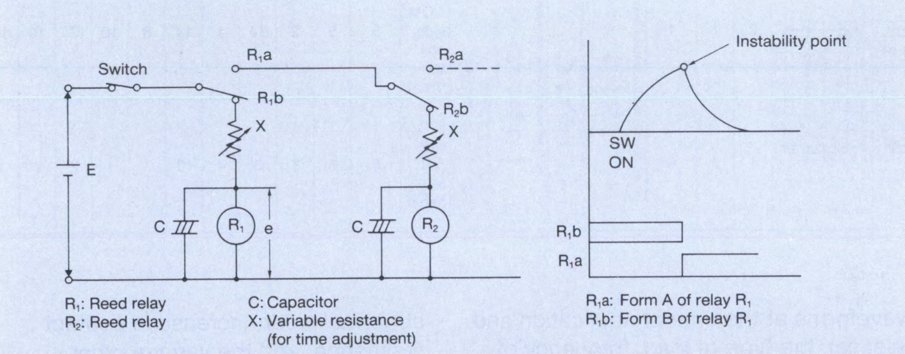


Fig. 7 A timing and sequential operation using a reed type relay

• Phase synchronization in AC load switching

If switching of the relay contacts is synchronized with the phase of the AC power, reduced electrical life, welded contacts, or a locking phenomenon (incomplete release) due to contact material transfer may occur. Therefore, check the relay while it is operating in the actual system. However, if problems develop, control the relay using an appropriate phase. (Fig. 8)

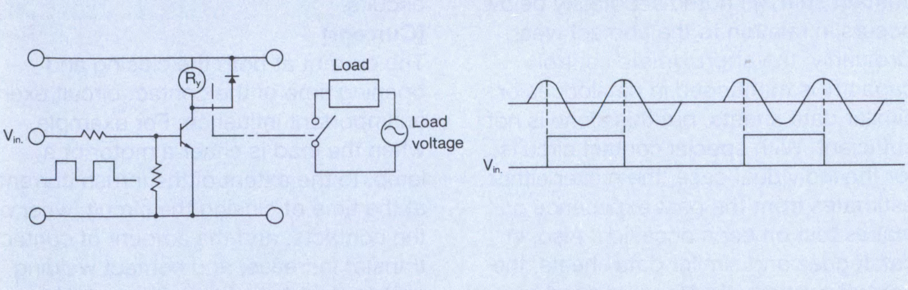


Fig. 8

• Erroneous operation due to inductive interference

In situations where both control and load wiring are in close proximity, thought should be given to separating or shielding the conductors in order to prevent false relay operation. This becomes increasingly important with long wiring runs, and can be achieved by using separate conduit for load and control conductors. Inductive coupling can also be minimized by maintaining a large physical separation of the load and control wiring.

• Influence of external magnetic fields

Many modern electro-mechanical relays are of polarized, high sensitivity design. Care should be exercised in the placement of these devices when strong, external magnetic fields are present, such as in proximity to power trans-formers or permanent magnets (speakers, etc.).

Operational characteristics may change under an external magnetic influence.

• Long term current carrying

In applications which involve lengthy duty cycles, the preferred configuration would be the use of the form B or N.C. contacts for long term duty. In those instances where the form A contact is held closed for extensive time periods, coil heating will increase contact "T" rise and may result in shorter than optimum life. Alternately, latching types may be considered for these applications, using a storage capacitor to "Reset" the relay on power-down.

• Regarding electrolytic corrosion of coils

In the case of comparatively high voltage coil circuits (in particular above 48V DC), when such relays are used in high temperature and high humidity atmos-pheres or with continuous passage of current, the corrosion can be said to be the result of the occurrence of electrolytic corrosion. Because of the possibility of open circuits occurring, attention should be given to the following points.

[1] The ⊕ side of the power source should be connected to the chassis. (Refer to Fig. 9) (Common to all relays)

[2] In the case where unavoidably the ⊖ side is grounded, or in the case where grounding is not possible.

(1) Insert the contacts (or switch) in the ⊕ side of the power source, and connect the start of the coil winding the the ⊖ side. (Refer to Fig. 10) (Common to all relays)

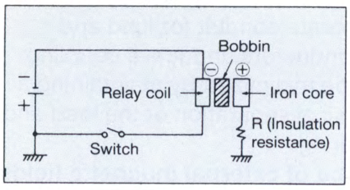
(2) When a grounding is not required, connect the ground terminal to the ⊕ side of the coil. (Refer to Fig. 11) (NF and NR with ground terminal)

[3] When the ⊖ side of the power source is grounded, always avoid interting the contacts (and switches) in the ⊖ side. (Refer to Fig. 12) (Common to all relays)

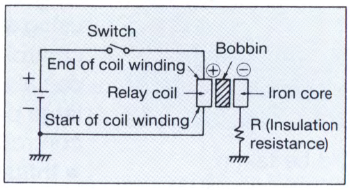
[4] In the case of relays provided with a ground terminal, when the ground terminal is not considered effective, not making a connection to ground plays an important role as a method for preventing electrolytic corrosion.

Note: The designation on the drawing indicates the insertion of insulation between the iron core and the chassis. In relays where a ground terminal is provided, the iron core can be grounded directly to the chassis, but in considera-tion of electrolytic corrosion, it is more expedient not to make the connection.

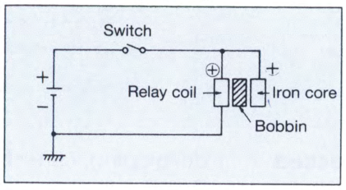
Judgment: Good **(Fig. 9)**



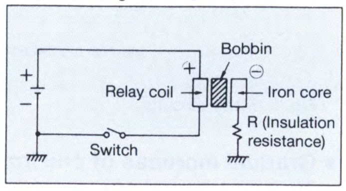
Judgment: Good **(Fig. 10)**



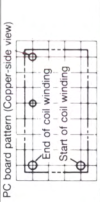
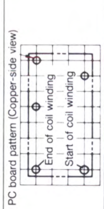
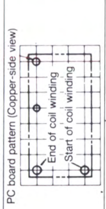
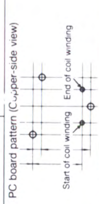
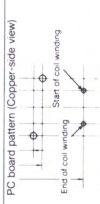
Judgment: Good **(Fig. 11)**



Judgment: No good **(Fig. 12)**



Product name	TQ TF TN	TW	TK	DS				DF	DSP	HD	HY	RK	RG	DK	S	ST	SP	NF	NB	NC (Flat type)	NC (Slim type)	NL	NT	K	JE-X	JZ	JG	JK	JY
Contact arrangement	2c	2c	1c	1c	2c	4c	2c	1a 1a1b 2a	1c		1c	1c 2c	1a	2a2b 4a	1a1b 2a	2c 4c	2c 4c	1c	2c 4c	2c 4c	6c	1c	2c 4c 6c	1a 1c	1a	1a	1a	1c
Start of coil winding (terminal number)	10	12	1	1	16	1	1	1	N.O. side coil terminal		7	16	6	12	1	2	2	4	4	5	5	2	1	1	1	1	2	1
End of coil winding (terminal number)	1	1	3	6	1	16	12	16	N.C. side coil terminal		1	15	1	1	4	1	1	6	5	4	6	1	4	2	2	2	1	2

Product name	JS	JV	JR	JW	JQ		PQ	JN	JM	JC	JT Open type Dust cover & Sealed types	JT TMP type	JA	JH	HE	HB		HA	HC	HL	HP	HG		
Contact arrangement	1a 1c	1a 1c	1a 1c	1a 1c 2a 2c	1a	1c	1a	1a	1a	1a 2a 1a1b	1a	1c	1a 1b 1c	1a 2a 3a 2a1b	1a 2a	1c	2c	1c	1c 2c 3c 4c	1c 2c	2c 3c 4c	2c	3c	4c
Start of coil winding (terminal number)	2	1	1	1				2	1	1			N.O. and COM side coil ter-minal	5	5	2	14	1	14	8	10	7	10	10
End of coil winding (terminal number)	5	2	8	8				1	2	6			N.C. side coil ter-minal	6	6	8	3	4	13	7	1	2	2	1

CONTACT

The contacts are the most important elements of relay construction. Contact performance conspicuously influenced by contact material, and voltage and current values applied to the contacts (in particular, the voltage and current waveforms at the time of application and release), the type of load, frequency of switching, ambient atmosphere, form of contact, contact switching speed, and of bounce.

Because of contact transfer, welding, abnormal wear, increase in contact resistance, and the various other damages which bring about unsuitable operation, the following items require full investigation.

1. Contact circuit voltage, current, and load

[Voltage, AC and DC]

When there is inductance included in the circuit, a rather high counter emf is generated as a contact circuit voltage, and since, to the extent of the value of that voltage, the energy applied to the contacts causes damage with con-sequent wear of the contacts, and transfer of the contacts, it is necesary to exercise care with regard to control capacity. In the case of DC, there is no zero current point such as there is with AC, and accordingly, once a cathode arc has been generated, because it is difficult to quench that arc, the extended time of the arc is a major cause. In addition, due to the direction of the current being fixed, the phenomenon of contact shift, as noted separately below, occurs in relation to the contact wear. Ordinarily, the approximate control capacity is mentioned in catalogues or similar data sheets, but this alone is not sufficient. With special contact circuits, for the individual case, the maker either estimates from the past experience or makes test on each occasion. Also, in catalogues and similar data sheets, the control capacity that is mentioned is limited to resistive load, but there is a broad meaning indicated for that class of relay, and ordinarily it is proper to think of current capacity as that for 125V AC circuits.

[Current]

The current at both the closing and opening time of the contact circuit exerts an important influence. For example, when the load is either a motor or a lamp, to the extent of the inrush current at the time of closing the circuit, wear of the contacts, and the amount of contact transfer increase, and contact welding and contact transfer make contact separation impossible.

2. Characteristics of Common Contact Materials

Characteristics of contact materials are given below. Refer to them when selecting a relay.

Contact Material	Ag (silver)	Electrical conductivity and thermal conductivity are the highest of all metals. Exhibits low contact resistance, is inexpensive and widely used. A disadvantage is it easily develops a sulfide film in a sulfide atmosphere. Care is required at low voltage and low current levels.
	AgCd (silver-cadmium)	Exhibits the conductivity and low contact resistance of silver as well as excellent resistance to welding. Like silver, it easily develops a sulfide film in a sulfide atmosphere.
	AgW (silver-tungsten)	Hardness and melting point are high, arc resistance is excellent, and it is highly resistant to material transfer. However, high contact pressure is required. Furthermore, contact resistance is relatively high and resistance to corrosion is poor. Also, there are constraints on processing and mounting to contact springs.
	AgNi (silver-nickel)	Equals the electrical conductivity of silver. Excellent arc resistance.
	AgPd (silver-palladium)	At standard temperature, good corrosion resistance and good sulfidation resistance. However, in dry circuits, organic gases adhere and it easily develops a polymer. Gold clad is used to prevent polymer buildup. Expensive.
	PGS alloy (platinum, gold, silver)	Excellent corrosion resistance. Mainly used for low current circuits. (Au : Ag : Pt = 69 : 25 : 6)
Surface Finish	Rh plating (rhodium)	Combines perfect corrosion resistance and hardness. As plated contacts, used for relatively light loads. In an organic gas atmosphere, care is required as polymers may develop. Therefore, it is used in hermetic seal relays (reed relays, etc.). Expensive.
	Au clad (gold clad)	Au with its excellent corrosion resistance is pressure welded onto a base metal. Special characteristics are uniform thickness and the nonexistence of pinholes. Greatly effective especially for low level loads under relatively adverse atmospheres. Often difficult to implement clad contacts in existing relays due to design and installation.
	Au plating (gold plating)	Similar effect to Au cladding. Depending on the plating process used, supervision is important as there is the possibility of pinholes and cracks. Relatively easy to implement gold plating in existing relays.
	Au flash plating (gold thin-film plating)	Purpose is to protect the contact base metal during storage of the switch or device with built-in switch. However, a certain degree of contact stability can be obtained even when switching loads.

3. Contact Protection

• Counter EMF

When switching inductive loads with a DC relay such as relay sequence circuits, DC motors, DC clutches, and DC solenoids, it is always important to absorb surges (e.g. with a diode) to protect the contacts.

When these inductive loads are switched off, a counter emf of several hundred to several thousand volts develops which can severely damage contacts and greatly shorten life. If the current in these loads is relatively small at around 1A or less, the counter emf will cause the ignition of a glow or arc discharge. The discharge decomposes organic matter contained in the air and causes black deposits (oxides, carbides) to develop on the contacts. This may result in contact failure.

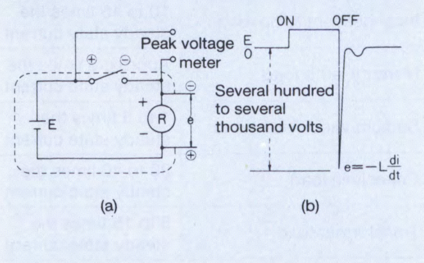


Fig. 13 **Example of counter emf and actual measurement on a peak hold meter.**

In Fig. 13(a), an emf ($e=-L\frac{di}{dt}$)with a steep waveform is generated across the coil with the polarity shown in Fig. 13(b) at the instant the inductive load is switched off. The counter emf passes through the power supply line and reaches both contacts.

Generally, the critical dielectric break-down voltage at standard temperature and pressure in air is about 200 to 300 volts. Therefore, if the counter emf exceeds this, discharge occurs at the contacts to dissipate the energy ($\frac{1}{2}Li^2$) stored in the coil. For this reason, it is desirable to absorb the counter emf so that it is 200V or less.

A memory oscilloscope, digital memory, peak hold meter, etc., can be used to measure the counter emf. However, since the waveform is extremely steep, considerable discrepancies may result depending on the precision of the equipment used. The table shows the counter emf of various relays measured on a high precision peak hold meter.

Actual measurement of counter emf on a peak hold meter

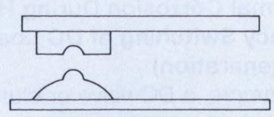
Nominal Coil Voltage / Relay Type	6V DC	12V DC	24V DC
NR relay (single side stable)	144V	165V	188V
NF4 relay	410V	470V	510V

• Material Transfer Phenomenon

Material transfer of contacts occurs when one contact melts or boils and the contact material transfers to the other contact. As the number of switching operations increases, uneven contact surfaces develop such as those shown in Fig. 14. After a while, the uneven contacts lock as if they were welded together. This often occurs in circuits where sparks are produced at the moment the contacts "make" such as when the DC current is large for DC inductive or capacitive loads or when the inrush current is large (several amperes or several tens of amperes).

Contact protection circuits and contact materials resistant to material transfer such as AgW or AgCu are used as countermeasures. Generally, a concave formation appears on the cathode and a convex formation appears on the anode.

For DC capacitive loads (several amperes to several tens of amperes), it is always necessary to conduct actual confirmation tests.



Material transfer of contacts

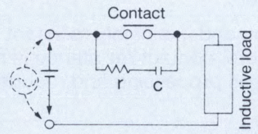
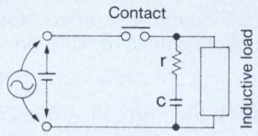
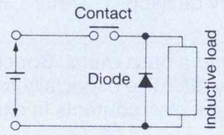
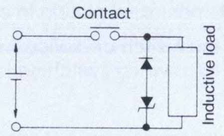
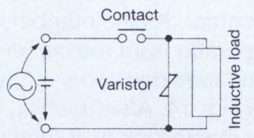
Fig. 14

General Application Guidelines

• Contact Protection Circuit

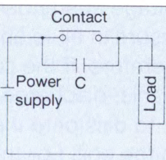
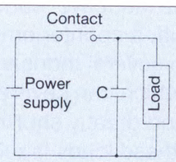
Use of contact protective devices or protection circuits can suppress the counter emf to a low level. However, note that incorrect use will result in an adverse effect. Typical contact protection circuits are given in the table below.

(○: Good ×: No Good)

Circuit		Application AC	Application DC	Features/Others	Device Selection
CR circuit		*	○	If the load is a timer, leakage current flows through the CR circuit causing faulty operation. * If used with AC voltage, be sure the impedance of the load is sufficiently smaller than that of the CR circuit.	As a guide in selecting r and c, r: 0.5 to 1Ω per 1V contact voltage c: 0.5 to 1μF per 1A contact current Values vary depending on the properties of the load and variations in relay characteristics. Capacitor c acts to suppress the discharge the moment the contacts open. Resistor r acts to limit the current when the power is turned on the next time. Test to confirm. Use a capacitor with a breakdown voltage of 200 to 300V. Use AC type capacitors (non-polarized) for AC circuits.
		○	○	If the load is a relay or solenoid, the release time lengthens. Effective when connected to both contacts if the power supply voltage is 24 or 48V and the voltage across the load is 100 to 200V.	
Diode circuit		×	○	The diode connected in parallel causes the energy stored in the coil to flow to the coil in the form of current and dissipates it as joule heat at the resistance component of the inductive load. This circuit further delays the release time compared to the CR circuit. (2 to 5 times the release time listed in the catalog)	Use a diode with a reverse breakdown voltage at least 10 times the circuit voltage and a forward current at least as large as the load current. In electronic circuits where the circuit voltages are not so high, a diode can be used with a reverse breakdown voltage of about 2 to 3 times the power supply voltage.
Diode and zener diode circuit		×	○	Effective when the release time in the diode circuit is too long.	Use a zener diode with a zener voltage about the same as the power supply voltage.
Varistor circuit		○	○	Using the stable voltage characteristics of the varistor, this circuit prevents excessively high voltages from being applied across the contacts. This circuit also slightly delays the release time. Effective when connected to both contacts if the power supply voltage is 24 or 48V and the voltage across the load is 100 to 200V.	————

• Avoid using the protection circuits shown in the figures on the right. Although DC inductive loads are usually more difficult to switch than resistive loads, use of the proper protection circuit will raise the characteristics to that for resistive loads. (Fig. 15)

Fig. 15

No good 	No good 
Although extremely effective in arc suppression as the contacts open, the contacts are susceptible to welding since energy is stored in C when the contacts open and discharge current flows from C when the contacts close.	Although extremely effective in arc suppression as the contacts open, the contacts are susceptible to welding since charging current flows to C when the contacts close.

• Mounting the Protective Device

In the actual circuit, it is necessary to locate the protective device (diode, resistor, capacitor, varistor, etc.) in the immediate vicinity of the load or contact. If located too far away, the effectiveness of the protective device may diminish. As a guide, the distance should be within 50cm.

• Abnormal Corrosion During High Frequency Switching of DC Loads (spark generation)

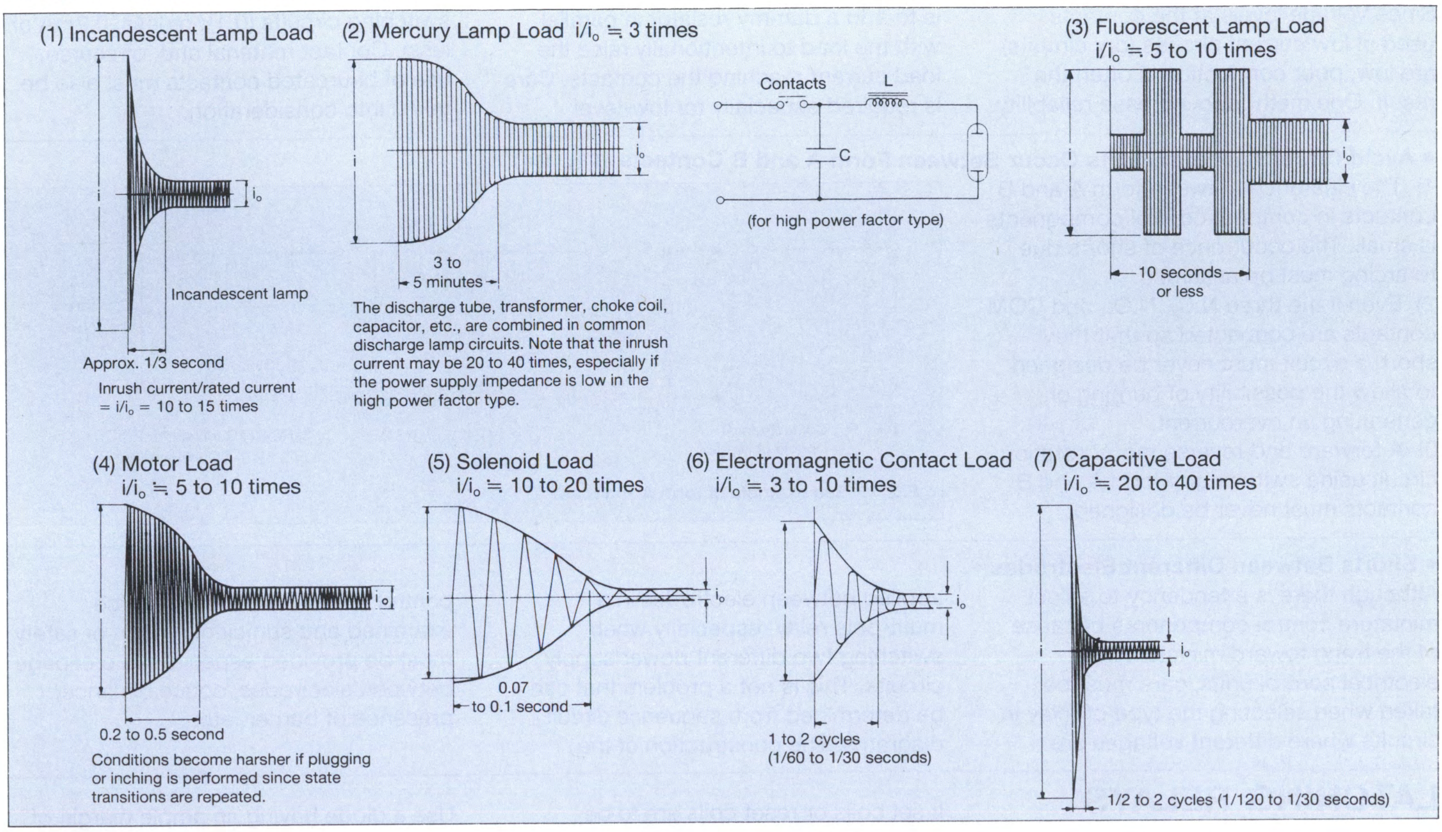
If, for example, a DC valve or clutch is switched at a high frequency, a blue-green corrosion may develop. This occurs from the reaction with nitrogen in the air when sparks (arc discharge) are generated during switching. For relays with a case, the case must be removed or air holes drilled in the case. A similar phenomenon occurs in the presence of ammonia-based gas. Therefore, care is required in circuits where sparks are generated at a high frequency.

• Type of Load and Inrush Current

The type of load and its inrush current characteristics, together with the switching frequency are important factors which cause contact welding. Particularly for loads with inrush currents, measure the steady state current and inrush current and select a relay which provides an ample margin of safety. The table on the right shows the relationship between typical loads and their inrush currents.

Type of load	Inrush current
Resistive load	Steady state current
Solenoid load	10 to 20 times the steady state current
Motor load	5 to 10 times the steady state current
Incandescent lamp load	10 to 15 times the steady state current
Mercury lamp load	Approx. 3 times the steady state current
Sodium vapor lamp load	1 to 3 times the steady state current
Capacitive load	20 to 40 times the steady state current
Transformer load	5 to 15 times the steady state current

Load Inrush Current Wave and Time



• When Using Long Wires

If long wires (100 to 300m) are to be used in a relay contact circuit, inrush current may become a problem due to the stray capacitance existing between wires. Add a resistor (approx. 10 to 50Ω) in series with the contacts. (Fig. 16)

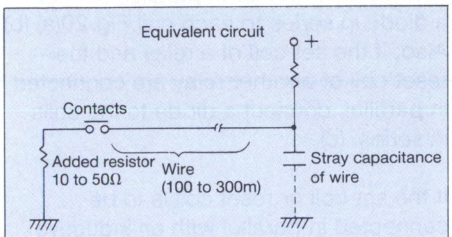


Fig. 16

• Phase Synchronization in Switching AC Loads

If switching of the relay contacts is synchronized with the phase of the AC power, reduced electrical life, welded contacts, or a locking phenomenon (incomplete release) due to contact material transfer may occur. Therefore, check the relay while it is operating in the actual system. However, if problems develop, control the relay using an appropriate phase. (Fig. 17)

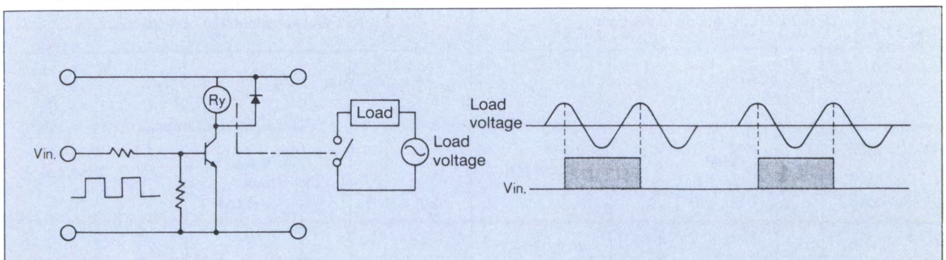


Fig. 17

4. Cautions on Use Related to Contacts

• Connection of load and contacts

Connect the load to one side of the power supply as shown in Fig. 18(a). Connect the contacts to the other side. This prevents high voltages from developing between contacts. If contacts are connected to both side of the power supply as shown in (b), there is a risk of shorting the power supply when relatively close contacts short.

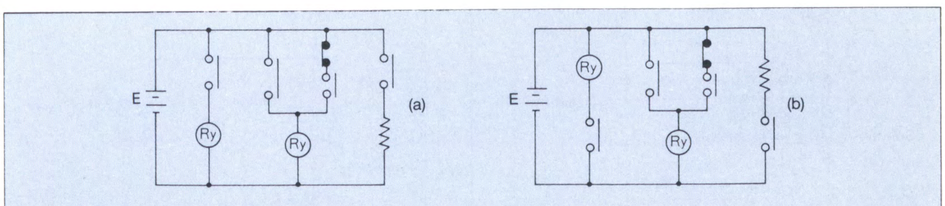


Fig. 18 (a) Good example (b) Bad example

• Dummy Resistor

Since voltage levels at the contacts used in low current circuits (dry circuits) are low, poor conduction is often the result. One method to increase reliability is to add a dummy resistor in parallel with the load to intentionally raise the load current reaching the contacts. Care is required especially for low-level switching circuits (0.1V or less, 0.2mA or less). Contact material and, of course, use of bifurcated contacts must also be taken into consideration.

• Avoid Circuits Where Shorts Occur Between Form A and B Contacts (Fig. 19)

1) The clearance between form A and B contacts in compact control components is small. The occurrence of shorts due to arcing must be assumed.

2) Even if the three N.C., N.O., and COM contacts are connected so that they short, a circuit must never be designed to allow the possibility of burning or generating an overcurrent.

3) A forward and reverse motor rotation circuit using switching of form A and B contacts must never be designed.

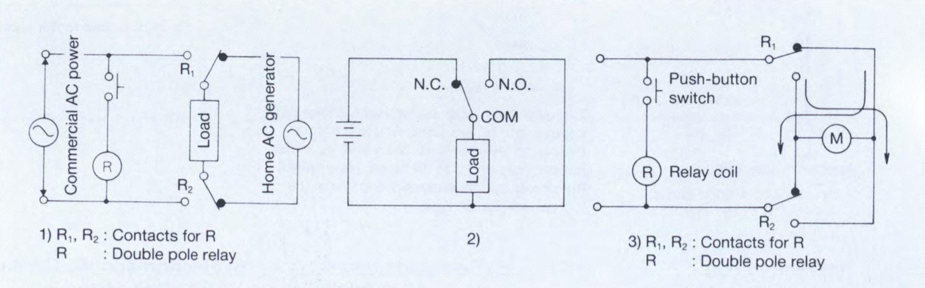


Fig. 19 Bad example of form A and B use

• Shorts Between Different Electrodes

Although there is a tendency to select miniature control components because of the trend toward miniaturizing electrical control units, care must be taken when selecting the type of relay in circuits where different voltages are applied between electrodes in a multi-pole relay, especially when switching two different power supply circuits. This is not a problem that can be determined from sequence circuit diagrams. The construction of the control component itself must be examined and sufficient margin of safety must be provided especially in creepage between electrodes, space distance, presence of barrier, etc.

LATCHING RELAYS

• Latching relays are shipped from the factory in the reset state. A shock to the relay during shipping or installation may cause it to change to the set state. Therefore, it is recommended that the relay be used in a circuit which initializes the relay to the required state (set or reset) whenever the power is turned on.

• Avoid impressing voltages to the set coil and reset coil at the same time.

• Connect a diode as shown since latching may be compromised when the relay is used in the following circuits.

If set coils or reset coils are to be connected together in parallel, connect a diode in series to each coil. Fig. 20(a) (b) Also, if the set coil of a relay and the reset coil of another relay are connected in parallel, connect a diode to the coils in series. (c)

If the set coil or reset coil is to be connected in parallel with an inductive load (e.g. another electromagnetic relay coil, motor, transformer, etc.), connect a diode to the set coil or reset coil in series. (d)

Use a diode having an ample margin of safety for repeated DC reverse voltage and peak reverse voltage applications and having an average rectified current greater than or equal to the coil current.

• Avoid applications in which conditions include frequent surges to the power supply.

• Avoid using the following circuit since self-excitation at the contacts will inhibit the normal keep state. (Fig. 21)

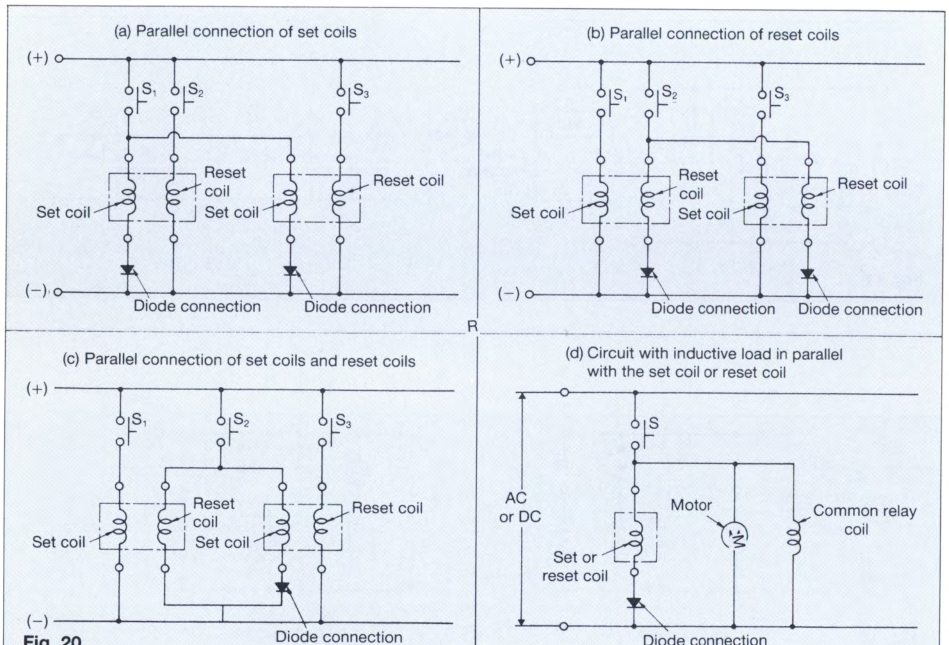


Fig. 20

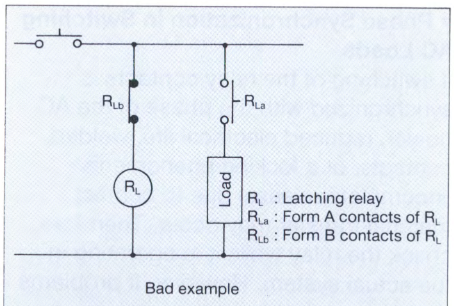


Fig. 21

• Four-Terminal Latching Relay

In the 2 coil latching type circuit in Fig. 22, one terminal at one end of the set coil and one terminal at one end of the reset coil are connected in common and voltages of the same polarity are applied to the other side for the set and reset operations. In this type of circuit, short 2 terminals of the relay as noted in the next table. This helps to keep the insulation high between the two winding.

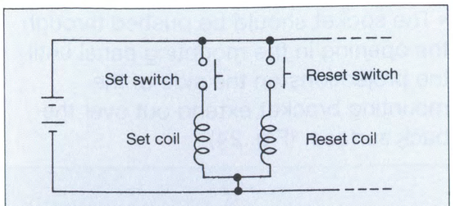


Fig. 22

Relay Type		Terminal Nos.
DX		5 & 11
NR		3 & 6
DR		3 & 6
DS	1c	—
	2c	15 & 16
	4c	*
NL		4 & 5
NC	Flat	3 & 4
	Slim	3 & 4
ST		*
SP		2 & 4

Notes
1. *DS4c and ST relays are constructed so that the set coil and reset coil are separated for high insulation resistance.
2. DSP, RG, TQ, TF, TN, TW, DF, and S relays are not applicable due to polarity.

AMBIENT ENVIRONMENT

1. Ambient Temperature and Atmosphere

Be sure the ambient temperature at the installation does not exceed the value listed in the catalog. Furthermore, environmentally sealed types (plastic sealed type, metallic hermetic seal type) should be considered for applications in a atmosphere with dust, sulfur gases (SO_2, H_2S), or organic gases.

2. Silicon Atmosphere

Silicon-based substances (silicon rubber, silicon oil, silicon-based coating material, silicon caulking compound, etc.) emit voltatile silicon gas. Note that when silicon is used near relays, switching the contacts in the presence of its gas causes silicon to adhere to the contacts and may result in contact failure.

In this case, use a substitute that is not silicon-based.

3. Vibration and Shock

If a relay and magnetic switch are mounted next to each other on a single plate, the relay contacts may separate momentarily from the shock produced when the magnetic switch is operated and result in faulty operation. Counter-measures include mounting them on separate plates, using a rubber sheet to absorb the shock, and changing the direction of the shock to a perpendicular angle.

4. Influence of External Magnetic Fields

Permanent magnets are used in reed relays and polarized relays (including NR relays), and their movable parts are constructed of ferrous materials. For this reason, when a magnet or permanent magnet in any other large relay, transformer, or speaker is located nearby, the relay characteristics may change and faulty operations may result. The influence depends on the strength of the magnetic field and it should be checked at the installation.

ENVIRONMENTALLY SEALED TYPE RELAYS

Sealed type relays such as the plastic sealed type are available. They are effective when problems arise during PC board mounting (e.g. automatic soldering and cleaning). They also, of course, feature excellent corrosion resistance. Note the cautions below regarding the features and use of environmentally sealed type relays to avoid problems when using them in applications.

1. Operating Environment

Plastic sealed type relays are especially not suited for use in environments which require airtight relays. Although there is no problem if they are used at sea level, avoid atmospheric pressures beyond 1013mb±20%. Also avoid using them in an atmosphere containing flammable or explosive gases. Use the metallic hermetic seal types for these applications.

2. Operating Environment of Sealed Type Relays (generation of NO_x)

Environmentally sealed type relays include the metallic hermetic seal type relay and the plastic sealed type relay. When a plastic sealed type relay is used in an atmosphere high in humidity to switch a load which easily produces an arc, the NO_x created by the arc and the water absorbed from outside the relay combine to produce nitric acid. This corrodes the internal metal parts and adversely affects operation.

Avoid use at an ambient humidity of 85%RH or higher (at 20°C 68°F). If use at high humidity is unavoidable, consult us.

PROCESSING CONSIDERATIONS

1. Handling

State of the art relays are precision mechanical devices and as such are sensitive to abusive handling practices. Every attempt is made during their manufacture to preclude any anomalies. Relays are packed in a variety of ways to best protect them during shipment and subsequent handling. These include the use of "Egg Crate" type inserts which support the relay and prevent damage to the terminals, foam trays which prevent shock damage, and tubes similar to those used by semiconductor manufacturers for machine dispensing and assembly. During incoming inspection and subsequent customer handling operations, care should be taken so as not to degrade the device which has been supplied in prime condition. Some key areas of concern:

① Terminals should not be handled in order to prevent contamination of the surface finish. This could lead to solderability problems.

② Terminal layout and P.C. board hole pattern should match. Any misalignment caused by mis-registered P.C. board holes can lead to severe stress on the relay, compromising performance and reliability (seal integrity).

③ The storage temperature specification should be observed.

④ Relays should be stored and handled in a suitably clean area.

2. Fluxing

Depending upon the type of relay involved, fluxing procedures should be researched carefully. An unsealed relay is prone to internal flux contamination which can compromise contact performance, and ideally should be hand soldered. "Flux-resistant" relays are available which will prevent flux migration through the terminal-header interface. These and "sealed" relays are compatible with most foam or spray fluxing operations, however "Flux-resistant" types are not totally sealed which precludes washing operations, and makes a non-active flux almost a necessity.

Pre-heating the board assembly prior to soldering "Flux-resistant" types will dry the flux and further help to prevent flux being driven into the relay during the soldering operation.

3. Soldering

As with fluxing, automated soldering processes can, unless controlled carefully, compromise the performance of unsealed relays.

Flux-resistant and sealed types are compatible with most dip or wave soldering procedures. Some state-of-the-art relays are suitable for various reflow processes, such as I.R. or vapor phase maximum soldering temperatures and times will vary from relay type to relay type, and should not be exceeded. The use of an I.R. reflow process with a relay not specifically designed to withstand the process, will in all probability degrade the relay and cause performance problems. A safe practice would be to review the thermal profile of the process on a case by case basis with your local Aromat office.

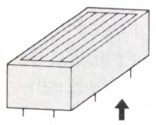
4. Cleaning

Any cleaning process which involves potential contamination of on unsealed relay should be avoided. Sealed devices can be immersion cleaned in a suitable solvent (see solvent compatibility chart). Cleaning in a ultrasonic bath should also be avoided. A harmonic of the bath frequency may be induced in the contacts causing friction welding and subsequent contact sticking. Relays with a removable "vent" tab should be vented after cooling to room temperature following cleaning and drying.

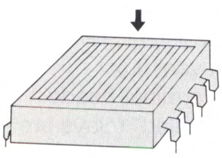
MOUNTING CONSIDERATIONS

• Top View and Bottom View

Relays used for PC boards, especially the flat type relays, have their top or bottom surface indicated in the terminal wiring diagrams.



Relay with terminals viewed from the bottom (terminals cannot be seen from the top)



Relay with terminals viewed from the top (all terminals can be seen from the top) Note during PC board pattern design (NL, NC)

• Mounting Direction

Mounting direction is important for optimum relay characteristics.

• Shock Resistance

It is ideal to mount the relay so that the movement of the contacts and movable parts is perpendicular to the direction of vibration or shock. Especially note that the vibration and shock resistance of Form B contacts while the coil is not excited is greatly affected by the mounting direction of the relay.

• Contact Reliability

Mounting the relay so the surfaces of its contacts (fixed contacts or movable contacts) are vertical prevents dirt and dust as well as scattered contact material (produced due to large loads from which arcs are generated) and powdered metal from adhering to them.

Furthermore, it is not desirable to switch both a large load and a low level load with a single relay. The scattered contact material produced when switching the large load adheres to the contacts when switching the low level load and may cause contact failure. Therefore, avoid mounting the relay with its low level load contacts located below the large load contacts.

• Adjacent Mounting

When many relays are mounted close together, abnormally high temperatures may result from the combined heat generated. Mount relays with sufficient spacing between them to prevent heat buildup.

This also applies when a large number of boards mounted with relays are installed as in a card rack. Be sure the ambient temperature of the relay does not exceed the value listed in the catalog.

• Influence of Adjacent Mounting of Polarized Relays

When polarized relays are mounted close together, their characteristics change. Since the affect of adjacent mounting differs according to the type of relay, refer to the data for the particular type.

• Tab Terminals

As a guide, use a quick connect mounting pressure of 4 to 7kg or 8.8 to 15.4lbs for relays with tab terminals.

METHOD OF MOUNTING

• The direction of mounting is not specifically designated, but to the extent possible, the direction of contact movement should be such that vibration and shock will not be applied.

When a terminal socket is used

• After drilling the mounting holes, the terminal socket should be mounted making certain the mounting screws are not loose. DIN standard sockets are available for one-touch mounting on DIN rail of 35mm 1.378 inch width.

When reversible terminal sockets are used

• The reversible terminal sockets (HC, HL socket) are for one-touch mounting. (A panel thickness of 1 to 2mm .039 to .079 inch should be used.) (Fig. 23)

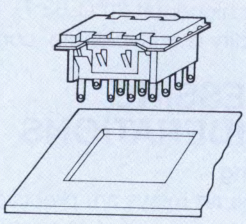


Fig. 23

• The socket should be pushed through the opening in the mounting panel until the projections on the side of the mounting bracket extend out over the back surface. (Fig. 24)

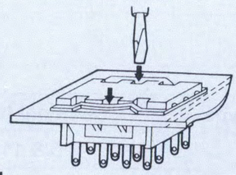


Fig. 24

• When all four of the projections are visible from the back side of the mounting panel, the mounting is completed and the socket is fastened.

• To remove the socket, the projections on the side of the mounting bracket should be pushed inward and at the same time the body of the socket should be pushed lightly from the back side. The socket can then be removed from the panel.

• The socket should be inserted through the opening in the mounting panel so that the terminal wiring side is toward the back side. The mounting panel can be used for 10 units, but it can be cut for use with less than that number. (Fig. 25)

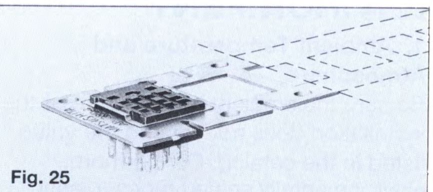


Fig. 25

REGARDING CONNECTION OF LEAD WIRES

• When making the connections, depending upon the size of load, the wire cross-section should be at least as large as the values shown in the table below.

Permissible current	Cross-section (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

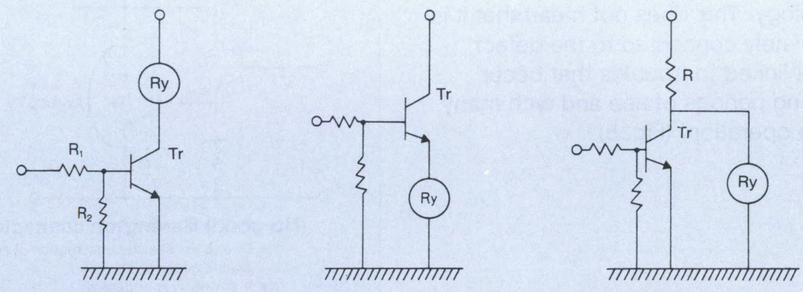
• When the terminal board uses screw fastening connections, either pressure terminals or other means should be used to make secure fastening of the wire.

Applications of Relays in Electronic Circuits

RELAY DRIVE BY MEANS OF A TRANSISTOR

• Connection method

The voltage impressed on the relay is always full rated voltage, and in the OFF time, the voltage is completely zero for avoidance of trouble in use. (Fig. 1)



(Good) Collector connection
With this most common connection, opertion is stable.

(Care) Emitter connection
When the circumstances make the use of this connection unavoidable, if the voltage is not completely impressed on the relay, the transistor does not conduct completely and operation is uncertain.

(Care) Parallel connection
When the power consumed by the complete circuit becomes large, consideration of the relay voltage is necessary.

Fig. 1

• Countermeasures for surge voltage of relay control transistor

If the coil current is suddenly interrupted, a sudden high voltage pulse is developed in the coil. If this voltage exceeds the voltage resistance of the transistor, the transistor will be degraded, and this will lead to damage. It is absolutely necessary to connect a diode in the circuit as a means of preventing damage from the counter emf.

As suitable ratings for this diode, the current should be equivalent to the average rectified current to the coil, and the inverse blocking voltage should be about 3 times the value of the power source voltage. (Fig. 2)

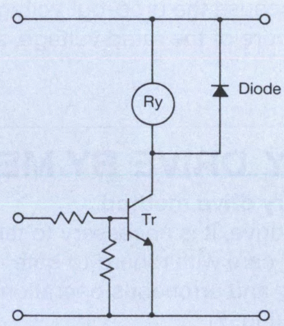


Fig. 2 Take care of ASO.

• Snap action

(Characteristic of relay with voltage rise and fall of voltage)

Unlike the characteristic when voltage is impressed slowly on the relay coil, this is the case where it is necessary to impress the rated voltage in a short time and also to drop the voltage in a short time. (Fig. 3)

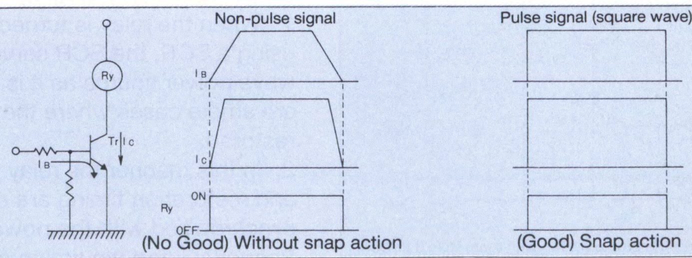


Fig. 3

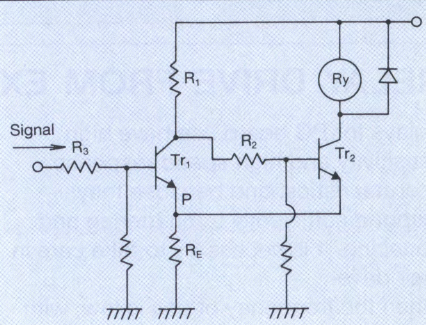
• Schmitt circuit (Snap action circuit)

(Wave rectifying circuit)

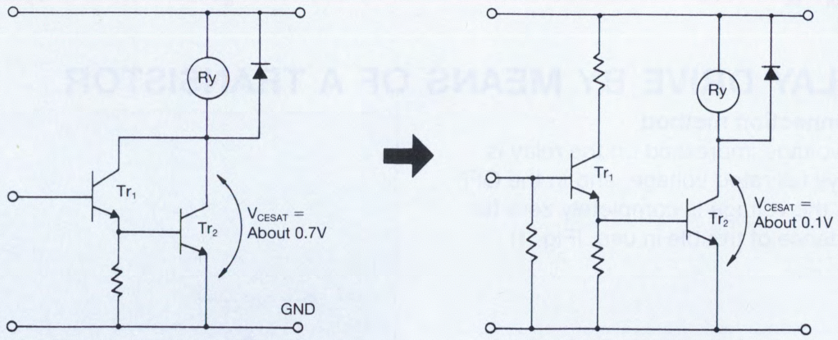
When the input signal does not produce a snap action, ordinarily a Schmitt trigger circuit is used to produce safe snap action.

Characteristic points

1. The common emitter resistor R_E must have a value sufficiently small compared with the resistance of the relay coil. (The voltage impressed on the relay must not be greater than the excitation voltage.)
2. Due to the relay coil current, the difference in the voltage at point P when T_2 is conducting and at point P when T_1 is conducting creates hysteresis in the detection capability of the Schmitt circuit, and care must be taken in setting the values.
3. When there is chattering in the input signal because of waveform oscillation, an RC time constant circuit should be inserted in the stage before the Schmitt trigger circuit. (However, the response speed drops.) (Fig. 4)



• Avoid Darlington circuit connections.
(High amplification)
This circuit is a trap into which it is easy to fall when dealing with high circuit technology. This does not mean that it is immediately connected to the defect, but it is linked to troubles that occur after long periods of use and with many units in operation. (Fig. 5)



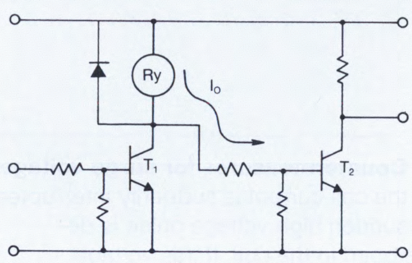
(No good) Darlington connection
(• Due to excessive consumption of power, heat is generated.)
(• A strong T_1 is necessary.)

(Good) Emitter connection
(T_2 conducts completely.)
(T_1 is sufficient for signal use.)

Fig. 5

• Residual Coil Voltage
In switching applications where a semiconductor (transistor, UJT, etc.) is connected to the coil, a residual voltage is retained at the relay coil which may cause incomplete restoration and faulty operation. By using DC coils, there may be a reduction in; the danger of incomplete restoration, the contact pressure, and the vibration resistance. This is bacause the drop-out voltage is 10% or more of the rated voltage, a low value compared to that for AC coil, and also there is a tendency to increase the life by lowering the drop-out voltage.
When the signal from the transistor's collector is taken and used to drive another circuit as shown in the figure on the right, a minute dark current flows to the relay even if the transistor is off. This may cause the problems described above. (Fig. 6)

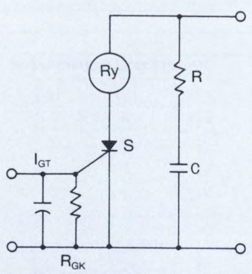
Fig. 6 Connection to the next stage through collector



I_O: dark current (No good)

RELAY DRIVE BY MEANS OF SCR

• Ordinary drive method
For SCR drive, it is necessary to take particular care with regard to gate sensitivity and erroneous operation due to noise. (Fig. 7)

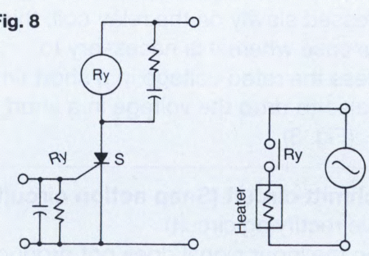


I_{GT} : There is no problem even with more than 3 times the rated current.
R_{GK} : 1K ohms must be connected.
R, C: This is for prevention of isolation point error due to a sudden rise in the power source or to noise. (dv/dt countermeasure)

Fig. 7

• Caution points regarding ON/OFF control circuits
(When used for temperature or similar control circuits)
When the relay contacts close simultaneously with an AC single phase power source, because the electrical life of the contacts suffers extreme shortening, care is necessary. (Fig. 8)
1. When the relay is turned ON and OFF using a SCR, the SCR serves as a half wave power source as it is, and there are ample cases where the SCR is easily restored.
2. In this manner the relay operation and restoration timing are easily synchronized with the power source frequency, and the timing of the load switching also is easily synchronized.
3. When the load for the temperature control is a high current load such as a heater, the switching can occur only at peak values and it can occur only at zero phase values as a phenomenon of this type of control. (Depending upon the sensitivity and response speed of the relay)
4. Accordingly, either an extremely long life or an extremely short life results with wide variation, and it is necessary to take care with the initial device quality check.

Fig. 8



RELAY DRIVE FROM EXTERNAL CONTACTS

Relays for PC board use have high sensitivity and high speed response characteristics, and because they respond sufficiently to chattering and bouncing, it is necessary to take care in their drive.
When the frequency of use is low, with the delay in response time caused by a condenser, it is possible to absorb the chattering and bouncing. (Fig. 9)
(However, it is not possible to use only a condenser. A resistor should also be used with the capacitor.)

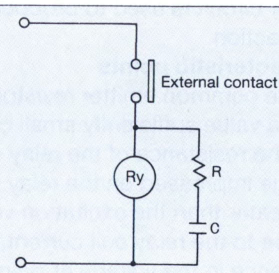
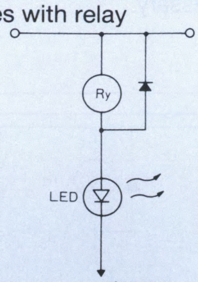


Fig. 9

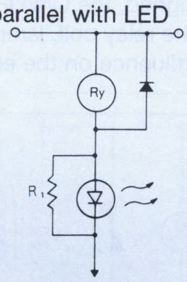
LED SERIES AND PARALLEL CONNECTIONS

1. In series with relay



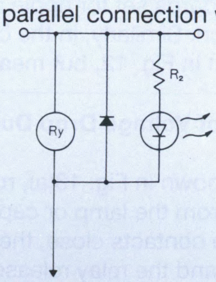
Power consumption:
In common with relay (Good)
Defective LED:
Relay does not operate (No good)
Low voltage circuit:
With LED, 1.5V down (No good)
No. of parts: (Good)

2. R in parallel with LED



Power consumption:
In common with relay (Good)
Defective LED:
Relay operate (Good)
Low voltage circuit:
With LED, 1.5V down (No good)
No. of parts: R_1 (Care)

3. In parallel connection with relay



Power consumption:
Current limiting resistor R_2 (Care)
Defective LED:
Relay operation stable (Good)
Low voltage circuit: (Good)
No. of parts: R_2 (Care)

ELECTRONIC CIRCUIT DRIVE BY MEANS OF A RELAY

• Chatterless electronic circuit

Even though a chatterless characteristic is a feature of relays, this is to the fullest extent a chatterless electrical circuit, much the same as a mercury relay. To meet the requirement for such circuits as the input to a binary counter, there is an electronic chatterless method in which chattering is absolutely not permissible. Even if chattering develops on one side, either the N.O. side contacts or the N.C. side contacts, the flip flop does not reverse, and the counter circuit can be fed pulsed without a miss. (However, bouncing from the N.O. side to N.C. side must be absolutely avoided.) (Fig. 10)

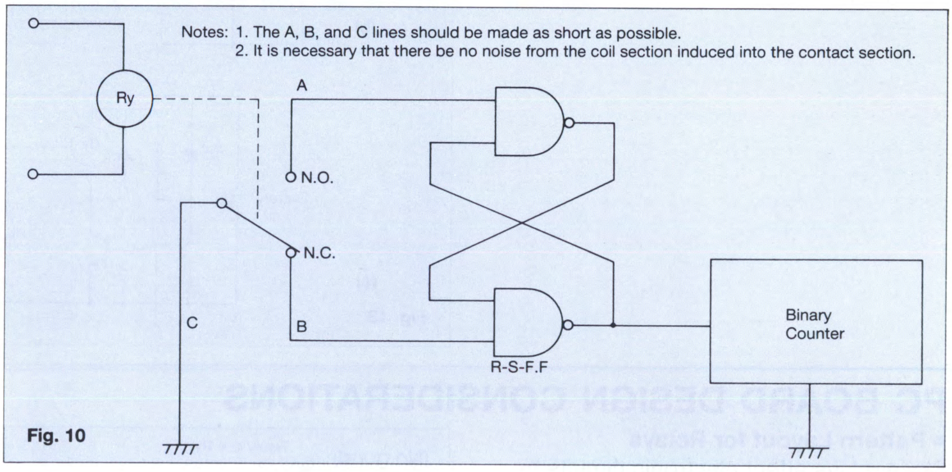


Fig. 10

• Triac drive

With an electronic circuit using a direct drive from a triac, the electronic circuit will not be isolated from the power circuit, and because of this, troubles due to erroneous operation and damage can develop easily. The introduction of a relay drive is the most economical and most effective solution. (Photo coupler and pulse transformer circuits are complicated.)
When a zero cross switching characteristic is necessary, a solid state relay (SSR) should be used. (Fig. 11)

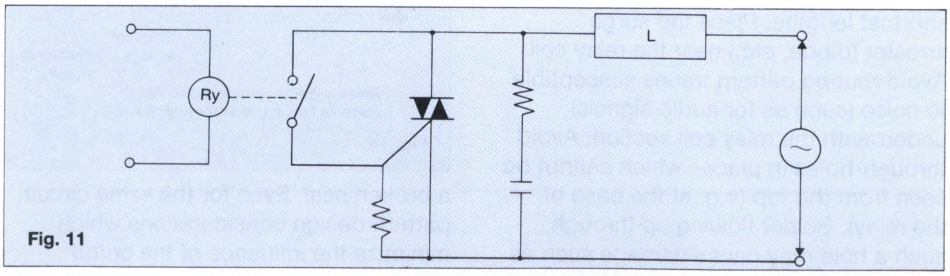


Fig. 11

ASSURANCE OF POWER SOURCE FOR RELAY AND ELECTRONIC CIRCUIT

• Constant Voltage circuit and PC board pattern

Ordinarily, it is extremely undesirable to have ripple and voltage variation in an electronic circuit power source. This is naturally true also for relay power sources but not to the same extent as for the electronic circuit. Accordingly, it is desirable to have a constant voltage circuit for dedicated use of the electronic circuit with a sufficient margin of current. Roughly speaking, this is also good for the relay, but from a practical

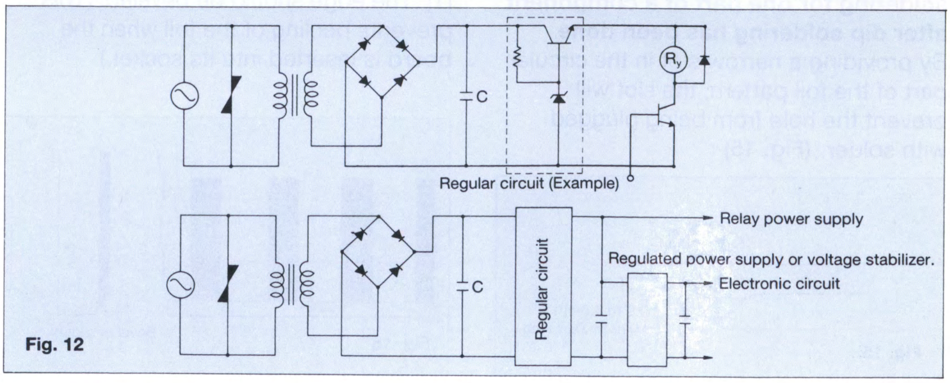


Fig. 12

viewpoint, the relay should be operated within the standards set for ripple and voltage variation. Similarly, in the circuit diagram shown in Fig. 12, but means of the manner in which the PC board pattern is designed, the ON/OFF operation of the relay coil, lamp, etc., will exert no influence on the electronic circuit. This is just a matter of technique that is necessary.

• Prevention of Voltage Drop Due to Rush Current

In the circuit shown in Fig. 13(a), rush current flows from the lamp or capacitor. The instant the contacts close, the voltage drops and the relay releases or chatters.

In this case, it is necessary to raise the transformer's capacity or add a smoothing circuit.

(b) shows an example of the modified circuit. (c) shows a battery-powered version.

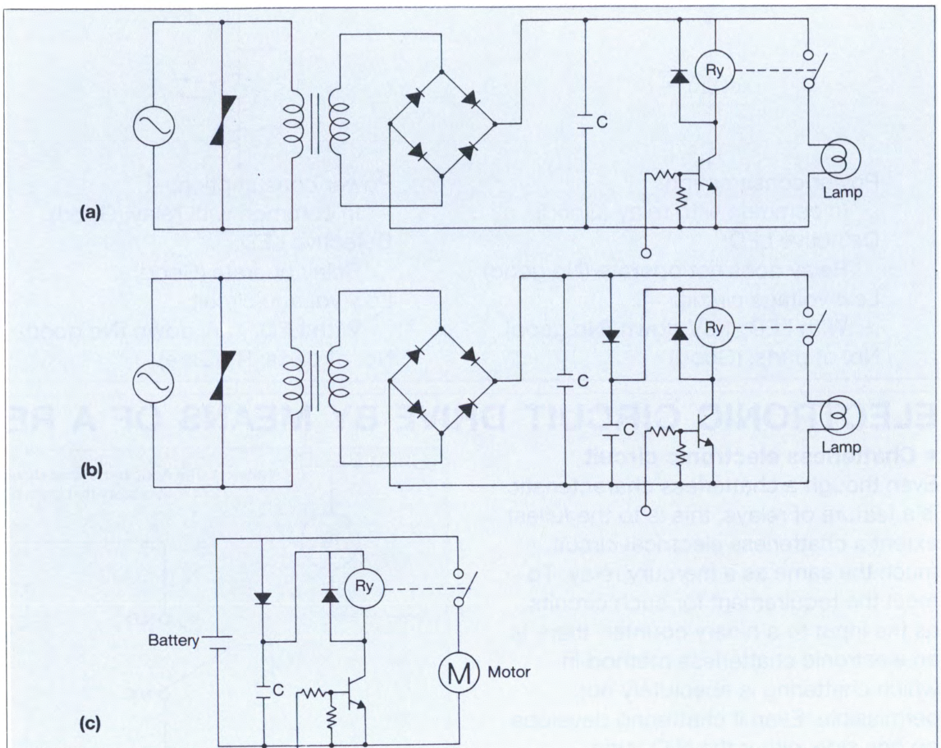


Fig. 13

PC BOARD DESIGN CONSIDERATIONS

• Pattern Layout for Relays

Since relays affect electronic circuits by generating noise, the following points should be noted.

Keep relays away from semiconductor devices. Design the pattern traces for shortest lengths. Place the surge arrester (diode, etc.) near the relay coil. Avoid routing pattern traces susceptible to noise (such as for audio signals) underneath the relay coil section. Avoid through-holes in places which cannot be seen from the top (e.g. at the base of the relay). Solder flowing up through such a hole may cause damage such as a broken seal. Even for the same circuit, pattern design considerations which minimize the influence of the on/off operations of the relay coil and lamp on other electronic circuits are necessary. (Fig. 14)

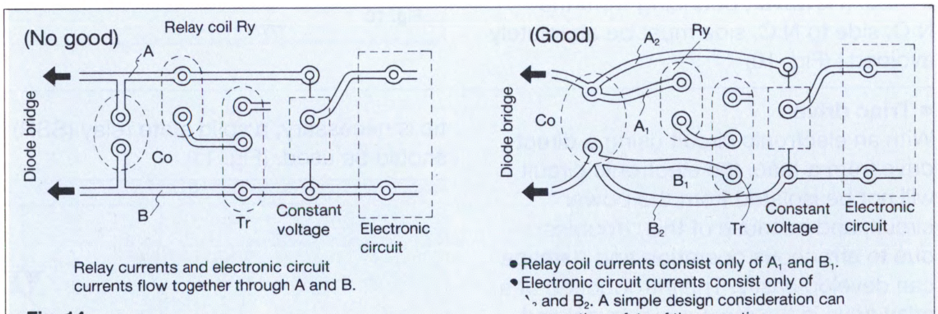


Fig. 14

• When it is necessary to use hand soldering for one part of a component after dip soldering has been done

By providing a narrow slot in the circular part of the foil pattern, the slot will prevent the hole from being plugged with solder. (Fig. 15)

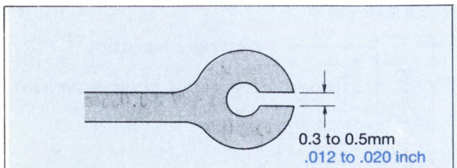


Fig. 15

• When the printed circuit board itself is used as a connector

[1] The edge should be beveled. (This prevents peeling of the foil when the board is inserted into its socket.)

[2] When only a single side is used as the connector blade, if there is distortion in the circuit board, contact will be defective. Care should be taken. (Fig. 16)

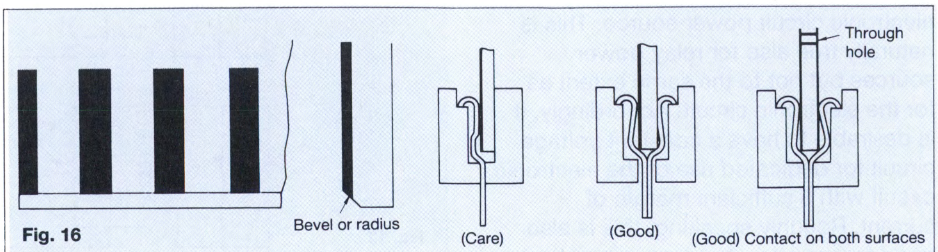


Fig. 16

PC BOARD REFERENCE DATA

(This data has been derived from samples of our company's products. When carrying out circuit design for the printed circuit board, this data will be found very useful as a reference.)

• Conductor width

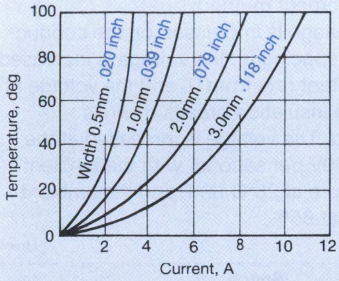
The width of the conductor has been determined for the benefit of current capacity, temperature rise, and corrosion as well as for the mechanical safety factor. Also,the current capacity is related to the temperature rise with respect to the ambient temperature.
In order to achieve a small temperature rise, the resistance value of the conductor must be lowered. Ordinarily in the wiring for electronic devices, the conductor width excluding the land is more than 0.5mm .020 inch. The conductor current and temperature rise, along with the conductor width and allowable current are shown in Fig. 17.
The conductor width and destruction current along with the conductor length and resistance value are shown in Fig. 18.
The conductor width and temperature change with allowable current is shown in the table below.

Unit: Copper foil thickness 0.035mm .001 inch

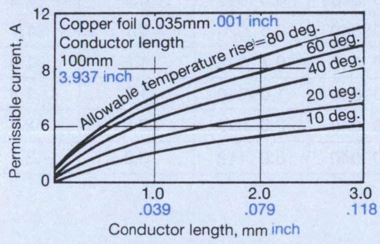
Temperature °C °F \ Conductor width mm inch	0.5 .020	1.0 .039	1.5 .059	2.0 .079	2.5 .098	3.0 .118
10 50	1.2	2.0	2.7	3.3	3.7	4.0
20 68	2.2	3.0	3.8	4.5	5.0	5.5
40 104	3.2	4.3	4.4	6.5	7.3	7.8
60 140	3.7	5.3	6.5	7.7	8.6	9.5
80 176	4.0	5.7	7.4	8.8	10.0	11.0

Fig. 17

[a] Conductor current vs temperature rise



[b] Conductor width vs permissible current

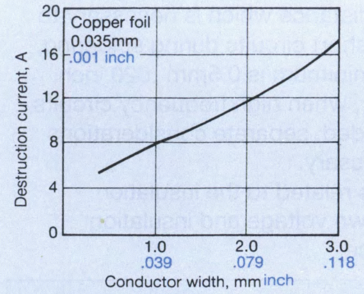


Test conditions:

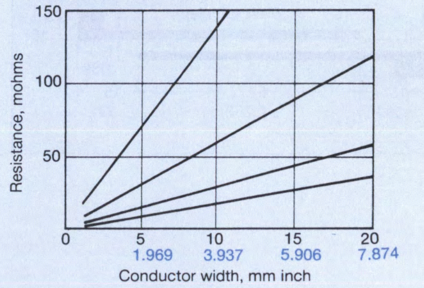
PC board thickness	1.6mm .063 inch
PC Board material	Paper phenol
Copper foil thickness	0.035mm .001 inch
Conductor length	100mm 3.937 inch
Room temperature	30°C 86°F
Measurement point	Center of conductor

Fig. 18

[a] Conductor width vs destruction current



[b] Conductor length vs resistance value



Test conditions:

PC board thickness	1.6mm .063 inch
PC Board material	Paper phenol
Copper foil thickness	0.035mm .001 inch
Room temperature	20°C 68°F

• Hole and land diameter

The hole diameter and land are made with the hole slightly larger than the lead wire so that the component may be inserted easily. Also, when soldering, the solder will build up in an eyelet condition, increasing the mounting strength.
The standard dimensions for the hole diameter and land are shown in the table below.

Standard dimensions for hole and land diameter mm inch

Standard hole diameter	Tolerance	Land diameter
0.8 .031	±0.1 ±.039	2.0 to 3.0 .079 to .118
1.0 .039		
1.2 .047		3.5 to 4.5 .138 to .177
1.6 .063		

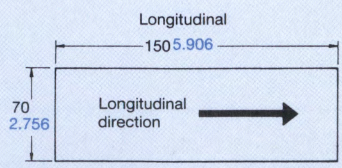
Remarks
1. The hole diameter is made 0.2 to 0.5mm larger than the lead diameter. However, if the jet method (wave type, jet type) of soldering is used, because of the fear of solder passing through to the component side, it is more suitable to make the hole diameter equal to the lead diameter +0.2mm.
2. The land diameter should be 2 to 3 times the hole diameter.
3. Do not put more than 1 lead in one hole.

• Expansion and shrinkage of copperclad laminates

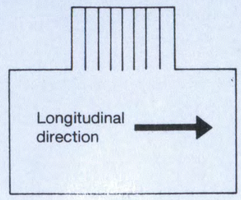
Because copperclad laminates have a longitudinal and lateral direction, the manner of punching fabrication and layout must be observed with care. The expansion and shrinkage in the longitudinal direction due to heat is 1/15 to 1/2 that in the lateral, and accordingly, after the punching fabrication, the distortion in the longitudinal direction will be 1/15 to 1/2 that of the lateral direction. The mechanical strength in the longitudinal direction is 10 to 15% greater than that in the lateral direction.
Because of this difference between the longitudinal and lateral directions, when products having long configurations are to be fabricated, the lengthwise direction of the configuration should be made in the longitudinal direction, and PC boards having a connector section should be made with the connector along the longitudinal side. (Fig. 19)

Fig. 19 mm inch

Example: As shwon in the drawing below, the 150mm 5.906 inch direction is taken as the longitudinal direction.



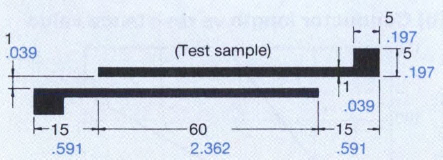
Also, as shown in the drawing below, when the pattern has a connector section, the direction is taken as shown by the arrow in the longitudinal direction.



• Space between conductors

The spacing between the conductors is decided on the basis of the relationship to dielectric strength, insulation resistance, the relative difficulty of corrosion, and also with regard to the limiting distance which is necessary to prevent short circuits during soldering, but the minimum is 0.5mm .020 inch. However, when high frequency circuits are included, separate considerations are necessary.
Fig. 20 is related to the insulation breakdown voltage and insulation resistance.

Fig. 20



[1] Insulation breakdown voltage

○ Sample:
Paper base phenolic resin copperclad laminate, 1.6mm .063 inch thick, with copper foil 0.035mm .001 inch thick
○ Measurement method:
An AC voltage is impressed on the conductors with spacing (t), the voltage is increased at a constant rate from 0, and the voltage at which the insulation breaks down is measured. The voltage is increased at the rate of 100V per second, with the ambient temperature at 20°C 68°F and the ambient humidity at 65%.

Unit: KV

Conductor width (mm) (inch)	Space between conductors (mm) (inch)	R-6700	R-6710
1.0 .040	0.3 .012	0.8	0.8
1.0 .040	0.5 .020	1.1	1.1
1.0 .040	0.7 .028	1.5	1.5
1.0 .040	1.0 .040	1.8	1.8
1.0 .040	2.0 .079	2.5	2.4
1.0 .040	3.0 .118	3.2	3.1

[2] Insulation resistance

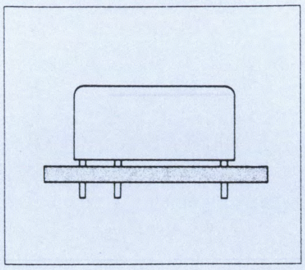
○ Sample:
Same specification as for breakdown voltage
○ Measurement method:
500V DC is impressed between the conductors and the measurement is made using an insulation resistance meter.

Unit: ohms

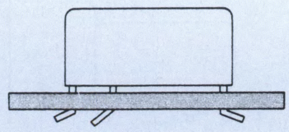
Conductor width (mm) (inch)	Space between conductors (mm) (inch)	R-6700	R-6710
1.0 .040	0.3 .012	4.8×10^{11}	1.9×10^{11}
1.0 .040	0.5 .020	2.5×10^{12}	2.7×10^{11}
1.0 .040	0.7 .028	2.7×10^{12}	6.5×10^{11}
1.0 .040	1.0 .040	6.6×10^{12}	7.0×10^{11}
1.0 .040	2.0 .079	1.3×10^{13}	9.7×10^{11}
1.0 .040	3.0 .118	3.6×10^{13}	1.4×10^{12}

Relay Soldering and Cleaning Guidelines

1. Mounting of Relay

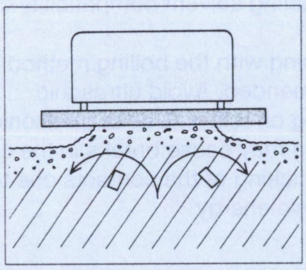


- Avoid bending the terminals to make the relay self-clinching. Relay performance cannot be guaranteed if the terminals are bent. Self-clinching terminal types are available depending on the type of relay.
- Correctly drill the PC board according to the given PC board pattern illustration.
- Stick packaging for automatic mounting is available depending on the type of relay.

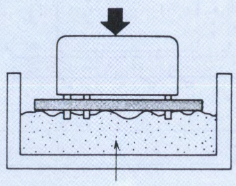


Bad example

2. Flux Application

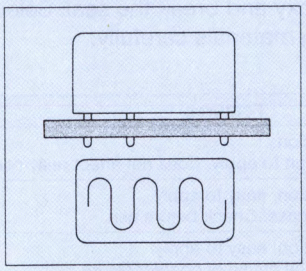


- Adjust the position of the PC board so that flux does not overflow onto the top of it. This must be observed especially for dust-cover type relays.
- Use rosin-based non-corrosive flux.
- If the PC board is pressed down into a flux-soaked sponge as shown on the right, the flux can easily penetrate a dust-cover type relay. Never use this method. Note that if the PC board is pressed down hard enough, flux may even penetrate a flux-resistant type relay.



Bad example

3. Preheating

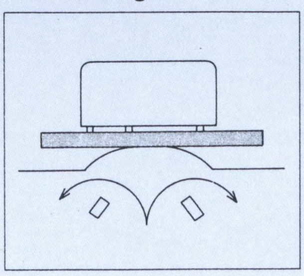


- Be sure to preheat before using automatic soldering. For dust-cover type relays and flux-resistant type relays, preheating acts to prevent the penetration of flux into the relay when soldering. Solderability also improves.
- Preheat according to the following conditions.

Temperature	100°C 212°F or less
Time	Within approx. 1 minute

- Note that long exposure to high temperatures (e.g. due to a malfunctioning unit) may affect relay characteristics.

4. Soldering



Automatic Soldering

- Flow solder is the optimum method for soldering.
- Adjust the level of solder so that it does not overflow onto the top of the PC board.
- Unless otherwise specified, solder under the following conditions depending on the type of relay.

Solder Temperature	Approx. 250°C 482°F
Soldering Time	Within approx. 5 seconds
Solder	JIS Z3282 H60 or H63

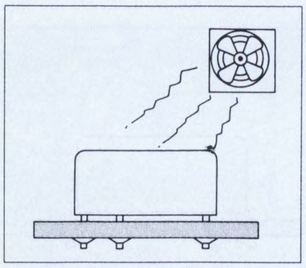
Hand Soldering

- Keep the tip of the soldering iron clean.

Soldering Iron	30W to 60W
Iron Tip Temperature	Approx. 300°C 572°F
Soldering Time	Within approx. 3 seconds
Solder	JIS Z3282 H60 or H63

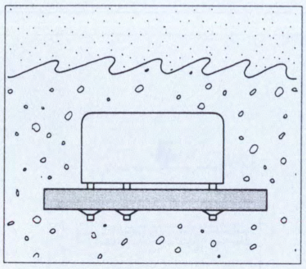
Relay Soldering and Cleaning Guidelines

5. Cooling



Automatic Soldering	Hand Soldering
• Immediate air cooling is recommended to prevent deterioration of the relay and surrounding parts due of soldering heat. • Although the environmentally sealed type relay (plastic sealed type, etc.) can be cleaned, avoid immersing the relay into cold liquid (such as cleaning solvent) immediately after soldering. Doing so may deteriorate the sealing performance.	————

6. Cleaning

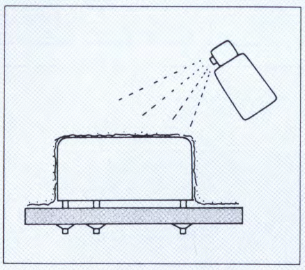


• Do not clean dust-cover type relays and flux-resistant type relays by immersion. Even if only the bottom surface of the PC board is cleaned (e.g. with a brush), careless cleaning may cause cleaning solvent to penetrate the relay.

• Plastic sealed type relays can be cleaned by immersion. Use a Freon- or alcohol-based cleaning solvent. Use of other cleaning solvents (e.g. Trichlene, chloroethene, thinner, benzyl alcohol) may damage the relay case. However, some types of relays use materials which are chemical resistant. Select the suitable relay or solvent by referring to the cleaning solvent compatibility chart below.

• Cleaning with the boiling method is recommended. Avoid ultrasonic cleaning on relays. Use of ultrasonic cleaning may cause breaks in the coil or slight sticking of the contacts due to the ultrasonic energy.

7. Coating



• If the PC board is to be coated to prevent the insulation of the PC board from deteriorating due to corrosive gases and high temperatures, note the following.

• Do not coat dust-cover type relays and flux-resistant type relays, since the coating material may penetrate the relay and cause contact failure. Or, mount the relay after coating.

• Depending on the type, some coating materials may have an adverse affect on relays. Furthermore, solvents (e.g. xylene, toluene, MEK, I.P.A.) may damage the case or chemically dissolve the epoxy and break the seal. Select coating materials carefully.

Type	Suitability for Relays	Features
Epoxy-base	Good	• Good electrical insulation. • Although slightly difficult to apply, does not affect relay contacts.
Urethane-base	Care	• Good electrical insulation, easy to apply. • Solvent may damage case. Check before use.
Silicon-base	Care	• Good electrical insulation, easy to apply. • Silicon gas becomes the cause of contact failure. • Do not use on dust-cover type relays and flux-resistant type relays.

• If the relay and all components (e.g. ICs) are to be coated, be sure to carefully check the flexibility of the coating material. The solder may peel off from thermal stress.

- **Cleaning Solvent Compatibility Chart** (○: Yes, ×: No)

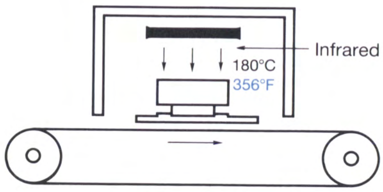
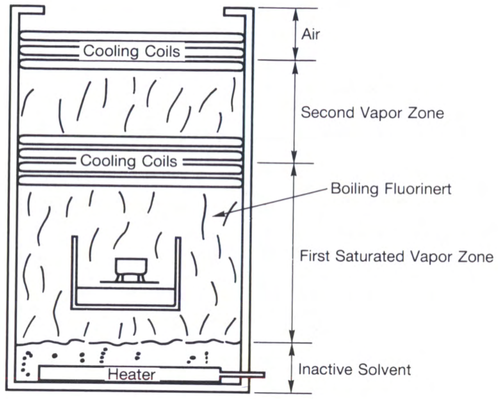
Cleaning Solvent		IC-C3	IC-C	TQ·TF·TN·TW·TK	DSE	DF	DSP	DK	NR	DR	DB	DX (Hermetic Seal Type)	DN (Hermetic Seal Type)	HD	HY	RFE	RG	RK	SE	ST	NFE	NBE	NCE	NLE	KE	HBE
Fluorine-base	•Freon TF, TE, TES, TMS •S3, S3-E, S3-ES •-AE, -AES, -AMS	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	•Freon TMC •S3-MC •-AM	○	○	○	○	○	○	○	×	○	○	○	○	×	○	○	○	○	×	○	○	○	×	×	×	○
Chlorine-base	•I.I.I. Trichloroethane (Chlorothene) •Trichloroethylene (Trichlene) •Perchloroethylene •Methylene chloride	○	○	○	○	○	○	○	×	○	×	○	○	○	○	○	○	○	×	○	○	○	×	×	×	○
Aqueous	•Indusco 624, 1000 •Hollis 310 •Lonco Terg	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Alcohol-base	•IPA •Ethanol	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Others	•Thiner •Gasoline	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×

Cleaning Solvent		HAE	HCE	JY (Sealed Type)	JS (Sealed Type)	JW (Sealed Type)	JV (Sealed Type)	JK (Sealed Type)	JQ	PQ	JT (Sealed Type)	AQ-SSR	AQ8SSR
Fluorine-base	•Freon TF, TE, TES, TMS •S3, S3-E, S3-ES •-AE, -AES, -AMS	○	○	○	○	○	○	○	○	○	○	○	○
	•Freon TMC •S3-MC •-AM	○	×	○	○	○	○	○	○	○	○	○	○
Chlorine-base	•I.I.I. Trichloroethane (Chlorothene) •Trichloroethylene (Trichlene) •Perchloroethylene •Methylene chloride	○	×	○	○	○	○	○	○	○	○	○	○
Aqueous	•Indusco 624, 1000 •Hollis 310 •Lonco Terg	○	○	○	○	○	○	○	○	○	○	○	○
Alcohol-base	•IPA •Ethanol	○	○	○	○	○	○	○	○	○	○	○	○
Others	•Thiner •Gasoline	×	×	×	×	×	×	×	×	×	×	×	×

SMT Soldering Guidelines

Advanced technological innovation has enabled Aromat to develop both electro-mechanical and solid state relays for surface-mount applications. This has been achieved through the use of advanced liquid crystal polymer plastics throughout the relay.

- **Representative soldering methods for SMT devices are listed as follows;**

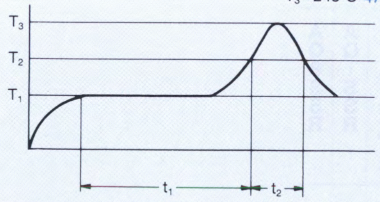
	IRS (Infrared Reflow Soldering)	VPS (Vapor Phase Soldering)
Soldering	 Soldering is conducted with high temperature generated from the infrared heat source.	 Soldering is conducted with saturated vapor generated from heating of the inactive solvent.

TYPICAL SOLDERING TEMPERATURE PROFILES FOR SURFACE-MOUNT TYPE RELAYS

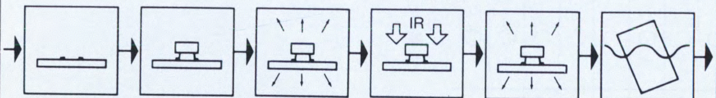
- **TF Relays: Please refer to page 55 for technical specifications and characteristics.**

(1) IR (Infrared reflow) soldering

T_1=155°C to 165°C 311°F to 329°F
T_2=180°C to 200°C 356°F to 392°F
T_3=245°C 473°F or less



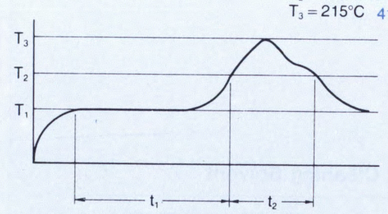
t_1=120 sec. or less
t_2=30 sec. or less



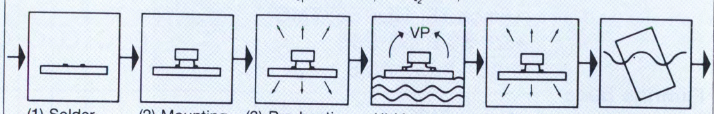
(1) Solder-paste printing → (2) Mounting → (3) Pre-heating t_1=120 sec. or less → (4) IR soldering t_2=30 sec. or less → (5) Cooling → (6) Cleaning

(2) VP (Vapor Phase) soldering

T_1=90°C to 100°C 194°F to 212°F
T_2=180°C to 200°C 356°F to 392°F
T_3=215°C 419°F or less



t_1=90 sec. to 120 sec.
t_2=60 sec. or less



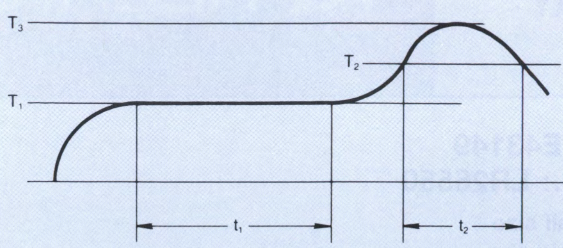
(1) Solder-paste printing → (2) Mounting → (3) Pre-heating t_1=90 sec. to 120 sec. → (4) Vapor Phase soldering t_2=60 sec. or less → (5) Cooling → (6) Cleaning

Check mounting conditions before using soldering methods.
The temperature profile indicates the temperature of the soldered terminal on the surface of the PC board. The ambient temperature may increase excessively. Check the temperature under mounting conditions.

In case the reflow condition differs from above mentioned, please contact us.

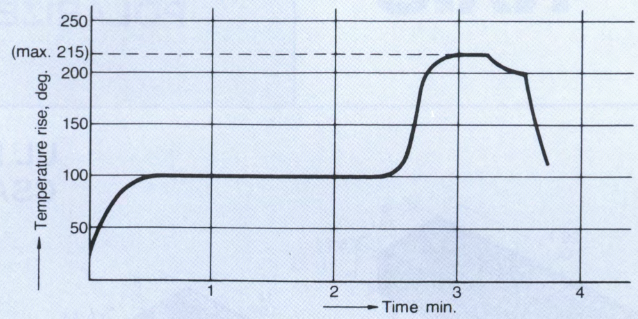
- **DF Relays: Please refer to page 92 for technical specifications and characteristics.**

(1) IR (Infrared reflow) soldering method



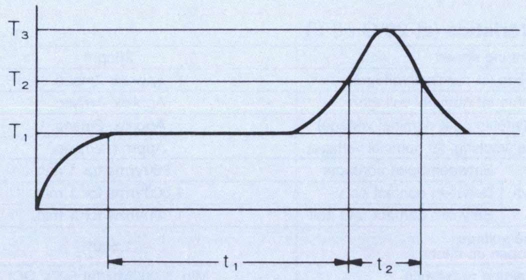
T_1 = 150 to 165°C 302°F to 329°F t_1 = 120 sec. or less
T_2 = 180°C 356°F or less t_2 = 20 to 30 sec. or less
T_3 = 245°C 473°F or less

(2) Vapor phase soldering method



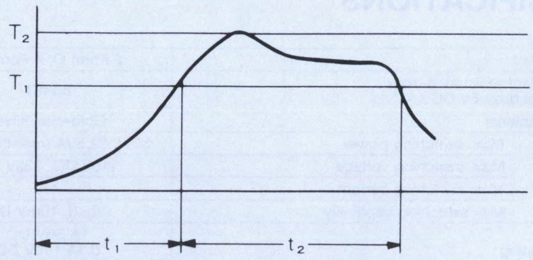
- **PhotoMOS Relays: Please refer to page 313 to 372 for technical specifications and characteristics.**

(1) IR (Infrared reflow) soldering method



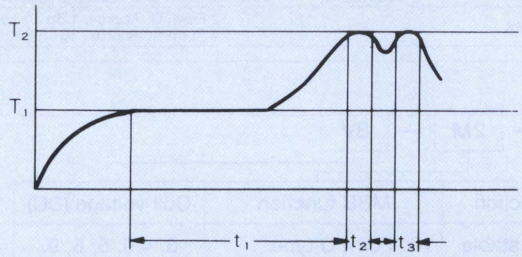
T_1=155°C to 165°C 311°F to 329°F t_1=120 sec. or less
T_2=180°C to 200°C 356°F to 392°F t_2=30 sec. or less
T_3=245°C 473°F or less

(2) Vapor phase soldering method



T_1=180°C to 200°C 356°F to 392°F t_1=40 sec.
T_2=215°C 419°F or less t_2=90 sec. or less

(3) Double wave soldering method



T_1=155°C to 165°C 311°F to 329°F t_1=60 sec. or less
T_2=260°C 500°F or less t_2+t_3=5 sec. or less

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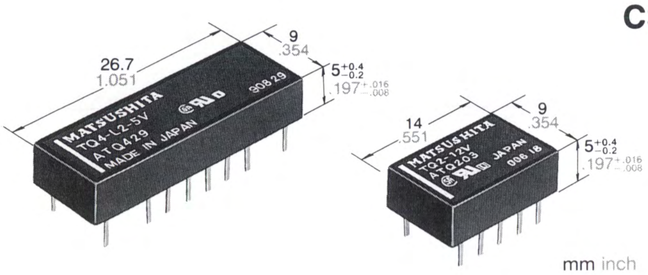
MOST ADVANCED POLARIZED RELAY

TQ-RELAYS



mm inch

UL File No.: E43149
CSA File No.: LR26550

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

SPECIFICATIONS

Contact

Arrangement			2 Form C, 4 Form C
Initial contact resistance, max. (By voltage drop 6V DC 1A)			50mΩ
Contact material			Gold-clad silver
Rating	Max. switching power		30W, 62.5VA (resistive load)
	Max. switching voltage		110V DC, 125V AC
	Max. switching current		1A
	Min. switching capability		10μA, 10mV DC
UL/CSA rating			1A 30V DC 0.3A 110V DC 0.5A 125V AC
Expected life (min. operations)	Mechanical (at 180cpm)		10^8
	Electrical (at 20cpm)	1A 30V DC resistive	2×10^5
		0.5A 125V AC resistive	10^5

Characteristics (at 20°C 68°F)

Max. operating speed		20cpm
Operate time (at nominal voltage)		Approx. 2msec.
Release time (at nominal voltage)		Approx. 1msec.
Set time (latching) (at nominal voltage)		Approx. 2msec.
Reset time (latching) (at nominal voltage)		Approx. 2msec.
Initial breakdown voltage	Between open contacts	750Vrms for 1 min.
	Between contact sets	1,000Vrms for 1 min.
	Between contact and coil	1,000Vrms for 1 min.
FCC surge voltage between open contacts		1,500V
Initial insulation resistance		Min. 1,000MΩ (at 500V DC)
Temperature rise (at nominal voltage)		Max. 50 deg.
Ambient temperature		−40°C to +70°C −40°F to +158°F
Shock resistance	Functional	50G
	Destructive	100G
Vibration resistance	Functional	18G, 10 to 55Hz at double amplitude of 3mm
	Destructive	30G, 10 to 55Hz at double amplitude of 5mm
Unit weight		2 Form C: Approx. 1.5g .053oz. 4 Form C: Approx. 3g .106oz.

ORDERING INFORMATION

Ex. TQ 2 H — L2 — 2M — 3V

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

Note: AgPd stationary contact types available for high resistance against contact sticking.
When ordering, please add suffix "-3" like TQ2-12V-3.

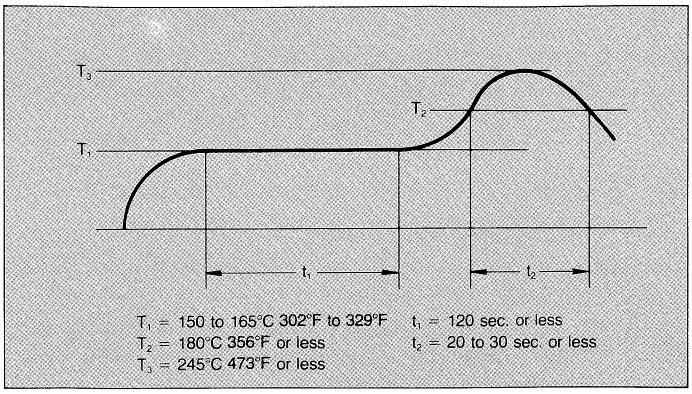
TYPES AND COIL DATA (at 20°C 68°F)

1. 2 Form C type

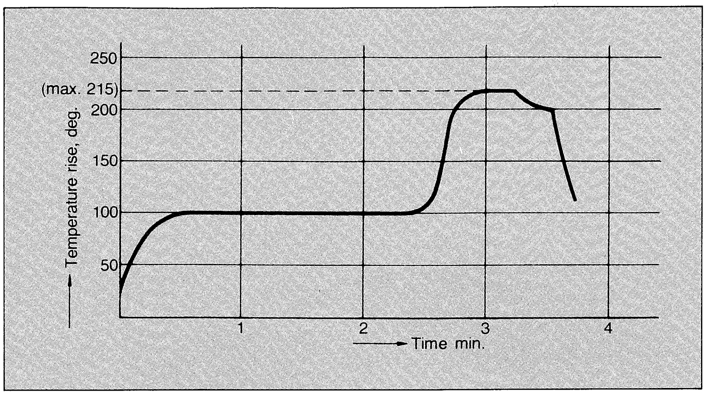
Operating function	Part No.	Nominal voltage, V DC	Pick-up/set voltage, V DC (max.)	Drop-out/reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	TQ2-3V	3	2.25	0.3	46.7	64.3	140	4.5
	TQ2-4.5V	4.5	3.38	0.45	31.1	144.6	140	6.7
	TQ2-5V	5	3.75	0.5	28.1	178	140	7.5
	TQ2-6V	6	4.5	0.6	23.3	257	140	9
	TQ2-9V	9	6.75	0.9	15.5	579	140	13.5
	TQ2-12V	12	9	1.2	11.7	1,028	140	18
	TQ2-24V	24	18	2.4	8.3	2,880	200	36
1 coil latching	TQ2-L-3V	3	2.25	2.25	33.3	90	100	4.5
	TQ2-L-4.5V	4.5	3.38	3.38	22.2	202.5	100	6.7
	TQ2-L-5V	5	3.75	3.75	20	250	100	7.5
	TQ2-L-6V	6	4.5	4.5	16.7	360	100	9
	TQ2-L-9V	9	6.75	6.75	11.1	810	100	13.5
	TQ2-L-12V	12	9	9	8.3	1,440	100	18
	TQ2-L-24V	24	18	18	6.3	3,840	150	36
2 coil latching	TQ2-L2-3V	3	2.25	2.25	66.7	45	200	4.5
	TQ2-L2-4.5V	4.5	3.38	3.38	44.4	101.2	200	6.7
	TQ2-L2-5V	5	3.75	3.75	40	125	200	7.5
	TQ2-L2-6V	6	4.5	4.5	33.3	180	200	9
	TQ2-L2-9V	9	6.75	6.75	22.2	405	200	13.5
	TQ2-L2-12V	12	9	9	16.7	720	200	18
	TQ2-L2-24V	24	18	18	12.5	1,920	300	28.8

- **DF Relays: Please refer to page 92 for technical specifications and characteristics.**

(1) IR (Infrared reflow) soldering method

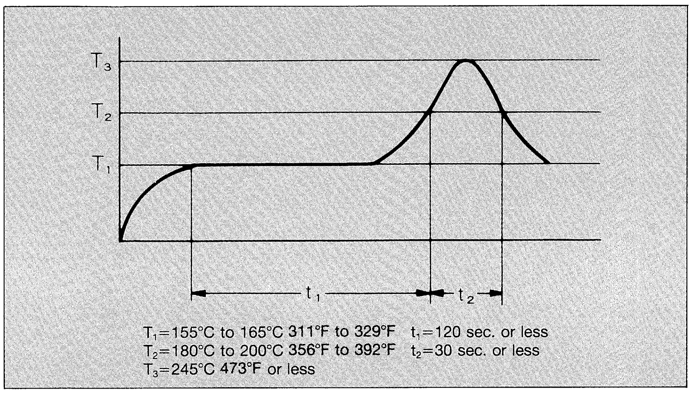


(2) Vapor phase soldering method

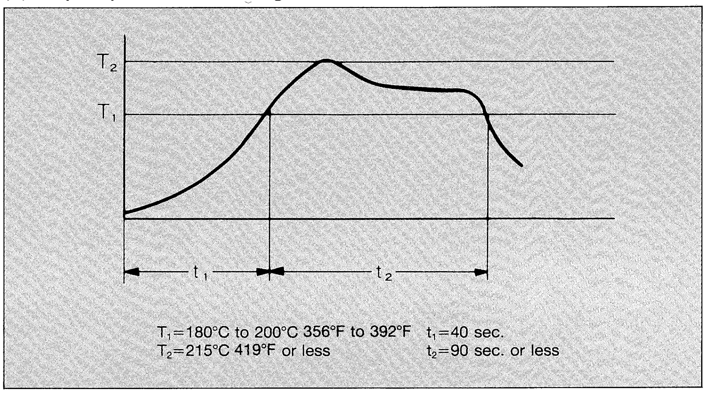


- **PhotoMOS Relays: Please refer to page 313 to 372 for technical specifications and characteristics.**

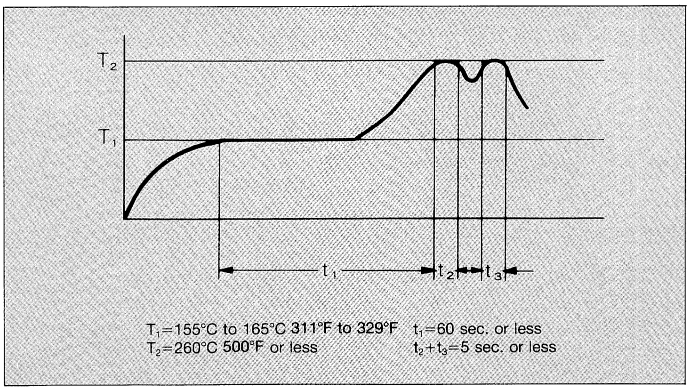
(1) IR (Infrared reflow) soldering method



(2) Vapor phase soldering method



(3) Double wave soldering method



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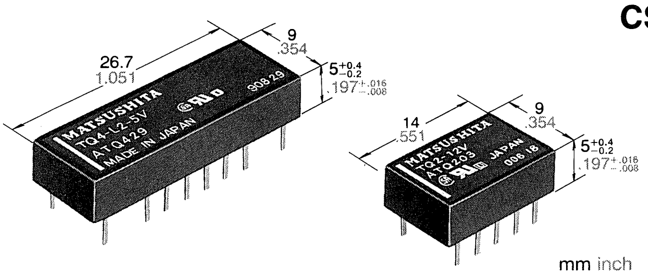
TQ-RELAYS



UL File No.: E43149
CSA File No.: LR26550

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

SPECIFICATIONS

Contact

Arrangement			2 Form C, 4 Form C
Initial contact resistance, max. (By voltage drop 6V DC 1A)			50mΩ
Contact material			Gold-clad silver
Rating	Max. switching power		30W, 62.5VA (resistive load)
	Max. switching voltage		110V DC, 125V AC
	Max. switching current		1A
	Min. switching capability		10μA, 10mV DC
UL/CSA rating			1A 30V DC 0.3A 110V DC 0.5A 125V AC
Expected life (min. operations)	Mechanical (at 180cpm)		10^8
	Electrical (at 20cpm)	1A 30V DC resistive	2×10^5
		0.5A 125V AC resistive	10^5

Characteristics (at 20°C 68°F)

Max. operating speed		20cpm
Operate time (at nominal voltage)		Approx. 2msec.
Release time (at nominal voltage)		Approx. 1msec.
Set time (latching) (at nominal voltage)		Approx. 2msec.
Reset time (latching) (at nominal voltage)		Approx. 2msec.
Initial breakdown voltage	Between open contacts	750Vrms for 1 min.
	Between contact sets	1,000Vrms for 1 min.
	Between contact and coil	1,000Vrms for 1 min.
FCC surge voltage between open contacts		1,500V
Initial insulation resistance		Min. 1,000MΩ (at 500V DC)
Temperature rise (at nominal voltage)		Max. 50 deg.
Ambient temperature		−40°C to +70°C −40°F to +158°F
Shock resistance	Functional	50G
	Destructive	100G
Vibration resistance	Functional	18G, 10 to 55Hz at double amplitude of 3mm
	Destructive	30G, 10 to 55Hz at double amplitude of 5mm
Unit weight		2 Form C: Approx. 1.5g .053oz. 4 Form C: Approx. 3g .106oz.

ORDERING INFORMATION

Ex. TQ [2] [H] — [L2] — [2M] — [3V]

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

Note: AgPd stationary contact types available for high resistance against contact sticking.
When ordering, please add suffix "-3" like TQ2-12V-3.

TYPES AND COIL DATA (at 20°C 68°F)

1. 2 Form C type

Operating function	Part No.	Nominal voltage, V DC	Pick-up/set voltage, V DC (max.)	Drop-out/reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	TQ2-3V	3	2.25	0.3	46.7	64.3	140	4.5
	TQ2-4.5V	4.5	3.38	0.45	31.1	144.6	140	6.7
	TQ2-5V	5	3.75	0.5	28.1	178	140	7.5
	TQ2-6V	6	4.5	0.6	23.3	257	140	9
	TQ2-9V	9	6.75	0.9	15.5	579	140	13.5
	TQ2-12V	12	9	1.2	11.7	1,028	140	18
	TQ2-24V	24	18	2.4	8.3	2,880	200	36
1 coil latching	TQ2-L-3V	3	2.25	2.25	33.3	90	100	4.5
	TQ2-L-4.5V	4.5	3.38	3.38	22.2	202.5	100	6.7
	TQ2-L-5V	5	3.75	3.75	20	250	100	7.5
	TQ2-L-6V	6	4.5	4.5	16.7	360	100	9
	TQ2-L-9V	9	6.75	6.75	11.1	810	100	13.5
	TQ2-L-12V	12	9	9	8.3	1,440	100	18
	TQ2-L-24V	24	18	18	6.3	3,840	150	36
2 coil latching	TQ2-L2-3V	3	2.25	2.25	66.7	45	200	4.5
	TQ2-L2-4.5V	4.5	3.38	3.38	44.4	101.2	200	6.7
	TQ2-L2-5V	5	3.75	3.75	40	125	200	7.5
	TQ2-L2-6V	6	4.5	4.5	33.3	180	200	9
	TQ2-L2-9V	9	6.75	6.75	22.2	405	200	13.5
	TQ2-L2-12V	12	9	9	16.7	720	200	18
	TQ2-L2-24V	24	18	18	12.5	1,920	300	28.8

2. 4 Form C type

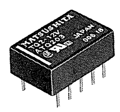
Operating function	Part No.	Nominal voltage, V DC	Pick-up/set voltage, V DC (max.)	Drop-out/reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	TQ4-3V	3	2.25	0.3	93.8	32	280	4.5
	TQ4-4.5V	4.5	3.38	0.45	62.2	72.3	280	6.7
	TQ4-5V	5	3.75	0.5	56.2	89	280	7.5
	TQ4-6V	6	4.5	0.6	46.5	129	280	9
	TQ4-9V	9	6.75	0.9	31.1	289	280	13.5
	TQ4-12V	12	9	1.2	23.3	514	280	18
	TQ4-24V	24	18	2.4	11.7	2,056	280	36
1 coil latching	TQ4-L-3V	3	2.25	2.25	66.6	45	200	4.5
	TQ4-L-4.5V	4.5	3.38	3.38	44.4	101.2	200	6.7
	TQ4-L-5V	5	3.75	3.75	40	125	200	7.5
	TQ4-L-6V	6	4.5	4.5	33.3	180	200	9
	TQ4-L-9V	9	6.75	6.75	22.2	405	200	13.5
	TQ4-L-12V	12	9	9	16.7	720	200	18
	TQ4-L-24V	24	18	18	8.3	2,880	200	36
2 coil latching	TQ4-L2-3V	3	2.25	2.25	133	22.5	400	4.5
	TQ4-L2-4.5V	4.5	3.38	3.38	88.9	50.6	400	6.7
	TQ4-L2-5V	5	3.75	3.75	80	62.5	400	7.5
	TQ4-L2-6V	6	4.5	4.5	66.6	90	400	9
	TQ4-L2-9V	9	6.75	6.75	44.4	202.5	400	13.5
	TQ4-L2-12V	12	9	9	33.3	360	400	18
	TQ4-L2-24V	24	18	18	16.7	1,440	400	36

Notes: 1. Please add "H" for self-clinching terminal types as TQ4H-L-3V, TQ2H-L-24V.
2. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
3. Standard packing: Tube:50pcs Case:1,000pcs

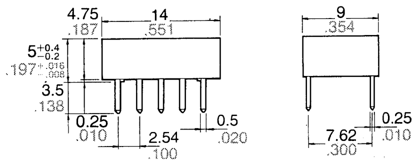
DIMENSIONS

mm inch

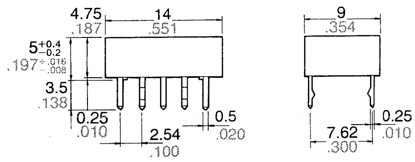
1) 2 Form C



Standard PC board terminal

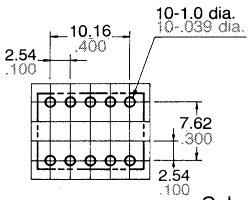


Self-clinching terminal



General tolerance: ±0.3 ±.012

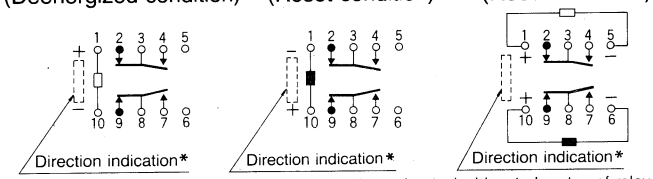
PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

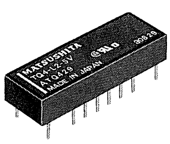
Schematic (Bottom view)

• Single side stable (Deenergized condition) • 1-coil latching (Reset condition) • 2-coil latching (Reset condition)

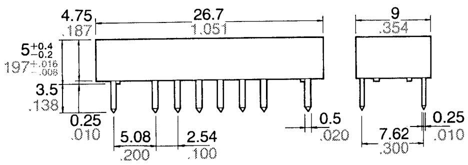


*Orientation stripe typical-located on top of relay

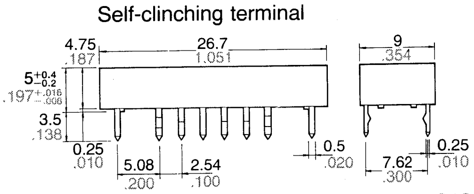
2) 4 Form C



Standard PC board terminal

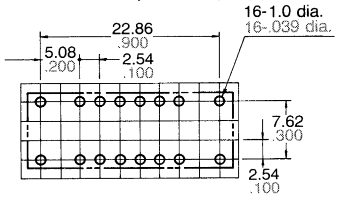


Self-clinching terminal



General tolerance: ±0.3 ±.012

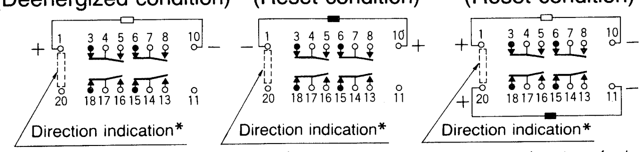
PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

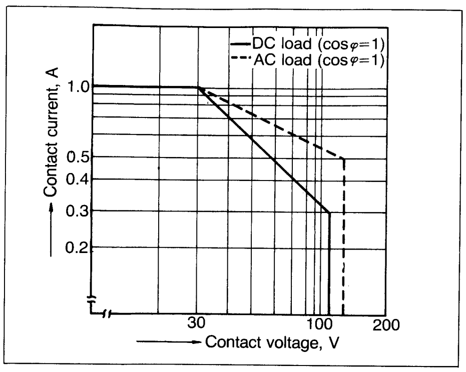
• Single side stable (Deenergized condition) • 1-coil latching (Reset condition) • 2-coil latching (Reset condition)



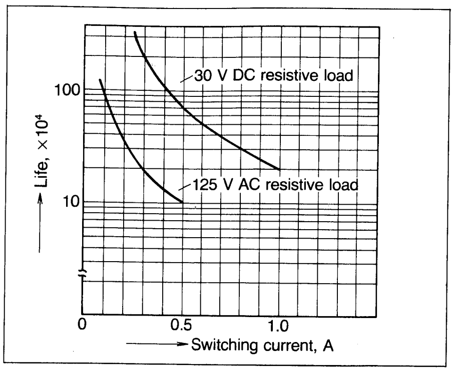
*Orientation stripe typical-located on top of relay

DATA

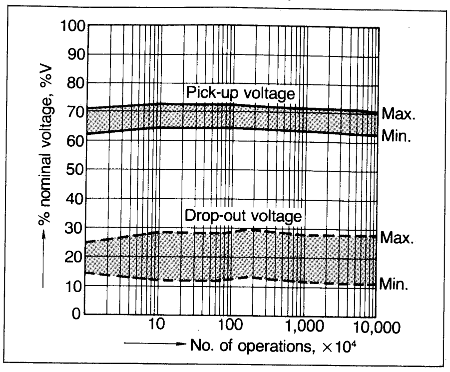
1. Maximum switching power



2. Life curve

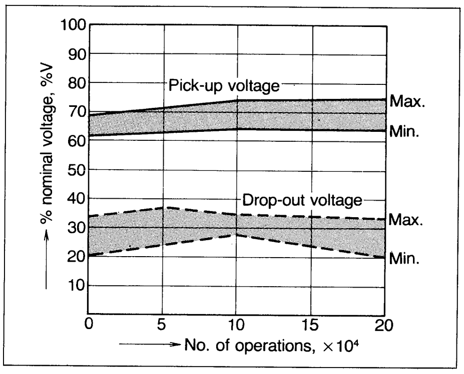


3. Mechanical life
Tested sample: TQ2-12V, 10 pcs.

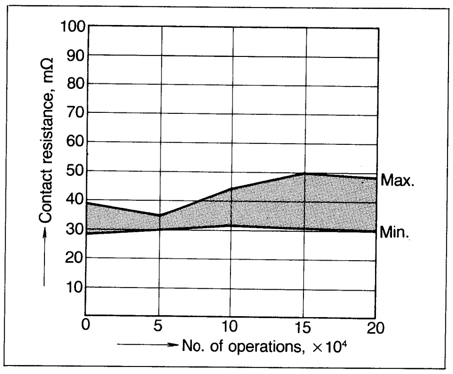


4.-(1) Electrical life (DC load)
Tested sample: TQ2-12V, 6 pcs.
Condition: 1 A 30 V DC resistive load, 20 cpm

Change of pick-up and drop-out voltage

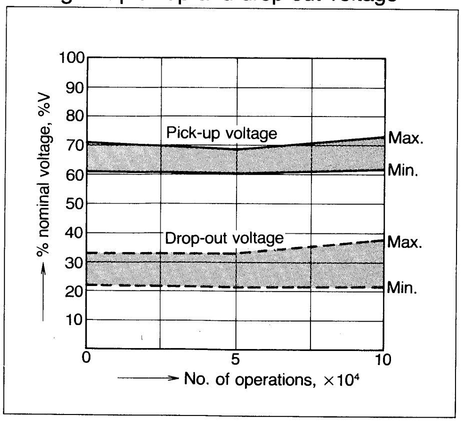


Change of contact resistance

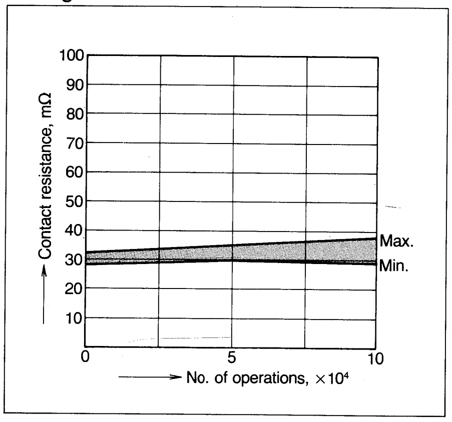


4.-(2) Electrical life (AC load)
Tested sample: TQ2-12V , 6 pcs.
Condition: 0.5 A 125 V AC resistive load, 20 cpm

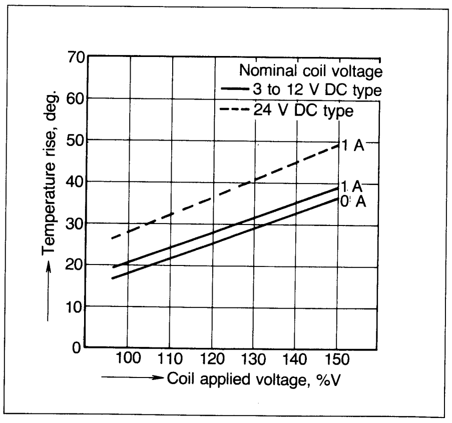
Change of pick-up and drop-out voltage



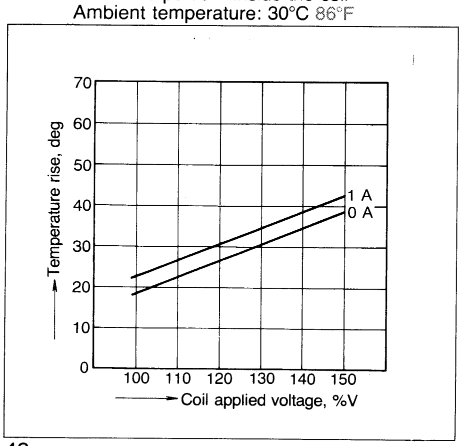
Change of contact resistance



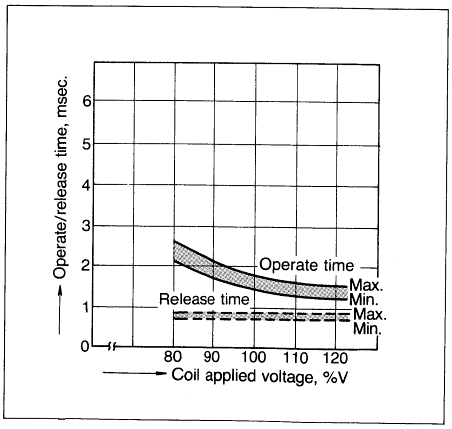
5.-(1) Coil temperature rise (2C)
Tested sample: TQ2-12V
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



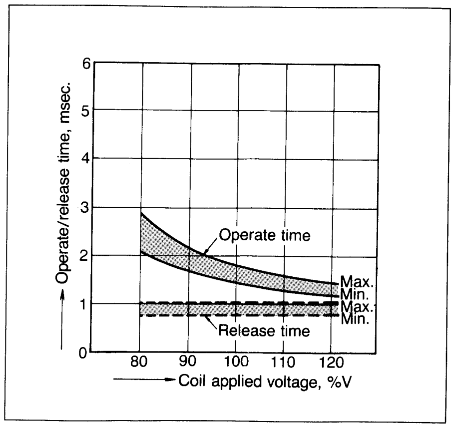
5.-(2) Coil temperature rise (4c)
Tested sample: TQ4-12V
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



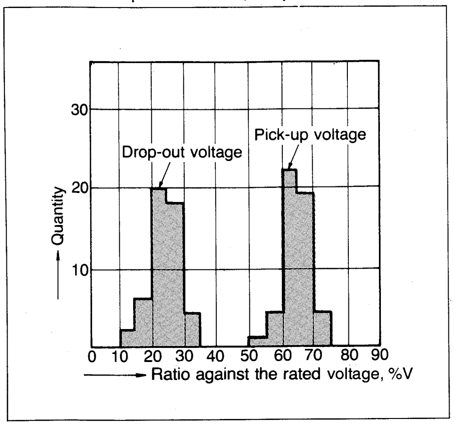
6.-(1) Operate/release time characteristics
Tested sample: TQ2-12V, 10 pcs.



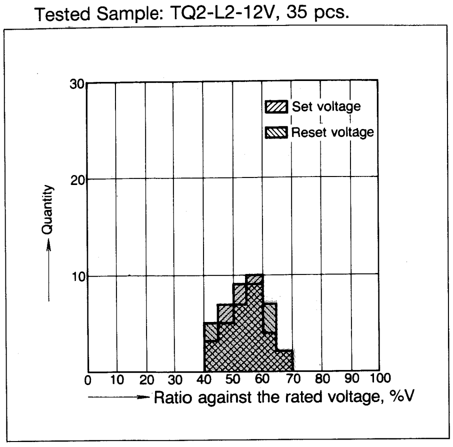
6.-(2) Operate/release time characteristics
Tested sample: TQ4-12V, 10 pcs.



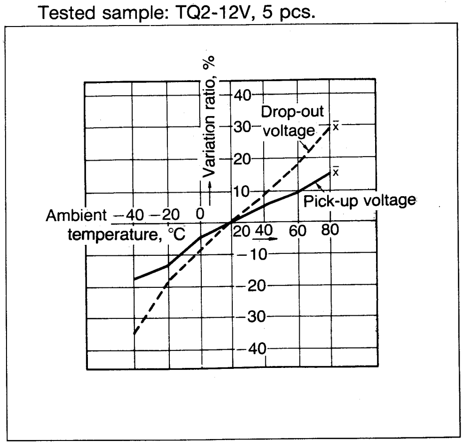
7. Distribution of pick-up and drop-out voltages
Tested sample: TQ2-12V, 50 pcs.



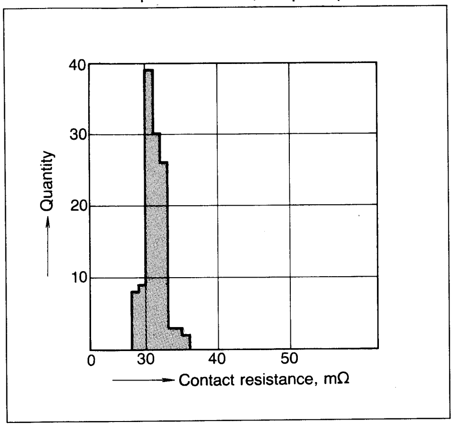
8. Distribution of set and reset voltage
Tested Sample: TQ2-L2-12V, 35 pcs.



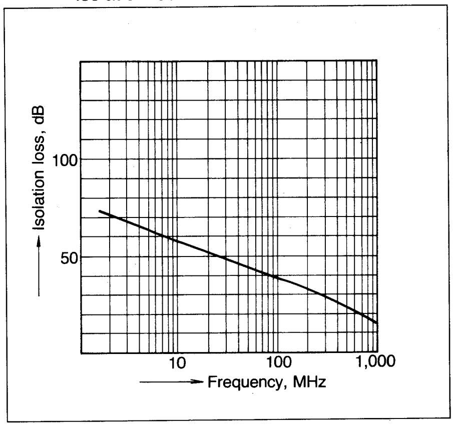
9. Ambient temperature characteristics
Tested sample: TQ2-12V, 5 pcs.



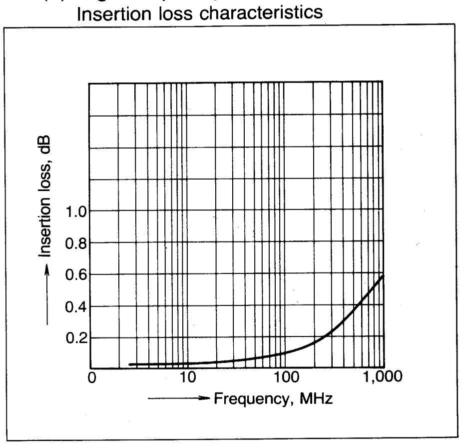
10. Distribution of contact resistance
Tested sample: TQ2-12V, 30 pcs. (30×4 contacts)



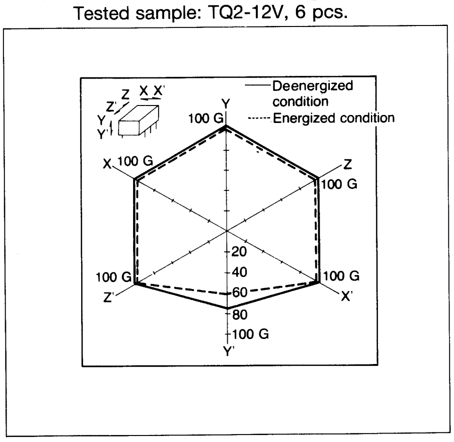
11.-(1) High-frequency characteristics
Isolation loss characteristics



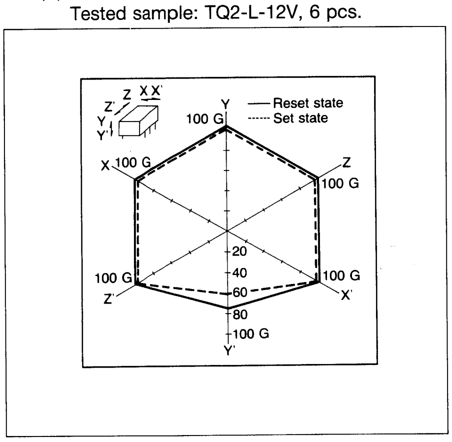
11.-(2) High-frequency characteristics
Insertion loss characteristics



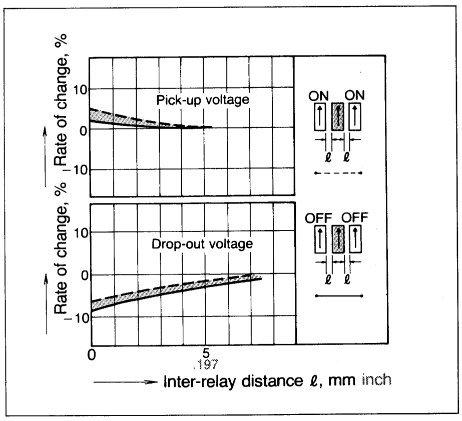
12.-(1) Malfunctional shock (single side stable)
Tested sample: TQ2-12V, 6 pcs.



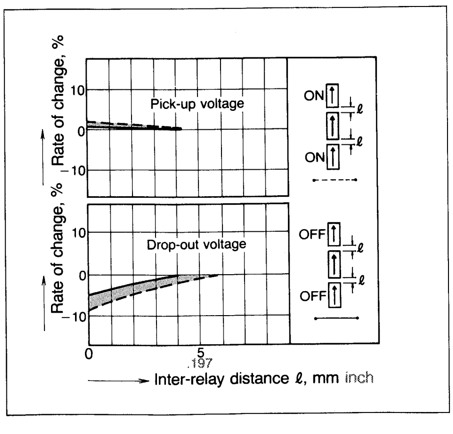
12.-(2) Malfunctional shock (latching)
Tested sample: TQ2-L-12V, 6 pcs.



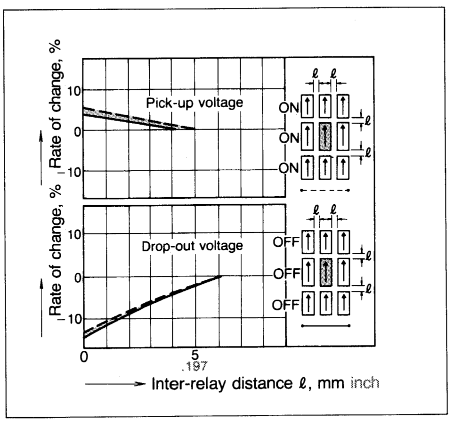
13.-(1) Influence of adjacent mounting



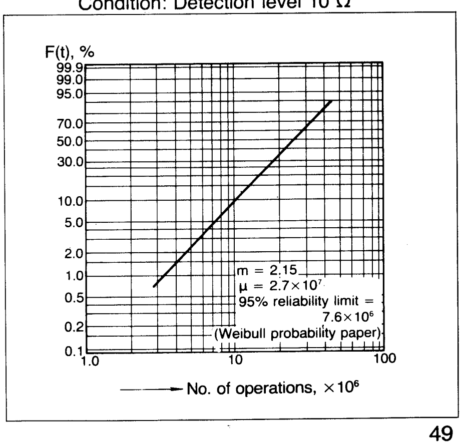
13.-(2) Influence of adjacent mounting



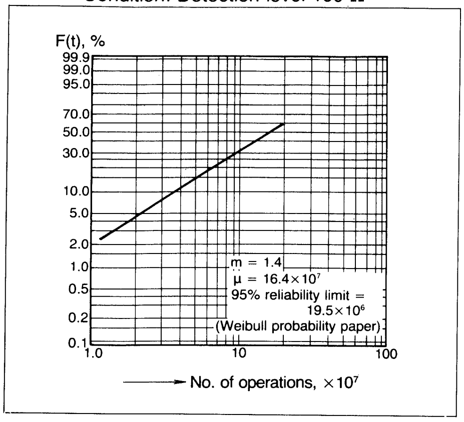
13.-(3) Influence of adjacent mounting



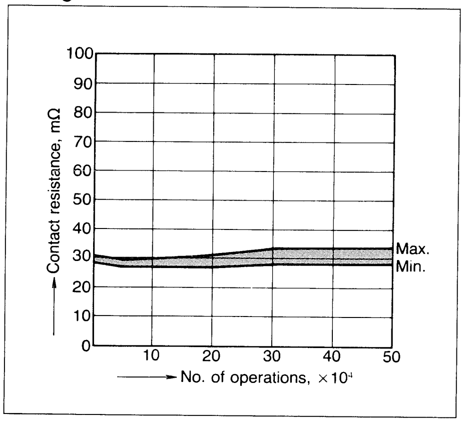
14-(1) Contact reliability
(1 mA 5 V DC resistive load)
Tested sample: TQ2-12V
Condition: Detection level 10 Ω



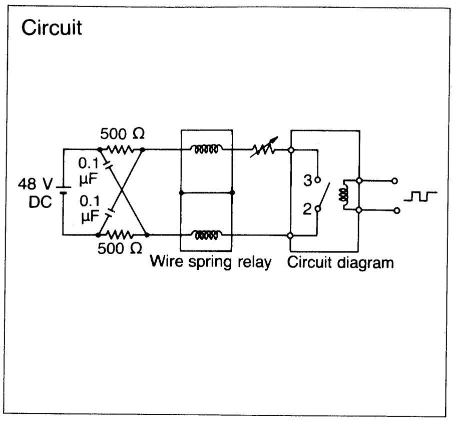
14.-(2) Contact reliability
(100 μA 5 V DC resistive load)
Tested sample: TQ2-12V
Condition: Detection level 100 Ω



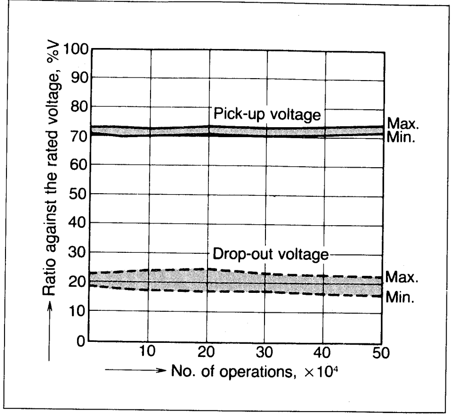
Change of contact resistance



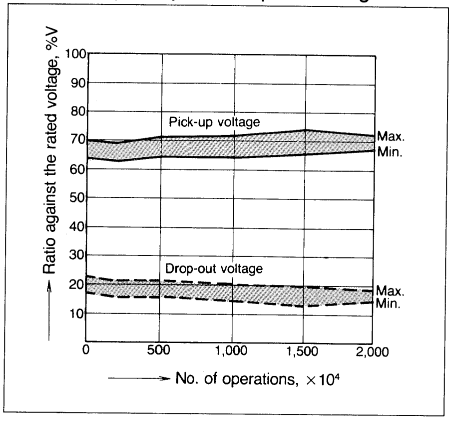
15. Pulse dialing test (35 mA 48 V DC wire spring relay load)



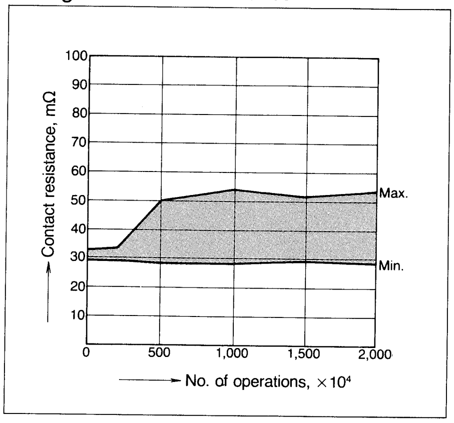
Change of pick-up and drop-out voltage



16. 0.1 A 53 V DC resistive load test
Change of pick-up and drop-out voltage



Change of contact resistance



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. External magnetic field

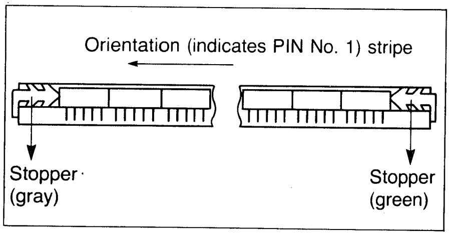
Since TQ-relay is highly sensitive polarized relay, its characteristics will be affected by a strong external magnetic field. Avoid using relays under that condition.

4. Cleaning

In automatic cleaning, cleaning with the boiling method is recommended. Avoid ultrasonic cleaning for relays. It is recommended that a fluorinated hydrocarbon or other alcoholic solvents be used. Trichlene and chloroethene can be used for cleaning.

5. Packing direction

Relays are packed in a tube with the orientation stripe (PIN No. 1) toward the gray stopper.



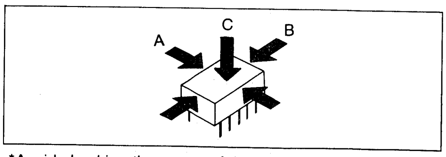
6. Automatic insertion

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

Chucking pressure in the direction A:
500 g or less*

Chucking pressure in the direction B:
1 kg or less

Mounting pressure in the direction C:
1 kg or less



*Avoid chucking the center of the relay.

7. Soldering

Preheat according to the following conditions.

Temperature	100°C 212°F or less
Time	Within 1 minute

Soldering should be done at 250°C 482°F within 5 sec.

8. Others

1) If in error the relay has been dropped, the appearance and characteristics should be checked before use without fail.

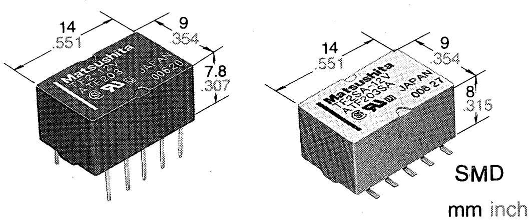
2) Latching relays are shipped from the factory in the reset state. A shock to the relay during shipping or installation may cause it to change to the set state. Therefore, it is recommended the relay be used in a circuit which initializes the relay to the required state (set or reset) whenever the power is turned on.

NAiS

SMALL POLARIZED RELAY WITH HIGH SENSITIVITY

TF-RELAYS

UL File No.: E43149
CSA File No.: LR26550



- **High sensitivity: Nominal operating power; 80mW (Single side stable 3-12V type)**
- **Surge voltage withstand: 1500V FCC Part 68**
- **Minimal magnetic interference allows high density mounting.**
- **Sealed construction allows automatic washing.**
- **Self-clinching terminal also available.**

SPECIFICATIONS

Contact

			Standard PC board terminal type, Self-clinching terminal type	Surface-mount terminal type
Arrangement			2 Form C	
Initial contact resistance, max. (By voltage drop 6V DC 1A)			50mΩ	60mΩ
Contact material			Gold-clad silver	Gold-clad silver palladium
Rating	Max. switching power		30W, 62.5VA	
	Max. switching voltage		110V DC, 125V AC	
	Max. switching current		1A	
	Min. switching capability		10μA, 10mV DC	
UL/CSA rating			1A 30V DC, 0.3A 110V DC, 0.5A 125V AC	
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8	5×10^7 (Single side stable type 3-24V DC) 10^7 (Single side stable type 48V DC, Laching type)
	Electrical (at 20cpm)	1A 30V DC resistive	2×10^5	
		0.5A 125V AC resistive	10^5	

Characteristics

Max. operating speed			20cpm
Operate time (at nominal voltage)			Approx. 2msec.
Release time (at nominal voltage)			Approx. 1msec.
Set time (latching) (at nominal voltage)			Approx. 2msec.
Reset time (latching) (at nominal voltage)			Approx. 2msec.
Initial breakdown voltage	Between open contacts		750Vrms for 1 min.
	Between contact sets		1,000Vrms for 1 min.
	Between contact and coil		1,000Vrms for 1 min.
FCC surge voltage between open contacts			1,500V
Initial insulation resistance			Min. 1,000MΩ (at 500V DC)
Temperature rise (at nominal voltage)			Max. 50 deg.
Ambient temperature			−40°C to +70°C −40°F to +158°F
Shock resistance		Functional	Min. 50G
		Destructive	Min. 100G
Vibration resistance		Functional	18G, 10 to 55Hz at double amplitude of 3mm
		Destructive	30G, 10 to 55Hz at double amplitude of 5mm
Unit weight			Approx. 2g .071 oz.

ORDERING INFORMATION

Ex. TF | 2 | SA | — | L | — | H | — | 3V

Contact arrangement	Surface-mount availability	Operating function	Terminal shape	Coil voltage (DC)
2: 2 Form C	Nil: Standard PC board terminal type or self-clinching terminal type SA: 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	3, 4.5, 5, 6, 9, 12, 24, 48*V

Note: AgPd stationary contact types available for high resistance against contact sticking.
When ordering, please add suffix "-3" like TF2-12V-3.

*48V coil type: Single side stable only

TYPES AND COIL DATA (at 20°C 68°F)

1. Standard PC board terminal type

Operating function	Part No.	Nominal voltage, V DC	Pick-up/set voltage, V DC (min.)	Drop-out/reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	TF2-3V	3	2.25	0.3	26.7	112.5	80	4.5
	TF2-4.5V	4.5	3.38	0.45	17.8	253	80	6.7
	TF2-5V	5	3.75	0.5	16	312.5	80	7.5
	TF2-6V	6	4.5	0.6	13.3	450	80	9
	TF2-9V	9	6.75	0.9	8.9	1,012.5	80	13.5
	TF2-12V	12	9	1.2	6.7	1,800	80	18
	TF2-24V	24	18	2.4	5.8	4,100	140	36
	TF2-48V	48	36	4.8	5.4	8,860	260	57.6
1 coil latching	TF2-L-3V	3	2.25	2.25	18.3	163.6	55	4.5
	TF2-L-4.5V	4.5	3.38	3.38	12.2	368.2	55	6.7
	TF2-L-5V	5	3.75	3.75	11	454.5	55	7.5
	TF2-L-6V	6	4.5	4.5	9.2	654.5	55	9
	TF2-L-9V	9	6.75	6.75	6.1	1,472	55	13.5
	TF2-L-12V	12	9	9	4.6	2,618	55	18
	TF2-L-24V	24	18	18	4.2	5,760	100	36
2 coil latching	TF2-L2-3V	3	2.25	2.25	36.7	81.8	110	4.5
	TF2-L2-4.5V	4.5	3.38	3.38	24.4	184.1	110	6.7
	TF2-L2-5V	5	3.75	3.75	22	227.3	110	7.5
	TF2-L2-6V	6	4.5	4.5	18.3	327.3	110	9
	TF2-L2-9V	9	6.75	6.75	12.2	736.4	110	13.5
	TF2-L2-12V	12	9	9	9.2	1,309	110	18
	TF2-L2-24V	24	18	18	8.3	2,880	200	36

2. Surface-mount terminal type

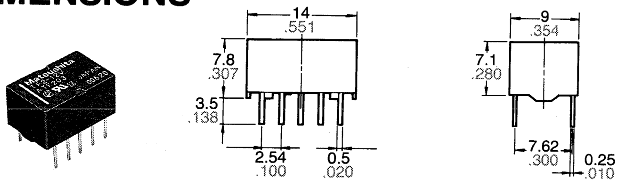
Operating function	Part No.	Nominal voltage, V DC	Pick-up/set voltage, V DC (max.)	Drop-out/reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	TF2SA-3V	3	2.25	0.3	46.7	64.2	140	4.5
	TF2SA-4.5V	4.5	3.38	0.45	31.1	144.6	140	6.7
	TF2SA-5V	5	3.75	0.5	28	178.5	140	7.5
	TF2SA-6V	6	4.5	0.6	23.3	257.1	140	9
	TF2SA-9V	9	6.75	0.9	15.6	578.5	140	13.5
	TF2SA-12V	12	9	1.2	11.7	1,028	140	18
	TF2SA-24V	24	18	2.4	5.8	4,100	140	36
	TF2SA-48V	48	36	4.8	5.4	8,860	260	57.6
1 coil latching	TF2SA-L-3V	3	2.25	2.25	26.7	112.5	80	4.5
	TF2SA-L-4.5V	4.5	3.38	3.38	17.7	253	80	6.7
	TF2SA-L-5V	5	3.75	3.75	16	312.5	80	7.5
	TF2SA-L-6V	6	4.5	4.5	13.3	450	80	9
	TF2SA-L-9V	9	6.75	6.75	8.9	1,012	80	13.5
	TF2SA-L-12V	12	9	9	6.7	1,800	80	18
	TF2SA-L-24V	24	18	18	4.2	5,760	100	36
2 coil latching	TF2SA-L2-3V	3	2.25	2.25	53.3	56	160	4.5
	TF2SA-L2-4.5V	4.5	3.38	3.38	35.7	126	160	6.7
	TF2SA-L2-5V	5	3.75	3.75	32	156	160	7.5
	TF2SA-L2-6V	6	4.5	4.5	26.7	225	160	9
	TF2SA-L2-9V	9	6.75	6.75	17.8	506	160	13.5
	TF2SA-L2-12V	12	9	9	13.3	900	160	18
	TF2SA-L2-24V	24	18	18	8.3	2,870	200	36

Notes: 1. Please add "H" for self-clinching terminal types as TF2-H-3V, TF2-L2-H-5V.
2. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
3. Standard packing: Tube:50pcs Case:1,000pcs

DIMENSIONS

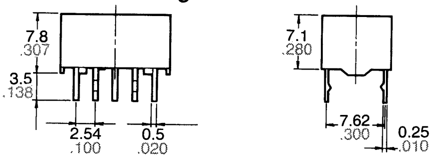
mm inch

Standard PC board terminal

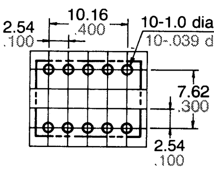


Self-clinching terminal

General tolerance: ±0.3 ±.012



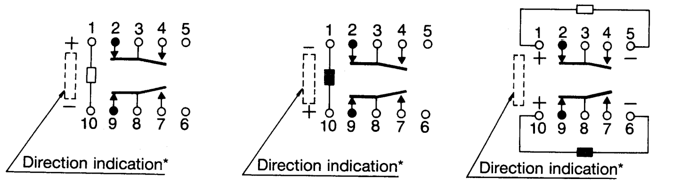
PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

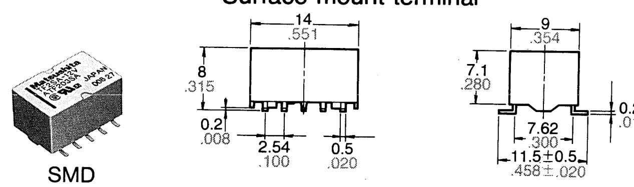
Schematic (Bottom view)

Single side stable (Deenergized condition) | 1-coil latching (Reset condition) | 2-coil latching (Reset condition)



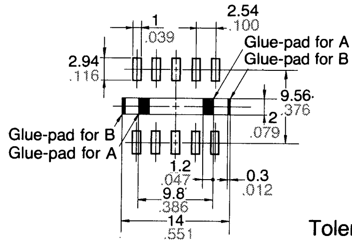
*Orientation stripe typical-located on top of relay

Surface-mount terminal



General tolerance: ±0.3 ±.012

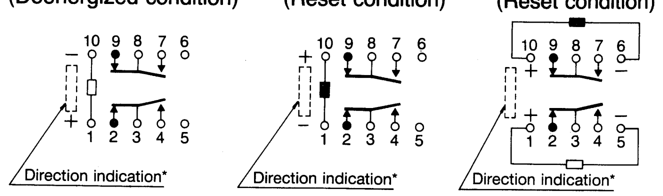
Suggested mounting pad (Top view)



Tolerance: ±0.1 ±.004

Schematic (Top view)

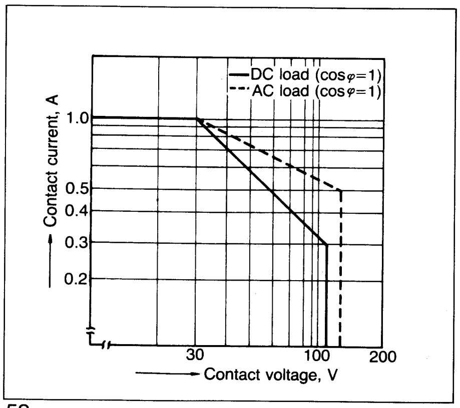
Single side stable (Deenergized condition) | 1-coil latching (Reset condition) | 2-coil latching (Reset condition)



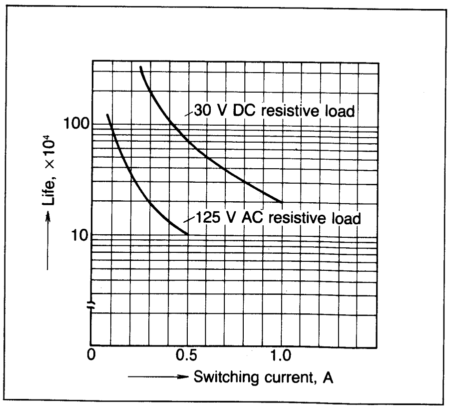
*Orientation stripe typical-located on top of relay

DATA

1. Maximum switching power

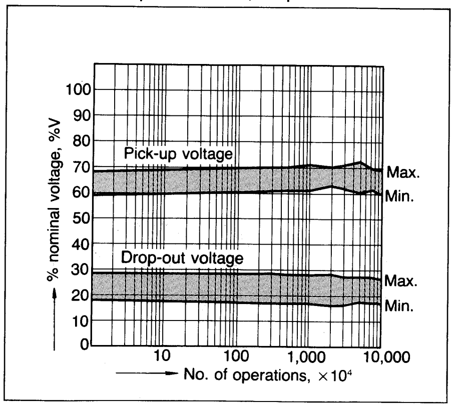


2. Life curve



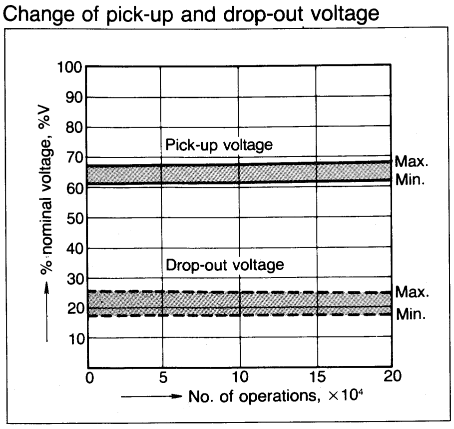
3. Mechanical life

Tested sample: TF2-12V, 10 pcs.

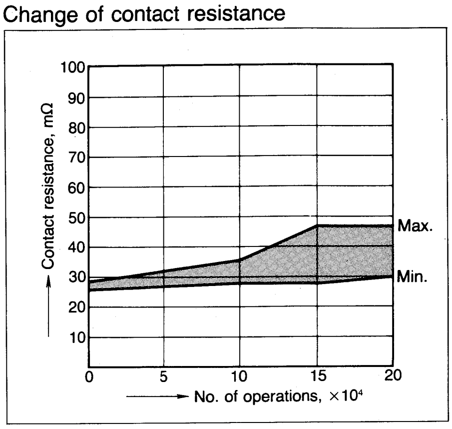


4.-(1) Electrical life (DC load)
Tested sample: TF2-12V, 6 pcs.
Condition: 1 A 30 V DC resistive load, 20 cpm

Change of pick-up and drop-out voltage

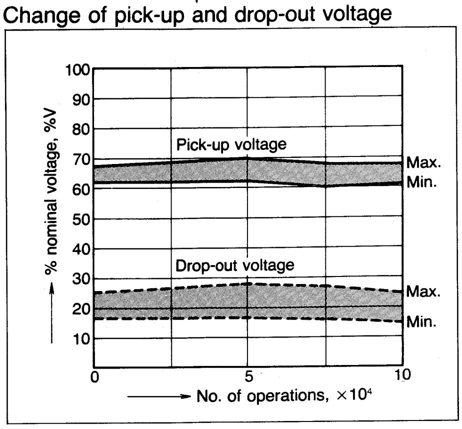


Change of contact resistance

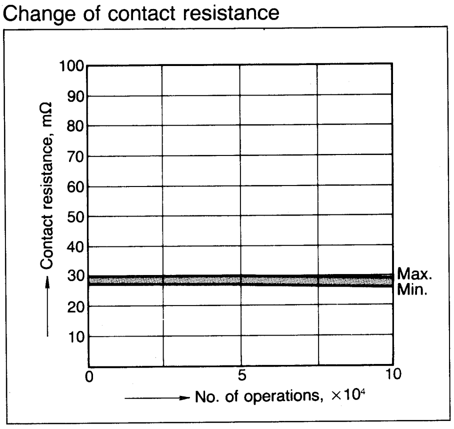


4.-(2) Electrical life (AC load)
Tested sample: TF2-12V, 6 pcs.
Condition: 0.5 A 125 V AC resistive load, 20 cpm

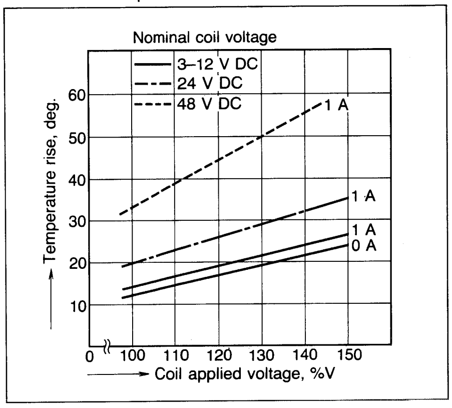
Change of pick-up and drop-out voltage



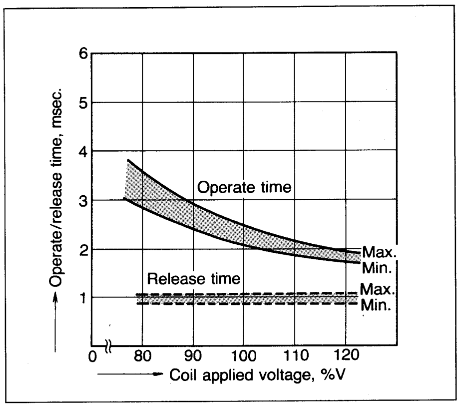
Change of contact resistance



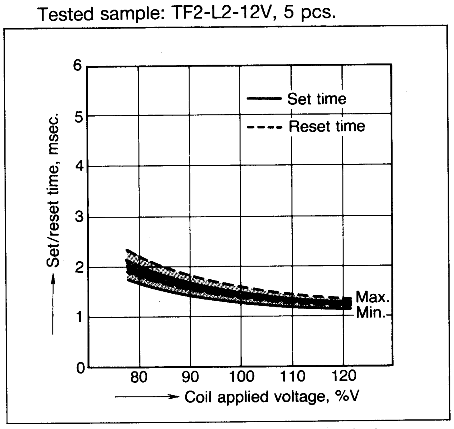
5. Coil temperature rise
Tested sample: TF2-xxV
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



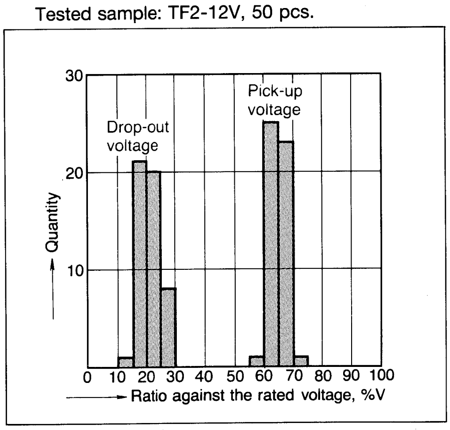
6. Operate/release time characteristics
Tested sample: TF2-12V, 5 pcs.



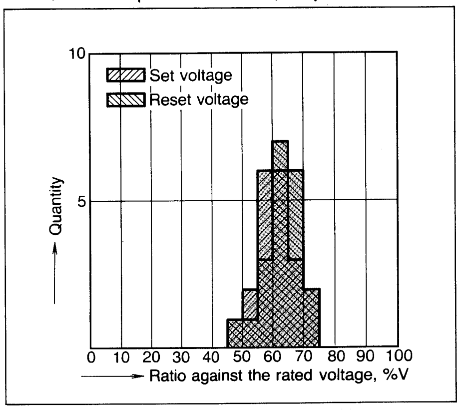
7. Set/reset time characteristics
Tested sample: TF2-L2-12V, 5 pcs.



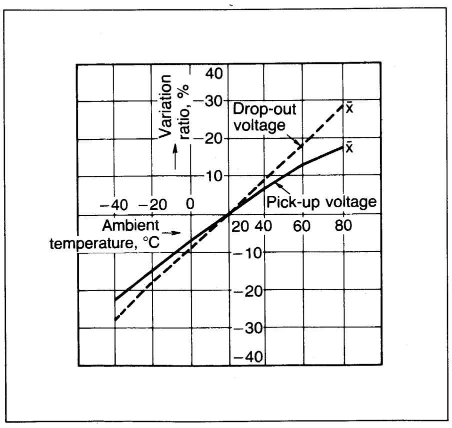
8. Distribution of pick-up and drop-out voltage
Tested sample: TF2-12V, 50 pcs.



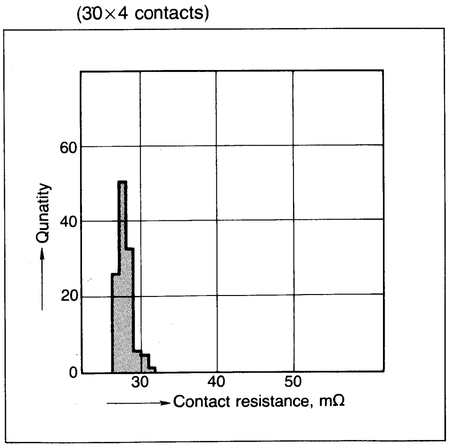
9. Distribution of set and reset voltage
Tested sample: TF2-L2-12V, 20 pcs.



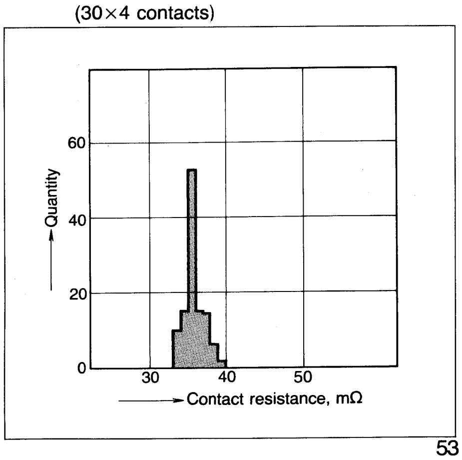
10. Ambient temperature characteristics
Tested sample: TF2-12V, 5 pcs.



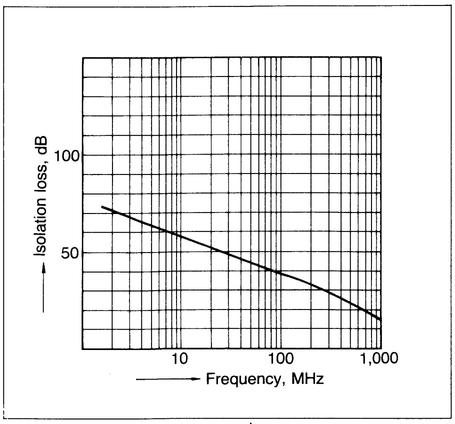
11.-(1) Distribution of contact resistance
Tested sample: TF2-12V, 30 pcs.
(30×4 contacts)



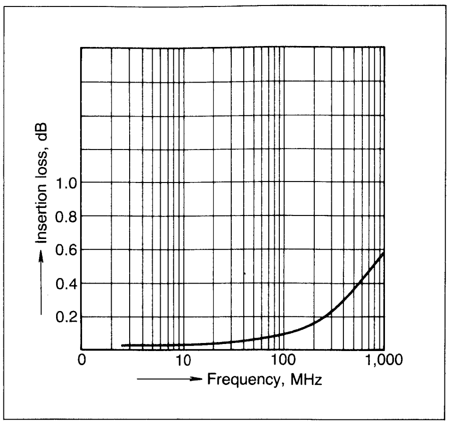
11.-(2) Distribution of contact resistance
Tested sample: TF2SA-12V, 30 pcs.
(30×4 contacts)



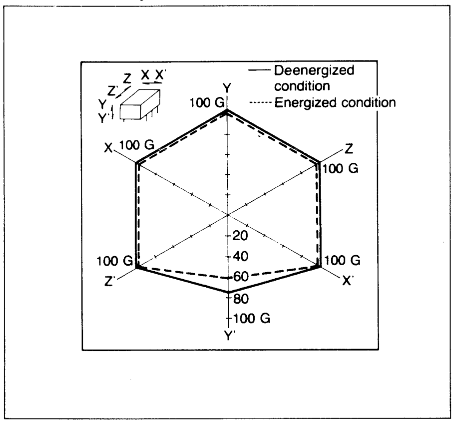
12.-(1) High-frequency characteristics
Tested sample: TF2-xxV
Isolation loss characteristics



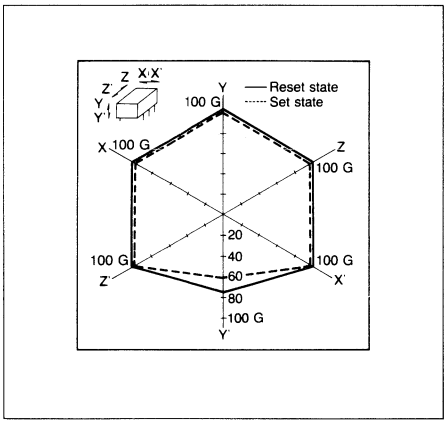
12.-(2) High-frequency characteristics
Tested sample: TF2-xxV
Insertion loss characteristics



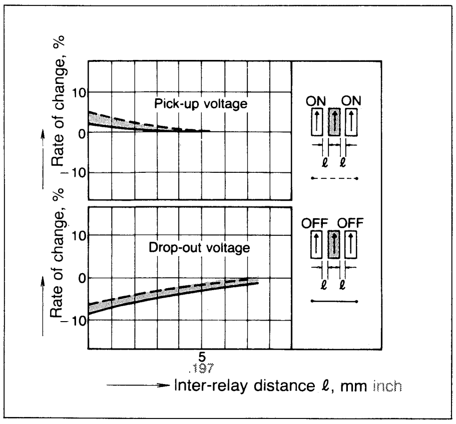
13.-(1) Malfunctional shock (single side stable)
Tested sample: TF2-12V
Quantity: n = 6



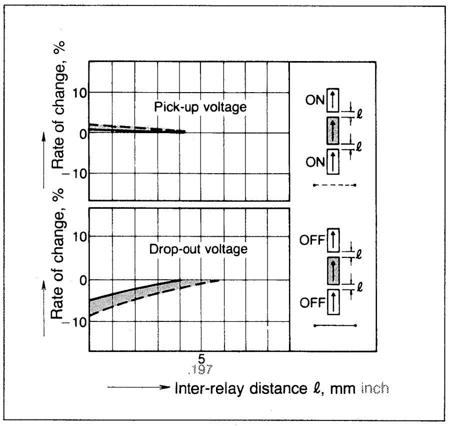
13.-(2) Malfunctional shock (latching)
Tested sample: TF2-L-12V
Quantity: n = 6



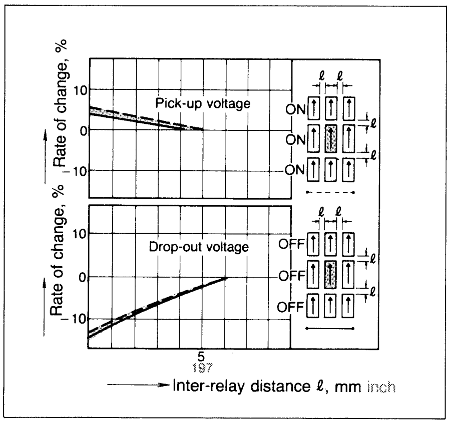
14.-(1) Influence of adjacent mounting



14.-(2) Influence of adjacent mounting

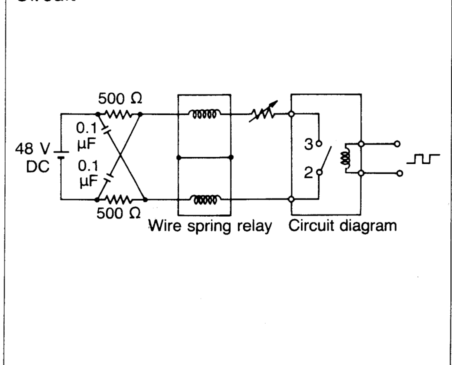


14.-(3) Influence of adjacent mounting

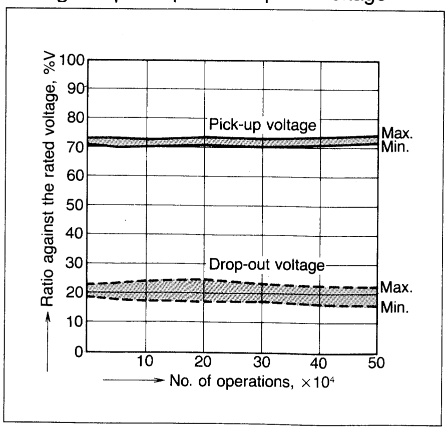


15. Pulse dialing test
Tested sample: TF2-12V
(35 mA 48 V DC wire spring relay load)

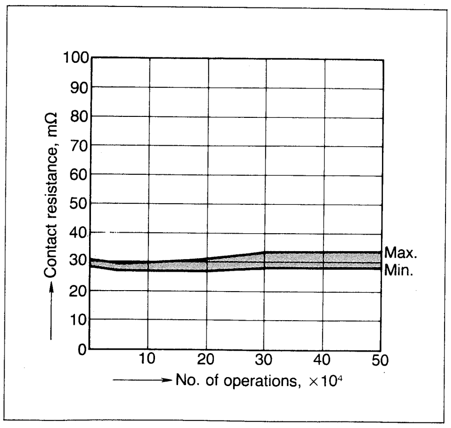
Circuit



Change of pick-up and drop-out voltage



Change of contact resistance



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. External magnetic field

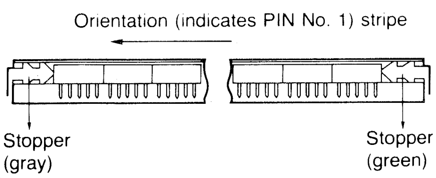
Since TF-relay is highly sensitive polarized relay, its characteristics will be affected by a strong external magnetic field. Avoid using relays under that condition.

4. Cleaning

In automatic cleaning, cleaning with the boiling method is recommended. Avoid ultrasonic cleaning for relays. It is recommended that a fluorinated hydrocarbon or other alcoholic solvent be used. Trichlene and chloroethene can be used for cleaning.

5. Packing direction

Relays are packed in a tube with the orientation stripe (PIN No. 1) toward the gray stopper.



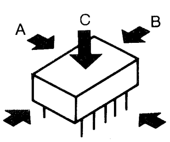
6. Automatic insertion

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

Chucking pressure in the direction A:
500 g or less*

Chucking pressure in the direction B:
1 kg or less

Mounting pressure in the direction C:
1 kg or less



*Avoid chucking the center of the relay

7. Soldering

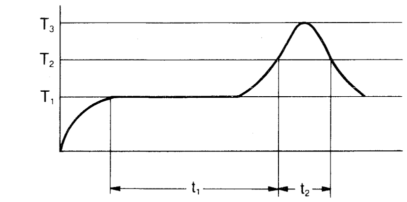
1) Preheat according to the following conditions.

Temperature	100°C 212°F or less
Time	Within 1 minute

When soldering through hole terminals, soldering should be done at 250°C 482°F with 5 sec.

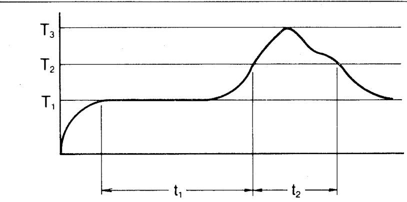
2) When soldering surface-mount terminals, the following conditions are recommended.

(1) IR (Infrared reflow) soldering method



T_1 = 155°C to 165°C 311°F to 329°F t_1 = 120 sec. or less
T_2 = 180°C to 200°C 356°F to 392°F t_2 = 30 sec. or less
T_3 = 245°C 473°F or less

(2) Vapor phase soldering method



T_1 = 90°C to 100°C 194°F to 212°F t_1 = 90 sec. to 120 sec.
T_2 = 180°C to 200°C 356°F to 392°F t_2 = 60 sec. or less
T_3 = 215°C 419°F or less

(3) Soldering iron method

Tip temperature: 280°C to 300°C
536°F to 572°F

Wattage: 30 to 60 W

Soldering time: within 5 sec.

(4) Other soldering methods

Check mounting conditions before using other soldering methods (hot-air, hot plate, pulse heater, etc.).

- The temperature profile indicates the temperature of the soldered terminal on the surface of the PC board. The ambient temperature may increase excessively. Check the temperature under mounting conditions.
- The conditions for the Infrared reflow soldering apply when preheating using the VPS method.

8. Others

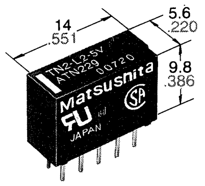
1) If in error the relay has been dropped, the appearance and characteristics should be checked before use without fail.

2) Latching relays are shipped from the factory in the reset state. A shock to the relay during shipping or installation may cause it to change to the set state. Therefore, it is recommended the relay be used in a circuit which initializes the relay to the required state (set or reset) whenever the power is turned on.

NAiS

ULTRA-SLIM
POLARIZED RELAY

TN-RELAYS



mm inch

UL File No.: E43149
CSA File No.: LR26550

- **Ultra-slim size for minimal PC board mounting requirements.**
- **Small header area makes higher density packaging possible.**
- **High sensitivity: 140mW nominal operating power**
- **Surge voltage withstand: 1500V FCC Part 68**
- **Sealed construction allows automatic cleaning.**
- **Self-clinching terminal also available**

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6V DC 1A)			60mΩ
Contact material			Gold-clad silver
Rating (resistive load)	Max. switching power		30W, 62.5VA
	Max. switching voltage		110V DC, 125V AC
	Max. switching current		1A
	Min. switching capability		10μA, 10mV DC
UL/CSA rating			1A 30V DC 0.5A 125V AC 0.3A 110V DC
Expected life (min. operations)	Mechanical (at 180cpm)		10^6
	Electrical (at 20cpm)	1A 30V DC resistive	2×10^5
		0.5A 125V AC resistive	10^5

Characteristics

Max. operating speed		20cpm
Operate time (at nominal voltage)		Approx. 2msec.
Release time (at nominal voltage)		Approx. 1msec.
Set time (latching) (at nominal voltage)		Approx. 2msec.
Reset time (latching) (at nominal voltage)		Approx. 2msec.
Initial breakdown voltage	Between open contacts	750Vrms for 1 min.
	Between contact sets	1,000Vrms for 1 min.
	Between contact and coil	1,000Vrms for 1 min.
FCC surge voltage between open contacts		1,500V
Initial insulation resistance		Min. 1,000MΩ (at 500V DC)
Temperature rise (at nominal voltage)		Max. 50 deg.
Ambient temperature		−40°C to +70°C −40°F to +158°F
Shock resistance	Functional	50G
	Destructive	100G
Vibration resistance	Functional	18G, 10 to 55Hz at double amplitude of 3mm
	Destructive	30G, 10 to 55Hz at double amplitude of 5mm
Unit weight		Approx. 1.5g .053 oz.

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, 24V

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)

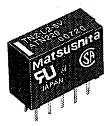
Operating function	Part No.	Nominal voltage, V DC	Pick-up/set voltage, V DC (max.)	Drop-out/reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	TN2-3V	3	2.25	0.3	46.7	64.3	140	4.5
	TN2-4.5V	4.5	3.38	0.45	31.1	145	140	6.7
	TN2-5V	5	3.75	0.5	28.1	178	140	7.5
	TN2-6V	6	4.5	0.6	23.3	257	140	9
	TN2-9V	9	6.75	0.9	15.5	579	140	13.5
	TN2-12V	12	9	1.2	11.7	1,028	140	18
	TN2-24V	24	18	2.4	8.3	2,880	200	36
1 coil latching	TN2-L-3V	3	2.25	2.25	33.3	90	100	4.5
	TN2-L-4.5V	4.5	3.38	3.38	22.2	203	100	6.7
	TN2-L-5V	5	3.75	3.75	20	250	100	7.5
	TN2-L-6V	6	4.5	4.5	16.7	360	100	9
	TN2-L-9V	9	6.75	6.75	11.1	810	100	13.5
	TN2-L-12V	12	9	9	8.3	1,440	100	18
	TN2-L-24V	24	18	18	6.3	3,840	150	36
2 coil latching	TN2-L2-3V	3	2.25	2.25	66.7	45	200	4.5
	TN2-L2-4.5V	4.5	3.38	3.38	44.4	101	200	6.7
	TN2-L2-5V	5	3.75	3.75	40	125	200	7.5
	TN2-L2-6V	6	4.5	4.5	33.3	180	200	9
	TN2-L2-9V	9	6.75	6.75	22.2	405	200	13.5
	TN2-L2-12V	12	9	9	16.7	720	200	18
	TN2-L2-24V	24	18	18	12.5	1,920	300	28.8

Notes: 1. Please add "H" for self-clinching terminal types as TN2-L-H-12V.
2. Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
3. Standard packing: Tube:50pcs Case:1,000pcs

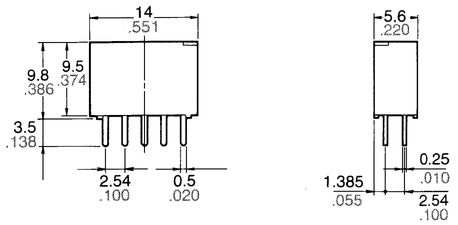
DIMENSIONS

mm inch

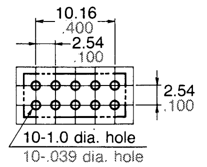
2C



Standard PC board terminal

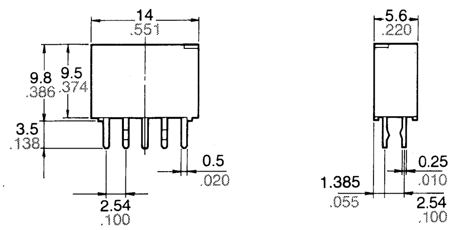


PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

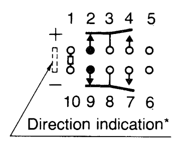
Self-clinching terminal



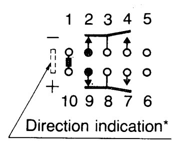
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

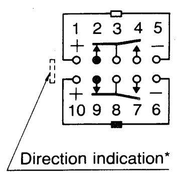
- Single side stable (Deenergized condition)



- 1-coil latching (Reset condition)



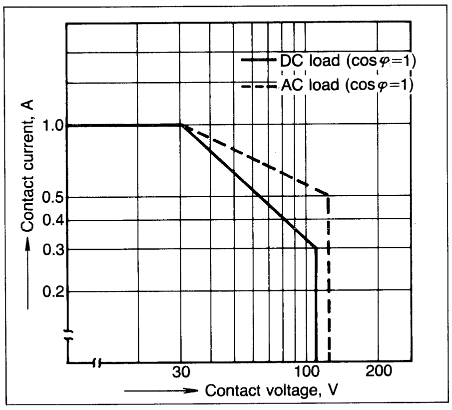
- 2-coil latching (Reset condition)



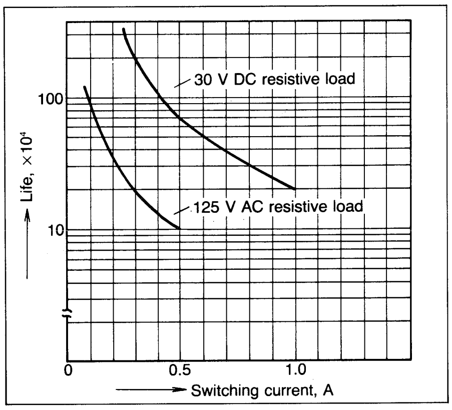
*Orientation stripe located on top of relay

DATA

1. Maximum switching power

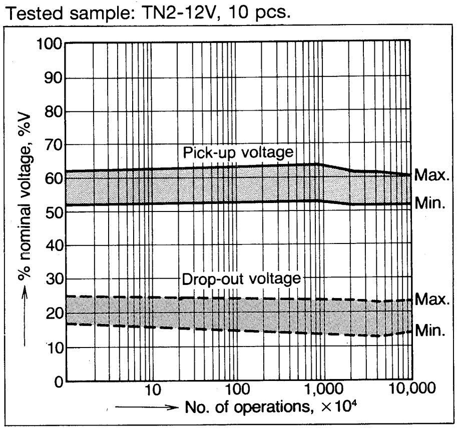


2. Life curve



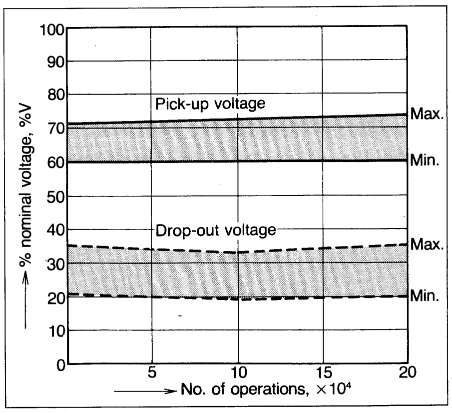
3. Mechanical life

Tested sample: TN2-12V, 10 pcs.



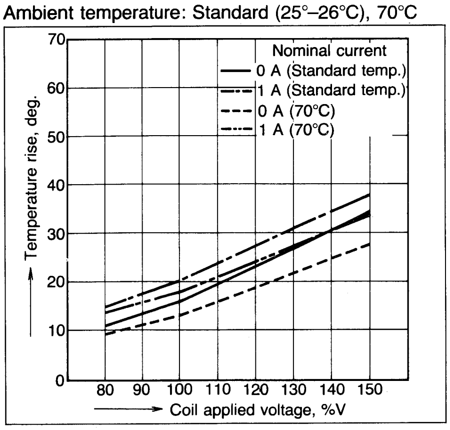
4. Eelectrical life

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



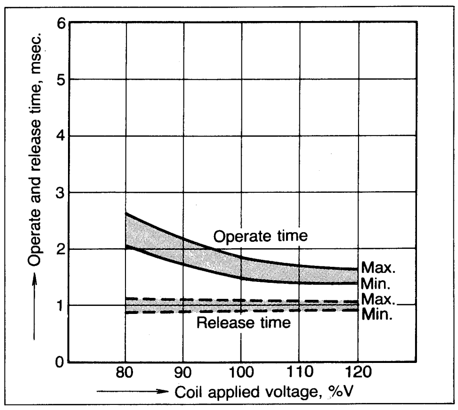
5. Coil temperature rise

Sample: TN2-12V
Point measured: Inside the coil
Ambient temperature: Standard (25°–26°C), 70°C



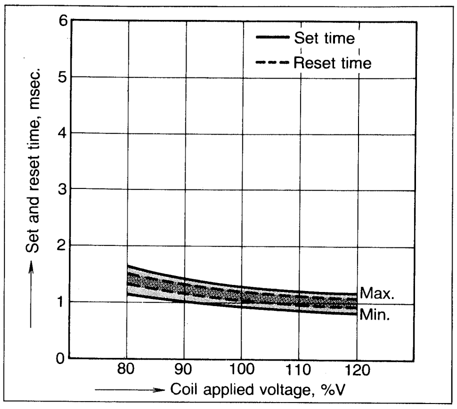
6. Operate and release time

Sample: TN2-12V, 5 pcs.



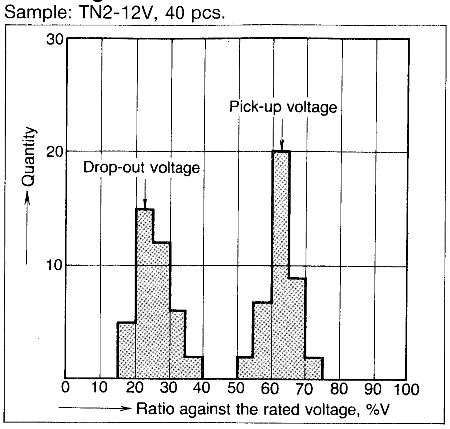
7. Set and reset time

Sample: TN2-L2-12V, 5 pcs.



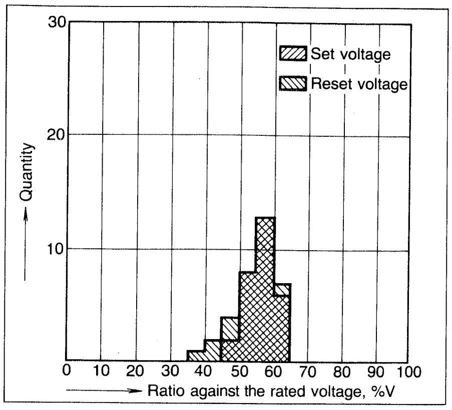
8. Distribution of pick-up and drop-out voltages

Sample: TN2-12V, 40 pcs.



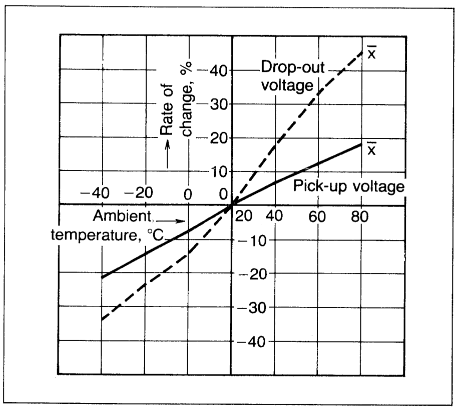
9. Distribution of set and reset voltage

Sample: TN2-L2-12V, 32 pcs.



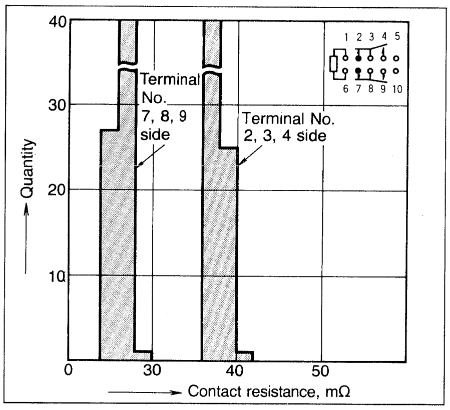
10. Ambient temperature characteristics

Sample: TN2-12V, 5 pcs.



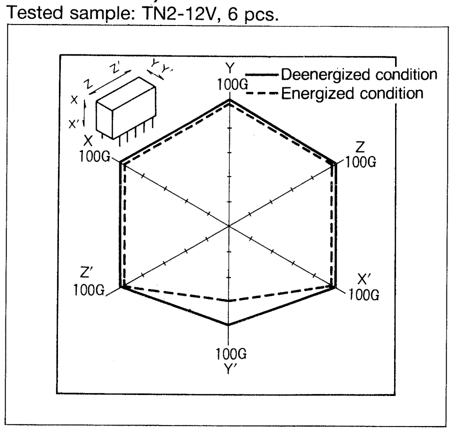
11. Distribution of contact resistance

Sample: TN2-12V, 38 pcs.



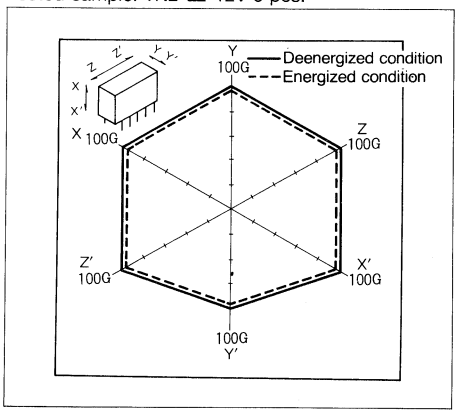
12-(1). Malfunctional shock (single side stable)

Tested sample: TN2-12V, 6 pcs.

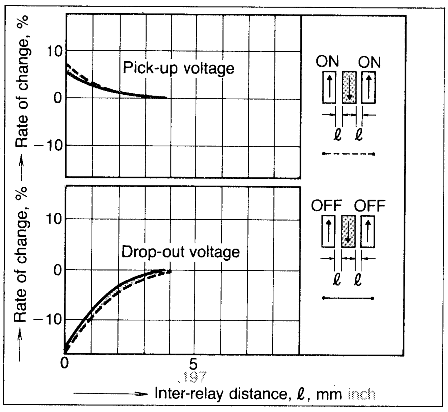


12-(2). Malfunctional shock (latching)

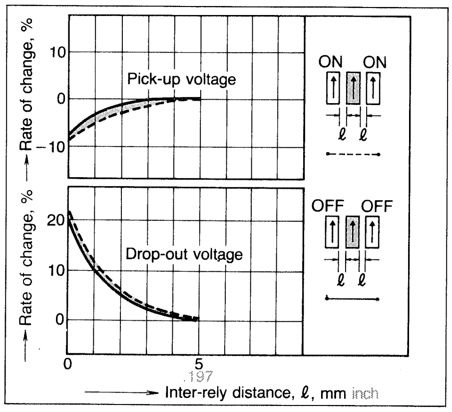
Tested sample: TN2-L2-12V 6 pcs.



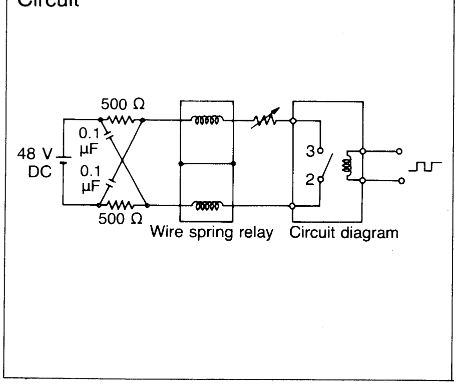
13-(1). Influence of adjacent mounting



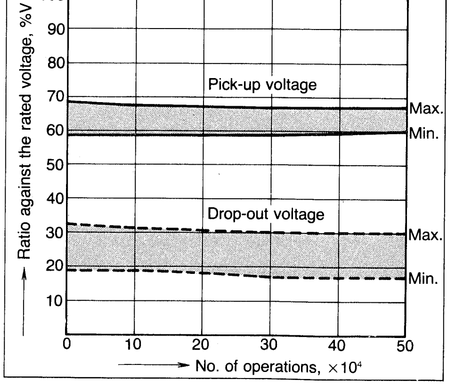
13-(2). Influence of adjacent mounting



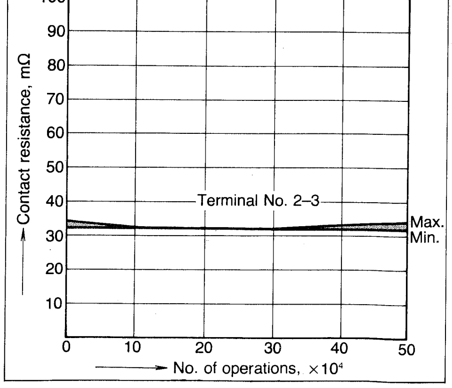
14. Pulse dialing test (35 mA 48 V DC wire spring relay load)



Change of pick-up and drop-out voltage



Change of contact resistance



NOTES

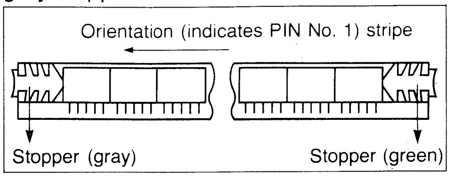
1. Coil operating power
Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%. However, check it with the actual circuit since the characteristics may be slightly different.

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

3. External magnetic field
Since **TN-relay** is highly sensitive polarized relay, its characteristics will be affected by a strong external magnetic field. Avoid using relays under that condition.

4. Cleaning
In automatic cleaning, cleaning with the boiling method is recommended. Avoid ultrasonic cleaning for relays. It is recommended that a fluorinated hydrocarbon or other alcoholic solvents be used. Trichlene and chloroethene can be used for cleaning.

5. Packing direction
Relays are packed in a tube with the orientation stripe (PIN No. 1) toward the gray stopper.

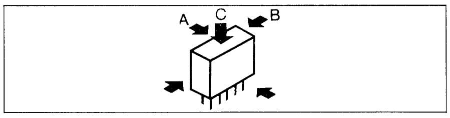


6. Automatic insertion
To maintain the internal function of the relay, the chucking pressure should not exceed the values below.

Chucking pressure in the direction A:
500 g or less*

Chucking pressure in the direction B:
1 kg or less

Mounting pressure in the direction C:
1 kg or less



*Avoid chucking the center of the relay

7. Soldering
Preheat according to the following conditions.

Temperature	100°C 212°F or less
Time	Within 1 minute

Soldering should be done at 250°C 482°F within 5 sec.

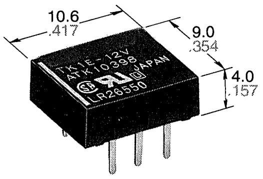
8. Others
1) If in error the relay has been dropped, the appearance and characteristics should be checked before use without fail.

2) Latching relays are shipped from the factory in the reset state. A shock to the relay during shipping or installation may cause it to change to the set state. Therefore, it is recommended the relay be used in a circuit which initializes the relay to the required state (set or reset) whenever the power is turned on.

NAiS

ULTRA LOW PROFILE 2 AMP. POLARIZED RELAY

TK-RELAYS



mm inch

UL File No.: E43149
CSA File No.: LR26550

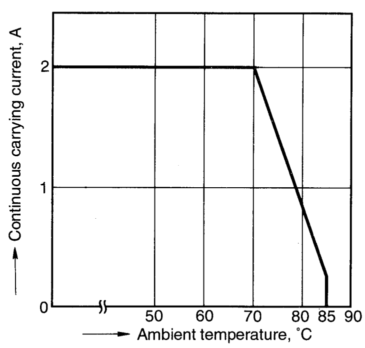
- **Low profile 4 mm .157 inch height**
- **High contact capacity: 2 A**
- **Surge withstand voltage between contact and coil: 2,500 V**

SPECIFICATION

Contact

Arrangement			1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			50 mΩ
Contact material			Gold-clad silver nickel
Rating (Resistive load)	Max. switching power		60 W
	Max. switching voltage		220 V DC
	Max. switching current		2 A
UL/CSA rating			2 A 30 V DC 0.5 A 125 V AC 0.5 A 110 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

*Maximum value of continuous carrying current
Test conditions:
Coil applied voltage: 110% of rated voltage
Continuous carrying time: 1,000 hours



Characteristics

Max. operating speed (at rated load)		20 cpm
Operate time (at nominal voltage)		Approx. 1.5 msec.
Release time (at nominal voltage)		Approx. 1 msec.
Set time (latching) (at nominal voltage)		Approx. 1 msec.
Reset time (latching) (at nominal voltage)		Approx. 1 msec.
Initial breakdown voltage	Between open contacts	750 Vrms for 1 min.
	Between contact and coil	1,500 Vrms for 1 min.
FCC surge voltage between open contacts (10×160 μsec)		1,500 V
Surge voltage between contacts and coil (2×10 μsec)		2,500 V
Initial insulation resistance		Min. 1,000 MΩ (at 500 V DC)
Temperature rise (at nominal voltage)		Max. 50 deg.
Ambient temperature*		–40°C to +85°C –40°F to +185°F
Shock resistancve	Functional	Min. 75 G
	Destructive	Min. 100 G
Vibration resistance	Functional	20 G, 10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	30 G, 10 to 55 Hz at double amplitude of 5 mm
Unit Weight		Approx. 1 g .035 oz

*The maximum ambient temperature allows for coil temperature rise at maximum allowable coil voltage.
As for the applicable range of continuous carrying current against ambient temperature, please refer to "Maximum value of continuous carrying current" chart.

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, 24 V

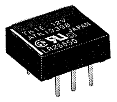
TYPES AND COIL DATA (at 20°C 68°F)

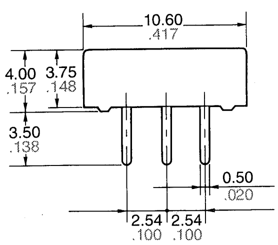
Operating function	Part No.	Nominal voltage, V DC (max.)	Pick-up/set voltage	Drop-out/reset voltage, V DC	Nominal Operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	TK1-1.5V	1.5	1.125	0.15	93.8	16	140	2.25
	TK1-3V	3	2.25	0.3	46.7	64.3	140	4.5
	TK1-4.5V	4.5	3.38	0.45	31.1	145	140	6.7
	TK1-5V	5	3.75	0.5	28.1	178	140	7.5
	TK1-6V	6	4.5	0.6	23.3	257	140	9
	TK1-9V	9	6.75	0.9	15.5	579	140	13.5
	TK1-12V	12	9	1.2	11.7	1,028	140	18
	TK1-24V	24	18	2.4	11.3	2,133	270	28.8
1 coil latching	TK1-L-1.5V	1.5	1.125	1.125	66.7	22.5	100	2.25
	TK1-L-3V	3	2.25	2.25	33.3	90	100	4.5
	TK1-L-4.5V	4.5	3.38	3.38	22.2	202.5	100	6.7
	TK1-L-5V	5	3.75	3.75	20	250	100	7.5
	TK1-L-6V	6	4.5	4.5	16.7	360	100	9
	TK1-L-9V	9	6.75	6.75	11.1	810	100	13.5
	TK1-L-12V	12	9	9	8.3	1,440	100	18
	TK1-L-24V	24	18	18	6.3	3,840	150	28.8
2 coil latching	TK1-L2-1.5V	1.5	1.125	1.125	133.9	11.2	200	2.25
	TK1-L2-3V	3	2.25	2.25	66.7	45	200	4.5
	TK1-L2-4.5V	4.5	3.38	3.38	44.4	101.2	200	6.7
	TK1-L2-5V	5	3.75	3.75	40	125	200	7.5
	TK1-L2-6V	6	4.5	4.5	33.3	180	200	9
	TK1-L2-9V	9	6.75	6.75	22.2	405	200	13.5
	TK1-L2-12V	12	9	9	20.8	576	250	14.4
	TK1-L2-24V	24	18	18	16.7	1,440	400	26.4

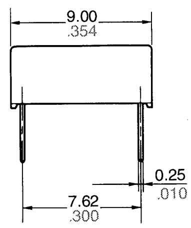
Notes: 1. Please add "H" for self-clinching terminal types as TK1-L-H-12V.
2. Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
3. Standard packing: Tube: 50 pcs. Case: 1,000 pcs.

DIMENSIONS

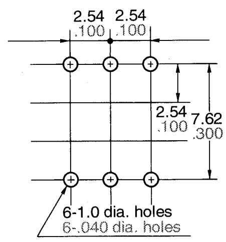
mm inch







PC board pattern
(Copper-side view)

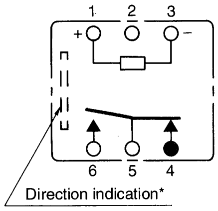


General tolerance: ±0.3 ±.012

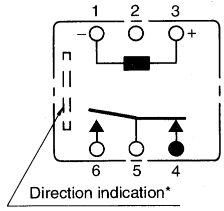
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

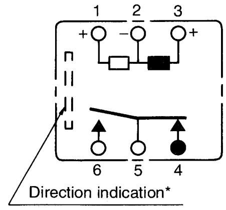
- Single side stable
  (Deenergized condition)



- 1 coil latching
  (Reset condition)



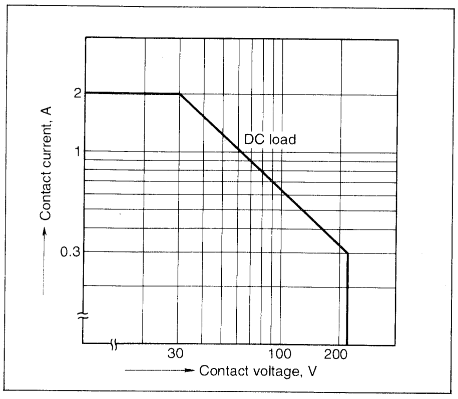
- 2 coil latching
  (reset condition)



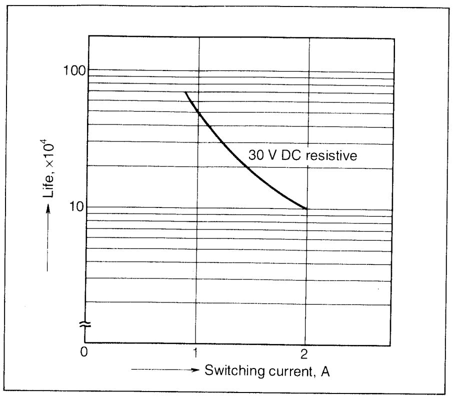
*Orientation stripe located on top of relay

DATA

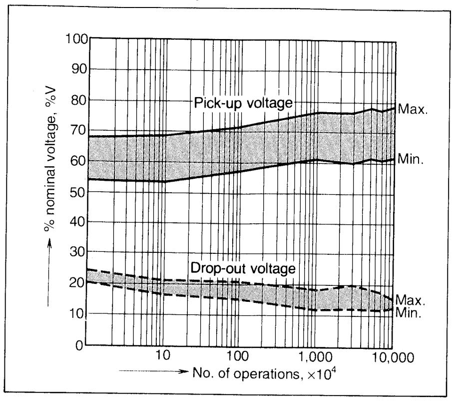
1. Maximum switching power



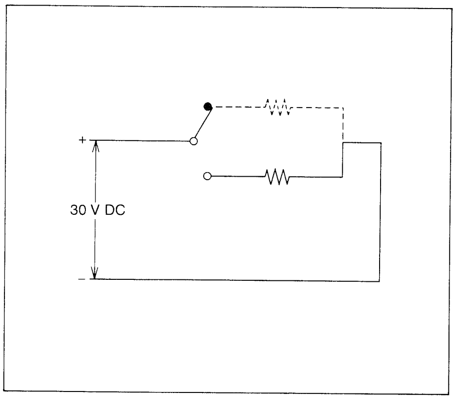
2. Life curve



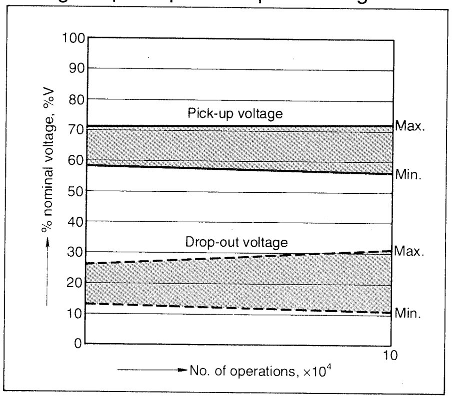
3. Mechanical life
Tested sample: TK1-12V, 8 pcs.
Switching frequency: 30 Hz



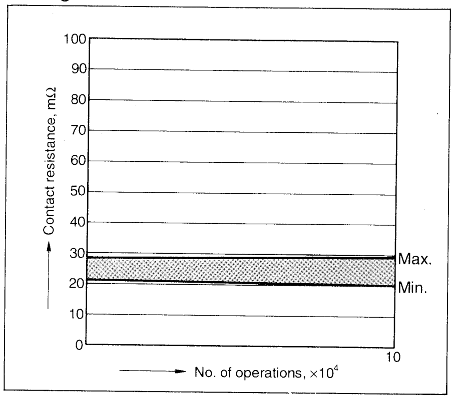
4. Electrical life
Tested sample: TK1-12V, 10 pcs.
Condition: 2 A 30 V DC resistive load, 20 cpm
Circuit:



Change of pick-up and drop-out voltage

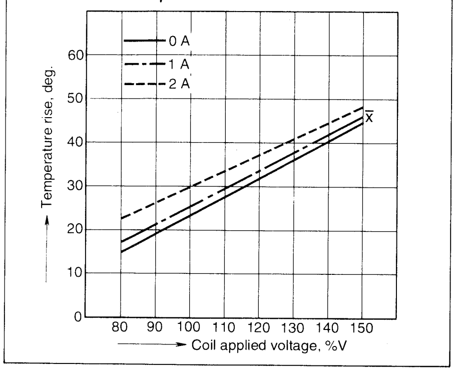


Change of contact resistance

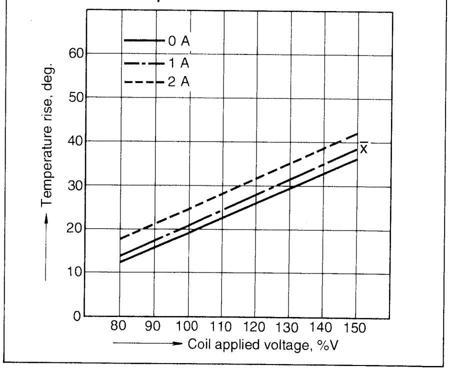


5. Coil temperature rise
Tested sample: TK1-12V, 6 pcs.
Measured portion Inside the coil
Carrying current: 0 A, 1 A, 2 A

Ambient temperature: 25°C 77°F

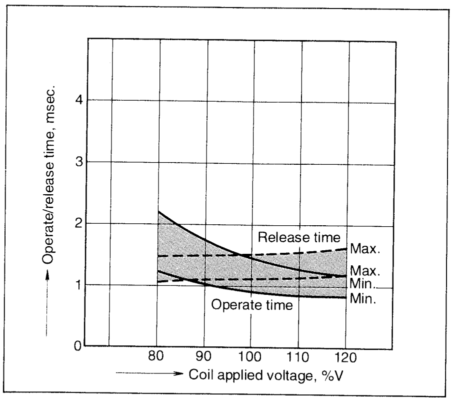


Ambient temperature: 70°C 158°F

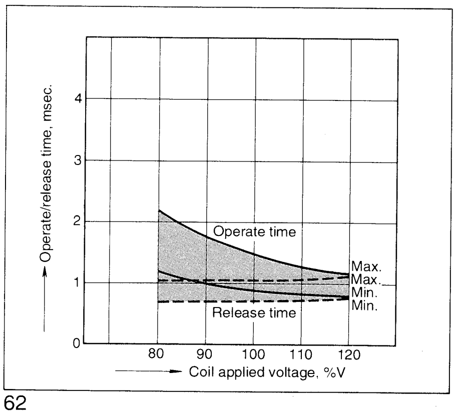


6. Operate/release time characteristics
Tested sample: TK1-5V, 50 pcs.

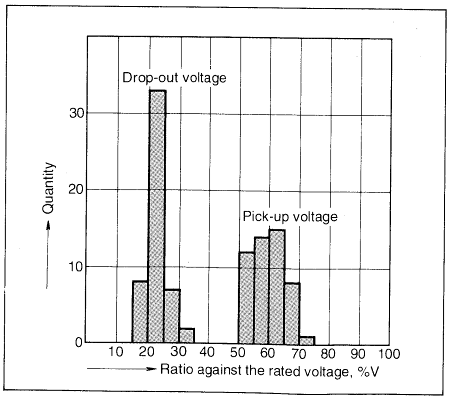
<With diode>



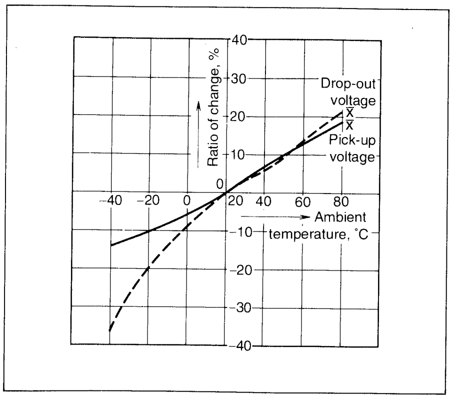
<Without diode>



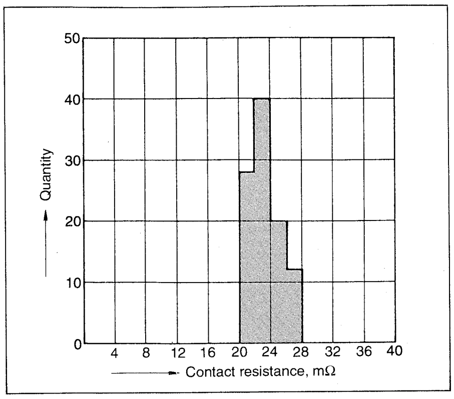
7. Distribution of pick-up and drop-out voltage
Tested sample: TK1-5V, 50 pcs.



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

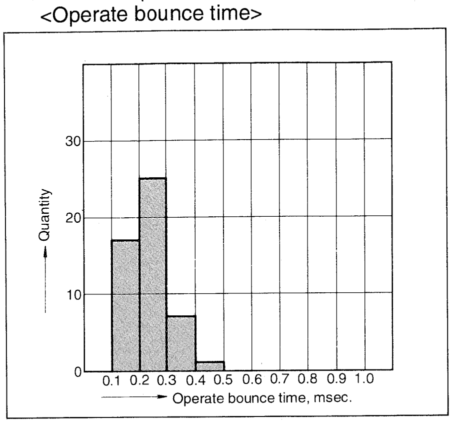


9. Distribution of contact resistance
Tested sample: TK1-5V, 100 pcs.

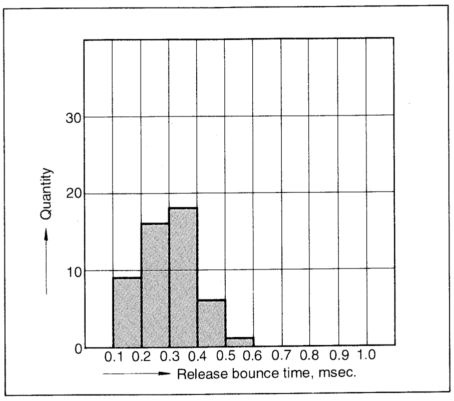


10. Distribution of operate/release bounce time
Tested sample: TK1-5V, 50 pcs.

<Operate bounce time>



<Release bounce time>



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. External magnetic field

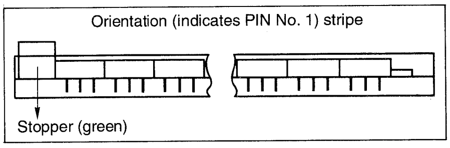
Since TK-relay is highly sensitive polarized relay, its characteristics will be affected by a strong external magnetic field. Avoid using relays under that condition.

4. Cleaning

In automatic cleaning, cleaning with the boiling method is recommended. Avoid ultrasonic cleaning for relays. It is recommended that a fluorinated hydrocarbon or other alcoholic solvents be used. Trichlene and chloroethene can be used for cleaning.

5. Packing direction

Relays are packed in a tube with the orientation stripe (PIN No. 1) toward the green stopper.



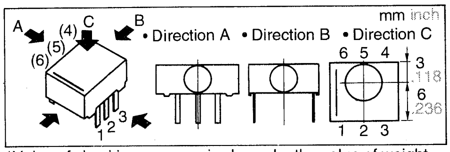
6. Automatic insertion

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

Chucking pressure* in the direction A:
1 kg or less

Chucking pressure* in the direction B:
3 kg or less

Chucking pressure* in the direction C:
1 kg or less



*Value of chucking pressure is shown by the value of weight pressed on the portion (4 mm dia.)

7. Soldering

Preheat according to the following conditions.

Temperature	100°C 212°F or less
Time	Within 1 minute

Soldering should be done at 250°C 482°F within 5 sec.

8. Others

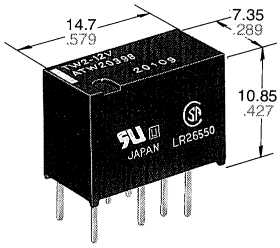
1) If in error the relay has been dropped, the appearance and characteristics should be checked before use without fail.

2) Latching relays are shipped from the factory in the reset state. A shock to the relay during shipping or installation may cause it to change to the set state. Therefore, it is recommended the relay be used in a circuit which initializes the relay to the required state (set or reset) whenever the power is turned on.

NAiS

ULTRA SMALL 2 AMP. POLARIZED RELAY WITH 2,500 V SURGE VOLTAGE

TW-RELAYS



mm inch

UL File No.: E43149
CSA File No. LR26550

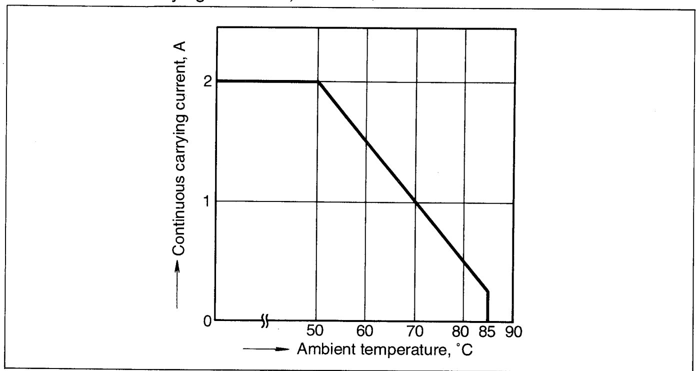
- **Surge withstand between contacts and coil: 2,500 V**
- **Current surge interrupt: 4.2 A 700 V AC**
- **High contact capacity: 2 A 30 V DC**

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			60 mΩ
Contact material			Gold-clad silver nickel
Rating (resistive load)	Max. switching power		60 W, 62.5 VA
	Max. switching voltage		220 V DC, 250 V AC
	Max. switching current		2 A
UL/CSA rating			2 A 30 V DC 0.5 A 125 V AC 0.3 A 110 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
		0.5 A 125 V AC resistive	10^5

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



Characteristics

Max. operating speed (at rated load)			20 cpm
Operate time (at nominal voltage)			Approx. 2 msec.
Release time (at nominal voltage)			Approx. 1 msec.
Set time (latching) (at nominal voltage)			Approx. 2 msec.
Reset time (latching) (at nominal voltage)			Approx. 2 msec.
Initial breakdown voltage	Between open contacts		1,000 Vrms for 1 min.
	Between contact sets		1,000 Vrms for 1 min.
	Between contact and coil		1,800 Vrms for 1 min.
Surge voltage	Between open contacts (10×160 μsec)		1,500 V FCC
	Between contacts and coil (2×10 μsec)		2,500 V
Current surge capacity (See Note)			4.2 A 700 V AC
Initial insulation resistance			Min. 1,000 MΩ (at 500 V DC)
Temperature rise (at nominal voltage)			Max. 50 deg.
Ambient temperature*			–40°C to +85°C –40°F to +185°F
Shock resistance		Functional	75 G
		Destructive	100 G
Vibration resistance		Functional	20 G, 10 to 55 Hz at double amplitude of 3.3 mm
		Destructive	30 G, 10 to 55 Hz at double amplitude of 5 mm
Unit weight			Approx. 2 g .071 oz

*The maximum ambient temperature allows for coil temperature rise at maximum allowable coil voltage.
As for the applicable range of continuous carrying current against ambient temperature, please refer to "Maximum value of continuous carrying current" chart.
Note: The contacts can interrupt a 4.2 A 700 V AC load four times, with 2 interruptions within the positive phase angle, and 2 interruptions within the negative phase angles of a sine wave form.

ORDERING INFORMATION

Ex. TW [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

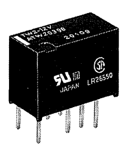
TYPES AND COIL DATA (at 20°C 68°F)

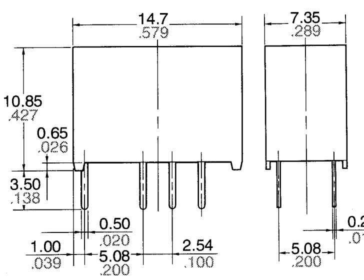
Operating function	Part No.	Nominal voltage, V DC	Pick-up/set voltage, V DC (max.)	Drop-out/reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	TW2-3V	3	2.25	0.3	46.7	64.3	140	4.5
	TW2-4.5V	4.5	3.38	0.45	31.1	145	140	6.7
	TW2-5V	5	3.75	0.5	28.1	178	140	7.5
	TW2-6V	6	4.5	0.6	23.3	257	140	9
	TW2-9V	9	6.75	0.9	15.5	579	140	13.5
	TW2-12V	12	9	1.2	11.7	1,028	140	18
	TW2-24V	24	18	2.4	8.3	2,880	200	36
	TW2-48V	48	36	4.8	5.42	8,860	260	57.6
1 coil latching	TW2-L-3V	3	2.25	2.25	33.3	90	100	4.5
	TW2-L-4.5V	4.5	3.38	3.38	22.2	202.5	100	6.7
	TW2-L-5V	5	3.75	3.75	20	250	100	7.5
	TW2-L-6V	6	4.5	4.5	16.7	360	100	9
	TW2-L-9V	9	6.75	6.75	11.1	810	100	13.5
	TW2-L-12V	12	9	9	8.3	1,440	100	18
	TW2-L-24V	24	18	18	4.17	5,760	100	36
2 coil latching	TW2-L2-3V	3	2.25	2.25	66.7	45	200	4.5
	TW2-L2-4.5V	4.5	3.38	3.38	44.5	101.2	200	6.7
	TW2-L2-5V	5	3.75	3.75	40	125	200	7.5
	TW2-L2-6V	6	4.5	4.5	33.3	180	200	9
	TW2-L2-9V	9	6.75	6.75	22.2	405	200	13.5
	TW2-L2-12V	12	9	9	16.7	720	200	18
	TW2-L2-24V	24	18	18	8.3	2,880	200	28.8

Notes: 1. Please add "H" for self-clinching type as TW2-H-12V.
2. Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
3. Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.

DIMENSIONS

mm inch

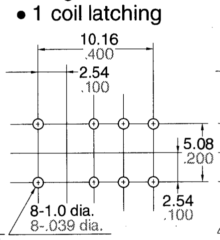




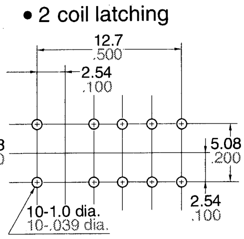
General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)

- Single side stable
- 1 coil latching



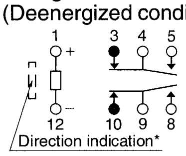
- 2 coil latching



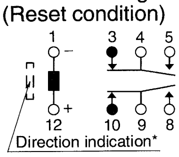
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

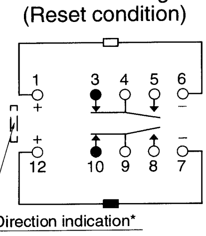
- Single side stable (Deenergized condition)



- 1 coil latching (Reset condition)



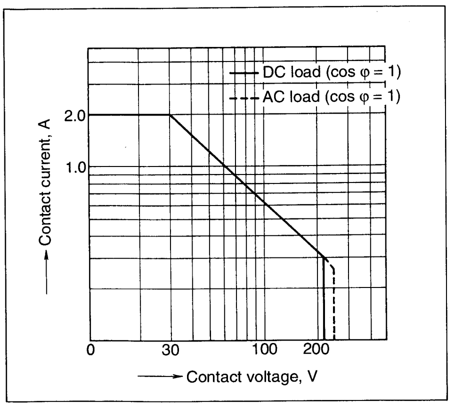
- 2 coil latching (Reset condition)



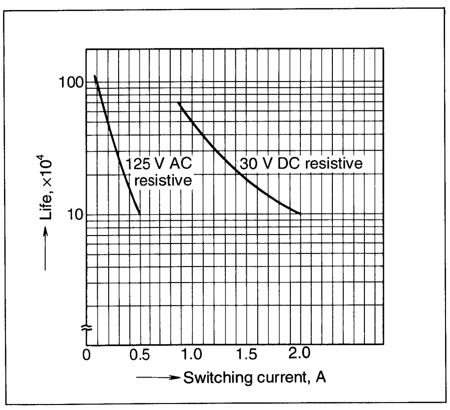
*Orientation stripe located on top of relay.

DATA

1. Maximum switching power

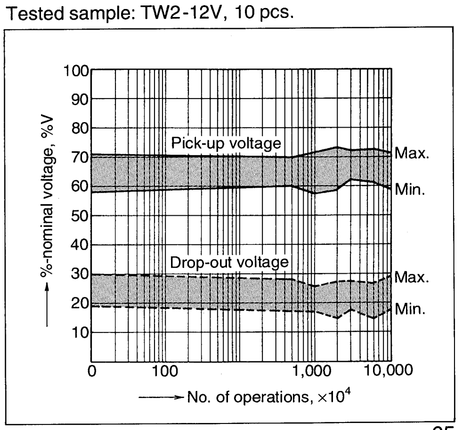


2. Life curve

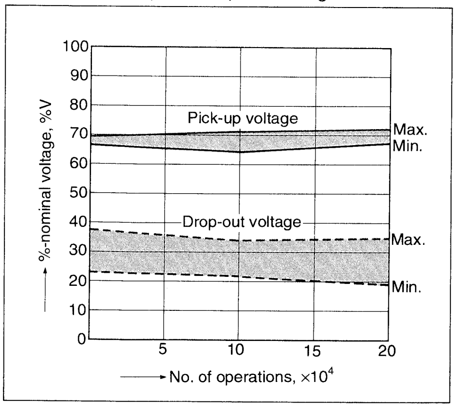


3. Mechanical life

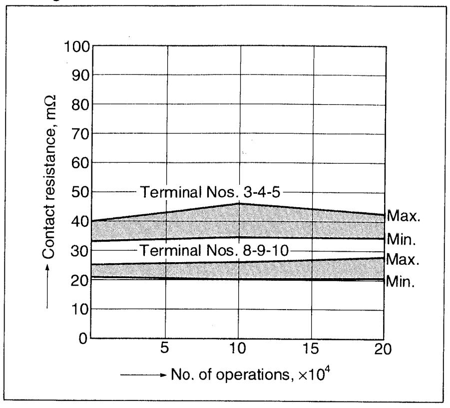
Tested sample: TW2-12V, 10 pcs.



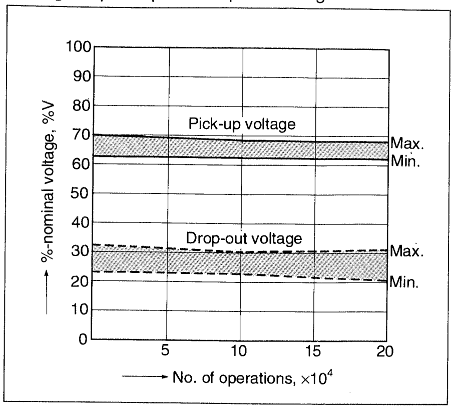
4-(1). Electrical life
Tested sample: TW2-12V, 6 pcs.
Condition: 2 A 30 V DC resistive load, 20 cpm
Change of pick-up and drop-out voltage



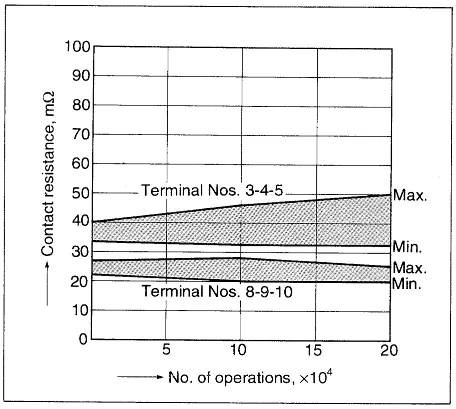
4-(1). Electrical life
Tested sample: TW2-12V, 6 pcs.
Condition: 2 A 30 V DC resistive load, 20 cpm
Change of contact resistance



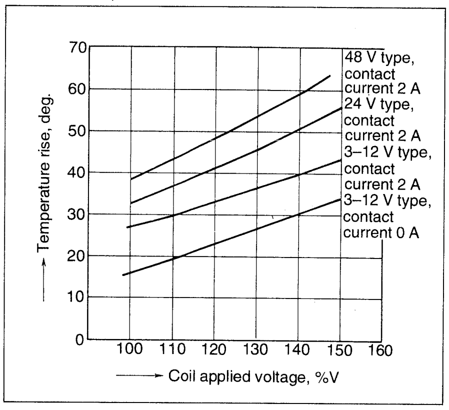
4-(2). Electrical life
Tested sample: TW2-12V, 6 pcs.
Condition: 0.5 A 125 V AC resistive load, 20 cpm
Change of pick-up and drop-out voltage



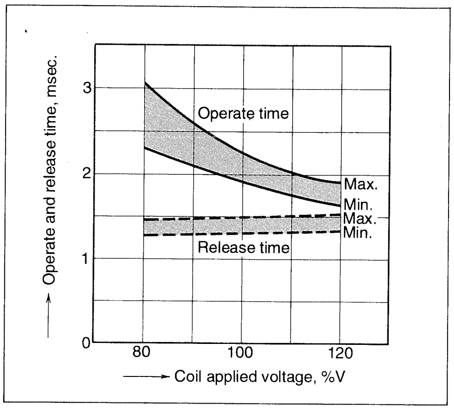
4-(2). Electrical life
Tested sample: TW2-12V, 6 pcs.
Condition: 0.5 A 125 V AC resistive load, 20 cpm
Change of contact resistance



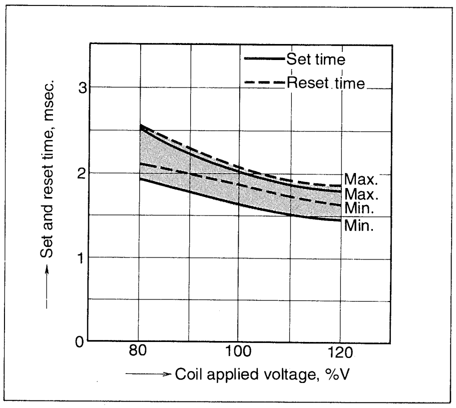
5. Coil temperature rise
Sample: TW2-xxV
Point measured: Inside the coil
Ambient temperature: 22˚C



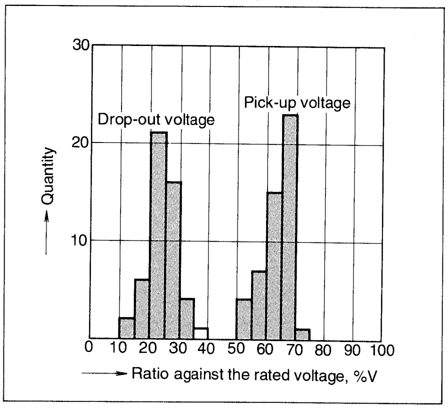
6. Operate and release time
Sample: TW2-12V, 5 pcs.



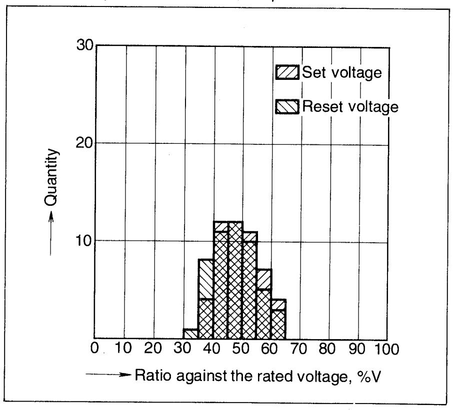
7. Set and reset time
Sample: TW2-L-12V, 5 pcs.



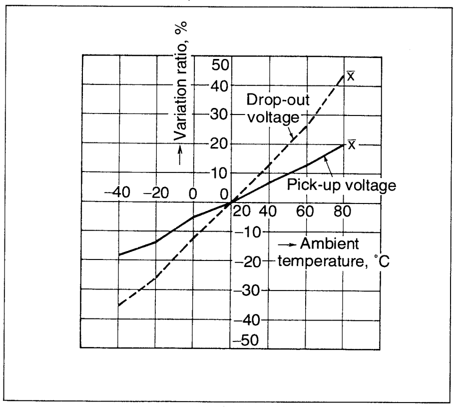
8. Distribution of pick-up and drop-out voltage
Tested sample: TW2-12V, 50 pcs.



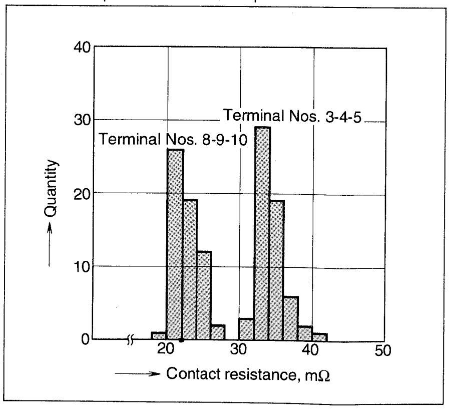
9. Distribution of set and reset voltage
Tested sample: TW2-L-12V, 50 pcs.



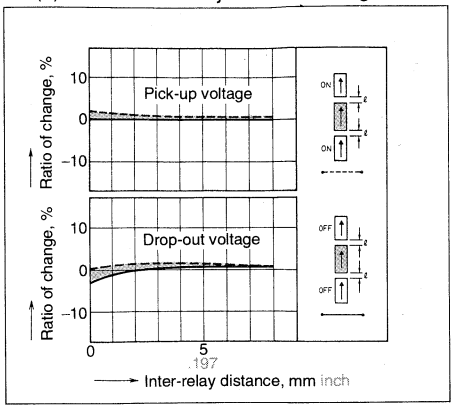
10. Ambient temperature characteristics
Sample: TW2-12V, 5 pcs.



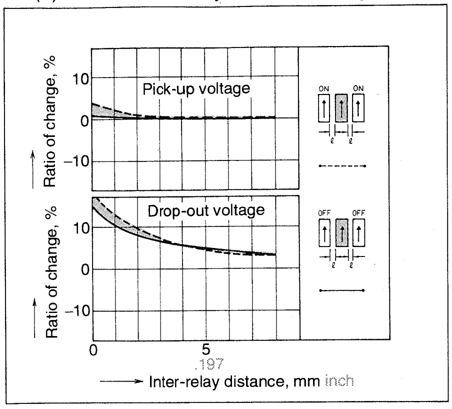
11. Distribution of contact resistance
Tested sample: TW2-12V, 30 pcs.



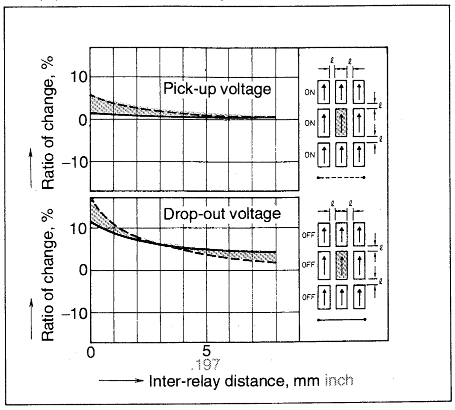
12-(1). Influence of adjacent mounting



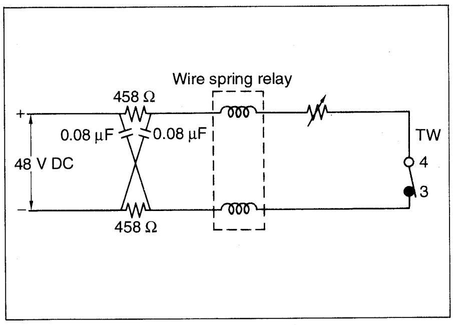
12-(2). Influence of adjacent mounting



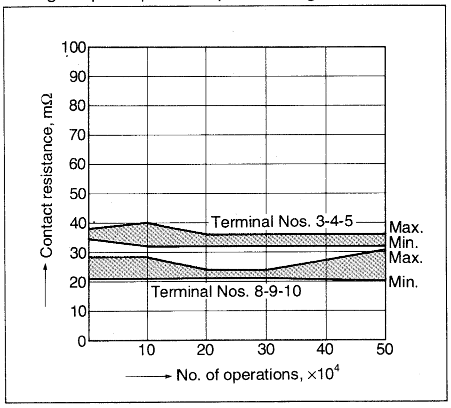
12-(3). Influence of adjacent mounting



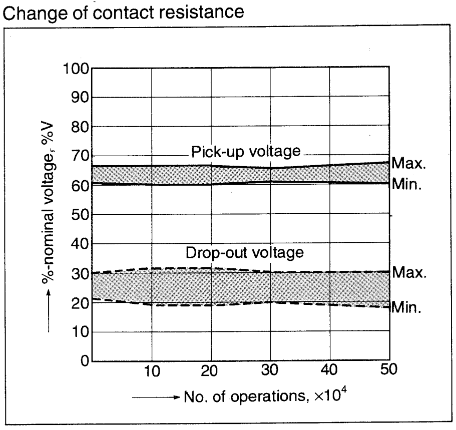
13. Pulse dialing test
(35 mA 48 V DC wire spring relay load)
(Reverse voltage: 192 V)
Tested sample: TW2-12V, 6 pcs.
Switching frequency: 1 Hz
Circuit:



Change of pick-up and drop-out voltage



Change of contact resistance



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. External magnetic field

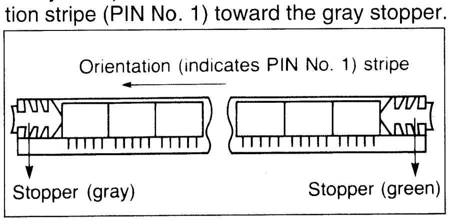
Since TW-relay is highly sensitive polarized relay, its characteristics will be affected by a strong external magnetic field. Avoid using relays under that condition.

4. Cleaning

In automatic cleaning, cleaning with the boiling method is recommended. Avoid ultrasonic cleaning for relays. It is recommended that a fluorinated hydrocarbon or other alcoholic solvents be used. Trichlene and chloroethene can be used for cleaning.

5. Packing direction

Relays are packed in a tube with tghe orientation stripe (PIN No. 1) toward the gray stopper.



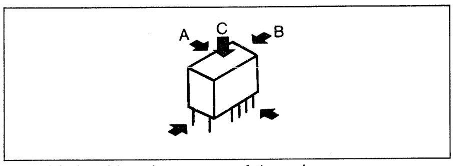
6. Automatic insertion

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

Chucking pressure in the direction A:
500 g or less*

Chucking pressure in the direction B:
1 kg or less

Mounting pressure in the direction C:
1 kg or less



*Avoid chucking the center of the relay

7. Soldering

Soldering should be done at 250°C 482°F within 5 sec.

8. Others

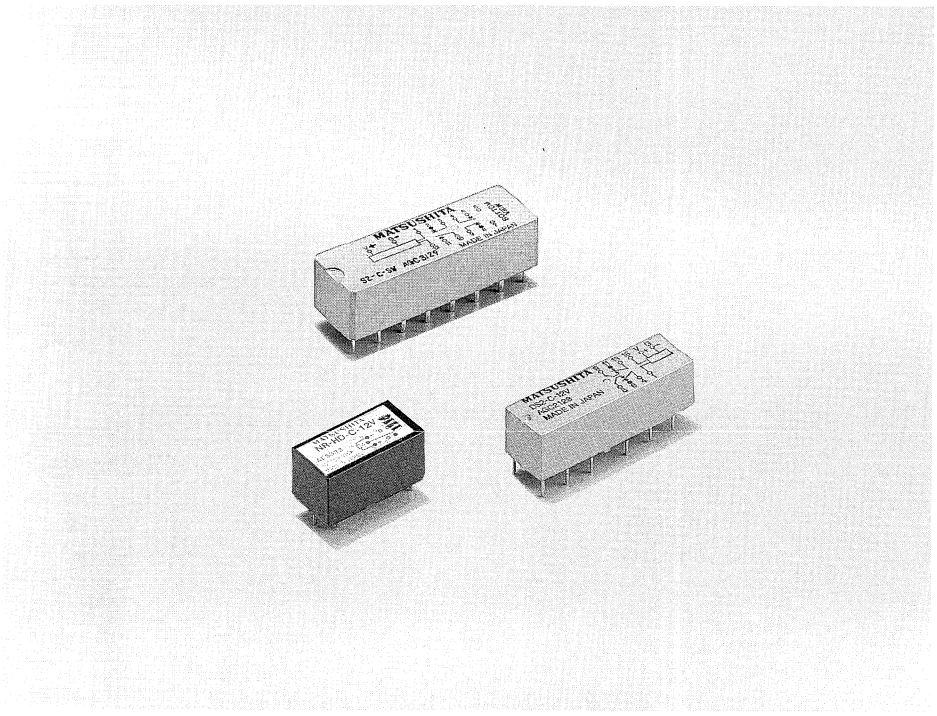
1) If in error the relay has been dropped, the appearance and characteristics should be checked before use without fail.

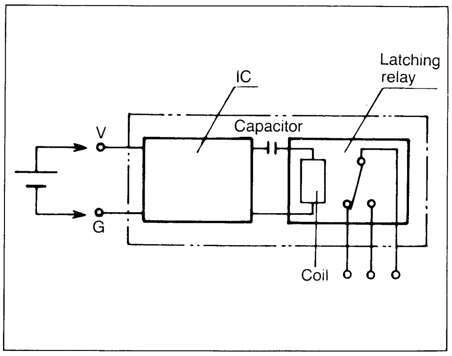
2) Latching relays are shipped from the factory in the reset state. A shock to the relay during shipping or installation may cause it to change to the set state. Therefore, it is recommended the relay be used in a circuit which initializes the relay to the required state (set or reset) whenever the power is turned on.

IC Relay

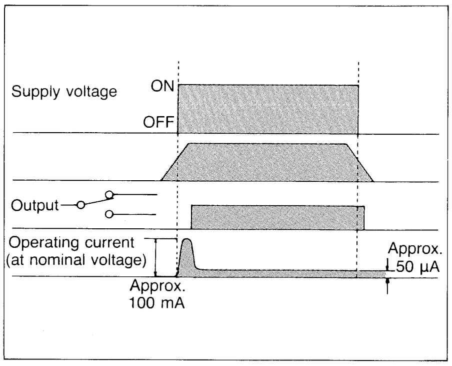
IC relay is a completely new product in which an exclusive IC is incorporated.
Two series lines are available, C unit relays and C3 relays.

C-Unit Relays suitable for energy saving application, especially battery devices.





• Time chart



1. Ultra low operating power: (1/450 compared with polarized non-latching relays)
Since C Unit relays utilize the charge and discharge of a capacitor, the coil current at steady-state is extremely low. The operating power is 1/450 when compared with polarized non-latching relays: In applications of battery devices, battery life is extended. Further the DC power source can be minimized and power failure can be compensated for easily.

2. Little heat generation at coil
Because only momentary current flows, heat generation from coil is very low. This makes low thermal electromotive force possible.

3. Wider operating voltage range
C Unit relays are suitable for use in electronic circuitry incorporating multiple power sources or use subject to wide fluctuation of line voltage.

4. High speed operation
The operation time of C Unit relays is shorter than single-side-stable relays.

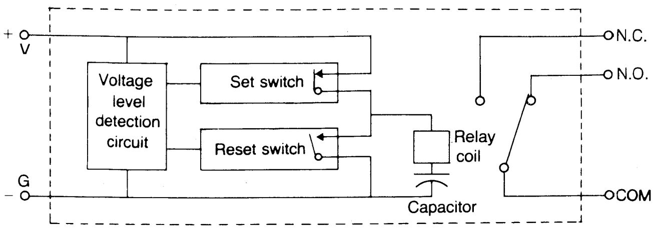
Type	Basic relay (Single-side-stable)	C Unit Relay
NR	1 msec.	0.5 msec.
DS	3 msec.	2 msec.
S	8 msec.	4 msec.

5. No counter electromotive force from the coil
Since C Unit relays utilize the charge and discharge of capacitor, counter electromotive force is not generated at the coil.
Therefore, a parallel connection of a diode to the relay coil is not necessary.

6. Easy handling
C Unit relay can be handled same as single-side-stable relays because of their 2-wire system.

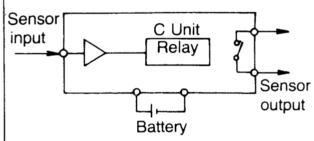
When V and G terminals are connected to a power source and to ground respectively and voltage is applied at certain rate of voltage rise, the C Unit relay is operated by the charging current of an internal capacity and the contact is switched. When the capacitor is charged enough, the current becomes very low, just leakage current. But contacts remain unchanged because of the magnetic force of permanent magnet.
Therefore, only low operating current is consumed. Then, when input voltage is lower than drop-out voltage, the capacitor starts discharging and the contacts return.

• Block diagram of C Unit Relays



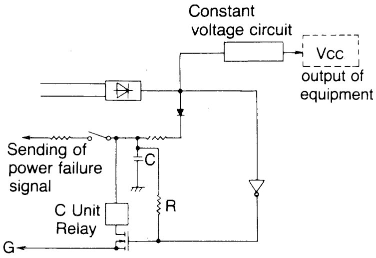
• Application

1. Output relays of sensors



C-Unit relays can be used as the output relays of sensors that are mounted far from control panels.

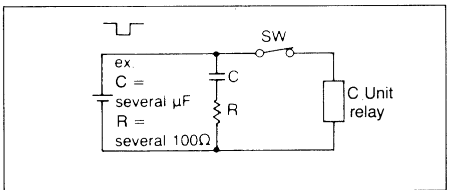
2. Power failure detection circuit



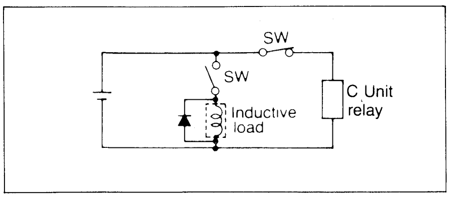
This is the circuit sending power failure signal continuously for a certain period after power failure occurs. When power failure occurs, the contact of C Unit relays closes and latches until the voltage of capacitor becomes the level of drop-out voltage.

• Notes

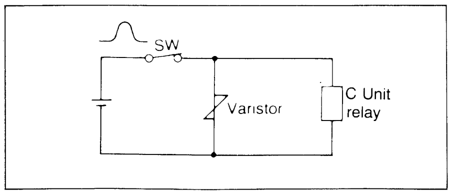
1. Do not apply the opposite polarity to the coil. The reverse polarity may damage the built-in IC.
2. Operate 5 V and 9V types by the rectangular pulse with more than 8000 V/S in supply voltage rising or falling rate. If supply voltage rising or falling rate is more than 0.1 V/sec., any input wave such as rectangular, trapezoid and triangle can operate 12 V and 24 V types without any problem.
3. When a sudden voltage drop (more than 1 V for 5 V and 9 V types, more than 2 V for 12 V and 24 V types) is expected even if the input voltage is more than drop-out voltage, misoperation may take place. Check possibility of a sudden input voltage drop in the actual circuit.
The following circuit is recommended for the protection:



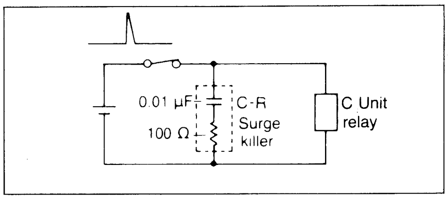
4. The surge riding on the input voltage may cause misoperation or damage to the relay.
(1) When a large inductive load circuit such as a relay coil is in parallel with C Unit relays, connect a diode for absorbing electromotive voltage as follows:



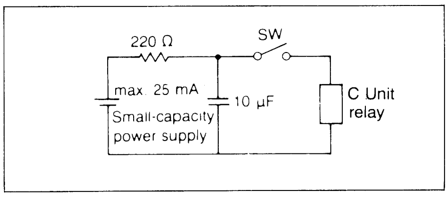
(2) Connect a varistor in parallel with C Unit relays when the wave is large with wide-pulse surge as follows:

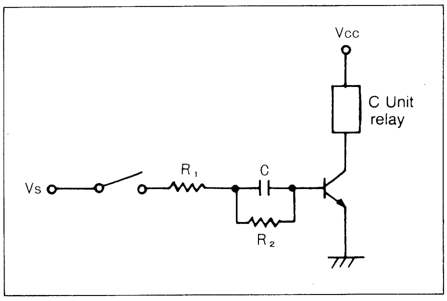


(3) Connect C-R circuit in parallel with C Unit relays when the surge is steep with small pulse-range as follows:



5. Switching by a switch with large contact bounce may cause misoperation. Use a switch with less than 0.2 msec. contact bounce or connect a chatter prevention circuit.
6. Inrush current of C Unit relays ranges from several 10 mA to 300 mA while steady-state current is several 10 µA. Construct the following circuits when a small-capacity power source is used or when the operating power of a transistor is reduced.

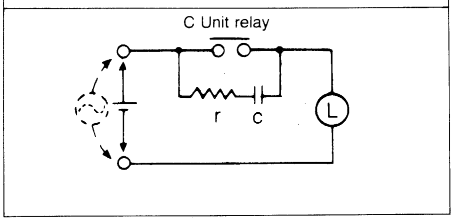




R1, R2: The value of R1 and R2 is decided so that collector current is about 100 µA same as steady-state current of C Unit relay.
R1, C: The value of R1 and C is decided so that collector allows rush current of C-Unit relay to flow (about 300 mA).
In case of 12 V use:
Vs: 12 V, R1: 47 kΩ, C: 0.1 µF, Vcc: 12 V, R2: 1MΩ

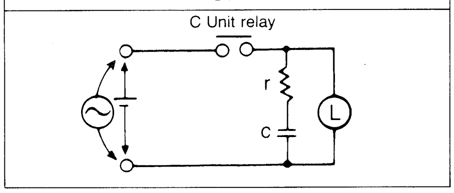
8. Contact protection circuit
When using C Unit relays in inductive load circuits a contact protection circuit is recommended.
Examples:

CR



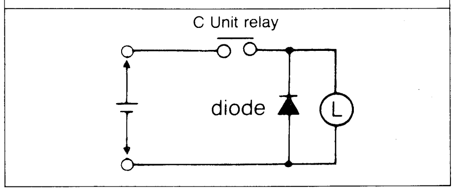
1. r = more than several 10 Ω.
2. In an AC circuit impedance of L is to be somewhat smaller than impedance of r and c.

CR



Can be used for both AC and DC circuits.
Use 500 to 1000 Ω for r and 0.1 µF for C.

Diode



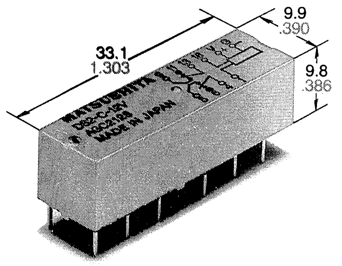
For DC circuits only.

9. When C Unit relays are operated by minimum pick-up voltage, the voltage width of coil energization should be more than 2.5 times of minimum operating time.

NAiS

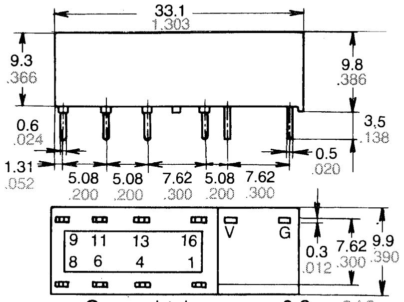
IC BUILT-IN POWER SAVING RELAY

DS-C UNIT RELAYS



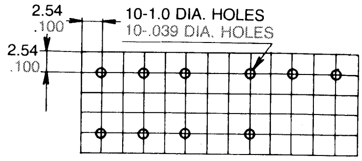
mm inch

DIMENSIONS mm inch



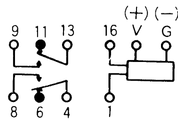
General tolerance: ±0.3 ±.012

• PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

• Schematic (Bottom view)



Note: Diagram shows the condition when volatge is not applied to V and G terminals.
Do not use 1 and 16 terminals.

TYPES AND COIL DATA at 25°C 77°F

Part No.	Nominal voltage, V DC	Pick-up voltage V DC (max.)	Drop-out voltage V DC (min.)	Maximum allowable voltage at 40°C, V DC	Maximum operating current, mA		Nominal operating power, mW	Surge resistance
					Rush current (0.5 msec.)	Steady current	at steady-state	
DS2-C-9V	9	*7	*0.5	20	Approx. 180 (20 V)	0.065 (12 V)	0.54	±100 Vp
DS2-C-12V	12	9	7.5	20	Approx. 180 (20 V)	0.1 (20 V)	1.2	±100 Vp
DS2-C-24V	24	18.6	14.0	28	Approx. 85 (28 V)	0.13 (28 V)	2.64	±100 Vp

*Operate by the rectangular pulse with more than 8,000 V/sec. supply voltage rising rate.

SPECIFICATIONS

Contacts

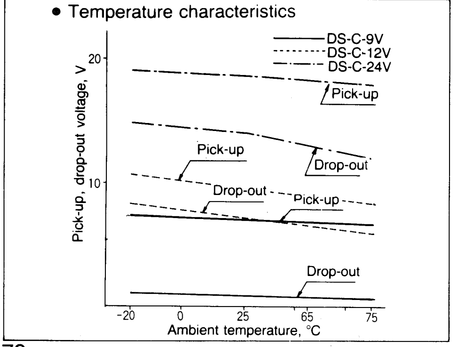
Style	Bifurcated
Arrangement	2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	50 mΩ
Contact material	Gold-clad silver
Rating (resistive) Max. switching power	60 W, 125 VA
Max. switching voltage	220 V DC, 250 V AC
Max. switching current	2 A DC, AC
Max. carrying current	3 A DC, AC
Expected life (min. operations) Mechanical	10^8
Electrical 2 A 30 V DC at 20 cpm	10^6
1 A 125 V AC at 20 cpm	10^5

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

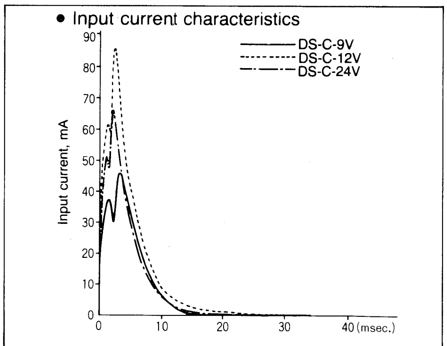
Max. operating speed	30 cps.	
Operate time	Approx. 2 msec.	
Release time	Approx. 2 msec.	
Initial breakdown voltage Between open contacts	1,000 Vrms	
Between contact sets	1,000 Vrms	
Between contact and coil	1,500 Vrms	
Between contact and input	1,500 Vrms	
Initial insulation resistance	1,000 MΩ at 500 V DC	
FCC surge voltage Between open contacts	1,500 V	
Ambient temperature	−20°C to +75°C −4°F to +167°F (−20°C to +50°C for 12 V type −4°F to +122°F)	
Storage temperature	−55°C to+85°C −67°F to+185°F	
Shock resistance	Functional: 30 G	Destructive: 100 G
Vibration resistance	Functional: 12 G, 10 to 55 Hz at double amplitude of 2 mm Destructive: 18 G, 10 to 55 Hz at double amplitude of 3 mm	
Unit weight	Approx. 5 g .14 oz	

DATA

• Temperature characteristics



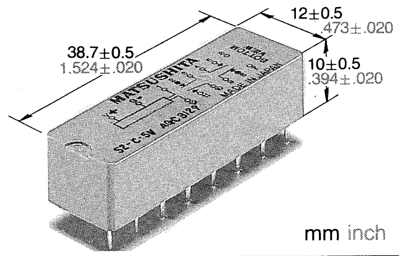
• Input current characteristics



NAIS

IC BUILT-IN POWER SAVING RELAY

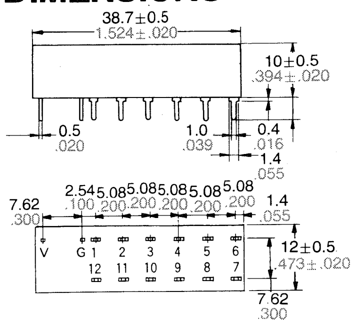
S-C UNIT RELAYS



Type	Contact arrangement
S2	2 Form A 2 Form B
S3	3 Form A 1 Form B
S4	4 Form A

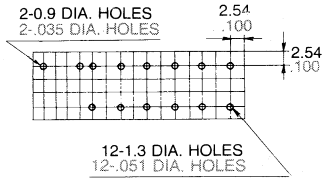
DIMENSIONS

mm inch

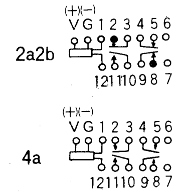


General tolerance: ±0.3 ±.012

• PC board pattern (Copper side view)



• Schematic (Bottom view)



Note: Diagram show the condition when voltage is not applied to V and G terminals.
Do not use 1 and 12 terminals.

TYPE AND COIL DATA at 25°C 77°F

Part No.	Nominal voltage V DC	Pick-up voltage V DC (max.)	Drop-out voltage V DC (min.)	Maximum allowable voltage at 40°C, V DC	Maximum operating current, mA: Rush current (0.5 msec.)	Maximum operating current, mA: Steady current	Nominal operating power, mW at steady-state	Surge resistance
S2-C-9V S3-C-9V S4-C-9V	9	*7	*0.5	20	Approx. 160 (20 V)	0.065 (12 V)	0.54	±100 Vp
S2-C-12V S3-C-12V S4-C-12V	12	9	7.5	20	Approx. 160 (20 V)	0.1 (20 V)	1.2	±100 Vp
S2-C-24V S3-C-24V S4-C-24V	24	18.6	14.0	28	Approx. 85 (28 V)	0.13 (28 V)	2.64	±100 Vp

*Operate by the rectangular pulse with more than 8000 V/sec. supply voltage rising rate.

SPECIFICATIONS

Contacts

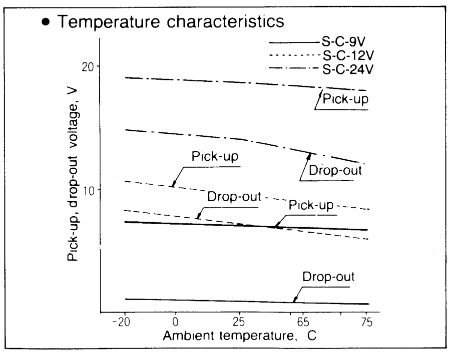
Arrangement	2 Form A 2 Form B 3 Form A 1 Form B 4 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	50 mΩ
Initial contact pressure	12 g .42 oz
Contact material	Gold clad silver alloy
Electrostatic capacitance	Approx. 3 pF
Thermal electromotive force (at nominal coil voltage)	Approx. 3 μV
Rating (resistive) Max. switching power	1,000 VA, 90 W
Max. switching voltage	250 V AC, 30 V DC
Max. switching current	4 A (AC), 3 A (DC)
Nominal switching capacity	4 A 250 V AC, 3 A 30 V DC
Min. switching capacity	100 μA 100 mV DC
Expected life (min. operations) Mechanical	10^8
Electrical (at 20 cpm) 4 A 250 V AC	10^5
3 A 30 V DC	2×10^5

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

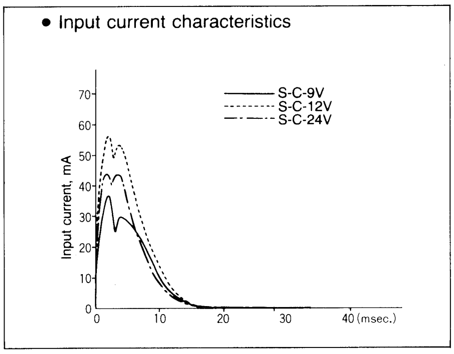
Max. operating speed	30 cps.
Operate time	Approx. 4 msec.
Release time	Approx. 4 msec.
Initial breakdown voltage: Between open contacts	750 Vrms
Between contact sets	1,000 Vrms
Between contact and coil	1,500 Vrms
Between contact and input	1,500 Vrms
Initial insulation resistance	10,000 MΩ at 500 V DC
Ambient temperature	−20°C to +65°C (−20°C to +45°C for 12 V type) −4°F to +149°F (−4°F to +113°F for 12 V type)
Storage temperature	−55°C to +85°C −67°F to +185°F
Shock resistance	Functional: 50 G / Destructive: 100 G
Vibration resistance	Functional: 18 G, 10 to 55 Hz at double amplitude of 3 mm Destructive: 24 G, 10 to 55 Hz at double amplitude of 4 mm
Unit weight	Approx. 9 g .31 oz.

DATA

• Temperature characteristics



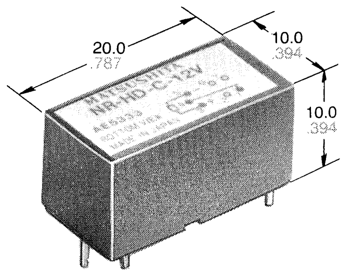
• Input current characteristics



NAiS

IC BUILT-IN POWER SAVING RELAY FOR BATTERY DEVICES

RH-C RELAYS



mm inch

The same size as R relay.

- Ultra low operating power, only 1/500 current of ordinary R relay, permits
  - Extended battery life
  - Miniaturizing the capacity of DC power source
  - Compensation at power failure by small-capacity capacitors
- Little heat generation at the coil permits
  - Low thermal electromotive force—the same as R latching types
  - Usage at high ambient temperature up to 75°C
- Wider operating voltage range:
  - suitable for use in electronic circuitry incorporating multiple power sources or use subject to wide fluctuations of the line voltage
- Low bounce coupled with high speed operation—RH-C relay operates approximately twice as fast as R relay: 0.5 msec
- No occurrence of counter electromotive force at the coil protects the circuitry from its influence: eliminating the parallel connection of the diode to the relay coil.

SPECIFICATIONS

Contacts

Style	Bifurcated
Arrangement	1 Form C
Contact material	Gold cobalt
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	60 mΩ
Contact pressure	More than 5 g .18 oz
Contact bounce	Approx. 0.3 msec.
Electrostatic capacitance (mean value)	
Contact/Contact	3 pF
N.O. contact/Coil	4 pF
N.C. contact/Coil	5 pF
Rating (resistive)	
Max. switching power	20 W (DC), 33 VA (AC)
Max. switching voltage	30 V (DC), 110 V (AC)
Max. switching current	1A (DC), 0.3 A (AC)
Min. switching power	100 mV 10 μA
Expected life (min. operations) Mechanical (at 400 cps)	10^9

Characteristics (at 25°C, 50% relative humidity)

Max. operating speed	RH-C-5V: 400 cps. RH-C-12V: 460 cps.
Operate time	Approx. 0.5 msec.
Release time	Approx. 0.5 msec.
Initial breakdown voltage	
Between open contacts	300 Vrms (500 V DC)
Between live parts and ground	1,000 Vrms
Between coil and contacts	1,000 Vrms
Initial insulation resistance	1,000 MΩ at 500 V DC
Ambient temperature	−20°C to +75°C −4°F to +167°F
Storage temperature	−55°C to +85°C −67°F to +185°F
Shock resistance (both functional and destructive)	100 G
Vibration resistance	Functional: 10 G, 10 to 55 Hz at double amplitude of 1.6 mm Destructive: 12 G, 10 to 55 Hz at double amplitude of 2 mm
Unit weight	4.5 g .16 oz

Electrical life

	Contact load, resistive				Operating cycles/sec.	*Expected life, operations
	DC load		AC load			
	Current	Voltage	Current	Voltage		
Resistive load	1 A	20 V	0.3 A	110 V	1	10^6
	0.5	30	0.1	110	2	3×10^6
	0.25	30	0.25	30	5	5×10^6
	0.2	24	0.2	24	25	10^7
	0.1	12	0.1	12	50	5×10^7
	0.1	9	0.1	9	100	10^8

*The expected life indicates 95% reliability in the weibul chart.

The following is life data under our HP2 relay load.

	Contact voltage	Contact current	Contact protection circuit	Operating speed	Expected life, min, op.
Inductive load	6 V DC	232 mA	0.2 μF+1 kΩ or diode	2 op./sec.	3×10^7
	12 V DC	106 mA	0.2 μF+1 kΩ or diode	2 op./sec.	3×10^7
	24 V DC	54 mA	0.1 μF+1 kΩ or diode	2 op./sec.	3×10^7
	100 V DC	15 mA	0.1 μF+1 kΩ or diode	2 op./sec.	2×10^7
	24 V AC	80 mA	0.2 μF+1 kΩ	2 op./sec.	3×10^7
	100 V AC	20 mA	0.1 μF+1 kΩ or varistor	2 op./sec.	2×10^7
	200 V AC	10 mA	0.1 μF+1 kΩ	2 op./sec.	2×10^7

*Above protection circuits are in parallel with HP relay loads.

Coil (polarized) at 25°C 77°F

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Maximum allowable voltage at 40°C, V DC	Maximum operating current, mA		Nominal operating power, mW	Surge resistance
					at instantaneous operation (0.5 msec.)	at steady-state	at steady-state	
RH-C-5V	5	*4.5	*0.5	12	300 (12 V)	0.065 (12 V)	0.33 to 0.78	±100 Vp (1 μsec.)
RH-C-12V	12	9	7.5	28	280 (28 V)	0.13 (28 V)	1.56 to 3.12	

*Operate by the rectangular pulse with more than 8000 V/sec. supply voltage rising rate.

TYPICAL APPLICATIONS

Battery-operated devices, measuring instruments, power-source monitoring devices.

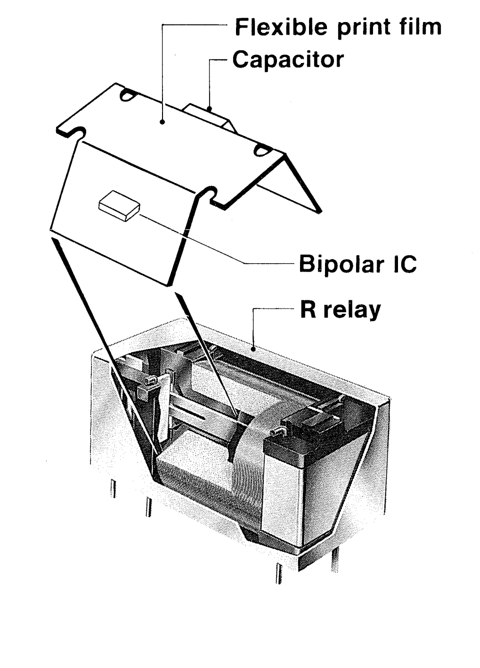
ORDERING INFORMATION

Ex. RH-C — 5V

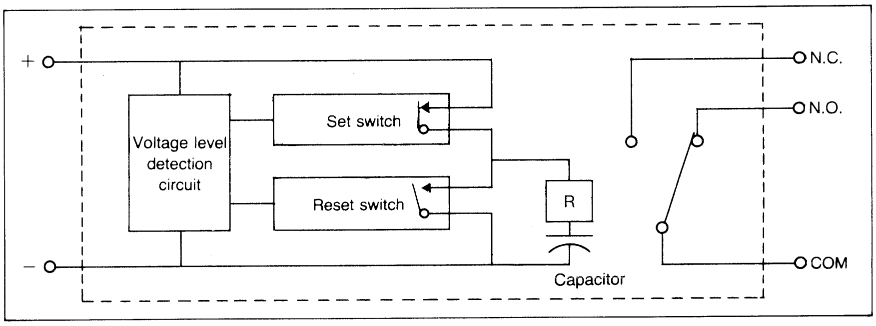
Type of relay	Coil voltage
RH-C unit relay	5, 12 V DC

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

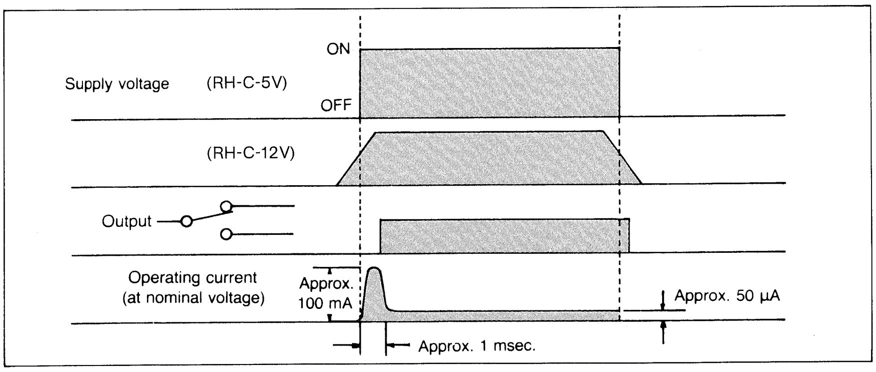
OPERATING PRINCIPLE



Inner circuit



Time chart

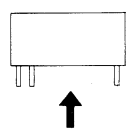


SCHEMATIC (Bottom view)

Same operations as the conventional magnetic relays.

(a) During deenergization, terminals No. 4 (COM) and No. 1 (N.C.) are on "make"

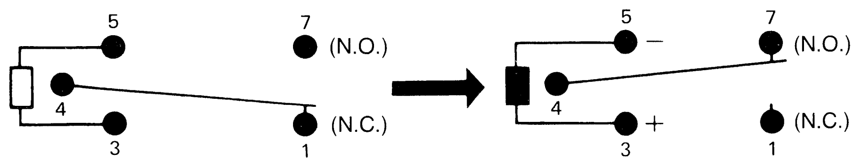
(b) During energization with the indicated polarity, terminals No. 4 and No. 7 (N.O.) are on "make"



(terminal view)

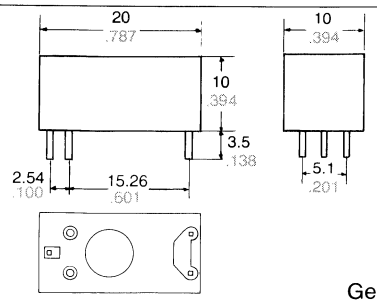
deenergized coil

energized coil



Note:
Energization with an opposite polarity does not switch the contact.
The reverse polarity may damage the built-in IC.
Apply proper polarity to switch the contact.

DIMENSIONS



Terminals (Except soldering)

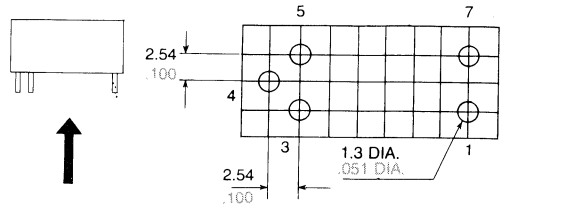
Terminal No.	Thickness	Width
1, 7	0.5 .020	0.6 .024
4	0.3 .012	0.7 .028
3, 5	0.5 .020 DIA.	

Soldering: 0.3 .012 max.

General tolerance: ±0.5 ±.020

PC board pattern (Bottom view)

mm inch



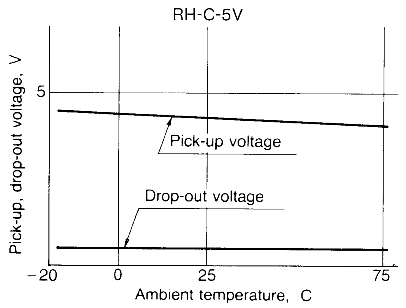
Tolerance: ±0.2 ±.008

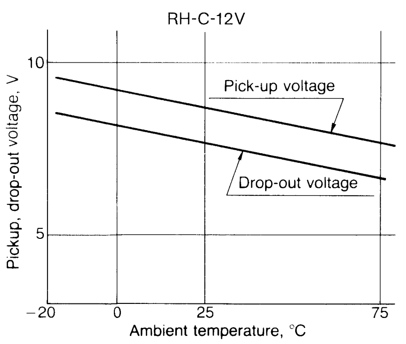
Notes

A standard pattern: PC board with a pitch of .100 inch is suitable for mounting RH-C relays.

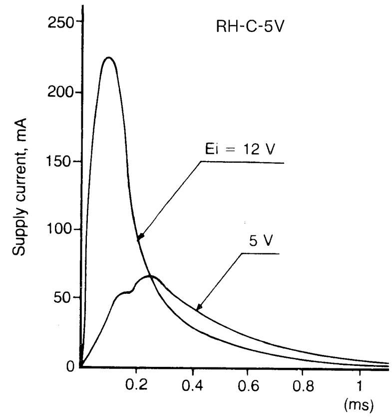
DATA

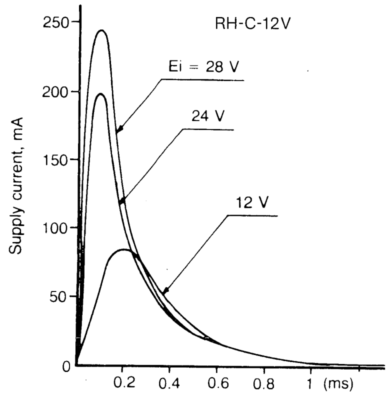
Temperature characteristics



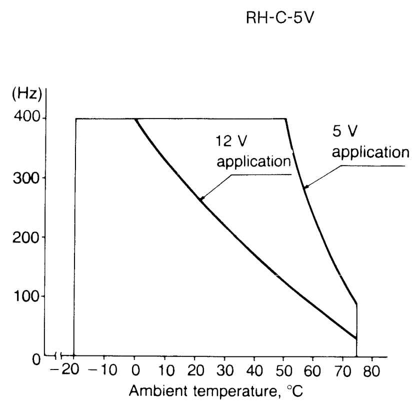


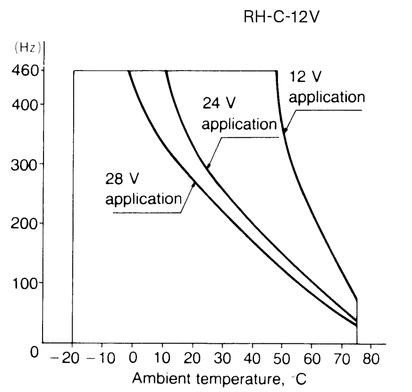
Supply current characteristics





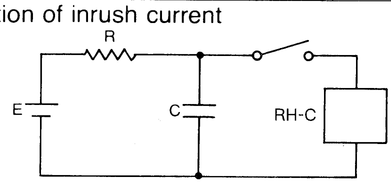
Maximum operating frequency





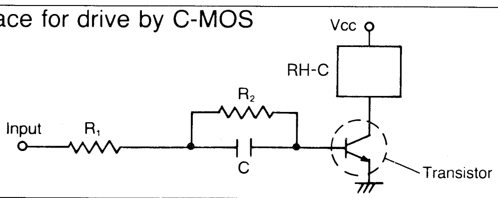
PRACTICAL CIRCUIT APPLICATIONS

Reduction of inrush current



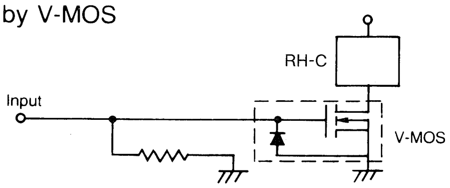
If inrush current at the instantaneous operation is provided by capacitor C, inrush current of the power source E can be reduced as well as the power source capacity.

Interface for drive by C-MOS



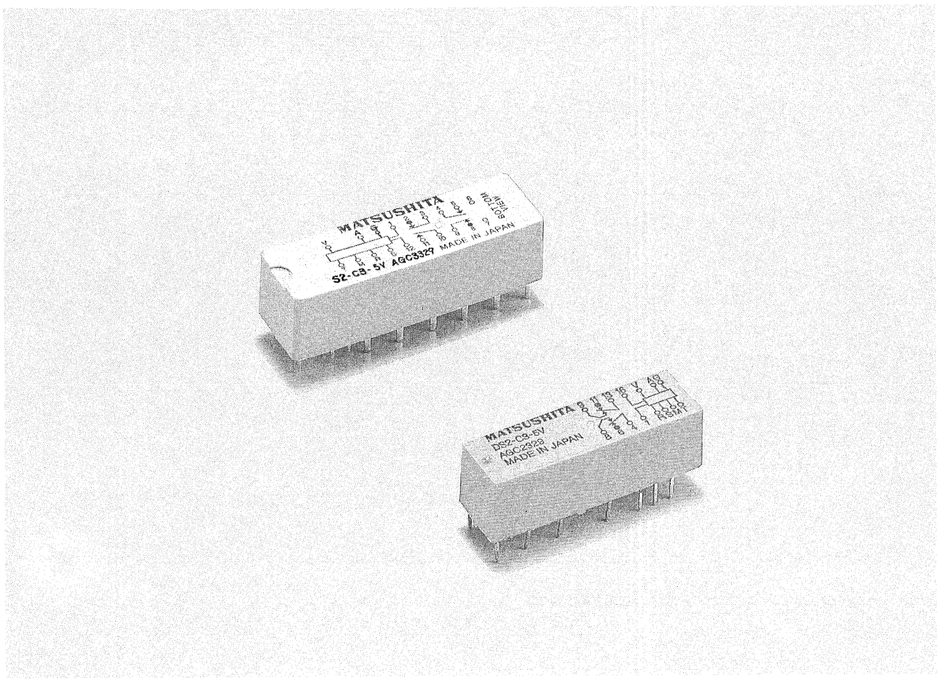
When driving a RH-C relay by transistor, instanteneous flowing of the base current is sufficient for its operation. This enables RH-C relays to be driven by C-MOS.

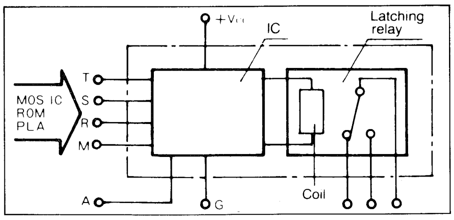
Drive by V-MOS



RH-C relays can be driven also by V-MOS.

C3 Relays have a built-in input signal processing IC especially for intelligent control interface.





C3 relays which are made with a combination of a highly efficient polarized relay and exclusive IC, are compatible with LSI. They have the following features:

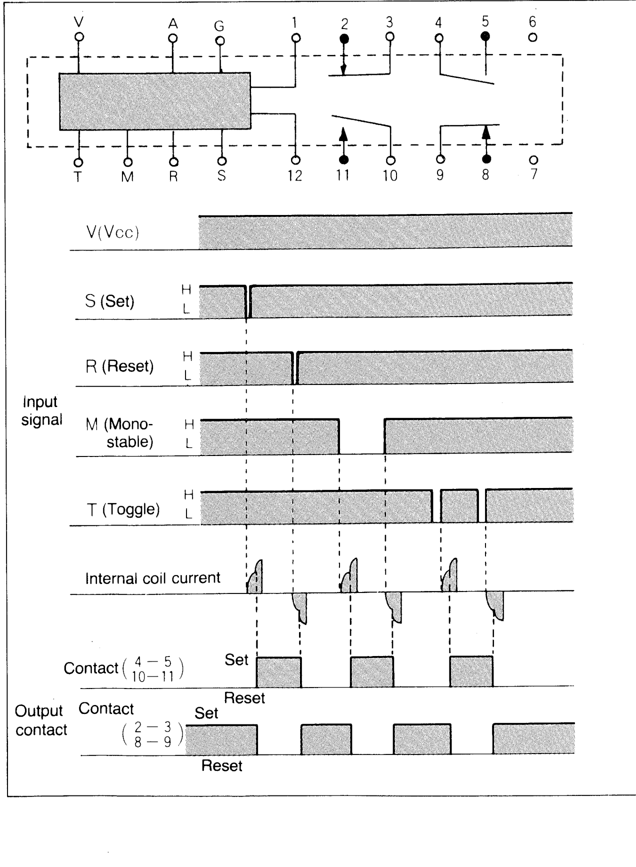
1. Input signal processing and amplification
2. Negative logic operation—only 100 µsec. input width is required to activate the armature.
3. A noise cancelling circuit and a bounce cancelling circuit are built-in to filter out noise and switch bounces on the input terminals.
4. Power failure protection.
5. Extremely lower consumption.

These relays help reduce costs by making it possible to simplify design, reduce the number of components, and save wiring and assembly time.

• Explanation of Technical Terms

Threshold voltage: To assure proper operation of the C3 relay, always make the H level more than 2 V and the L level less than 0.8 V when changing the state of any input terminal.
H level: Voltage level such that input voltage is above threshold voltage.
L level: Voltage level such that input voltage is below threshold voltage.
Negative logic: Logic system that turns on at L level and turns off at H level.
Maximum power source voltage (Vcc): Maximum voltage that can be applied between V terminal and G terminal. This power source voltage is directly related to the breakdown voltage of the element used in the internal circuit, and when this voltage is exceeded, breakdown of IC may occur.
Maximum input voltage: Maximum voltage that can be applied to the input terminals. If this value is exceeded, breakdown may possibly occur.
Maximum power source current: Maximum current that can be made to flow into V terminal.
Storage temperature: Temperature range at which the relay is stored without letting it operate.

• Explanation of operation (S2-C3 Relay)

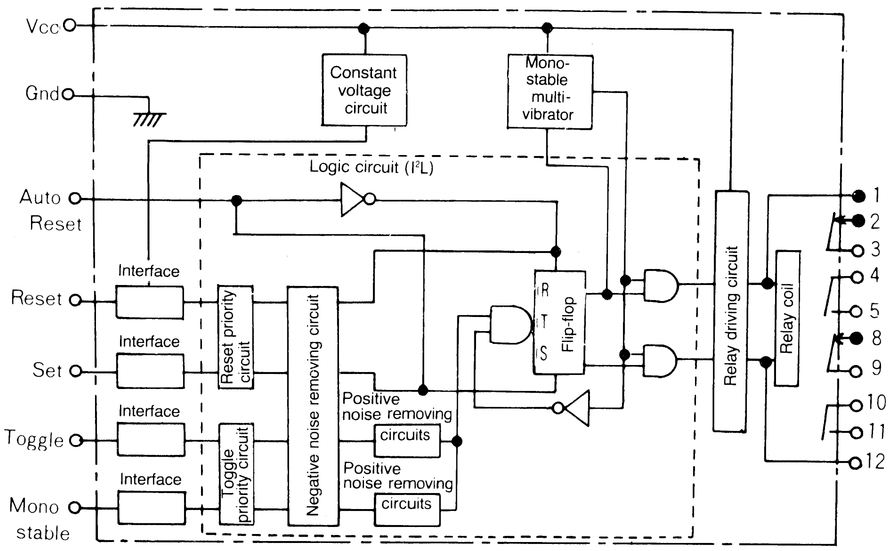


V: Power source input terminal
It can be in the range of Vcc = 5 to 15 V.
G: Ground terminal
Grounding
S: Set operation terminal
Input signal terminal for setting operation of the relay. When it changes from H level to L level, the relay will go to the set condition. When the input returns to H level, the contacts remain in the set position.
R: Reset operation terminal
Input signal for resetting the relay. When it changes from H level to L level, the relay will go to the reset condition. When the input changes back to H level, it remains in the reset position.
M: Mono-stable operation terminal
Input signal terminal for non-latching operation (single side stable operation) of the relay. When it changes from H level to L level and from L level to H level, the relay operates to alternate positions.
T: Toggle operation terminal
Input signal terminal for making the relay perform toggle operation (binary stepping operation). When it changes from L level to H level, the relay operates, but when it changes from H level to L level, it does not operate.
A: Auto set and reset terminal
Terminal for setting or resetting the relay for memory function automatically, when power source Vcc returns to normal after a power failure.
• Selection of Operating Condition when power source is restored.

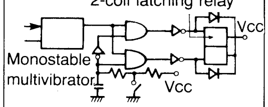
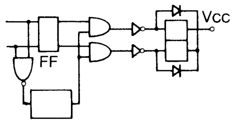
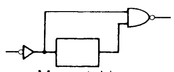
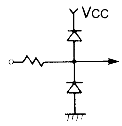
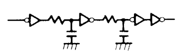
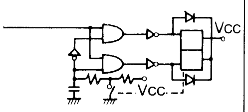
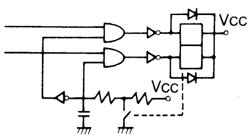
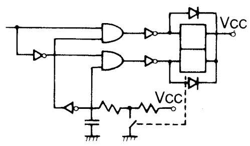
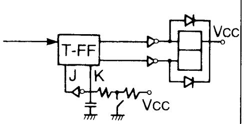
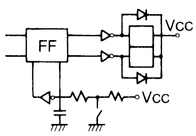
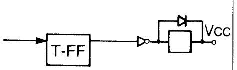
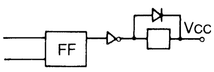
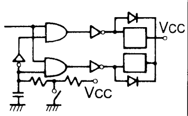
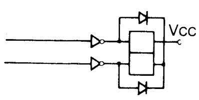
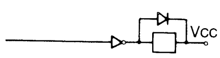
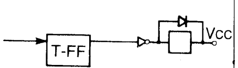
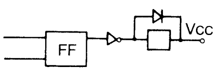
Connections of terminal A	Position of relay contacts when power source is restored
Terminal A is open	Relay is in reset condition
Terminal A is connected to ground	Relay is in set condition
Its own N.O. contact is connected between terminal A and ground	Relay remains in the same position as it was before power source was interrupted
Its own N.C. contact is connected between terminal A and ground	Relay is in reverse position to that before the power source interruption

1–12: Terminals for return signal
Terminals for confirming that the relay has received a signal surely. (Max. current 1 mA)

• Block-diagram (S2-C3 Relay)



• C3 relay's functions composed of discreet components

	Operate time	Memory function	Toggle	Set and Reset	Mono-stable	Others
With power saving function	100 µsec.	Yes	2-coil latching relay  Noise protection is needed.	 Noise protection is needed.		Bounce cancel function  Input protection function  Noise cancel function 
		No	Same as above	Same as above		
	Operate time of relay	Yes				
		No	Same as above	Same as above	Same as above	
Without power saving function	100 µsec.	Yes	 Noise protection is needed.	 Noise protection is needed.		
		No	 Noise protection is needed.	 Noise protection is needed.		
	Operate time of relays	Yes				
		No	 Noise protection is needed.	 Noise protection is needed.	Same as above	

• C3 relays' common characteristics and How to use them

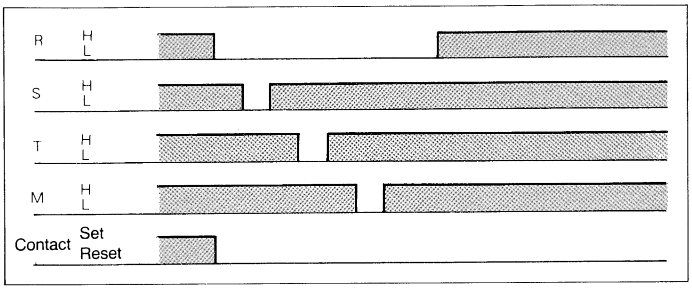
1. Input pulse:

Pulse width must be 100 µsec or longer. If voltage rise and voltage fall rate are 100 V/sec. or over, operation is possible by rectangular wave, trapezoidal wave or triangular wave without any problem.

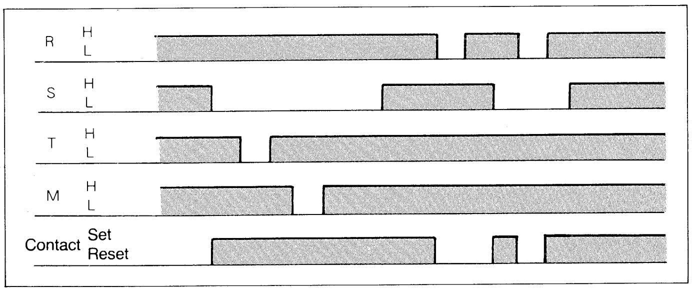
2. Timing chart of input signal:

• When 2 or more input signals become L level simultaneously, their priority order is: R>S>T>M.

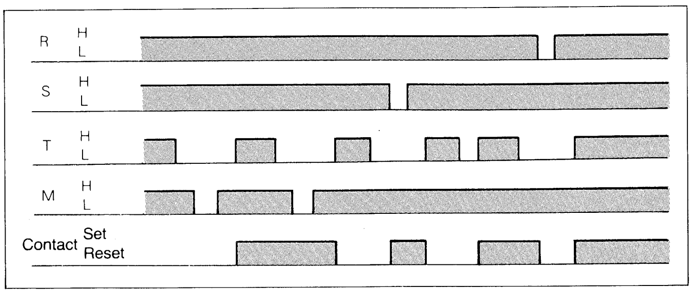
• When the input signal to terminal R changes from H to L, the contacts go to reset. When it changes back to H from L, the contacts remain in reset positions. When R is at L level, the condition of the contact, remains unchanged even if S, T, M change from H to L and from L to H.



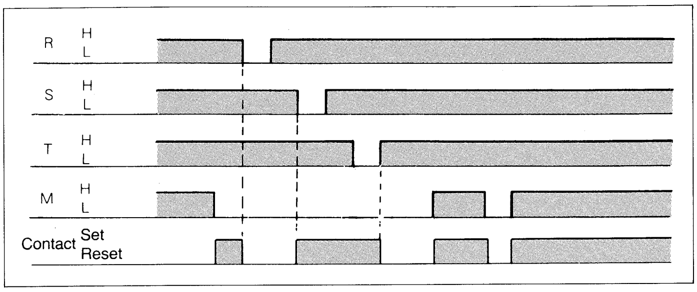
• When the input signal to terminal S changes from H to L, the contacts go to the set position, and stay there even when it changes back to H from L. When S is at the level of L, condition of the contact remains unchanged even if T, M change from H to L and from L to H, but when R changes from H to L, the armature will return to rest.



• If signal to terminal T changes from H to L, the contact remains unchanged, but when it changes from L to H, the contacts change their position reverse to previous position. When T is at L level, condition of the contacts do not change even if M changes from H to L, and from L to H, but if R changes from H to L with the contact set or if S changes from H to L with the contact reset, condition of the contact changes. Therefore, in these cases, condition of binary stepping by T changes.



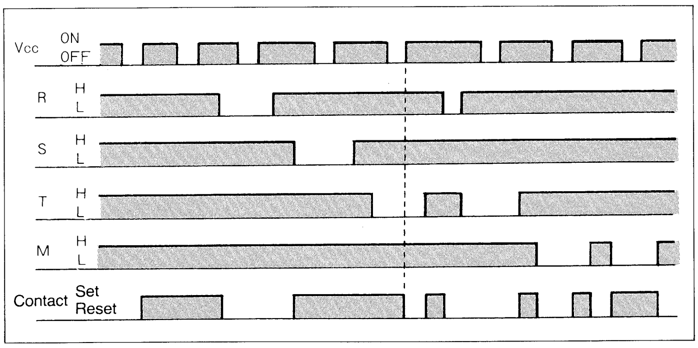
• When the input signal to terminal M changes from H to L or from L to H, condition of the contact becomes reverse to its previous position. If signal level of R.S.T. changes (even if M is at L level), the relay has the same operation as in a normal case.
Therefore, depending upon the previous condition of the contact, there are cases where the contact sets when M changes from H to L, and where the contact resets when M changes from H to L and vice versa. Thus, operation is performed differently from conventional single-side stable relays.



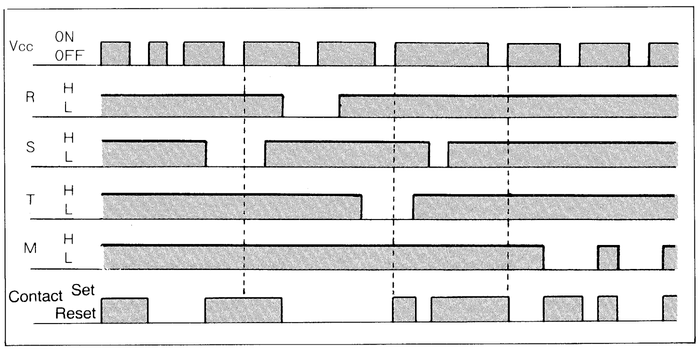
3. Auto set and reset terminals

There are 3 functions available on the C3 relays to protect contact integrity, according to the application in case Vcc fails.

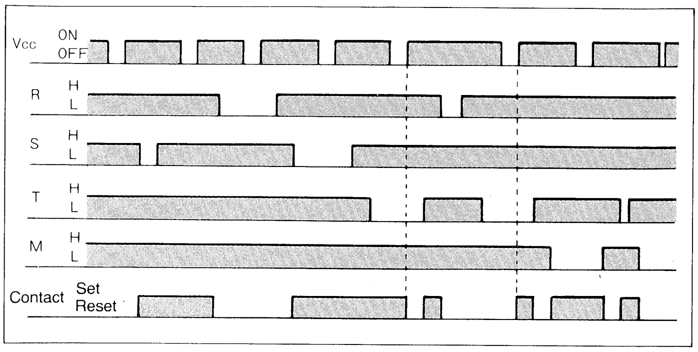
• Auto set:
If terminal A is connected to ground, the contact goes to the set position when Vcc is restored to normal as shown in the Figure below. However, if R or T is at L level the contact resets. Therefore, condition of the binary step by T before Vcc fails is different from that after it fails.



• Auto reset:
If terminal A is kept unconnected, the contact resets when Vcc returns to normal, as shown in the figure below. However, if S or T is at L level, the contact sets. Therefore, the condition of binary step by T before Vcc fails is different from that after it fails.



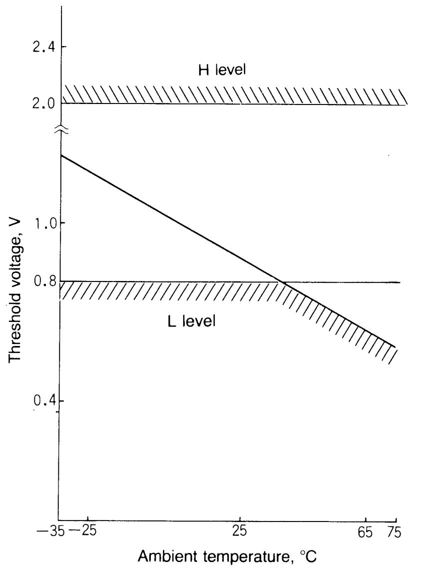
• Memory:
If the set contact is connected between A and ground, the contact remains in the same condition before Vcc fails, when it is restored to normal. However, if T is at L level, condition becomes reverse to that of before Vcc fails.



Further if own reset contact is kept connected between A and ground, the condition is entirely reverse to that shown in the above Figure.

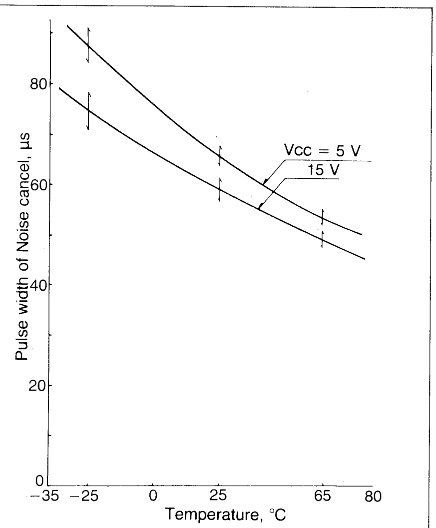
4. Temperature characteristics of Threshold value of input voltage

The relationship between the threshold value of relay input voltage and temperature is as shown in the right.



5. Temperature characteristics of pulse width for noise cancellation.

The positive and negative noise multiplexed on input signal is cancelled. The width of noise cancellation depends on Vcc and temperature.



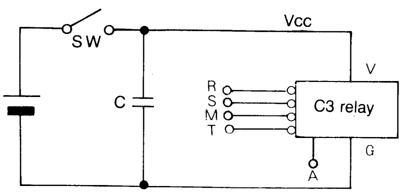
6. Bounce cancelling time

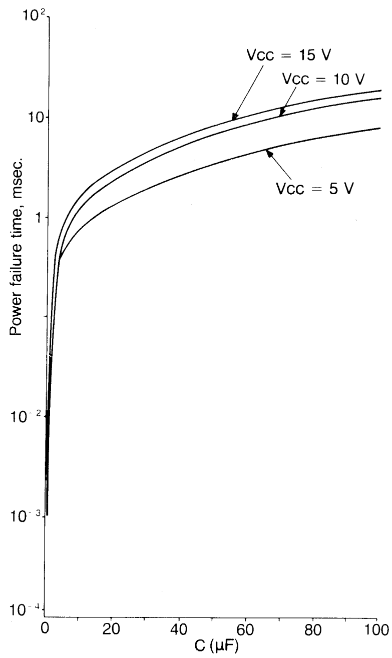
If one pulse signal enters the input, C3 relay does not operate when the next signal enters the same terminal during the following time:

C3 Relay	Bounce cancelling time
DS-C3 relay	Approx. 8 msec.
S-C3 relay	Approx. 10 msec.

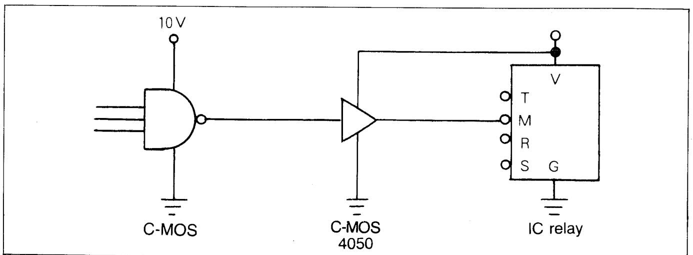
7. Instantaneous failure of input voltage (Vcc)

This figure shows the relationship between capacitor C and power failure time.
C3 relay can disregard the power failure, if Vcc fails instantaneously when the capacitor C is connected between V and G as shown here.
If power failure time is longer than that shown in this figure, Auto-set, reset and memory function work.
In this example, since A terminal is open, Auto-reset function works. If capacitor is not connected, auto-set, reset and memory start working after 0.5 μsec power failure.

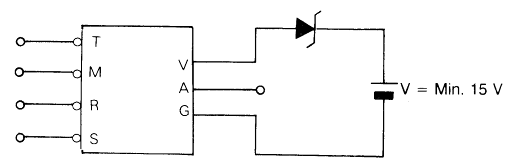




8. If the voltage of the power source of TTL/C-MOS is higher than the supply voltage of the C3 relay (Vcc), insert the level converter as shown below.



9. When power source voltage is 15 V or higher, a zener diode should be connected.



Zener voltage of Zener diode Vz = V−(5 to 15)

• Notes

1. Do not let current flow through the coil terminal. If such a current flows through it, misoperation or breakdown may possibly occur.

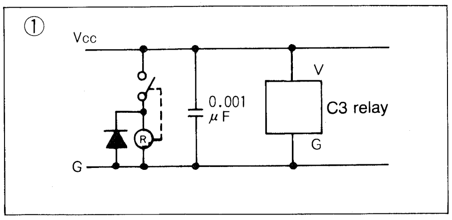
Relay	No. of terminal (Do not connect)
DS-C3	1, 16
S-C3	1, 12

2. Do not short-circuit terminals V to A.
3. The mono-stable of C3 relays is different from the single-side stable relays. (Refer to the Timing chart in page 77.)
4. When using the binary step by T terminal, set or reset position of contacts may reverse before or after the change, if condition of R, S or Vcc changes when T is at L level. (Refer details to the timing chart in page 77.)
5. When driving the C3 relay with contacts which have bounce, bounce of less than the operation frequency for set and reset operation is allowable, but in the cases of mono-stable and toggle operation, bounce should be less than bounce cancelling time of C3 relay.
6. Allowable electrostatic capacitance between input terminals:

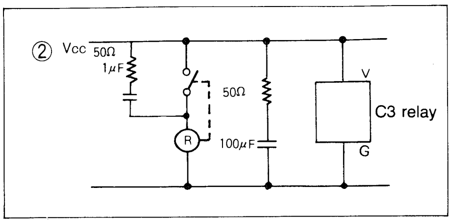
Unit: PF

	A	S	R	M	T
V	47000	47000	47000	47000	47000
G	11800	14700	14700	14700	14700
A		47000	14700	47000	14700
S			4300	4300	4300
R				4300	4300
M					4300
T					

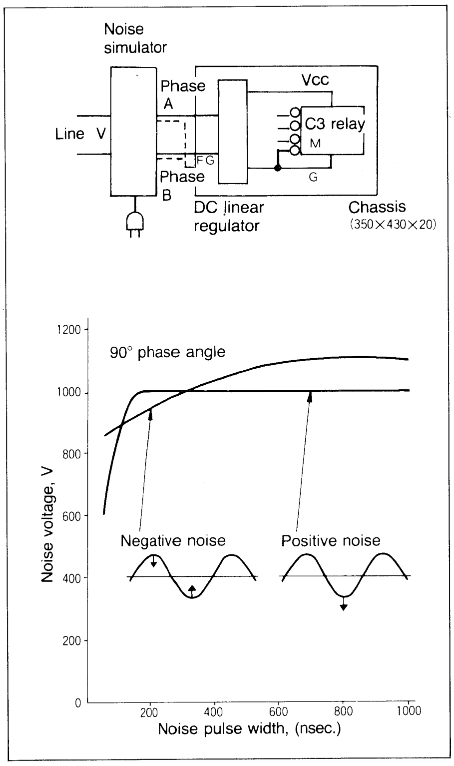
7. Misoperation due to surge:
When voltage surge from other relays is super imposed on Vcc, there is possibility of C3 relay misoperating if M or T terminal is at L level and other terminals are in open condition. The corrective actions are shown below:
A. Connect R, S, M, T terminals not being used, to V terminal.
B. When using C3 relays together with a relay, etc.
(1) Fit the relay with a surge absorbing circuit



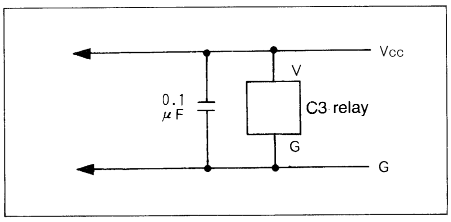
(2) Fit the relay contact with an arc suppressing circuit and provide a resistance and capacitor between V and G.



C. If R, S terminals are at L level and other terminals are at H level, misoperation does not occur easily. When M or T terminal is used, check it for misoperation at the time of system formation.
8. There are some cases where impulse noise enters the power source line and causes misoperation. The figure belows shows relationship between voltage value and width of noise which starts misoperation when M or T terminal are at L level and other terminals are open.

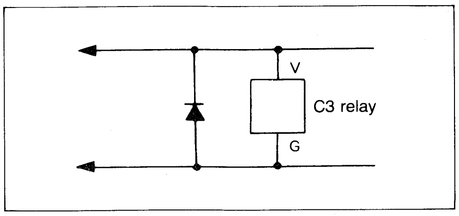


The its corrective actions are as follows:
A. For C3 relay power source, switching power source is used.
B. A capacitor is inserted between V and G.

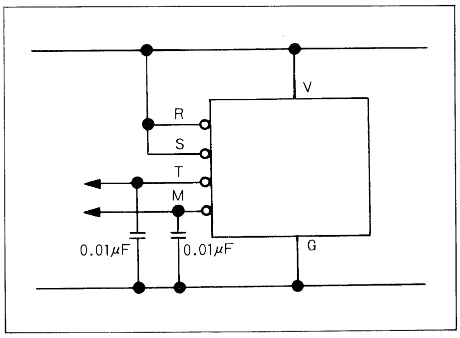


Use a ceramic capacitor.

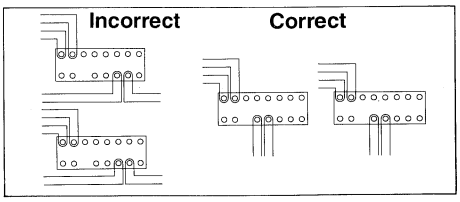
C. A diode is inserted between V and G.



D. When R, S terminals are at L level and other terminals are at H level, misoperation due to above-mentioned noise does not occur easily. When using M or T terminal, check it for misoperation at the time of system formation.
9. C3 relay sometimes causes misoperation due to noise made by the relay, motor, solenoid, etc. Misoperation is apt to occur when M, T terminals are at L level.
To avoid misoperation, the following should be considered.
A. Connect unused terminals to V terminal
B. Place M, T terminals input away from the surge generating source as far as possible.
C. For M, T terminal input line, use a shielded wire.
D. When using it on a PC board:
(1) Make the ground line wide.
(2) Make the M, T terminals input line parallel with the ground line.
E. Insert a capacitor (0.01 μF) into the ground and the M, T input terminal portion.



F. Make the input signal line as short as possible.
G. Don't make the load line parallel with M, T terminal input line.

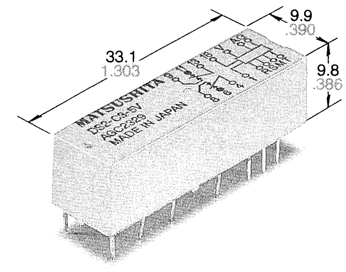


10. There are cases where misoperation is caused due to surge circulating along AC load line→DC power source line→C3 relay→V terminal. In such cases, add a surge absorber.
11. If the power source for DC load and for C3 relays are the same, do not make electric potential between DC load and grounding line of IC relay and between IC relays.
12. There is a possibility of misoperation due to static electricity. Careful handling is required.

NAiS

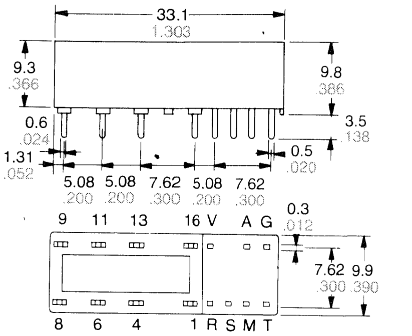
IC BUILT-IN RELAY FOR INTELLIGENT CONTROL INTERFACE

DS-C3 RELAYS



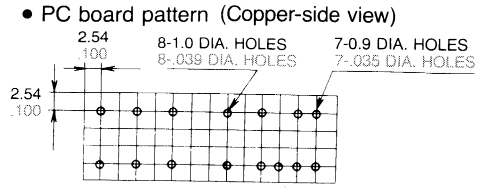
mm inch

DIMENSIONS mm inch



General tolerance: ±0.3 ±.012

• PC board pattern (Copper-side view)



• Schematic (Bottom view)

Tolerance: ±0.1 ±.004

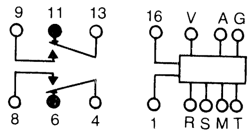


Diagram shows the condition when 5 V is applied to V and G terminals and signal of L level is applied to R terminal.

SPECIFICATIONS

Contacts

Style	Bifurcated
Arrangement	2 Form C
Contact material	Gold-clad silver
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	50 mΩ
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	10^8
Electrical 2 A 30 V DC	10^6
1 A 125 VAC	10^5

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

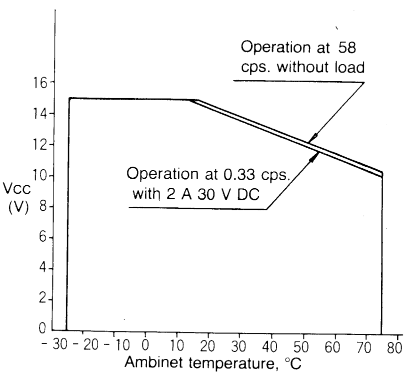
Max. operating speed	55 cps.	
Operate time	Approx. 5 msec.	
Release time	Approx. 5 msec.	
Initial breakdown voltage		
Between open contacts	1,000 Vrms	
Between contact sets	1,000 Vrms	
Between contact and coil	1,500 Vrms	
Between contact and input	1,500 Vrms	
Between contact and power source	1,500 Vrms	
Initial insulation resistance	1,000 MΩ at 500 V DC	
FCC surge voltage between open contacts	1,500 V	
Ambient temperature	−25°C to +75°C −13°F to +167°F	
Storage temperature	−55°C to +85°C −67°F to +185°F	
Shock resistance	Functional: 30 G	Destructive: 100 G
Vibration resistance	Functional: 12 G, 10 to 55 Hz at double amplitude of 2 mm Destructive: 18 G, 10 to 55 Hz at double amplitude of 3 mm	
Unit weight	2C: Approx. 5 g .14 oz	

TYPE AND INPUT DATA at 25°C 77°F

Type: DS2-C3-5V

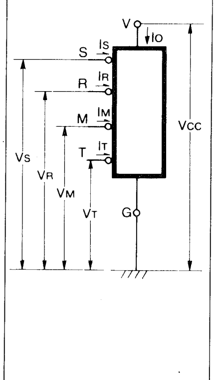
DATA

Temperature characteristics



INPUT DATA

Symbol



A. Absolute maximum rating

Item	Symbol	Value	Unit
Max. power source voltage	Vcc	14	V
Max. Input Voltage	VHS, VHR, VHM, VHT	Vcc	V
Max. power source current	I_0	100	mA

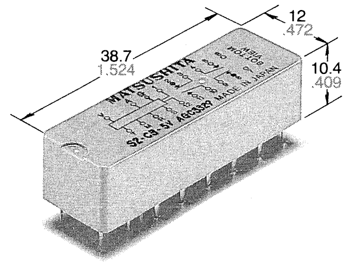
B. Operation conditions

Item		Symbol	Condition	Allowable value Min.	Center	Max.	Unit
Rated power source voltage		Vcc		4.75	5	14	V
Power source current	Operating	I_0	Vcc = 5 V (when relay is operating)			45	mA
	Steady		Vcc = 5 V			2	mA
L level voltage		Vs, VR, VT, VM	Vcc = 5 V	−0.5		0.8	V
H level voltage		Vs, VR, VM, VT	Vcc = 5 V	2.0		Vcc	V
Input current		IR, Is, IT, IM	Vcc = 5 V, Input is 5 V			50	μA
			Vcc = 5 V, Input is 0 V			−200	μA

NAiS

IC BUILT-IN RELAY FOR INTELLIGENT CONTROL INTERFACE

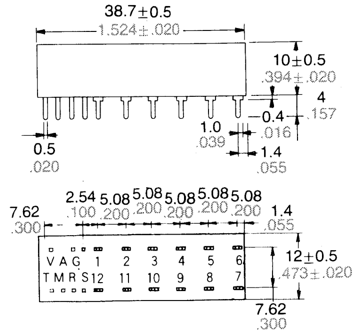
S-C3 RELAYS



mm inch

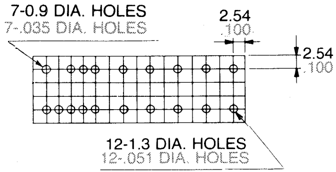
DIMENSIONS

mm inch

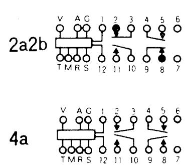


General tolerance: ±0.3 ±.012

• PC board pattern (Copper-side view)



• Schematic (Bottom view)



Note: Diagram show the condition when voltage is not applied to V and G terminals.

SPECIFICATIONS

Contacts

Arrangement	2 Form A 2 Form B 3 Form A 1 Form B 4 From A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	50 mΩ
Contact material	Gold clad silver alloy
Electrostatic capacitance	Approx. 3 pF
Rating (resistive)	
Max. switching power	1,000 VA, 90 W
Max. switching voltage	250 V AC, 30 V DC
Max. switching current	4 A (AC), 3 A (DC)
Expected life (min. operations)	
Mechanical	10^8
Electrical (at 20 cpm)	
4 A 250 V AC	10^5
3 A 30 V DC	2×10^5

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

Max. operating speed	30 cps.
Operate time	Approx. 8 msec.
Release time	Approx. 8 msec.
Initial breakdown voltage	
Between open contacts	750 Vrms
Between contact sets	1,000 Vrms
Between contact and coil	1,500 Vrms
Between contact and input	1,500 Vrms
Between contact and power source	1,500 Vrms
Initial insulation resistance	10,000 MΩ at 500 V DC
Ambient temperature	−25°C to +65°C −13°F to +149°F
Storage temperature	−55°C to +85°C −67°F to +185°F
Shock resistance	Functional: 50 G / Destructive: 100 G
Vibration resistance	Functional: 18 G, 10 to 55 Hz at double amplitude of 3 mm Destructive: 24 G, 10 to 55 Hz at double amplitude of 4 mm
Unit weight	Approx. 10 g .35 oz

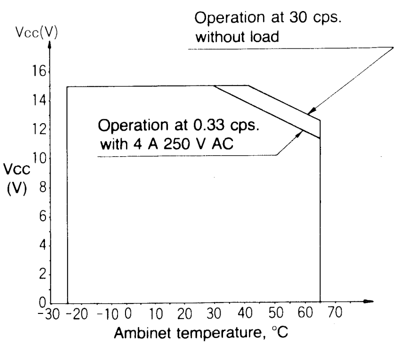
TYPE AND INPUT DATA at 25°C 77°F

Type:

Part No.	Contact arrangement
S2-C3-5V	2a2b
S3-C3-5V	3a1b
S4-C3-5V	4a

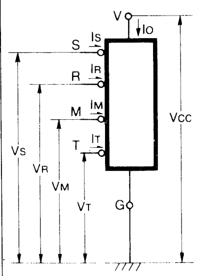
DATA

• Temperature characteristics



INPUT DATA

Symbol



A. Absolute maximum rating

Item	Symbol	Value	Unit
Max. power source voltage	Vcc	15	V
Max. Input Voltage	VHS, VHR, VHM, VHT	Vcc	V
Max. power source current	I_0	100	mA

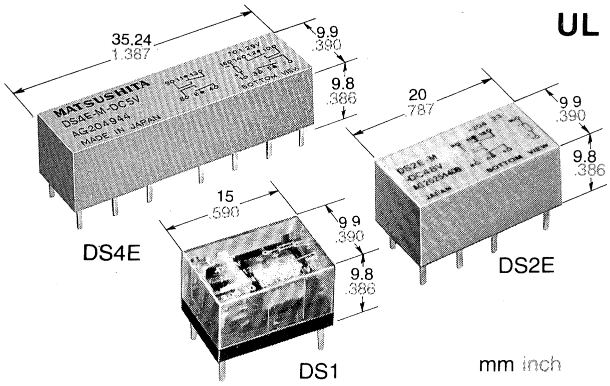
B. Operation conditions

Item		Symbol	Condition	Allowable value Min.	Center	Max.	Unit
Rated power source voltage		Vcc		4.75	5	15	V
Power source current	Operating	I_0	Vcc = 5 V (when relay is operating)			45	mA
	Steady		Vcc = 5 V			2	mA
L level voltage		Vs, VR, VT, VM	Vcc = 5 V	−0.5		0.8	V
H level voltage		Vs, VR, VM, VT	Vcc = 5 V	2.0		Vcc	V
Input current		IR, Is, IT, IM	Vcc = 5 V, Input is 5 V			50	μA
			Vcc = 5 V, Input is 0 V			−200	μA

NAiS

HIGHLY SENSITIVE 1500 V FCC SURGE WITHSTANDING MINIATURE RELAY

DS-RELAYS



UL File No.: E43149 CSA File No.: LR26550

- **High sensitivity** 200 mW pick-up power
  100 mW pick-up power types available
- **Latching types available**
- **High switching capacity:** 60 W, 125 VA
- **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
- **Amber sealed types and MBB contact types available**
- **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
UL/CSA rating	0.6 A 125 V AC 0.6 A 110 V DC 2 A 30 V DC
Expected life (min. operations) Mechanical (at 600 cpm)	10^8 (1 Form C 2 coil latching type: 10^7)
Electrical 2 A 30 V DC resistive	5×10^5
1 A 30 V DC resistive	2×10^6

*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 25°C 77°F)

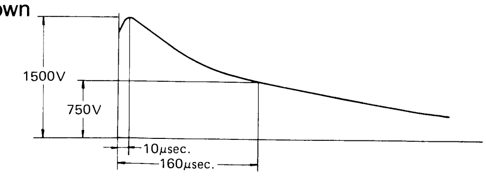
"M" type	Single side stable	Minimum operating power	Approx. 200 mW
		Nominal operating power	Approx. 400 mW
	1 coil latching	Minimum set and reset power	Approx. 90 mW
		Nominal set and reset power	Approx. 180 mW
	2 coil latching	Minimum set and reset power	Approx. 180 mW
		Nominal set and reset power	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 (58mW)*
		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.

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

Max. operating speed		20 cpm at rated load 50 cps at low level load	
Operate time (at nominal voltage)		Approx. 3 msec.	
Release time (at nominal voltage)		Approx. 2 msec.	
Set time (latching) (at nominal voltage)		Approx. 3 msec.	
Reset time (latching) (at nominal voltage)		Approx. 3 msec.	
Initial breakdown voltage		(DS1-S type)	(Other types)
Between open contacts		500 Vrms	1,000 Vrms
Between contact sets		—	1,000 Vrms
Between contact and coil		1,000 Vrms	1,500 Vrms
Initial insulation resistance		Min. 1,000 MΩ (at 500 V DC)	
FCC* surge voltage between open contacts		1,500 V (Except DS1-S type)	
Temperature rise		Max. 65 deg.	
Ambient temperature		−40°C to +70°C −40°F to +158°F	
Shock resistance	Functional	1C, 2C; 50 G 4C; 30 G	
	Destructive	100 G	
Vibration resistance	Functional	20 G, 10 to 55 Hz at double amplitude of 3.3 mm	
	Destructive	30 G, 10 to 55 Hz at double amplitude of 5 mm	
Unit weight		1 Form C: Approx. 3.2 g .11 oz 2 Form C: Approx. 4 g .14 oz 4 Form C: Approx. 7 g .25 oz	

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



ORDERING INFORMATION

Ex. DS 2 E — M L2 — DC 48V —* R

Contact arrangement	Classification of type	Sensitivity	Operating function	Coil voltage
1: 1 Form C 2: 2 Form C 4: 4 Form C	Nil: Standard type 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

(Notes) 1. *Reverse polarity types available (Add suffix-R)
2. For UL/CSA recognized types, add suffix UL/CSA.
3. Standard packing: Carton: 50 pcs. Case: 500 pcs.

TYPICAL APPLICATIONS

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

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

1 coil latching

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

2 coil latching

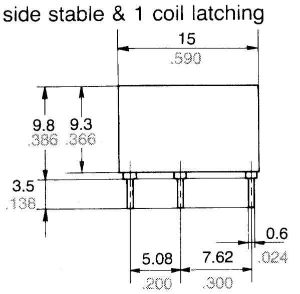
	Nominal voltage, V DC	*Reset Set, V DC (max.)	*Maximum allowable, V DC (at 50°C 122°F)	Coil resistance, Ω (±10%) Coil I	Coil resistance, Ω (±10%) Coil II
"M" type	1.5	1.05	1.8 / 2.25	6.25	
	3	2.1	3.6 / 4.5	25	
	5	3.5	6 / 7.5	69.4	
	6	4.2	7.2 / 9	100	
	9	6.3	10.8 / 13.5	225	
	12	8.4	14.4 / 18	400	
	24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

*Top: 1 Form C
Bottom: 2, 4 Form C

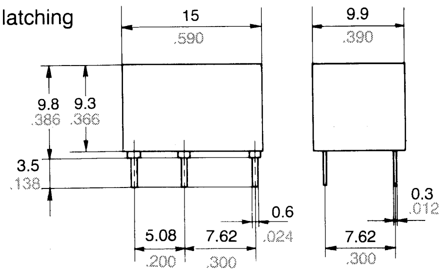
DIMENSIONS

mm inch

1 Form C General tolerance: ±0.3 ±.012
Single side stable & 1 coil latching

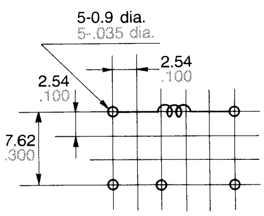


2 coil latching

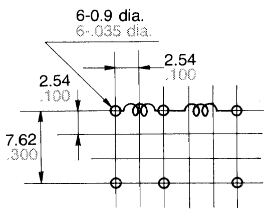


PC board pattern (Copper-side view)
Tolerance: ±0.1 ±.004

Single side stable & 1 coil latching

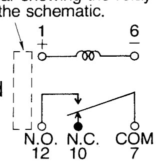


2 coil latching



Schematic (Bottom view)
- A polarity bar showing the relay direction can replace the schematic.

Single side stable
Deenergized condition



1 coil latching

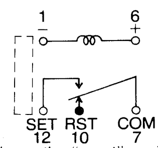


Diagram shows the "reset" position when terminals 1 and 6 are energized. Energize with reverse polarity to transfer contacts.

2 coil latching

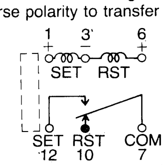


Diagram shows the "reset" position when terminals 3 and 6 are energized. Energize terminals 1 and 3 to transfer contacts.

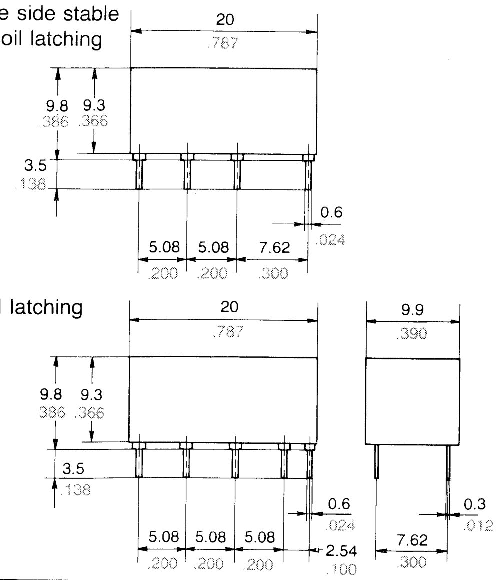
mm inch

2 Form C

General tolerance: ±0.3 ±.012

Single side stable & 1 coil latching

2 coil latching

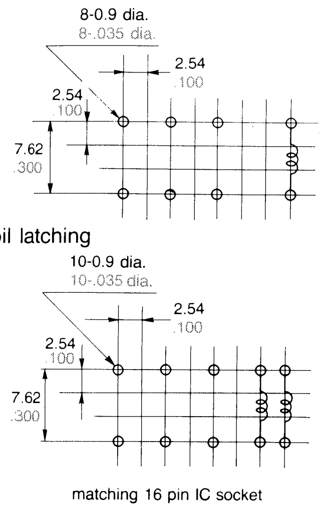


PC board pattern (Copper-side view)

Tolerance: ±0.1 ±.004

Single side stable & 1 coil latching

2 coil latching



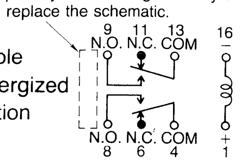
matching 16 pin IC socket

Schematic (Bottom view)

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

Single side stable

Deenergized condition



1 coil latching

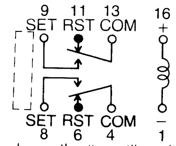


Diagram shows the "reset" position when terminals 1 and 16 are energized. Energize with reverse polarity to transfer contacts.

2 coil latching

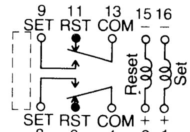


Diagram shows the "reset" position when terminals 2 and 15 are energized. Energize terminals 1 and 16 to transfer contacts.

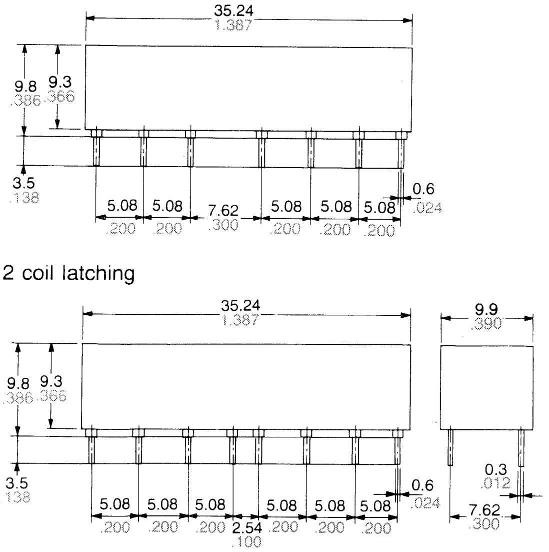
mm inch

4 Form C

General tolerance: ±0.3 ±.012

Single side stable & 1 coil latching

2 coil latching

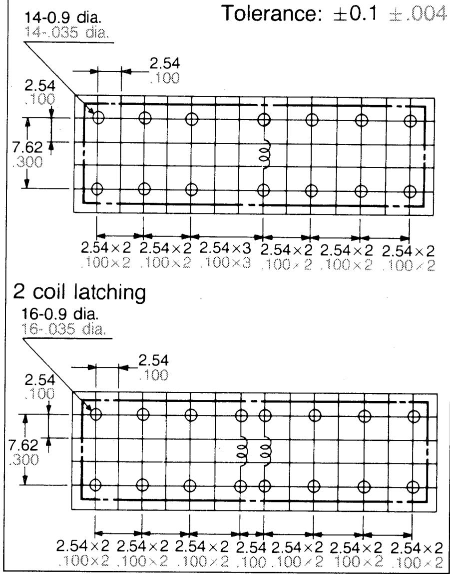


PC board pattern (Copper-side view)

Single side stable & 1 coil latching

Tolerance: ±0.1 ±.004

2 coil latching

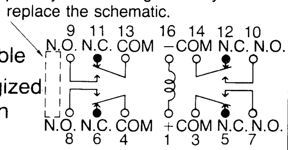


Schematic (Bottom view)

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

Single side stable

Deenergized condition



1 coil latching

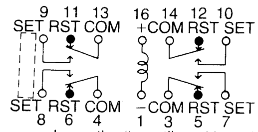


Diagram shows the "reset" position when terminals 1 and 16 are energized. Energize with reverse polarity to transfer contacts.

2 coil latching

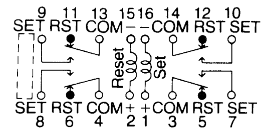


Diagram shows the "reset" position when terminals 2 and 15 are energized. Energize terminals 1 and 16 to transfer contacts.

OPERATING PRINCIPLE - 4 Form C

DS4 (Single side stable)

Fig. 1 Deenergized position

Fig. 2 Energized position

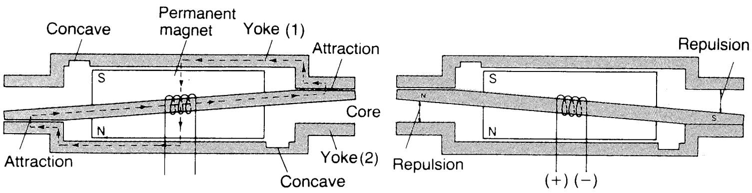
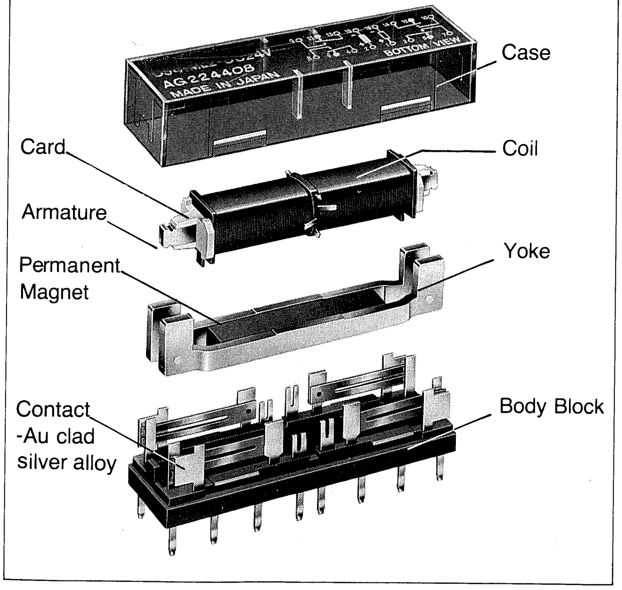


Fig. 1 shows the deenergized position of single side stable versions. Concaves both in yoke (1) and yoke (2) create an unbalance of the magnetic circuit. Therefore the armature is attracted to the yoke (1) and yoke (2) as shown due to the magnetic flux of the permanent magnet.
Energized condition is illustrated in Fig. 2. When the armature is energized as shown, the magnetic repulsion-attraction between the yokes takes place rotating the armature. When the power is removed from the coil, contacts return to the original stage as shown in Fig. 1.

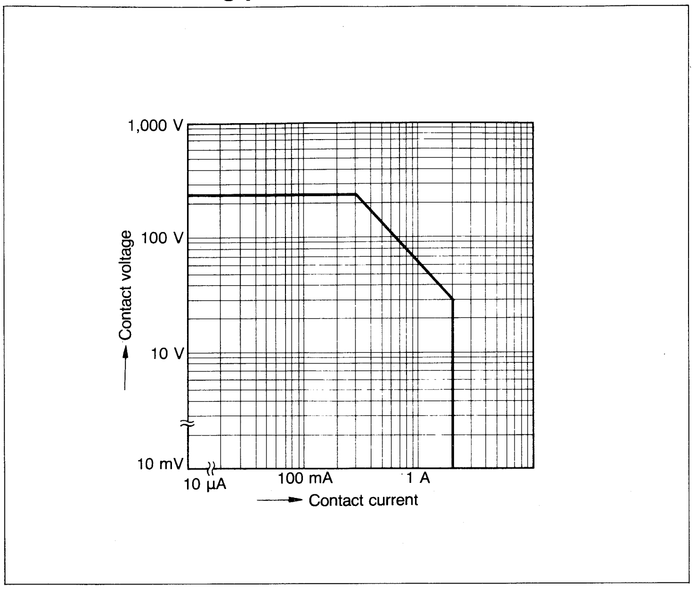
CONSTRUCTION - 4 Form C

Maximum reliability in a high density simplified design

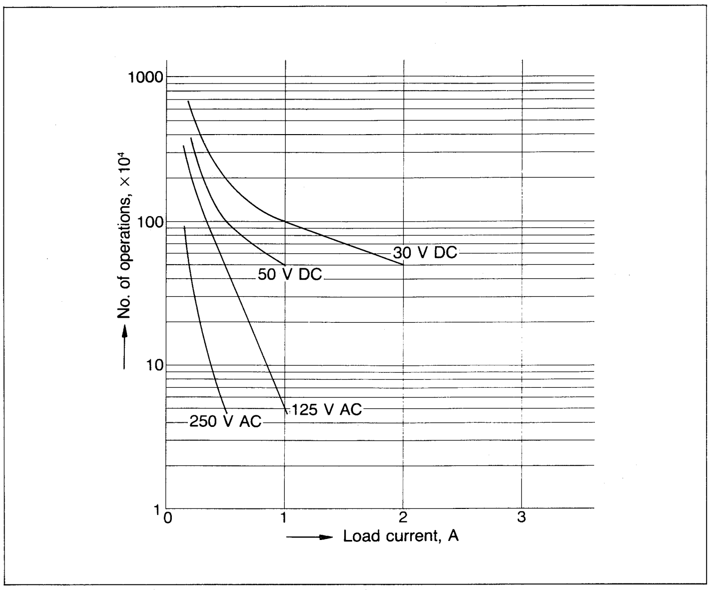


DATA

Maximum switching power

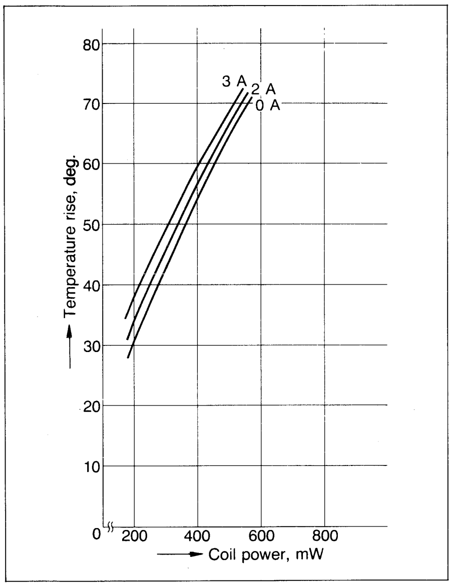


Life curve (Resistive load)

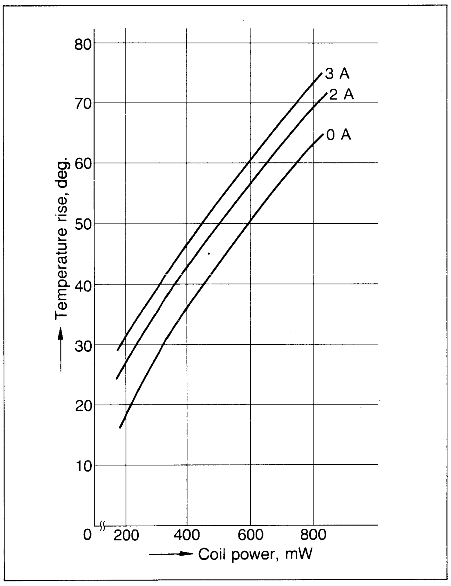


Coil temperature rise (at 20°C 68°F)

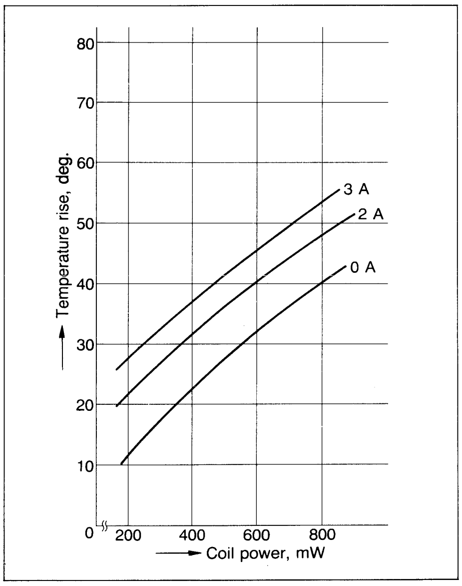
DS1 type



DS2 type

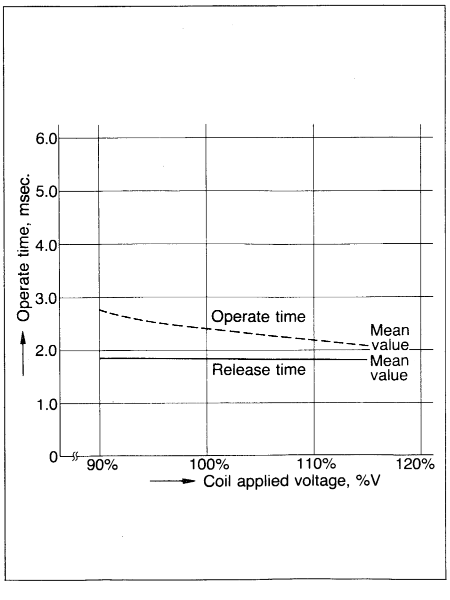


DS4 type

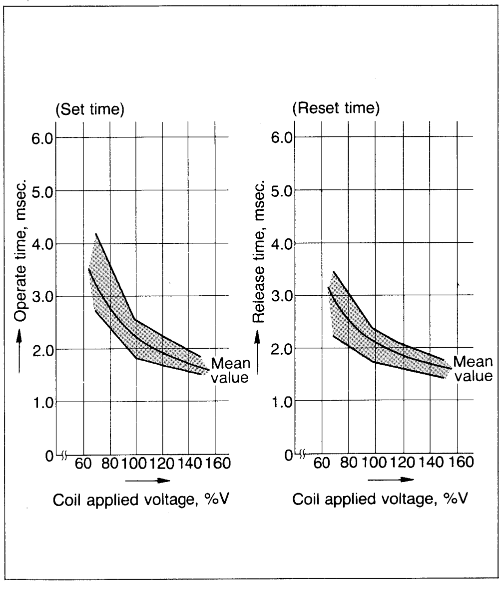


Operate/release time for single side stable (at 20°C 68°F, excluding bounce)

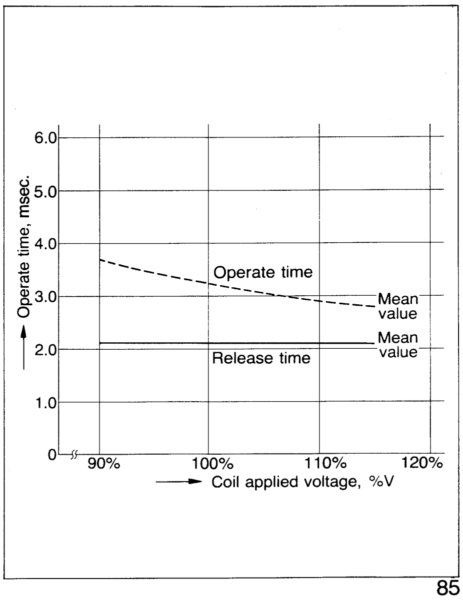
Sample: DS1-M-DC12V



Sample: DS2-ML2-DC12V

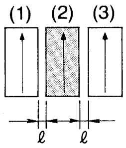


Sample: DS4-M-DC12V



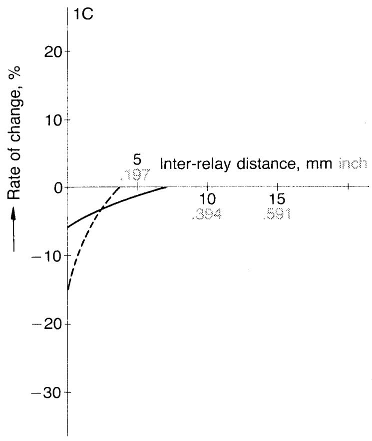
Influence of adjacent mounting

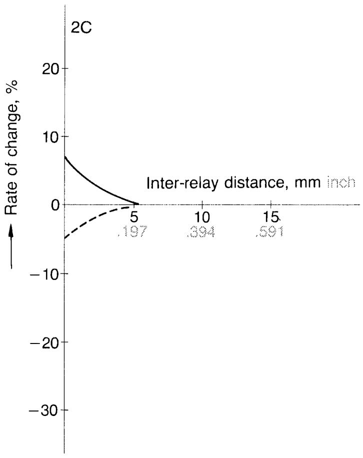
TEST METHOD
1. Apply nominal voltage to No. (1), and (3) DS relays.
2. Measure pick-up voltage and drop-out voltage of No. (2) relay when inter-relay distance (ℓ) changes.

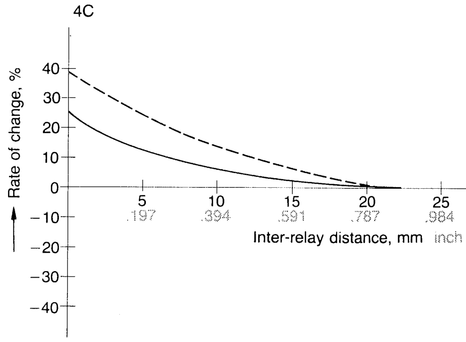


Sample: DS1-M-DC24V
DS2-M-DC24V
DS4-M-DC24V

——— Pick-up voltage
------ Drop-out voltage



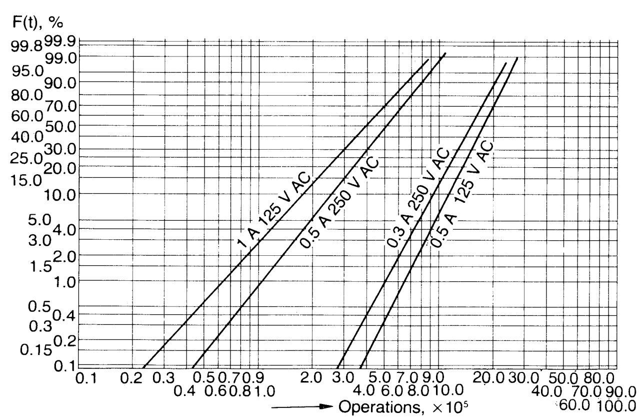




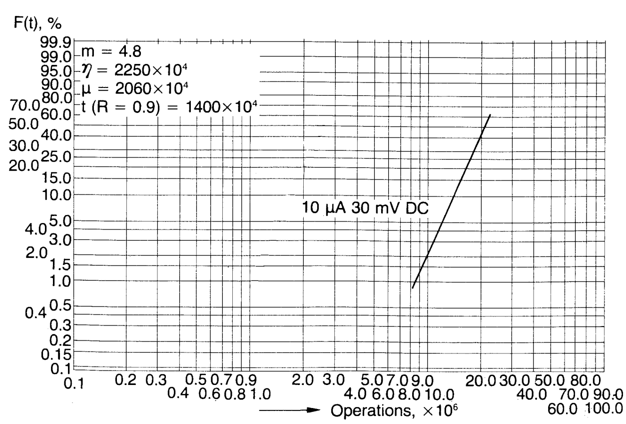
Notes on usage:
1. Although mounting 2 Form C DS relays side-by-side (zero space between the relay cases) will not cause misoperation to occur, the relays should be separated by approximately 5 mm (.197 inches) to completely eliminate the influence of the external magnetic field.
2. In mounting 4 Form C DS relays, care should be excercised to mount them towards the same direction.
3. Under worst-case conditions, mounting 4 Form C DS relays side-by-side (zero space between the relay cases) could cause them to remain in the energized stage. Therefore, the relays should be separated by 5 mm (.197 inches) minimum to assure correct operation.

Weilbull probability data

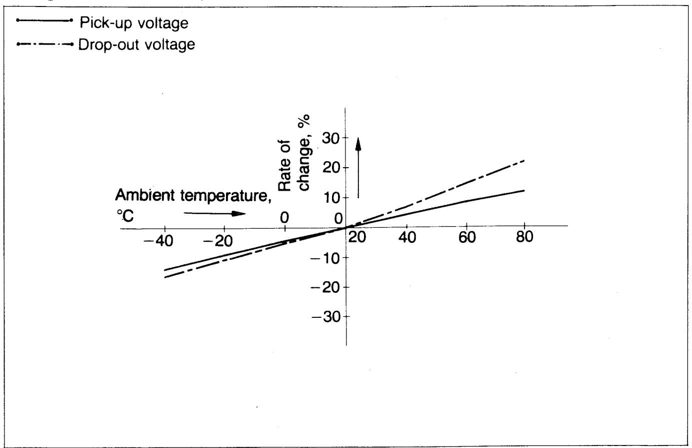
Contact reliability for AC loads
Sample: DS2-M-DC24V
TEST CONDITION
1. Cycle rate: 20 cpm.
2. Load (resistive): 1 A 125 V AC, 0.5 A 250 V AC, 0.3 A 250 V AC, 0.5 A 125 V AC
3. Rejection level: 200 mΩ



Low-level load test
Sample: DS2-M-DC24V
TEST CONDITION
1. Test equipment: Low-level load contact reliability measuring machine
2. Load: Voltage: 30 mV DC; Current: 10 µA; Kind: Resistance (Metal-grades)
3. Detection level: 200 Ω (1 contact)
4. Detection time: 3 msec.

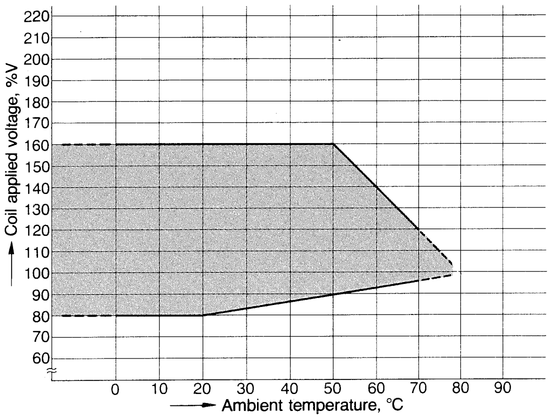


Change of rate of pick-up and drop-out voltage
(Single side stable)

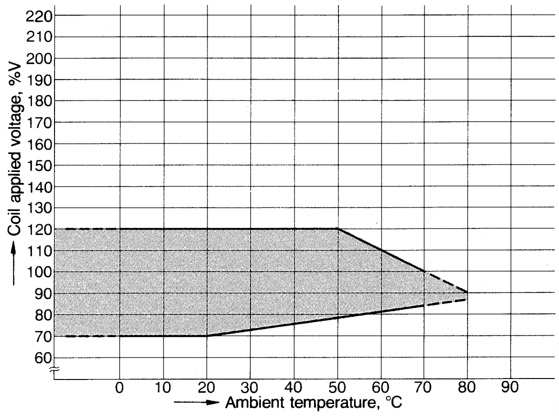


Ambient temperature and operating voltage range

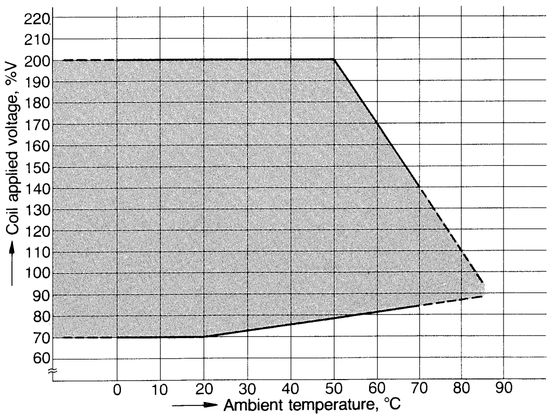
DS1-S type



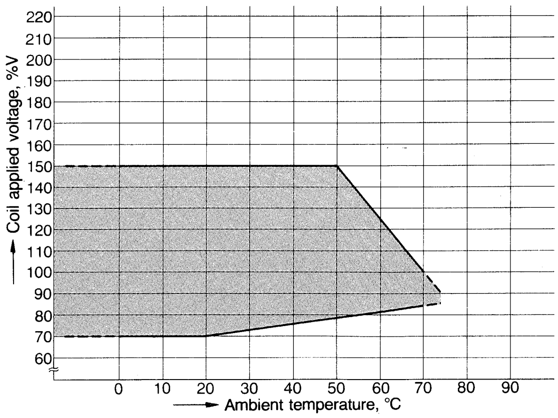
DS1-M type



DS2-S type DS4-S type



DS2-M type DS4-M type

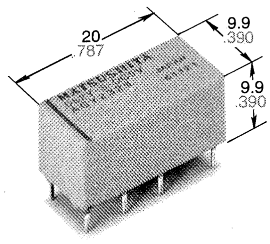


Note: Data assumes that the maximum allowable temperature is 120°C, and is not applicable to hot start.

NAiS

2 FORM C—200 mW SENSITIVE MINIATURE RELAY 1500 V FCC SURGE WITHSTAND

DS2Y-RELAYS



mm inch

UL File No.: E43149
CSA File No.: LR26550

- 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 silver
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
UL/CSA rating	0.3 A 125 V AC 0.3 A 110 V DC 1 A 30 V DC
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

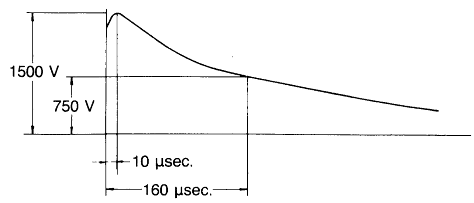
Coil (polarized) (at 20°C 68°F)

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)

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

Operate time (at nominal voltage)		Approx. 4 msec.
Release time (at nominal voltage)		Approx. 3 msec.
Set time (latching) (at nominal voltage)		Approx. 3 msec.
Reset time (latching) (at nominal voltage)		Approx. 3 msec.
Initial breakdown voltage Between open contacts		750 Vrms
Between contact sets		1,000 Vrms
Between contact and coil		1,000 Vrms
Initial insulation resistance		Min. 1,000 MΩ (at 500 V DC)
FCC surge voltage between open contacts		1,500 V
Temperature rise		Max. 65 deg.
Ambient temperature		−40°C to +70°C −40°F to +158°F
Shock resistance	Functional	Min. 50 G
	Destructive	Min. 100 G
Vibration resistance	Functional	20 G, 10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	30 G, 10 to 55 Hz at double amplitude of 5 mm
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 | — | DC12V | — | 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. For UL/CSA recognized types, add suffix UL/CSA.
2. Standard packing: Carton: 50 pcs. Case: 500 pcs.

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

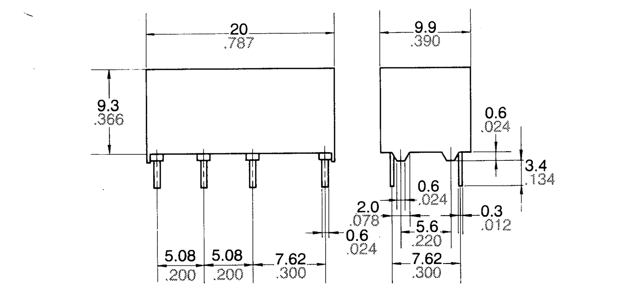
2 coil latching

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		12.5		180		3
3	DS2Y-SL2-DC3V	2.1	60		50		180		6
5	DS2Y-SL2-DC5V	3.5	36		139		180		10
6	DS2Y-SL2-DC6V	4.2	30		200		180		12
9	DS2Y-SL2-DC9V	6.3	20		450		180		18
12	DS2Y-SL2-DC12V	8.4	15		800		180		24
24	DS2Y-SL2-DC24V	16.8	7.5		3,200		180		48
48	DS2Y-SL2-DC48V	33.6	7.5		6,400		360		72

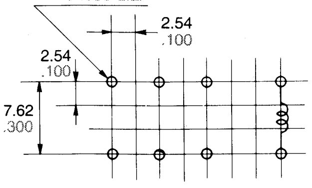
DIMENSIONS

mm inch

Single side stable General tolerance: ±0.3 ±.012



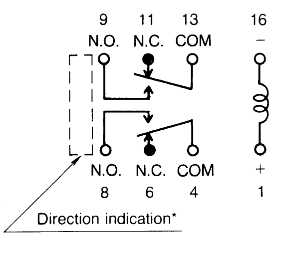
PC board pattern (Copper-side view)
Tolerance: ±0.1 ±.004



matching 16 pin IC socket

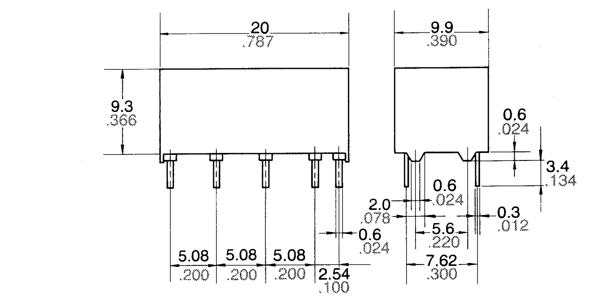
Schematic (Bottom view)

(Deenergized position)

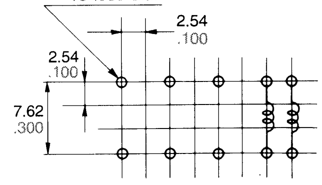


*A polarity bar shows the relay direction.

2 coil latching General tolerance: ±0.3 ±.012



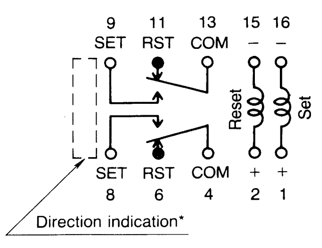
PC board pattern (Copper-side view)
Tolerance: ±0.1 ±.004



matching 16 pin IC socket

Schematic (Bottom view)

(Reset position)

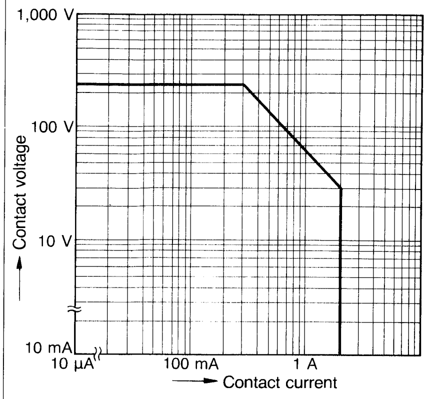


*A polarity bar shows the relay direction.

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

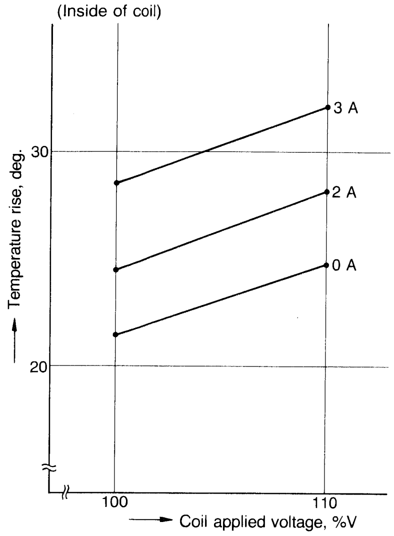
DATA

Maximum switching power

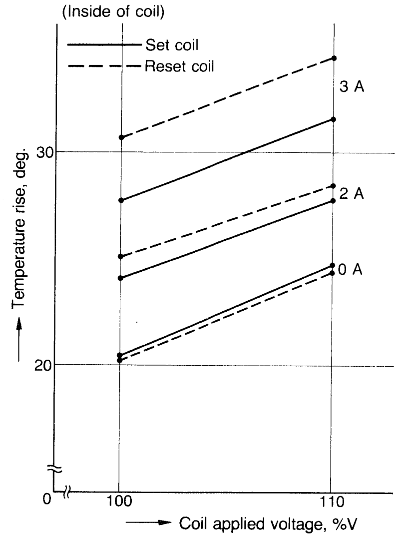


Coil temperature rise

1. Single side stable
Ambinet temperature: 21°C to 25°C 70°F to 77°F
Sample: DS2Y-S-DC12V, 5 pcs.

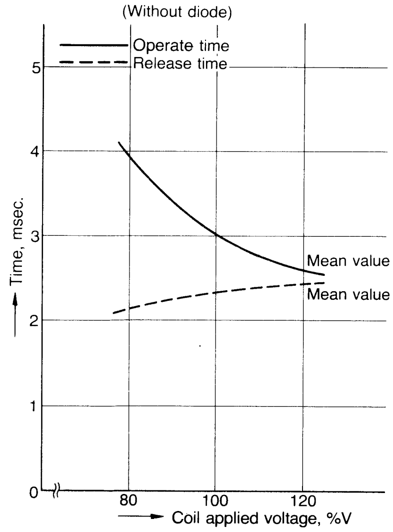


2. 2 coil latching
Ambinet temperature: 21°C to 25°C 70°F to 77°F
Sample: DS2Y-SL2-DC12V, 5 pcs.



Operate/release time for single side stable

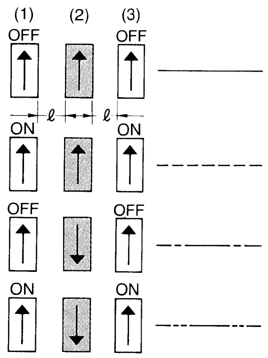
Ambient temperature: 20°C 68°F
Sample: DS2Y-S-DC12V, 10 pcs.

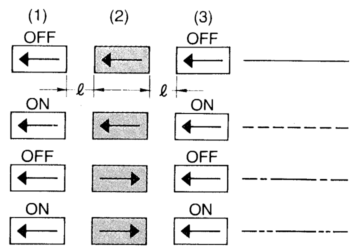


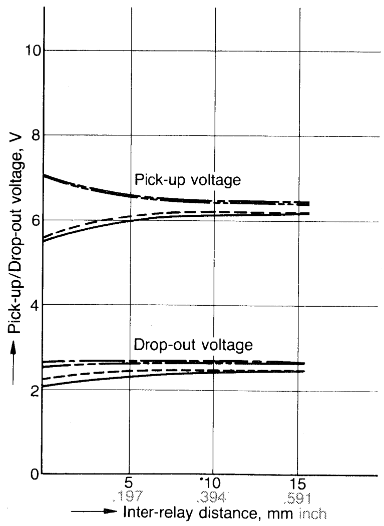
Influence of adjacent mounting

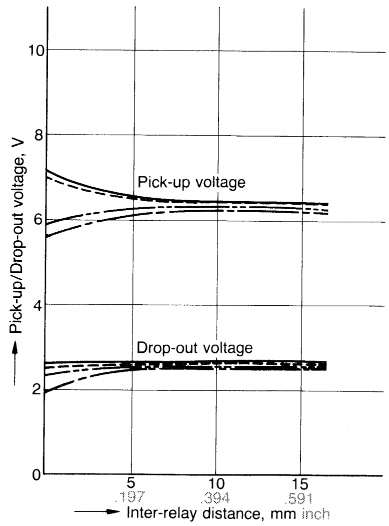
Ambient temperature: 20°C 68°F
Sample: DS2Y-S-DC12V, 10 pcs.

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.









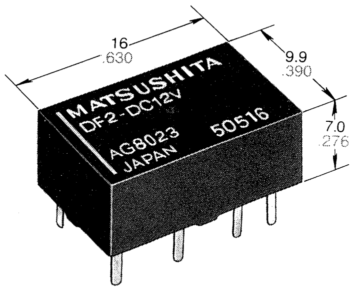
NOTES

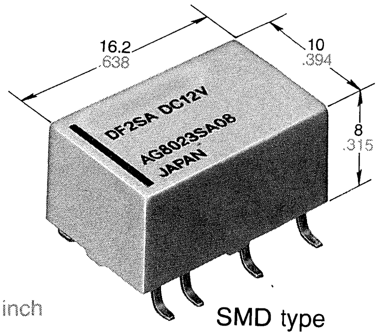
1. Coil operating power
   Pure DC current should be applied to the coil. And wave form should be rectangular. If its includes ripple, the ripple factor should be less than 5%. However, check it with the actual circuit since the characteristics are slightly different.
2. External magnetic field
   Since DS2Y relay is highly sensitive polarized relay, its characteristics will be affected by a strong external magnetic field. So avoid using relays under that condition.
3. DS2Y relays do not operate with the opposite polarity because DS2Y relays are polarized.
4. In automatic cleaning, cleaning with the boiling method is recommended. Avoid ultrasonic cleaning for relays.

NAiS

HIGHLY SENSITIVE DIP MINIATURE RELAY

DF-RELAYS





mm inch

SMD type

UL File No.: E43149
CSA File No.: LR26550

- **Smaller than most of 2 form C relays**
  Header area: 80% of DS2 relay
  Cubic measure: 57% of DS2 relay
- **High sensitivity—100 mW nominal power for 1 coil latching type**
- **DIP—matching 14 pin IC socket**
- **Surface-mount terminal type available**

SPECIFICATIONS

Contact

Arrangement	2 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	30 W, 30 V A
Max. switching voltage	60 V DC, 125 V AC
Max. switching current	1 A
Max. carrying current	1 A
Min. switching capacity	1 mA 1 V DC
UL/CSA rating	1 A 30 V DC 0.3 A 125 V AC 0.3 A 110 V DC
Expected life (min. operations) Mechanical	Single side stable: 5×10^6 1 coil & 2 coil latching: 10^6
Electrical (at 20 cpm) 1 A 30 V DC resistive 0.5 A 30 V AC resistive	10^5

Coil (Polarized) (at 25°C 77°F)

	Nominal	Minimum
Single side stable	200 mW	100 mW*
1 coil latching	100 mW	65 mW
2 coil latching	200 mW	130 mW

*112.5 mW in case of SMD type

Characteristics

Max. operating speed		60 cpm
Operate time (at nominal voltage)		Approx. 2.5 msec.
Release time (at nominal voltage)		Approx. 1 msec.
Set time (latching) (at nominal voltage)		Approx. 3 msec.
Reset time (latching) (at nominal voltage)		Approx. 3 msec.
Initial breakdown voltage Between open contacts Between contact sets Between contact and coil		 500 Vrms for 1 min. 500 Vrms for 1 min. 1,000 Vrms for 1 min.
Initial insulation resistance		Min. 100 MΩ (at 500 V DC)
Temperature rise		Max. 65 deg.
Ambient temperature		−40°C to +70°C −40°F to +158°F
Shock resistance	Functional	Min. 30 G
	Destructive	Min. 100 G
Vibration resistance	Functional	9 G. 10 to 55 Hz at double amplitude 1.5 mm
	Destructive	9 G, 10 to 55 Hz at double amplitude 1.5 mm
Unit weight		Approx. 2.4 g .085 oz

TYPICAL APPLICATIONS

Signal transmission application requiring high sensitivity and low profile miniature size

- Audio visual equipment
- Telecommunication equipment
- Computer peripherals

ORDERING INFORMATION

Ex. DF2 | SA | — | L | — | DC5V |

Surface-mount availability	Operating function	Coil voltage
Nil: Standard PC board terminal type SA: Surface-mount terminal type*	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	DC 1.5, 3, 5, 6, 9, 12, 24 V

(Notes) 1. For UL/CSA recognized type, add suffix UL/CSA.
2. Standard packing: Carton: 50 pcs. Case: 500 pcs.

*Only for Single side stable.

TYPES AND COIL DATA (at 20°C 68°F)

1. Standard PC board terminal type

Single side stable

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	Max. allowable voltage, V DC (70°C 158°F)
DF2-DC1.5V	1.5	1.05	0.15	11.25	133.3	200	1.8
DF2-DC3V	3	2.1	0.3	45	66.7	200	3.6
DF2-DC5V	5	3.5	0.5	125	40.0	200	6.0
DF2-DC6V	6	4.2	0.6	180	33.3	200	7.2
DF2-DC9V	9	6.3	0.9	405	22.2	200	10.8
DF2-DC12V	12	8.4	1.2	720	16.7	200	14.4
DF2-DC24V	24	16.8	2.4	2,880	8.3	200	28.8

1 coil latching

Part No.	Nominal voltage, V DC	Set and Reset voltage, V DC (max.)	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Max. allowable voltage, V DC (70°C 158°F)
DF2-L-DC1.5V	1.5	1.2	22.5	66.7	100	1.8
DF2-L-DC3V	3	2.4	90	33.3	100	3.6
DF2-L-DC5V	5	4.0	250	20.0	100	6.0
DF2-L-DC6V	6	4.8	360	16.7	100	7.2
DF2-L-DC9V	9	7.2	810	11.1	100	10.8
DF2-L-DC12V	12	9.6	1,440	8.3	100	14.4
DF2-L-DC24V	24	19.2	5,760	4.1	100	28.8

2 coil latching

Part No.	Nominal voltage, V DC	Set and Reset voltage, V DC (max.)	Coil resistance, Ω (±10%)		Nominal operating current, mA	Nominal operating power, mW	Max. allowable voltage, V DC (70°C 158°F)
			Coil 1	Coil 2			
DF2-L2-DC1.5V	1.5	1.2	11.25	11.25	133.3	200	1.8
DF2-L2-DC3V	3	2.4	45	45	66.6	200	3.6
DF2-L2-DC5V	5	4.0	125	125	40	200	6.0
DF2-L2-DC6V	6	4.8	180	180	33.3	200	7.2
DF2-L2-DC9V	9	7.2	405	405	22.2	200	10.8
DF2-L2-DC12V	12	9.6	720	720	16.7	200	14.4
DF2-L2-DC24V	24	19.2	2,880	2,880	8.3	200	28.8

2. Surface-mount terminal type

Single side stable

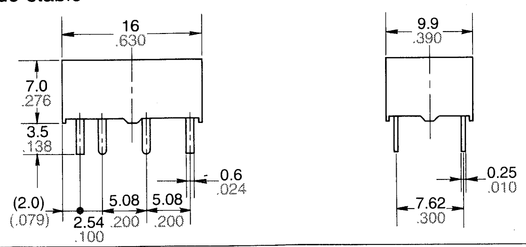
Part No.	Nominal voltage, V DC	Pick-up voltage, max. V DC	Drop-out voltage min. V DC	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Max. allowable voltage, V DC (70°C 158°F)
DF2SA-DC1.5V	1.5	1.13	0.15	11.25	133.3	200	1.8
DF2SA-DC3V	3	2.25	0.3	45	66.7	200	3.6
DF2SA-DC5V	5	3.75	0.5	125	40.0	200	6.0
DF2SA-DC6V	6	4.5	0.6	180	33.3	200	7.2
DF2SA-DC9V	9	6.75	0.9	405	22.2	200	10.8
DF2SA-DC12V	12	9	1.2	720	16.7	200	14.4
DF2SA-DC24V	24	18	2.4	2,880	8.3	200	28.8

DIMENSIONS

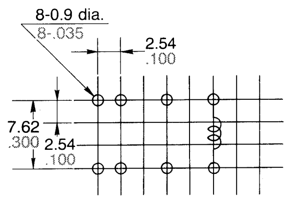
1. Standard PC board terminal type

mm inch

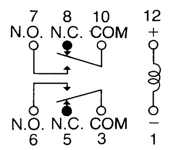
Single side stable



PC board pattern (Copper-side view)

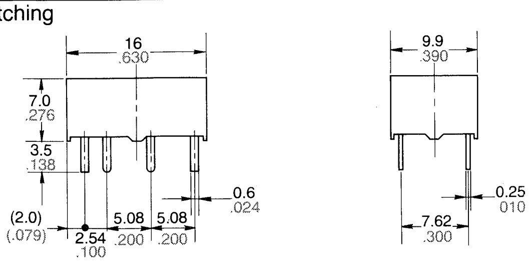


Schematic
(Bottom view)

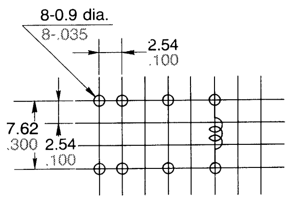


Deenergized condition

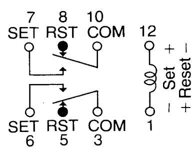
1 coil latching



PC board pattern (Copper-side view)



Schematic
(Bottom view)

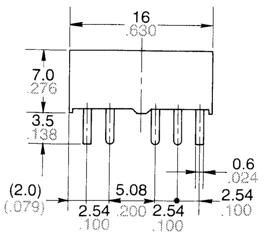


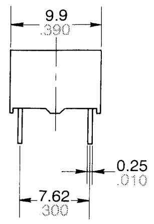
Reset condition

DF

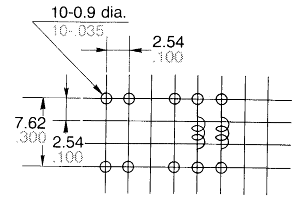
mm inch

2 coil latching

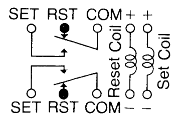




PC board pattern (Copper-side view)



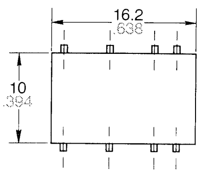
Schematic
(Bottom view)

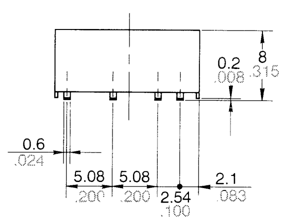


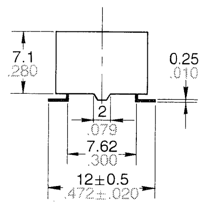
Reset condition

2. Surface-mount terminal type

Single side stable

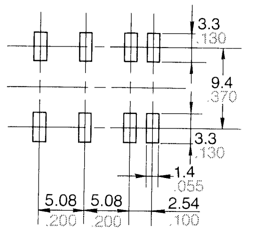






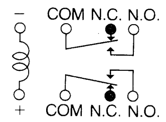
General tolerance: ±0.3 ±.012

PC board pattern



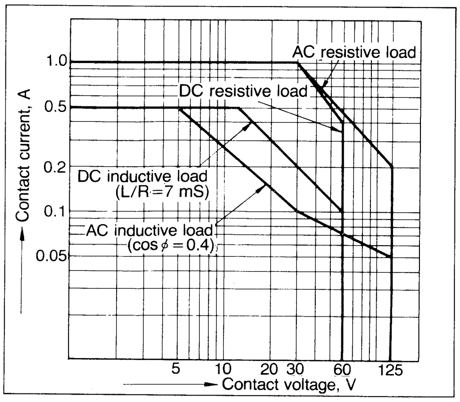
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

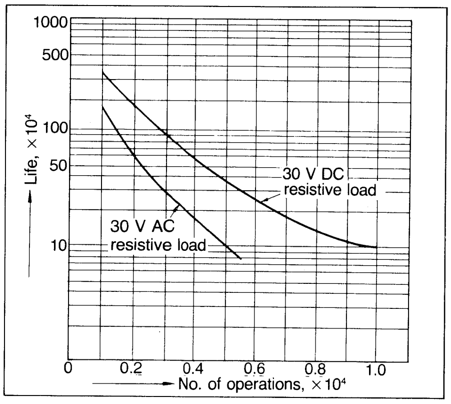


DATA

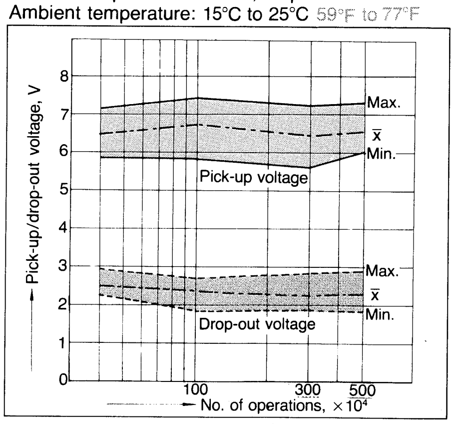
1. Maximum switching power
Tested sample: DF2-DC12V



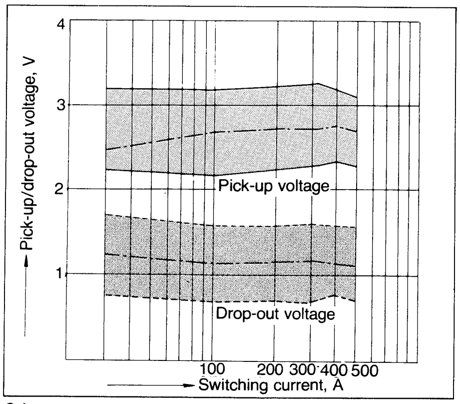
2. Life curve
Tested sample: DF2-DC12V



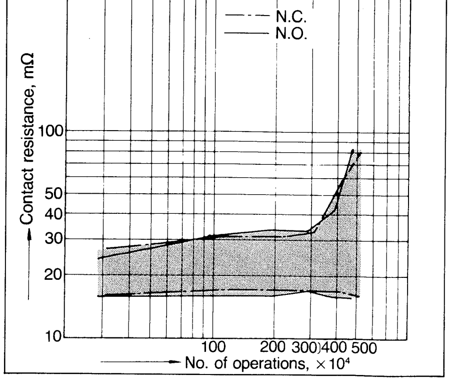
3. Mechanical life
Tested sample: DF2-DC12V, 12 pcs.
Ambient temperature: 15°C to 25°C 59°F to 77°F



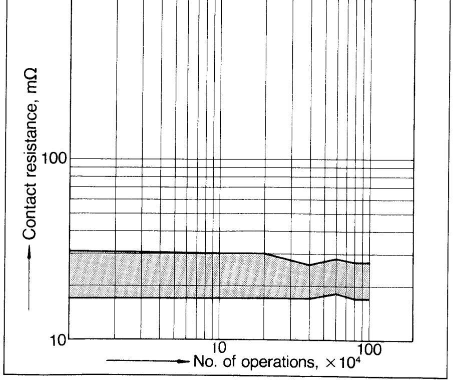
4. Electrical life
Change of pick-up and drop-out voltage
Tested sample: DF2-DC5V, 8 pcs.
Condition: 1 mA 1 V DC resistibe load
Switching frequency: 10 Hz
Ambient temperature: 20°C to 25°C 68°F to 77°F



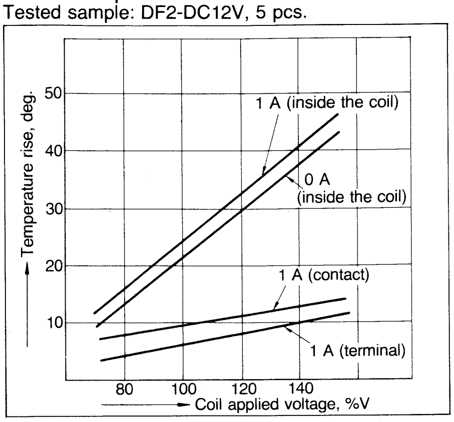
Change of contact resistance
Tested sample: DF2-DC5V, 8 pcs.
Condition: 1 mA 1 V DC resistibe load
Switching frequency: 10 Hz
Ambient temperature: 20°C to 25°C 68°F to 77°F



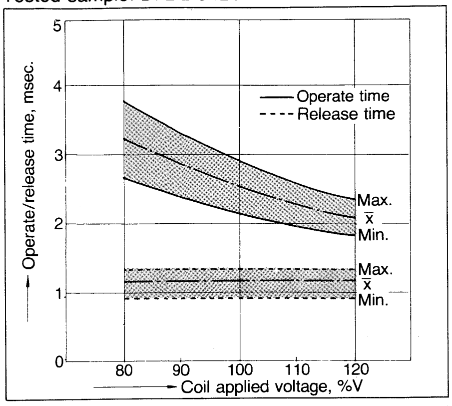
Change of contact resistance (Surface-mount terminal type)
Tested sample: DF2SA-DC24V, 8 pcs.
Condition: 10 mA 10 V DC resistive load
Switching frequency: 2 Hz
Ambient temperature: 85°C 185°F



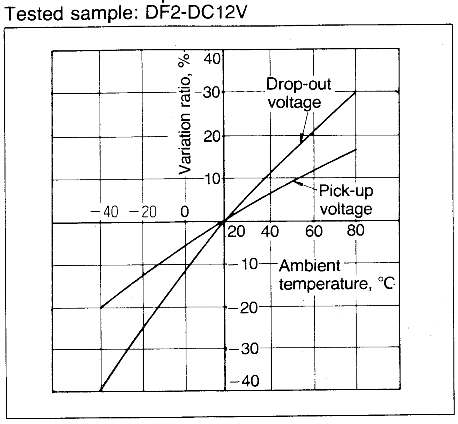
5. Coil temperature rise
Tested sample: DF2-DC12V, 5 pcs.



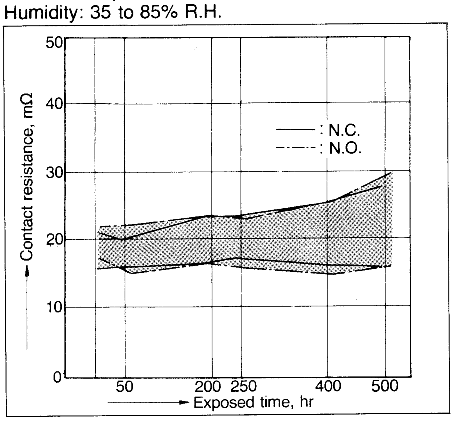
6. Operate/release time characteristics
Tested sample: DF2-DC12V



7. Ambient temperature characteristics
Tested sample: DF2-DC12V



8. H_2S gas test
Gas density: 2 to 5 p.p.m.
Ambient temperature: 20°C to 26°C 68°F to 79°F
Humidity: 35 to 85% R.H.



NOTES

1. Coil operating power

Pure DC current should be applied to the coil. And 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 are slightly different.

2. Coil connection

DF-relay does not operate with the opposite polarity because DF-relay is polarized.

3. External magnetic field

Since DF-relay is polarized relay, its characteristics will be affected by a strong external magnetic field. So avoid using relays under that condition.

4. Cleaning

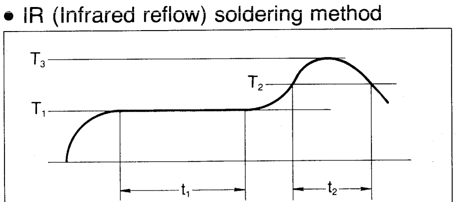
In automatic cleaning, cleaning with the boiling method is recommended. Avoid ultrasonic cleaning for relays.

5. Soldering

1) When soldering through hole terminals, soldering should be done at 245°C 473°F within 10 sec.

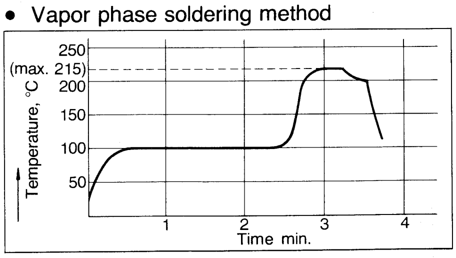
2) When soldering surface-mount terminals, the following conditions are recommended.

• IR (Infrared reflow) soldering method



t_1 = 120 sec. or less
t_2 = 20 to 30 sec. or less
T_1 = 150 to 165°C 302°F to 329°F
T_2 = 180°C 356°F or less
T_3 = 245°C 473°F or less

• Vapor phase soldering method

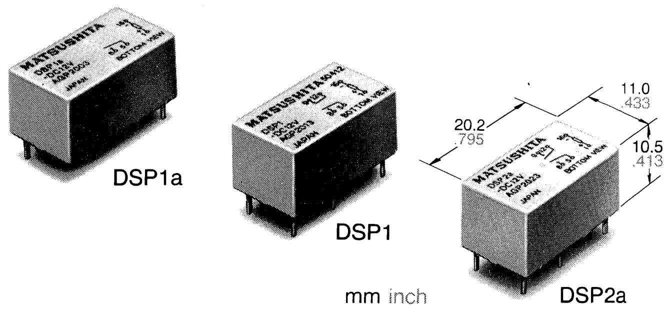


NAIS

MINIATURE POWER RELAY IN DS RELAY SERIES

DSP-RELAYS

UL File No.: E43149, CSA File No.: LR26550, TÜV File No.: 86071645519, SEV



- **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

Contacts

Arrangement	1a	1a1b	2a
Contact material	Gold flash over silver alloy		
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	30 mΩ		
Rating (resistive) Max. switching power *	2,000 VA 150 W	1,250 VA 150 W	
Max. switching voltage	380 V AC, 220 V DC		
Max. switching current	8 A	5 A	
UL/CSA rating	8 A 1/6 HP 125, 250 V AC 5 A 30 V DC*	5 A 1/6 HP 125, 250 V AC 5 A 30 V DC 30 W max. 1 A 30 V DC - 0.24 A 125 V DC	5 A, 1/10 HP 125, 250 V AC 5 A 30 V DC*
TÜV rating	8 A 250 V~ (cos φ = 1.0) 5 A 250 V~ (cos φ = 0.4) 5 A 30 V ⎓ (0 ms)	5 A 250 V~ (cos φ = 1.0) 3 A 250 V~ (cos φ = 0.4) 5 A 30 V ⎓ (0 ms)	
Expected life (min. operations) Mechanical (at 180 cpm)	5×10^7		
Electrical	10^5		

Coil (polarized) (at 20°C 68°F)

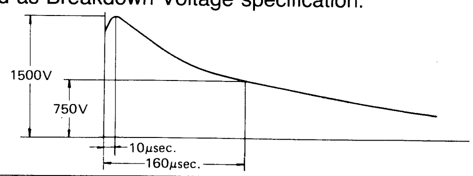
Minimum operating power Single side stable	192 mW
1 coil bistable	96 mW
2 coil bistable	192 mW
Nominal operating power Single side stable	300 mW
1 coil bistable	150 mW
2 coil bistable	300 mW

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

Characteristics

Max. operating speed		30 cps. at rated load
Operate time		Approx. 5 msec.
Release time		Approx. 4 msec.
Set time (latching)		Approx. 5 msec.
Reset time (latching)		Approx. 5 msec.
Initial breakdown voltage Between open contacts		1,000 Vrms
Between contact sets		2,000 Vrms (1a1b, 2a)
Between contacts and coil		3,000 Vrms
Initial insulation resistance		1,000 MΩ at 500 V DC
*FCC surge voltage between open contacts		1,500 V
Temperature rise		Max. 40 deg. (1a1b type), Max. 45 deg. (1a, 2a types)
Ambient temperature		1a1b: −40 to +65°C, −40 to +149°F 1a, 2a: −40 to +60°C, −40 to +140°F
Soldering temperature		250°C (10 sec.), 300°C (5 sec.), 350°C (3 sec.)
Shock resistance	Functional	20 G
	Destructive	100 G
Vibration resistance	Functional	12 G, 10 to 55 Hz at double amplitude of 2 mm
	Destructive	21 G, 10 to 55 Hz at double amplitude of 3.5 mm
Unit weight		Approx. 4.3 g .15 oz

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



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

(Notes) 1. For UL/CSA recognized types, add suffix UL/CSA.
2. For TÜV recognized types, add suffix TUV.
3. Standard packing—Carton: 50 pcs.; Case: 500 pcs.

*DC-load limit curve available

TYPES AND COIL DATA at 20°C 68°F

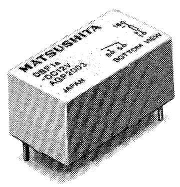
Type	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA		Nominal operating power, mW		Coil resistance, Ω (±10%)		Max. allowable voltage at 50°C, V DC
Single side stable	DSP□-DC3V	3	2.4	0.3	100		300		30		3.9
	DSP□-DC5V	5	4.0	0.5	60		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	DSP□-L-DC3V	3	Set 2.4	Reset 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	DSP□-L2-DC3V	3	Set 2.4	Reset 2.4	Set 100	Reset 100	300	300	30	30	3.9
	DSP□-L2-DC5V	5	4.0	4.0	60	60	300	300	83	83	6.5
	DSP□-L2-DC6V	6	4.8	4.8	50	50	300	300	120	120	7.8
	DSP□-L2-DC9V	9	7.2	7.2	33.3	33.3	300	300	270	270	11.7
	DSP□-L2-DC12V	12	9.6	9.6	25	25	300	300	480	480	15.6
	DSP□-L2-DC24V	24	19.2	19.2	12.5	12.5	300	300	1,920	1,920	31.2

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

DIMENSIONS

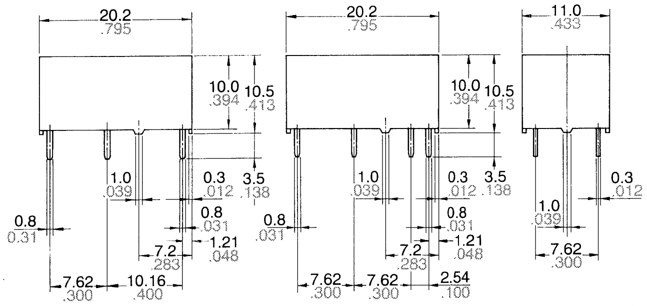
mm inch

1a type (DSP1a)



Single side stable
1 coil latching

2 coil latching

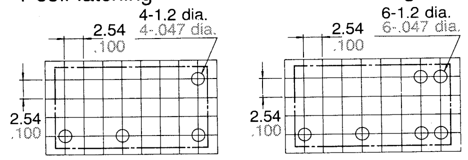


General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)

Single side stable
1 coil latching

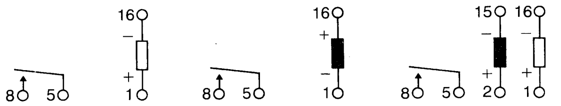
2 coil latching



Tolerance: ±0.1 ±.004

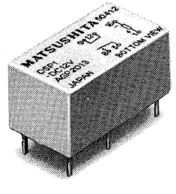
Schematic (Bottom view)

Single side stable | 1 coil latching | 2 coil latching



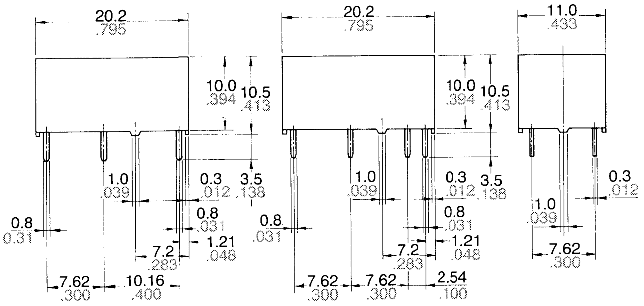
(Deenergized condition) (Reset condition) (Reset condition)

1a1b type (DSP1)



Single side stable
1 coil latching

2 coil latching

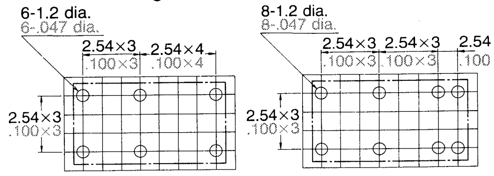


General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)

Single side stable
1 coil latching

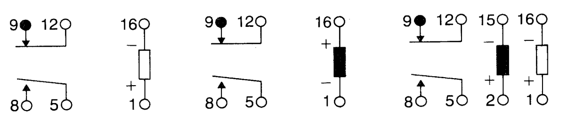
2 coil latching



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

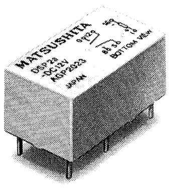
Single side stable | 1 coil latching | 2 coil latching



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

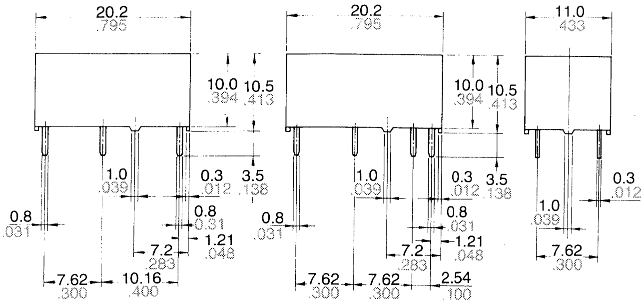
2a type (DSP2a)

mm inch



Single side stable
1 coil latching

2 coil latching

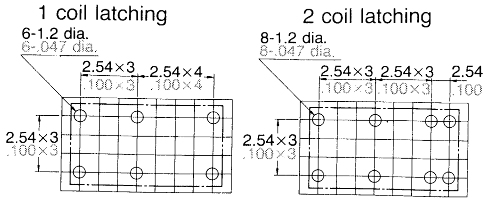


General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)

Single side stable
1 coil latching

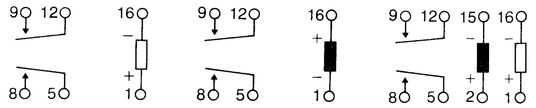
2 coil latching



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

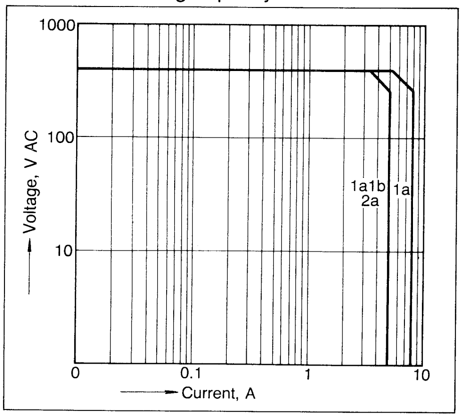
Single side stable | 1 coil latching | 2 coil latching



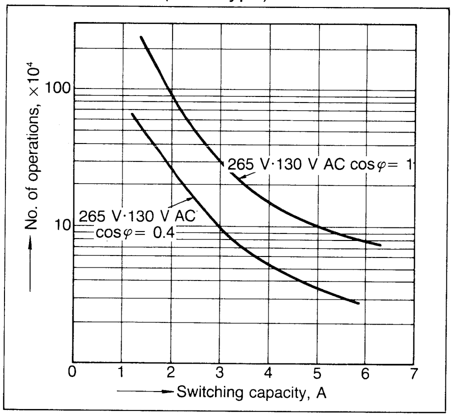
(Deenergized condition) (Reset condition) (Reset condition)

DATA

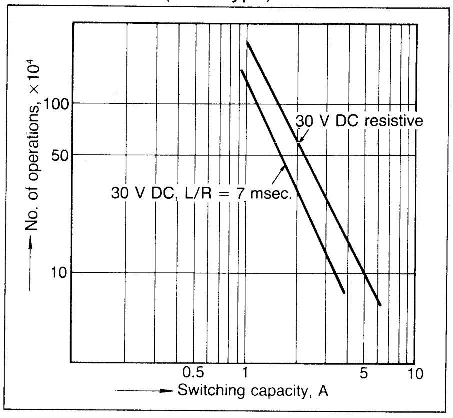
1. Max. switching capacity



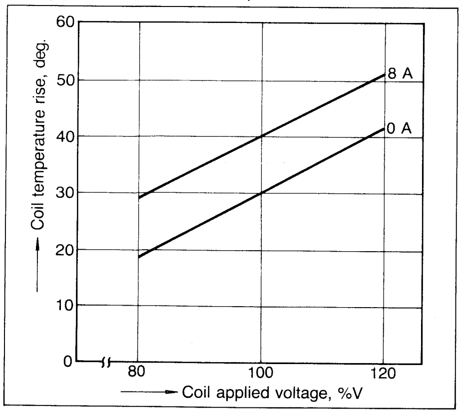
2-1. Life curve (1a1b type)



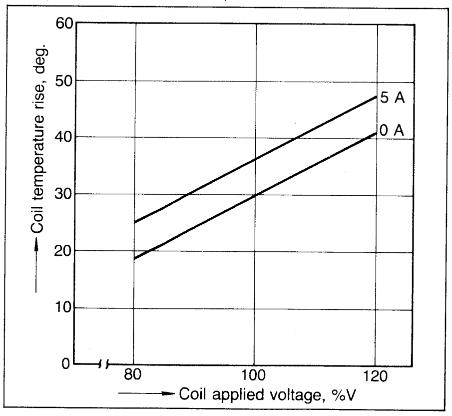
2-2. Life curve (1a1b type)



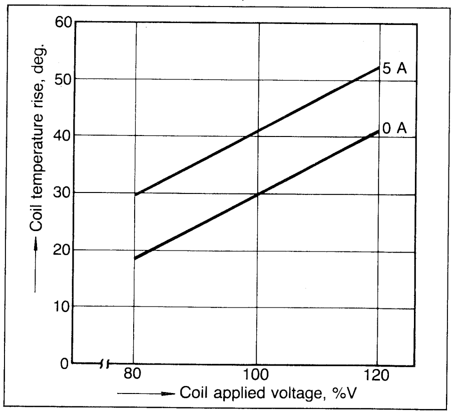
3-1. Coil temperature rise (1a type)
Sample: DSP1a-DC12V, 5 pcs.



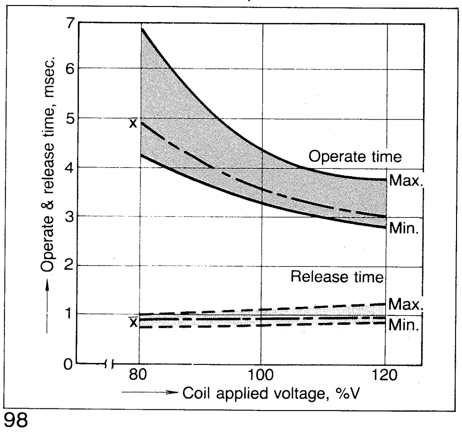
3-2. Coil temperature rise (1a1b type)
Sample: DSP1-DC12V, 5 pcs.



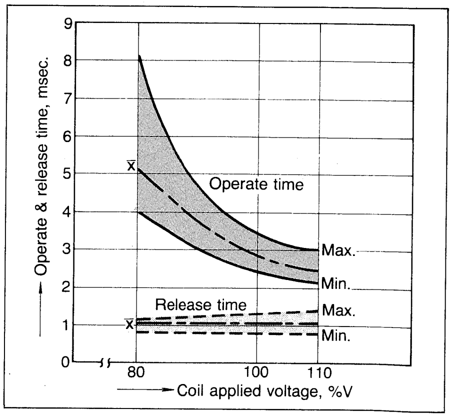
3-3. Coil temperature rise (2a type)
Sample: DSP2a-DC12V, 5 pcs.



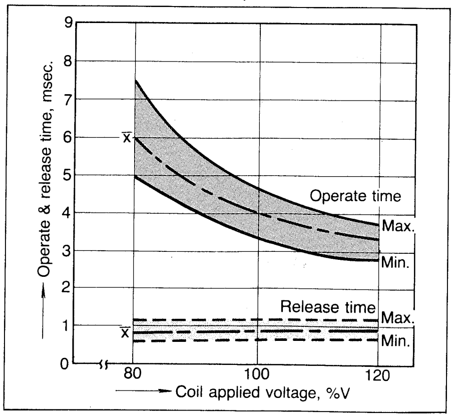
4-1. Operate & release time
(without diode, 1a type)
Sample: DSP1a-DC12V, 5 pcs.



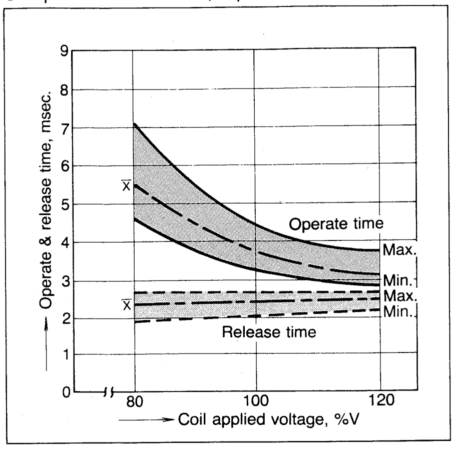
4-2. Operate & release time
(without diode, 1a1b type)
Sample: DSP1-DC12V, 5 pcs.



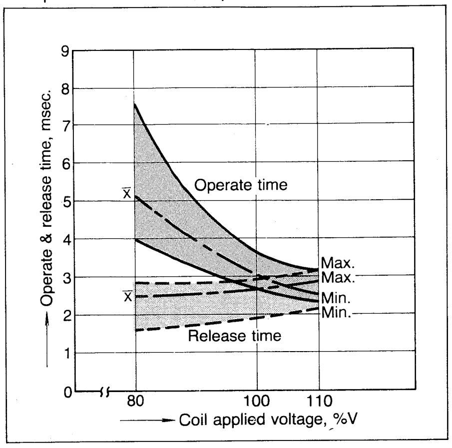
4-3. Operate & release time
(without diode, 2a type)
Sample: DSP2a-DC12V, 5 pcs.



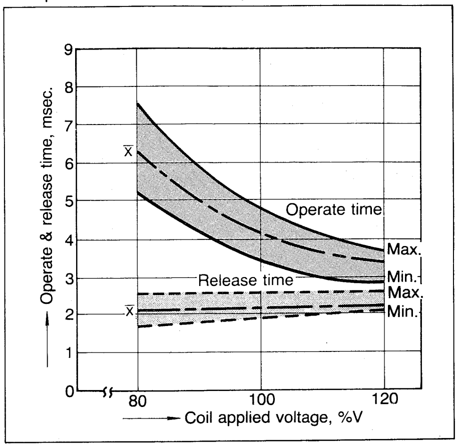
4-4. Operate & release time
(with diode, 1a type)
Sample: DSP1a-DC12V, 5 pcs.



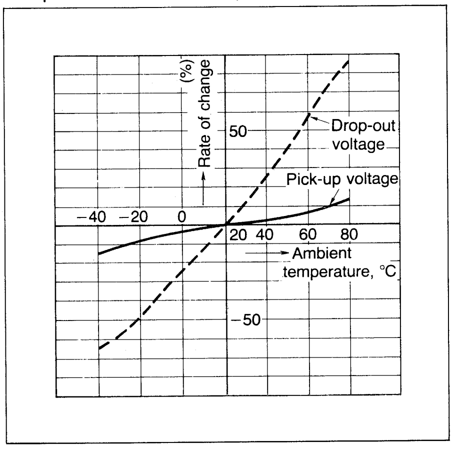
4-5. Operate & release time
(with diode, 1a1b type)
Sample: DSP1-DC12V, 5 pcs.



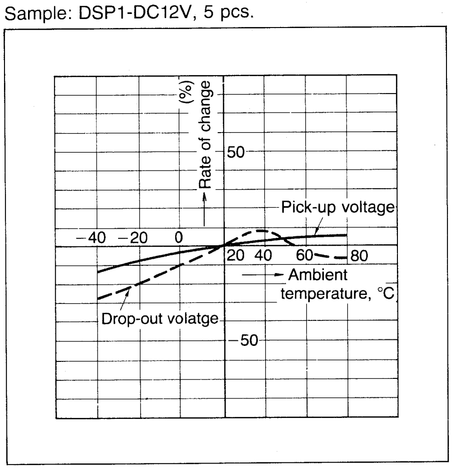
4-6. Operate & release time
(with diode, 2a type)
Sample: DSP2a-DC12V, 5 pcs.



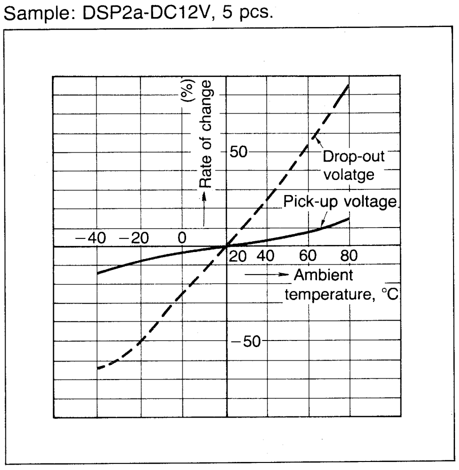
5-1. Change of pick-up and drop-out voltage (1a type)
Sample: DSP1a-DC12V, 5 pcs.



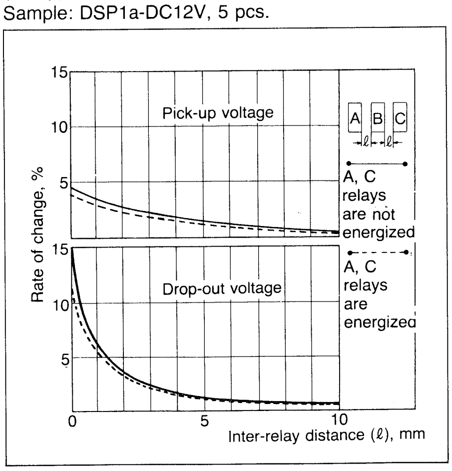
5-2. Change of pick-up and drop-out voltage (1a1b type)
Sample: DSP1-DC12V, 5 pcs.



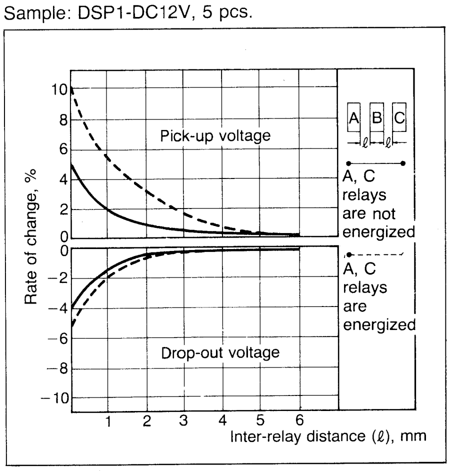
5-3. Change of pick-up and drop-out voltage (2a type)
Sample: DSP2a-DC12V, 5 pcs.



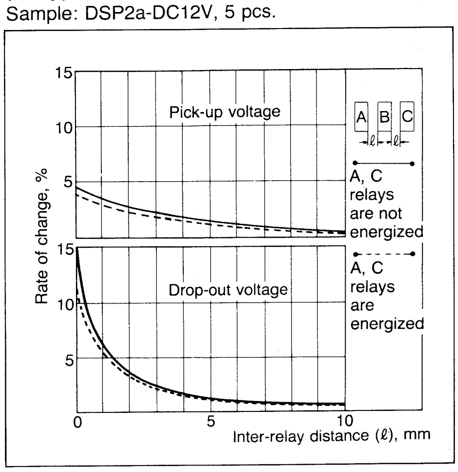
6-1. Influence of adjacent mounting (1a type)
Sample: DSP1a-DC12V, 5 pcs.



6-2. Influence of adjacent mounting (1a1b type)
Sample: DSP1-DC12V, 5 pcs.



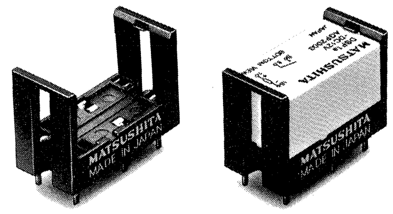
6-3. Influence of adjacent mounting (2a type)
Sample: DSP2a-DC12V, 5 pcs.



NOTES

1. Coil operating power
   a. Pure DC current should be applied
   b. If it includes ripple, the ripple factor should be less than 5%.
   However, check it with the actual circuit since the characteristics are slightly different.
   c. Wave form should be rectangular.
2. External magnetic field
   Since DSP relay is highly sensitive polarized relay, its characteristics will be affected by a strong external magnetic field.
3. Soldering should be done under the following conditions:
   250°C 482°F within 10 sec.
   300°C 572°F within 5 sec.
   350°C 662°F within 3 sec.
4. In automatic cleaning, it is recommendable to use boiling cleaning. Avoid ultrasonic cleaning.

SOCKETS FOR DSP RELAYS



SPECIFICATIONS

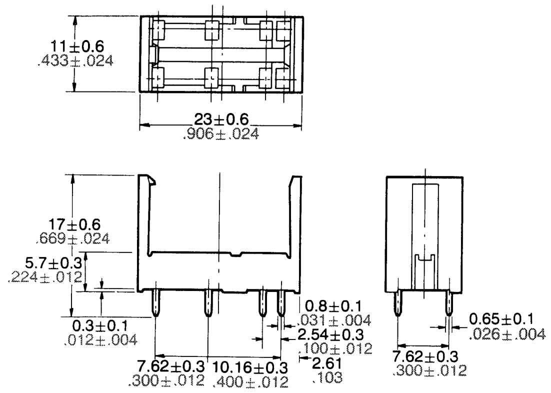
Item	Specifications
Breakdown voltage	3,000 Vrms between terminals (Except for the portion between coil terminals)
Insulation resistance	1,000 MΩ between terminals at 500 V
Heat resistance	150°C for 1 hour
Max. continuous carrying current	8 A

TYPES AND APPLICABLE RELAYS

Type No. / Applicable relays	For DSP1a		For DSP1a, DSP1, DSP2a	
	DSP1a-PS	DSP1a-PSL2	DSP2a-PS	DSP2a-PSL2
DSP1a relays	OK	OK	OK	OK
DSP1a-L relays	OK	OK	OK	OK
DSP1a-L2 relays		OK		OK
DSP1 relays			OK	OK
DSP1-L relays			OK	OK
DSP1-L2 relays				OK
DSP2a relays			OK	OK
DSP2a-L relays			OK	OK
DSP2a-L2 relays				OK

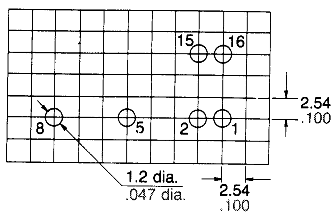
DIMENSIONS

mm inch



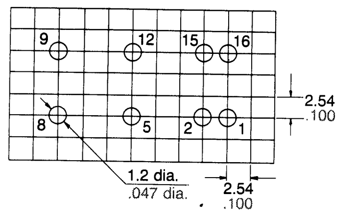
PC board pattern (Copper-side view)

DSP1a-PS, DSP1a-PSL2



Terminal No. 2 and 15 are for DSP1a-PSL2 only.

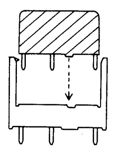
DSP2a-PS, DSP2a-PSL2



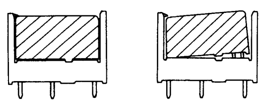
Terminal No. 2 and 15 are for DSP2a-PSL2 only.

FIXING AND REMOVAL METHOD

1. Match the direction of relay and socket.

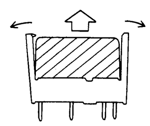


2. Both ends of relays are fixed so surely that the socket hooks on the top surface of relays.

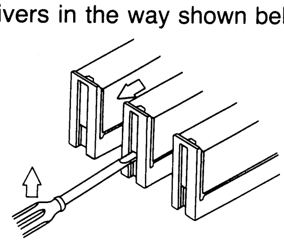


Good No good

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



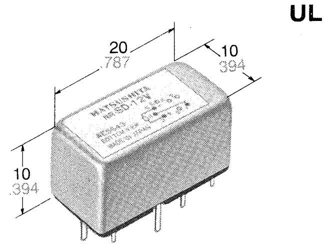
4. In case there is not enough space for finger to pick relay up, use screw drivers in the way shown below.



NAiS

HALF SIZE Amber **RELAY**

R-RELAYS



mm inch

UL File No.: E43149 CSA File No.: LR26550

- **Amber sealed construction for automatic wave soldering and cleaning**
- **Latching types available**
- **High sensitivity—TTL direct drive possible**
- **High speed—Up to 500 cycle/sec. operations**
- **Wide switching range and high welding resistance**
  Gold cobalt (AuCo) contact permits
  - **Wider switching range from low level up to high current: 10 μA to 1 A**
  - **Higher sticking resistance to inrush current**
  - **Stable contact resistance from initial stage throughout life**

SPECIFICATIONS

Contact

Arrangement	1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	60 mΩ
Initial contact pressure	Approx. 5 g .18 oz
Electrostatic capacitance: Contact-Contact	4 pF
Electrostatic capacitance: N.O. contact-coil	5 pF
Electrostatic capacitance: N.C. contact-coil	6 pF
Rating (resistive): Max. switching power	33 VA, 20 W
Rating (resistive): Max. switching voltage	110 V AC, 30 V DC
Rating (resistive): Max. switching current	AC 0.3 A, DC 1 A
Rating (resistive): Min. switching power	Approx. 100 mV 10 μA
Rating (resistive): UL/CSA rating	0.3 A 125 V AC, 1 A 30 V DC
Contact material	Gold cobalt
Expected life (min. operations): Mechanical (at 500 cps.)	10^9
Electrical (resistive): 1 A 20 V DC/0.3 A 110 V AC	10^6 (at 1 cps.)
0.5 A 30 V DC/0.1 A 110 V AC	3×10^6 (at 2 cps.)
0.25 A 30 V DC/0.25 A 30 V AC	5×10^6 (at 5 cps.)
0.2 A 24 V DC/0.2 A 24 V AC	10^7 (at 25 cps.)
0.1 A 12 V DC/0.1 A 12 V AC	5×10^7 (at 50 cps.)
0.1 A 9 V DC/0.1 A 9 V AC	10^8 (at 100 cps.)
Contact bounce	Approx. 0.3 msec.

Coil (polarized) (at 25°C 77°F)

Minimum operating power: Single side stable	72 to 133 mW
1 coil latching	41 to 45 mW
2 coil latching	72 to 107 mW
Nominal operating power: Single side stable	147 to 300 mW
1 coil latching	74 to 153 mW
2 coil latching	147 to 331 mW

Characteristics

Max. operating speed	500 cps. (mechanical)
Operate time	Approx. 1 msec.
Release time	Approx. 0.5 msec.
Initial breakdown voltage: Between live parts and ground	1,000 Vrms*1
Between open contacts	350 Vrms (500 V DC)
Between contact and coil	1,000Vrms
Initial insulation resistance (min.)	1,000 MΩ at 500 V DC
Temperature rise	Max. 35°C at 0.5 W operating power; Max. 65°C at 1 W operating power
Ambient temperature*2	−55°C to +65°C −67°F to 149°F
Shock resistance	100 G
Vibration resistance*3	10 G, 10 to 55 Hz at double amplitude of 1.6 mm
Unit weight	RS: 6.5 g .23 oz; RH: 4.5 g .16 oz

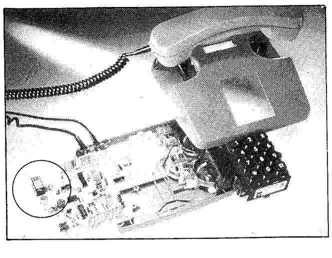
(Notes) *1 Except for between coils of 2 coil latching type

*2 Total temperature (ambinet temperature plus temperature rise in coil) should not exceed 90°C 194°F for single side stable, and 105°C 221°F for bistable relays. See DATA for determination of coil voltage versus temperature.

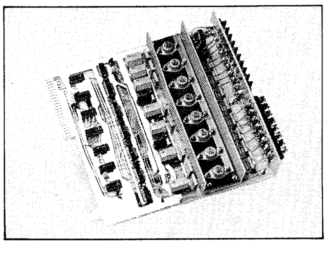
*3 Although R relays are rated at 10G/55cps. vibration resistance, they will withstand up to 60G/2,000 cps., provided they receive additional support such as anchoring to the PC board with epoxy resin.

TYPICAL APPLICATIONS

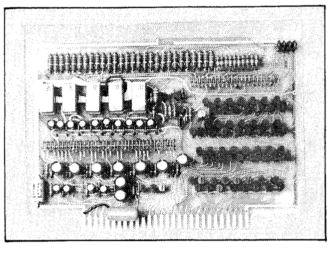
Telecommunications equipment, alarm devices, machine tools, NC machines, automatic warehouse control, conveyors, air-conditioners, pressing machines, textile machinery, elevators, control panels, pin-board programmers, parking meters, industrial robots, detectors, annunciators, optical instruments, business machines, time recorders, cash registers, copiers, vending machines, medical equipment.



Pushbutton telephone



Industrial robot



Sequence processor

ORDERING INFORMATION

EX. R | H | L2 | — | 12V

Types of case	Operating function	Coil voltage (DC)
H: Sealed S: Magnetically shielded	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	5, 6, 12, 24, 42 V other coil voltages on request

(Notes) 1. Power types and 1 Form A types are available on request.
2. For UL/CSA recognized types, add suffix UL/CSA, when ordering. Ex. RS -12V UL/CSA
3. Standard packing Carton: 50 pcs., Case: 500 pcs.

TYPES AND COIL DATA at 25°C 77°F

Single side stable (RS , RH)

Nominal coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Maximum allowable voltage, V DC (40°C)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Inductance, Henrys
5	3.5	0.5	13	170	147	0.050
6	4.7	0.6	14	220	164	0.075
12	9.3	1.2	28	890	162	0.3
24	16	2.4	42	2,000	288	0.66
42	28	4.2	85	8,000	221	2.7

1 coil latching (RSL , RHL)

Nominal coil voltage, V DC	Pick-up voltage, V DC (max.)	Maximam allowable voltage, V DC (40°C)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Inductance, Henrys
5	3.5	18	340	74	0.12
6	4.3	20	450	80	0.16
12	8.0	30	1,500	96	0.66
24	17	75	6,000	96	2.4
42	23	110	12,000	147	3.9

2 coil latching (RSL2 , RHL2)

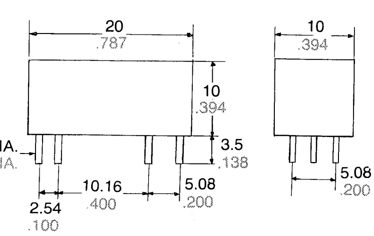
Nominal coil voltage, V DC	Pick-up voltage, V DC (max.)	Maximum allowable voltage, V DC (40°C)	Coil resiatnce, Ω (±10%)		Nominal operating power, mW	Inductance, Henrys
			Coil 1	Coil 2		
5	3.5	13.0	170	170	147	0.024
6	4.3	14.0	225	225	160	0.04
12	8.0	26.0	650	650	230	0.14
24	17.0	50.0	2,700	2,700	213	0.35
42	23.0	75.0	5,500	5,500	321	0.8

(Notes) 1. Maximum allowable operating power: 1000 mW at 25°C 77°F.
2. Change rate of pick-up voltage vs. temperature is described in Data on page 105.

DIMENSIONS

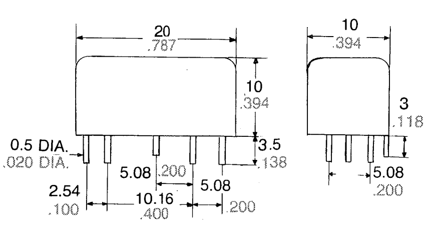
mm inch

Sealed type (RH series)



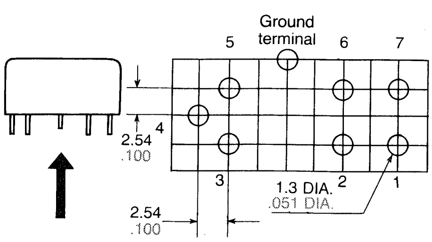
General tolerance: ±0.5 ±.020

Magnetically shieled type (RS series)



General tolerance: ±0.5 ±.020

PC board pattern (Copper-side view)



Tolerance: ±0.2 ±.008

Notes: 1. A Standard pattern: P/C board with a pitch of .100 inch is suitable for mounting R relays.
2. Ground terminal for the megnetically shieled type (RS series) only.

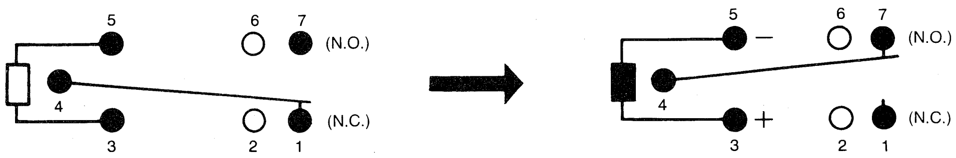
SCHEMATIC

1. Single side stable (2, 6: free terminals)

Same operation as the conventional magnetic relays.

(a) During deenergization, terminals **No. 4 (COM)** and **No. 1 (N.C.)** are on "make".

(b) During energization with the indicated polarity, terminals **No. 4** and **No. 7 (N.O.)** are on "make".



Note:
Energization with an opposite polarity does not switch the contact. Apply proper polarity to switch the contact.

2. Latching type

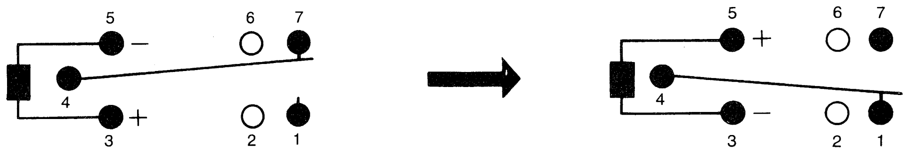
Once energized, the **COM** contact is kept under the same condition without further energizing continuously.

To switch over the contact, energy with an opposite polarity should be applied to the coil.

1 coil latching (2, 6: free terminals) (HL , SL)

(a) When terminals **No. 5 (−)** and **No. 3 (+)** are energized, terminals **No. 4** and **No. 7** are switched to "make". (or stay on "make"). When the coil current is switched off, terminals **No. 4** and **No. 7** are held on "make".

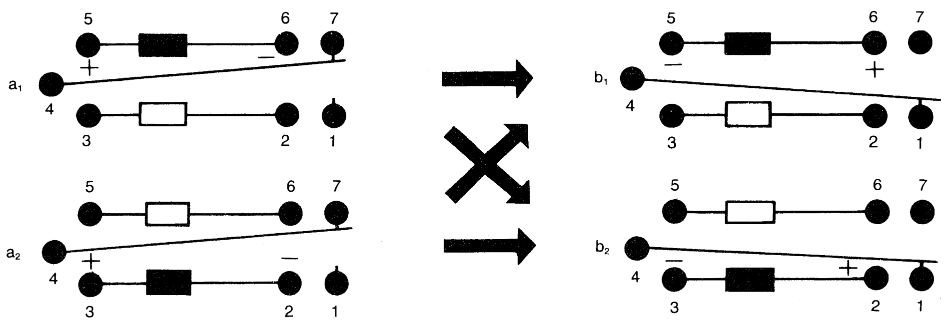
(b) When energized with reverse polarity terminals **No. 4** and **No. 1** are switched to "make" and held on "make" until energized again with an opposite polarity.



2 coil latching (HL2 , SL2)

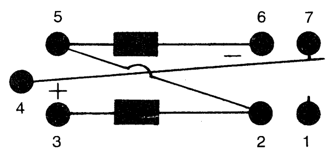
(a) When terminals **No. 5 (+)** and **No. 6 (−)** or terminals **No. 3 (+)** and **No. 2 (−)** are energized terminals **No. 4** and **No. 7** are switched to "make". (or remain on "make"). When the coil current is switched off, these terminals are held on "make".

(b) When terminals **No. 5 (−)** and **No. 6 (+)** or terminals **No. 3 (−)** and **No. 2 (+)** are energized in the reverse of condition (a), terminals **No. 4** and **No. 1** are switched to "make" and held on "make" until energized in an opposite polarity once again.



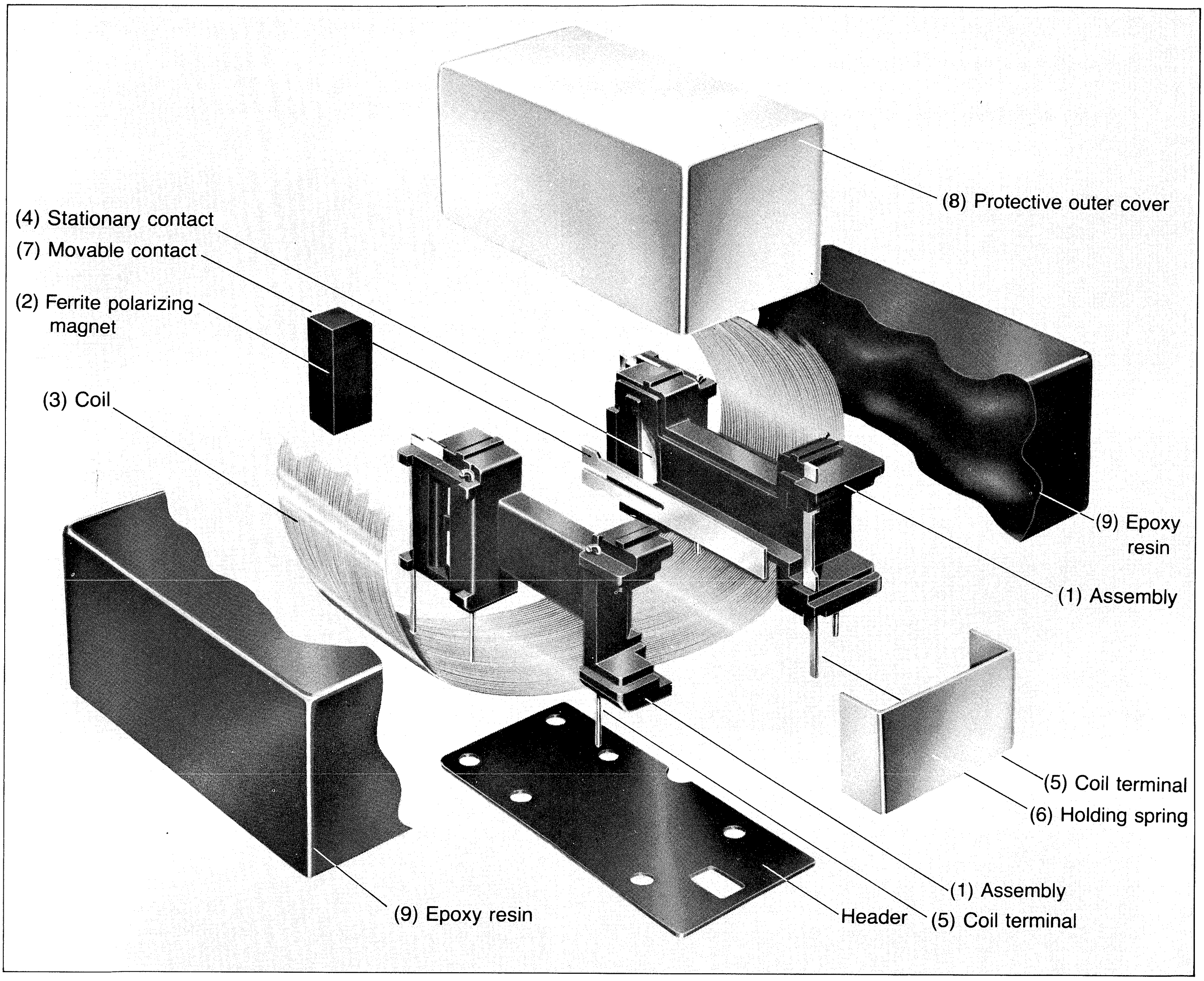
Special use of 2 coil latching

2 coil latching can be used in the same manner as 1 coil latching by shorting **No. 5** and **No. 2** or **No. 3** and **No. 6**.



1. The latching type of R relay can be used as the memory element to be operated by a pulse supplied from one or two different sources.
2. With the 2 coil latching type, when simultaneously applying one polarity to one coil and the opposite polarity to the other, the previously energized coil will take priority of operation and will maintain the contact condition.
3. In practical use, switching either from $\mathbf{a_1}$ to $\mathbf{b_2}$ or from $\mathbf{a_2}$ to $\mathbf{b_1}$ is recommendable.

CONSTRUCTION

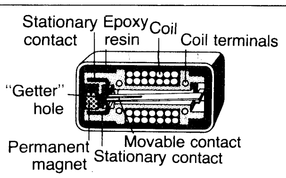
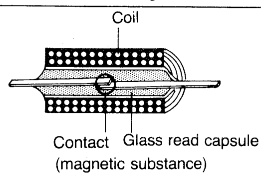


The R relay is a unique relay which not only replaces reed relays but provides the design engineer with a far more versatile device capable of much broader usage. An explanation of its operation will show why.

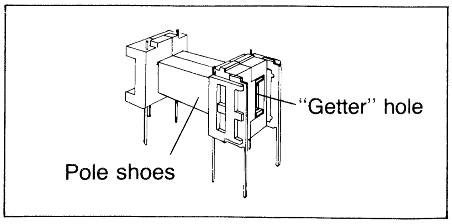
The assembly (1) is constructed of a high temperature, organic free, degassed plastic. Mounted internally is a single pole double throw bifurcated contact assembly. The ferrite polarizing magnet (2) is mounted as shown in the diagram and the coil (3) is wound around a molded frame. Stationary contacts (4) and coil terminals (5) are molded into the frame. This assembly is fitted with a holding spring (6). Each relay is individually calibrated by adjusting the movable contact (7).

The protective outer cover (8) is then fitted over the assembly. A special metallic cover is used to prevent interaction between relays mounted in close proximity to each other and also to protect the relay from other external magnetic fields (transformers, solenoids, etc.). A highly stable epoxy resin (9) is finally used to assure complete protection.

DIFFERENCES BETWEEN R RELAYS AND REED RELAYS

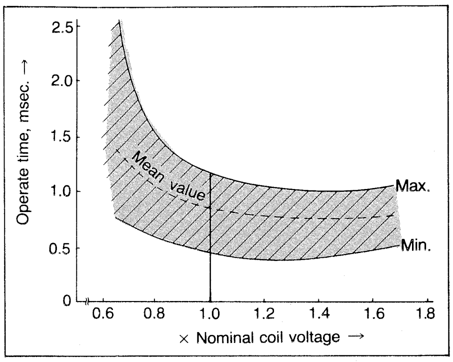
	R relays	Reed relays
Structure		
Contact arrangement	1 Form C	1 Form A or 1 Form B
Contact capacity	20 W (high contact pressure)	5 to 15 W
Operating function	Single side stable Latching	Single side stable
"Getter" hole	Yes	No

"Getter" holes are formed on both pole shoes to obtain uniform contact resistance throughout life. Film-forming phenomena on contacts is thus fully prevented.

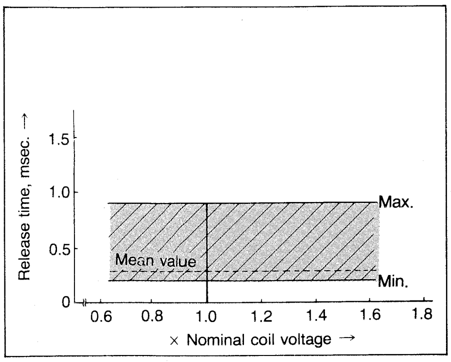


DATA

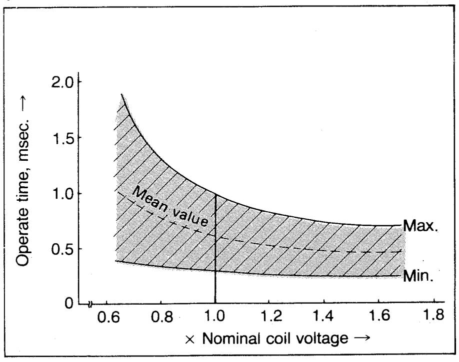
Operate time including bounce time (Single side stable)



Release time including bounce time (Single side stable)

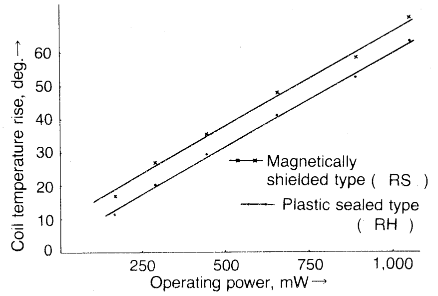


Operate time including bounce time (2 coil latching)

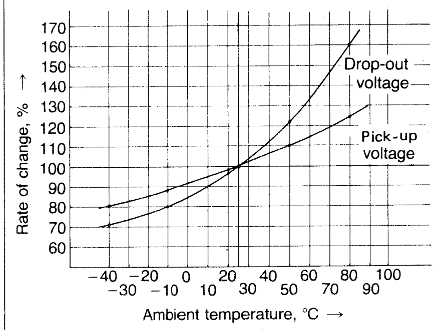


Coil temperature rise (under saturated condition)

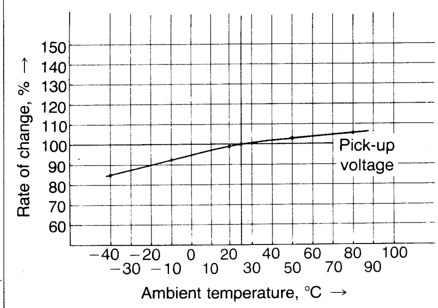
Tested sample: RS -12V
10 pcs. each



Rate of change in pick-up and drop-out voltage (Single side stable)

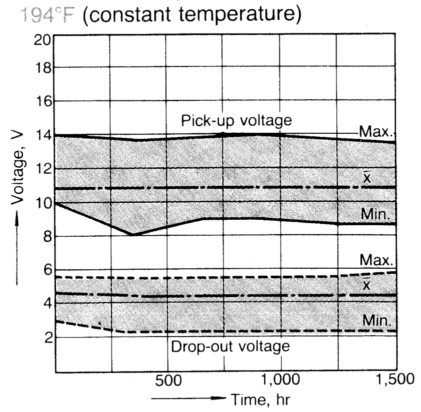


Rate of change in pick-up voltage (2 coil latching)



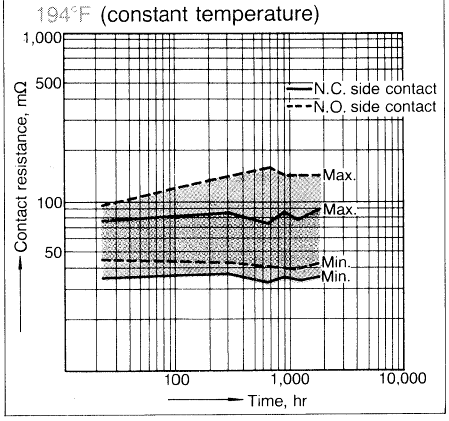
Leaving at high temperature (Change of pick-up and drop-out voltages)

Tested sample: RS -24V 30 pcs.
Condition: Deenergized leaving at 90°C 194°F (constant temperature)



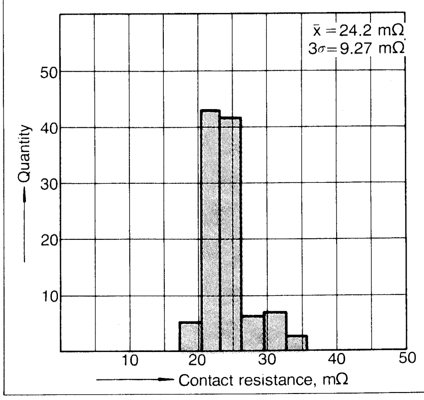
Leaving at high temperature (Change of contact resistance)

Tested sample: RS -24V 30 pcs.
Condition: Deenergized leaving at 90°C 194°F (constant temperature)



Distribution of contact resistance

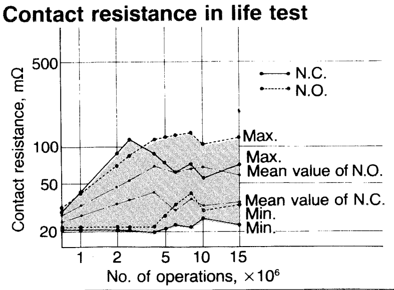
Tested sample: RS -24V (WG type)
105 pcs.



Resistive load test

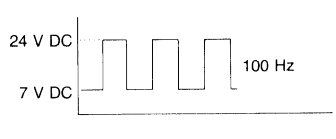
TEST CONDITION
1. Sample: RS -24V 10 pcs.
2. Load: 1 A 20 V DC Resistive
3. Cycle rate: 1.4 cps.

Contact resistance in life test



Contact sticking resistance

TEST CONDITION
The purpose of this test was to confirm contact sticking reistance and contact stability against coil ripples.
1. Sample: RS -24V 10 pcs.
2. Test method: Following coil ripples were applied.
3. Test period: 500 hours



TEST RESULT
1. No occurance of sticking was observed.
2. Contact resistance: Fig. 1
RS -24V: 29 mΩ to 30.4 mΩ

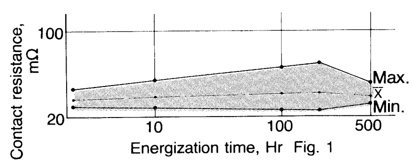
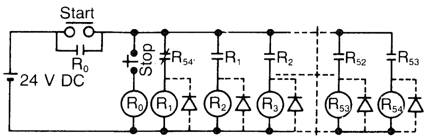


Fig. 1

In actual application, above coil ripples should be avoided and use of a capacitor in the circuit is recommended to keep the ripple factor below 5%.

Contact reliability

Tested sample: RS -24V
54 pcs.
Circuits: (A) Following figure with diode
(B) Following figure without diode

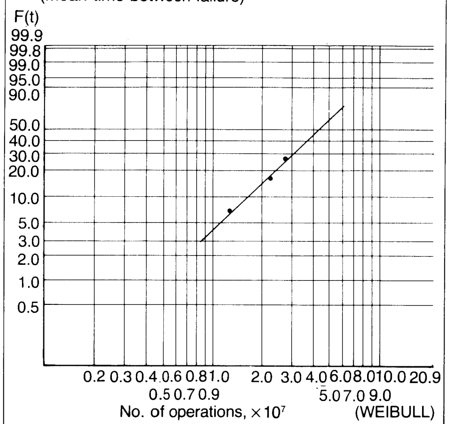


Item to be checked: Detect with the circuit stopped
Circuits:
(A) Diode provided: The circuit does not stop throughout 100 million times.
(B) Diode not provided: $\lambda_{60} = 2.5 \times 10^{-8}$ times

Contact reliability

TEST CONDITION
1. Sample: RS -24V 10 pcs.
2. Contact voltage: 100 mV
3. Contact current: 10 μA
4. Cycle rate: 50 cps.
5. Rejection level: 100 Ω
6. Testing operation: 3×10^7

m = 1.9 $\sigma = 2.5 \times 10^7$
$\mu = 4.7 \times 10^7$ 95% reliability limit: 1.15×10^7
(Mean time between failure)



High temperature test

TEST CONDITION
1. Sample: RS -24V 30 pcs.
2. Ambient temperature: 80°C
3. Humidity: less than 50% R.H.
4. Exposure time: 2,000 hours with relays deenergized.

TEST RESULT
Contact resistance: Fig. 1
All samples were measured less than 100 mΩ in contact resistance throughout this test.

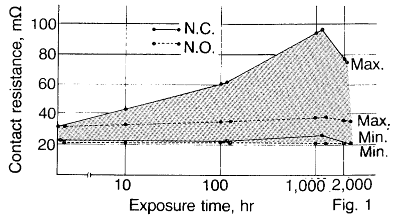
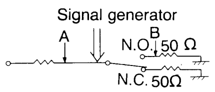
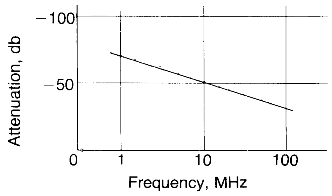


Fig. 1

High frequency characteristics

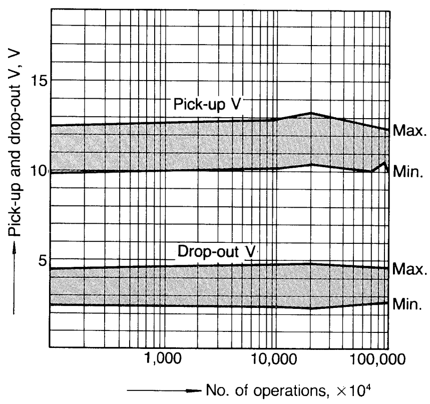


Isolation loss between A and B is measured.

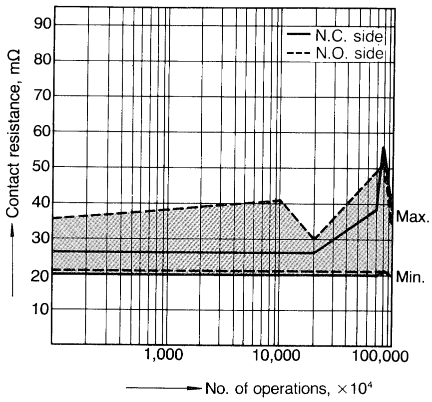


Mechanical life

Change of pick-up and drop-out V
Sample: 10 pcs. RS -24V
Operation frequency: 500 cps



Change of contact resistance
Sample: 10 pcs. RS -24V
Operation frequency: 500 cps

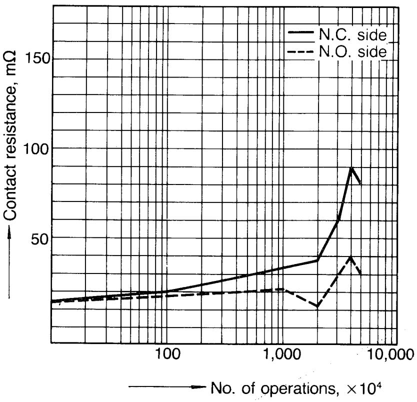


Influence of adjacent mounting

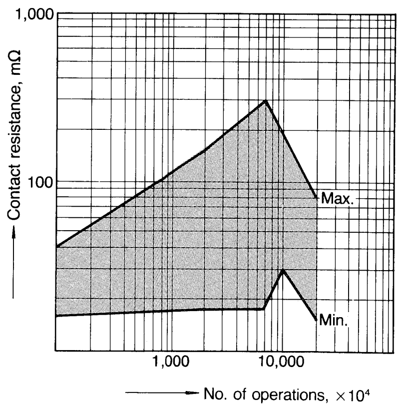
Type \ Distance (mm) (inch)	0 (0)	5 (.197)	10 (.394)	15 (.591)
Magnetically shielded type	±5%	±1%	0	0
Sealed type	—	±10%	±6%	±2%

Electrical life

Sample: 10 pcs. RS -24V
Load: 60 mA 24 V DC resistive load
Frequency: 50 cps

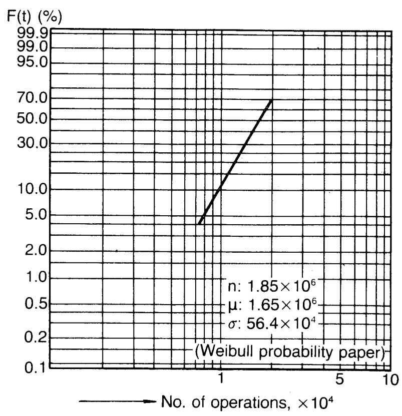


Sample: 10 pcs. RS -12V
Load: 54 mA 12 V DC inductive load with diode protection
(4 relay coils in parallel of RS -12V)
Frequency: 50 cps



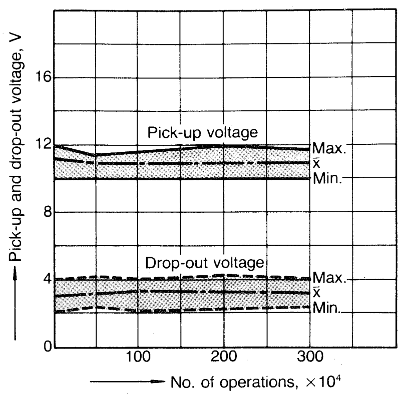
Electrical life (1 A 20 V DC resistive load)

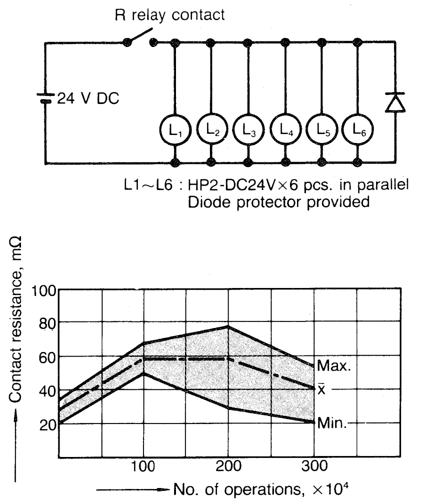
Tested sample: RS -24V
10 pcs.



Electrical life (327 mA 24 V DC relay coil load)

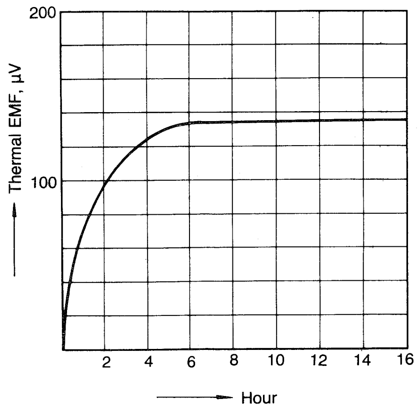
Tested sample: RS -24V
5 pcs.
Condition: HP2-DC24V×6 pcs. in parallel, diode protector provided





Thermal electro motive force

Sample: 5 pcs. RS -12V
Coil applied V: 12 V DC
Ambient atmosphere: 25°C, 60% RH

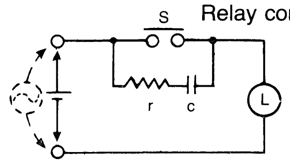
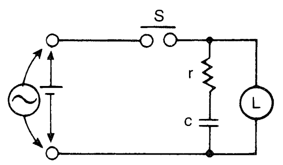
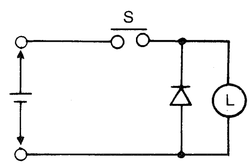


APPLICATION HINTS

Contact protection circuit

When using NR relays in inductive load circuits, a contact protection circuit is recommended.

Examples:

CR	CR	Diode
		
1. r = more than 20 to 30 ohms 2. In an AC circuit impedance of L is to be somewhat smaller than impedance of r and c.	Can be used for both AC and DC circuits. Use 500 to 1000 ohms for r and 0.1 μF to 0.2 μF 200 V for c in a general 12 to 24 V load circuit.	For DC circuits only.

The following is life data under our HP2 relay load.

Contact voltage	Contact current	Contact protection circuit	Operating speed	Expected life, min. op.
6 V DC	232 mA	0.2 μF+1 kΩ or diode	2 op./sec.	3×10^7
12 V DC	106 mA	0.2 μF+1 kΩ or diode	2 op./sec.	3×10^7
24 V DC	54 mA	0.1 μF+1 kΩ or diode	2 op./sec.	3×10^7
100 V DC	15 mA	0.1 μF+1 kΩ or diode	2 op./sec.	2×10^7
24 V AC	80 mA	0.2 μF+1 kΩ	2 op./sec.	3×10^7
100 V AC	20 mA	0.1 μF+1 kΩ or varistor	2 op./sec.	2×10^7
200 V AC	10 mA	0.1 μF+1 kΩ	2 op./sec.	2×10^7

(Notes)

1. When inrush current occurs in the capacitor load circuit or incandescent lamp load circuit, reduce it to less than 5 A. Electrical life of "AuCo" contact types is 10,000 operations in a 5 A inrush current circuit.
2. When 5 A to 10 A inrush current occurs in the capacitor load circuit or incandescent lamp load circuit, the use of power types is recommended.

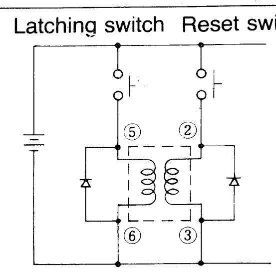
2 coil latching types

A) The circuit at right is recommended when using one coil for latching and the other coil for reset.

R relays are sensitive enough to be operated by the discharge of energy accumulated in the inner-coil capacitance. The use of a diode of over 200 V breakdown will prevent misoperation from this source.

In order to maintain the insulation between the two coils, connection of the terminal No. 3 and No. 6 or the terminal No. 2 and No. 5 is recommended, as shown in the right figure.

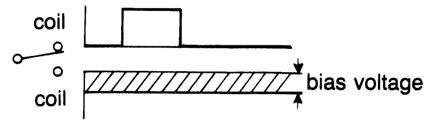
Rectifiers should be inserted in this circuit when the nominal coil voltage of the R relay is more than 24 V DC.



B) No damage will occur to the coil of either the one or two coil bistable types even if the operating voltage is as much as 2 or 3 times the nominal coil voltage.

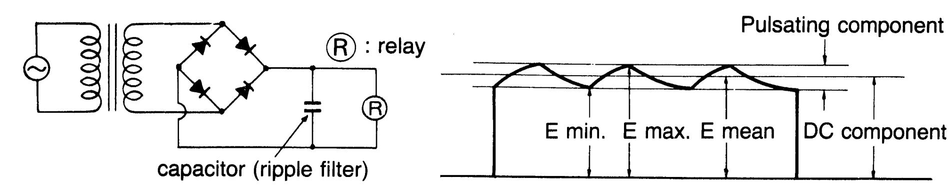
C) If separate pulses are applied to each coil of the 2 coil bistable types, the first pulse will operate when the pulses are of equal voltage. When voltages differ the higher voltage will cause operation provided the voltage difference is greater than the measured pick-up voltage. Voltage difference on the coils will reduce contact pressure proportionately.

Continuous bias voltage after an operating pulse lowers contact pressure and vibration resistance.



Ripple factor

Coils should be operated on pure DC. Rectified AC may cause changes in the pick-up/drop-out characteristics because of the ripple factor. Use of a capacitor in the circuit is recommended to keep the ripple factor below 5%.



To calculate the ripple factor

$$\text{Ripple factor (\%)} = \frac{\text{E max.} - \text{E min.}}{\text{E mean}} \times 100\%$$

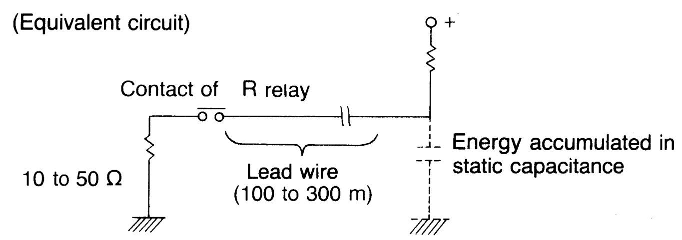
E max. = max. value of pulsating component
E min. = min. value of pulsating component
E mean = average value DC component

When designing R relay circuits

Care should be taken when designing relay circuits since the response of the relay is so fast that bouncing or chattering from conventional relays in the circuit may cause false operation.

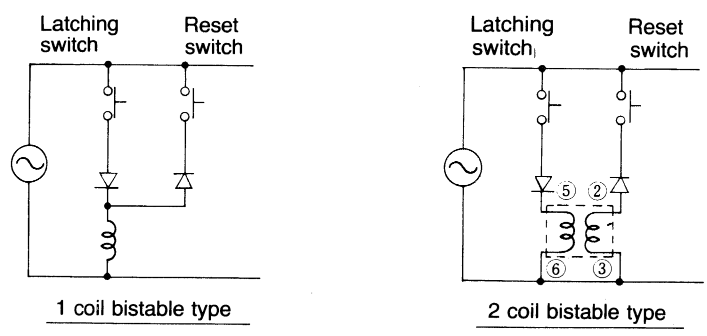
When using long lead wires

When long wires (as long as 100 m or more) are to be used, the use of resistance (10 to 50 Ω) in series with the contact is required in order to eliminate the effect of the possible inrush current due to the stray capacitance existing between the two wires or between the wire and ground.



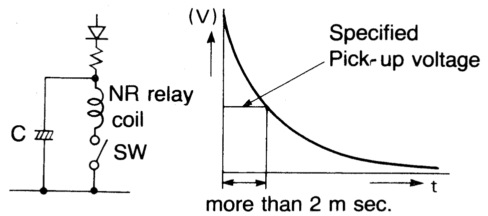
AC operation of latching relays

When using circuits such as those at the right, avoid continued or extended latching or resetting power input.



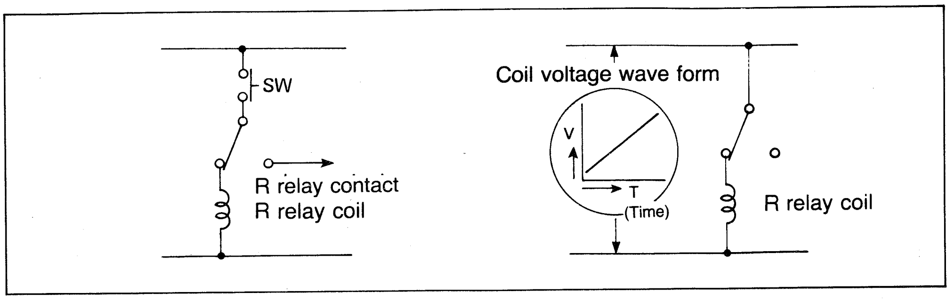
Capacitor discharge operation of latching types

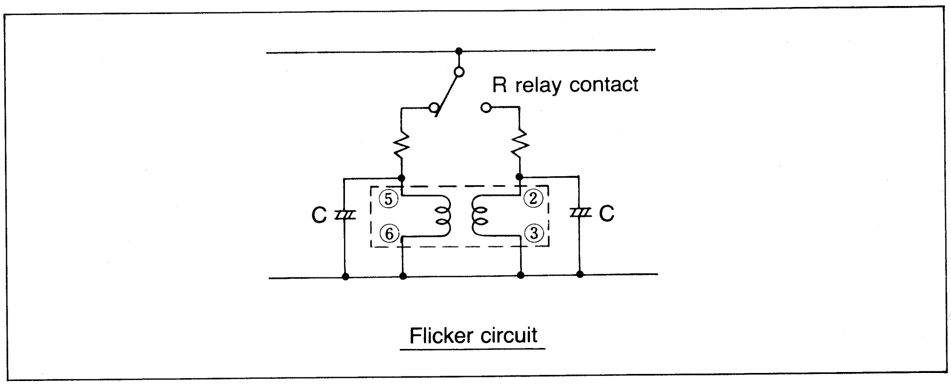
When operating bistable (latching) types by discharge of a capacitor, more reliable operation can be expected if the time to reach pick-up voltage is greater than 2 msec. at 5 to 10 μF: (24 V type).



Automatic coil circuit interruption

Misoperation may occur in self-operated cutoff circuits such as shown at right. This can be avoided by adding a resistor and capacitor and increasing the pick-up voltage to above that specified.
In a timer circuit, step-pulse voltage from PUT (Programable Unijunction Transistor) or SBS (Silicon Bilateral Switch) is recommended.





Flicker circuit

Residual voltage

When single side stable types or latching types are driven by transistor or UJT, residual voltage is sometimes applied to the coils and decreases contact pressure at N.O. side even if the transistor or UJT are in OFF condition. As a result, characteristics of relays may be harmed. Design your circuits in principle to make such residual voltage zero.

Short circuit prevention between N.C. and N.O.

The separation of loads or insertion of a resistor for circuit protection are recommended for the circuits where large current flows due to arcing. (See Fig. 1).

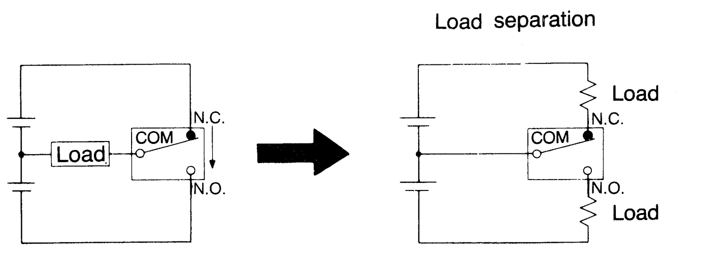
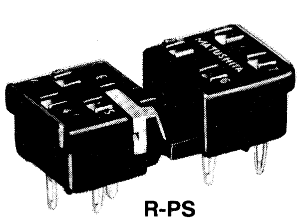


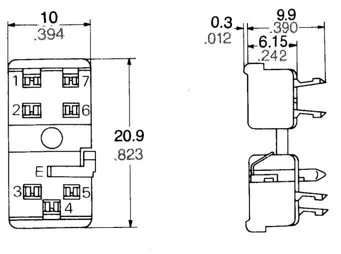
Fig. 1

ACCESSORIES

PC board terminal sockets (with hold-down clip)

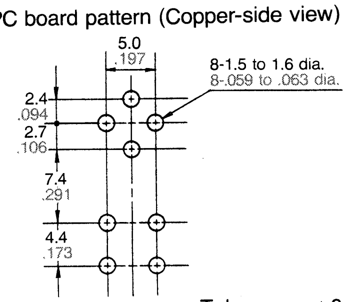
mm inch


R-PS

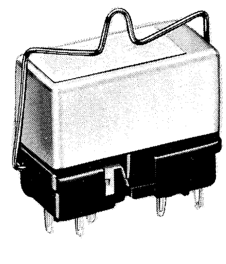


General tolerance: ±0.5 ±.020

PC board pattern (Copper-side view)



Tolerance: ±0.2 ±.008

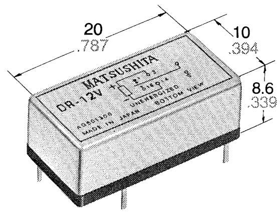


NAiS

HIGHLY RELIABLE MINIATURE DIP RELAYS

DR-RELAYS

UL File No.: E43149 CSA File No.: LR26550



mm inch

- **High breakdown voltage — Between open contacts: 750 Vrms**
  Between contacts and coil: 1500 Vrms
- **Surge voltage withstand: 1500 V (Based on part 68, FCC standard)**
- **1 coil and 2 coil latching types available**
- **High sensitivity**
- **High contact pressure**
- **Miniature size and low profile — standing only 8.6 mm (.339 inches) including stand-offs on headers**
- **High speed — Operate time: Approx. 1 msec.**

SPECIFICATIONS

Contacts

Arrangement	1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	60 mΩ
Initial contact pressure	Approx. 9 g .32 oz
Electrostatic capacitance	
Contact-Contact	3 pF
N.O. contact-Coil	4 pF
N.C. contact-Coil	5 pF
Rating (resistive)	
Max. switching power	33 VA, 20 W
Max. switching voltage	110 V AC, 30 V DC
Max. switching current	AC 0.3 A, DC 1 A
Contact material	Gold cobalt
Expected life (min. operations)	
Mechanical (at 50 cps.)	10^9
Electrical	
1 A 20 V DC resistive	10^6
0.3 A 110 V AC resistive	10^6
0.2 A 24 V DC resistive	10^7

Contact bounce	
Single side stable	Approx. 0.5 msec.
1 coil latching	Approx. 0.3 msec.
2 coil latching	Approx. 0.3 msec.

Characteristics

Max. operating speed	60 cpm at nominal load 300 cps. at no load
Operate time	Approx. 1 msec.
Release time	Approx. 0.5 msec.
Initial breakdown voltage	
Between open contacts	750 Vrms
Between live parts and ground	1,000 Vrms
Between coil and contact	1,500 Vrms
Initial insulation resistance	Min. 1,000 MΩ at 500 V DC
Max. continuous power	0.5 W
Temperature rise	20 deg. (at 120 mW application) 47 deg. (at 500 mW application)
Ambient temperature	−50°C to +85°C −58°F to +185°F
Shock resistance	More than 100 G
Vibration resistance	20 G, 10 to 55 Hz at double amplitude of 3.3 mm
Unit weight	4 g .14 oz

TYPES AND COIL DATA at 20°C 68°F

Single side stable	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Maximum allowable voltage, V DC	Coil resistance, Ω (±10%)	Nominal Operating power, mW
DR-3V	2.4	0.3	6.8	94	96
DR-5V	4.0	0.3	10.9	320	78
DR-6V	4.8	0.6	12.8	330	109
DR-12V	9.6	1.2	26.4	1,400	103
DR-24V	17.0	2.4	42.4	3,600	160
DR-48V	33.6	4.8	74.1	11,000	209

1 coil latching	Pick-up voltage, V DC (max.)	Maximum allowable voltage, V DC	Coil resistance, Ω (±10%)	Nominal operating power, mW
DR-L-3V	2.4	8.9	160	56
DR-L-5V	4.0	14.5	420	59
DR-L-6V	4.8	17.4	610	59
DR-L-12V	9.6	33.9	2,300	63
DR-L-24V	17.0	53.8	5,800	99
DR-L-48V	33.6	102.7	21,100	110

2 coil latching	Pick-up voltage, V DC (max.)	Maximum allowable voltage, V DC	Coil resistance, Ω (±10%) Coil I & Coil II	Nominal operating power, mW
DR-L2-3V	2.4	6.3	80	112
DR-L2-5V	4.0	10.6	225	111
DR-L2-6V	4.8	12.0	290	124
DR-L2-12V	9.6	24.6	1,210	119
DR-L2-24V	18.0	43.8	3,840	150
DR-L2-48V	33.6	63.0	7,950	290

ORDERING INFORMATION

Ex. DR— L2 — 24V

Operating function	Coil voltage
Nil: Single side stable L: 1 coil latching L2: 2 coil latching	3, 5, 6, 12, 24, 48 V

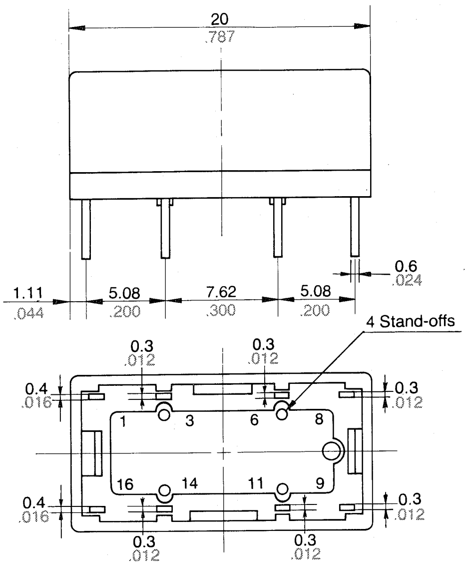
(Notes) 1. For UL/CSA recognized types, add suffix UL/CSA.
2. Standard packing: Carton; 50 pcs. Case; 500 pcs.

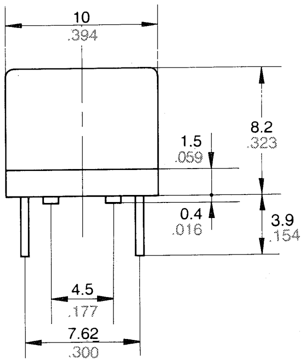
TYPICAL APPLICATIONS

Telecommunications equipment, alarm devices, machine tools, NC machines, automatic warehouse control, conveyors, air-conditioners, pressing machines, textile machinery, elevators, control panels, pin-board programmers, parking meters, industrial robots, detectors, annunciators, optical instruments, business machine, time recorders, cash registers, copiers, vending machines, medical equipment.

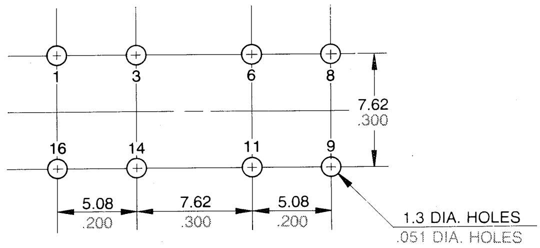
DIMENSIONS

mm inch





PC board pattern (Copper-side view)



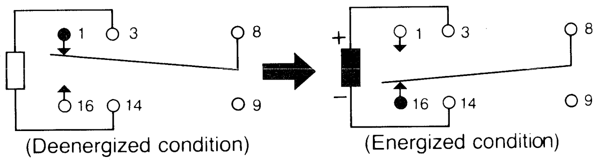
Note: No.6 and 11 terminals for the 2 coil latching types only.

General tolerance: ±0.3 ±.012

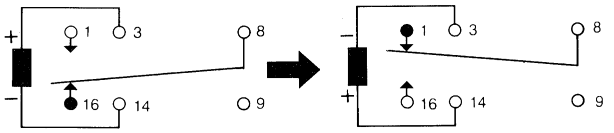
SCHEMATIC

(Bottom view)

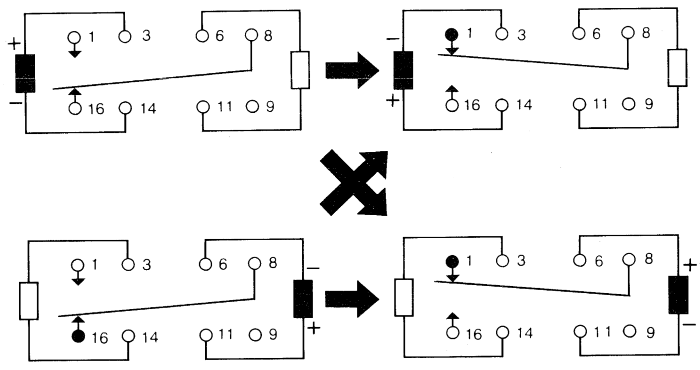
Single side stable



1 coil latching

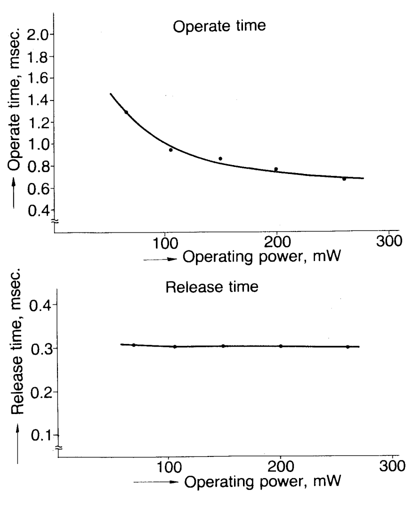


2 coil latching

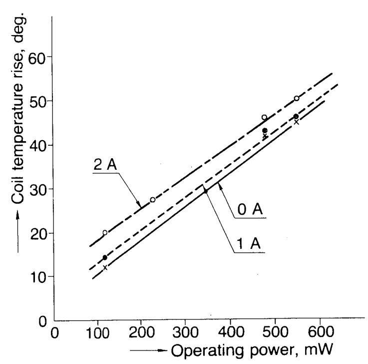


DATA

Operate and release time (Single side stable)

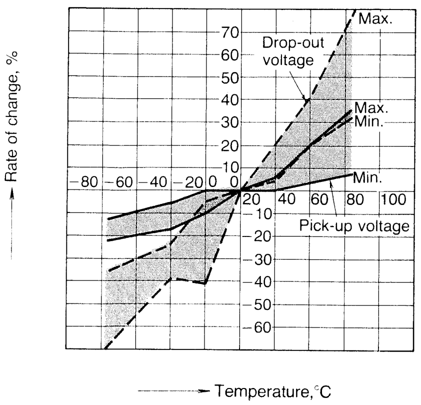


Coil temperature rise (Single side stable)



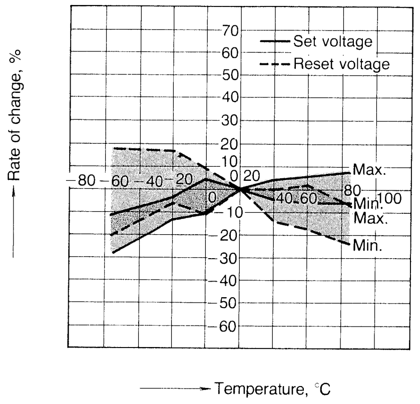
Pick-up/drop-out voltage vs. temperature (Single side stable)

Sample: 5 pcs. DR-5V



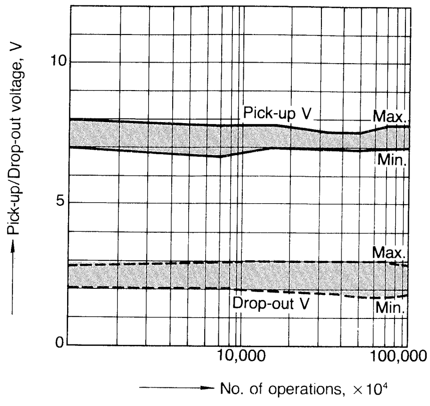
Pick-up/drop-out voltage vs. temperature (1-coil latching)

Sample: 5 pcs. DR-L-5V



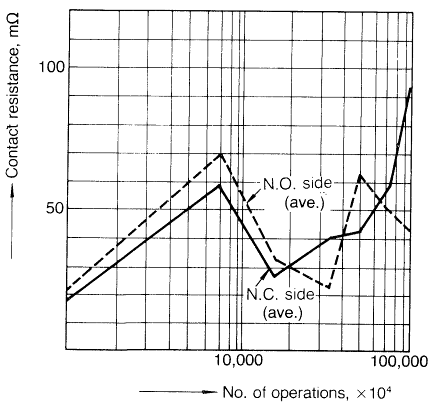
Mechanical life
Change of pick-up and drop-out V

Sample: 5 pcs. DR-12V
Frequency: 300 cps



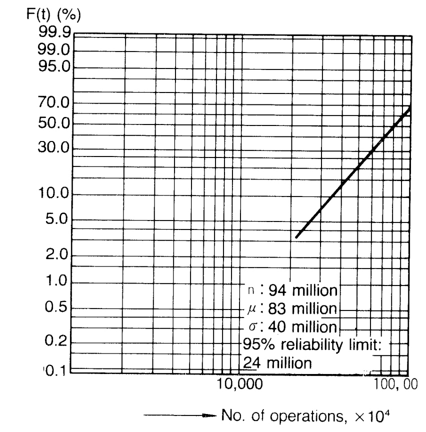
Mechanical life
Change of contact resistance

Sample: 5 pcs. DR-12V
Frequency: 300 cps



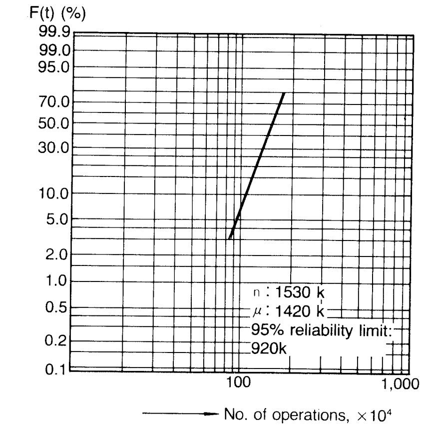
Contact reliability test

Sample: 10 pcs. DR-12V
Load: 10 μA 100 mV DC, 50 cps
Detection level: 100 Ω



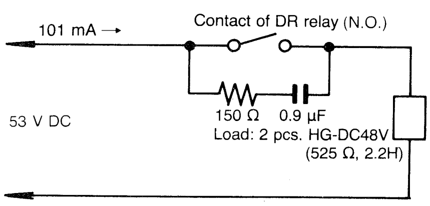
Electrical life

Sample: 10 pcs. DR-12V
Load: 1 A 20 V DC resistive

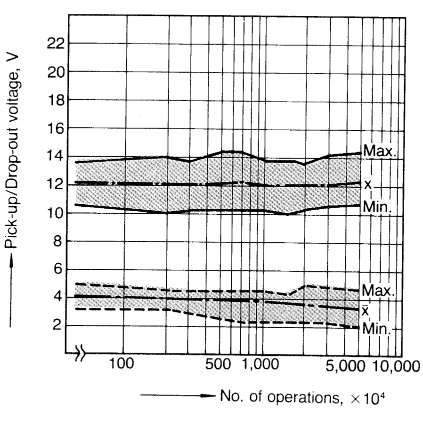


Electrical life test

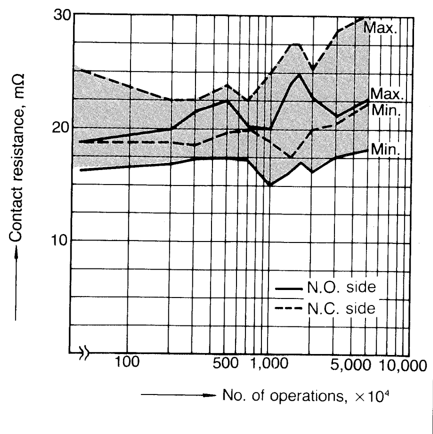
Sample 10 pcs. DR-12V
Load: 101 mA 53 V DC relay coil
2 pcs. HG4-DC48V coils in parallel



Change of pick-up and drop-out voltage



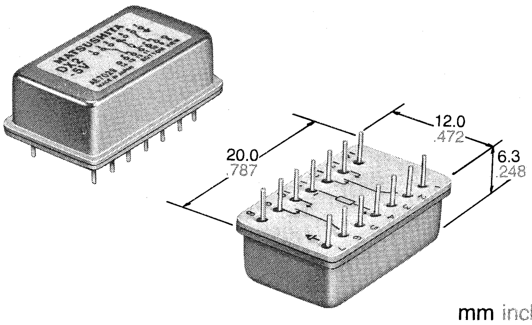
Change of contact resistance



NAiS

HERMETICALLY SEALED ULTRA SMALL RELAY WITH T0–5 SENSITIVITY AND RF SWITCHING CAPABILITY

DX-RELAYS



mm inch

- **High radio frequency characteristics—isolation loss: 40 dB at 300 MHz**
- **Latching types available**
- **High sensitivity to be IC drivable: 60 mW pick-up only**
- **High insulation resistance**
- **High shock and vibration resistance thanks to unique balanced armature construction**
  Shock: 50 G
  Vibration: 30 G, 10 to 55 Hz at double amplitude of 5 mm

SPECIFICATIONS

Contacts

Style	Bifurcated
Arrangement	2 Form C
Initial contact bounce, max.	1 msec.
Contact pressure	Approx. 6 g .21 oz
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	60 mΩ
Electrostatic capacitance Contact to contact	1 pF
Thermal electromotive force (at nominal coil voltage) Single side stable	35 µV
Latching type	1 µV
Rating (resistive) Max. switching power	30 W DC, 50 VA
Max. switching voltage	30 V DC, 110 V AC
Max. switching current	1 A DC, 0.5 A AC
Expected life (min. operations) Mechanical	3×10^7
Electrical 1 A 30 V DC	2×10^5
0.5 A 30 V DC	10^6
0.1 A 12 V DC	10^7

Characteristics (25°C, 50% Relative humidity)

Max. operating speed	200 cps.	
Operate time	Approx. 2 msec.	
Release time	Approx. 1 msec.	
Set time (latching)	Approx. 2 msec.	
Reset time (latching)	Approx. 2 msec.	
Minimum pulse width (latching)	1.6 msec.	
High frequency characteristics	Approx. isolation 40 dB at 300 MHz (50 Ω)	
Initial breakdown voltage Between open contacts	500 Vrms	
Between contact sets	500 Vrms	
Between contact and coil	500 Vrms	
Between live parts and ground	500 Vrms	
Initial insulation resistance	10,000 MΩ at 100 V DC	
Temperature rise, max.	25 deg. at 120 mW operating power 65 deg. at 500 mW operating power	
Ambient temperature	−55°C to +85°C −67°F to +185°F	
Shock resistance	Functional:50G	Destructive:50G
Vibration resistance	Functional & Destructive: 30 G, 10 to 55 Hz at double amplitude of 5 mm	
Unit weight	Approx. 4 g .14 oz	

TYPICAL APPLICATIONS

1. Communication equipment
2. Measuring equipment
3. Computer peripherals
4. Precision equipment for ships and airplanes

ORDERING INFORMATION

Ex. DX [2] — [L2] — [24V]

Contact arrangement	Operating function	Coil voltage
2: 2 Form C	Nil: Single side stable L : 1 coil latching L2: 2 coil latching	DC: 3, 5, 6, 12, 24 V

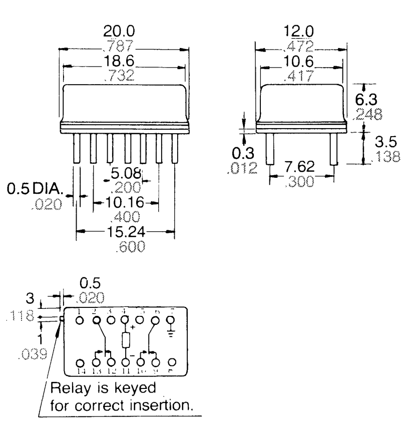
(Standard packing) Carton: 50 pcs., Case: 500 pcs.

TYPES AND COIL DATA at 25°C 77°F

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 40°C, V DC
Single side stable	DX2-3V	3	2.1	0.3	42.8	128	70	6.6
	DX2-5V	5	3.5	0.5	25	125	200	11.0
	DX2-6V	6	4.2	0.6	21.4	128	280	13.2
	DX2-12V	12	8.4	1.2	12	144	1,000	26.4
	DX2-24V	24	16.8	2.4	6	144	4,000	53.0
1 coil latching	DX2-L-3V	3	(Set) 2.1	(Reset) 2.1	42.8	128	70	6.6
	DX2-L-5V	5	3.5	3.5	25	125	200	11.0
	DX2-L-6V	6	4.2	4.2	21.4	128	280	13.2
	DX2-L-12V	12	8.4	8.4	12	144	1,000	26.4
	DX2-L-24V	24	16.8	16.8	6	144	4,000	53.0
2 coil latching	DX2-L2-3V	3	(Set) 2.1	(Reset) 2.1	85.7 85.7	257 257	35 35	4.6
	DX2-L2-5V	5	3.5	3.5	50 50	250 250	100 100	7.8
	DX2-L2-6V	6	4.2	4.2	42.8 42.8	257 257	140 140	9.3
	DX2-L2-12V	12	8.4	8.4	24 24	288 288	500 500	18.6
	DX2-L2-24V	24	16.8	16.8	12 12	288 288	2,000 2,000	37.2

DIMENSIONS

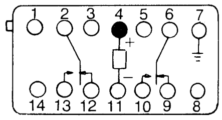
mm inch



General tolerance: ±0.3 ±.012

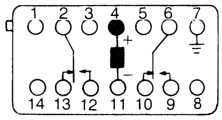
Schematic (Bottom view)

Single side stable



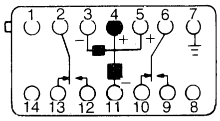
Deenergized position (Terminals 1, 3, 5, 8, 14 are idle terminals.)

1 coil latching



"Set" position when terminals 4 and 11 are energized. (Terminals 1, 3, 5, 8, 14 are idle terminals.)

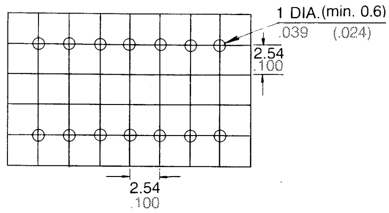
2 coil latching



"Set" position when either terminals 4 and 11 or terminals 3 and 5 are energized. (Terminals 1, 8, 14 are idle terminals.)

PC board pattern (Copper-side view)

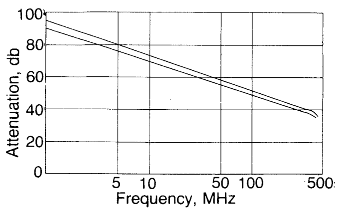
Tolerance: ±0.1 .004



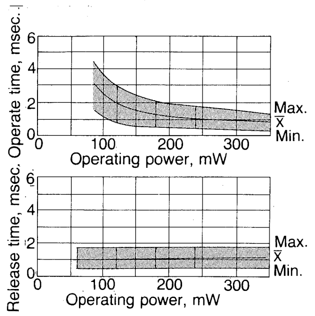
Matching 14 pins IC socket

DATA

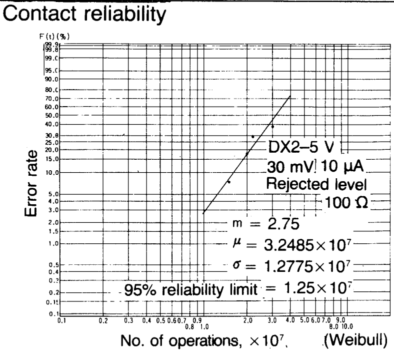
High frequency characteristics (Isolation) (50 Ω)
Sample: 10 pcs. DX2-12V
Ambient temperature: 20°C 68°F



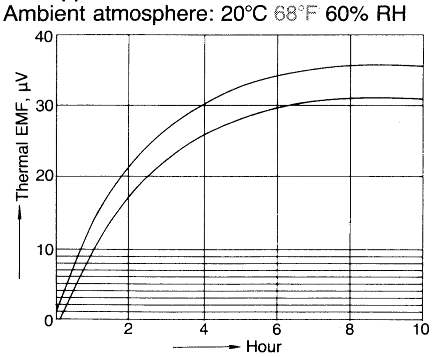
Operate & release time



Contact reliability



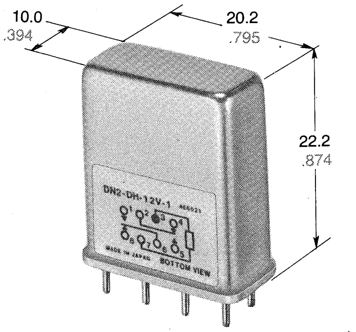
Thermal electro motive force
Sample: 5 pcs. DX2-5V
Coil applied V: 100%V
Ambient atmosphere: 20°C 68°F 60% RH



NAiS

FULL-SIZE CRYSTAL CAN DPDT RELAY

DN-RELAYS



mm inch

- **Unique balanced armature construction**
- **High radio frequency characteristics—isolation loss: 40 db at 200 MHz**
- **High insulation resistance—10^{10} Ω at 100 V DC**
- **High contact reliability—filled with dry N_2 gas**

SPECIFICATIONS

Contact

Contact arrangement	2 Form C	
Contact pressure	Approx. 9 g 0.32 oz	
Contact material	Gold clad	
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	50 mΩ	
Electrostatic capacitance		
Contact to contact:	deenegized condition	1 pF
	energized conditon	2 pF
Contact to coil	3 pF	
Contact to case	3 pF	
Contact rating		
Max. switching power	15W, 20VA	
Max. voltage	30V DC, 125V AC	
Max. current	0.5A DC, 0.5A AC	
Expected life (min. operations)		
Mechanical	3×10^7	
Electrical (0.5A 30V DC resistive)	10^6	

Coil

Minimum operating power	Approx. 280 mW
Nominal operating power	Approx. 580 mW

Characteristics

Max. operating speed	25 cps.
Initial insulation resistance	more than 10,000 MΩ at 100 V DC
Operate time	Approx. 7 msec.
Release time	Approx. 4 msec.
Temperature rise	Max. 45 deg.
Operate bounce time	Approx. 3 msec.
Release bounce time	Approx. 3 msec.
Breakdown voltage	500 V rms for 1 min.
Shock resistance	more than 100 G
Vibration resistance	more than 30 G
Ambient temperature	−55°C to +80°C −67°F to +176°F
Gas leakage rate	10^{-8} atm·c.c./sec.
Unit weight	Approx. 12 g .42 oz

2 Amp contact rating types also available on request

TYPES AND COIL DATA

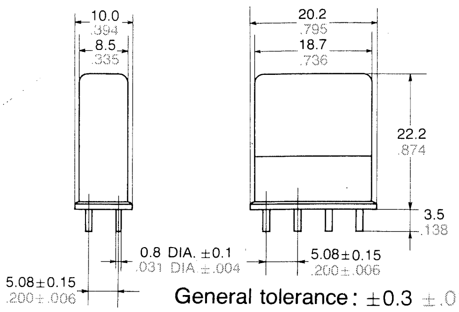
Part No.	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω at 25°C, ±10%	Nominal operating power, mW	Max. allowable voltage, V DC (40°C)
DN2-DH-5V-1	5	3.5	0.5	44	568	7.5
DN2-DH-6V-1	6	4.2	0.6	60	600	8.8
DN2-DH-12V-1	12	8.4	1.2	250	576	18
DN2-DH-24V-1	24	17	2.4	1,000	576	36
DN2-DH-48V-1	48	32	4.8	3,500	658	72

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

TYPICAL APPLICATIONS

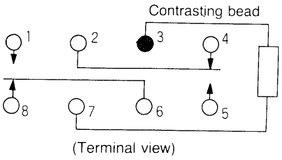
1. Communication equipment
2. Measuring equipment
3. Computer peripherals
4. Precision equipment for ships and airplanes

DIMENSIONS



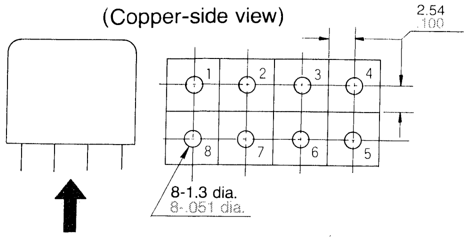
General tolerance: ±0.3 ±.012

Schematic



PC board pattern
(Copper-side view)

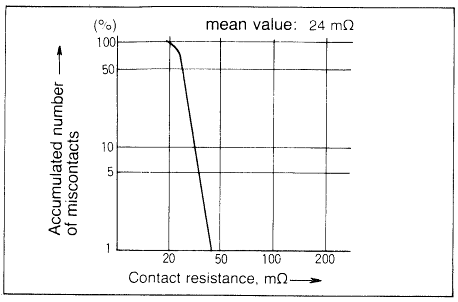
mm inch



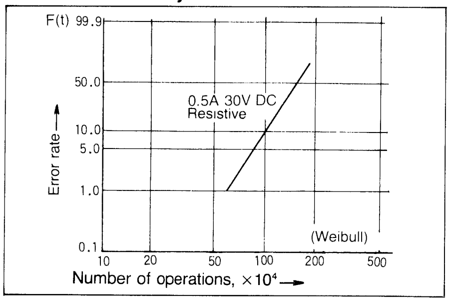
Tolerance: ±0.1 ±.004

DATA

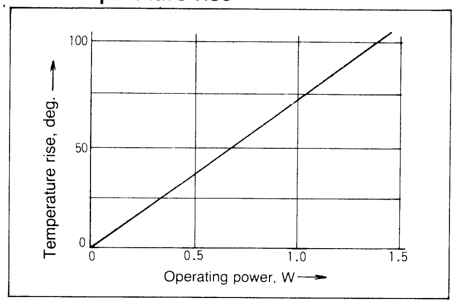
Initial contact resistance



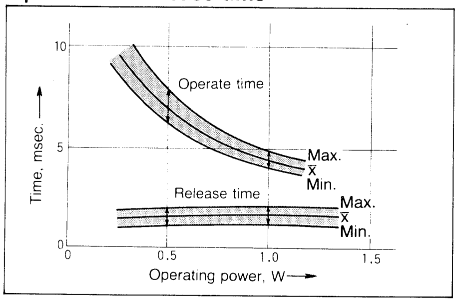
Contact reliability



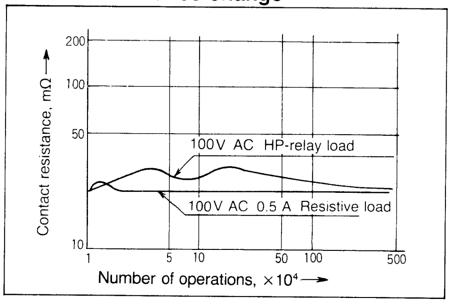
Coil temperature rise



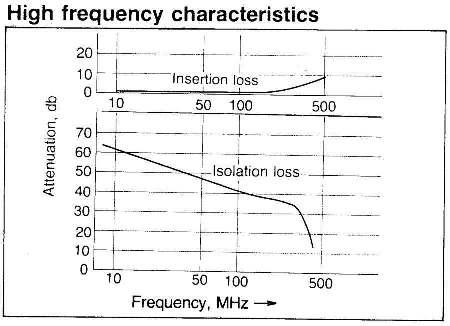
Operate and release time



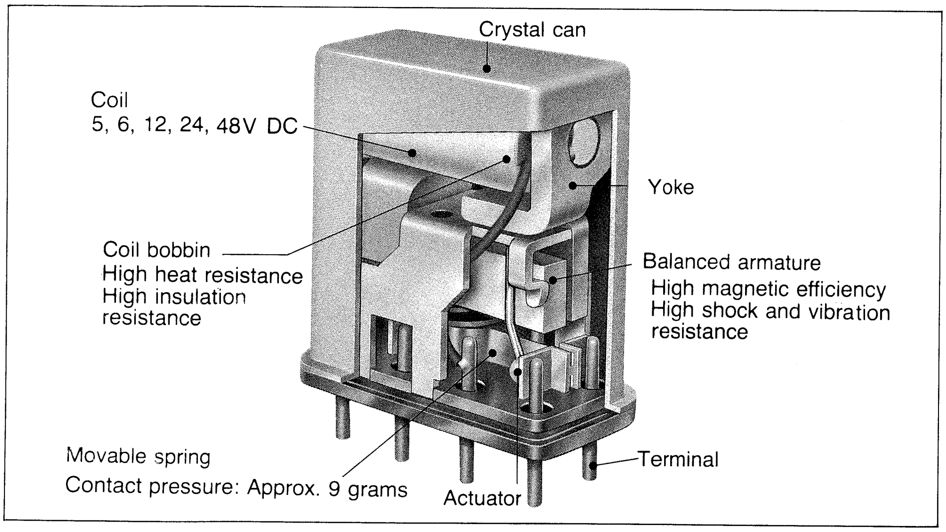
Contact resistance change



High frequency characteristics



CONSTRUCTION



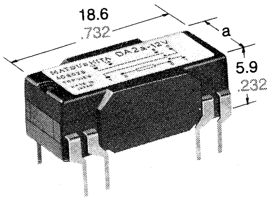
NOTES

1. Initial insulation resistance is $10^{10}\Omega$ at 100V DC. To maintain this high insulation resistance, coating of PC board surface is recommended, especially for such applications as measuring equipment.
2. The bottom surface of DN relay is a metal plate. Therefore, when double sided printed circuit boards are used, an insulating plate is required.

NAiS

THIN-LINE LOW PROFILE DIP REED RELAY

DA-RELAYS



mm inch

	a
DA1a	7.2 .283
DA2a	9.2 .362

- High contact reliability—Contacts completely protected from adverse atmosphere
- Sensitive—89 mW (1 Form A 5V) low operating power
  Direct drive by TTL, DTL possible
- Thin-line, low profile—Stands 6.2 mm (.244 inches) off PC boards. Ideal for high density packaging
- DIP terminal arrangement—Matches IC socket
- Magnetic shielded—Negligible influence of stray magnetic fields
- Contact arrangement—1 Form A, 2 Form A

SPECIFICATIONS

Contacts

Arrangement	1 Form A, 2 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	150 mΩ
Rating (resistive load)	
Max. switching power	10 W (10 VA)
Max. switching voltage	100V AC 50V DC
Max. switching current	0.2 A
Expected life (min. operations)	
Mechanical	10^8
Electrical (resistive)	
0.1 A 100 V AC	10^6
0.001 to 0.2 A 6 V DC	10^7
0.001 to 0.03 A 12 V DC	10^7
0.04 to 0.2 A 12 V DC	5×10^6
0.001 to 0.02 A 24 V DC	10^7
0.03 A to 0.2 A 24 V DC	2.5×10^6
0.01 A to 0.2 A 48 V DC	4×10^5

Coil (at 25°C 77°F)

Minimum operating power	DA1a	48 to 113 mW
	DA2a	91 to 160 mW
Nominal operating power	DA1a	89 to 230 mW
	DA2a	167 to 325 mW

Characteristics (at 25°C 77°F, 50% R.H.)

Maximum operating speed	500 cps.
Operate time	max. 0.5 msec.
Release time	max. 0.1 msec.
Breakdown voltage	
Between open contacts	200 V DC for 1 min.
Between contacts and coil	500 V DC for 1 min.
Initial insulation resistance	1,000 MΩ at 100V DC
Electrostatic capacitance (contact/contact)	Approx. 1 pF
Ambient temperature	−30°C to +70°C −22°F to +158°F
Shock resistance	Functional: 50 G Destructive: 100 G
Vibration resistance (both functional and destructive)	20 G, 10 to 55 Hz at double amplitude of 3.4 mm
Unit weight	DA1a Approx. 1.4 g .05 oz DA2a Approx. 1.6 g .06 oz

TYPICAL APPLICATIONS

Electronic computers and their peripherals, security equipment, medical equipment, measuring devices and various consumer appliances.

ORDERING INFORMATION

Ex. DA 1a — 12 V — D

Contact arrangement	Coil voltage (DC)	Classification of types
1a: 1 Form A 2a: 2 Form A	5, 6, 12, 24 V	Nil: without diode inside D: with diode inside

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

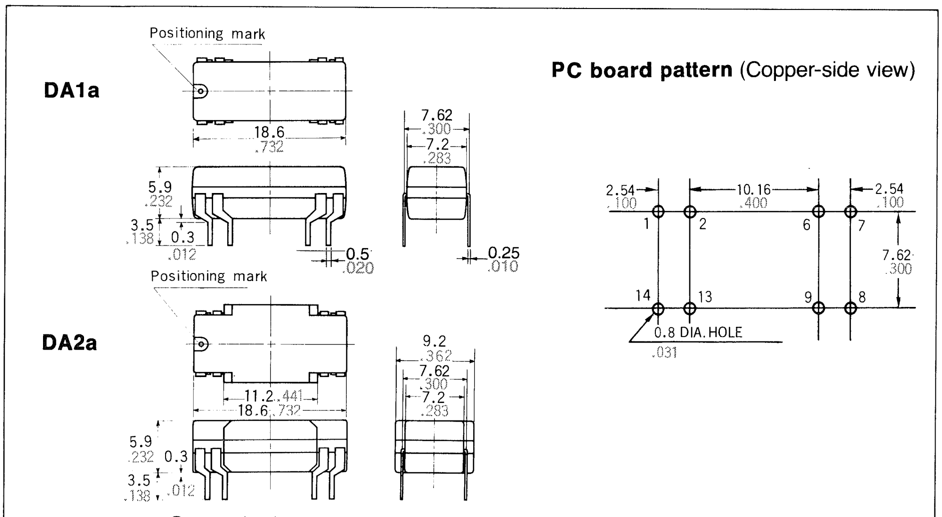
TYPES AND COIL DATA at 25°C 77°F

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Maximum allowable operating power, mW (40°C)	Maximum allowable voltage, V DC (40°C)
DA1a-5V	5	3.7	0.5	280	89	357	10
DA1a-6V	6	4.2	0.6	280	129	357	10
DA1a-12V	12	8.4	1.2	720	200	356	16
DA1a-24V	24	16.8	2.4	2,500	230	360	30
DA2a-5V	5	3.7	0.5	150	167	540	9
DA2a-6V	6	4.2	0.6	150	240	540	9
DA2a-12V	12	8.4	1.2	510	282	500	16
DA2a-24V	24	16.8	2.4	1,770	325	508	30

Notes: 1. Coil resistance varies ±0.4% for each ±1°C change in coil temperature.
2. Diode-incorporated types are also available.

DIMENSIONS

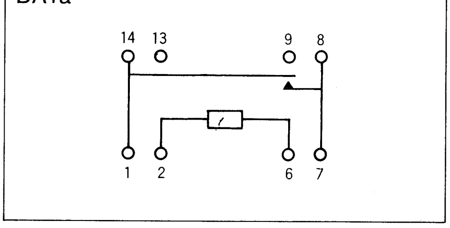
mm inch

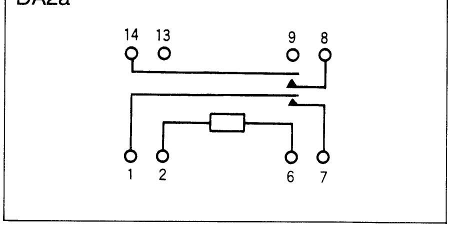


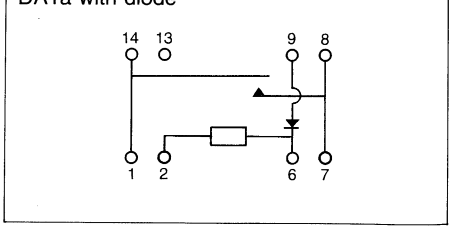
General tolerance: ±0.2 ±.008

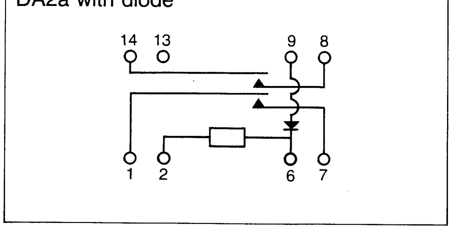
Tolerance: ±0.1 ±.004

Shematic (Top view)



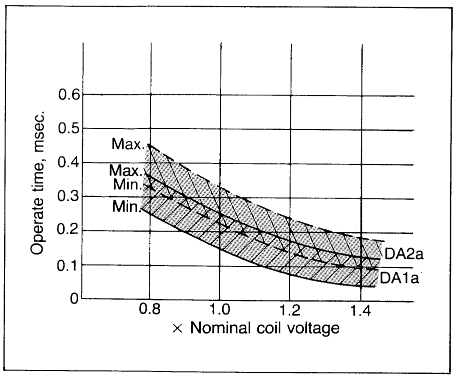




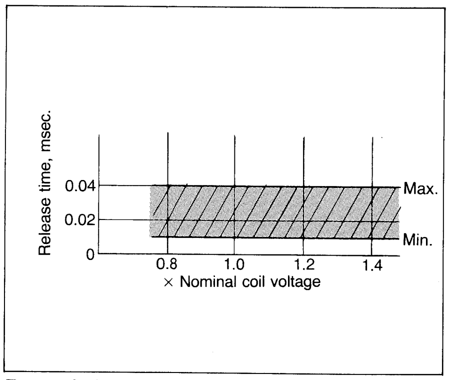


DATA

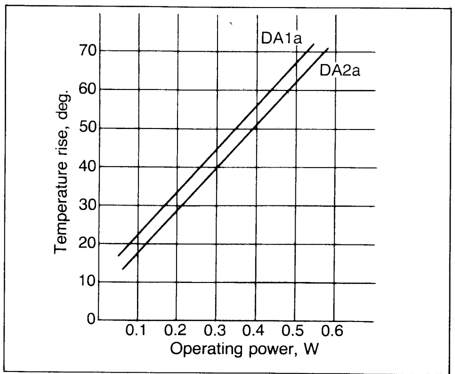
Operate time



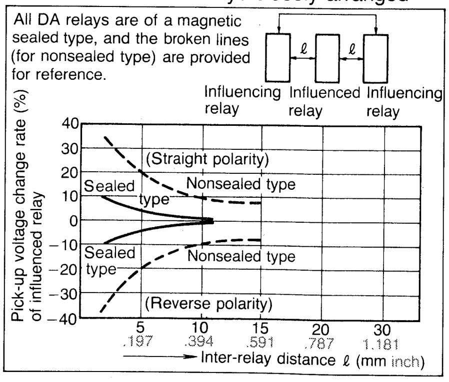
Release time



Temperature rise in coil



Rate of change in pick-up voltage against distance when DA relays closely arranged



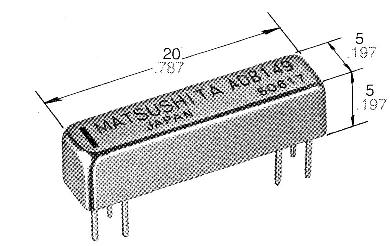
NOTES

When 1 Form C contact, latching function and 20 VA switching capacity are required, please use our NR-relays.

NAiS

HIGH QUALITY REED RELAY FOR MEASURING INSTRUMENTATION

DB-RELAYS



mm inch

- Most suitable for measuring instrumentation
- Wide variety for versatile applications

  Standard version — No electrostatic shield — General use
  — 1 electrostatic shield pin / 2 electrostatic shield pins: Measuring instrument use

  "Q" version — 1 electrostatic shield pin / 2 electrostatic shield pins: High quality measuring instrument (IC, LSI checker)
- High insulation resistance: Standard version: 1000 MΩ; "Q" version: 10,000 MΩ
- High sensitivity: 130 mW nominal power
- High speed operation: 0.5 msec. operating time

SPECIFICATIONS

Contact

Arrangement	1 Form A	
Initial contact resistance, max.	150 mΩ	
Contact material	Rhodium	
Electrostatic capacitance (measured at 1 MHz)	With electrostatic shield pin	No electrostatic shield pin
Between open contacts	1.0 pF	1.5 pF
Between contact and ground	4.0 pF	—
Between contact and coil	4.0 pF	6.0 pF
Thermal electromotive force (at nominal coil voltage)	Max. 20 µV	
Rating (resistive) Max. switching power	10 W, 10 VA	
Max. switching voltage	100 V DC, 100 V AC	
Max. switching current	0.5 A	
Max. carrying current	1.0 A	
High frequency characteristics (at 900 MHz)	1 electrostatic shield pin	2 electrostatic shield pins
Isolation	Min. 20 dB	Min. 20 dB
Insertion loss	Max. 2.0 dB	Max. 1.6 dB
V.S.W.R.	Max. 2.5	Max. 2.0
Expected life (min. operations)	Standard version	"Q" version
Mechanical	10^8	2×10^8
Electrical	10^6 (0.4 A 24 V DC)	10^6 (0.4 A 24 V DC) 10^8 (10 mA 30 mV DC)

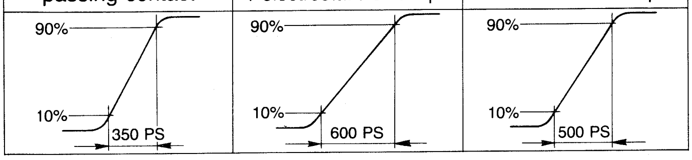
Characteristics

Initial insulation resistance	Standard version	"Q" version
Between open contacts	10^9	10^{10}
Between contacts and coil	10^9	10^{10}
Between contacts and ground	10^9	10^{10}
Initial breakdown voltage Between open contacts	200 V DC for 1 min.	
Between contacts and coil	500 V DC for 1 min.	
Between contacts and ground	500 V DC for 1 min.	
Operating charactoristics	Standard version	"Q" version
Operate time (msec.)	0.5	0.5
Release time (msec.)	0.2	0.2
Bounce time (msec.)	0.5	0.2
Max. operating speed	200 cps. (mechanical)	
Temperature rise	30 deg. (25 deg. for 5 V high sensitive type)	
Shock resistance Functional	50 G	
Destructive	100 G	
Vibration resistance Functional	20G, 10 to 55 Hz at double amplitude of 3.3 mm	
Destructive	20G, 10 to 55 Hz at double amplitude of 3.3 mm	
Ambient temperature	−40°C to +80°C −40°F to +176°F	
Unit weight	Approx. 1.5 g .05 oz	

Pulse transmission characteristics

DB relay contact can transmit the pulse signal of shorter than 1.0 nsec.

Pulse before passing contact	Pulse form after passing contact	
	1 electrostatic shield pin	2 electrostatic shield pins



TYPICAL APPLICATIONS

Standard version: General measuring instrument
Telecommunication

"Q" version: Signal switching applications for IC checker and LSI checker

ORDERING INFORMATION

- High sensitive type (80 mW) is only available for 5 V.
- 1 electrostatic shield type and 2 electrostatic shields type are available with coil voltage 5 V and 12 V.
- "Q" version is only available with 1 electrostatic shield or 2 electrostatic shields type.
- Epoxy coating on metal can is available.

Ex. DB [1] [Q] — [S] [1] — [12] V

Contact arrangement	Standard or "Q"	Sensitivity	No. of shield pin	Coil voltage
1: 1 form A	Nil: Standard version Q: "Q" version	Nil: Standard (130 mW) S: High sensitivity (80 mW only for 5 V)	Nil: No electrostatic shield pin 1: 1 electrostatic shield pin 2: 2 electrostatic shield pins	1.5, 3, 5, 6, 9, 12, 15, 18, 24

Note: Standard packing; Carton: 100 pcs. Case: 1,000 pcs.

TYPES AND COIL DATA

Standard Versions

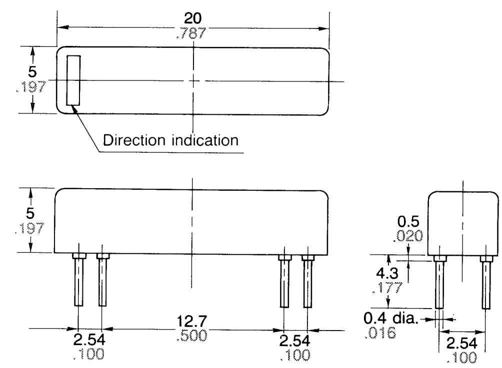
Part No.			Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal current, mA	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
No electrostatic shield pin	1 electrostatic shield pin	2 electrostatic shield pins							
DB1-1.5 V	—	—	1.5	1.05	0.3	86.2	17.4	130	1.8
DB1-3 V	—	—	3	2.1	0.6	43.5	69	130	3.6
DB1-5 V	DB1-1-5 V	DB1-2-5 V	5	3.5	1.0	25.9	193	130	6.0
DB1-S-5 V	DB1-S1-5 V	DB1-S2-5 V	5	4.0	0.5	16.0	312	80	6.0
DB1-6 V	—	—	6	4.2	1.2	21.5	279	130	7.2
DB1-9 V	—	—	9	6.3	1.8	14.2	636	130	10.8
DB1-12 V	DB1-1-12 V	DB1-2-12 V	12	8.4	2.4	10.8	1,115	130	14.4
DB1-15 V	—	—	15	10.5	3.0	8.5	1,768	130	18.0
DB1-18 V	—	—	18	12.6	3.6	6.9	2,600	130	21.6
DB1-24 V	—	—	24	16.8	4.8	5.3	4,544	130	28.8

"Q" versions

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC	Drop-out voltage, V DC	Nominal current, mA	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
1 electrostatic shield pin	2 electrostatic shield pins							
DB1Q-1-5V	DB1Q-2-5V	5	3.5	1.0	25.9	193	130	6.0
DB1Q-S1-5V	DB1Q-S2-5V	5	4.0	0.5	16.0	312	80	6.0
DB1Q-1-12V	DB1Q-2-12V	12	8.4	2.4	10.8	1,115	130	14.4

DIMENSIONS

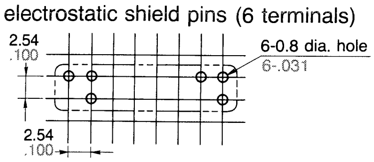
mm inch



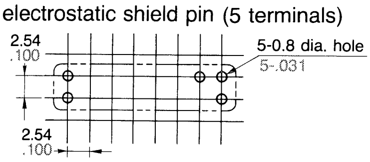
General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)

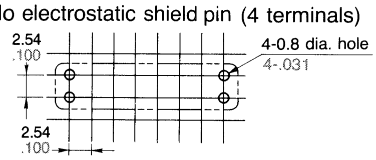
2 electrostatic shield pins (6 terminals)



1 electrostatic shield pin (5 terminals)



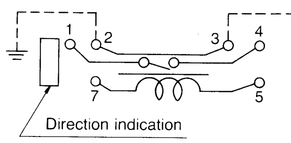
No electrostatic shield pin (4 terminals)



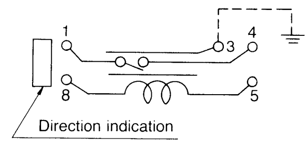
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

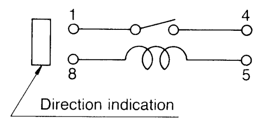
2 shield pins (6 terminals)



1 shield pin (5 terminals)

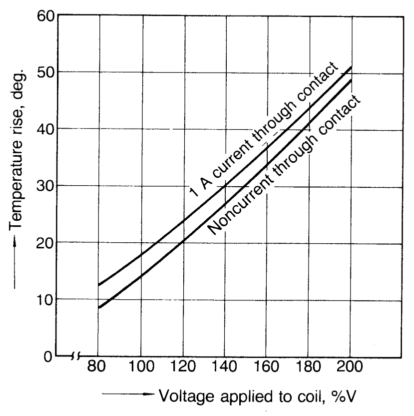


No shield pin (4 terminals)

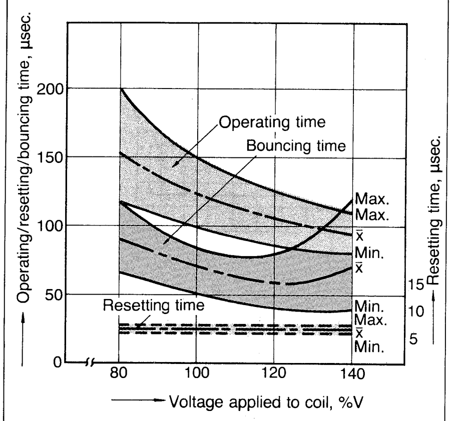


DATA

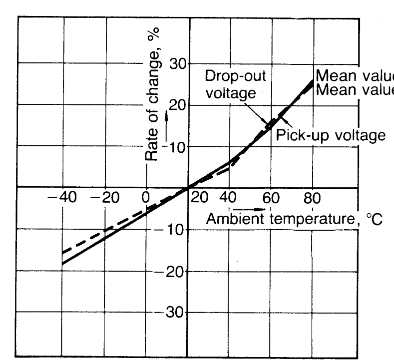
1. Coil temperature rise
   Sample: DB1Q-2-5V
   Quantity: 10 pcs.



2. Operating/resetting/bouncing time characteristics
   Sample: DB1Q-2-5V
   Quantity: 10 pcs.

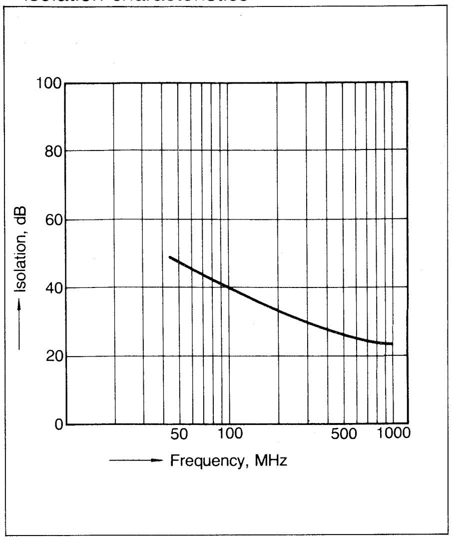


3. Ambient temperature characteristics
   Sample: DB1Q-1-5V
   Quantity: 10 pcs.

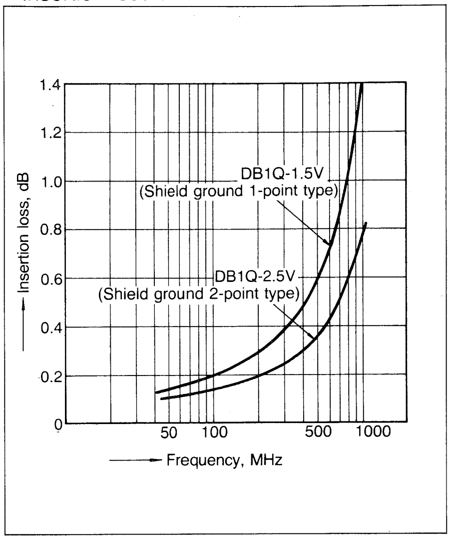


4. High frequency characteristics
   Sample: DB1Q-2-5V (shield ground 2-point type)

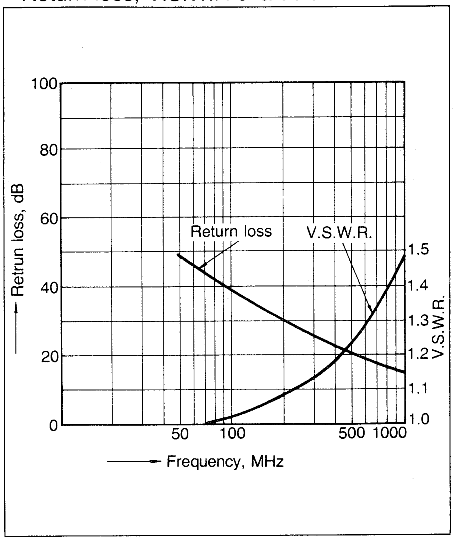
• Isolation characteristics



• Insertion loss characteristics



• Return loss, V.S.W.R characteristics



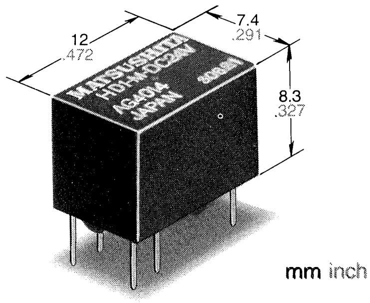
NOTES

1. Ripple factor: Coils should be operated on pure DC. Rectified AC may cause changes in the pickup-dropout characteristics because of the ripple factor. Use of a capacitor in the circuit is recommended to keep the ripple factor below 5%.
2. Soldering: Soldering should be done within 3 seconds.
3. Avoid applying external force to terminals since this may affect reed inside.
4. This relay contain glass encapsulated reed inside. So avoid shock, vibration and dropping as much as possible.

NAiS

ULTRA-MINIATURE SINGLE POLE RELAY

HD-RELAYS



UL File No.: E43149
CSA File No.: LR26550

- **Ideal for portable devices! Only 1.7 g.**
- **Ultra-small type with dimensions:**
  8.3 mm height×12 mm length×7.4 mm width
- **High sensitivity: 280 mW nominal operating power**
- **Gold-clad bifurcated contact for high reliability**
- **Sealed construction**

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) Max. switching power	30 W, 50 VA
Max. switching voltage	60 V DC, 125 V AC
Max. switching current	1 A DC, AC
Max. carrying current	2 A DC, AC
UL/CSA rating	1 A 30 V DC
Expected life (min. operations) Mechanical (at 180 cpm)	5×10^6
Electrical (at 20 cpm) 1 A 30 V DC	10^5
0.5 A 100 V AC	10^5

Coil (at 25°C 77°F)

Minimum operating power	179 to 192 mW
Nominal operating power	280 to 300 mW

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

Max. operating speed		20 cpm (at nominal voltage)
Operate time		Approx. 3 msec.
Release time		Approx. 3 msec.
Initial breakdown voltage Between open contacts		500 Vrms
Between contact and coil		500 Vrms
Initial insulation resistance		100 MΩ at 500 V DC
Temperature rise		Max. 50 deg.
Ambient temperature		−25°C to +60°C −13°F to +140°F
Shock resistance	Functional	10 G
	Destructive	100 G
Vibration resistance	Functional	6 G, 10 to 55 Hz at double amplitude of 1 mm
	Destructive	12 G, 10 to 55 Hz at double amplitude of 2 mm
Unit weight		1.7 g .06 oz

TYPICAL APPLICATION

1. Low voltage signal change-over in portable VCR, camera, audio, and other small household devices.
2. Use in lap top computers and other small computer and peripheral devices (printers, plotters, etc.).

ORDERING INFORMATION

HD [1] — M — [DC12V]

Contact arrangement	Coil voltage
1: 1 Form C	DC 1.5, 3, 5, 6, 9, 12, 24 V

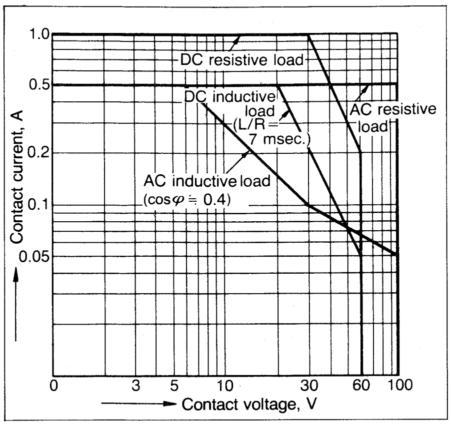
Notes: 1. For UL/CSA recognized types, add suffix UL/CSA.
2. Standard packing; Carton: 100 pcs. Case: 500 pcs.

TYPES AND COIL DATA

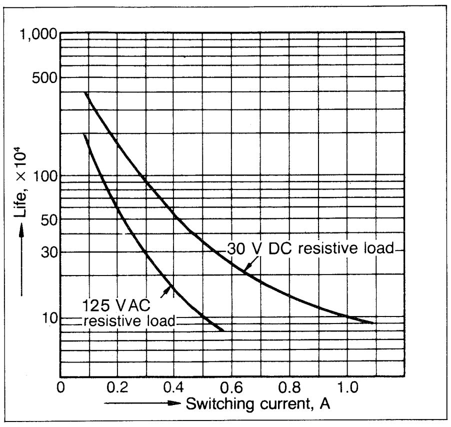
Part No.	Nominal voltage, V DC (at 20°C 68°F)	Pick-up voltage, V DC (max.) (at 20°C 68°F)	Drop-out voltage, V DC (min.) (at 20°C 68°F)	Coil resistance Ω (±10%) (at 20°C 68°F)	Nominal operating current, mA (at 20°C 68°F)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C 140°F)
HD1-M-DC1.5V	1.5	1.2	0.15	8	187.5	280	1.65
HD1-M-DC3V	3	2.4	0.3	32	93.7	280	3.3
HD1-M-DC5V	5	4.0	0.5	89	56.1	280	5.5
HD1-M-DC6V	6	4.8	0.6	128	46.8	280	6.6
HD1-M-DC9V	9	7.2	0.9	270	33.3	300	9.9
HD1-M-DC12V	12	9.6	1.2	515	23.5	280	13.2
HD1-M-DC24V	24	19.2	2.4	2,060	11.6	280	26.4

DATA

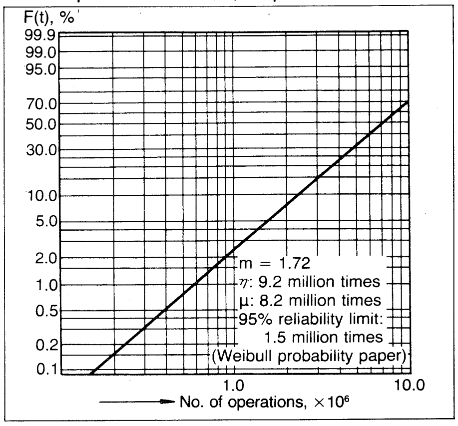
1. Maximum switching power



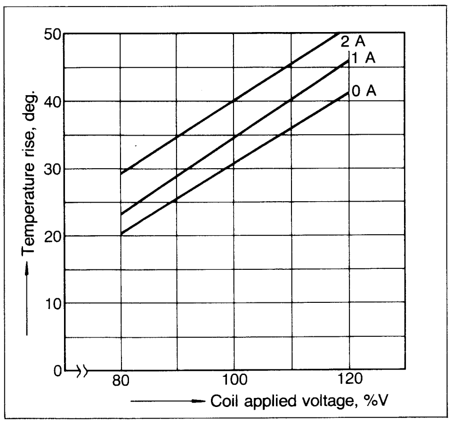
2. Life curve



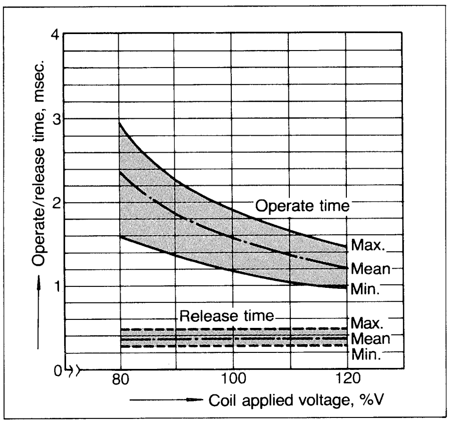
3. Contact reliability test
Condition: 1 V, 1 mA, 1 kHz AC
Detection level (5 Ω)
Sample: HD1-M-9VDC, 10 pcs.



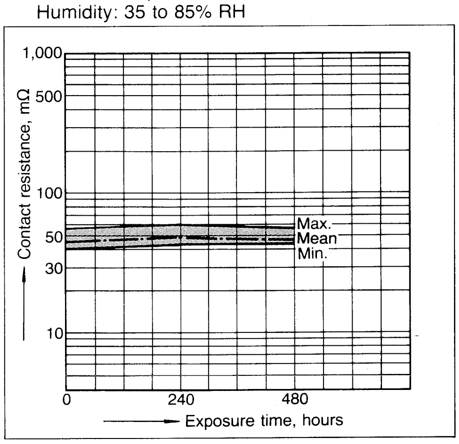
4. Coil temperature rise



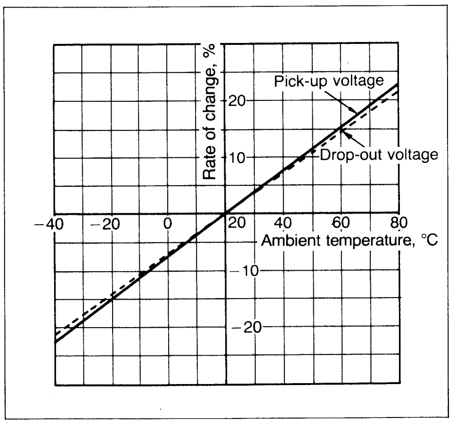
5. Operate/release time



6. H_2S gas test
Gas density: 2 to 5 ppm
Ambient temperature: 35 to 37°C 95 to 99°F
Humidity: 35 to 85% RH

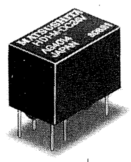


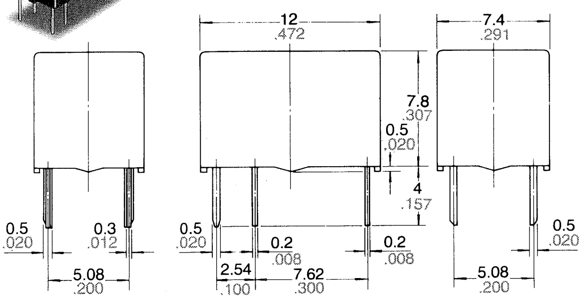
7. Ambient temperature characteristics



DIMENSIONS

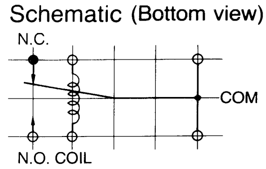
mm inch



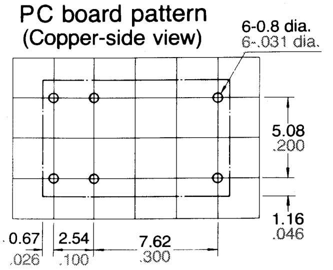


General tolerance: ±0.3 ±.012

Schematic (Bottom view)



PC board pattern (Copper-side view)

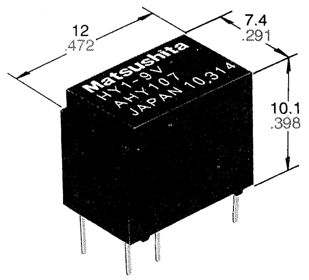


Tolerance: ±0.1 ±.004

NAiS

High Sensitivity 1 Form C Relay in Ultra Small Size

HY-RELAYS



mm inch

UL File No.: E43149
CSA File No.: LR26550

- **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
UL1CSA rating	1 A 30 V DC
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

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

Max. operating speed		20 cpm (at nominal voltage)
Operate time (at nominal voltage)		Approx. 3 msec.
Release time (at nominal voltage)		Approx. 3 msec.
Initial breakdown voltage Between open contacts		500 Vrms
Between contact and coil		1,000 Vrms
Initial insulation resistance	Between contacts	Min. 100 MΩ at 500 V DC
	Between contact and coil	Min. 100 MΩ at 500 V DC
Temperature rise (max.) at nominal voltage Contact carrying current 1 A at 20°C		50 deg.
Ambient temperature		–40°C to +70°C –40°F to +158°F
Shock resistance	Functional	10 G
	Destructive	100 G
Vibration resistance	Functional	6 G, 10 to 55 H,z at double amplitude of 1 mm
	Destructive	12 G, 10 to 55 Hz at double amplitude of 2 mm
Unit weight		1.8 g .066 oz

TYPICAL APPLICATION

- 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

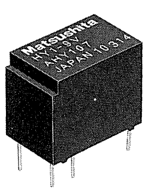
Standard packing: Carton: 100 pcs. Case 500 pcs.

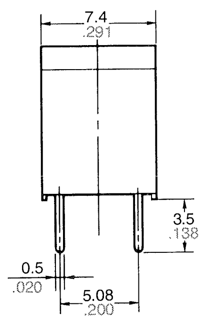
TYPES AND COIL DATA at 20°C 68°F

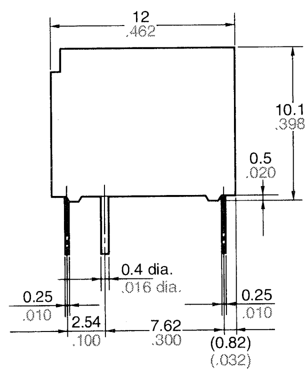
	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min)	Coil resistance Ω (±10%)	Nominal operating current, mA	Nominal operating power. mW	Max. allowable voltage, VDC (at 70°C 158°F)
200 mW Standard type	HY1Z-1.5V	1.5	1.125	0.15	11.25	133.3	200 mW	1.8
	HY1Z-3V	3	2.25	0.3	45	66.7		3.6
	HY1Z-4.5V	4.5	3.375	0.45	101.2	44.5		5.4
	HY1Z-5V	5	3.75	0.5	125	40		6
	HY1Z-6V	6	4.5	0.6	180	33.3		7.2
	HY1Z-9V	9	6.75	0.9	405	22.2		10.8
	HY1Z-12V	12	9	1.2	720	16.7		14.4
	HY1Z-24V	24	18	2.4	2,880	8.3		28.8
150 mW High sensitivity type	HY1-1.5V	1.5	1.125	0.15	15	100	150 mW	1.95
	HY1-3V	3	2.25	0.3	60	50		3.9
	HY1-4.5V	4.5	3.375	0.45	135	33.3		5.85
	HY1-5V	5	3.75	0.5	166	30.1		6.5
	HY1-6V	6	4.5	0.6	240	25		7.8
	HY1-9V	9	6.75	0.9	540	16.7		11.7
	HY1-12V	12	9	1.2	960	12.5		15.6
	HY1-24V	24	18	2.4	3,840	6.25		31.2

DIMENSIONS

mm inch

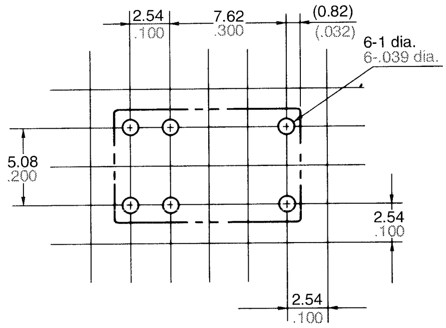




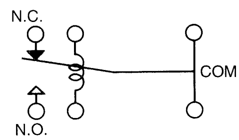


General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)



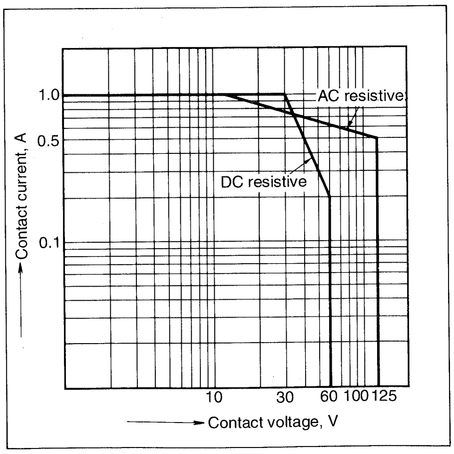
Schematic (Bottom view)



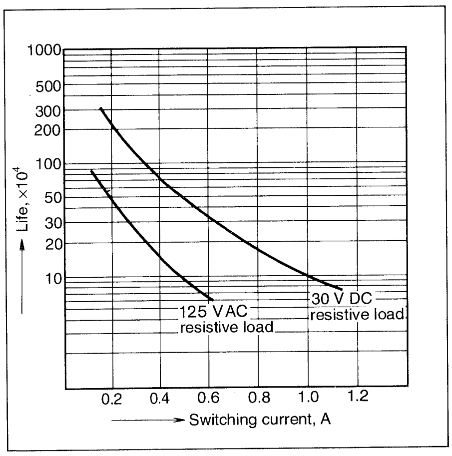
Tolerance: ±0.1 ±.004

DATA

1. Maximum switching power

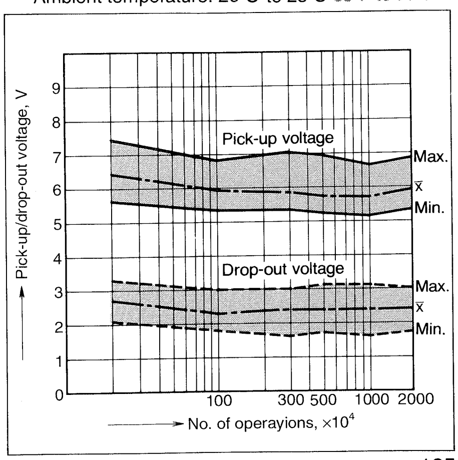


2. Life curve



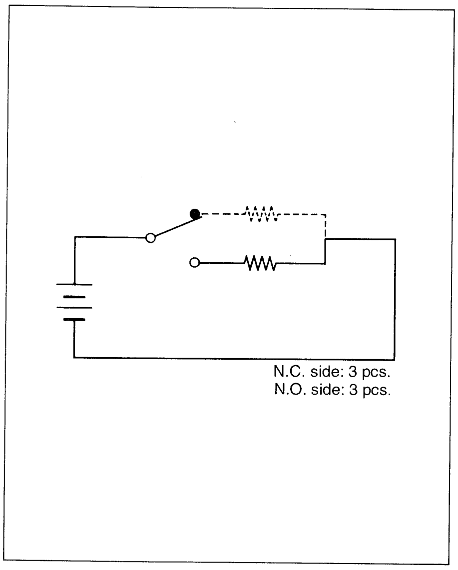
3. Mechanical life

Tested sample: HY1Z-12V, 10 pcs.
Ambient temperature: 20°C to 25°C 68°F to 77°F

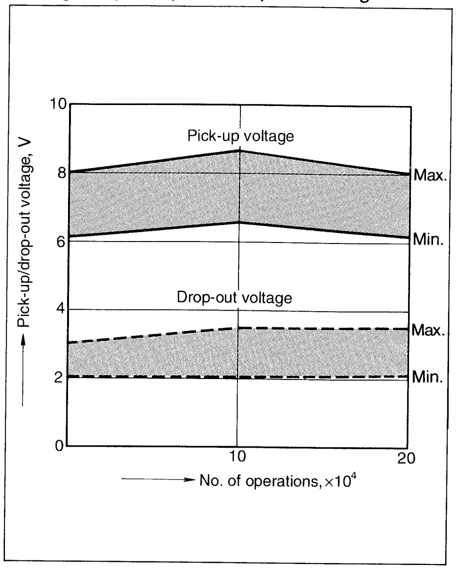


4. Electrical life

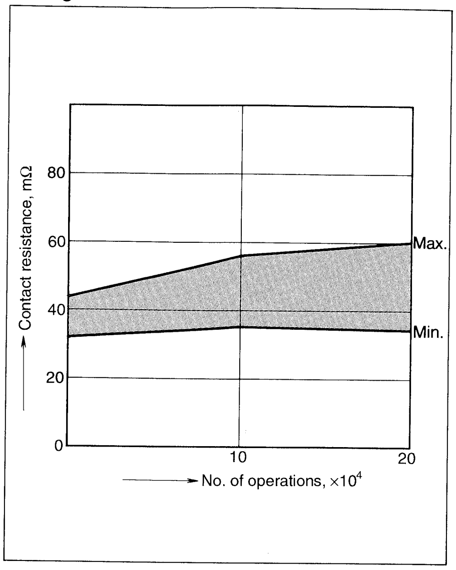
Tested sample: HY1-12V, 6 pcs.
Condition: 1 A 30 V DC resistive load, 30 cpm
Circuit:



Change of pick-up and drop-out voltage

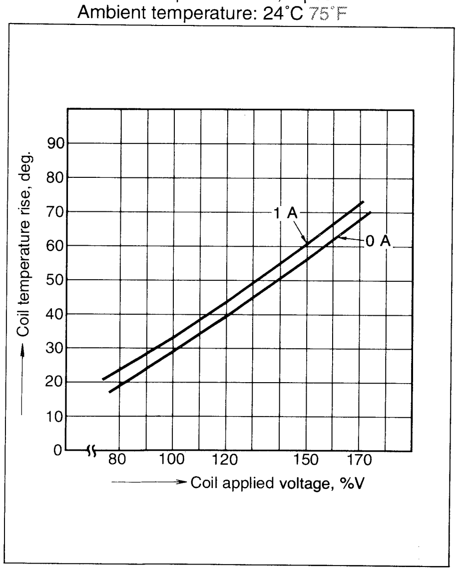


Change of contact resistance



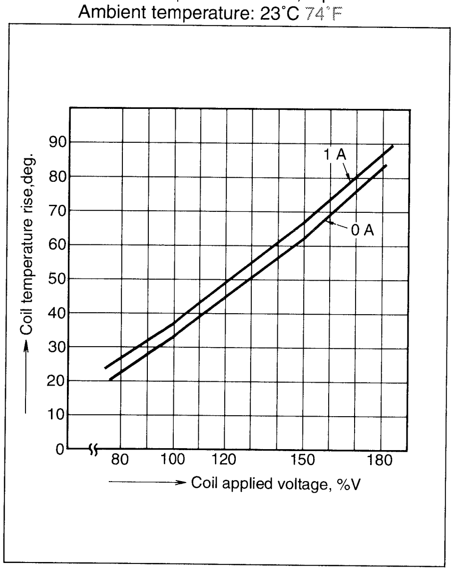
5-(1). Coil temperature rise
(150 mW high sensitivity type)

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



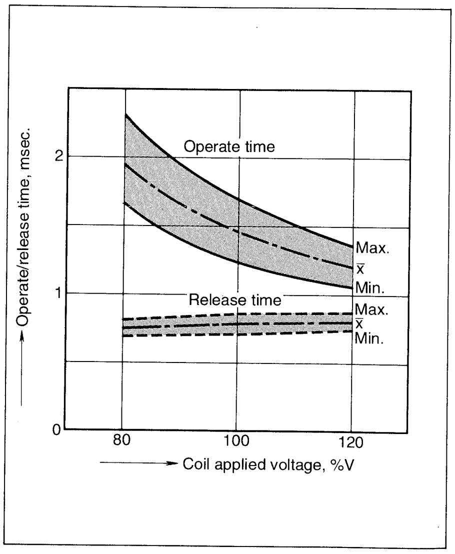
5-(2). Coil temperature rise
(200 mW Standard type)

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



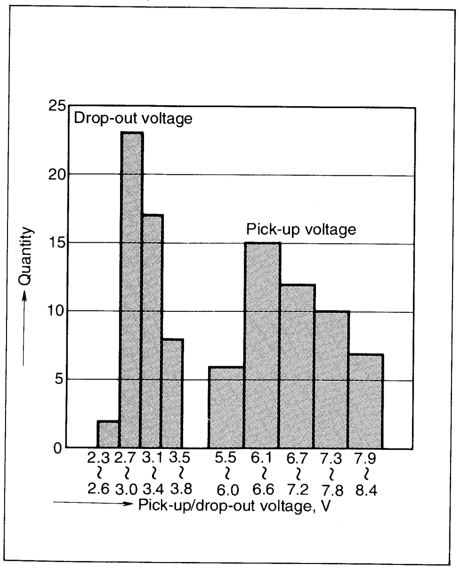
6. Operate/release time characteristics

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



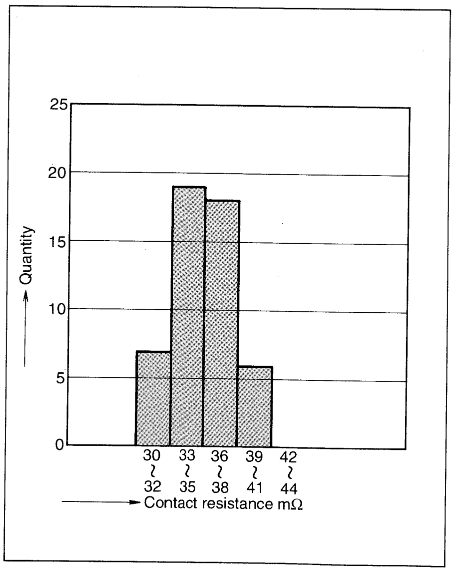
7. Distribution of pick-up and rop-out voltages

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



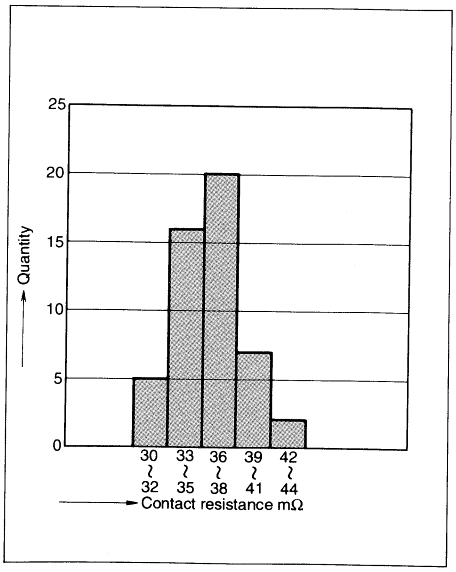
8. Distribution of contact resistance

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



Distribution of contact resistance

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



NOTE

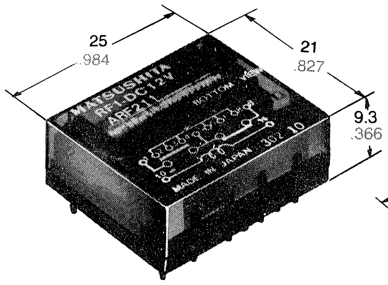
Soldering and cleaning

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.

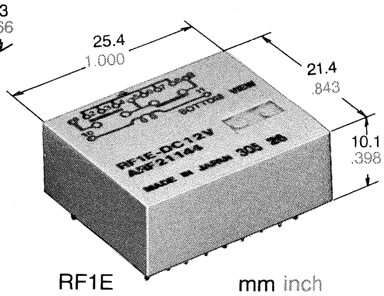
NAiS

HIGHLY RELIABLE, MINIATURE HIGH FREQUENCY RELAY

RF-RELAYS



RF1



RF1E

mm inch

- Excellent high frequency characteristics
  —Isolation: 65 dB min. (900 MHz), Insertion loss: 1.5 dB max. (900 MHz).
- Satisfies the high frequency standard of FCC: more than 60 dB isolation loss
- High reliability and long life
  —Mechanical: more than 5×10^6 operations
  Electrical: more than 10^5 operations
- Compact size and light weight
  —Small mounting space, Unit weight: 9.2 g (Dust cover type)
- Amber sealed types available
- DIL terminal arrangement: 2.54 mm .1 inch pitch

SPECIFICATIONS

Contacts

Arrangement	1 Form C
Contact material	
Stationary contact	Gold plated nickel silver
Movable contact	Gold clad phosphorus bronze
Initial contact resistance, max. (By HP4328A)	100 mΩ
Rating (resistive load)	
Contact rating	0.01 A 24 V AC 0.01 A 24 V DC
Minimum switching capacity	30 μA 3 mV DC
Nominal operating power	450 mW
High frequency characteristics	
Isolation	80 dB min. (250 MHz) 65 dB min. (900 MHz)
Insertion loss	0.5 dB max. (250 MHz) 1.0 dB max. (900 MHz)
V.S.W.R.	1.2 max. (250 MHz) 2.0 max. (900 MHz)
Expected life (min. operations)	
Mechanical (at 180 cpm)	5×10^6
Electrical (at rated load, 20 cpm)	10^5

Characteristics

Initial insulation resistance	100 MΩ at 500 V DC
Initial breakdown voltage	
Between open contacts	1,000 Vrms
Between contacts and coil	2,000 Vrms
Between contacts and earth	500 Vrms
Between earth and coil	2,000 Vrms
Operate time	Max. 10 msec.
Release time	Max. 5 msec.
Bounce time	Approx. 3 msec.
Temperature rise	Max. 55 deg.
Shock resistance	
Functional	20 G
Destructive	100 G
Vibration resistance	
Functional	12 G, 10 to 55 Hz at double amplitude of 2 mm
Destructive	18 G, 10 to 55 Hz at double amplitude of 3 mm
Ambient temperature	−50°C to +60°C −58°F to +140°F
Unit weight RF1	Approx. 9.2 g .32 oz
RF1E	Approx. 9.5 g .34 oz

TYPICAL APPLICATIONS

VTR, Video disc drivers, CATV converters, TV-games, transceivers and measuring instrumentation.

ORDERING INFORMATION

Ex. RF | 1 | E | — | DC9V

Terminal layout	Type classification	Coil voltage
1: N.O. terminal at left 1R: N.O. terminal at right (See Schematic on next page.)	NIL: Dust cover E: Amber sealed	DC 5, 6, 9, 12, 24, 48 V

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

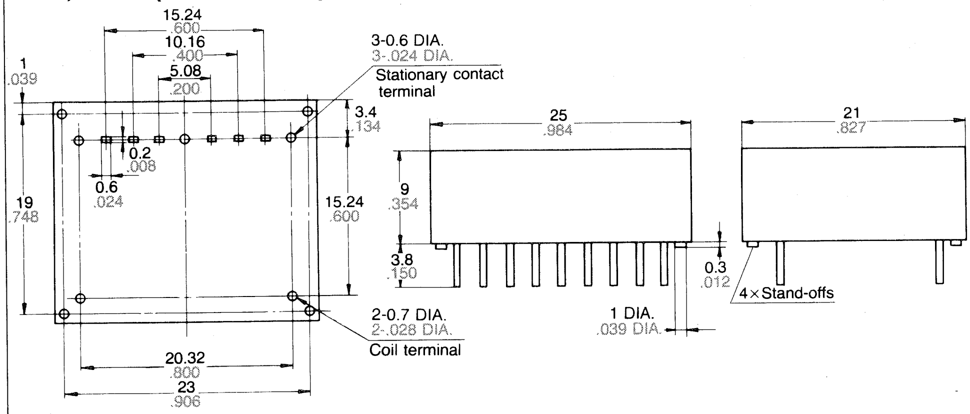
COIL DATA at 20°C 68°F

Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal current, mA	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
5	4.0	0.5	90	56	450	6
6	4.8	0.6	75	80	450	7.2
9	7.2	0.9	50	180	450	10.8
12	9.6	1.2	37.5	320	450	14.4
24	19.2	2.4	18.8	1,280	450	28.8
48	38.4	4.8	9.4	5,120	450	57.6

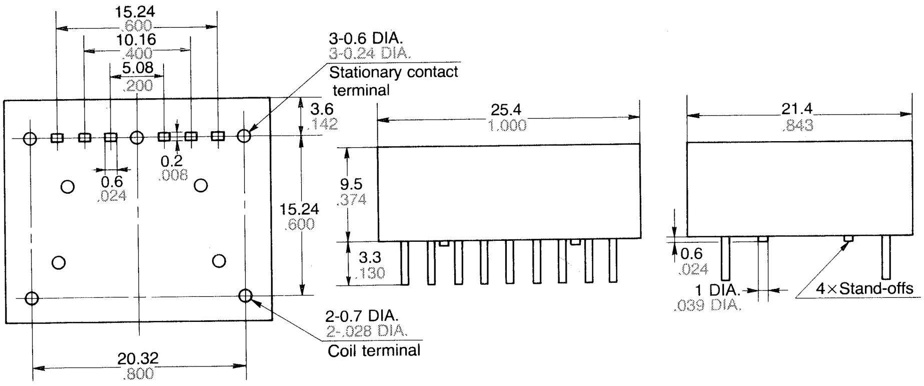
DIMENSIONS

RF1, RF1R (Dust Cover Type)

mm inch



RF1E, RF1RE (Amber Sealed Type)

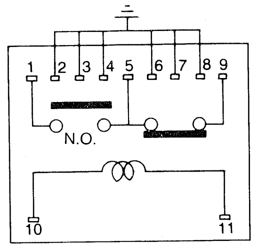


General tolerance: ±0.2 ±.008

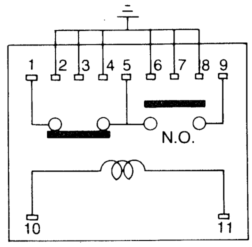
COMMON INFORMATION

SCHEMATIC (BOTTOM VIEW)

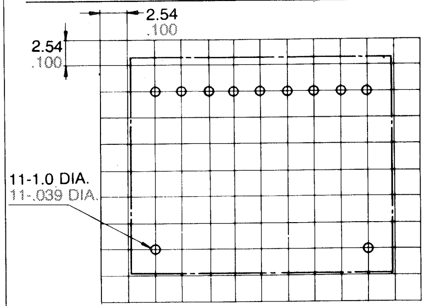
RF1: N.O. Terminal on the left



RF1R: N.O. Terminal on the right



PC board pattern (Copper-side view)

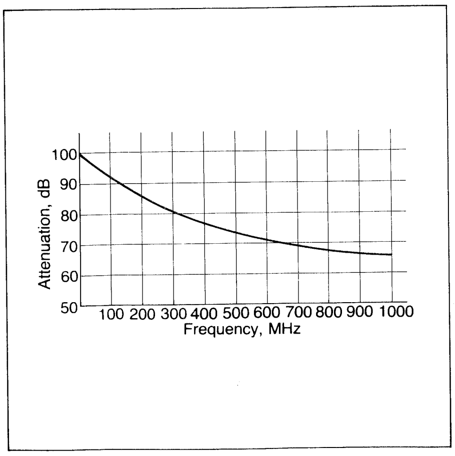


Tolerance: ±0.1 ±.004

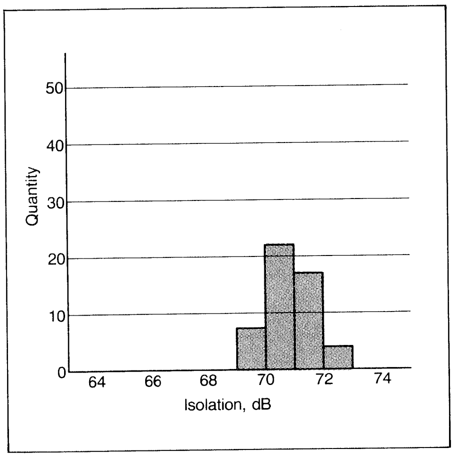
TEST DATA

1. High frequency characteristics

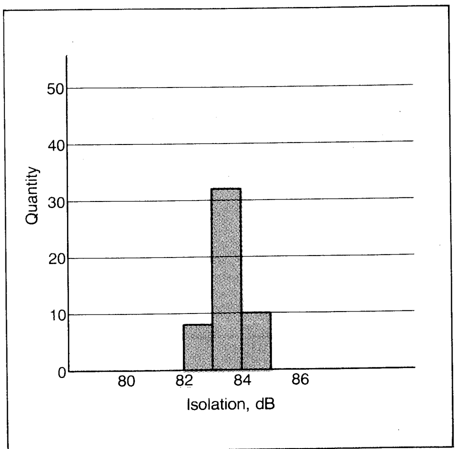
- Isolation



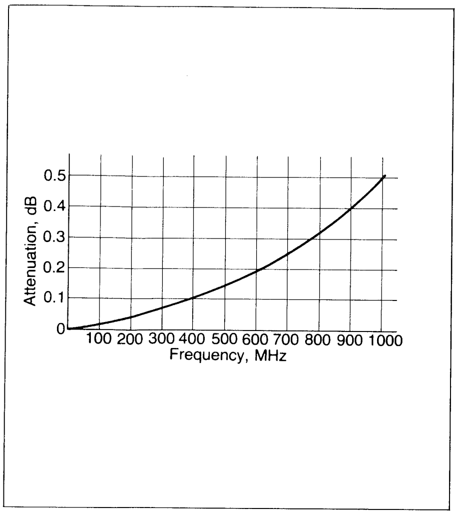
- Isolation distribution of 900 MHz



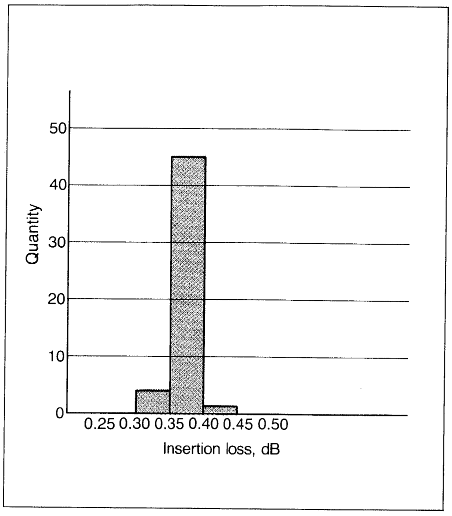
- Isolation distribution of 250 MHz



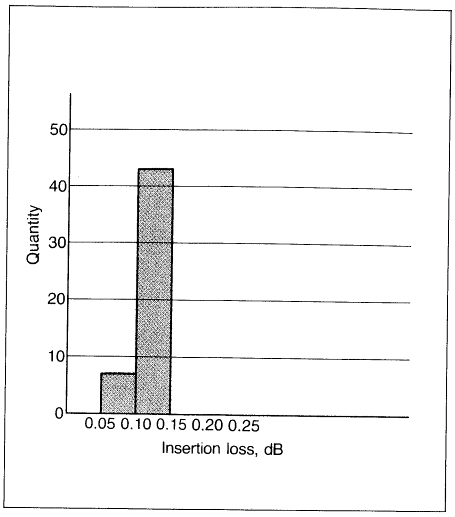
• Insertion loss



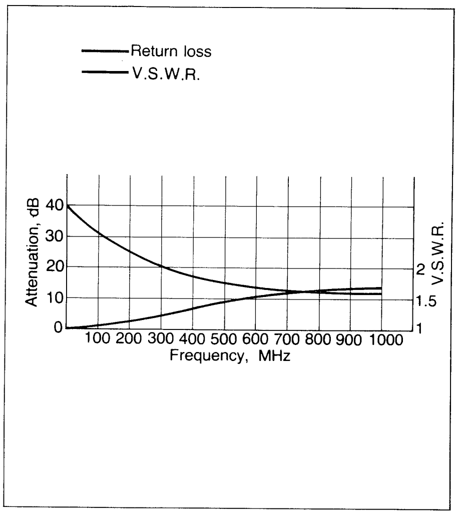
• Insertion loss distribution of 900 MHz



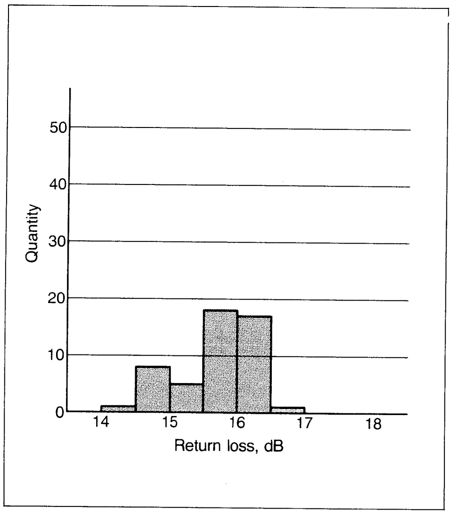
• Insertion loss distribution of 250 MHz



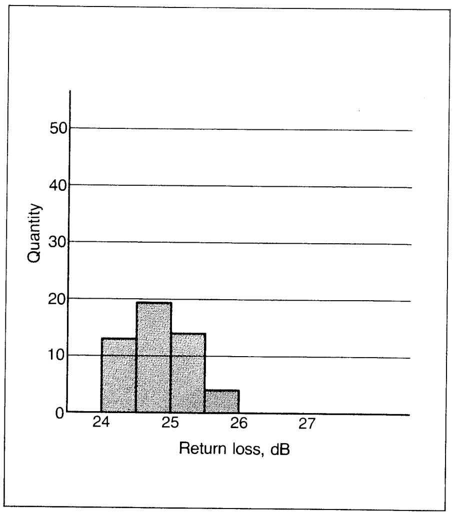
• Return loss • V.S.W.R.



• Return loss distribution of 900 MHz

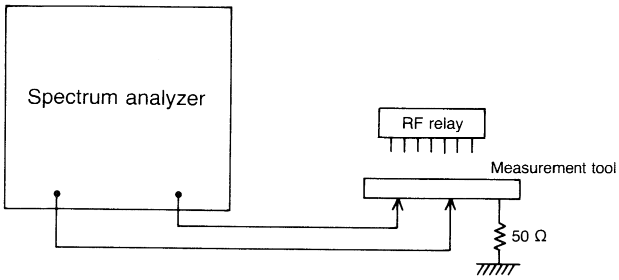


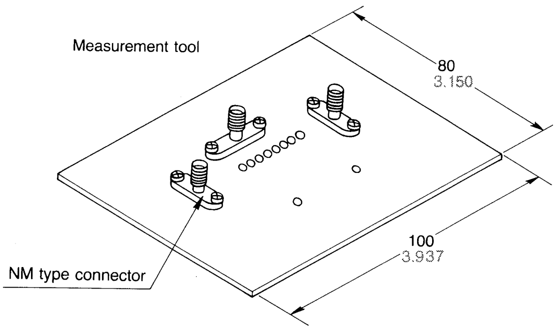
• Return loss distribution of 250 MHz



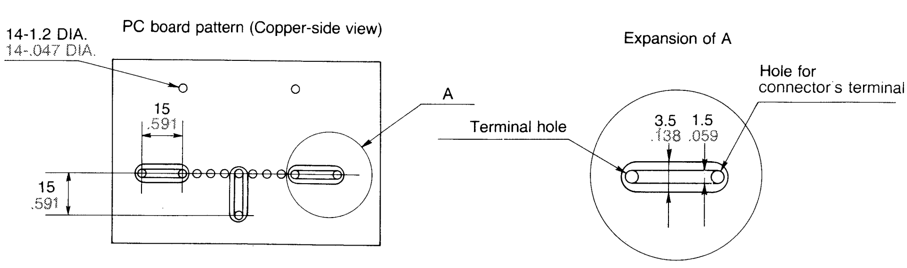
Test condition

mm inch

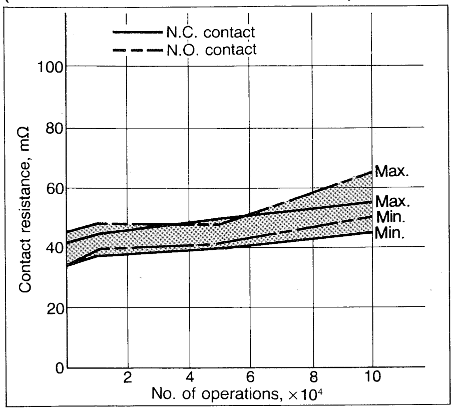




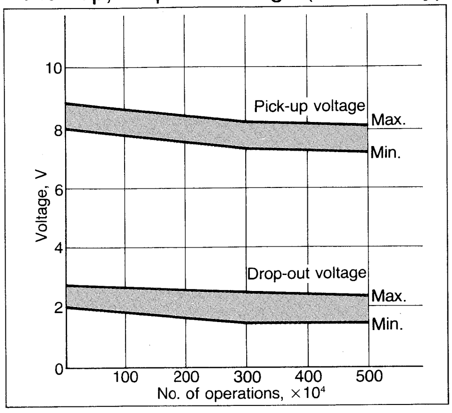
1. Characteristic impedance of all the measuring devices (signal generator and cable) is 50 Ω.
2. The PC board for the test is double side copper clad phenolic paper laminate with thickness of 1.6 mm.
3. Grounding terminal holes are plated through with silver applied.
4. Grounding terminal and one of the coil terminals are soldered to the PC board to be grounded.
5. Connection with measurement instrument is made with semi-rigid cable (Uniform Tube UT 141A) and high frequency NM type connector.



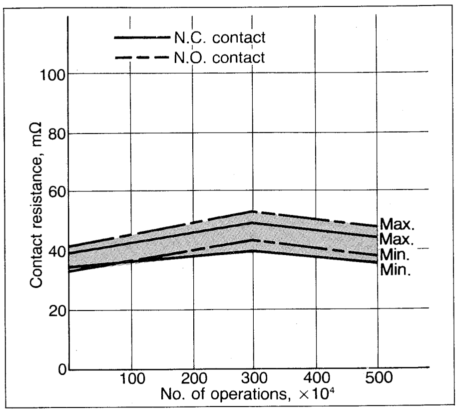
2. Electrical life
(Load: 10 mA 24 V DC resistive)



3. Mechanical life
• Pick-up, drop-out voltage (12 V DC type)

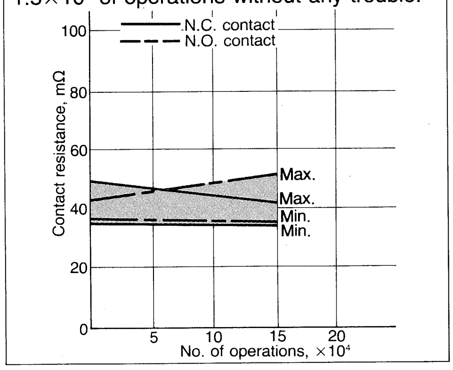


• Contact resistance



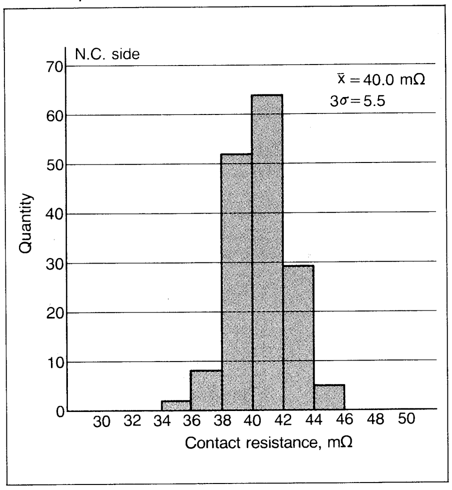
4. Contact reliability
• Contact resistance

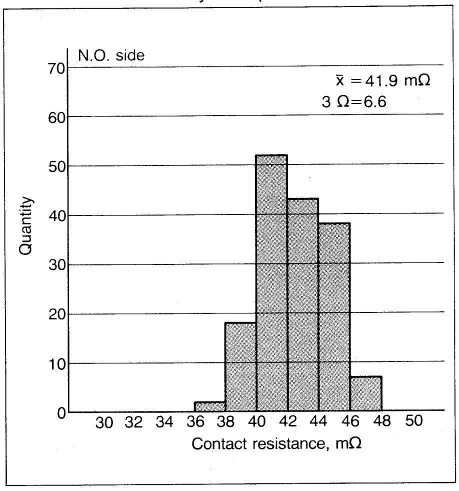
Test condition: Voltage: 3 mV,
Current: 30 μA, Cycle rate: 10 Hz
Miscontact detection level: 3.3 Ω
Test result:
1.5×10^5 of operations without any trouble.



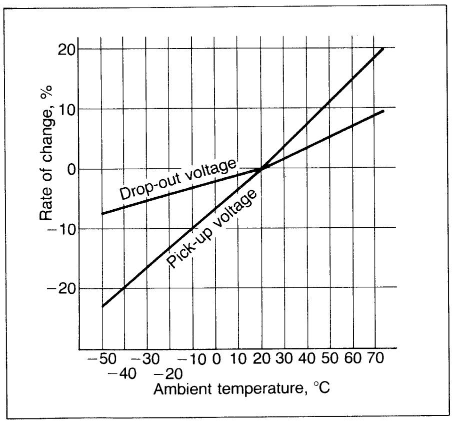
5. Contact resistance distribution (initial)

Sample: RF1-9VDC Condition: Measured with YHP4328A. Quantity: 160 pcs.

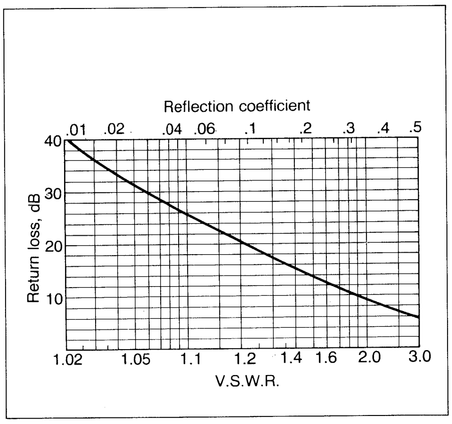




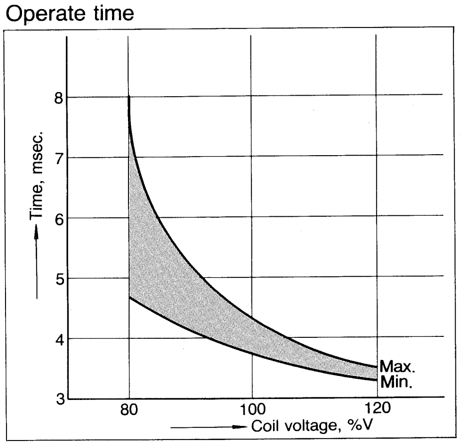
6. Ambient temperature characteristics



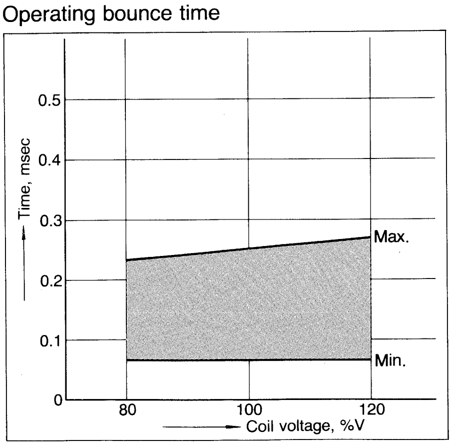
7. V.S.W.R., Return loss, Reflection coefficient conversion



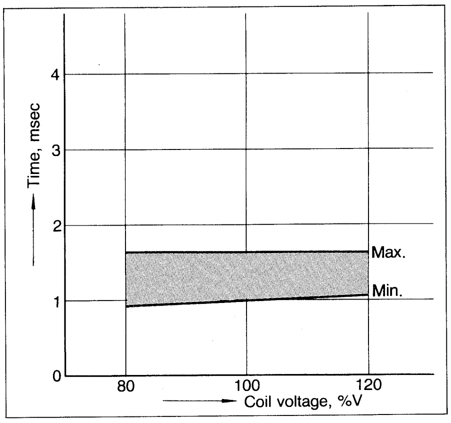
8. Operate and release time
Sample: 10 pcs. RF1-DC12V
Operate time



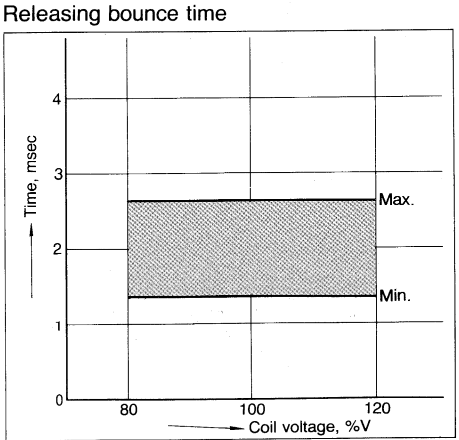
Operating bounce time



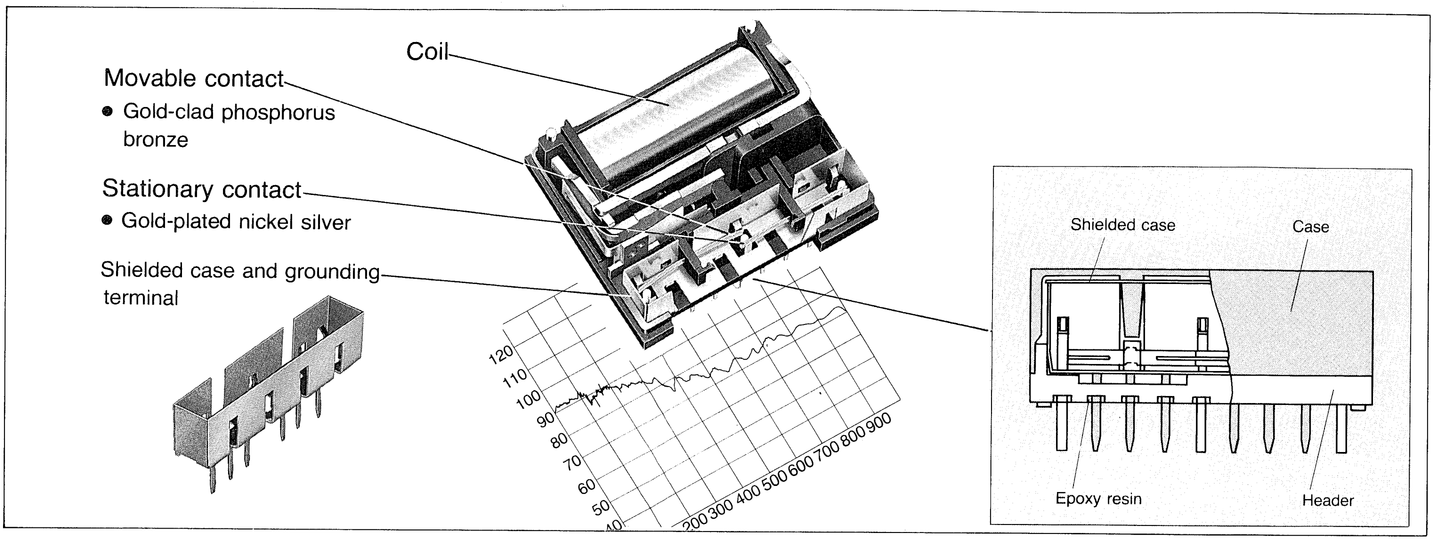
Release time



Releasing bounce time



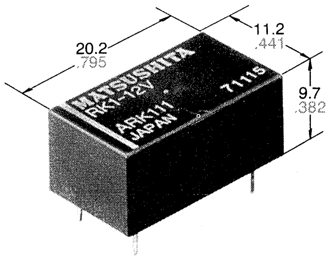
CONSTRUCTION



NAiS

HIGH FREQUENCY RELAY

RK-RELAYS



mm inch

- **Excellent high frequency characteristics**
  Isolation: 60 dB or more (at 1.5 GHz)
  Insertion loss: 0.3 dB or less (at 900 MHz)
- **High sensitivity in small size**
  Size: 20.2×11.2×9.7 mm .795×.441×.382 icnh
  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 silver
Initial contact resistance max. (By HP4328A)	100 mΩ
Rating: Max. switching power	10 W
Max. switching voltage	30 V DC
Max. switching current	0.01 A
Nominal switching capacity	0.01 A 24 V DC (10 W at 1.2 GHz, Zo = 50 Ω system)
High frequency characteristics (50 Ω system): Isolation loss	Min. 60 dB (at 1.5 GHz)
Insertion loss	Max. 0.3 dB (at 900 MHz)
V.S.W.R.	Max. 1.5 (at 900 MHz)
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, min.	100 MΩ at 500 V DC
Initial breakdown voltage: Between open contacts	500 Vrms
Between contact and coil	1000 Vrms
Between contact and earth	500 Vrms
Operate time	Approx. 6 msec (without bounce)
Release time	Apporx. 3 msec (without bounce)
Temperature rise (max.)	60 deg. with nominal coil voltage across coil and rated contact current
Shock resistance: Functional	20 G
Destructive	100 G
Vibration resistance: Functional	10 to 55 Hz at double amplitude of 3 mm
Destructive	10 to 55 Hz at double amplitude of 5 mm
Ambient temperature	−40°C to 60°C −40°F to 140°F
Unit weight	Approx. 4.4 g .155 oz

TYPICAL APPLICATIONS

- Audio visual equipment
  broadcast satellite tuners
  VCRs, CATVs, TVs
- Communication equipment
  automobile telephones
  maritime telephones
- 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, 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)
RK1-3V	RK1R-3V	3	2.25	0.3	45	67	200	3.3
RK1-5V	RK1R-5V	5	3.75	0.5	125	40	200	5.5
RK1-6V	RK1R-6V	6	4.5	0.6	180	34	200	6.6
RK1-9V	RK1R-9V	9	6.75	0.9	405	23	200	9.9
RK1-12V	RK1R-12V	12	9	1.2	720	17	200	13.2
RK1-24V	RK1R-24V	24	18	2.4	2,880	9	200	26.4

• 1 coil latching type

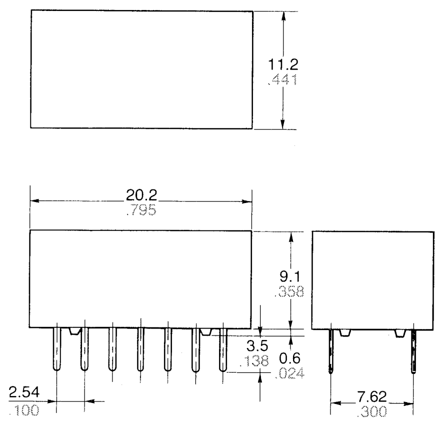
Part No.		Nominal voltage, V DC	Set voltage, max. V DC	Reset voltage, max. V DC	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Maximum allowable voltage, V DC (at 60°C)
RK1-L-3V	RK1R-L-3V	3	2.25	2.25	45	67	200	3.3
RK1-L-5V	RK1R-L-5V	5	3.75	3.75	125	40	200	5.5
RK1-L-6V	RK1R-L-6V	6	4.5	4.5	180	34	200	6.6
RK1-L-9V	RK1R-L-9V	9	6.75	6.75	405	23	200	9.9
RK1-L-12V	RK1R-L-12V	12	9	9	720	17	200	13.2
RK1-L-24V	RK1R-L-24V	24	18	18	2,880	9	200	26.4

• 2 coil latching type

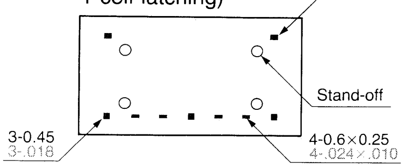
Part No.		Nominal voltage, V DC	Set voltage, max. V DC	Reset voltage, max. V DC	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Maximum allowable voltage, V DC (at 60°C)
RK1-L2-3V	RK1R-L2-3V	3	2.25	2.25	22.5	133	400	3.3
RK1-L2-5V	RK1R-L2-5V	5	3.75	3.75	62.5	80	400	5.5
RK1-L2-6V	RK1R-L2-6V	6	4.5	4.5	90	67	400	6.6
RK1-L2-9V	RK1R-L2-9V	9	6.75	6.75	202.5	45	400	9.9
RK1-L2-12V	RK1R-L2-12V	12	9	9	360	34	400	13.2
RK1-L2-24V	RK1R-L2-24V	24	18	18	1440	17	400	26.4

DIMENSIONS

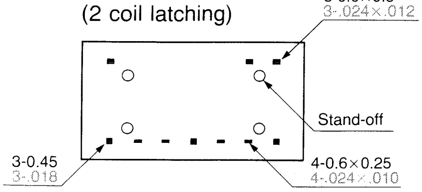
mm inch



(Single side stable and 1 coil latching)



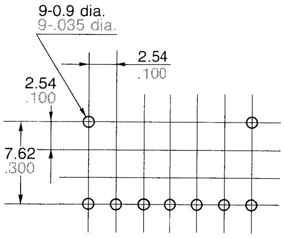
(2 coil latching)



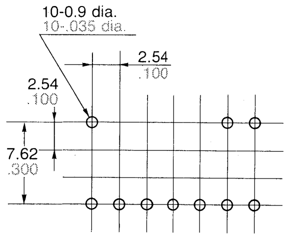
General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)

(Single side stable and 1 coil latching)



(2 coil latching)



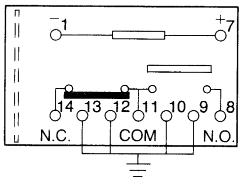
Tolerance: ±0.1 ±.003

Schematic (Bottom view)

Standard contact arrangement

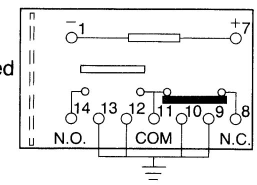
R type contact arrangement

RK1

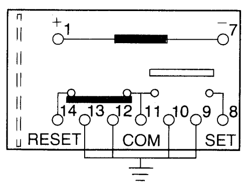


Single side stable (Deenergized condition)

RK1R

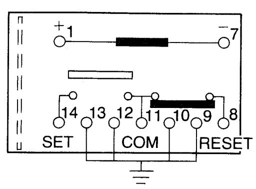


RK1-L

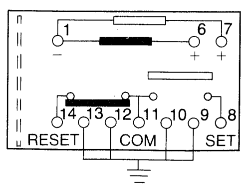


1 coil latching (Reset condition)

RK1R-L

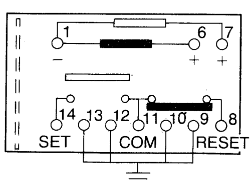


RK1-L2



2 coil latching (Reset condition)

RK1R-L2

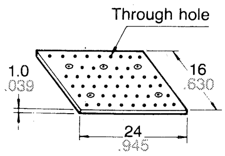


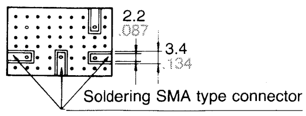
DATA

mm inch

1. High frequency characteristics

Sample: RK1-12V
No. of samples: n = 10 (10×2 contacts)

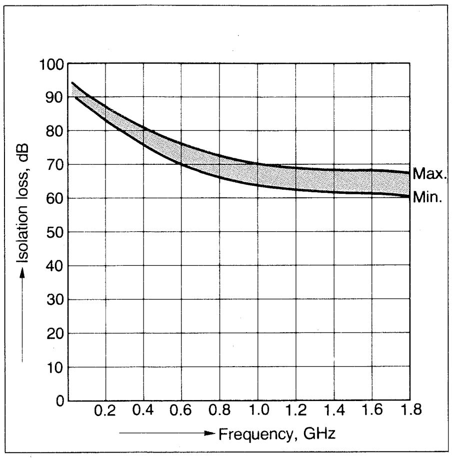




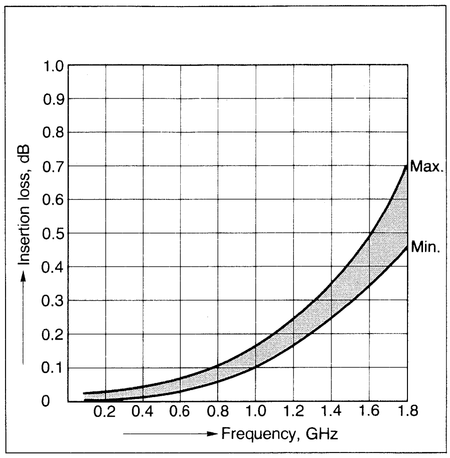
(Wiring diagram)

PC board
- Double-sided through hole
- Material: Glass-epoxy resin

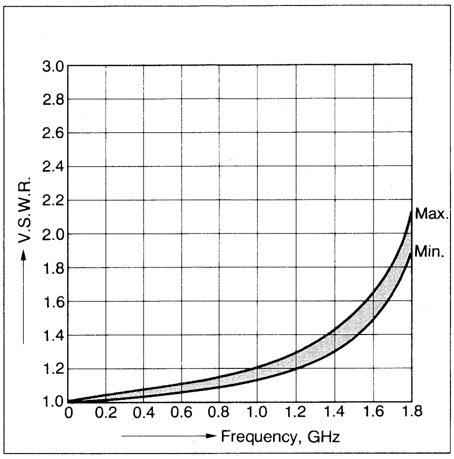
- Isolation loss



- Insertion loss

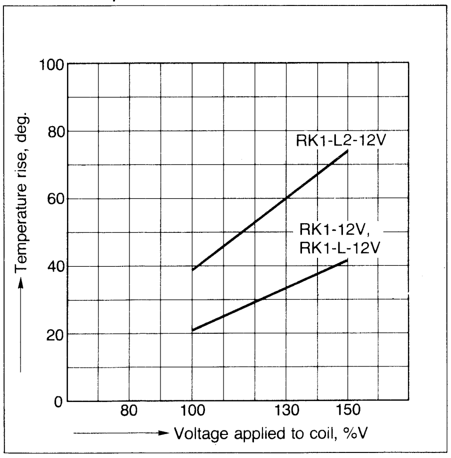


- V.S.W.R.



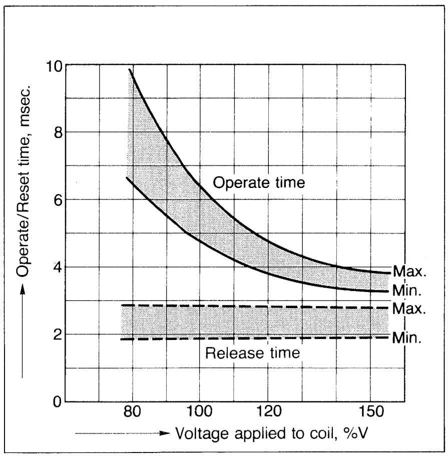
2. Coil temperature rise

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



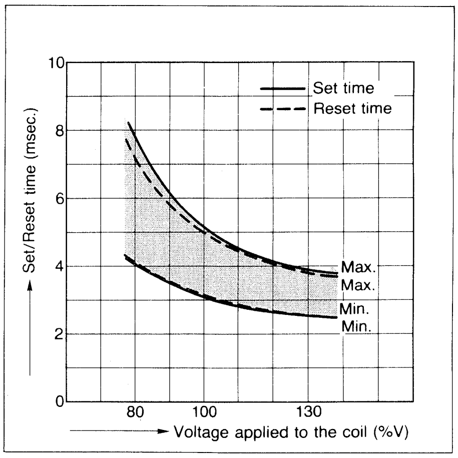
3.-(1) Operate/Release time (Single side stable)

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



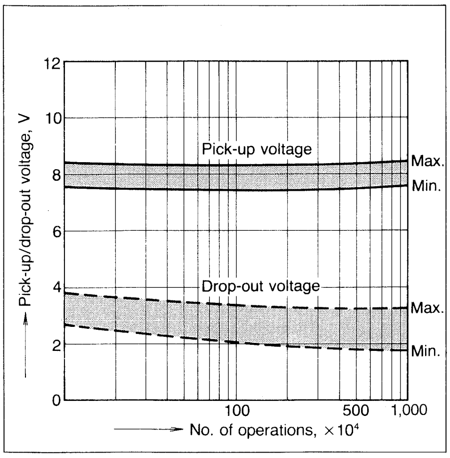
3.-(2) Set/Reset time (Latching)

Sample: RK1-L-12V, RK1-L2-12V
No. of samples: n = 12



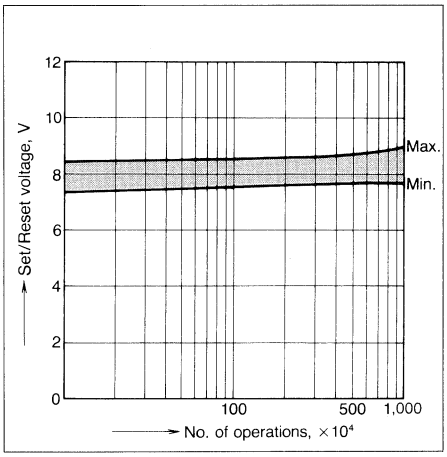
4.-(1) Mechanical life test (Single side stable)

Sample: RK1-12V; No. of samples: n = 12



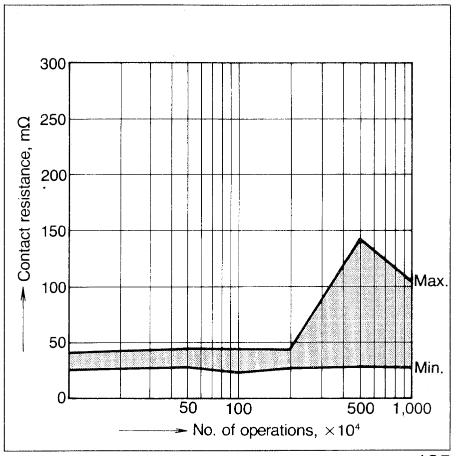
4.-(2) Mechanical life test (Latching)

Sample: RK1-L2-12V
No. of samples: n = 12

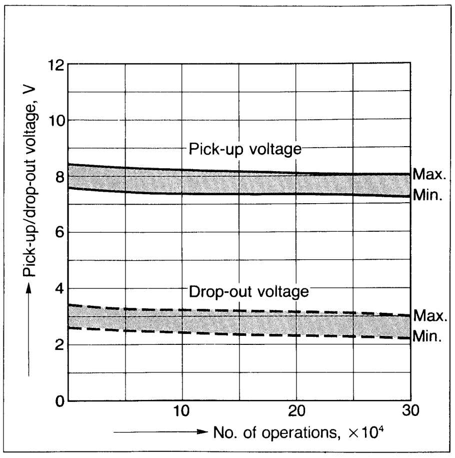


4.-(3) Mechanical life test

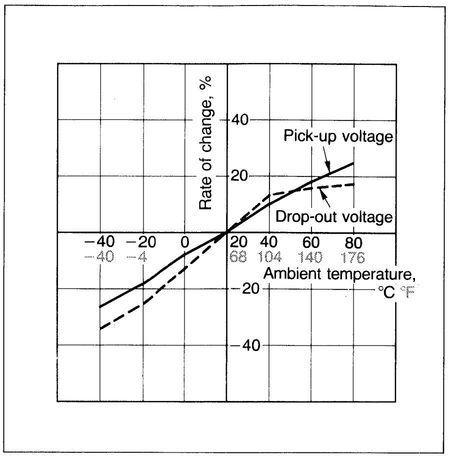
Sample: RK1-12V
No. of samples: n = 20 (20×2 contacts)



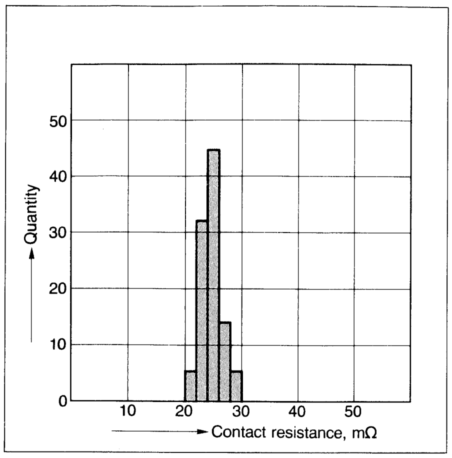
5. Electrical life test (0.01 A 24 V DC)
Sample: RK1-12V; No. of samples: n = 6



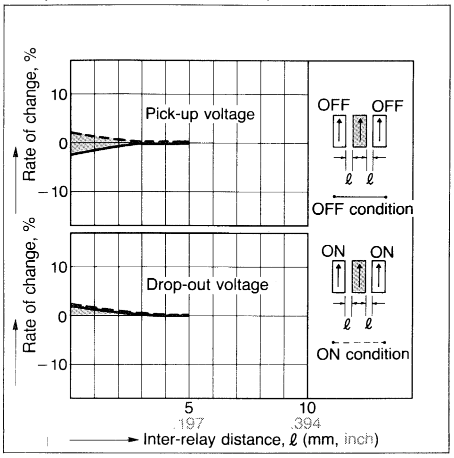
6. Ambient temperature characteristics
Sample: RK1-12V; No. of samples: n = 6



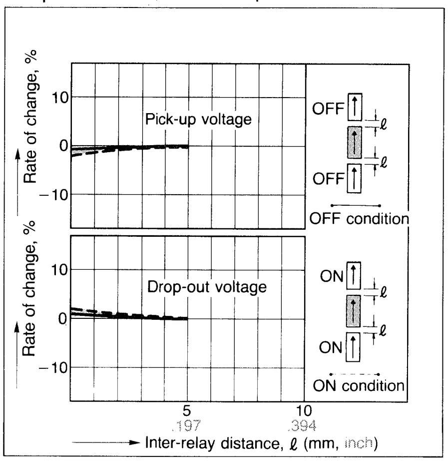
7. Contact resistance deviation (initial)
Sample: RK1-12V
No. of samples: n = 50 (50×2 contacts)



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



NOTES

1. Coil drive power supply

The voltage applied to the coil should be DC one. For DC power, the ripple factor is 5% or less.

2. Coil connection

Since an RK relay is polarized, it will not operate if the coil terminals are connected with incorrect polarity (+ and −).

3. External magnetic fields

Avoid using RK relays in strong magnetic fields.

4. Soldering and cleaning the relay

a. Perform soldering under the conditions below.

- Within 10 seconds at 260°C 500°F
- Within 3 seconds at 350°C 662°F

b. If automatic cleaning is used, boiling cleaning is recommended. Avoid ultrasonic cleaning.

5. Others

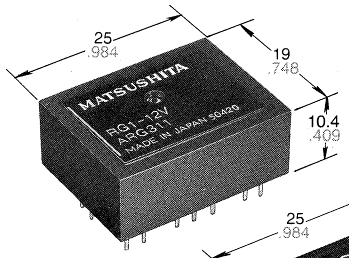
a. Dropping the relay may deform the internal construction and adversely affect performance. If the relay has been dropped, check its appearance and characteristics before use.

b. Although the latching type relay is shipped in the reset state, it is recommended that a reset voltage be applied to the relay before initial use.

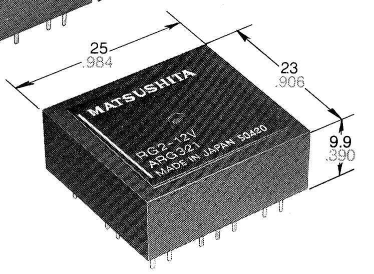
NAIS

NEW HIGH FREQUENCY RG RELAYS WITH 1C AND 2C CONTACTS

RG-RELAYS



1 Form C



2 Form C

mm inch

- **Excellent high frequency characteristics**
  Isolation: 65 dB min. (at 900 MHz)
  Insertion loss: 1.0 dB max. (at 900 MHz)
- **Wide selection**
  Characteristic impedance: 50 Ω type and 75 Ω type
  Coil: Single side stable and latching type
- **1 A 24 V DC switching capacity**
- **Sealed construction for automatic cleaning**
- **High sensitivity in small size**

SPECIFICATIONS

Contacts

Arrangement	1 Form C, 2 Form C	
Contact material	Gold-clad silver	
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	100 mΩ	
Rating (resistive) Max. switching power	24 W	
Max. switching voltage	24 V DC	
Max. switching current	1 A	
Nominal switching capcity	1 A 24 V DC	
High frequency characteristics (at 900 MHz)	50 Ω	75 Ω
Isolation	Min. 65 dB	Min. 65 dB
Insertion loss	Max. 1 dB	Max. 1 dB
V.S.W.R.	Max. 1.2	Max. 1.5
Expected life (min. operations) Mechanical	5×10^6	
Electrical 1 A 24 V DC	10^5	

Coil (polarized) (at 25°C, 68°F)

	1 Form C	2 Form C
Single side stable	350 mW	400 mW
1 coil latching	180 mW	200 mW
2 coil latching	350 mW	400 mW

Characteristics

Initial insulation resistance		100 MΩ at 500 V DC
Initial breakdown voltage Between open contacts		1,000 V rms
Between contacts and coil		2,000 V rms
Between contacts and earth		500 V rms
Operate time		Approx. 10 msec.
Release time		Approx. 5 msec.
Temperature rise		Max. 55 deg.
Shock resistance	Functional	20 G
	Destructive	100 G
Vibration resistance	Functional	6G, 10 to 55 Hz at double amplitude of 1 mm
	Destructive	9G, 10 to 55 Hz at double amplitude of 1.5 mm
Ambient temperature		−50°C to +60°C −58°F to +140°F
Unit weight	1C type	Approx. 8 g .282 oz
	2C type	Approx. 10 g .353 oz

TYPICAL APPLICATIONS

- Measuring instrument
- Testing equipment
- CATV converter
- Audio visual equipment
- TV game set

ORDERING INFORMATION

Ex. RG 1 T — L — 5V

Contact arrangement	Characteristic impedance	Operating function	Coil voltage
1: 1 Form C 2: 2 Form C	Nil: 75 Ω T: 50 Ω	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	DC: 3, 5, 6, 9, 12, 24, 48 V

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

TYPES AND COIL DATA at 20°C 68°F

1 FORM C

Single side stable

Part No.	Nominal voltage, VDC	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 (40°C)
RG1-3V RG1T-3V	3	2.4	0.3	25.7	117	350	3.6
RG1-5V RG1T-5V	5	4.0	0.5	71.4	70	350	6.0
RG1-6V RG1T-6V	6	4.8	0.6	103	59	350	7.2
RG1-9V RG1T-9V	9	7.2	0.9	231	39	350	10.8
RG1-12V RG1T-12V	12	9.6	1.2	411	30	350	14.4
RG1-24V RG1T-24V	24	19.2	2.4	1,646	15	350	28.8
RG1-48V RG1T-48V	48	38.4	4.8	6,583	8	350	57.6

1 coil latching

Part No.	Nominal voltage, V DC	Set and reset voltage, V DC (max.)	Coil, resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
RG1-L-3V RG1T-L-3V	3	2.4	50	60	180	3.6
RG1-L-5V RG1T-L-5V	5	4.0	139	36	180	6.0
RG1-L-6V RG1T-L-6V	6	4.8	200	30	180	7.2
RG1-L-9V RG1T-L-9V	9	7.2	450	20	180	10.8
RG1-L-12V RG1T-L-12V	12	9.6	800	15	180	14.4
RG1-L-24V RG1T-L-24V	24	19.2	3,200	8	180	28.8
RG1-L-48V RG1T-L-48V	48	38.4	12,800	4	180	57.6

2 coil latching

Part No.	Nominal voltage, V DC	Set and reset voltage, V DC (max.)	Coil resistance, Ω (±10%)		Nominal operating current, mA	Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
			Coil 1	Coil 2			
RG1-L2-3V RG1T-L2-3V	3	2.4	25.7	25.7	117	350	3.6
RG1-L2-5V RG1T-L2-5V	5	4.0	71.4	71.4	70	350	6.0
RG1-L2-6V RG1T-L2-6V	6	4.8	103	103	59	350	7.2
RG1-L2-9V RG1T-L2-9V	9	7.2	231	231	39	350	10.8
RG1-L2-12V RG1T-L2-12V	12	9.6	411	411	30	350	14.4
RG1-L2-24V RG1T-L2-24V	24	19.2	1,646	1,646	15	350	28.8
RG1-L2-48V RG1T-L2-48V	48	38.4	6,583	6,583	8	350	57.6

2 FORM C

Single side stable

Part No.	Nominal voltage, VDC	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 (40°C)
RG2-3V RG2T-3V	3	2.4	0.3	22.5	133	400	3.6
RG2-5V RG2T-5V	5	4.0	0.5	62.5	80	400	6.0
RG2-6V RG2T-6V	6	4.8	0.6	90	67	400	7.2
RG2-9V RG2T-9V	9	7.2	0.9	203	45	400	10.8
RG2-12V RG2T-12V	12	9.6	1.2	360	34	400	14.4
RG2-24V RG2T-24V	24	19.2	2.4	1,440	17	400	28.8
RG2-48V RG2T-48V	48	38.4	4.8	5,760	9	400	57.6

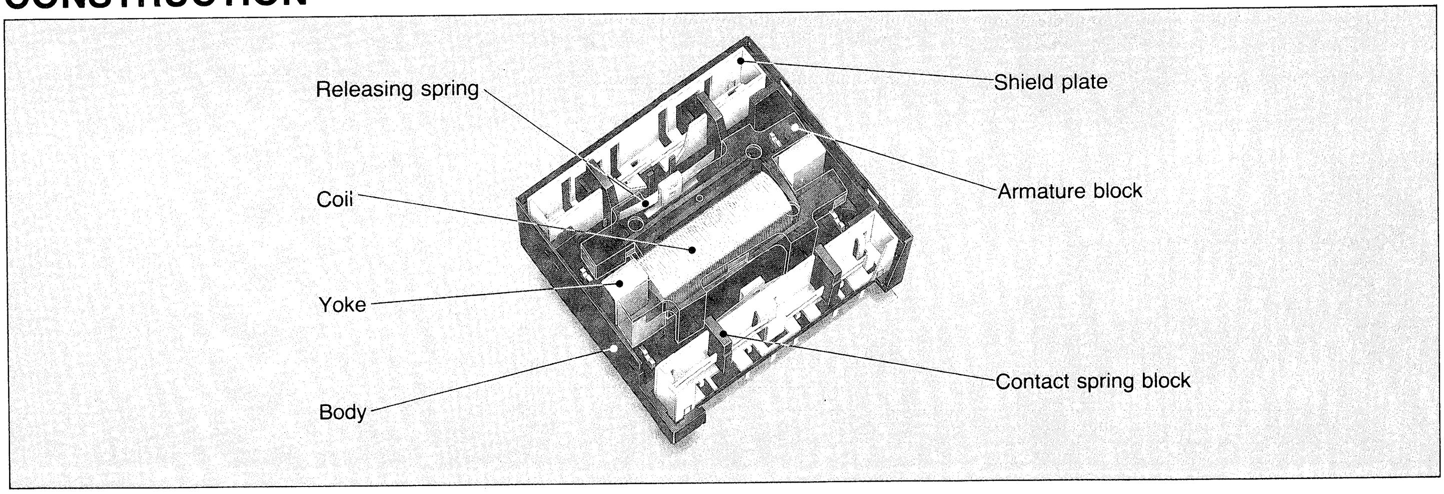
1 coil latching

Part No.	Nominal voltage, V DC	Set and reset voltage, V DC (max.)	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
RG2-L-3V RG2T-L-3V	3	2.4	45	67	200	3.6
RG2-L-5V RG2T-L-5V	5	4.0	125	40	200	6.0
RG2-L-6V RG2T-L-6V	6	4.8	180	34	200	7.2
RG2-L-9V RG2T-L-9V	9	7.2	405	23	200	10.8
RG2-L-12V RG2T-L-12V	12	9.6	720	17	200	14.4
RG2-L-24V RG2T-L-24V	24	19.2	2,880	9	200	28.8
RG2-L-48V RG2T-L-48V	48	38.4	11,520	5	200	57.6

2 coil latching

Part No.	Nominal voltage, V DC	Set and reset voltage, V DC (max.)	Coil resistance, Ω (±10%)		Nominal operating current, mA	Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
			Coil 1	Coil 2			
RG2-L2-3V RG2T-L2-3V	3	2.4	22.5	22.5	133	400	3.6
RG2-L2-5V RG2T-L2-5V	5	4.0	62.5	62.5	80	400	6.0
RG2-L2-6V RG2T-L2-6V	6	4.8	90	90	67	400	7.2
RG2-L2-9V RG2T-L2-9V	9	7.2	203	203	45	400	10.8
RG2-L2-12V RG2T-L2-12V	12	9.6	360	360	34	400	14.4
RG2-L2-24V RG2T-L2-24V	24	19.2	1,440	1,440	17	400	28.8
RG2-L2-48V RG2T-L2-48V	48	38.4	5,760	5,760	9	400	57.6

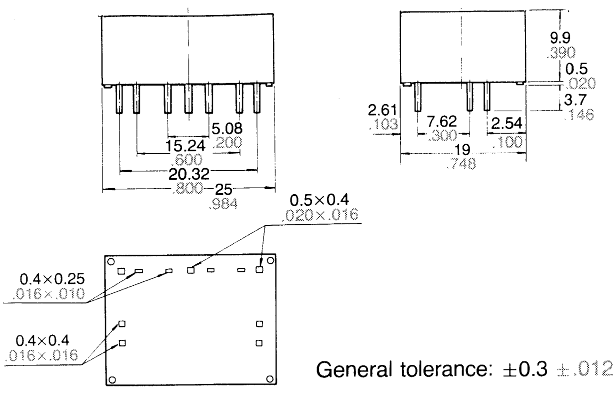
CONSTRUCTION



DIMENSIONS

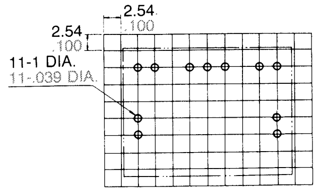
mm inch

1 Form C type



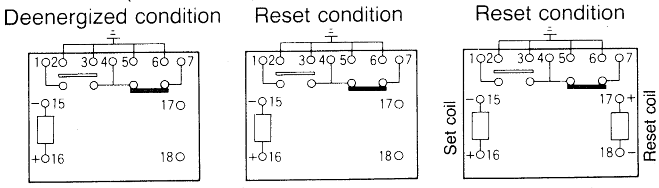
General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

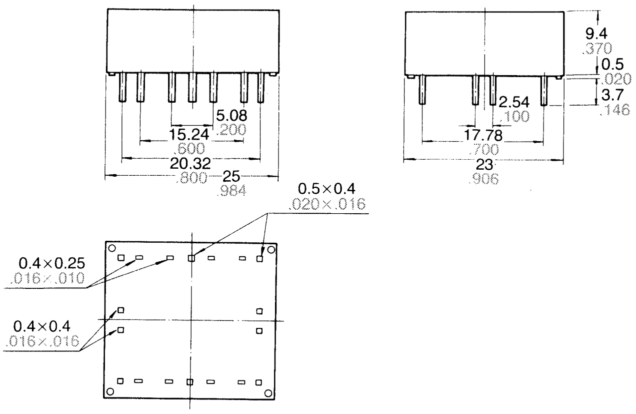
Schematic (Bottom view)



Single side stable   1 coil latching   2 coil latching

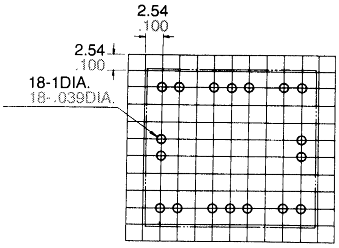
mm inch

2 Form C type



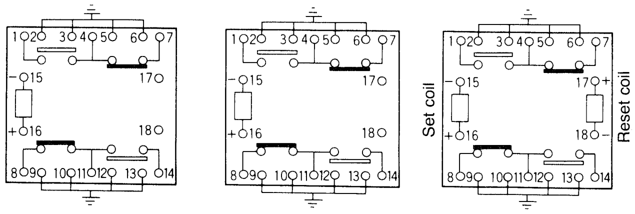
General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

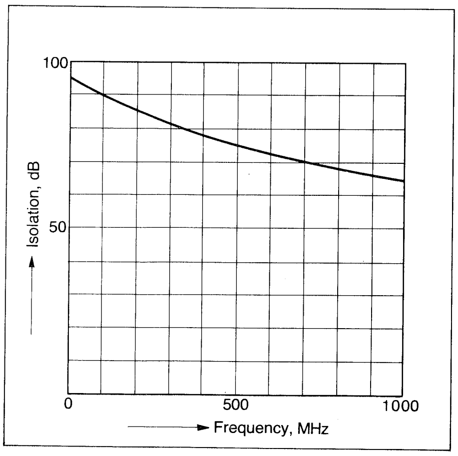


Single side stable	1 coil latching	2 coil latching
Deenergized condition	Reset condition	Reset condition

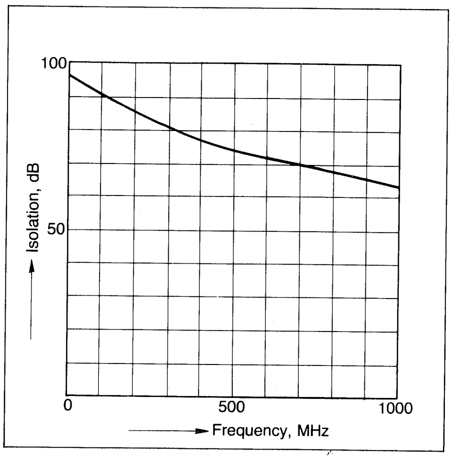
DATA

1. Isolation

RG2-12V
75 Ω characteristic impedance

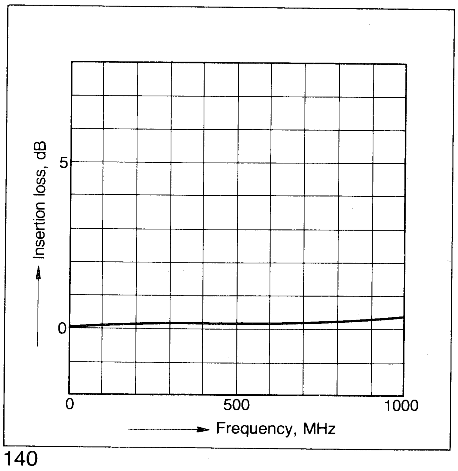


RG2T-12V
50 Ω characteristic impedance

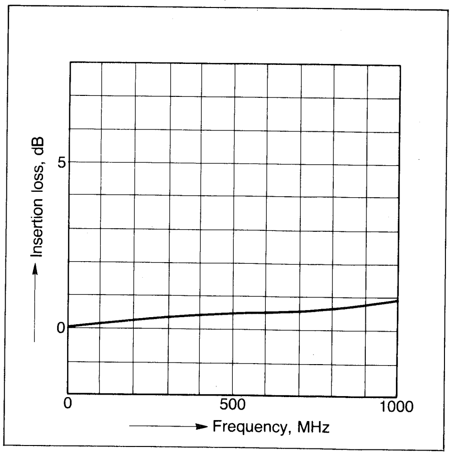


2. Insertion loss

RG2-12V
75 Ω characteristic impedance



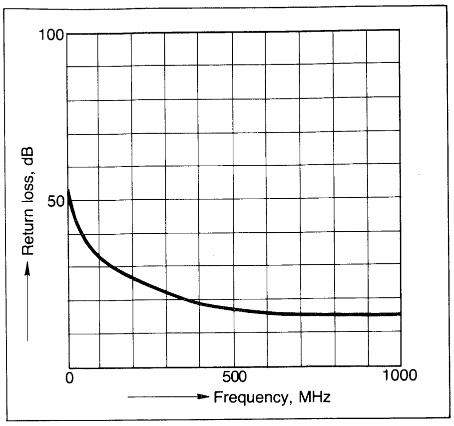
RG2T-12V
50 Ω characteristic impedance



3. Return loss

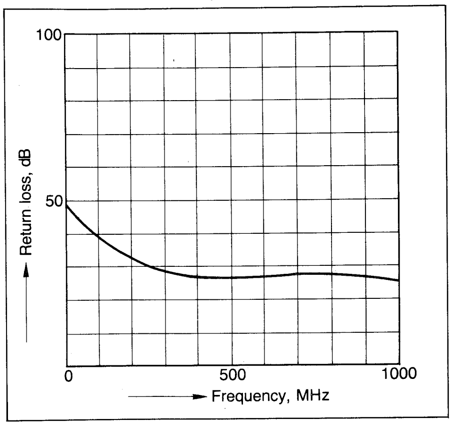
RG2-12V

75 Ω characteristic impedance



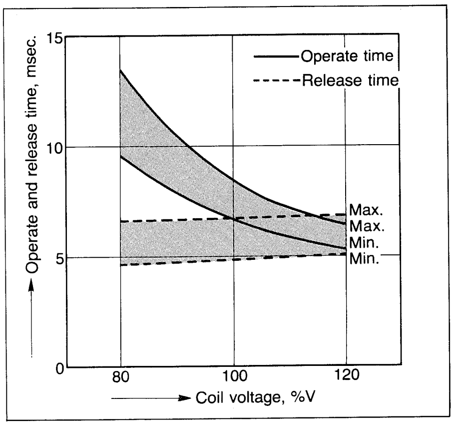
RG2T-12V

50 Ω characteristic impedance



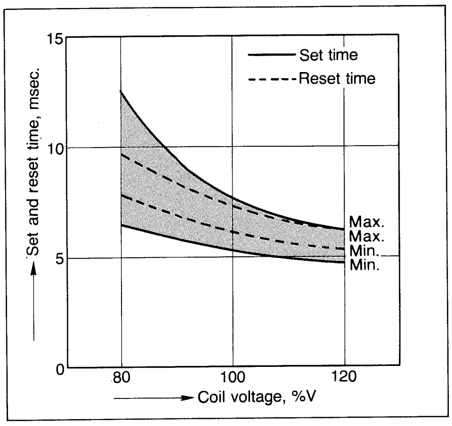
4-1. Operate and release time (1C)

RG1-12V 6 pcs.



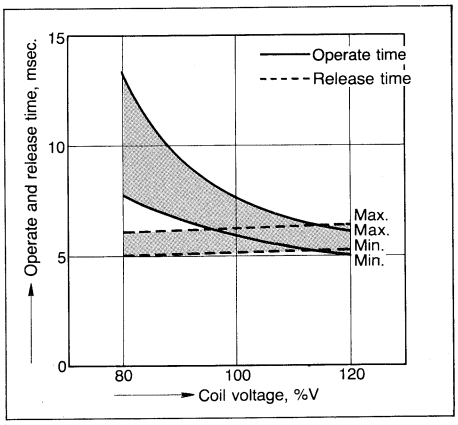
4-2. Set and reset time (1C)

RG1-L2-12V 6 pcs.



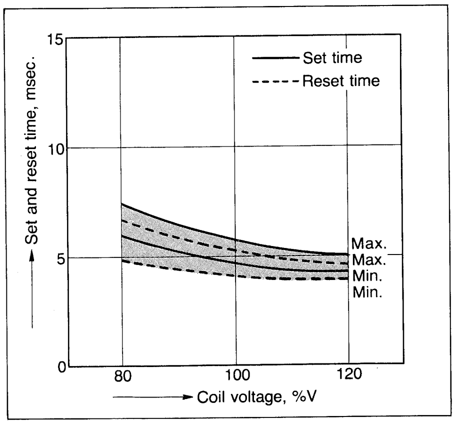
4-3. Operate and release time (2C)

RG2-12V 6 pcs.



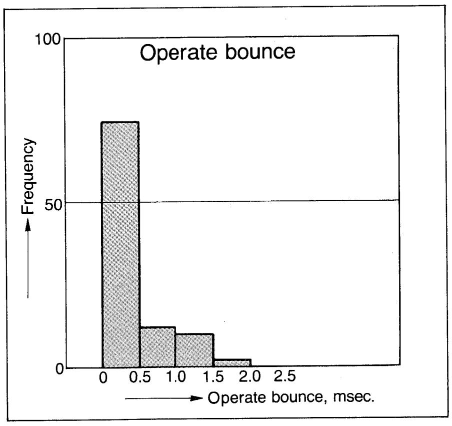
4-4. Set and reset time (2C)

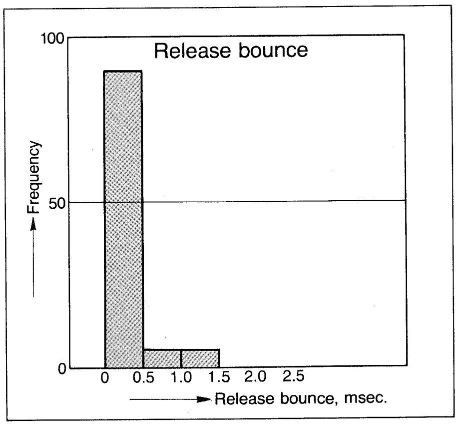
RG2-L2-12V 6 pcs.



5-1. Bounce time (2C)

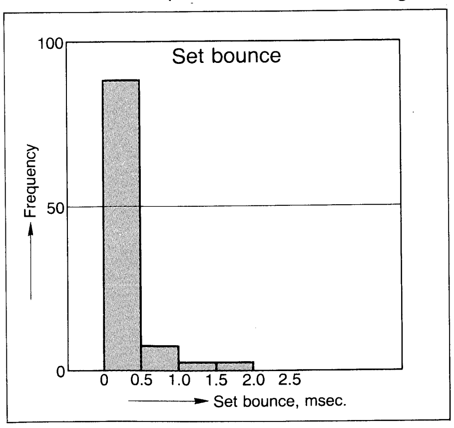
RG2-12V 100 pcs. Nominal voltage is applied.

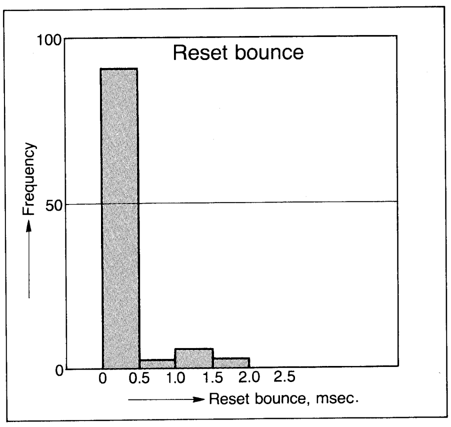




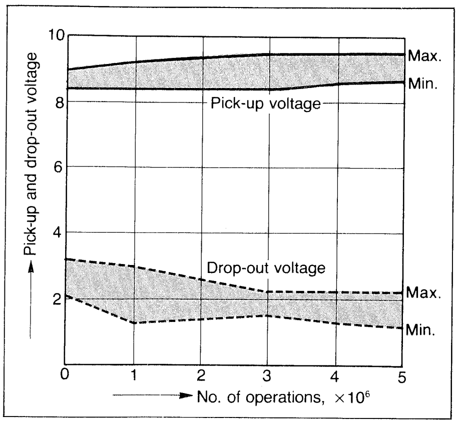
5-2. Bounce time (2C)

RG2-L2-12V 100 pcs. Nominal voltage is applied.

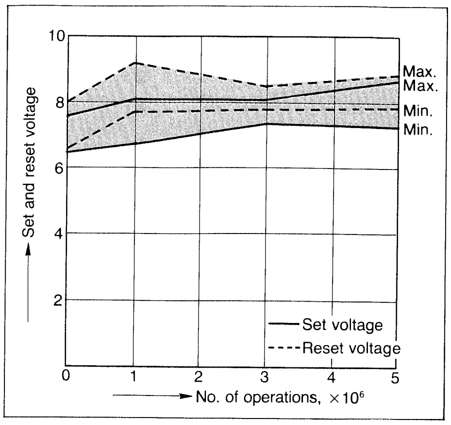




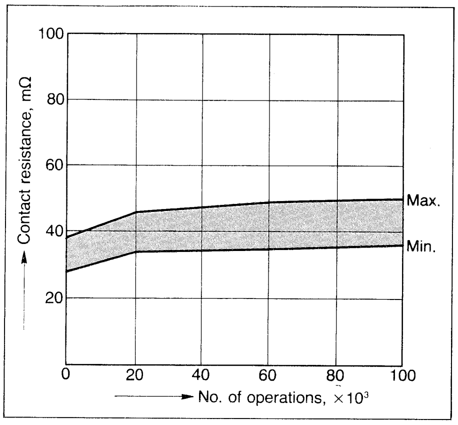
6-1. Mechanical life (1C)
RG1-12V 12 pcs.



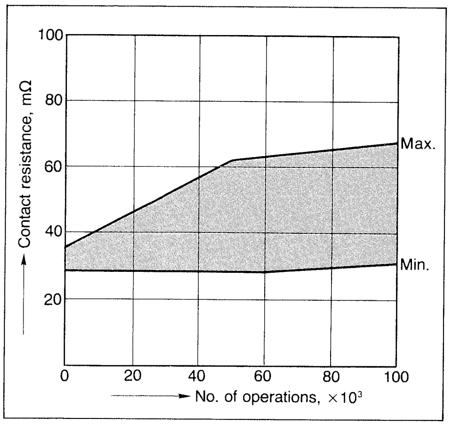
6-2. Mechanical life (1C latching type)
RG1-L2-12V 6 pcs.



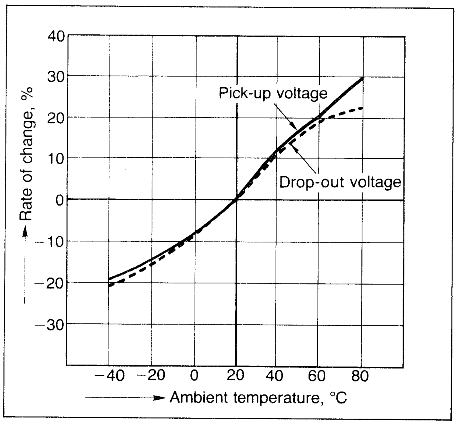
7-1. Electrical life
(10 mA 24 V DC resistive load)
RG2-12V 6 pcs.



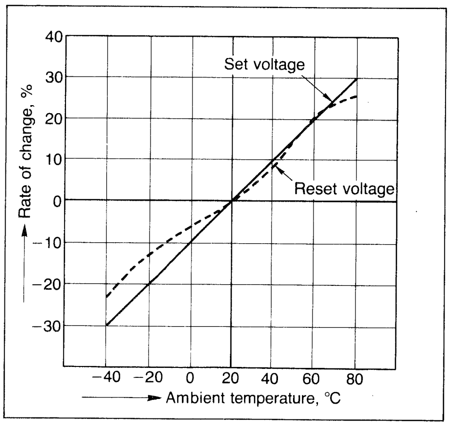
7-2. Electrical life
(1 A 24 V DC resistive load)
RG2-12V 6 pcs.



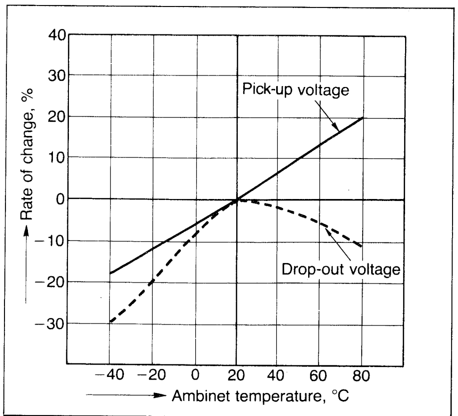
8-1. Rate of change in pick-up and drop-out voltage (1C)
RG1-12V 5 pcs.



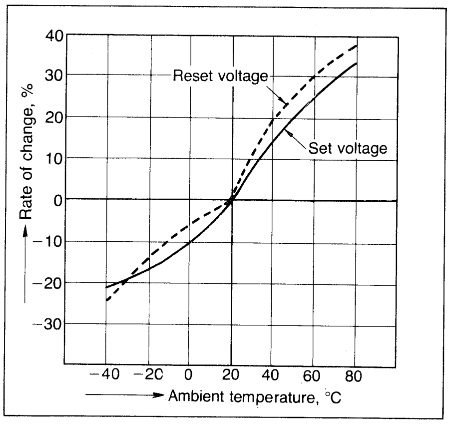
RG1-L2-12V 5 pcs.



8-2. Rate of change in pick-up and drop-out voltage (2C)
RG2-12V 5 pcs.

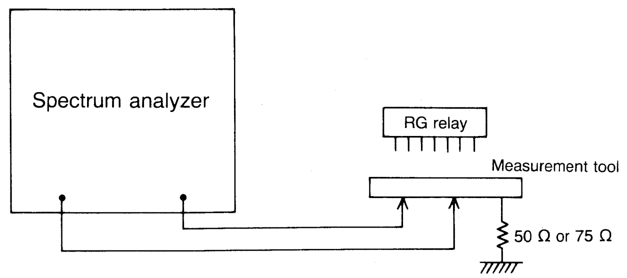


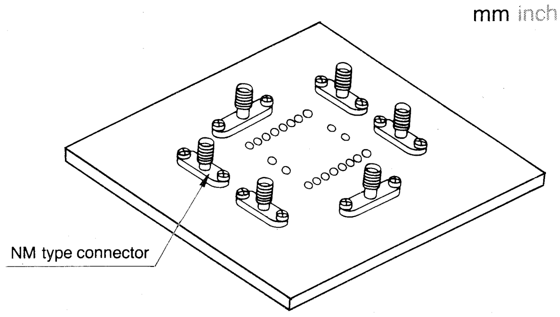
RG2-L2-12V 5 pcs.



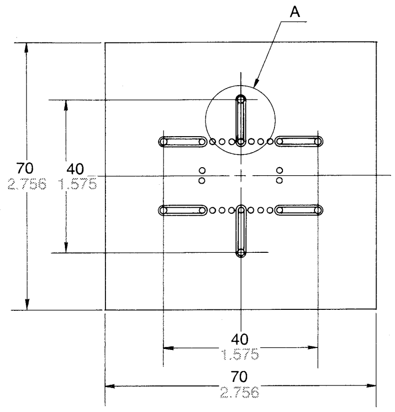
Test condition

mm inch

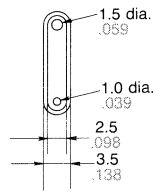




1. Characteristic impedance of all the measuring devices (signal generator and cable) is 50 Ω or 75 Ω.
2. The PC board for the test is double side copper clad phenolic paper laminate with thickness of 1.6 mm.
3. Grounding terminal holes are plated through.
4. Grounding terminal and one of the coil terminals are soldered to the PC board to be grounded.
5. Connection with measurement instrument is made with semi-rigid cable (Uniform Tube UT 141A) and high frequency NM type connector.



PC board pattern



Expansion of A

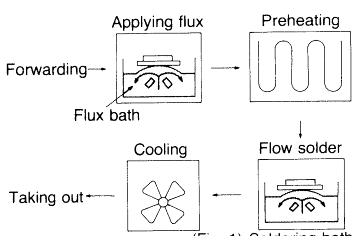
NOTES

1. Ripple factor
Coils should be operated on pure DC. Rectified AC may cause changes in the pickup-dropout charcteristics because of the ripple factor. Use of a capacitor in the circuit is recommended to keep the ripple factor below 5%.

2. Soldering & Cleaning Recommendations

A. Soldering

(1) Hand soldering is recommended to avoid flux penetration.
(2) Automatic soldering (dip-soldering) The sequence of automatic dip-soldering should be as shown in the diagram below.

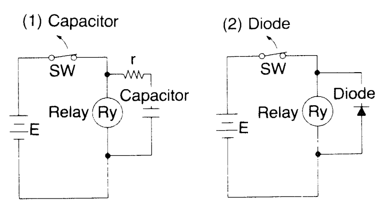


(Fig. 1) Soldering bath

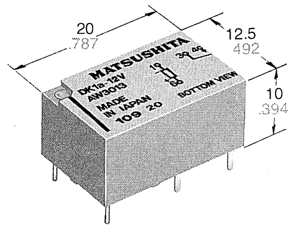
(3) Apply flux thinly and evenly to the portion to be soldered. Care should be taken to position the board properly to prevent flux overflow.
(4) The use of a low-corrosive rosin flux is recommended to simplify cleaning of solder terminals.
(5) Do not fail to preheat before dip-soldering. This will help to dry flux and prevent penetration as well as improve solderability.
(6) Use a soldering tub which forms a convex surface, not a flat surface, or the melted solder. The PC board should just skim the surface.
(7) Soldering must be done as quickly as possible. That is, within 10 seconds at 250°C (482°F) solder temperature, or 3 seconds at 350°C (662°F) solder temperature.

B. Cleaning
It is recommended that fluorinated hydrocarbon, Solvent 113 (CCi_2F-$CClF_2$) or other alcoholic solvent be used. Do not clean by "glass-shot method."

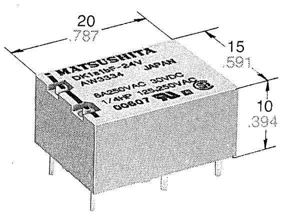
3. Counter voltage of DC relays
If input is cut off in DC relays, a counter voltage is developed across the coil as a result of the collapse of the magnetic field. If the coil is used in a transistor circuit, the reverse voltage produced from the coil can cause a serious circuit malfunction.
This counter voltage can be reduced considerably by connecting a capacitor or a diode in parallel with the coil. The level of reduction must be determined either by calculation if the coil data is available or by experiment.



NAiS | MINIATURE POWER RELAY | **DK-RELAYS**



1a



1a1b

mm inch

UL File No.: E43028
CSA File No.: LR26550
TÜV File No.: 87051645520
VDE File No.: VDE-Reg.-Nr. 3722, SEV

- **Large capacity in small size: 10 A 250 V AC**
- **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	1 Form A 1 Form B
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	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	380 V AC, 125 V DC	
Max. switching current	10 A	8 A
UL/CSA rating	1/3 HP, 125, 250 V AC; 10 A 250 V AC, 30 V DC	1/4 HP, 125, 250 V AC; 8 A 250 V AC, 30 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

Minimum operating power	98 mW
Nominal operating power	200 mW

Characteristics

Max. operating speed		20 cpm at rated load
Operate time (at nominal voltage)		Approx. 5 msec.
Release time (at nominal voltage)		Approx. 3 msec.
Initial breakdown voltage Between open contacts		1,000 Vrms
Between contacts and coil		4,000 Vrms
Surge voltage between coil and contact		Min. 10,000 V
Initial insulation resistance		Min. 1,000 MΩ (at 500 V DC)
Temperature rise		Max. 40 deg. (at nominal voltage)
Ambient temperature at max. contact load and nominal coil voltage		−40 to +65°C −40 to +149°F
Shock resistance	Functional	Min. 10 G
	Destructive	Min. 100 G
Vibration resistance	Functional	9 G, 10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	18 G, 10 to 55 Hz at double amplitude of 3.0 mm
Unit weight	1 Form A	Approx. 5.6 g, .20 oz
	1 Form A 1 Form B	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]

Contact arrangement	Operating function	Coil voltage
1a: 1 Form A 1a1b: 1 Form A 1 Form B	Nil: Single side stable L : 1 coil latching L2: 2 coil latching	3, 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

	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)
1 Form A	DK1a-3V	3	2.1	0.3	66.6	45	200	3.9
	DK1a-5V	5	3.5	0.5	40	125	200	6.5
	DK1a-6V	6	4.2	0.6	33.3	180	200	7.8
	DK1a-9V	9	6.3	0.9	22.2	405	200	11.7
	DK1a-12V	12	8.4	1.2	16.6	720	200	15.6
	DK1a-24V	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

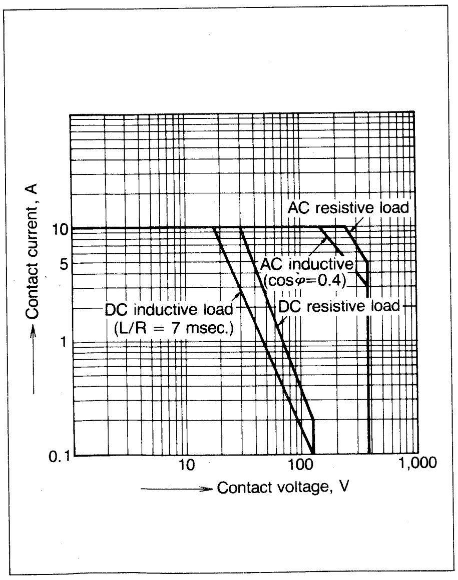
2 coil latching (1 coil latching also available)

	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)
					Set	Reset	Set	Reset	Set	Reset	
1 Form A	DK1a-L2-3V	3	2.1	2.1	66.6	66.6	45	45	200	200	3.9
	DK1a-L2-5V	5	3.5	3.5	40	40	125	125	200	200	6.5
	DK1a-L2-6V	6	4.2	4.2	33.3	33.3	180	180	200	200	7.8
	DK1a-L2-9V	9	6.3	6.3	22.2	22.2	405	405	200	200	11.7
	DK1a-L2-12V	12	8.4	8.4	16.6	16.6	720	720	200	200	15.6
	DK1a-L2-24V	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

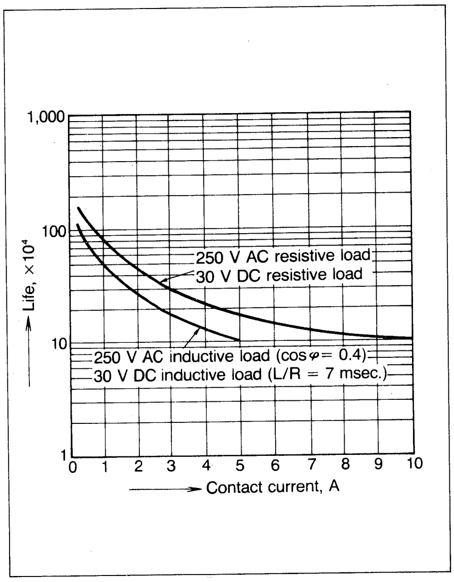
DATA

1. 1 Form A type

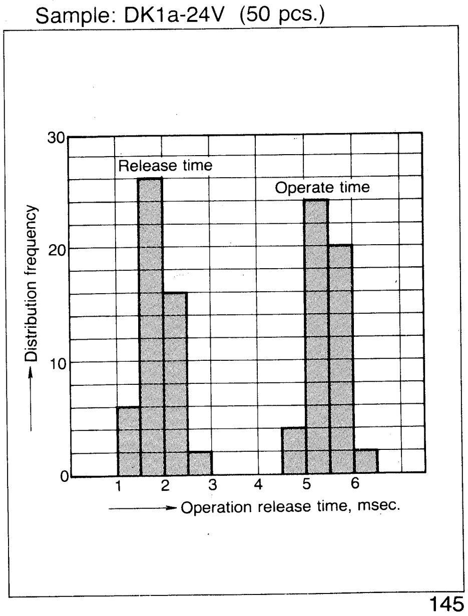
1. Maximum operating power



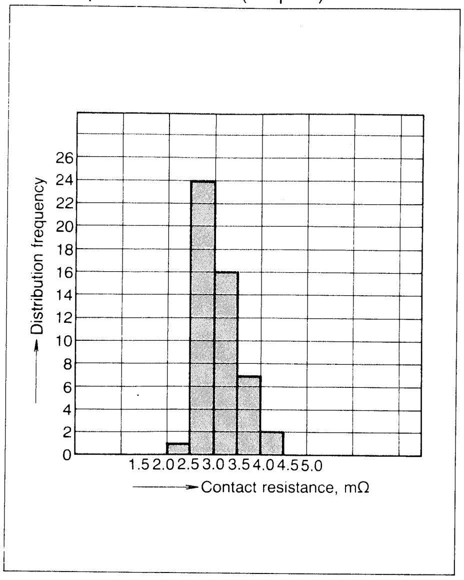
2. Life curve



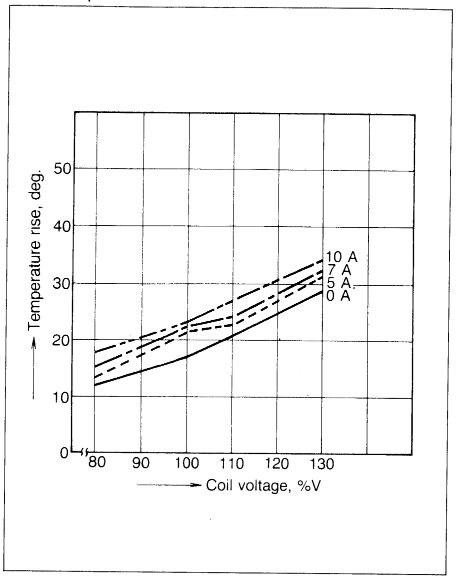
3. Operate/Release time (at 20°C 68°F)
Sample: DK1a-24V (50 pcs.)



4. Contact resistance (at 20°C 68°F)
Sample: DK1a-24V (50 pcs.)

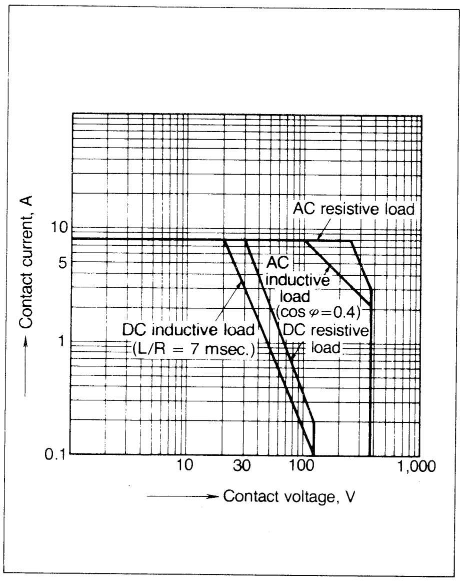


5. Coil temperature rise (at 30°C 86°F)
Sample: DK1a-12V

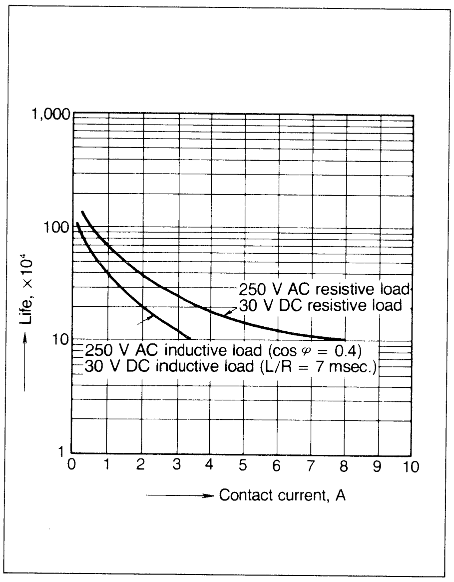


2. 1 Form A 1 Form B type

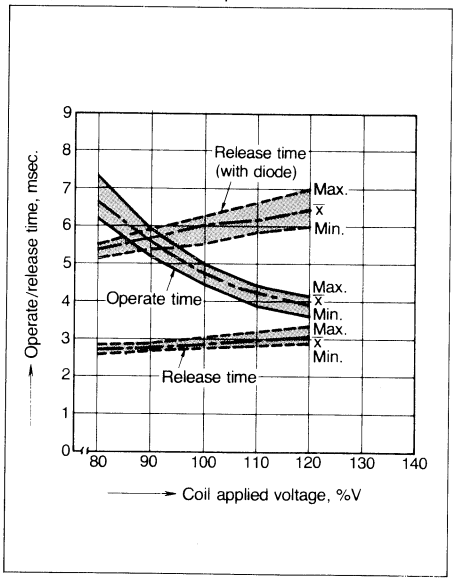
1. Maximum operating power



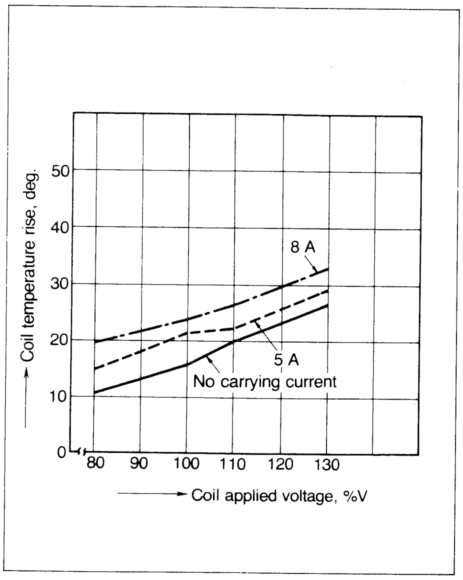
2. Life curve



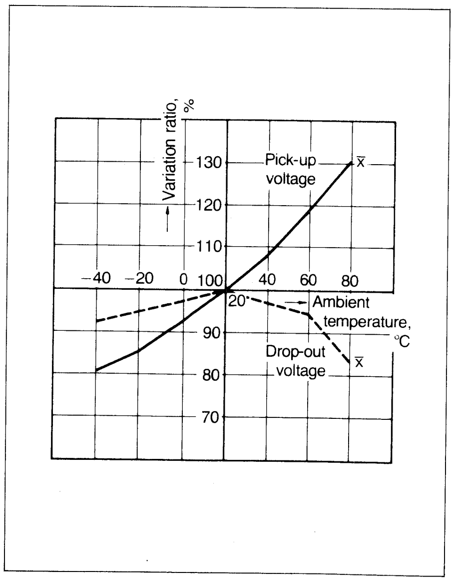
3. Operate/Release time (at 20°C 68°F)
Sample: DK1a1b-12V, 5 pcs.



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



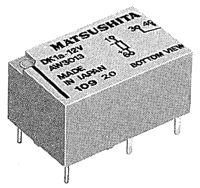
5. Ambient temperature characteristics

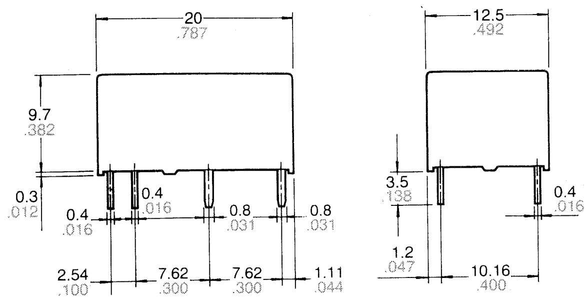


DIMENSIONS

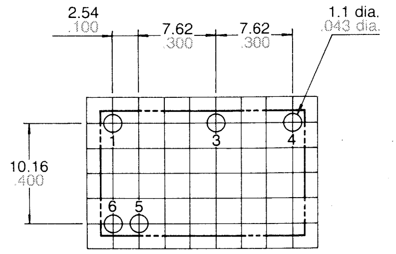
mm inch

1. 1 Form A type





PC board pattern (Copper-side view)

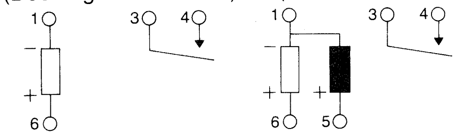


The above shows 2 coil latching type.
No. 5 terminal is eliminated on single side stable type.

Tolerance: ±0.1 ±.004

Schematic (Bottom view)

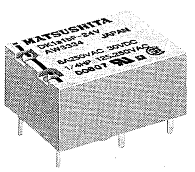
Single side stable (Deenergized condition) | 2 coil lacthing (Reset condition)



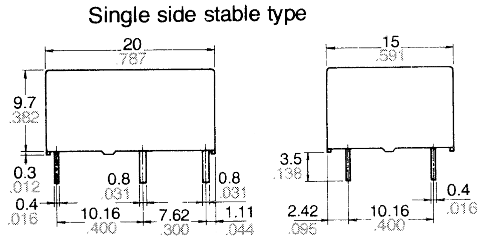
Since this is a polarized relay, the connection to the coil should be done according to the above schematic.

General tolerance: ±0.3 ±.012

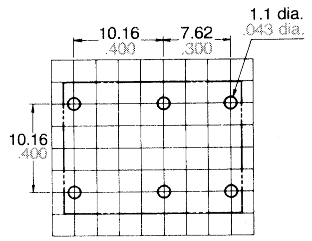
2. 1 Form A 1 Form B type



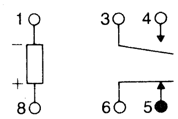
Single side stable type



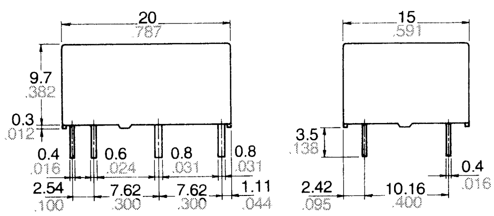
PC board pattern (Copper-side view)

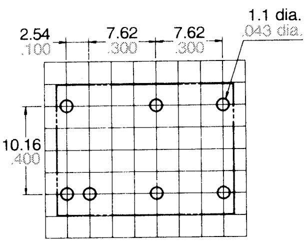


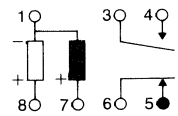
Schematic



2 coil latching type





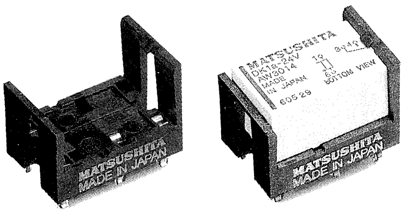


Since this is a polarized relay, the connection to the coil should be done according to the above schematic.

General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.004

DK relay socket



TYPES AND RELAY COMPATIBILITY

Relay \ Socket		1a: Single side stable type	1a: 2 coil latching type	1a1b: Single side stable type	1a1b: 2 coil latching type
1a	Single side stable type	DK1a-PS	DK1a-PSL2	—	—
	2 coil latching type	—	DK1a-PSL2	—	—
1a1b	Single side stable type	—	—	DK2a-PS	DK2a-PSL2
	2 coil latching type	—	—	—	DK2a-PSL2

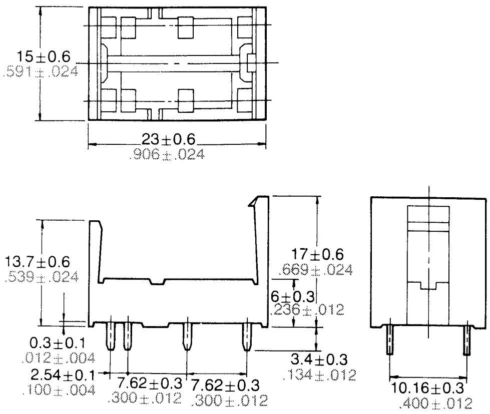
SPECIFICATIONS

Breakdown voltage	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-carrying capacity	10 A

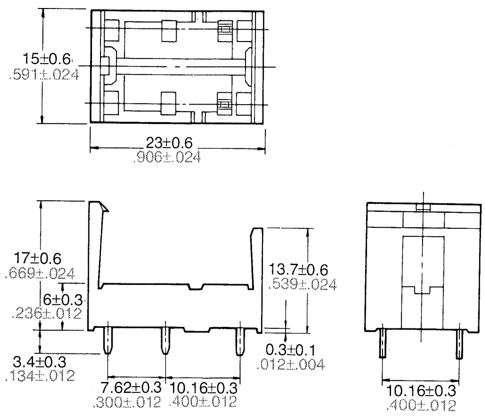
DIMENSIONS

mm inch

1 Form A type



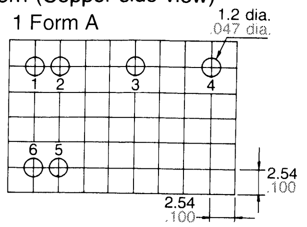
1 Form A 1 Form B type



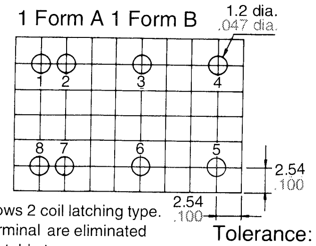
General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)

1 Form A



1 Form A 1 Form B

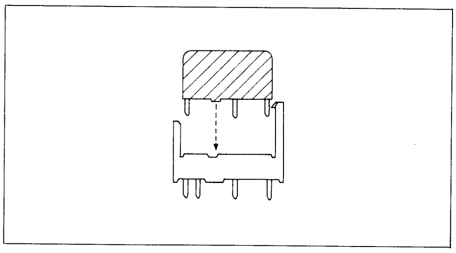


The above shows 2 coil latching type. No. 2 and 5 terminal are eliminated on single side stable type.

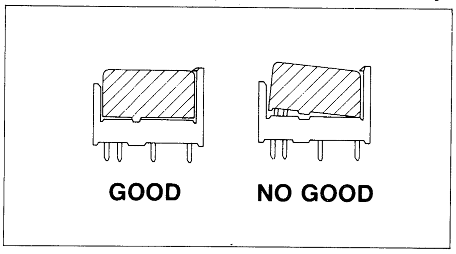
Tolerance: ±0.1 ±.004

FIXING AND REMOVAL METHOD

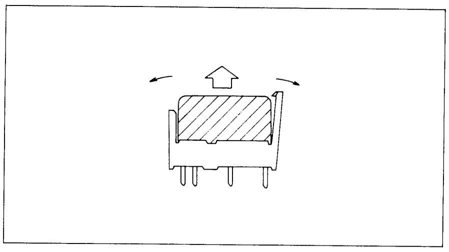
1. Match the direction of relay and socket.



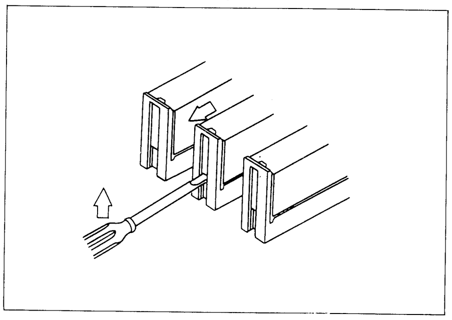
2. Both ends of the relay are to be secured firmly so that the socket hooks on the top surface of the relay.



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

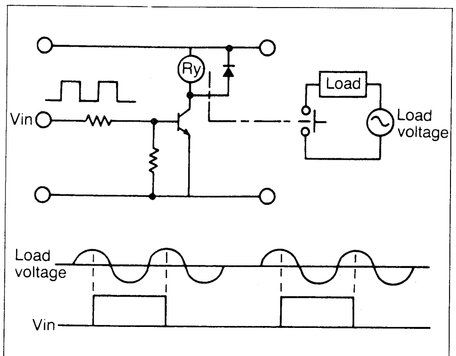


4. In case there is not enough space to grasp relay with fingers, use screw-drivers in the way shown below.



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.

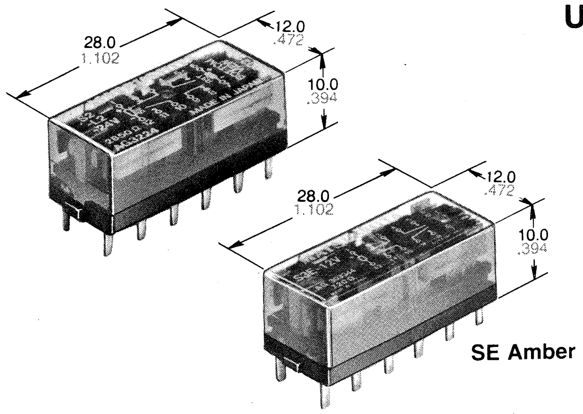


2. Soldering should be done under the following conditions:
   250°C 482°F within 10 sec.
   300°C 572°F within 5 sec.
   350°C 662°F within 3 sec.
3. In automatic cleaning, it is recommendable to use boiling cleaning.
4. External magnetic field
   Since DK relay is a highly sensitive polarized relay, its characteristics will be affected by the strong external magnetic field.
5. Coil operating power
   a. Pure DC current should be applied.
   b. If it includes ripple, the ripple factor should be less than 5%.
   And relay should be tested in the actual circuit to verify its characteristics.
   c. Wave form should be rectangular.

NAiS

4 AMP POLARIZED HIGH DENSITY RELAY WITH HIGH SENSITIVITY

S-RELAYS



SE Amber Relays

mm inch

UL File No.: E43028 CSA File No.: LR26550

- **A 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
- **Wide switching range**
  From 100 μA 100 mV DC to 4 A 250 V AC
- **Low thermal electromotive force**
  Approx. 3 μV
- **Dual-In-Line packaging arrangement**
- **Amber types available**

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
Initial contact bounce, max.	1 msec
Contact material	Gold clad silver alloy
Electrostatic capacitance	Approx. 3 pF
Thermal electromotive force (at nominal coil voltage)	Approx. 3 μV
Rating (resistive) Max. switching power	1,000 VA, 90 W
Max. switching voltage	250 V AC, 200 V DC
Max. switching current	5 A
Nominal switching capacity	4 A 250 V AC, 3 A 30 V DC
Min. switching capacity	100 μA 100 mV DC
UL/CSA rating See weibul characteristics	4 A 1/20 HP 125, 250 V AC, 3 A 30 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. 100mW
	Nominal operating power	Approx. 200 mW
Latching	Minimum set and reset power	Approx. 100 mW
	Nominal set and reset power	Approx. 200 mW

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)
Operate time	Approx. 8 msec
Release time	Approx. 5 msec
Set time (latching)	Approx. 8 msec
Reset time (latching)	Approx. 8 msec
Initial breakdown voltage Between open contacts	750 Vrms
Between contact sets	1,000 Vrms
Between contact and coil	1,500 Vrms
Initial insulation resistance	10,000 MΩ at 500 V DC
Temperature rise at nominal voltage	Max. 35 deg.
Ambient temperature	−40°C to +65°C −40°F to +149°F
Shock resistance	Functional: 50 G Destructive: 100 G
Vibration resistance	Functional: 18 G, 10 to 55 Hz at double amplitude of 3 mm Destructive: 24 G, 10 to 55 Hz at double amplitude of 4 mm
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] —— [48V]

Contact arrangement	Operating function	Coil voltage (DC)
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 V

(Notes) 1. For UL/CSA recognized types, add suffix UL/CSA.
2. Standard packing Carton: 50 pcs. Case: 500 pcs.

TYPES AND COIL DATA at 20°C 68°F

Single side stable

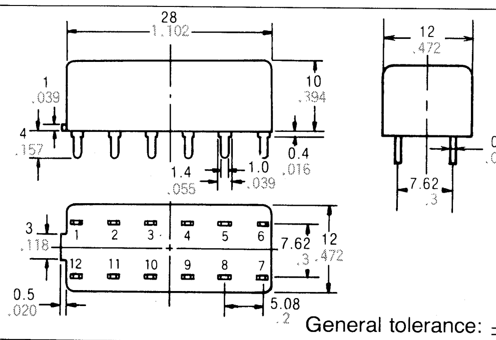
Type	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA	Coil resistance, Ω (±10%)	Inductance, mH	Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
S2, S3, S4	3	2.1	0.3	66.7	45	23	200	5.5
	5	3.5	0.5	38.5	130	65	192	9.0
	6	4.2	0.6	33.3	180	93	200	11.0
	12	8.4	1.2	16.7	720	370	200	22.0
	24	16.8	2.4	8.4	2,850	1,427	202	44.0
	48	33.6	4.8	5.6	8,500	3,410	271	75.0

2 coil latching (1 coil latching also available)

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		
S2-L2, S3-L2, S4-L2	3	2.1	66.7	45	45	10	10	200	5.5
	5	3.5	38.5	130	130	31	31	192	9.0
	6	4.2	33.7	180	180	40	40	200	11.0
	12	8.4	16.7	720	720	170	170	200	22.0
	24	16.8	8.4	2,850	2,850	680	680	202	44.0
	48	33.6	7.4	6,500	6,500	1,250	1,250	355	65.0

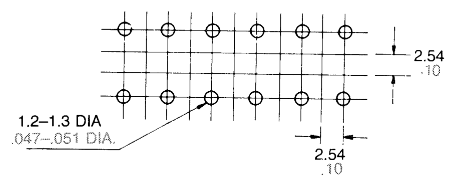
DIMENSIONS

mm inch



General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)

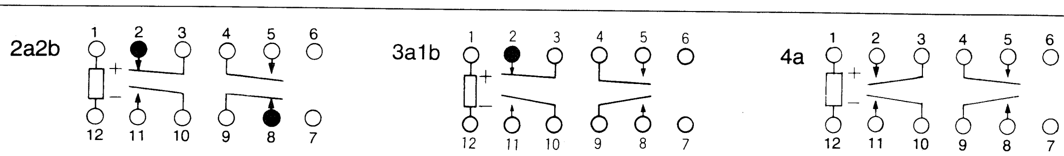


Tolerance: ±0.1 ±.003

SCHEMATIC (Bottom view)

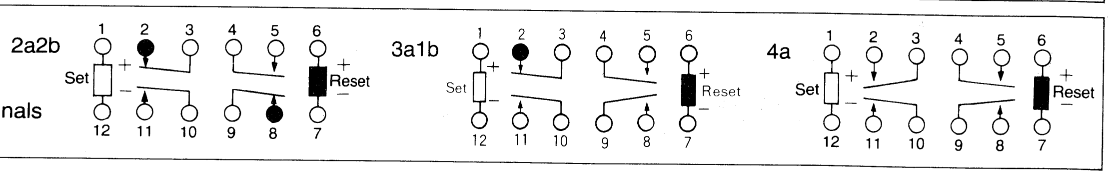
Single side stable

Deenergized position



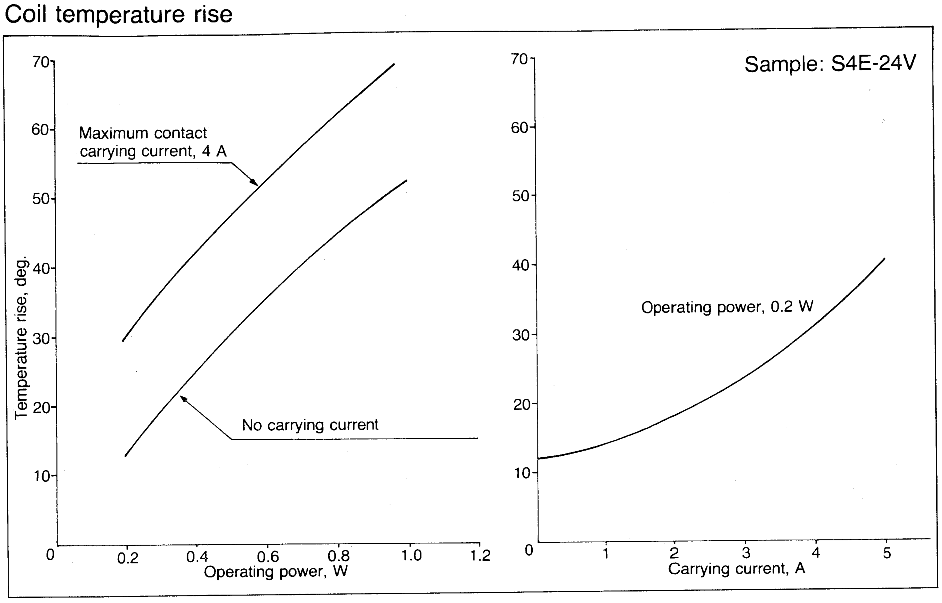
2 coil latching

Diagram shows the "reset" position when terminals 6 and 7 are energized. Energize terminals 1 and12 to transfer contacts.

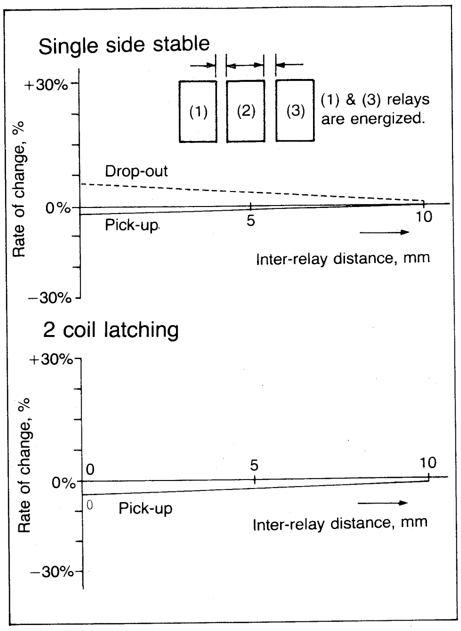


DATA

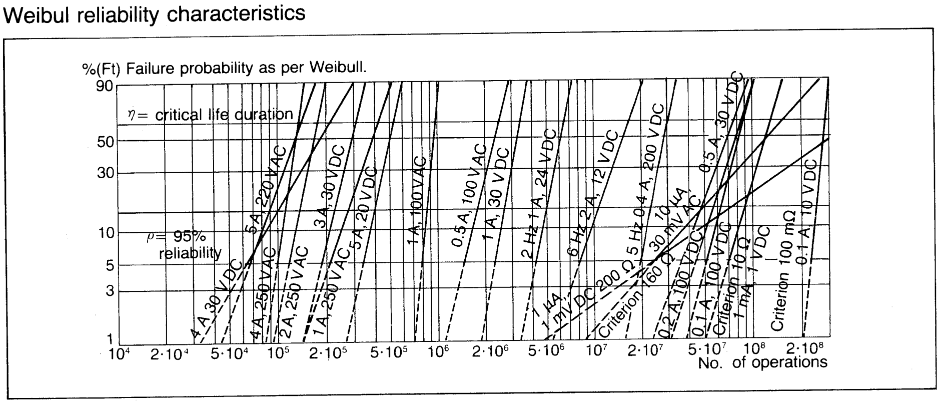
Coil temperature rise



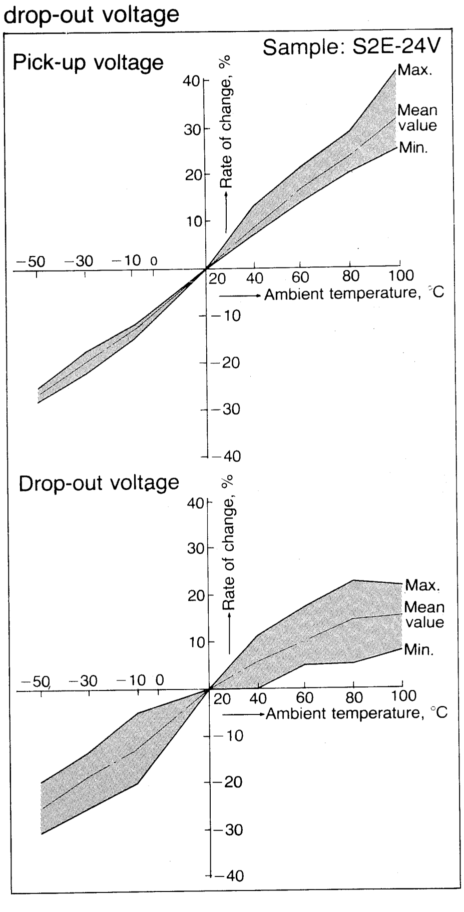
Influence of adjacent mounting



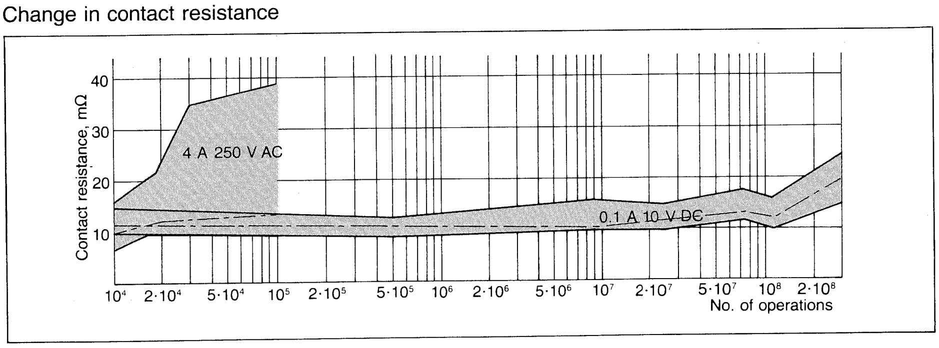
Weibul reliability characteristics



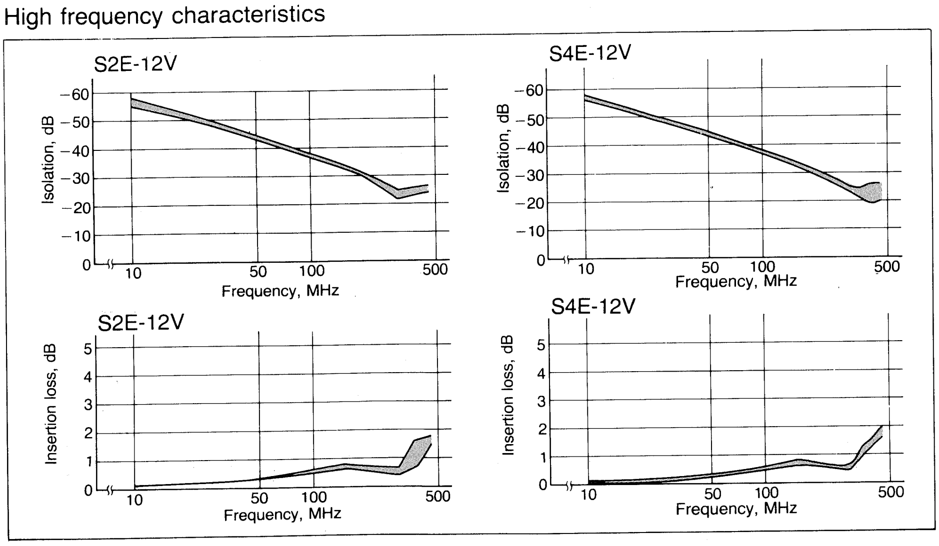
Rate of change of pick-up and drop-out voltage



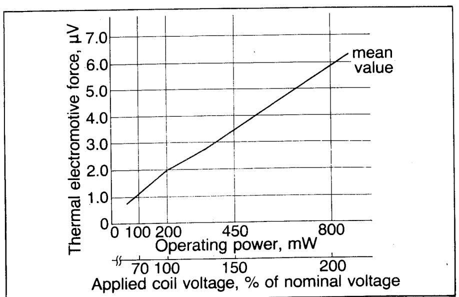
Change in contact resistance



High frequency characteristics

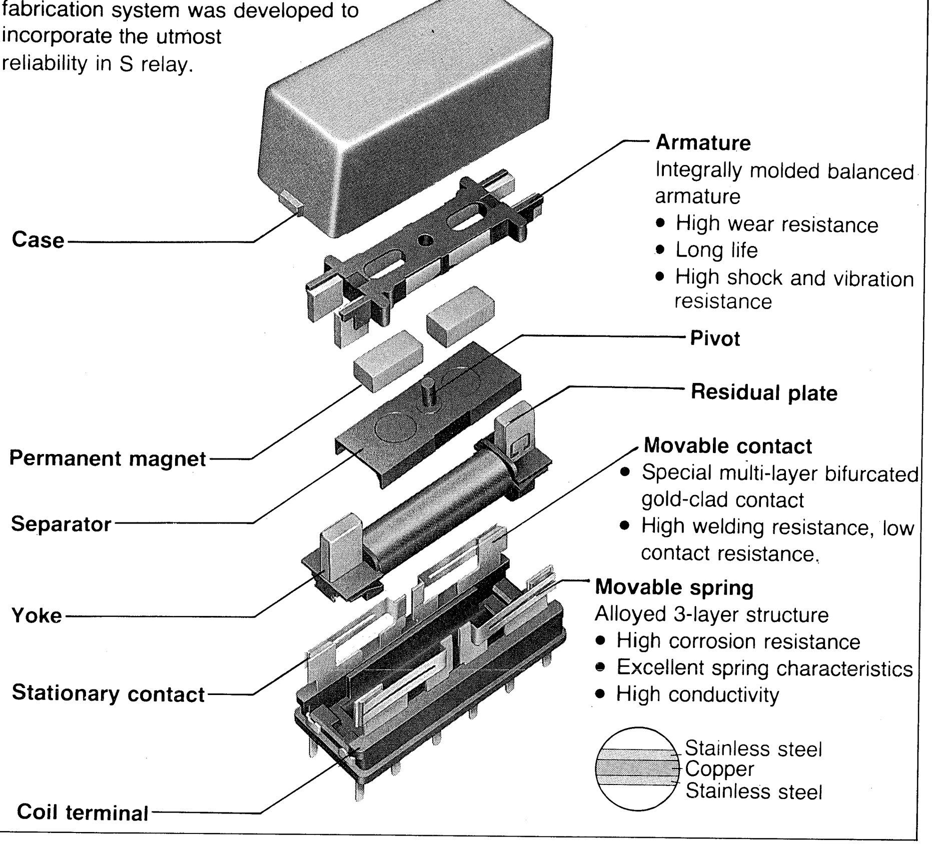


Thermal electromotive force

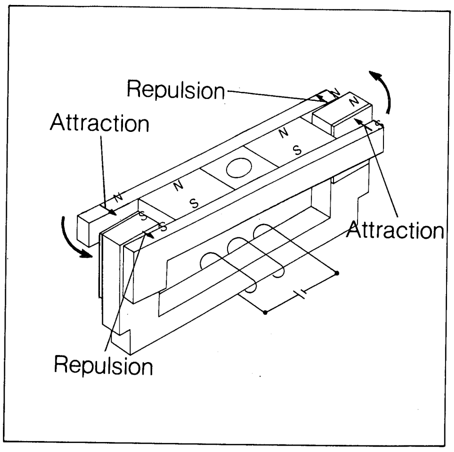


CONSTRUCTION

A sophisticated automatic progressive fabrication system was developed to incorporate the utmost reliability in S relay.



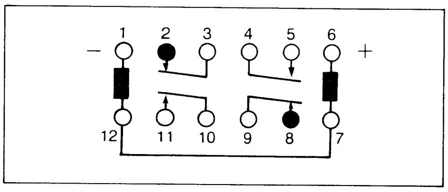
Balanced armature



The balanced armature provides high resistance to shock and vibration since a large pivoting force is not generated with respect to each directional force. S series relays incorporate a polarized balanced armature having 2 permanent magnets and four contact gaps. Therefore, contacts are made or closed on either side of the armature symmetrically with respect to the pivot.
This unusual design feature creates a high-efficiency polarized magnetic circuit, thus making possible key features of the S series relays such as high sensitivity in miniaturized size and multiple contact arrangement.

NOTES

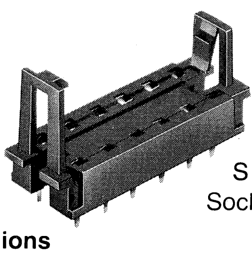
1. Special use of 2 coil latching types: 2 ways can be considered if 2 coil latching types are used as 1 coil latching types.
   (A) Reverse polarity is applied to the set coil of 2 coil latching type.
   (B) By shorting terminals 12 and 7, apply plus to 1, minus to 6 at set and plus to 6, minus to 1 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.

ACCESSORIES



S Relay
Socket, S-PS

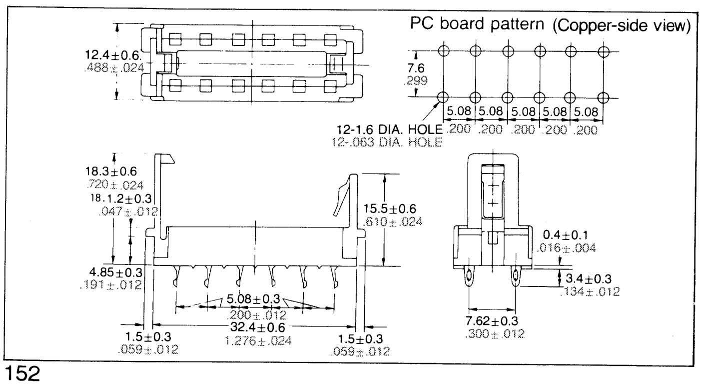
Specifications

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



Inserting and removing method

Inserting method: Insert the relay as shown in Fig. 1 until the rib of the relay snaps into the clip of the socket.

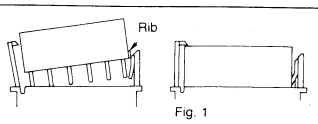


Fig. 1

Removing method:
(1) Remove the relay straight from the socket holding the shaded portion of the relay as shown in Fig. 2.

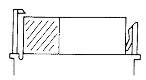


Fig. 2

(2) When sockets are mounted in close proximity, use a slotted screw driver as shown in Fig. 3.

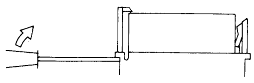


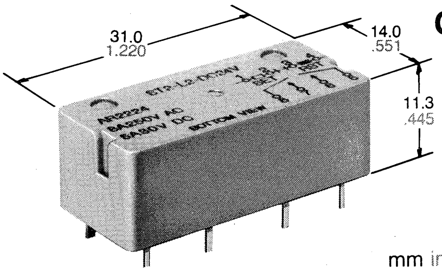
Fig. 3

NAiS

IC DRIVABLE PC BOARD RELAY FOR FIELD LOAD SWITCHING

ST-RELAYS

UL File No.: E43028 VDE File No.: VDE-Reg.-Nr. 4811, 2
CSA File No.: LR26550, SEV



- 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	
Max. switching current	8 A	
HP rating	1/4 HP 125, 250 V AC	
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

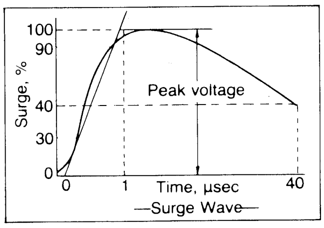
Coil (polarized) (at 25°C 77°F)

Single side stable	Minimum operating power	Approx. 150 mW
	Nominal operating power	Approx. 240 mW
Latching	Minimum set and reset power	Approx. 150 mW
	Nominal set and reset power	Approx. 240 mW

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

Max. operating speed	30 cps.
Operate time	Approx. 10 msec.
Release time	Approx. 8 msec.
Set time (latching)	Approx. 8 msec.
Reset time (latching)	Approx. 8 msec.
Initial breakdown voltage Between contact sets	2,000 Vrms
Between open contacts	1,200 Vrms
Between contacts and coil	3,750 Vrms
Initial insulation resistance	1,000 MΩ at 500 V DC
Inrush current capability	51 A (TV-3 equivalence) for 1a1b 35 A (TV-1 equivalence) for 2a
*Surge voltage between coil and contact	6,000 V
Temperature rise	Max. 55 deg.
Ambient temperature at max. load and nominal coil voltage	−40°C to +60°C −40°F to +140°F
Shock resistance	Functional: 20 G / Destructive: 100 G
Vibration resistance	Functional: 12 G, 10 to 55 Hz at double amplitude of 2 mm Destructive: 18 G, 10 to 55 Hz at double amplitude of 3 mm
Unit weight	Approx. 8 g .28 oz

Note: * Applied surge wave.



—Surge Wave—

TYPICAL APPLICATIONS

Sequence controllers, facsimiles, telephone controls, remote control security devices and security equipment.

ORDERING INFORMATION

Ex. ST | 1 | — | L2 | — | DC48V

Contact arrangement	Operating function	Coil voltage
1: 1 Form A 1 Form B 2: 2 Form A	Nil: Single side stable L : 1 coil latching L2: 2 coil latching	DC 3, 5, 6, 9, 12, 24, 48 V

(Notes) 1. For UL/CSA recognized types, add suffix UL/CSA.
2. For VDE recognized types, add suffix VDE.
3. Standard packing: Carton; 50 pcs., Case; 500 pcs.

TYPES AND COIL DATA at 20°C 68°F

Single side stable

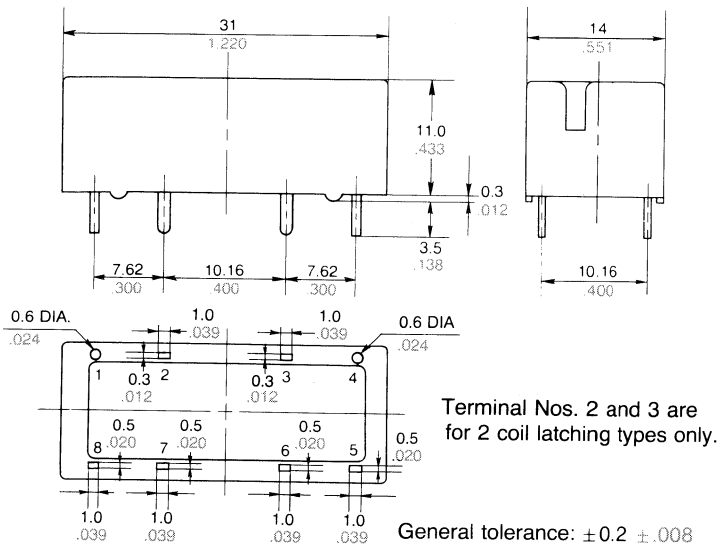
Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Maximum allowable voltage, V DC (60°C)	Coil resistance, Ω (±10%)	Nominal operating current, mA
ST1-DC3V	ST2-DC3V	3	2.4	0.3	4.5	38	75
ST1-DC5V	ST2-DC5V	5	4.0	0.5	7.5	105	47.6
ST1-DC6V	ST2-DC6V	6	4.8	0.6	9.0	150	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	18.8
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

2 coil latching (1 coil latching also available)

Part No.		Nominal voltage V DC	Set and reset voltage, V DC (max.)	Maximum allowable voltage, V DC (60°C)	Coil resistance, Ω (±10%)	Nominal operating current, mA
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
ST1-L2-DC6V	ST2-L2-DC6V	6	4.8	9.0	155	37.5
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	9.8
ST1-L2-DC48V	ST2-L2-DC48V	48	38.4	72.0	10,200	4.7

DIMENSIONS

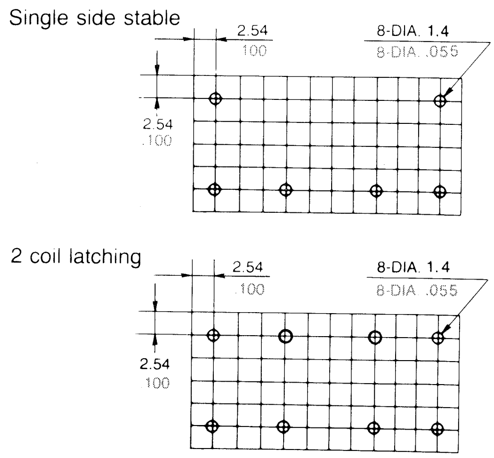
mm inch



Terminal Nos. 2 and 3 are for 2 coil latching types only.

General tolerance: ±0.2 ±.008

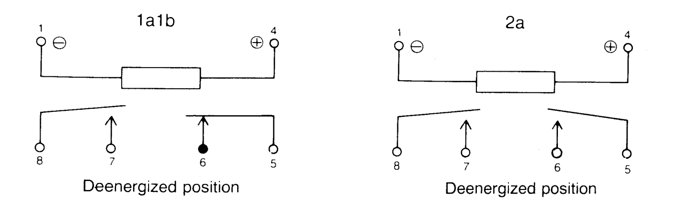
PC board pattern (Copper-side view)



Tolerance: ±0.2 ±.008

SCHEMATIC (Bottom view)

Single side stable



2 coil latching

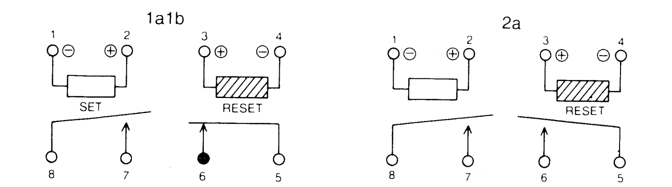
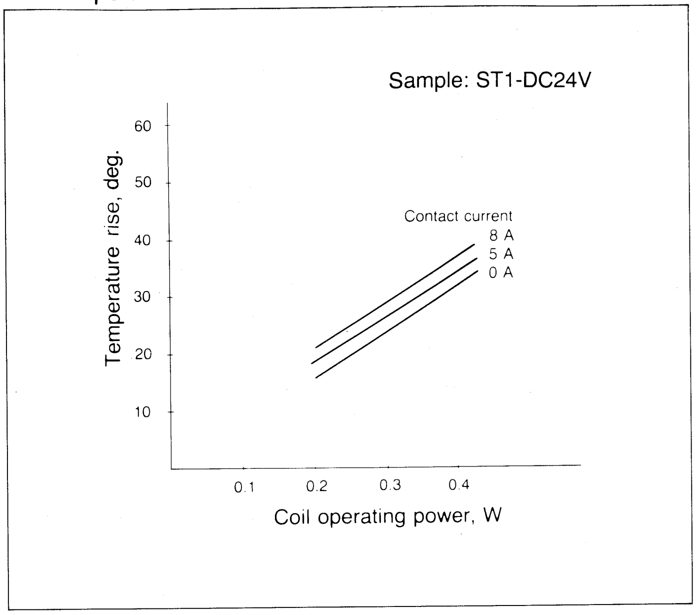


Diagram shows the "reset" position when terminals 3 and 4 are energized. Energize terminals 1 and 2 to transfer contacts.

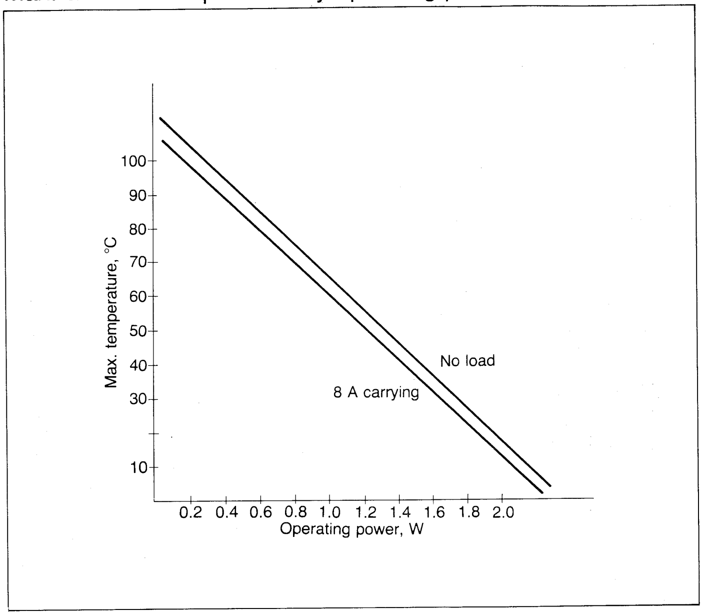
Diagram shows the "reset" position when terminals 3 and 4 are energized. Energize terminals 1 and 2 to transfer contacts.

DATA

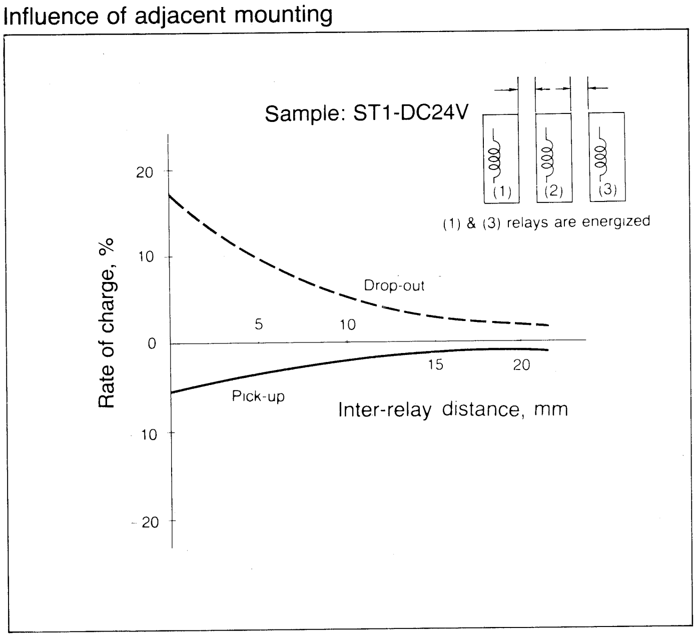
Coil temperature rise



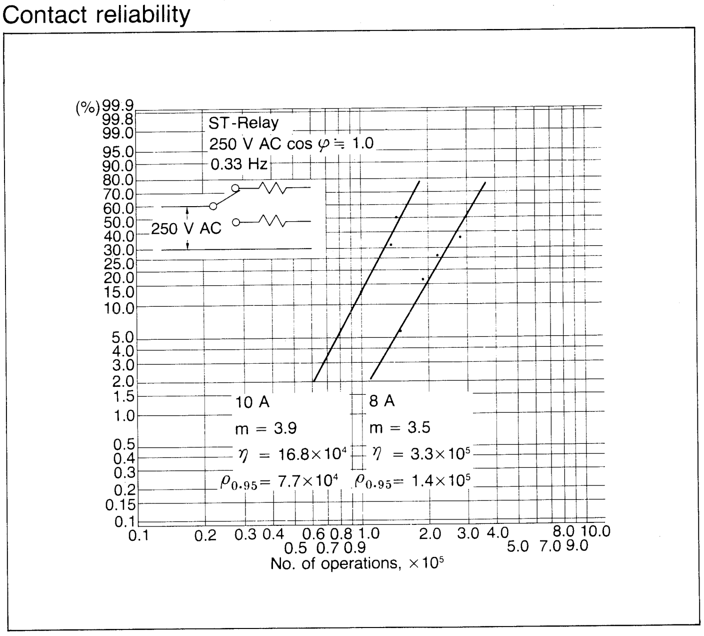
Max. ambient temperature by operating power



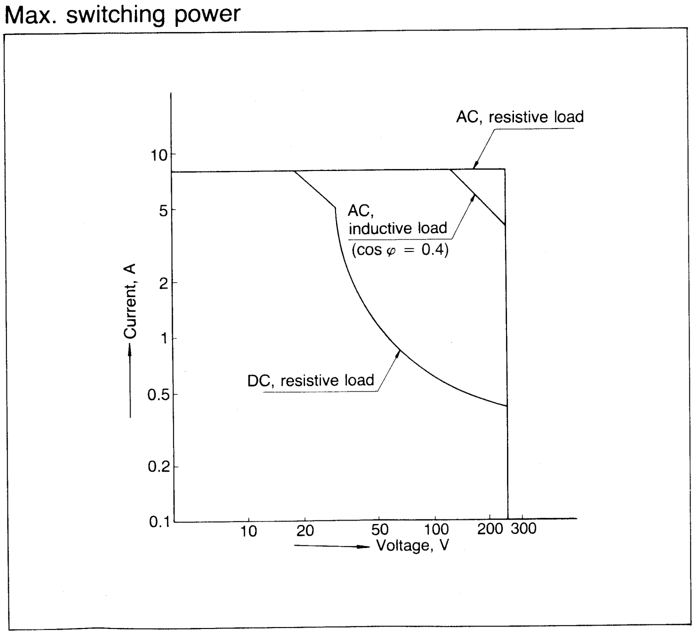
Influence of adjacent mounting



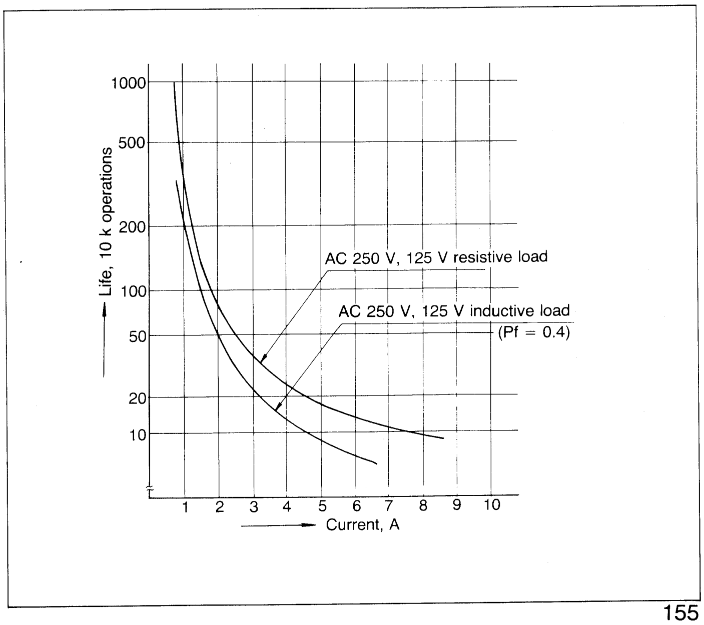
Contact reliability



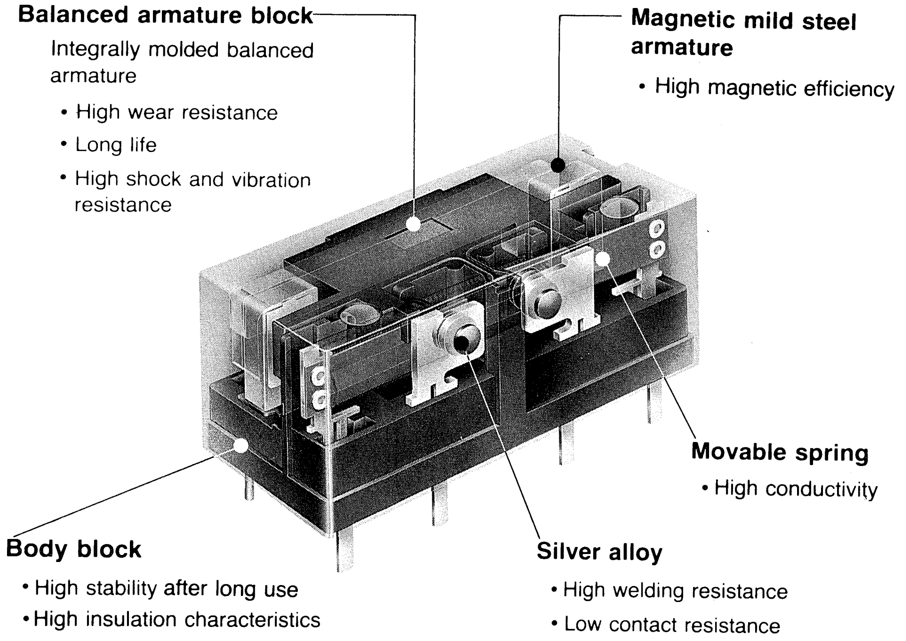
Max. switching power



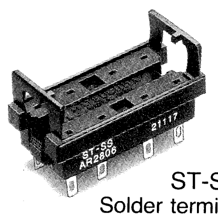
Life curve

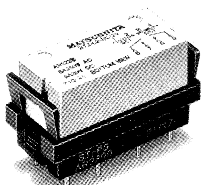


CONSTRUCTION



ACCESSORIES


ST-SS
Solder terminal socket

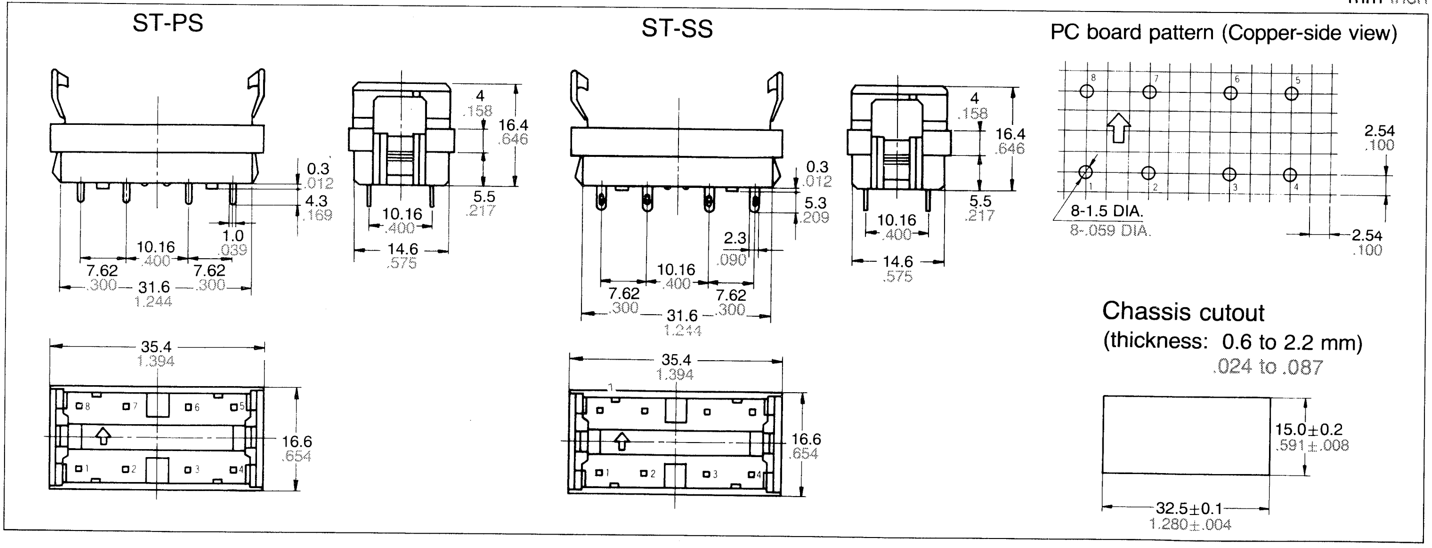

ST-PS
PC board terminal socket

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

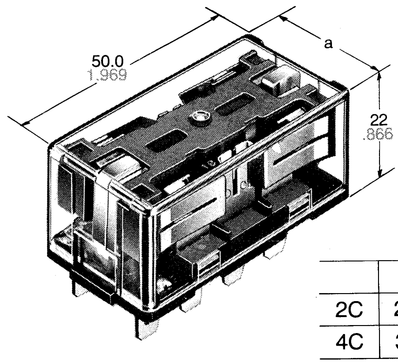
mm inch



NAiS

15 A (2C), 10 A (4C) COMPACT POWER RELAYS WITH HIGH SENSITIVITY

SP-RELAYS



mm inch

	a
2C	25.6 1.008
4C	36.8 1.449

UL File No.: E43028
CSA File No.: LR26550 , VDE

- **High Vibration/Shock Resistance**
  Vibration resistance: 18 G, amplitude 3 mm (10 to 55 Hz)
  Shock resistance: 40 G (11 msec.)
- **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. 40 g 1.41 oz, 4C: Approx. 20 g 0.71 oz
Contact material	Stationary contact: Gold plated silver alloy
	Movable contact: Silver alloy
Rating (resistive) Max. switching power	2C: 3,750 VA, 300 W 4C: 2,500 VA, 300 W
Max. switching voltage	2C, 4C: 250 V AC
Max. switching current	2C: 16 A, 4 C: 10 A
Nominal switching capacity	2C: 16 A, 250 V AC 10 A 30 V DC 4C: 10 A 250 V AC 10 A 30 V DC
UL/CSA rating	2C: 15 A, 1/2 HP 125, 250 V AC, 10 A 30 V DC 4C: 10 A, 1/3 HP 125, 250 V AC, 10 A 30 V DC
Expected life (min. operations) Mechanical (at 180 cpm)	5×10^7
Electrical (at 20 cpm) 15 A 250 V AC 10 A 30 V DC 10 A 250 V AC 10 A 30 V DC	2C: 10^5 10^5 4C: 10^5 10^5

Coil (polarized) at 20°C 68°F

Single side stable	Minimum operating power	150 mW
	Nominal operating power	300 mW
Latching	Minimum set and reset power	150 mW
	Nominal set and reset power	300 mW

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

Max. operating speed	20 cpm for rated load
Operate time	Approx. 25 msec.
Release time	Approx. 15 msec.
Initial breakdown voltage Between open contacts Between contact sets Between contact and coil	 1,500 Vrms 3,000 Vrms 3,000 Vrms
Initial insulation resistance	1,000 MΩ at 500 V DC
Surge resistance between coil and contact	Approx. 6,000 V
Temperature rise at nominal voltage	Max. 40 deg.
Ambient temperature	−50°C to +60°C −58°F to +140°F
Shock resistance	40 G (11 msec.)
Vibration resistance	18G, 10 to 55 Hz at double amplitude of 3 mm
Unit weight	2C: 50 g 1.76 oz 4C: 65 g 2.29 oz

TYPICAL APPLICATIONS

NC machines, remote control panels, sophisticated business equipment.

ORDERING INFORMATION

Ex. SP | 2 | — | L2 | — | DC24V

Contact arrangement	Operating function	Coil voltage
2: 2 Form C 4: 4 Form C	Nil: Single side stable L1: 1 coil latching L2: 2 coil latching	DC 3, 5, 6, 12, 24, 48 V

(Notes) 1. PC board termial types available as option.
2. For UL/CSA recognized types, add suffix UL/CSA.
3. Standard packing Carton: 20 pcs., Case: 200 pcs.

COIL DATA at 20°C 68°F

Single side stable

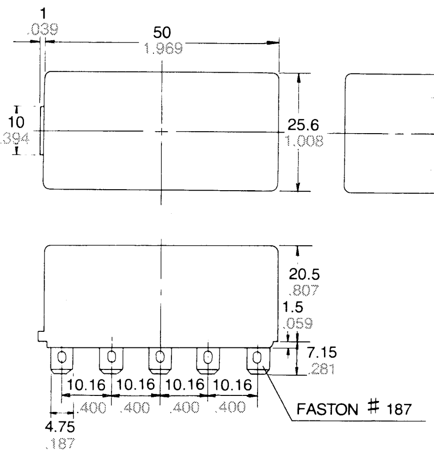
Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA	Coil resistance, Ω (±10%) 20°C	Inductance, H (at 120 Hz)	Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
3	2.1	0.3	100.0	30	Approx. 0.05	300	4.5
5	3.5	0.5	60.2	83	0.1	300	7.5
6	4.2	0.6	50.0	120	0.2	300	9
12	8.4	1.2	25.0	480	0.7	300	18
24	16.8	2.4	12.5	1,920	3.0	300	36
48	33.6	4.8	6.2	7,700	11.2	300	72

2-coil latching (1-coil latching also available)

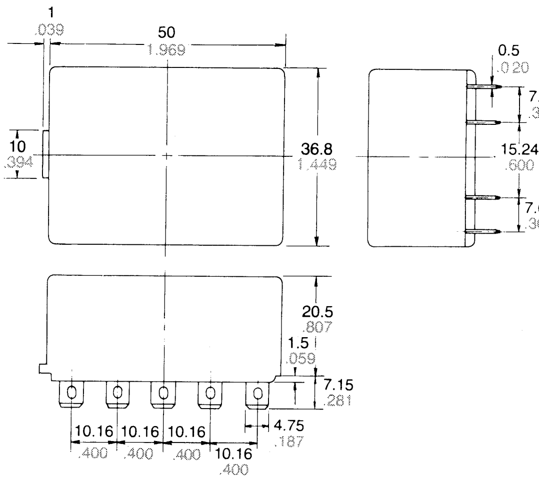
Nominal voltage, V DC	Set and reset voltage, V DC (max.)	Nominal operating current, mA	Coil resistance, Ω (±10%)		Inductance, H (at 120 Hz)		Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
			Coil I	Coil II	Coil I	Coil II		
3	2.1	100.0	30	30	Approx. 0.03	Approx. 0.03	300	4.5
5	3.5	60.2	83	83	0.07	0.07	300	7.5
6	4.2	50.0	120	120	0.1	0.1	300	9
12	8.4	25.0	480	480	0.4	0.4	300	18
24	16.8	12.5	1,920	1,920	1.4	1.4	300	36
48	33.6	6.2	7,680	7,680	5.6	5.6	300	72

DIMENSIONS

mm inch



SP2



SP4

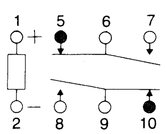
Note: No. 3 and 4 terminals for the latching types only.

General tolerance: ±0.5 ±.020

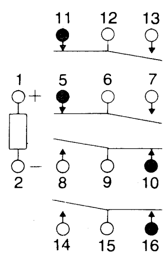
SCHEMATIC (Bottom view)

Single side stable

SP2



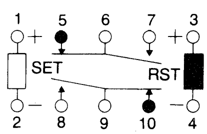
SP4



Deenergized position

2 coil latching

SP2



SP4

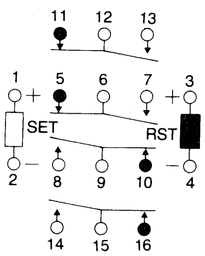
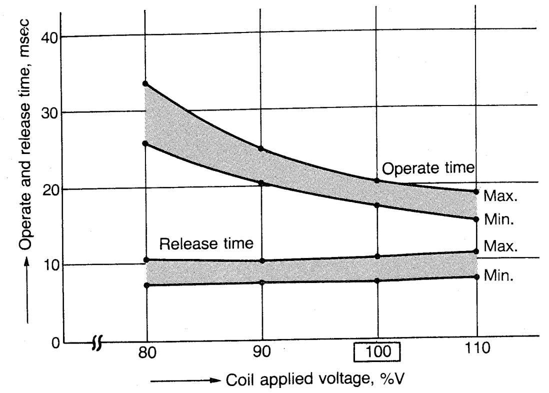


Diagram shows the "reset" position when terminals 3 and 4 are energized. Energize terminals 1 and 2 to transfer contacts.

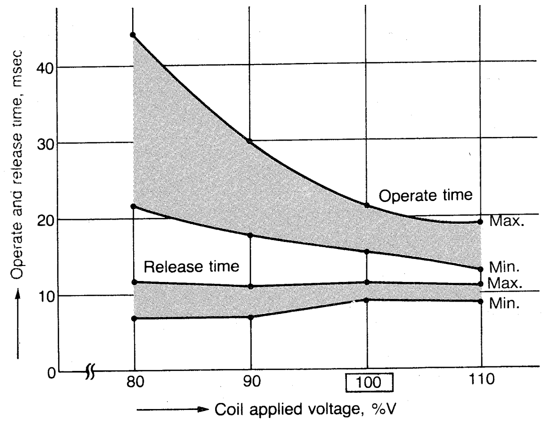
DATA

Operate and release time (Single side stable)

SP2

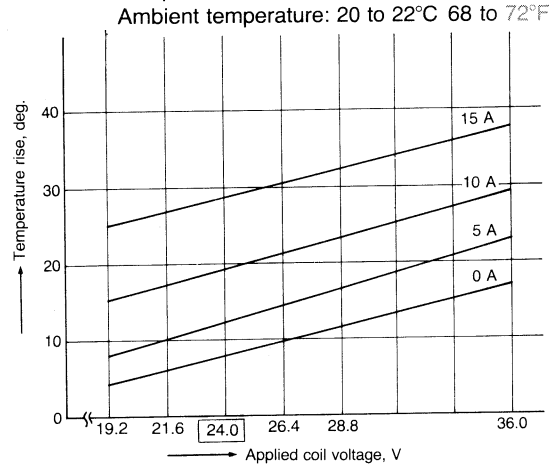


SP4

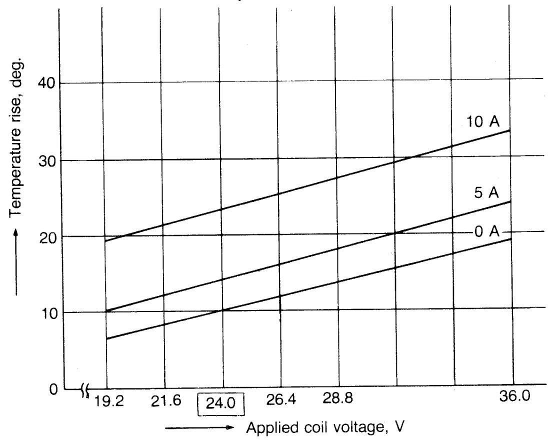


Coil temperature rise

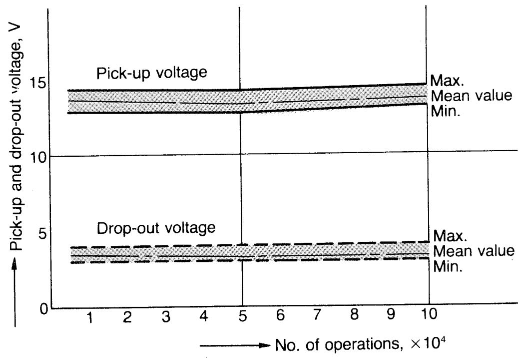
Sample: SP2-DC 24V
Ambient temperature: 20 to 22°C 68 to 72°F

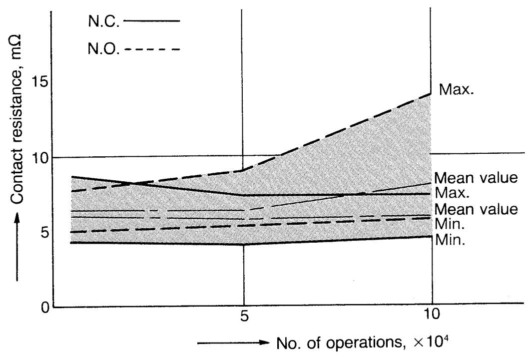


Sample: SP4-DC 24V
Ambient temperature: 27 to 29°C 81 to 84°F

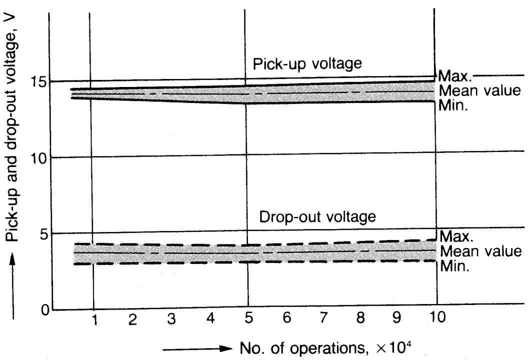


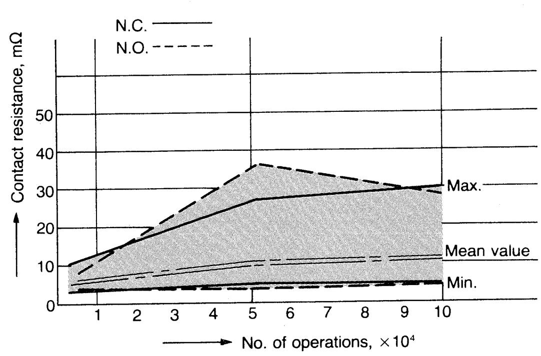
Electrical life (SP2, 15 A 250 V AC resistive load)



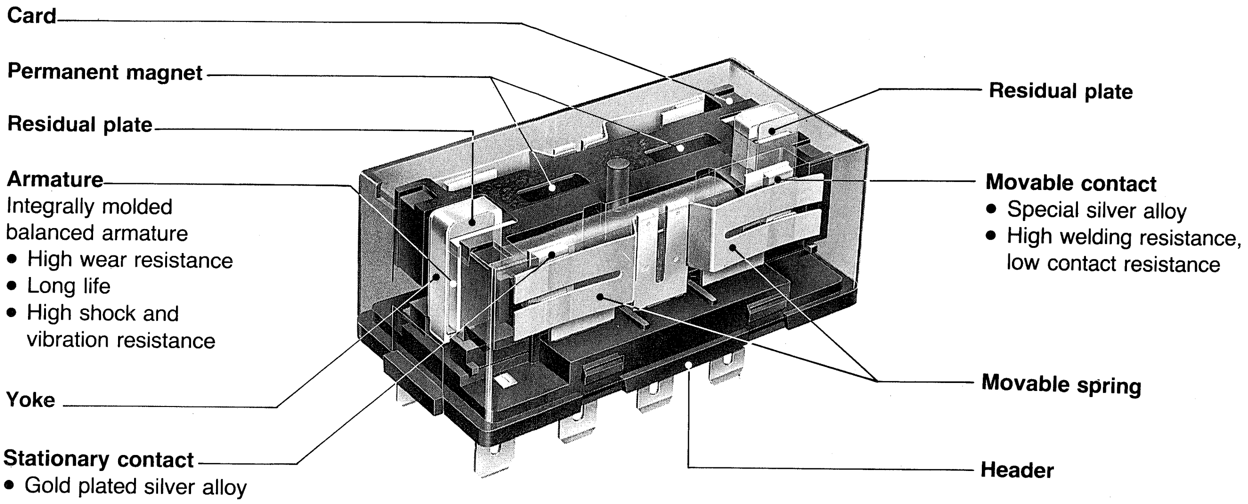


Electrical life (SP4, 10 A 250 V AC resistive load)





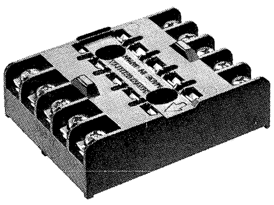
CONSTRUCTION



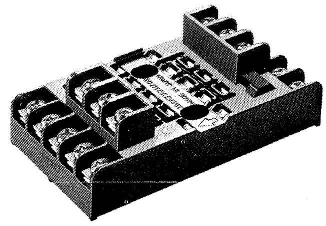
ACCESSORIES

Screw terminal socket

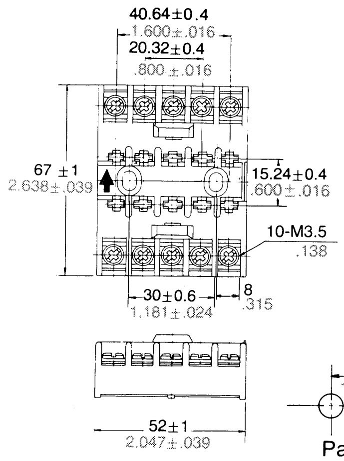
mm inch

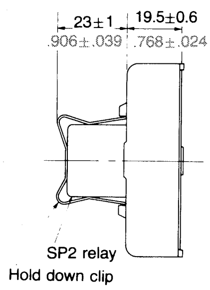


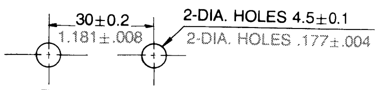
SP2-SF



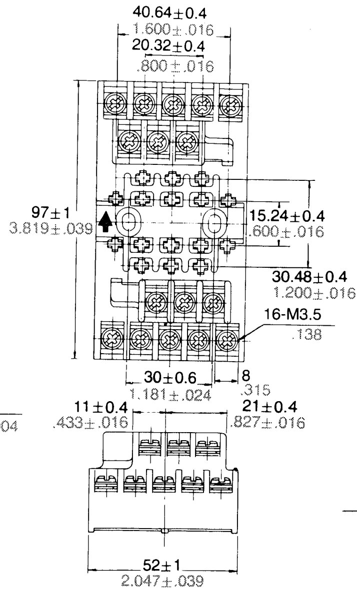
SP4-SF

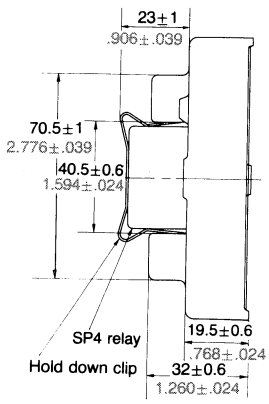


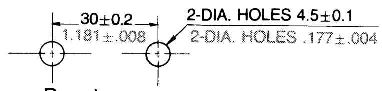




Panel cutout

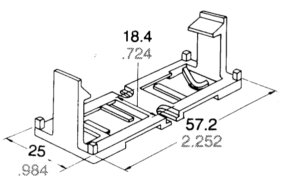




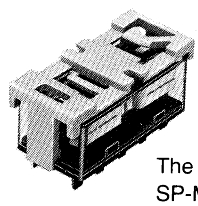


Panel cutout

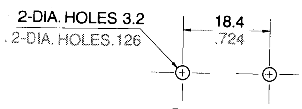
Mounting plate



SP-MA

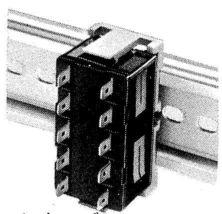


The SP-Relay with SP-MA attached



Panel cutout

Tolerance: ±0.1 ±.004

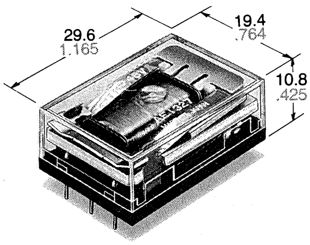


Direct chassis mounting possible, and applicable to DIN rail.
[DIN 46277 (35 mm width) is applicable.]

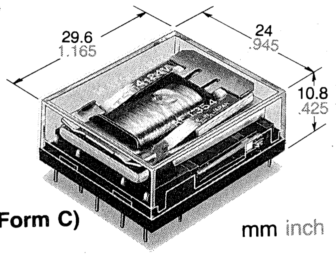
NAiS

FLATPACK RELAY WITH HIGH SENSITIVITY AND RELIABILITY

NF-RELAYS



NF2 (2 Form C)



NF4 (4 Form C)

UL File No.: E43019
CSA File No.: LR26550
VDE File No.: VDE-Reg.-Nr. 2770

- **Low profile—Stands only 10.2 mm (.402 inches) high Ideal for high density packaging**
- **Low power—Minimum operating power, NF2/150 mW, NF4/240 mW**
- **1,500 V FCC surge between open contacts**
- **Long life—DPDT: 3×10⁸, 4PDT: 10⁸ mechanical operations**
- **Variety of available types**
  —Amber Sealed types
  —M.B.B. (From D) contact types

SPECIFICATIONS

Contact

Arrangement	2 Form C, 4 Form C
Rating (resistive load) Max. switching power Max. switching voltage Max. switching current	 60 W 100 VA 220 V AC, DC 2 A
UL rating	0.5 A 125 V AC, 2 A 30 V DC 0.25 A 220 V DC
VDE rating	1 A 65 V AC, 2 A 30 V DC
Expected life (min. operations) Mechanical Electrical (2 A 30 V DC Resistive) (1 A 30 V DC Resistive)	 NF2: 3×10^8, NF4: 10^8 10^6 5×10^6
Initial contact pressure	Approx. 8.5 g 0.3 oz
Contact bounce	Approx. 1.5 msec.
Contact material Movable contact Stationary contact	 Gold clad silver Gold clad silver
Initial contact resistance (By voltage drop 6 V DC 1 A) Max. Typical	 50 mΩ 25 mΩ

Coil (polarized) (at 25°C 77°F)

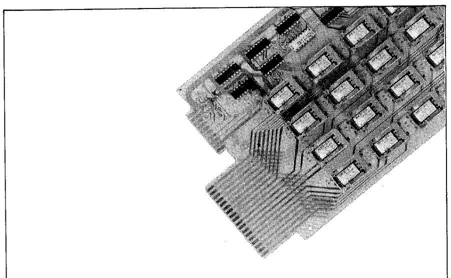
Minimum operating power	NF2: Approx. 150 mW, NF4: Approx. 240 mW
Nominal operating power	NF2: Approx. 300 mW, NF4: Approx. 480 mW
Max. operating power for continuous duty	Approx. 1 W at 40°C 104°F

Characteristics (at 25°C 77°F, 50% R.H. sea level)

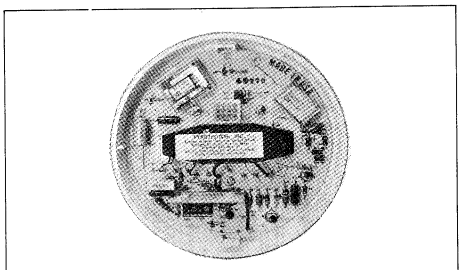
Max. operating speed	50 cps.
Operate time	Approx. 10 msec.
Release time	Approx. 5 msec.
Electro-static capacitance Contact/Contact Contact/Coil Contact/Earth	 Approx. 4 pF Approx. 7 pF Approx. 6 pF
Breakdown voltage Between open contacts Between contact sets Between live parts and ground Between contacts and coil	 750 Vrms 1,000 Vrms 1,000 Vrms 1,000 Vrms
Initial insulation resistance	1,000 MΩ at 500 V DC
Ambient temperature	−40 to +65°C −40 to +149°F
Shock resistance Functional In deenergized condition In energized condition Destructive	 8 G 20 G 100 G
Vibration resistance Functional In deenergized condition Energized condition Destructive In deenergized condition Energized condition	 8 G, 10 to 55 Hz at double amplitude of 1.3 mm 12 G, 10 to 55 Hz at double amplitude of 2 mm 12 G, 10 to 55 Hz at double amplitude of 2 mm 20 G, 10 to 55 Hz at double amplitude of 3.3 mm
Unit Weight	NF2: Approx. 14 g .49 oz NF4: Approx. 16 g .56 oz

TYPICAL APPLICATIONS

NF relays are widely acceptable in applications where small size and high sensitivity are required.
Such applications include:
Electronic equipment, Household applications, Alarm systems, Office machines, Communication equipment, Measuring equipment, Remote control systems, General control circuits, Machine tools, Industrial machinery, etc.



A printed circuit application for microwave communication as designed by Granger Associates.



A printed circuit application for smoke detectors as designed by Chloride Pyrotector Inc.

ORDERING INFORMATION

Ex. NF 4 EB — 4M — 48V — 1

Contact arrangement	Type classification	MBB function	Coil voltage (DC)	Contact material
2: 2 Form C 4: 4 Form C	Nil: Standard type EB: Amber sealed type	Nil: Form C type 2M: 2MBB (2 Form D) 4M: 4MBB (4 Form D)	5, 6, 12, 24, 48, 60 V	Nil: Gold-clad silver 1: Gold-cap over silver palladium

(Notes) 1. For UL or VDE recognized types, add suffix UL or VDE.
2. Standard packing Carton: 20 pcs. Case: 200 pcs.

TYPES AND COIL DATA at 25°C 77°F

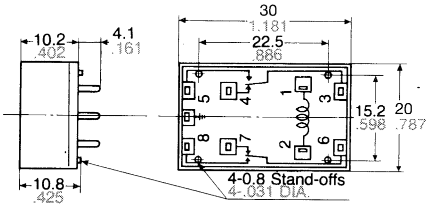
*Less than 1,000 Ω : ±10%
More than 1,000 Ω : ±15%

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Maximum allowable voltage, V DC (at 40°C)	Coil resistance,* Ω	Nominal operating power, mW	Inductance, H	
							Open	Close
NF2-5V	5	3.5	0.5	8.7	90	278	0.071	0.071
NF2-6V	6	4.2	0.6	10.5	137	260	0.093	0.094
NF2-12V	12	8.4	1.2	21	500	290	0.338	0.344
NF2-24V	24	16.8	2.4	42	2,000	290	1.29	1.31
NF2-48V	48	33.6	4.8	84	7,000	330	4.12	4.18
NF2-60V	60	42.0	6.0	105	9,700	370	5.29	5.38
NF4-5V	5	3.5	0.5	7.0	53	472	0.029	0.029
NF4-6V	6	4.2	0.6	8.5	90	400	0.070	0.071
NF4-12V	12	8.4	1.2	17.0	330	440	0.22	0.23
NF4-24V	24	16.8	2.4	34	1,200	480	0.77	0.79
NF4-48V	48	33.6	4.8	68	4,200	550	2.22	2.25
NF4-60V	60	42.0	6.0	85	7,000	510	4.12	4.18

DIMENSIONS

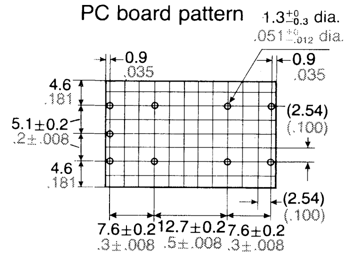
mm inch

NF2

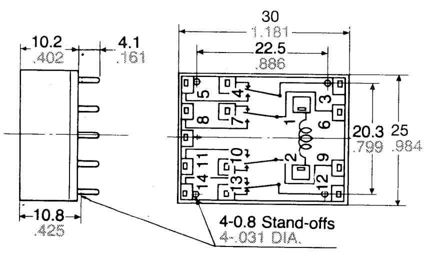


Terminal dimensions (except soldering)
Width: 0.8 .031
Thickness: 0.3 .012

PC board pattern

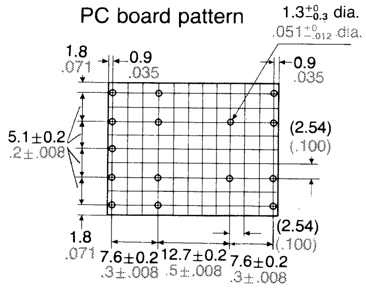


NF4



Terminal dimensions (except soldering)
Width: 0.8 .031
Thickness: 0.3 .012

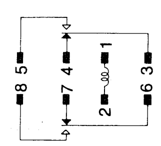
PC board pattern



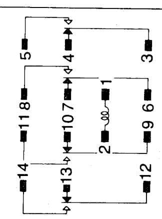
General tolerance: ±0.3 ±.012

SCHEMATIC (Bottom view)

NF2



NF4

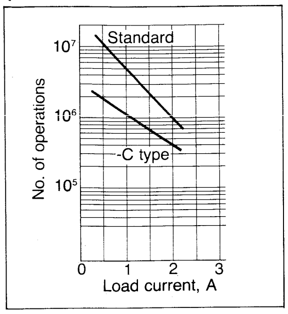


Note:
4 stand-offs are provided on the header to give the proper height off the P/C board with the both side copper foil for better soldering. If it is required that these stand-offs be eliminated, please remove these stand-offs.

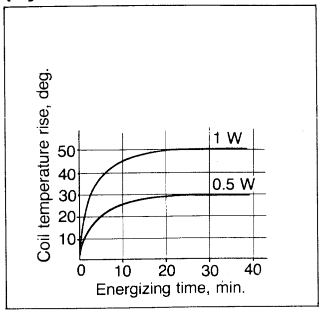
MBB contact positions	
	NF2-2M: terminals 6-7-8, 3-4-5
	NF4-2M: terminals 6-7-8, 9-10-11
	NF4-4M: terminals 6-7-8, 3-4-5 12-13-14, 9-10-11

DATA

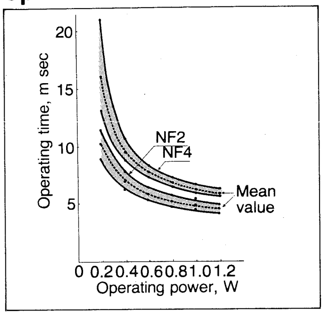
Life curve (30 V DC cos φ = 1)



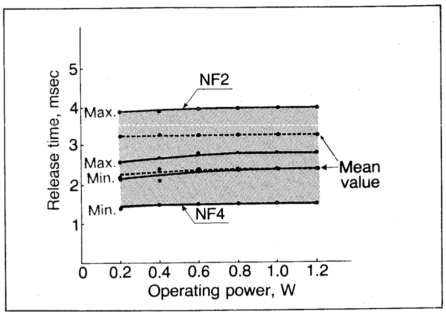
Coil temp. rise (by resistive method)



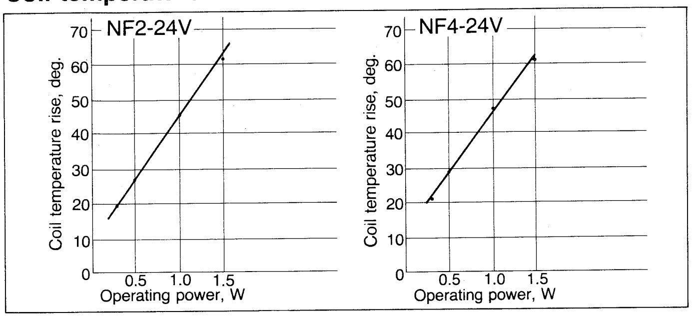
Operate time



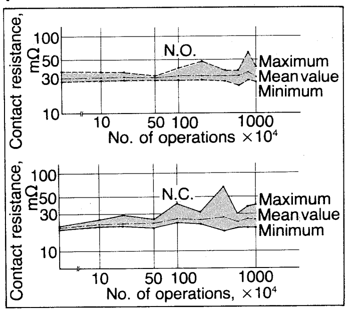
Release time



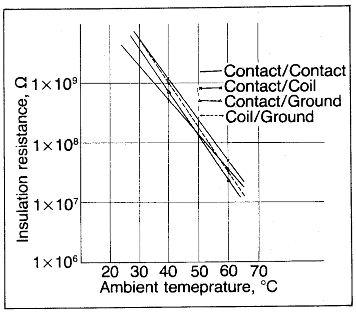
Coil temperature rise



Electrical life (1 A 30 V DC resistive, 1 cps.)



Insulation resistance

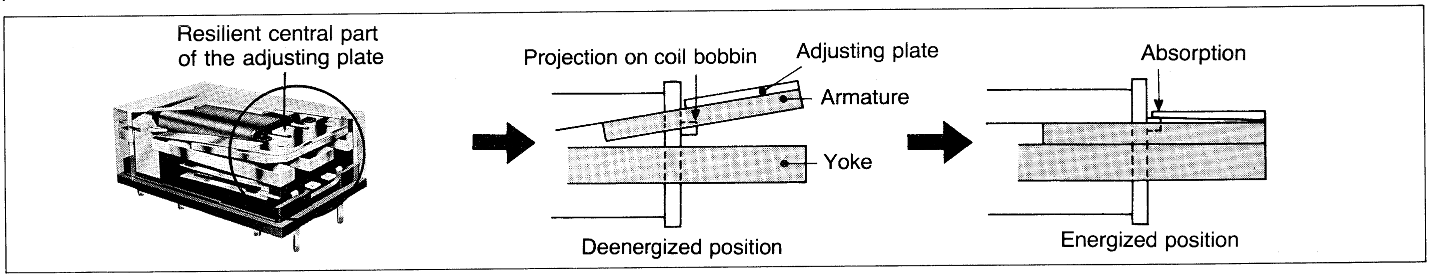


FEATURES

Shock-absorbing structure

An outstanding feature of the NF relay is its armature structure. The adjusting plate is so arranged as to act as a shock absorber. Before the armature is closed, the adjusting plate strikes a projection on the coil bobbin and efficiently absorbs the shock.

This reduction in shock eliminates chattering and promotes long relay life.



Rebound-absorbing structure

Another feature of the NF relay is the armature rebound absorbing structure. In NF relays, armature rebound is efficiently absorbed by the clearance which is provided between the armature and actuating card as follows.
(see right)

Rebound-absorbing process

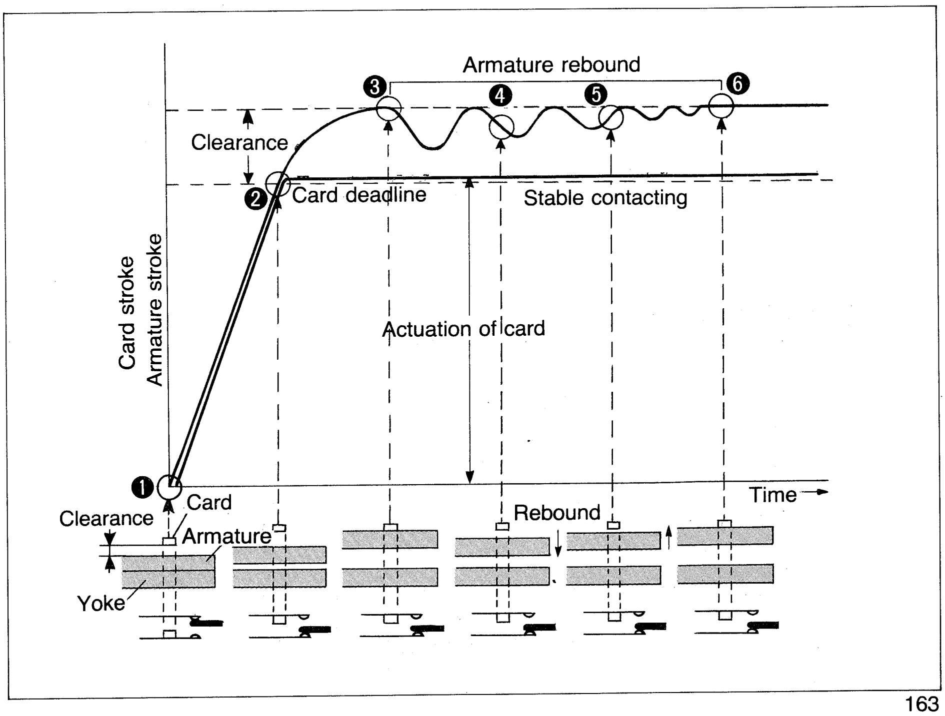
❶ Energized position

❷ When coil is deenergized, card and armature are drawn up together. The actuating card touches the back-stop of the coil bobbin. The contact is switched over at this point of card dead line.

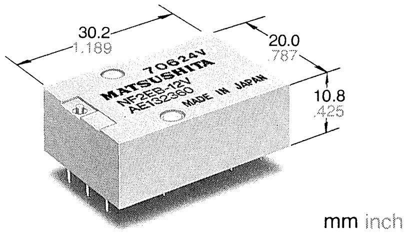
❸ The armature continues to move upward and returns to the uppermost position of the card.

❹ ❺ Rebound begins.
Chattering and bouncing are absorbed by the clearance between card and armature and have no effect upon contact operation.

❻ Armature movement is finished.



Amber Relays NFEB



NF2EB (2 Form C)

Sealed construction of the NFEB offers more reliability than standard NF relays and prevents soldering flux vapors from entering the relay and condensing as an insulating film. So they are simple to clean with any degreaser and detergent cleaner due to the PBT case material, without affecting the maximum contact reliability of the relays.

SPECIFICATIONS

Contacts

Arrangement[1]	2 Form C, 4 Form C
Rating, resistive load Max. switching power Max. switching voltage Max. switching current	 60 W 100 VA 220 V AC, DC 2 A
UL rating	0.5 A 125 V AC, 2 A 30 V DC, 0.25 A 220 V DC
Expected life (min. operations) Mechanical Electrical (2 A 30 V DC Resistive) Electrical (1 A 30 V DC Resistive)	 10^8 2×10^5 10^6
Contact bounce	Approx. 1.5 msec.
Contact material Movable contact Stationary contact	 Gold-clad silver Gold-clad silver
Initial contact resistance (By voltage drop 6 V DC 1 A) Maximum Typical	 50 mΩ 25 mΩ

[1] MBB types available: 2MBB & 4MBB
(See page 162 for contact positions.)

Coil

Minimum operating power, at 25°C	2C: Approx. 190 mW 4C: Approx. 310 mW
Nominal operating power, at 25°C	2C: Approx. 300 mW 4C: Approx. 480 mW
Max. operating power for continuous duty	Approx. 1 W at 40° C 104°F

Characteristics

Maximum cycle rate	50 cps.
Operate time	Approx. 10 msec.
Release time	Approx. 5 msec.

Electrostatic capacitance Contact/Contact Contact/Coil Contact/Ground	 Approx. 4 pF Approx. 7 pF Approx. 6 pF
Breakdown voltage Between open contacts, Between contact sets Between live parts and ground Between contacts and coil	 750 Vrms 1,000 Vrms 1,000 Vrms 1,000 Vrms
Initial insulation resistance	1,000 MΩat 500 V DC
Ambient temperature[2]	−40° to +65°C −40° to +149°F
Ambient pressure	760 mmHg ±20%
Shock resistance Functional In deenergized condition In energized condition Destructive	 3 G (in contact direction) 10 G (perpendicular to contact) 20 G 100 G
Vibration resistance Functional In deenergized condition In energized condition Destructive	 3 G, 10 to 55 Hz at double amplitude of 0.5 mm (in contact direction) 10 G, 10 to 55 Hz at double amplitude of 1.6 mm (perpendicular to contact) 12 G, 10 to 55 Hz at double amplitude of 2 mm 20 G, 10 to 55 Hz at double amplitude of 3.3 mm
Unit weight	2C: Approx. 14 g .49 oz 4C: Approx. 16 g .56 oz

[2] Total temperature (temperature rise in coil plus ambient temperature) should be kept less than 105°C 221°F max. (No freezing below 0°C 32°F)

TYPES AND COIL DATA at 25°C 77°F

*Less than 1,000 Ω: ±10%
More than 1,000 Ω: ±15%

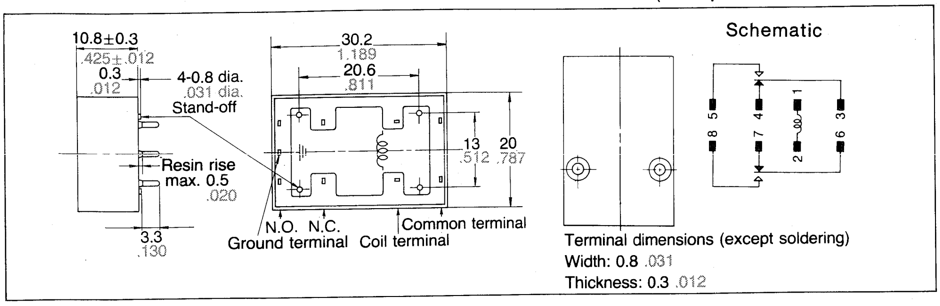
Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable voltage, V DC (at 40°C)	Coil resistance,* Ω	Nominal operating power, mW	Inductance, H Armature Open	Inductance, H Armature Close
NF2EB-5V	5	4.0	0.5	8.7	90	278	0.071	0.071
NF2EB-6V	6	4.8	0.6	10.5	137	260	0.093	0.094
NF2EB-12V	12	9.6	1.2	21	500	290	0.338	0.344
NF2EB-24V	24	19.2	2.4	42	2,000	290	1.29	1.31
NF2EB-48V	48	38.4	4.8	84	7,000	330	4.12	4.18
NF2EB-60V	60	48.0	6.0	105	9,700	370	5.29	5.38
NF4EB-5V	5	4.0	0.5	7	53	472	0.029	0.029
NF4EB-6V	6	4.8	0.6	8.5	90	400	0.070	0.071
NF4EB-12V	12	9.6	1.2	17.0	330	440	0.22	0.23
NF4EB-24V	24	19.2	2.4	34	1,200	480	0.77	0.79
NF4EB-48V	48	38.4	4.8	68	4,200	550	2.22	2.25
NF4EB-60V	60	48.0	6.0	85	7,000	510	4.12	4.18

DIMENSIONS

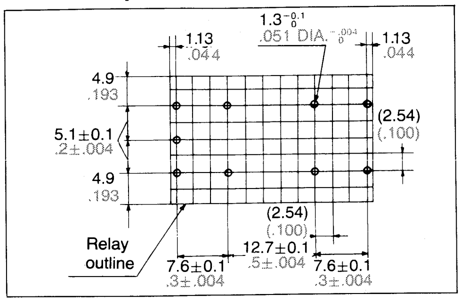
mm inch

General tolerance: ±0.5 ±.020
(Except for the cover height)

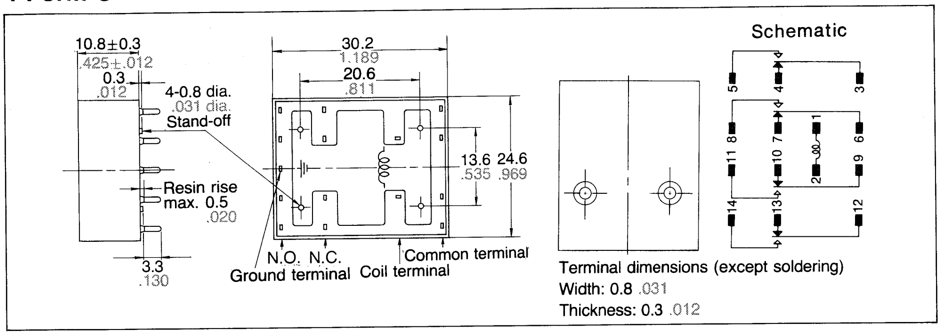
2 Form C



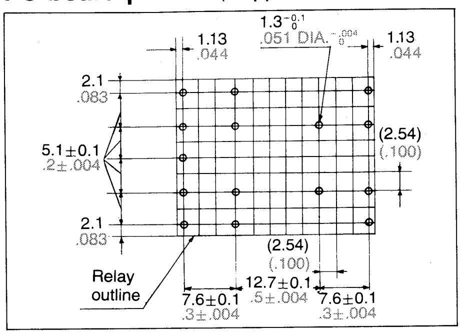
PC board pattern (Copper-side view)



4 Form C

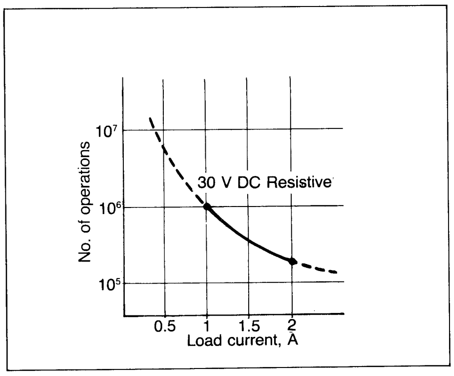


PC board pattern (Copper-side view)

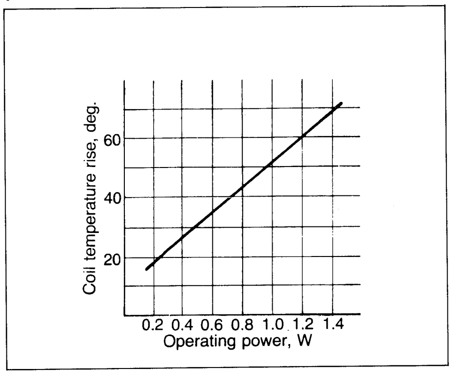


DATA

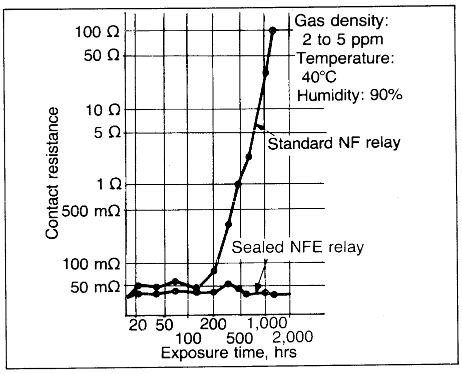
Life curve



Coil temperature rise (resistance method)



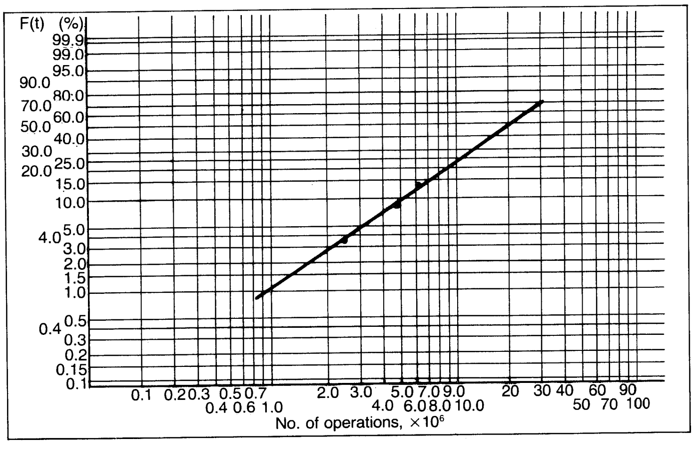
H_2S gas test



Contact reliability

Test conditions:

1. Contact current/voltage: 10 µA 100 mV 1 kHz
2. Cycle rate: 20 cps.
3. Miscontact detection level: 1 mV (= 100 Ω)
4. Detection method: Observation of all changeover contacts



Test result:

m = 1.5 $\mu = 21.2\times10^6$
95% confidence level = 3.1×10^6
17 contacts out of 20 achieved 10 million no miscontact operations.

High temperature test

Test conditions:

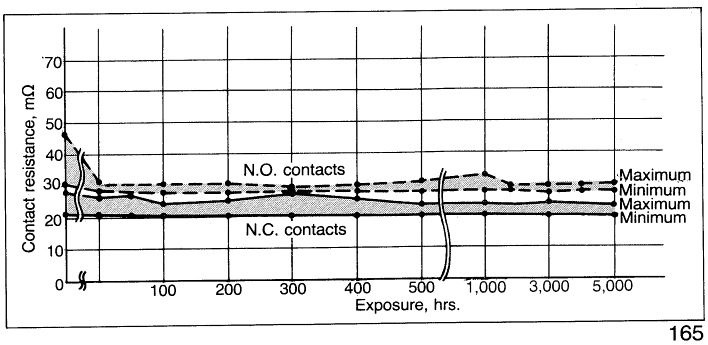
Ambient temperature: 80°C±2°C

Test method:

1. All contacts were switched for 100 operations on 2 A 30 V DC resistive load.
2. Samples then were exposed to 80°C temperature for 5,000 hours, continuous.
3. Contact resistance was measured with Hewlett-Packard testing equipment.

Test result:

Amber relays showed a stable spread of contact resistance within the initially specified 50 mΩ after 5,000 hours exposure.

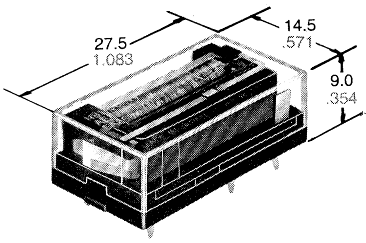


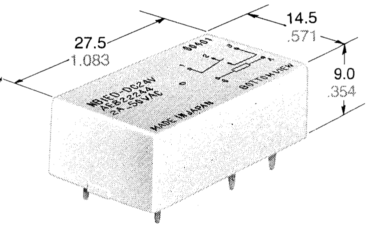
NAiS

1 FORM C THIN PC BOARD RELAY, STANDING ONLY 0.35" HEIGHT

NB-RELAYS

UL File No.: E43028
CSA File No.: LR26550





NBE Amber Relays mm inch

- **Latching types available**
- **Low height—stands only 0.35 inches (9 mm) high ideal for high density packaging**
- **3A bifurcated and 5A single contact types available**
- **1,500 V FCC surge between open contacts**
- **High dielectric strength for transient protection— 5,000 V surge in 1×40 µsec. between coil and contact**
- **DIL terminal arrangement—with more than 0.3" (7.6 mm) inter-terminal spacing for safety-oriented PC board design**
- **Amber sealed types available**

SPECIFICATIONS

Contacts

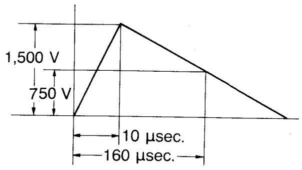
Type	Standard		Amber sealed	
Style	Single	Bifurcated	Single	Bifurcated
Arrangement	1 Form C		1 Form C	
Contact material	Silver nickel	Gold-clad silver nickel	Gold-clad silver nickel	
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	100 mΩ	50 mΩ	100 mΩ	50 mΩ
Rating (resistive) Max. switching power	150 W 1,250 VA	90 W 750 VA	90 W 750 VA	60 W 500 VA
Max. switching voltage	250 V AC, 30 V DC		250 V AC, 30 V DC	
Max. switching current	5 A	3 A	3 A	2 A
UL/CSA rating	5 A, 1/10 HP 125, 250 V AC 5 A 30 V DC, 0.6 A 110 V DC	3 A, 1/20 HP 125, 250 V AC 5 A 30 V DC, 0.6 A 110 V DC	3 A, 1/10 HP 125, 250 V AC 5 A 30 V DC, 0.6 A 110 V DC	2 A, 1/20 HP 125, 250 V AC 5 A 30 V DC, 0.6 A 110 V DC
Expected life (min. operations) Mechanical	10^7		10^7	
Electrical 5 A 250 V AC, 30 V DC	2×10^5			
3 A 250 V AC, 30 V DC	—	2×10^5	*2×10^5	—
3 A 250 V AC, 30 V DC	—	*2×10^5	—	2×10^5
0.1 A 50 V DC	—	10^7	—	10^7
0.1 A 50 V DC (inductive)	—	10^6	—	10^6

*5 A 250 V AC, 30 V DC available with 6×10^3 ope.

Coil (at 25°C 77°F)

Single side stable	Minimum operating power	Approx. 260 mW
	Nominal operating power	Approx. 400 mW
Latching	Minimum set power	Approx. 1,300 mW
	Minimum reset power	Approx. 400 mW
	Nominal set power	Approx. 2,100 mW
	Nominal reset power	Approx. 600 mW

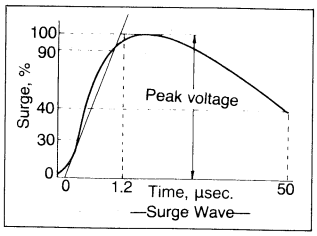
*2 FCC (Federal Communication Commission) requests following standard as Breakdown Voltage specification.



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

Max. operating speed	20 cpm.
Operate time	Approx. 10 msec.
Release time	Approx. 10 msec.
Set time (latching)	Approx. 10 msec.
Reset time (latching)	Approx. 10 msec.
Initial breakdown voltage Between open contacts	1,000 Vrms
Between contacts and coil	2,000 Vrms
Initial insulation resistance	100 MΩ at 500 V DC
*1 Surge voltage between coil and contact	5,000 V
*2 FCC surge voltage between open contacts	1,500 V
Temperature rise Single side stable	Max. 40 deg.
*3 2 coil latching	Max. 65 deg.
Ambient temperature	−40°C to +80°C −40°F to +176°F
Shock resistance	Functional: 10 G Destructive: 100 G
Vibration resistance	10 to 55 Hz at double amplitude of 1 mm
Unit weight	Approx. 8 g .28 oz

Notes:
*1 Applied surge wave.
*2 FCC surge wave.
*3 Set coils of 2 coil latching types are for intermittent operation only. Power should be applied to the coil continuously for no more than 1 minute.



TYPICAL APPLICATIONS

Electric home appliances, stereo equipment, telecommunications and industrial equipment.

ORDERING INFORMATION

Ex. NB [1] [E] [D] — [L2] — [DC 48V]

Contact arrangement	Classification of type	Contact style	Operating function	Coil voltage
1 : 1 Form C	Nil: Standard type E: Amber sealed type	Nil: Single contact D: Bifurcated contact	Nil: Single side stable L2: 2 coil latching	DC 3, 5, 6, 12, 24, 48 V

COIL DATA at 20°C 68°F

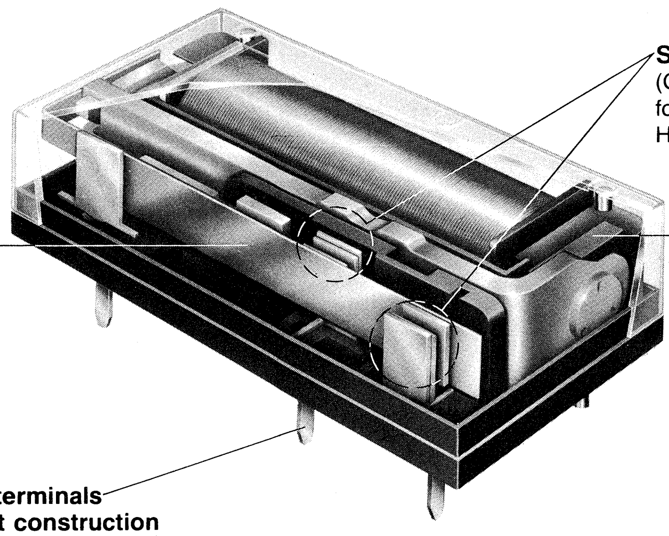
Single side stable

Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Maximum allowable voltage, V DC (60°C)	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Inductance, mH	
							Open	Closed
3	2.4	0.3	3.3	23	130.4	391	28.1	43.9
5	4.0	0.5	5.5	63	79.4	397	75.6	118.3
6	4.8	0.6	6.6	90	66.7	400	103.7	162.3
12	9.6	1.2	13.2	360	33.3	400	436.1	682.8
24	19.2	2.4	26.4	1,400	17.1	410	1,589	2,488
48	38.4	4.8	52.8	4,500	10.7	514	5,639	8,830

2 coil latching

Nominal voltage, V DC	Set, Reset, V DC (max.)	Maximum allowable voltage, V DC (60°C)	Coil resistance, Ω (±10%)		Nominal operating power, mW		Inductance, mH			
							Set coil		Reset coil	
			Set coil	Reset coil	Set coil	Reset coil	Open	Closed	Open	Closed
3	2.4	3.3	4.3	15	2,093	600	1.0	1.2	2.3	2.3
5	4.0	5.5	12	42	2,083	595	2.6	3.2	7.1	7.1
6	4.8	6.6	17	60	2,118	600	3.8	4.6	10.8	10.8
12	9.6	13.2	70	240	2,057	600	16.1	19.4	37.1	37.2
24	19.2	26.4	270	960	2,133	600	60.5	73.1	175.9	176.2
48	38.4	52.8	960	3,300	2,400	698	231.1	279.2	462.9	463.7

CONSTRUCTION

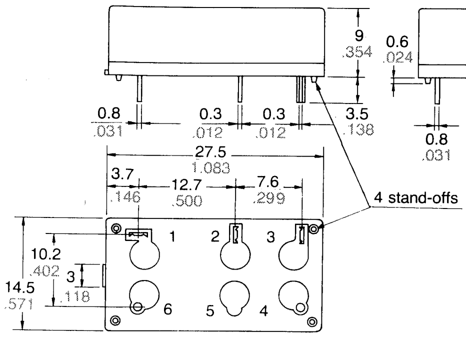


DIMENSIONS

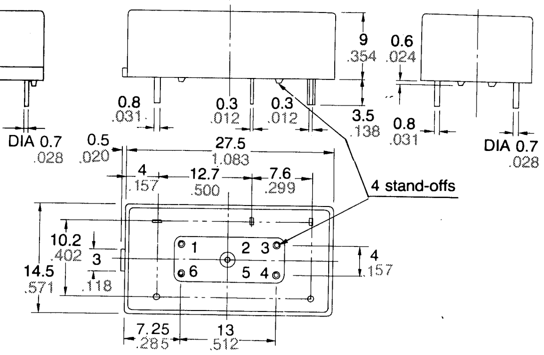
mm inch

Single side stable

Standard type

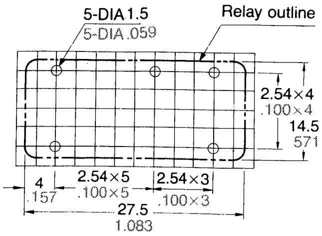


Amber sealed type



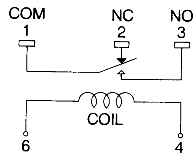
General tolerance: ±0.5 ±.020

PC board pattern (Copper-side view)

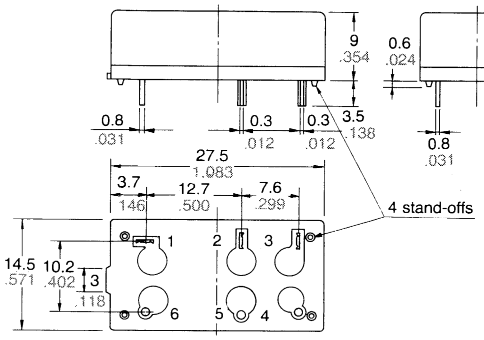


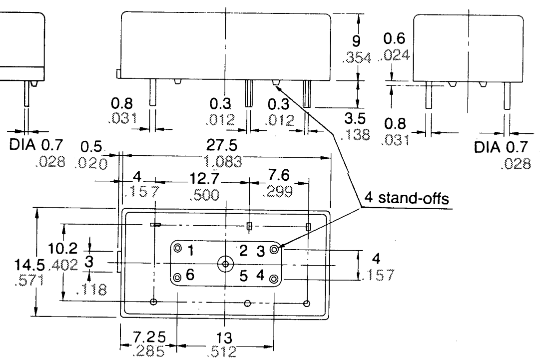
Tolerance: ±0.1 ±.004

Schematic (Bottom view)



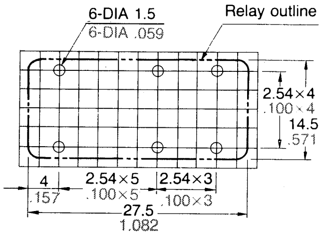
2 coil latching





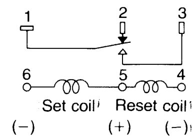
General tolerance: ±0.5 ±.020

PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



DATA

Fig. 1 **Coil temperature rise** (Single side stable)

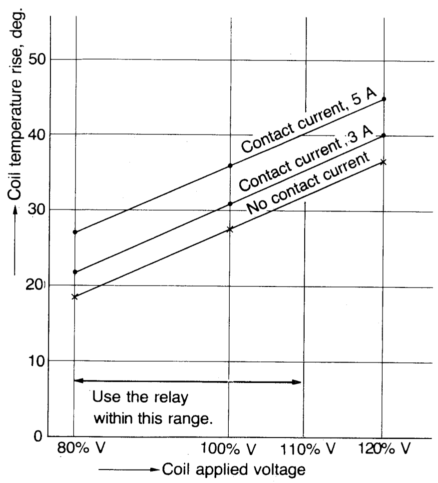
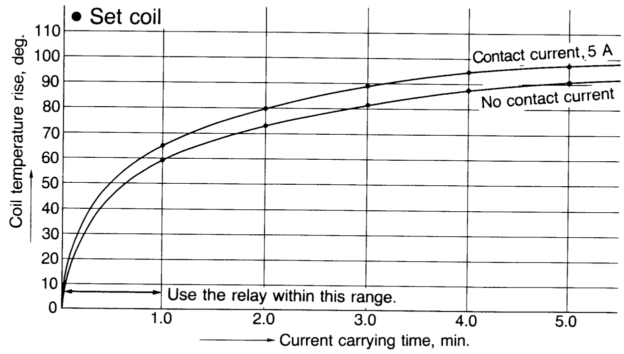


Fig. 2 **Coil temperature rise** (2 coil latching)



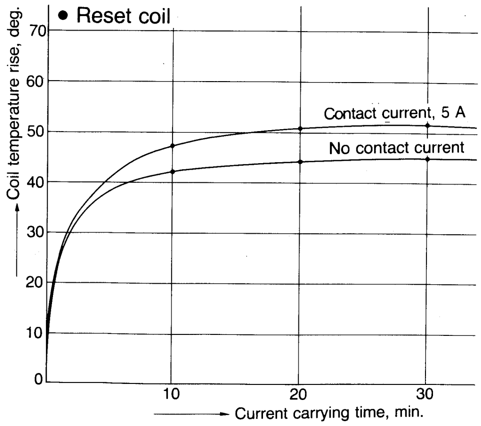


Fig. 3 **Operate time** (Single side stable, single contact)

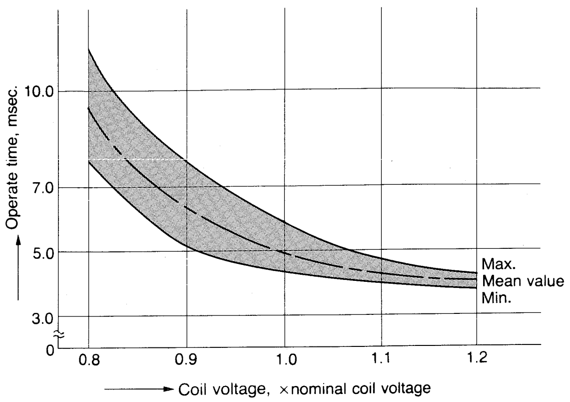


Fig. 4 **Release time** (Single side stable, single contact)

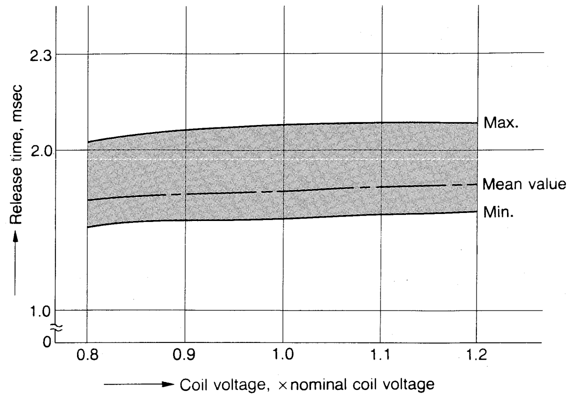


Fig. 5 **Set time** (2 coil latching, single contact)

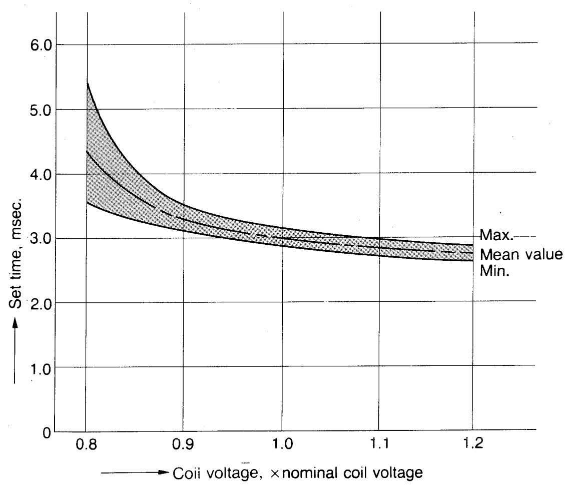


Fig. 6 **Reset time** (2 coil latching, single contact)

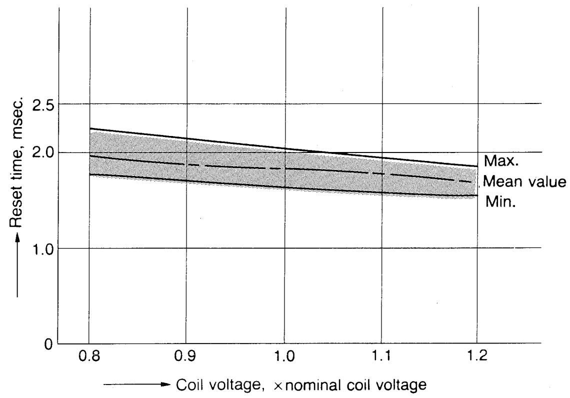


Fig. 7 **Rate of change of pick-up and drop-out voltage**
(Single side stable)

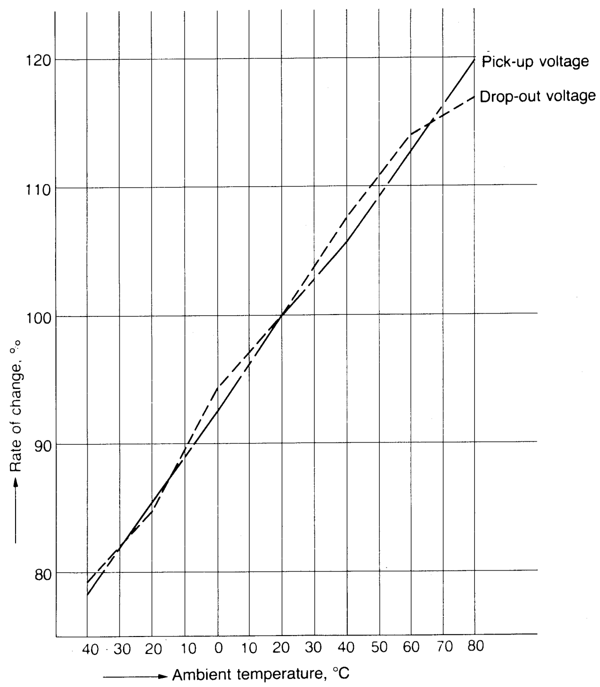
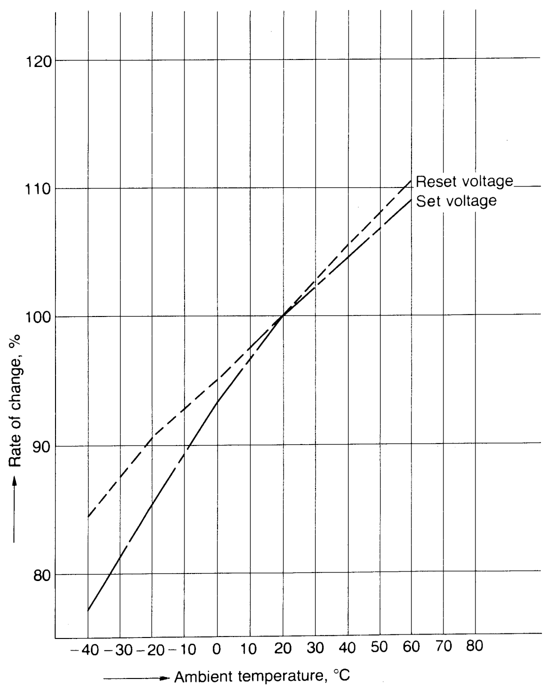


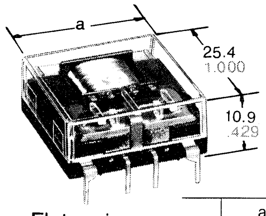
Fig. 8 **Rate of change of pick-up and drop-out voltage**
(2 coil latching)



NAiS

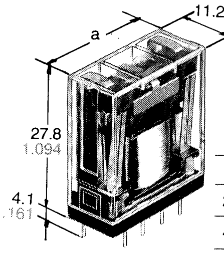
FLAT/VERTICAL TYPE HIGH POWER BIFURCATED CONTACT RELAY

NC-RELAYS



Flat series

	a
2C	25.4 1.000
4C	38.1 1.500



NCED Amber Relays

mm inch

	a
2C	25.4 1.000
4C	38.1 1.500

Vertical series (PC board)

UL File No.: E43028; CSA File No.: LR26550; VDE File No.: VDE-Reg.-Nr. 859

- **Space saver—Flat series and vertical series**
- **High contact reliability due to bifurcated contacts— 2C: 5 A 250 V AC, 4C: 5 A 125 V AC, 4 A 250 V AC**
- **Latching types available**
- **Low operating power—2C: 200 mW, 4C: 400 mW (Single side stable)**
- **Soldering flux inflow prevented by terminal location**
- **Amber sealed types available**
- **High breakdown voltage for transient protection— 1,000 Vrms between open contacts, contact sets**

SPECIFICATIONS

Contacts

Types		Standard	Amber sealed
Arrangement		2 Form C, 4 Form C	
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		50 mΩ	
Rating (resistive) Max. switching power		(2C) 1,250 VA (4C) 1,000 VA	
Max. switching voltage		250 V AC	
Max. switching current		5 A	
Max. switching carrying current		5 A	
Min. switching power		100 µA 1 V DC	
UL/CSA rating		(2C) 5A 125, 250V AC (4C) 5A 125V, 4A 250VAC 1/10 HP 125, 250 V AC 5A 30V DC	(2C) 3 A 250 V AC (4C) 2 A 250 V AC 1/20 HP 125, 250 V AC 5 A 30 V DC
VDE rating		3 A 125 V AC (cos φ = 1.0) 0.5 A 125 V AC (cos φ = 0.4) 3 A 30 V DC	1 A 125 V AC (cos φ = 1.0) 0.5 A 125 V AC (cos φ = 0.4) 1 A 30 V DC
Expected life (minimum)	2C	10^5 at 5 A 250 V AC 5×10^5 at 5 A 30 V DC	10^5 at 3 A 250 V AC 10^5 at 5 A 125 V AC 5×10^5 at 5 A 30 VDC
	4C	10^5 at 4 A 250 V AC 10^5 at 5 A 125 V AC 5×10^5 at 5 A 30 V DC	10^5 at 2 A 250 V AC 10^4 at 4 A 125 V AC 5×10^5 at 5 A 30 VDC
Contact material		Gold-clad silver nickel	

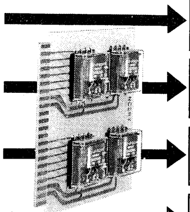
Coil (polarized) (at 25°C 77°F)

Minimum operating power	up to 48 V DC	110 V DC
2C single side stable	Approx. 200 mW	500 mW
4C single side stable	Approx. 400 mW	500 mW
Nominal operating power 2C single side stable	Approx. 360 mW	900 mW
4C single side stable	Approx. 720 mW	900 mW
Minimum set and reset power 2C 2 coil latching	Approx. 450 mW	
4C 2 coil latching	Approx. 900 mW	
Nominal set and reset power 2C 2 coil latching	Approx. 800 mW	
4C 2 coil latching	Approx. 1,600 mW	

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

Max. operating speed			50 cps.
Operate time			Approx. 10 msec.
Release time			Approx. 5 msec.
Operate time (latching)			Approx. 10 msec.
Reset time (latching)			Approx. 5 msec.
Initial breakdown voltage	Between open contacts, contact sets		1,000 Vrms
	Between contacts and coil		2,000 Vrms
Initial insulation resistance			100 MΩ at 500 V DC
Temperature rise			Max. 65 deg.
Ambient temperature	Single side stable	2C	up to 48 V DC: −40°C to +70°C −40°F to +158°F 110 V DC: −40°C to +55°C −40°F to +131°F
		4C	−40°C to +55°C −40°F to +131°F
	2 coil latching		−40°C to +55°C −40°F to +131°F
Shock resistance	Functional		10 G
	Destructive		100 G
Vibration resistance	Functional		6 G, 10 to 55 Hz at double amplitude of 1 mm
	Destructive		12 G, 10 to 55 Hz at double amplitude of 2 mm
Unit weight			2C/Approx. 16 g .56 oz 4C/Approx. 18 g .63 oz

TYPICAL APPLICATIONS Use NC Relays for power control up to 5 A or—



Where equipment size limits relay mounting space	Tape recorders, temperature controls, video tape recorders
Where transistor drive demands high sensitivity, low power	Telecommunications equipment, measuring controls, copiers
Where relays must be mounted on P/C boards at minimum cost and labor	Data processing equipment, computer peripherals
Where low-capacity power requires low power dissipation	Automatic vendors, copiers, automatic storage controls, N.C. machines

ORDERING INFORMATION

Ex. NC 2 E D— J P L2 — DC12V

Contact arrangement	Type classification	Housing	Mounting method	Operating function	Coil voltage
2: 2 Form C 4: 4 Form C	Nil: Standard type E: Amber sealed type	Nil: Vertical series J: Flat series	Nil: Plug-in P: PC board terminal	Nil: Single side stable L2: 2 coil latching	DC 5, 6, 12, 24, 48, 110 V

Remarks: 1. Flat series are available in PC board terminal types only.
2. For VDE recognized types, add suffix VDE.
3. Standard packing Carton: 20 pcs. Case: 200 pcs.

TYPE AND COIL DATA at 20°C 68°F (Coil data for Amber sealed types are same as those for standard types.)

2 Form C Single side stable

Flat series	Vertical series		Coil volatge, V DC			Coil	Nominal
PC board terminal	Plug-in	PC board terminal	Pick-up voltage (max.)	Drop-out voltage (min.)	Maximum allowable voltage	resistance, Ω (±10%)	operating power, mW
NC2D-JP-DC5V	NC2D-DC5V	NC2D-P-DC5V	4.0	0.5	6.75	69.4	
NC2D-JP-DC6V	NC2D-DC6V	NC2D-P-DC6V	4.8	0.6	8.1	100	
NC2D-JP-DC12V	NC2D-DC12V	NC2D-P-DC12V	9.6	1.2	16.2	400	360
NC2D-JP-DC24V	NC2D-DC24V	NC2D-P-DC24V	19.2	2.4	32.4	1,600	
NC2D-JP-DC48V	NC2D-DC48V	NC2D-P-DC48V	38.4	4.8	64.8	6,400	
NC2D-JP-DC110V	NC2D-DC110V	NC2D-P-DC110V	88.0	11.0	121	13,500	900

2 Form C 2 coil latching

Flat series	Vertical series		Coil voltage, V DC			Coil	Nominal
PC board terminal	Plug-in	PC board terminal	Set voltage (max.)	Reset voltage (max.)	Maximum allowable voltage	resistance, Ω (±10%)	operating power, mW
NC2D-JPL2-DC5V	NC2D-L2-DC5V	NC2D-PL2-DC5V	4.0	4.0	5.5	31.3	
NC2D-JPL2-DC6V	NC2D-L2-DC6V	NC2D-PL2-DC6V	4.8	4.8	6.6	45.0	
NC2D-JPL2-DC12V	NC2D-L2-DC12V	NC2D-PL2-DC12V	9.6	9.6	13.2	180	800
NC2D-JPL2-DC24V	NC2D-L2-DC24V	NC2D-PL2-DC24V	19.2	19.2	26.4	720	
NC2D-JPL2-DC48V	NC2D-L2-DC48V	NC2D-PL2-DC48V	38.4	38.4	52.8	2,880	
NC2D-JPL2-DC110V	NC2D-L2-DC110V	NC2D-PL2-DC110V	88.0	88.0	121	15,100	

4 Form C Single side stable

Flat series	Vertical series		Coil voltage, V DC			Coil	Nominal
PC board terminal	Plug-in	PC board terminal	Pick-up voltage (max.)	Drop-out voltage (min.)	Maximum allowable voltage	resistance, Ω (±10%)	operating power, mW
NC4D-JP-DC5V	NC4D-DC5V	NC4D-P-DC5V	4.0	0.5	5.5	34.7	
NC4D-JP-DC6V	NC4D-DC6V	NC4D-P-DC6V	4.8	0.6	6.6	50	
NC4D-JP-DC12V	NC4D-DC12V	NC4D-P-DC12V	9.6	1.2	13.2	200	720
NC4D-JP-DC24V	NC4D-DC24V	NC4D-P-DC24V	19.2	2.4	26.4	800	
NC4D-JP-DC48V	NC4D-DC48V	NC4D-P-DC48V	38.4	4.8	52.8	3,200	
NC4D-JP-DC110V	NC4D-DC110V	NC4D-P-DC110V	88.0	11.0	121	13,500	900

4 Form C 2 coil latching

Flat series	Vertical series		Coil voltage, V DC (See Note 1)			Coil	Nominal
PC board terminal	Plug-in	PC board terminal	Set voltage (max.)	Reset voltage (max.)	Maximum allowable voltage	resistance, Ω (±10%)	operating power, mW
NC4D-JPL2-DC5V	NC4D-L2-DC5V	NC4D-PL2-DC5V	4.0	4.0	5.5	15.6	
NC4D-JPL2-DC6V	NC4D-L2-DC6V	NC4D-PL2-DC6V	4.8	4.8	6.6	22.5	
NC4D-JPL2-DC12V	NC4D-L2-DC12V	NC4D-PL2-DC12V	9.6	9.6	13.2	90	1,600
NC4D-JPL2-DC24V	NC4D-L2-DC24V	NC4D-PL2-DC24V	19.2	19.2	26.4	360	
NC4D-JPL2-DC48V	NC4D-L2-DC48V	NC4D-PL2-DC48V	38.4	38.4	52.8	1,440	
NC4D-JPL2-DC110V	NC4D-L2-DC110V	NC4D-PL2-DC110V	88.0	88.0	121	7,560	

Notes:
1. Two coil latching relay 4C series are for intermittent operation only. Power should be applied to coil continuously for no more than two minutes.
2. Coil resistance is the measured value at a coil temperature of 20°C. Compensate coil resistance by plus or minus 0.4% for each degree (°C) of coil temperature change.
3. "Maximum allowable voltage" is that value at maximum contact rating and maximum ambient temperature. The graph shown in the data describes the inter-relationship; care should be taken to prevent the total of ambient temperature and the coil temperature rise from exceeding 120°C.

DIMENSIONS

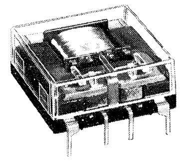
mm inch

Flat series

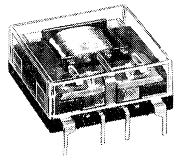
	Dimensions General tolerance: ±0.5 ±.020 Standard type	Amber sealed type	Schematic (Top view)	PC board pattern (Copper-side view) Tolerance: ±0.1 ±.004

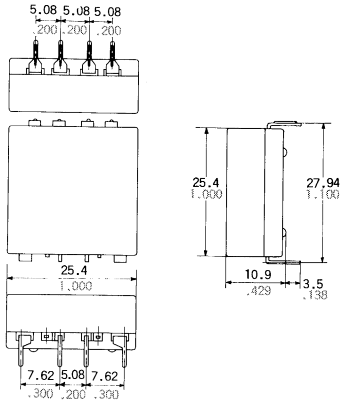
2C Single side stable

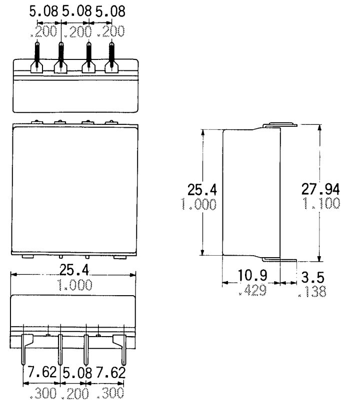
(NC2D-JP)

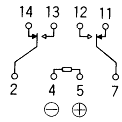


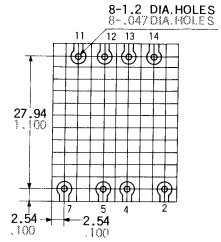
(NC2ED-JP)







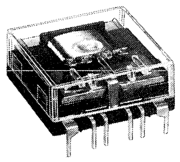




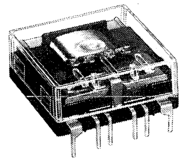
Deenergized position

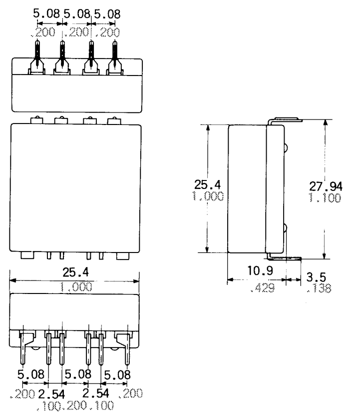
2C 2 coil latching

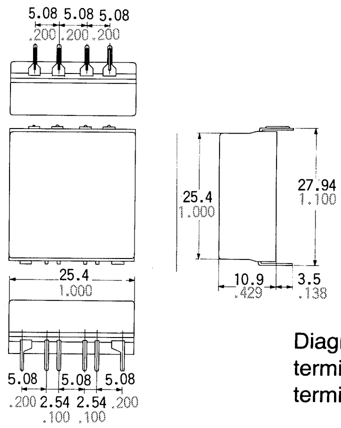
(NC2D-JPL2)

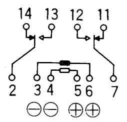


(NC2ED-JPL2)









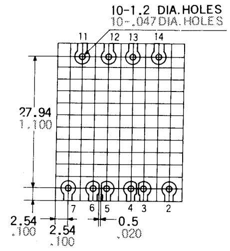
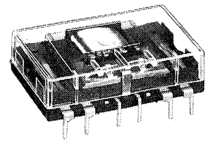


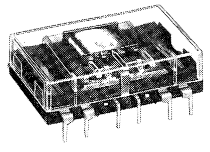
Diagram shows the "reset" position when terminals 3 and 6 are energized. Energize terminals 4 and 5 to transfer contacts.

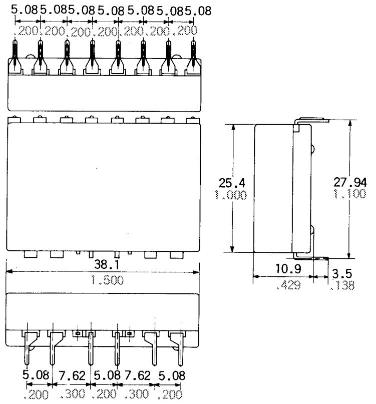
4C single side stable

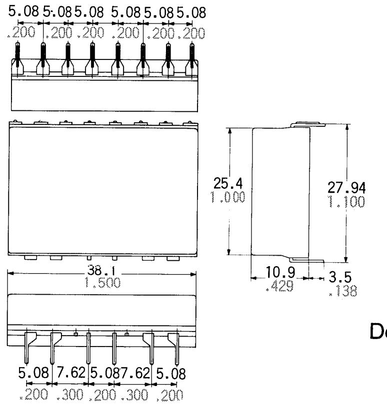
(NC4D-JP)

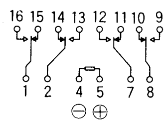


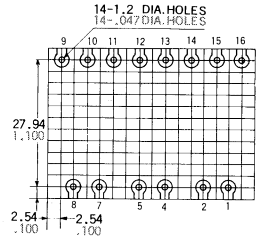
(NC4ED-JP)







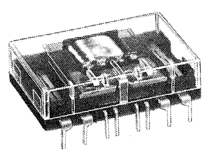




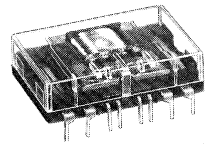
Deenergized position

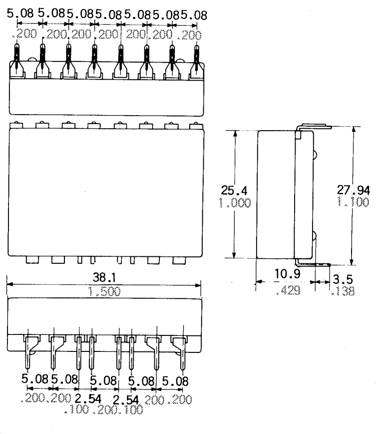
4C 2 coil latching

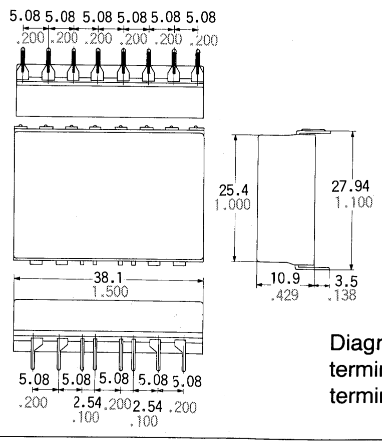
(NC4D-JPL2)

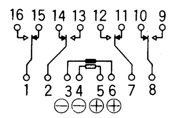


(NC4ED-JPL2)









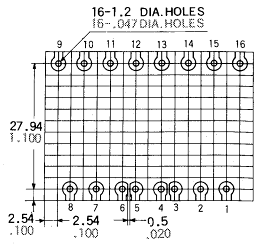
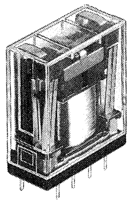


Diagram shows the "reset" position when terminals 3 and 6 are energized. Energize terminals 4 and 5 to transfer contacts.

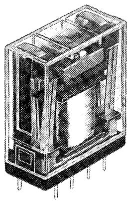
mm inch

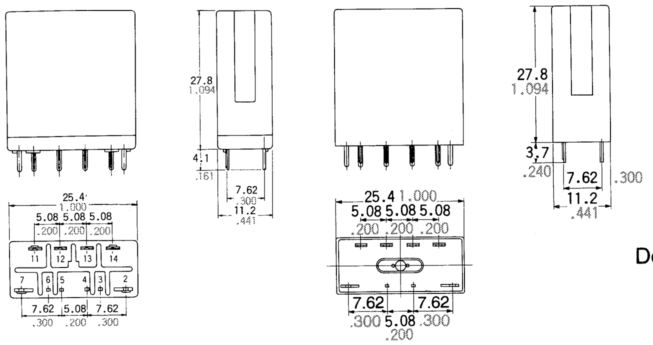
Slim series	PC board series	Dimensions General tolerance: ±0.5 ±.020 Standard type	Amber sealed type	Schematic (Bottom view)	PC board pattern (Copper-side view) Tolerance: ±0.1 ±.004

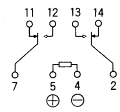
2C Single side stable
(NC2D-P)

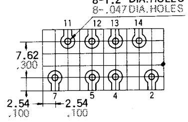


(NC2ED-PL2)



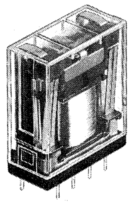




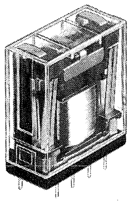


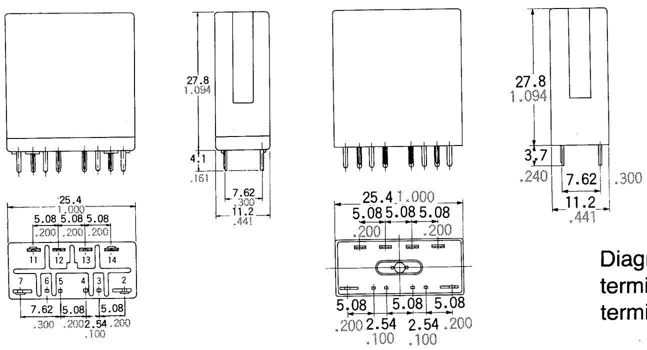
Deenergized position

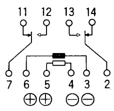
2C 2 coil latching
(NC2D-PL2)



(NC2ED-P)







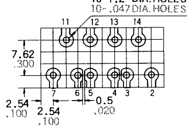
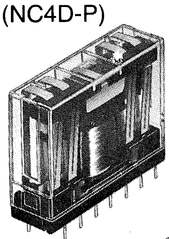
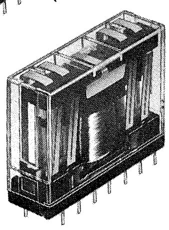


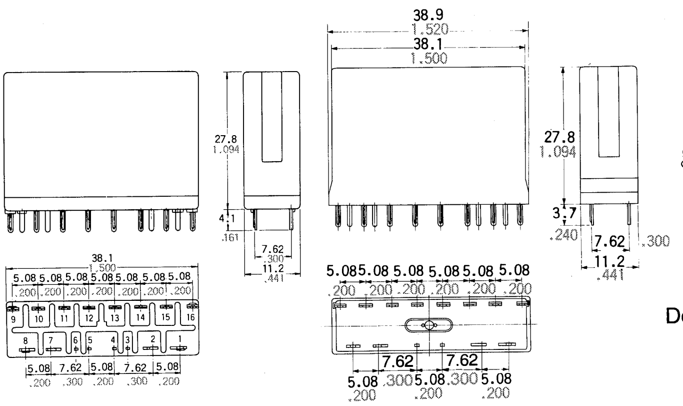
Diagram shows the "reset" position when terminals 3 and 6 are energized. Energize terminals 4 and 5 to transfer contacts.

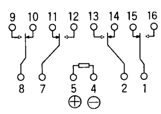
4C Single side stable
(NC4D-P)

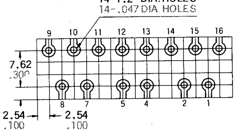


(NC4ED-P)



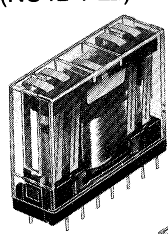




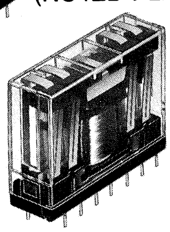


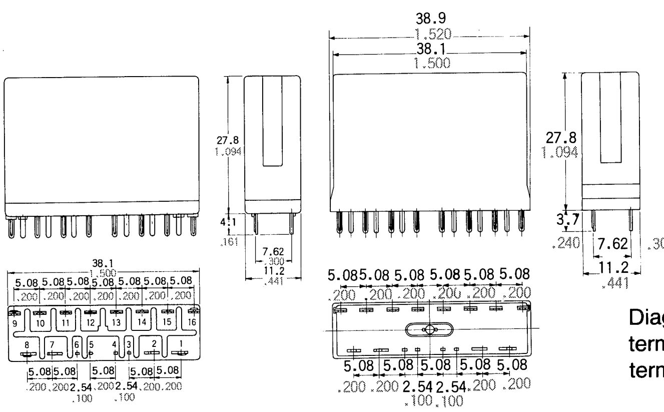
Deenergized position

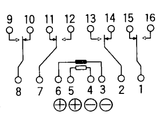
4C 2 coil latching
(NC4D-PL2)



(NC4ED-PL2)







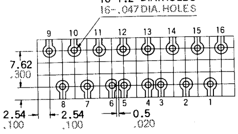


Diagram shows the "reset" position when terminals 3 and 6 are energized. Energize terminals 4 and 5 to transfer contacts.

mm inch

Slim series

Plug-in series

Dimensions

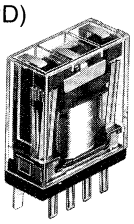
General tolerance: ±0.5 ±.020

Standard type | Amber sealed type

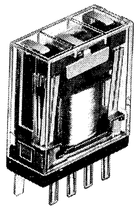
Schematic (Bottom view)

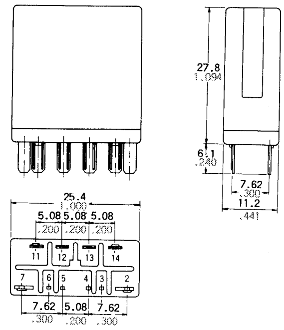
2C Single side stable

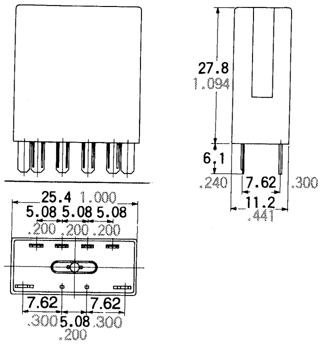
(NC2D)

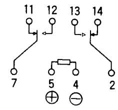


(NC2ED)





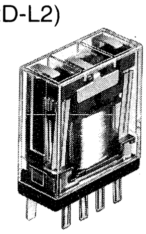




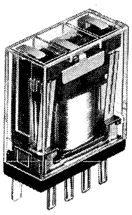
Deenergized position

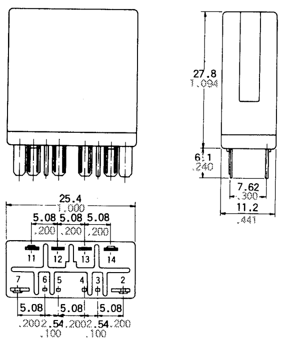
2C 2 coil latching

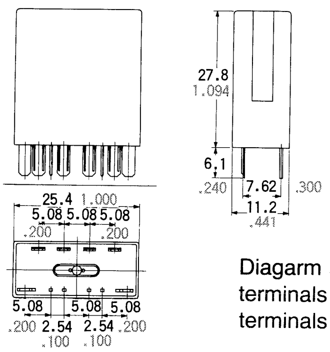
(NC2D-L2)

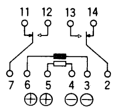


(NC2ED-L2)





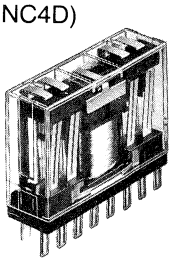




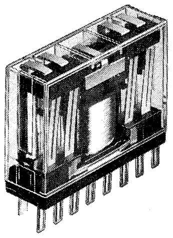
Diagarm shows the "reset" position when terminals 3 and 6 are energized. Energize terminals 4 and 5 to transfer contacts.

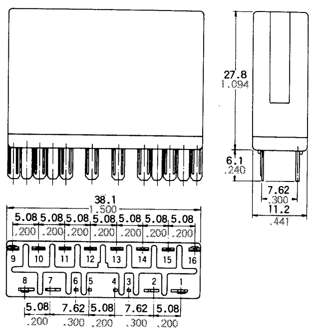
4C Single side stable

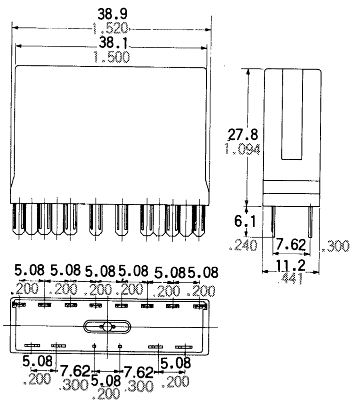
(NC4D)

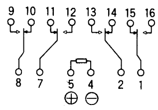


(NC4ED-L2)





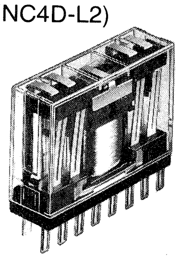




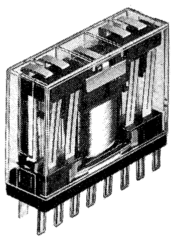
Deenergized position

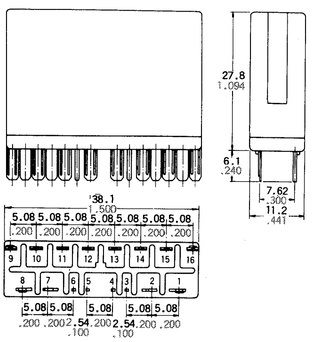
4C 2 coil latching

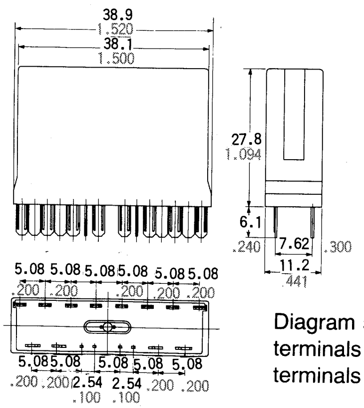
(NC4D-L2)



(NC4ED-L2)







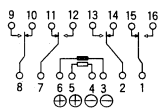


Diagram shows the "reset" position when terminals 3 and 6 are energized. Energize terminals 4 and 5 to transfer contacts.

SCHEMATIC

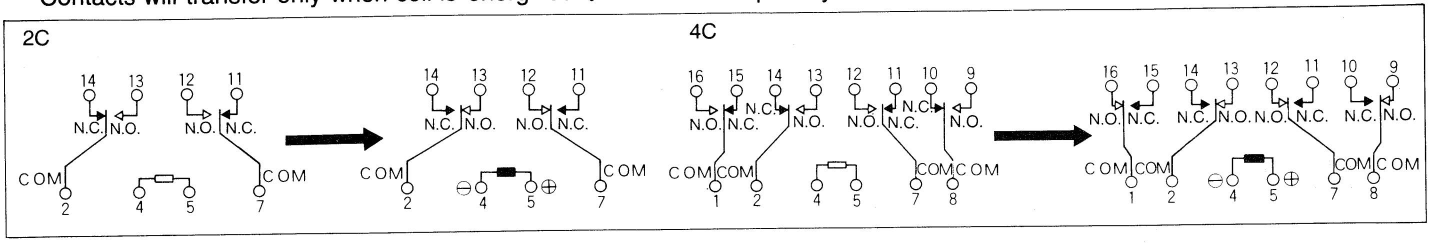
—Energize relays only in the polarities shown—

□ deenergized coil

■ energized coil

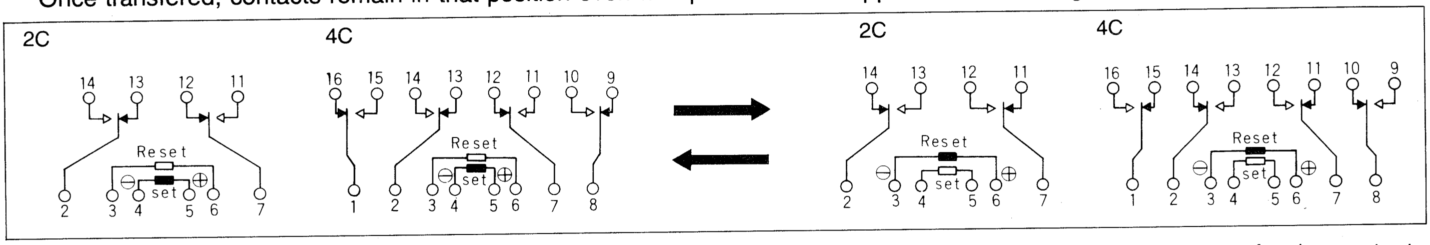
1. Single side stable

Same operation as conventional magnetic relays.
Contacts will transfer only when coil is energized under indicated polarity.



2. 2 coil latching

Contacts will transfer only when coil is energized under indicated polarity.
Once transfered, contacts remain in that position even with power off until opposite coil is energized at indicated polarity.

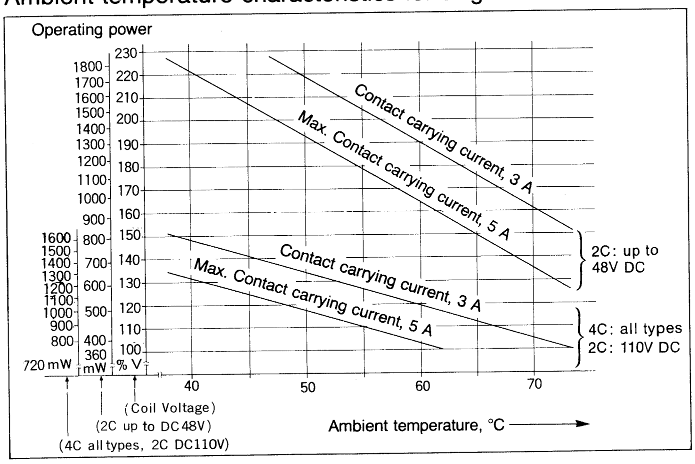


Diagrams show the "set" position when terminals 4(−) and 5(+) are energized. When the coil current is switched off, these contacts remain in "make" position. Energize terminals 3(−) and 6(+) to transfer the contacts.

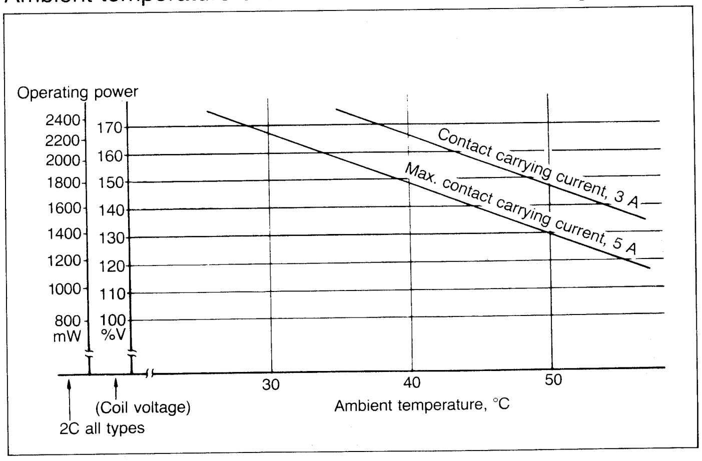
Diagrams show the "reset" position when terminals 3(−) and 6(+) are energized. Energize terminals 4(−) and 5(+) to transfer the contacts.

DATA

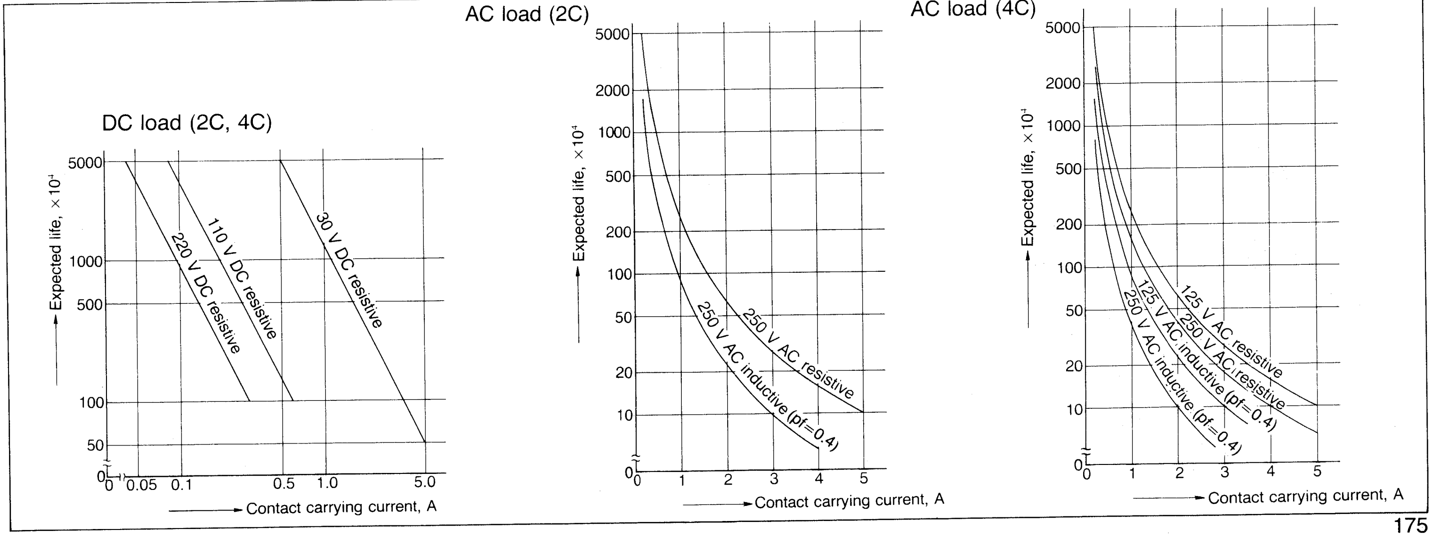
Ambient temperature characteristics for single side stable



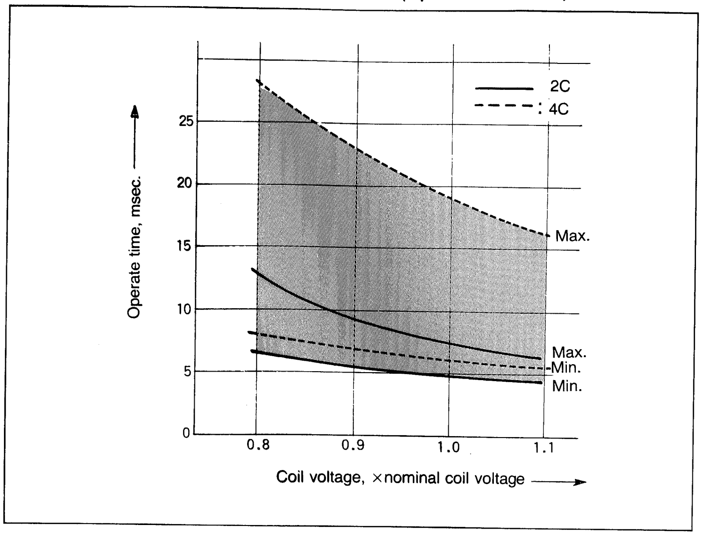
Ambient temperature characteristics for 2 coil lathcing (2C only)



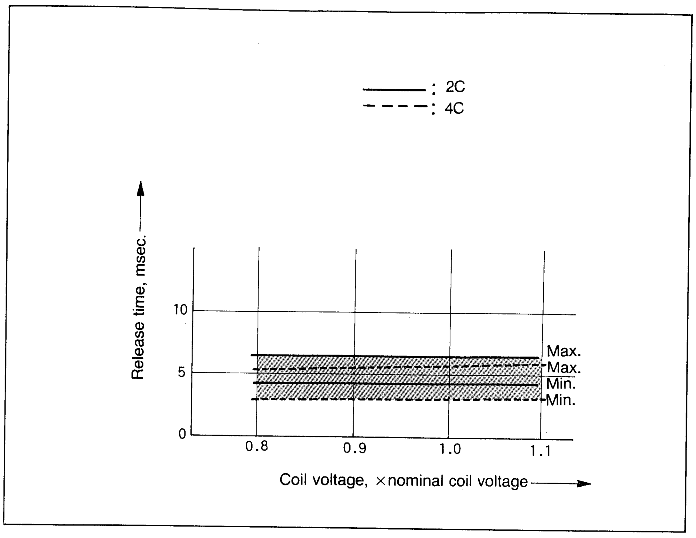
Life curve



Operate time for single side stable (up to 48 V DC)

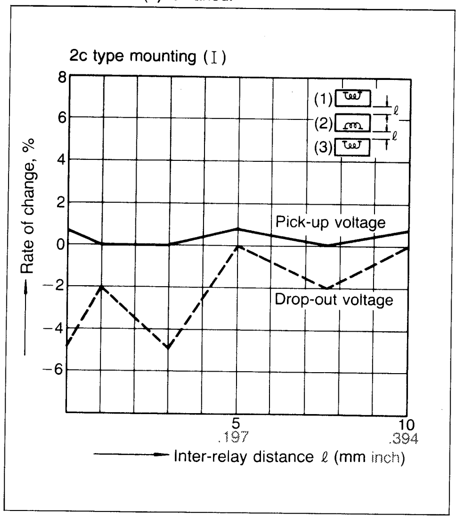


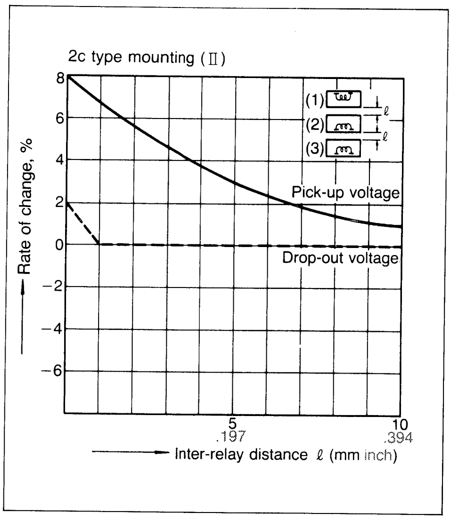
Release time for single side stable

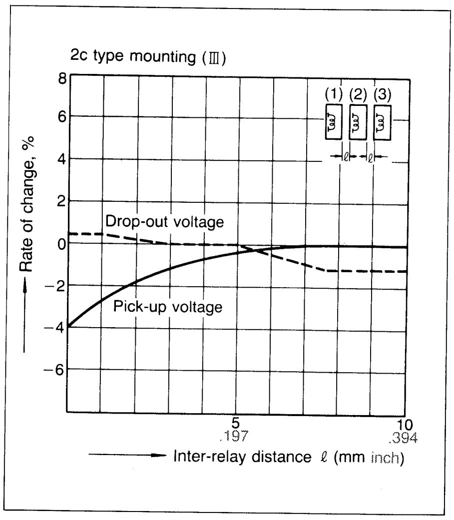


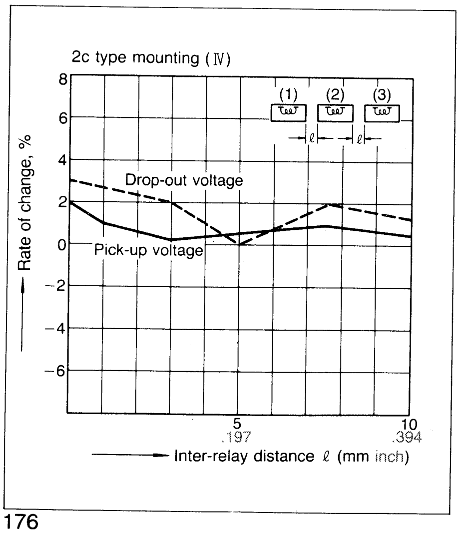
Rate of change in pick-up/drop-out voltage against distance when closely arranged

Samples: NC2D-P-24VDC (2c slim single side stable)
3 pcs. each for Nos. (1), (2) and (3)
Condition: Rated voltage is applied to both Nos. (1) and (3) relays, and pick-up/drop-out voltage of No. 2 are measured as the distance (ℓ) is varied.



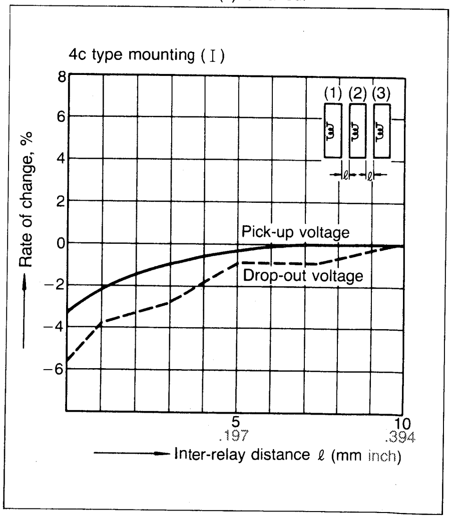


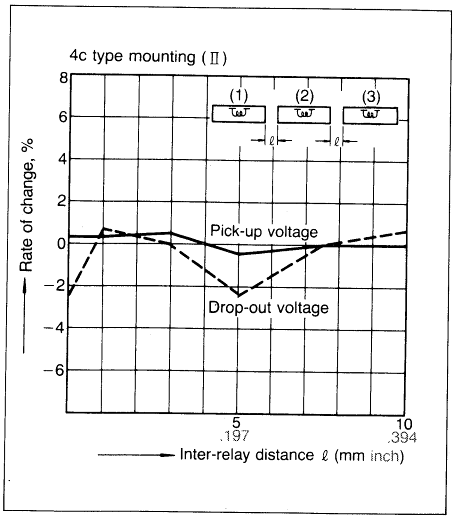


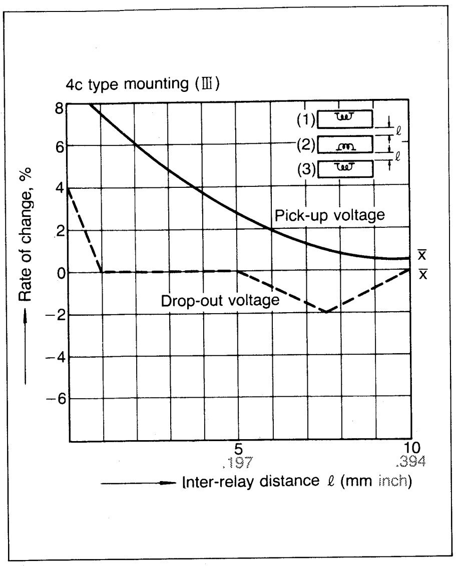


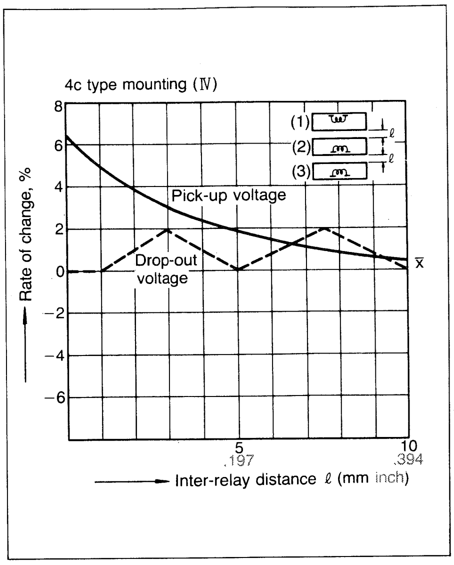
Rate of change in pick-up/drop-out voltage againt distance when closely arranged

Samples: NC2D-P-24VDC (4c slim single side stable)
3 pcs. each for Nos. (1), (2) and (3)
Condition: Rated voltage is applied to both Nos. (1) and (3) relays, and the pick-up/drop-out voltages of No. 2 are measured as the distance (ℓ) is varied.

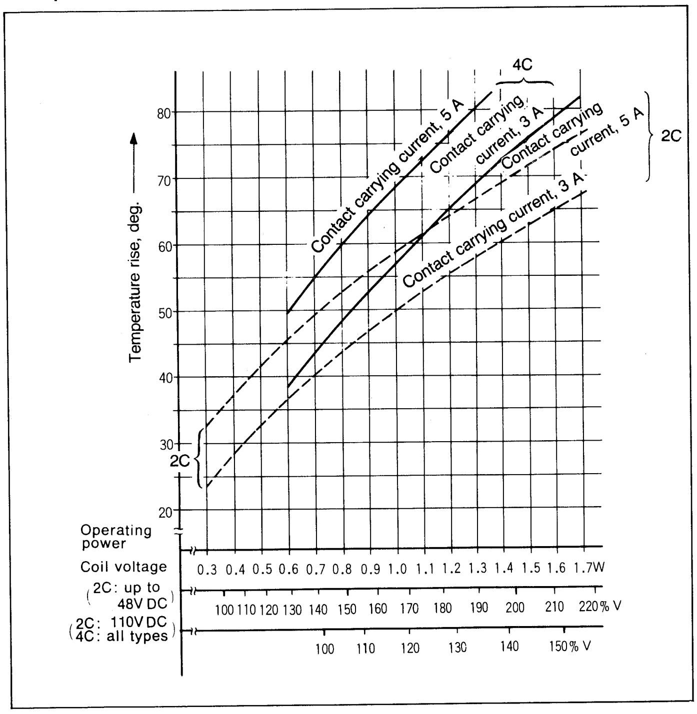




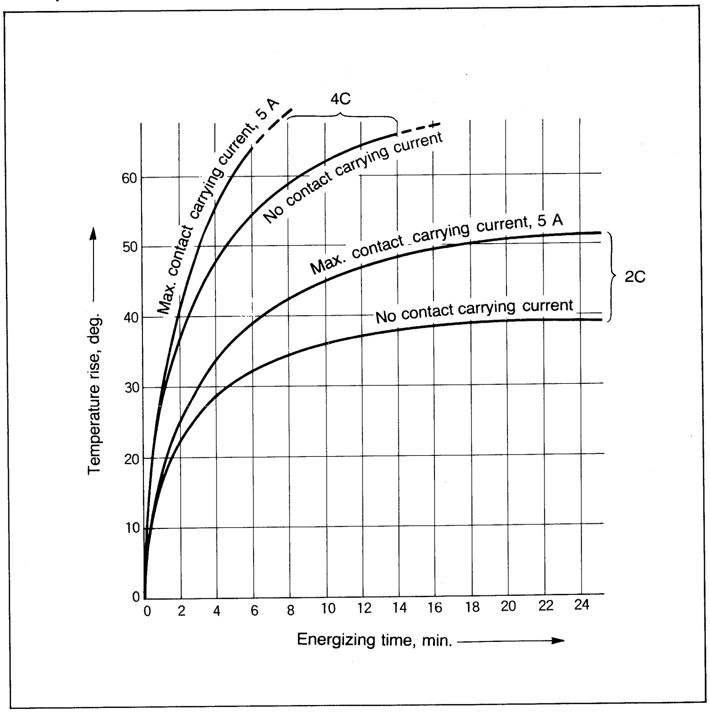




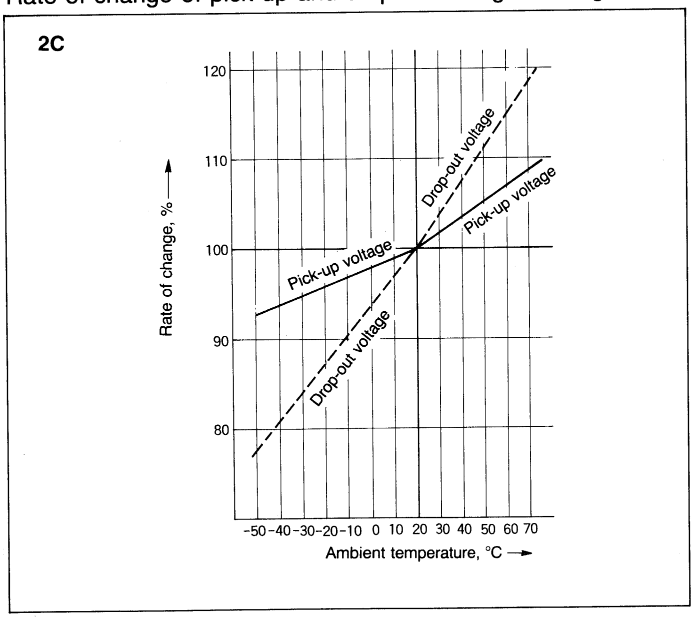
Temperature rise characteristics for single side stable

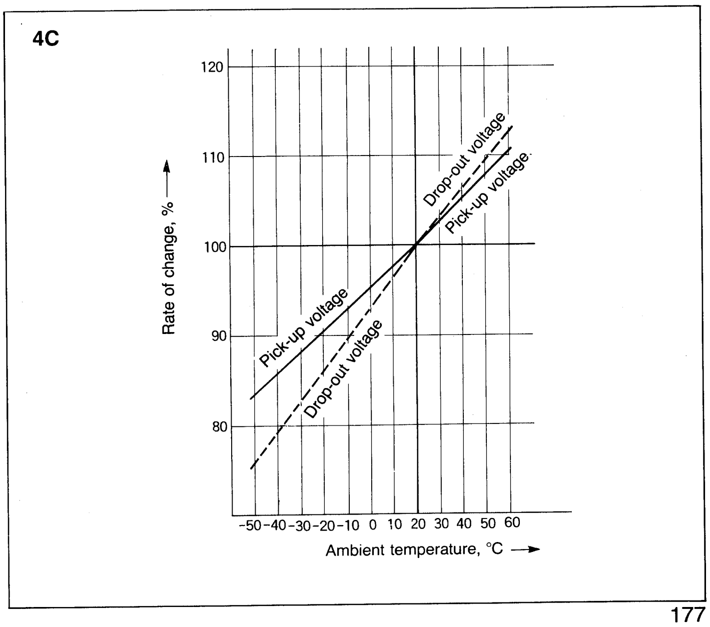


Temperature rise characteristics for 2 coil latching

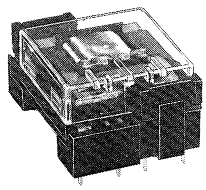
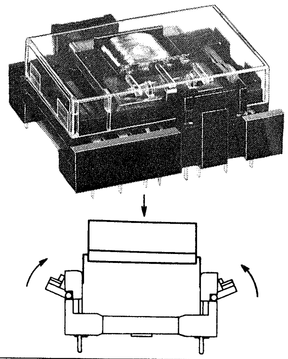
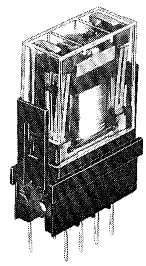
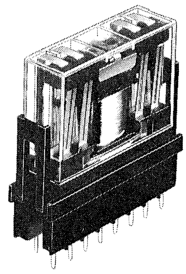


Rate of change of pick-up and drop-out voltage for single side stable





ACCESSORIES

			
NC2 Flat	**NC4 Flat**	**NC2 Slim**	**NC4 Slim**

Sockets incorporate a spring clip at each end permitting single "snap-in" attachment to chassis or panels—no screws necessary. Relays are held firmly in the socket by clips integrally molded into the socket.

TYPES

For Flat series

Part No.	Terminals	Mating relay
NC2-JPS	P/C board	NC2D-JP
NC4-JPS	P/C board	NC4D-JP
NC2-JPL2S	P/C board	NC2D-JPL2
NC4-JPL2S	P/C board	NC4D-JPL2

Standard packing:
Carton: 20 pieces
Case: 200 pieces

For Slim series

Part No.	Terminals	Mating relay
NC2-PS	P/C board	NC2D-P
NC4-PS	P/C board	NC4D-P
NC2-SS	Solder	NC2D
NC4-SS	Solder	NC4D
NC2-L2PS	P/C board	NC2D-PL2
NC4-L2PS	P/C board	NC4D-PL2
NC4-L2SS	Solder	NC2D-L2
NC4-L2ss	Solder	NC4D-L2

SPECIFICATIONS

Maximum continuous current	Flat series: 5 A 250 V AC Slim series: 5 A 250 V AC
Initial breakdown voltage	2,000 V AC (Except for coil-coil of L2 types: 1,500 V AC)
Initial insulation resistance	100 MΩ at 500 V DC
Heat resistance	150°C (302°F) for one hour

Caution: Do not insert or remove relays while in the energized condition.

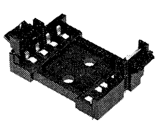
DIMENSIONS

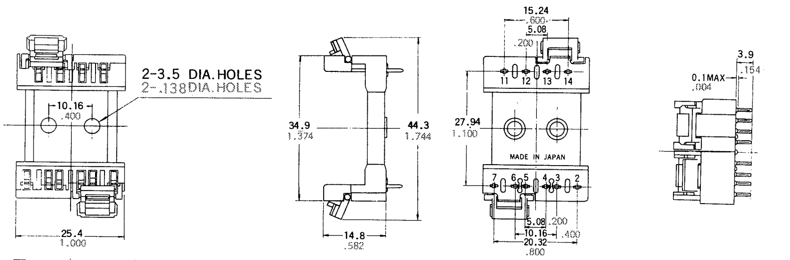
Flat series

General tolerance: ±0.5 ±.020

mm inch

NC2-JPS
NC2-JPL2S

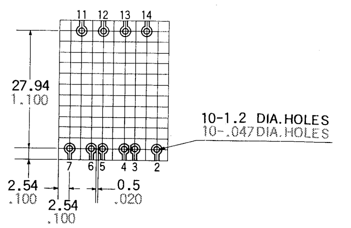




Terminals 3 and 6 excluded for NC2-JPS.

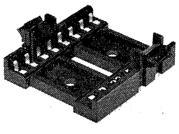
Terminal portion

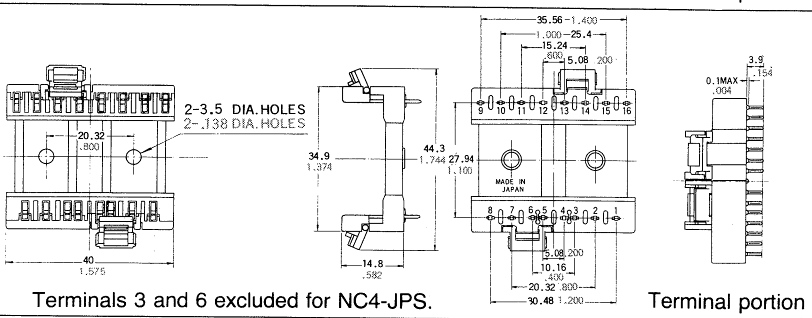
PC board pattern
(copper-side view)



Tolerance: ±0.1 ±.004

NC4-JPS
NC4-JPL2S

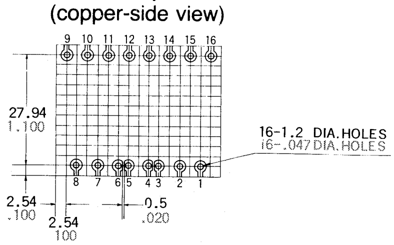




Terminals 3 and 6 excluded for NC4-JPS.

Terminal portion

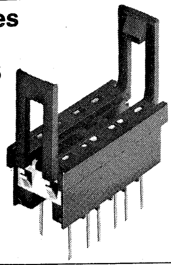
PC board pattern
(copper-side view)

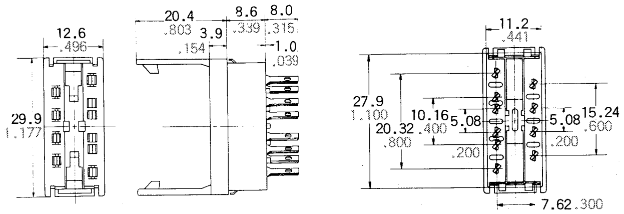


Tolerance: ±0.1 ±.004

mm inch

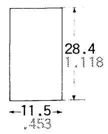
Slim series
NC2-SS
NC2-L2SS





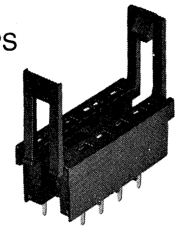
Terminals 3 and 6 excluded for NC2-SS.

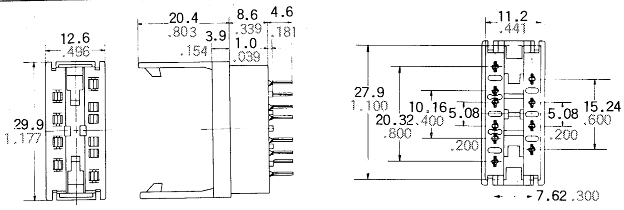
Chassis cutout



Chassis thickness range: 1.0 to 2.0
.039 .079

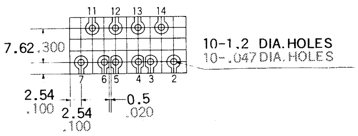
NC2-PS
NC2-L2PS





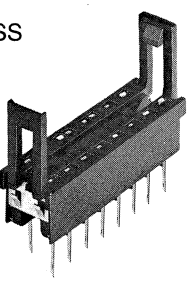
Terminal 3 and 6 excluded for NC2-PS.

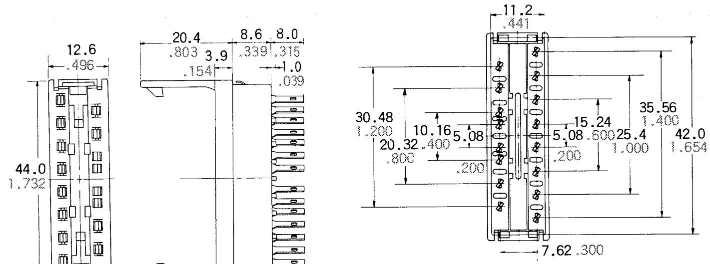
PC board pattern
(copper-side view)



Tolerance: ±0.1 ±.004

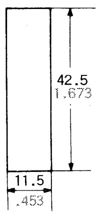
NC4-SS
NC4-L2SS





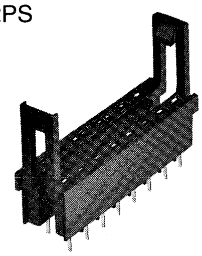
Terminals 3 and 6 excluded for NC4-SS.

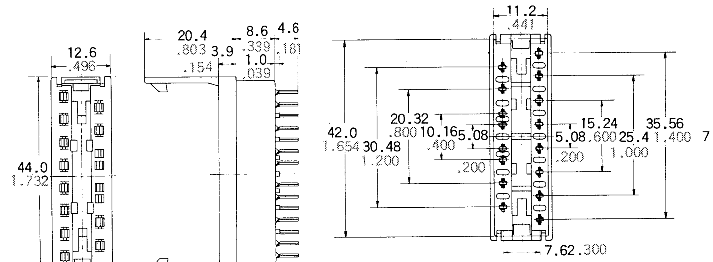
Chassis cutout



Chassis thickness range: 1.0 to 2.
.039 .079

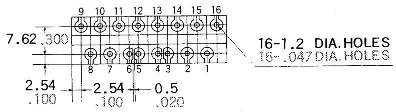
NC4-PS
NC4-L2PS





Terminals 3 and 6 excluded for NC4-PS.

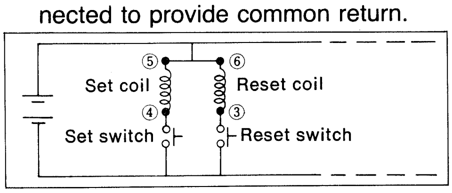
PC board pattern
(cooper-side view)



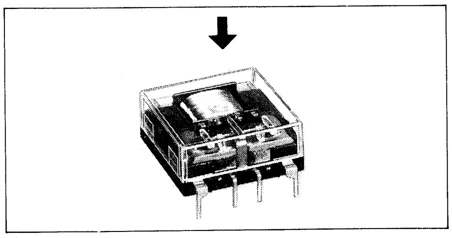
Tolerance: ±0.1 ±.004

NOTES

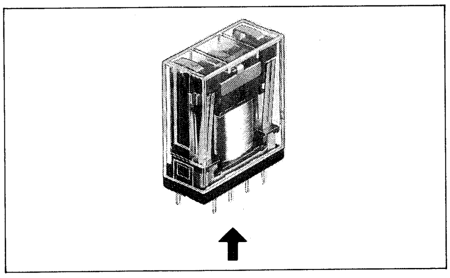
1. To maintain insulation between coils of 2 coil latching series, terminals 5 and 6 for flat series, and terminals 3 and 4 for slim series should be connected to provide common return.



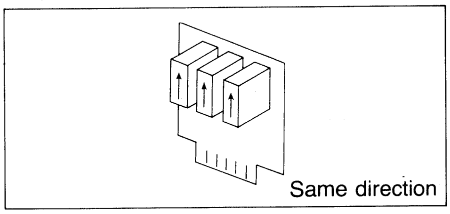
2. 2 coil latching series 4C are for intermittent operation only. Power should be applied to coils continuously for no more than two minutes.
3. When designing printed circuit board patterns, note that:
   (1) "Top View" wiring diagram is indicated for the Flat series because terminals can be seen from above.



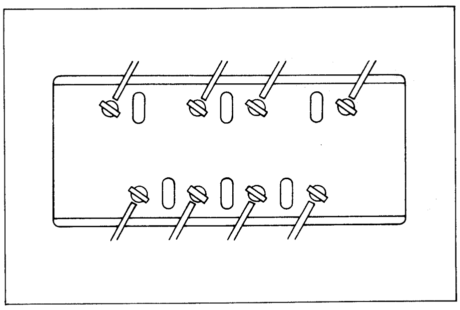
   (2) "Bottom View" wiring diagram is indicated for the Slim series because terminals can not be seen from above.



4. When using slim series in close proximity, mount all relays facing the same direction.
   Different mounting directions may cause change in the relay characteristics because NC relays are polarized.



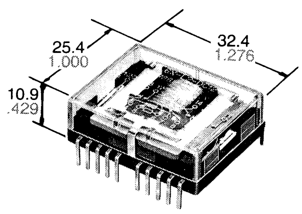
5. Sockets
   (1) When PC board series are used with socket, do not apply loads exceeding 3 A.
   (2) Soldering should be done quickly to avoid damaging the thermoplastic body.
   (3) Insulation will be optimum when wire connections are soldered as shown with all slim sockets.

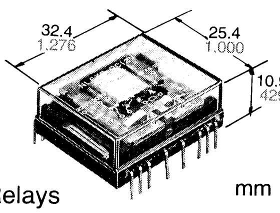


NAiS

6PDT FLATPACK 2AMP DIL RELAY

NL-RELAYS





NLE Amber Relays

mm inch

UL File No.: E43149 **VDE File No.: VDE-Reg.-Nr. 2769**
CSA File No.: LR26550

- **Space saving dimensions—25.4 mm×32.4 mm×10.9 mm**
  1.000 1.276 0.429
- **Latching types available**
- **Low operating power—400 mW (single side stable) Transistor compatible**
- **High breakdown voltage for transient protection—1,000Vrms between open contacts, contact sets, and 1,500 V FCC surge between open contacts**
- **Soldering flux inflow completely prevented**
- **Amber sealed types available**

SPECIFICATIONS

Contacts

Arrangement*1	6 Form C
Contact material	gold-clad silver*2
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	100 mΩ
Rating (resistive) Max. switching power	60 VA, 60 W
Max. switching voltage	110 V AC, DC
Max. switching current	2 A
UL/CSA rating	0.5 A 125 V AC, 2 A 30 V DC
VDE rating*3	1 A 65 V AC, 2 A 30 V DC
Expected life (min. operations) Mechanical	5×10^7
Electrical, resistive 2A 30 VDC	5×10^5

Coil (polarized) (at 25°C 77°F)

Minimum operating power	Approx. 400 mW
Nominal operating power	up to 60 V DC: Approx. 720 mW 110 V DC: Approx. 900 mW
Minimum set and reset power	Approx. 900 mW
Nominal set and reset power	Approx. 1,600 mW

*1 MBB contact types also available: 2MBB, 4MBB & 6MBB

Characteristics

Maximum operating speed	50 cps
Operate time	Approx. 10 msec.
Release time	Approx. 5 msec.
Initial insulation resistance	more than 100 MΩ at 500 V DC
Breakdown voltage Between open contacts, contact sets Between contacts and coil	 1,000 Vrms 2,000 Vrms
Temperature rise (at nominal voltage)	Max. 65 deg.
Ambient temperature	−40°C to +55°C −40°F to +131°F
Shock resistance	15 G
Vibration resistance	6 G, 10 to 55 Hz at double amplitude of 1 mm
Weight	Approx. 17 grams .60 oz

*2 Gold capped silver-palladium contact also available
*3 NLE Amber Relays are not approved by VDE.

TYPICAL APPLICATIONS

Telecommunications, security equipment, detection systems.

ORDERING INFORMATION

Ex. NL [6] [E] X— [6M] — [L2] — [DC48V] — [1]

Contact arrangement	Classification of type	MBB function	Operating function	Coil voltage	Contact material
6: 6 Form C	Nil: Standard type E: Amber sealed type	Nil: 6 Form C 2M: 2 Form D 4 Form C 4M: 4 Form D 2 Form C 6M: 6 Form D	Nil: Single side stable L2: 2 coil latching	DC: 5, 6, 12, 24, 48, 60, 110 V	Nil: Gold-clad silver 1: Gold-cap over silver palladium

(Notes) 1. For UL/CSA or VDE recognized types, add suffix UL/CSA or VDE.
2. Standard packing Carton: 20 pcs. Case: 200 pcs.

TYPES AND COIL DATA at 20°C 68°F

Single side stable

Part No.	Coil voltage, V DC			Coil resistance, Ω (±10%)	Nominal operating power, mW
	Pick-up (max.)	Drop-out (min.)	Maximum allowable		
NL6X-DC5V NL6EX-DC5V	4.0	0.5	6.0	34.7	720
NL6X-DC6V NL6EX-DC6V	4.8	0.6	7.2	50	
NL6X-DC12V NL6EX-DC12V	9.6	1.2	14.4	200	
NL6X-DC24V NL6EX-DC24V	19.2	2.4	28.8	800	
NL6X-DC48V NL6EX-DC48V	38.4	4.8	57.6	3,200	
NL6X-DC60V NL6EX-DC60V	48	6.0	72	5,000	
NL6X-DC110V NL6EX-DC110V	88	11.0	132	13,467	898

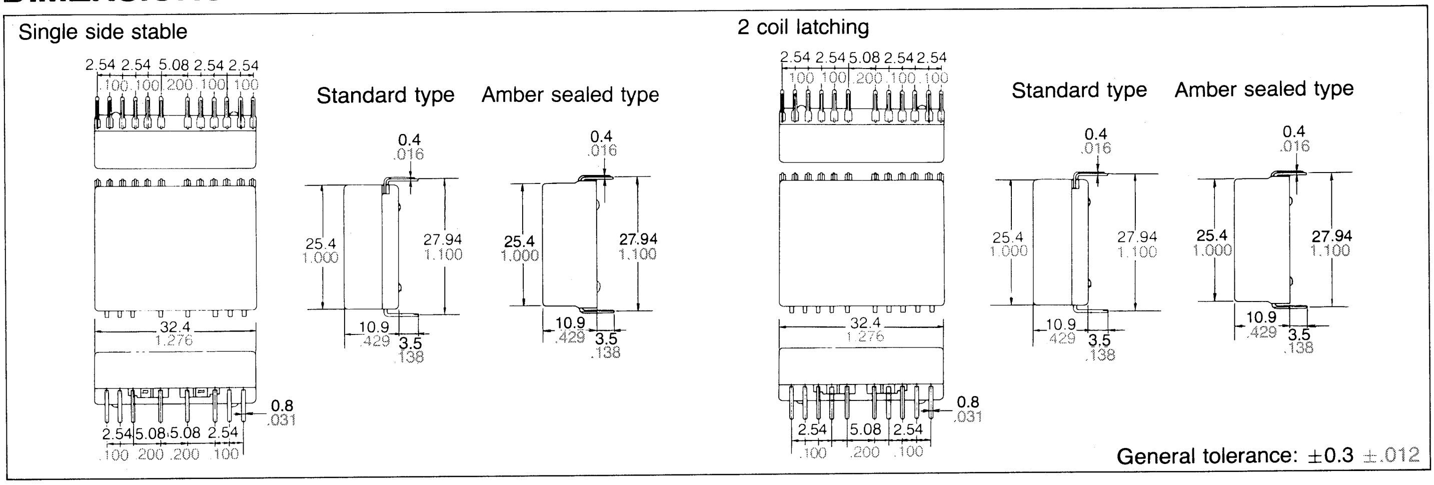
2 coil latching

Part No.	Coil voltage,* V DC			Coil resistance, Ω (±10%)	Nominal operating power, mW
	Set (max.)	Reset (max.)	Maximum allowable		
NL6X-L2-DC5V NL6EX-L2-DC5V	4.0	4.0	5.5	15.6	1,600
NL6X-L2-DC6V NL6EX-L2-DC6V	4.8	4.8	6.6	22.5	
NL6X-L2-DC12V NL6EX-L2-DC12V	9.6	9.6	13.2	90	
NL6X-L2-DC24V NL6EX-L2-DC24V	19.2	19.2	26.4	360	
NL6X-L2-DC48V NL6EX-L2-DC48V	38.4	38.4	52.8	1,440	
NL6X-L2-DC60V NL6EX-L2-DC60V	48	6.0	66	2,250	
NL6X-L2-DC110V NL6EX-L2-DC110V	88	11.0	121	7,563	

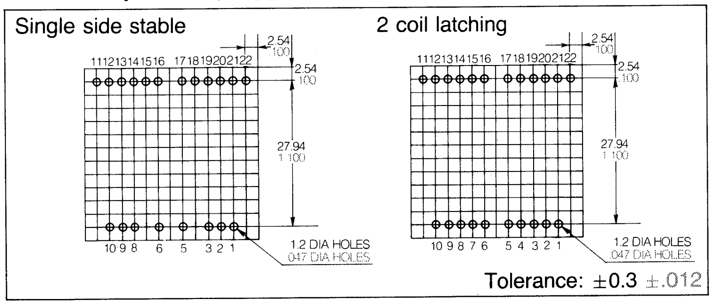
*See NOTES 2.

DIMENSIONS

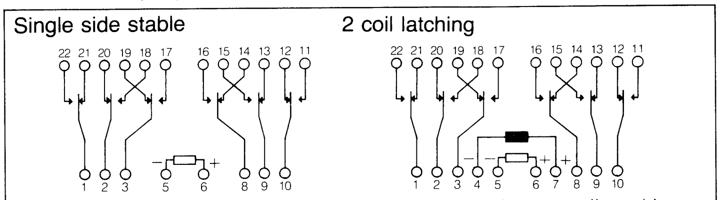
mm inch



PC board pattern (Copper-side view)



Schematic (Top view)

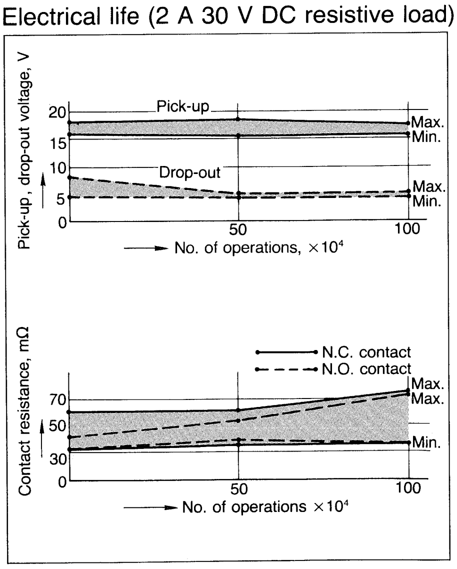


Deenergized position

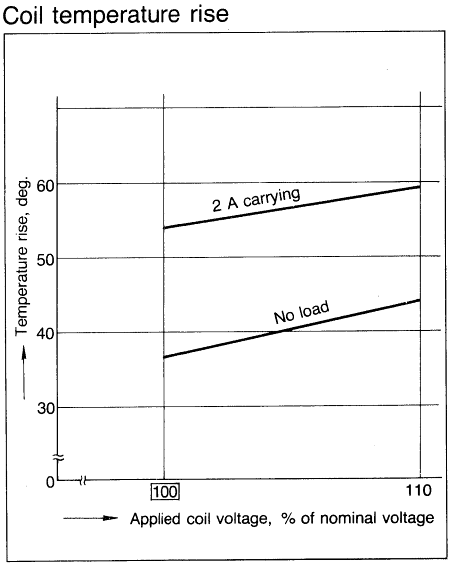
Diagram shows the "reset" position when terminals 4 and 7 are energized. Energize terminals 5 and 6 to transfer contacts.

DATA

Electrical life (2 A 30 V DC resistive load)



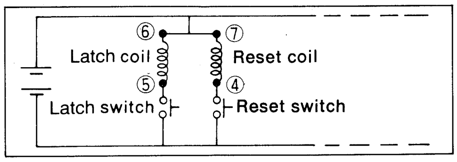
Coil temperature rise



NOTES

On two coil latching relays

1. To maintain insulation between coils, terminals 6 and 7 should be connected to provide common return.



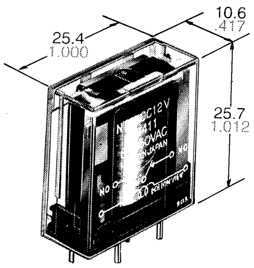
2. Two coil latching relays are for intermittent operation only. Power should be applied to coils for no more than two minutes; continuous operation may burn out the coils.
3. Position of MBB contacts
   2M (2 Form D 4 Form C):
   1-21-22, 10-11-12
   4M (4 Form D 2 Form C):
   1-21-22, 2-20-18, 9-13-15, 10-11-12

NAiS

VERTICAL TYPE POWER RELAYS

NT-RELAYS

UL File No.: E43149
CSA File No.: LR26550 SEV



mm inch

- **High contact capacity of 8 A 250 VAC**
- **Sensitive: 140 mW (DC) low operating power**
- **Compact size, small mounting space for high density packaging**
- **Long life, Mechanical: more than 10^7 operations**
  Electrical (8A 250 VAC resistive): more than 10^5 operations
- **Standard terminal grid, .100 inch (2.54 mm)**
- **AC coils available**

SPECIFICATIONS

Contacts

Arrangement	1 Form C
Initial contact pressure	Approx. 12 g 0.4 oz
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	50 mΩ
Contact material	Gold-clad silver nickel
Rating (resistive load)	
Maximum switching power	2,000 VA (AC), 192 W (DC)
Maximum switching voltage	250 V AC, 30 V DC
Maximum switching current	
UL/CSA rating	8 A, 1/10 HP 125, 250 V AC 5 A 30 V DC
Expected life (min. operations)	
Mechanical	10^7
Electrical (resistive)	
8 A 250 V AC, 8 A 24 V DC	10^5
5 A 250 V AC, 5 A 24 V DC	2×10^5

Coil

Nominal operating power	Approx. 290 mW (DC), Approx. 0.75 VA (AC)
Minimum operating power	Approx. 140 mW (DC), Approx. 0.48 VA (AC)

Characteristics

Maximum operating speed	20 cps. (DC), 5 cps. (AC)
Operate time	Approx. 10 msec.
Release time	Approx. 5 msec. (DC), Approx. 20 msec. (AC)
Initial insulation resistance	100 MΩ at 500 V DC
Breakdown voltage	
Between open contacts	1,000 Vrms
Between contacts and coil	2,000 Vrms
Temperature rise	Max. 65 deg.
Ambient temperature	−55 to +55°C −67 to +131°F
Shock resistance	Functional: 10 G Destructive: 100 G
Vibration resistance	Functional: 10 G, 10 to 55 Hz at 1.6 mm double amplitude Destructive: 12 G, 10 to 55 Hz at 2 mm double amplitude
Unit weight	Approx. 14 g .49 oz

TYPICAL APPLICATIONS

Electronic computer and peripheral equipment, data transmission equipment, security equipment, communication equipment, various machine tools, etc.

ORDERING INFORMATION

Ex. NT [1] —— [DC12V]

Contact arrangement	Coil voltage
1: 1 Form C	DC 5, 6, 12, 24 V AC 6, 12, 24, 48, 115 V

(Notes) 1. For UL/CSA recognized types, add suffix UL/CSA.
2. Standard packing Carton: 50 pcs., Case: 500 pcs.

TYPES AND COIL DATA

DC coils at 20°C 68°F

Part No.	Nominal voltage	Pick-up voltage, (max.)	Drop-out voltage, (min.)	Coil resistance	Nominal operating current	Nominal operating power	Maximum allowable voltage
NT1-DC5V	5 VDC	3.5 V DC	0.5 V DC	100 Ω	50 mA	0.25 W	10 VDC
NT1-DC6V	6	4.2	0.6	130	46	0.28	12
NT1-DC12V	12	8.4	1.2	500	24	0.29	24
NT1-DC24V	24	16.8	2.4	2,000	12	0.29	48

AC coils (50/60 Hz)

Part No.	Nominal voltage	Pick-up voltage, (max.)	Drop-out voltage, (min.)	Coil resistance	Nominal operating current	Nominal operating power	Maximum allowable voltage
NT1-AC6V	6 V AC	4.8 V AC	1.8 V AC	—	124 mA*	0.75 VA*	6.6 V AC
NT1-AC12V	12	9.6	3.6	—	62*	0.75*	13.2
NT1-AC24V	24	19.2	7.2	—	31*	0.75*	26.4
NT1-AC48V	48	38.4	14.4	—	15.6*	0.75*	52.8
NT1-AC115V	115	92.0	34.5	—	6.5*	0.75*	126.5

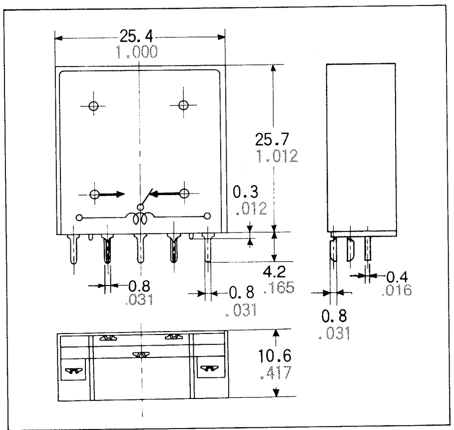
*Value for AC (60 Hz)

Note:

1. The range of coil current is ±15% for AC (60 Hz), ±10% for DC (20°C).
2. Each coil resistance of the DC types is the measured value at the coil temperature of 20°C. Compensate coil resistance by plus or minus 0.4% for each °C of coil temperature change.

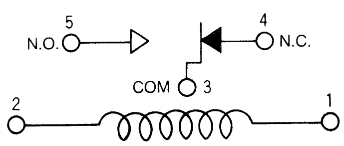
DIMENSIONS

mm inch

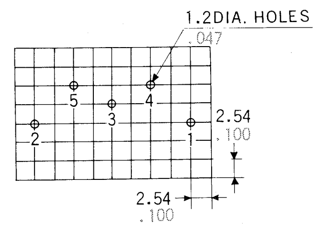


General tolerance: ±0.1 ±.004

Schematic (Bottom view)



PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

DATA

Fig. 1 Operate and Release time (AC types)

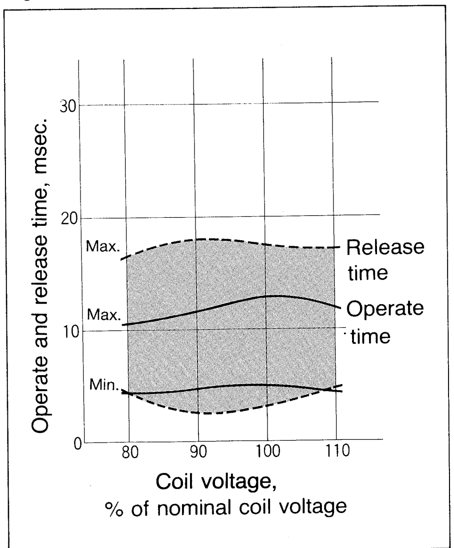


Fig. 2 Operate and Release time (DC types)

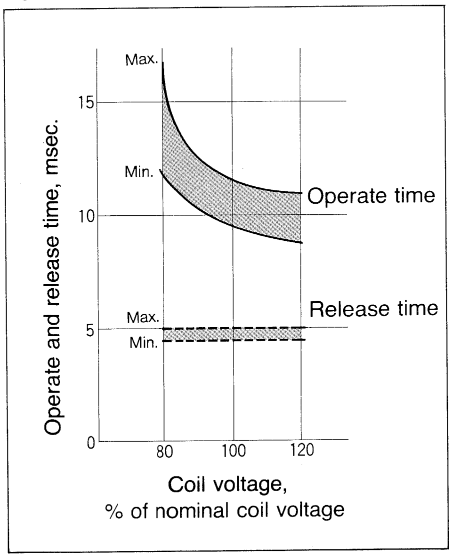
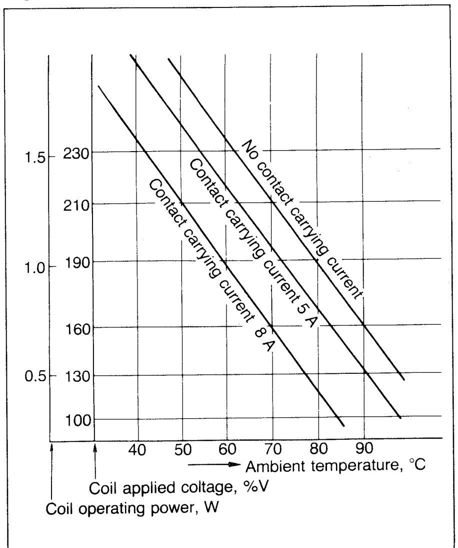
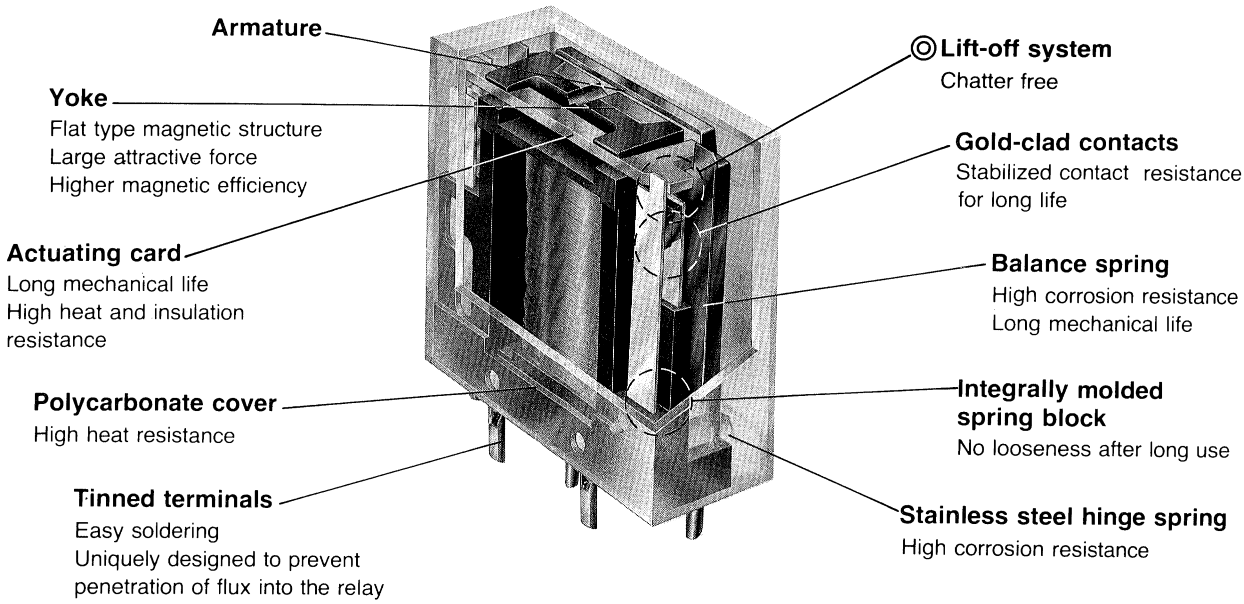


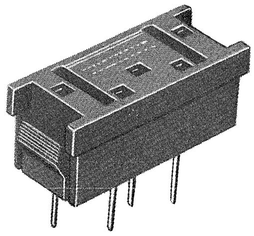
Fig. 3 Coil temperature rise

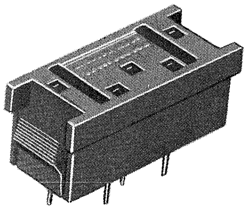


CONSTRUCTION



ACCESSORIES


NT-SS
Solder terminal socket


NT-PS
PC board terminal socket

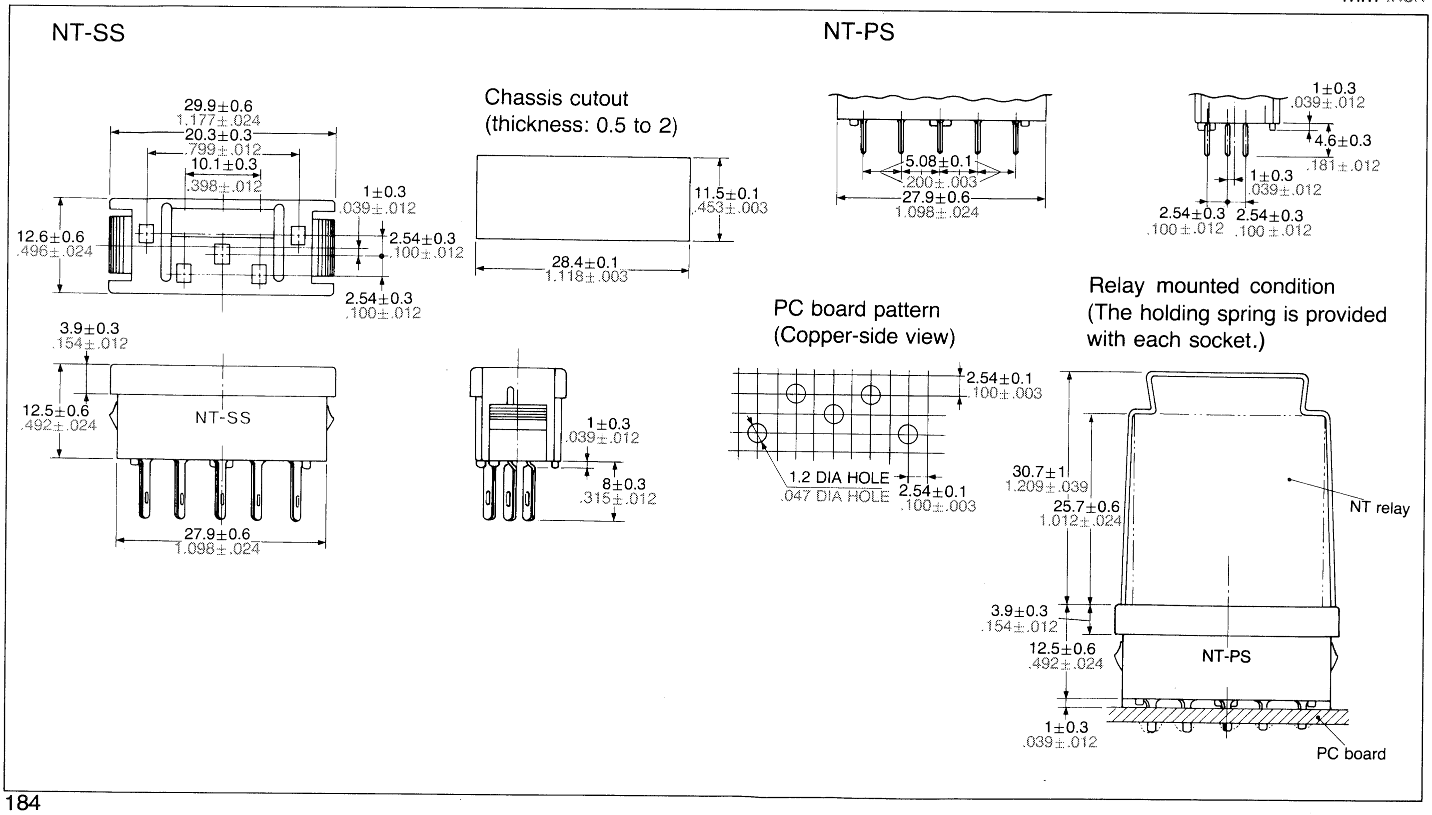
Specifications

Breakdown voltage	2,000 Vrms between terminals
Insulation resistance	More than 100 MΩ between terminals
Heat resistance	150±3°C (302±5.4°F) for 1 hr
Maximum continuous current	5 A

(Notes)
1. Do not insert or remove relays while in the energized condition.
2. Standard packing Carton : 50 pcs., Case: 200 pcs.

Dimensions

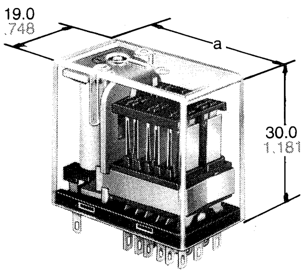
mm inch



NAiS

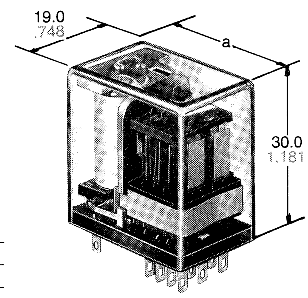
UNIQUELY DESIGNED RELAY WITH HIGH SENSITIVITY

K-RELAYS



	a
K2, K2E	23.6 .929
K4, K4E	29.4 1.157
K6, K6E	34.8 1.370

KE Amber Rleays



mm inch

UL File No.: E43149
CSA File No.: LR26550
VDE File No.: VDE-Reg.-Nr. 2738

- **100 times more reliable than similar designs**
- **Extra long life—Mechanical: more than 10^8 operations**
  Electrical (1 A 30 W): more than 10^7 operations
- **Exclusive magnetic system**
- **Versatile range for all applications**
- **Amber sealed types available**

SPECIFICATIONS

Contacts

Types	Standard types (K2, K2P, K4, K4P, K6, K6P)	AC types (K2A, K2AP)	Power types (K2F)
Arrangements	2, 4, 6C	2C	2C
Rating, resistive load			
Max. switching power	50 W, 120 VA		100 W, 500 VA
Max. voltage	220 V AC, DC		250 V AC, DC
Max. current	2 A		5 A
UL, CSA rating	1 A 125 V AC, 2 A 28 V DC		5A1/20HP125VAC,3A28VDC
VDE rating	1 A 60 V AC		
Expected life (min. operation)			
Mechanical	10^8		10^8
Electrical, 1 A 100 V AC	10^6		—
Electrical, 4 A 100 V AC	—		10^5
Contact material	(Bifurcated contacts)		(Single contacts)
Movable contact	Gold-clad silver		Silver
Stationary contact	Silver (Gold-clad silver available)		Silver
Initial contact resistance (By voltage drop 6 V DC 1 A)			
Maximum	50 mΩ		50 mΩ
Typical	25 mΩ		25 mΩ
Capacitance			
Contact/Contact	3 pF		3 pF
Contact/Ground	5 pF		5 pF

Note: Plastic sealed types are available. See following pages.

Characteristics (at 20°C 68°F, 50% R.H.; sea level)

Max. operating speed	50 cps.
Operate time	Approx. 15 msec.
Release time	Approx. 5 msec.
Bounce time (at nominal voltage)	Approx. 1 msec.
Breakdown voltage	
Between open contacts, contact sets	750 Vrms
Between live parts and ground	750 Vrms
Between contacts and coils	750 Vrms
Initial insulation resistance	1,000 MΩ at 500 V DC
Ambient temperature	
K2, K4 series	−40 to +80°C −40 to +176°F
K6 series	−40 to +60°C −40 to +140°F
Shock resistance	10 G
Vibration resistance	10 G, 10 to 55 Hz at double amplitude of 1.6 mm
Unit weight (approx.)	K2: 23 g 0.8 oz K4: 27 g 1.0 oz K6: 30 g 1.1 oz

Coil

Types	Standard DC types High sensitivity/Standard types (K2, K2P, K4, K4P, K6, K6P)	AC types 50/60 Hz (K2A, K2AP)	Power type (K2F)
Min. operating power (Approx. 20°C)	2C: 100/200 mW 4C: 200/300 mW 6C: —/600 mW	—	300 mW
Nominal operating power (Approx. 20°C)	2C: 200/400 mW 4C: 500/400 mW 6C: —/1,300 mW	0.8/0.7 VA	700 mW
Max. operating power for continuous duty	1.5 W at 40°C	1.0/1.0 VA at 60°C	1.5 W at 40°C

ORDERING INFORMATION

Ex. K 2 A P — 24V — 1

Contact arrangement	Type classification	Terminal	Coil	Sensitivity
2: 2 Form C 4: 4 Form C 6: 6 Form C	Nil: Standard DC relays A: AC relays, K2A F: 5 Amp. contacts, K2F E: Sealed type, K2E, K4E, K6E	Nil: Plug-in, solder terminal P: PC board terminal	(Voltage) 3 to 220 V	Nil: High sensitivity relays 1: Ordinary sensitive relays

(Notes) 1. Other coil and contact specifications are available on request for orders of more than 1,000 pcs.
Please state: Required coil resistance Gold clad/Gold clad contacts
2. For UL/CSA or VDE recognized types, and suffix UL/CSA or VDE.
3. Standard packing Carton 20 pcs. Case: 200 pcs.

TYPICAL APPLICATIONS

General electronic equipment, measuring devices, alarm equipment, remote control devices, office machines, communication equipment, computors, sequence control circuits for general industrial machinery, etc.

TYPES AND COIL DATA

Standard DC K relays

Plug-in and Solder	For PC board	Coil voltage (V) Drop out: 15% of Pickup — Pickup at 20°C	Max. allowable at 40°C	*Coil resistance at 20°C (Ω)	Number of turns	Inductance (H) Armature — Closed	Open
DPDT K2-3V-1	K2P-3V-1	1.8	6.7	28	1,300	0.52	0.26
K2-6V-1	K2P-6V-1	3.9	12.0	110	2,500	2.1	1.1
K2-12V	K2P-12V	8.9	38.0	890	6,600	15	7.5
K2-12V-1	K2P-12V-1	8.0	30.0	530	5,800	11	5.6
K2-24V	K2P-24V	18.0	64.0	3,200	12,200	54	28
K2-24V-1	K2P-24V-1	16.5	47.0	1,700	9,900	35	18
K2-42V-1	K2P-42V-1	30.0	82.0	5,300	16,000	95	48
K2-48V-1	K2P-48V-1	39.0	100.0	7,600	18,000	120	62
K2-60V	K2P-60V	42.0	180.0	16,000	27,000	270	138
K2-110V-1	K2P-110V-1	60.0	180.0	16,000	27,000	270	138
4DPT K4-3V-1	K4P-3V-1	2.3	5.0	18	1,100	0.36	0.18
K4-6V-1	K4P-6V-1	4.2	9.0	58	1,800	1.0	0.5
K4-12V	K4P-12V	7.8	21.0	325	4,300	6.0	3.1
K4-12V-1	K4P-12V-1	8.7	18.5	250	3,800	5.2	2.6
K4-24V	K4P-24V	15.0	40.0	1,100	7,700	20	11
K4-24V-1	K4P-24V-1	18.0	35.0	890	6,600	15	7.5
K4-28V-1	K4P-28V-1	19.0	40.0	1,100	7,700	20	11
K4-48V-1	K4P-48V-1	36.0	64.0	3,200	12,200	54	28
K4-60V	K4P-60V	42.0	110.0	7,600	18,000	120	62
K4-110V-1	K4P-110V-1	85.0	160.0	16,000	27,000	270	138
6DPT K6-6V	K6P-6V	4.2	6.6	28	1,300	0.52	0.26
K6-12V	K6P-12V	8.4	13.2	110	2,500	2.1	1.1
K6-24V	K6P-24V	16.8	26.4	440	4,800	8.3	4.2
K6-48V	K6P-48V	33.6	52.8	1,700	9,900	35	18
K6-60V	K6P-60V	42.0	66.0	2,800	11,000	44	23
K6-110V	K6P-110V	77.0	121.0	10,000	22,000	164	84

*Less than 1,000 Ω: ±10% More than 1,000 Ω: ±15%

AC K relays (50/60 Hz)

UL, CSA, VDE recognized

Plug-in and Solder	For PC board	Coil voltage (V) Dropout: 15% of Pickup — Pickup at 20°C	Max. allowable at 40°C	*Coil resistance at 20°C (Ω)	Number of turns
DPDT K2A-6V	K2AP-6A	4.5/4.8	7.2/7.5	17	1,000
K2A-12V	K2AP-12V	9/9.6	14.4/15	69	1,900
K2A-24V	K2AP-24V	18/19.2	29/30	260	3,900
K2A-48V	K2AP-48V	36/38	58/60	1,100	7,300
K2A-110V	K2AP-110V	82/88	132/140	6,100	16,000
K2A-220V	K2AP-220V	165/176	240/250	22,600	24,000

*Less than 1,000 Ω: ±10% More than 1,000 Ω: ±15%

5 amp. K relays

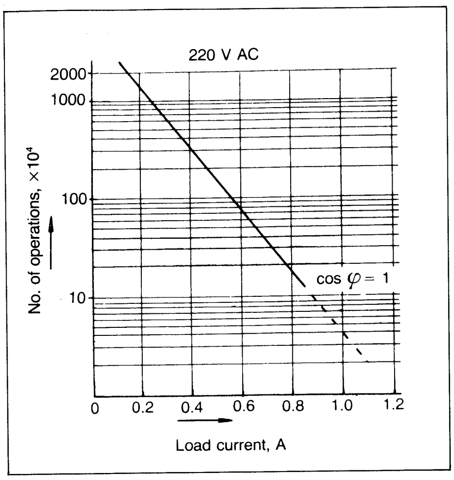
UL, CSA VDE recognized except K2X

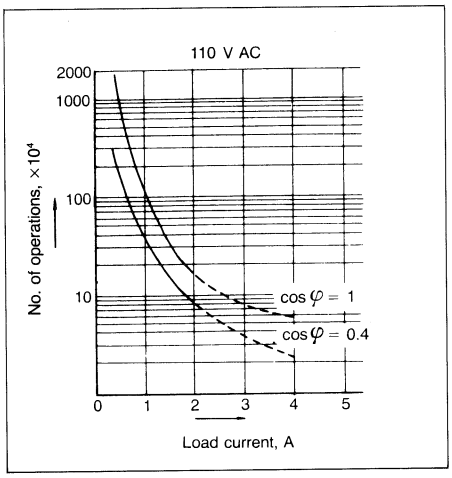
Plug-in and Solder	Coil voltage (V) Drop-out: 15% of Pick-up		*Coil resistance at 20°C (Ω)	Number of turns	Inductance (H) Armature	
	Pickup at 20°C	Max. allowable at 40°C			Closed	Open
DPDT K2F-6V	4.2	7	58	1,800	1.0	0.5
K2F-12V	8.4	14	250	3,800	5.2	2.6
K2F-24V	16.8	28	890	6,600	15	7.5
K2F-28V	19.6	33	1,100	7,700	20	11
K2F-42V	29.4	49	3,200	12,200	54	28
K2F-60V	42	70	7,600	18,000	120	62
K2F-110V	77	130	16,000	27,000	270	138

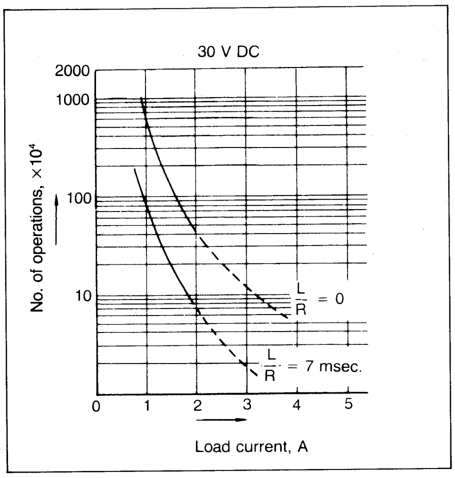
*Less than 1000 Ω: ±10% More than 1,000 Ω: ±15%

DATA

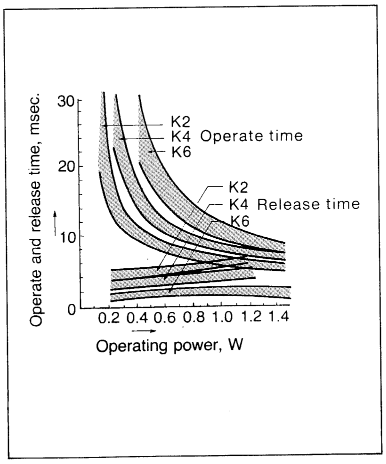
Life curve (for bifurcated contact types)



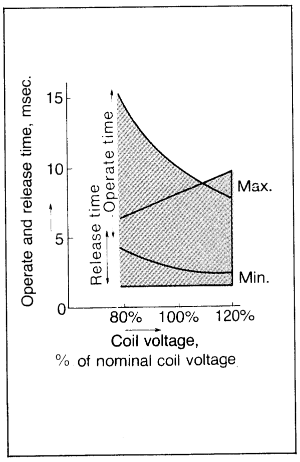




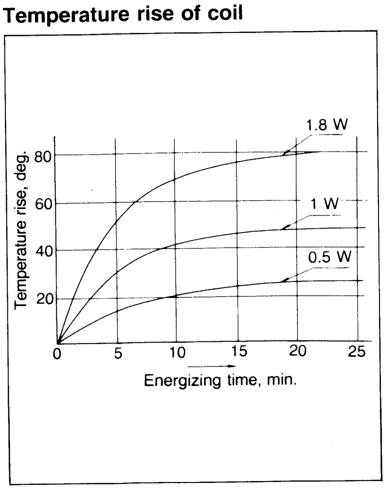
Operate and Release time, DC type



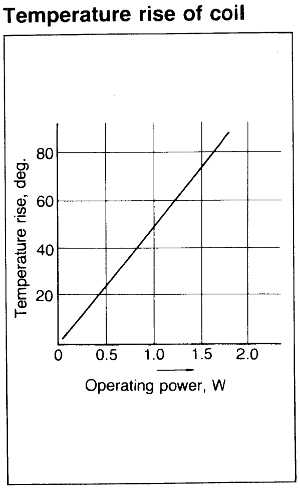
Operate and Release time, AC type



Temperature rise of coil



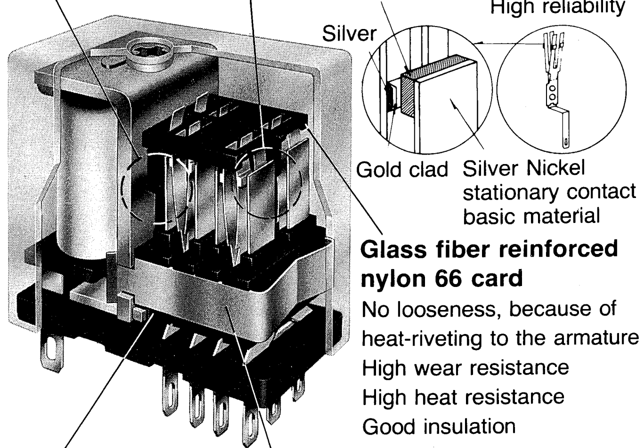
Temperature rise of coil



CONSTRUCTION

Patented magnetic system
Large attractive force—11 g contact pressure
Wide contact gap—2 A 220 V AC (120 VA)
Large capacity

Semi-independent movable bifurcated contacts
Welded silver contact (Gold clad contact also available)
High reliability



Glass fiber reinforced nylon 66 card
No looseness, because of heat-riveting to the armature
High wear resistance
High heat resistance
Good insulation

Stainless steel retainer spring
Screwless design
High stability
No looseness under vibration

Integrally molded spring block
No looseness even after long use
High thermal stability
Good insulation

Life-off system
Chatter-free, with high vibration resistance
Stabilized contact pressure

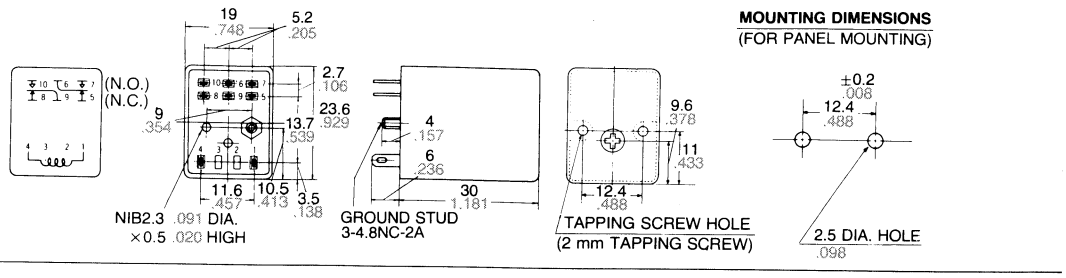
DIMENSIONS Standard Types

2 Form C

mm inch

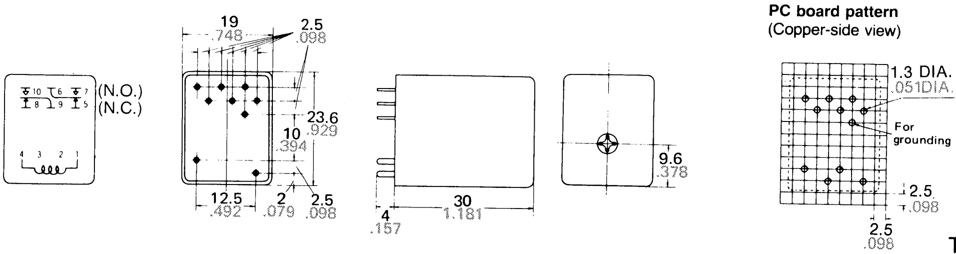
Plug-in/Solder terminal

(K2, K2A, K2F)



PC board terminal

(K2P, K2AP)

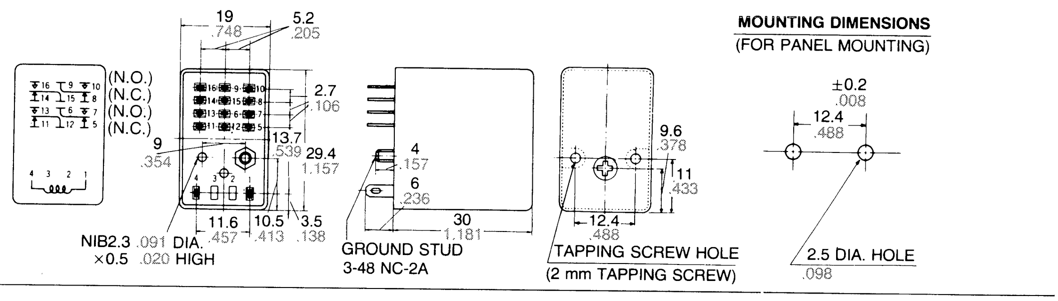


Tolerance: ±0.3 ±.012

4 Form C

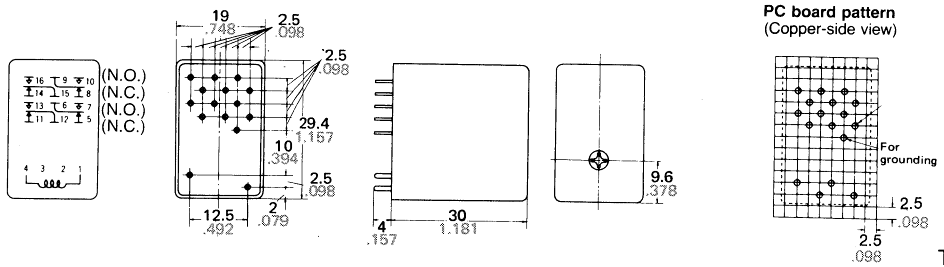
Plug-in/Solder terminal

(K4)



PC board terminal

(K4P)

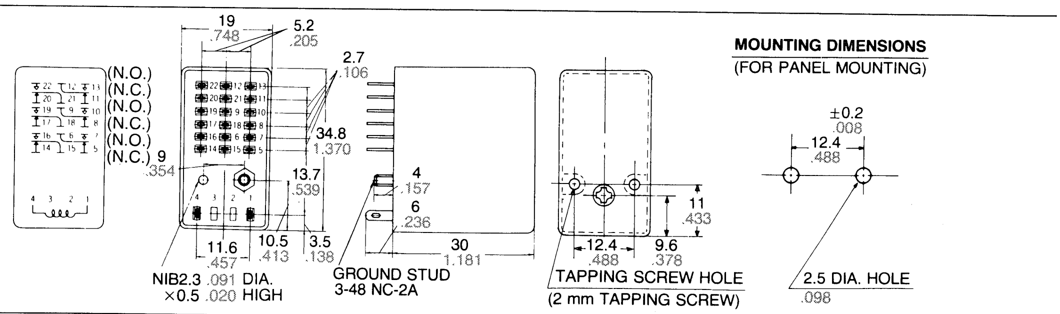


Tolerance: ±0.3 ±.012

6 Form C

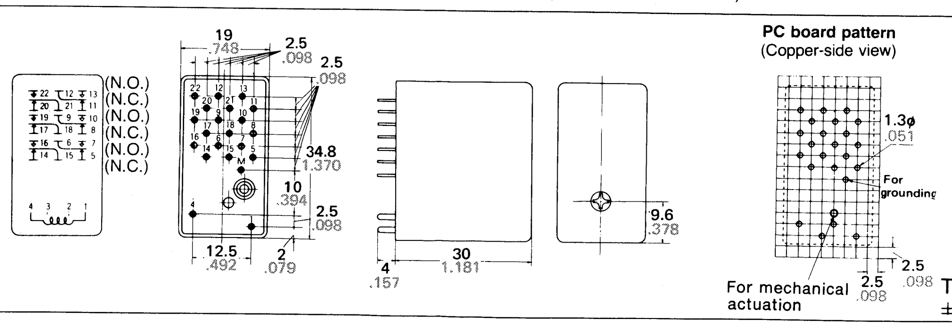
Plug-in/Solder terminal

(K6)



PC board terminal

(K6P)

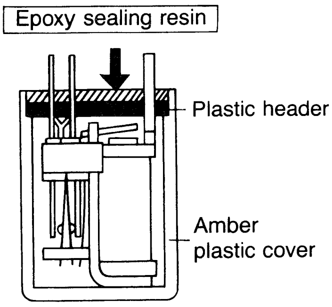


Tolerance: ±0.3 ±.012

Amber Relays KE

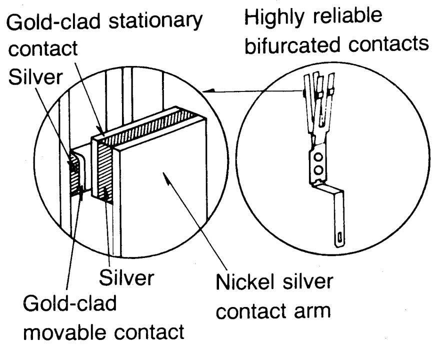
In addition to having the same high reliability as the K Relays, the sealed KE Relays are designed for use under severe environmental conditions, such as high humidity, H_2S gas, or in dusty or salty locations. Also, they can be used for low switching where high reliability is required. The test data on the next page shows that the resistance of Series KE relys is quite low and stable even when used with extermely high density H_2S gas. They are priced more economically than metal can hermetically sealed relays.

Sealed construction

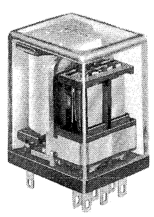


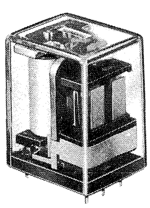
Gold-clad bifurcated contacts

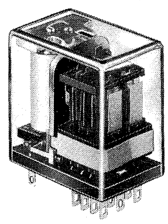
Low and stable contact resistance
Low level current switching possible

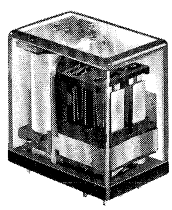


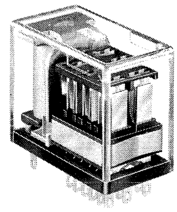
Typical applications include:
Systems and equipment requiring higher reliability,
Severe environmental uses,
Alarm devices,
Office machines,
Telecommunication equipment,
Pollution control equipment

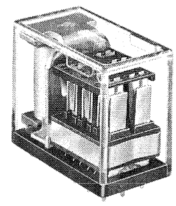

K2E


K2EP


K4E


K4EP


K6E


K6EP

SPECIFICATIONS

Contacts

Arrangement	2, 4, 6 Form C
Rating, resistive load **Max. switching power** **Max. voltage** **Max. current**	 50 W, 100 VA 220 V AC DC 2 A
Expected life (min. operations) **Mechanical** **Electrical (1 A 100 V AC)**	 10^8 10^6
Contact material **Movable contact** **Sationary contact**	(Bifurcated contacts) Gold-clad silver Gold-clad silver
Initial contact resistance **(By voltage drop 6 V DC 1 A)** **Maximum** **Typical**	 50 mΩ 25 mΩ
Capacitance **Contact/Contact** **Contact/Ground**	 3 pF 5 pF

Characteristics (at 20°C 68°F, 50% R.H.)

Max. operating speed Operate time Release time	50 cps. Approx. 15 msec. Approx. 5 msec.
Breakdown voltage	Same as standard K (Page 185)
Initial insulation resistance	1,000 MΩ at 500 V DC
Ambient temperature*	2, 4C: −40° to +60°C −40° to +140°F (No freezing below 0°C) 6C: −40° to +40°C −40° to +104°F
Ambient pressure	760 mmHg ±20% (1,013 mb ±20%)
Shock resistance	10 G
Vibration resistance	10 G, 10 to 50 Hz at double amplitude of 1.6 mm
Unit weight (approx.)	K2E/23 g .81 oz, K4E/27 g .95 oz K6E/30 g 1.06 oz

*Total temperature (temperature rise in coil plus ambient temperature) should be kept less than max. 115°C 221°F (No freezing below 0°C 32°F).

Coil

Min. operating power (Approx. 20°C)	2 Form C: 200 mW 4 Form C: 300 mW 6 Form C: 600 mW
Nominal operating power (Approx. 20°C)	2 Form C: 400 mW 4 Form C: 700 mW 6 Form C: 1,300 mW
Max. operating power for continuous duty	2, 4 From C: 1 W at 60°C 6 Form C: 1.9 W at 40°C

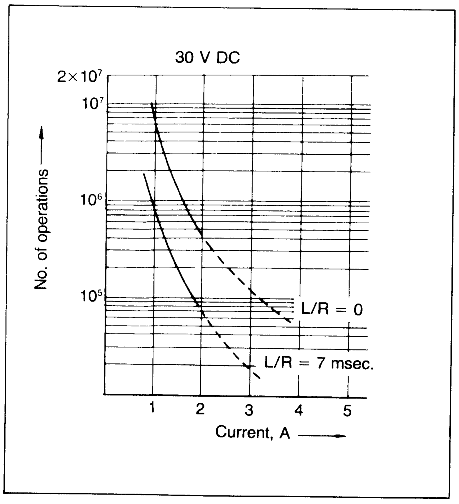
TYPES AND COIL DATA

Part No.		Coil voltage (V)				Coil resistance* (Ω at 20°C)	Nominal coil power (mW)	Inductance (H)	
								Armature	
Plug-in and Solder	For PC board	Nominal (DC)	Pick-up (max. at 20°C)	Drop-out (min. at 20°C)	Max. allowable voltage, (at 40°C)			Closed	Open
2PDT									
K2E-3V-1	K2EP-3V-1	3	1.8	0.27	6.7	28	320	0.52	0.26
K2E-6V-1	K2EP-6V-1	6	3.9	0.58	12.0	110	330	2.1	1.1
K2E-12V-1	K2EP-12V-1	12	8.0	1.2	30.0	530	270	11	5.6
K2E-24V-1	K2EP-24V-1	24	16.5	2.5	47.0	1,700	340	35	18
K2E-42V-1	K2EP-42V-1	42	30.0	4.5	72.0	5,300	333	95	48
K2E-48V-1	K2EP-48V-1	48	39.0	5.9	100.0	7,600	300	120	62
K2E-110V-1	K2EP-110V-1	110	60.0	9.0	180.0	16,000	760	270	138
4PDT									
K4E-3V-1	K4EP-3V-1	3	2.3	0.35	5.0	18	500	0.36	0.18
K4E-6V-1	K4EP-6V-1	6	4.2	0.63	9.0	58	620	1.0	0.5
K4E-12V-1	K4EP-12V-1	12	8.7	1.3	18.5	250	580	5.2	2.6
K4E-24V-1	K4EP-24V-1	24	18.0	2.7	35.0	890	650	15	7.5
K4E-28V-1	K4EP-28V-1	28	19.0	2.85	33.0	1,100	713	20	11
K4E-48V-1	K4EP-48V-1	48	36.0	5.4	64.0	3,200	720	54	28
K4E-110V-1	K4EP-110V-1	110	85.0	12.8	160.0	16,000	760	270	138
6PDT									
K6E-6V		6	4.2	0.63	6.6	28	1,286	0.52	0.26
K6E-12V		12	8.4	1.26	13.2	110	1,309	2.1	1.1
K6E-24V		24	16.8	2.52	26.4	440	1,309	8.3	4.2
K6E-48V		48	33.6	5.04	52.8	1,700	1,355	35	18
K6E-60V		60	42.0	6.3	66.0	2,800	1,286	44	23
K6E-110V		110	77.0	11.55	121.0	10,000	1,210	164	84

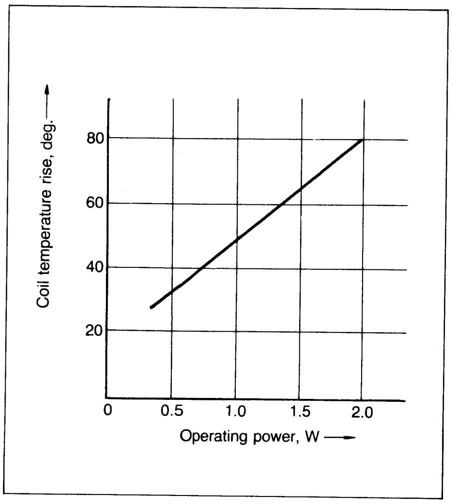
*Less than 1,000 Ω: ±10% More than 1,000 Ω: ±15%

DATA

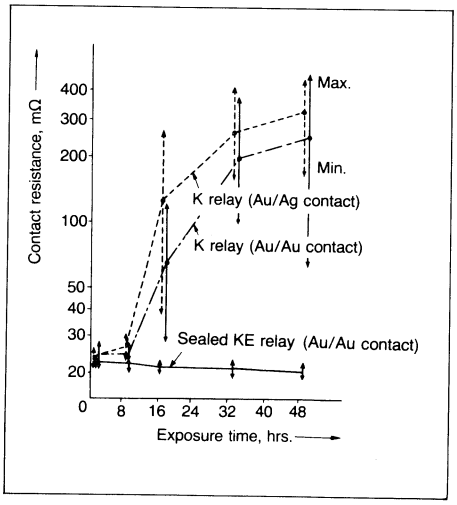
Life curve



Coil temperature rise (resistance method)



H_2S gas test (1,000 ppm)



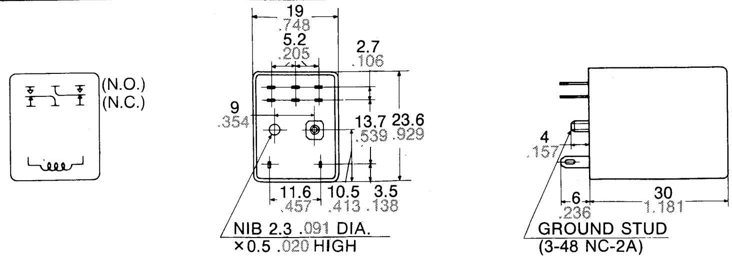
DIMENSIONS Amber Sealed Types

mm inch

2 Form C

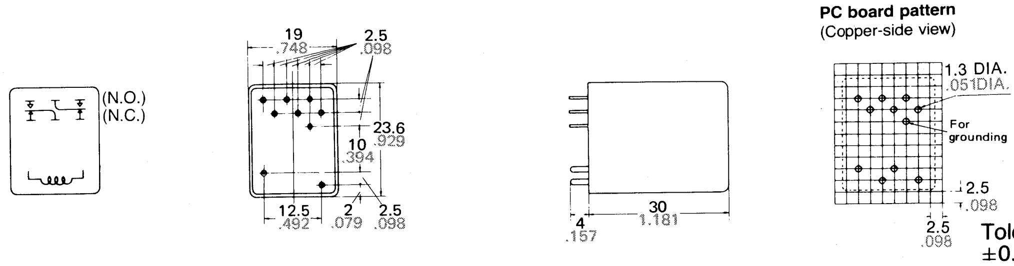
Plug-in terminal

(K2E)



PC board terminal

(K2EP)

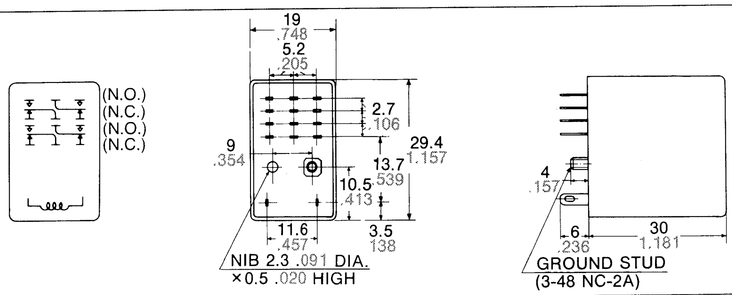


Tolerance: ±0.3 ±.012

4 Form C

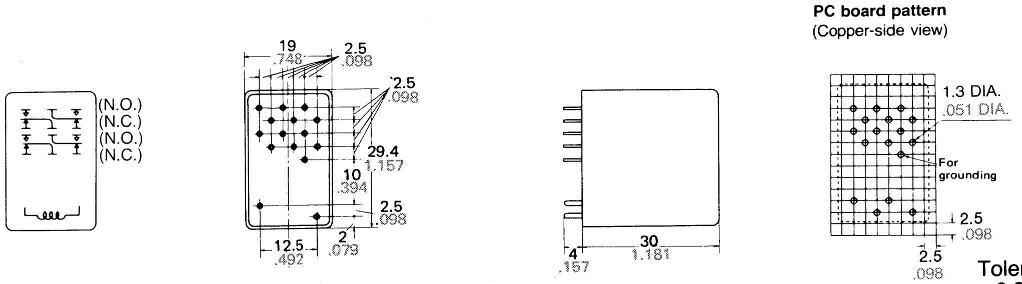
Plug-in terminal

(K4E)



PC board terminal

(K4EP)

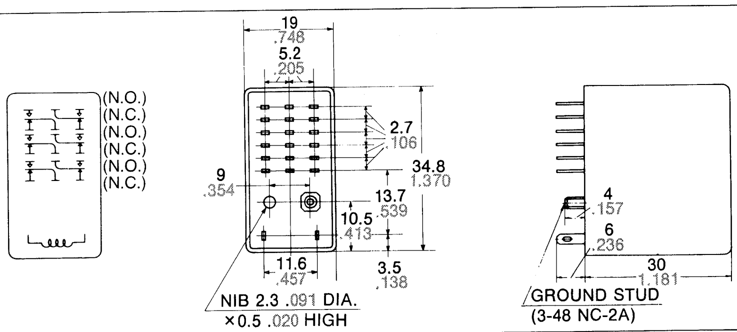


Tolerance: ±0.3 ±.012

6 Form C

Plug-in terminal

(K6E)



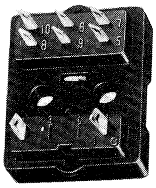
General tolerance: ±0.5 ±.020

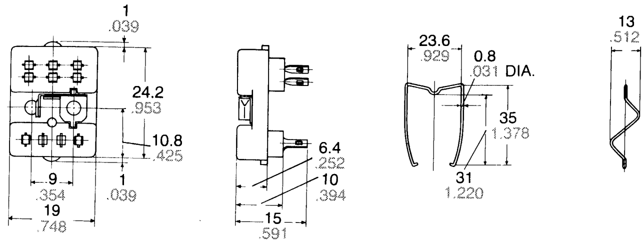
ACCESSORIES

Solder terminal sockets (with hold-down clip)

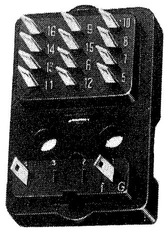
mm inch

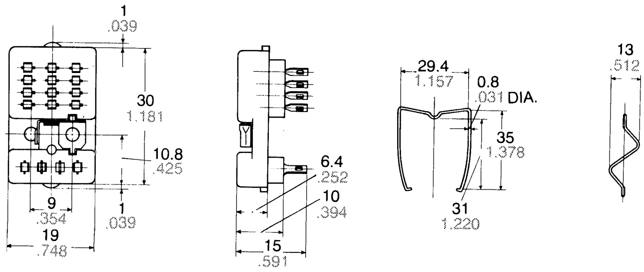
K2-SS
2 Form C
(for K2, K2A, K2F, K2E)



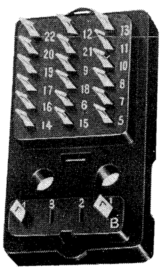


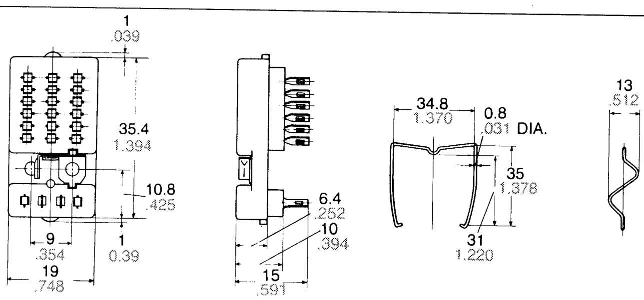
K4-SS
4 Form C
(for K4, K4E)





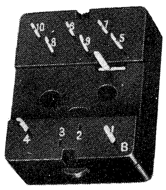
K6-SS
6 Form C
(for K6, K6E)

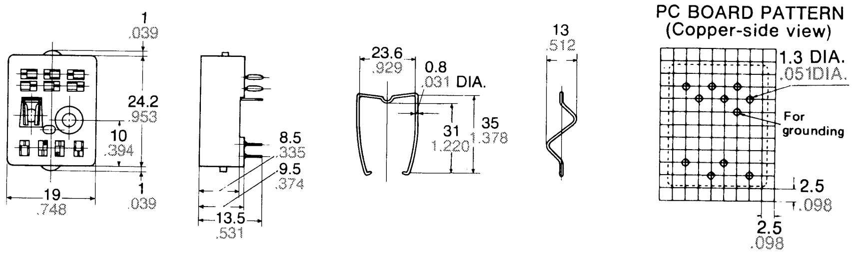




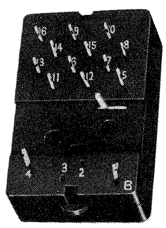
PC board terminal sockets (with hold-down clip)

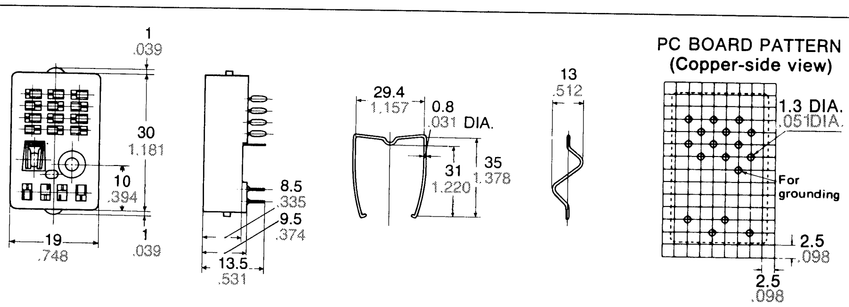
K2-PS
2 Form C
(for K2, K2A, K2F, K2E)



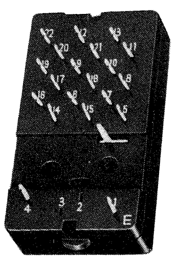


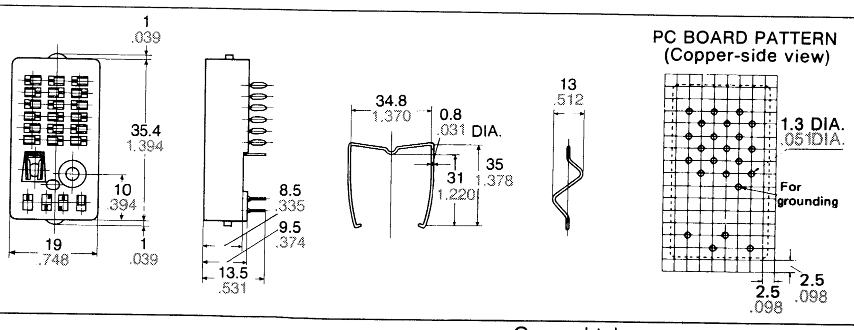
K4-PS
4 Form C
(for K4, K4E)





K6-PS
6 Form C
(for K6, K6E)



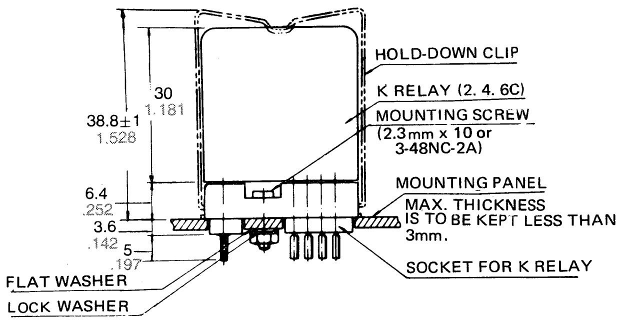


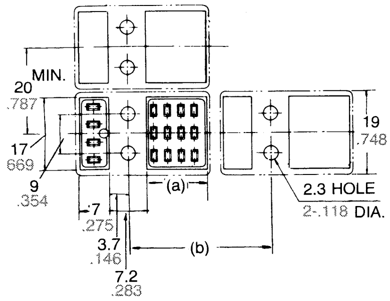
General tolerance: ±1 ±.039

MOUNTING DIMENSIONS

Plug-in socket mounting

mm inch





(a)
K2: 8.5 .335
K4: 14 .551
K6: 19.5 .768

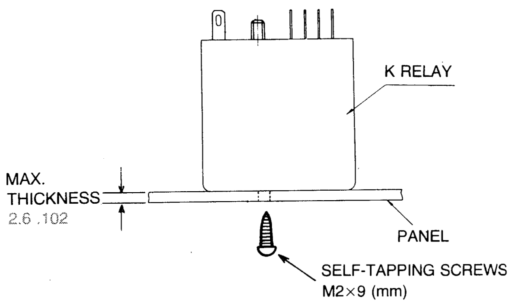
(b)
K2: 26 1.024 MIN.
K4: 31.8 1.252 MIN.
K6: 37.2 1.465 MIN.

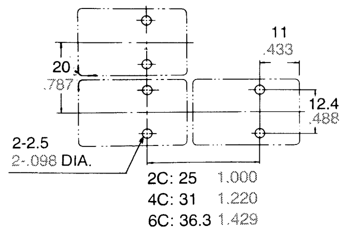
General tolerance: ±0.5 ±.020

Tolerance: ±0.1 ±.004

Direct mounting: for K2, K4, K6 series plug-in/solder types, only, not for K2E, K4E, K6E series

Direct mounting is faster and more economical since only two screw holes are needed, doing away with the need for a square hole.





Tolerance: ±0.1 ±.004

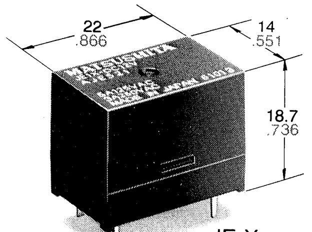
PC board mounting

See "PC BOARD PATTERN" shown in the DIMENSIONS section.

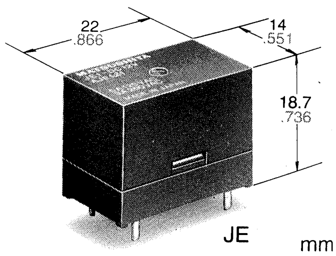
NAiS

COMPACT ECONOMICAL POWER RELAYS

JE-X·JE RELAYS



JE-X



JE

mm inch

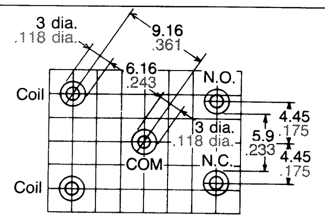
UL File No.: E43028
CSA File No.: LR26550
TÜV File No.: 91021645558

- **Compact size—Height Max. 18.7 mm** .736 inch **lower than JY relay (22.5 mm)** (.886 inch)
- **High contact capacity—5 A 125 V AC**
- **Safety-oriented between coil and contact terminals**
- **All plastic materials: UL flame retardance 94V-0**

TERMINAL LAYOUT

• JE-X

Distance of 9.16 mm .360 inch between common and coil terminals and 8.9 mm .350 inch between contacts give room to the land diameter width when the relay is mounted on PC board, and allow design of patterns with insulation distances of 6 mm .236 inch between common and coil and 5.9 mm .232 inch between contacts.

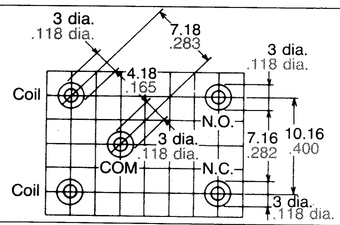


In case of 3 mm .118 inch land diamter

mm inch

• JE

Since terminal pitches are 7.18 mm .283 inch between common and coil terminals and 10.16 mm .400 inch between contacts, design of patterns with insulation distance of 4 mm .157 inch between common and coil and 7 mm .276 inch between contacts is possible. Moreover, the terminal layout matches the international terminal pitch of 2.54 mm .100 inch.



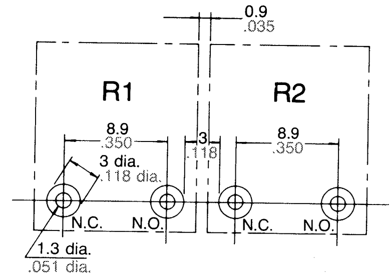
In case of 3 mm .118 inch land diamter

mm inch

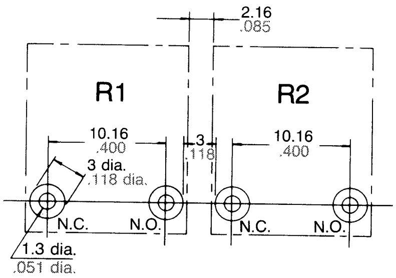
• 3 mm .118 inch or more insulation distance for close mounting can be kept easily with JE-X relays.

Compared with JE relays, each N.O. and N.C. terminal is 0.63 mm .025 inch toward inside. It gives room to the distance between the land of terminals when closely mounted, to maintain 3 mm .118 inch or more insulation distance.

JE-X



JE



mm inch

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) Max. switching power	831 VA	
Max. switching voltage	277 V AC, 30 V DC	
Max. switching current	5 A	
UL/CSA rating	3 A 1/10 HP 277 V AC 5 A 1/10 HP 125 V AC 5 A 30 V DC	
TÜV rating	5 A 125 V～ (cos φ = 0.4, 1.0) 3 A 250 V～ (cos φ = 0.4, 1.0) 3 A 30 V ⎓	
Expected life (min. operations) Mechanical	5×10^6	
Electrical (resistive)	10^5 (3A, 250VAC, 5A 125VAC, 5A 30VDC)	

Coil

Minimum operating power	256mW (196 mW for JE1aXN, JE1XN, JE1aN & JE1N types)
Nominal operating power	400 mW

Characteristics (at 25°C 77°F)

Max. operating speed		20 cpm (at 70°C)
Operate time (at nominal voltage)		Approx. 10 msec.
Release time (at nominal voltage)		Approx. 10 msec.
Initial breakdown voltage Between open contacts		750 Vrms
Between contacts and coil		1,500 Vrms
Surge voltage between coil and contact		Min. 5,000 V
Initial insulation resistance		Min. 100 MΩ (at 500 V DC)
Temperature rise		Max. 65 deg. (at nominal voltage)
Ambient temperature		−40 to +70°C −40 to +158°F
Shock resistance	Functional	Min. 10 G
	Destructive	Min. 100 G
Vibration resistance	Functional	10 G, 10 to 55 Hz at double amplitude of 1.6 mm
	Destructive	12 G, 10 to 55 Hz at double amplitude of 2.0 mm
Unit weight		Approx. 9.2 g, .32 oz

TYPICAL APPLICATIONS

- Home appliances
  Oven, range, dryer, heater,
  Air conditioner etc.
- Automotive
- Garage door opener
- Personal computer
- Programmable controller

ORDERING INFORMATION

Ex. JE [1] [X] [N] — [DC12V] — [H]

Contact arrangement	Type	Pick-up voltage	Coil voltage	Protective construction
1a: 1 form a 1: 1 form C	Nil: JE relay X: JE-X relay	Nil: 80% of nominal voltage N: 70% of nominal voltage	DC 5, 6, 9, 12, 24, 48 V	Nil: Dust cover type H: Flux-resistant type

(Note) Standard packing Carton: 100 pcs. Case: 500 pcs.

TYPES

Contact arrangement	Coil voltage	Part No. JE-X Standard type	Part No. JE-X Flux-resistant type	Part No. JE Standard type	Part No. JE Flux-resistant type
1 Form A	5 V DC	JE1aX-DC5V	JE1aX-DC5V-H	JE1a-DC5V	JE1a-DC5V-H
	6 V DC	JE1aX-DC6V	JE1aX-DC6V-H	JE1a-DC6V	JE1a-DC6V-H
	9 V DC	JE1aX-DC9V	JE1aX-DC9V-H	JE1a-DC9V	JE1a-DC9V-H
	12 V DC	JE1aX-DC12V	JE1aX-DC12V-H	JE1a-DC12V	JE1a-DC12V-H
	24 V DC	JE1aX-DC24V	JE1aX-DC24V-H	JE1a-DC24V	JE1a-DC24V-H
	48 V DC	JE1aX-DC48V	JE1aX-DC48V-H	JE1a-DC48V	JE1a-DC48V-H
1 Form C	5 V DC	JE1X-DC5V	JE1X-DC5V-H	JE1-DC5V	JE1-DC5V-H
	6 V DC	JE1X-DC6V	JE1X-DC6V-H	JE1-DC6V	JE1-DC6V-H
	9 V DC	JE1X-DC9V	JE1X-DC9V-H	JE1-DC9V	JE1-DC9V-H
	12 V DC	JE1X-DC12V	JE1X-DC12V-H	JE1-DC12V	JE1-DC12V-H
	24 V DC	JE1X-DC24V	JE1X-DC24V-H	JE1-DC24V	JE1-DC24V-H
	48 V DC	JE1X-DC48V	JE1X-DC48V-H	JE1-DC48V	JE1-DC48V-H

Note: Pick-up 70% voltage types (JE1aXN, JE1XN, JE1aN, JE1N) are available.

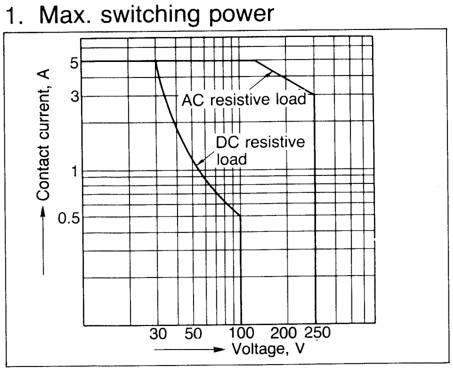
COIL DATA at 20°C 68°F

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 70°C)
5	4.0	0.5	80	62.5	400	6.5
6	4.8	0.6	67	90	400	7.8
9	7.2	0.9	44	202	400	11.7
12	9.6	1.2	33	360	400	15.6
24	19.2	2.4	17	1,440	400	31.2
48	38.4	4.8	8.3	5,760	400	62.4

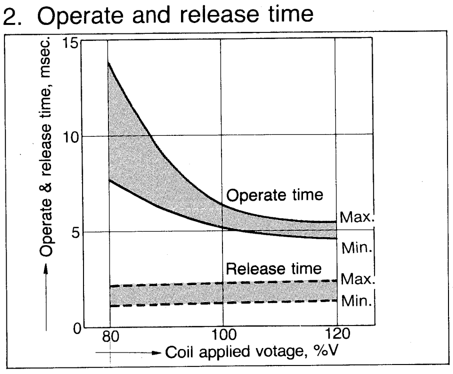
Notes: 1. Flux-resistant types have the same coil data as standard types.
2. Pick-up 70% voltage types (JE1aXN, JE1XN, JE1aN, JE1N) have also the same coil data as above except for pick-up voltage.

DATA

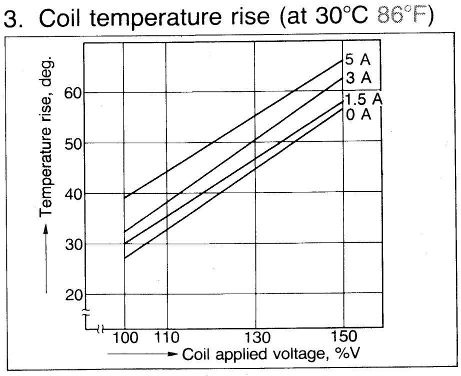
1. Max. switching power



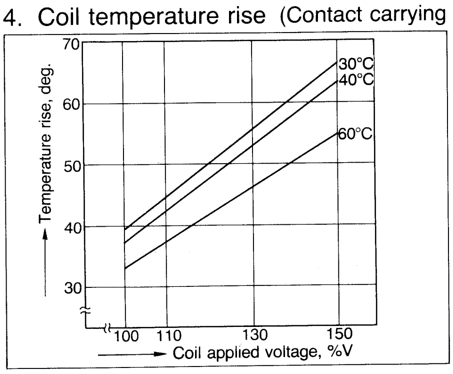
2. Operate and release time



3. Coil temperature rise (at 30°C 86°F)



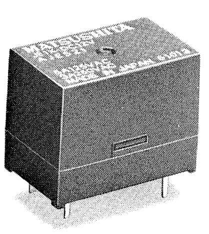
4. Coil temperature rise (Contact carrying current: 5 A)

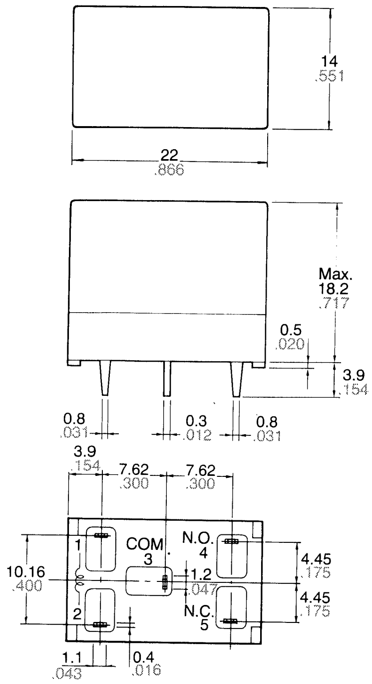


DIMENSIONS

mm inch

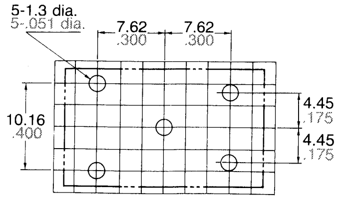
1. JE-X





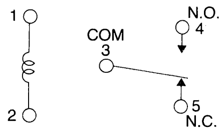
General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

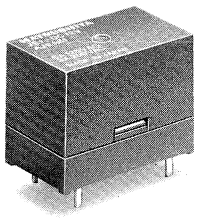
Schematic (BOTTOM VIEW)

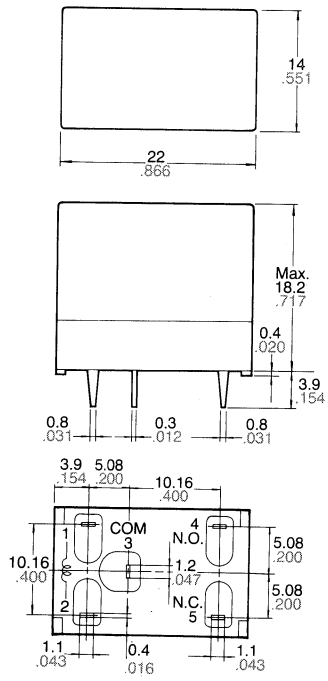


Note: The above shows 1 form C type, and No. 5 terminal is eliminated on the 1 form A type.

2. JE

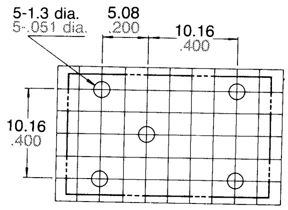
mm inch





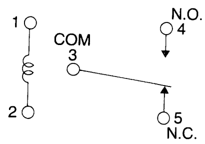
General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

Schematic (BOTTOM VIEW)



Note: The above shows 1 form C type, and No. 5 terminal is eliminated on the 1 form A type.

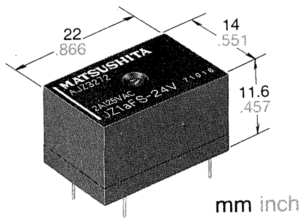
NOTES

1. Soldering should be carried out within 3 sec. at 350°C 662°F or within 5 sec. at 250°C 482°F.
2. Do not remove covers from relays to keep operating characteristics.
3. Avoid using in a location where there is excessive dust, dirt, organic vapors, humidity, water dropping, oil, vibration and shock.

NAiS

SMALL SIZED POWER RELAY

JZ-RELAYS



UL File No.: E43028
CSA File No.: LR26550
TÜV File No.: Nr. 90061645552
VDE File No. VDE-Reg.-Nr. 3518, SEMKO

- **Small sized flat type: 22×14×11.6 mm** .866×.551×.457 inch
- **High dielectric withstanding: 10,000 V surge in μsec. between coil and contact**
- **High electrical noise immunity**
- **High sensitivity type available**

SPECIFICATIONS

Contacts

Type	Standard type	High sensitivity type	TV-5 type	TV-5 High sensitivity type
Arrangement	1 Form A			
Contact material	Silver alloy			
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	100 mΩ			
Rating (resistive) Nominal switching capacity	5 A 125 V AC	3 A 125 V AC	8 A 125 V AC	
Max. switching power	625 VA	375 VA	1,000 VA	
Max. switching voltage	250 V AC			
Max. switching current	5 A	3 A	8 A	
UL/CSA rating	5 A 125 V AC 3 A 277 V AC 1/10 HP 125, 277 V AC 5 A 30 V DC, 0.3 A 110 V DC	3 A 125 V AC 2 A 277 V AC 1/10 HP 125, 277 V AC 3 A 30 V DC, 0.3 A 110 V DC	8 A 125 V AC 5 A 277 V AC 1/10 HP 125, 277 V AC 5 A 30 V DC 0.3 A 110 V DC TV-5	
TÜV rating	3 A 250 V ~ (cos $\varphi = 0.4$) 5 A 125 V ~ (cos $\varphi = 0.4$) 5 A 30 V ⎓	2 A 250 V ~ (cos $\varphi = 0.4$) 3 A 125 V ~ (cos $\varphi = 0.4$) 3 A 30 V ⎓	3 A 250 V ~ (cos $\varphi = 0.4$) 5 A 125 V ~ (cos $\varphi = 0.4$) 5 A 30 V ⎓	—
VDE rating	5 A 125 V ~ (cos $\varphi = 0.4$) 5 A 30 V ⎓	3 A 125 V ~ (cos $\varphi = 0.4$) 3 A 30 V ⎓	5 A 125 V ~ (cos $\varphi = 0.4$) 5 A 30 V ⎓	—
Expected life (min. operations) Mechanical (at 180 cpm)	5×10^6			
Electrical (at 20 cpm)	10^5	2×10^5	10^5	5×10^4

Coil (at 20°C 68°F)

Standard type	Minimum operating power	196 mW
	Nominal operating power	400 mW
High sensitive type	Minimum operating power	128 mW
	Nominal operating power	200 mW

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

Max. operating speed		180 cpm
Operate time		Approx. 8 msec.
Release time		Approx. 4 msec.
Initial breakdown voltage Between open contacts Between contacts and coil		 750 Vrms for 1 min. 2,000 Vrms for 1 min.
Initial insulation reistance		Min. 100 MΩ at 500 V DC
Temperature rise, max. (ambient temperature at 70°C)		65 deg. with nominal coil voltage across coil and rated contact current
Ambient temperature		−40°C to +70°C −40°F to +158°F
Shock resistance, min.	Functional	10 G
	Destructive	100 G
Vibration resistance	Functional	10 G, 10 to 55 Hz at double amplitude of 1.6 mm
	Destructive	12 G, 10 to 55 Hz at double amplitude of 2 mm
Unit weight		Approx. 7 g .25 oz

TYPICAL APPLICATIONS

- Microwave oven (fan, inside lamp)
- Machineries which need electrical noise resistance and surge resistance, (Ex. hot-water heater)

ORDERING INFORMATION

Ex. JZ 1a F S — 9V — TV

Contact arrangement	Protective construction	Type classification	Coil voltage (DC)	Type classification
1a: 1 Form A	F: Flux-resistant type	Nil: Standard (400 mW) S: High sensitive (200 mW)	5, 6, 9, 12, 18, 24	Nil: UL/CSA recognized type TV: TV-5 rated type

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

TYPES AND COIL DATA (at 20°C, 68°F)

1) Standard type

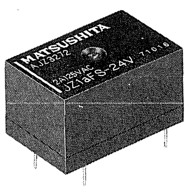
Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Max. allowable voltage at 70°C, V DC
JZ1aF-5V	5	3.5	0.25	62.5	80	400	6
JZ1aF-6V	6	4.2	0.3	90	67	400	7.2
JZ1aF-9V	9	6.3	0.45	202	45	400	10.8
JZ1aF-12V	12	8.4	0.6	360	33	400	14.4
JZ1aF-18V	18	12.6	0.9	810	22	400	21.6
JZ1aF-24V	24	16.8	1.2	1,440	17	400	28.8

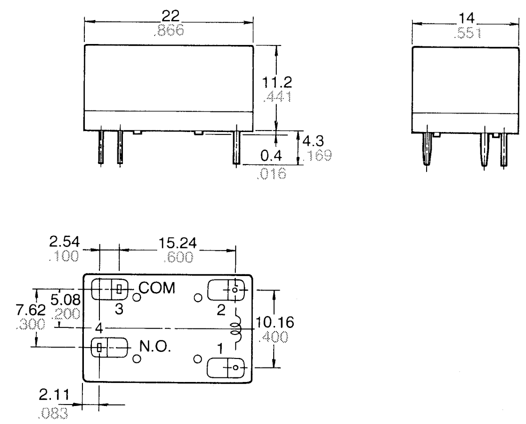
2) High sensitivity type

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 at 20°C, V DC
JZ1aFS-5V	5	4	0.25	125	40	200	9
JZ1aFS-6V	6	4.8	0.3	180	33	200	10.8
JZ1aFS-9V	9	7.2	0.45	404	22	200	16.2
JZ1aFS-12V	12	9.6	0.6	720	17	200	21.6
JZ1aFS-18V	18	14.4	0.9	1,620	11	200	32.4
JZ1aFS-24V	24	19.2	1.2	2,880	8.3	200	43.2

DIMENSIONS

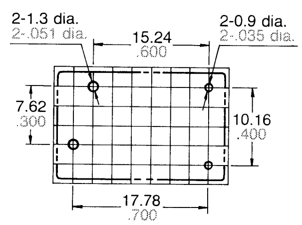
mm inch





General tolerance: ±0.3 ±.012

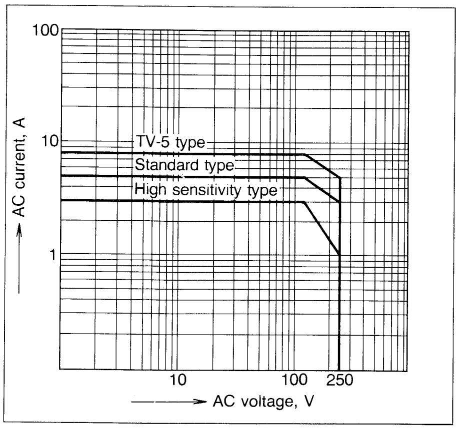
PC board pattern (Copper-side view)



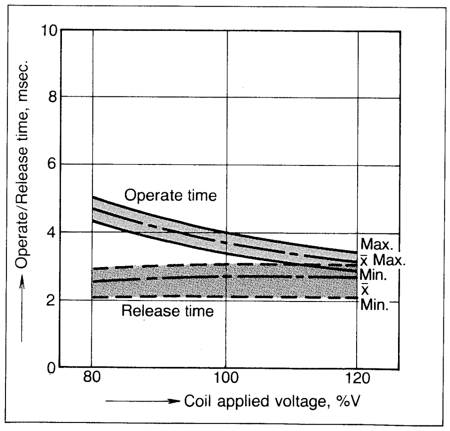
Tolerance: ±0.1 ±.004

DATA

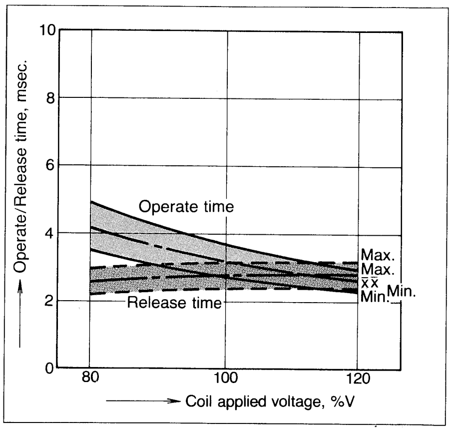
1. Max. switching power



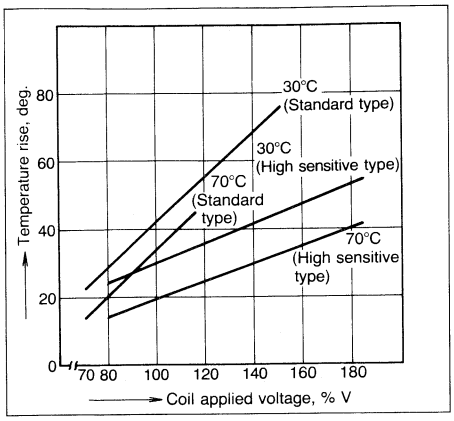
2.-(1) Operate/Release time (Standard type)



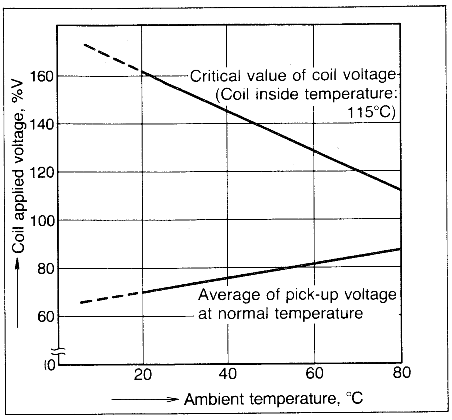
2.-(2) Operate/Release time (High sensitive type)



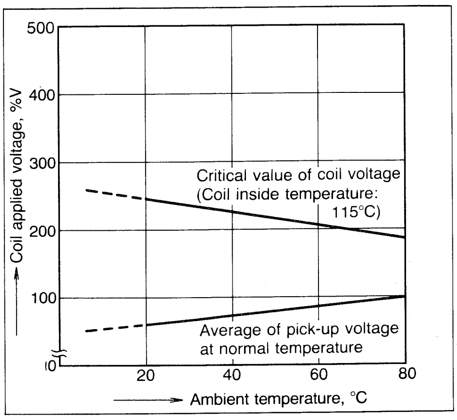
3. Coil temperature rise
Point measured: Coil inside
Contact current: 3 A



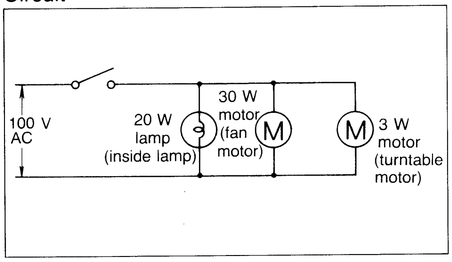
4.-(1) Ambient temperature vs. coil applied voltage (Standard type)
Contact current: 1 A



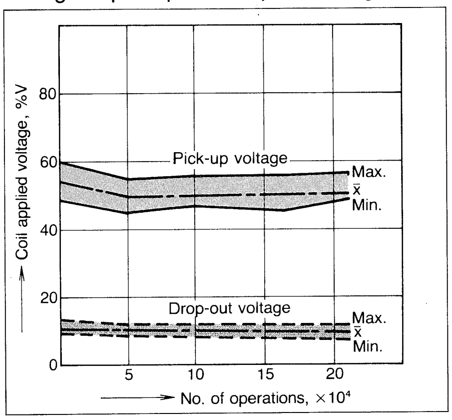
4.-(2) Ambient temperature vs. coil applied voltage (High sensitive type)
Contact current: 1 A



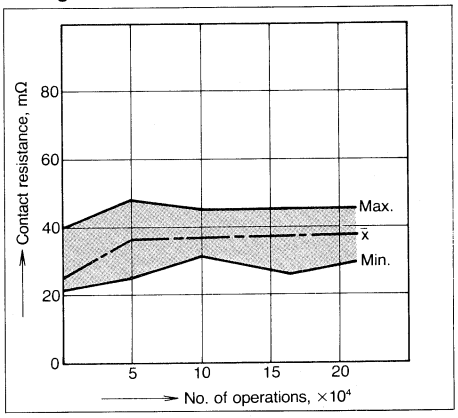
5. Electrical life (load test: fan motor, turntable motor and inside lamp of microwave oven)
Tested sample: JZ1aFS-24V n = 6 pcs.
Load: 100 V AC 0.5 A; Rush current: 2.5 A
Operation frequency: 4 times/min.
(ON:OFF = 3s:12s)
With coil diode protection
Ambient temperature: 70°C 158°F
Circuit



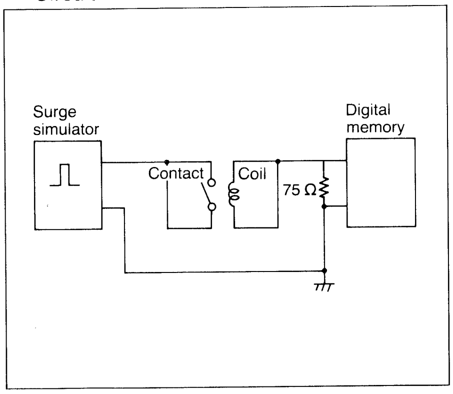
Change of pick-up and drop-out voltage



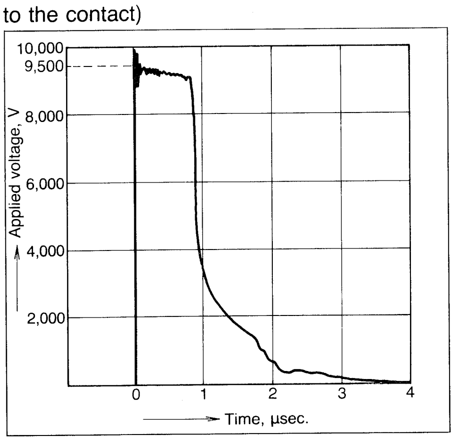
Change of contact resistance



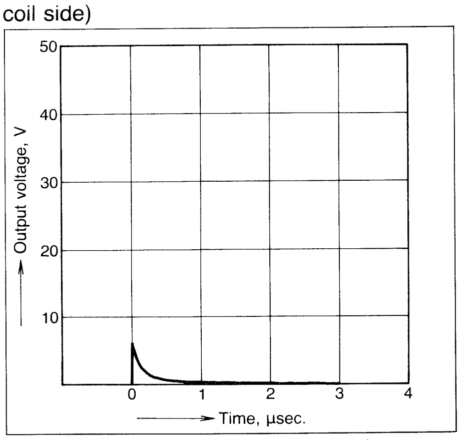
6. Noise resistance
Tested sample: JZ1aFS-24V
Circuit



Noise wave form (Applied voltage wave form to the contact)

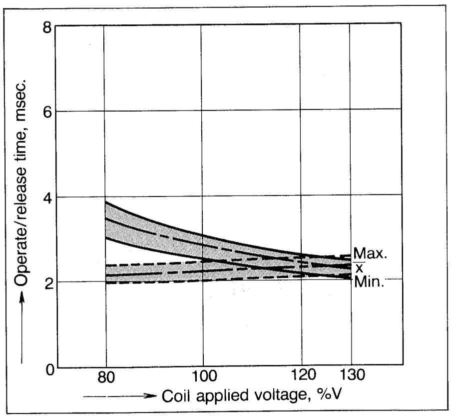


Output wave form (Output wave form on the coil side)

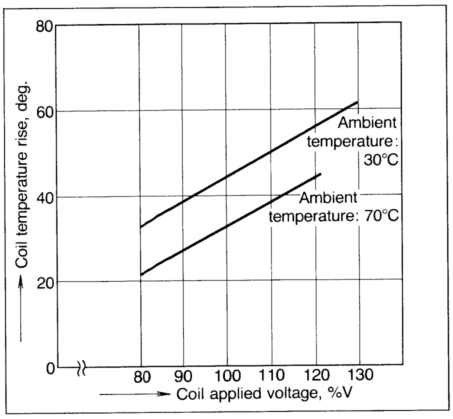


DATA for TV-5 rated type

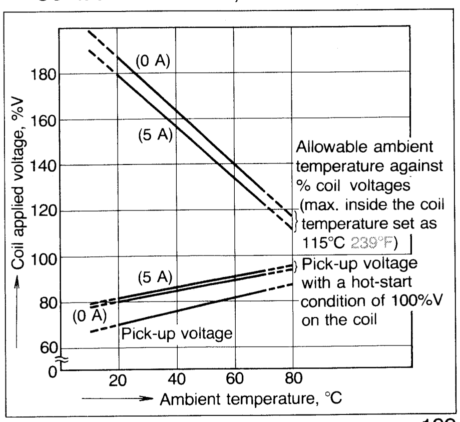
1. Operate/release time
Sample: JZ1aF-12V-TV, n = 25 pcs.



2. Coil temperature rise
Point measured: Coil inside
Contact current: 5 A



3. Ambient temperature vs. coil applied voltage
Sample: JZ1aF-12V-TV
Contact current: 0 A, 5 A



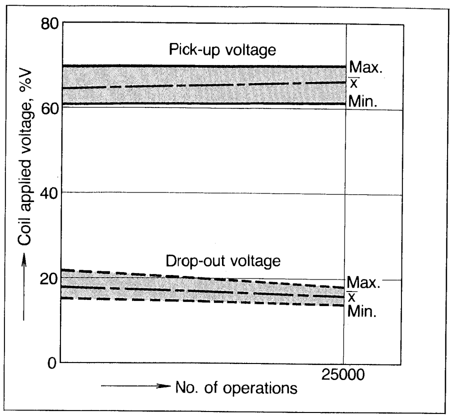
4. Electrical life test (TV-5)
   Tested sample: JZ1aF-12V-TV n = 6 pcs.
   UL Lamp load test

(TV-5)

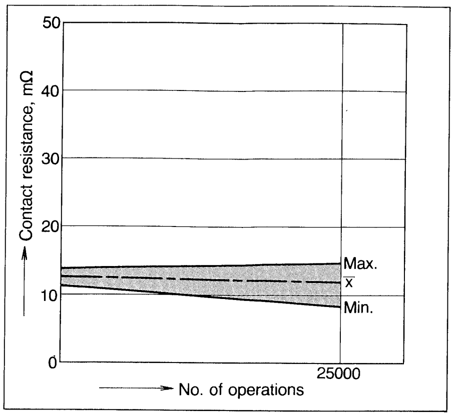
	Overload	Endurance
Voltage	AC 120 V	AC 120 V
Switching frequency	60 Hz	60 Hz
Current	Inrush: 111 A; Steady: 7.5 A	Inrush: 78 A; Steady: 5.0 A
Operating speed	10 cpm (ON:OFF = 1s:5s)	10 cpm (ON:OFF = 1s:5s)
No. of operations	50 ope.	25,000 ope.

Overload test shall be followed by endurance test.

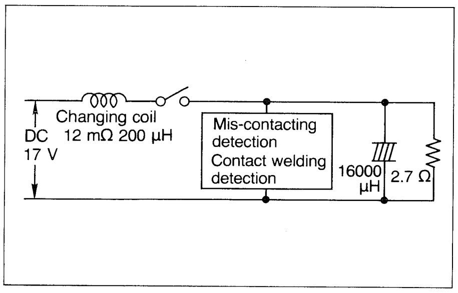
Change of pick-up and drop-out voltage



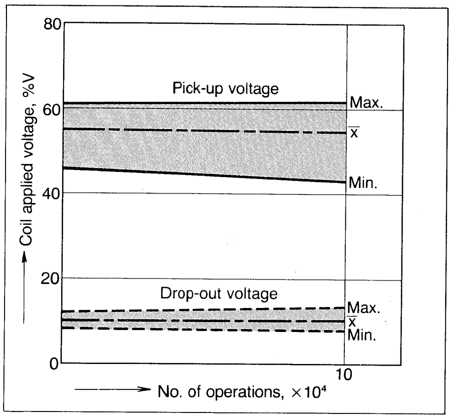
Change of contact resistance



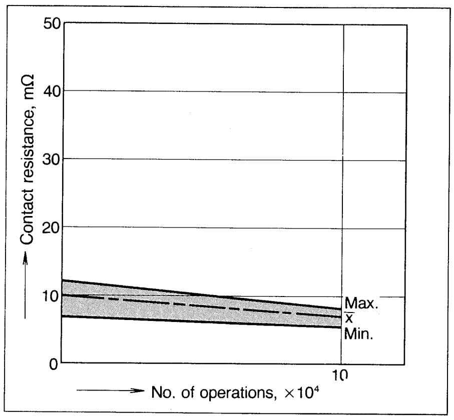
5. Electrical life test (Condenser load)
   Tested sample: JZ1aF-12V-TV, n = 6 pcs.
   Load: DC 17 V 6.4 A, Inrush max. 139 A
   Operating speed: 20 cpm
   (ON:OFF = 1 sec.:2 sec.)
   Ambient temperature: 27°C 81°F
   Circuit:



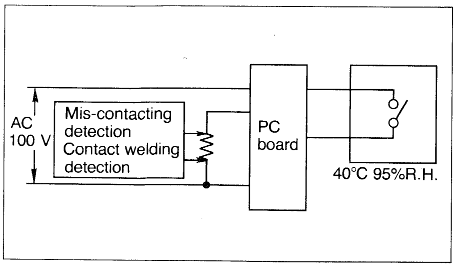
Change of pick-up and drop-out voltage



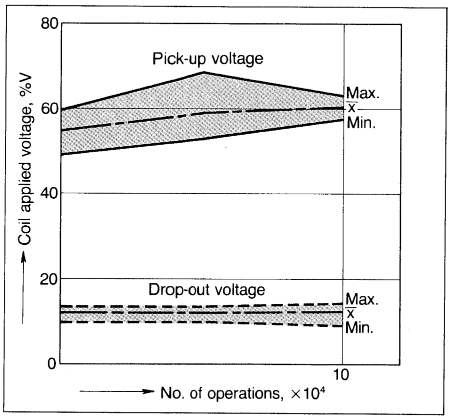
Change of contact resistance



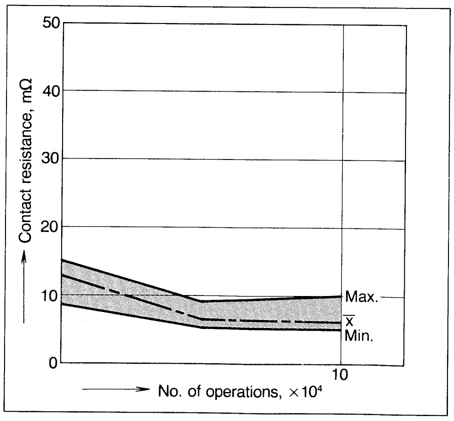
6. Electrical life test (TV power source)
   Tested sample: JZ1aF-12V-TV, n = 10 pcs.
   Load: AC 100 V TV power source
   Inrush: 100 A max.; Steady: 5.0 A
   Operating speed: 20 cpm
   (ON:OFF = 1 sec.:2 sec.)
   Ambient temperature: 40°C 104°F 95%R.H.
   Circuit:



Change of pick-up and drop-out voltage



Change of contact resistance



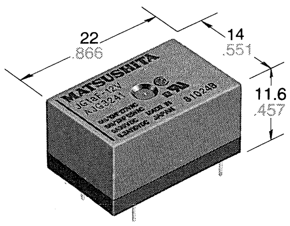
NOTES

1. Dropping the relay may deform the internal construction and affect performance. If the relay is dropped, check its appearance and characteristics before use.
2. Do not remove covers from relays to keep operating characteristics.
3. Avoid using in a location where there is excessive dust, dirt, organic vapors, humidity, water, oil, vibration and shock.
4. The voltage applied to the coil should be nominal voltage with rectangular wave form.
5. When mounting the relay on a PC board, do not bend the terminals or twist them in order to fasten the relay.

NAiS

8 A POWER RELAY

JG-RELAYS



mm inch

UL File No.: E43028
CSA File No.: LR26550
TÜV File No.: Nr. 88041645529
VDE File No.: VDE-Reg.-Nr. 3774, SEMKO

- **Compact & flat design: 22 mm .866 inch (length)×14 mm .551 inch (width) ×11.2 mm .441 inch (height)**
- **High capacity: 8 A nominal switching capacity**
- **High surge resistance: Min. 10,000 V between contact and coil**
- **High sensitivity: 200 mW nominal operating power**

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	8 A 125 V AC
Max. switching power	1,000 VA
Max. switching voltage	250 V AC
Max. switching current	8 A
Expected life (min. operations) Mechanical (at 180 cpm)	5×10^6
Electrical at 8 A 125 V AC (at 20 cpm)	10^5

Coil

Nominal operating power	200 mW

Rating

Standard	Current rating	HP rating
UL/CSA	8 A 125 V AC 5 A 277 V AC 5 A 30 V DC 0.3 A 100 V DC	1/10 HP 277 V AC 1/10 HP 125 V AC
TÜV	8 A 125 V AC (cos φ = 0.4) 5 A 250 V AC (cos φ = 0.4) 5 A 30 V DC (0 ms)	
VDE	8 A 125 V ~ (cos φ = 0.4) 5 A 30 V ⎓ (0 ms)	

Characteristics

Max. operating speed		180 cpm
Operate time (at nominal voltage)		Approx. 8 msec.
Release time (at nominal voltage)		Approx. 4 msec.
Initial breakdown voltage	Between open contacts	750 Vrms for 1 min.
	Between contact and coil	2,000 Vrms for 1 min.
Surge voltage between contact and coil		Min. 10,000 V
Initial insulation resistance		Min. 100 MΩ at 500 V DC
Temperature rise (max.)		65 deg.
Ambient temperature		−40 to +70°C −40 to +158°F
Shock resistance	Functional	Min. 10 G
	Destructive	Min. 100 G
Vibration resistance	Functional	10 G, 10 to 55 Hz at double amplitude of 1.6 mm
	Destructive	12 G, 10 to 55 Hz at double amplitude of 2 mm
Unit weight		Approx. 7 g .25 oz

TYPICAL APPLICATIONS

- Microwave ovens
- Small household appliances
- Water heaters
- Electric irons
- Coffee makers

ORDERING INFORMATION

Ex. JG1aF —— 24V

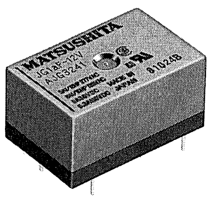
Coil voltage (DC)
5, 6, 9, 12, 18, 24 V

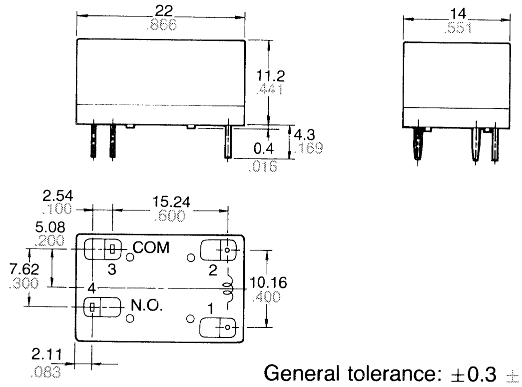
TYPES AND COIL DATA

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	Max. allowable voltage, V DC (at 70°C 158°F)
JG1aF-5V	5	4.0	0.25	125	40	200	6.5
JG1aF-6V	6	4.8	0.3	180	33	200	7.8
JG1aF-9V	9	7.2	0.45	404	22	200	11.7
JG1aF-12V	12	9.6	0.6	720	17	200	15.6
JG1aF-18V	18	14.4	0.9	1,620	11.1	200	23.4
JG1aF-24V	24	19.2	1.2	2,880	8.3	200	31.2

DIMENSIONS

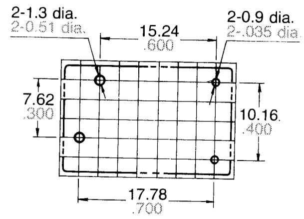
mm inch





General tolerance: ±0.3 ±.012

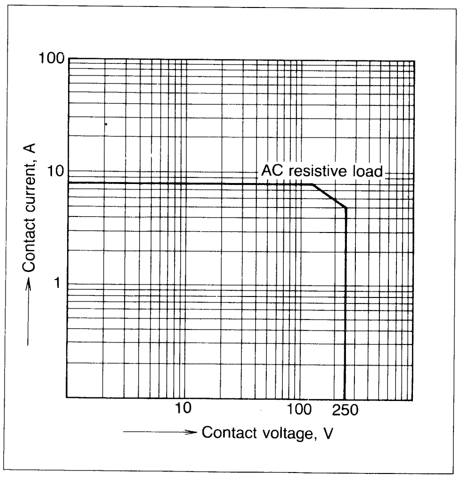
PC board pattern (Copper-side view)



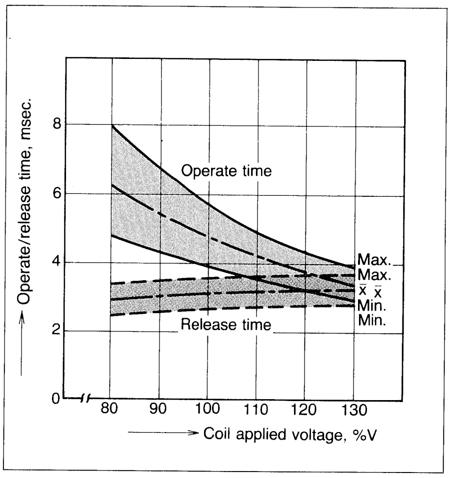
Tolerance: ±0.1 ±.004

DATA

1. Maximum value for switching capacity



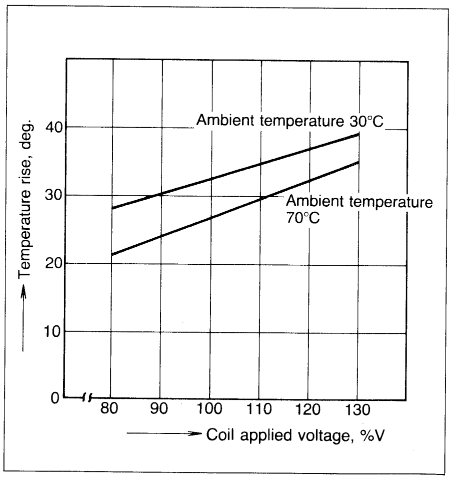
2. Operate/release time



3. Coil temperature rise

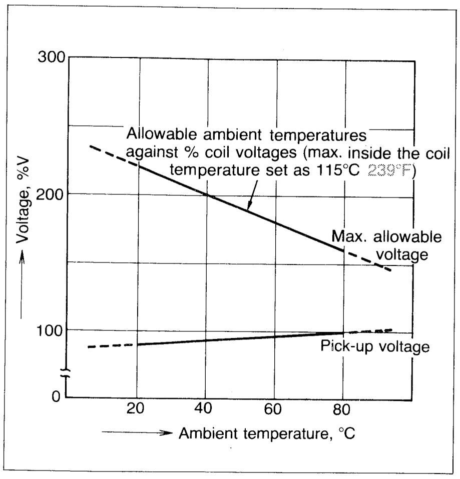
Point measured: Inside the coil

Contact current: 8 A



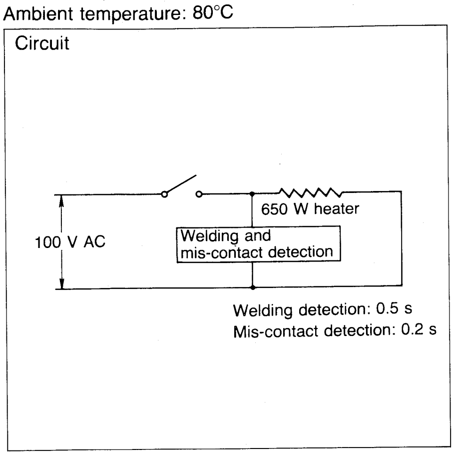
4. Ambient temperature characteristics

Contact current: 8 A

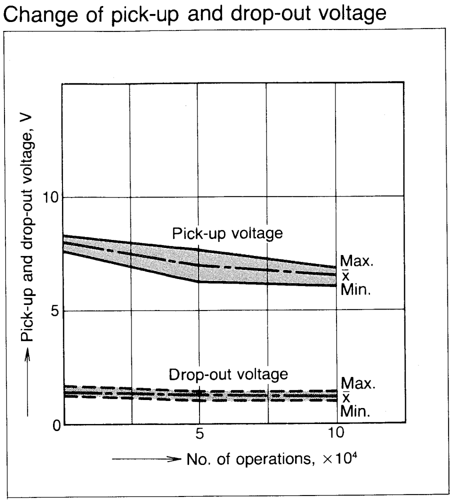


5. Electrical life test (5.8 A 100 V AC resistive load)

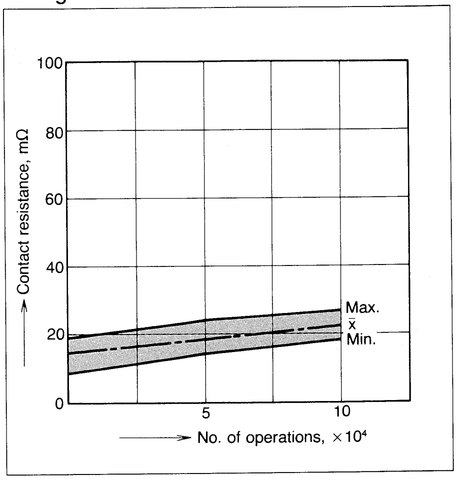
Sample: JG1aF-12V, 6 pcs.
Operating speed: 20 cpm
Ambient temperature: 80°C



Change of pick-up and drop-out voltage

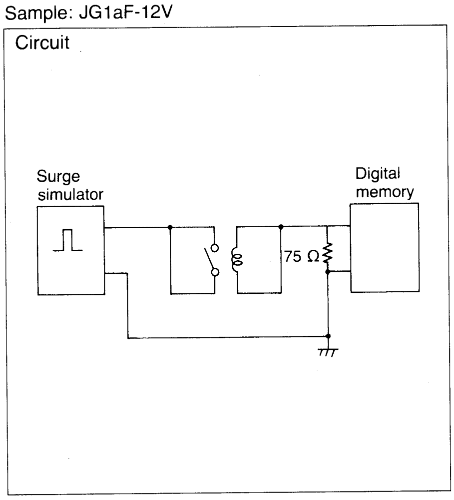


Change of contact resistance

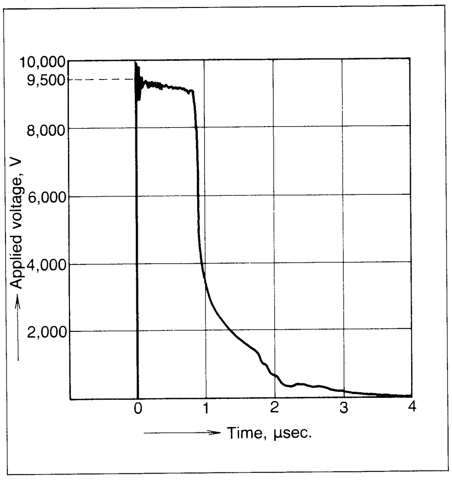


6. Electrical noise resistance characteristics between contact and coil

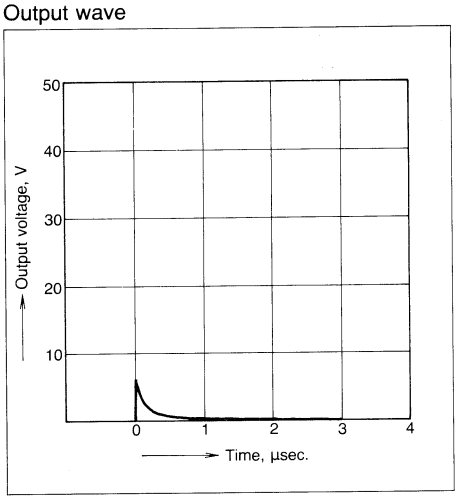
Sample: JG1aF-12V



Noise wave



Output wave



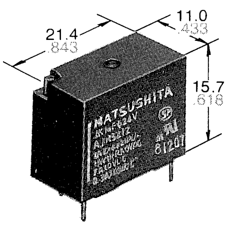
NOTES

1. To maintain initial performance, care should be taken to avoid dropping or hitting the relay.
2. To maintain the relay's characteristics, do not remove the cover. (It should not be removed during normal handling.)
3. Avoid using in the location where there are excessive dust, dirt, organic gases, humidity, water, oil, vibration and shock.
4. The voltage applied to coil should be nominal voltage with rectangular wave.
5. The voltage applied to coil should not exceed the max. switching voltage.
6. The switching voltage and current to contact should not exceed the rated value.
7. The rated contact capacity and life are typical values. Since contact phenomena and life vary depending on kinds of load and other conditions, please examine them through actual conditions.
8. Relays should be used within the rated ambient temperature.
9. Avoid bending terminals, because it may cause malfunction.

NAiS

SLIM TYPE POWER RELAY

JK-RELAYS



mm inch

UL File No.: E43028 **TÜV File No.: Nr. 88091645534**
CSA File No.: LR26550 **VDE File No.: VDE-Reg.-Nr. 3773, SEMKO**

- **Compact & Slim design: 11.0 mm (length)×21.4 mm (width)×15.4 mm (height)** (.433×.843×.606 inch)
- **High capacity type (8 A) available**
- **Surge resistance: Min. 8,000 V between contact and coil**
- **High sensitivity: 200 mW nominal operating power**
- **Sealed type available**

SPECIFICATIONS

Contact

Type		Standard type	High capacity type
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	3 A 125 V AC	8 A 125 V AC
	Max. switching power	375 VA	1,000 VA
	Max. switching voltage	250 V AC	250 V AC
	Max. switching current	3 A	8 A
Expected life (min. operations)	Mechanical (at 180 cpm)	5×10^6	
	Electrical (at 20 cpm) (resistive load) 3 A 125 V AC	10^5	—
	8 A 125 V AC	—	10^5

Coil

Nominal operating power	200 mW

Rating

Standard	Type	Current rating	HP rating
UL	Standard type (3 A)	3 A 125 V AC 2 A 277 V AC 3 A 30 V DC 0.3 A 110 V DC	1/10 HP 277 V AC 1/10 HP 125 V AC
UL	High capacity type (8 A)	8 A 125 V AC 5 A 277 V AC 5 A 30 V DC 0.3 A 110 V DC	1/10 HP 277 V AC 1/10 HP 125 V AC
CSA	Standard type (3 A)	3 A 125 V AC 2 A 277 V AC 3 A 30 V DC 0.3 A 110 V DC	1/10 HP 277 V AC 1/10 HP 125 V AC
CSA	High capacity type (8 A)	8 A 125 V AC 5 A 277 V AC 5 A 30 V DC 0.3 A 110 V DC	1/10 HP 277 V AC 1/10 HP 125 V AC
TÜV	Standard type (3 A)	3 A 125 V AC ($\cos\varphi = 0.4$) 2 A 250 V AC ($\cos\varphi = 0.4$) 3 A 30 V DC (0 ms)	
TÜV	High capacity type (8 A)	8 A 125 V AC ($\cos\varphi = 0.4$) 5 A 250 V AC ($\cos\varphi = 0.4$) 5 A 30 V DC (0 ms)	
VDE	Standard type (3 A)	3 A 125 V ~ ($\cos\varphi = 0.4$) 3 A 30 V ⎓ (0 ms)	
VDE	High capacity type (8 A)	8 A 125 V ~ ($\cos\varphi = 0.4$) 5 A 30 V ⎓ (0 ms)	

Characteristics

Max. operating speed		20 cpm
Operate time (at nominal voltage)		Approx. 8 msec.
Release time (at nominal voltage)		Approx. 4 msec.
Initial breakdown voltage	Between open contacts	750 Vrms for 1 min.
	Between contact and coil	2,000 Vrms for 1 min.
Surge voltage between contact and coil		Min. 8,000 V
Initial insulation resistance		Min. 100 MΩ at 500 V DC
Temperature rise (max.)		65 deg.
Ambient temperature		−40 to +70°C −40 to +158°F
Shock resistance	Functional	Min. 10 G
	Destructive	Min. 100 G
Vibration resistance	Functional	Approx. 10 G, 10 to 55 Hz at double amplitude of 1.6 mm
	Destructive	Approx. 12 G, 10 to 55 Hz at double amplitude of 2 mm
Unit weight		Approx. 7 g .25 oz

TYPICAL APPLICATIONS

- Home appliances
  Microwave ovens, Air conditioners
- Office equipment
  Photocopiers, Facsimiles
- Industrial machines
  NC machines

ORDERING INFORMATION

Ex. JK 1a | P | F | — | 12V |

Contact capacity	Protective construction	Coil voltage (DC)
Nil: Standard 3 A P: High capacity 8 A	Nil: Sealed type F: Flux-resistant type	3, 5, 6, 9, 12, 18, 24, 48 V

Notes: 1. For VDE recognized type, add suffix VDE.
2. Standard packing: Carton: 100 pcs. Case: 500 pcs.

TYPES

1. Standard type (3 A)

Coil voltage, V DC	Part No.	
	Sealed type	Flux-resistant type
3	JK1a-3V	JK1aF-3V
5	JK1a-5V	JK1aF-5V
6	JK1a-6V	JK1aF-6V
9	JK1a-9V	JK1aF-9V
12	JK1a-12V	JK1aF-12V
18	JK1a-18V	JK1aF-18V
24	JK1a-24V	JK1aF-24V
48	JK1a-48V	JK1aF-48V

2. High capacity type (8 A)

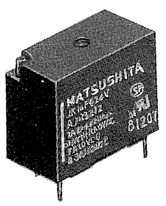
Coil voltage, V DC	Part No.	
	Sealed type	Flux-resistant type
3	JK1aP-3V	JK1aPF-3V
5	JK1aP-5V	JK1aPF-5V
6	JK1aP-6V	JK1aPF-6V
9	JK1aP-9V	JK1aPF-9V
12	JK1aP-12V	JK1aPF-12V
18	JK1aP-18V	JK1aPF-18V
24	JK1aP-24V	JK1aPF-24V
48	JK1aP-48V	JK1aPF-48V

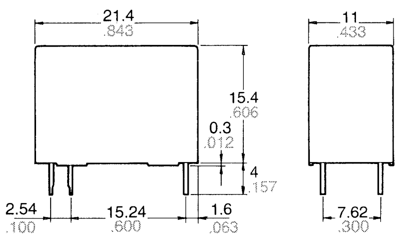
COIL DATA (at 20°C 68°F)

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	Max. allowable voltage, VDC
3	2.4	0.15	45	67	200	5.4
5	4.0	0.25	125	40	200	9.0
6	4.8	0.3	180	33	200	10.8
9	7.2	0.45	404	22	200	16.2
12	9.6	0.6	720	17	200	21.6
18	14.4	0.9	1,620	11	200	32.4
24	19.2	1.2	2,880	8.3	200	43.2
48	38.4	2.4	11,520	4.2	200	86.4

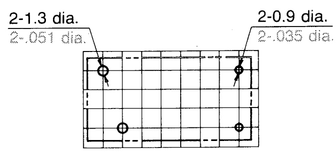
DIMENSIONS

mm inch

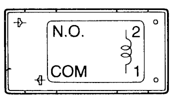




PC board pattern (Copper-side view)



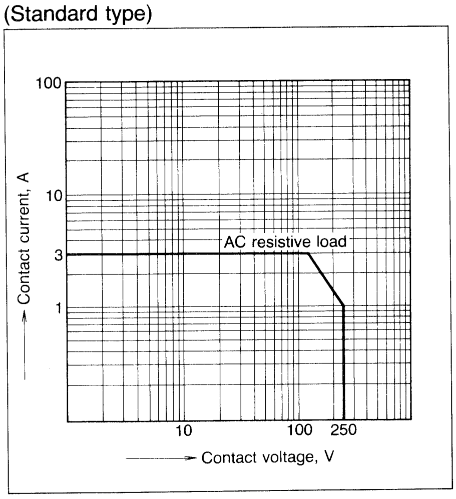
Tolerance: ±0.1 ±.004



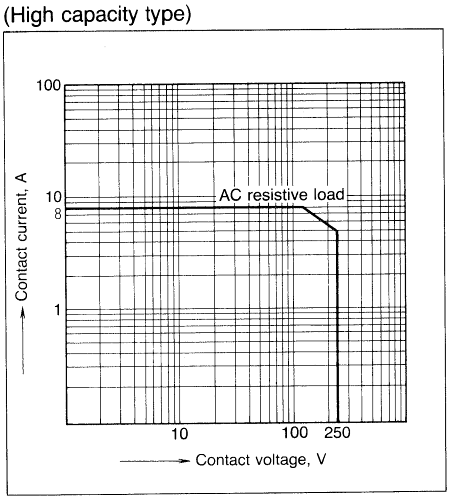
General tolerance: ±0.3 ±.012

DATA

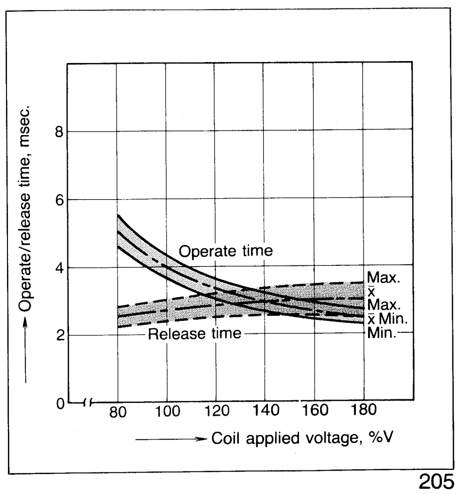
1-(1). Maximum value for switching capacity (Standard type)



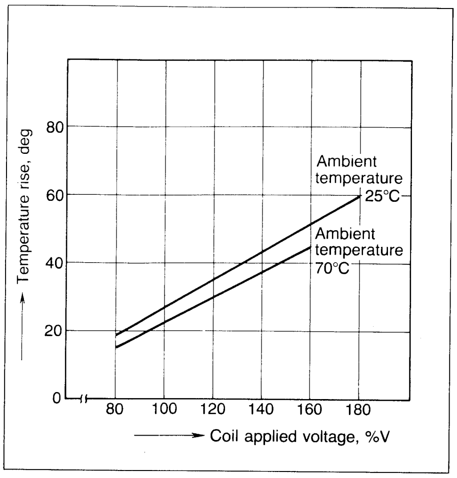
1-(2). Maximum value for switching capacity (High capacity type)



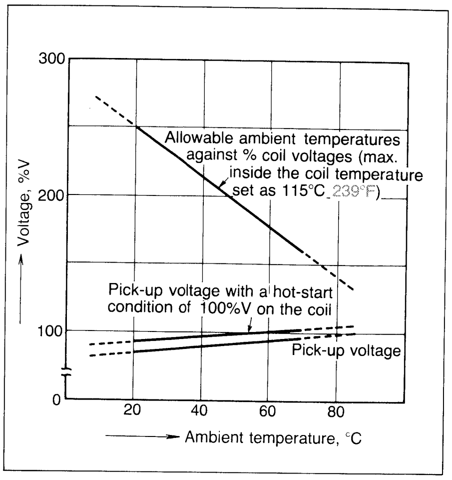
2. Operate/release time



3. Coil temperature rise
(High capacity type)
Measured portion: Inside the coil
Contact current: 8 A



4. Ambient temperature characteristics
(High capacity type)
Contact current: 8 A



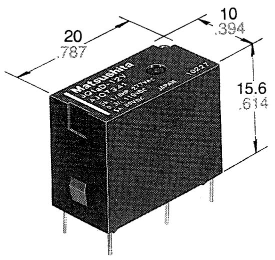
NOTES

1. To maintain initial performance, care should be taken to avoid dropping or hitting the relay.
2. To maintain the relay's characteristics, do not remove the cover. (It should not be removed during normal handling.)
3. Avoid using in the location where there are excessive dust, SO_2 gas and organic gases. Note that switching contact in the silicon atmosphere may result in contact failure.
4. The voltage applied to coil should be nominal voltage with rectangular wave.
5. The voltage applied to coil should not exceed the max. switching voltage.
6. The switching voltage and current to the contact should not exceed the rated value.
7. The rated contact capacity and life are typical values. Since contact phenomena and life vary depending on kinds of load and other conditions, please examine them through actual conditions.
8. Relays should be used within the rated ambient temperature.
9. For automatic cleaning, use sealed types. It is recommended that fluorinated hydrocarbon of other alcoholic solvent be used, and that the ultrasonic cleaning be avoided.
10. Avoid bending terminals, because it may cause malfunction.

NAiS

HIGH ELECTRICAL & MECHANICAL NOISE IMMUNITY RELAY

JQ-RELAYS



mm inch

UL File No.: E43028
CSA File No.: LR26550, SEV

- 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

SPECIFICATIONS

Contacts

			Standard type	High capacity type
Arrangement			1 Form A, 1 Form C	
Contact material			Silver alloy	
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			100 mΩ	
Rating (resistive) Switching capacity and electrical life (min. operations)	1a		5 A 125 V AC (5×10^4) 3 A 125 V AC (2×10^5) 2 A 277 V AC (2×10^5)	10 A 125 V AC (5×10^4) 5 A 277 V AC (5×10^4)
	1c	N.O.	5 A 125 V AC (5×10^4) 3 A 125 V AC (2×10^5) 2 A 277 V AC (2×10^5)	10 A 125 V AC (5×10^4) 5 A 277 V AC (5×10^4)
		N.C.	2 A 125 V AC (2×10^5) 1 A 277 V AC (2×10^5)	3 A 125 V AC (2×10^5) 2 A 277 V AC (2×10^5)
Max. switching power			1,250 VA	2,500 VA
Max. switching voltage			250 V AC, 110 V DC	
Max. switching current			5 A	10 A
UL/CSA rating			5 A 1/10 HP 125 V AC 5 A 1/6 HP 277 V AC 5 A 30 V DC 0.3 A 110 V DC	10 A 1/6 HP 125 V AC 8 A 1/6 HP 277 V AC 5 A 30 V DC 0.3 A 110 V DC
Mechanical life (at 180 cpm) (min. operations)			10^7	

Coil (at 20°C 68°F)

Nominal operating power	1a: 200 mW	1c: 400 mW

Characteristics

Max. operating speed		20 cpm
Operate time		Approx. 6 ms
Release time		Approx. 4 ms
Initial breakdown voltage	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
Initial insulation resistance		1,000 MΩ at 500 V DC
Surge voltage between contacts and coil		8,000 V
Temperature rise		65 deg.*1
Ambient temperature		–40°C to +70°C –40°F to 158°F
Shock resistance	Functional	30 G
	Destructive	100 G
Vibration resistance	Functional	10 G, 10 to 55 Hz at double amplitude of 1.6 mm
	Destructive	12 G, 10 to 55 Hz at double amplitude of 2.0 mm
Unit weight		Approx. 10 g .35 oz

*1Measured conditions

Standard type	Resistive, nominal voltage applied to the coil. Contact carrying current: 5 A, at 70°C
High capacity type	Resistive, nominal voltage applied to the coil. Contact carrying current: 10 A, at 70°C

TYPICAL APPLICATIONS

- Air conditioners
- Refrigerators
- Microwave ovens
- Heaters

ORDERING INFORMATION

Ex. JQ | 1a | P | — | 12 | V

Contact arrangement	Contact capacity	Coil voltage (DC)
1a: 1 Form A 1: 1 Form C	Nil: Standard P: High capacity	3, 5, 6, 9, 12, 18, 24, 48* V

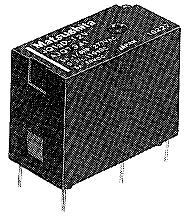
*Available only for 1 Form C type.

TYPES AND COIL DATA at 20°C 68°F

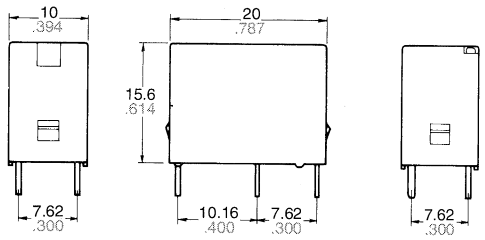
		Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, V DC
1 Form A	Standard type	JQ1a-3V	3	2.25	0.15	66.7	200	45	180% of nominal voltage (at 20°C) 130% of nominal voltage (at 70°C)
		JQ1a-5V	5	3.75	0.25	40		125	
		JQ1a-6V	6	4.5	0.3	33.3		180	
		JQ1a-9V	9	6.75	0.45	22.2		405	
		JQ1a-12V	12	9	0.6	16.7		720	
		JQ1a-18V	18	13.5	0.9	11.1		1,620	
		JQ1a-24V	24	18	1.2	8.3		2,880	
	High capacity type	JQ1aP-3V	3	2.4	0.15	66.7	200	45	180% of nominal voltage (at 20°C) 130% of nominal voltage (at 70°C)
		JQ1aP-5V	5	4	0.25	40		125	
		JQ1aP-6V	6	4.8	0.3	33.3		180	
		JQ1aP-9V	9	7.2	0.45	22.2		405	
		JQ1aP-12V	12	9.6	0.6	16.7		720	
		JQ1aP-18V	18	14.4	0.9	11.1		1,620	
		JQ1aP-24V	24	19.2	1.2	8.3		2,880	
1 Form C	Standard type	JQ1-3V	3	2.25	0.15	133.3	400	22.5	150% of nominal voltage (at 20°C) 110% of nominal voltage (at 70°C)
		JQ1-5V	5	3.75	0.25	80		62.5	
		JQ1-6V	6	4.5	0.3	66.7		90	
		JQ1-9V	9	6.75	0.45	44.4		202.5	
		JQ1-12V	12	9	0.6	33.3		360	
		JQ1-18V	18	13.5	0.9	22.2		810	
		JQ1-24V	24	18	1.2	16.7		1,440	
		JQ1-48V	48	36	2.4	8.3		5,760	
	High capacity type	JQ1P-3V	3	2.4	0.15	133.3	400	22.5	150% of nominal voltage (at 20°C) 110% of nominal voltage (at 70°C)
		JQ1P-5V	5	4	0.25	80		62.5	
		JQ1P-6V	6	4.8	0.3	66.7		90	
		JQ1P-9V	9	7.2	0.45	44.4		202.5	
		JQ1P-12V	12	9.6	0.6	33.3		360	
		JQ1P-18V	18	14.4	0.9	22.2		810	
		JQ1P-24V	24	19.2	1.2	16.7		1,440	
		JQ1P-48V	48	38.4	2.4	8.3		5,760	

DIMENSIONS

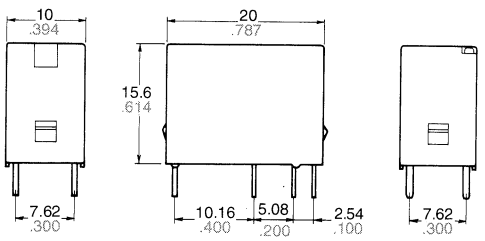
mm inch



1 Form A



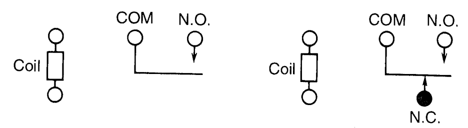
1 Form C



General tolerance: ±0.3 ±.012

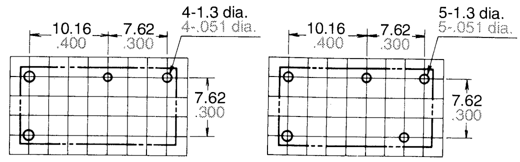
Schematic (Bottom view)

1 Form A 1 Form C



PC board pattern (Copper-side view)

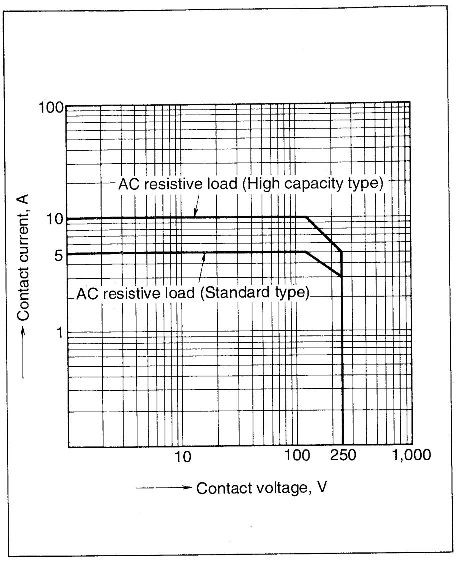
1 Form A 1 Form C



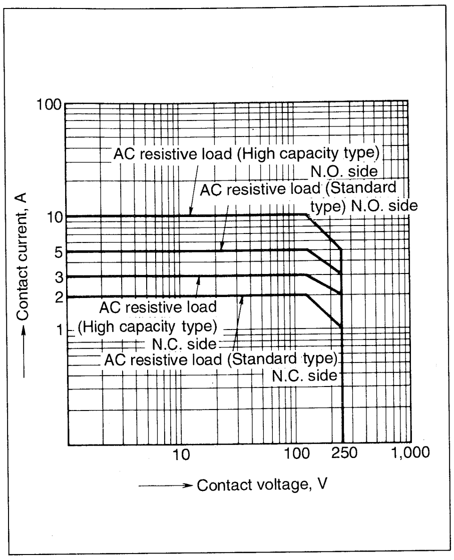
Tolerance: ±0.1 ±.004

DATA

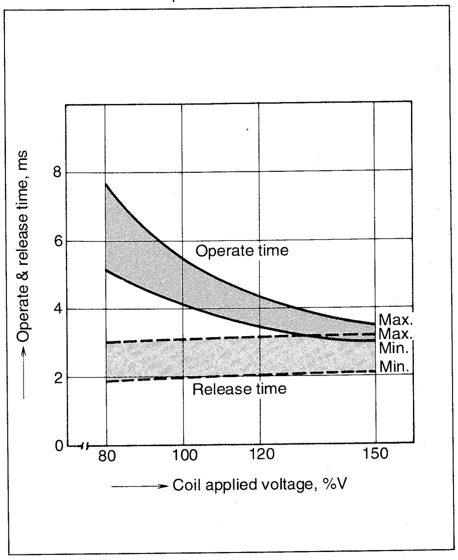
1-(1). Max. switching capacity (1 Form A type)



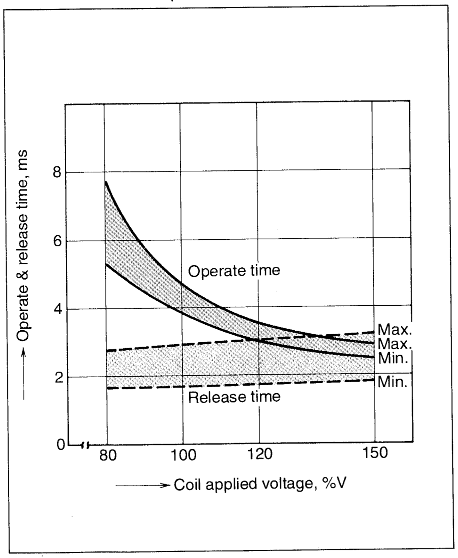
1-(2). Max. switching capacity (1 Form C type)



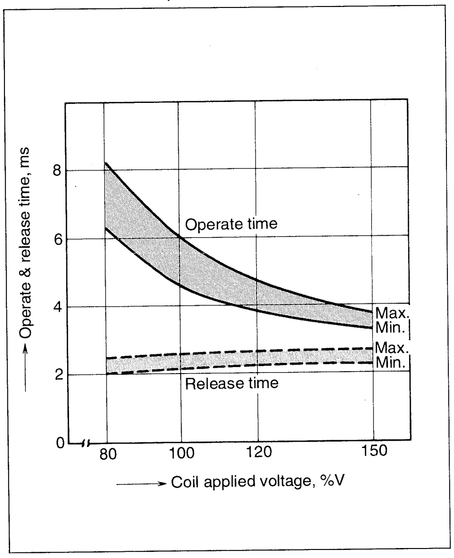
2-(1). Operate & release time (Standard 1 Form A type)
Tested sample: JQ1a-12V, 25 pcs



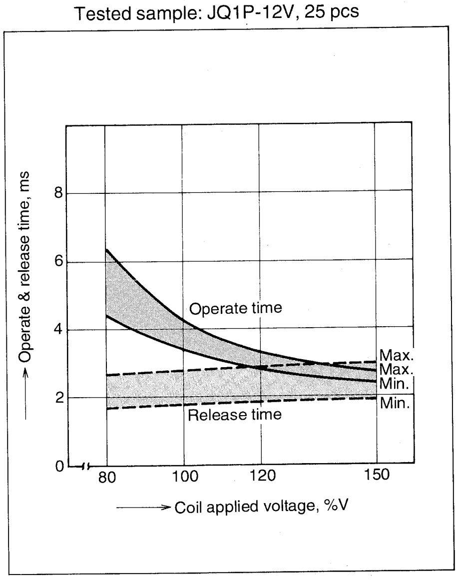
2-(2). Operate & release time (Standard 1 Form C type)
Tested sample: JQ1-24V, 25 pcs



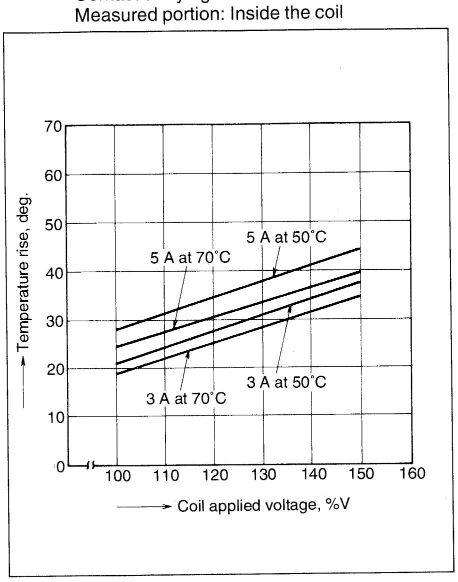
2-(3). Operate & release time (High capacity 1 Form A type)
Tested sample: JQ1aP-12V, 25 pcs



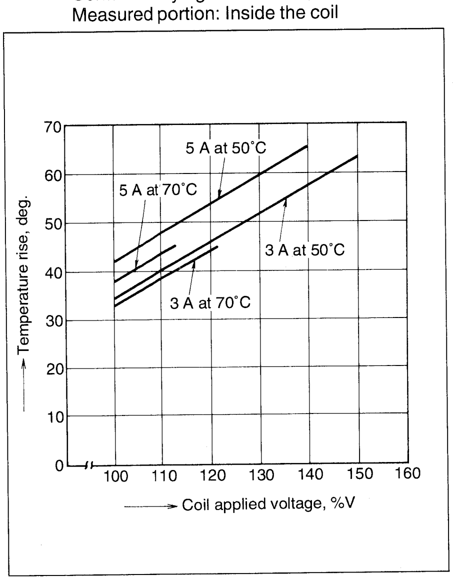
2-(4). Operate & release time (High capacity 1 Form C type)
Tested sample: JQ1P-12V, 25 pcs



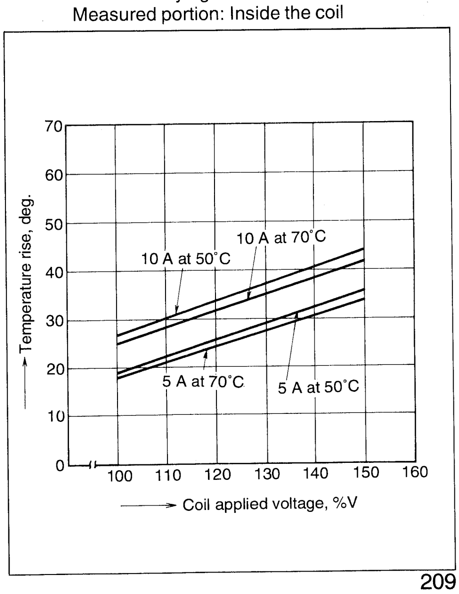
3-(1). Coil temperature rise (Standard 1 Form A type)
Contact carrying current: 3 A, 5 A
Measured portion: Inside the coil



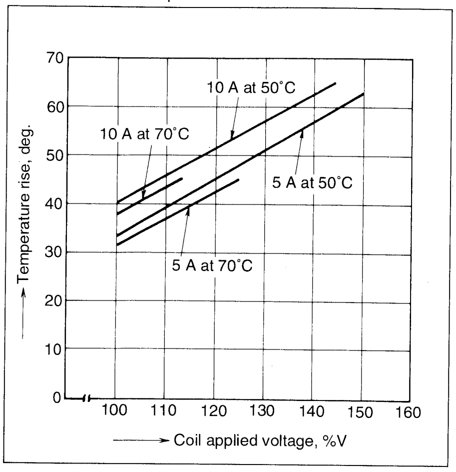
3-(2). Coil temperature rise (Standard 1 Form C type)
Contact carrying current: 3 A, 5 A
Measured portion: Inside the coil



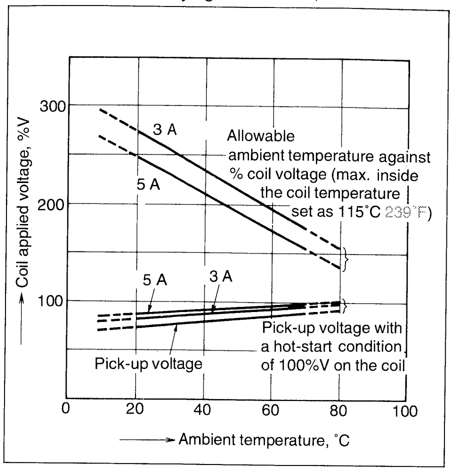
3-(3). Coil temperature rise (High capacity 1 Form A type)
Contact carrying current: 5 A, 10 A
Measured portion: Inside the coil



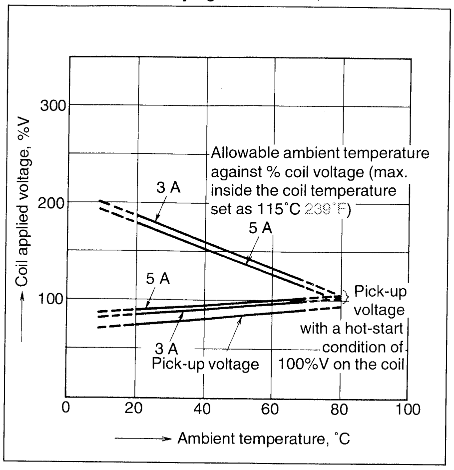
3-(4). Coil temperature rise (High capacity 1 Form C type)
Contact carrying current: 5 A, 10 A
Measured portion: Inside the coil



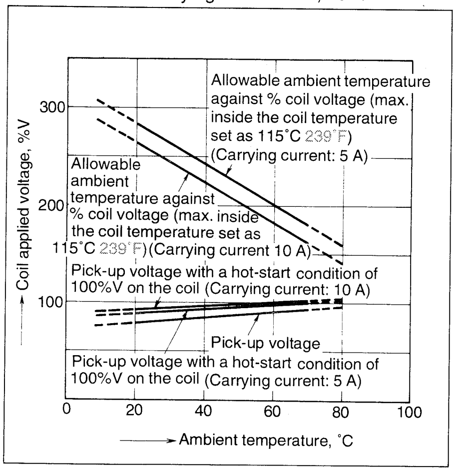
4-(1). Ambient temperature characteristics (Standard 1 Form A type)
Tested sample: JQ1a-24V
Contact carrying current: 3 A, 5 A



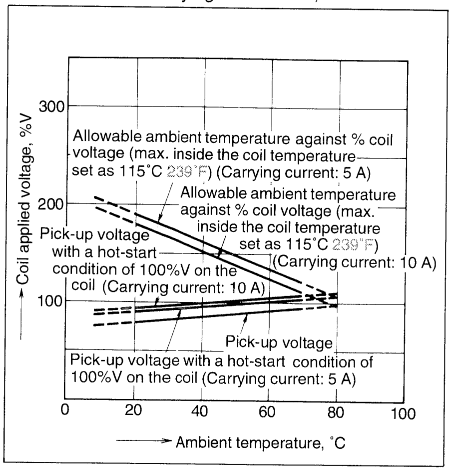
4-(2). Ambient temperature characteristics (Standard 1 Form C type)
Tested sample: JQ1-24V
Contact carrying current: 3 A, 5 A



4-(3). Ambient temperature characteristics (High capacity 1 Form A type)
Tested sample: JQ1aP-24V
Contact carrying current: 5 A, 10 A



4-(4). Ambient temperature characteristics (High capacity 1 Form C type)
Tested sample: JQ1P-24V
Contact carrying current: 5 A, 10 A



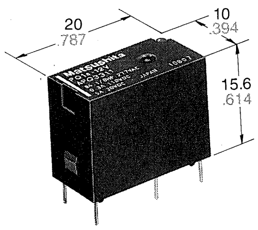
NOTES

1. To maintain initial performance, care should be taken to avoid dropping or hitting the relay.
2. To maintain the relay's characteristics, do not remove the cover. (It should not be removed during normal handling.)
3. Avoid using in the location where there are excessive dust, SO_2 gas and organic gases. Note that switching contact in the silicon atmosphere may result in contact failure.
4. The voltage applied to coil should be nominal voltage with rectangular wave.
5. The voltage applied to coil should not exceed the max. switching voltage.
6. The switching voltage and current to the contact should not exceed the rated value.
7. The rated contact capacity and life are typical values. Since contact phenomena and life vary depending on kinds of load and other conditions, please examine them through actual conditions.
8. Relays should be used within the rated ambient temperature.
9. For automatic cleaning, it is recommended that fluorinated hydrocarbon of other alcoholic solvent be used, and that the ultrasonic cleaning be avoided.
10. Avoid bending terminals, because it may cause malfunction.

NAiS

HIGH ELECTRICAL & MECHANICAL NOISE IMMUNITY RELAY

PQ-RELAYS



mm inch

UL File No.: E43028
CSA File No.: LR26550
SEMKO File No.: 9123071, SEV

- **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 277 V AC, 5 A 30 V DC
	Max. switching power	1,250 VA
	Max. switching voltage	250 V AC, 110 V DC
	Max. switching current	5 A
UL/CSA rating		5 A 1/6 HP 277 V AC, 5 A 30 V DC, 0.3 A 110 V DC
Expected life(min. operations)	Mechanical (at 180 cpm)	10^7
Electrical (at 20 cpm)	5 A 125 V AC	2×10^5
	5 A 277 V AC	10^5
	5 A 30 V DC	10^5

Coil (at 20°C 68°F)

Nominal operating power	200 mW

Characteristics

Max. operating speed		20 cpm at rated load
Operate time		Approx. 6 ms
Release time		Approx. 4 ms
Initial breakdown voltage	Between open contacts	1,000 Vrms
	Between contacts and coil	4,000 Vrms
Initial insulation resistance		1,000 MΩ at 500 V DC
Surge voltage between contacts and coil		8,000 V
Temperature rise (Resistive at nominal voltage, contact carrying current: 5 A, at 70°C)		65 deg.
Ambient temperature		–40°C to +70°C, –40°F to 158°F
Shock resistance	Functional	30 G
	Destructive	100 G
Vibration resistance	Functional	12 G, 10 to 55 Hz at double amplitude of 2.0 mm 15 G (10 to 500 Hz).
	Destructive	21 G, 10 to 55 Hz at double amplitude of 3.5 mm
Unit weight		Approx. 10 g .35 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

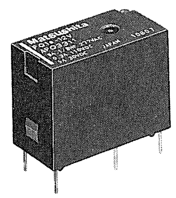
Note: Standard packing: Carton: 100 pcs.; Case: 500 pcs.

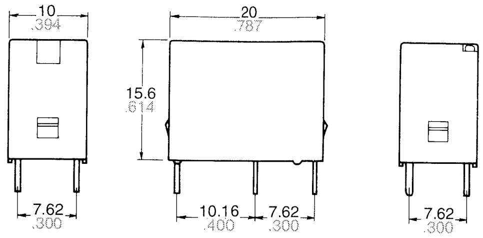
TYPES AND COIL DATA at 20°C 68°F

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA	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 the nominal voltage (at 20°C) 130%V of the nominal voltage (at 70°C)
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	

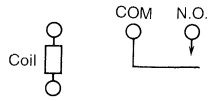
DIMENSIONS

mm inch

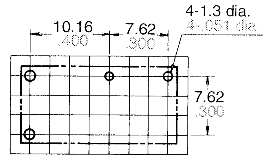




Schematic (Bottom view)



PC board pattern
(Copper-side view)

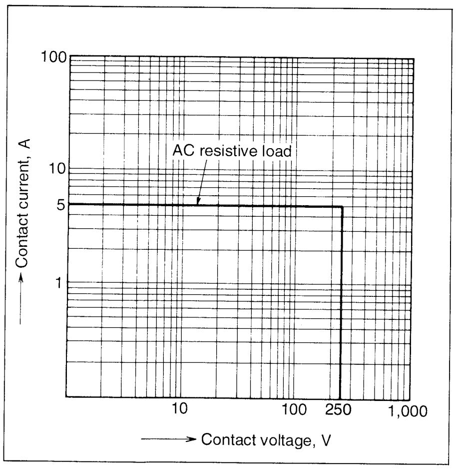


General tolerance: ±0.3 ±.012

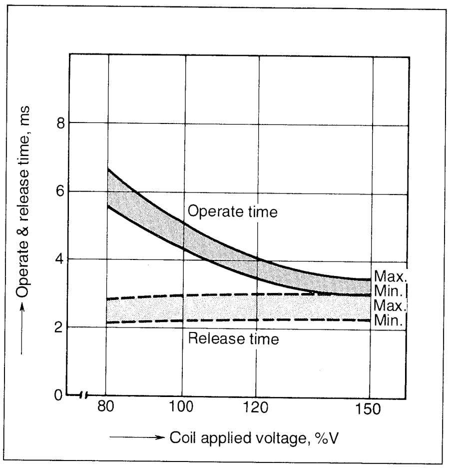
Tolerance: ±0.1 ±.004

DATA

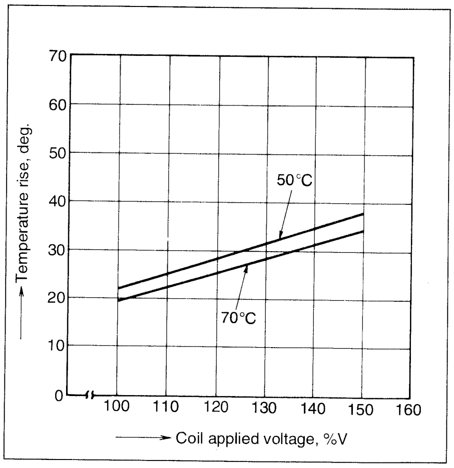
1. Max. switching capacity



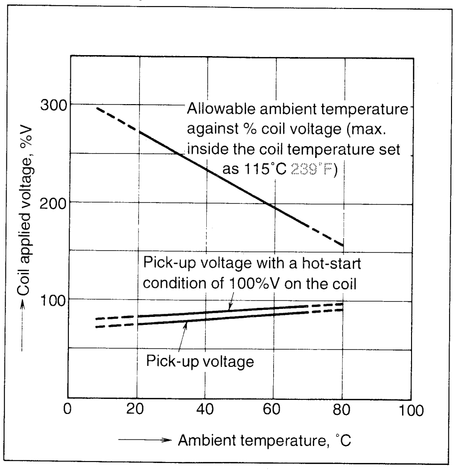
2. Operate & release time
Tested sample: PQ1a-24V, 25 pcs.



3. Coil temperature rise
Measured portion: Inside the coil
Contact carrying current: 5 A



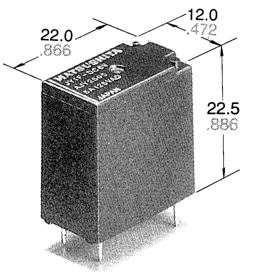
4. Ambient temperature characteristics
Tested sample: PQ1a-24V
Contact carrying current: 5 A



NOTES

1. To maintain initial performance, care should be taken to avoid dropping or hitting the relay.
2. To maintain the relay's characteristics, do not remove the cover. (It should not be removed during normal handling.)
3. Avoid using in the location where there are excessive dust, SO_2 gas and organic gases. Note that switching contact in the silicon atmosphere may result in contact failure.
4. The voltage applied to coil should be nominal voltage with rectangular wave.
5. The voltage applied to coil should not exceed the max. switching voltage.
6. The switching voltage and current to the contact should not exceed the rated value.
7. The rated contact capacity and life are typical values. Since contact phenomena and life vary depending on kinds of load and other conditions, please examine them through actual conditions.
8. Relays should be used within the rated ambient temperature.
9. For automatic cleaning, it is recommended that fluorinated hydrocarbon of other alcoholic solvent be used, and that the ultrasonic cleaning be avoided.
10. Avoid bending terminals, because it may cause malfunction.

NAiS | COMPACT POWER RELAYS | **JY-RELAYS**



mm inch

UL File No.: E43028
CSA File No.: LR26550
TÜV File No.: 89081645545

- **Compact-size small mounting space for high density packaging.**
- **High contact capacity: 5 A (Standard F type), 10 A (Power J type)**
- **2 contact arrangements: 1 Form A, 1 Form C**
- **Pick-up voltage: Max. 70% (of the nominal voltage) types available**
- **Sealed types for automated cleaning**
- **UL class B coil insulation type available**

SPECIFICATIONS (at 20°C 68°F)

Contact

	Standard F type, 5 A	Power J type, 10 A
Arrangement	1 Form A, 1 Form C	
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	50 mΩ	
Contact material	Silver alloy	
Rating (resistive load) Nominal switching capacity	5 A 125 V AC	10 A 125 V AC
Max. switching power	625 VA	1,250 VA
Max. switching voltage	125 V AC, 30 V DC	
Max. switching current	5 A (AC/DC)	5 A (DC), 10 A (AC)
Expected life (min. operations) Mechanical (at 180 cpm)	Min. 5×10^6	
Electrical (at 20 cpm)	Min. 1×10^5 (at rated load)	

Coil

Nominal operating power	400 mW

Characteristics

Max. operating speed		20 cpm
Operate time (at nominal voltage)		Approx. 10 msec.
Release (at nominal voltage)		Approx. 10 msec.
Initial insulation resistance		100 MΩ or more (at 500 V DC)
Breakdown voltage	Between open contacts	800 Vrms for 1 min.
	Between contacts and coil	2,000 Vrms for 1 min.
Surge voltage* between coil and contact		Min. 5,000 V
Temperature rise (max.)		65 deg. with nominal coil voltage across coil and rated contact current
Ambient temperature		−40°C to +50°C −40°F to +122°F
Shock resistance	Functional	10 G or more
	Destruction	100 G or more
Vibration resistance	Functional	Approx. 6 G 10 to 55 Hz at double amplitude of 1 mm
	Destruction	Approx. 12 G 10 to 55 Hz at double amplitude of 2 mm
Unit weight		Standard F type: Approx. 10 g .35 oz Power J type: Approx. 11 g .39 oz

*JY relays can withstand 5,000 V surge in ±(1.2×50) µsec. between coil and contact.

TYPICAL APPLICATION

1. Home appliances
   Air conditioners, refrigerators, etc.
2. Office machines
   Photocopiers, facsimiles, power source equipment, etc.
3. Automotive
   Car-stereo, car antenna, car-wiper, etc.

ORDERING INFORMATION

JY [1] [F] [S] [N] — [B] — [DC24V]

Contact arrangement	Contact capacity	Protective construction	Pick-up voltage	Coil type	Coil voltage
1: 1 Form C 1a: 1 Form A	F: Standard (5 A) J: Power (10 A)	Nil: Flux-resistant type S: Sealed type	Nil: 80% or less of nominal voltage N: 70% or less of nominal voltage	Nil: Class A type B: Class B type	DC 5, 6, 9, 12, 24, 48 V

Notes: 1. For UL/CSA or VDE recognized types, add suffix UL/CSA or VDE.
2. Standard packing: Carton 100 pcs. Case 500 pcs.

TYPES AND COIL DATA (at 20°C 68°F)

1. Standard F types (pick-up voltage: 70% or less of nominal voltage)

Contact arrangement	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%)	Max. allowable impressed voltage (at 50°C)
	Sealed type	Flux resistant type						
1 Form A	JY1aFSN-DC5V	JY1aFN-DC5V	5	3.5	0.5	62.5	80	5.5
	JY1aFSN-DC6V	JY1aFN-DC6V	6	4.2	0.6	90.0	67	6.6
	JY1aFSN-DC9V	JY1aFN-DC-9V	9	6.3	0.9	202.0	45	9.9
	JY1aFSN-DC12V	JY1aFN-DC12V	12	8.4	1.2	360.0	33	13.2
	JY1aFSN-DC24V	JY1aFN-DC24V	24	16.8	2.4	1,440.0	17	26.4
	JY1aFSN-DC48V	JY1aFN-DC48V	48	33.6	4.8	5,760.0	8.3	52.8
1 Form C	JY1FSN-DC5V	JY1FN-DC5V	5	3.5	0.5	62.5	80	5.5
	JY1FSN-DC6V	JY1FN-DC6V	6	4.2	0.6	90.0	67	6.6
	JY1FSN-DC9V	JY1FN-DC9V	9	6.3	0.9	203.0	44	9.9
	JY1FSN-DC12V	JY1FN-DC12V	12	8.4	1.2	360.0	33	13.2
	JY1FSN-DC24V	JY1FN-DC24V	24	16.8	2.4	1,440.0	17	26.4
	JY1FSN-DC48V	JY1FN-DC48V	48	33.6	4.8	5,760.0	8.3	52.8

2. Standard F types (pick-up voltage: 80% or less of nominal voltage)

Contact arrangement	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%)	Max. allowable impressed voltage (at 50°C)
	Sealed type	Flux resistant type						
1 Form A	JY1aFS-DC5V	JY1aF-DC5V	5	4	0.5	62.5	80	5.5
	JY1aFS-DC6V	JY1aF-DC6V	6	4.8	0.6	90.0	67	6.6
	JY1aFS-DC9V	JY1aF-DC9V	9	7.2	0.9	202.0	45	9.9
	JY1aFS-DC12V	JY1aF-DC12V	12	9.6	1.2	360.0	33	13.2
	JY1aFS-DC24V	JY1aF-DC24V	24	19.2	2.4	1,440.0	17	26.4
	JY1aFS-DC48V	JY1aF-DC48V	48	38.4	4.8	5,760.0	8.3	52.8
1 Form C	JY1FS-DC5V	JY1F-DC5V	5	4	0.5	62.5	80	5.5
	JY1FS-DC6V	JY1F-DC6V	6	4.8	0.6	90.0	67	6.6
	JY1FS-DC9V	JY1F-DC9V	9	7.2	0.9	203.0	44	9.9
	JY1FS-DC12V	JY1F-DC12V	12	9.6	1.2	360.0	33	13.2
	JY1FS-DC24V	JY1F-DC24V	24	19.2	2.4	1,440.0	17	26.4
	JY1FS-DC48V	JY1F-DC48V	48	38.4	4.8	5,760.0	8.3	52.8

3. Power J types (pick-up voltage: 70% or less of nominal voltage)

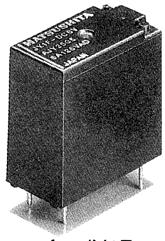
Contact arrangement	Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance Ω (±10%)	Nominal operating current mA (±10%)	Max. allowable impressed voltage (at 50°C)
	Sealed type	Flux resistant type						
1 Form A	JY1aJSN-DC5V	JY1aJN-DC5V	5	3.5	0.5	62.5	80	5.5
	JY1aJSN-DC6V	JY1aJN-DC6V	6	4.2	0.6	90.0	67	6.6
	JY1aJSN-DC9V	JY1aJN-DC9V	9	6.3	0.9	202.0	45	9.9
	JY1aJSN-DC12V	JY1aJN-DC12V	12	8.4	1.2	360.0	33	13.2
	JY1aJSN-DC24V	JY1aJN-DC24V	24	16.8	2.4	1,440.0	17	26.4
	JY1aJSN-DC48V	JY1aJN-DC48V	48	33.6	4.8	5,760.0	8.3	52.8
1 Form C	JY1JSN-DC5V	JY1JN-DC5V	5	3.5	0.5	62.5	80	5.5
	JY1JSN-DC6V	JY1JN-DC6V	6	4.2	0.6	90.0	67	6.6
	JY1JSN-DC9V	JY1JN-DC9V	9	6.3	0.9	203.0	44	9.9
	JY1JSN-DC12V	JY1JN-DC12V	12	8.4	1.2	360.0	33	13.2
	JY1JSN-DC24V	JY1JN-DC24V	24	16.8	2.4	1,440.0	17	26.4
	JY1JSN-DC48V	JY1JN-DC48V	48	33.6	4.8	5,760.0	8.3	52.8

4. Power J types (pick-up voltage: 80% or less of nominal voltage)

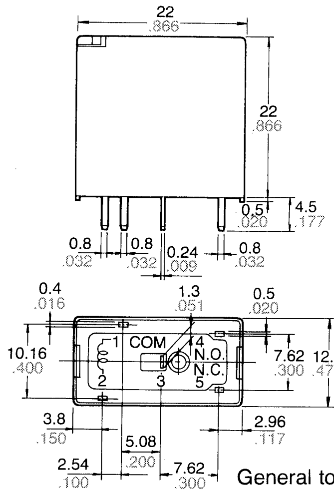
Contact arrangement	Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance Ω (±10%)	Nominal operating current mA (±10%)	Max. allowable impressed voltage (at 50°C)
	Sealed type	Flux resistant type						
1 Form A	JY1aJS-DC5V	JY1aJ-DC5V	5	4	0.5	62.5	80	5.5
	JY1aJS-DC6V	JY1aJ-DC6V	6	4.8	0.6	90.0	67	6.6
	JY1aJS-DC9V	JY1aJ-DC9V	9	7.2	0.9	202.0	45	9.9
	JY1aJS-DC12V	JY1aJ-DC12V	12	9.6	1.2	360.0	33	13.2
	JY1aJS-DC24V	JY1aJ-DC24V	24	19.2	2.4	1,440.0	17	26.4
	JY1aJS-DC48V	JY1aJ-DC48V	48	38.4	4.8	5,760.0	8.3	52.8
1 Form C	JY1JS-DC5V	JY1J-DC5V	5	4	0.5	62.5	80	5.5
	JY1JS-DC6V	JY1J-DC6V	6	4.8	0.6	90.0	67	6.6
	JY1JS-DC9V	JY1J-DC9V	9	7.2	0.9	203.0	44	9.9
	JY1JS-DC12V	JY1J-DC12V	12	9.6	1.2	360.0	33	13.2
	JY1JS-DC24V	JY1J-DC24V	24	19.2	2.4	1,440.0	17	26.4
	JY1JS-DC48V	JY1J-DC48V	48	38.4	4.8	5,760.0	8.3	52.8

DIMENSIONS

mm inch

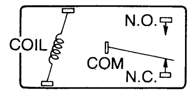


Common for JY1F and JY1J types

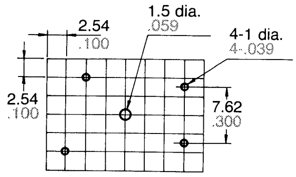


General tolerance: ±0.3 ±.012

Schematic (Bottom view)



PC board pattern (Copper-side view)

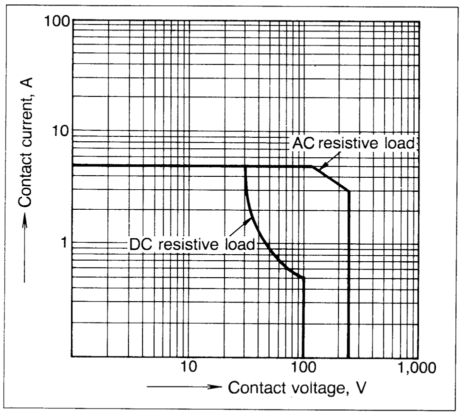


Tolerance: ±0.1 ±.004

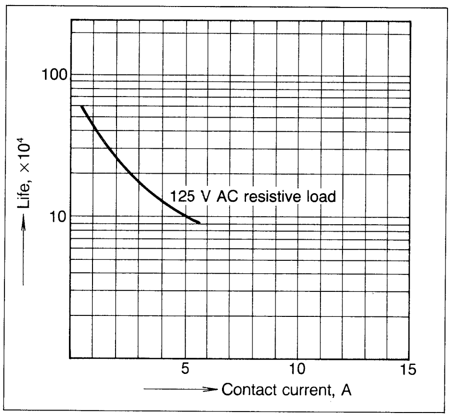
DATA

F type

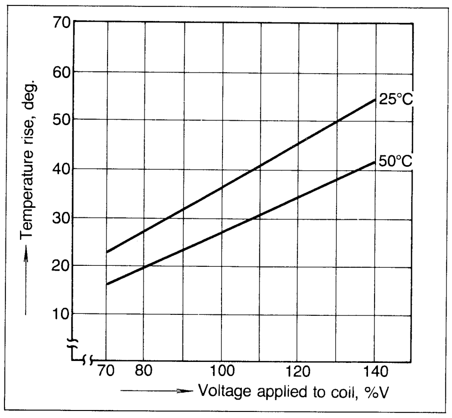
1. Maximum switching capacity



2. Life curve

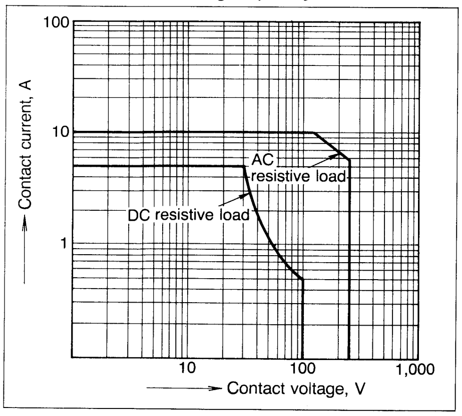


3. Coil temperature rise
Point measured: Inside the coil
Contact current: 5 A

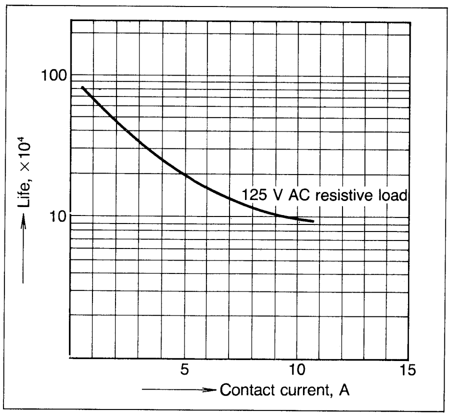


J Type

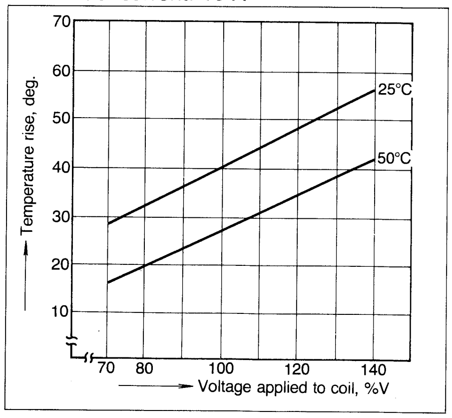
1. Maximum switching capacity



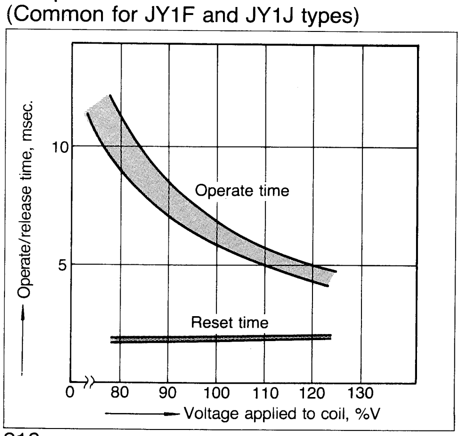
2. Life curve



3. Coil temperature rise
Point measured: Inside the coil
Contact current: 10 A



4. Operate/release time
(Common for JY1F and JY1J types)



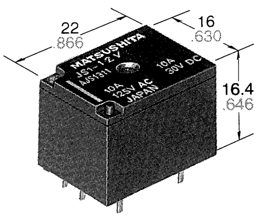
NOTES

1. Care should be taken not to drop relay or give shock to it.
2. Do not remove covers from relays to maintain relay characteristics.
3. Avoid using in the location where excessive dust, SO_2 gas, H_2S gas, organic gases and silicon exist. When relays are used in the location where siliconic resin exists, it may cause contact failure.
4. The voltage applied to coil should be nominal voltage with rectangular wave.
5. The switching voltage and current to the contact should not exceed the rated value.
6. The rated contact capacity and life are reference values. Since contact phenomena and life vary depending on kinds of loads and other conditions, please examine them through actual conditions.
7. For automatic cleaning, use sealed types. It is recommended that fluorinated hydrocarbon or other alcholic solvent be used, and t hat the ultrasonic cleaning be avoided.
8. Avoid bending terminals, because it may cause malfunction.

NAiS

ULTRA-MINIATURE PC BOARD TYPE POWER RELAY

JS-RELAYS



mm inch

UL File No.: E43028
CSA File No.: LR26550
TÜV File No.: 88121645537
VDE File No.: VDE-Reg.-Nr. 4065

- Ultra-miniature size with universal terminal footprint
- High contact capacity: 10 A
- Pick-up voltage: two types (70% and 80% of nominal voltage) available
- Sealed types available
- UL class B coil insulation type available
- TV-5 type available

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	10 A 125 V AC 6 A 277 V AC
Max. switching power	1,250 VA
Max. switching voltage	125 V AC, 24 V DC
Max. switching current	10 A (AC), 5 A (DC)
UL/CSA rating	10 A 125, 6 A 277 V AC 1/8 HP 125, 277 V AC 5 A 30 V DC
TÜV rating	10 A 125 V AC (cos φ=1.0) 6 A 250 V AC (cos φ=1.0) 5 A 30 V DC (0 ms)
VDE rating	10 A 125 V ~ (cos φ=1.0) 5 A 30 V ⎓ (0 ms)
Expected life (min. ope.) Mechanical (at 180 cpm)	10^7
Electrical at 10 A 125 V AC, 6 A 277 V AC resistive (at 20 cpm)	10^5

Coil

Nominal operating power	360 mW

Characteristics

Max. operating speed		20 cpm
Operate time (at nominal voltage)		Approx. 10 msec.
Release time (at nominal voltage)		Approx. 10 msec.
Initial insulation resistance		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage	Between open contacts	750 Vrms for 1 min.
	Between contacts and coil	1,500 Vrms for 1 min.
Temperature rise (max.) (at nominal voltage)		35 deg.
Ambient temperature		–40°C to +70°C –40°F to +158°F
Shock resistance	Functional	Min. 10 G
	Destruction	Min. 100 G
Vibration resistance	Functional	Approx. 10 G 10 to 55 Hz at double amplitude of 1.6 mm
	Destruction	Approx. 12 G 10 to 55 Hz at double amplitude of 2 mm
Unit weight		Approx. 12 g .423 oz

TYPICAL APPLICATION

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] [J] — [B] — [12V]

Contact arrangement	Protective construction	Pick-up voltage	Coil insulation class	Coil voltage (DC)
1: 1 Form C 1a: 1 Form A	Nil: Sealed type F: Flux-resistant type	Nil: 70% of nominal voltage J: 80% of nominal voltage	Nil: Class A insulation B: Class B insulation	5, 6, 9, 12, 24, 48 V

Notes: 1. Standard packing: Carton: 100 pcs. Case: 500 pcs.
2. When ordering TV rated (TV-5) types, add suffix -TV.

TYPES

1. Pick-up voltage: 70% of nominal voltage type

Contact arrangement	Coil voltage, V DC	Part No.	
		Sealed type	Flux-resistant type
1 Form A	5	JS1a-5V	JS1aF-5V
	6	JS1a-6V	JS1aF-6V
	9	JS1a-9V	JS1aF-9V
	12	JS1a-12V	JS1aF-12V
	24	JS1a-24V	JS1aF-24V
	48	JS1a-48V	JS1aF-48V
1 Form C	5	JS1-5V	JS1F-5V
	6	JS1-6V	JS1F-6V
	9	JS1-9V	JS1F-9V
	12	JS1-12V	JS1F-12V
	24	JS1-24V	JS1F-24V
	48	JS1-48V	JS1F-48V

2. Pick-up voltage: 80% of nominal voltage type

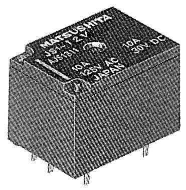
Contact arrangement	Coil voltage, V DC	Part No.	
		Sealed type	Flux-resistant type
1 Form A	5	JS1aJ-5V	JS1aFJ-5V
	6	JS1aJ-6V	JS1aFJ-6V
	9	JS1aJ-9V	JS1aFJ-9V
	12	JS1aJ-12V	JS1aFJ-12V
	24	JS1aJ-24V	JS1aFJ-24V
	48	JS1aJ-48V	JS1aFJ-48V
1 Form C	5	JS1J-5V	JS1FJ-5V
	6	JS1J-6V	JS1FJ-6V
	9	JS1J-9V	JS1FJ-9V
	12	JS1J-12V	JS1FJ-12V
	24	JS1J-24V	JS1FJ-24V
	48	JS1J-48V	JS1FJ-48V

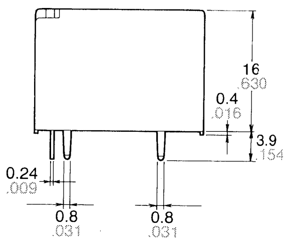
COIL DATA

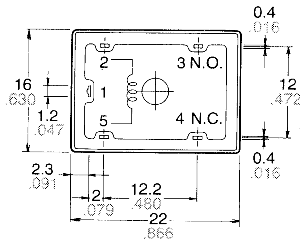
Nominal voltage, V DC	Pick-up voltage, V DC (max.) (at 20°C 68°F)	Drop-out voltage, V DC (min.) (at 20°C 68°F)	Coil resistance, Ω (±10%) (at 20°C 68°F)	Nominal operating current, mA (±10%) (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Max. allowable voltage (at 60°C 140°F)
5	70(80)% of nominal voltage	10% of nominal voltage	69.4	72	360	130%V of nominal voltage
6			100	60		
9			225	40		
12			400	30		
24			1,600	15		
48			6,400	7.5		

DIMENSIONS

mm inch





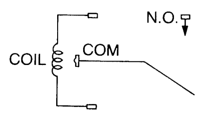


Note: Terminal No. 4 is only for 1 Form C type

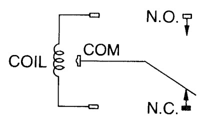
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

1a

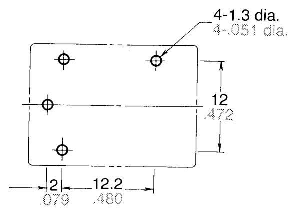


1c

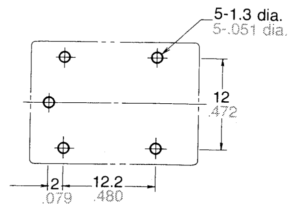


PC board pattern (Copper-side view)

1a



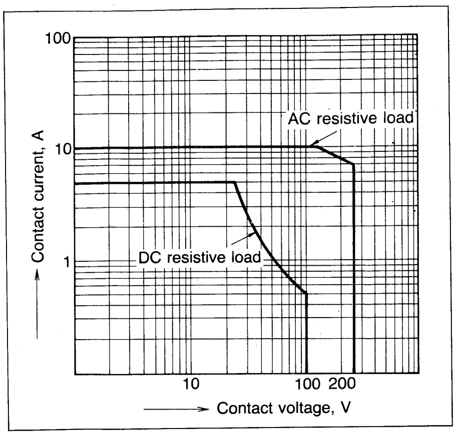
1c



Tolerance: ±0.1 ±.004

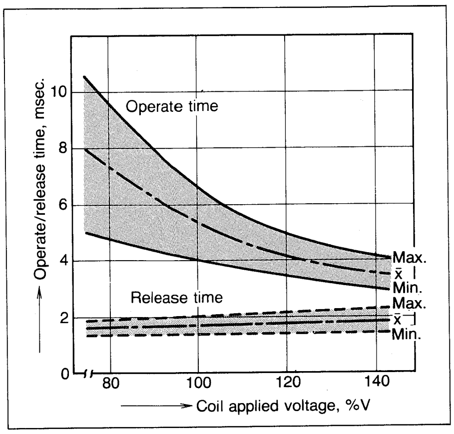
DATA

1. Maximum value for switching capacity



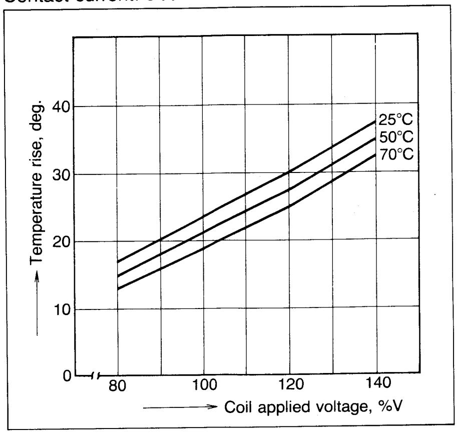
2. Operate/release time

Sample: 25 pcs., JS1-12V



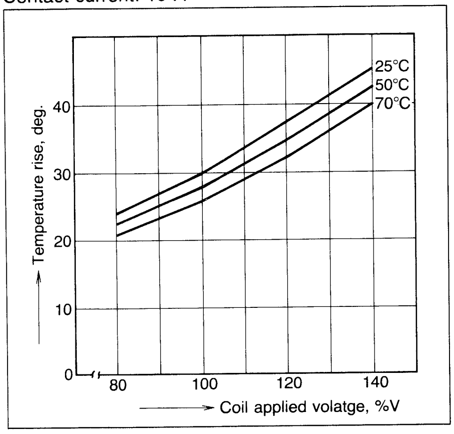
3-(1). Coil temperature rise

Sample: 5 pcs., JS1-12V
Measured portion: Inside the coil
Contact current: 5 A



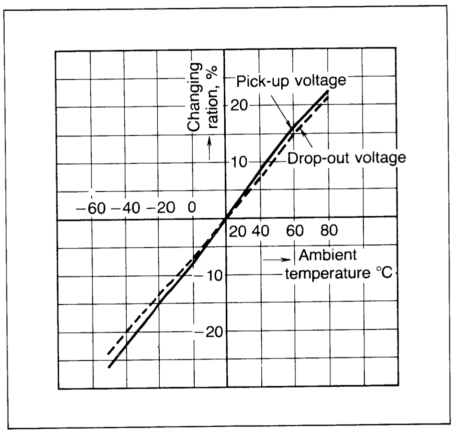
3-(2). Coil temperature rise

Sample: 5 pcs., JS1-12V
Measured portion: Inside the coil
Contact current: 10 A



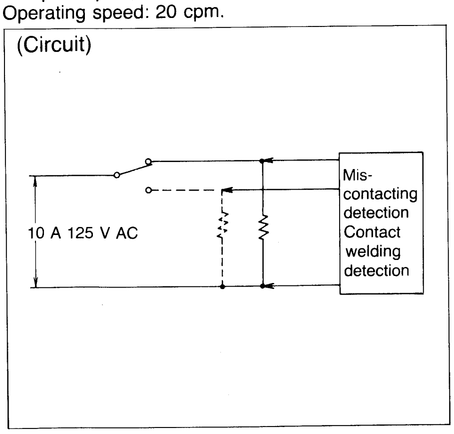
4. Ambient temperature characteristics

Sample: 6 pcs., JS1-12V

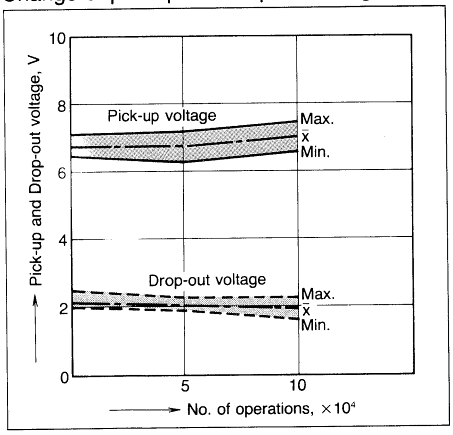


5. Electrical life test (10 A 125 V AC, resistive load)

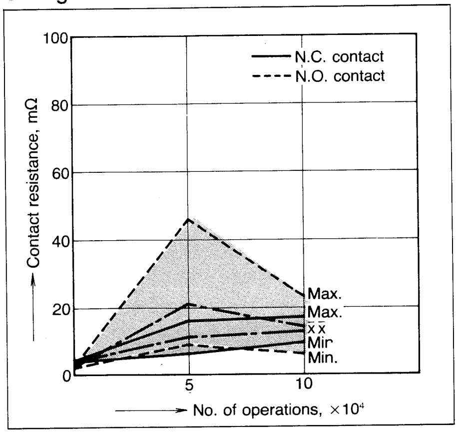
Sample: 6 pcs., JS1F-12V
Operating speed: 20 cpm.



Change of pick-up and drop-out voltage



Change of contact resistance



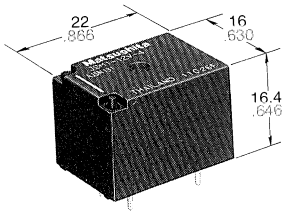
NOTES

1. To maintain initial performance, care should be taken to avoid dropping or hitting the relay.
2. Avoid using in the location where there is excessive dust or organic gas such as SO_2 gas and H_2S gas. Note that switching contact in the silicon atmosphere may result in contact failure.
3. The voltage applied to coil should not exceed the max. switching voltage.
4. The voltage applied to coil should be nominal voltage with rectangular wave.
5. The switching voltage and current to the contact should not exceed the rated value.
6. The rated contact capacity and life are typical values. Since contact phenomena and life vary depending on kinds of load and other conditions, please examine them through actual conditions.
7. Relays should be used within the rated ambient temperature.
8. For automatic cleaning, use sealed types. It is recommended that fluorinated hydrocarbon or other alcholic solvent be used, and that the ultrasonic cleaning be avoided.
9. Avoid bending terminals, because it may cause malfunction.

NAiS

Automotive Ultra-Miniature Power Relay

JSM-RELAYS



mm inch

- **Low pick-up voltage for high ambient use**
- **Sealed construction**
- **Ultra-miniature size with universal footprint**
- **Contact capacity: 5 A 16 VDC, Inrush 25 A (Motor load)**
- **Usable at high temperature: 85°C 185°F**

SPECIFICATIONS

Contact

Arrangement	1 Form A, 1 Form C
Contact material	Silver copper
Initial contact resistance, max. (By voltage drop 12 V DC 10 A)	100 mΩ
Rating Nominal switching capacity Max. switching power Max. switching voltage Max. switching current	 10 A 14 V DC (resistive) 5 A 16 V DC, Inrush 25 A (motor load) 160 W 16 V DC See Contact Rating table
Expected life (min. ope.) Mechanical (at 180 cpm)	10^7
Electrical 5 A 16 V DC, Inrush 25 A (Motor load)	10^5

Coil

Nominal operating power	640 mW

Contact rating

Load	Form A	Form C	
		N.O.	N.C.
Max. carry current	25 A	25 A	15 A
Max. make current	25 A	25 A	10 A
Max. break current	10 A	10 A	5 A

Characteristics

Max. operating speed (at rated load)		20 cpm
Operate time (at nominal voltage)		Approx. 10 msec.
Release time (at nominal voltage)		Approx. 10 msec.
Initial insulation resistance		Min. 100 mΩ (at 500 V DC)
Initial breakdown voltage Between open contacts Between contacts and coil		 750 Vrms for 1 min. 1,500 Vrms for 1 min.
Ambient temperature		–40°C to +85°C –40°F to +185°F
Shock resistance	Functional*1	Min. 10 G
	Destructive*2	Min. 100 G
Vibration resistance	Functional*1	Approx. 10 G, 10 to 55 Hz at double amplitude of 1.6 mm
	Destructive*2	Approx. 12 G, 10 to 55 Hz at double amplitude of 2 mm
Unit weight		Approx. 12 g .423 oz

*1 Tolerated by relay during service without causing the closed to open for more than the specified time.
*2 Withstood by the relay during shipping, installation or use, without it suffering damage, and without causing a change in its operating characteristics.

TYPICAL APPLICATIONS

- Automotive: Power-window, car antenna, door lock, intermittent wiper, interior lighting, power seat, power sunroof, car stereo power antenna, etc.

ORDERING INFORMATIONS

Ex. JSM $\boxed{1a}$ — $\boxed{12V}$ — 4

Contact arrangement	Coil voltage (DC)
1a: 1 Form A 1: 1 Form C	9, 12, 24 V

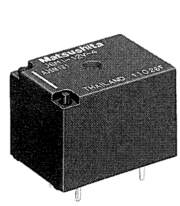
Note: Standard packing: Carton: 100 pcs. Case: 500 pcs.

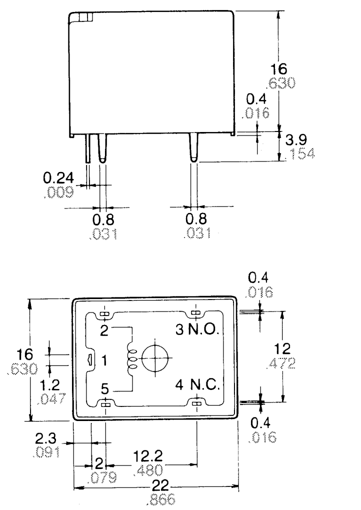
TYPES AND COIL DATA (at 20°C 68°F)

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 80°C 176°F)
JSM1a-9V-4 JSM1-9V-4	9	4.7	0.7	126	71.4	600	12
JSM1a-12V-4 JSM1-12V-4	12	6.3	0.9	225	53.3	640	16
JSM1a-24V-4 JSM1-24V-4	24	12.6	1.8	900	26.7	640	32

DIMENSIONS

mm inch





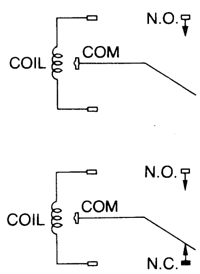
Note: Terminal No. 4 is only for 1 Form C type

General tolerance: ±0.3 ±.012

Schematic (Bottom view)

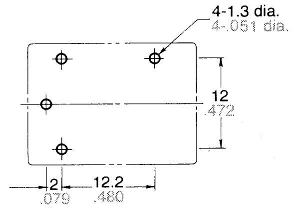
1a

1c

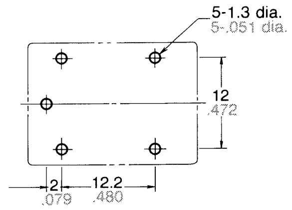


PC board pattern (Copper-side view)

1a



1c



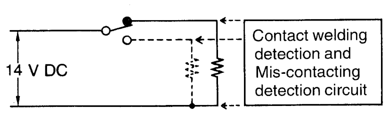
Tolerance: ±0.1 ±.004

DATA

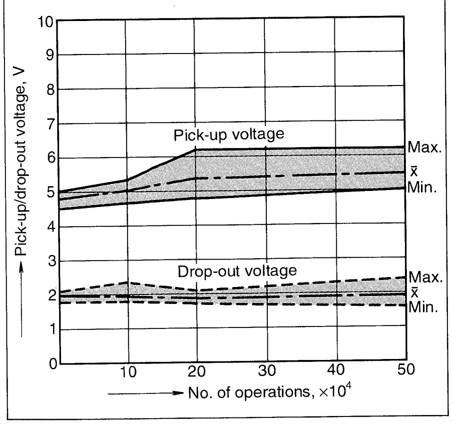
1-(1) Electrical life test (Resistive)

Tested sample: JSM1-12V-4, 6 pcs.
Condition: 10 A 14 V DC resistive load, 20 cpm
Ambient temperature: 30°C 86°F

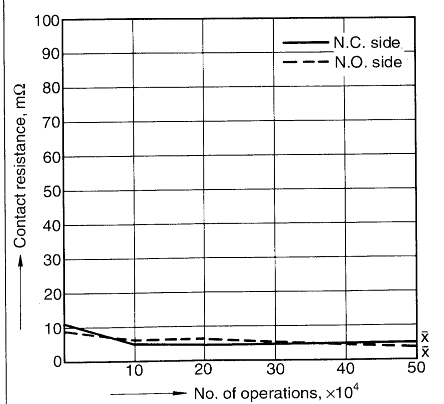
Circuit



Change of pick-up and drop-out voltage

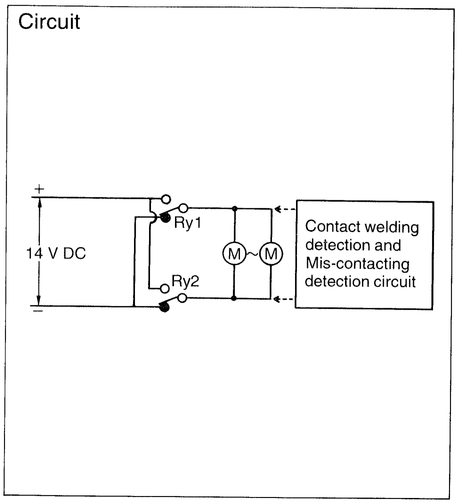


Change of contact resistance

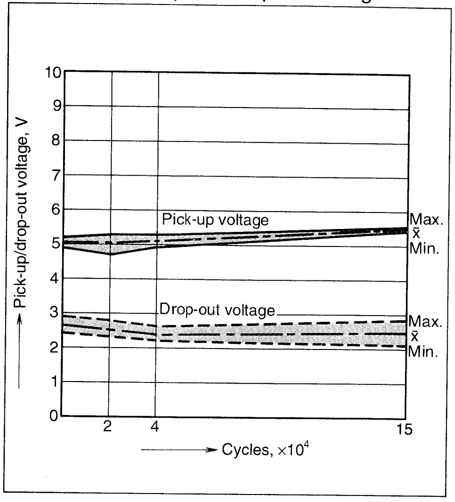


1-(2) Electrical life test (Power window motor load)

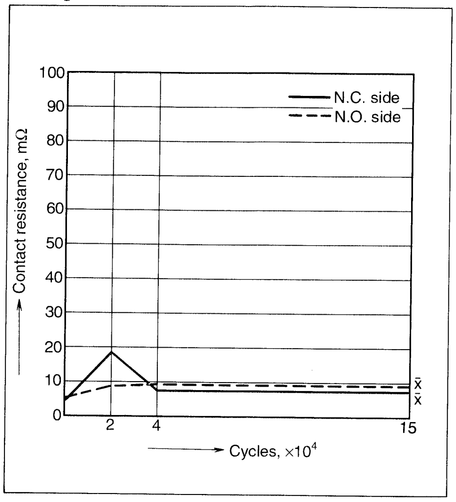
Tested sample: JSM1-12V-4, 4 pcs.
Load: DC 14 V
(1) Max. 14.8 A (Inrush) Max. 14.2 A (Break)
(2) Max. 20.3 A (Inrush) Max. 20.0 A (Break)
(3) Max. 16.2 A (Inrush) Max. 11.6 A (Break)
Switching frequency: 3 cycle/min. (ON:OFF = 1:9 sec.)
Ambient temperature: (1) 85°C 185°F; (2) –40°C –40°F; (3) 35°C 95°F
Tested cycle: (1) 2×10^4 cycle → (2) 2×10^4 cycle → (3) 11×10^4 cycle (Total 15×10^4 cycles)



Change of pick-up and drop-out voltage

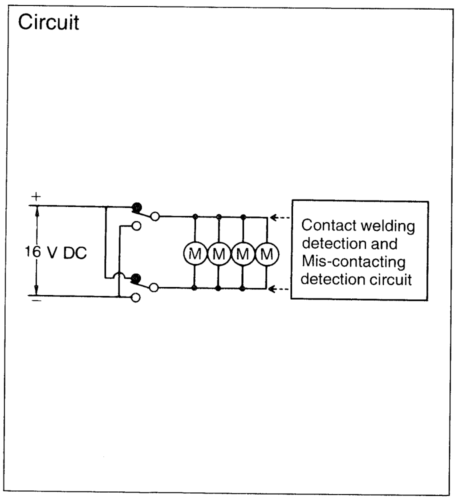


Change of contact resistance

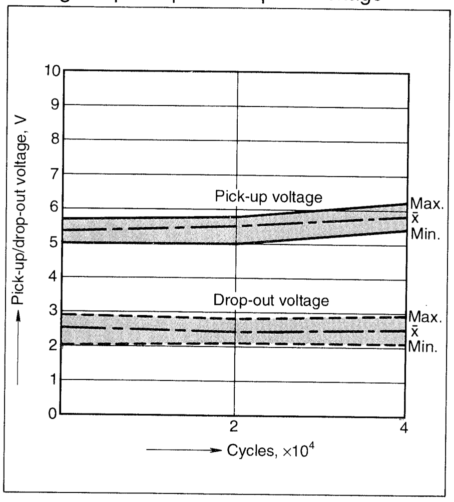


1-(3) Electrical life test (Door lock motor load)

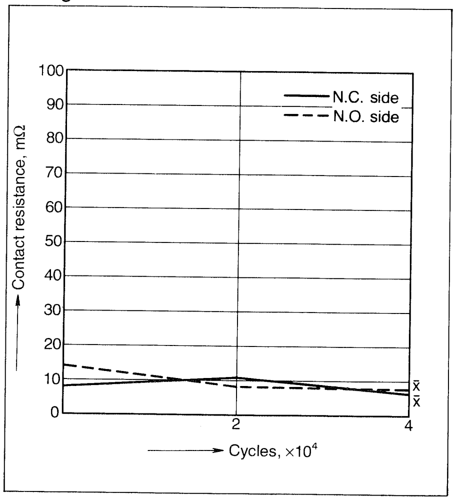
Tested sample: JSM1-12V-4, 10 pcs.
Load: DC 16 V Max. 17.7 A, Min. 15.2 A
Switching frequency: 6 cycles/min. (ON:OFF = 0.5:0.5 sec.)
Ambient temperature: 30°C 86°F
Tested cycle: 4×10^4 cycles



Change of pick-up and drop-out voltage

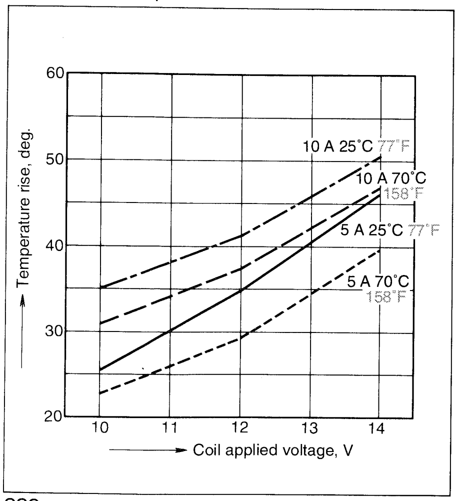


Change of contact resistance



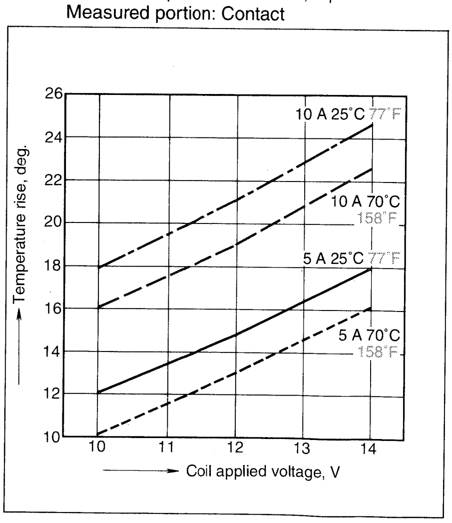
2-(1) Temperature rise

Tested sample: JSM1-12V-4, 5 pcs.
Measured portion: Inside the coil



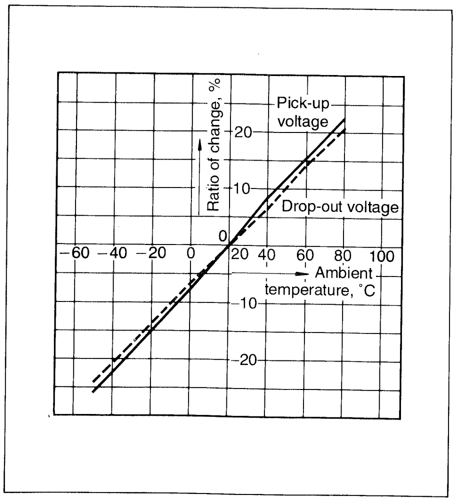
2-(2) Temperature rise

Tested sample: JSM1-12V-4, 5 pcs.
Measured portion: Contact

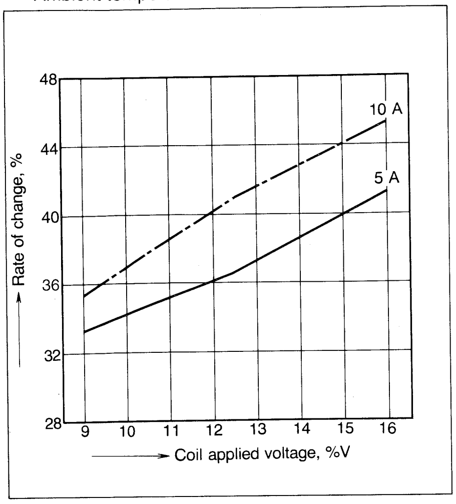


3. Ambient temperature characteristics

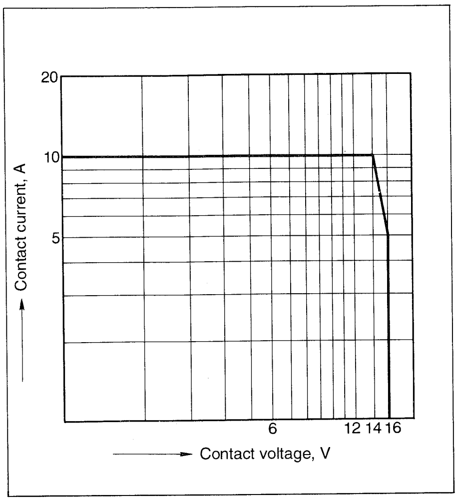
Tested sample: JSM1-12V-4, 6 pcs.



4. Hot start test
Tested sample: JSM1-12V-4, 6 pcs.
Ambient temperature: 85°C 185°F



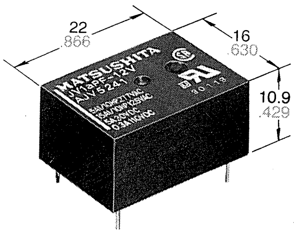
5. Maximum switching power



NOTES

1. Avoid using in the location where there is organic gas such as SO_2 gas and H_2S gas. Note that switching contact in the silicon atmosphere may result in contact failure.
2. The switching voltage and current to the contact should not exceed the rated value.
3. The rated contact capacity and life are typical values. Since contact conditions and life vary depending on kinds of loads and other conditions, please examine them in actual conditions.
4. Relays should be used only within the rated ambient temperature.

NAiS | FLAT TYPE POWER RELAY | JV-RELAYS



mm inch

UL File No.: E43028
CSA File No.: LR26550
TÜV File No.: Nr. 88091645535

- **Flat type: 16 mm (length)× 22 mm (width)× 10.9 mm (height) (.630×.866×429 inch)**
- **High capacity type (15 A) available**
- **High sensitivity: 200 mW (1 Form A)**

SPECIFICATIONS

Contact

		Standard type		High capacity type
Arrangement		1 Form A	1 Form C	1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		50 mΩ		
Contact material		Silver alloy		
Rating (resistive load)	Normal switching capacity	10 A 125 V AC	10 A 125 V AC (N.O.) 6 A 125 V AC (N.C.)	16 A 125 V AC
	Max. switching power	1,250 VA	1,250 VA (N.O.) 750 VA (N.C.)	1,875 VA
	Max. switching voltage	250 V		
	Max. switching current	10 A	10 A (N.O.) 6 A (N.C.)	15 A
UL/CSA rating		10 A 125, 277 V AC 10 A 30 V DC 0.3 A 110 V DC 1/10 HP 125, 277 V AC	10 A 125 V AC 5 A 277 V AC 5 A 30 V DC 0.3 A 110 V DC 1/10 HP 125 V AC 1/10 HP 277 V AC	16 A 125, 277 V AC 10 A 30 V DC 0.3 A 110 V DC 1/10 HP 125, 277 V AC
TÜV rating		10 A 125 V∼ (cos φ = 0.4) 5 A 250 V∼ (cos φ = 0.4) 5 A 30 V⎓		15 A 125 V∼ (cos φ = 0.4) 15 A 250 V∼ (cos φ = 0.4) 10 A 30 V⎓
Expected life (min. ope.)	Mechanical (at 180 cpm)	10^7		
Electrical at resistive (at 20 cpm)	Sealed type	10^5	10^5	10^5
	Flux-resistant type	3×10^5	10^5	2×10^5

Coil

	1 Form A type	1 Form C type
Nominal operating power	200 mW	400 mW

Characteristics

Max. operating speed		20 cpm
Operate time (at nominal voltage)		Approx. 10 msec.
Release time (at nominal voltage)		Approx. 4 msec.
Initial insulation resistance		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	1,500 Vrms for 1 min.
Temperature rise (max.) (at nominal voltage)		65 deg.
Ambient temperature		−40°C to +70°C −40°F to +158°F
Shock resistance	Functional	Min. 10 G
	Destruction	Min. 100 G
Vibration resistance	Functional	Approx. 10 G, 10 to 55 Hz at double amplitude of 1.6 mm
	Destruction	Approx. 10 G, 10 to 55 Hz at double amplitude of 1.6 mm
Unit weight		Approx. 8 g .282 oz

TYPICAL APPLICATION

1. Home appliances: Air conditioner, heater, etc.
2. Automotive: Power supply for car stereo and air conditioner

ORDERING INFORMATION

JV | 1a | P | F — 12 V

Contact arrangement	Rating	Protective construction	Coil voltage (DC)
1: 1 Form C 1a: 1 Form A	Nil: Standard type P: High capacity type*	Nil: Sealed type F: Flux-resistant type	5, 6, 9, 12, 18, 24, 48 V

Notes: 1. Standard packing: Carton: 100 pcs.; Case: 500 pcs.
2. Coil voltage DC 100 V type available.

*only for 1 Form A type

TYPES

Contact arrangement	Coil voltage, V DC	Part No.	
		Sealed type	Flux-resistant type
1 Form A Standard type	5	JV1a-5V	JV1aF-5V
	6	JV1a-6V	JV1aF-6V
	9	JV1a-9V	JV1aF-9V
	12	JV1a-12V	JV1aF-12V
	18	JV1a-18V	JV1aF-18V
	24	JV1a-24V	JV1aF-24V
	48	JV1a-48V	JV1aF-48V
1 Form A High capacity type	5	JV1aP-5V	JV1aPF-5V
	6	JV1aP-6V	JV1aPF-6V
	9	JV1aP-9V	JV1aPF-9V
	12	JV1aP-12V	JV1aPF-12V
	18	JV1aP-18V	JV1aPF-18V
	24	JV1aP-24V	JV1aPF-24V
	48	JV1aP-48V	JV1aPF-48V
1 Form C	5	JV1-5V	JV1F-5V
	6	JV1-6V	JV1F-6V
	9	JV1-9V	JV1F-9V
	12	JV1-12V	JV1F-12V
	18	JV1-18V	JV1F-18V
	24	JV1-24V	JV1F-24V
	48	JV1-48V	JV1F-48V

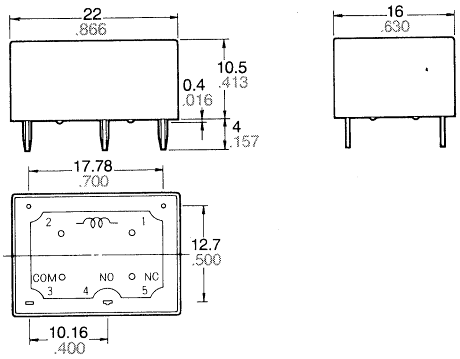
COIL DATA

Contact arrangement	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 20°C 68°F)
1 Form A	5	4	0.25	125	40	200	7.5
	6	4.8	0.3	180	33.3		9
	9	7.2	0.45	405	22.2		13.5
	12	9.6	0.6	720	16.7		18
	18	14.4	0.9	1,620	11.1		27
	24	19.2	1.2	2,880	8.3		36
	48	38.4	2.4	11,520	4.2		72
1 Form C	5	4	0.25	62.5	80	400	6.5
	6	4.8	0.3	90	66.7		7.8
	9	7.2	0.45	202.5	44.4		11.7
	12	9.6	0.6	360	33.3		15.6
	18	14.4	0.9	810	22.2		23.4
	24	19.2	1.2	1,440	16.7		31.2
	48	38.4	2.4	5,760	8.3		62.4

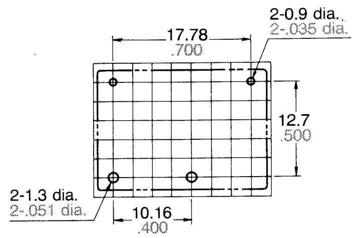
DIMENSIONS

mm inch

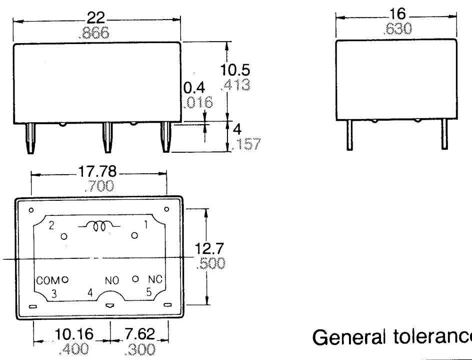
1 Form A type

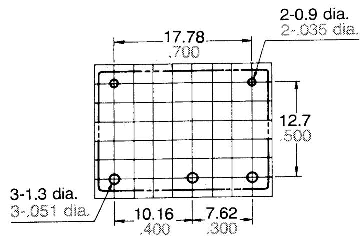


PC board pattern
(Copper-side view)



1 Form C type



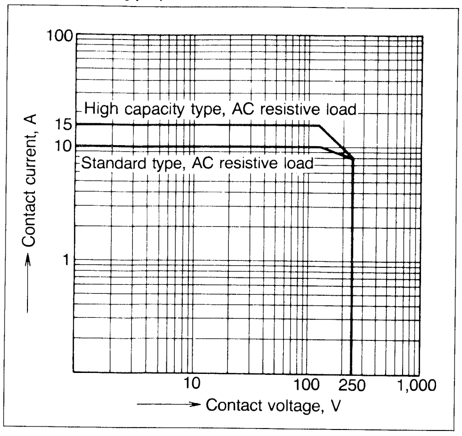


General tolerance: ±0.3 ±.012

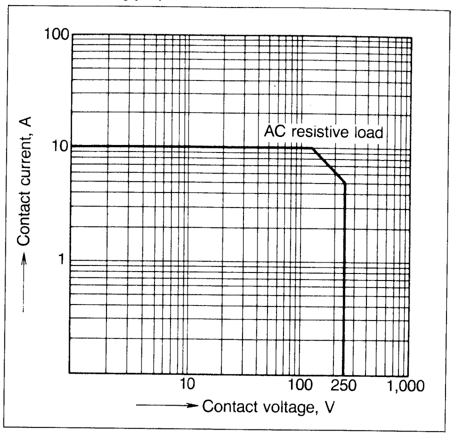
Tolerance: ±0.1 ±.004

DATA

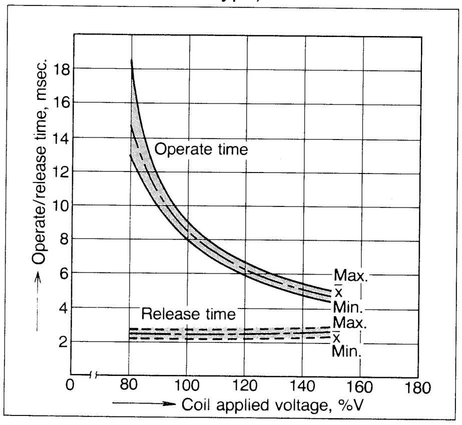
1.-(1) Maximum value for switching capacity
(1 Form A type)



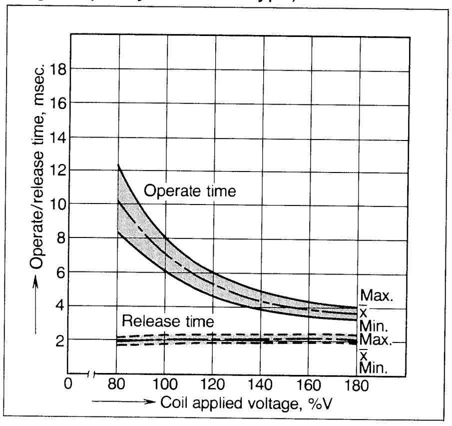
1.-(2) Maximum value for switching capacity
(1 Form C type)



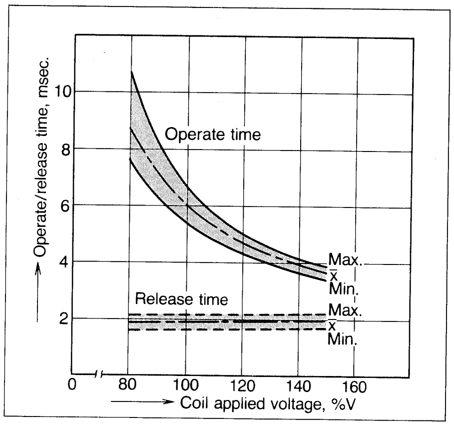
2.-(1) Operate/release time
(Standard 1 Form A type)



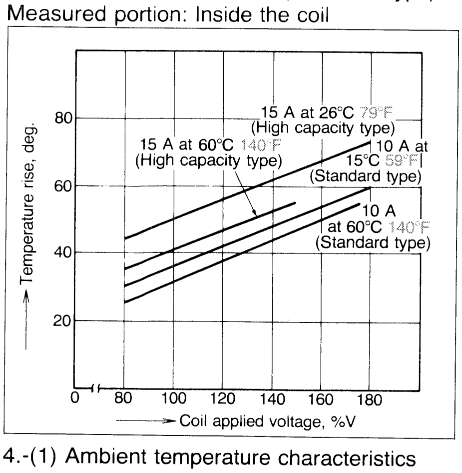
2.-(2) Operate/release time
(High capacity 1 Form A type)



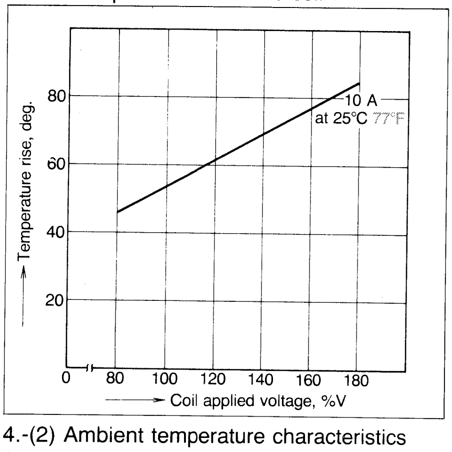
2.-(3) Operate/release time (1 Form C type)



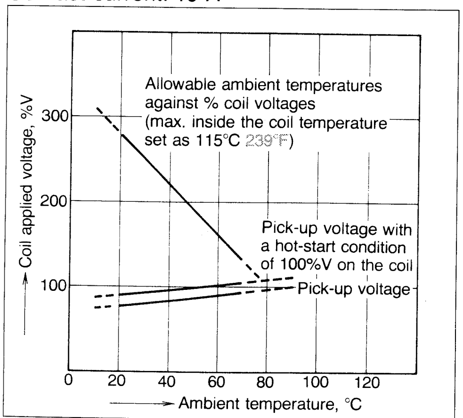
3.-(1) Coil temperature rise (1 Form A type)
Measured portion: Inside the coil



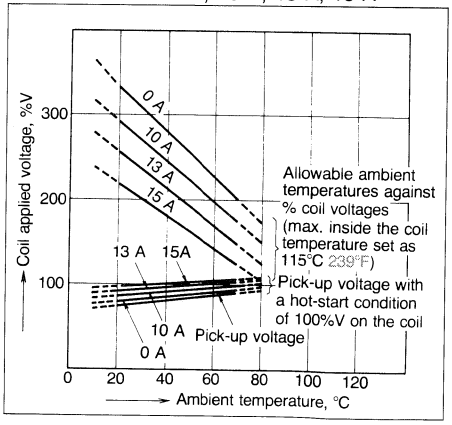
3.-(2) Coil temperature rise (1 Form C type)
Measured portion: Inside the coil



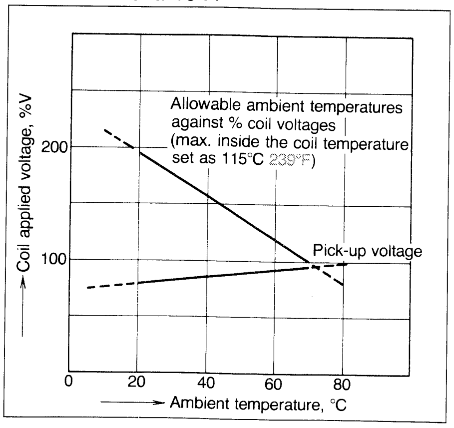
4.-(1) Ambient temperature characteristics
(Standard 10 A type, 1 Form A)
Contact current: 10 A



4.-(2) Ambient temperature characteristics
(High capacity 15 A type, 1 Form A)
Contact current: 0 A, 10 A, 13 A, 15 A



4.-(3) Ambient temperature characteristics
(1 Form C type)
Contact current: 10 A



NOTES

1. To maintain initial performance, care should be taken to avoid dropping or hitting the relay.
2. Avoid using in the location where there is excessive dust or organic gas such as SO_2 gas and H_2S gas. Note that switching contact in the silicon atmosphere may result in contact failure.
3. The voltage applied to coil should not exceed the max. switching voltage.
4. The voltage applied to coil should be nominal voltage with rectangular wave.
5. The switching voltage and current to the contact should not exceed the rated value.
6. The rated contact capacity and life are typical values. Since contact phenomena and life vary depending on kinds of load and other conditions, please examine them through actual conditions.
7. Relays should be used within the rated ambient temperature.
8. For automatic cleaning, use sealed types. It is recommended that fluorinated hydrocarbon or other alcholic solvent be used, and that the ultrasonic cleaning be avoided.
9. Avoid bending terminals, because it may cause malfunction.

Types dedicated to a wider variety of automotive applications are available, upon receipt of order, with the following specifications:

SPECIFICATIONS

Contact

Arrangement		1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ
Contact material		Silver alloy
Rating (resistaive load)	Nominal switching capacity	10 A 125 V AC 6 A 30 V DC
	Max. switching power	1,250 V AC 180 V DC
	Max. switching voltage	250 V (AC) 30 V (DC)
	Max. switching current	10 A (AC) 6 A (DC)
Expected life (min. ope.)	Mechanical (at 300 cpm)	5×10^6
	Electrical (DC 12 V motor, 6 A steady current, 20 A lock current)	4×10^4

Coil

Nominal votage, V DC	5, 6, 9, 12, 18, 24
Nominal operating power	450 mW
Pick-up voltage, V DC (max.)	70% of nominal voltage
Drop-out voltage; V DC (min.)	5% of nominal voltage
Max. allowable voltage	150% of nominal voltage

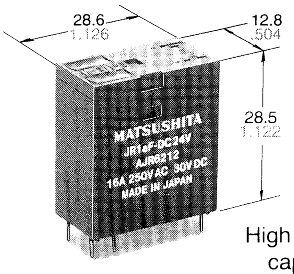
Characteristics

Max. operating speed		20 cpm
Operate time (at nominal voltage)		Approx. 10 msec.
Release time (at nominal voltage)		Approx. 4 msec.
Initial insulation resistance		Min. 100 MΩ (at 500 V DC)
Inital breakdown voltage	Between open contacts	750 Vrms for 1 min.
	Between contacts and coil	1,500 Vrms for 1 min.
Temperature rise (max.) (at nominal voltage)		65 deg.
Ambient temperature		−40°C to +70°C −40°F to +158°F
Shock resistance	Functional	Min. 20 G
	Destruction	Min. 100 G
Vibration resistance	Functional	Approx. 9 G, 10 to 55 Hz at double amplitude of 1.5 mm
	Destruction	Approx. 4.4 G, 66 Hz
Unit weight		Approx. 8 g .282 oz

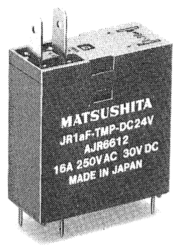
NAiS

SLIM TYPE POWER RELAYS

JR-RELAYS



High contact capacity type



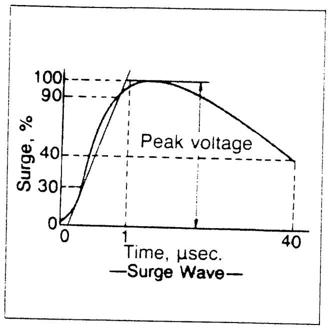
TMP type

TM type

mm inch

UL File No.: E43028
CSA File No.: LR26550
TÜV File No.: 89041645541, SEV

- **AC coil types and high capacity (16 A) types**
- **Wide insulation distance:**
  8 mm .315 inch **between coil and contact**
- **High dielectric withstanding for transient protection: JR can withstand 10,000 V surge in μsec. between coil and contact.**
- **High inrush current capability:**
  1 Form A: 111 A inrush (TV-5),
- **Slim package for tandem mounting: Header area is 28.6 mm×12.8 mm** 1.126×.504 inch
- **Molded materials: all 94 V-0**
- **"TM" and "TMP" types available**



SPECIFICATIONS

Contact

	AC coil type	High capacity type
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) Maximum switching power	2,500 VA, 300 W	4,432 VA, 480 W
Maximum switching voltage	250 V AC, 30 V DC	277 V AC, 30 V DC
Maximum switching current	10 A	16 A
UL/CSA rating	1/3 HP 125 V AC 1/2 HP 250 V AC 10 A 277 V AC 10 A 30 V DC	1/2 HP, 125, 250 V AC 16 A 277 V AC 16 A 30 V DC
Expected life (min. operations) Mechanical (180 cpm)	5×10^6	
Electrical (resistive) 16 A 277 V AC	—	10^5
10 A 250 V AC	10^5	—

Coil

Minimum operating power	340 mW
Nominal operating power	530 mW

Characteristics

	AC coil type	High capacity type
Arrangement	1 Form A	
Maximum operating speed	20 cpm	
Operate time	Max. 15 msec.	
Release time	Max. 5 msec. (10 msec. for AC type)	
Initial insulation resistance	Min. 1,000 MΩ at 500 V DC	
Breakdown voltage Between open contacts	1,000 Vrms for 1 min.	
Between contacts and coil	5,000 Vrms for 1 min.	
Between contacts sets	3,000 Vrms for 1 min.	
Surge voltage between coil and contact	10,000 V	
Temperature rise, max. (at nominal voltage)	45 deg.	
Ambient temperature	−50°C to +55°C −58°F to +131°F	−50°C to +70°C −58°F to +158°F
Shock resistance Functional	10 G	
Destructive	100 G	
Vibration resistance Functional	9 G, 10 to 55 Hz at double amplitude of 1.5 mm	
Destructive	12 G, to 55 Hz at double amplitude of 2.0 mm	
Unit weight	Approx. 16 g .56 oz (Approx. 20 g for high capacity type	

TYPICAL APPLICATIONS

Microwave ovens	Facsimilies	TV sets
Refrigerators	Air conditioners	Vending machines
Copiers	Stereo equipment	Temperature controllers

TYPES

High contact capacity types

1. PC board terminals (Double terminal layout)

Contact arrangement	Coil voltage	Part No.
1a	6 V DC 12 V DC 24 V DC 48 V DC	JR1aF-DC6V JR1aF-DC12V JR1aF-DC24V JR1aF-DC48V

2. "TMP" type

Contact arrangement	Coil voltage	Part No.
1a	6 V DC 12 V DC 24 V DC 48 V DC	JR1aF-TMP-DC6V JR1aF-TMP-DC12V JR1aF-TMP-DC24V JR1aF-TMP-DC48V

3. "TM" type

Contact arrangement	Coil voltage	Part No.
1a	6 V DC 12 V DC 24 V DC 48 V DC	JR1aF-TM-DC6V JR1aF-TM-DC12V JR1aF-TM-DC24V JR1aF-TM-DC48V

AC coil type

1a	115 V AC	JR1a-TM-AC115V

(Notes) 1. For UL/CSA recognized types, add suffix UL/CSA.
2. Standard packing Carton: 100 pcs., Case 500 pcs.

UL CSA TV rating types available

Type	UL	CSA
JR1a AC coil type	TV-5	TV-5
JR1aF high capacity type	TV-5	TV-5

COIL DATA at 20°C 68°F

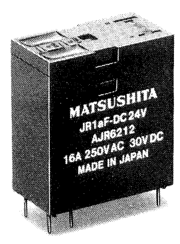
Contact arrangement	Nominal voltage	Pick-up voltage, (max.)	Drop-out voltage, (min.)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum allowable voltage, (at 70°C)
1 Form A	6 V DC	4.8 V DC	0.6 V DC	68	88	530	6.6 V DC
	12 V DC	9.6 V DC	1.2 V DC	270	44	530	13.2 V DC
	24 V DC	19.2 V DC	2.4 V DC	1,100	22.1	530	26.4 V DC
	48 V DC	38.4 V DC	4.8 V DC	4,350	11	530	52.8 V DC
	115 V AC*	92 V AC	34.5 V AC	—	7.8/9.6 (60 Hz)/(50 Hz)	0.9/1.1 VA (60 Hz)/(50 Hz)	126.5 V AC (at 55°C)

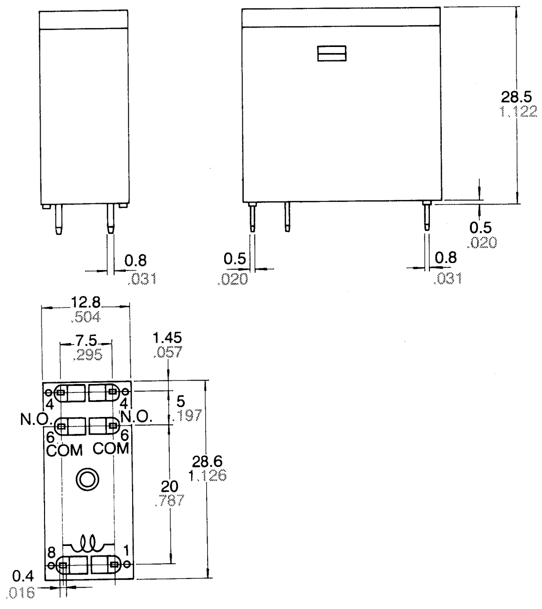
Note: Coil resistance varies ±10% for less than 1,000 Ω coil and ±15% for more than 1,000 Ω.
For each ±1°C change in ambient temperature, coil resistance varies ±0.4%.
*AC 115 V coil is available only for JR1a-TM type.

DIMENSIONS

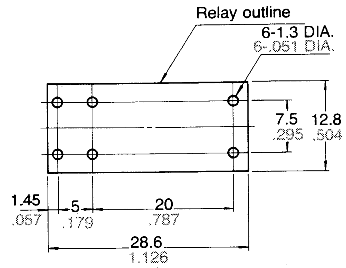
mm inch

■ JR1aF (DC)



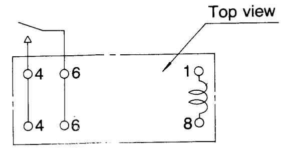


PC board pattern (Copper-side view)



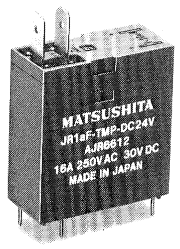
Tolerance: ±0.1 ±.004

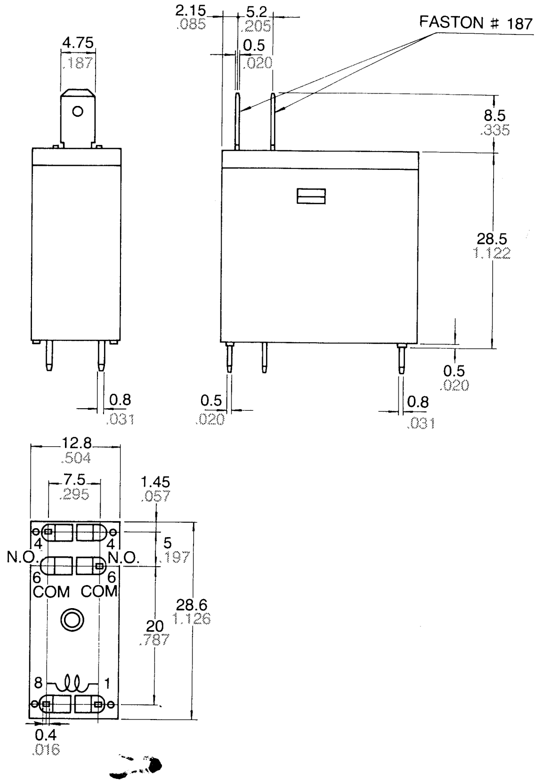
Schematic (BOTTOM VIEW)



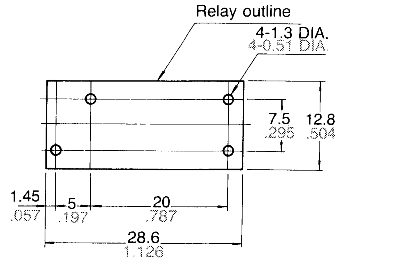
■ JR1aF-TMP (DC)

mm inch



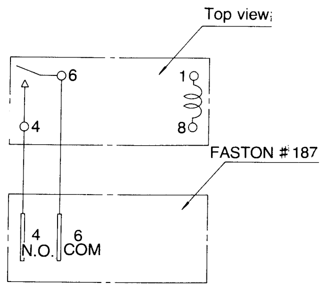


PC board pattern (Copper-side view)

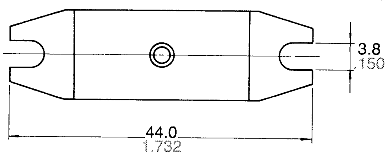


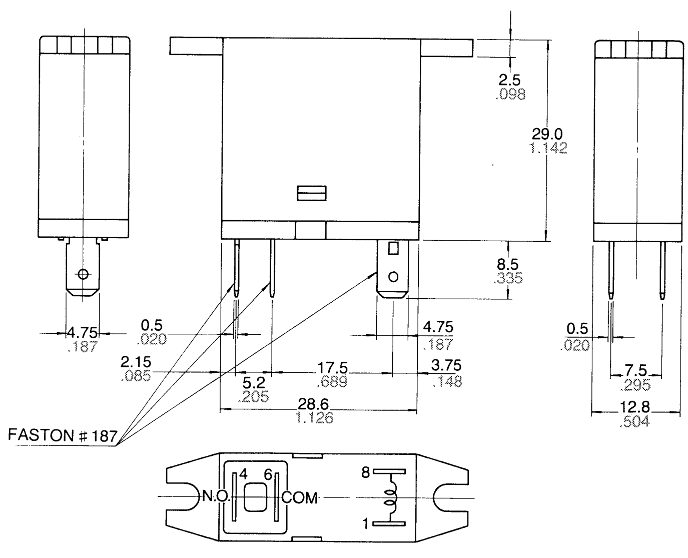
Tolerance: ±0.1 ±.004

Schematic (BOTTOM VIEW)

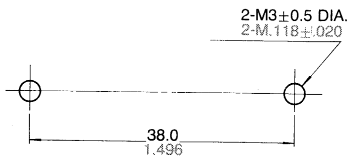


■ JR1aF-TM (DC)
JR1a-TM (AC)

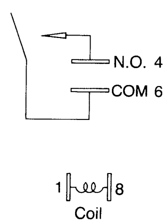




Panel cutout



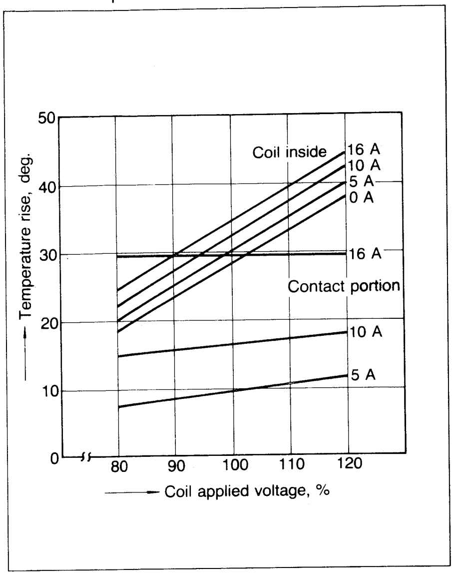
Schematic (BOTTOM VIEW)



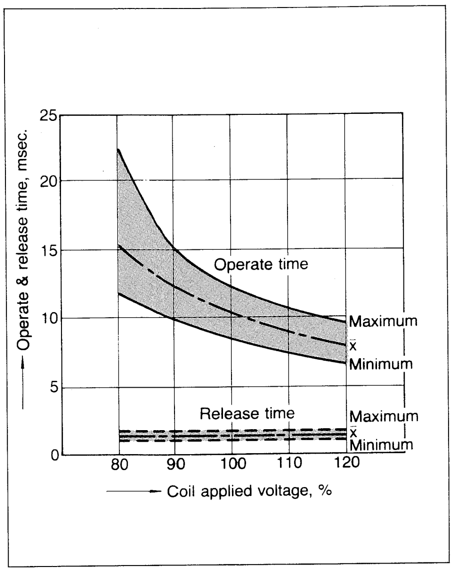
*JR1a-TM-AC115V is not high contact capacity version but has the same dimensions as JR1aF-TM.

DATA

1. Coil temperature rise
Sample: JR1aF-TM-DC24V
Measurement at coil inside and contact portion
Ambient temperature: 22°C to 25°C 72°F to 77°F



2. Operate & release time
Sample: JR1aF-TM-DC24V



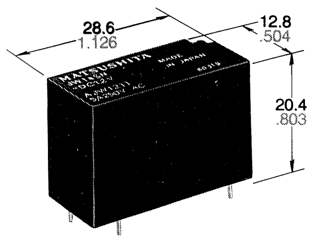
NOTES

1. "TM" and "TMP" types of high contact capacity types:
   When the contact carrying current exceeds 10 A, the soldering connection at terminals is recommended.
2. Do not remove dust cover from relay to maintain relay characteristics.
3. Avoid using in a location where there is excessive dust, dirt, organic vapors, humidity, water dropping, oil, vibration and shock.
4. When mounting the relay on a PC board, do not bend terminals or twist them in order to fasten the relay.

NAiS

COMPACT PC BOARD POWER RELAY

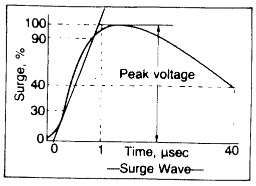
JW-RELAYS



mm inch

UL File No.: E43028
CSA File No.: LR26550
SEMKO File No.: 9041072
TÜV File No.: 87051645521
VDE File No. VDE-Reg.-Nr. 3586
SEV

- **Miniature package with universal terminal footprint**
- **High dielectric withstanding for transient protection: 10,000 V surge in µsec. between coil and contact**
- **Sealed construction**
- **Class B coil insulation types available**
- **TV rated types available**
- **VDE application standards;**



	VDE0435	VDE0631	VDE0700
1 Form A 1 Form C 2 Form A	Approved	Approved	Approved
2 Form C	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, 100 V DC	
Max. switching current	5 A	10 A
UL/CSA rating	5 A 125, 277 V AC 5 A 30 V DC 1/8 HP 125, 250 V AC	10 A 125, 277 V AC 10 A 30 V DC 1/3 HP 125, 250 V AC
TÜV rating	5 A 250 V AC ($\cos\varphi=1.0$) 3 A 250 V AC ($\cos\varphi=0.4$) 5 A 30 V DC	10 A 250 V AC ($\cos\varphi=1.0$) 7 A 250 V AC ($\cos\varphi=0.4$) 10 A 30 V DC
VDE rating	5 A 250 V ~ ($\cos\varphi=1.0$) 3 A 250 V ~ ($\cos\varphi=0.4$) 5 A 30 V ⎓	10 A 250 V ~ ($\cos\varphi=1.0$) 7 A 250 V ~ ($\cos\varphi=0.4$) 10 A 30 V ⎓
Expected life (min. ope.) Mechanical (at 180 cpm) Electrical (at 20 cpm) (Resistive load)	 5×10^6 10^5	
Coil		
Nominal operating power	530 mW	

Characteristics		Standard type	High capacity type
Max. operating speed		20 cpm	
Operate time (at nominal voltage)		Approx. 15 msec.	
Release time (at nominal voltage)		Approx. 5 msec.	
Initial insulation resistance		Min. 1,000 MΩ (at 500 V DC)	
Initial breakdown voltage	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		Min. 10,000 V	
Temperature rise, max. (at nominal voltage)		1a: 39 deg. 1c, 2a, 2c: 55 deg.	1a: 45 deg. 1c: 55 deg.
Ambient temperature		−40°C to +60°C −40°F to +140°F	
Shock resistance	Functional	Min. 10 G	
	Destruction	Min. 100 G	
Vibration resistance	Functional	Approx. 10 G 10 to 55 Hz at double amplitude of 1.6 mm	
	Destruction	Approx. 12 G 10 to 55 Hz at double amplitude of 2 mm	
Unit weight		Approx. 13 g .46 oz	

TYPICAL APPLICATION

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
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)*	H: Flux-resistant type S: Sealed type	Nil: 80% of nominal voltage N: 70% of nominal	Nil: Class A insulation B: Class B insulation	DC 5, 6, 9, 12, 24, 48 V

* Only for 1 Form A and 1 Form C type

**see load limit curve

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 (5 A) types

Contact arrangement	Coil voltage, V DC	70% pick-up voltage type		80% pick-up voltage type	
		Sealed type	Flux-resistant type	Sealed type	Flux-resistant type
1 Form A	5	JW1aSN-DC5V	JW1aHN-DC5V	JW1aS-DC5V	JW1aH-DC5V
	6	JW1aSN-DC6V	JW1aHN-DC6V	JW1aS-DC6V	JW1aH-DC6V
	9	JW1aSN-DC9V	JW1aHN-DC9V	JW1aS-DC9V	JW1aH-DC9V
	12	JW1aSN-DC12V	JW1aHN-DC12V	JW1aS-DC12V	JW1aH-DC12V
	24	JW1aSN-DC24V	JW1aHN-DC24V	JW1aS-DC24V	JW1aH-DC24V
	48	JW1aSN-DC48V	JW1aHN-DC48V	JW1aS-DC48V	JW1aH-DC48V
1 Form C	5	JW1SN-DC5V	JW1HN-DC5V	JW1S-DC5V	JW1H-DC5V
	6	JW1SN-DC6V	JW1HN-DC6V	JW1S-DC6V	JW1H-DC6V
	9	JW1SN-DC9V	JW1HN-DC9V	JW1S-DC9V	JW1H-DC9V
	12	JW1SN-DC12V	JW1HN-DC12V	JW1S-DC12V	JW1H-DC12V
	24	JW1SN-DC24V	JW1HN-DC24V	JW1S-DC24V	JW1H-DC24V
	48	JW1SN-DC48V	JW1HN-DC48V	JW1S-DC48V	JW1H-DC48V
2 Form A	5	JW2aSN-DC5V	JW2aHN-DC5V	JW2aS-DC5V	JW2aH-DC5V
	6	JW2aSN-DC6V	JW2aHN-DC6V	JW2aS-DC6V	JW2aH-DC6V
	9	JW2aSN-DC9V	JW2aHN-DC9V	JW2aS-DC9V	JW2aH-DC9V
	12	JW2aSN-DC12V	JW2aHN-DC12V	JW2aS-DC12V	JW2aH-DC12V
	24	JW2aSN-DC24V	JW2aHN-DC24V	JW2aS-DC24V	JW2aH-DC24V
	48	JW2aSN-DC48V	JW2aHN-DC48V	JW2aS-DC48V	JW2aH-DC48V
2 Form C	5	JW2SN-DC5V	JW2HN-DC5V	JW2S-DC5V	JW2H-DC5V
	6	JW2SN-DC6V	JW2HN-DC6V	JW2S-DC6V	JW2H-DC6V
	9	JW2SN-DC9V	JW2HN-DC9V	JW2S-DC9V	JW2H-DC9V
	12	JW2SN-DC12V	JW2HN-DC12V	JW2S-DC12V	JW2H-DC12V
	24	JW2SN-DC24V	JW2HN-DC24V	JW2S-DC24V	JW2H-DC24V
	48	JW2SN-DC48V	JW2HN-DC48V	JW2S-DC48V	JW2H-DC48V

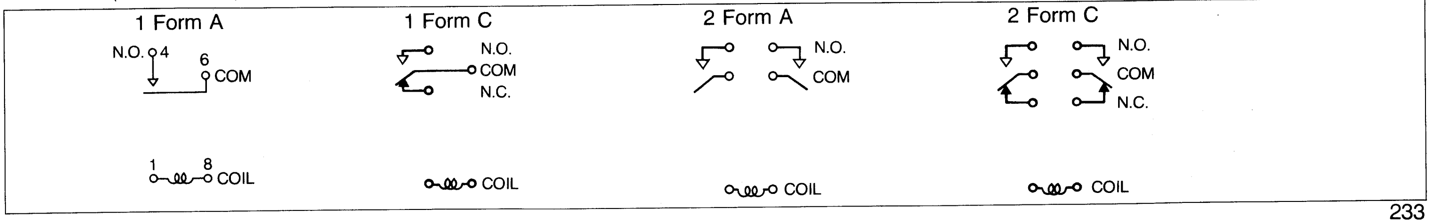
High capacity (10 A) types

Contact arrangement	Coil voltage, V DC	70% pick-up voltage type		80% pick-up voltage type	
		Selaed type	Flux-resistant type	Sealed type	Flux-resistant type
1 Form A	5	JW1aFSN-DC5V	JW1aFHN-DC5V	JW1aFS-DC5V	JW1aFH-DC5V
	6	JW1aFSN-DC6V	JW1aFHN-DC6V	JW1aFS-DC6V	JW1aFH-DC6V
	9	JW1aFSN-DC9V	JW1aFHN-DC9V	JW1aFS-DC9V	JW1aFH-DC9V
	12	JW1aFSN-DC12V	JW1aFHN-DC12V	JW1aFS-DC12V	JW1aFH-DC12V
	24	JW1aFSN-DC24V	JW1aFHN-DC24V	JW1aFS-DC24V	JW1aFH-DC24V
	48	JW1aFSN-DC48V	JW1aFHN-DC48V	JW1aFS-DC48V	JW1aFH-DC48V
1 Form C	5	JW1FSN-DC5V	JW1FHN-DC5V	JW1FS-DC5V	JW1FH-DC5V
	6	JW1FSN-DC6V	JW1FHN-DC6V	JW1FS-DC6V	JW1FH-DC6V
	9	JW1FSN-DC9V	JW1FHN-DC9V	JW1FS-DC9V	JW1FH-DC9V
	12	JW1FSN-DC12V	JW1FHN-DC12V	JW1FS-DC12V	JW1FH-DC12V
	24	JW1FSN-DC24V	JW1FHN-DC24V	JW1FS-DC24V	JW1FH-DC24V
	48	JW1FSN-DC48V	JW1FHN-DC48V	JW1FS-DC48V	JW1FH-DC48V

COIL DATA (at 20°C 68°F)

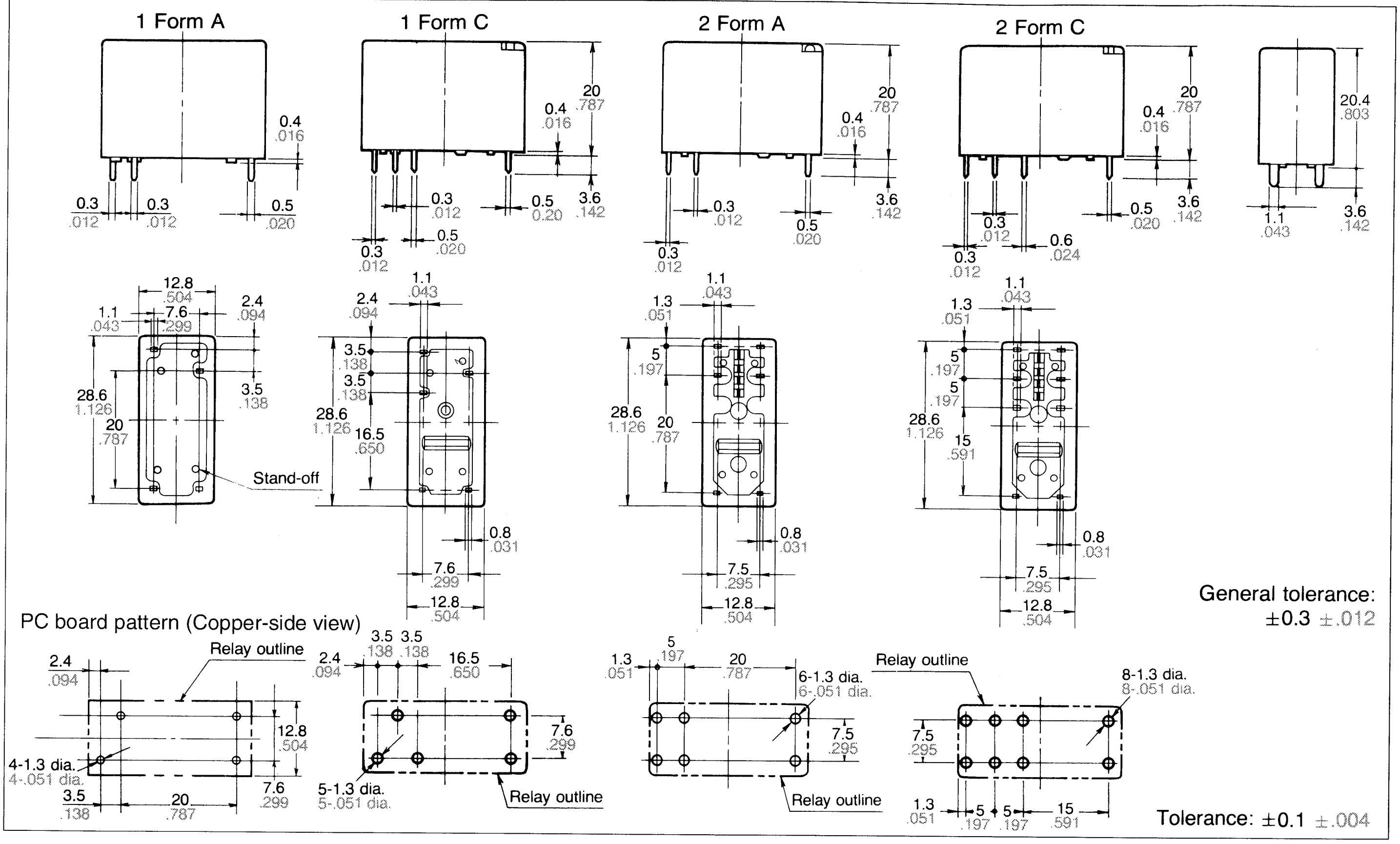
Nominal voltage, V DC	Pick-up voltage, V DC (min.)	Drop-out voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, (at 60°C 140°F)
5	3.5	0.5	106	47	530	6.5
6	4.2	0.6	88	68		7.8
9	6.3	0.9	58	155		11.7
12	8.4	1.2	44	270		15.6
24	16.8	2.4	22	1,100		31.2
48	33.6	4.8	11	4,400		62.4

Schematic (Bottom view)



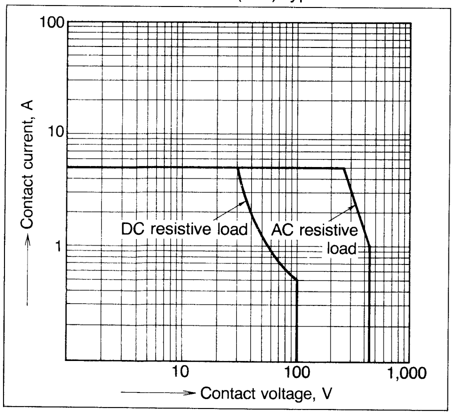
DIMENSIONS

mm inch

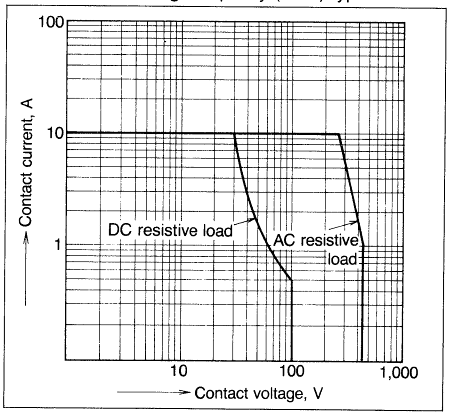


DATA

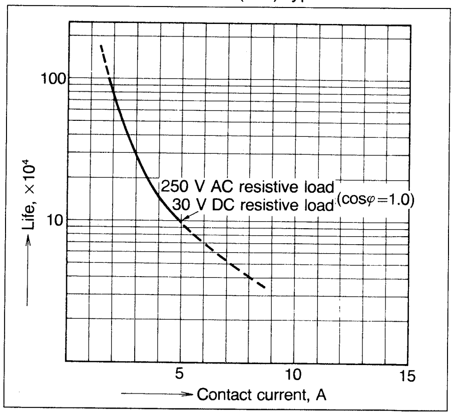
1-(1). Maximum operating power
1 Form A Standard (5 A) type



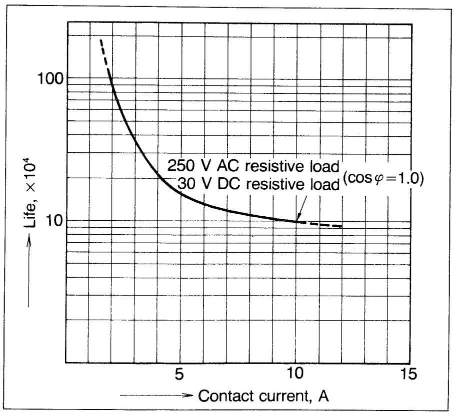
1-(2). Maximum operating power
1 Form A High Capacity (10 A) type



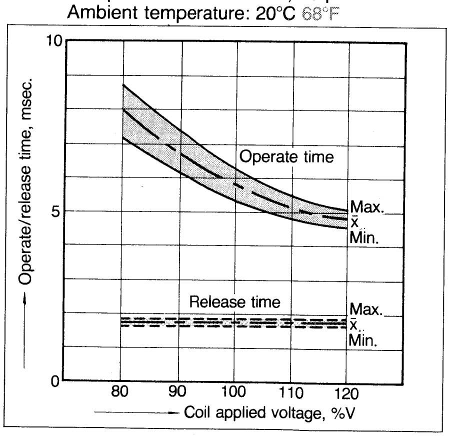
2-(1). Life curve
1 Form A Standard (5 A) type



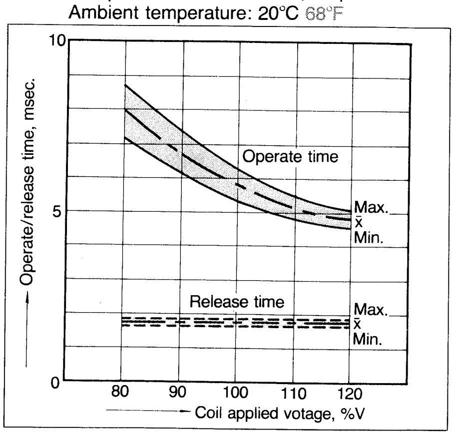
2-(2). Life curve
1 Form A High Capacity (10 A) type



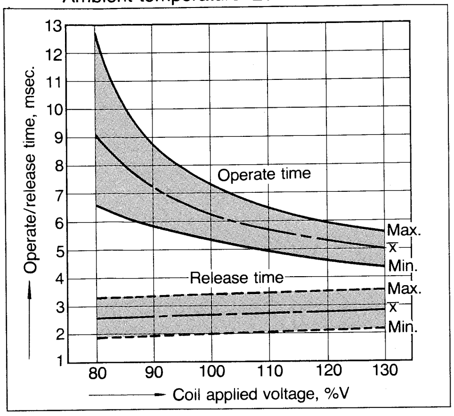
3-(1). Operate/release time
Sample: JW1aHN-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F



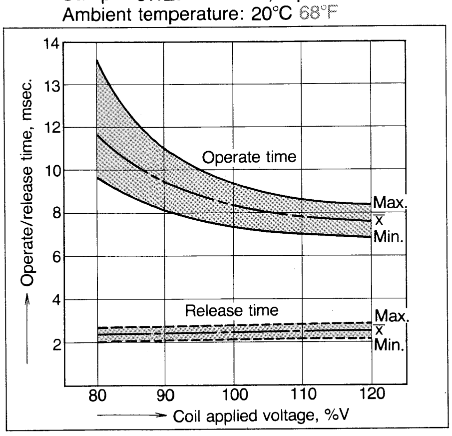
3-(2). Operate/release time
Sample: JW1aFHN-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F



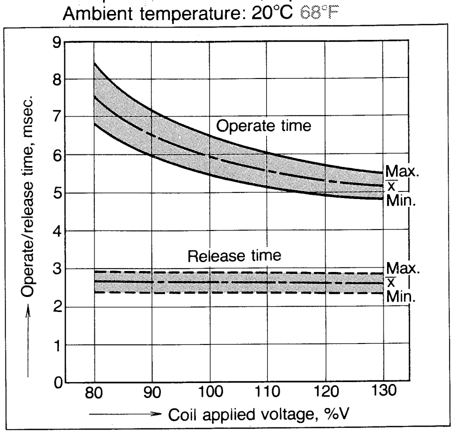
3-(3). Operate/release time
Sample: JW1S-DC12V, 6 pcs.
Ambient temperature: 20°C 68°F



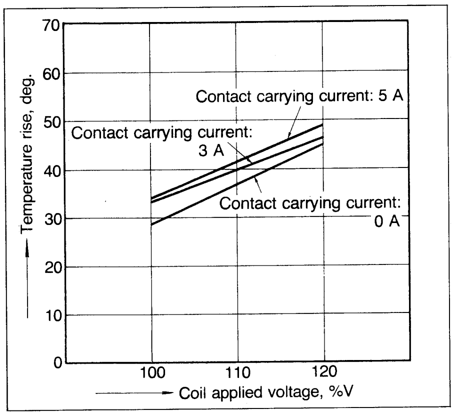
3-(4). Operate/release time
Sample: JW2aH-DC24V, 6 pcs.
Ambient temperature: 20°C 68°F



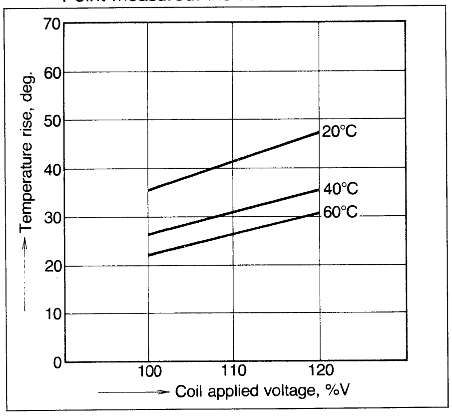
3-(5). Operate/release time
Sample: JW2S-DC12V, 6 pcs.
Ambient temperature: 20°C 68°F



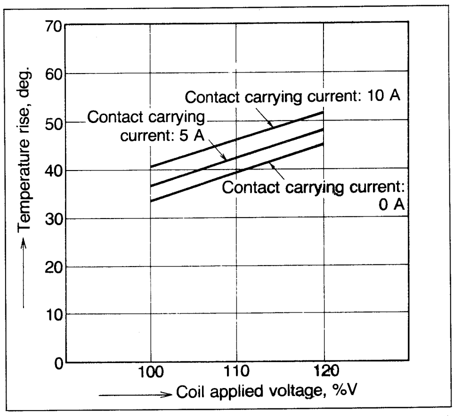
4-(1). Coil temperature rise (at 20°C 68°F)
Sample: JW1aHN-DC12V, 6 pcs.
Point measured: Inside the coil



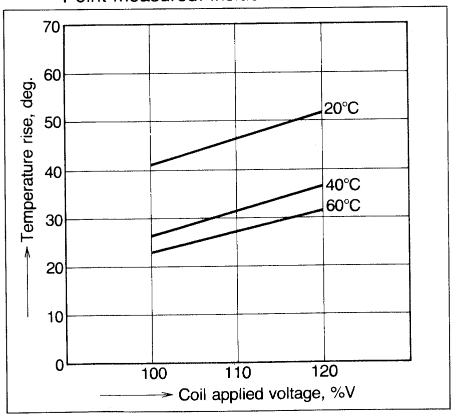
4-(2). Coil temperature rise (at 20°C 68°F)
(Contact carrying current: 5 A)
Sample: JW1aHN-DC12V, 6 pcs.
Point measured: Inside the coil



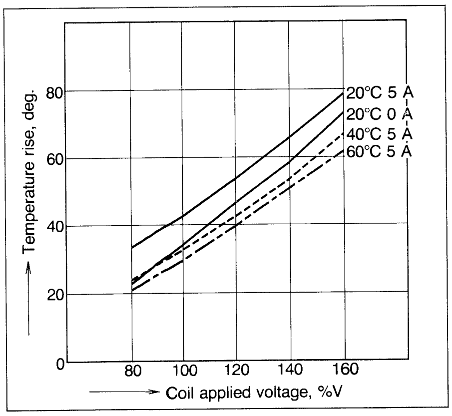
4-(3). Coil temperature rise (at 20°C 68°F)
Sample: JW1aFHN-DC12V, 6 pcs.
Point measured: Inside the coil



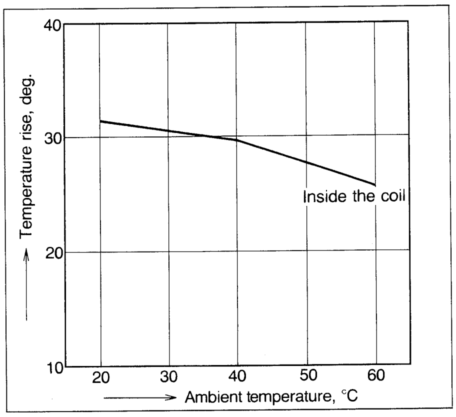
4-(4). Coil temperature rise (at 20°C 68°F)
(Contact carrying current: 10 A)
Sample: JW1aFHN-DC12V, 6 pcs.
Point measured: Inside the coil



4-(5). Coil temperature rise (at 20°C 68°F)
Sample: JW2aSN-DC12V, 6 pcs.
Point measured: Inside the coil



5. Ambient temperature vs. temperature rise characteristics
Sample: JW1FHN-DC12V



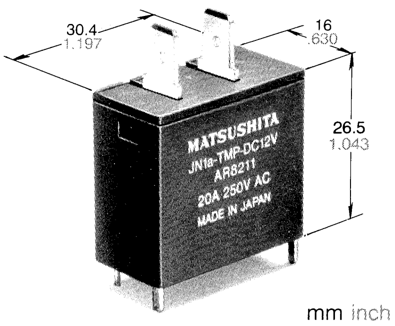
NOTES

1. To maintain initial performance, care should be taken to avoid dropping or hitting the relay.
2. Avoid using in the location where there is excessive dust or organic gas such as SO_2 gas and H_2S gas. Note that switching contact in a silicon atmosphere can result in contact failure.
3. The voltage applied to coil should not exceed the maximum allowable voltage.
4. The voltage applied to coil should be nominal voltage with rectangular wave.
5. The switching voltage and current to the contact should not exceed the rated value.
6. The rated contact capacity and life are typical values. Since contact phenomena and life vary depending on kinds of load and other conditions, please examine them through actual conditions.
7. Relays should be used within the rated ambient temperature.
8. For automatic cleaning, use sealed types. It is recommended that fluorinated hydrocarbon or other alcholic solvent be used, and that the ultrasonic cleaning be avoided.
9. Avoid bending terminals, because it may cause malfunction.

NAiS

MINIATURE HIGH POWER RELAYS

JN-RELAYS



UL File No.: E43028
CSA File No.: LR26550

- **Miniature high capacity relay—**
  - **70 A inrush, 20 A steady state inductive load**
  - **Volume: 40% of JA relays**
  - **Mounting space: 46% of JA relays**
- **Ideal for use in home appliance motors, lamps, heaters, etc.**
- **Strong resistance to contact welding**
- **"TMP" type for PC board mounting**
- **Molded material: all 94 V-0**
- **TV-8 rated types available**

SPECIFICATIONS

Contacts

Arrangement	1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	30 mΩ
Initial contact pressure	Approx. 50 g 1.76 oz
Contact material	Silver alloy
Rating (resistive) 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
UL/CSA rating	15 A 125 V AC 10 A 250 V AC 10 A 30 V DC 1 HP 125, 250 V AC TV rating: TV-8
Expected life (min. operations) Mechanical (at 180 cpm)	10^6
Electrical (at 20 cpm)	10^5 (Inrush 70 A, steady 20 A 250 V AC cos $\varphi = 0.7$)

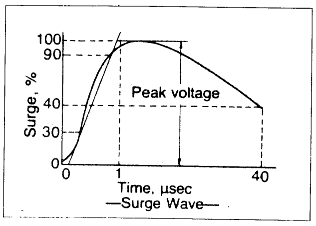
Coil (at 25°C 77°F)

Minimum operating power	576 mW
Nominal operating power	900 mW

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

Max. operating speed		180 cpm
Operate time (at nominal voltage)		Approx. 10 msec.
Release time (at nominal voltage)		Approx. 5 msec.
Initial insulation resistance		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	3,000 Vrms for 1 min.
Temperature rise, max.		55 deg. at 20 A contact carrying current and 110% coil applied voltage.
Ambient temperature		−40°C to +55°C −40°F to +131°F
Shock resistance	Functional	Min. 10 G
	Destructive	Min. 100 G
Vibration resistance	Functional	6 G, 10 to 55 Hz at double amplitude of 1 mm
	Destructive	12 G, 10 to 55 Hz at double amplitude of 2 mm
Unit weight		Approx. 28 g .99 oz

JN relays can withstand 5,000 V surge in µsec. between coil and contact.



TYPICAL APPLICATION

1. Air condition compressor controls and heater controls
2. Power control for heating devices
3. Magnetron control for microwave ovens
4. Lamp and motor control for copiers and facsimile

ORDERING INFORMATION

JN [1a] — TMP — [DC12V]

Contact arrangement	Coil voltage
1a: 1 Form A	DC 5, 6, 9, 12, 24, 48 V

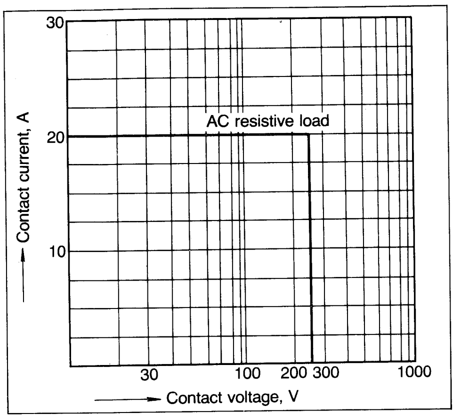
Notes:
1. When ordering UL/CSA recognized types, add suffix UL/CSA.
2. When ordering TV-8 recognized types, add suffix - TV.
3. Standard packing; Carton: 20 pcs.; Case: 200 pcs.

TYPES AND COIL DATA at 20°C 68°F

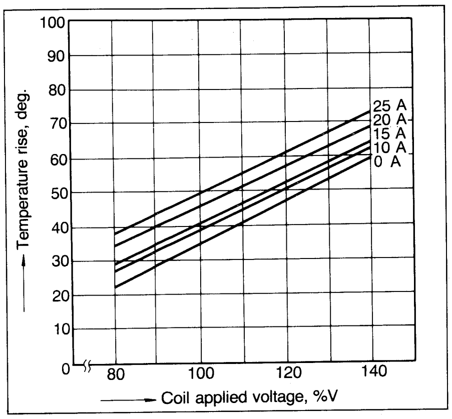
Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Max. allowable voltage at 55°C (131°F), V DC
JN1a-TMP-DC5V	5	4	0.5	27.8	180	900	5.5
JN1a-TMP-DC6V	6	4.8	0.6	40	150	900	6.6
JN1a-TMP-DC9V	9	7.2	0.9	90	100	900	9.9
JN1a-TMP-DC12V	12	9.6	1.2	160	75	900	13.2
JN1a-TMP-DC24V	24	19.2	2.4	640	37.5	900	26.4
JN1a-TMP-DC48V	48	38.4	4.8	2,560	18.75	900	52.8

DATA

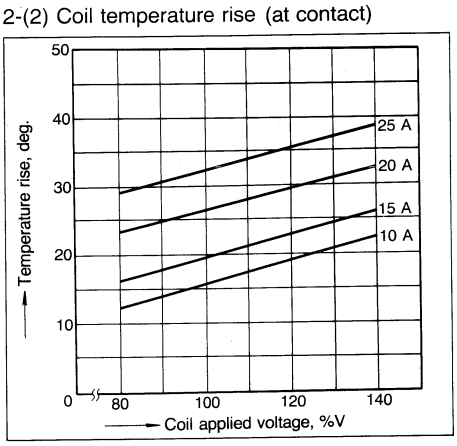
1. Max. switching capacity (Resistive load)



2-(1) Coil temperature rise (at coil)

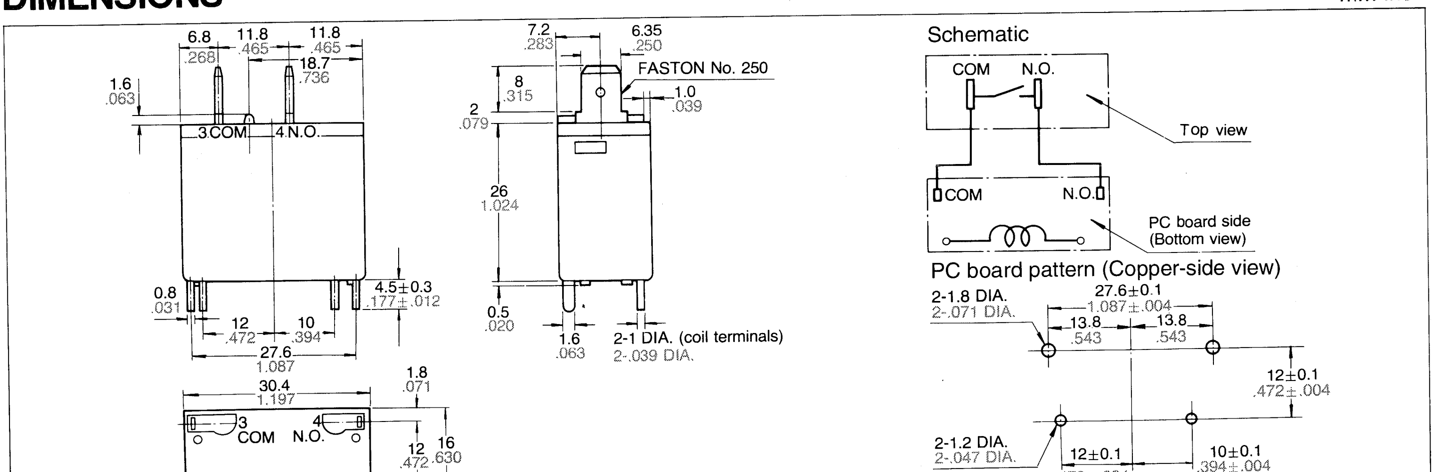


2-(2) Coil temperature rise (at contact)



DIMENSIONS

mm inch



General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.004

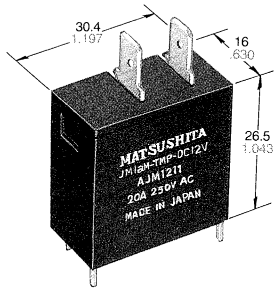
NOTES

1. Avoid using in a location where there is excessive dust, dirt, organic vapors, humidity, water dropping, oil, vibration, and shock.
2. When mounting the relay on a printed circuit board, do not bend the terminals or twist them in order to fasten the relay.
3. Do not loosen the Faston terminals; plug them in firmly. In addition, avoid plugging in or unplugging two terminals at the same time. Positively plug in one at a time.

NAiS

COMPACT POWER RELAY FOR INDUCTIVE LOAD

JM-RELAYS



mm inch

UL File No.: E43028
CSA File No.: LR26550
TÜV File No.: 88121645536

- **Compact, high capacity relay for inductive loads.**
  The JM relay controls inductive loads (cos φ = 0.7°) with an inrush current of 70 A and steady state current of 20 A.
- **High surge resistance: Min. 10,000 V between contact and coil.**
- **Flux-resistant type.**
- **TMP type permits economical wiring.**

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 Max. switching power Max. switching voltage Max. switching current	 20 A 250 V AC 5,000 VA 250 V AC 20 A
UL/CSA rating	1 HP, 20 A 250 V AC 1-1/2 HP, 20 A 125 V AC
TÜV rating	20 A 250 V ~ (cosφ = 1.0) 12 A 250 V ~ (cosφ = 0.4) 10 A 30 V ⎓
Expected life (min. ope.)	
Mechanical (at 180 cpm)	10^6
Electrical Life (at 20 cpm)	
Resistive load 20 A, 250 V AC (cos φ = 1)	10^5
Inductive load (cos φ = 0.7) Inrush 70 A Steady 20 A (250 V AC cos φ = 0.7)	10^5
Inrush 80 A Cut-off 80 A (When the motor is locked) (250 V AC cos φ = 0.7)	1.5×10^3

Coil

Nominal operating power	900 mW

Characteristics

Max. operating speed		180 cpm
Operate time (at nominal voltage)		Approx. 8 msec.
Release time (at nominal voltage)		Approx. 3 msec.
Initial insulation resistance		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage	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		Min. 10,000 V
Temperature rise (max.) (at nominal voltage)		55 deg.
Ambient temperature		−40°C to +60°C −40°F to +140°F
Shock resistance	Functional	Min. 10 G
	Destruction	Min. 100 G
Vibration resistance	Functional	Approx. 6 G 10 to 55 Hz at double amplitude of 1 mm
	Destruction	Approx. 12 G 10 to 55 Hz at double amplitude of 2 mm
Unit weight		Approx. 28 g .99 oz

TYPICAL APPLICATIONS

- Compressor control and heater control for air conditioners
- Power control for room heaters
- Magnetron control for microwave ovens
- Lamp control and motor control for OA equipment such as copying machines and facsimiles

ORDERING INFORMATION

EX. JM | 1a | N | — | TMP | — | DC 24V |

Contact arrangement	Pick-up voltage	Mounting classification	Coil voltage
1a: 1 Form A	N: 70% of Nominal voltage	TMP: Solder terminal and PC terminal	DC 5, 6, 9, 12, 24, 48 V

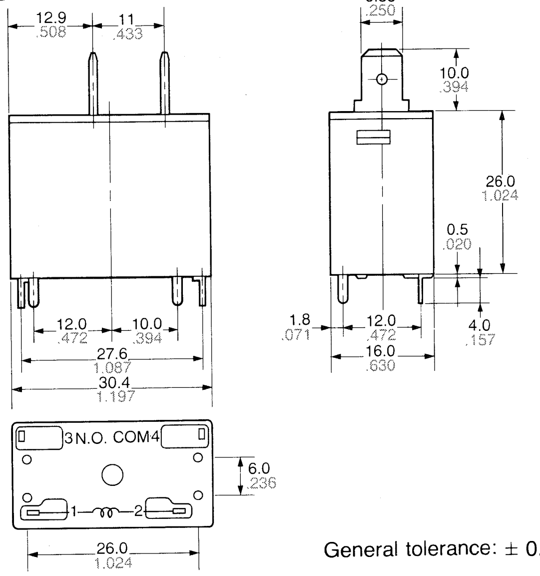
(Note) Standard packing; Carton: 50 pcs. Case: 200 pcs.

TYPES AND COIL DATA (at 20°C 68°F)

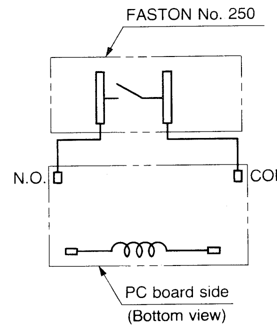
Part No.	Nominal voltage, V DC	Pick-up voltage, V DC	Drop-out voltage, V DC	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C 140°F)
JM1aN-TMP-DC5V	5	3.5	0.5	27.8	180	900	5.5
JM1aN-TMP-DC6V	6	4.2	0.6	40	150	900	6.6
JM1aN-TMP-DC9V	9	6.3	0.9	90	100	900	9.9
JM1aN-TMP-DC12V	12	8.4	1.2	160	75	900	13.2
JM1aN-TMP-DC24V	24	16.8	2.4	640	37.5	900	26.4
JM1aN-TMP-DC48V	48	33.6	4.8	2,560	18.75	900	52.8

DIMENSIONS

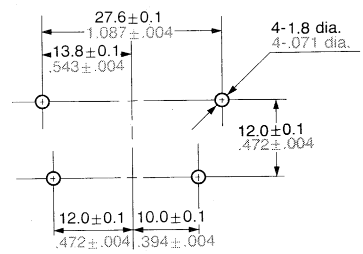
mm inch



Schematic



PC board pattern (Copper-side view)

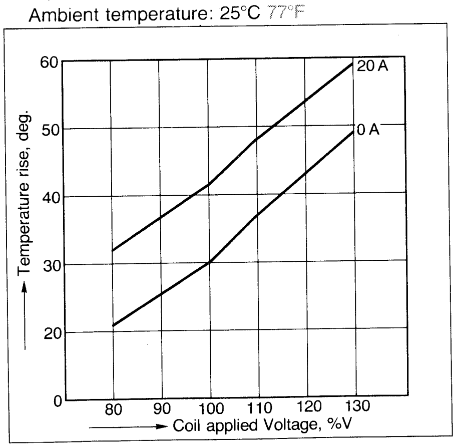


General tolerance: ± 0.4 ±.016

DATA

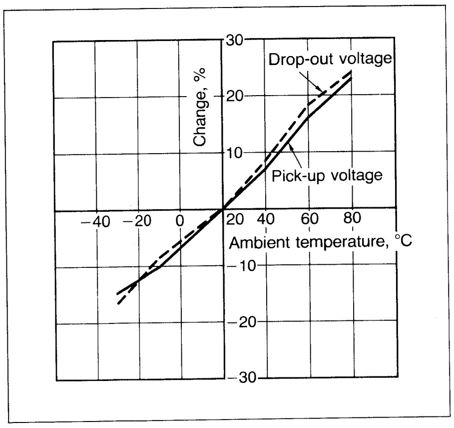
1. Coil temperature rise

Place to be measured: Inside of coil
Ambient temperature: 25°C 77°F



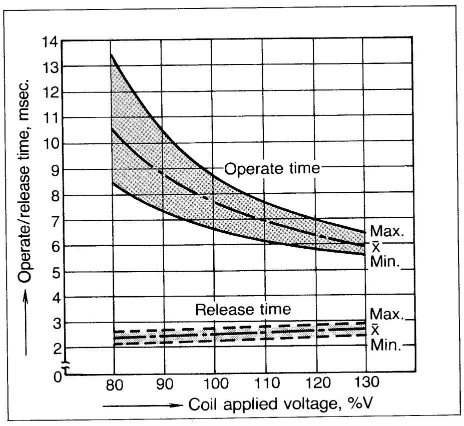
2. Ambient temperature characteristics

Sample: JM1aN-TMP-DC24V, 5 pcs.



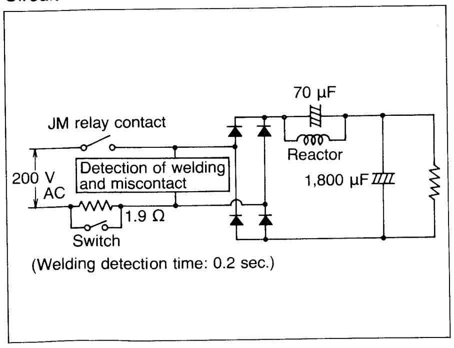
3. Operate/release time

Sample: JM1aN-TMP-DC24V, 5 pcs.

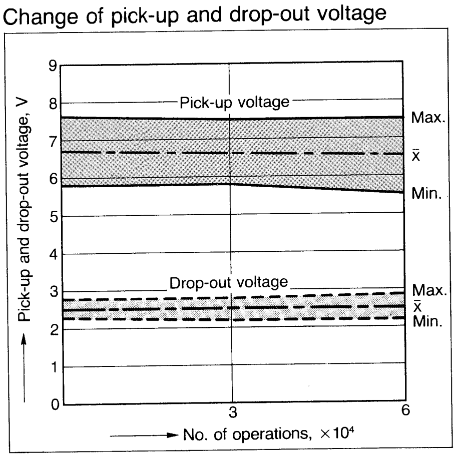


4-(1). 200 V AC electrical life test (200 V AC inverter dummy load)

Sample: JM1aN-TMP-DC12V, 6 pcs.
Load: Inrush 108 A, Steady 15 A,
Inverter dummy 200 V AC
Switching frequency: ON 5 sec., OFF 5 sec.
Circuit



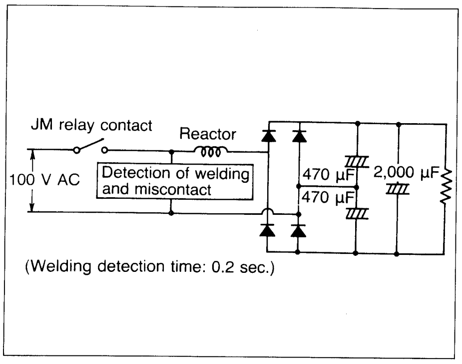
Change of pick-up and drop-out voltage



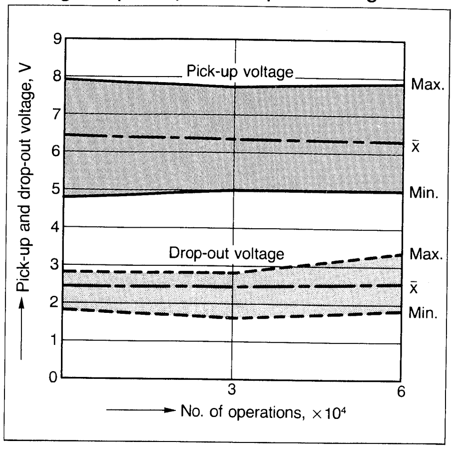
Contact welding: 0 time
Miscontact: 0 time

4-(2). 100 V AC electrical life test (100 V AC inverter dummy load)

Sample: JM1aN-TMP-DC12V, 20 pcs.
Load: Inrush 224 A, Steady 20 A,
Inverter dummy 100 V AC
Switching frequency: ON 10 sec., OFF 10 sec.
Circuit



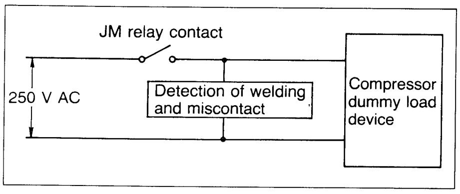
Change of pick-up and drop-out voltage



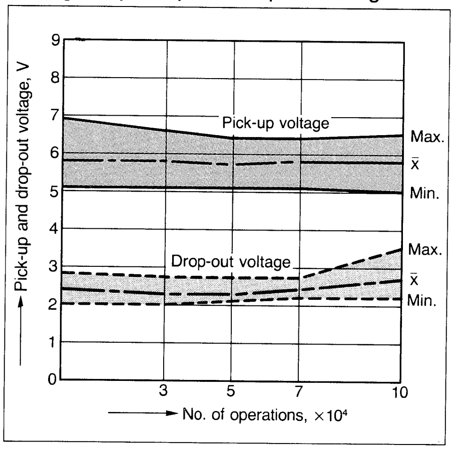
Contact welding: 0 time
Miscontact: 0 time

4-(3). Inrush 70 A, Steady 20 A, 250 V AC compressor dummy load

Sample: JM1aN-TMP-DC12V, 6 pcs.
Load: (Endurance) inrush 70 A cos φ = 0.7 (0.3 sec.), steady 20A pf = 0.9, 250 V AC compressor dummy
(Overload) 80A cos φ = 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 sec., OFF 1.5 sec.
(Overload) ON 3 sec., OFF 2min., 57 sec.
Circuit (endurance)



Change of pick-up and drop-out voltage



Contact welding: 0 time
Miscontact: 0 time

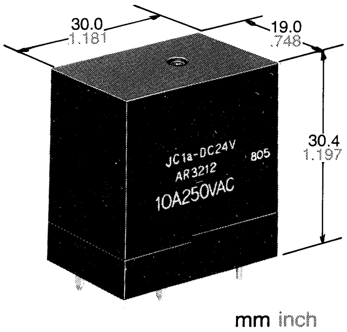
NOTES

1. Dropping the relay may deform the internal construction and affect performance. If the relay is dropped, check its appearance and characteristics before use.
2. Do not remove covers from relays to keep operating characteristics.
3. Avoid using in a location where there is excessive dust, dirt, organic vapors, humidity, water dropping, oil, vibration and shock.
4. The voltage applied to the coil should be nominal voltage with rectangular wave form.
5. When mounting the relay on a PC board, do not bend the terminals or twist them in order to fasten the relay.
6. Insert properly so that the plug-in terminals are not loose. Always connect or disconnect one terminal at a time. Avoid connecting or disconnecting two terminals at the same time.

NAiS

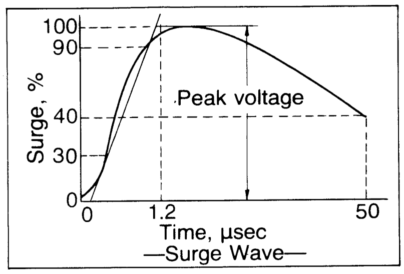
COMPACT POWER RELAYS

JC-RELAYS



UL File No.: E43028 VDE File No.: VDE-Reg.-Nr. 894
CSA File No.: LR26550 SEMKO, SEV

- **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 μsec. between coil and contact.**
- **Electrical life:**
  1 Form A: 10^5 ope. at 10 A 250 V AC resistive load
  2 Form A, 1 Form A 1 Form B: 10^5 ope. at 5 A 250 V AC resistive load



SPECIFICATIONS

Contacts

	1 Form A	2 Form A, 1 Form A 1 Form B
Arrangement	1 Form A	2 Form A, 1 Form A 1 Form B
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	30 mΩ	
Contact material	Silver alloy	
Contact force, min.	30 g (N.C. contact of 1a1b: 20 g)	
Rating (resistive load)		
Maximum switching power	2,500 VA	1,250 VA
Maximum switching voltage	250 V AC	250 V AC
Max. switching current	10 A	5 A
UL/CSA rating	10 A 250 V AC, 1/2 HP 125 V AC 10 A 30 V DC, 1 HP 250 V AC	5 A 250 V AC, 1/4 HP 125 V AC 5 A 30 V DC, 1/2 HP 250 V AC
VDE rating	10 A 250 V AC (cos φ = 1.0) 7.5 A 250 V AC (cos φ = 0.4) 10 A 30 V DC	5 A 250 V AC (cos φ = 1.0) 3 A 250 V AC (cos φ = 0.4) 5 A 30 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

Minimum operating power	576 mW	640 mW
Nominal operating power	900 mW	1,000 mW

Characteristics

Maximum operating speed	20 cpm
Operate time	Approx. 15 msec.
Release time	Approx. 5 msec. (1a1b: Approx. 10 msec.)
Initial insulation resistance	More than 100 MΩ at 500 V DC
Breakdown voltage	
Between open contacts	2,000 Vrms for 1 min. (N.C. contact of 1a1b: 1,000 Vrms)
Between contacts sets	2,000 Vrms for 1 min.
Between contacts and coil	4,000 Vrms for 1 min.
Temperature rise (at nominal voltage)	Max. 55 deg.
Ambient temperature	−50 to +60°C −58 to +140°F
Shock resistance Functional:	20 G
Destructive:	100 G
Vibration resistance Functional:	10G, 10 to 55Hz at double amplitude of 1.6 mm (1a1b type at double amplitude: 1.0 mm, 6G)
Destructive:	12 G, 10 to 55Hz at double amplitude of 2 mm
Unit weight	31 g 1.09 oz

*JC relays can withstand 10,000 V surge in μsec. between coil and contact.

TYPICAL APPLICATIONS

Automatic garage door openers
Microwave ovens
Dryers
Vending machines
Copiers
Air conditioners
Stereo equipment
TV sets

ORDERING INFORMATION

Ex. JC 1a — TM — DC12V

Contact arrangement	Mounting classification	Coil voltage
1a: 1 Form A 2a: 2 Form A 1a1b: 1 Form A 1 Form B	Nil: PC board terminal S: Plug-in terminal TM: Top mounting	DC 6, 12, 24, 48 V

(Notes)
1. TV rated types available 1 Form A: TV-8, 2 Form A: TV-5, 1 Form A, 1 Form B: TV-3.
2. For UL/CSA or VDE recognized types, add suffix UL/CSA or VDE.
3. Plug-in terminal types are not approved by VDE. All terminals of TM types should be used as solder terminals for VDE approval.
4. Standard packing Carton: 50 pcs., Case: 200 pcs.

ADDITIONAL SERIES

Following up-graded contact rating types recognized by UL and CSA are available.

Contact arrangement \ Additional letter	F (JC1aF, JC2aF, JC1a1bF)
1 Form A	15 A 250 V AC, 1 HP 125 V AC 15 A 30 V DC, 1 HP 250 V AC
2 Form A	10 A 250 V AC, 1/3 HP 125 V AC 10 A 30 V DC, 1/2 HP 250 V AC
1 Form A 1 Form B	5 A 250 V AC, 1/3 HP 125 V AC 5 A 30 V DC, 1/2 HP 250 V AC

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 1 Form A 1 Form B	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

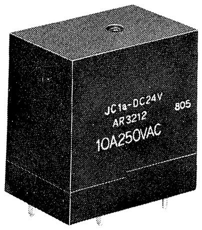
Note: Coil resistance varies ±10% for less than 1,000 Ω, and ±15% for more than 1,000 Ω.
For each ±1°C change in ambient temperature, coil resistance varies ±0.4%.

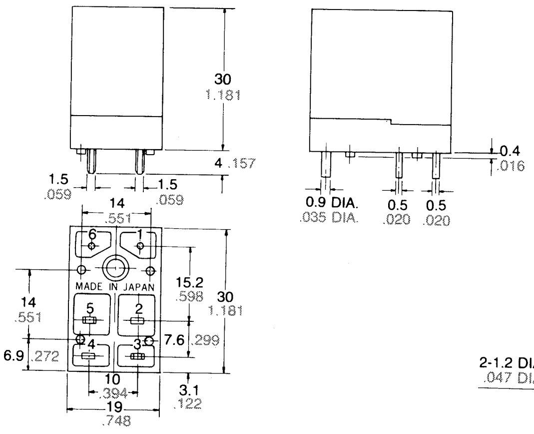
DIMENSIONS

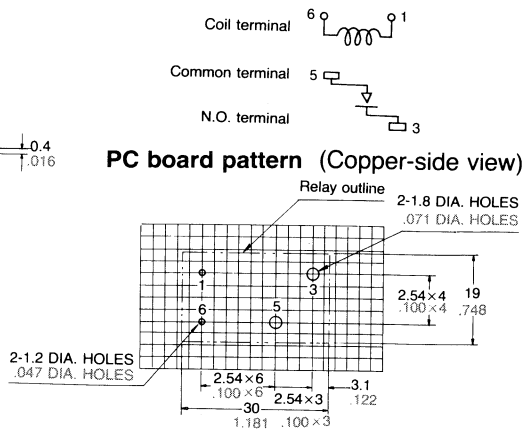
PC board type

mm inch

JC1a

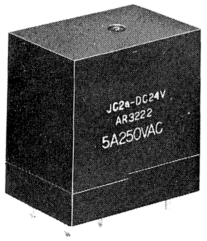


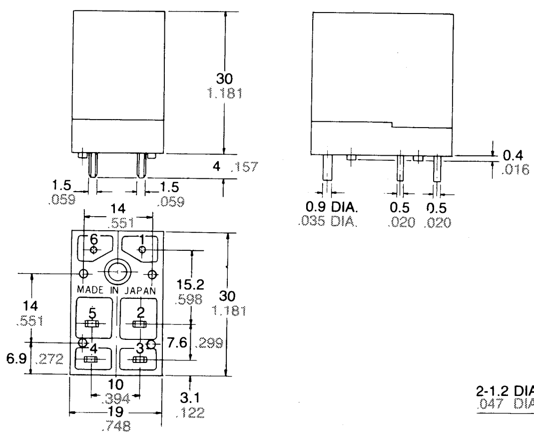




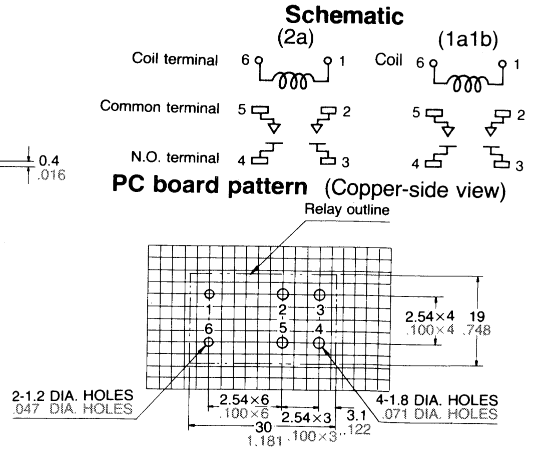
PC board type

JC2a, JC1a1b



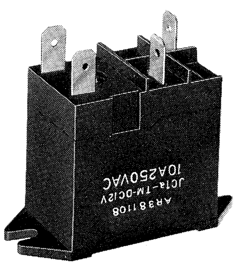


General tolerance: ±0.3 ±.012

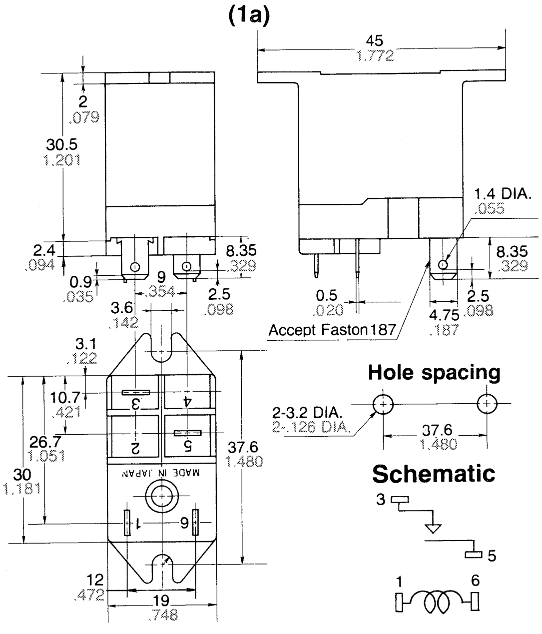


Tolerance: ±0.1 ±.004

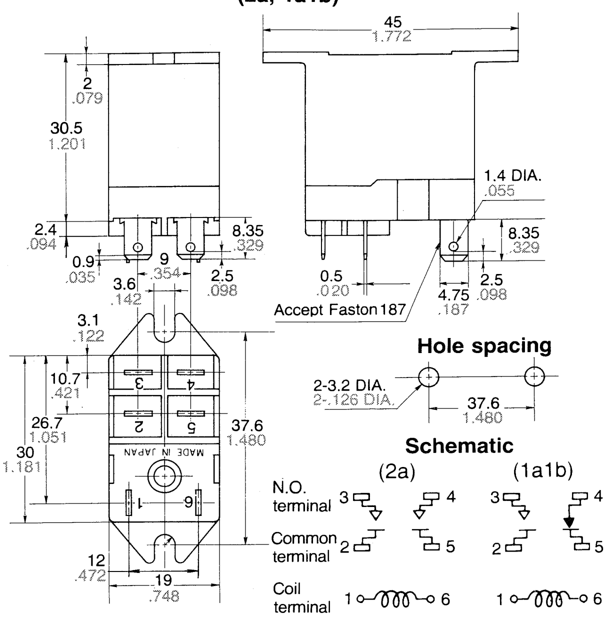
Top mount type



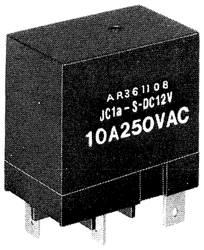
(1a)



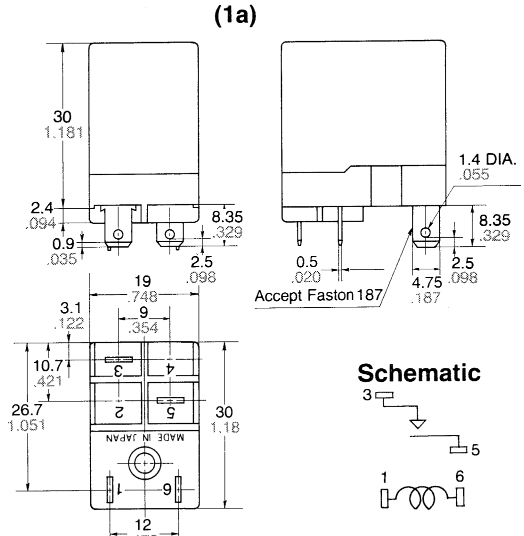
(2a, 1a1b) mm inch



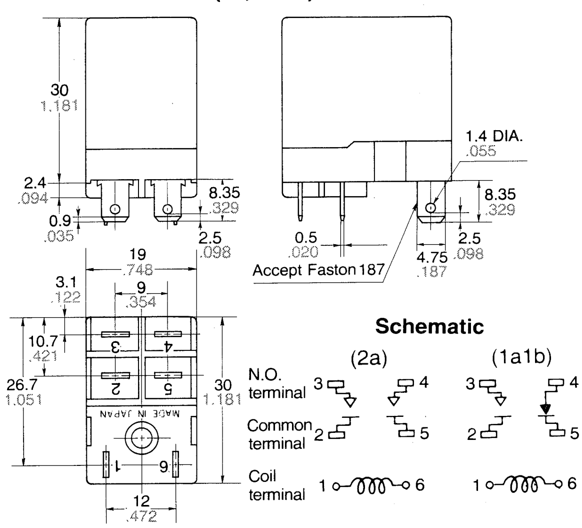
Plug-in type



(1a)



(2a, 1a1b)

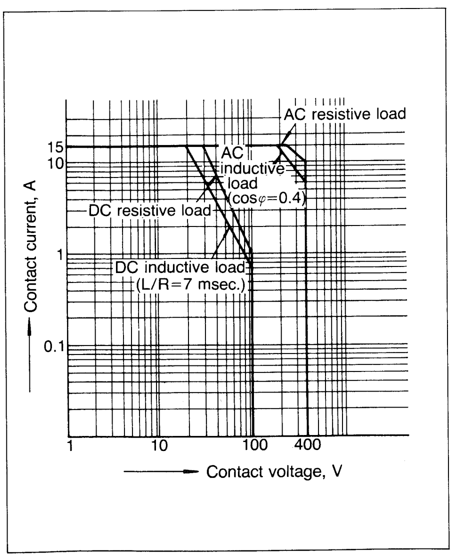


General tolerance: ±0.3 ±.012

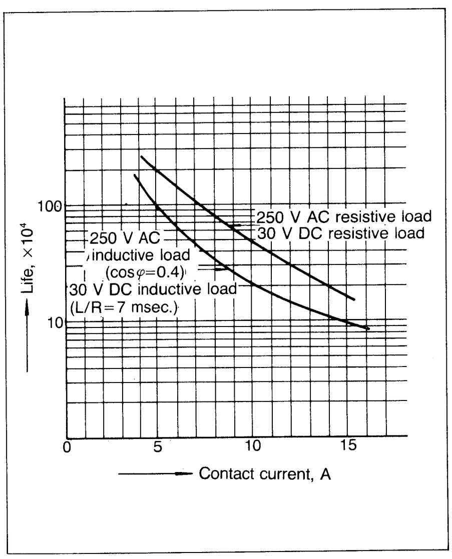
DATA

JC1a type

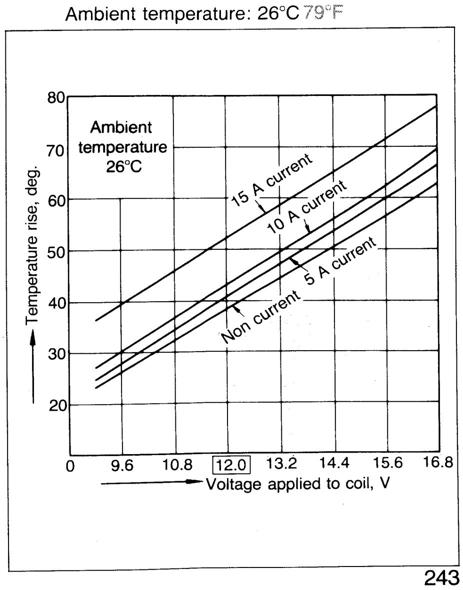
1. Maximum value for switching capacity



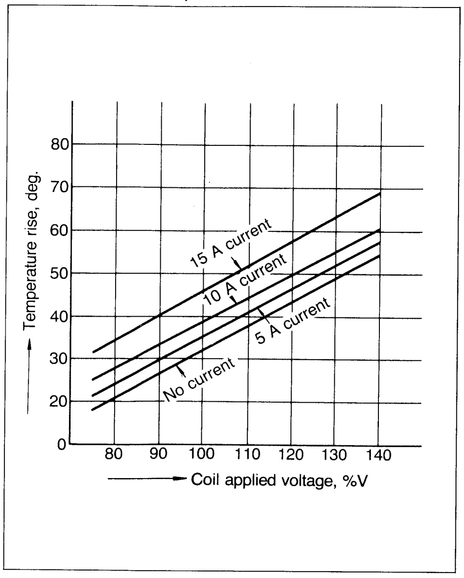
2. Life curve



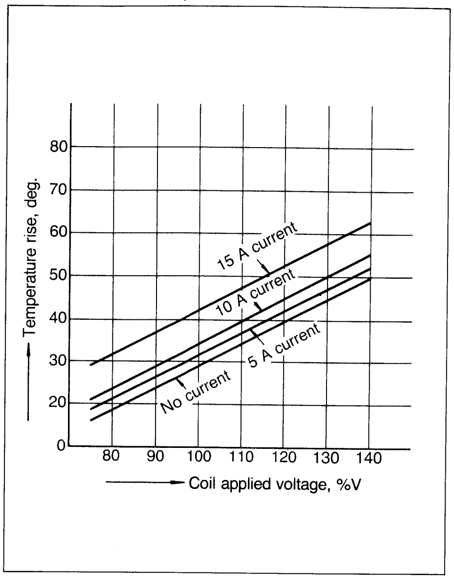
3.-(1) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 26°C 79°F



3.-(2) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 40°C 104°F

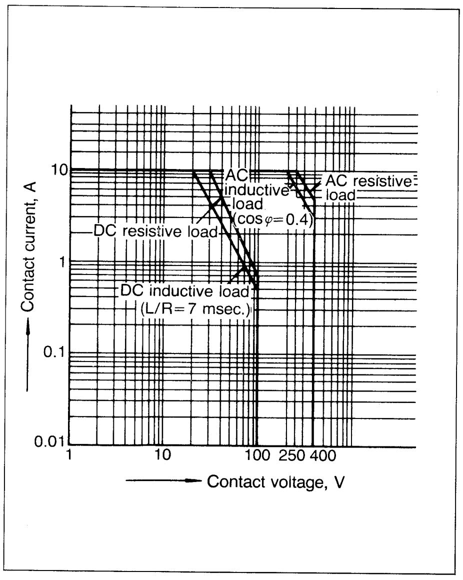


3.-(3) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 60°C 140°F

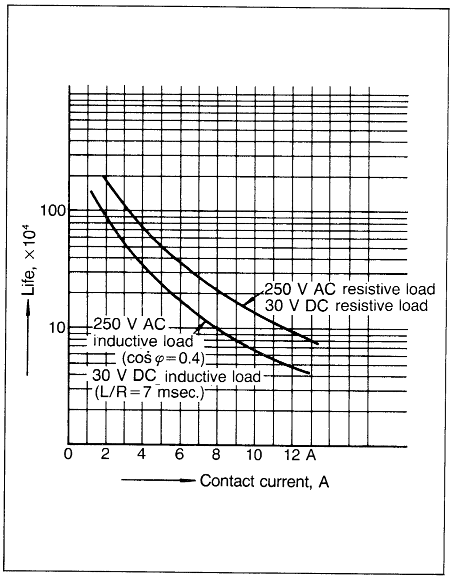


JC2a type

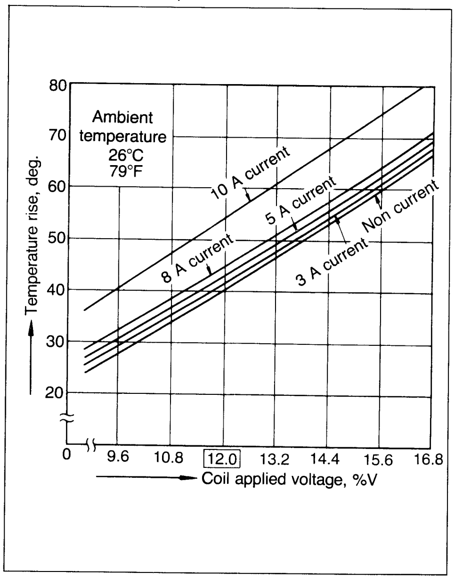
1. Maximum value for switching capacity



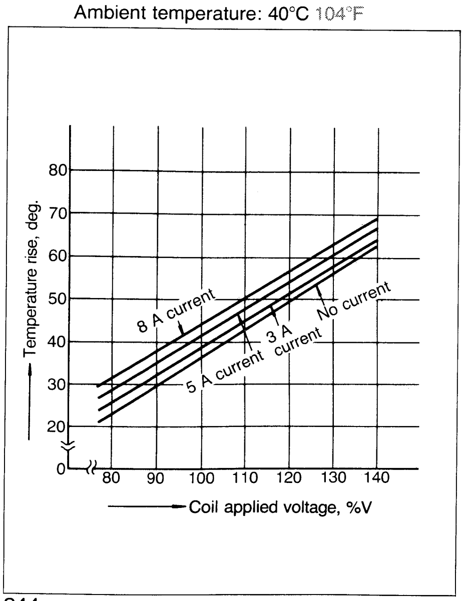
2. Life curve



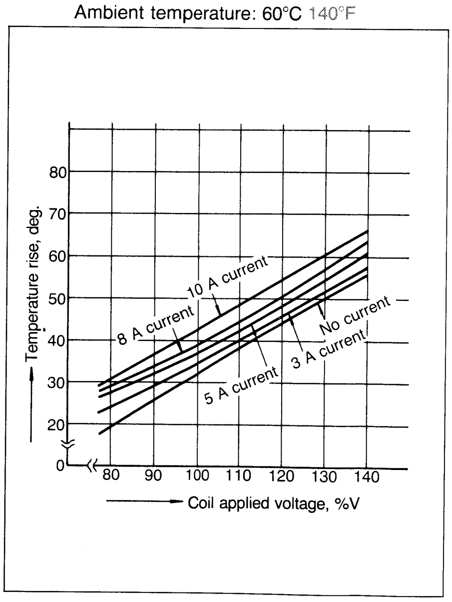
3.-(1) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 26°C 79°F



3.-(2) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 40°C 104°F

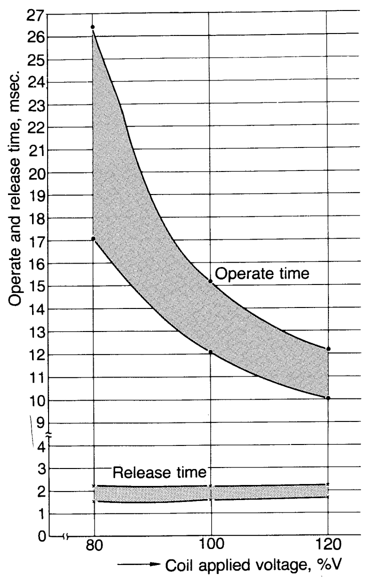


3.-(3) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 60°C 140°F

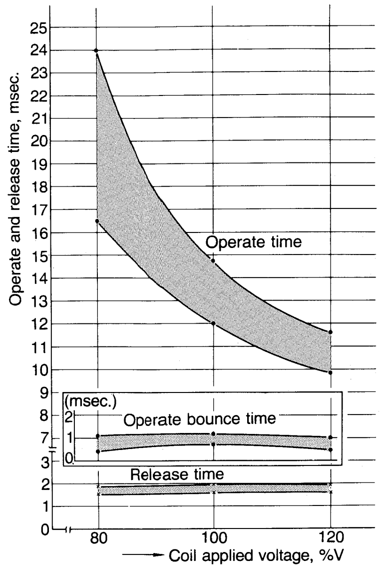


Operate and release time

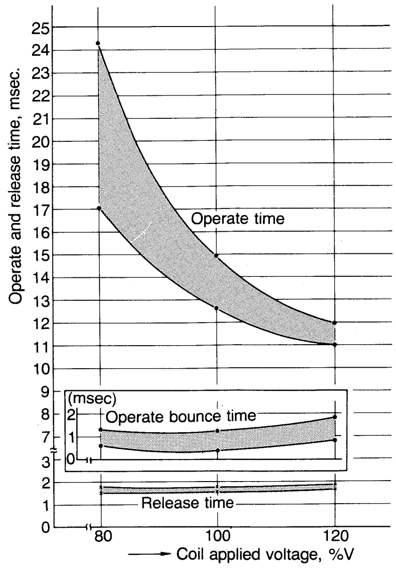
JC1a



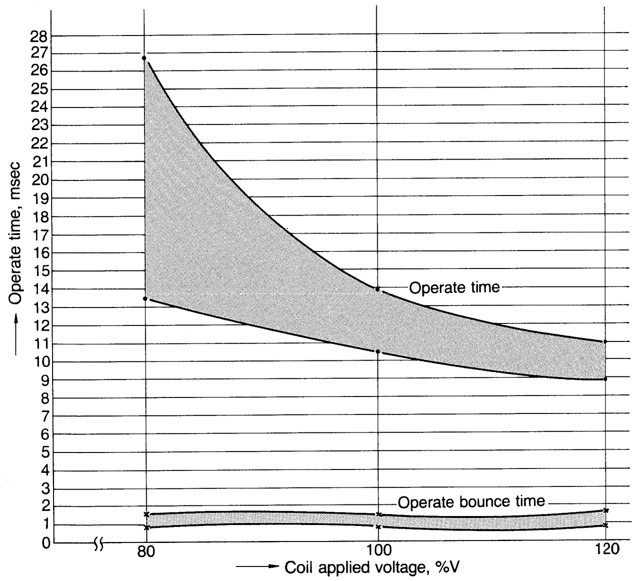
JC2a (Terminal No. 2 to No.3)



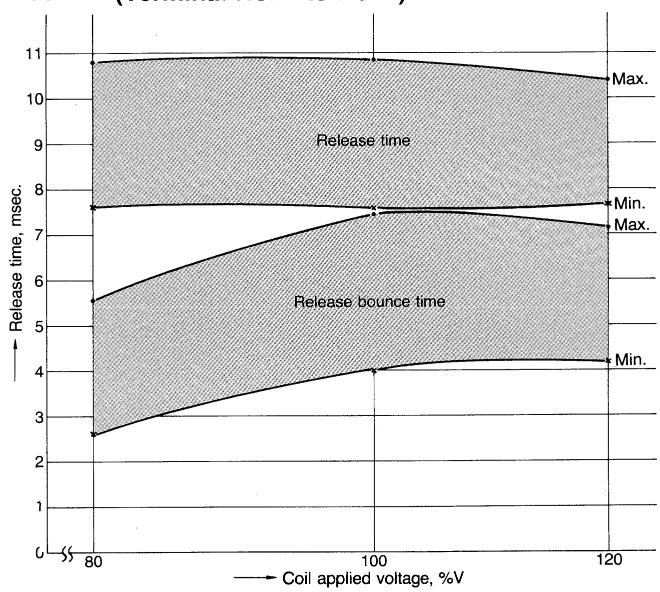
JC2a (Terminal No. 4 to No. 5)



JC1a1b (Terminal No. 2 to No.3)

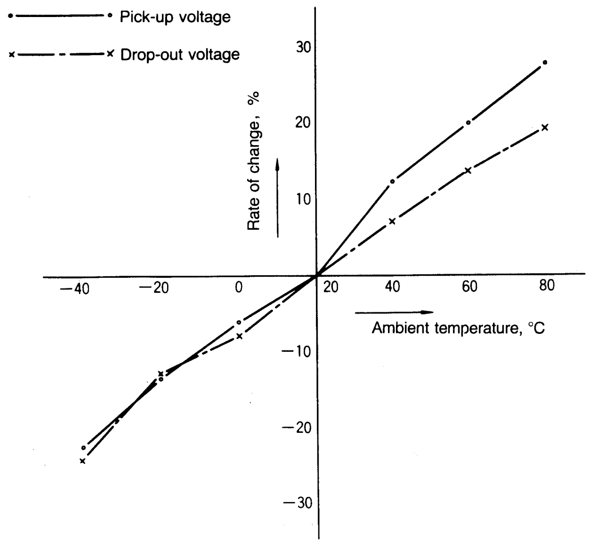


JC1a1b (Terminal No. 4 to No. 5)

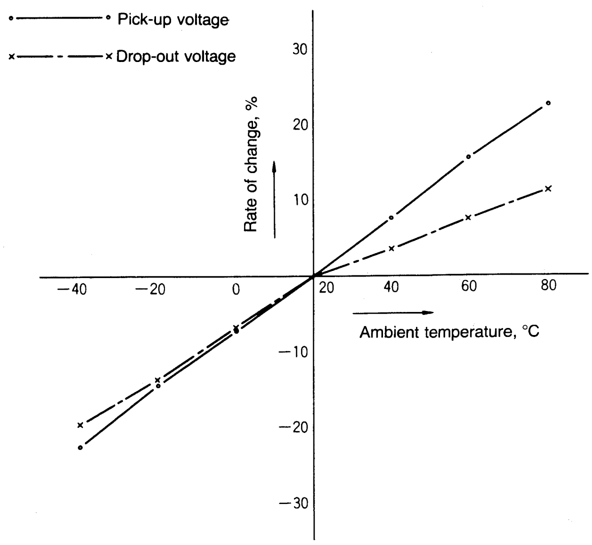


Change of pick-up and drop-out voltage

JC1a

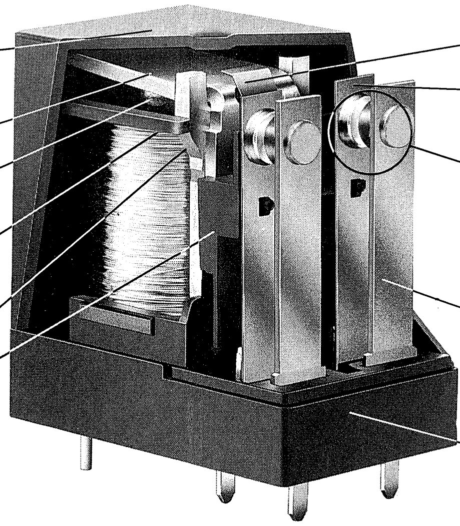


JC2a, JC1a1b

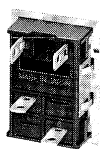


CONSTRUCTION

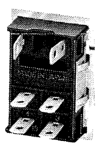
Molded materials: all 94 V-0



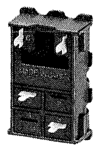
ACCESSORIES



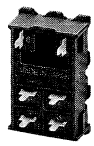
JC1-SS



JC2-SS



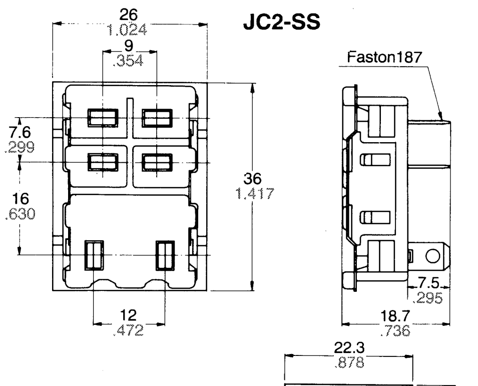
JC1-PS

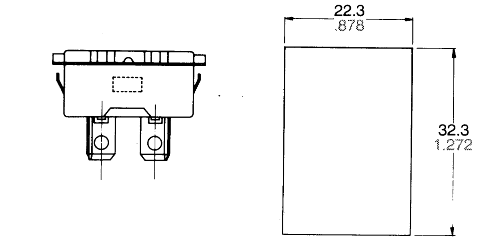


JC2-PS

mm inch

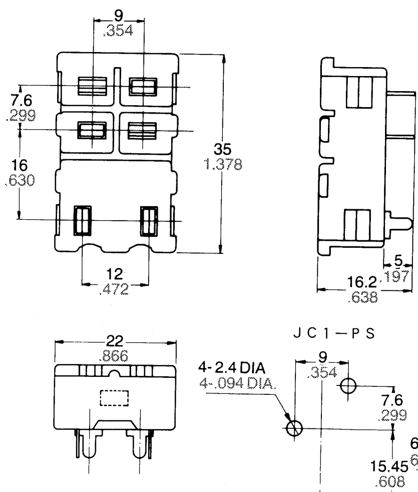
JC2-SS



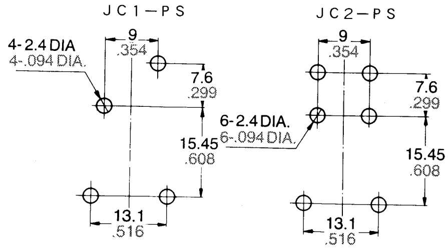


Panel cutout

JC2-PS



Tolerance: ±0.1 ±.004



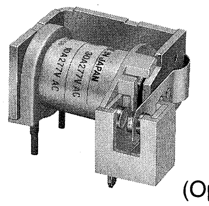
PC board pattern

(Note)
Outward dimensions and chassis cutout dimensions for JC1-SS and JC1-PS are same as those of JC2-SS and JC2-PS respectively.

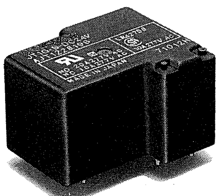
NAiS

COMPACT ECONOMICAL
30 AMP. RELAY

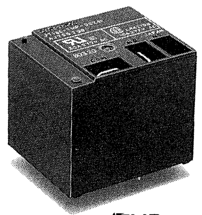
JT-RELAYS



(Open type)



(PCB type)



(TMP type)

UL File No.: E43028
CSA File No.: LR42758

- **High switching capacity—30 A for 1 Form A**
- **2 contact arrangements—1 Form A or 1 Form C**
- **Sealed and "TMP" types available**
- **UL/CSA recognized (TMP type: UL508 group A spacing, UL873 spacing)**
- **Class B and class F types available as options**

	1 Form A	1 Form C N.C.	1 Form C N.O.
UL	30 A 277 V AC, 30 A 30 V DC 2 HP 250 V AC, 1 HP 125 V AC Tungsten 15 A 125 V AC, 5 A 250 V AC	10 A 277 V AC 10 A 28 V DC 1/2 HP 250 V AC 1/4 HP 125 V AC	20 A 277 V AC 20 A 28 V DC 2 HP 250 V AC 1 HP 125 V AC
CSA	10 A 277 V AC, 15 A 125 V AC 30 A 30 V DC 1 HP 250 V AC, 1/2 HP 125 V AC Tungsten 15 A 125 V AC, 5 A 250 V AC	10 A 277 V AC 10 A 28 V DC 1/2 HP 250 V AC 1/4 HP 125 V AC	10 A 277 V AC 10 A 28 V DC 1 HP 250 V AC 1/2 HP 125 V AC

SPECIFICATIONS

Contacts

Arrangement	1 Form A	1 Form C
Initial contact resistance, max. (By voltage drop method, 6 V DC 1 A)	20 mΩ	
Contact material	Silver alloy	
Rating Max. switching power	8310 VA 900 W	N.C. 2770 VA, 280 W N.O. 5440 VA, 560 W
Max. switching voltage	277 V AC, 30 V DC	
Max. switching current	30 A	N.C. 10 A N.O. 20 A
Expected life Mechanical	Min. 1×10^7	
Electrical (Resistive load)	(Open type) 30 A 277 V AC 30 A 30 V DC Min. 1×10^5 (Dust cover, Sealed types)* 20 A 277 V AC 20 A 30 V DC Min. 1×10^5	N.O.: 20 A 277 V AC 20 A 30 V DC Min. 1×10^5 N.C.: 10 A 277 V AC 10 A 30 V DC Min. 1×10^5

*For dust cover and sealed types, the life shown is for open venting-hole condition.

Coil at 20°C 68°F

Minimum operating power	Approx. 498 mW
Nominal operating power	Approx. 890 mW

Characteristics

Operate time	Max. 15 msec.
Release time	Max. 10 msec.
Initial insulation resistance	Min. 10 MΩ at 500 V DC
Breakdown voltage Between contacts Between contacts and coil	(Initial) 1,500 Vrms 1,500 Vrms (For TMP type, 2500 Vrms)
Shock resistance Functional Destructive	Min. 10 G Min. 100 G
Vibration resistance Functional Destructive	9 G, 10 to 55 Hz at double amplitude of 1.5 mm 12 G, 10 to 55 Hz at double amplitude of 2 mm
Ambient temperature	−55°C to +85°C −67°F to +185°F
Unit weight	Open type: Approx. 20 g (.71 oz) PCB type: Approx. 25 g (.88 oz) TMP type: Approx. 30 g (1.06 oz)

TYPICAL APPLICATIONS

- Automotive
- Air conditioner
- Heating & ventilation
- Home appliance

ORDERING INFORMATION

JT [1a] [S] — [TMP] — [DC12V]

Contact arrangement	Protective construction	Mounting classification	Coil voltage
1a: 1 Form A 1: 1 Form C	Nil: Open type G: Dust cover type S: Sealed type	Nil: PCB terminal TMP: Solder and PCB terminal	DC 5, 6, 9, 12, 15, 18, 24 V

Notes:
1. Class B type available for sealed and dust cover types.
2. For class F type, please contact us.
3. Open types are available only in PCB terminals.
4. For UL/CSA recognized types, add suffix UL/CSA.

COIL DATA at 20°C 68°F

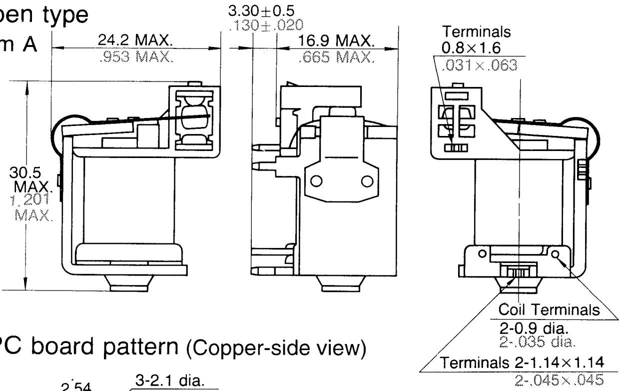
Nominal voltage V DC	Pick-up voltage V DC (max.)	Drop-out voltage V DC (min.)	Coil resistance Ω (±10%)	Nominal operating power mW	Maximum allowable voltage, V DC
5	3.75	0.5	27	926	6
6	4.5	0.6	40	900	7.2
9	6.75	0.9	97	835	10.8
12	9.0	1.2	155	930	14.4
15	11.25	1.5	256	879	18
18	13.5	1.8	380	853	21.6
24	18.0	2.4	660	873	28.8

DIMENSIONS

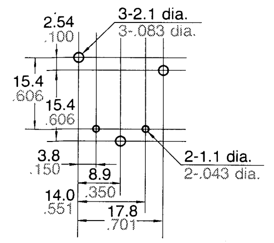
mm inch

1. Open type

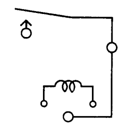
1 Form A



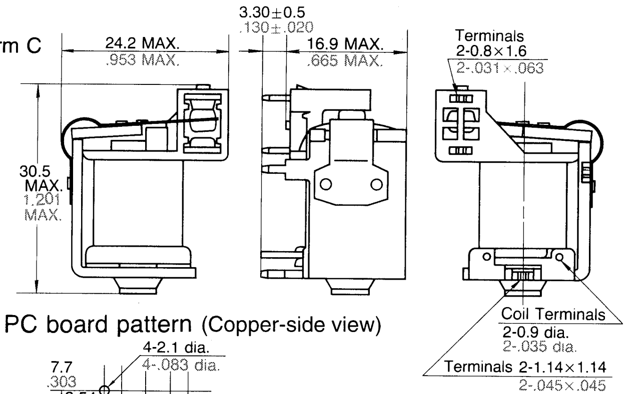
PC board pattern (Copper-side view)



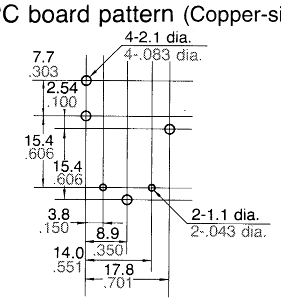
Schematic (Bottom view)



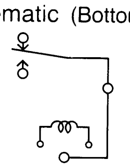
1 Form C



PC board pattern (Copper-side view)



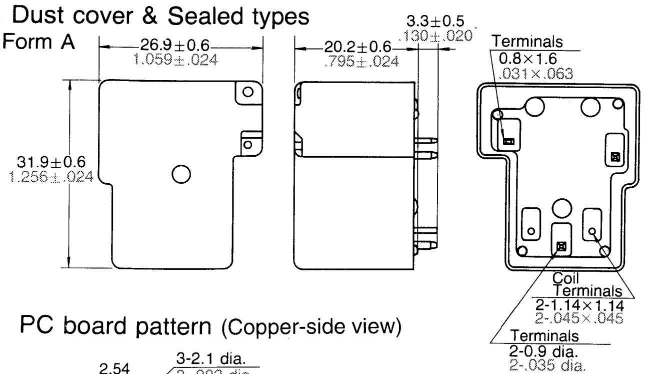
Schematic (Bottom view)



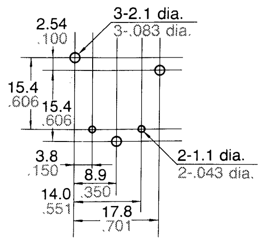
Tolerance: ±0.1 .004

2. Dust cover & Sealed types

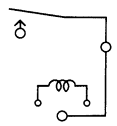
1 Form A



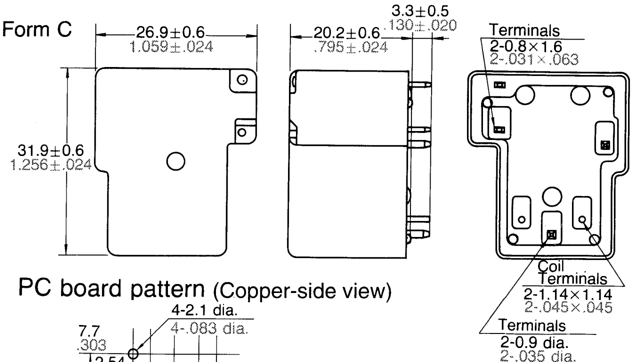
PC board pattern (Copper-side view)



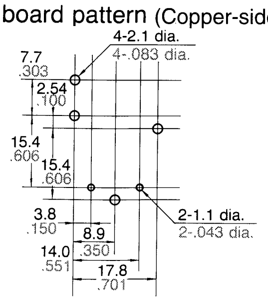
Schematic (Bottom view)



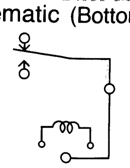
1 Form C



PC board pattern (Copper-side view)



Schematic (Bottom view)

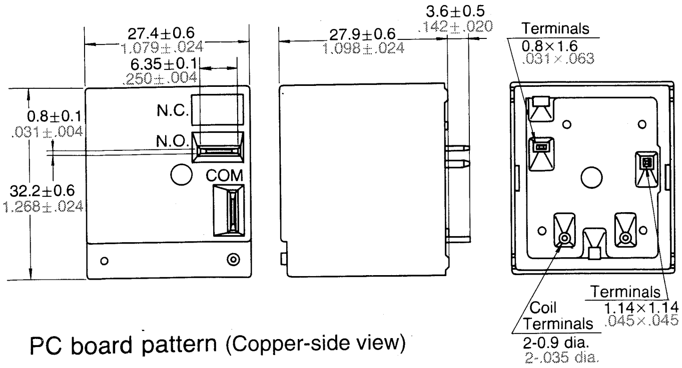


Tolerance: ±0.1 .004

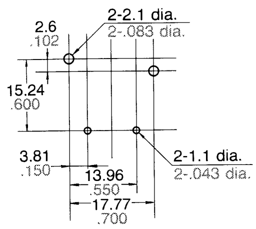
mm inch

3. TMP type

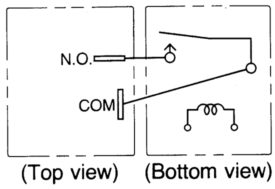
1 Form A



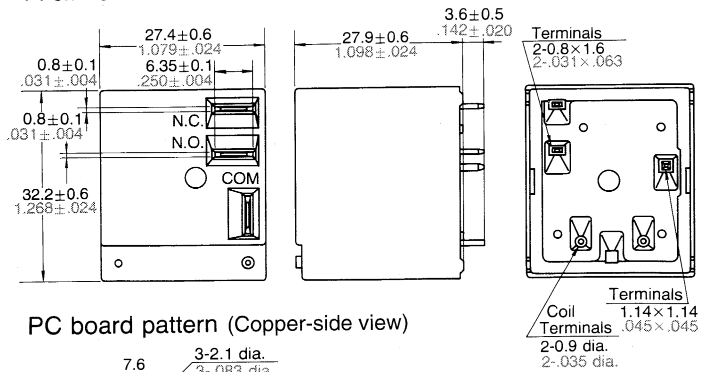
PC board pattern (Copper-side view)



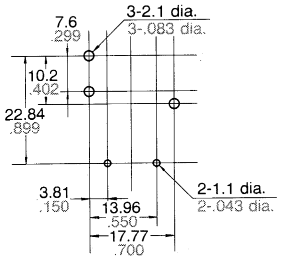
Schematic



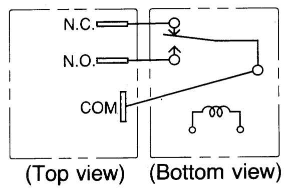
1 Form C



PC board pattern (Copper-side view)



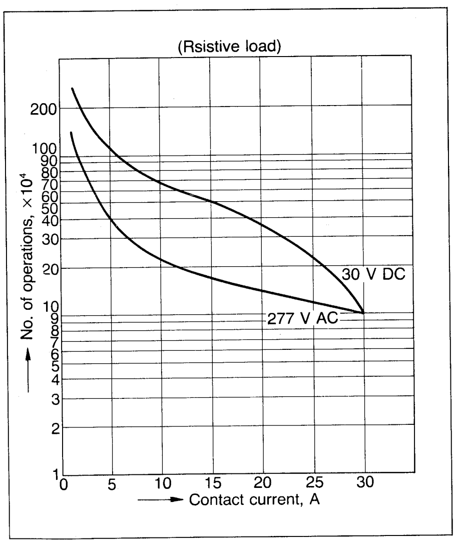
Schematic



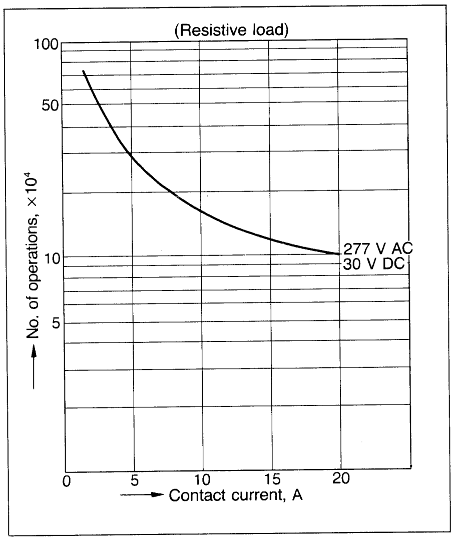
Tolerance: ±0.1 ±.004

DATA

1.-(1) Life curve (Open type) (at 20°C 68°F)

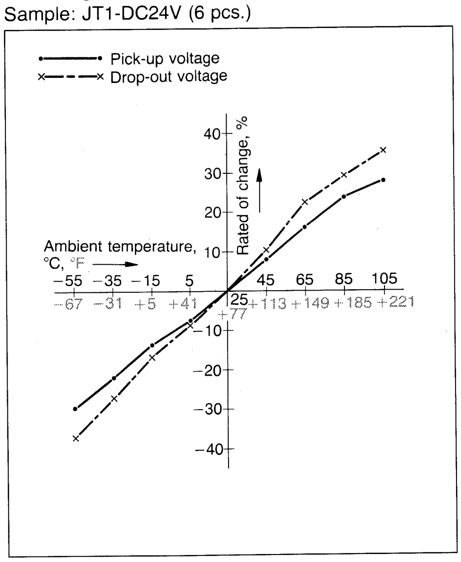


1.-(2) Life curve (dust cover and sealed types) (at 20°C 68°F)



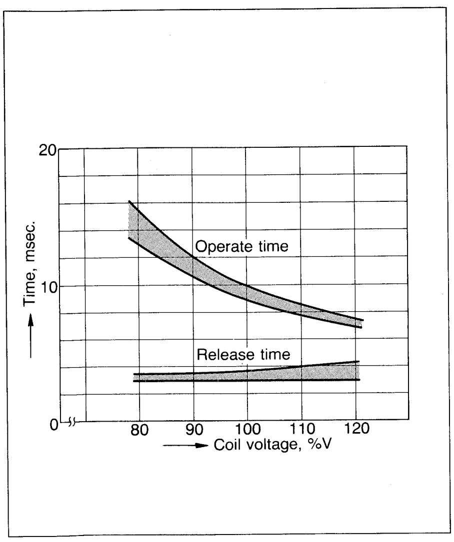
2. Change of rate of pick-up and drop-out voltage (at 20°C 68°F)

Sample: JT1-DC24V (6 pcs.)



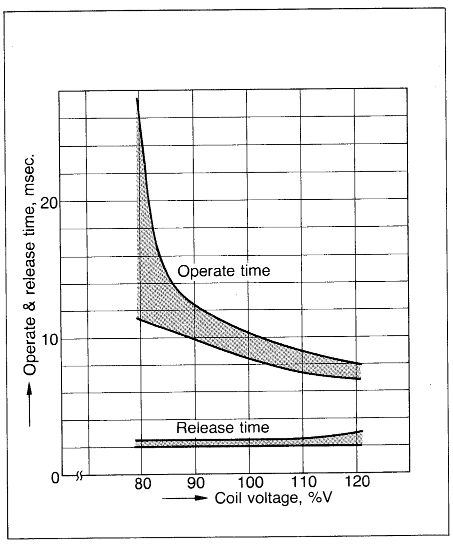
3. Operate & release time (at 20°C 68°F)

Sample: JT1-DC24V (6 pcs.)



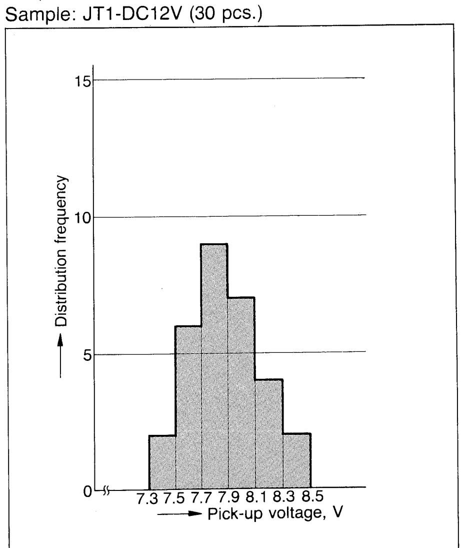
4. Operate & release time (at 20°C 68°F)

Sample: JT1a-DC24V (6 pcs.)



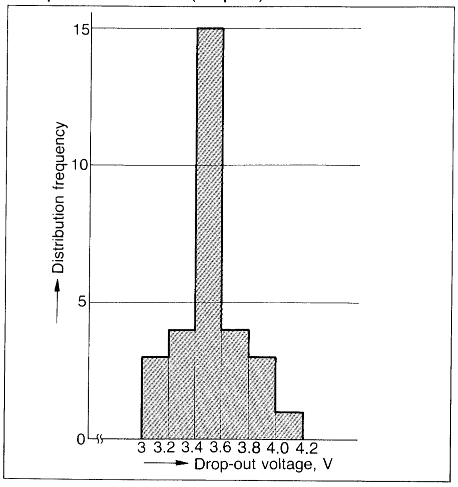
5. Distribution frequency of pick-up voltage (at 20°C 68°F)

Sample: JT1-DC12V (30 pcs.)



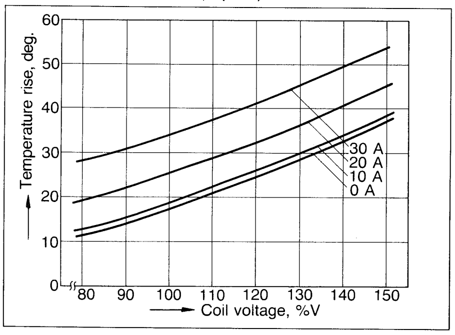
6. Distribution frequency of drop-out voltage (at 20°C 68°F)

Sample: JT1-DC12V (30 pcs.)

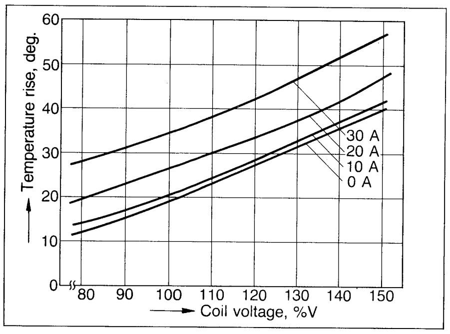


7. Coil temperature rise (Open type)

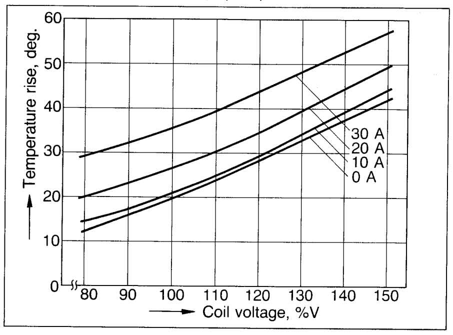
Ambient temperature: 85°C 185°F
Sample: JT1a-DC12V (6 pcs.)



Ambient temperature: 50°C 122°F
Sample: JT1a-DC12V (6 pcs.)

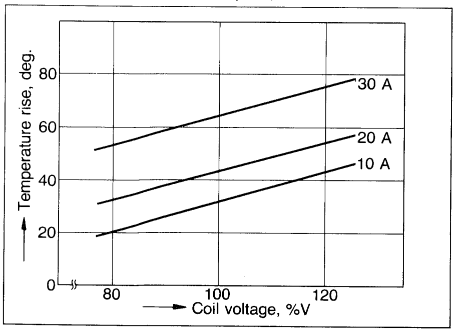


Ambient temperature: 20°C 68°F
Sample: JT1a-DC12V (6 pcs.)

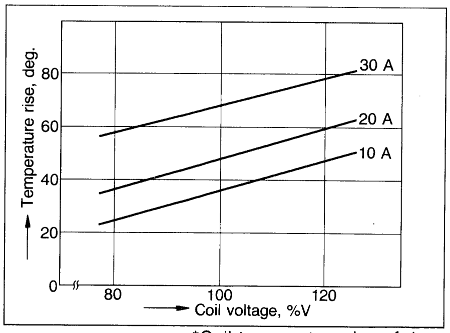


8. Coil temperature rise (Sealed type)*

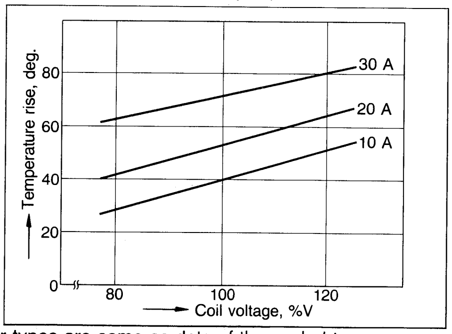
Ambient temperature: 85°C 185°F
Sample: JT1aS-DC12V (6 pcs.)



Ambient temperature: 50°C 122°F
Sample: JT1aS-DC12V (6 pcs.)



Ambient temperature: 20°C 68°F
Sample: JT1aS-DC12V (6 pcs.)



*Coil temperature rise of dust cover types are same as data of the sealed types.

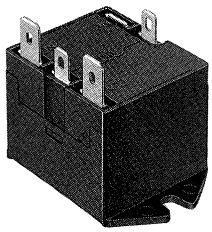
NOTES

1. Coil operating power
   a. Pure DC current should be applied.
   b. If it includes ripple, the ripple factor should be less than 5%. And the relay should be tested in the actual circuit to verify its characteristics.
2. Cleaning recommendation
   A. Clean the PC board prior to relay mounting
   B. Do not immerse the relay into the cleaning solvent.

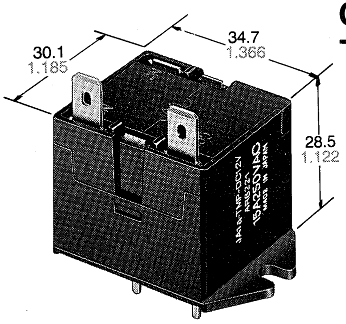
NAiS

1 HORSE-POWER COMPACT POWER RELAYS

JA-RELAYS



"TM" type



"TMP" type

mm inch

UL File No.: E43028
CSA File No.: LR26550
TÜV File No.: 90061645549, SEV

- **High switching capacity—55 A inrush, 15 A steady state inductive load (1 Form A)**
- **Particularly suitable for air conditioners, dish washers, microwave ovens, ranges, central cleaning systems, copiers, facsimiles, etc.**
- **Two types available**
  "TM" type for direct chassis mounting
  "TMP" type for PC board mounting
- **TV-rated types available**

SPECIFICATIONS

Contacts

Arrangement	1 Form A, 1 Form B, 1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	30 mΩ
Contact material	Silver alloy
Rating (resistive load) Maximum switching power Maximum switching voltage Max. switching current UL/CSA rating	 3,750 VA 250 V AC 15 A 10 A 250 V AC, 15 A 125 V AC, 1 HP 125, 250 V AC
Expected life (min. operations) Mechanical (at 180 cpm.) Electrical (at 20 cpm.)	 5×10^6 10^5 (at rated load)

Coil

Nominal operating power	1.2 W 1.4 VA (50 Hz)/ 1.3 VA (60 Hz)
Minimum operating power	0.77 W 0.90 VA (50 Hz)/ 0.84 VA (60 Hz)

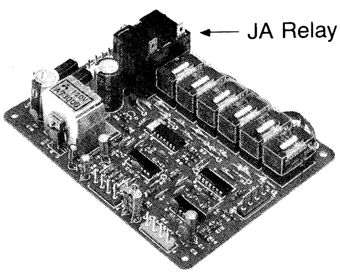
Characteristics

Maximum operating cycle rate		20 cpm.
Operate time		Approx. 15 msec
Release time		Approx. 15 msec
Initial insulation resistance		more than 100 MΩ at 500 V DC
Breakdown voltage Between open contacts Between contacts and coil		 1,000 Vrms 2,000 Vrms
Temperature rise (at nominal voltage)		Max. 65 deg.
Ambient temperature		−50°C to +50°C +40°F to 122°F
Shock resistance	Functional	10 G
	Destructive	100 G
Vibration resistance	Functional	9 G, 10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	12 G, 10 to 55 Hz at double amplitude of 2.0 mm
Unit weight		44 g 1.55 oz

TYPICAL APPLICATIONS

Air conditioners, microwave ovens, load management equipment, copiers, process control equipment

- **Control circuit of Air conditioner**



ORDERING INFORMATION

Ex. JA [1a] — [TM] — [DC12V]

Contact arrangement	Mounting classification	Coil voltage
1c: 1 Form C 1a: 1 Form A 1b: 1 Form B	TM: Solder Terminal TMP: Solder Terminal and PCB Terminal	DC 6, 12, 24 V AC 6, 12, 24, 115 V

(Notes) 1. For UL/CSA recognized types, add suffix UL/CSA.
2. Standard packing Carton: 20 pcs. Case: 200 pcs.

COIL DATA

DC Type at 20°C 68°F

Nominal voltage	Pick-up voltage (max.)	Drop-out* voltage (min.)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power	Maximum allowable voltage (at 60°C)
6 V DC	4.8 V DC	0.6 (0.3*) V DC	30	200	1.2 W	6.6 V DC
12	9.6	1.2 (0.6*)	120	100	1.2	13.2
24	19.2	2.4 (1.2*)	480	50	1.2	26.4

AC Type

				Nominal operating current, mA 50 Hz	Nominal operating current, mA 60 Hz	Nominal operating power 50 Hz	Nominal operating power 60 Hz	
6 V AC	4.8 V AC	1.8 V AC	—	233	217	1.4 VA	1.3 VA	6.6 V AC
12	9.6	3.6	—	117	108	1.4 VA	1.3 VA	13.2
24	19.2	7.2	—	58	54	1.4 VA	1.3 VA	26.4
115	92	34.5	—	12	11	1.4 VA	1.3 VA	126.5

*Drop-out voltage for 1 Form B type is 5% of nominal voltage.

NOTES
1. The range of coil current for AC relay is ±15% (60 Hz). For DC relay it is ±10% at 20°C.
2. The JA 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%.

ADDITIONAL SERIES

1. Following up-graded contact rating types recognized by UL are available. (For use in office appliances)

Contact arrangement \ Suffix	P (Ex. JA 1a - TM DC12V -P)
1 Form C	25 A 250 V AC, 1 HP 125, 250 V AC
1 Form A	25 A 250 V AC, 1 HP 125, 250 V AC
1 Form B	25 A 250 V AC, 1 HP 125, 250 V AC

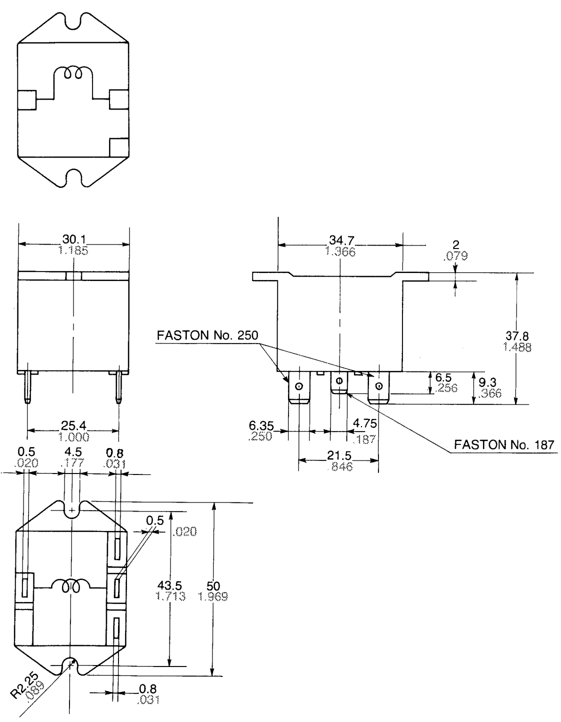
2. TV-Rated Series

Contact arrangement \ Suffix	UL TV	CSA TV
1 Form A	TV-5	TV-5

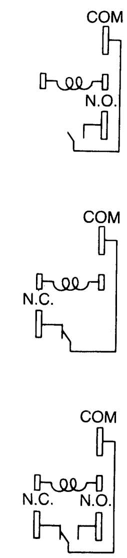
DIMENSIONS

mm inch

TM



Schematic (Bottom view)

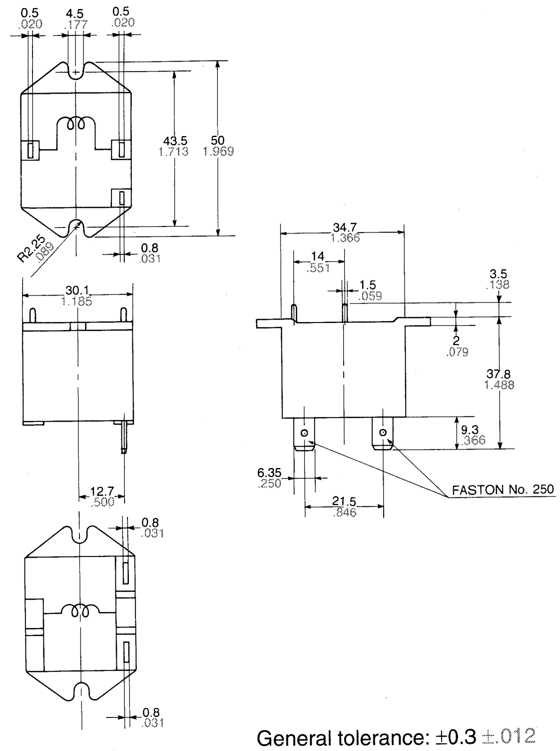


Terminals—.187" quick connect terminals for coil and .250" for contacts

General tolerance: ±0.3 ±.012

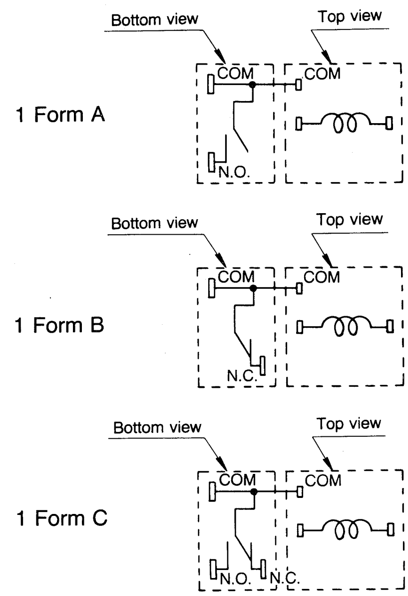
TMP

mm inch



General tolerance: ±0.3 ±.012

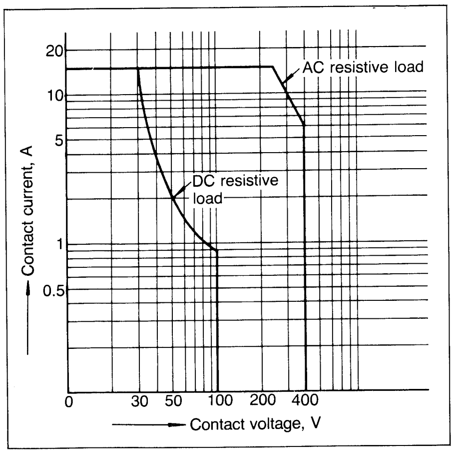
Schematic



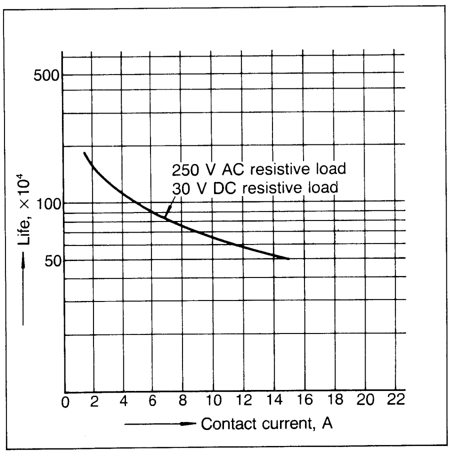
Terminals—PC board terminals for coils and .250" quick connect terminals for contacts

DATA

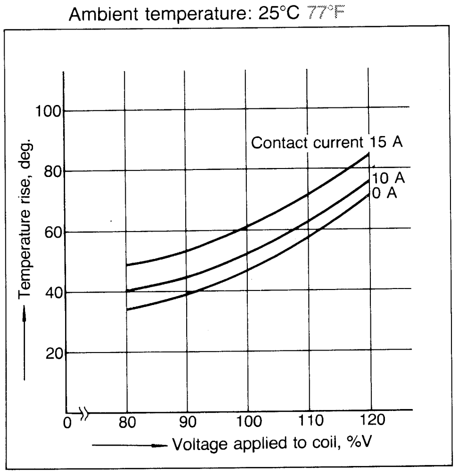
1. Maximum value for switching capacity (Common for 1a, 2b, and 1C)



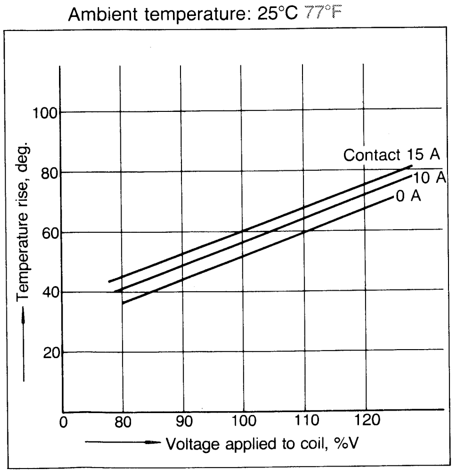
2. Life curve (Common for 1a, 1b, and 1C)



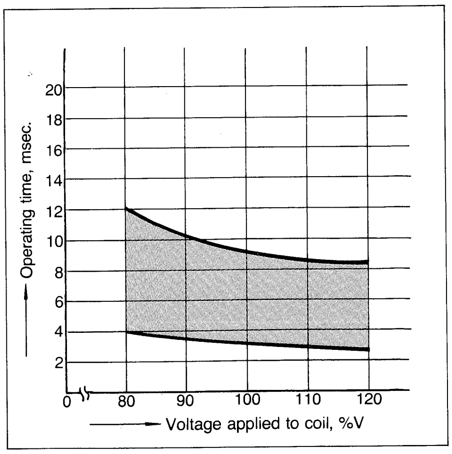
3.-(1) Coil temperature rise (1a-AC type)
Point measured: Inside the coil
Ambient temperature: 25°C 77°F



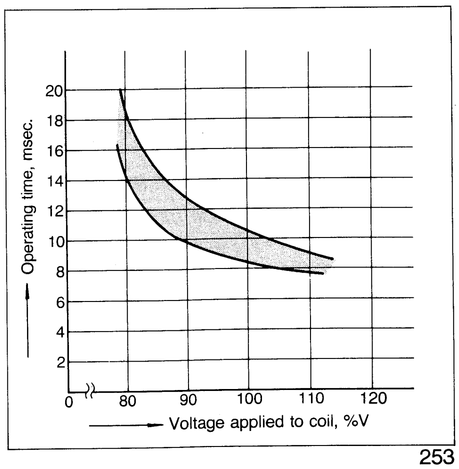
3.-(2) Coil temperature rise (1a-DC type)
Point measured: Inside the coil
Ambient temperature: 25°C 77°F



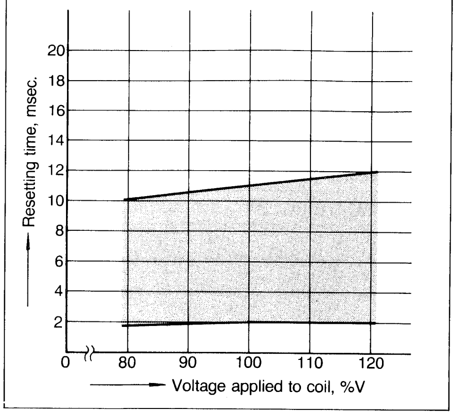
4.-(1) Operating time (1a-AC type)



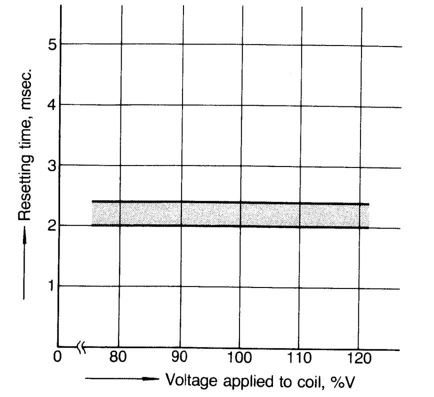
4.-(2) Operating time (1a-DC type)



5.-(1) Resetting time (1a-AC type)



5.-(2) Resetting time (1a-DC type)



Electrical life (15 A 250 V AC resistive) : JA1c-TMP-AC115V

TEST CONDITION:
1. Load: 15 A 250 V AC resistive load
2. Cycle rate: 20 cpm.
3. Circuit: Fig. 1

TEST RESULT:
1. Pick-up and drop-out voltage: Fig. 2
2. Contact resistance: Fig. 3, Fig. 4
3. No abnormality was observed in either insulation resistance or breakdown voltage.

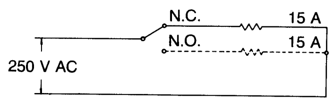


Fig. 1

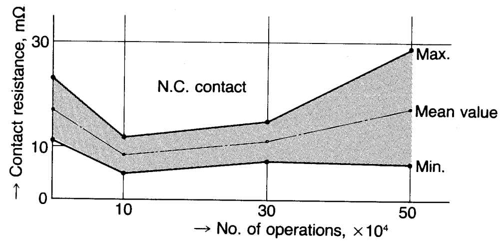


Fig. 3

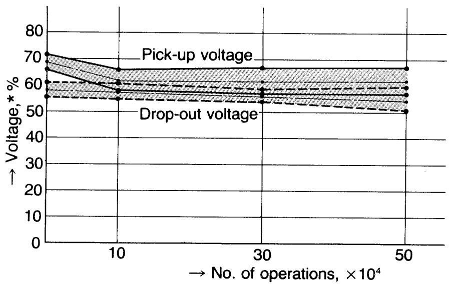


Fig. 2

* This shows percent rate against nominal coil voltage.

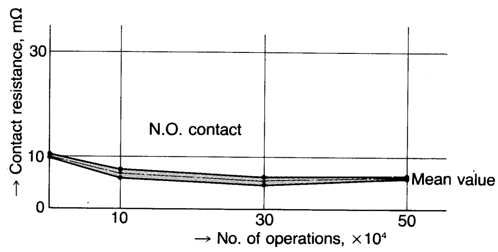
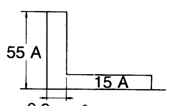


Fig. 4

Electrical life (15 A 250 V AC Motor simulated load): JA1a-TM-DC12V

TEST CONDITION:
1. Load: 250 V AC inductive load (cos $\varphi = 0.7$)
   15 A steady and 55 A (0.3 sec.*) inrush current.



*0.1 sec. for AC coil voltage 1 From A type.

2. Cycle rate: 20 cpm.
3. Circuit: Fig. 1

TEST RESULT:
1. Pick-up and drop-out voltage: Fig. 2
2. Contact resistance: Fig. 3
3. No abnormality was observed in either insulation resistance or breakdown voltage.

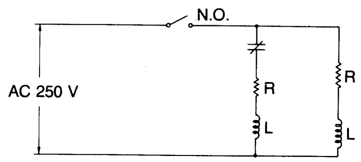


Fig. 1

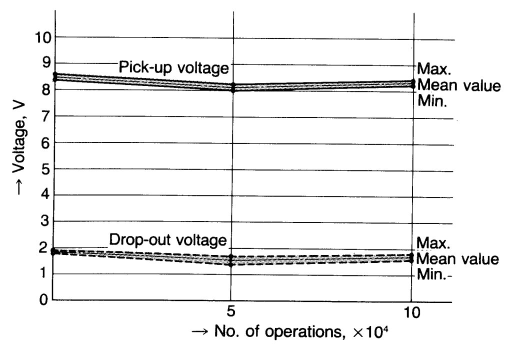


Fig. 2

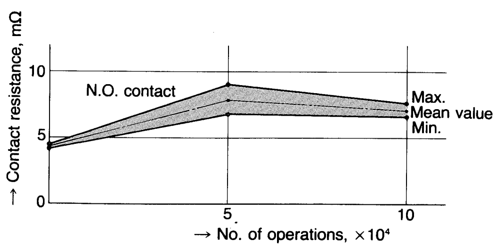
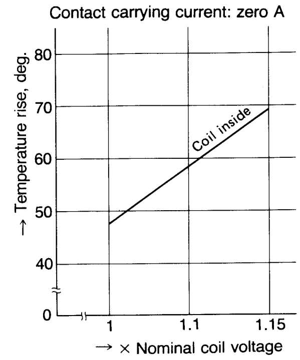


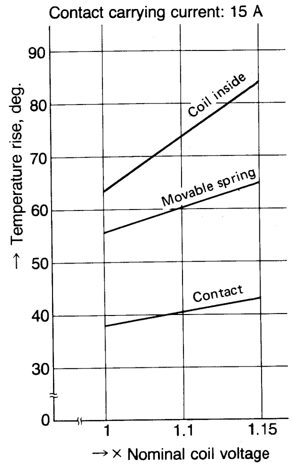
Fig. 3

Temperature rise: JA1a-TMP-AC115V

TEST CONDITION:
1. Applied coil voltage: 100%, 110% and 115% of nominal voltage at 50 Hz
2. Carrying current: 0 A, 15 A
3. Ambient temperature: 32°C 90°F
4. Portions to be measured:
   a. Coil inside
   b. Contact
   c. Movable spring

TEST RESULT:





Surge resistance: JA1a-TM-DC12V

TEST CONDITION:
1. Surge wave: Fig. 1
2. Surge applied time: 3 times each.
3. Surge applied portions:
   a. Between coil and COM.
   b. Between coil and N.O.
   c. Between coil and N.C.
   d. Between coil and yoke
   e. Between coil and armature

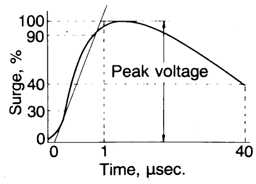


Fig. 1

TEST RESULT:
a. Between coil and COM. terminal:
   No abnormality was observed up to 6,500 V.
b. Between coil and N.O. terminal:
   No abnormality was observed up to 7,000 V.
c. Between coil and N.C. terminal:
   No abnormality was observed up to 7,500 V.
d. Between coil and yoke:
   No abnormality was observed up to 6,000 V.
e. Between coil and armature:
   No abnormality was observed up to 7,500 V.

Field load switching

Magnetron transformer for microwave oven: JA1a-TMP-DC12V

TEST CONDITION:
1. Load: Magnetron transformer (100 V AC) and resistance
   15 A steady, 117 A inrush
2. Cycle rate: 20 cpm.
3. Circuit: Fig. 1

TEST RESULT:
1. No abnormality was observed after 5×10^5 operations.
2. Pick-up and drop-out voltage: Fig. 2

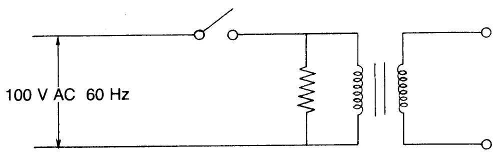


Fig. 1

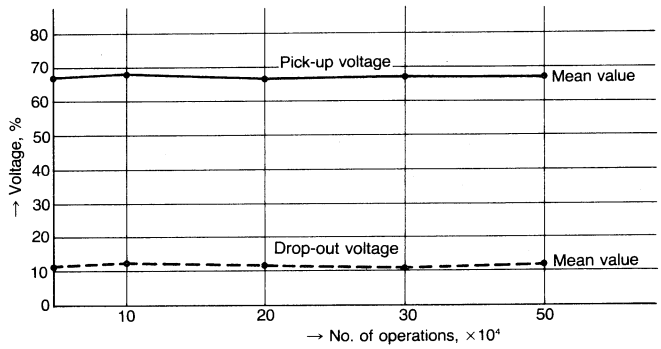


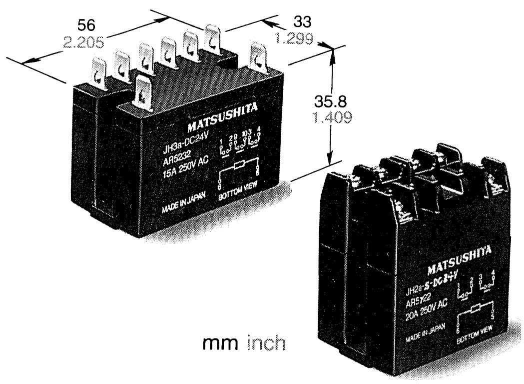
Fig. 2

NAiS

30 AMP (1 Form X) POWER RELAY WITH SPACE SAVING DESIGN

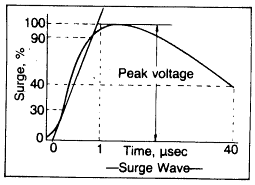
JH-RELAYS

UL File No.: E43028; CSA File No.: LR26550; TÜV File No.: 84041645503; VDE File No.: VDE-Reg.-Nr. 1669



- Many safety-oriented characteristics incorporated
  Contact gap: more than 3 mm for 1 Form A and 2 Form A
  Breakdown voltage for N.O. contact: 2,000 V AC between contacts
  5,000 V AC between coil and contact
  Molded materials: all 94 V-0
- Various contact arrangements
  1 Form A, 2 Form A, 3 Form A, 2 Form A 1 Form B
- High dielectric strength for transient protection
  10,000 V surge is µsec. between coil and contact
- High inrush resistance
  1 Form A type: 117 A (meets TV-8 requirement)
  2 Form A type: 91 A (meets TV-6 requirement)

*Applied surge wave



SPECIFICATIONS

Contacts

Arrangement	1 Form A	2 Form A	3 Form A	2 Form A 1 Form B
Initial contact pressure	Approx. 80 g (2.82 oz)	Approx. 40 g (1.41 oz)	Approx. 30 g (1.06 oz)	N.O.: 30 g (1.06 oz); N.C.: 20 g (0.71 oz)
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	100 mΩ			
Contact material	Silver alloy			
Rating (resistive load) Nominal switching rating	30 A 250 V AC	20 A 250 V AC	15 A 250 V AC	N.O.: 15 A 250 V AC; N.C.: 5 A 250 V AC
Max. switching power	7,500 VA	5,000 VA	3,750 VA	N.O.: 3,750 VA; N.C.: 1,250 VA
Max. switching voltage	277 V AC			
Max. switching current	30 A	20 A	15 A	N.O.: 15 A; N.C.: 5 A
UL/CSA rating	1 HP 125 V AC 2 HP 250 V AC 30 A 277 V AC	1 HP 125 V AC 2 HP 250 V AC 20 A 277 V AC	1/2 HP 250 V AC 10 A 277 V AC 15 A 125 V AC	N.O.: 1/2 HP 250 V AC, 10 A 277 V AC, 15 A 125 V AC N.C.: 1/4 HP 250 V AC, 10 A 277 V AC, 5 A 125 AC
Expected life (min. operations) Mechanical	5×10^6 at 180 cpm (10^6 at 180 cpm for latching and AC types)			
Electrical (at nominal resistive load)	10^5 at 180 cpm			

Coil

Minimum operating power	1.23 W (DC) Approx. 2.0 VA (AC)
Nominal operating power	1.92 W (DC) Approx. 3.2 VA (AC)

Characteristics

Contact arrangement	1 Form A	2 Form A	3 Form A	2 Form A 1 Form B
Maximum operating speed	20 cpm			
Operate time	Approx. 20 msec. at nominal voltage (DC)			
Release time	Approx. 5 msec. at nominal voltage (DC)			
Initial insulation resistance	More than 100 MΩ at 500 V DC			
Breakdown voltage Beteeen open contacts	2,000 Vrms			N.O.: 2,000 Vrms; N.C.: 1,500 Vrms
Between contact sets	—	4,000 Vrms	3,000 Vrms	
Between contacts and coil	5,000 Vrms			N.O.: 5,000 Vrms; N.C.: 3,000 Vrms
Surge voltage	More than 10,000 V between contacts and coil			
Temperature rise (at nominal voltage)	DC: Max. 65 deg., AC: Max. 85 deg.			
Ambient temperature	−50° to +55°C (−58°F to +131°F)			
Shock resistance	Functional: min. 10 G Destructive: min. 100 G			Functional: Approx. 5 G Destructive: min. 100 G
Vibration resistance	Functional: 10 to 55 Hz at 1 mm double amplitude Destructive: 10 to 55 Hz at 1.5 mm double amplitude			
Molded materials used	94 V-0			
Unit weight	Approx. 90 g 3.17 oz (Approx. 115 g 4.06 oz)	Approx. 96 g 3.39 oz (Approx. 129 g 4.55 oz)	Approx. 100 g 3.53 oz (Approx. 130 g 4.59 oz)	

( ): screw type

TYPICAL APPLICATIONS

Air conditioners, microwave ovens, load management equipment, copiers, process control equipment.

ORDERING INFORMATION

Ex. JH [2a] [S] — [L2] — [DC24V]

Contact arrangement	Terminals	Operating function	Coil voltage
1a: 1 Form A 2a: 2 From A 3a: 3 Form A 2a1b: 2 Form A 1 Form B	Nil: Plug-in terminal type S: Screw terminal type	Nil: Single side stable for 1 Form A, 2 Form A W: Single side stable for 3 Form A, 2 Form A 1 Form B L2: 2 coil latching for 1 Form A, 2 Form A WL2: 2 coil latching for 3 Form A	DC 6, 12, 24, 48, 110 V AC 6, 12, 24, 48, 120, 220, 240 V

(Note) For UL/CSA recognized types, please add suffix UL/CSA.

TYPES AND COIL DATA

Single side stable (DC coils at 20°C 68°F): DC types of JH1a, JH2a, JH3a-W, and JH2a1b-W

Nominal voltage, V DC	Pick-up voltage	Drop-out voltage	Maximum allowable voltage, at 50°C	Coil resistance (Ω)	Nominal operating power, (W)
6	Less than 80% of nominal voltage	More than 10% of nominal voltage	110% of nominal voltage	18.7	1.92
12				75	1.92
24				300	1.92
48				1,200	1.92
110				6,300	1.92

Single side stable (AC coils at 50/60 Hz, 20°C 68°F): AC type of JH1a, JH2a, JH3a-W and JH2a1b-W

Nominal voltage, V AC	Pick-up voltage	Drop-out voltage	Maximum allowable voltage, at 50°C	Coil resistance (Ω)	Nominal operating power, (VA)
6	Less than 80% of nominal voltage	*More than 30% of nominal voltage	110% of nominal voltage	—	3.05
12				—	3.19
24				—	3.00
48				—	3.19
120				—	2.95
220				—	3.12
240				—	3.30

*JH3a-W, JH2a1b-W: More than 10% of nominal voltage.

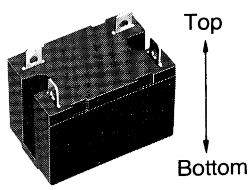
2 coil latching (DC coils only at 20°C 68°F): DC types of JH1a-L2, JH2a-L2 and JH3a-WL2

Nominal voltage, V DC	set and reset voltage	Maximum allowable voltage, at 50°C	Coil resistance, (Ω)		Nominal operating power, (W)	
			Coil I	Coil II	Coil I	Coil II
6	Less than 80% of nominal voltage	110% of nominal voltage	18.7	18.7	1.92	1.92
12			75	75	1.92	1.92
24			300	300	1.92	1.92
48			1,200	1,200	1.92	1.92
110			6,300	6,300	1.92	1.92

Standard Packing: Carton 20 pcs, Case 100 pcs.

Notes:

1. Coil resistance varies ±10% for less than 1,000 Ω, and ±15% for more than 1,000 Ω. For each ±1°C change in ambient temperature, coil resistance varies ±0.4%.
2. For each ±1°C change in ambient temperature, pick-up and drop-out voltages vary approximately ±0.4%.
3. Pick-up and drop-out voltages are measured with the relay mounted as follows.
4. The coil operating current should be pure direct current in principle. When rectified alternating current is applied to the coil, the relay characteristics (pick-up, drop-out voltage) may be changed due to the ripple factor. Confirmation of the characteristics in the actual circuit is suggested.



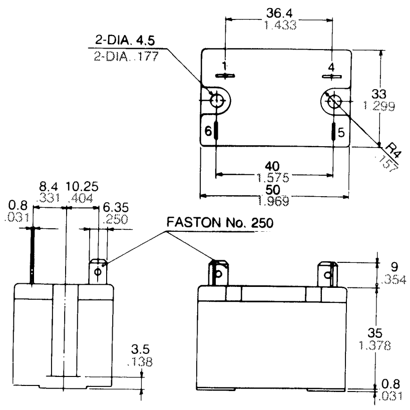
DIMENSIONS

mm inch

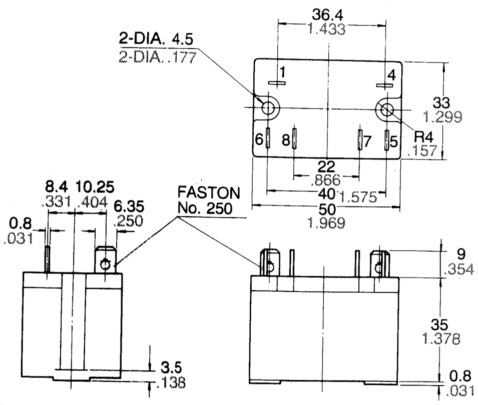
Plug-in type

1 Form A (JH1a, JH1a-L2)

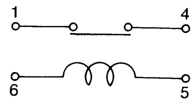
Single side stable



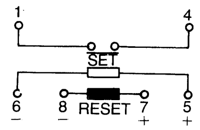
2 coil latching



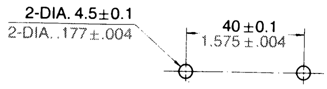
Schematic (Bottom view)
Single side stable



2 coil latching

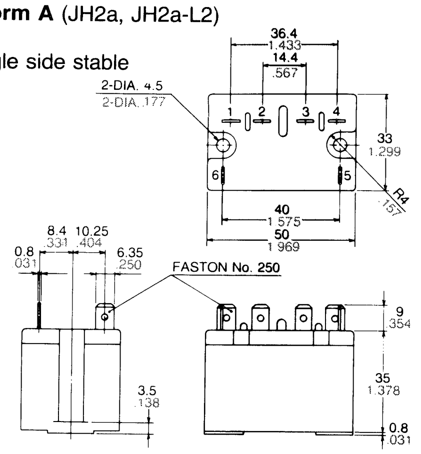


Panel cutout

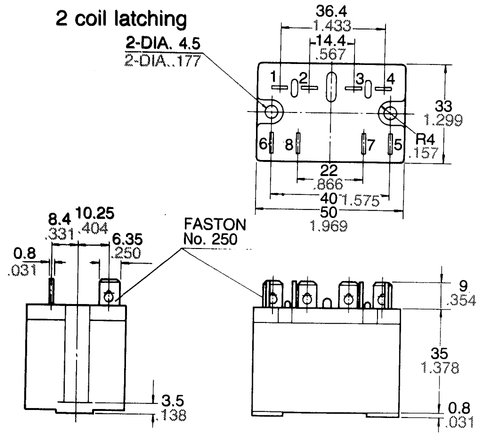


2 Form A (JH2a, JH2a-L2)

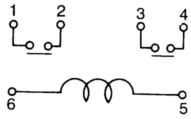
Single side stable



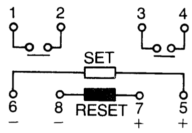
2 coil latching



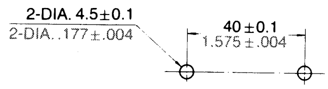
Schematic (Bottom view)
Single side stable



2 coil latching

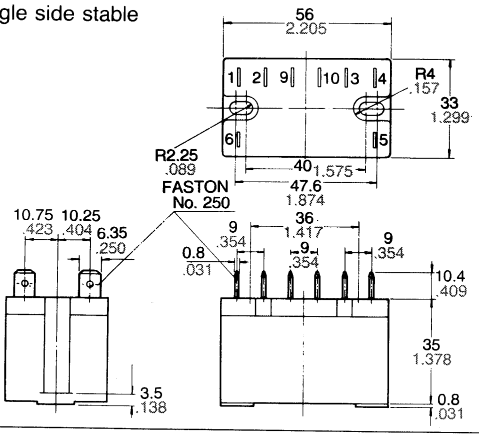


Panel cutout

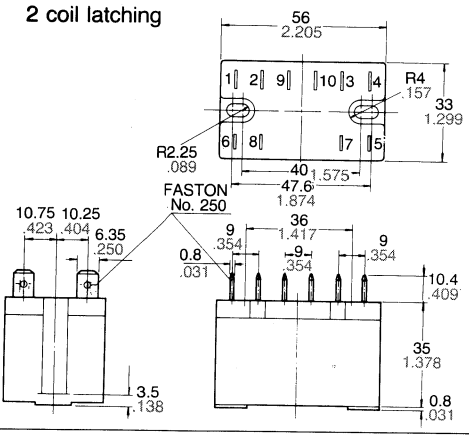


3 Form A (JH3a-W, JH3a-WL2)

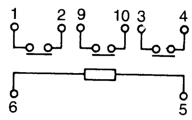
Single side stable



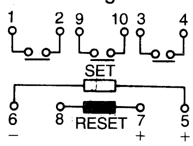
2 coil latching



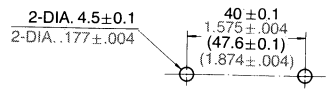
Schematic (Bottom view)
Single side stable



2 coil latching

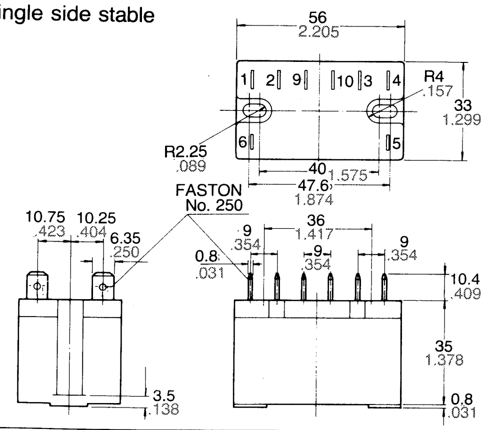


Panel cutout

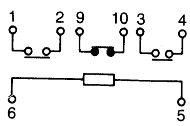


2 Form A 1 Form B (JH2a1b-W)

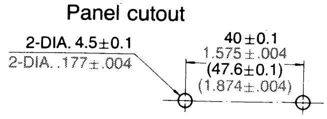
Single side stable



Schematic (Bottom view)



Panel cutout



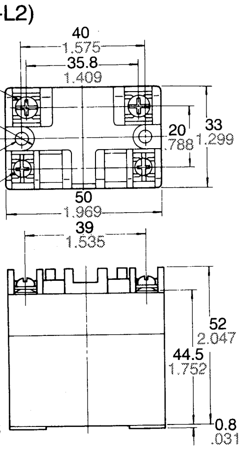
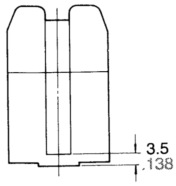
Note: 2 coil latching types of 2 Form A 1 Form B contact arrangement are not available.

mm inch

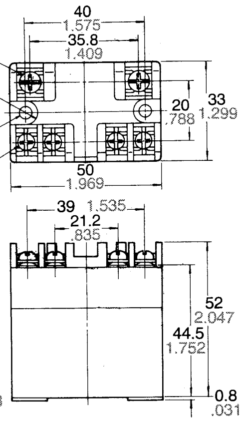
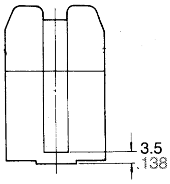
Screw type

1 Form A (JH1aS, JH1aS-L2)

Single side stable

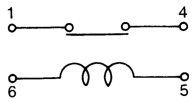



2 coil latching

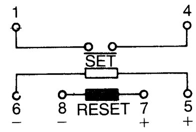



Schematic (Bottom view)

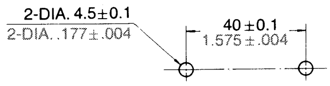
Single side stable



2 coil latching



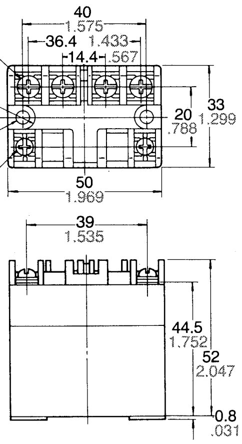
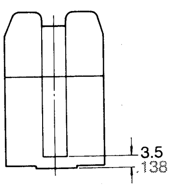
Panel cutout



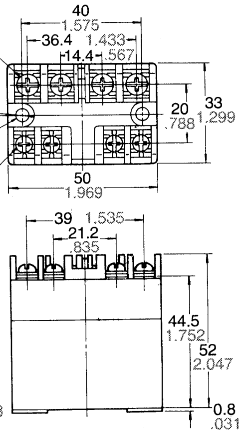
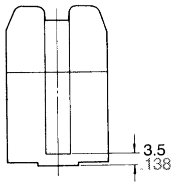
2 Form A

(JH2aS, JH2aS-L2)

Single side stable

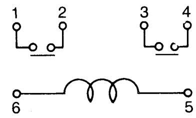



2 coil latching

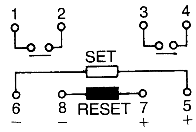



Schematic (Bottom view)

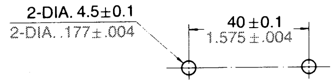
Single side stable



2 coil latching



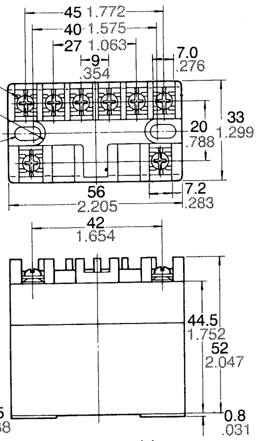
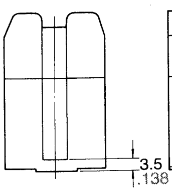
Panel cutout



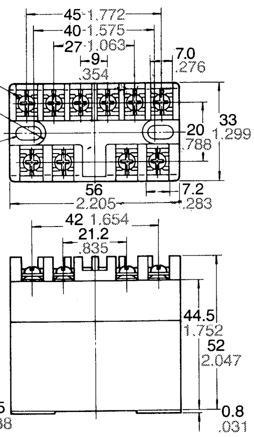
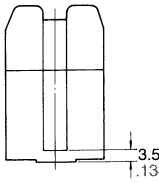
3 Form A

(JH3aS-W, JH3aS-WL2)

Single side stable

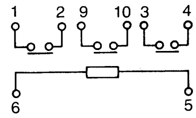



2 coil latching

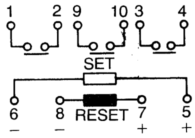



Schematic (Bottom view)

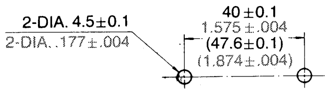
Single side stable



2 coil latching



Panel cutout

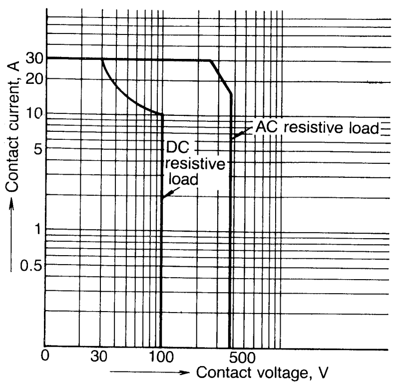


Note: 2 Form A 1 From B types with screw terminals are not available.

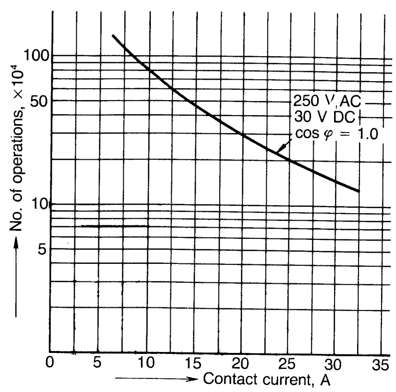
DATA

1 Form A

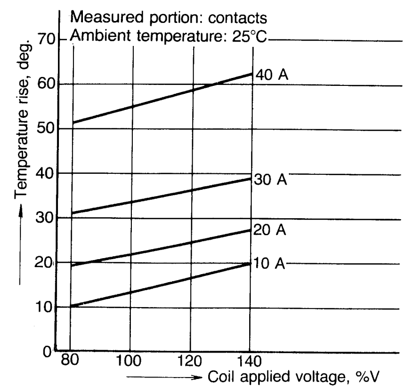
1. Maximum switching power



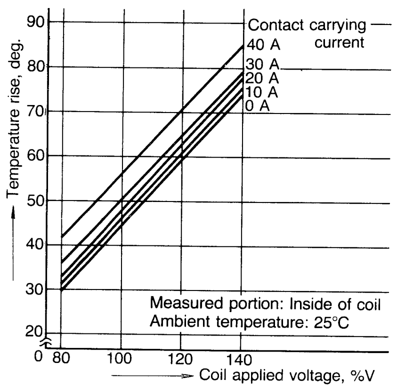
2. Life curve



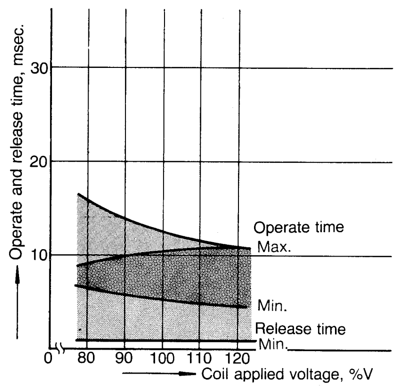
3.1 Contact temperature rise (DC type)



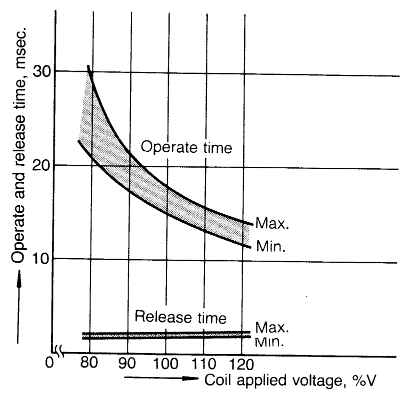
3.2 Coil temperature rise (DC type)



4. Operate and release time (1a,2a) AC type

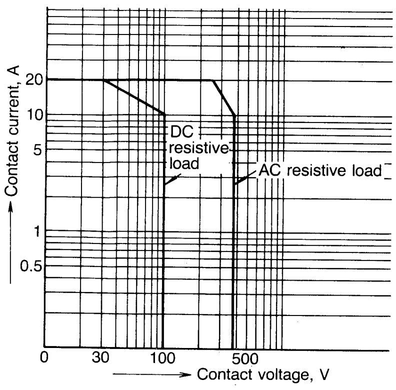


5. Operate and release time (1a,2a) DC type

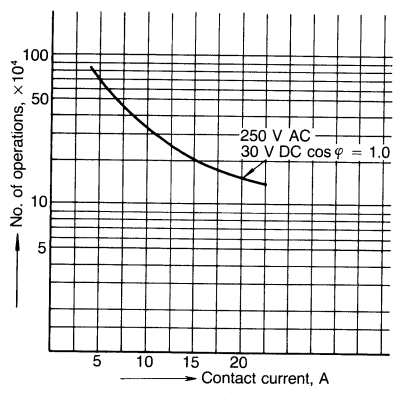


2 Form A

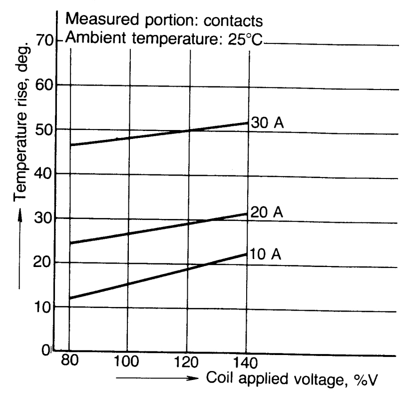
1. Maximum switching power



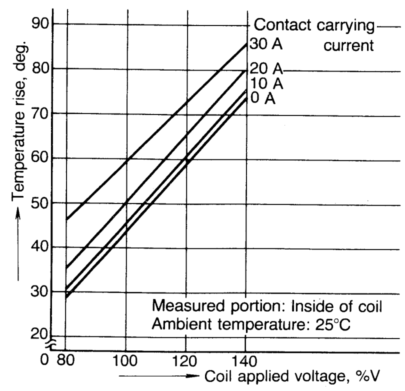
2. Life curve



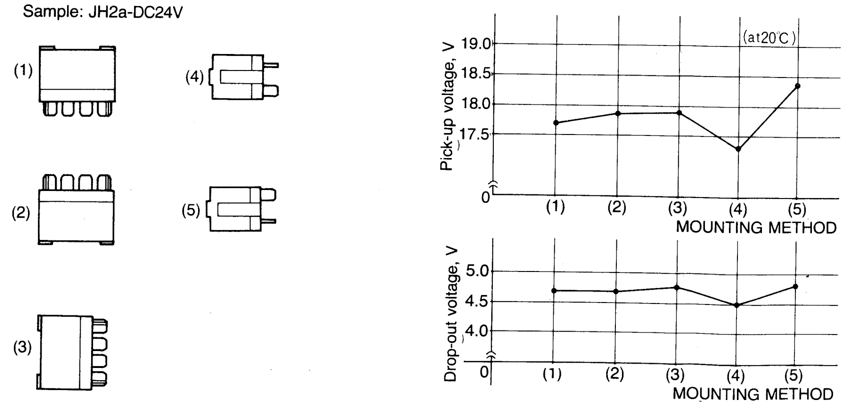
3.1 Contact temperature rise (DC type)



3.2 Coil temperature rise (DC type)

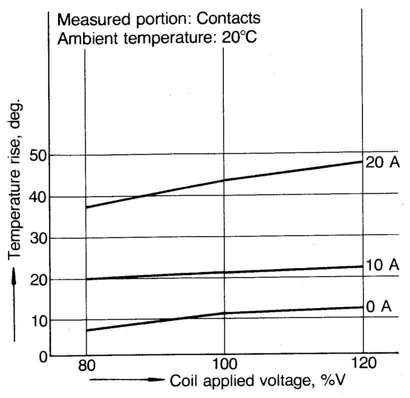


4. Pick-up and drop-out voltage change by mounting method

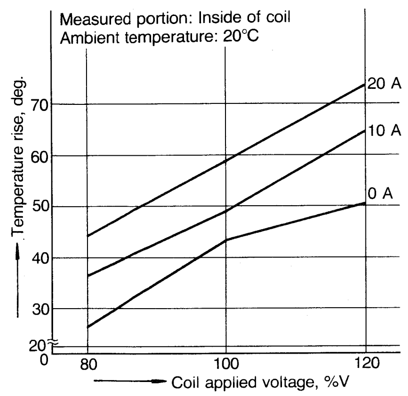


3 Form A

1. Contact temperature rise (DC type)



2. Coil temperature rise (DC type)

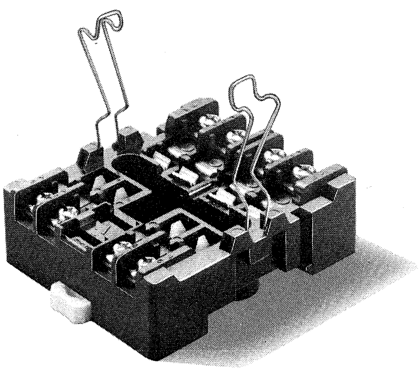


NOTES

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. As 2 coil latching types are polarized relays, do not apply the opposite polarity to the coil. The reverse polarity may cause malfunction.

JH RELAY ACCESSORIES

Terminal socket instantly attachable to DIN rail



TYPES

Part No.	Applicable relays
JH1-SF	JH1a
JH1-L2-SF	JH1a-L2
JH2-SF	JH2a
JH2-L2-SF	JH2a-L2
JH3-SF	JH3a and 2a1b
JH3-L2-SF	JH3a-WL2

SPECIFICATIONS

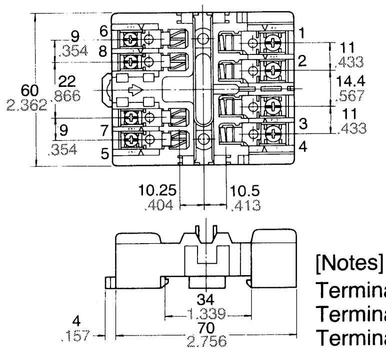
Types	JH1, JH2	JH3
Maximum continuous current*	20 A 250 V AC (1a: 30 A 250 V AC)	15 A 250 V AC
Breakdown voltage	2,000 Vrms between terminals	
Insulation resistance	More than 1,000 MΩ between poles	
Heat resistance	150°C±3°C for 1 hour	

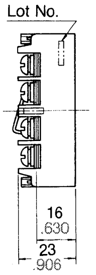
*Don't insert or remove relays while in the energized condition.

DIMENSIONS

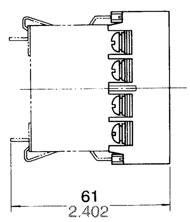
mm inch

1 Form A, 2 Form A

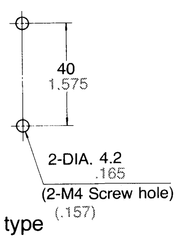




Relay mounting diagram

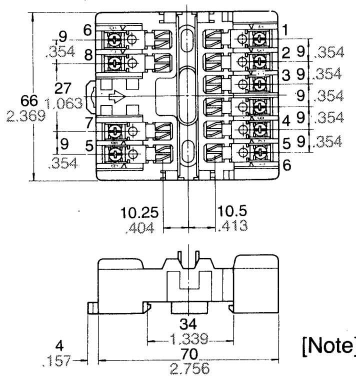


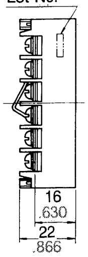
Panel cutout



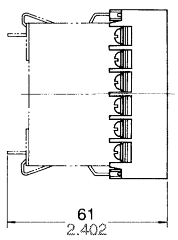
[Notes]
Terminals 2, 3, 7 and 8 excluded for 1 Form A single side stable type
Terminals 7 and 8 excluded for 2 Form A single side stable type
Terminals 2, 3 and 8 excluded for 1 Form A 2 coil latching type
The above diagrams show 2 Form A 2 coil latching type

3 Form A, 2 Form A 1 Form B

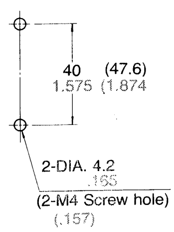




Relay mounting diagram



Panel cutout

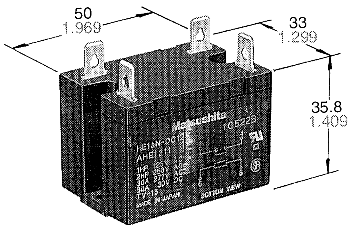


[Note] Terminals 7 and 8 excluded for single side stable type

NAiS

TV-15, 30 AMP (1 Form A) Power Relay

HE-RELAYS



mm inch

UL File No.: E43028 (DC coil type)
CSA File No. LR26550 (DC coil type)

- **High contact capacity with superior inrush current characteristics;**

	1 Form A	2 Form A
Rating	30 A 277 V AC	20 A 277 V AC
TV rating	TV-15	TV-10

- **Excellent high heat-resistance;**
  2×10^5 operations at 60°C
- **High dielectric strength: 10,000 V surge**
  Conforming to VDE0806 (Insulation gap: 8 mm)

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 switchig capacity	30 A 277 V AC	20 A 277 V AC	30 A 277 V AC	20 A 277 V AC
Max. Switching power	7,500 VA	5,000 VA	7,500 VA	5,000 VA
Max. switching voltage	277 V AC			
Max. switching current	30 A	20 A	30 A	20 A
UL/CSA rating	30 A 277 V AC 30 A 30 V DC 1 HP 125 V AC 2 HP 250 V AC TV-15	20 A 277 V AC 20 A 30 V DC 1 HP 125 V AC 2 HP 250 V AC TV-10	Under application	
Expected life (min. operations) Mechanical (at 180 cpm) Electrical (at 20 cpm)	 10^7 2×10^5			

Coil (at 20°C 68°F)

	DC coil type	AC coil type
Nominal operating power	1.92 W	See Coil data(Page 263)

Characteristics

		DC coil type	AC coil type
Max. operating speed		20 cpm	
Operate time (at nominal voltage)		Approx. 20 msec.	
Release time (at nominal voltage)		Approx. 5 msec.	
Initial breakdown voltage Between open contacts Between contacts and coil Between contact sets (2a)		 2,000 Vrms for 1 min. 5,000 Vrms for 1 min. 4,000 Vrms for 1 min.	
Surge voltage between contacts and coil		Min. 10,000 V	
Initial insulation resistance		Min. 1,000 MΩ at 500 V DC	
Temperature rise, max. (resistive load)		60 deg.	65 deg.
Ambient temperature		–50°C to +55°C –58°F to +131°F (No freezing, no condensing)	
Shock resistance, min.	Functional	10 G	
	Destructive	100 G	
Vibration resistance	Functional	6 G, 10 to 55 Hz at double amplitude of 1 mm	
	Destructive	9 G, 10 to 55 Hz at double amplitude of 1.5 mm	
Unit weight		Approx. 90 g 3.17 oz	

TYPICAL APPLICATIONS

1. Home appliances
   - Air conditioners
   - Microwave ovens
   - TV sets
   - Heaters
   - Stereo
2. Office equipment
   - Copiers
   - Vending machines

ORDERING INFORMATIONS

HE [1a] [N] — [S] — [DC12] V

Contact arrangement	Pick-up voltage	Terminals	Coil voltage
1a: 1 Form A 2a: 2 Form A	Nil: 80% of nominal voltage N: 70% of nominal voltage	Nil: Plug-in terminal type S: Screw terminal type Q: NEMA terminal type	DC: 6, 12, 24, 48, 110 V AC: 6, 12, 24, 48, 120, 240 V

Standard packing; Carton: 20 pcs. Case: 100 pcs.

COIL DATA at 20°C 68°F

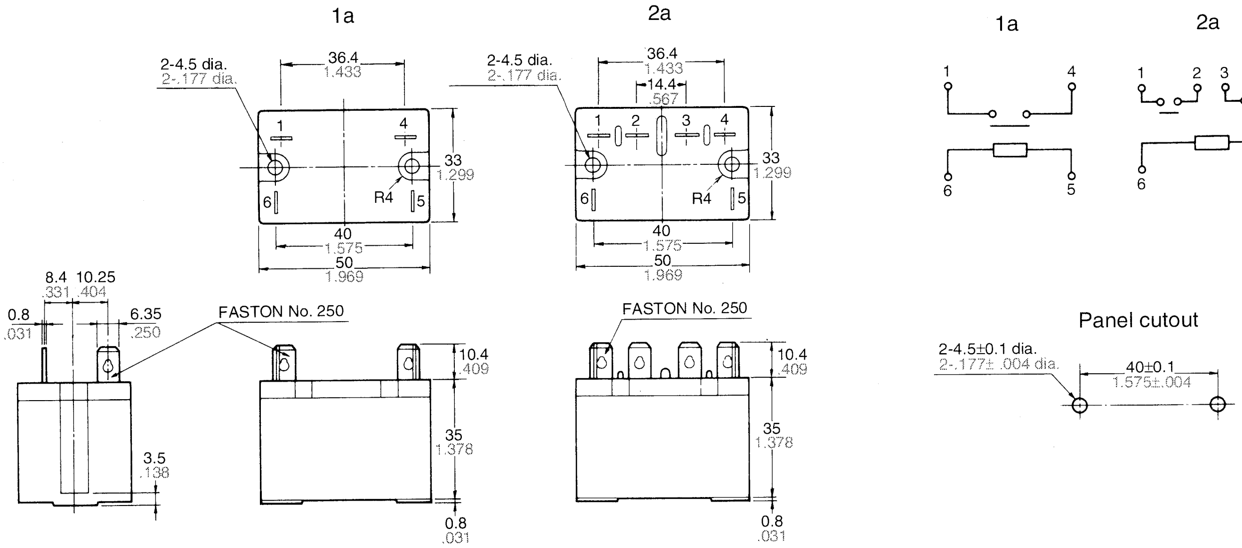
	Nominal voltage	Pick-up voltage	Drop-out voltage	Nominal coil current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power	Max. allowable voltage (at 50°C 122°F)
DC coil type	6 V DC	• 70% pick-up voltage type: Less than 70% of nominal voltage • 80% pick-up voltage: less than 80% of nominal voltage	More than 10% of nominal voltage	320.9	18.8	1.92 W	110% of nominal voltage
	12 V DC			160	75	1.92 W	
	24 V DC			80	300	1.92 W	
	48 V DC			40	1200	1.92 W	
	110 V DC			17.5	6300	1.92 W	
AC coil type	6 V AC	• 70% pick-up voltage type: Less than 70% of nominal voltage • 80% pick-up voltage: less than 80% of nominal voltage	More than 15% of nominal voltage	275*	18.8	1.65 VA	110% of nominal voltage
	12 V AC			138*	75	1.66 VA	
	24 V AC			74*	300	1.78 VA	
	48 V AC			39*	1200	1.87 VA	
	120 V AC			22.1*	5200	2.65 VA	
	240 V AC			10.8*	20800	2.59 VA	

*Value at 60 Hz

DIMENSIONS

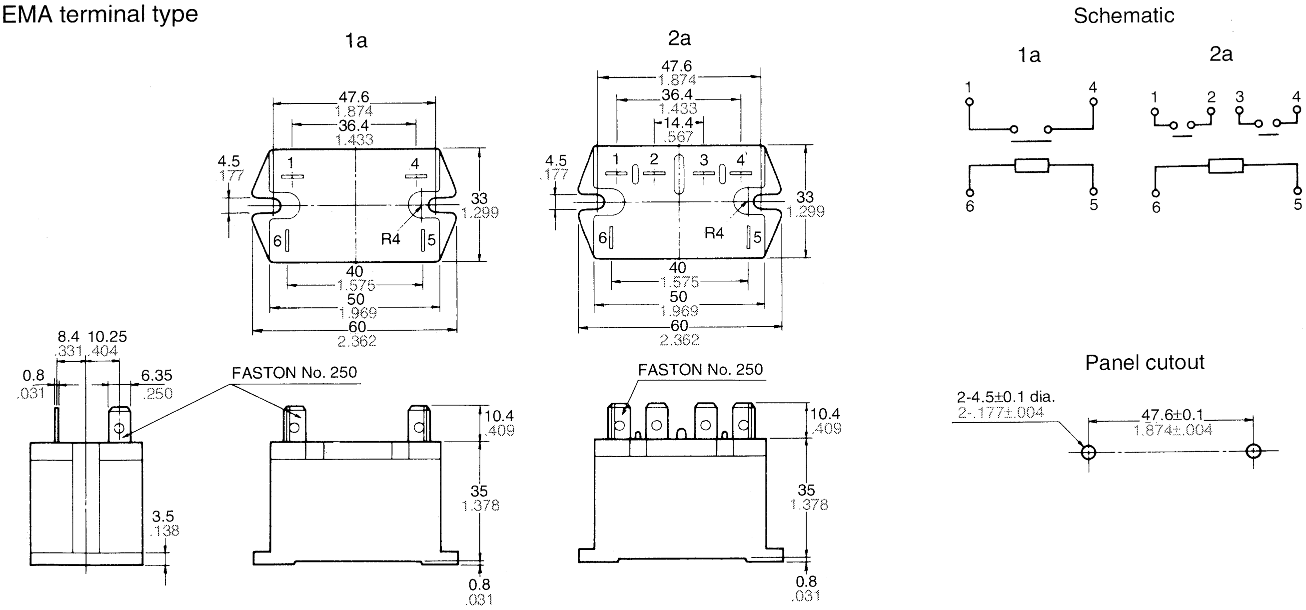
mm inch

1. Plug-in terminal type



General tolerance: ±0.3 ±.012

2. NEMA terminal type

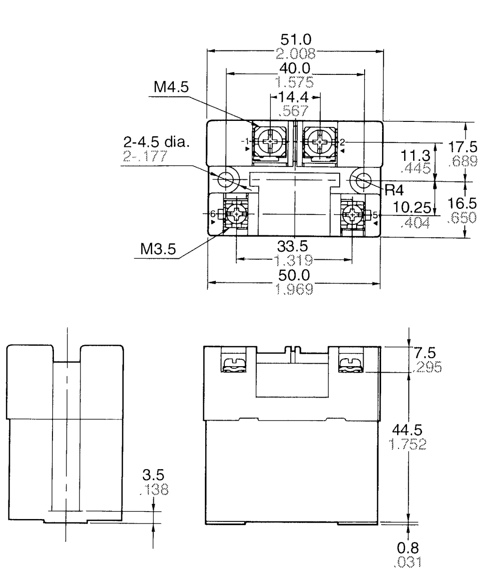


General tolerance: ±0.3 ±.012

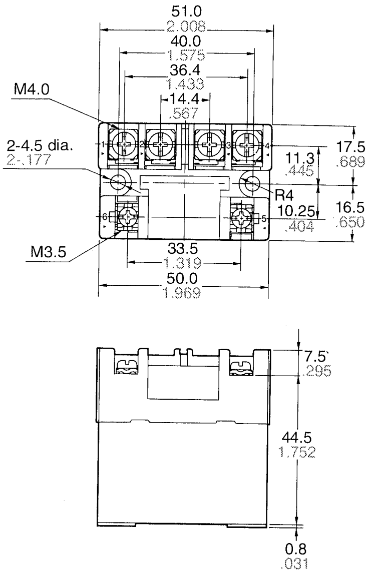
3. Screw terminal type

mm inch

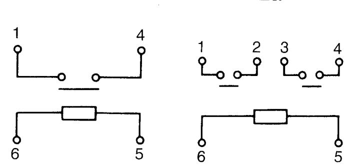
1a



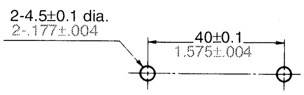
2a



Schematic



Panel cutout

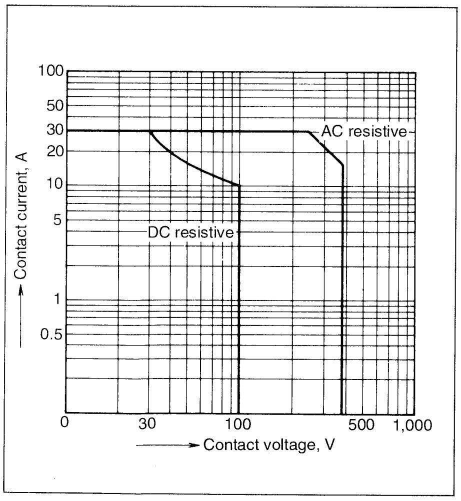


General tolerance: ±0.3 ±.012

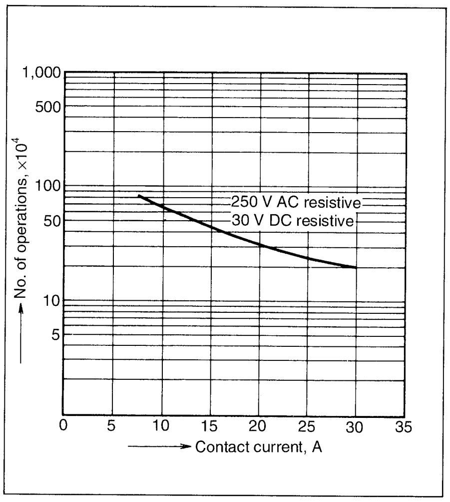
DATA

1 Form A

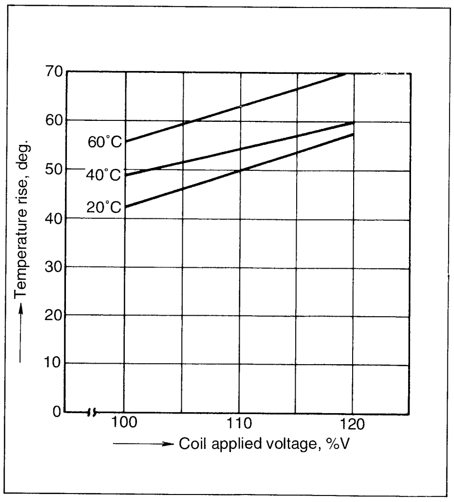
1. Maximum switching power



2. Life curve

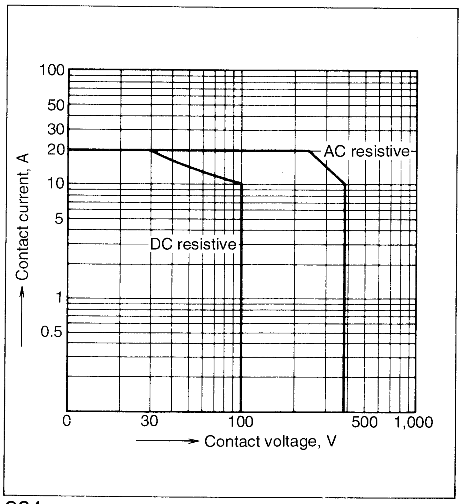


3. Contact temperature rise (DC type)
Measured portion: Inside the coil
Contact current: 30 A

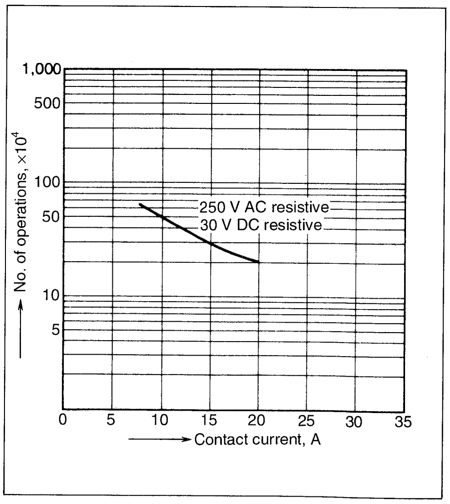


2 Form A

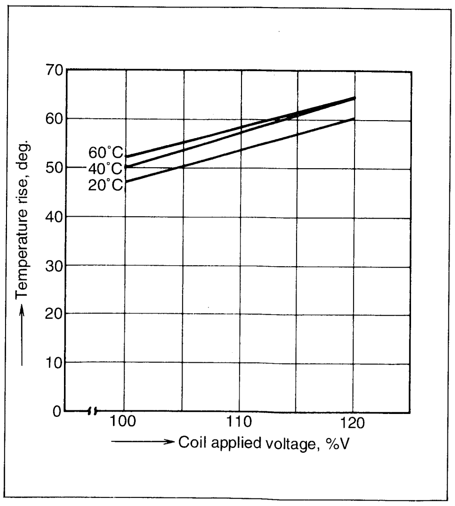
1. Maximum switching power



2. Life curve

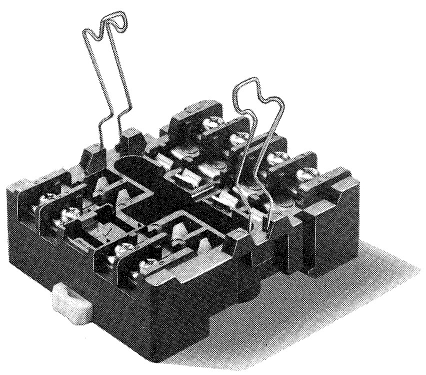


3. Contact temperature rise (DC type)
Measured portion: Inside the coil
Contact current: 30 A



HE RELAY ACCESSORIESS (Common to that of JH Relays)

Terminal socket instantly attachable to DIN rail



TYPES

Part No.	Applicable relays
JH1-SF	HE1a
JH2-SF	HE2a

SPECIFICATIONS

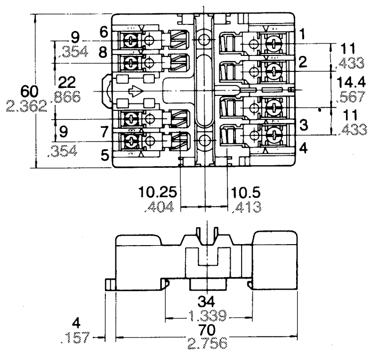
Part No.	JH1, JH2
Maximum continuous current*	20 A 250 V AC (1a: 30 A 250 V AC)
Breakdown voltage	2,000 Vrms between terminals
Insulation resistance	More than 1,000 MΩ between poles
Heat resistance	150°C±3°C for 1 hour

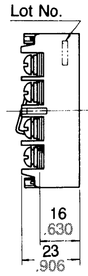
*Don't insert or remove relays while in the energized condition.

DIMENSIONS

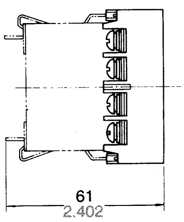
mm inch

1 Form A, 2 Form A

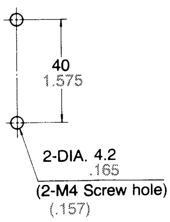




Relay mounting diagram



Panel cutout



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-(1). When mounting, use spring washers. Optimum fastening torque ranges from 5 kg to 7 kg·cm 4.5 to 6 pounds·inch.

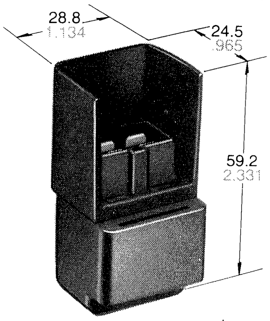
3-(2). Attach the receptacle firmly. When pulling out, the recommended strength is 2 to 4 kg. In this case, be sure to pull out receptacles one by one.

4. Pure DC current should be applied to the coil. If it includes ripple, the ripple factor should be less than 5%.
5. Dropping the relay may deform the internal construction and affect performance. If the relay is dropped, check its appearance and characteristics before use.

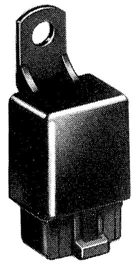
NAiS

AUTOMOTIVE POWER RELAYS — SMALL SIZE, LIGHT WEIGHT AND COMPLETELY WATER TIGHT

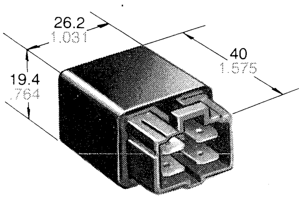
CA-RELAYS



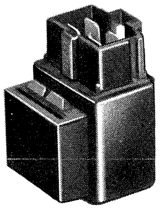
Rubber bracket B type



Screw-mounting type



Direct coupling type



Rubber bracket A type

mm inch

FEATURES

1. Small size and light weight
For space saving, the outside dimensions of the main body are reduced to be 19.4 mm (length)×26.2 mm (width)×28 mm (height) (.764×1.031×1.102 inch). Moreover, the number of parts is also reduced and a resin casing is used, thus achieving a light weight design of 28 to 39 g (.99 to 1.88 oz).

2. Complete water tightness
Since the relays comply with the water tightness standards, JIS D 0203, water and dust will not enter the relay even if it is mounted in the engine area.

3. Stable operation even at low or high temperatures

4. Since the terminal arrangement complies with JIS D5011 B4-M1, commercial connectors are available for these types of relays.

SPECIFICATIONS

Contact

Arrangement	1 Form A (1 Form B and 1 Form C available as option)
Initial contact resistance, max. (by voltage drop 6 V DC 1 A)	50 mΩ
Contact material	Silver alloy
Initial contact pressure, min.	45 g
Rating (resistive or motor load) Maximum switching power Maximum switching voltage Maximum switching current Inrush current	 240 W 12 V DC 20 A 100 A (0.1 sec. or less)
Expected life (min. operation) Mechanical (120 cpm) Electrical	 5×10^5 10^5 Ref. 240 W H4 Halogen lamp (ON 1 sec., OFF 14 sec.) 20 A steady current DC motor (ON 2 sec., OFF 2 sec.)

Coil (at 20°C 68°F)

Minimum operating power	0.8 W (0.826 W for 5 V type)
Nominal operating power	1.8 W

Characteristics

Operate time	Max. 10 msec.
Release time	Max. 5 msec. (1 Form B, 1 Form C: Max. 10 m sec.)
Initial insulation resistance	10 MΩ at 500 V DC
Breakdown voltage Between contacts Between contacts and coil	 500 V rms 500 V rms
Ambient temperature	−40°C to +85°C −40°F to +185°F (Not frozen under 0°C)
Shock resistance Functional Destructive	 10 G 100 G
Vibration resistance Rubber bracket type Direct coupling type or Screw-mounting type	 10 G 50 to 500 Hz (2 hours X, Y, Z directions) 4 G 2000 Hz (8 hours X, Y, Z directions)
Unit weight Rubber bracket A type Rubber bracket B type Direct coupling type Screw-mounting type	 Approx. 32 g Approx. 39 g Approx. 28 g Approx. 28 g

TYPICAL APPLICATIONS

1. Motorcycles, mopeds
2. Compressor in automotive air conditioners
3. Halogen lamp
4. Power windows
5. Sun roof

ORDERING INFORMATION

CA [1a] — [DC12V] — [A]

Contact composition	Coil voltage	Mounting method
1a: 1 Form A	DC 5, 9, 12, 24V	A: Rubber bracket A type B: Rubber bracket B type N: Screw mounting type C: Direct coupling type

Notes: 1) 1c only for screw mounting type.
2) 1b or 1c: 1 Form B or 1 Form C available as option.

COIL DATA at 20°C 68°F

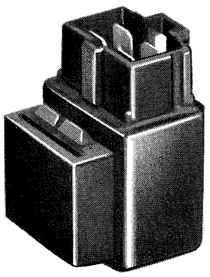
Nominal voltage V DC	Pick-up voltage V DC (max.)	Drop-out voltage V DC (min.)	Nominal current mA	Coil resistance Ω (±10%)	Nominal operating power, W	Maximum allowable voltage, V DC (at 85°C)
5	3.4	0.5	360	14	1.8	6.2
9	6	0.9	200	45	1.8	11.2
12	8	1.2	150	80	1.8	16
24	16	2.4	75	320	1.8	30

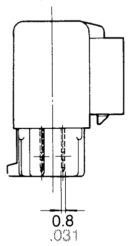
1 From B and 1 From C available as option; Drop-out voltage min. 5% of nominal voltage.

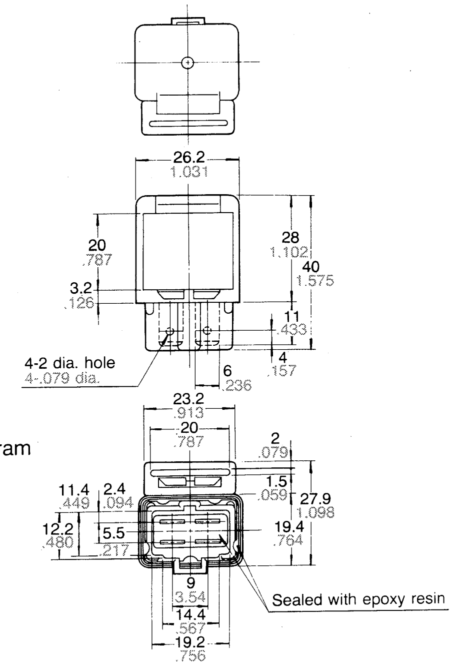
DIMENSIONS

mm inch

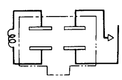
1. Rubber bracket A type



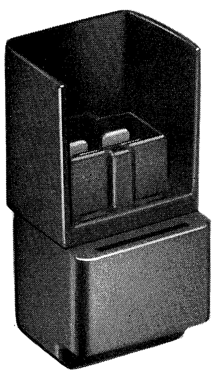


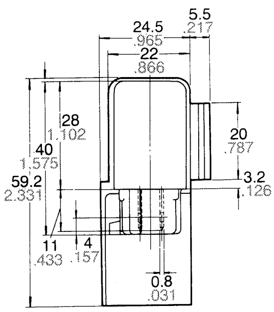


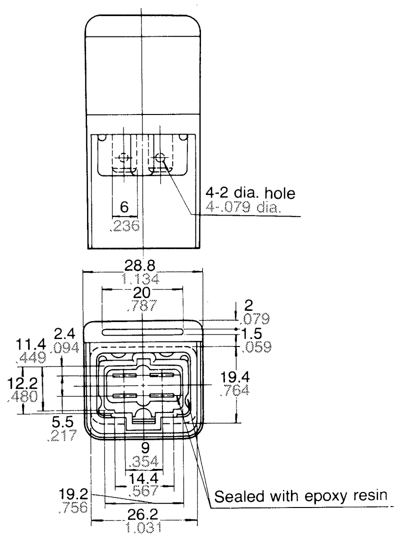
Internal wiring diagram
(Bottom view)



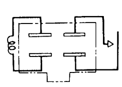
2. Rubber bracket B type





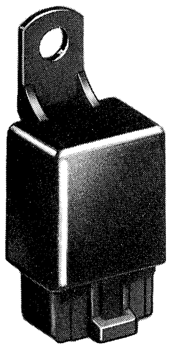


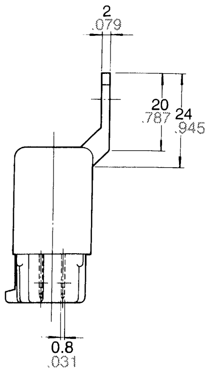
Internal wiring diagram
(Bottom view)

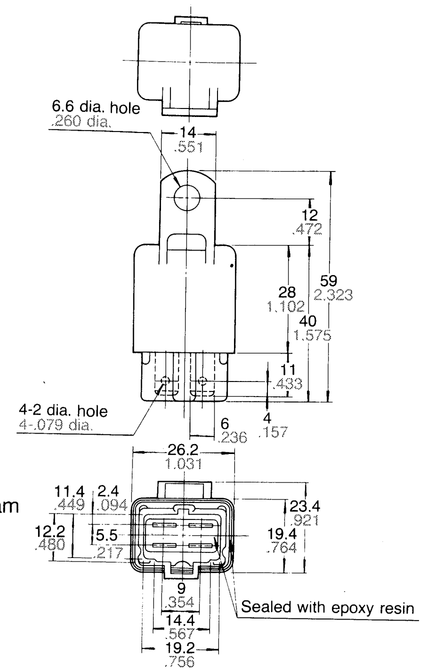


3. Screw mounting type

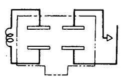
mm inch



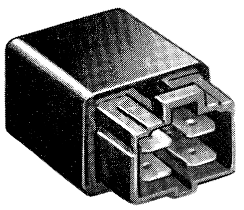


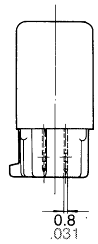


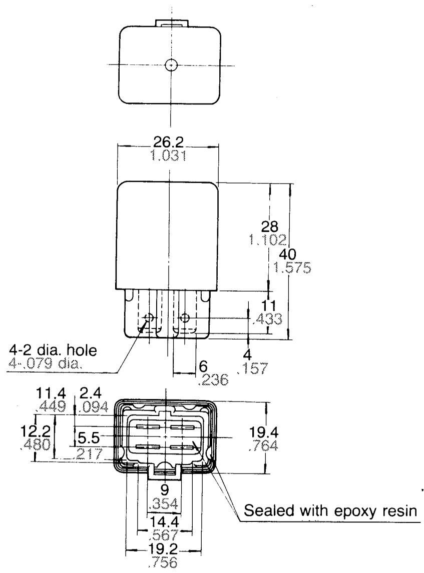
Internal wiring diagram
(Bottom view)



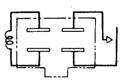
4. Direct coupling type







Internal wiring diagram
(Bottom view)



General tolerance: ±0.3 ±.012

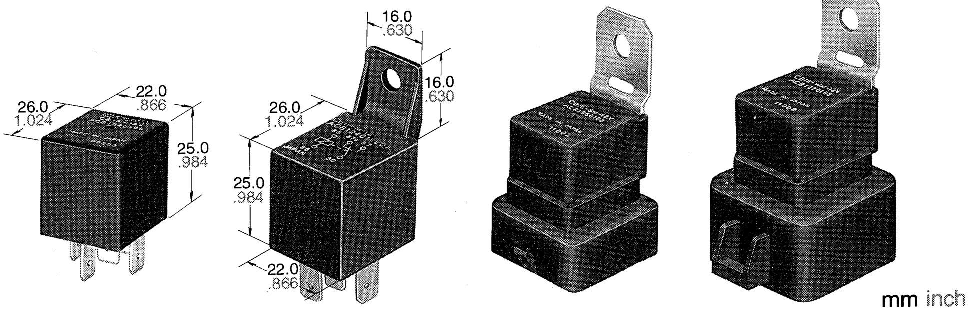
NOTES

1. Insure that the relay is properly fixed.
2. Cables connected to these relays shall have sufficient current capacities.

NAiS

HIGH POWER AUTOMOTIVE RELAY

CB-RELAYS



- 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.
- Quick connect and pc board type
- Various enclosure options

SPECIFICATIONS

Contacts

Arrangement	1 Form A, 1 Form C
Initial voltage drop	N.C.: Max. 0.25 V (at 10 A 12 V DC) N.O.: Max. 0.2 V (at 10 A 12 V DC)
Contact material	Ag alloy
Rating (resistive load) Nominal switching capacity Max. switching power Max. switching voltage*1 Max. switching current	 N.C.: 30 A 14 V DC N.O.: 40 A 14 V DC 50–500 W (voltage dependent) 75 V DC See Contact Rating table
Expected life (min. ope.) Mechanical (at 120 cps) Electrical (at rated load, operating frequency 2 sec. ON, 2 sec. OFF)	 10^6 10^5 40 A 14 V DC resistive (N.O. side)

*1Switching current: 0.7 A

Coil

Nominal operating power	1.4 W

Contact Rating

Load	Form A	Form C	
		N.O.	N.C.
Max. carry current	40 A	40 A	30 A
Max. make current	80 A	80 A	45 A
Max. break current	40 A	40 A	30 A

Characteristics

Max. operating speed (at rated load)		20 cpm
Operate time (at nominal voltage)		See Data
Release time (at nominal voltage)		See Data
Initial breakdown voltage Between open contacts Between contacts and coil		 AC 500 V for 1 min. AC 500 V for 1 min.
Initial insulation resistance		Min. 20 MΩ at 500 V DC
Temperature rise, max. (at nominal voltage)		75 deg. at 20°C
Ambient temperature*2		–40°C to +85°C –40°F to +185°F
Storage temperature		–40°C to +125°C –40°F to +257°F
Shock resistance	Functional	Min. 20 G
	Destructive	Min. 100 G
Vibration resistance	Functional	4.4 G, 10 to 500 Hz/0.5 hr in X, Y, Z directions for 4 hrs.
	Destructive	4.4 G, 10 to 2,000 Hz/0.5 hr in X, Y, Z directions for 4 hrs.
Drop test		Capable of meeting specification after 6.6 feet (2 meters) drop onto concrete
Unit weight		33 g .86 oz

*2–40°C +125°C –40°F to +257°F type also available as option. Please consult us for details.

ORDERING INFORMATION

CB [1] [F] — [R] — [P] — [12 V]

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: Quick connect type P: PC board type M: Bracket type SM: Shrounded type with bracket WM: Weatherproof type with bracket	12, 24 V

COIL DATA

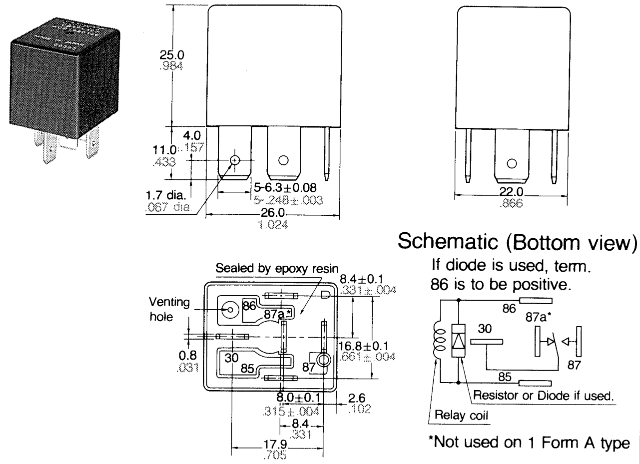
Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, W	Maximum allowable voltage, V DC (at 85°C)
12	7	1.2	117	103	1.4	16
24	14	2.4	75	320	1.8	32

Note: Bulk pakage: 50 pcs.; Case: 200 pcs.

DIMENSIONS

mm inch

Quick connect type



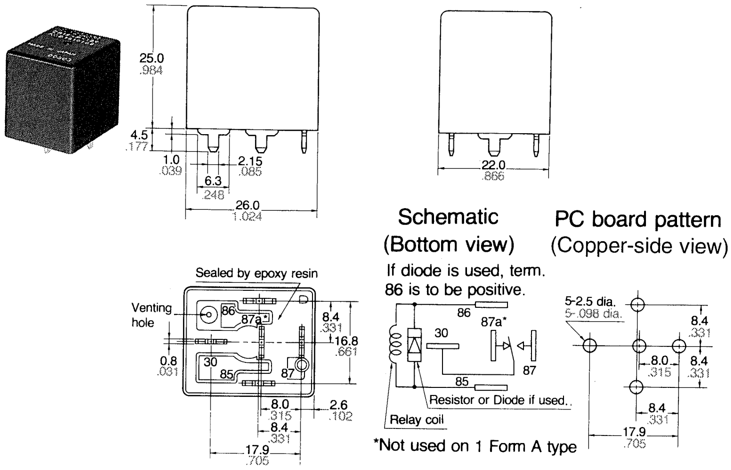
Schematic (Bottom view)

If diode is used, term. 86 is to be positive.

*Not used on 1 Form A type

General tolerance: ±0.3 ±.012

PC board type



Schematic (Bottom view)

PC board pattern (Copper-side view)

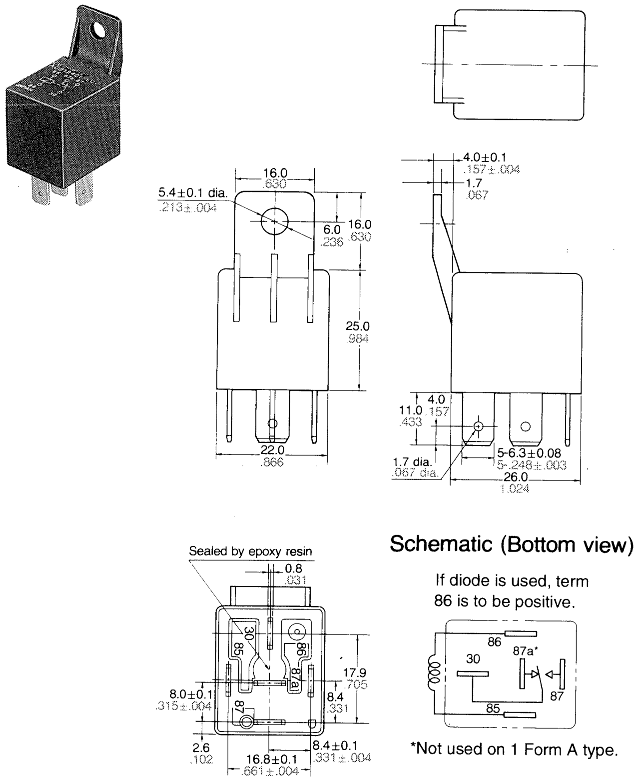
If diode is used, term. 86 is to be positive.

*Not used on 1 Form A type

General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.004

Bracket type



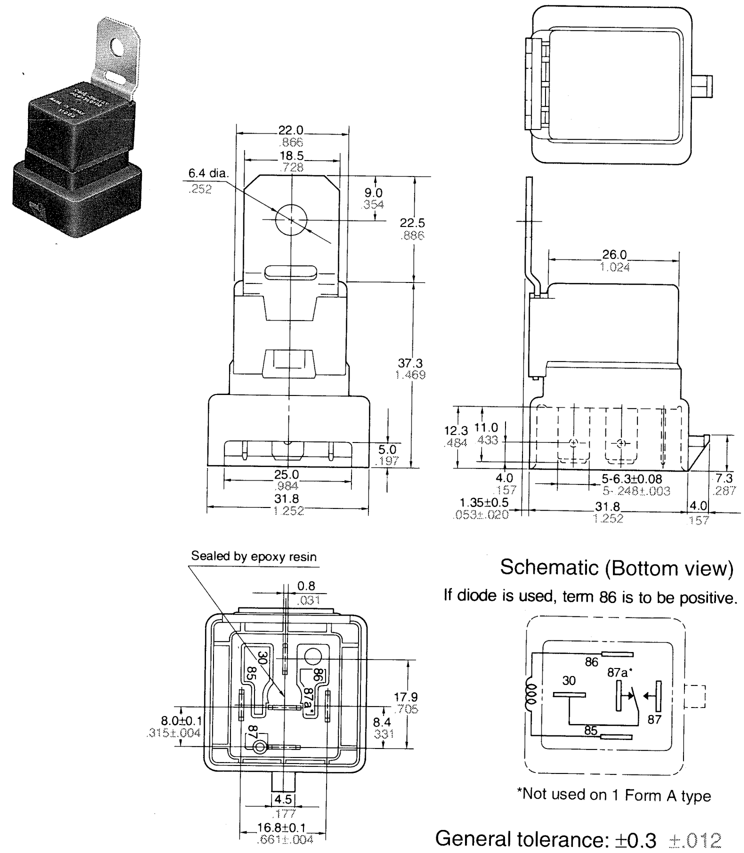
Schematic (Bottom view)

If diode is used, term 86 is to be positive.

*Not used on 1 Form A type.

General tolerance: ±0.3 ±.012

Shrouded type with bracket



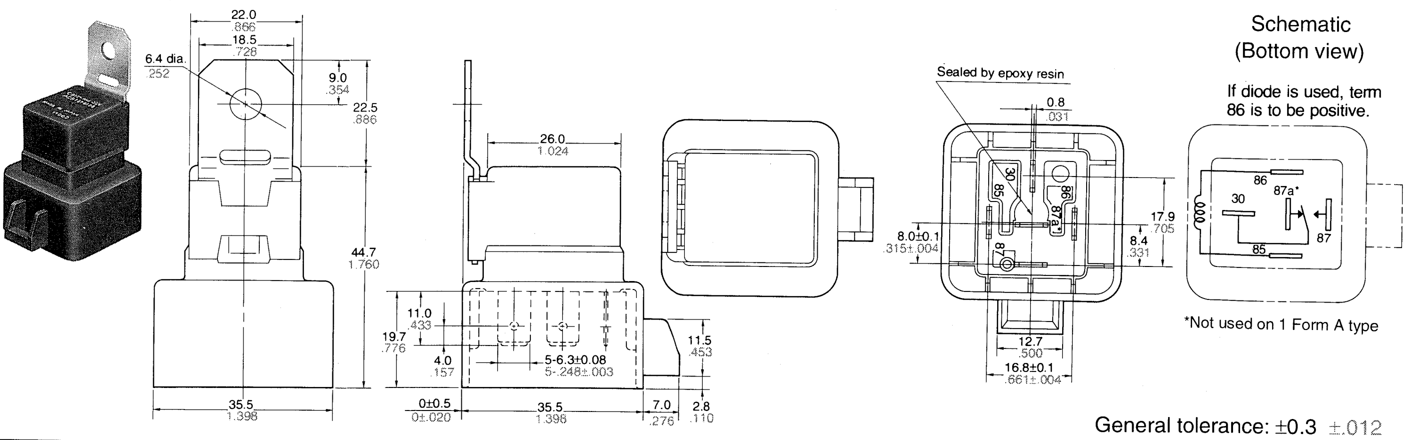
Schematic (Bottom view)

If diode is used, term 86 is to be positive.

*Not used on 1 Form A type

General tolerance: ±0.3 ±.012

Weatherproof type with bracket



Schematic (Bottom view)

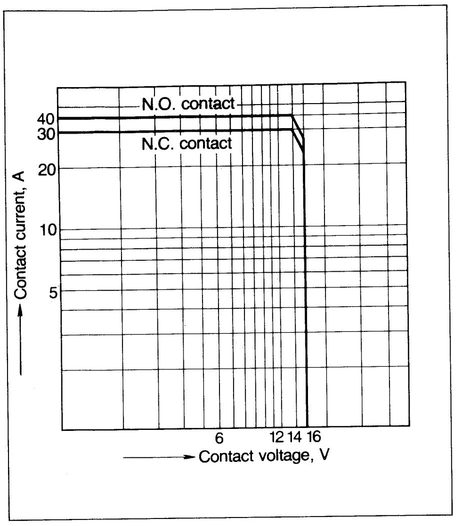
If diode is used, term 86 is to be positive.

*Not used on 1 Form A type

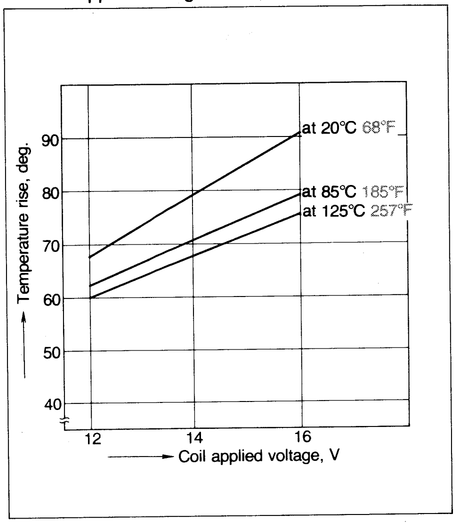
General tolerance: ±0.3 ±.012

DATA

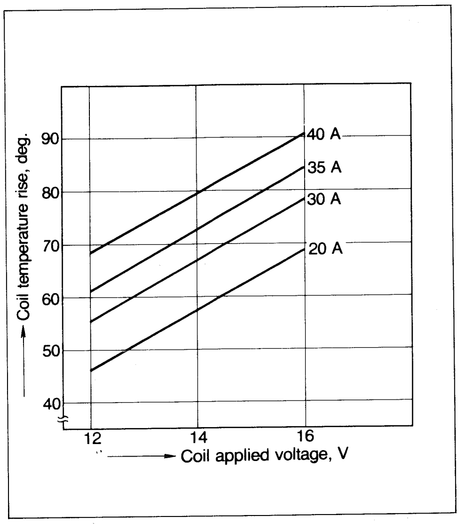
1. Maximum value for switching capacity
Tested sample: CB1F-12V
No. of operations: 10^5



2-(1). Coil temperature rise (resistive)
Tested sample: CB1F-12V, 6 pcs.
Ambient temperature: 20°C, 85°C, 125°C
68°F, 185°F, 257°F
Contact carrying current: 40 A
Coil applied voltage: 12 V, 14 V, 16 V DC

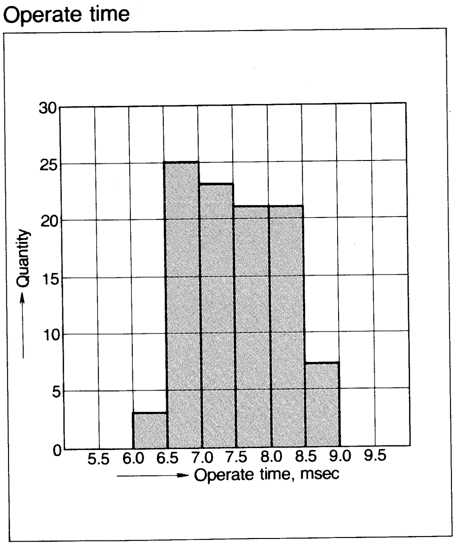


2-(2). Coil temperature rise (resistive)
Tested sample: CB1F-12V, 6 pcs.
Ambient temperature: 20°C 68°F
Contact carrying current: 20 A, 30 A, 35 A, 40 A
Coil applied voltage: 12 V, 14 V, 16 V DC

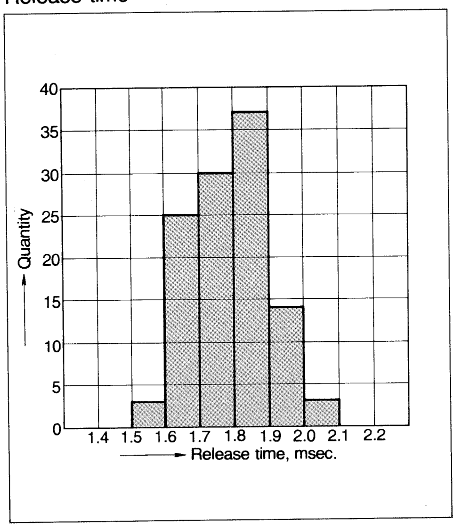


3. Distribution of operate/release time (at nominal voltage)
Tested sample: CB1F-12V, 100 pcs.
Ambient temperature: 22°C 72°F

Operate time

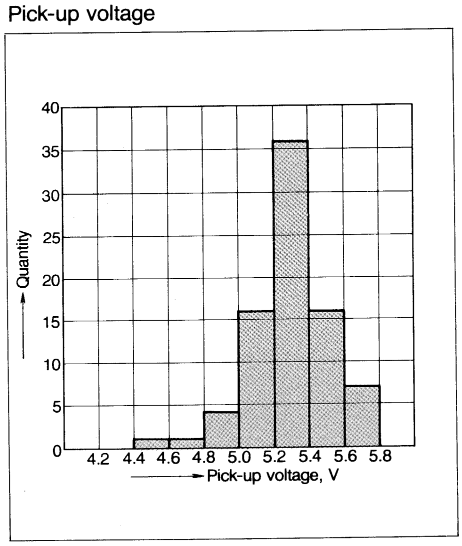


Release time



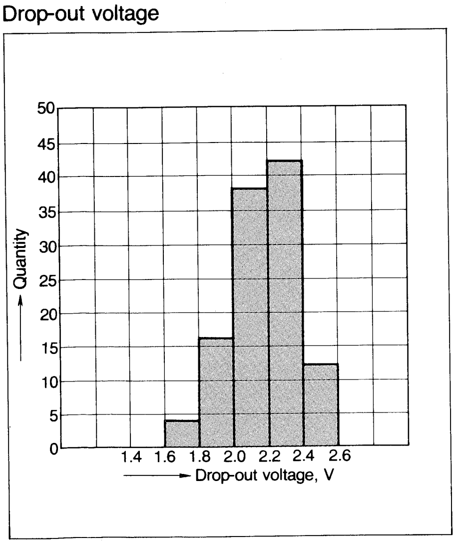
4. Distribution of pick-up/drop-out voltage
Tested sample: CB1F-12V, 100 pcs.

Pick-up voltage



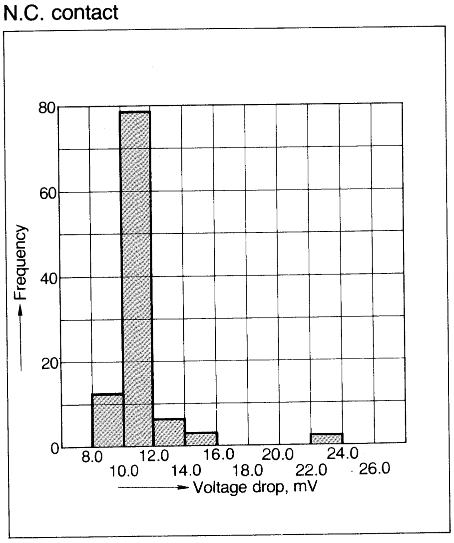
Distribution of pick-up/drop-out voltage
Tested sample: CB1F-12V, 100 pcs.

Drop-out voltage

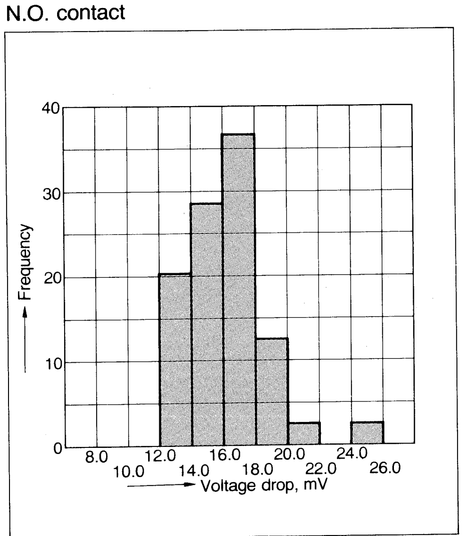


5. Distribution of voltage drop
Tested sample: CB1F-12V, 100 pcs.
Tested method: at 10 A voltage drop

N.C. contact



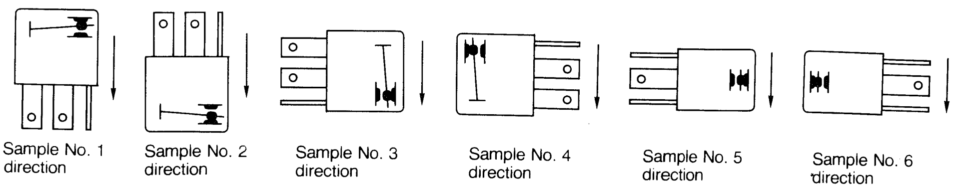
N.O. contact



6. Free-fall test

Test conditions:

Drop height: 2 meters to concrete surface
Drop direction: 6 directions, each 1 drop
Sample: CB1F-12V
Quantity: 6 pcs.



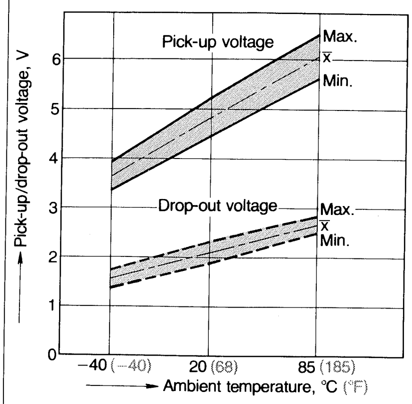
Test result: No abnormality was observed.

Sample No.	No. of operations	Pick-up voltage, V	Drop-out voltage, V	Contact resistance, mΩ		Insulation resistance	Breakdown voltage
				N.C.	N.O.		
1	Initial (at 28°C)	5.2	1.8	1.9	1.5	good	good
2		5.2	1.9	1.5	1.7	good	good
3		4.9	1.8	1.6	1.9	good	good
4		5.1	1.8	1.7	2.6	good	good
5		5.2	1.8	1.9	1.7	good	good
6		5.3	2.1	2.0	1.5	good	good
1	After (at 28°C)	4.7	1.6	1.7	1.4	good	good
2		4.9	1.8	2.2	1.7	good	good
3		4.4	1.5	2.5	1.6	good	good
4		4.7	1.6	2.2	2.3	good	good
5		4.8	1.6	2.5	1.6	good	good
6		4.7	1.7	1.7	1.6	good	good

Contact resistance: contact voltage drop (10 A)
Insulation resistance: 20 MΩ at 500 V DC
Breakdown voltage: Between open contacts: 500 Vrms
Between contacts and coil: 500 Vrms.

7. Ambient temperature characteristics

Tested sample: CB1F-12V, 6 pcs.



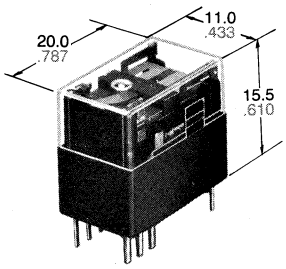
NOTES

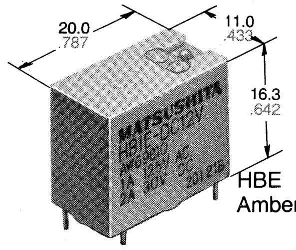
1. Avoid using in the location where there is organic gas such as SO_2 gas and H_2S gas. Note that switching contact in the silicon atmosphere may result in contact failure.
2. The switching voltage and current to the contact should not exceed the rated value.
3. The rated contact capacity and life are typical values. Since contact conditions and life vary depending on kinds of loads and other conditions, please examine them through actual conditions.
4. Relays should be used within the rated ambient temperature.

NAiS

COST SAVING SUBMINIATURE DIP RELAY

HB-RELAYS





HBE
Amber Relays

mm inch

UL File No.: E43028
CSA File No.: LR26550

- **Small size for increased packaging density**
- **Sensitive—Very low operating power**
- **Simple mechanism for stable quality—only 7 pieceparts**
- **DIP—matching 16 pin IC socket**
- **Contact capacity—1 A 125 V AC, 2 A 30 V DC**
- **Amber sealed versions available**

SPECIFICATIONS

HB Standard type

Contacts

Arrangement	1 Form C, 2 Form C
Contact material	Silver-nickel
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	100 mΩ
Rating (resistive load) Max. switching power Max. switching voltage Max. switching current	 125 VA, 60 W 125 V AC, 30 V DC 2 A
UL/CSA rating	1 A, 1/20 HP 125 V AC, 2 A 30 V DC
Expected life (min. operations) Mechanical Electrical (resistive) 1 A 125 V AC, 2 A 30 V DC	 10^7 2×10^5

Coil

Minimum operating power	(1C) 230 mW, (2C) 370 mW
Nominal operating power	(1C) 360 mW, (2C) 576 mW

Characteristics

Maximum operating cycles	20 cpm
Operate time	Approx. 5 m sec.
Release time	Approx. 5 msec.
Initial insulation resistance	more than 100 MΩ at 500 V DC
Breakdown voltage Between open contacts Between contact sets Between contacts and coil	 500 Vrms 500 Vrms 1,000 Vrms
Temperature rise (at nominal voltage)	Max. (1C) 45 deg., (2C) 55 deg.
Ambient temperature	−40°C to +50°C −40°F to +122°F
Shock resistance	10 G
Vibration resistance	6 G, 10 to 55 Hz at double amplitude of 1 mm
Unit weight	8 g .28 oz

HBE Amber sealed type

Contacts

Arrangement	1 Form C, 2 Form C
Contact material	Gold-clad over Silver-nickel
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	100 mΩ
Rating (resistive load) Max. switching power Max. switching voltage Max. switching current	 62.5 VA, 60 W 125 V AC, 30 V DC 0.5 A AC, 2 A DC
UL/CSA rating	1 A, 1/20 HP 125 V AC, 2 A 30 V DC
Expected life (min. operations) Mechanical Electrical (resistive) 0.5 A 125 V AC, 2 A 30 V DC	 10^7 2×10^5

Coil

Minimum operating power	(1C) 230 mW, (2C) 370 mW
Nominal operating power	(1C) 360 mW, (2C) 576 mW

Characteristics

Maximum operating cycles	20 cpm
Operate time	Approx. 5 m sec.
Release time	Approx. 5 m sec.
Initial insulation resistance	more than 100 MΩ at 500 V DC
Breakdown voltage Between open contacts Between contact sets Between contacts and coil	 500 Vrms 500 Vrms 1,000 Vrms
Temperature rise (at nominal voltage)	Max. (1C) 50 deg., (2C) 60 deg.
Ambient temperature	−40°C to +50°C −40°F to +122°F
Shock resistance	10 G
Vibration resistance	6 G, 10 to 55 Hz at double amplitude of 1 mm
Unit weight	8 g .28 oz

TYPICAL APPLICATIONS

Office machines, electrical home appliances, telecommunications equipment, personal computers

ORDERING INFORMATION

Ex. HB | 2 | E | — | DC5V

Contact arrangement	Type classification	Coil voltage
1: 1 Form C 2: 2 Form C	Nil: Dust cover type E: Amber sealed type	DC 3, 5, 6, 9, 12, 24, 48 V

(Notes) 1. For UL/CSA recognized types, add suffix UL/CSA.
2. Standard packing Carton: 100 pcs., Case: 500 pcs. or 2,000 pcs.

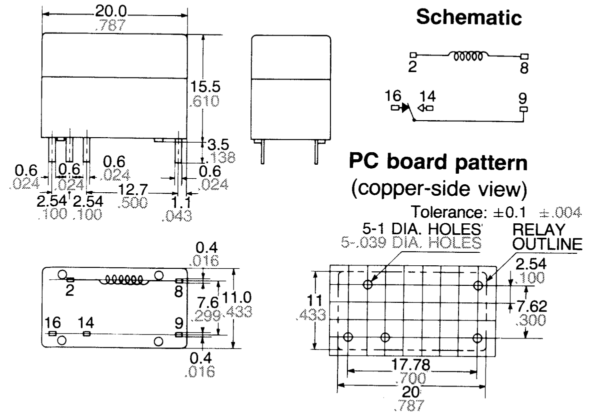
TYPES AND COIL DATA at 20°C 68°F

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%)	Maximum allowable voltage, V DC
HB1-DC3V HB1E-DC3V	3	2.4	0.3	120	360	25	3.6
HB1-DC5V HB1E-DC5V	5	4.0	0.5	72	360	69	6.0
HB1-DC6V HB1E-DC6V	6	4.8	0.6	60	360	100	7.2
HB1-DC9V HB1E-DC9V	9	7.2	0.9	40	360	225	10.8
HB1-DC12V HB1E-DC12V	12	9.6	1.2	30	360	400	14.4
HB1-DC24V HB1E-DC24V	24	19.2	2.4	15	360	1,600	28.8
HB1-DC48V HB1E-DC48V	48	38.4	4.8	8	384	6,000	57.6
HB2-DC3V HB2E-DC3V	3	2.4	0.3	192	576	15.6	3.6
HB2-DC5V HB2E-DC5V	5	4.0	0.5	115	576	43.4	6.0
HB2-DC6V HB2E-DC6V	6	4.8	0.6	96	576	62.5	7.2
HB2-DC9V HB2E-DC9V	9	7.2	0.9	69	623	130	10.8
HB2-DC12V HB2E-DC12V	12	9.6	1.2	48	576	250	14.4
HB2-DC24V HB2E-DC24V	24	19.2	2.4	24	576	1,000	28.8
HB2-DC48V HB2E-DC48V	48	38.4	4.8	12	576	4,000	57.6

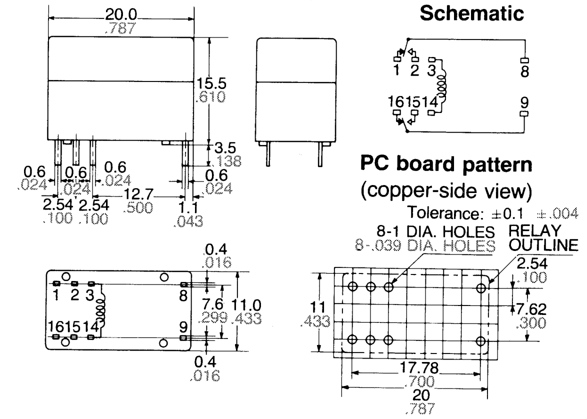
DIMENSIONS

mm inch

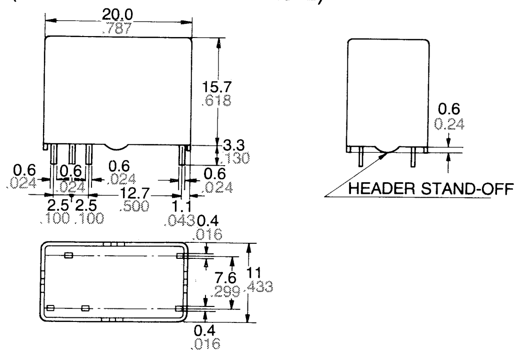
HB1 (General tolerance: ±0.5 ±.020)



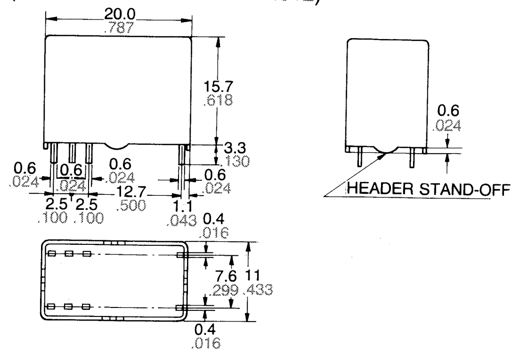
HB2 (General tolerance: ±0.5 ±.020)



HB1E (General tolerance: ±0.3 ±.012)

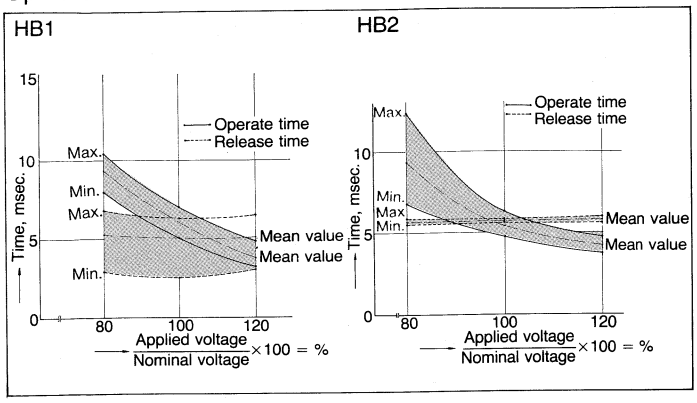


HB2E (General tolerance: ±0.3 ±.012)

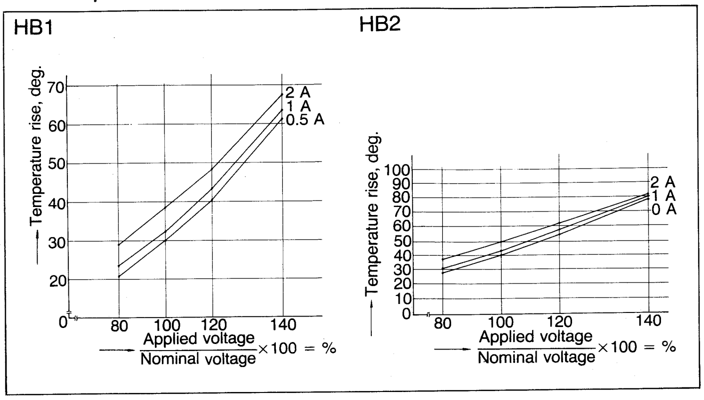


DATA

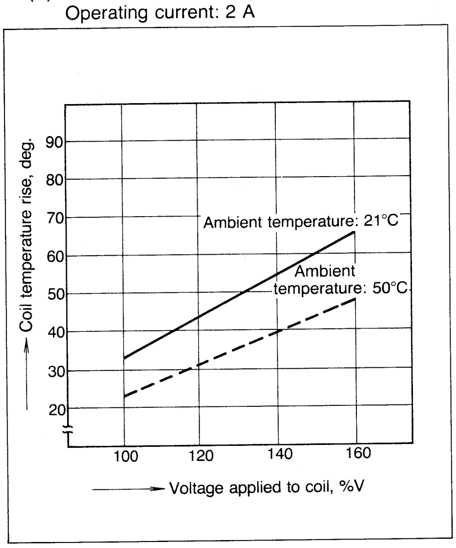
Operate and release time



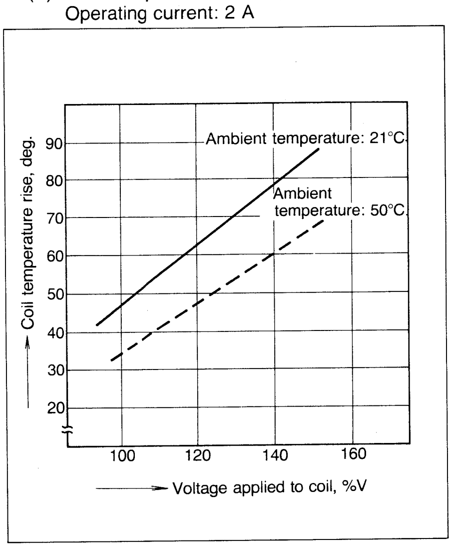
Coil temperature rise



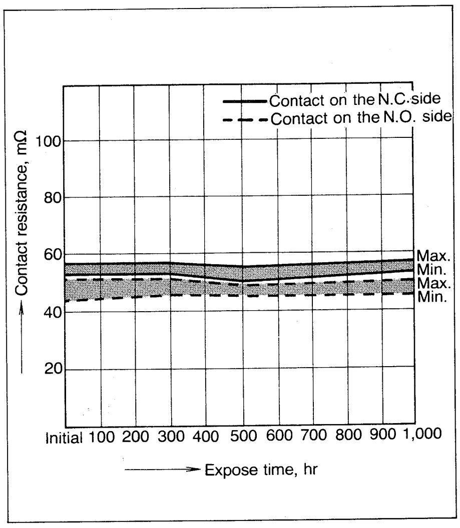
1.-(1) Coil temperature rise (HB1E)
Operating current: 2 A



1.-(2) Coil temperature rise (HB2E)
Operating current: 2 A



2. Exposure to H_2S gas



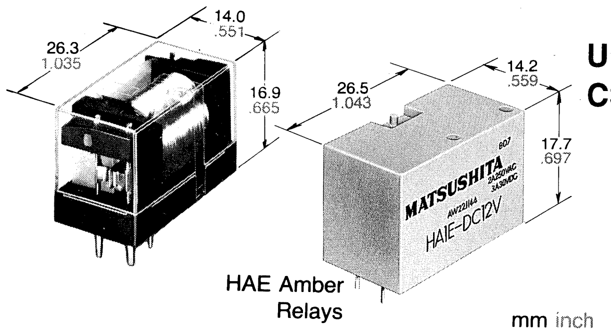
3. Minute-load test for HB amber relay

1. Load: 10 V DC 1 mA resistive load
2. Detection level: 50 Ω
3. Sample: HB2E-12VDC
4. Sample quantity: 5 pcs. (Contact quantity 20)
5. Result: After switching is repeated 10 million times.
   No improper contact is observed.
   Trouble rate at 60% reliability level (at 10 millionth time)
   $\lambda_{60} = 0.18 \times 10^{6}$ (pcs./time)

NAiS

COST SAVING SUBMINIATURE PC BOARD RELAYS

HA-RELAYS



UL File No.: E43028
CSA File No.: LR26550

- **Compact construction**
- **Sensitive—very low operating power**
- **Soldering flux inflow prevented by molded construction**
- **Contact capacity—3 A 250 V AC, 30 V DC**
- **Simple mechanism for stable quality—only 9 pieceparts**
- **Amber sealed types available**

SPECIFICATIONS

HA1 Standard type

Contacts

Arrangement	1 Form C
Contact material	Silver-nickel
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	50 mΩ
Rating (resistive load) Max. switching power Max. switching voltage Max. switching current	 750 VA, 90 W 250 V AC, 30 V DC 3 A
UL/CSA rating	3 A 250 V AC, 3 A 30 V DC, 1/10 HP 250 V AC
Expected life (min. operations) Mechanical Electrical (resistive) 3 A 250 V AC 3 A 30 V DC	 10^7 10^5 2×10^5

Coil

Minimum operating power	(AC) 0.58 VA, (DC) 230 mW
Nominal operating power	(AC) 0.9 VA, (DC) 360 mW

Characteristics

Maximum operating cycles	20 cpm
Operate time	Approx. 10 m sec.
Release time	Approx. 10 m sec.
Initial insulation resistance	more than 100 MΩ at 500 V DC
Breakdown voltage Between open contacts Between contacts and coil	 750 Vrms for 1 min. 1,500 Vrms for 1 min.
Temperature rise (at nominal voltage)	Max. (AC) 60 deg. (DC) 40 deg.
Ambient temperature	−40°C to +50°C −40°F to +122°F
Shock resistance	10 G
Vibration resistance	6 G, 10 to 55 Hz at double amplitude of 1 mm
Unit weight	Approx. 12 g .42 oz

HA1E Amber sealed type

Contacts

Arrangement	1 Form C
Contact material	Gold-clad over Silver-nickel
Initial contact resistance, max.	50 mΩ
Rating (resistive load) Max. switching power Max. switching voltage Max. switching current	 500 VA, 90 W 250 V AC, 30 V DC 2 A AC, 3 A DC
UL/CSA rating	2 A 250 V AC, 3 A 30 V DC, 1/10 HP 250 V AC
Expected life (min. operations) Mechanical Electrical (resistive) 2 A 250 V AC 3 A 30 V DC	 10^7 10^5 2×10^5

Coil

Minimum operating power	(AC) 0.58 VA, (DC) 230 mW
Nominal operating power	(AC) 0.9 VA, (DC) 360 mW

Characteristics

Maximum operating cycles	20 cpm
Operate time	Approx. 10 m sec.
Release time	Approx. 10 m sec.
Initial insulation resistance	more than 100 MΩ at 500 V DC
Breakdown voltage Between open contacts Between contacts and coil	 750 Vrms for 1 min. 1,500 Vrms for 1 min.
Temperature rise (at nominal voltage)	Max. (AC) 60 deg. (DC) 40 deg.
Ambient temperature	−40°C to +50°C −40°F to +122°F
Shock resistance	10 G
Vibration resistance	6 G, 10 to 55 Hz at double amplitude of 1 mm
Unit weight	Approx. 12 g .42 oz

TYPICAL APPLICATIONS

Office machines, electrical home appliances, load management equipment.

ORDERING INFORMATION

Ex. HA 1 E — DC6V

Contact arrangement	Type classification	Coil voltage
1: 1 Form C	Nil: Dsut cover type E: Amber sealed type	DC 5, 6, 9, 12, 24, 48 V AC 6, 12, 24, 48, 115 V

(Notes) 1. For UL/CSA recognized types, add suffix UL/CSA.
2. Standard packing Carton: 100 pcs., Case: 500 pcs. or 2,000 pcs.

TYPES AND COIL DATA at 20°C 68°F

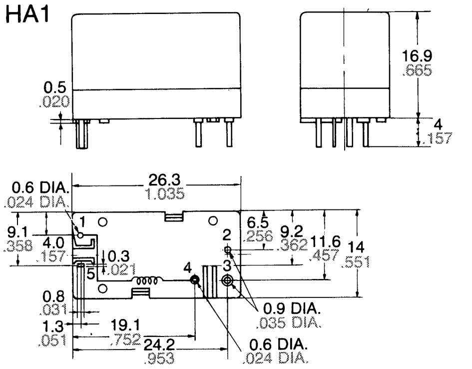
Part No.	Nominal voltage	Pick-up voltage, (max.)	Drop-out voltage, (min.)	* Nominal operating current, mA	Nominal operating power	Coil resistance, Ω (±10%)	Maximum allowable voltage
HA1-AC6V HA1E-AC6V	6 V AC	4.8 V AC	1.2 V AC	150	0.9 VA	—	6.6 V AC
HA1-AC12V HA1E-AC12V	12 V AC	9.6 V AC	2.4 V AC	76	0.9 VA	—	13.2 V AC
HA1-AC24V HA1E-AC24V	24 V AC	19.2 V AC	4.8 V AC	37	0.9 VA	—	26.4 V AC
HA1-AC48V HA1E-AC48V	48 V DC	38.4 V AC	9.6 V AC	19	0.9 VA	—	52.8 V AC
HA1-AC115V HA1E-AC115V	115 V AC	92.0 V AC	23.0 V AC	8	0.9 VA	—	126.5 V AC
HA1-DC5V HA1E-DC5V	5 V DC	4.0 V DC	0.5 V DC	72	360 mW	69	6.0 V DC
HA1-DC6V HA1E-DC6V	6 V DC	4.8 V DC	0.6 V DC	60	360 mW	100	7.2 V DC
HA1-DC9V HA1E-DC9V	9 V DC	7.2 V DC	0.9 V DC	40	360 mW	225	10.8 V DC
HA1-DC12V HA1E-DC12V	12 V DC	9.6 V DC	1.2 V DC	30	360 mW	400	14.4 V DC
HA1-DC24V HA1E-DC24V	24 V DC	19.2 V DC	2.4 V DC	15	360 mW	1,600	28.8 V DC
HA1-DC48V HA1E-DC48V	48 V DC	38.4 V DC	4.8 V DC	7.5	360 mW	6,400	57.6 V DC

Note: The range of coil current—AC type: ±15% at 60 Hz, DC type: ±10% at 20°C coil temperature.

DIMENSIONS

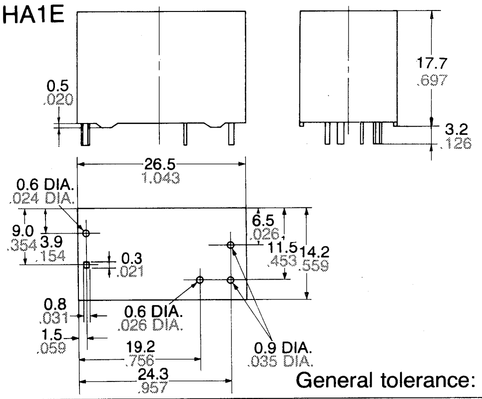
mm inch

HA1



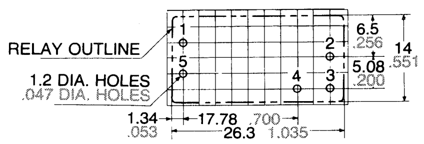
General tolerance: ±0.5 ±.020

HA1E



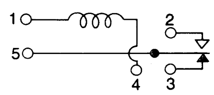
General tolerance: ±0.3 ±.012

PC board pattern (copper-side view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

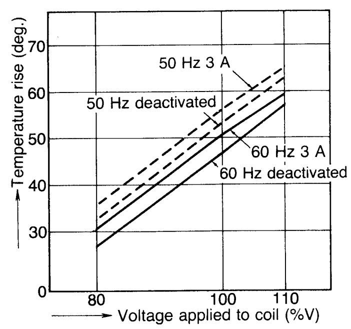


DATA

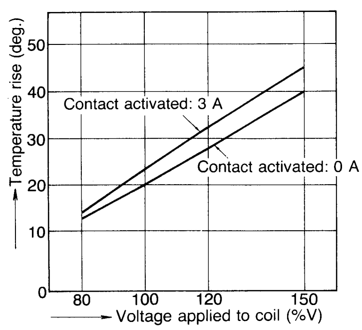
Coil temperature rise

Point measured: Inside the coil

(AC PC board type)

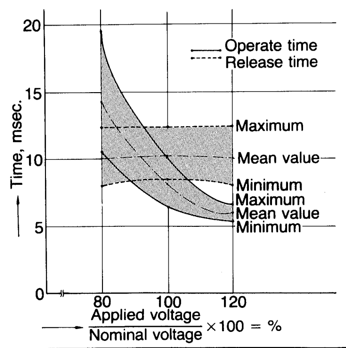


(DC PC board type)

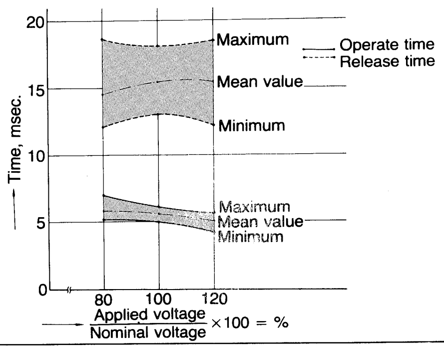


Operate and release time

Sample: HA1-DC12V



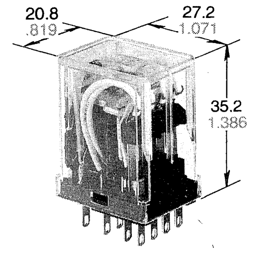
Sample: HA1-AC115V

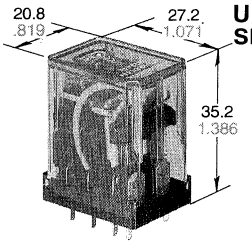


NAIS

MINIATURE RELAY FOR WIDER APPLICATIONS

HC-RELAYS





mm inch HCE Amber Relays

UL File No.: E43028; CSA File No.: LR26550; VDE File No.: VDE-Reg.-Nr. 2735 SEV only Form 1C/2C/3C

- **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 (100 μA to 10 A)**
- **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 (resistaive) 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

Coil

Nominal operating power	AC (50 Hz): 1.3 VA, AC (60 Hz): 1.2 VA DC: 0.9 to 1.1 W

Characteristics

Max. operating speed		20 cpm (at max. rating)
Operate time (at nominal voltage)		Approx. 20 msec.
Release time (at nominal voltage)		Approx. 20 msec.
Initial breakdown voltage Between open contacts Between contact sets Between contact and coil		 700 Vrms for 1 min. 700 Vrms for 1 min. 2,000 Vrms for 1 min.
Initial insulation resistance		Min. 1,000 MΩ at 500 V DC
Temperature rise, max. (at nominal voltage)		80 deg.
Ambient temperature		−50°C to +70°C −58°F to +158°F (No freezing below 0°C)
Shock resistance	Functional	Min. 20 G
	Destructive	Min. 100 G
Vibration resistance	Functional	Approx. 6 G, 10 to 55 Hz at double amplitude at 1 mm
	Destructive	Approx. 12 G, 10 to 55 Hz at double amplitude of 2 mm
Unit weight		Approx. 34 g 1.2 oz

Expected life (min. operations)

Eelectrical (at 20 cpm)

Voltage		125 V AC		250 V AC		30 V DC		Expected life
Load		Resistive ($\cos\varphi=1$)	Inductive ($\cos\varphi\fallingdotseq0.4$)	Resistive ($\cos\varphi=1$)	Inductive ($\cos\varphi\fallingdotseq0.4$)	Resistive	Inductive	
HC1 1 Form C	Current	10 A	5 A	10 A	3 A	—	—	2×10^5
		7 A	3 A	7 A	2.5 A	3 A	1 A	5×10^5
		5 A	2 A	5 A	1.5 A	—	—	1×10^6
HC2 2 Form C	Current	7 A	3.5 A	7 A	2 A	—	—	2×10^5
		5 A	2.5 A	5 A	1.5 A	3 A	0.6 A	5×10^5
		3 A	1.5 A	3 A	1 A	—	—	1×10^6
HC3 3 Form C	Current	7 A	—	7 A	—	—	—	10^5
		—	3.5 A	—	2 A	—	—	2×10^5
		5 A	—	5 A	—	3 A	0.4 A	5×10^5
HC4 4 Form C	Current	5 A	2 A	5 A	1 A	—	—	2×10^5
		3 A	1 A	3 A	0.8 A	3 A	0.4 A	5×10^5
		2 A	0.5 A	2 A	0.4 A	—	—	1×10^6

Mechanical life (at 180 cpm)	DC type: 10^8, AC type: 5×10^7

UL/CSA rating	1 Form C	10 A 250 V AC 1/3 HP 125, 250 V AC 3 A 30 V DC
	2 Form C	7 A 250 V AC 1/6 HP 125, 250 V AC 3 A 30 V DC
	3 Form C	7 A 250 V AC 1/6 HP 125, 250 V AC 3 A 30 V DC
	4 Form C	5 A 250 V AC 1/10 HP 125, 250 V AC 3 A 30 V DC

VDE rating	1 Form C	10 A 250 V ~ ($\cos\varphi=1.0$) 3 A 250 V ~ ($\cos\varphi=0.4$) 3 A 30 V ⎓ (Oms)
	2 Form C	7 A 250 V ~ ($\cos\varphi=1.0$) 2 A 250 V ~ ($\cos\varphi=0.4$) 3 A 30 V ⎓ (Oms)
	4 Form C	5 A 65 V ~ ($\cos\varphi=1.0$) 3 A 65 V ~ ($\cos\varphi=0.4$) 3 A 30 V ⎓ (Oms)

Note: HC3 (3 Form C) series are not approved by VDE.

ORDERING INFORMATION

EX. HC [4] [D] — [H] — [AC 240V]

Contact arrangement	Type classifications	Terminal arrangement	Coil voltage
1: 1 Form C 2: 2 Form C 3: 3 Form C 4: 4 Form C	Nil: Standard type D: Bifurcated contact type (HC4D only. See page 283.) S: Stepping relay type (See page 284.) K: Latching relay type (HC2K only. See page 285.)	H: Plug-in HP: PC board terminal HTM: Top mounting HL: Light emitting diode wired, plug-in HPL: Light emitting diode wired, PC board	AC 6, 12, 24, 48, 120, 240 V DC 6, 12, 24, 48, 110 V

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.

TYPICAL APPLICATIONS

Transportation, power station control equipment, refrigerators, building control equipment, office machines, coin operated machines, amusement devices, medical equipment, etc.

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	Approx. 0.9	Approx. 0.58
12	9.6	1.2	13.2	160	75	Approx. 0.9	Approx. 0.58
24	19.2	2.4	26.4	650	37	Approx. 0.9	Approx. 0.58
48	38.4	4.8	52.8	2,600	18.5	Approx. 0.9	Approx. 0.58
110	88.0	11.0	121.0	10,000	10	Approx. 1.0	Approx. 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 (±10%)	Operating power, VA	
					Nominal	Minimum
6	4.8	1.8	6.6	200	Approx. 1.20	Approx. 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		
120	96	36	132	11.9		
240	176.0	66.0	264.0	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.

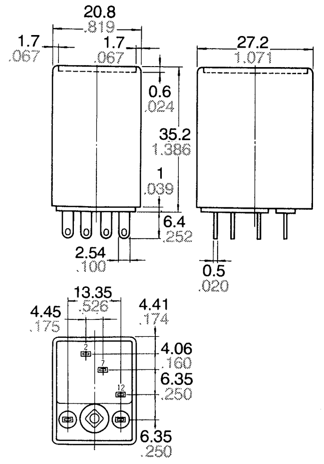
Voltage	1 Form C, 2 Form C, 3 Form C, 4 Form C
220 V DC	11 kΩ (5 W)
240 V DC	13 kΩ (5 W)

DIMENSIONS (Common for standard, Amber sealed and Bifurcated contact (4C only) types)

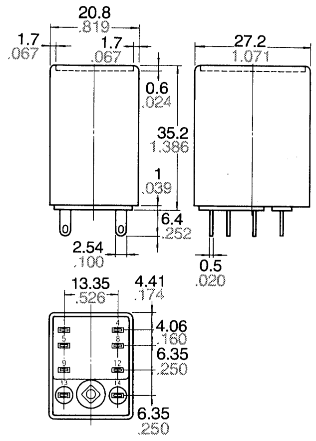
Plug-in type

mm inch

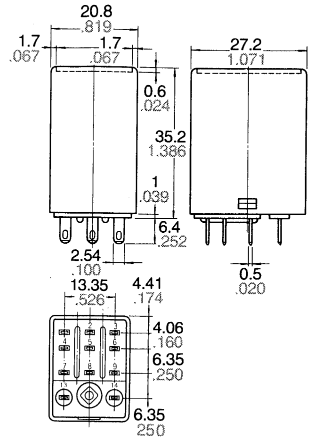
HC1-H (1 Form C)



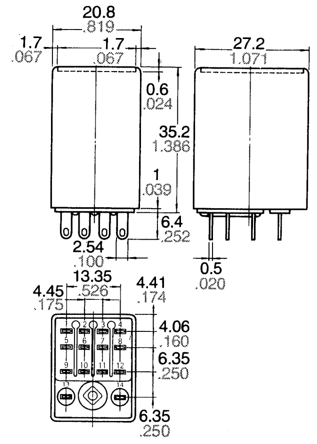
HC2-H (2 Form C)



HC3-H (3 Form C)



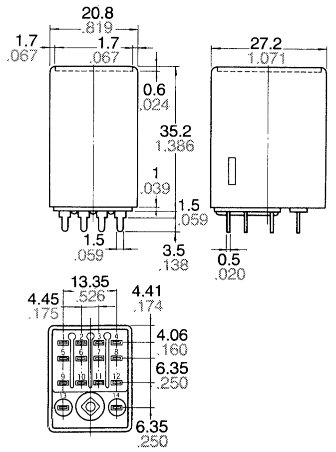
HC4-H (4 Form C)



General tolerance: ±0.2 ±.008

PC board type

HC4-HP (4 Form C)

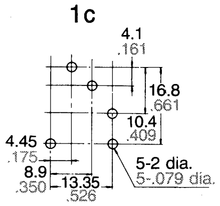


Dimensions of HC1-HP, HC2-HP, HC3-HP are the same as those of plug-in type except shapes of terminals.

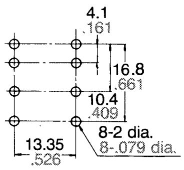
General tolerance: ±0.2 ±.008

PC board pattern (Copper-side view)

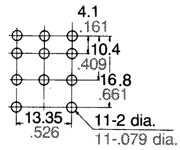
1c



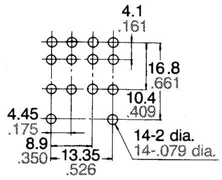
2c



3c



4c

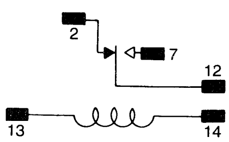


Tolerance: ±0.1 ±.004

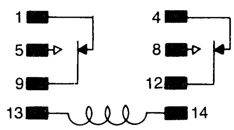
Note: Special PC terminal with 0.9 mm (.035 inch) width available with suffix "-31".

Schematic (bottom view)

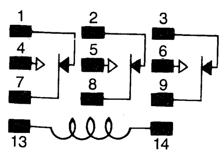
HC1-H, HC1-HP (1 Form C)



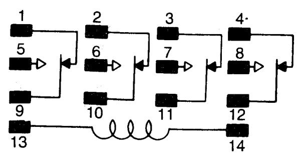
HC2-H, HC2-HP (2 Form C)



HC3-H, HC3-HP (3 Form C)

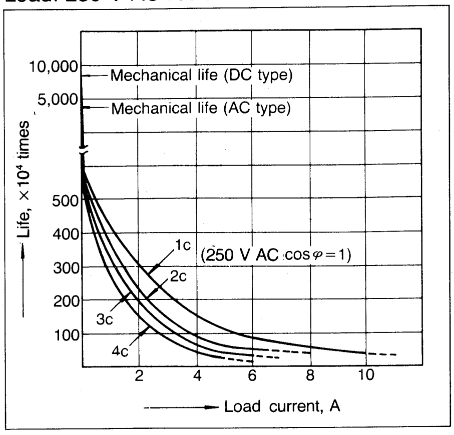


HC4-H, HC4-HP (4 Form C)

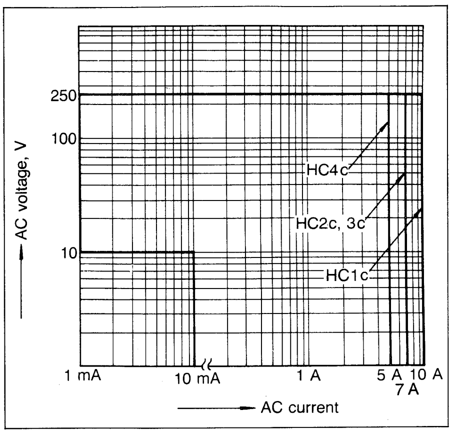


DATA

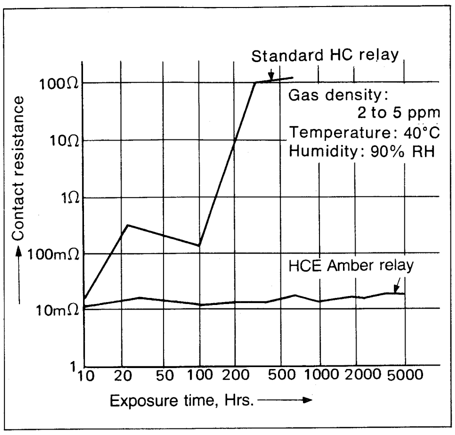
1. Life curve
Load: 250 V AC resistive load



2. Switching capacity range



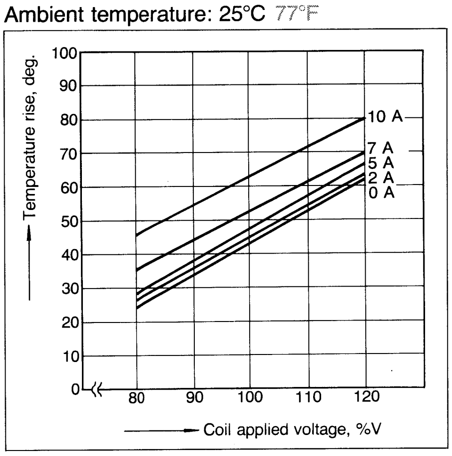
3. H_2S gas test



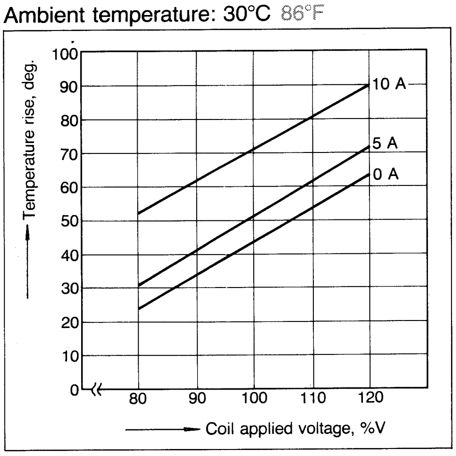
4. Coil temperature rise
Measured portion: Inside the coil

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.

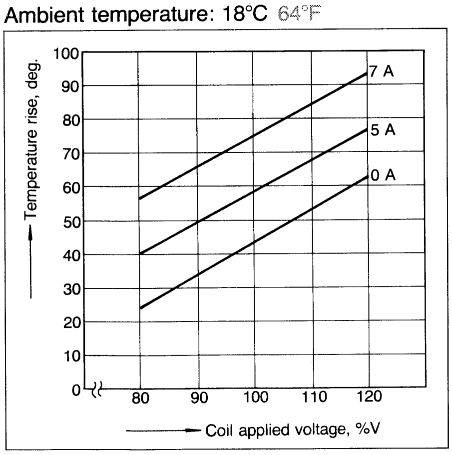
HC1 AC coil
Ambient temperature: 25°C 77°F



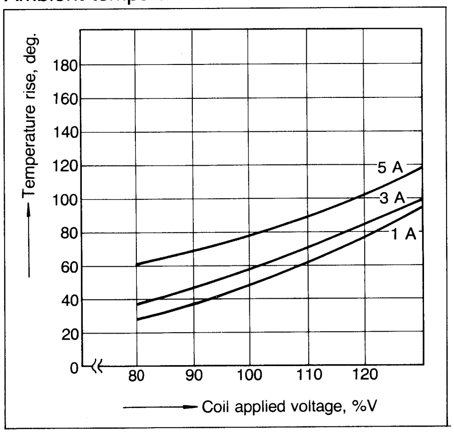
HC2 AC coil
Ambient temperature: 30°C 86°F



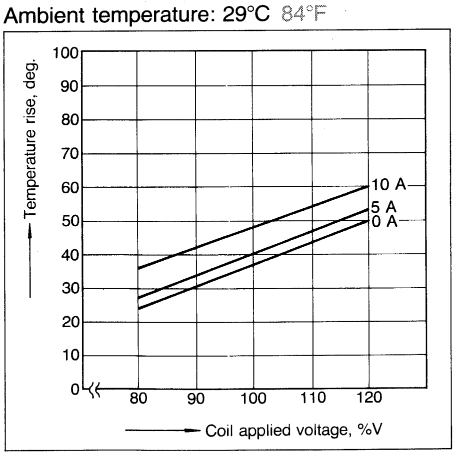
HC3 AC coil
Ambient temperature: 18°C 64°F



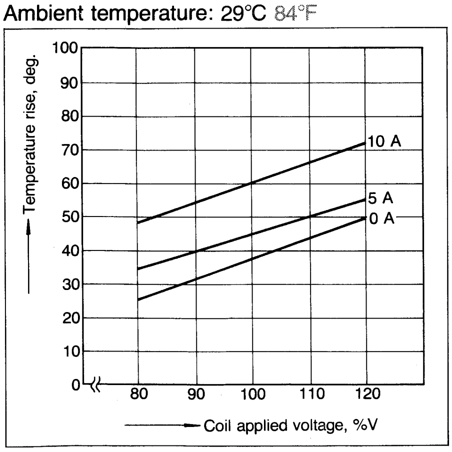
HC4 AC coil
Ambient temperature: 15 to 21°C 59 to 70°F



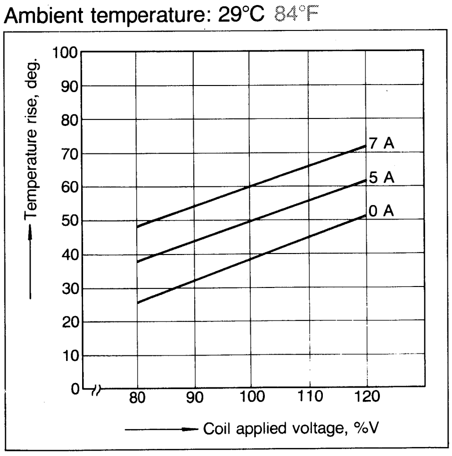
HC1 DC coil
Ambient temperature: 29°C 84°F



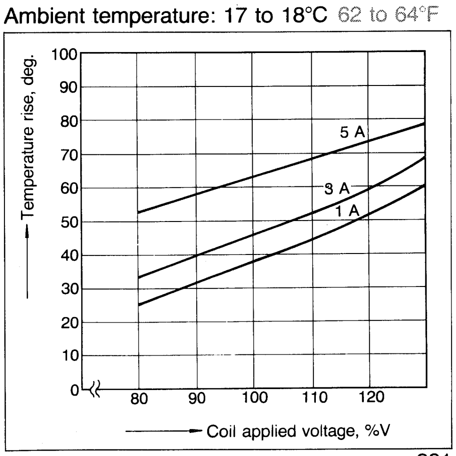
HC2 DC coil
Ambient temperature: 29°C 84°F



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.

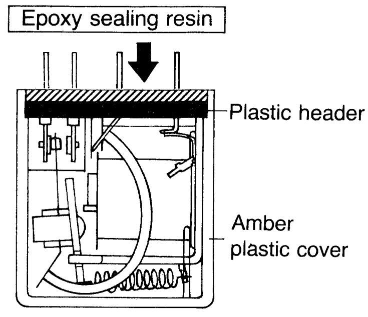
Typical applications

Safety devices and circuits
Business machines (copier)
Pollution control equipment
Computers
Communication equipment
Emergency broadcasting systems
Textile machines
Alarm devices
Flour mills
System control devices

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
Ambient temperature		−40°C to +50°C −40°F to +122°F (No freezing below 0°C)		
Ambient humidity		760 mmHg +20% (1.013 mb+20%)		

Expected life (min. operations)
Electrical (at 20 cpm)

Voltage		125 V AC		250 V AC		30 V DC		Expected life
Load		Resistive ($\cos\varphi = 1$)	Inductive ($\cos\varphi \fallingdotseq 0.4$)	Resistive ($\cos\varphi = 1$)	Inductive ($\cos\varphi \fallingdotseq 0.4$)	Resistive	Inductive	
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 (at 180 cpm)	DC type: 10^8, AC type: 5×10^7

Characteristics

Operate time (Approx.)	DC, AC: 13 msec.
Release time (Approx.)	DC: 10 msec.; AC 16 msec.

Note: All other specifications are the same as those of standard types. See page 278.

ORDERING INFORMATION

Ex. HC [4] E [D] — [HP] — [AC240V]

Contact arrangement

1: 1 Form C
2: 2 Form C
4: 4 Form C

Type classification

Nil: Standard type
D: Bifurcated contact type (HC4ED only. See page 283.)

Terminal arrangement

H: Plug-in
HP: PC board terminal
HTM: Top mounting
L: Light emitting diode wired, plug-in
PL: Light emitting diode wired, PC board

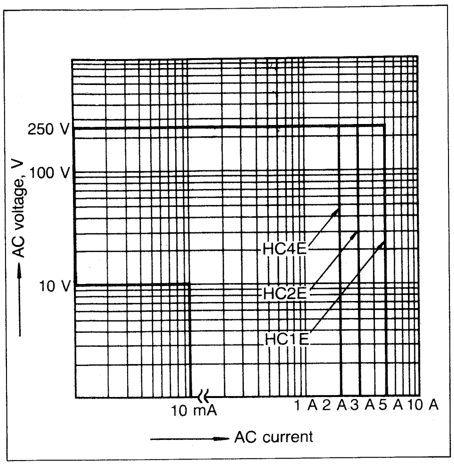
Coil voltage

AC 6, 12, 24, 48, 120, 240 V

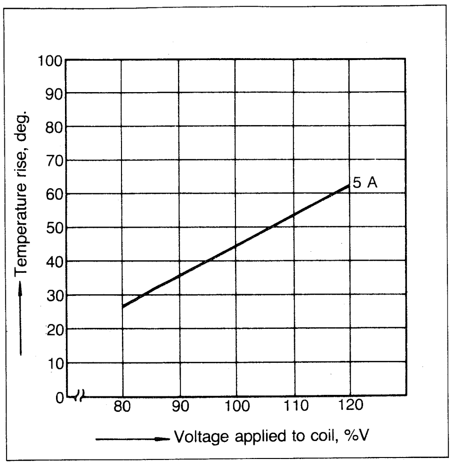
DC 6, 12, 24, 48, 110 V

DATA (HC Amber Relays)

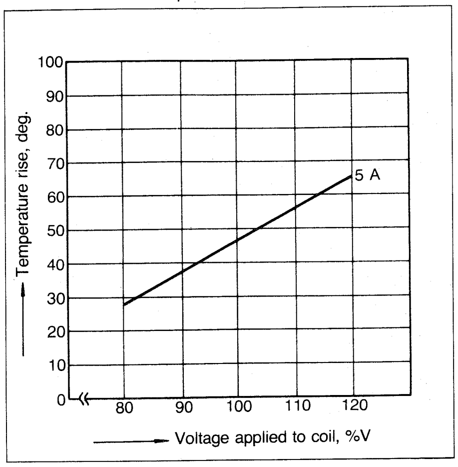
1. Switching capacity range



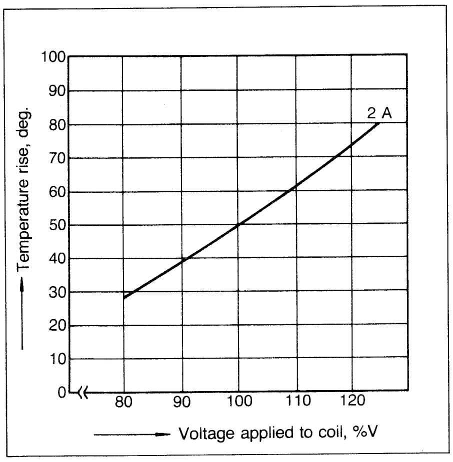
2.-(1) Coil temperature rise (1c AC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



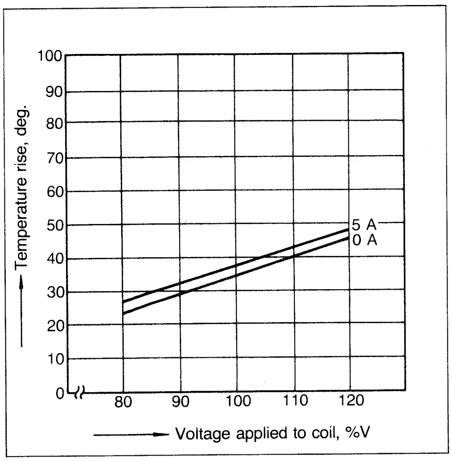
2.-(2) Coil temperature rise (2c AC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



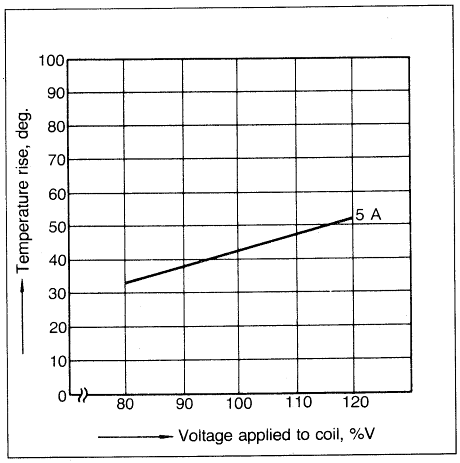
2.-(3) Coil temperature rise (4c AC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



2.-(4) Coil temperature rise (1c DC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F

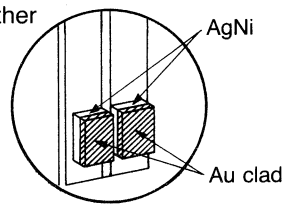


2.-(5) Coil temperature rise (2c DC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



Bifurcated contact types HC4D

Extremly 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.



Typical applications
Burglar alarm systems
Measuring equipment
Fire alarm systems
Business machines
Machine controls
Communication equipment

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	3 A

Characteristics

Operate time (Approx.)	DC, AC: 13 msec.
Release time (Approx.)	DC: 10 msec. AC: 16 msec.

Expected life (min. operations)
Electrical (at 20 cpm)

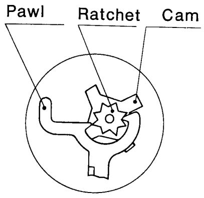
Voltage	125 V AC		250 V AC		30 V DC		Expected life
Load	Resistive (cos φ = 1)	Inductive (cos $\varphi \fallingdotseq$ 0.4)	Resistive (cos φ = 1)	Inductive (cos $\varphi \fallingdotseq$ 0.4)	Resistive	Inductive	
HC4D	3 A	1 A	3 A	0.8 A	—	—	2×10^5
HC4ED	1 A	—	1 A	—	—	—	

Note: All other specifications are the same as those of standard types. See page 278.

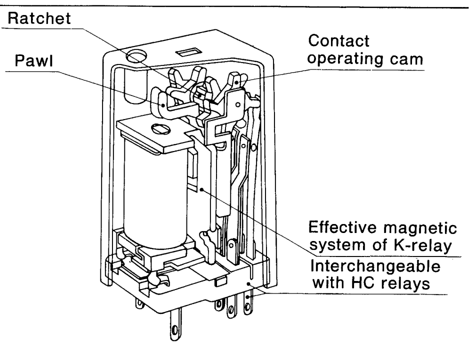
Stepping relay types: HCS

HC stepping relay is a single coil mechanical latching relay. An impulse to the coil operates a pawl and ratchet to step the operating cam through the sequence. This switching operation is terminated when the coil is deenergized and the contacts are held in the on-off condition until the next impulse is applied to the coil. 4-pulse signals complete the operation sequence, returning to the original condition.

Typical applications
HC stepping relay is suitable for sequence circuits, electrical power saving circuits and one by one operation circuits, etc.



Structure of pawl and ratchet system



SPECIFICATIONS

Contacts

Arrangement		4 Form A only
Initial contact resistance (By voltage drop 6 V DC 1 A)		30 mΩ
Rating (resistive)	Nominal switching capacity	5 A 100 V AC, 5 A 30 V DC
	Max. switching power	150 W, 500 VA
	Max. switching voltage	250 V
	Max. switching current	5 A
Contact pressure		Min. 10 g

Characteristics

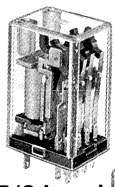
Max. operating speed	20 cps.
Operate time (at nominal voltage)	Approx. 18 msec.
Release time (at nominal voltage)	Approx. 18 msec.
Min. pulse time (energizing time)	10 msec.
Expected life (min. operations) Mechanical (at 600 cpm)	5×10^6
Expected life (min. operations) Electrical (resistive) (at 180 cpm)	2×10^5
Initial breakdown voltage Between open contacts	1,000 V AC for 1 min.
Initial breakdown voltage Between contacts and coil	1,500 V AC for 1 min.
Initial insulation resistance	1,000 MΩ at 500 V DC
Shock/vibration resistance	Min. 10 G
Ambient temperature	−40°C to 50°C −40°F to +122°F
Unit weight	Approx. 35 g 1.23 oz

Note: All other specifications are the same as those of standard types. See page 278.

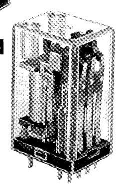
TYPES

Type	Coil voltage	Plug-in type	P/C board type
4-pulse type (4PST)	DC 6 V	HCSA-DC6V	HCSA-P-DC6V
	DC 12 V	HCSA-DC12V	HCSA-P-DC12V
	DC 24 V	HCSA-DC24V	HCSA-P-DC24V
	DC 48 V	HCSA-DC48V	HCSA-P-DC48V
	DC 110 V	HCSA-DC110V	HCSA-P-DC110V
2-pulse type (4PST)	DC 6 V	HCSB-DC6V	HCSB-P-DC6V
	DC 12 V	HCSB-DC12V	HCSB-P-DC12V
	DC 24 V	HCSB-DC24V	HCSB-P-DC24V
	DC 48 V	HCSB-DC48V	HCSB-P-DC48V
	DC 110 V	HCSB-DC110V	HCSB-P-DC110V

Note: Suitable accessories are HC4-SS-K, HC4-PS-K, HC4-WS-K and HC-HSF-K.



P/C board



Plug-in

A) 4-pulse stepping operation

Terminal No.	Operating process I	II	III	IV
1-5	ON	OFF	OFF	OFF
2-6	OFF	ON	OFF	OFF
3-7	OFF	OFF	ON	OFF
4-8	OFF	OFF	OFF	ON

B) 2-pulse stepping operation

Terminal No.	Operating process I	II	III	IV
1-5	ON	OFF	ON	OFF
2-6	OFF	ON	OFF	ON
3-7	ON	OFF	ON	OFF
4-8	OFF	ON	OFF	ON

Note: According to input pulse, operation is made as follows I→II→III→IV→I→II→III . . . .

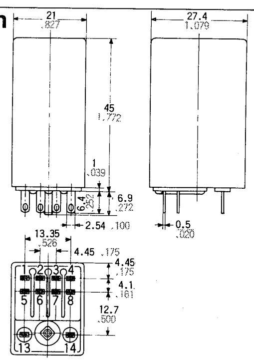
COIL DATA at 25°C 77°F

Coil voltage	Pick-up voltage (max.)	Drop-out voltage (min.)	Max. allowable voltage	Coil resistance Ω (±10%)	Nominal operating power, W	Inductance, H Closed	Inductance, H Open
6 V DC	4.8 V DC	0.6 V DC	7 V DC	28	1.28	0.52	0.04
12 V DC	9.6 V DC	1.2 V DC	14 V DC	110	1.31	2.1	0.13
24 V DC	19.2 V DC	2.4 V DC	28 V DC	440	1.31	8.3	0.5
48 V DC	38.4 V DC	4.8 V DC	55 V DC	1,700	1.36	35	2.2
110 V DC	88 V DC	11.0 V DC	127 V DC	9,000	1.34	144	8.9

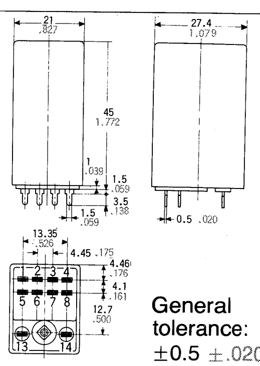
DIMENSIONS AND CIRCUIT DIAGRAM

mm inch

Plug-in type

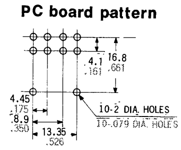


PC board type



General tolerance: ±0.5 ±.020

PC board pattern

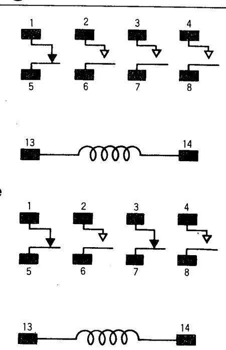


Tolerance: ±0.1 ±.004

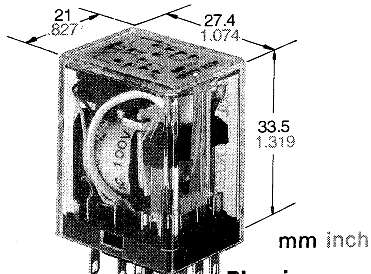
Wiring diagram

4-pulse type

2-pulse type



Latching relay types: HC2K



Plug-in

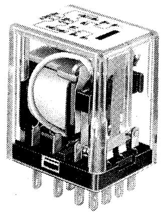
HC magnetic latching relays are particulary suitable for various vending machines, remote control devices, parking meters, conveyor, NC machinery, etc.

TYPES AND COIL DATA

DC coils at 20°C 68°F

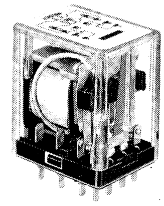
UL, CSA recognized

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	**HC2K-P-DC6V**	207	107	1.24	0.64	80% of Nominal voltage	110% of Nominal voltage
HC2K-DC12V	**HC2K-P-DC12V**	100	52.2	1.20	0.63		
HC2K-DC24V	**HC2K-P-DC24V**	51.1	25.5	1.23	0.61		
HC2K-DC48V	**HC2K-P-DC48V**	25.3	13.7	1.21	0.66		
HC2K-DC100V	**HC2K-P-DC100V**	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	**HC2K-P-AC6V**	206	103	1.23	0.62	80% of Nominal Voltage	110% of Nominal Voltage
HC2K-AC12V	**HC2K-P-AC12V**	100	52	1.20	0.62		
HC2K-AC24V	**HC2K-P-AC24V**	51	21.4	1.22	0.51		
HC2K-AC48V	**HC2K-P-AC48V**	25.2	18.5	1.2	0.88		
HC2K-AC115V	**HC2K-P-AC115V**	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.

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	3 A

Coil

Nominal operating power	Set coil	1.2 VA to 1.33 VA
	Reset coil	0.51 VA to 0.88 VA

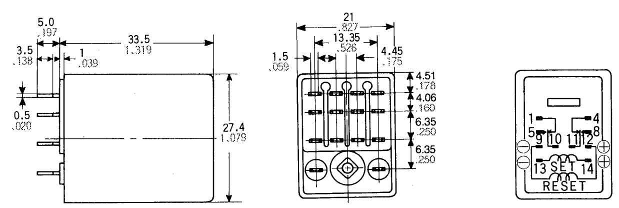
Note: All other specifications are the same as those of standard types. See page 278.

Characteristics

Set time (at nominal voltage)		AC, DC: Approx. 20 msec.
Reset time (at nominal voltage)		AC: Approx. 30 msec. DC: Approx. 50 msec.
Initial breakdown voltage Between contact and coil		1,500 Vrms for 1 min.
Temperature rise (at nominal voltage)	Set coil	Max. 80 deg.
	Reset coil	Max. 50 deg.
Shock/vibration resistance		Min. 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 (No freezing below 0°C)

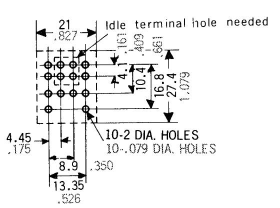
DIMENSIONS AND CIRCUIT DIAGRAM

Dimensions **Circuit diagram** mm inch



General tolerance: ±0.5 ±.020

PC board pattern (Copper-side view)

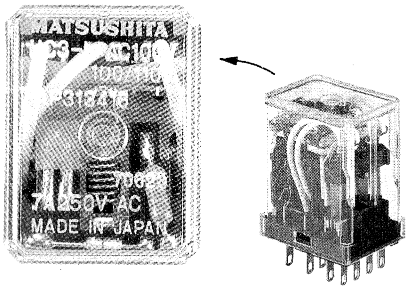


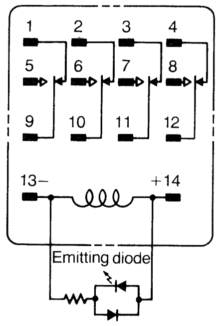
Tolerance: ±0.1 ±.004

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

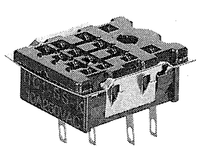
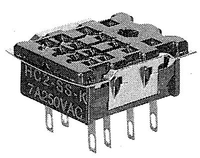
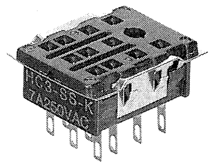
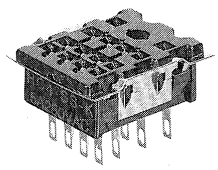
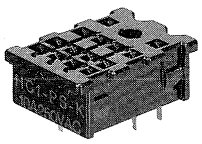
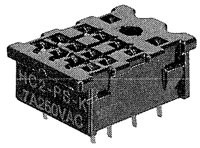
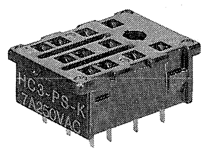
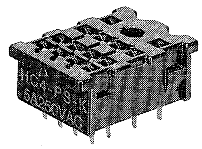
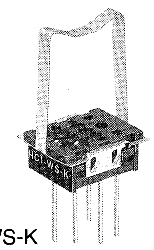
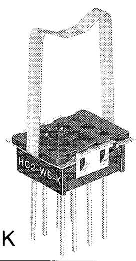
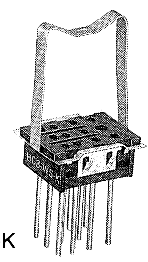
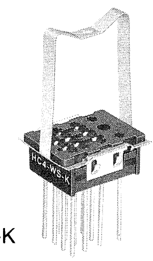
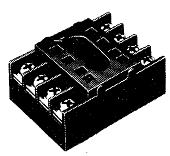
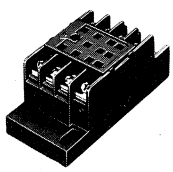
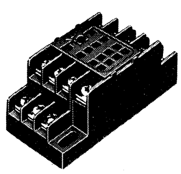
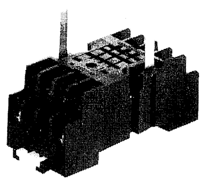
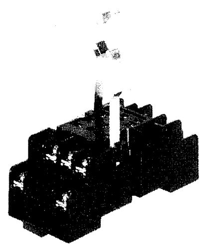
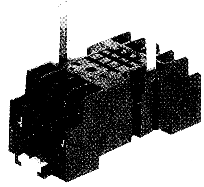
The built-in indication LED (Light emitting diode) Series are suitable for instant indication of operate function in applications where numerous relays are to be used. The HC-L relays are supplied with LED wired in parallel with the coil for visual indication that the relay is functioning. A Red LED is used for AC type and green one for DC.





(BOTTOM VIEW)

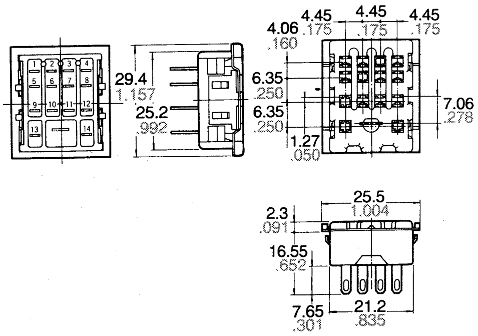
ACCESSORIES

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)	 HC1-WS-K	 HC2-WS-K	 HC3-WS-K	 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-K Exclusively for HC2-H	 HC3-SFD-K For HC2-H, HC3-H	 HC4-SFD-K For HC1-H, HC2-H, HC4-H

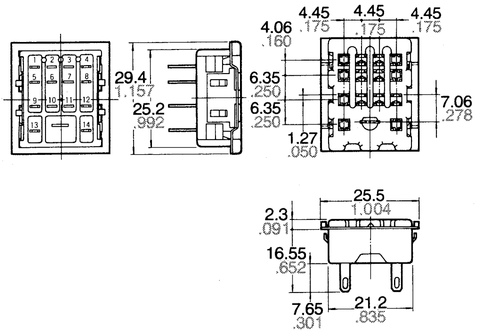
DIMENSIONS

mm inch

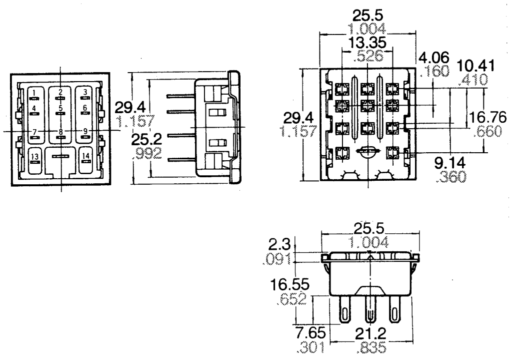
Socket with solder tab (with hold-down clip)



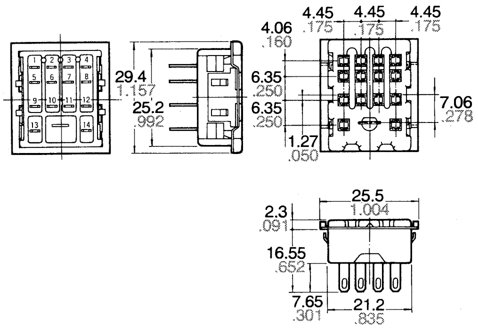
HC1-SS-K



HC2-SS-K

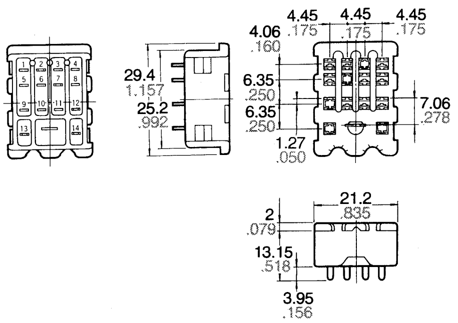


HC3-SS-K

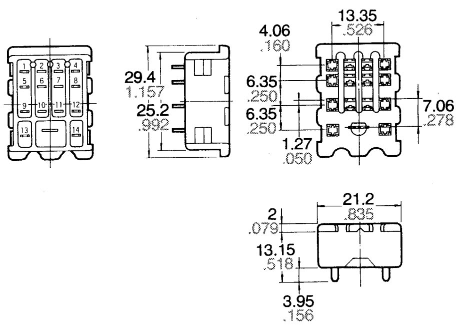


HC4-SS-K

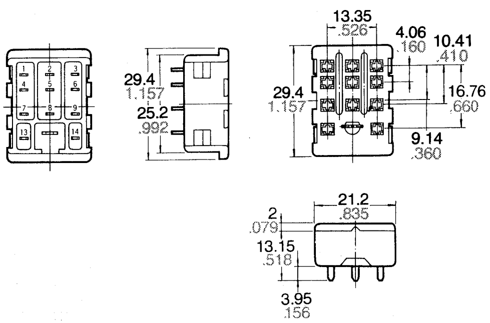
PC board socket (with hold-down clip)



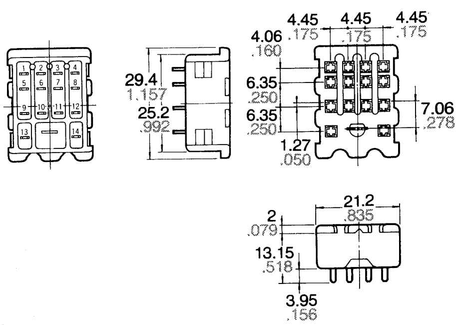
HC1-PS-K



HC2-PS-K

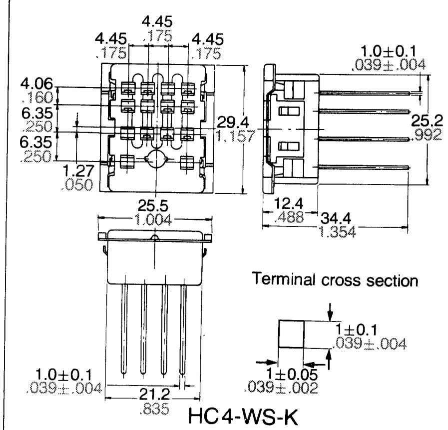


HC3-PS-K



HC4-PS-K

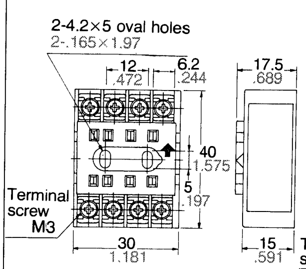
Socket for wrapping (with hold-down clip)



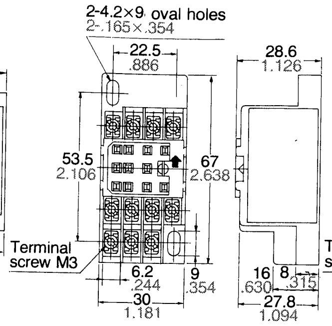
HC4-WS-K

Screw terminal socket for front wiring (with hold-down clip)

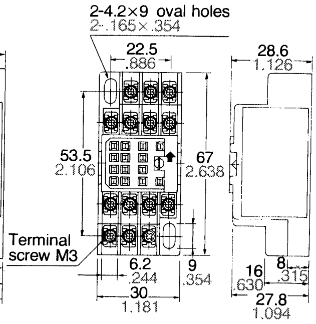
mm inch



HC2-SF-K

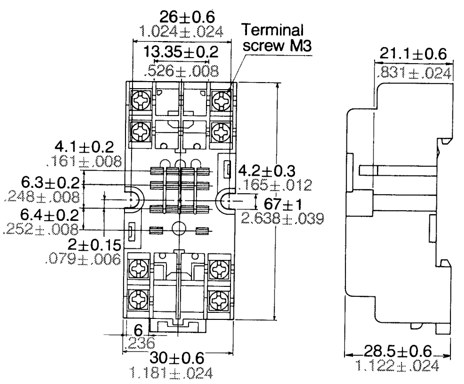


HC3-HSF-K

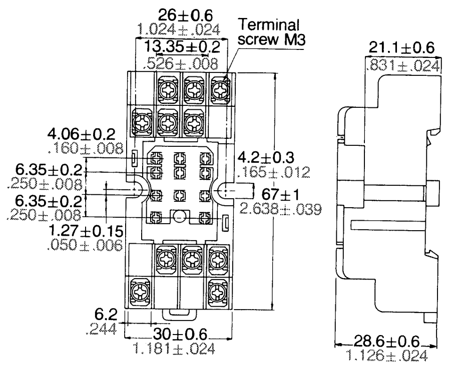


HC4-HSF-K

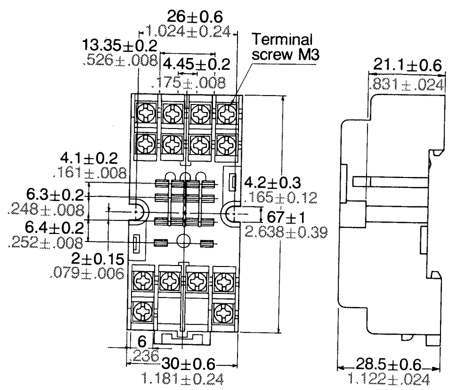
Screw terminal socket for DIN rail assembly (with hold-down dip)



HC2-SFD-K



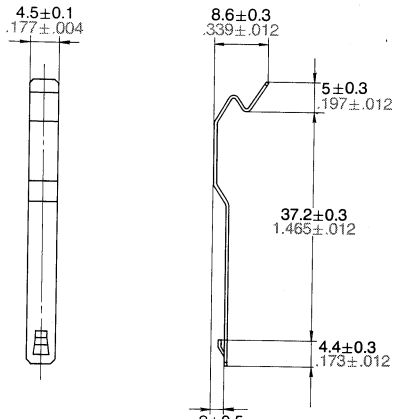
HC3-SFD-K



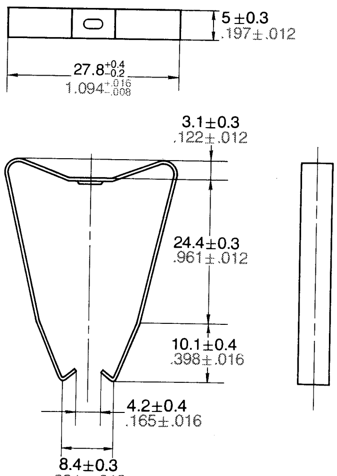
HC4-SFD-K

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



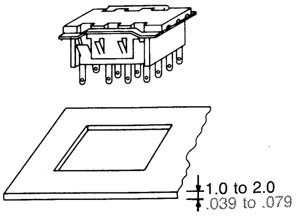
(2) "M shape" leaf spring: Applied to HC1-WS-K, HC2-WS-K, HC3-WS-K, HC4-WS-K



MOUNTING DIMENSIONS AND METHOD

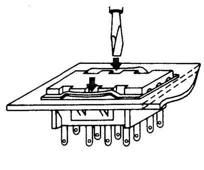
Solder and wrapping socket mount

mm inch



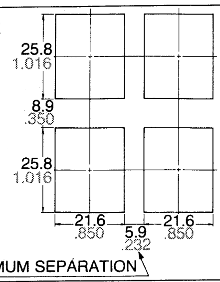
Chassis thickness

Merely press the socket into the chassis and lock in place with a screwdriver.



Quick mounting

Chassis cutout

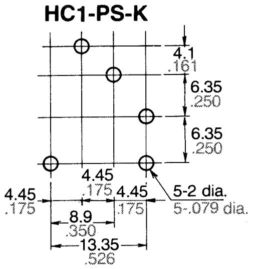


Tolerance: ±0.1 ±.004

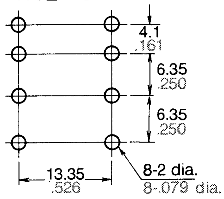
PC board pattern for PC board socket (Copper-side view)

For socket-mount

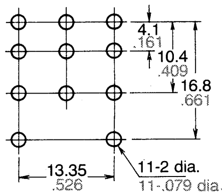
HC1-PS-K



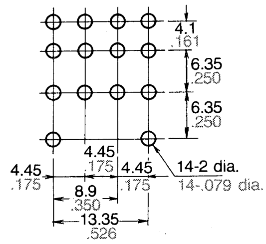
HC2-PS-K



HC3-PS-K



HC4-PS-K

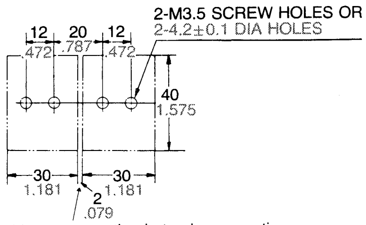


General tolerance: ±0.5 ±.020

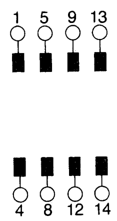
Screw socket mounts (Top view)

HC2-SF-K

Chassis cutout

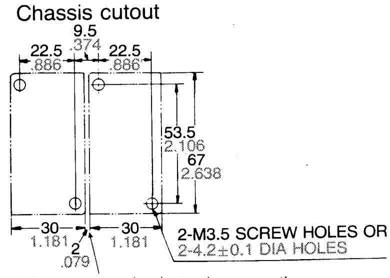


Schematic

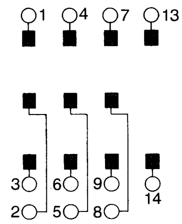


HC3-HSF-K

Chassis cutout

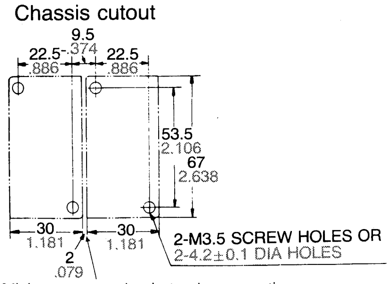


Schematic

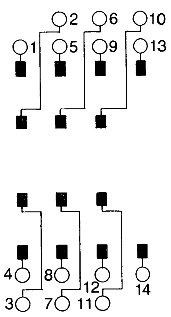


HC4-HSF-K

Chassis cutout

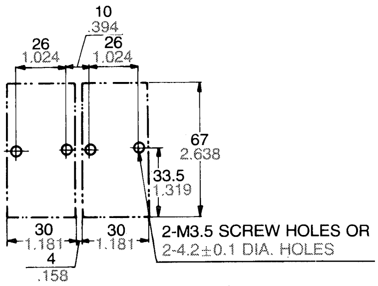


Schematic

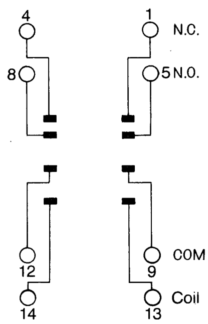


HC2-SFD-K

Chassis cutout

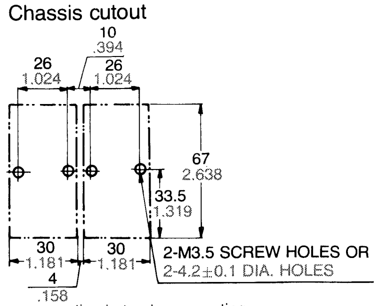


Schematic

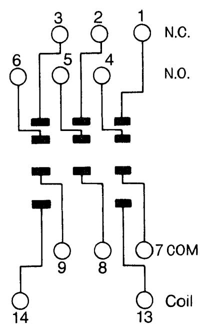


HC3-SFD-K

Chassis cutout

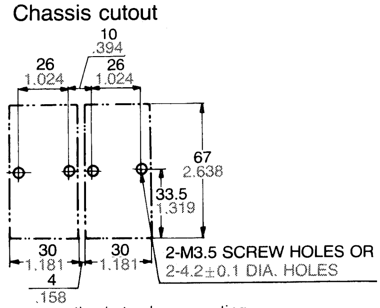


Schematic

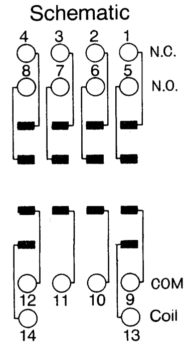


HC4-SFD-K

Chassis cutout

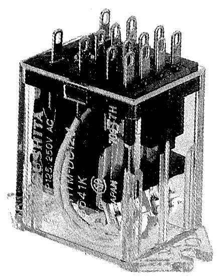


Schematic

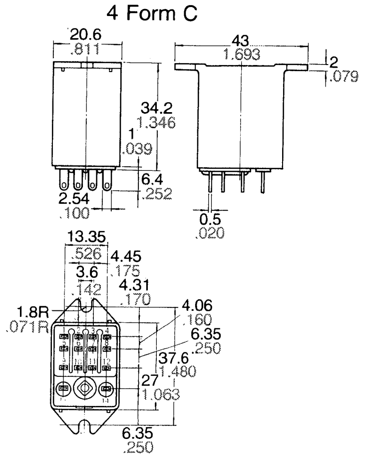


Direct mount for HC-TM relay series

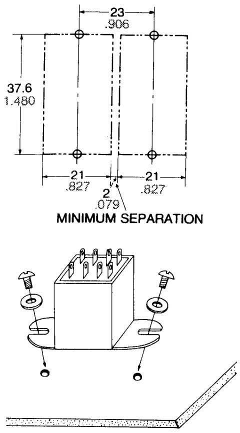
mm inch



HC-HTM



CHASSIS CUTOUT
IN TANDEM MOUNTING

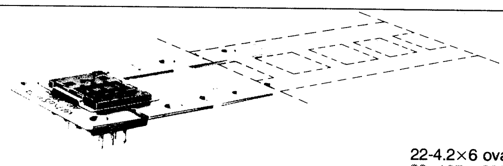


Notes:
1. HC1-HTM, HC2-HTM, HC3-HTM, HC4-HTM types all have dimensions in common except for the number of terminals.
2. For the specifications, please refer to page 278.
3. In mounting, use M3 screw and M3 washer.

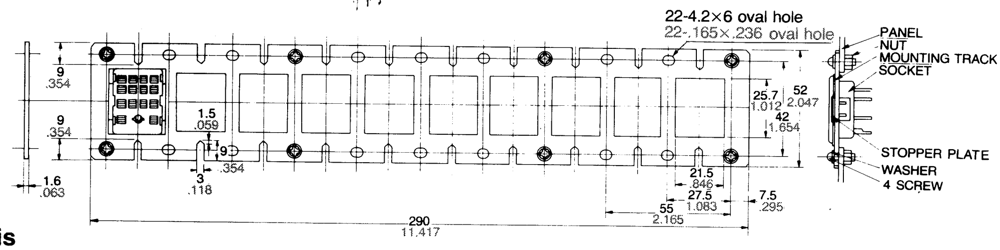
Tolerance: ±0.1 ±.004

Mounting track for solder socket

Track-mounted solder lug sockets
HC-MOUNTING TRACK

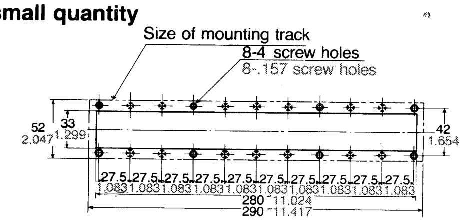


Up to 10 sockets per track.
Cut at notch for desired track length.

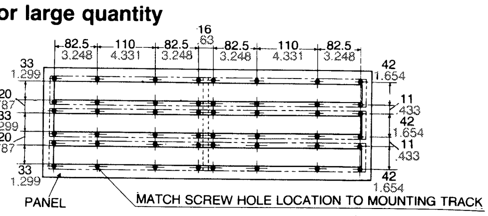


Chassis

For small quantity



For large quantity

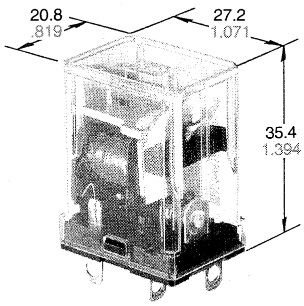


Tolerance: ±0.1 ±.004

NAiS

15 A (1C), 10 A (2C) SPACE SAVING POWER RELAY

HL-RELAYS



mm inch

UL File No.: E43028
CSA File No.: LR26550

- **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	10 A 250 V AC	
Max. switching power	AC: 2,500 VA DC: 90W	AC: 2,500 VA DC: 90W
Max. switching voltage	250 V AC 30 V DC	250 V AC 30 V DC
Max. switching current	15 A	10 A
UL rating	15 A, 1/3 HP 125, 250 V AC 10 A 30 V DC (Max. 10 A when used with socket)	10 A, 1/3 HP 125, 250 V AC 10 A 30 V DC
CSA rating	10 A, 1/3 HP 125, 250 V AC 10 A 30 V DC	10 A, 1/4 HP 125, 250 V AC 10 A 30V DC
Expected life Mechanical (at 180 cpm.)	5×10^7 (AC), 10^8 (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

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

Max. operating speed		20 cpm.
Operating time (at nominal voltage)		Approx. 20 msec.
Release time (at nominal voltage)		Approx. 20 msec.
Initial insulation resistance		100 MΩ (at 500 V DC)
Initial breakdown voltage Bewteen contact sets		1,500 Vrms for 1 min.
Between open contacts		1,000 Vrms for 1 min.
Bewteen contacts and coil		2,000 Vrms for 1 min.
Temperature rise (at nominal voltage)		Max. 80 deg.
Ambient temperature		−50°C to +70°C −58°F to +158°F
Shock resistance	Functional	Min. 20 G
	Destructive	Min. 100 G
Vibration resistance	Functional	6 G, 10 to 55 Hz at double amplitude of 1 mm
	Destructive	12 G, 10 to 55 Hz at double amplitude of 2 mm
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 | — | AC120V

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.

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	Approx. 0.90	Approx. 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	Approx. 1.0	Approx. 0.64

AC coils (50/60 Hz), at 60 Hz

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	Operating power, VA	
					Nominal	Minimum
6	4.8	1.8	6.6	200	Approx. 1.20	Approx. 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		
120	96	36	132	11.9		
240	176.0	66	242.0	6.5		

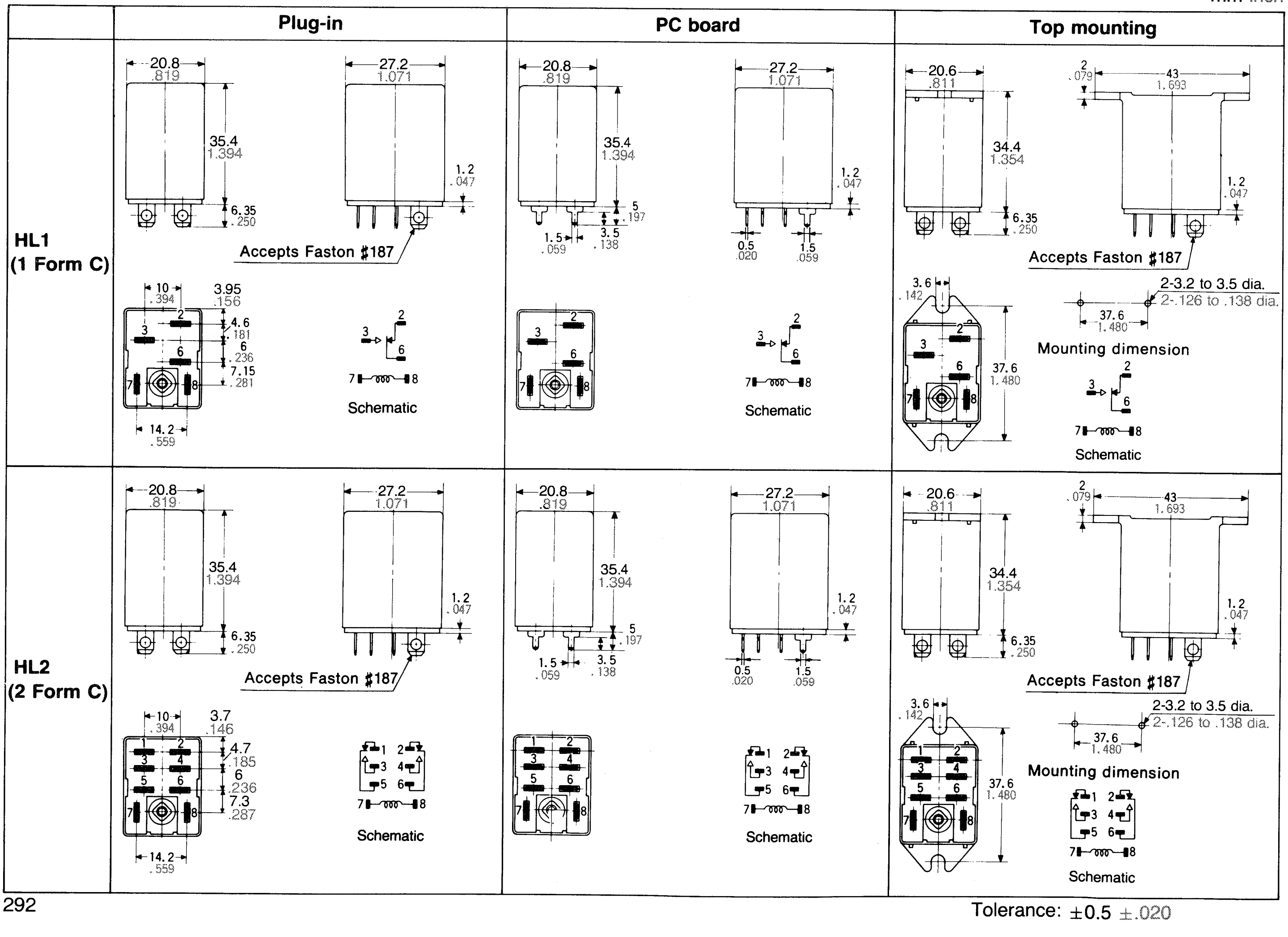
Notes:

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	11 kΩ (5 W)
240 V DC	13 kΩ (5 W)

DIMENSIONS

mm inch

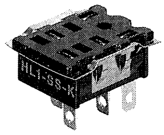


Tolerance: ±0.5 ±.020

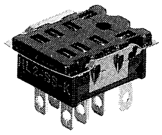
ACCESSORIES

mm inch

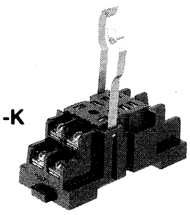
HL1-SS-K



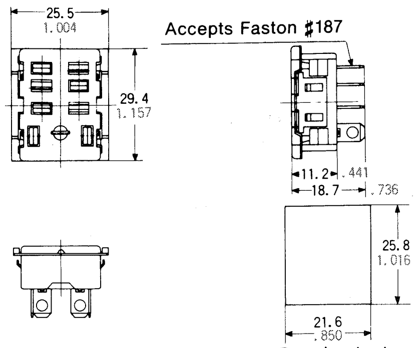
HL2-SS-K



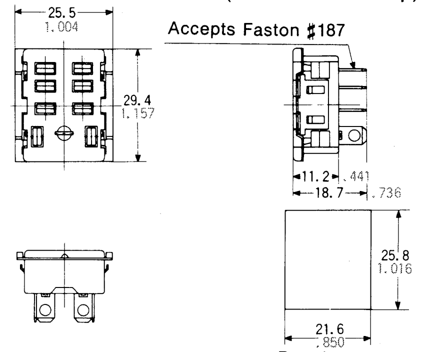
HL2-SFD-K



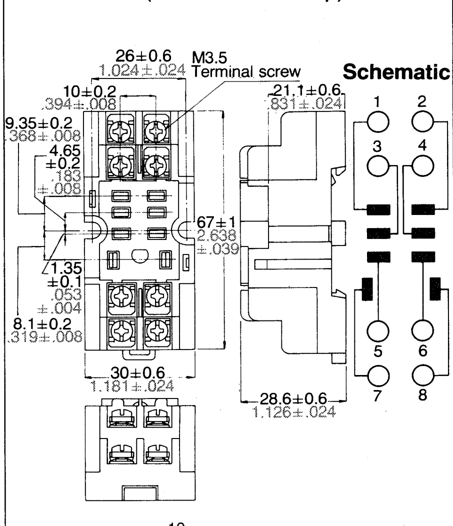
HL1-SS-K (with hold-down clip)



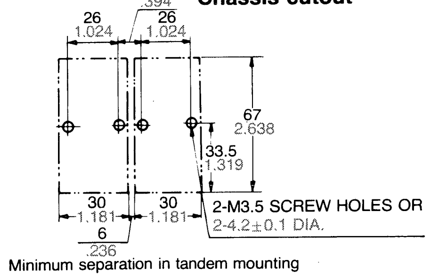
HL2-SS-K (with hold-down clip)



HL2-SFD-K (with hold-down clip)

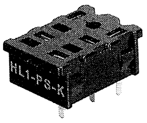


Chassis cutout

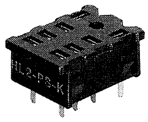


Tolerance: ±0.1 ±.004

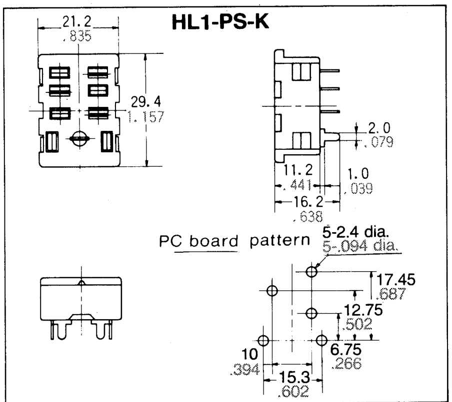
HL1-PS-K



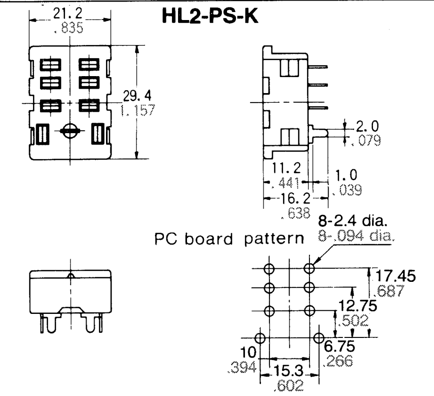
HL2-PS-K



HL1-PS-K



HL2-PS-K



(Remark) Max. continuous current of all HL sockets is 10 A.

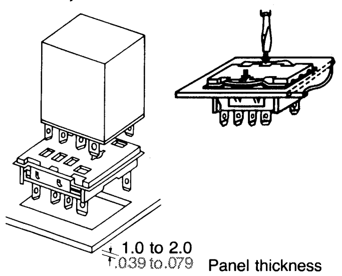
Tolerance: ±0.1 ±.004

MOUNTING METHODS AND DIMENSIONS

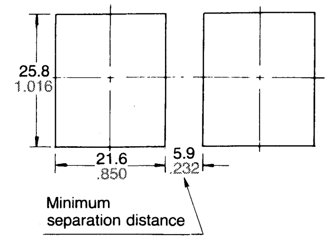
mm inch

Solder socket mount

Simply insert socket into panel hole and push down as indicated to lock socket in place.

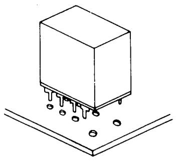


Panel cutout for tandem mounting

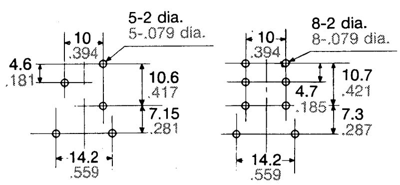


Tolerance: ±0.5 ±.020

PC board pattern



Copper-side view

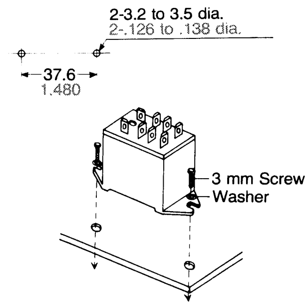


(HL1) **(HL2)**

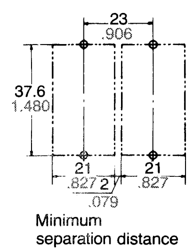
Tolerance: ±0.1 ±.004

Top mounting

Hole spacing



Panel cutout for tandem mounting

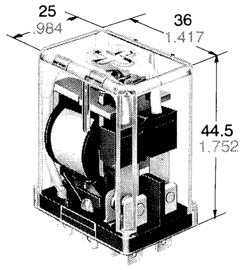


Tolerance: ±0.5 ±.020

NAiS

10 AMP POWER RELAY

HP-RELAYS



mm inch

UL File No.: E43028
CSA File No.: LR26550
VDE File No.: VDE-Reg.-Nr. 05, SEV

- **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 quich-connect terminals**

SPECIFICATIONS

Contacts

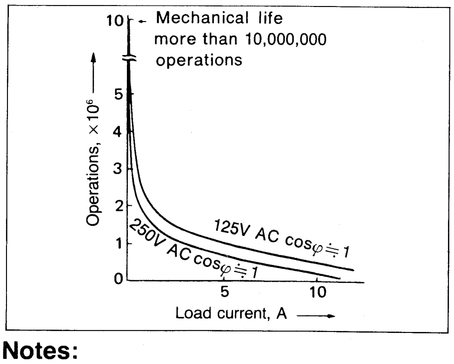
Arrangement	2 Form C	3 Form C	4 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	15 mΩ		
Rating UL/CSA rating VDE rating	10 A, 1/3 HP 125, 250 V AC 10 A (7.5 A), 250 V AC (HP2) 10 A, 250 V AC (HP3)		
Contact material	Silver		Silver alloy

Characteristics (at 60 Hz, 20°C 68°F)

Breakdown voltage			
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
Initial insulation resistance	more than 100 MΩ at 500 V DC		

Operate time	Approx. 15 msec. (HP2) Approx. 25 msec. (HP3, HP4)	
Release time	Approx. 15 msec. (HP2) Approx. 25 msec. (HP3, HP4)	
Maximum operating speed	20 cpm	
Temperature rise	Max. 65 deg.	
Ambient temperature	−50 to 40°C −58 to 104°F	
Shock resistance	Functional: 10 G	Destructive: 100 G
Vibration resistance	Functional: 6 G, 10 to 55 Hz at double amplitude of 1 mm Destructive: 12 G, 10 to 55 Hz at double amplitude of 2 mm	
Unit weight	60 g 2.12 oz (HP2) 100 g 3.53 oz (HP3) 125 g 4.41 oz (HP4)	

Life curve



Contact rating and expected life For AC load

Voltage	125 V AC		250 V AC		Expected life (min. operations)
Load	Rsistive (cos φ ≒ 1)	Inductive (cos φ ≒ 0.4)	Resistive (cos φ ≒ 1)	Inductive (cos φ ≒ 0.4)	
Current	—	—	10 A	7.5 A	2×10⁵
	10 A	7.5 A	7.5 A	5 A	5×10⁵
	5 A	3 A	3 A	2 A	1×10⁶
	1 A	0.7 A	0.6 A	0.4 A	2×10⁶
Mechanical life					1×10⁷

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

Voltage	24 V DC		125 V DC		Expected life (min. operations)
Load	Resistive (cos φ ≒ 1)	Inductive (cos φ ≒ 0.4)	Resistive (cos φ ≒ 1)	Inductive (cos φ ≒ 0.4)	
Current	—	7 A	—	—	2×10⁵
	7.5 A	5 A	0.5 A	0.4 A	5×10⁵
	5 A	3 A	0.3 A	0.2 A	1×10⁶
	1 A	0.6 A	0.1 A	0.06 A	2×10⁶
Mechanical life					1×10⁷

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.

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 pierced terminal M: Slotted-flange enclosure for direct chassis mounting (3 Form C only) TM: Top mounting (2 Form C only) L: Lamp wired, standard pierced 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.

Terminal arrangements

Contact arrangements	Pierced terminal
2 Form C	HP2, HP2-TM: Plug-in/solder/QC Faston 205
3 Form C	HP3, HP3-M : Plug-in/solder/QC Faston 187
4 Form C	HP4 : Plug-in/solder/QC Faston 205

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

TYPES AND COIL DATA

DC TYPE at 20°C 68°F

Part No.	Nominal coil voltage	Pick-up voltage (max.)	Drop-out voltage (min.)	Max. allowable voltage	Coil resistance, Ω (±10%)	Nominal coil current, mA	Nominal operating power
HP2-DC6V	6 V DC	4.8 V DC	0.9 V DC	6.6 V DC	25	240	1.5 W
HP2-DC12V	12	9.6	1.8	13.2	110	109	1.5
HP2-DC24V	24	19.2	3.6	26.4	440	54.5	1.5
HP2-DC48V	48	38.4	7.2	52.8	1,800	26.7	1.5
HP2-DC110V	110	88	16.5	121	7,300	15.0	1.6
HP3-DC6V	6	4.8	0.9	6.6	24	250	1.5
HP3-DC12V	12	9.6	1.8	13.2	100	120	1.5
HP3-DC24V	24	19.2	3.6	26.4	400	60	1.5
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	1.5
HP4-DC6V	6	4.8	0.9	6.6	22	273	1.5
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

Part No.	Nominal coil voltage	Pick-up voltage (max.)	Drop-out voltage (min.)	Max. allowable voltage	Coil resistance, Ω (±10%)	Nominal coil current, mA	Nominal operating power
HP2-AC6V	6 V DC	4.8 V AC	1.8 V AC	6.6 V AC	—	310	1.9 VA
HP2-AC12V	12	9.6	3.6	13.2	—	160	1.9
HP2-AC24V	24	19.2	7.2	26.4	—	78	1.9
HP2-AC48V	48	38.4	14.4	52.8	—	39	1.9
HP2-AC115V	115	92	34.5	126.5	—	18	2.1
HP2-AC220V	220	176	66	242	—	9.5	2.1
HP2-AC240V	240	192	72	264	—	9.0	2.2
HP3-AC6V	6	4.8	1.8	6.6	—	520	3.1
HP3-AC12V	12	9.6	3.6	13.2	—	260	3.1
HP3-AC24V	24	19.2	7.2	26.4	—	130	3.1
HP3-AC48V	48	38.4	14.4	52.8	—	65	3.1
HP3-AC115V	115	92	34.5	126.5	—	28.5	3.3
HP3-AC220V	220	176	66	242	—	14.2	3.1
HP3-AC240V	240	192	72	264	—	13.9	3.3
HP4-AC6V	6	4.8	1.8	6.6	—	800	4.8
HP4-AC12V	12	9.6	3.6	13.2	—	400	4.8
HP4-AC24V	24	19.2	7.2	26.4	—	200	4.8
HP4-AC48V	48	38.4	14.4	52.8	—	95	4.6
HP4-AC115V	115	92	34.5	126.5	—	42	4.8
HP4-AC220V	220	176	66	242	—	21	4.6
HP4-AC240V	240	192	72	264	—	20.5	4.9

NOTES

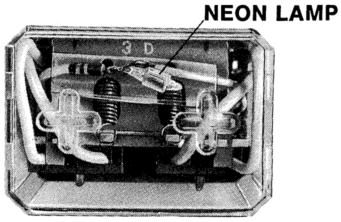
1. The range of coil current for AC relays is ±15% (60 Hz). For DC relays it is ±10% at 20° C, 68°F
2. The HP relay will operate in a range from 80% to 110% of the nominal coil voltage. It is, however, recommended that the relay be used in the range of 85% to 110% of the nominal coil voltage, with the 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.

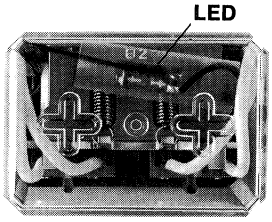
Voltage	2 Form C	3 Form C	4 Form C
220 V DC	7.3kΩ(5W)	7.45kΩ(5W)	7 kΩ(5W)
240 V DC	8.7kΩ(5W)	8.8 kΩ(5W)	8.3kΩ(5W)

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)





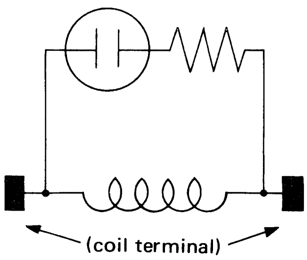
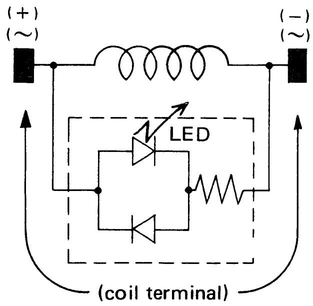
Types

Type	Coil Voltage	Indicating Lamp
HP2-L HP3-L HP3-ML HP4-L	(AC) 6V (DC) 6V 12V 12V 24V 24V 48V	LED (Light emitting diode)
	(AC) 115V (DC) 110V 220V 240V	Neon lamp

Note:

1. AC 48V 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

Note:

1. Pay attention to the polarity of coil. See circuit diagram (LED type only).

Operating current of LED

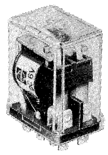
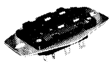
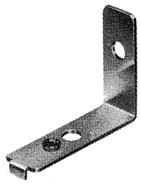
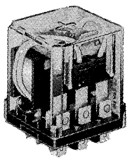
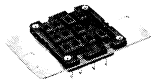
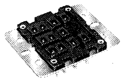
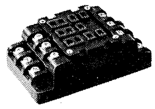
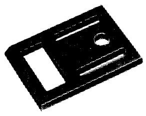
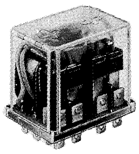
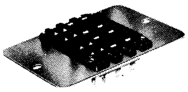
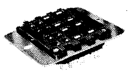
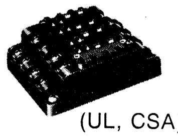
Coil Voltage	Operating current of LED
DC 6V	DC 6.4 mA
12V	5.7 mA
24V	4.7 mA
48V	4.5 mA
AC 6V	AC 10.5 mA
12V	9.0 mA
24V	7.7 mA

Note:

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

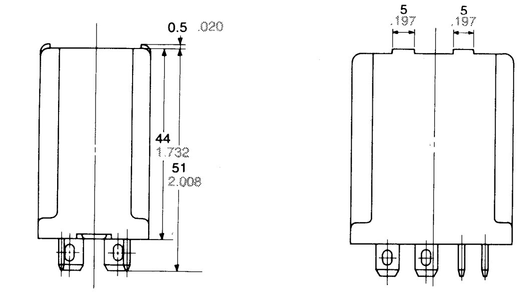
Please refer to "MOUNTING METHODS" for further information.
UL, CSA recognized except BRACKET and INSERTING PLATE.

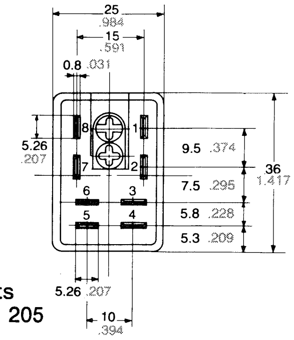
HP	Relay	**Solder terminal socket for round hole punching** (with hold-down clip)	**Solder terminal socket for rectangular hole boring** (with hold-down clip)	**Screw terminal socket for front wiring** (with hold-down clip)	**For HP2, HP4**
HP2		HP2-SRR  (UL, CSA, VDE)	HP2-SRS  (UL, CSA, VDE)	HP2-SF  (UL, CSA)	HP-BRACKET for direct mounting 
HP3		HP3-SRR  (UL, CSA, VDE)	HP3-SRS  (UL, CSA, VDE)	HP3-SF  (UL, CSA, VDE)	HP INSERTION PLATE for P/C board mounting 
HP4		HP4-SRR  (UL, CSA)	HP4-SRS  (UL, CSA)	HP4-SF  (UL, CSA)	

Note: Mounting screw is included in HP2-SF, HP3-SF and HP4-SF.

DIMENSIONS AND WIRING DIAGRAM

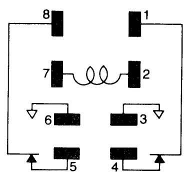
HP2 (2 Form C) Pierced terminal types





Accepts Faston 205

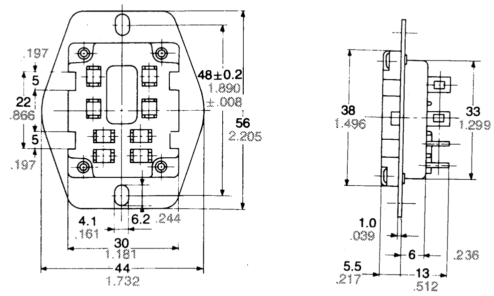
Circuit diagram



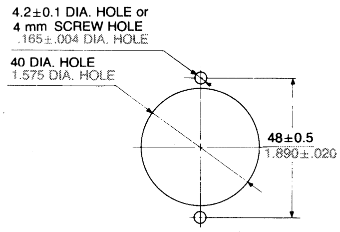
HP2-SRR (with hold-down clip)

mm inch

Easy mounting, round panel cut-out

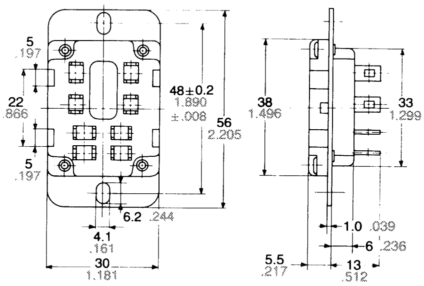


Mounting dimensions

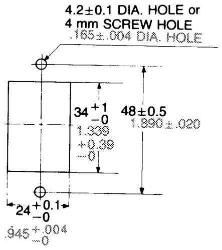


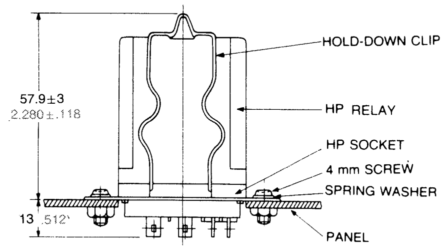
HP2-SRS (with hold-down clip)

Optimum space-saving panel cut-out.
Can be mounted from either the front or the rear of the panel.

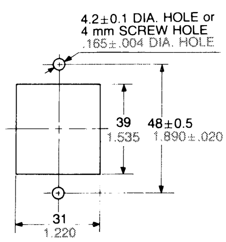


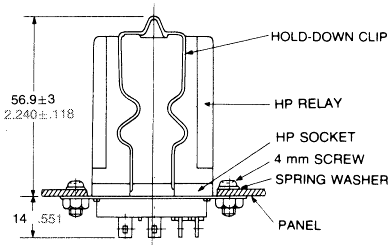
Front surface-mounting





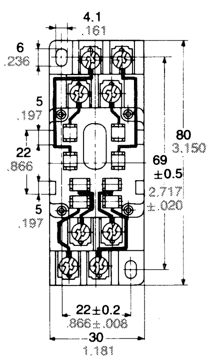
Rear surface-mounting

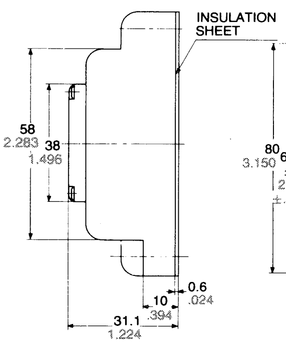




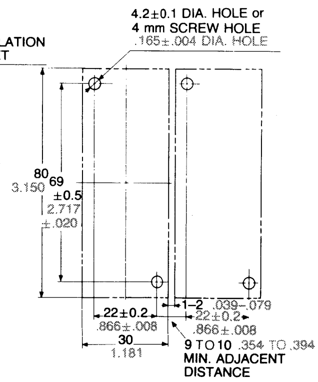
HP2-SF (with hold-down clip, mounting screw)

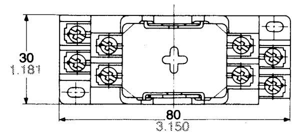
Front wiring in restricted space

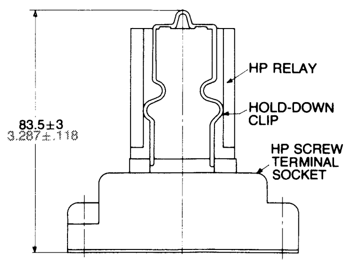




Mounting dimensions

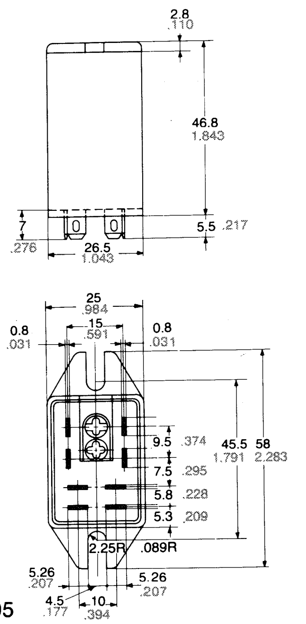


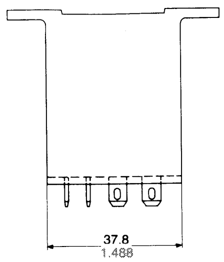




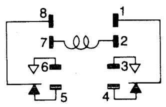
General tolerance: ±0.5 ±.020

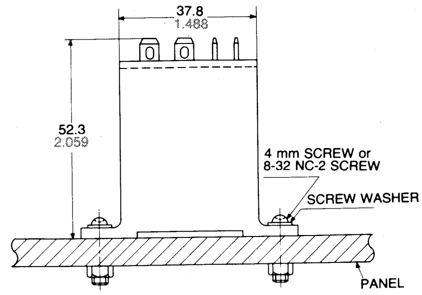
HP2-TM (2 Form C) Top mounting types



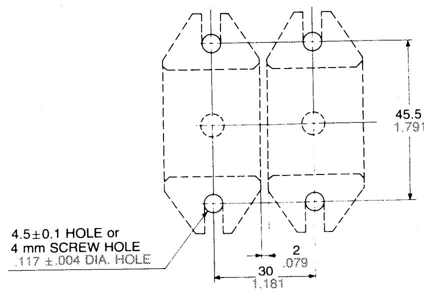


Circuit diagram



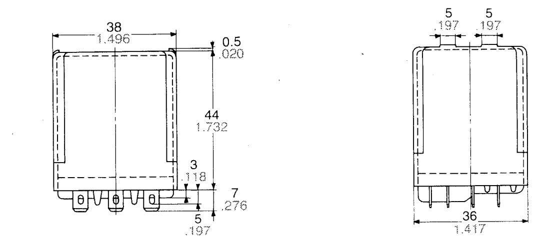


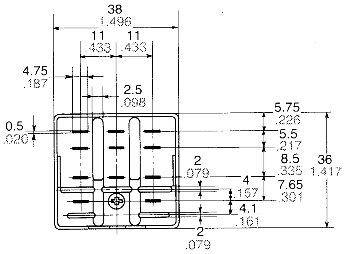
Mounting dimensions



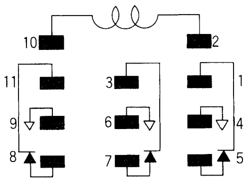
Accepts
Faston 205

HP3 (3 Form C) Pierced terminal types





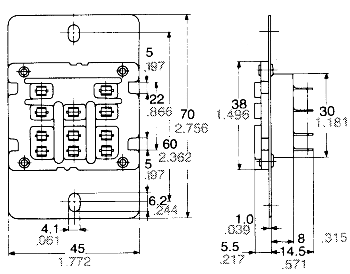
Circuit diagram



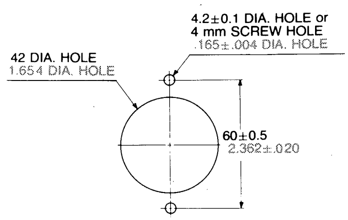
Accepts
Faston 187

HP3-SRR (with hold-down clip)

Easy mounting, round panel cut-out

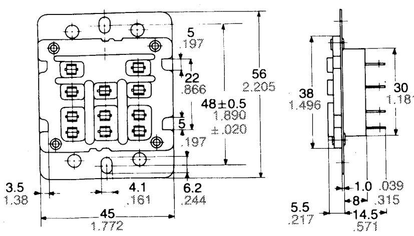


Mounting dimensions

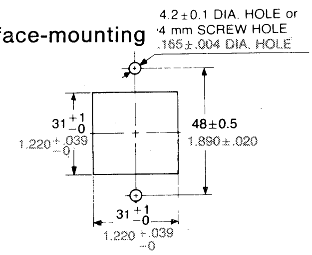


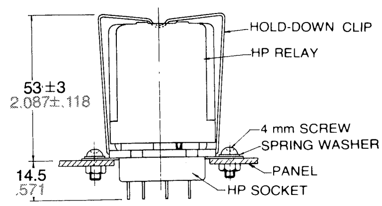
HP3-SRS (with hold-down clip)

Optimum space-saving panel cut-out
Can be mounted from either the front
or the rear of the panel

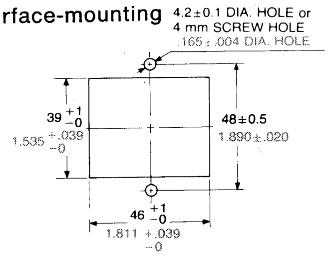


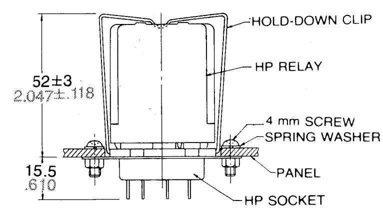
Front surface-mounting





Rear surface-mounting



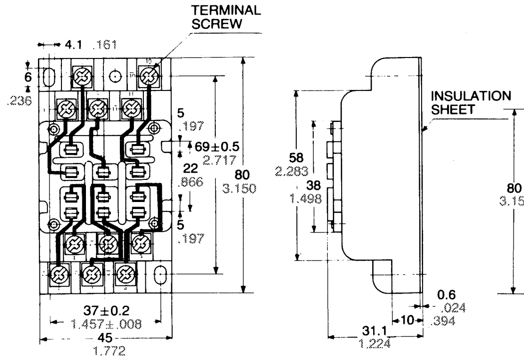


General tolerance: ±0.5 ±.020

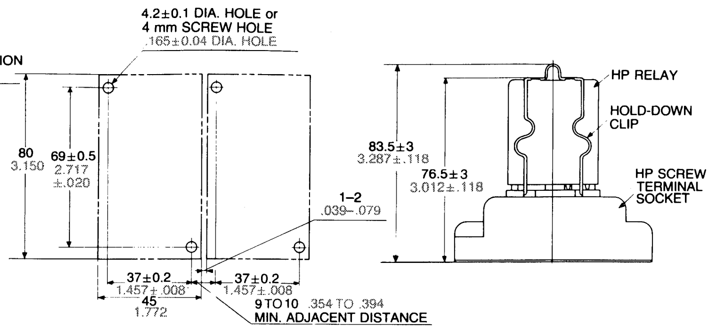
HP3-SF (with hold-down clip, mounting screw)

mm inch

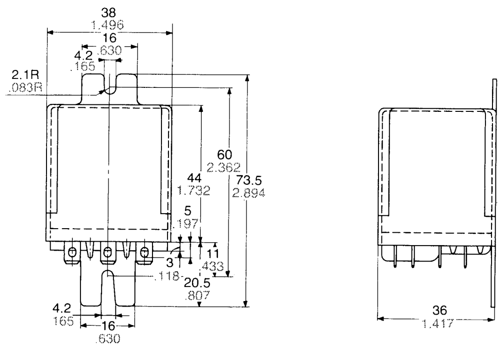
Front wiring in restricted space



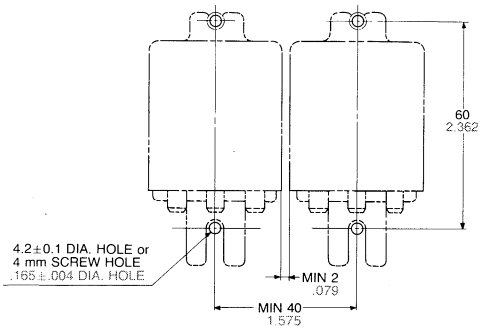
Mounting dimensions

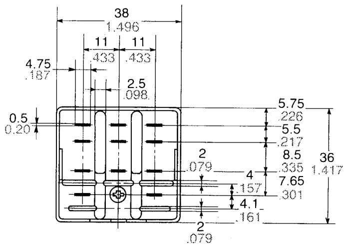


HP3-M (3 Form C) Slotted flange enclosure types

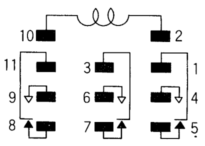


Mounting dimension

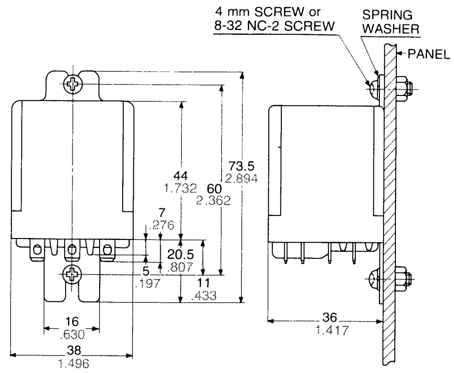




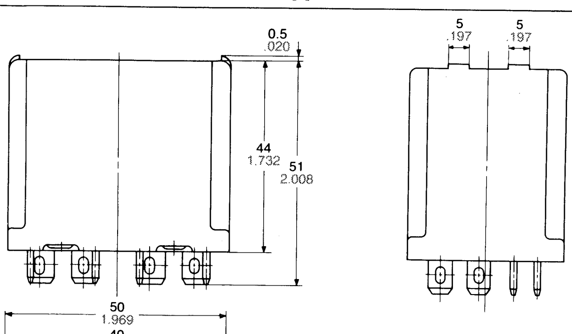
Circuit diagram

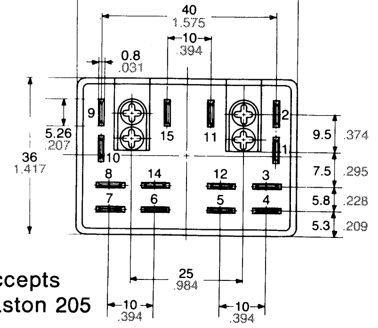


Accepts
Faston 187

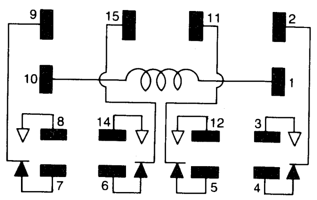


HP4 (4 Form C) Pierced terminal types





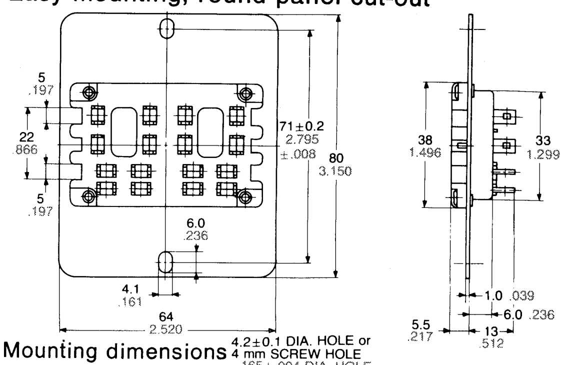
Circuit diagram



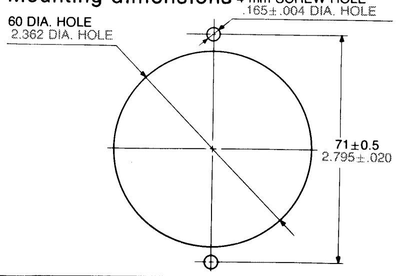
Accepts
Faston 205

HP4-SRR (with hold-down clip)

Easy mounting, round panel cut-out



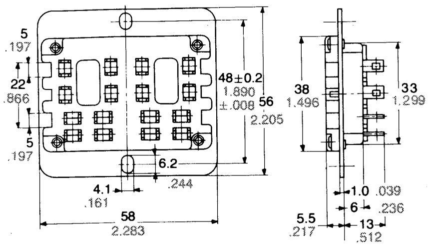
Mounting dimensions



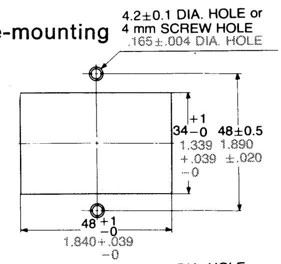
General tolerance: ±0.5 ±.020

HP4-SRS (with hold-down clip)

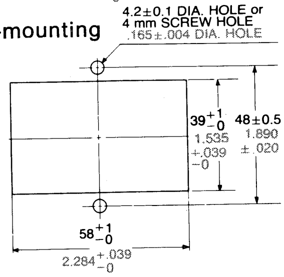
Optimum space-saving panel **cut-out**. Can be mounted from either the front or the rear of the panel.

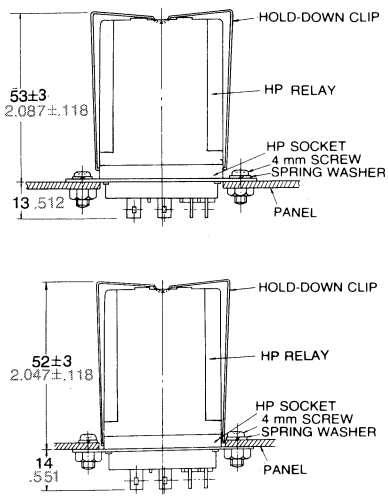


Front surface-mounting



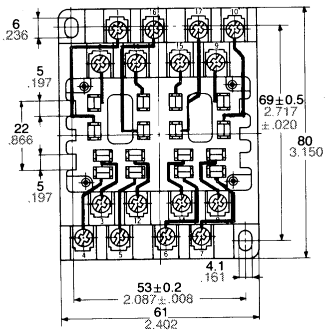
Rear surface-mounting

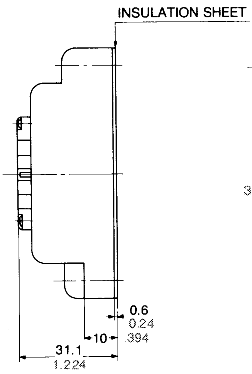




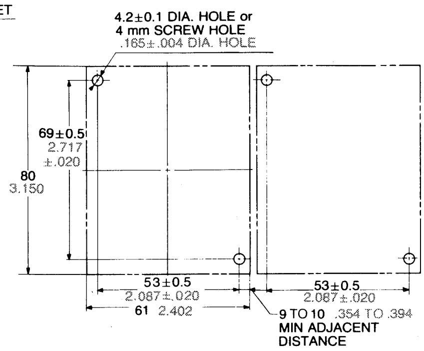
HP4-SF (with hold-down clip, mounting screw)

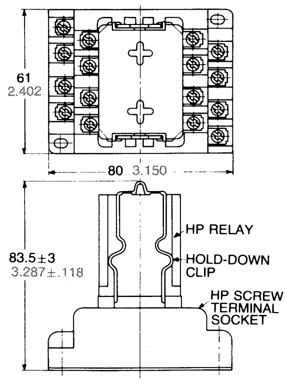
Front wiring in restricted space.
Two HP2 relays can be mounted in one socket.





Mounting dimensions





General tolerance: ±0.5 ±.020

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 0.8mm.

Mounting methods

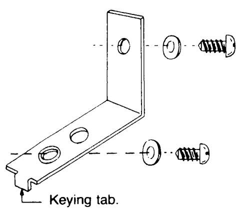
(a) Remove the M3 ×7 screw (red colored) fixed to the relay, and place the bracket on the relay with the attaching M3 ×7 screw (blue colored) and the spring washer.

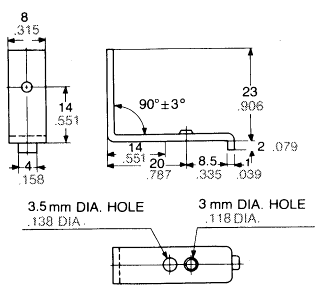
(b) Use the additional M3 ×7 screw and washer for attaching the bracket to the panel.

Note:

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.

For the HP4 type relay two brackets are used.





HP

Thickness of a special bracket	1.0mm (.039 inch)	1.6mm (.063 inch)	2.0mm (.079 inch)
A suitable screw	M3 × 7–M3 × 8	M3 × 8	M3 × 8–M3 × 10
A suitable washer	for M3	for M3	for M3

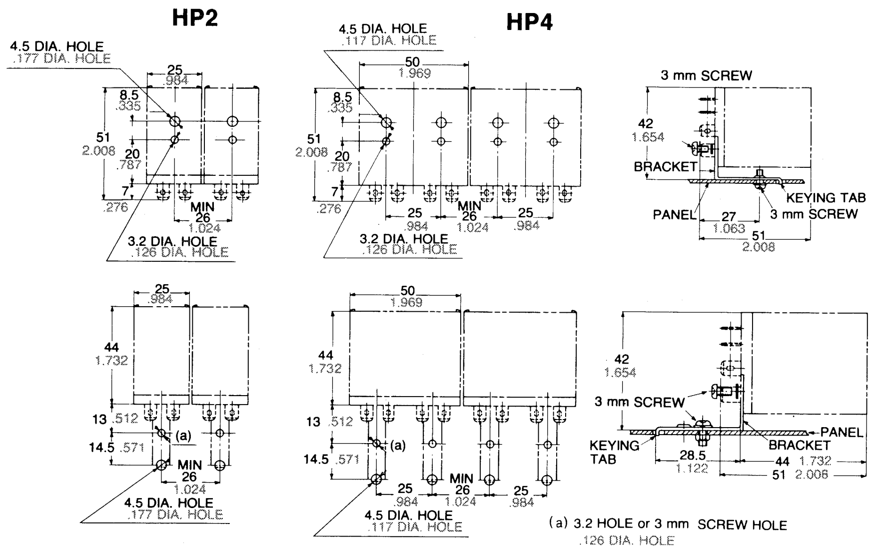
Screw M 3 × 7

Millimeter (M)
3mm diameter (3)
7mm length (7)

Dimensions and mounting methods

mm inch

1. Rear-surface mounting
2. Front-surface mounting

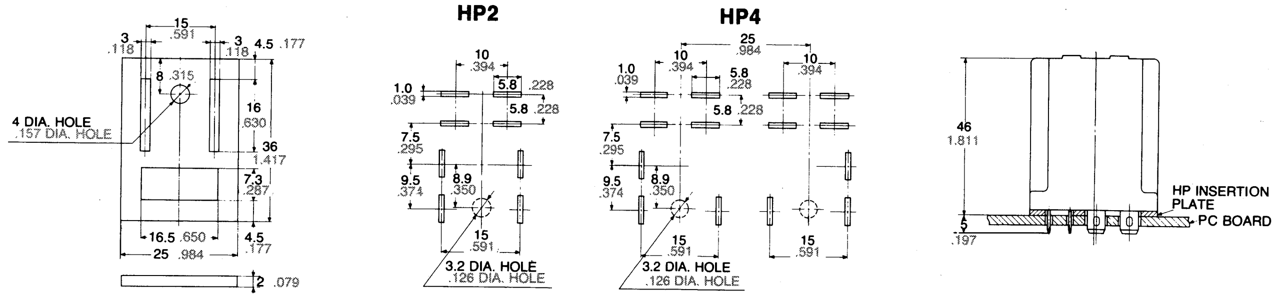


HP Inserting Plate for HP2 and HP4 types

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
1.0mm (.039 inch)	M3 × 10
1.2mm (.047 inch)	M3 × 10

PC board pattern



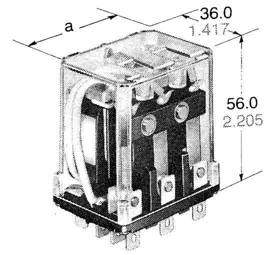
Please refer to the above second instruction.

Tolerance: ±0.1 ±.004

NAiS

20 AMP POWER RELAY

HG-RELAYS



mm inch

	a
HG2	34.0 1.339
HG3	50.0 1.969
HG4	68.0 2.667

UL File No.: E43028
CSA File No.: LR26550

- **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 1 A)	15 mΩ
UL rating (at 60 Hz) Single phase Three phase p.f. ≒ 0.75	 3/4 HP 125 V AC, 2 HP 250 V AC 2 HP 125 V AC, 3 HP 250 V AC 20 A 250 V AC
CSA rating (at 60 Hz) Single phase Three phase p.f. ≒ 0.75	 3/4 HP 125 V AC, 1 HP 250 V AC 2 HP 125 V AC, 1 HP 250 V AC 15 A 125 V AC, 10 A 250 V AC
Contact material	Silver-cadmium oxide

Characteristics (at 60 Hz, 20°C 68°F)

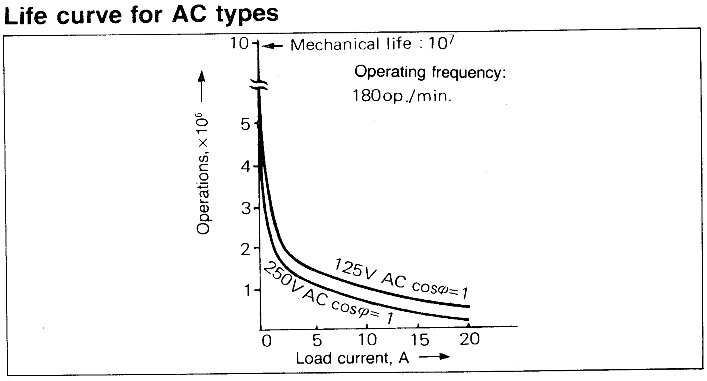
Maximum operating speed	20 cpm
Operate time (approx.)	(HG2) 15 msec. (HG3, HG4) 25 msec.
Release time (approx.)	(HG2) 15 msec. (HG3, HG4) 25 msec.
Breakdown voltage Between open contacts Between contact sets Between contacts and coil	 2,000 Vrms for 1 min. 2,000 Vrms for 1 min. 2,000 Vrms for 1 min.
Initial insulation resistance	Min. 100 MΩ at 500 V DC
Ambient temperature	−50°C to +40°C −58°F to +104°F

Shock resistance	Functional: 10 G (except for the contact moving direction)	
	Destructive: 100 G	
Vibration resistance	Functional: 6 G, 10 to 55 Hz at 1 mm double amplitude	
	Destructive: 12 G, 10 to 55 Hz at 2 mm double amplitude	
Unit weight	Approx. 130 g 4.59 oz (HG2) 185 g 6.53 oz (HG3) 250 g 8.82 oz (HG4)	

Expected life (min. operations)

Mechanical	AC type: 10^7, DC type: 10^6

Life curve for AC types



Electrical life with AC load

AC load	Voltage, V AC	Current, A	Expected life (min. operations)
Resistive (cosφ ≒ 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 msec.)	24	10	5×10^5
	125	0.4	5×10^5

Note: For DC inductive load, use of an arc extinguishing circuit is recommended.

ORDERING INFORMATION

Ex. HG [2] — [AC240V]

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 V

(Notes) 1. For UL/CSA recognized types, add suffix UL/CSA.
2. Standard packing Carton: HG2 20 pcs. Case: HG2 100 pcs.
HG3, HG4 10 pcs. HG3, HG4 50 pcs.

TYPICAL APPLICATIONS

Industrial machinery, machine tools, food processing and packing machines, office machines, transportation equipment and amusement devices.

TYPES AND COIL DATA

DC TYPES at 20°C 68°F

HG2 (2 Form C)

Part No.	Nominal coil voltage	Pick-up voltage (max.)	Drop-out voltage (min.)	Max. allowable voltage	Coil resistance, Ω (±10%)	Nominal coil current, mA	Operating power
HG2-DC6V	6 V DC	4.8 V DC	0.9 V DC	6.6 V DC	26.4	230	(approx.) 1.4 W
HG2-DC12V	12	9.6	1.8	13.2	100	119.6	
HG2-DC24V	24	19.2	3.6	26.4	416	57.6	
HG2-DC48V	48	38.4	7.2	52.8	1,585	30.3	
HG2-DC110V	110	88	16.5	121	7,650	14.4	

HG3 (3 Form C)

Part No.	Nominal coil voltage	Pick-up voltage (max.)	Drop-out voltage (min.)	Max. allowable voltage	Coil resistance, Ω (±10%)	Nominal coil current, mA	Operating power
HG3-DC6V	6 V DC	4.8 V DC	0.9 V DC	6.6 V DC	22.7	264	(approx.) 1.6 W
HG3-DC12V	12	9.6	1.8	13.2	89.5	134	
HG3-DC24V	24	19.2	3.6	26.4	364	66	
HG3-DC48V	48	38.4	7.2	52.8	1,450	33.1	
HG3-DC110V	110	88	16.5	121	6,670	16.5	

HG4 (4 Form C)

Part No.	Nominal coil voltage	Pick-up voltage (max.)	Drop-out voltage (min.)	Max. allowable voltage	Coil resistance, Ω (±10%)	Nominal coil current, mA	Operating power
HG4-DC6V	6V DC	4.8 V DC	0.9 V DC	6.6 V DC	18.5	325	(approx.) 2.1 W
HG4-DC12V	12	9.6	1.8	13.2	71.4	168	
HG4-DC24V	24	19.2	3.6	26.4	296	81.2	
HG4-DC48V	48	38.4	7.2	52.8	1,050	45.7	
HG4-DC110V	110	88	16.5	121	5,420	20.3	

AC TYPES (50/60 Hz) at 60 Hz, 20°C 68°F

HG2(2 Form C)

Part No.	Nominal coil voltage	Pick-up voltage (max.)	Drop-out voltage (min.)	Max. allowable voltage	Coil resistance, Ω (±10%)	Nominal coil current, mA	Operating power
HG2-AC6V	6 V AC	4.8 V AC	1.8 V AC	6.6 V AC	—	600	(approx.) 3.6 VA
HG2-AC12V	12	9.6	3.6	13.2	—	300	
HG2-AC24V	24	19.2	7.2	26.4	—	150	
HG2-AC48V	48	38.4	14.4	52.8	—	75	
HG2-AC115V	115	92	34.5	126.5	—	31.3	
HG2-AC220V	220	176	66	242	—	16.4	
HG2-AC240V	240	192	72	264	—	15	

HG3 (3 Form C)

Part No.	Nominal coil voltage	Pick-up voltage (max.)	Drop-out voltage (min.)	Max. allowable voltage	Coil resistance, Ω (±10%)	Nominal coil current, mA	Operating power
HG3-AC6V	6 V AC	4.8 V AC	1.8 V AC	6.6 V AC	—	864	(approx.) 5.2 VA
HG3-AC12V	12	9.6	3.6	13.2	—	432	
HG3-AC24V	24	19.2	7.2	26.4	—	216	
HG3-AC48V	48	38.4	14.4	52.8	—	108	
HG3-AC115V	115	92	34.5	126.5	—	45.2	
HG3-AC220V	220	176	66	242	—	23.6	
HG3-AC240V	240	192	72	264	—	21.6	

HG4 (4 Form C)

Part No.	Nominal coil voltage	Pick-up voltage (max.)	Drop-out voltage (min.)	Max. allowable voltage	Coil resistance, Ω (±10%)	Nominal coil current, mA	Operating power
HG4-AC6V	6 V AC	4.8 V AC	1.8 V AC	6.6 V AC	—	1,264	(approx.) 7.6 VA
HG4-AC12V	12	9.6	3.6	13.2	—	632	
HG4-AC24V	24	19.2	7.2	26.4	—	316	
HG4-AC48V	48	38.4	14.4	52.8	—	158	
HG4-AC115V	115	92	34.5	126.5	—	66.1	
HG4-AC220V	220	176	66	242	—	34	
HG4-AC240V	240	192	72	264	—	31.6	

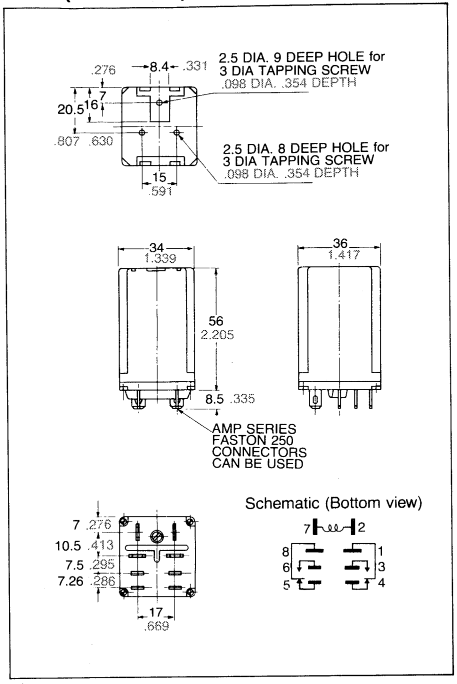
Notes:

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.

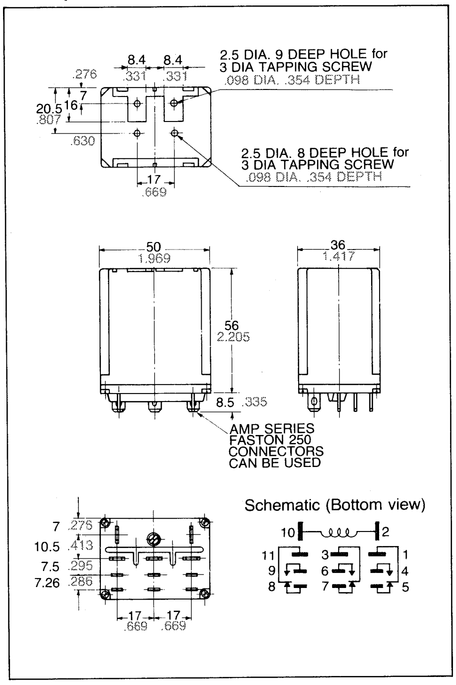
DIMENSIONS

mm inch

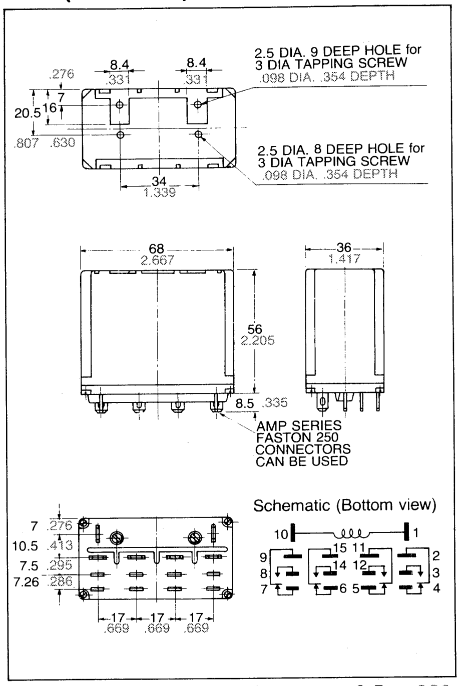
HG2 (2 Form C)



HG3 (3 Form C)



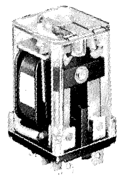
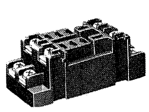
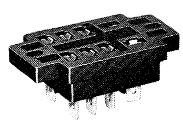
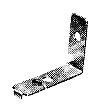
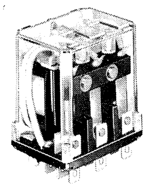
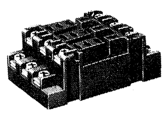
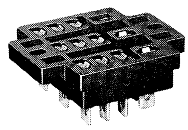
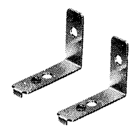
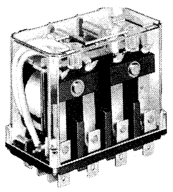
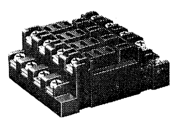
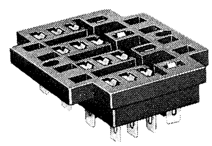
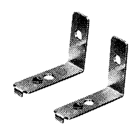
HG4 (4 Form C)



General tolerance: ±0.5 ±.020

ACCESSORIES

Please refer to "MOUNTING METHOD" for further information.

HG	Relay	Screw terminal socket front wiring (with hold-down clip)	Solder terminal socket for rectangular hole (with hold-down clip)	Bracket for direct mounting
HG2 (2 Form C)		HG2-SF 	HG2-SS 	HP-BRACKET  1 pc.
HG3 (3 Form C)		HG3-SF 	HG3-SS 	HP-BRACKET  2 pcs.
HG4 (4 Form C)		HG4-SF 	HG4-SS 	HP-BRACKET  2 pcs.

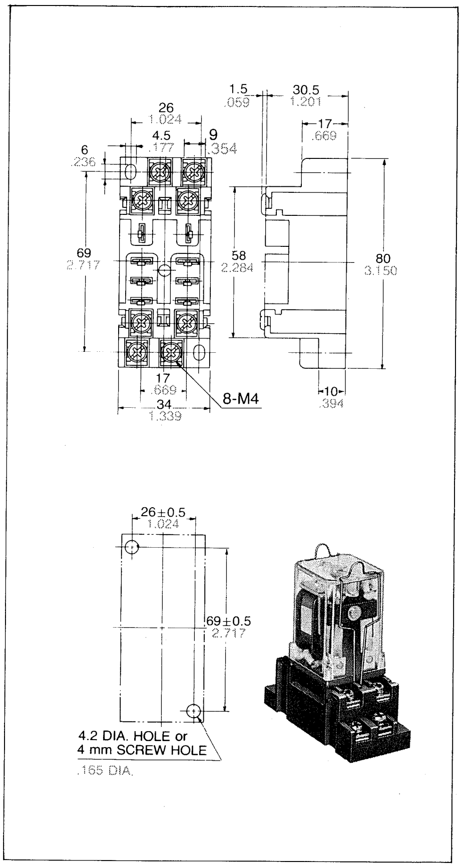
Note: Tapping-screw holes are provided on the cover top for direct mounting.

MOUNTING METHOD AND DIMENSIONS

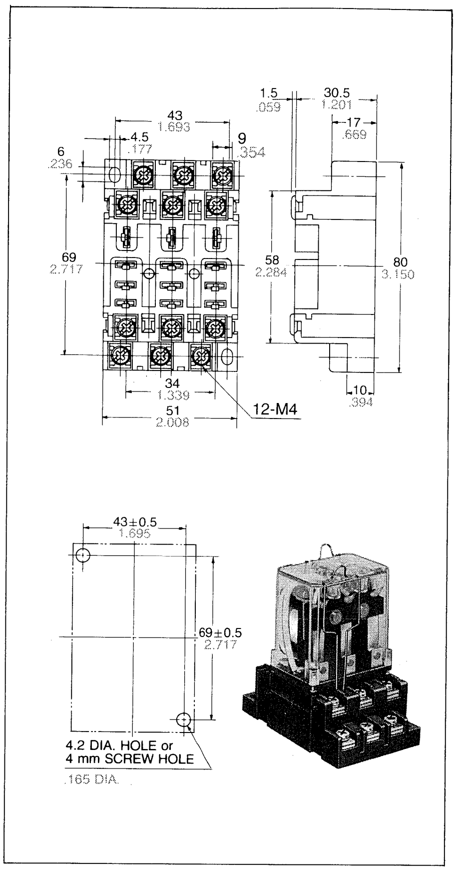
Screw terminal socket (Hold-down clips included)

mm inch

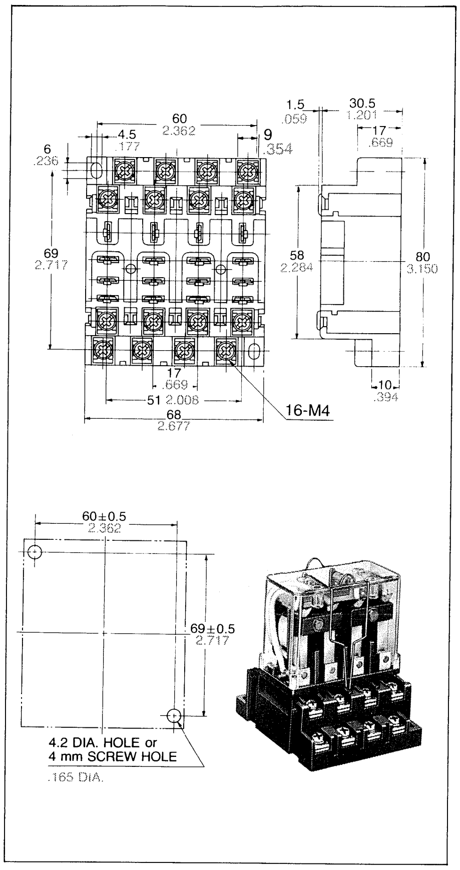
HG2-SF



HG3-SF

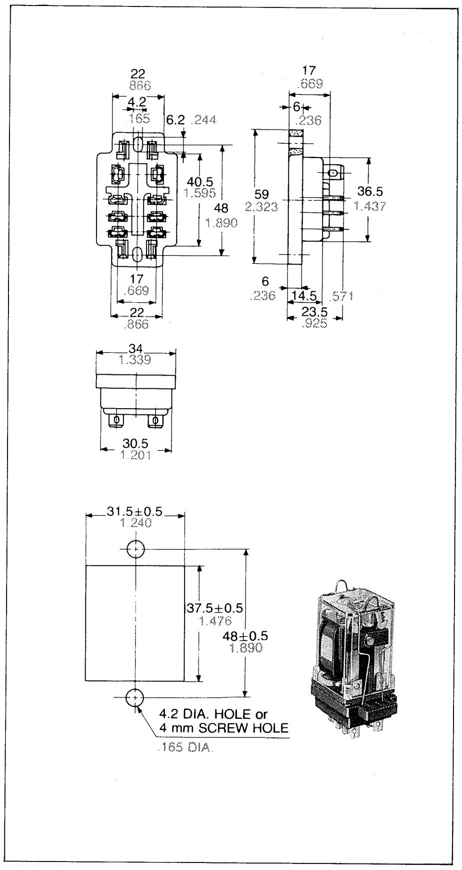


HG4-SF

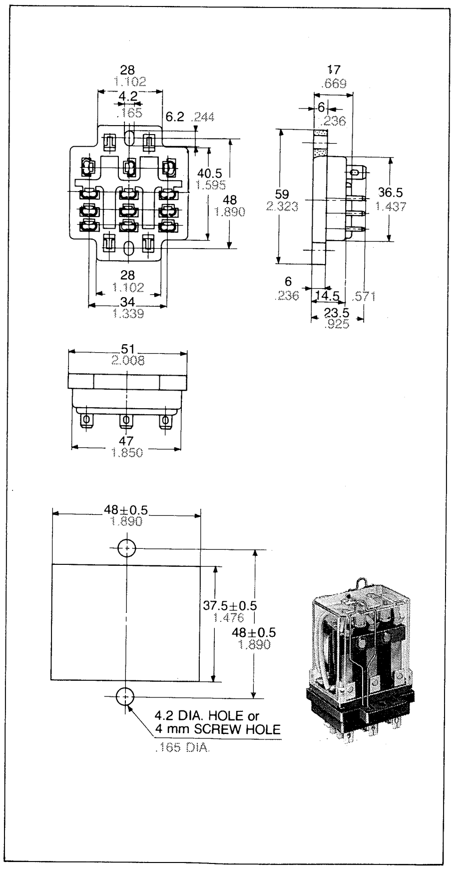


Solder terminal socket (Hold-down clips included)

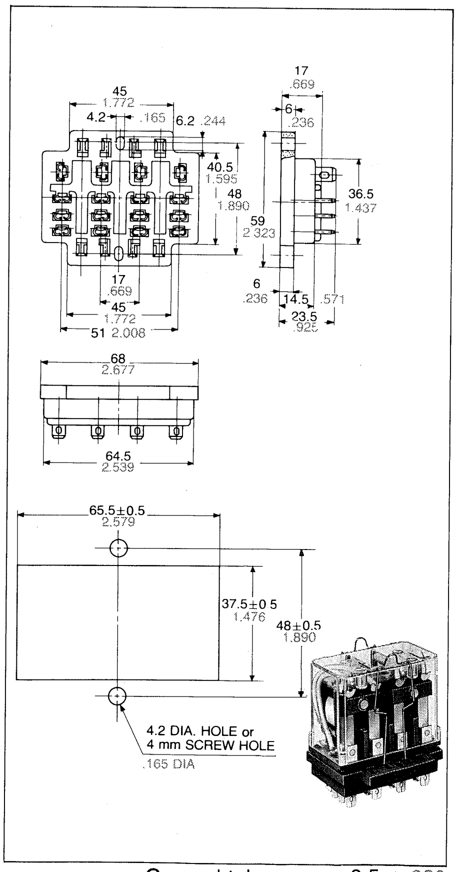
HG2-SS



HG3-SS



HG4-SS



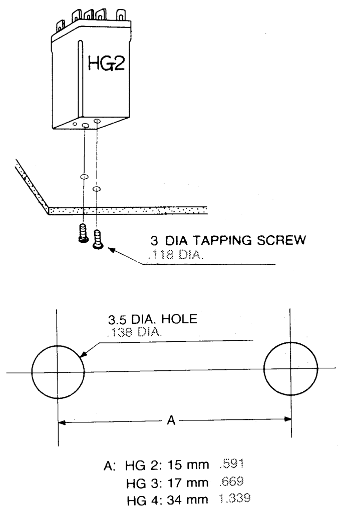
Note: HG sockets accept Faston 250.

General tolerance: ±0.5 ±.020

mm inch

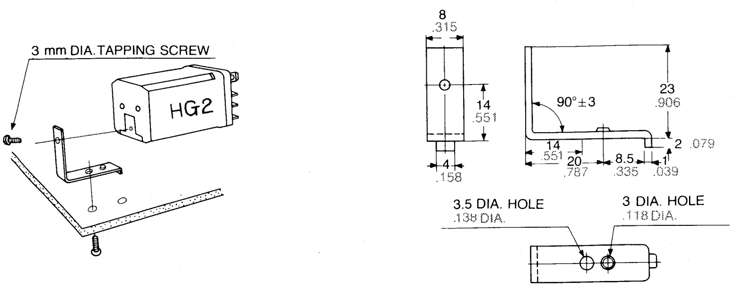
Direct mounting

Faston 250 series quick-connectors can be used.



Direct mounting with HP-BRACKET

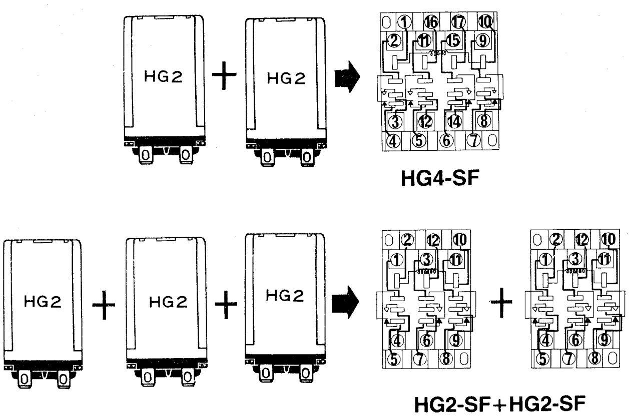
Faston 250 series quick-connectors can be used.

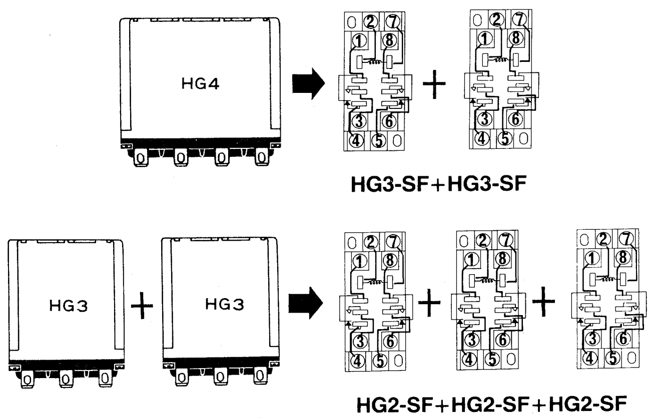


Use two brackets for HG3 and HG4.

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 to avoid damage to relay coils.

Socket Combinations





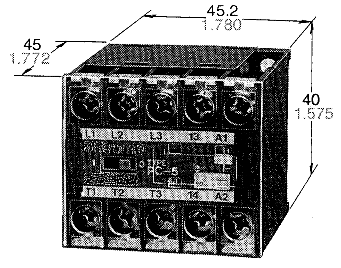
NOTES

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.

NAiS

POLARIZED HIGH POWER RELAYS

MC Mini-Contactor



UL File No.: E43028
CSA File No.: LR52199-6, SEV

- High sensitive and small sized power relay
- Direct motor drive by IC output (Power consumption: 500 mW)
- Surge suppression circuit incorporated
- DIN rail mounting possible

SPECIFICATIONS

Contact arrangement			4 Form X, 3 Form X 1 Form Y, 2 Form X 2 Form Y		
Terminals			M3.5 screws		
"a" contact (Form X)	Motor load		1 phase 120 V	1 phase 240 V	3 phase 240 V
		F.L.A.	10 A	10 A	10 A
		L.R.A.	60 A	60 A	60 A
	General use		15 A 120 V, 10 A 240 V		
	Tungsten lamp		6 A 240 V		
"b" contact (Form Y)	General use		10 A 240 V		
	Pilot duty		A 300		
Expected life			Mechanical: 10^7 Electrical: 25×10^4 (Motor/General) 10^5 (Tungsten lamp)		
Insulation resistance			More than 100 MΩ (by 500 V DC megger)		
Dielectric strength			2,500 V AC for more than 1 minute (initial)		
Coil surge voltage			Less than 50 V		
Impulse resistance of surge absorption circuit			More than 500 V		
Usable range of coil voltage			85%V to 120%V of rated voltage		
Usable temp. & humidity			−10°C to +50°C 14°F to 122°F, less than 85% RH		
Permissible mounting direction			Gravity ↓ or		
Weight			150 g 5.29 oz		

TYPICAL APPLICATIONS

Transportation machines, Machine tools, Copiers, Dryers, etc.

ORDERING INFORMATION

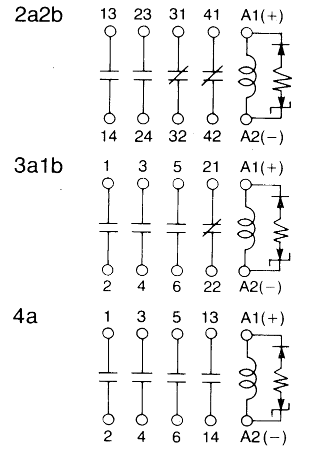
Ex. MC — 4a — DC12V

Contact arrangement	Coil voltage
4a: 4 Form X 3a1b: 3 Form X 1 Form Y 2a2b: 2 Form X 2 Form Y	DC 12 V DC 24 V

COIL DATA at 20°C 68°F

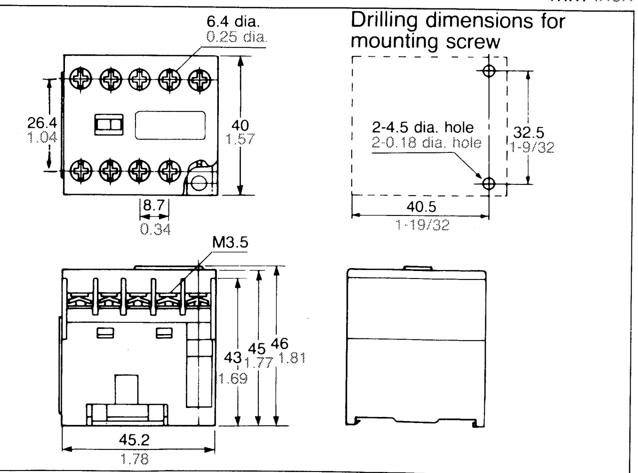
Rated coil voltage	Pick-up voltage	Drop-out voltage	Rated energized current	Rated power consumption	Operating speed	
					Making	Breaking
DC 12 V	Max. 9.6 V DC	Min. 1.2 V DC	42 mA	500 mW	Below 100 ms	Below 30 ms
DC 24 V	Max. 19.2 V DC	Min. 2.4 V DC	21 mA	500 mW	Below 100 ms	Below 30 ms

CONTACT ARRANGEMENT

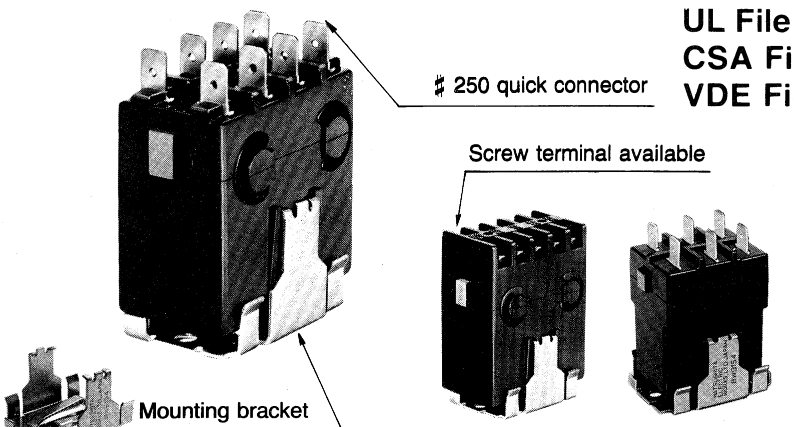


DIMENSIONS

mm inch



NAiS | HEAVY DUTY POWER RELAYS | # VC-RELAYS



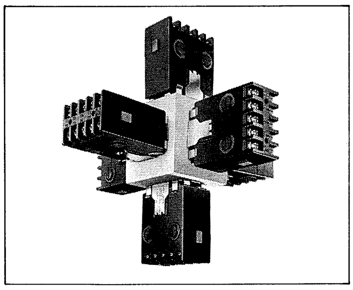
VC15S-4a AC coil VC20-2a DC coil

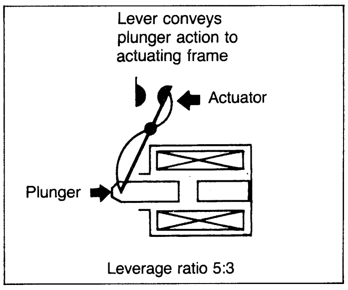
UL File No.: E43028
CSA File No.: LR26550
VDE File No.: VDE-Reg.-Nr. 1785 (VC15 type)
VDE-Reg.-Nr. 1786 (VC20 type)

- **Large capacity with Form X contacts —1.5 kW 1 phase through 3.7 kW 3 phase 240 V AC motor**
- **Wide range of types for various applications**

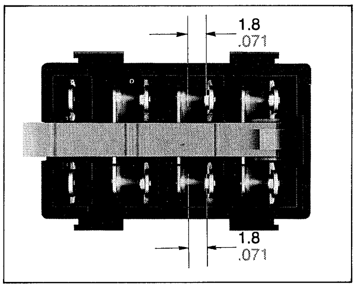
FEATURES ON CONSTRUCTION

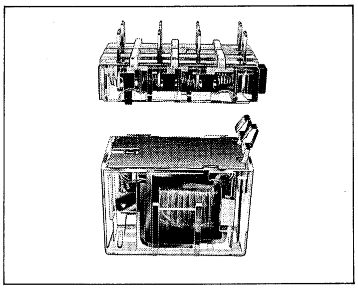
1. Multipositional snap-mounting
2. Lever action mechanism provides heavy-duty switching
3. Wide, 3.6 mm contact-gap with 2-point contacts
4. Separate blocks for contacts and coils provides high insulation





mm inch





TYPICAL APPLICATIONS

VC Power relays are specially designed for control of heavy duty loads. You can be assured of a minimum of 250,000 faultless operations of this unit. It also ensures the lowest total cost with highest quality for applications such as:

Home appliances: Air conditioners, blowers, electronic ranges . . . .
Office equipment: Copiers, time recorders, shredders . . . .
Power devices: Pumps, fans, motor drives . . . .
Automatic vending machines: Food and cigarette venders . . . .
Electrical heating equipment: Dryers, heaters, molding machines . . . .

ORDERING INFORMATION

Ex. VC 15 (20) [S] — [4a] — [AC240V] — [K]

Terminal type
Nil: Quick connection
S: Screw terminal (only for 4a or 3a1b)

Contact arrangement*
4a: 4 Form X
3a1b: 3 Form X 1 Form Y
2a2b: 2 Form X 2 Form Y
3a: 3 Form X
2a1b: 2 Form X 1 Form Y
2a: 2 Form X
1a1b: 1 Form X 1 From Y
1a: 1 Form X

Coil voltage*	
AC 24 V	DC 12 V
AC 48 V	DC 24 V
AC 110 V	DC 48 V
AC 120 V	
AC 220 V	
AC 240 V	

Suffix "K" follows some type numbers with AC coil type. For detail, refer to the TYPES at pages 311.

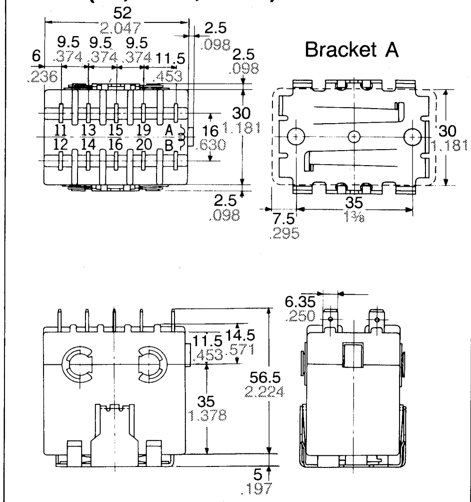
(Notes) 1. For UL/CSA recognized types, add suffix UL/CSA.
2. Standard packing Case: 50 pcs.

*As to combination availability of contact arrangement and coil voltage, refer to TYPES in page 311 and 312.

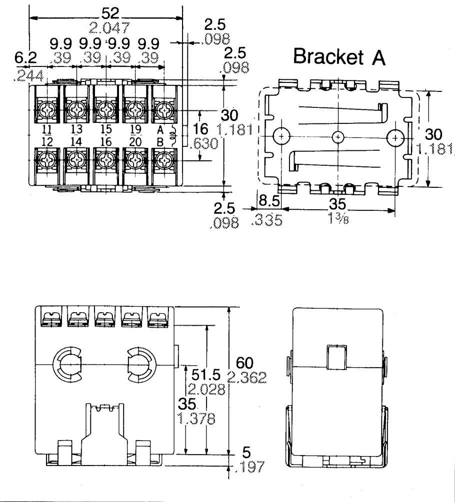
DIMENSIONS

mm inch

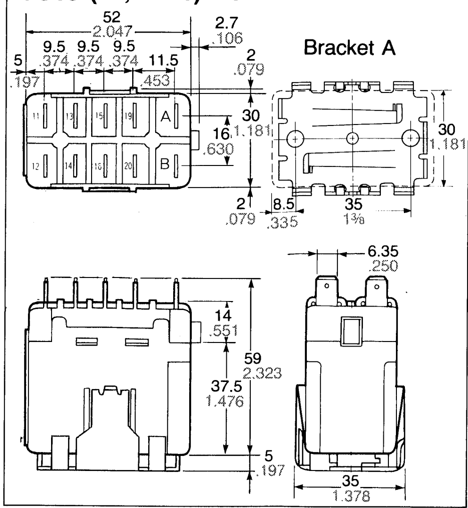
VC15 (4a, 3a1b, 2a2b)-AC-K



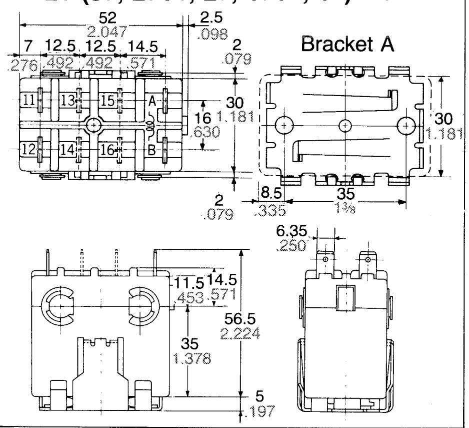
VC15S-AC-K



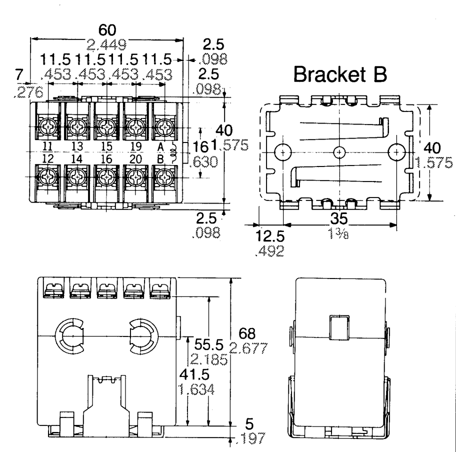
VC15 (4a, 3a1b)-DC



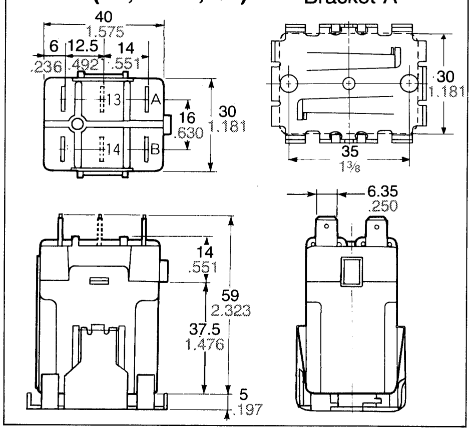
VC15 (3a, 2a1b, 2a)-AC-K
VC20 (3a, 2a1b, 2a, 1a1b, 1a)-AC-K



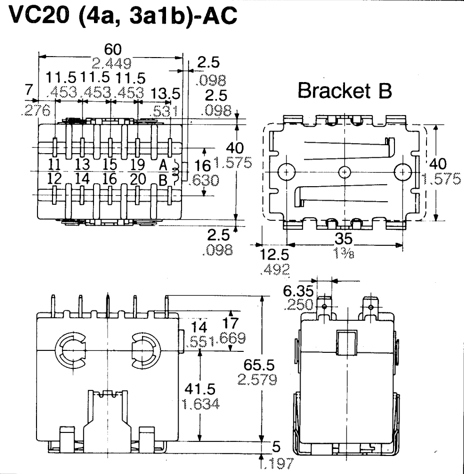
VC20S-AC



VC15 (2a, 1a1b, 1a)-DC
VC20 (2a, 1a1b, 1a)-DC



VC20 (4a, 3a1b)-AC



SPECIFICATIONS

Coil input		AC						
Types		**VC15**		**VC15S**	**VC20**		**VC20S**	**Remarks**
Contact arrangement		4a, 3a1b, 2a2b	3a, 2a1b, 2a	4a, 3a1b	4a, 3a1b	3a, 2a1b, 2a, 1a1b, 1a	4a, 3a1b	
Terminals		#250 quick connector		3.5 mm dia. screw	#250 quick connector		4 mm dia. screw	
Acceptable wire size	**Single wire**	1.6 mm (AWG14)			2.0 mm (AWG12)			
	Stranded wire	2.0 mm² (AWG14)			3.5 mm² (AWG12)			
Motor loads	**1 phase, 120 V**	1/3 HP			1 HP			
	1 phase, 240 V	1 HP			2 HP			
	3 phase, 240 V	2 HP		1 HP	5 HP			
	3 phase, 380 V	(2 HP)			(5 HP)			(IEC)
Resistive loads	**1 phase, 120 V**	15 A			20 A			
	1 phase, 240 V	15 A		10 A	20 A			
	3 phase, 240 V	15 A		10 A	20 A			
Tungsten, lamp loads	**1 phase, 240 V**	6 A			12 A			
Maximum contact current	**"b" contact (p.f. = 1)**	3 A			3 A			
Max. operating voltage		IEC 380 V AC			UL, CSA 300 V AC			
Breaking capacity ("a" contact)	**3 phase, 240 V (p.f. = 0.4)**	80 A			160 A			IEC AC3
	3 phase, 380 V (p.f. = 0.4)	40 A			80 A			
Making capacity ("a" contact)	**3 phase, 240 V (p.f. = 0.4)**	80 A			160 A			IEC AC3
	3 phase, 380 V (p.f. = 0.4)	40 A			80 A			
Expected life	**Electrical (max. rated current)**	250,000 operations*						
	Mechanical	1,000,000 operations						
Unit weight (with bracket)		190 g	180 g	210 g	270 g	190 g	320 g	

Note: *In the case of 12 A lamp loads, the expected life is 100,000 operations.

TYPES

• **AC coils**

Contact arrangement \ Types	VC15	VC15S	VC20	VC20S
4 Form X	VC15-4a-AC***V-K	VC15S-4a-AC***V-K	VC20-4a-AC***V	VC20S-4a-AC***V
3 Form X 1 Form Y	VC15-3a1b-AC***V-K	VC15S-3a1b-AC***V-K	VC20-3a1b-AC***V	VC20S-3a1b-AC***V
2 Form X 2 Form Y	VC15-2a2b-AC***V-K	—	—	—
3 Form X	VC15-3a-AC***V-K	—	VC20-3a-AC***V-K	—
2 Form X 1 Form Y	VC15-2a1b-AC***V-K	—	VC20-2a1b-AC***V-K	—
2 Form X	VC15-2a-AC***V-K	—	VC20-2a-AC***V-K	—
1 Form X 1 Form Y	—	—	VC20-1a1b-AC***V-K	—
1 Form X	—	—	VC20-1a-AC***V-K	—

COIL DATA at 20°C 68°F

• **AC coils** (120 V AC)

Types			VC15 (3a, 2a1b, 2a) VC20 (2a, 1a1b, 1a)		VC15 (4a, 3a1b, 2a2b) VC15S, VC20 (3a, 2a1b)		VC20 (4a, 3a1b) VC20S	
Nominal coil voltage			120 V AC		120 V AC		120 V AC	
Frequency, Hz			60	50	60	50	60	50
Coil input	**Inrush**	**mA**	138	167	167	200	267	292
		VA	16.5	20	20	24	32	35
	Sealed	**mA**	42	50	46	55	65	77
		VA	5	6	5.5	6.6	7.8	9.2
Pick-up voltage, V AC (max.)			96	96	96	96	96	96
Drop-out voltage, V AC (min.)			24	24	24	24	24	24

SPECIFICATIONS

Coil input		DC			
Types		VC15		VC20	Remarks
Contact arrangement		4a, 3a1b	2a, 1a1b, 1a	2a, 1a1b, 1a	
Terminals		♯ 250 quick connector			
Acceptable wire size	Single wire	1.6 mm (AWG14)		2.0 mm (AWG12)	
	Stranded wire	2.0 mm² (AWG14)		3.5 mm² (AWG12)	
Motor loads	1 phase, 120 V	1/2 HP	1/3 HP	1 HP	
	1 phase, 240 V	1 HP		2 HP	
	3 phase, 240 V	2 HP		—	
	3 phase, 380 V	(2 HP)		—	(IEC)
Resistive loads	1 phase, 120 V	15 A		20 A	
	1 phase, 240 V	15 A		20 A	
	3 phase, 240 V	15 A		—	
Tungsten, lamp loads	1 phase, 240 V	6 A		12 A	
Maximum contact current	"b" contact (p.f. = 1)	3 A		3 A	
Max. operating voltage		IEC 380 V AC UL, CSA 300 V AC			
Breaking capacity ("a" contact)	3 phase, 240 V (p.f. = 0.4)	80 A		—	IEC AC3
	3 phase, 380 V (p.f. = 0.4)	40 A		—	
Making capacity ("a" contact)	3 phase, 240 V (p.f. = 0.4)	80 A		—	IEC AC3
	3 phase, 380 V (p.f. = 0.4)	40 A		—	
Expected life	Electrical (max. rated current)	250,000 operations*			
	Mechanical	1,000,000 operations			
Unit weight (with bracket)		190 g	150 g	150 g	

Note: *In the case of 12 A lamp loads, the expected life is 100,000 operations.

TYPES

• **DC coils**

Contact arrangement \ Types	VC15	VC20
4 Form X	VC15-4a-DC**V	—
3 Form X 1 From Y	VC15-3a1b-DC**V	—
2 Form X	VC15-2a-DC**V	VC20-2a-DC**V
1 Form X 1 Form Y	VC15-1a1b-DC**V	VC20-1a1b-DC**V
1 Form X	VC15-1a-DC**V	VC20-1a-DC**V

COIL DATA at 20°C 68°F

• **DC coils** (24 V DC)

Types	VC15 (4a, 3a1b)	VC15 (2a, 1a1b, 1a) VC20 (2a, 1a1b, 1a)
Nominal coil voltage	24 V DC	24 V DC
Coil resistance (±10%)	163 Ω	174 Ω
Pick-up voltage, V DC (max.)	20.4	20.4
Drop-out voltage, V DC (min.)	2.4	2.4

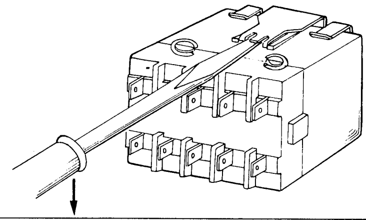
Note: Above values are average under hot condition, when horizontally mounted.

Characteristics (AC, DC common)

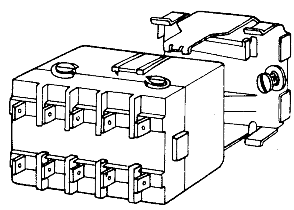
Max. operate time	25 msec.
Max. release time	25 msec.
Contact bounce time	5 msec.
Dielectric strength	(Initial)
Between open contacts (inc. coil terminal)	2,500 Vrms
Between load & source with open contacts	2,500 Vrms
Insulation resistance	
Between open contacts (inc. coil terminal)	Over 100 MΩ (initial) at 500 V DC
Between load & source with open contacts	Over 100 MΩ (initial) at 500 V DC
Switching speed	
Electrical	1,200 times/hour
Mechanical	14,400 times/hour
Ambient temp. (max. humidity)	−10°C to +40°C 14°F to +40°F (max. 85% R.H.) +40°C to +55°C 104°F to 131°F (max. 75% R.H.)
Shock resistance	Min. 20 G
Vibration resistance	Min. 5 G

MOUNTING

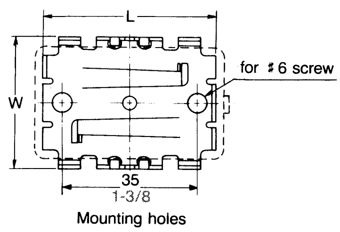
Gentle lifting of the bracket clamp with the tip of a screwdriver permits easy removal.



The mounting bracket is simply screwed in the desired location and the relay firmly snapped into the bracket.



mm inch



Mounting bracket

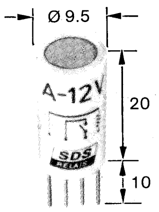
	L	W
Bracket A	45 1.772	35 1.378
Bracket B	50 1.969	45 1.772

• Bracket B is for VC-20-4a, 3a1b and VC20S-4a, 3a1b types.
• Mounting bracket is provided with each model.

NAiS

REED RELAY

A-RELAYS



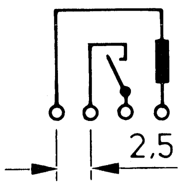
- **Single-in-line reed relay.**
- **Horizontal mounting possible by bending the pin connections.**

Specifications

max. make/break current	A	0.8/0.1	insulation resistance	Ω	10^9
max. rated current	A	0.5	shock resistance	g	30
max. break voltage	V	50	vibration resistance	g/Hz	20/55
max. break load	W(VA)	3(5)	capacitance: contact/contact/coil	pF	1.1/4.3
max. make/break/bounce time	ms	0.5/0.1/0.7	permissible temperature limits	°C	−10/+80
max. switching frequency	Hz	300	dwell time at 350°C in solder bath	s	5
voltage withstand: contact/contact	V_{rms}	250	operational life 1) mechanical / 0.2 A, 10 W	ops.	10^9/–
voltage withstand: contact/coil	V_{rms}	500	0.1 A, 5 W / 0.1 A, 2.4 W	ops.	$10^6/5 \cdot 10^6$

Connection diagramm Bottom view. Hole dia. $0.9^{+0.2}$

A



Coil data

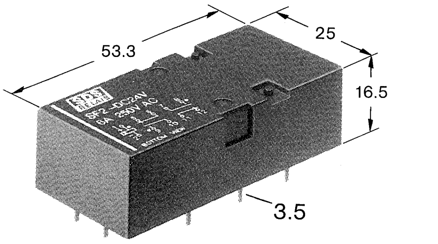
Type	Coil voltage Pick-up V	Coil voltage Drop-out V	Coil voltage Per-miss. 40°C	No. of win-dings	Resi-stance Ω	Power con-sumpt. mW
A - 5V	3.5	0.5	7	2930	200	125
A -12V	7.5	1	15	5700	800	180
A -24V	16	2	28	9110	2000	288

Excitation voltage ripple should be maintained below 5% by use of appropriate smoothing.
Suitable for most common washing methods except ultrasonic cleaning.
Strong external magnetic fields influence relay data.
1) Data concerning operational life is based on resistive loads and ambient temperature of 20–30°C.

NAiS

POLARISED, MONOSTABLE SAFETY RELAY WITH FORCED OPERATION CONTACTS COMPLYING WITH ZH1/457

SF2-RELAYS



Tolerance ± 0.3
Weight approx 37 g

- **Creepage distances and airgaps:**
  Contact/Contact C = 4.7 mm
  A = 4.3 mm
  Contact/coil C = 4.6 mm
  A = 4.4 mm
- **As per VDE 0110**
  Contamination level 3/250 V
  Overvoltage category III/300 V
- **Degree of protection IP67 (washable)**

Characteristics

Contact configuration (a = Normally open, b = Normally closed)		2a2b
Volumetric resistance (at 6 Vdc, 1 A new condition)	mΩ	-/<30
Max. make-/rated-/break current	A	20/10/6
Max. switched voltage	V	440
Max. switched load (resistive load, 1))	W (VA)	150 (1500 2))
Min. switched voltage/switching current	V/mA	10/10
Pick-up/nominal power consumption at 20°C	mW	280/500
Pick-up/drop-out voltage in % of nominal voltage at 20°C		75/10
Pick-up/drop-out-/bounce time (approx. values at U_{rated})	ms	17/7/2
Max. switching frequency	Hz	10
Operational life mechanical	Sw.ops	10^7
Permissable ambient temperature at rated power consumption	°C	-40/+70
Upper temperature limit	°C	105
Thermal resistance (max. packing density)	K/W	see Thermal Loading capability
Test voltage open contact/contact-contact/contact-coil	V_{rms}	2500
Insulation resistance at 500 Vdc (new condition)	Ω	10^9
Shock resistance (11 ms), Vibration resistance3)	g, g/Hz	30, 10/10-55
Degree of protection		IP67/IP302)

1) at 10^5 switching operations, ambient temperature +70°C
2) with breather hole; 3) Contact interruption <10µs

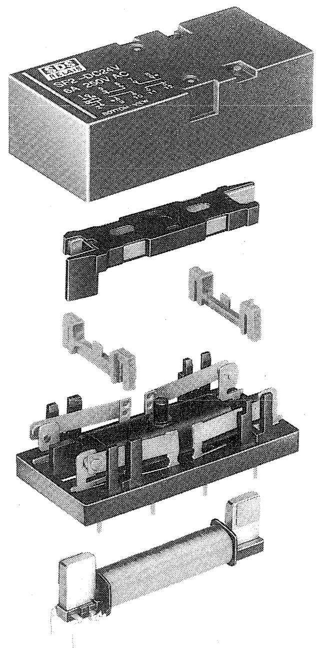
Electrical operational life

Switched voltage	Switched current	Switched load	Load type	Switching freq.	No. of sw.ops. 4)
250 VAC	8.00 A	2000 VA	cos φ = 1	0.2 Hz	30.000
220 VAC	6.82 A	1500 VA	cos φ = 1	0.2 Hz	100.000
220 VAC	5.11 A	1125 VA	cos φ = 0.6	0.2 Hz	100.000
220 VAC	4.43 A	975 VA	cos φ = 0.35	0.2 Hz	100.000
220 VAC	2.27 A	500 VA	cos φ = 1	0.2 Hz	300.000
220 VAC	1.70 A	375 VA	cos φ = 0.6	0.2 Hz	300.000
220 VAC	1.45 A	320 VA	cos φ = 0.35	0.2 Hz	300.000
30 VDC	2.00 A	60 W	resistive	0.5 Hz	2 Mio.
60 VDC	0.05 A	3 W	L/R = 28 ms	0.5 Hz	2 Mio.
10 VDC	0.01 A	0.1 W	resistive	0.5 Hz	2 Mio.

4) at ambient temperature of +70 °C

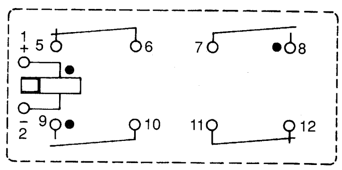
Ordering Information / Coil data

Part-number	Coil nominal voltage (V)	Pick-up voltage (V)	Drop-out voltage (V)	Coil resistance (Ω) ± 10%, 20°C	Coil inductance (mH)
SF2- 5 V	5	3.75	0.5	50	48
SF2-12 V	12	9	1.2	288	240
SF2-24 V	24	18	2.4	1152	1000
SF2-48 V	48	36	4.8	4608	3300
SF2-60 V	60	45	6.0	7200	6100

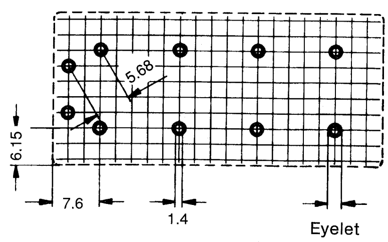


Connection diagram and pcb bore hole data

Bottom view

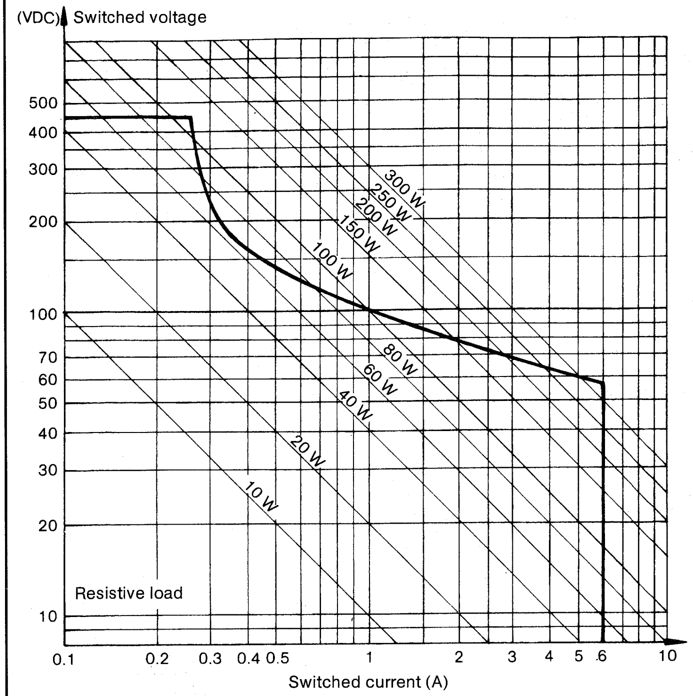


The contacts are shown in the de-energised condition. Changeover takes place when the coil is energised with the polarity shown.



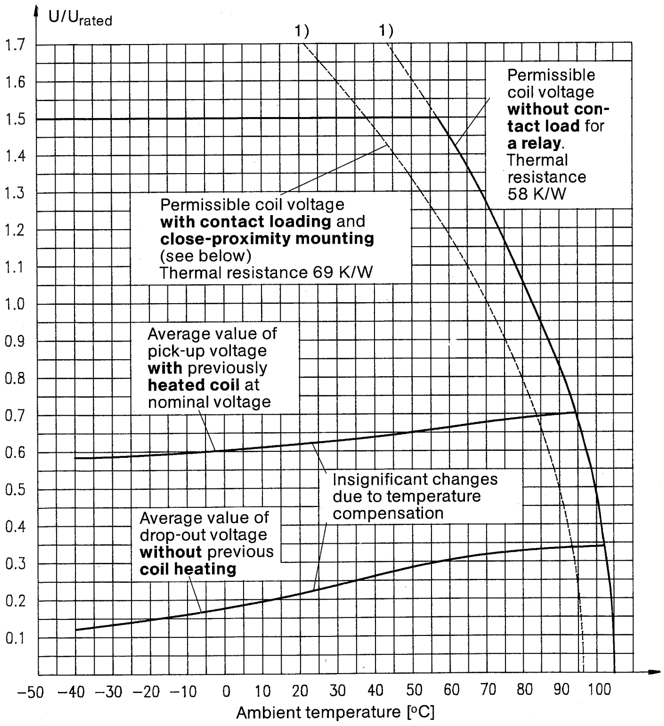
Grid 2.54

Load Limit Curves



Loads in the range under the curve can be switched safely. The arc will extinguish before the opposite contact makes (important if NO (a) and NC (b) contacts are connected to dissimilar voltages).

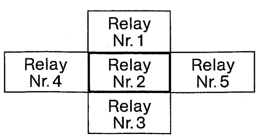
Continuous Thermal Loading Capability of the Coil



1) The curves shown apply to an average value coil resistance

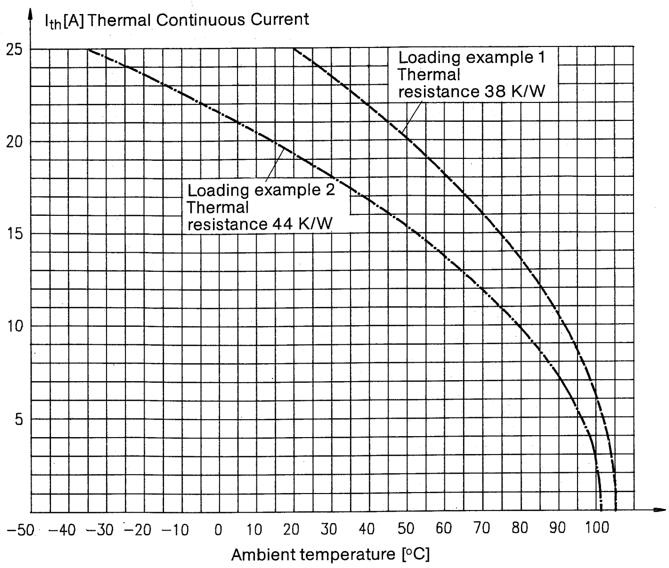
Permissible coil voltages and pick-up and drop-out characteristics at various ambient temperatures and contact loads.

Relay layout for high density packing with load carrying contacts



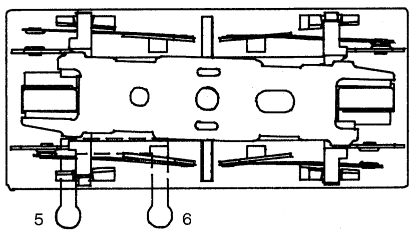
Relay coils 1–5 energised by up to 1.5 U_{rated}. **All normally open (a) contacts** carrying 10 Amps.

Continuous Contact Thermal Loading Capability



Permissible continuous current for a relay at varying ambient temperatures.

Loading example 1

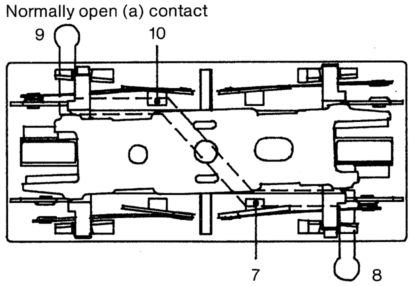


Normally closed (b) contact

Coil de-energised:
A normally closed (b) contact carrying current.
Contact volumetric resistance $R_{d\,5\text{-}6} = 3.6\ m\Omega$

Loading example 2

Normally open (a) contact



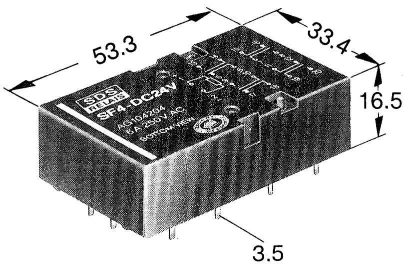
Normally open (a) contact

Coil energised at rated voltage.
All Normally open (a) contacts are load carrying.
Contact volumetric resistance $R_d = 5\ m\Omega$

NAiS

SAFETY RELAY WITH FORCED – OPERATED CONTACTS

SF4-RELAYS



Tolerance ± 0.3
Weight approx 47 g

- Creepage distances and airgaps as per VDE 0110
  Isolation Gr C 250 Vac / 300 Vdc
  Isolation Gr B 380 Vac / 450 Vdc
- TÜV test, no. 9.45 / EL 178/88
  SEV approval, no. D3.31/192
  SUVA approval, no. 3662
  Delayed operation, 5 Amp fuse
  UL recognised, file no. E43149
- 1.4 mm contact gaps
- Temperature compensated
- Polarised monostable PCB relay
- Forced contact operation complies with safety specification ZH 1/457; Also refer to application notes

Characteristics

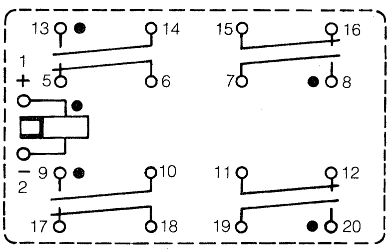
Contact configuration (a = Normally open, b = Normally closed)		4a 4b
Volumetric resistance (at 6Vdc, 1A new condition)	mΩ	-/< 30
max. make-/rated-/break current	A	20/6/6
max. switched voltage	V	440
max. switched load (resistive load, 1))	W (VA)	150 (1500 2))
min. switching voltage/switching current	V/mA	10/10
Pick-up/nominal power consumption at 20°C	mW	280/500
Pick-up/drop-out voltage in % of nominal voltage at 20°C	V/mA	75/15
Pick-up/drop-out-/bounce time (approx. values at U_{rated})	ms	18/6/4
max. switching frequency	Hz	10
Operational life mechanical (electrical see page 2)	Sw.ops	10^7
Permissable ambient temperature at rated power consumption	°C	-40/+70
Upper temperature limit	°C	100
Thermal resistance (max packing density)	K/W	44
Test voltage open contact/contact-contact/contact-coil	Vms	2500
Insulation resistance at 500 Vdc (new condition)	Ω	10^9
Shock resistance (11 ms) 3)/Vibration resistance 3)	g, g/Hz	30.10/10-55
Degree of protection		IP67 / IP30 2)

1) at 10^5 switching operations, ambient temperature +70°C
2) with breather hole 3) Contact interruption <10µs

Ordering Information / Coil data

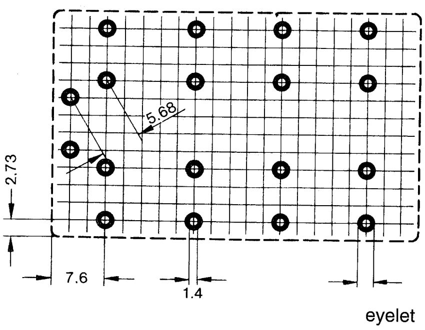
Part-number	Coil nominal voltage (V)	Pick-up voltage (V)	Drop-out voltage (V)	Coil resistance (Ω) ± 10%, 20°C	Coil inductance (mH)
SF4- 5V	5	3.75	0.75	50	48
SF4-12V	12	9	1.80	288	240
SF4-24V	24	18	3.60	1152	1000
SF4-48V	48	36	7.20	4608	3300
SF4-60V	60	45	9.00	7200	6100

Connection diagram and pcb bore hole data



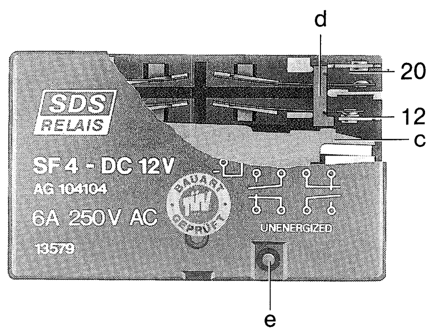
Bottom view

The contacts are shown in the de-energised condition.
Change over takes place when the coil is energiesed with the polarity shown.



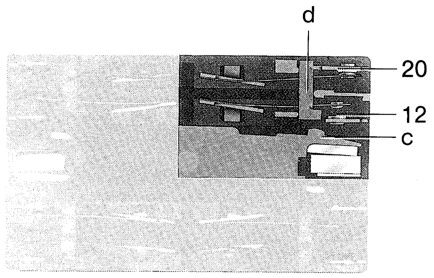
grid 2.54

Application notes

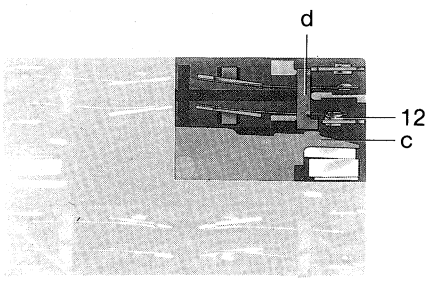


(12) Inner contact
(20) Outer contact
(c) Rotating armature
(d) Actuator
(e) Nipple
If required a breathing hole can be made in the cover.
However be aware that the degree of protection will reduce from IP67 to IP30!

Operation of forced contacts

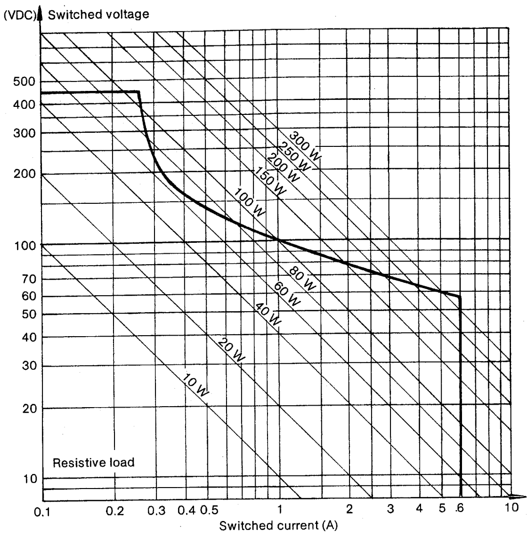


If an outer contact should weld (20)
then the forced operated inner contacts (d) driven by the operator (12) remain open. The rotating armature (c) remains free to move. The unaffected contact pairs can operate normally, (e.g. their function to make or break remains unaffected).



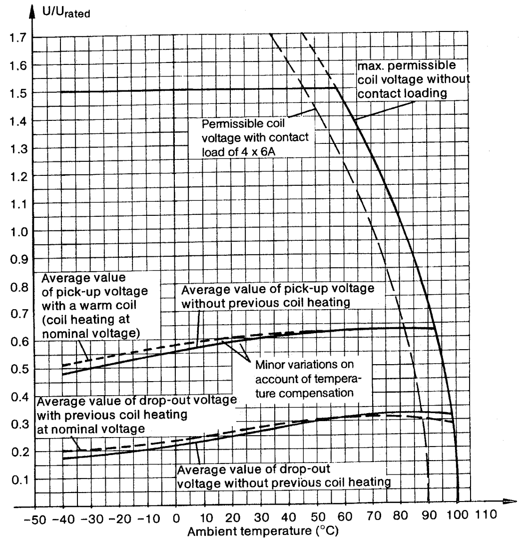
If an inner contact should weld (12)
then the movement of the rotating armature (c) is blocked via the operator (d). Open contacts of all four contact pairs remain open.
This arrangement corresponds to conventional forced contact operation.

Load Limit Curves



Loads in the range under the curve can be switched safely. The arc will extinguish before the opposite contact makes (important if NO and NC contacts are connected to dissimilar voltages).

Coil Temperature characteristics



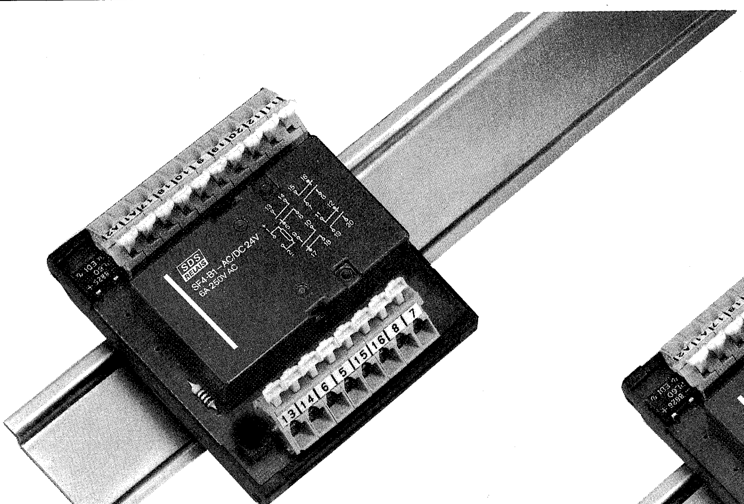
Pick-up, drop-out and coil loading characteristics for varying ambient temperatures.

Electrical Operational Life

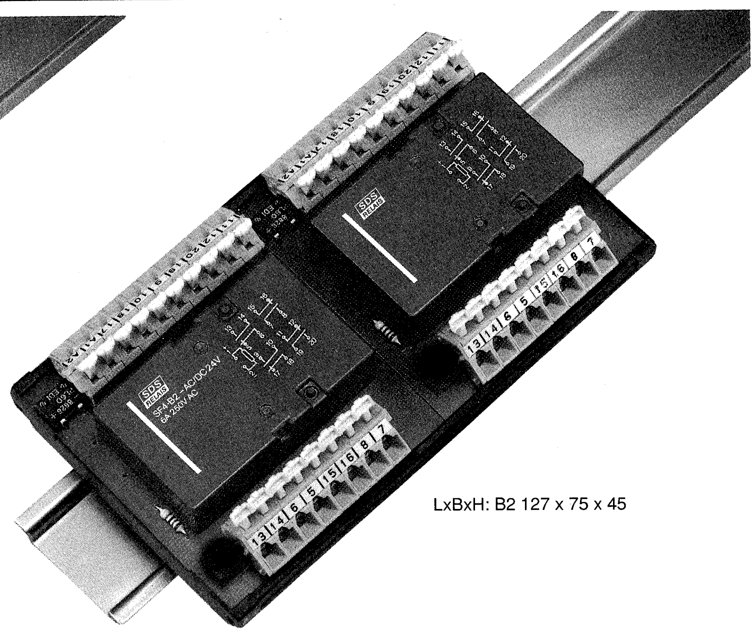
Switched voltage	Switched current	Switched load	Load type	Switching frequency	No. of Sw. Ops[4]
220 VAC	6.82 A	1500 VA	cos φ = 1	0.2 Hz	100,000
220 VAC	5.11 A	1125 VA	cos φ = 0.6	0.2 Hz	100,000
220 VAC	4.43 A	975 VA	cos φ = 0,35	0.2 Hz	100,000
220 VAC	2.27 A	500 VA	cos φ = 1	0.2 Hz	500,000
220 VAC	1.70 A	375 VA	cos φ = 0.6	0.2 Hz	500,000
220 VAC	1.45 A	320 VA	cos φ = 0.35	0.2 Hz	500,000
30 VDC	2.00 A	60 W	resistive	0.2 Hz	1 Mio.
28 VDC	2.00 A	56 W	resistive	0.5 Hz	2 Mio.
60 VDC	0.05 A	3 W	L/R = 28 ms	0.5 Hz	2 Mio.
10 VDC	0.01 A	0.1 W	resistive	0.5 Hz	2 Mio.

4) at ambient temperature of + 70°C

Connection Module SF4-B with 1 or 2 SF4-Relays



LxBxH: B1 63.5 x 75 x 45



LxBxH: B2 127 x 75 x 45

Characteristics

- Relay data* as stated on pages 1 and 2
- Control: 5 and 12 V versions only with DC
  24. 48 and 60 V versions universally with AC or DC (integrated rectifier)
  220 V (240 V) versions only with AC
- All versions are provided with LED function indication and suppression diode.
- Universal mounting arrangement for DIN-/EN-TS32 and TS35 mounting rail
- Connections via compression screw-free terminal
- Connector cross section 0.08 mm2 to 2.5 mm2
- Volumetric resistance terminal/terminal <50mΩ

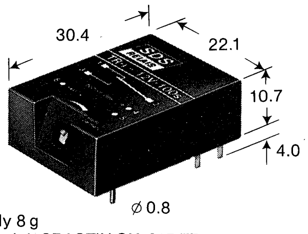
* The approvals data stated on page 1 of the datasheet applies only to relay types SF4-5 – 60 VDC

Note: Suitable for most common washing methods except ultrasonic cleaning. Strong external magnetic fields influence relay data.

NAiS

PROVEN PCB TIME DELAY RELAY WITH ADJUSTABLE TIME-ON OR TIME-OFF DELAY OR PULSE RELAY

TR-RELAYS

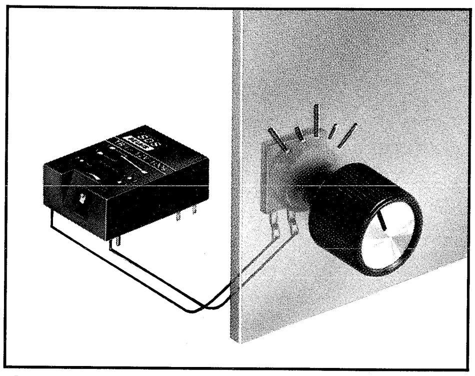


Approximately 8 g
Housing material: CRASTIN SK-615 FR
Basic grid 2.54 mm
PCB hole dia. Ø 1.0 mm ± 0.1 mm
Housing tolerance ± 0.3 mm

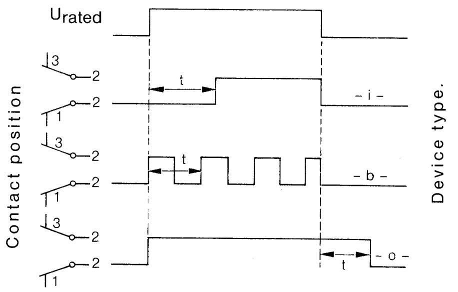
- **Not susceptable to external disturbance.**
- **Increase in timing range by using an external capacitor with time-off delay device -o-.**
- **No „first cycle effect", with the time-on delay device. The first and following operations are of the same duration.**

Characteristics

Characteristics			Remarks
Type of contacts (CO = changeover)		1CO	
Max. make/rated/break current	A	3 / 1 / 1	
Voltage switching range	VDC (VAC)	10^{-5} – 110 (240)	240 V using only
Power switching range	W (VA)	10^{-4} – 20 (30)	1 circuit
Contact material		AuCo	See also the R relay data sheet
Volumetric/contact resistance (at 5 V, 10 mA)	mΩ	50/30	
Operat. life [1] mech. with contact loading	switching ops.	10^9	
0.5 A, 10 W / 1 A, 1 W	switching ops.	10^7 / 10^8	
0.2 A, 12 V / 1 mA, 1 mV	switching ops.	10^8 / 10^9	
Voltage withstand: cont./cont.-control circuitry	V_{eff}	500 / 750	
Insulation resistance: cont./cont.-control circuitry	Ω	10^9 / 10^{10}	
Shock and vibration resistance	g-g/Hz	50–20 / 2000	Independant of position
Life of trimmer		> 100 operations	typically 1000 ops.
Type of protection		dust tight	
Storage temperature	°C	-20/+85	
Permiss. ambient temp. at max. load	°C	-20/+65	Consequently, time tol.: < 4 % with -i- devices ≈ 30 % with -o- devices
Min. control pulse duration at rated voltage.	ms	100	



Operation



+ The trimmer is omitted on the -i/-o- 0 s device. This must be replaced by an external potentiometer. The time delay thus achievable is 20 s per 100 kΩ with the - i - devices and approx 20 s per 1 MΩ with the - o - devices. The minimum time delays are 1 s (with -i-) and 0.1 s (with -o-).

* With the -o- 0 s device, the pulse frequency is 5 Hz. max., and is inversely proportional to R_{ext} (e. g. at 20 kΩ the pulse frequency is 1 Hz.

Operating characteristics

Type: - i - "on" delay - b - pulse relay	Operating voltage V	Current consumpt. mA
TR-i- 5 V/TR-b- 5 V	4.0 – 9.0	≈30
TR-i-12 V/TR-b-12 V	8.5 – 18.0	≈15
TR-i-24 V/TR-b-24 V	17.0 – 30.0	≈14

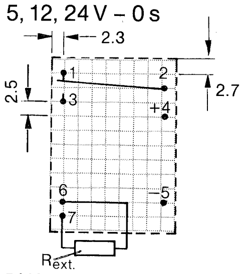
Rated time: „on" delay „i"	0 s+)	10 s	100 s	800 s
Minimum timing range [s] at rated voltage	1-1000	0.1-10	1-100	8-800
Time tolerance at U_{rated} ± 20%	< 2%			
Pulse relay „b" pulse frequency	0.04 ... 5 Hz*			

Type: - o - "off" delay	Operating voltage V	Current consumpt. mA
TR-o- 5 V	4.5 – 9.0	≈65
TR-o-12 V	8.5 – 18.0	≈35
TR-o-24 V	18.0 – 28.0	≈25

Rated time: „off" delay „o"	0 s+)	10 s	100s
Minimum timing range [s] at rated voltage	0.3-100	0.1-10	1-100
Time tolerance at U_{rated} ± 20%	–	approx 5%	
Time delay increase with C_{ext} per µF	–	1.5 s	4.7 s

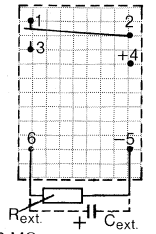
Connection diagram (bottom view) Warning! No revers battery protection

TR - i - 5, 12, 24 V - 0 s
TR - b - 5, 12, 24 V - 0 s



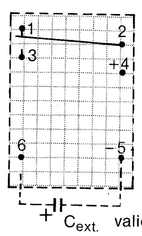
0 < R_{ext} < 5 MΩ

TR - o - 5, 12, 24 V - 0 s



10 kΩ < R_{ext} < 2.2 MΩ

TR - o - 5, 12, 24 V - 10 s or 100 s
TR - i - 5, 12, 24 V - 10 s, 100 s or 800 s
TR - b - 5, 12, 24 V - 25 s



valid only for - o -

Ordering example

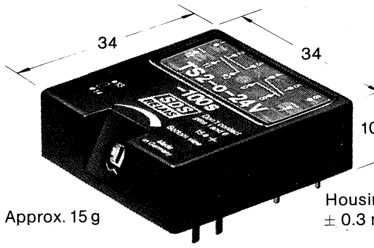
TR - i - 24V - 10s

Type
i = time-„on", o = time-„off" delay
b = pulse relay
Rated voltage
Rated time

Note:
Excitation voltage ripple should be maintained below 5% by use of appropriate smoothing.
Strong external magnetic fields influence relay data.
[1] Data concerning operational life is based on resistive loads and ambient temperature of 20–30°C.

NEW PCB TIME DELAY RELAY TIME-ON OR TIME-OFF DELAY OR PULSE RELAY

TS-RELAYS



Approx. 15 g

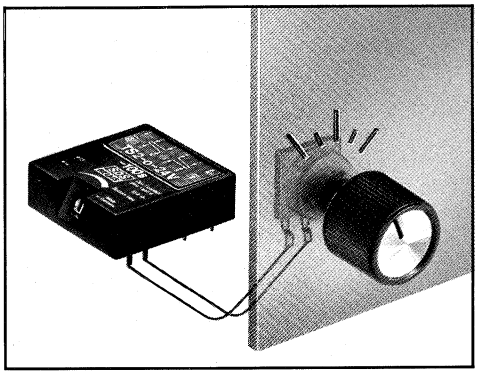
Housing tolerance ± 0.3 mm

Housing material: CRASTIN SK-615 FR Polycarbonate
Basic grid 2.54 mm
PCB hole dia. Ø 1.3 mm ± 0.1 mm

- **The elegant solution to time delay problems.**
- **High repeat accuracy and reliability.**
- **Not susceptible to external disturbance.**
- **Increase in timing delay by using an external capacitor with time-off delay device -o-.**
- **No auxiliary power supply required with time-off delay operation.**
- **No „first cycle effect", with the time-on delay device. The first and following operations are of the same duration.**

Characteristics

Characteristics			Remarks
Contact arrangement (NO = normally open, NC = normally closed, CO = changeover)		2NO2NC(2CO)/3NO1NC (2NO1CO)/4NO	
Max. make/rated/break current	A	20 / 5 / 5	
Voltage switching range	V	10^{-5}–250	
Power switching range	W (VA)	10^{-10}–100 (1000)	
Contact material		AuAg10	See also the S relay data sheet
Volumetric/contact resistance	mΩ	30/10	
Operational life [1]			
5 A, 1000 VA / 5 A, 100 W	switching ops.	$6 \cdot 10^4 / 3 \cdot 10^5$	
4 A, 1000 VA / 0.1 A, 1 W	switching ops..	$10^5 / 2 \cdot 10^8$	
Voltage withstand: cont./cont.-control circuitry	V_{eff}	750 / 1500	
Insulation resistance: cont./cont.-control circuitry	Ω	$10^{13} / 10^{10}$	
Shock-, vibration resistance	g, g/Hz	50, 20 / 1000	Independant of position
Life of trimmer		>100 operations	Typically 1000 ops.
Type of protection Potentiometer/Contacts		dust tight / sealed / IP 67 DIN 40050	
Storage temperature	°C	–20/+85	
Permiss. ambient temp. at max. load	°C	– 20/+65	Consequently, time tol.: < 4 % with -i- devices ≈ 25 % with -o- devices
Min. control pulse duration at rated voltage.	ms	100	



Operating characteristics

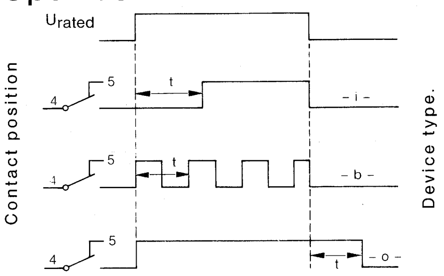
Type: – i – "on" delay – b – pulse relay	Operating voltage V	Current consumpt. mA
TS2-/TS3-/TS4–i/–b– 5 V	4.0 – 9.0	≈40
TS2-/TS3-/TS4–i/–b– 12 V	8.5 – 18.0	≈20
TS2-/TS3-/TS4–i/–b– 24 V	17.0 – 30.0	≈11

Rated time: „on" delay „i"	0 s +)	10 s	100 s	800 s
Minimum timing range [s] at rated voltage	1-1000	0.1-10	1-100	8-800
Time tolerance at U_{rated} ± 10%	< 1%			
pulse relay „b" pulse frequency	0.04 . . . 5 Hz *			

Type: – o – "off" delay	Operating voltage V	Current consumpt. mA
TS2-/TS3-/TS4–o– 5 V	4.5 – 9.0	≈31
TS2-/TS3-/TS4–o– 12 V	8.5 – 18.0	≈23
TS2-/TS3-/TS4–o– 24 V	18.0 – 28.0	≈23

Rated time: „off" delay „o"	0 s +)	10 s	100s
Minimum timing range [s] at rated voltage	0.3-100	0.1-10	1-100
Time tolerance at U_{rated} ± 10%	–	approx 20%	
Time delay increase with C_{ext} per μF**	–	1.5 s	4.7 s

Operation



+ The trimmer is omitted on the -i/-o- 0 s device. This must be replaced by an external potentiometer. The time delay thus achievable is 20 s per 100 kΩ with the -i- devices and approx 20 s per 1 MΩ with the -o- devices. The minimum time delays are 1 s (with -i-) and 0.1 s (with -o-).

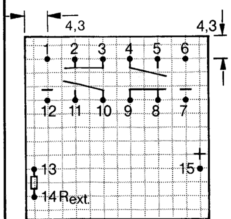
* With the -o- 0 s device, the pulse frequency is 5 Hz. max., and is inversely proportional to R_{ext} (e. g. at 12 kΩ the pulse frequency is 1 Hz.

** Connect C_{ext} between pins 12 and 13!

Connection diagrams (bottom view) Warning! No reverse battery protection

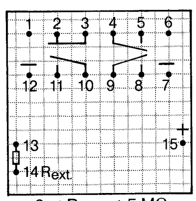
Warning! pins 1 and 6 may not be connected. Pins 7 and 12 are negative and connected internally

TS2–i,–o– or –b
– 5, 12, 24 V
– 0 s



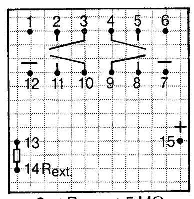
0 < R_{ext} < 5 MΩ

TS3–i,–o– or –b
– 5, 12, 24 V
– 0 s



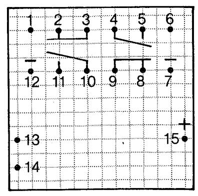
0 < R_{ext} < 5 MΩ

TS4–i,–o– or –b
– 5, 12, 24 V
– 0 s

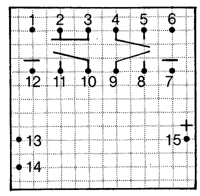


0 < R_{ext} < 5 MΩ

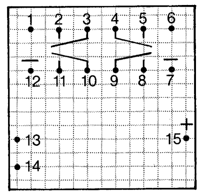
TS2–i,–o– or –b
– 5, 12, 24 V
– 10 s or – 100 s
– i – 800 s, – b – 25 s



TS3–i,–o– or –b
– 5, 12, 24 V
– 10 s or – 100 s
– i – 800 s, – b – 25 s



TS4–i,–o– or –b
– 5, 12, 24 V
– 10 s or – 100 s
– i – 800 s, – b – 25 s



Ordering example

TS 2 – i – 24 V – 10s

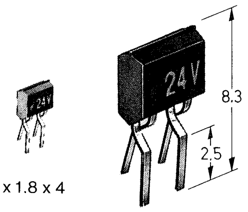
Type
i = time-„on" o = time-„off" delay
b = pulse relay
Rated voltage
Rated time

Note:
Excitation voltage ripple should be maintained below 5% by use of appropriate smoothing.
Strong external magnetic fields influence relay data.
[1] Data concerning operational life is based on resistive loads and ambient temperature of 20–30°C.

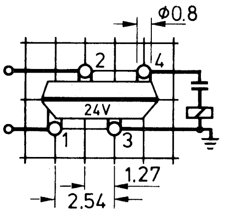
NAiS

MODERN CONTROL OF RELAYS USING THE C SWITCHING CIRCUIT WITH THE NEW IC

IC Module



5 x 1.8 x 4



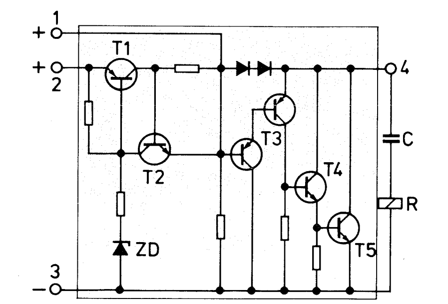
- **Up to 99% energy saving.**
- **Low coil inductance.**
- **Short pick-up and drop-out times.**
- **Thermovoltage approx. 1 μV.**
- **Almost no self heating effect.**
- **Defined pick-up and drop-out voltage.**
- **SM version for all current SMT soldering methods.**

C switching circuit

The C switching circuit bestows monostable switching capability on bistable relays. It ensures that after the initial energisation only a leakage current of 10–100 μA flows.
Uses: To save operating power especially with high package densities or battery powered equipment; to increase reliability with measurement and control circuitry, since the relay remains cool in operation and consequently makes minimal disturbance on neighbouring components.

Operation

The IC module is connected in series with a bistable relay and a capacitor. The size of the capacitor C is selected depending on the coil resistance R of the relay so that the charge time constant is in the range of the pick-up time of the relay. Thus the power consumption is virtually limited to the pick-up time when the excitation voltage is applied.
In general whilst the relay is energised at rated voltage, a leakage current flows of max. value 100 μA. If the excitation voltage is interrupted then the capacitor C discharges via the trigger circuit T3, T4 and T5 in the IC module. Thus the relay is energised in the opposite sense and changes state.



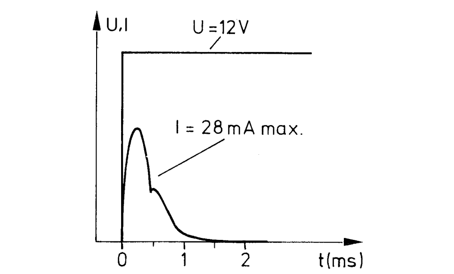
Connection 1 for IC-12V (IC-24V) untriggered:
Excitation voltage 4.5V to 16V (7V to 28V)

Connection 2 for IC-12V triggered:
Threshold value 9V
Excitation voltage 9V to 16V

Connection 2 for IC-24V triggered:
Threshold value 18.6V
Excitation voltage 18.6V to 28V

Special Features

By controlling the IC-12V or IC-24V at input 1 (5V to 28V) then a sharp operating edge (du/dt > 8V/ms) is required. (black/white operation).
By controlling via input 2 (12V or 24V) slow rising or falling edges of excitation voltage are permissible. The transistor circuit T1, T2 in conjunction with a Zener diode ZD in the IC module guarantee defined switching voltages (or pick-up or drop-up values). These have a negative temperature co-efficient of approximately 0.028 V/°C. A relay which switches on at 7.6 V excitation voltage at 75°C ambient temperature requires for example 9.8V at −5°C. If the edge rate of rise of the excitation voltage du/dt > 8V/ms it is possible that the relay can pick-up and drop-out before the trigger circuit has reached the appropriate voltage. In such instances the relay should be driven via input 1. The 12V or 24V IC module also offers the possibility of switching the relay with approx. 20s of drop-out time delay. This is achieved via a capacitor connected in parallel to the input (connections 2, 3). The time delays achievable are then approximatley 0.26 s / μ F.



Principal curves of excitation voltage and current.

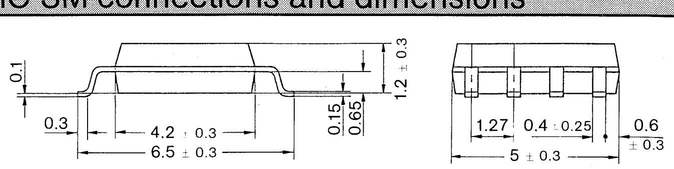
Max. Ratings of the IC module

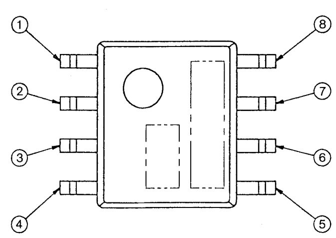
Max. operating voltage	16 V / 28 V
Max. current consumption	300 mA
Permissible ambient temp. during operation	-20/+80°C
Storage temp.	-55/+125°C

IC-SM (Surface Mounting) data

		Pins	Min.	Max.
Operating Voltage	V	8–3	4.5	28
Operating Voltage	V	2–3	10	28
Trigger operate level	V	2-3	8	9
Trigger switch off level	V	2-3	7.5	

IC-SM connections and dimensions



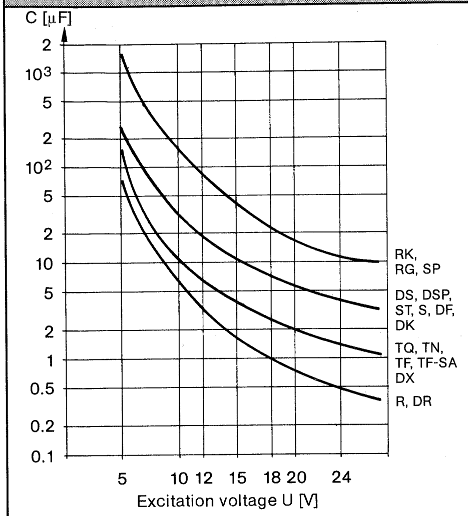


① No connection
② Input (2): DC 12 V
③ Earth (3)
④ No connection
⑤ Output (4)
⑥ No connection
⑦ No connection
⑧ Input (1): DC 5 V

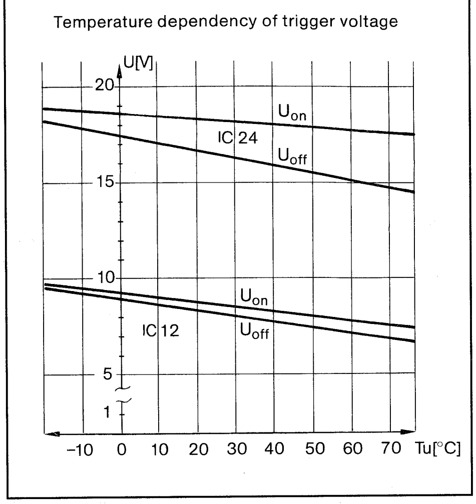
Selection of the capacitor for the C switching circuit

The capacitance value for the capacitor is given in the diagrams below and is shown as dependant on the excitation voltage when using the below listed relays with the IC module. To guarantee reliable switching of the relay in spite of line voltage drop at the IC module, the relay rated voltage is chosen lower than the supply voltage. In this way shorter pick-up and drop-out times are achieved. In the voltage range 6–10 V the 3 V configuration and in the range 10–20 V the 6 V configuration and from 20 V the 12 V configuration of the appropriate bistable relay is recommended. From the diagram for the S, ST and DS relays it is seen that at 5, 12 and 24 V the selected capacitance values would be approx. 330, 22 or 4.7 µF.

Recommended capacitance values



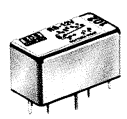
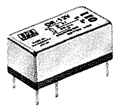
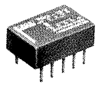
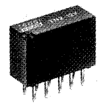
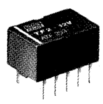
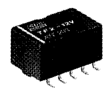
Temperature dependency

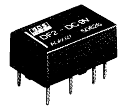
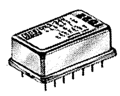
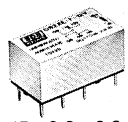
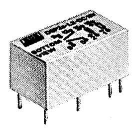
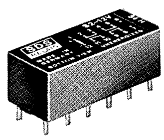
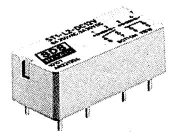


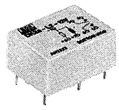
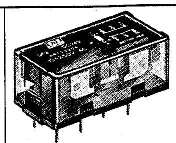
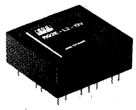
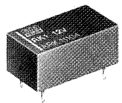
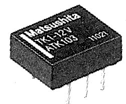
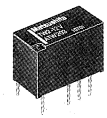
Common data

Excitation voltage	V	5	12	24
Pick-up voltage	V	4.5	9	18.6
Drop-out voltage	V	0	7.5	14
Relay rated voltage	V	1.5	6	12
Max. operating voltage	V	12	16	28
Leakage current at rated voltage	mA	0.02	0.05	0.1

Ratings of relays controlled by a C switching circuit

																			
Dimensions: l x b x h	mm	20 x 10 x 10.2			20 x 10 x 8.3			14 x 9 x 5			14 x 5.6 x 9.8			14 x 9 x 7.8			14 x 9 x 8		
Relay type		RH-L		RS-L	DR-L			TQ2-L			TN2-L			TF2-L			TF2-SA-L		
Types of contacts		1c			1c			2c			2c			2c			2c		
Make/breake current	A	3/1			8/3			5/1			5/1			5/1			5/1		
Max. switch-off voltage	V	110 (240*)			250			125			125			125			125		
Max. load	W/VA	20/40			30/60			30/62.5			30/62.5			30/62.5			30/62.5		
Test voltage, contact-contact/coil	V_{rms}	500/1000			750/1500			750/1000			750/1000			750/1000			750/1000		
Pick-up and drop-out time	ms	1/1			1/1			3/2			3/2			3/2			3/2		
IC nom. voltage/Relay rated voltage	V	5/1.5	12/6	24/12	5/1.5	12/6	24/12	5/3	12/6	24/12	5/3	12/6	24/12	5/3	12/6	24/12	5/3	12/6	24/12
Current consumption during pick-up time	mA	150	23	15	100	25	10	160	28	15	160	28	15	88	15	8	160	28	15

																			
Dimensions: l x b x h	mm	16 x 9.9 x 7			20 x 12 x 6			15 x 9.9 x 9.8 20 x 9.9 x 9.8 35.2 x 9.9 x 9.8			20 x 11 x 10			28.4 x 12.5 x 10.2			31 x 14 x 11		
Relay type		DF2-L			DX2-L			DS1-L, DS2-L, DS4-L			DSP1-L			S2-L	S3-L	S4-L	ST1-L		ST2-L
Types of contacts		2c			2c			1c/2c/4c			1a/2a/1a1b/1c			2a2b 2c	3a1b 2a1c	4a	1a1b 1c		2a
Make/breake current	A	–/1			3/1			8/3			26/8	18/5	26/5	20/5			50/8		35/8
Max. switch-off voltage	V	125			240*			250			380			250			380		
Max. load	W/VA	30/30			30/50			60/125			150/2000		150/1250	100/1000			150/2000		
Test voltage, contact-contact/coil	V_{rms}	500/1000			500/500			1000/1500			1000/3000			750/1500			1200/3750		
Pick-up and drop-out time	ms	3/2			2/1			3/2			5/4			8/5			10/4		
IC nom. voltage/Relay rated voltage	V	5/3	12/6	24/12	5/3	12/6	24/12	5/3	12/6	24/12	5/3	12/6	24/12	5/1.5	12/6	24/12	5/3	12/6	24/12
Current consumption during pick-up time	mA	160	28	15	200	37	22	260	50	27	220	43	23	160	28	15	180	30	17

																			
Dimensions: l x b x h	mm	NO: 20 x 12.5 x 9.7 2NO/1NO1NC: 20x15x9.7			2CO: 50 x 25.6 x 20.5 4CO: 50 x 36.8 x 20.5			25 x 23 x 9.2			20.2 x 11.2 x 9.1			10.6 x 9 x 4			14.7 x 7.35 x 10.85		
Relay type		DK1a-L			SP2-L		SP4-L	RG1-L		RG2-L	RK-L			TK			TW		
Types of contacts		1a		1a1b	2c		4c	1c		2c	1c			1c			2c		
Make/breake current	A	–/10			70/16		50/10	–/1			–/0.5			5/1			5/1		
Max. switch-off voltage	V	380			250			24			30			220			220		
Max. load	W/VA	300/2500		240/2000	300/4000		300/2500	24/–			10/–			60/–			60/62.5		
Test voltage, contact-contact/coil	V_{rms}	1000/4000			1500/3000			1000/2000			500/1000			1500/2500			1000/1800		
Pick-up and drop-out time	ms	5/3			25/15		28/15	10/5			6/3			1.5/1			2/1		
IC nom. voltage/Relay rated voltage	V	5/3	12/6	24/12	5/3	12/6	24/12	5/3	12/6	24/12	5/3	12/6	24/12	5/3	12/6	24/12	5/3	12/6	24/12
Current consumption during pick-up time	mA	160	28	15	225	28	15	280	110	60	280	55	30	160	28	15	160	28	15

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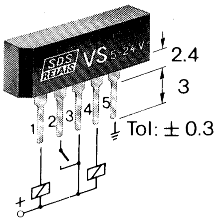
MODERN STEPPER RELAY USING ELECTRONIC SWITCHING CIRCUIT

VS MODULE



Dimensions 18.5 x 3.3 x 6.3

Weight 0.7 g
Pin Grid 2.54
PCB hole dia 0.6

- **High reliability and efficiency**
- **Low power requirement**
- **Short switching times**
- **Economic and spacesaving**
- **Universal application in stepper devices or counters**
- **Suitable for most common washing methods except ultrasonic cleaning**

Relay connection – In contrast to connecting between pins 2 and 4 connecting contact K across pins 2 and 3 of the new VS monolithic module (as shown above) ensures reliable switching even with bouncing signals. On the earlier design of thick film VS module, the contact K had to be connected between pins 2 and 4 in all cases.

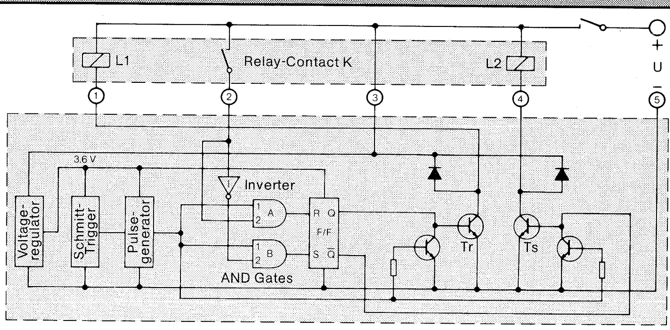
Traditional stepper relays maintain their latched position mechanically, but by using the VS switching principle with polarised 2 coil relays this is not required. The already well known operating characteristics of polarised relays remain unchanged. Switching of the relay using the VS module is achieved as shown in the above diagram. A relay contact is required for the internal circuitry and is thus not available for other switching circuits. This applies also to changeover contacts.
The VS5-24V Electronic module is suitable for 4V to 30V coil voltage. It withstands temperatures between −55°C to +125°C and can be operated between −20°C and +80°C.

Operation

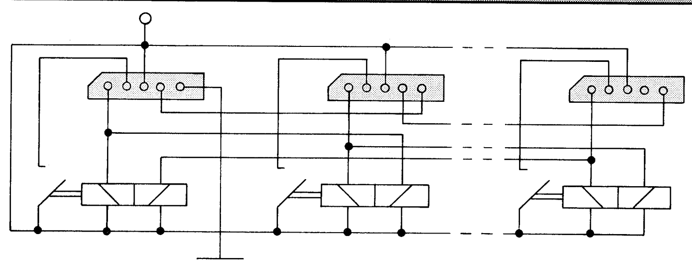
A logic level of 3.6 V for the logic circuitry is obtained as shown in the block diagram, from the voltage regulator. A relay contact K is connected between pin 2 and the positive terminal 3 of the power supply. On receiving a signal from the output of the schmitt trigger the pulse generator gives a 10 micro second impulse which changes the logical state at input 1 of both AND gates to "high". The logical state of input 2 of gate A is "low" since the relay contact K is open: input 2 of gate B is "high" due to the inverter I depending on the input signals, the output of the AND gate B is driven "high" and the flip flop F/F is set switching the output "Q" high and turning on the transistor Ts.
The relay is then latched by coil L2 and the contact K closes.
With contact K now closed and the voltage U applied, the logical state of input 2 goes "high" so that both inputs 2 of the AND gates change state from their previous condition.
(Input 2 of AND gate A goes high and input 2 of AND gate B goes "low"). Simultaneously a 10 microsecond impulse from the pulse generator is fed to the input 1 of both AND gates consequently the output of gate A goes "high" and the output of gate B goes "low". The F/F is reset, the transistor Tr is driven on by output "Q", and the relay coil L1 is energized, opening the contact K.
The maximum output current of the VS module is 100 mA. Thus depending on coil resistance several relays can be controlled by a single VS module.

The more important characteristics of relay types which can be combined with the VS module are described on the rear of this datasheet.

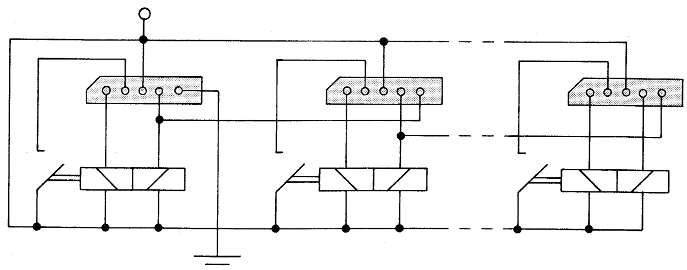
Block diagram of VS module (For connection diagram see over)



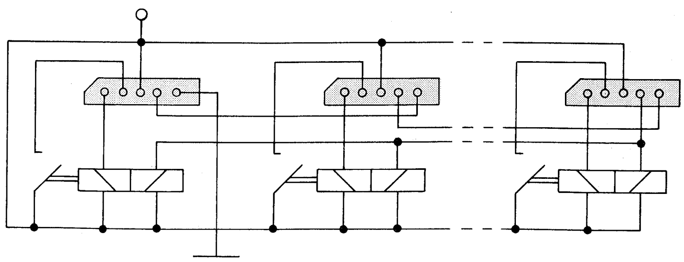
Stepping devices



Binary counters, Frequency dividers



Counters

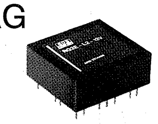


Characteristics

Further relay data is available on the appropriate data sheets.

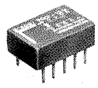
* Depending on the switching configuration, the given contact arrangement can vary;
a and b contacts can be wired as change-over contacts.
Contact configuration:
a = normaly open
b = normaly closed
c = change over

RG

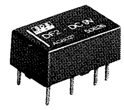


for high frequency application

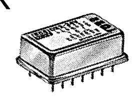
TQ TF TN TW



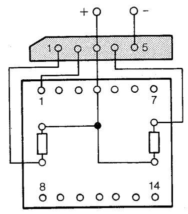
DF

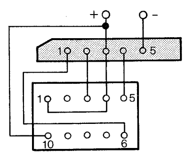


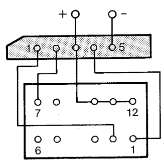
DX

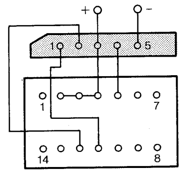


		RG	TQ	DF	DX
Type		RG2-L2	TQ2-L2	DF2-L2	DX-L2
Dimensions: (l x b x h)	mm	25 x 23 x 9.9	14 x 9 x 5	16 x 9.9 x 7	20 x 12 x 6
No. of available contacts *		1c	1c	1c	1c
Max. make current	A	–	5	–	3
Max. continuous current	A	1	2	1	2
Max. break current	A	1	1	1	1
Max. break voltage	V	24	125	125	220
Max. break power	W/VA	24	30/62.5	30/30	30/50
Nom. power consumption	W	0.52	0.32	0.32	0.4
Test voltage: cont./cont./coil	V_{rms}	1000/2000	750/1000	500/1000	500/500
Max. switching frequency	Hz	50	100	100	200









* Depending on the switching configuration, the given contact arrangement can vary;
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Contact configuration:
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b = normaly closed
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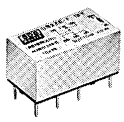
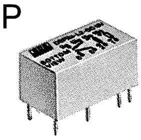
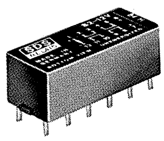
DS



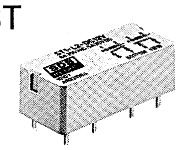
DSP



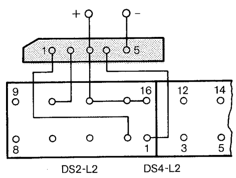
S

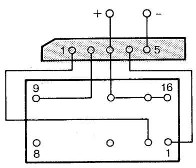


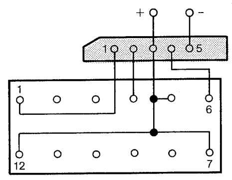
ST

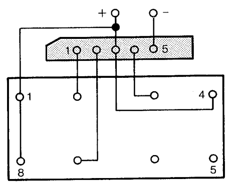


		DS	DSP		S	ST
Type		DS2-/DS4-L2	DSP1-L2		S2-/S3-/S4-L2	ST1-/ST2-L2
Dimensions: (l x b x h)	mm	20/35.2 x 9.9 x 9.3	20.2 x 11 x 10.5		28.4 x 12.5 x 10.2	31 x 14 x 11
No. of available contacts *		1c/3c	1a		2a1b/3a/1a2b	1a/1b
Max. make current	A	8	18	26	20	50/35
Max. continuous current	A	3	5	5	5	8
Max. break current	A	2	5	5	5	8
Max. break voltage	V	250	380		250	250
Max. break power	W/VA	60/125	150/1250		100/1000	150/2000
Nom. power consumption	W	0.48	0.42		0.32	0.345
Test voltage: cont./cont./coil	V_{rms}	1000/1500	1000/3000		750/1500	1200/3750
Max. switching frequency	Hz	100	50		50	50









* Depending on the switching configuration, the given contact arrangement can vary;
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Contact configuration:
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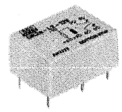
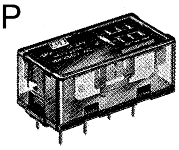
c = change over

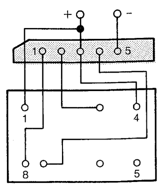
DK

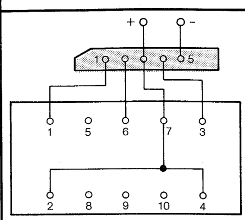


SP



		DK	SP	
Type		DK1a1b-L2	SP2-L2	SP4-L2
Dimensions: (l x b x h)	mm	20 x 12.5 x 9.7	50x25.6x20.5	50x36.8x20.5
No. of available contacts *		1a	1c	3c
Max. make current	A	–	70	50
Max. continuous current	A	8	16	10
Max. break current	A	8	16	10
Max. break voltage	V	380	250	
Max. break power	W/VA	240/2000	300/4000	300/2500
Nom. power consumption	W	0.32	0.42	
Test voltage: cont./cont./coil	V_{rms}	1000/4000	1500/3000	
Max. switching frequency	Hz	50	10	





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