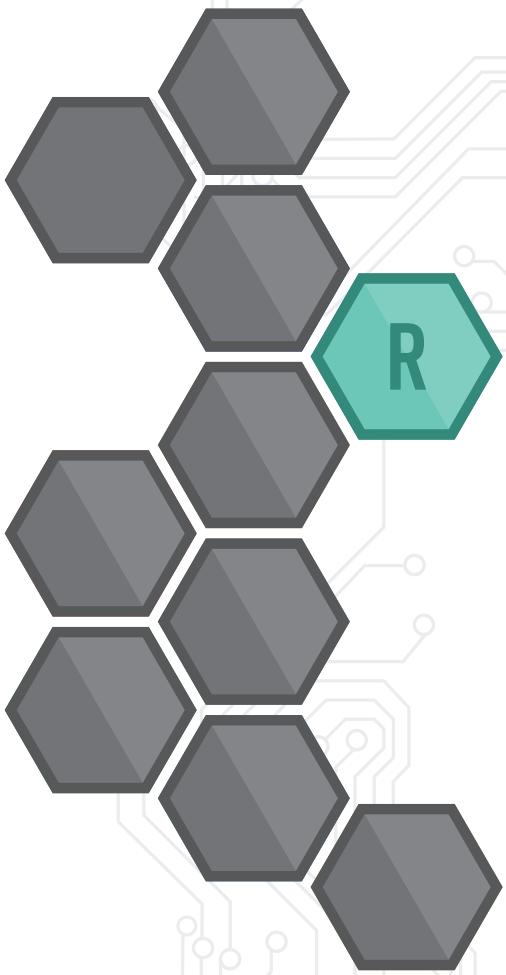
каталог, описание, технические, характеристики, datasheet, параметры, маркировка,габариты, фото

QR код

Panasonic

Relays
Line Card Catalog



800-344-2112 | na.industrial.panasonic.com | industrial@us.panasonic.com

RELAYS

na.industrial.panasonic.com/products/relays-connectors

Power

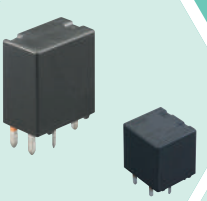
PhotoMOS®

Solid State

Automotive

Microwave Devices

Signal



	Series	Contact Arrangement	Nominal Switching Capacity (A)	Max. Switching Voltage (V)	Latching: Single Side Stable (S)	Nominal Operating Power (mW)
General Purpose Power Relays	AHN	1a, 1c, 2c	10A 30VDC/250VAC (1c) 5A 30VDC/250VAC (2c) 16A 30VDC/250VAC (1a)	250VAC, 30VDC	S	0.53W, 0.9VA
	HC	1c, 2c, 3c, 4c, 4c twin	10A 250VAC (1c) 7A 250VAC (2c, 3c) 5A 250VAC (4c) 3A 250VAC (4c twin)	250VAC	S	AC (50Hz): 1.3VA, AC (60Hz): 1.2VA DC: 0.9 to 1.1W
	HJ	2c, 4c	7A 250VAC (2c) 5A 250VAC (4c)	250VAC, 125VDC	S	0.9W, 1.2VA
	HK	1c, 2c	15A 125VAC (1c) 10A 125VAC (2c)	250VAC, 125VDC	S	AC: (50Hz) 1.3VA, (60Hz) 1.2VA DC: 0.9 to 1W
	HL	1c, 2c	10A 125/250VAC (1c, 2c) 15A 125VAC (1c)	250VAC	S	AC: (50Hz) 1.3VA, (60Hz) 1.2VA DC: 0.9 to 1W
Safety Power Relays	SFS	2a2b, 3a1b, 4a2b, 5a1b, 3a3b	6A 250VAC/125VDC	250VAC, 125VDC	S	360 (2a2b, 3a1b) 500 (4a2b, 5a1b, 3a3b)
	SFY	2A2B, 3A1B, 4A2B, 5A1B	6A 250VAC, 6A 30VDC	250VAC, 30VDC	S	670
NON-Polarized Power Relays	ALA	2a	3A 125VAC, 5A 277VAC	125VAC, 277VAC	S	530
	ALDP	1a	5A 277vac	277VAC	S	200mW
	ALE	1a	16A 277VAC	277VAC	S	200 (std), 400 (high sensitivity)
	ALF	1a	20A 250VAC	250VAC	S	900
	ALFG	1a	22A 250VAC (Standard) 31A 250VAC (1.5mm contact gap High capacity type) 33A 250VAC (1.8mm contact gap High capacity type)	250VAC	S	1400mW
	ALZ	1a, 1c	16A 250VAC	440VAC	S	400
	HE	1a, 2a	30A 277VAC (1a) 25A 277VAC (2a)	30VDC, 277VAC	S	1.92W (DC coil), 1.7 to 2.7VA (AC coil)
	HE-PV	1a, 1a (high capacity)	35A 250VAC (1a) 48A 250VAC (1a high capacity)	250VAC	S	1920
	JM	1a	20A 250VAC	250VAC	S	900

NON-Polarized Power Relays

Series	Contact Arrangement	Nominal Switching Capacity (A)	Max. Switching Voltage (V)	Latching: Single Side Stable (S)	Nominal Operating Power (mW)
JQ	1a, 1a (high capacity), 1c, 1c (high capacity)	1a standard: 2A 250VAC, 5A 30VDC/125VAC	250VAC, 110VDC (0.3A)	S	200 (1a, 1a high capacity)
		1c standard NO: 2A 250VAC, 3A 30VAC, 5A 125VAC			400 (1c, 1c high capacity)
		1c standard NC: 1A 30VDC, 1A 250VAC, 2A 125VAC			
		1a high capacity: 5A 30VDC/250VAC, 10A 125VAC			
		1c high capacity NO: 5A 30VAC/250VAC, 10A 125VAC			
		1c high capacity NC: 1A 30VDC, 2A 250VAC, 3A 125VAC			
JS	1a, 1c, 1a (long life)	1a, 1c: 5A 30VDC, 6A 277VAC, 10A 125VAC, 10A 250VAC (NO)	250VAC, 100VDC (0.5A)	S	360
		1a (long life): 10A 250/277VAC, 5A 30VDC			
JTN	1a, 1c	20A 277VAC (1a, 1c NO)	277VAC	S	800
		10A 277VAC (1c NC)			
JTV	1a, 1c	20A 277VAC (1a, 1c NO)	277VAC	S	1000
		10A 277VAC (1c NC)			
JVN	1a	10A 30VDC, 125/277VAC	30VDC, 277VAC	S	200 (4.5 to 48VDC)
		16A 125VAC			600 (100VDC)
JW	1a, 1c, 2a, 2c	5A 30VDC/250VAC (1a, 1c, 2a, 2c)	250VAC, 30VDC	S	530
		10A 250VAC/30VDC (1a, 1c)			
LFG	1a	31A 250VAC	250 VAC	S	1400
LKP	1a	10A 277VAC, 5A 30VDC	30VDC, 277VAC	S	530
LQ	1a, 1c	1a: 5A 250VAC, 5A 30VDC	250 VAC	S	200mW (1a)
		1c: 5A 250VAC (NO), 5A 30VDC (NO), 2A 250VAC (NC), 1A 30VDC (NC)			400mW (1c)
NC	2c, 4c	5A 250VAC	250VAC	S	2c DC: 360mW (740mw: 100 VDC)
					2c AC: 0.5 to 1.05 VA
					4c DC: 720mW (740mW:100 VDC)
					4c AC: 1.08 to 1.3VA
PA	1a	5A 250VAC/30VDC	110VDC, 250VAC	S	120 mW (5 to 18 VDC)
PF	1a, 1c	6A 250VAC	250VAC	S	170 mW (5-24 VDC)
					217 mW (48 V DC)
					175 mW (60 V DC)
PQ	1a	5A 250VAC/30VDC	110VDC (0.3A), 250VAC	S	200

	Series	Contact Arrangement	Nominal Switching Capacity (A)	Max. Switching Voltage (V)	Latching: Single Side Stable (S), 1 coil latching (L1), 2 coil latching (L2)	Nominal Operating Power (mW)
Polarized Power Relays	ADJ	1a, 1b, 1c, 1a1b, 2a, 2b, 2c	16A 250VAC (1a, 1b, 1c) 10A 250VAC (1a1b, 2a, 2b 2c)	250 VAC	S, L1, L2	150 (L1), 250 (S, L2)
	ADQ	1a	30A 250VAC	250 VAC	L1, L2	500 (L1), 1000(L2)
	ADY	1a, 1a1b	10A 250VAC/30VDC (1a) 8A 250VAC/30VDC (1a1b)	380 VAC, 125 VDC	S, L2	200
	DE	1a, 1a1b, 2a	10A 250VAC/30VDC (1a) 8A 250VAC/30VDC (1a1b, 2a)	250 VAC, 30 VDC	S, L2	200
	DK	1a, 1a1b, 2a	10A 250VAC/30VDC (1a) 8A 250VAC/30VDC (1a1b, 2a)	250 VAC, 125 VDC	S, L2	200
	DQM	1a	60A 250VAC	250 VAC	L1, L2	500 (L1), 1000 (L2)
	DSP	1a, 1a1b, 2a	8A 250VAC (1a) 5A 250VAC/30VDC (1a, 1a1b, 2a)	380 VAC, 125 VDC	S, L2	300
	DW	1a	8A 250VAC(standard type) 16A 277VAC(Inrush type)	8A 250VAC(standard type) 16A 277VAC(Inrush type)	L1, L2	200 (L1) 400 (L2)
	S	2a2b, 3a1b, 4a	4A 250VAC, 3A 30VDC	250 VAC, 48 VDC (30~48 VDC at less than 0.5 A)	S, L2	200
	SP	2c, 4c	15A 250VAC (2c) 10A 250VAC (4c)	250 VAC, 30 VDC (48V DC: Max. 2A)	S, L2	300
	ST	1a1b, 2a	8A 250 VAC	380 VAC, 250 VDC	S, L2	240
High Capacity DC Power Relays	AEJ	1a	100A 100VDC	100 A, 100 VDC	S	5W
	ADZ	1a	120A 250 VAC	276 VAC	L1, L2	1400mw (L1) 2800mw (L2)
	AEP	1a (Molybdenum), 1a (tungsten, copper alloy), 1a (copper alloy)	10A 400VDC (Molybdenum)	10 A, 400 VDC	S	Max 1.4W
			80A 400VDC (Tungsten, Copper alloy)	8 A, 400 VDC	S	Max 4.5W
			200A 400VDC (Lead Wire type)	200A 400VDC	S	Max 4 to 6W
			300A 400VDC (Copper alloy)	300 A, 400 VDC	S	Max 4 to 40W
	HEV	2a	20A 800VDC (400VDC at each 1 form A contact)	1000 VDC	S	1920

			Load Voltage											
Load	Output	PKG	20V	25V/30V	40V	80V	100V	200V	250V	350V	400V	600V	1000V	1500V
0.11 - 0.2 A	1a	SOP4									AQY214S AQY234S			
	1a	DIP4										AQY216EH		
	1a	SOP6						AQV227NS			AQV214S AQV224NS	AQV216S		
	1a	DIP6			AQV221	AQV225		AQV227N			AQV224N	AQV216	AQV259	AQV258
	1a1b	SOP8								AQW610S				
	1a1b	DIP8									AQW614EH AQW614			
	1b	SOP4									AQY414S			
	1b	SOP6									AQV414S			
	1b	DIP6									AQV414			
	2a	SOP8						AQW227NS		AQW210S	AQW214S AQW224N			
	2a	DIP8						AQW227N		AQW210HL	AQW214EH AQW214	AQW216EH AQW216		
	2b	SOP8									AQW414S			
	2b	DIP8									AQW414EH AQW414			
	4a	SOP16			AQS221FN2S AQS221N2S	AQS225R2S								
	1a	VSSOP		AQY221N3T										
	1a	VSSOP			AQY221N2T									
	1a	SSOP					AQY225R3V							
	1a	VSSOP	AQY221N5T											
		SSOP	AQY221N5V											
	1a	SON		AQY221N3M	AQY221N2M									
	1a	SSOP		AQY221N3V	AQY221FN2V AQY221N2V	AQY225R2V								
	1a	SOP4			AQY221N2S	AQY225R2S				AQY210KS AQY210LS AQY210S	AQY230S			
	1a	DIP4								AQY210EH	AQY214EH			
	1a	SOP6						AQV217S		AQV210S				
	1a	DIP6						AQV217	AQV253 AQV253H AQV203	AQV210E AQV210EH AQV210	AQV214E AQV214EH AQV214 AQV214H AQV254 AQV254H AQV104 AQV204 AQV234			
	1a1b	DIP8								AQW610EH	AQW654			
	1b	SOP4								AQY410S				
	1b	DIP4								AQY410EH	AQY414EH			
	1b	DIP6							AQV453	AQV410EH	AQV414E AQV414EH AQV454 AQV454H			
	2a	SOP8							AQW223R2S					
	2a	DIP8						AQW217		AQW210EH AQW210	AQW254			
	2b	DIP8									AQW454			
	4a	SOP16			AQS221FR2S AQS221R2S									

			Load Voltage								
Load	Output	Packaging	25V/30V	40V	50V	60V	80V	100V	200V	250V	400V
0.21-0.5A	1a	VSSOP		AQY221R2T							
	1a	VSSOP				AQY222R2T					
	1a	VSSOP		AQY221R2T							
	1a	SON		AQY221R2M							
	1a	SSOP		AQY221FR2V AQY221R2V AQY221R4V							
	1a	SOP4		AQY221R2S		AQY212S AQY232S AQY222R1S	AQY225R1S				
	1a	SOP6				AQV212S		AQV215S			
	1a	DIP6		AQV251 AQV201		AQV112KL AQV252 AQV202		AQV215 AQV255	AQV257	AQV103	
	1a	Power-DIP4									AQY274
	1a	SIL4									AQZ204 AQZ204D
	1b	SOP4				AQY412S					
	1b	SIL4									AQZ404
	1a1b	SOP8				AQW612S					
	1a1b	DIP8				AQW612EH					
	2a	SOP8				AQW212S					
	2a	DIP8				AQW212EH AQW212		AQW215			
0.51-1A	1a	VSSOP	AQY221R6T								
	1a	SSOP	AQY221R6V								
	1a	SOP4				AQY212GS					
	1a	DIP4	AQY211EH			AQY212EH					
	1a	Power-DIP4							AQY277		
	1a	DIP6		AQV101		AQV212 AQV102					
	1a	SIL4							AQZ207 AQZ207D		AQZ104 AQZ104D AQZ264
	1b	DIP4				AQY412EH					
	1b	DIP6				AQV412EH					
1.1-2A	1a	SOP		AQY211G2S							
	1a	SOP4				AQY212G2S					
	1a	DIP4				AQY212GH					
	1a	SOP6					AQV255GS				
	1a	Power-DIP4				AQY272		AQY275			
	1a	SIL4						AQZ205 AQZ205D	AQZ107 AQZ107D		
2.1-4A	1a	SOP			AQV252G2S						
	1a	DIP6	AQV251G			AQV252G					
	1a	SIL4				AQZ102 (DC) AQZ102D (DC) AQZ202 AQZ202D		AQZ105 AQZ105D			
4.1-10A	1a	SIL4							AQZ197		
	1a	SIL4				AQZ192 (DC) AQZ262					

	Series	Installation Method & Shape	Load Current	Load Voltage	Non-repetitive surge current	Breakdown Voltage
Through-hole & SMD	AQAD	Screw mounting, hockey puck type	30A	100VDC	90A	4,000 Vrms between input and output 2500 Vrms between input and output case
			10A	600VDC	20A	
	AQ-C	PC board terminal, DIL	1A	3 to 60VDC	1.5A	2500VAC
			1A	75 to 125/250VAC	20A	
			25mA	4 to 32VDC	-	
	AQ-F	Plug in terminal	2A & 3A	75 to 250 VAC	80A	2000VAC
			2A & 3A	3 to 60 VDC	5A & 6A	2500VAC
	AQ-G	PC board terminal, SIL	1A	75 to 264VAC	8A	3000VAC
			2A	75 to 264VAC	30A	
	AQ-H	PC board terminal, DIP8	0.3A		3A	5000VAC
			0.6A		6A	
			0.9A		9A	
			1.2A		12A	
	AQ1	PC board terminal, SIL	1A	10 to 200VDC	5A (1sec.)	3000VAC
			2A	3 to 60VDC	5A (1sec.)	
			3A	75 to 250VAC	80A	4000VAC (between input & output) 2500VAC (between input, output & case)
			10A (Heat sink)	75 to 250VAC	100A	
	AQ8	PC board terminal, SIL	2A	75 to 125/250VAC	30A	3000VAC
			3A	75 to 125/250VAC	80A	
Phototriac Coupler	APT	PC board terminal, SOP & DIP	0.05A	-	0.6A	3750VAC
			0.1A		1.2A	5000VAC
High Capacity	AQ-A	Screw mounting, hockey puck type	30A	4 to 32 VDC	90A	4000VAC (between input & output) 2500VAC (between input, output & case)
			15A	75 to 250 VAC	150A	
			25A	75 to 250 VAC	250A	
			40A	75 to 250 VAC	400A	
	AQ-J	DIN rail mounting, hockey puck type	10A	75 to 264VAC	100A	3000 Vrms (between input & output) 2500 Vrms (between input, output & case)
			20A	75 to 264VAC	250A	
			15A	75 to 264VAC	100A	
	AQ-J	Screw mounting, hockey puck type (tab terminal)	10A	75 to 264VAC	100A	3000 Vrms (between input & output) 2500 Vrms (between input, output & case)
			15A	75 to 264VAC	150A	
			25A	75 to 264VAC	250A	

	Series	Contact Arrangement	Nominal Switching Capacity (A) (Resistive Loads)	Max. Switching Voltage (V)	Nominal Operating Power (mW)
Automotive	CA	1a	20/30A 12VDC	15VDC, 16VDC, 30VDC	1.4W, 1.8W
		1b	20A 12VDC		
		1c	20A 12VDC		
	CB	1a (high capacity)	70A 14VDC	16VDC (12V TYPE)	1.4W, 1.8W
		1a	40A 14VDC	32VDC (24V TYPE)	
		1c N.O.	40A 14VDC		
		1c N.C.	30A 14VDC		
	CJ	1c	20A 14VDC (N.O.)	14VDC	640/800mW
		1cx2	10A 14VDC (N.C.)		
	CM	1a	35A 14VDC (N.O.)	16VDC	1.5/1.8W
		1c	20A 14VDC (N.C.)		
	CN-H	1a	30A 14VDC	16VDC	450/640mW
	CN-M	1a	30A 14VDC (N.O.)	16VDC	640mW
		1c	15A 14VDC (N.C.)		
	CP	1a	20A 14VDC (N.O.)	-	640mW
		1c	10A 14VDC (N.C.)		
	CP-Power	1a	20A 14VDC	-	450/640mW
		1c	10A 14VDC		
	CQ	1c	20A 14VDC (N.O.)	-	640mW
			10A 14VDC (N.C.)		
	CT	1c	20A 14VDC (N.O.)	-	800mW
		1cx2	10A 14VDC (N.C.)		
	CT-Power	1c	30A 14VDC(N.O.)	-	1000mW
		1cx2	10A 14VDC (N.C.)		
	CV	1a	20A 14VDC (N.O.)	14VDC	800mW
		1c	10A 14VDC (N.C.)		
	CW	2a	120A (5sec @20C)	100VDC	1.4W
			70A (1min @85C)	16VDC	
			45A (continued @85C)		
	JJ-M	1a	20A 14VDC (N.O.)	14VDC	640mW
		1c	10A 14VDC (N.C.)		
	AJJM	Double make contact	12A 14VDC	-	1000mW
			6A 1contact		
	JS-M	1a	10A 16VDC	16VDC	640mW
		1c	15A 16VDC		
	AEB	1a	100A 42VDC	42VDC	5W
	AEV	1a	10A 400VDC	400VDC	1.4W
			20A 400VDC		3.9W
			80A 400VDC		4.5W
			120A 400VDC		4.2W
			300A 400VDC		37.9W (0.1sec inrush) 3.6W stable / 44.4(0.1sec inrush) 3.8W stable
	AEV (Quiet)	1a	60A 12VDC		4.5W

	Series	Contact Arrangement	Nominal Switching Capacity (A) (Resistive Loads)	Max. Switching Voltage (V)	Nominal Operating Power (mW)
Automotive	TA	1c	N.O.: 20A N.C.: 10A	12 VDC	640mW 900mW
	TB	1a 1c 1c x 2	N.O.: 20A N.C.: 10A	12 VDC	640mW 900mW 1,440mW
	TC	1a 1c Double make contact 2a	N.O.: 30A N.C.: 15A	12 VDC	640mW 900mW 1,309mW
	TE	1c 1c x 2 (10 pin)	N.O.: 20A N.C.: 10A	12 VDC	640mW 900mW 1,309mW
	TG	1a 1c	N.O.: 30A N.C.: 15A	12 VDC	450mW 640mW
	TH	1c 1c x 2 (10 pin)	N.O.: 20A N.C.: 10A	12 VDC	655mW 900mW
	TJ	1c	N.O.: 30A N.C.: 15A	12 VDC	450mW

		Series	Contact Arrangement	Maximum Switching Voltage	Frequency Range	Contact Input Power	Latching: Single Side Stable (S), 1 Coil Latching (L1), 2 Coil Latching (L2)	Nominal Operating Power (mW)
Microwave Devices	High Frequency Relays	ARA	2c	30VDC	1GHz	3W @ 1GHz	S, L1, L2	S: 140mW (1.5 to 12V), 200mW (24V) 300mW (48V) L1: 70mW (1.5 to 12V), 100mW (24V) L2: 140mW (1.5 to 12V), 200mW (24V)
		ARE	1c	30VDC	2.6GHz	10W @ 2.6GHz	S	200
		ARJ	2c	30VDC	8GHz	1W @ 5GHz	S, L2	200mW (S), 150mW (L2)
		ARN	SPDT		1 GHz to 6 GHz	80W at 2GHz	S, L2	320mW (S), 400mW (L2)
		ARS	1c	30VDC	3GHz	10W @ 3GHz	S, L1, L2	200mW (S, L1), 400mW (L2)
	Coaxial Switches	ARD	SPDT, Transfer, SP6T	30VDC 100mA (indicator)	6 to 26.5GHz	120W @ 3GHz	S	840mW (SPDT/SP6T, Fail-safe, with indicator) 1540mW (Transfer, Fail-safe with indicator)
		ARV	SPDT		4 to 18GHz (PIN) 8 to 26.5GHZ (SMA)	Max 50W @3GHz	S	700mW

Signal

Series	Contact Arrangement	Nominal Switching Capacity (A)	Max. Switching Voltage (V)	Latching: Single Side Stable (S), 1 coil latching (L1), 2 coil latching (L2)	Nominal Operating Power
AGN	2c	1A 30 VDC, 0.3 A 125 VAC	110 VDC, 125 VAC	S, L1, S (high sensitivity)	L1 and S (high sensitivity type): 100mW (1.5 to 12VDC), 120mW (24VDC)
					S: 140mW (1.5 to 12VDC), 230mW (24VDC)
AGQ	2c	1 A 30 VDC, 0.3 A 125 VAC	110 VDC, 125 VAC	S, L1, S (high sensitivity)	L1 and S (high sensitivity type): 100mW (1.5 to 12VDC), 120mW (24VDC)
					S: 140mW (1.5 to 12VDC), 230mW (24VDC)
DS	1c, 2c	2 A 30 VDC	220 VDC, 250 VAC	S, L2	S: 200mW (standard), 400mW (high sensitivity)
					L2: 180mW (standard), 360mW (high sensitivity)
TQ	2c, 2d (M.B.B.), 4c	1 A 30 VDC, 0.5A 125 VAC	110 VDC, 125 VAC	S, L1, L2	S 2c: 140mW (3 to 12VDC), 200mW (24VDC), 300mW (48VDC)
					S 2d M.B.B.: 200mW
					S 4c: 280mW (3 to 24VDC), 400mW (48VDC)
					L1 (2c, 2d M.B.B.): 100mW (3 to 12VDC), 150mW (24VDC)
					L1 4c: 200mW
					L2 (2c, 2d M.B.B): 200mW (3 to 12VDC), 300mW (24VDC)
					L2 4c: 400mW
TQ-SMD	2c	2A 30 VDC, 0.5A 125 VAC	220 VDC, 125 VAC	S, L1, L2	S: 140, 200, 300mW
					L1: 70, 100mW
					L2: 140, 200mW
TX	2c	2A 30 VDC, 1A 30 VDC	220 VDC	S, L1, L2	S: 140 mW (1.5 to 24 V DC), 270 mW (48 V DC)
					L1: 100 mW (1.5 to 24 V DC)
					L2: 200 mW (1.5 to 24 V DC)
TX-D	2c, 2d (M.B.B.)	2A 30 VDC (2c)	220 VDC (2c)	S, L1	2c S: 200mW (1.5 to 12VDC), 230mW (24VDC)
					2c L1: 150mW (1.5 to 12VDC), 170mW (24VDC)
		1A 30 VDC (2d M.B.B.)	110 VDC (2d M.B.B.)		2d M.B.B. S: 250mW (1.5 to 12VDC), 270mW (24VDC)
TX-S	2c	1A 30 VDC	110 VDC	S, L1, L2	S: 50 mW (1.5 to 12 V DC), 70 mW (24 V DC)
					L1: 35 mW (1.5 to 12 V DC), 50 mW (24 V DC)
					L2: 70 mW (1.5 to 12 V DC),150 mW (24 V DC)
TX (TH type)	2c	2A 30 VDC, 0.5A 125 VAC	220 VDC, 250 VAC	S, L1, L2	S: 140 mW (1.5 to 24 V DC), 270 mW (48 V DC)
					L1: 100 mW (1.5 to 24 V DC)
					L2: 140 mW (1.5 to 24 V DC)
DS2Y	2c	2A 30 VDC	220VDC 250 VAC	S	S: 200 mW (1.5 to 24 VDC), 300 mW (48 VDC)

Over 65,000 Part Numbers
Are Just a Click Away

Visit the NEW Panasonic Website Today at:
na.industrial.panasonic.com

Quickly and Easily Search Product Details

Discover The Latest Panasonic Products

Easily Find Inventory By Part Number

Locate Distributors & Get Support

Panasonic

industrial@us.panasonic.com | 1-800-344-2112

Panasonic

Panasonic Industrial Devices Sales Company of America
Two Riverfront Plaza, 7th Floor, Newark, NJ 07102

800-344-2112 | na.industrial.panasonic.com | industrial@us.panasonic.com

Panasonic
ideas for life

GENERAL CATALOG

MICROWAVE DEVICES

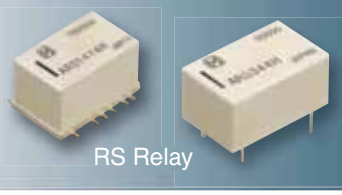
Product lineup

MICROWAVE DEVICES

Terminal type for PC board

HIGH FREQUENCY RELAYS

RA Relay | RE Relay | RS Relay
RN Relay | RJ Relay



RS Relay

Coaxial connector contact terminal

COAXIAL SWITCHES

RD Coaxial Switch (SPDT, Transfer, SP6T)

- Frequency 13 GHz (SP6T) (~26.5GHz, SPDT/Transfer)
- High capacity load (120W)

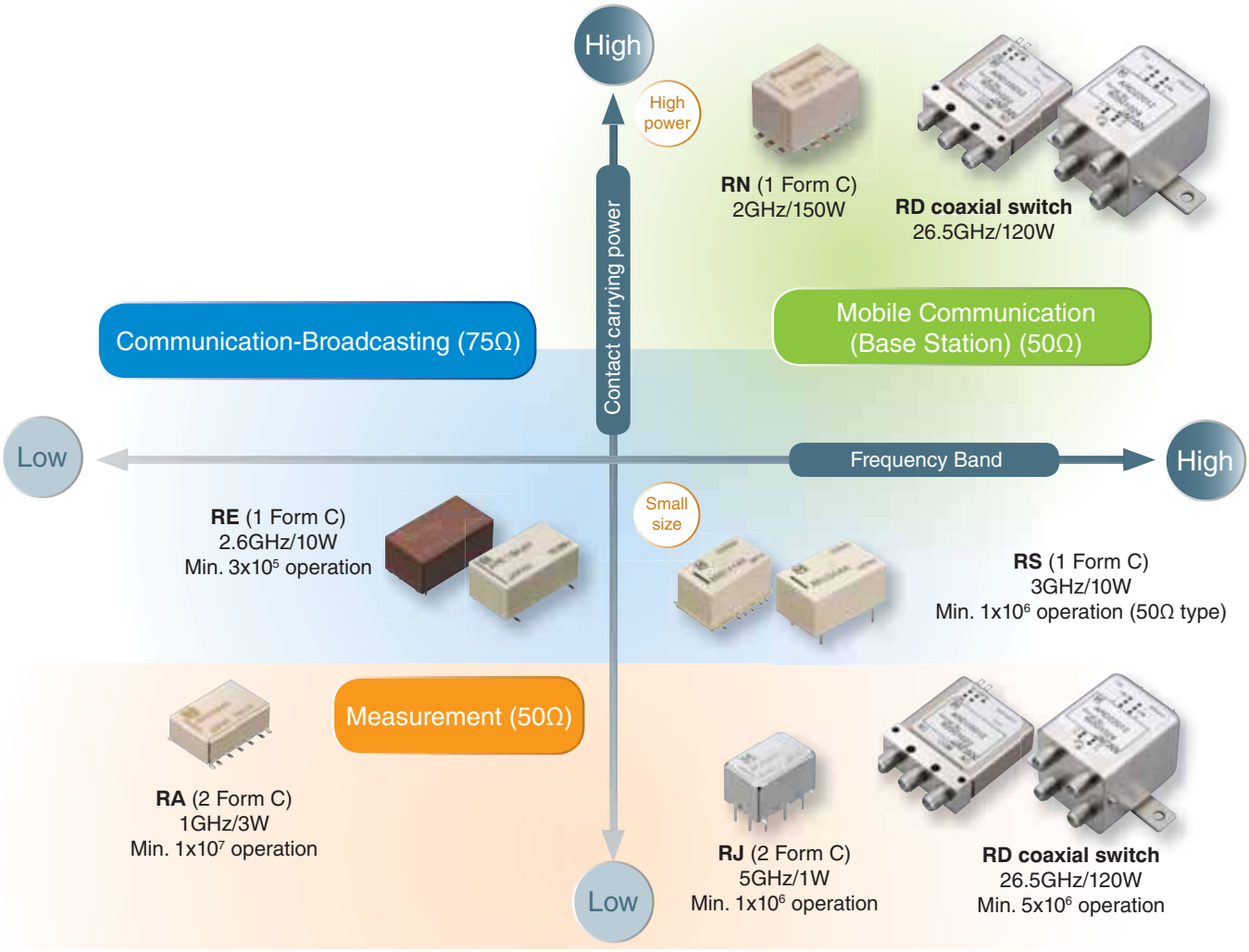
SPDT

RV Coaxial Switch (SPDT)

- Frequency ~26.5GHz
- Small size

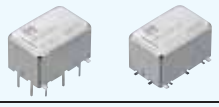
SMA

Types — Applications



Contents

Support for wide range of frequencies

Product lineup	Features	Impe-dance	Contact arrange-ments	Frequency range (GHz) 1 2 3 8 13 18 26.5
RJ 	Up to 8GHz* SMD terminal available	50Ω	2 Form C	
RN 	Up to 8GHz 150W contact carry-ing power available	50Ω	1 Form C	
RS 	Miniature design Reversed contact/E/Y layout available	50/75Ω	1 Form C	
RE 	SMD and THT terminal available 50Ω and 75Ω type available	50/75Ω	1 Form C	
RA 	10 million operations for measurement market	50Ω	2 Form C	
RV 	Up to 26.5GHz small size coaxial switch	50Ω	SPDT	
RD  	Long life and high sensitivity coaxial switch	50Ω	SPDT	
			Transfer	
			SP6T	

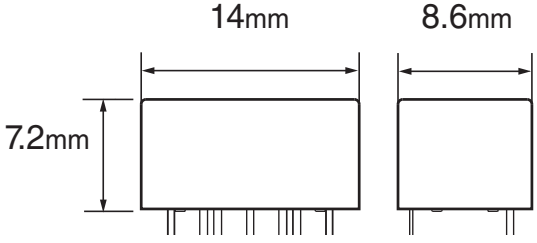
*Ratings are 5GHz

Expanding design possibilities with miniature microwave relays

Presenting the new RS relay with excellent high-frequency characteristics for communications and measurement applications.

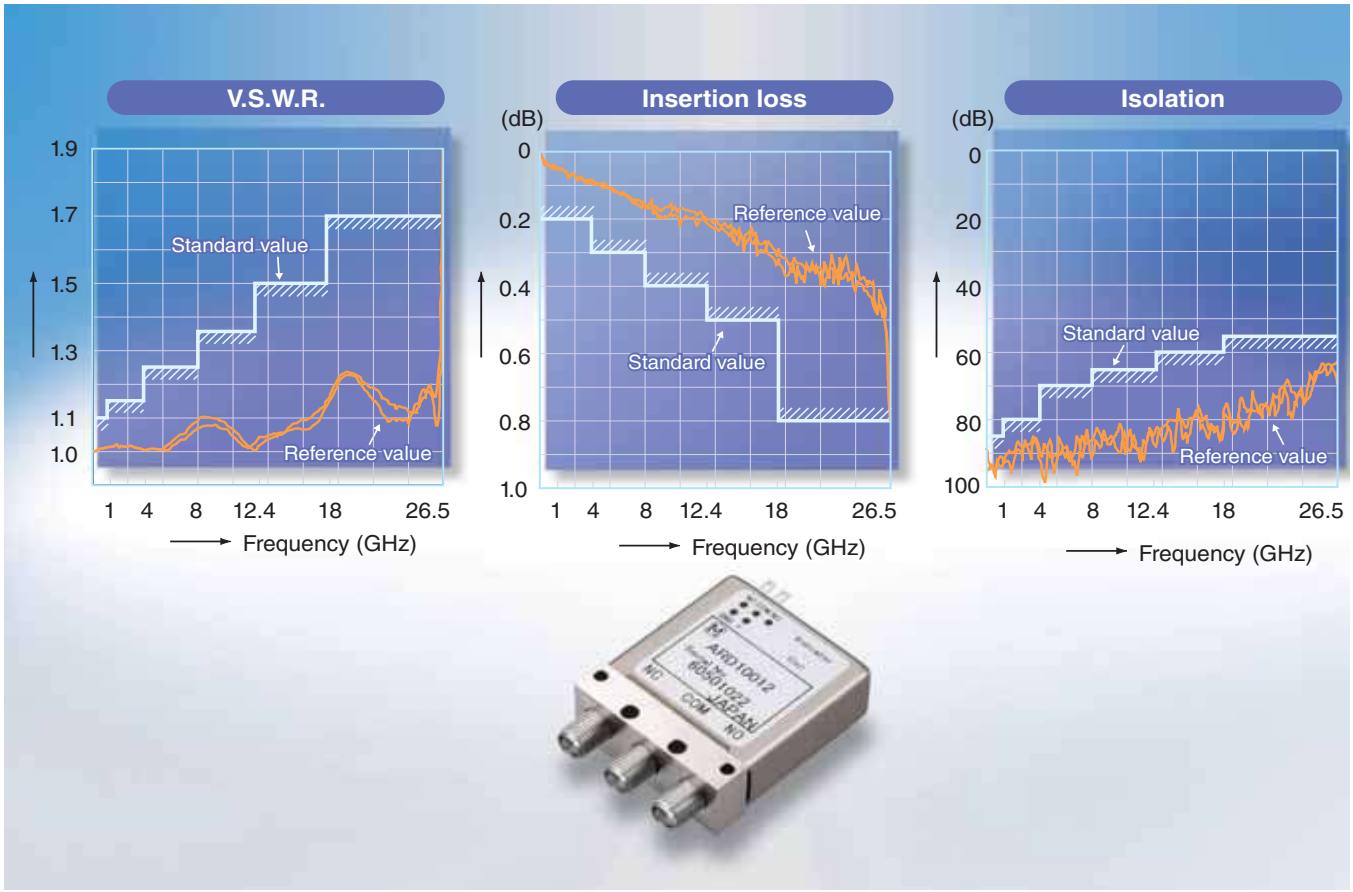
A new 50Ω type (up to 3GHz) is now available for applications demanding high quality such as mobile phone base stations, wireless devices, and measurement equipment. While maintaining excellent high-frequency characteristics this model is 60% smaller than its predecessor*.
A 75Ω type is also available for broadcasting equipment.

*Compared to RK relay.

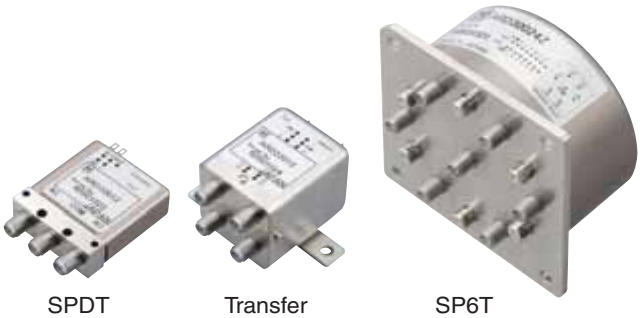


Rich lineup of coaxial switches with excellent HF characteristics

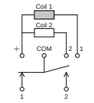
High quality to bolster device reliability. The RD coaxial switch is available in SPDT, Transfer and SP6T types.



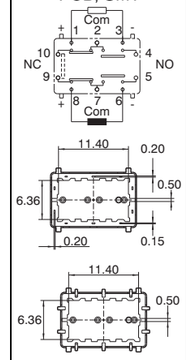
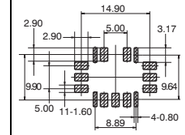
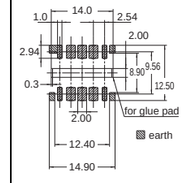
These coaxial switches are ideal for applications that require high quality and reliability such as base stations, wireless devices, and measurement instruments. With excellent high-frequency characteristics extending into the high-frequency band, these switches achieve a long working life of 5 million switchings.
A rich lineup is offered that includes a with-termination-type (SP6T) and a coil drive (+COM type) type to suit many different applications.



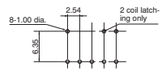
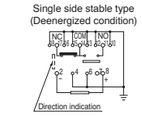
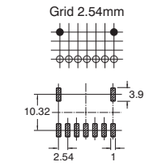
SPDT Transfer SP6T

Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage				Life (min. operations)		Mounting method (bottom view)	Page Approvals
							Between open contacts	Between contact sets	Contacts to coil	Between live parts and ground	Electrical	Mechanical		
RV SPDT 1:1  15.9 x 15.9 x 11.2mm	• Ultra small coaxial switch • Up to 26.5 GHz • Impedance 50Ω • PIN and SMA terminals available • Latching types available • 2-coil latching type helps reduce power consumption • Failsafe type available • Reverse type available • Surge withstand voltage: 500Vrms HF Characteristics at 18GHz/ SMA type: • Isolation min. 40dB • Insertion loss max. 0.7dB • V.S.W.R. max. 1.7	**HF:** 50W (3GHz)	—	SPDT	(DC) 4.5, 12, 24V	700mW	500Vrms	500Vrms	500Vrms	500Vrms	3×10^5	10^6	PIN, SMA 	44 —
★**RD SPDT** 1:2  34 x 13.2 x 39mm	• Coaxial relay • Up to 26.5GHz (18GHz) • Impedance 50Ω • Latching types available • TTL Version available HF Characteristics at 18GHz: • Isolation min. 60dB • Insertion loss max. 0.5dB • V.S.W.R. max. 1.5	**DC:** 100mA (indicator) **HF:** 120W (3GHz)	• 30V DC (indicator)	SPDT	(DC) 4.5, 12, 24V	**Single side stable:** 840-970mW (4.5, 12, 24V) **2 coil latching:** 700-900mW (4.5, 12, 24V) **Latching with TTL driver (self cut-off function):** 5, 12, 24V	500Vrms	500Vrms	500Vrms	500Vrms	5×10^6	5×10^6	Coax	50 —
★**RD TRANSFER** 1:2  32 x 32 x 39mm	• Coaxial relay • Up to 26.5GHz (18GHz) • Impedance 50Ω • Latching types available • TTL Version available HF Characteristics at 18GHz: • Isolation min. 60dB • Insertion loss max. 0.5dB • V.S.W.R. max. 1.5	**DC:** 100mA (indicator) **HF:** 120W (3GHz)	• 30V DC (indicator)	DPDT	(DC) 4.5, 5, 12, 24V	**Single side stable:** 1540-1670mW (4.5, 12, 24V) **2 coil latching:** 1200-1400mW (4.5, 12, 24V) **Latching with TTL driver (self cut-off function):** 5, 12, 24V	500Vrms	500Vrms	500Vrms	500Vrms	5×10^6	5×10^6	Coax	50 —
★**RD SP6T** 1:4  80 x 80 x 39.5mm	• Coaxial relay • Up to 13GHz (18GHz) • Terminated type available • Impedance 50Ω • Latching types available HF Characteristics at 13GHz: • Isolation min. 65dB • Insertion loss max. 0.4dB • V.S.W.R. max. 1.5	**DC:** 100mA (indicator) **HF:** 120W (3GHz)	• 30V DC (indicator)	SP6T	(DC) 4.5, 5, 12, 24V	**Single side stable:** 840mW (4.5, 12V) 970mW (24V) **Latching:** 700mW (SET 4.5V) 750mW (SET 12V) 900mW (SET 24V)	500Vrms	500Vrms	500Vrms	500Vrms	5×10^6	5×10^6	Coax	50 —

Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current	Max. switching voltage	Contact arrangement	Coil voltage
★**RJ** 1:1  14 x 9 x 8.2mm	• Shielded HF relay • Up to 8GHz • Impedance 50Ω • Latching types available • SMD and PCB version available HF Characteristics at 5GHz: • Isolation min. 35dB • Isolation min. 30dB between contact sets • Insertion loss max. 0.5dB • V.S.W.R. max.1.25	**DC:** 0.3A **HF:** 1W (5GHz)	• 30V DC	2c	(DC) 3, 4.5, 12, 24V
★**RN** 1:1  14.6 x 9.6 x 10.0mm	• High hot switching capability up to 80W at 2GHz, contact rating up to 150W at 2GHz • High frequency capability up to 6GHz • 1 changeover contact, impedance 50Ω • Reversed contact type available • Single side stable or 2 coil latching types available • SMT version available • Very good HF characteristics HF Characteristics at 2GHz: • Isolation min. 55dB • Insertion loss max. 0.12dB • V.S.W.R. max. 1.15	**DC:** 0.5A **HF:** 80W	• 30V DC	1c SPDT	(DC) 4.5, 12, 24V
RA 1:1  14.7 x 9.7 x 5.9mm	• HF relay in SMT version • Up to 1GHz • Impedance 50Ω • Latching types available HF Characteristics at 1GHz: • Isolation min. 20dB • Isolation min. 30dB between contact sets • Insertion loss max. 0.3dB • V.S.W.R. max. 1.2	**DC:** 1A **HF:** 3W (1GHz, carrying point to carrying current)	• 30V DC	2c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V

Coil power	Breakdown voltage				Life (min. operations)		Mounting method (bottom view)	Page Approvals
	Between open contacts	Between contact sets	Contacts to coil	Between live parts and ground	Electrical	Mechanical		
Single side stable: 200mW **2 coil latching:** 150mW	500Vrms	500Vrms	500Vrms	500Vrms	10^6	10^7	PCB, SMT  	17 —
Single side stable: 320mW **2 coil latching:** 400mW	500Vrms	—	500Vrms	500Vrms	10^5	10^6	SMT  	37 —
Single side stable: 140mW (1.5 - 12V) 200mW (24V) 300mW (48V) **1 coil latching:** 70mW (1.5 - 12V) 100mW (24V) **2 coil latching:** 140mW (1.5 - 12V) 200mW (24V)	750Vrms	1000Vrms	1000Vrms	1000Vrms	10^7	10^8	SMT Suggested mounting pads (Top view)  	12 —

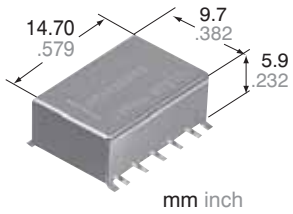
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current	Max. switching voltage	Contact arrangement	Coil voltage
★**RS** 1:1  14 x 8.6 x 7/8mm	• HF relay • Up to 3GHz • Impedance 50/75Ω • Silent type available • Latching types available • SMT and PCB version available • 10W at 3GHz contact carrying power HF Characteristics at 3GHz (50Ω PCB type): • Isolation min. 35dB • Insertion loss max. 0.35dB • V.S.W.R. max. 1.4	**DC:** 0.5A **HF:** 1W (3GHz)	• 30V DC	1c	(DC) 3, 4.5, 9, 12, 24V
RE 1:1  20.2 x 11.2 x 8.9/9.6mm	• HF relay • Up to 2.6GHz • Impedance 50/75Ω • SMT and PCB version available HF Characteristics at 2.6GHz (75Ω PCB type): • Isolation min. 30dB • Insertion loss max. 0.5dB • V.S.W.R. max. 1.5	**DC:** 0.5A **HF:** 1W (2.6GHz)	• 30V DC	1c	(DC) 3, 4.5, 6, 9, 12, 24V

Coil power	Breakdown voltage				Life (min. operations)		Mounting method (bottom view)	Page Approvals
	Between open contacts	Between contact sets	Contacts to coil	Between live parts and ground	Electrical	Mechanical		
Single side stable: 200mW **1 coil latching:** 200mW **2 coil latching:** 400mW	500Vrms	—	1000Vrms	500Vrms	3 x 10^5	5 x 10^6	PCB, SMT  50Ω PCB type Single side stable type (Deenergized condition)  50Ω SMT type	22 —
Single side stable: 200mW	500Vrms	—	1000Vrms	500Vrms	3 x 10^5	10^6	PCB, SMT Grid 2.54mm  	33 —

Panasonic
ideas for life

1.0 GHz 2 Form C relay

RA RELAYS (ARA)



FEATURES

1. High frequency characteristics (Impedance 50Ω, ~1.0GHz)
- Insertion loss; Max. 0.3dB
- Isolation; Min. 20dB (Between open contacts) Min. 30dB (Between contact sets)
- V.S.W.R.; Max. 1.2

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

3. Low profile small type
9.7(W)×14.7(L)×5.9(H) mm
.382(W)×.579(L)×.232(H) inch

4. High sensitivity: 140 mW nominal operating power

5. High contact reliability
Electrical life: Min. 10^7 (10mA 10V DC)

TYPICAL APPLICATIONS

- **Measurement instruments**
  Oscilloscope attenuator circuit

SPECIFICATIONS

Contact

Arrangement			2 Form C
Contact material		Stationary	AgPd + Au clad
		Movable	AgPd
Initial contact resistance (By voltage 6V DC 1A)			Max. 75m¾
Rating	Contact rating (resistive)		10mA 10 V DC 1A 30 V DC
	Contact carrying power		Max. 3W (at 1.0GHz, impedance 50¾, V.S.W.R. max.1.2)
	Max. switching voltage		30 V DC
	Max. switching current		1A
High frequency characteristics (~1GHz, Impedance 50¾) (Initial)	Isolation	Between open contacts	Min. 20dB
		Between contact sets	Min. 30dB
	Insertion loss		Max. 0.3dB
	V.S.W.R.		Max. 1.2
	Input power		Max. 3W (at 1.0GHz, impedance 50¾, V.S.W.R. max.1.2)
Nominal operating power	Single side stable		140mW (1.5 to 12V) 200mW (24V) 300mW (48V)
	1 coil latching		70 mW (1.5 to 12V) 100mW (24V)
	2 coil latching		140mW (1.5 to 12V) 200mW (24V)
Expected life (min. operation)	Mechanical (at 180 cpm)		10^8
	Electrical (at 20 cpm)	10mA 10 V DC (resistive load)	10^7
		1A 30 V DC (resistive load)	10^5

Characteristics

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

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Nominal operating voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil: 3W contact carrying power: at 1.0GHz, Impedance 50Ω, V.S.W.R. Max.1.2
*5 Half-wave pulse of sine wave: 11ms, detection time: 10μs.
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage conditions in NOTES (Page 16).

ORDERING INFORMATION

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

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

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

TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type

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

• 1 coil latching type

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

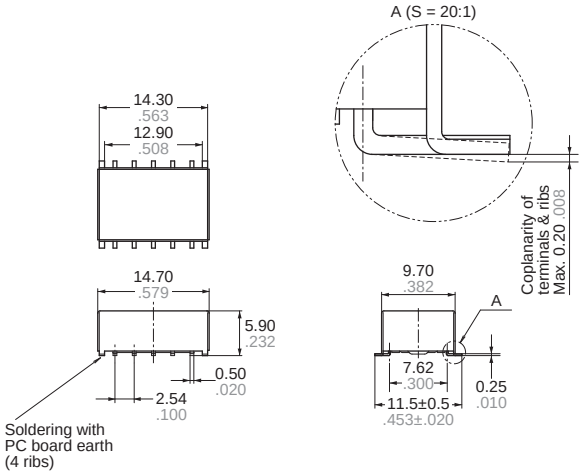
• 2 coil latching type

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

DIMENSIONS mm inch

Download CAD Data from our Web site.

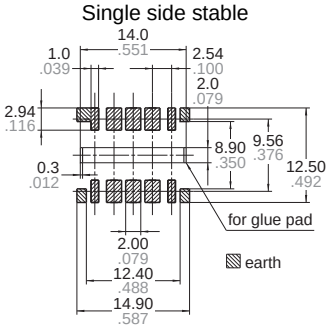
CAD Data



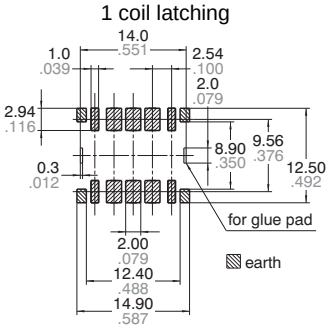
Tolerance: ±0.3 ±.012

Suggested Mounting Pads (Top view)

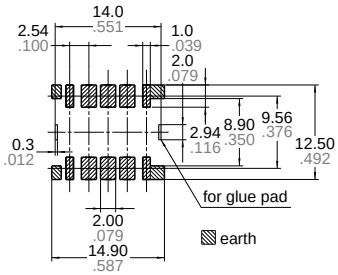
Single side stable



1 coil latching



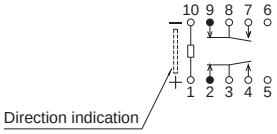
2 coil latching



Tolerance: ±0.1 ±.004

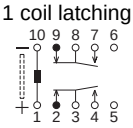
Schematic (Top view)

Single side stable



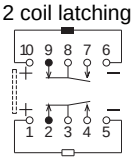
(Deenergized condition)

1 coil latching



(Reset condition)

2 coil latching



(Reset condition)

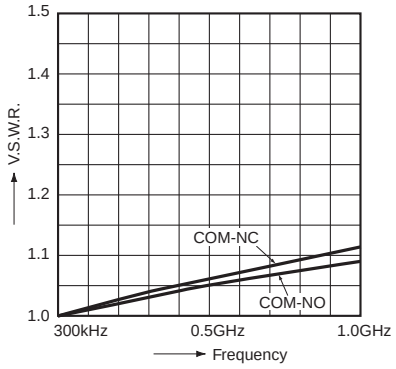
REFERENCE DATA

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

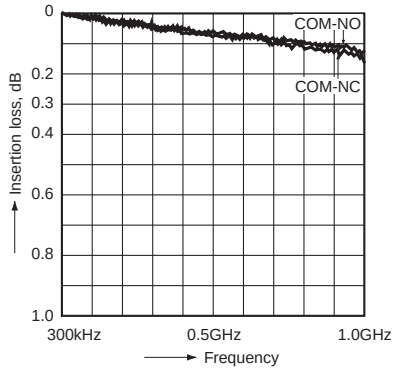
Sample: ARA200A12

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

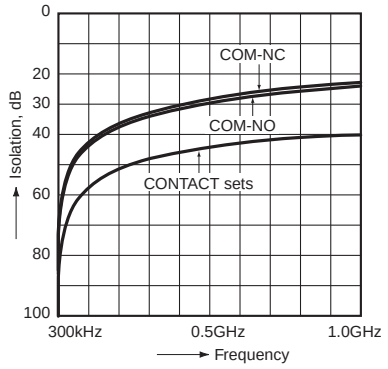
• V.S.W.R.



• Insertion loss



• Isolation

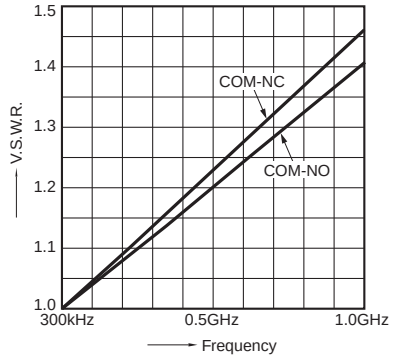


1-(2). High frequency characteristics (Impedance 75Ω)

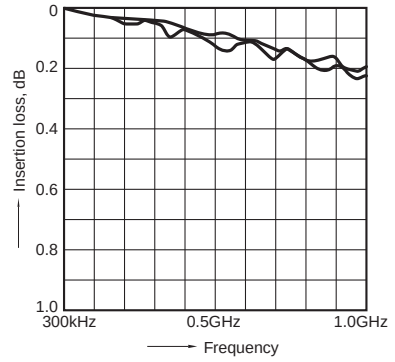
Sample: ARA200A12

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

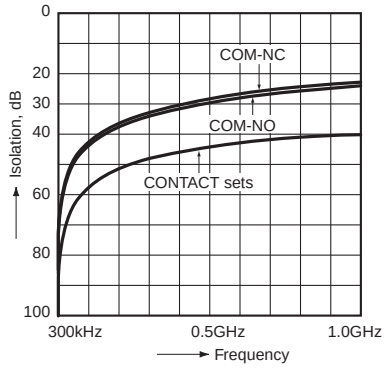
• V.S.W.R.



• Insertion loss



• Isolation



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. The nominal operating voltage should be applied to the coil for more than 10 ms to set/reset the latching type relay.

2. Coil connection

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

3. External magnetic field

Since RA relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

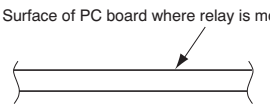
4. Cleaning

For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick.
It is recommended that alcoholic solvents be used.

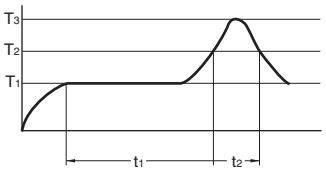
5. Soldering

Manual soldering shall be performed under following condition.
Tip temperature: 280°C to 300°C 536°F to 572°F.
Wattage: 30 to 60W
Soldering time: within 5s
In case of automatic soldering, the following conditions should be observed

1) Position of measuring temperature



2) IR (infrared reflow) soldering method



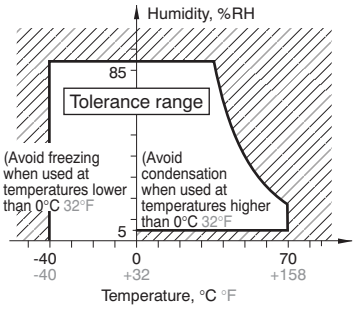
T_1 = 150 to 180C 302 to 356F
T_2 = 230C 446F and higher
T_3 = Within 250C 482F
t_1 = 60 to 120 sec.
t_2 = Within 30 sec.

Temperature rise of relay itself may vary according to the mounting level or the heating method of reflow equipment. Therefore, please set the temperature of soldering portion of relay terminal and the top surface of the relay case not to exceed the above mentioned soldering condition.
It is recommended to check the temperature rise of each portion under actual mounting condition before use.
The soldering earth shall be performed by manual soldering.

6. Conditions for operation, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +70°C –40 to +158°F
(2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.

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



2) Condensation

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

3) Freezing

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

4) Low temperature, low humidity environments

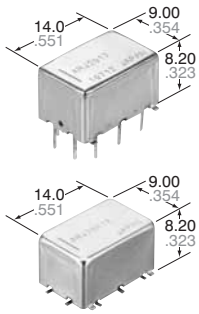
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

For complete “Cautions for Use”, please download the “Relay Technical Information” from our Web site. For instructions on soldering, see page 66. For information on reliability, see page 64.

Panasonic
ideas for life

Up to 8 GHz small microwave relays

RJ RELAYS (ARJ)



FEATURES

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

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

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

TYPICAL APPLICATIONS

Measuring equipment market
Attenuator circuits, spectrum analyzer, oscilloscope

Mobile telecommunication market
IMT2000, microwave communication

Medical instrument market

SPECIFICATIONS

Contact

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

Coil (at 20°C, 68°F)

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

Characteristics

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

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Nominal operating voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil, 5GHz, V.S.W.R. & 1.25
*5 Half-wave pulse of sine wave: 6ms, detection time: 10μs.
*6 Pulse of sine wave: 11ms.
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage conditions in NOTES (Page 20).

ORDERING INFORMATION

Ex. ARJ 2 ☐ ☐ ☐ ☐

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

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

TYPES AND COIL DATA (at 20°C 68°F)

1. Standard PC board terminal

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

Operating function	Coil Rating, V DC	Part No.	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
		Standard PC board terminal						
Single side stable	3	ARJ2003	2.25	0.3	66.6	45	200	3.3
	4.5	ARJ204H	3.375	0.45	44.4	101.2	200	4.95
	12	ARJ2012	9	1.2	16.6	720	200	13.2
	24	ARJ2024	18	2.4	8.3	2,880	200	26.4

Operating function	Coil Rating, V DC	Part No.	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
		Standard PC board terminal						
2 coil latching	3	ARJ2203	2.25	2.25	50	60	150	3.3
	4.5	ARJ224H	3.375	3.375	33.3	135	150	4.95
	12	ARJ2212	9	9	12.5	960	150	13.2
	24	ARJ2224	18	18	6.3	3,840	150	26.4

2. Surface-mount terminal

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

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

Operating function	Coil Rating, V DC	Part No.		Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
		Carton packing	Tape and reel packing						
Single side stable	3	ARJ20A03	ARJ20A03Z	2.25	0.3	66.6	45	200	3.3
	4.5	ARJ20A4H	ARJ20A4HZ	3.375	0.45	44.4	101.2	200	4.95
	12	ARJ20A12	ARJ20A12Z	9	1.2	16.6	720	200	13.2
	24	ARJ20A24	ARJ20A24Z	18	2.4	8.3	2,880	200	26.4

Operating function	Coil Rating, V DC	Part No.		Set voltage, V DC (max.) (initial)	Reset voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
		Carton packing	Tape and reel packing						
2 coil latching	3	ARJ22A03	ARJ22A03Z	2.25	2.25	50	60	150	3.3
	4.5	ARJ22A4H	ARJ22A4HZ	3.375	3.375	33.3	135	150	4.95
	12	ARJ22A12	ARJ22A12Z	9	9	12.5	960	150	13.2
	24	ARJ22A24	ARJ22A24Z	18	18	6.3	3,840	150	26.4

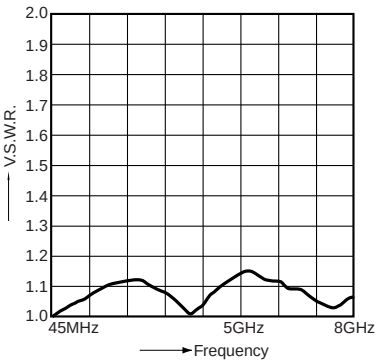
REFERENCE DATA

1. High frequency characteristics

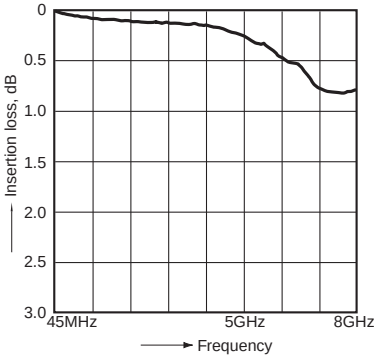
Sample: ARJ20A12

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

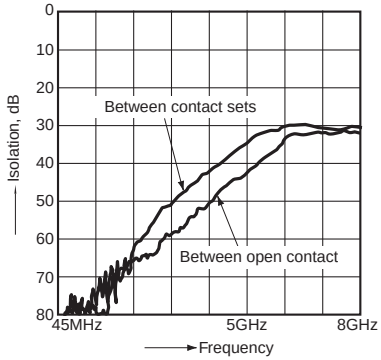
• V.S.W.R. characteristics



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



• Isolation characteristics

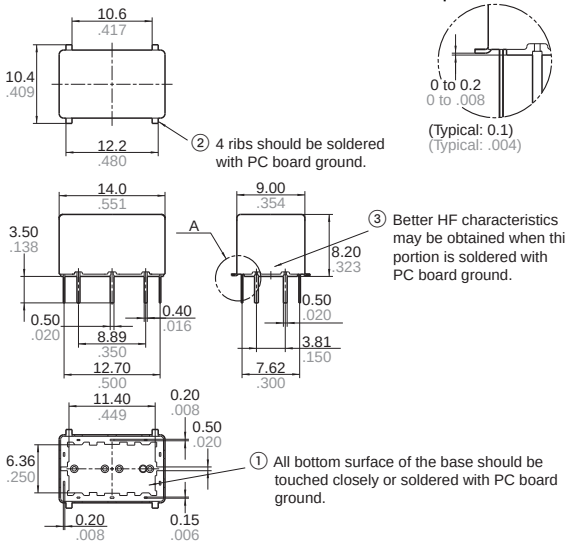


DIMENSIONS mm inch

Download CAD Data from our Web site.

1. Standard PC board terminal

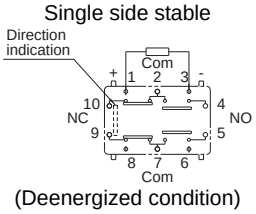
CAD Data



Expansion of A

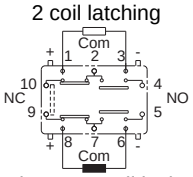
Schematic (Bottom view)

Single side stable



(Deenergized condition)

2 coil latching

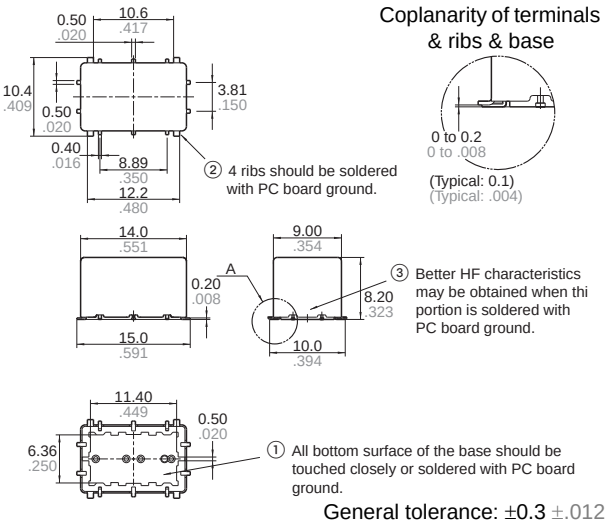


(Reset condition)

General tolerance: ±0.3 ±.012

2. Surface mount terminal

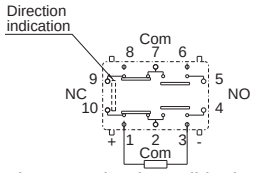
CAD Data



Expansion of A: Coplanarity of terminals & ribs & base

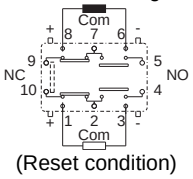
Schematic (Top view)

Single side stable



(Deenergized condition)

2 coil latching



(Reset condition)

General tolerance: ±0.3 ±.012

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. The nominal operating voltage should be applied to the coil for more than 20 ms to set/reset the latching type relay.

2. Coil connection

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

3. External magnetic field

Since RJ relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

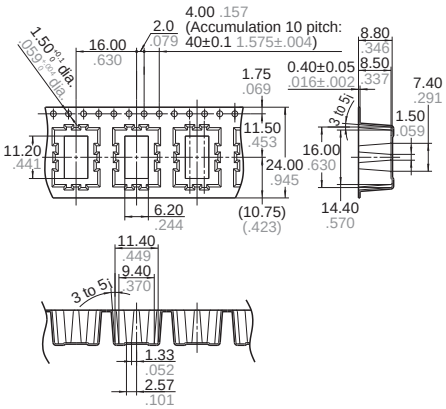
4. Cleaning

For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick.

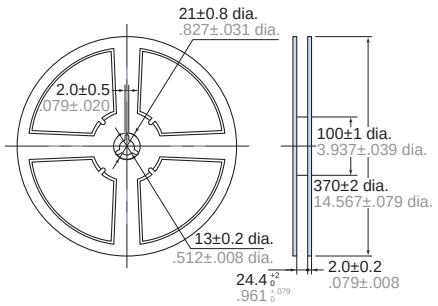
It is recommended that alcoholic solvents be used.

5. Tape and reel packing

1) Tape dimensions



2) Dimensions of plastic reel



6. Conditions for operation, transport and storage conditions

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

(1) Temperature:

–30 to +70°C –22 to +158°F

(However, tolerance range is –30 to +60°C –22 to +140°F if package is carried as is.)

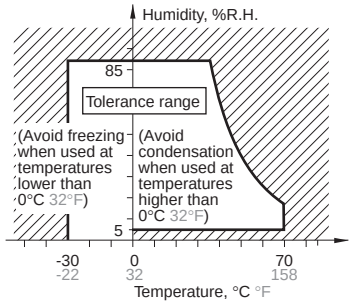
(2) Humidity: 5 to 85% RH

(Avoid freezing and condensation.)

The humidity range varies with the temperature. Use within the range indicated in the graph below.

(3) Atmospheric pressure: 86 to 106 kPa

Temperature and humidity range for usage, transport, and storage:



2) Condensation

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

3) Freezing

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

4) Low temperature, low humidity environments

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

5) Storage procedures for surface-mount terminal types

Since the relay is very sensitive to humidity, it is packed in humidity-free, hermetically sealed packaging. When storing the relay, be careful of the following points:

(1) Be sure to use the relay immediately after removing it from its sealed package.

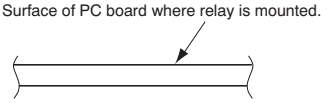
(2) When storing the relay for long periods of time after removing it from its sealed package, we recommend using a humidity-free bag with silica gel to prevent subjecting the relay to humidity. Furthermore, if the relay is solder mounted when it has been subjected to excessive humidity, cracks and leaks can occur. Be sure to mount the relay under the required mounting conditions.

7. Soldering

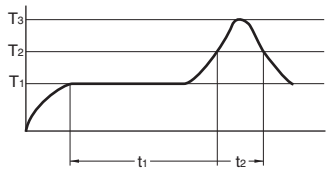
1) Surface-mount terminal

In case of automatic soldering, the following conditions should be observed

(1) Position of measuring temperature



(2) IR (infrared reflow) soldering method



T_1 = 150 to 180C 302 to 356F
T_2 = 230C 446F and higher
T_3 = Within 250C 482F
t_1 = 60 to 120 sec.
t_2 = Within 30 sec.

Temperature rise of relay itself may vary according to the mounting level or the heating method of reflow equipment. Therefore, please set the temperature of soldering portion of relay terminal and the top surface of the relay case not to exceed the above mentioned soldering condition.

It is recommended to check the temperature rise of each portion under actual mounting condition before use.

2) Standard PC board terminal

Please meet the following conditions if this relay is to be automatically soldered.

(1) Preheating: Max. 120°C 248°F (terminal solder surface) for max. 120 seconds

(2) Soldering: Max. 260±5°C 500±9°F for max. 6 seconds

The effect on the relay depends on the actual substrate used. Please verify the substrate to be used.

Moisture-proof packaging enables RJ relay's standard PCB type capable for reflow soldering.

Please contact us in the case of reflow soldering considerations.

3) Hand soldering

Please meet the following conditions if this relay is to be soldered by hand.

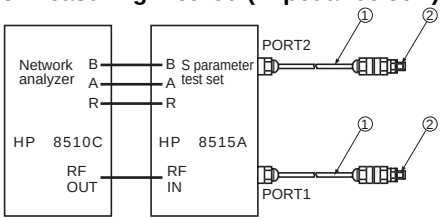
(1) Wattage: 30 to 60 W

(2) Tip temperature/time: 280 to 300°C 536 to 572°F for max. 5 seconds

The effect on the relay depends on the actual substrate used. Please verify the substrate to be used.

4) Avoid high frequency cleaning since this may adversely affect relay characteristics. Use alcohol-based cleaning solutions when cleaning relays.

8. Measuring method (Impedance 50Ω)



Connector

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

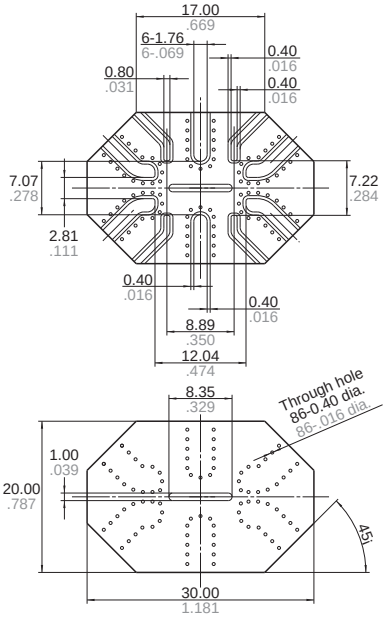
(Step 1) Calibrate the test system with HP calibration kit [HP85052B]
(Step 2) After calibration, connect the D.U.T. board and measure. Connect 50 Ω terminals on connectors other than those for measurement.

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

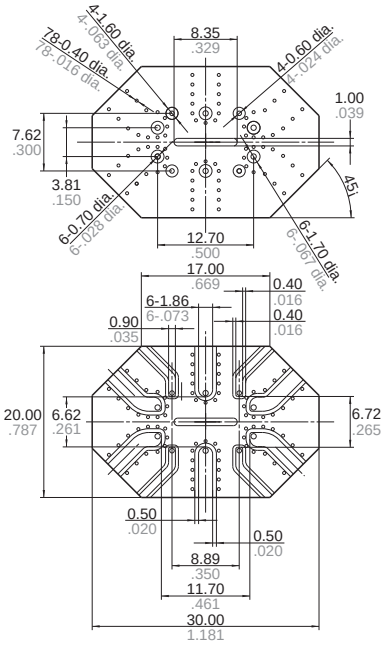
Measuring board

1) Dimensions

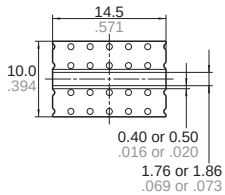
<Surface mount terminal>



<Standard PC board terminal>



<Calibration board>



2) Material: Glass PTFE double-sided through hole PC board R-4737 (Matsushita Electric Works)
3) Board thickness: t = 0.8 mm
4) Copper plating: 18μm
• Connector (SMA type receptacle)
Product name: R125 510 (RADIALL)
Insertion loss compensation
The insertion loss of relay itself is given by subtracting the insertion loss of short-circuit the Com and the NC (or NO). (signal path and two connectors)

9. Others

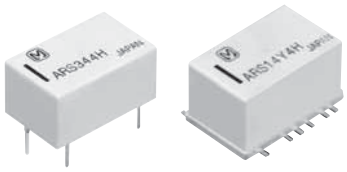
1) The switching lifetime is defined under the standard test condition specified in the JIS* C 5442-1996 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.
Also, be especially careful of loads such as those listed below.
• When used for AC load-operating and the operating phase is synchronous.
Rocking and fusing can easily occur due to contact shifting.
• High-frequency load-operating
When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
(1) Incorporate an arc-extinguishing circuit.
(2) Lower the operating frequency
(3) Lower the ambient humidity
2) Use the relay within specifications such as coil rating, contact rating and on/off service life. If used beyond limits, the relay may overheat, generate smoke or catch fire.
3) Be careful not to drop the relay. If accidentally dropped, carefully check its appearance and characteristics before use.
4) Be careful to wire the relay correctly. Otherwise, malfunction, overheat, fire or other trouble may occur.
5) If a relay stays on in a circuit for many months or years at a time without being activated, circuit design should be reviewed so that the relay can remain non-excited. A coil that receives current all the time heats, which degrades insulation earlier than expected. A latching type relay is recommended for such circuits.
6) The latching type relay is shipped in the reset position. But jolts during transport or impacts during installation can change the reset position. It is, therefore, advisable to build a circuit in which the relay can be initialized (set and reset) just after turning on the power.
7) If silicone materials (e.g., silicone rubbers, silicone oils, silicone coating agents, silicone sealers) are used in the vicinity of the relay, the gas emitted from the silicone may adhere to the contacts of the relay during opening and closing and lead to improper contact. If this is the case, use a material other than silicone.
8) We recommend latching type when using in applications which involve lengthy duty cycles.
* Japanese Industrial Standards

For complete “Cautions for Use”, please download the “Relay Technical Information” from our Web site. For instructions on soldering, see page 66. For information on reliability, see page 64.

Panasonic
ideas for life

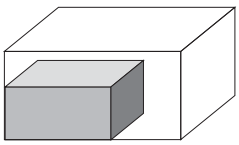
3 GHz microwave relays miniature size lineup includes 50/75 Ω type

RS RELAYS (ARS)



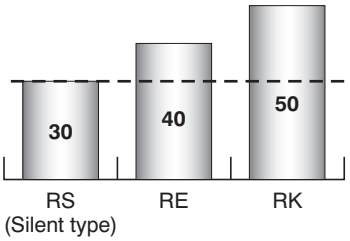
FEATURES

1. Super miniature design
14 × 8.6 × 7.2 mm .551 × .339 × .283 inch
(standard PC board terminal)



60% OFF in volume
(Compared to
RK relay)

2. Lineup includes silent type.
(75Ω type only)
Operation noise (Unit: dB)



3. Excellent high frequency characteristics

• Impedance: 50Ω
(Standard PC board terminal)

Frequency	to 900 MHz	to 3 GHz
V. S. W. R. (Max.)	1.20	1.40
Insertion loss (dB, Max.)	0.10	0.35
Isolation (dB, Min.)	60	35

• Impedance: 75Ω
(Standard PC board terminal)

Frequency	to 900 MHz	to 3 GHz
V. S. W. R. (Max.)	1.15	1.40
Insertion loss (dB, Max.)	0.10	0.30
Isolation (dB, Min.)	60	30

• Impedance: 50Ω
(Surface-mount terminal)

Frequency	to 900 MHz	to 3 GHz
V. S. W. R. (Max.)	1.20	1.40
Insertion loss (dB, Max.)	0.20	0.40
Isolation (dB, Min.)	55	30

• Impedance: 75Ω
(Surface-mount terminal)

Frequency	to 900 MHz	to 3 GHz
V. S. W. R. (Max.)	1.20	1.50
Insertion loss (dB, Max.)	0.20	0.50
Isolation (dB, Min.)	55	30

4. Lineup includes surface-mount terminal type
E and Y layouts available.

5. Lineup includes reversed contact type
Great design freedom is possible using reversed contact type in which the positions of the N.O. and N.C. contacts are switched.

TYPICAL APPLICATIONS

1. Broadcasting and video equipment markets
• Digital broadcasting equipment
• STB/tuner, etc.
2. Mobile phone base stations
3. Communications market
• Antenna switching
• All types of wireless devices
4. Measurement equipment market
• Spectrum analyzer and oscilloscope, etc.

ORDERING INFORMATION

ARS □ □ □ □ □ □

RS relays

Contact arrangement
1: Standard contact type (1 Form C)
3: Reversed contact type (1 Form C)

Operating function
0: Single side stable standard type (Impedance: 75Ω)
1: 1 coil latching type (Impedance: 75Ω)
2: 2 coil latching type (Impedance: 75Ω)
3: Single side stable silent type (Impedance: 75Ω)
4: Single side stable type (Impedance: 50Ω)
5: 1 coil latching type (Impedance: 50Ω)
6: 2 coil latching type (Impedance: 50Ω)

Nil: Standard PC board terminal
A: Surface-mount terminal, E layout
Y: Surface-mount terminal, Y layout

Coil voltage, DC
03: 3 V 4H: 4.5 V 09: 9 V 12: 12 V 24: 24 V

Packing style
Nil: Carton packing (Standard PC board terminal only)
Tube packing (Surface-mount terminal only)
X: Tape and reel packing (picked from 2-pin side) (Surface-mount terminal only)
Z: Tape and reel packing (picked from 18-pin side) (Surface-mount terminal only)

TYPES

1. Standard PC board terminal and standard contact type

Impedance	Nominal coil voltage	Part No.		
		Single side stable type	1 coil latching type	2 coil latching type
50Ω	3 V DC	ARS1403	ARS1503	ARS1603
	4.5 V DC	ARS144H	ARS154H	ARS164H
	9 V DC	ARS1409	ARS1509	ARS1609
	12 V DC	ARS1412	ARS1512	ARS1612
	24 V DC	ARS1424	ARS1524	ARS1624

Impedance	Nominal coil voltage	Part No.			
		Standard type			Silent type
		Single side stable type	1 coil latching type	2 coil latching type	Single side stable type
75Ω	3 V DC	ARS1003	ARS1103	ARS1203	ARS1303
	4.5 V DC	ARS104H	ARS114H	ARS124H	ARS134H
	9 V DC	ARS1009	ARS1109	ARS1209	ARS1309
	12 V DC	ARS1012	ARS1112	ARS1212	ARS1312
	24 V DC	ARS1024	ARS1124	ARS1224	ARS1324

Standard packing: 50 pcs. in an inner package; 500 pcs. in an outer package

2. Standard PC board terminal and reversed contact type

Impedance	Nominal coil voltage	Part No.		
		Single side stable type	1 coil latching type	2 coil latching type
50Ω	3 V DC	ARS3403	ARS3503	ARS3603
	4.5 V DC	ARS344H	ARS354H	ARS364H
	9 V DC	ARS3409	ARS3509	ARS3609
	12 V DC	ARS3412	ARS3512	ARS3612
	24 V DC	ARS3424	ARS3524	ARS3624

Impedance	Nominal coil voltage	Part No.			
		Standard type			Silent type
		Single side stable type	1 coil latching type	2 coil latching type	Single side stable type
75Ω	3 V DC	ARS3003	ARS3103	ARS3203	ARS3303
	4.5 V DC	ARS304H	ARS314H	ARS324H	ARS334H
	9 V DC	ARS3009	ARS3109	ARS3209	ARS3309
	12 V DC	ARS3012	ARS3112	ARS3212	ARS3312
	24 V DC	ARS3024	ARS3124	ARS3224	ARS3324

Standard packing: 50 pcs. in an inner package; 500 pcs. in an outer package

3. Surface-mount terminal and standard contact type, E layout

Impedance	Nominal coil voltage	Part No.		
		Single side stable type	1 coil latching type	2 coil latching type
50Ω	3 V DC	ARS14A03❑	ARS15A03❑	ARS16A03❑
	4.5 V DC	ARS14A4H❑	ARS15A4H❑	ARS16A4H❑
	9 V DC	ARS14A09❑	ARS15A09❑	ARS16A09❑
	12 V DC	ARS14A12❑	ARS15A12❑	ARS16A12❑
	24 V DC	ARS14A24❑	ARS15A24❑	ARS16A24❑
75Ω	3 V DC	ARS10A03❑	ARS11A03❑	ARS12A03❑
	4.5 V DC	ARS10A4H❑	ARS11A4H❑	ARS12A4H❑
	9 V DC	ARS10A09❑	ARS11A09❑	ARS12A09❑
	12 V DC	ARS10A12❑	ARS11A12❑	ARS12A12❑
	24 V DC	ARS10A24❑	ARS11A24❑	ARS12A24❑

Standard packing: 40 pcs. in an inner package (tube); 1,000 pcs. in an outer package
Standard packing: 500 pcs. in an inner package (tape and reel); 500 pcs. in an outer package
Note: The box at the end of a part number shows where packing type is indicated. If there is no indication, tube packing will be used.
If "X" or "Z" is added, tape and reel packing will be used. Example: ARS14A03 (tube packing), ARS14A03X (tape and reel packing)

4. Surface-mount terminal and standard contact type, Y layout

Impedance	Nominal coil voltage	Part No.		
		Single side stable type	1 coil latching type	2 coil latching type
50Ω	3 V DC	ARS14Y03❑	ARS15Y03❑	ARS16Y03❑
	4.5 V DC	ARS14Y4H❑	ARS15Y4H❑	ARS16Y4H❑
	9 V DC	ARS14Y09❑	ARS15Y09❑	ARS16Y09❑
	12 V DC	ARS14Y12❑	ARS15Y12❑	ARS16Y12❑
	24 V DC	ARS14Y24❑	ARS15Y24❑	ARS16Y24❑
75Ω	3 V DC	ARS10Y03❑	ARS11Y03❑	ARS12Y03❑
	4.5 V DC	ARS10Y4H❑	ARS11Y4H❑	ARS12Y4H❑
	9 V DC	ARS10Y09❑	ARS11Y09❑	ARS12Y09❑
	12 V DC	ARS10Y12❑	ARS11Y12❑	ARS12Y12❑
	24 V DC	ARS10Y24❑	ARS11Y24❑	ARS12Y24❑

Standard packing: 40 pcs. in an inner package (tube); 1,000 pcs. in an outer package
Standard packing: 500 pcs. in an inner package (tape and reel); 500 pcs. in an outer package
Note: The box at the end of a part number shows where packing type is indicated. If there is no indication, tube packing will be used.
If "X" or "Z" is added, tape and reel packing will be used. Example: ARS14Y03 (tube packing), ARS14Y03X (tape and reel packing)

5. Surface-mount terminal and reversed contact type, E layout

Impedance	Nominal coil voltage	Part No.		
		Single side stable type	1 coil latching type	2 coil latching type
50Ω	3 V DC	ARS34A03❑	ARS35A03❑	ARS36A03❑
	4.5 V DC	ARS34A4H❑	ARS35A4H❑	ARS36A4H❑
	9 V DC	ARS34A09❑	ARS35A09❑	ARS36A09❑
	12 V DC	ARS34A12❑	ARS35A12❑	ARS36A12❑
	24 V DC	ARS34A24❑	ARS35A24❑	ARS36A24❑
75Ω	3 V DC	ARS30A03❑	ARS31A03❑	ARS32A03❑
	4.5 V DC	ARS30A4H❑	ARS31A4H❑	ARS32A4H❑
	9 V DC	ARS30A09❑	ARS31A09❑	ARS32A09❑
	12 V DC	ARS30A12❑	ARS31A12❑	ARS32A12❑
	24 V DC	ARS30A24❑	ARS31A24❑	ARS32A24❑

Standard packing: 40 pcs. in an inner package (tube); 1,000 pcs. in an outer package
Standard packing: 500 pcs. in an inner package (tape and reel); 500 pcs. in an outer package
Note: The box at the end of a part number shows where packing type is indicated. If there is no indication, tube packing will be used.
If "X" or "Z" is added, tape and reel packing will be used. Example: ARS34A03 (tube packing), ARS34A03X (tape and reel packing)

6. Surface-mount terminal and reversed contact type, Y layout

Impedance	Nominal coil voltage	Part No.		
		Single side stable type	1 coil latching type	2 coil latching type
50Ω	3 V DC	ARS34Y03❑	ARS35Y03❑	ARS36Y03❑
	4.5 V DC	ARS34Y4H❑	ARS35Y4H❑	ARS36Y4H❑
	9 V DC	ARS34Y09❑	ARS35Y09❑	ARS36Y09❑
	12 V DC	ARS34Y12❑	ARS35Y12❑	ARS36Y12❑
	24 V DC	ARS34Y24❑	ARS35Y24❑	ARS36Y24❑
75Ω	3 V DC	ARS30Y03❑	ARS31Y03❑	ARS32Y03❑
	4.5 V DC	ARS30Y4H❑	ARS31Y4H❑	ARS32Y4H❑
	9 V DC	ARS30Y09❑	ARS31Y09❑	ARS32Y09❑
	12 V DC	ARS30Y12❑	ARS31Y12❑	ARS32Y12❑
	24 V DC	ARS30Y24❑	ARS31Y24❑	ARS32Y24❑

Standard packing: 40 pcs. in an inner package (tube); 1,000 pcs. in an outer package
Standard packing: 500 pcs. in an inner package (tape and reel); 500 pcs. in an outer package
Note: The box at the end of a part number shows where packing type is indicated. If there is no indication, tube packing will be used.
If "X" or "Z" is added, tape and reel packing will be used. Example: ARS34Y03 (tube packing), ARS34Y03X (tape and reel packing)

RATING

1. Coil data

1) Single side stable type

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 60°C 140°F)
3 V DC	75%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	66.7 mA	45 Ω	200 mW	110%V or less of nominal voltage
4.5 V DC			44.4 mA	101.3Ω		
9 V DC			22.2 mA	405 Ω		
12 V DC			16.7 mA	720 Ω		
24 V DC			8.3 mA	2,880 Ω		

2) 1 coil latching type

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 60°C 140°F)
3 V DC	75%V or less of nominal voltage (Initial)	75%V or less of nominal voltage (Initial)	66.7 mA	45 Ω	200 mW	110%V or less of nominal voltage
4.5 V DC			44.4 mA	101.3Ω		
9 V DC			22.2 mA	405 Ω		
12 V DC			16.7 mA	720 Ω		
24 V DC			8.3 mA	2,880 Ω		

3) 2 coil latching type

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. allowable voltage (at 60°C 140°F)
3 V DC	75%V or less of nominal voltage (Initial)	75%V or less of nominal voltage (Initial)	133.3 mA	22.5Ω	400 mW	110%V or less of nominal voltage
4.5 V DC			88.9 mA	50.6Ω		
9 V DC			44.4 mA	202.5Ω		
12 V DC			33.3 mA	360 Ω		
24 V DC			16.7 mA	1,440 Ω		

2. Specifications

Item			Specifications
Contact	Arrangement		1 Form C
	Contact material		Gold plating
	Contact resistance (Initial)		Max. 100 mΩ (By voltage drop 10 V AC 10mA)
Rating	Nominal switching capacity		1W (at 3 GHz, Impedance: 50/75Ω, V.S.W.R.: Max. 1.4), 10 mA 24 V DC (resistive load)
	Contact carrying power		Max. 10W (at 3GHz, Impedance: 50/75Ω, V.S.W.R.: Max. 1.4)
	Max. switching voltage		30 V DC
	Max. switching current		0.5 A DC
	Nominal operating power	Single side stable type	200mW
		1 coil latching type	200mW
		2 coil latching type	400mW
High frequency characteristics, Impedance: 50Ω (Initial)	V.S.W.R.		Max. 1.20/900MHz, Max. 1.40/3GHz (Standard PC board terminal) Max. 1.20/900MHz, Max. 1.40/3GHz (Surface-mount terminal)
	Insertion loss (without D.U.T. board's loss)		Max. 0.10dB/900MHz, Max. 0.35dB/3GHz (Standard PC board terminal) Max. 0.20dB/900MHz, Max. 0.40dB/3GHz (Surface-mount terminal)
	Isolation		Min. 60dB/900MHz, Min. 35dB/3GHz (Standard PC board terminal) Min. 55dB/900MHz, Min. 30dB/3GHz (Surface-mount terminal)
High frequency characteristics, Impedance: 75Ω (Initial)	V.S.W.R.		Max. 1.15/900MHz, Max. 1.40/3GHz (Standard PC board terminal) Max. 1.20/900MHz, Max. 1.50/3GHz (Surface-mount terminal)
	Insertion loss (without D.U.T. board's loss)		Max. 0.10dB/900MHz, Max. 0.30dB/3GHz (Standard PC board terminal) Max. 0.20dB/900MHz, Max. 0.50dB/3GHz (Surface-mount terminal)
	Isolation		Min. 60dB/900MHz, Min. 30dB/3GHz (Standard PC board terminal) Min. 55dB/900MHz, Min. 30dB/3GHz (Surface-mount terminal)
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC, Measurement at same location as "Breakdown voltage" section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1min. (Detection current: 10mA)
		Between contact and earth terminal	500 Vrms for 1min. (Detection current: 10mA)
		Between contact and coil	1,000 Vrms for 1min. (Detection current: 10mA)
	Temperature rise (at 20°C 68°F)		Max. 60°C 140°F (By resistive method, nominal voltage applied to the coil, contact carrying current: 10mA)
	Operate time (at 20°C 68°F)		Max. 10 ms (Nominal voltage applied to the coil, excluding contact bounce time)
	Release time (at 20°C 68°F)		Max. 6 ms (Nominal voltage applied to the coil, excluding contact bounce time) (without diode)
	Set time and Reset time (at 20°C 68°F)		Max. 10 ms (Nominal voltage applied to the coil, excluding contact bounce time)
Mechanical characteristics	Shock resistance	Functional	Min. 196 m/s² (Half-wave pulse of sine wave: 11 ms, detection time: 10μs)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3 mm (Detection time: 10μs)
		Destructive	10 to 55 Hz at double amplitude of 5 mm
Operation noise*	Standard type		Approx. 40dB
	Silent type (75Ω, PC board terminal type only)		Approx. 30dB
Expected life	Mechanical life	Single side stable standard type	Min. 5×10^6 (at 180 cpm)
		Single side stable silent type	Min. 10^6 (at 180 cpm)
		Latching type	Min. 10^6 (at 180 cpm)
	Electrical life	50Ω type	Min. 10^6 (Standard PC board terminal), Min. 3×10^5 (Surface-mount terminal) (10V DC 10mA resistive load)/Min. 3×10^5 (24V DC 10mA resistive load) Min. 10^6 (Standard PC board terminal), Min. 3×10^5 (Surface-mount terminal) (1W, at 3GHz, Impedance: 50Ω, V.S.W.R: Max. 1.4) (at 20 cpm)
		75Ω type	Min. 3×10^5 (10mA 24V DC resistive load) Min. 3×10^5 (1W, at 3GHz, Impedance: 75Ω, V.S.W.R: Max. 1.4) (at 20 cpm)
Conditions	Conditions for operation, transport and storage		Ambient temperature: –40 to 70°C –40°F to 158°F (Single side stable standard and Latching type) Ambient temperature: –40 to 60°C –40°F to 140°F (Single side stable silent type) Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
Unit weight			Approx. 2 g .071 oz

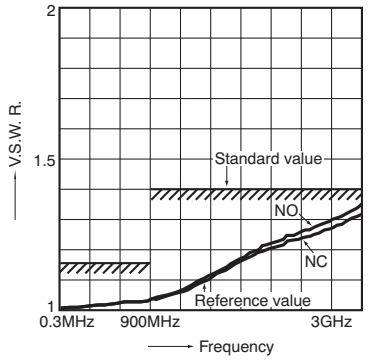
* Measured the operation noise of the relay alone (with diodes at both ends of the coil) 30cm away from top side, by the A-weighted, FAST method while applying the rated voltage.
(Reference) Operation noise of RK relay (existing model): Approx. 50dB

REFERENCE DATA

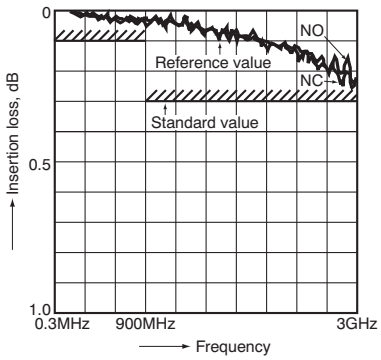
1.-(1) High frequency characteristics (Impedance: 50Ω, Standard PC board terminal)

Sample: ARS144H; Measuring method: Measured with Agilent Technologies network analyzer (E8363B). *For details see No. 7 under “NOTES”.

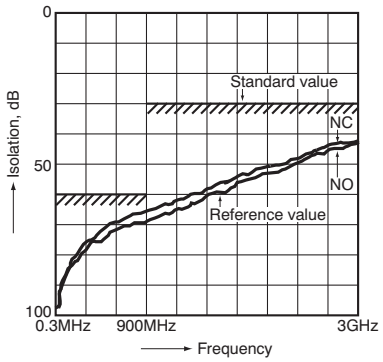
• V.S.W.R. characteristics



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



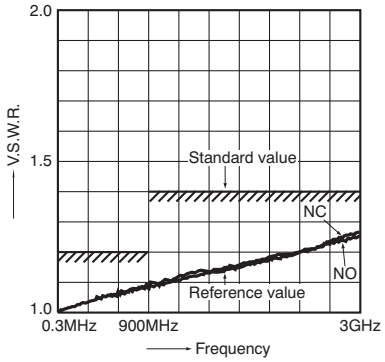
• Isolation characteristics



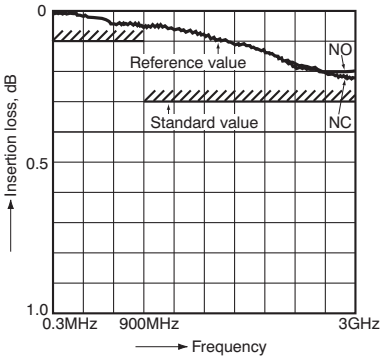
1.-(2) High frequency characteristics (Impedance: 75Ω, Standard PC board terminal)

Sample: ARS104H; Measuring method: Measured with Agilent Technologies network analyzer (E8363B). *For details see No. 7 under “NOTES”.

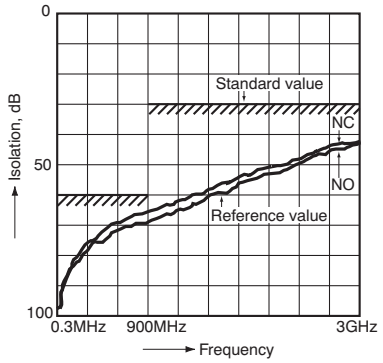
• V.S.W.R. characteristics



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



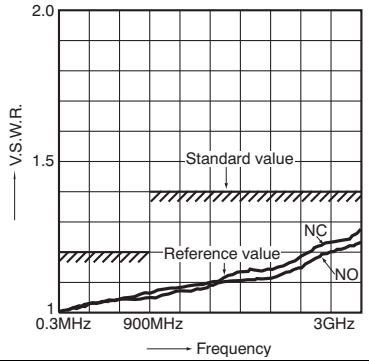
• Isolation characteristics



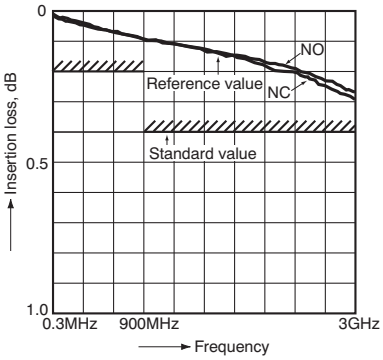
1.-(3) High frequency characteristics (Impedance: 50Ω, Surface-mount terminal)

Sample: ARS14A4H; Measuring method: Measured with Agilent Technologies network analyzer (E8363B). *For details see No. 7 under “NOTES”.

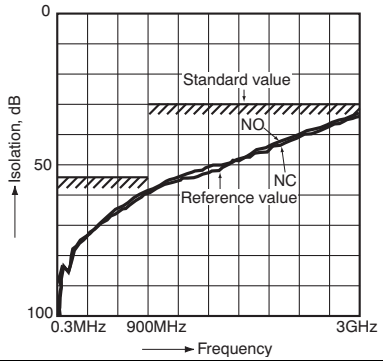
• V.S.W.R. characteristics



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



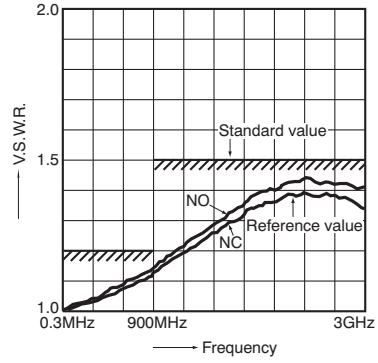
• Isolation characteristics



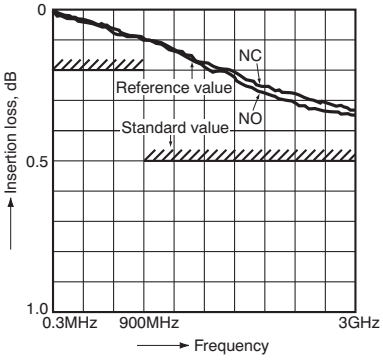
1.-(4) High frequency characteristics (Impedance: 75Ω, Surface-mount terminal)

Sample: ARS10A4H; Measuring method: Measured with Agilent Technologies network analyzer (E8363B). *For details see No. 7 under “NOTES”.

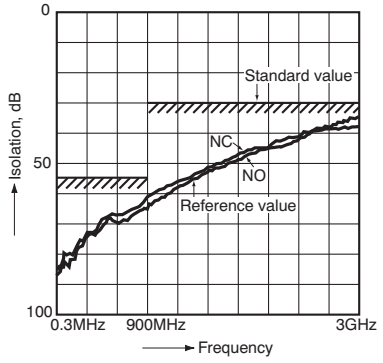
• V.S.W.R. characteristics



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

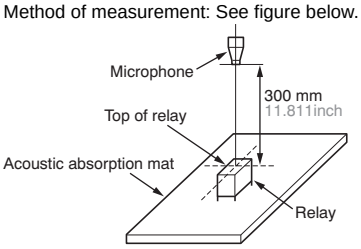


• Isolation characteristics

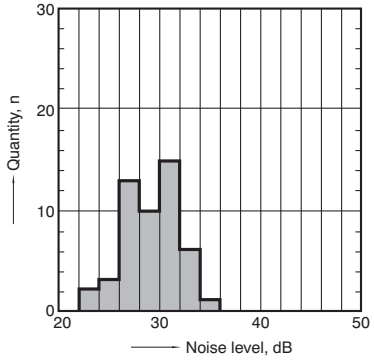


2.-(1) Operation noise distribution

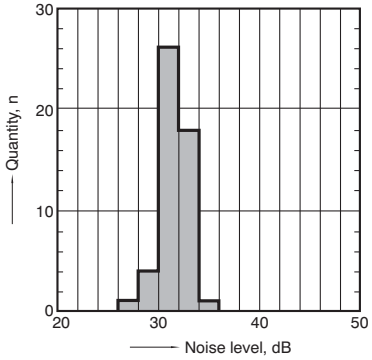
Sample: ARS134H (single side stable silent type), 50 pcs.
Coil voltage: rated voltage applied (with diode)
Equipment setting: A weighted sound pressure level, FAST.
Background noise: approx. 20 dB
Method of measurement: See figure below.



When operated

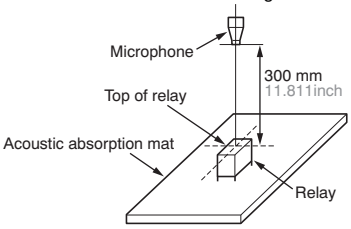


When released

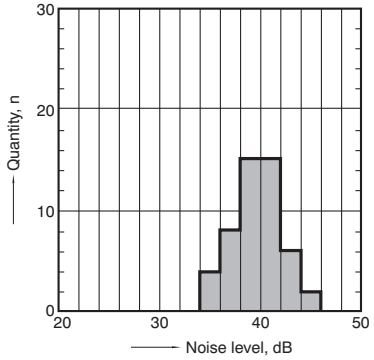


2.-(2) Operation noise distribution

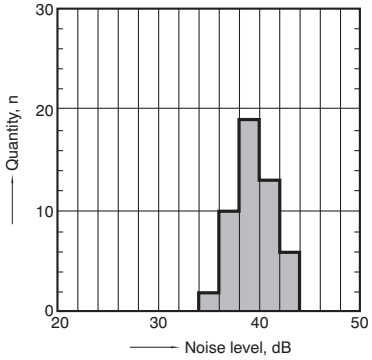
Sample: ARS104H (single side stable standard type), 50 pcs.
Coil voltage: rated voltage applied (with diode)
Equipment setting: A weighted sound pressure level, FAST.
Background noise: approx. 20 dB
Method of measurement: See figure below.



When operated

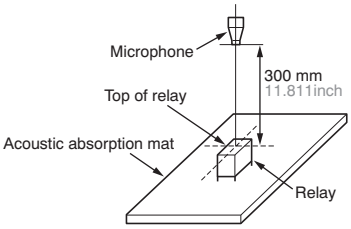


When released

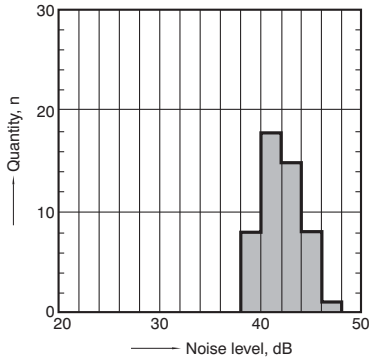


2.-(3) Operation noise distribution

Sample: ARS114H (latching type), 50 pcs.
Coil voltage: rated voltage applied (with diode)
Equipment setting: A weighted sound pressure level, FAST.
Background noise: approx. 20 dB
Method of measurement: See figure below.



When set and reset



DIMENSIONS (mm inch)

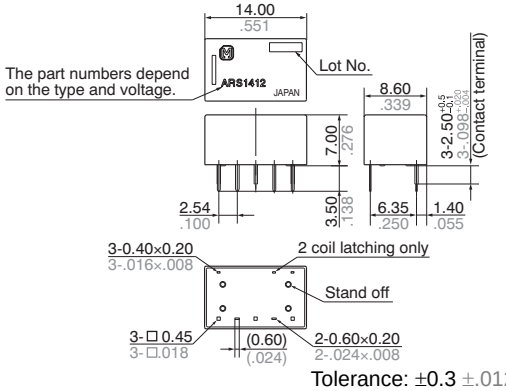
Download CAD Data from our Web site.

<Standard PC board terminal>

1. 50Ω type

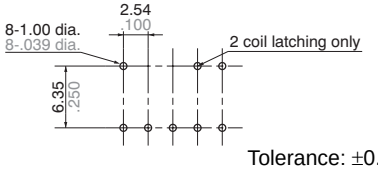
CAD Data

External dimensions



Tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

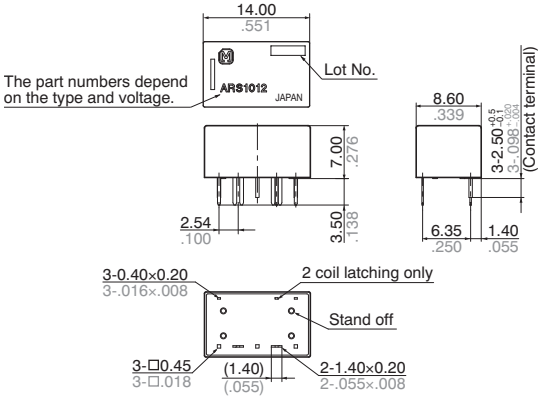


Tolerance: ±0.1 ±.004

2. 75Ω type

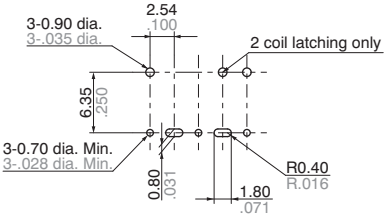
CAD Data

External dimensions



Tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

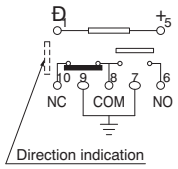


Tolerance: ±0.1 ±.004

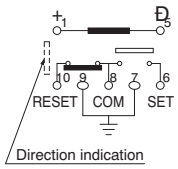
Schematic (Bottom view)

1. Standard contact type

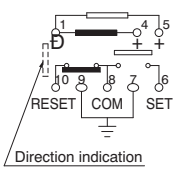
Single side stable type (Deenergized condition)



1 coil latching type (Reset condition)

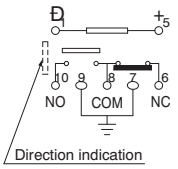


2 coil latching type (Reset condition)

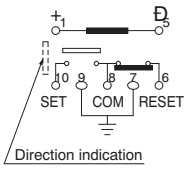


2. Reversed contact type

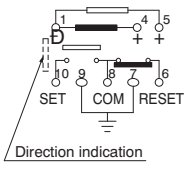
Single side stable type (Deenergized condition)



1 coil latching type (Reset condition)



2 coil latching type (Reset condition)



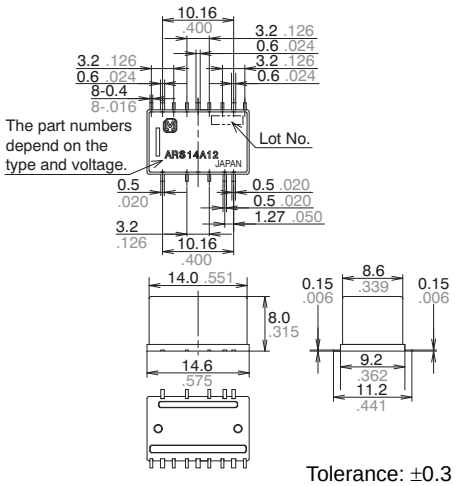
<Surface-mount terminal>

1. Impedance: 50Ω type

1) E layout

CAD Data

External dimensions

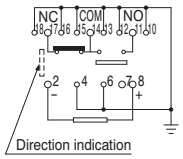


Tolerance: ±0.3 ±.012

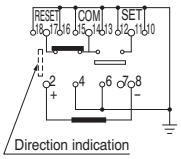
Schematic (Top view)

<Standard contact type>

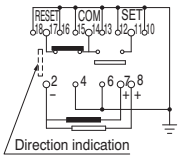
Single side stable type (Deenergized condition)



1 coil latching type (Reset condition)

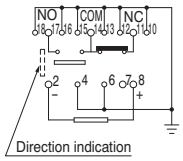


2-coil latching type (Reset condition)

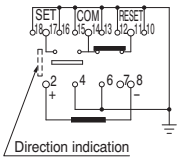


<Reversed contact type>

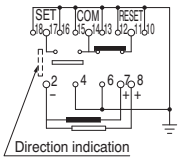
Single side stable type (Deenergized condition)



1 coil latching type (Reset condition)



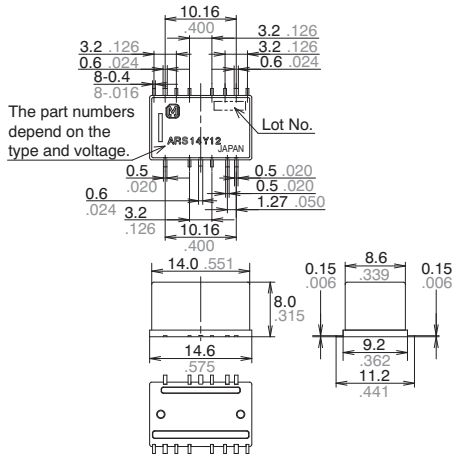
2-coil latching type (Reset condition)



2) Y layout

CAD Data

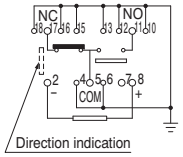
External dimensions



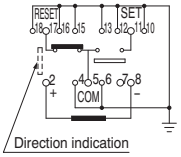
Schematic (Top view)

<Standard contact type>

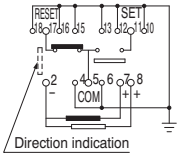
Single side stable type (Deenergized condition)



1 coil latching type (Reset condition)

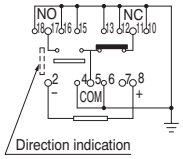


2-coil latching type (Reset condition)

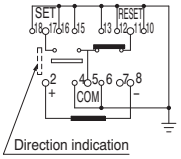


<Reversed contact type>

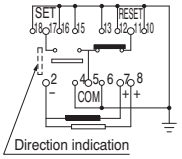
Single side stable type (Deenergized condition)



1 coil latching type (Reset condition)



2-coil latching type (Reset condition)



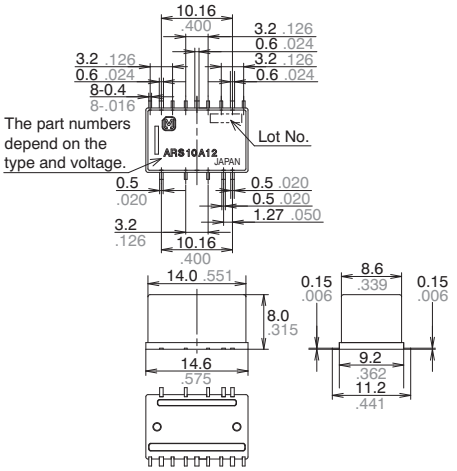
Tolerance: ±0.3 ±.012

2. Impedance: 75Ω type

1) E layout

CAD Data

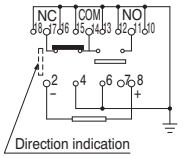
External dimensions



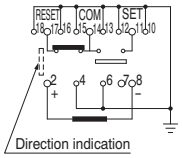
Schematic (Top view)

<Standard contact type>

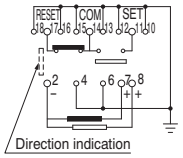
Single side stable type (Deenergized condition)



1 coil latching type (Reset condition)

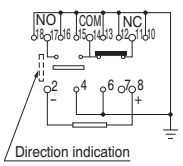


2-coil latching type (Reset condition)

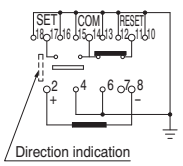


<Reversed contact type>

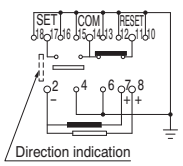
Single side stable type (Deenergized condition)



1 coil latching type (Reset condition)



2-coil latching type (Reset condition)

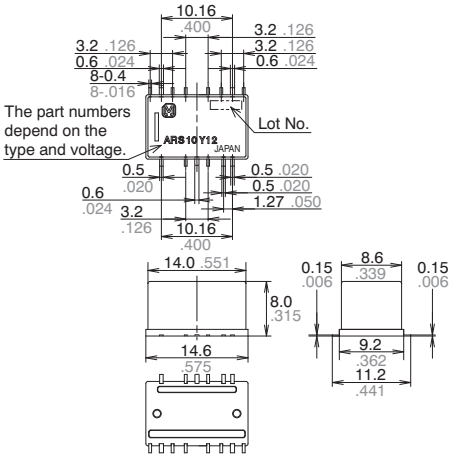


Tolerance: ±0.3 ±.012

2) Y layout

CAD Data

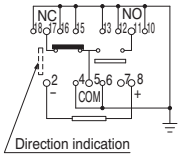
External dimensions



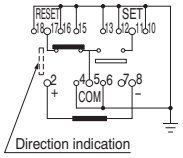
Schematic (Top view)

<Standard contact type>

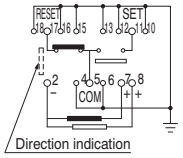
Single side stable type (Deenergized condition)



1 coil latching type (Reset condition)

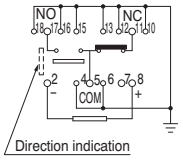


2-coil latching type (Reset condition)

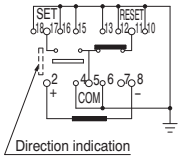


<Reversed contact type>

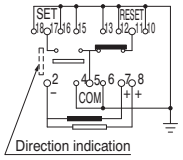
Single side stable type (Deenergized condition)



1 coil latching type (Reset condition)



2-coil latching type (Reset condition)



Tolerance: ±0.3 ±.012

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. The nominal operating voltage should be applied to the coil for more than 30 ms to set/reset the latching type relay.

2. Coil connection

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

3. External magnetic field

Since RS relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

4. Cleaning

For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick.

It is recommended that alcoholic solvents be used.

5. Conditions for operation, transport and storage conditions

1) Temperature

- Single side stable standard and latching type: –40 to 70°C –40 to 158°F
- Single side stable silent type: –40 to 60°C –40 to 140°F

2) Humidity: 5 to 85% RH

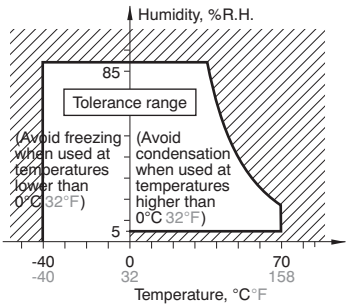
(Avoid freezing and condensation.)

The humidity range varies with the temperature. Use within the range indicated in the graph below.

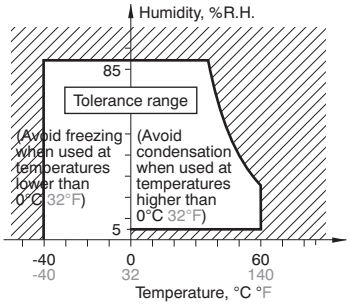
3) Atmospheric pressure: 86 to 106 kPa

Temperature and humidity range for usage, transport, and storage:

Single side stable standard and latching type



Single side stable silent type



4) Condensation

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

5) Freezing

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

6) Low temperature, low humidity environments

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

7) Storage requirements

Since the relay is sensitive to humidity, the surface-mount type is packaged with tightly sealed anti-humidity packaging. However, when storing, please be careful of the following.

(1) Please use promptly once the anti-humidity pack is opened.

If relays are left as is after unpacking, they will absorb moisture which will result in loss of air tightness as a result of case expansion due to thermal stress when reflow soldering during the mounting process. (within one day, 30°C and 60%R.H or less)

(2) When storing for a log period after opening the anti-humidity pack, storage in anti-humidity packaging with an anti-humidity bag to which silica gel has been added, is recommended.

*Furthermore, if the relay is solder mounted when it has been subjected to excessive humidity, cracks and leaks can occur. Be sure to mount the relay under the required mounting conditions.

6. Soldering

1) Please meet the following conditions if this relay is to be automatically soldered.

(1) Preheating: Max. 120°C 248°F (terminal solder surface) for max. 120 seconds

(2) Soldering: Max. 260±5°C 500±9°F for max. 6 seconds

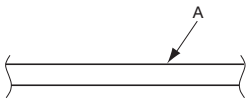
*Relays are influenced by the type of PC board used. Please confirm with the actual PC board you plan to use.

*Please avoid reflow soldering.

2) Surface-mount terminal

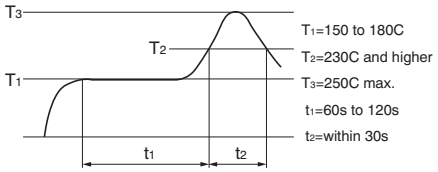
In case of automatic soldering, the following conditions should be observed

(1) Position of measuring temperature



A: Surface of PC board where relay is mounted.

(2) IR (infrared reflow) soldering method



• Mounting cautions

Rise in relay temperature depends greatly on the component mix on a given PC board and the heating method of the reflow equipment. Therefore, please test beforehand using actual equipment to ensure that the temperature where the relay terminals are soldered and the temperature at the top of the relay case are within the conditions given above.

3) Please meet the following conditions if this relay is to be soldered by hand.

(1) 260°C 500°F for max. 10 seconds

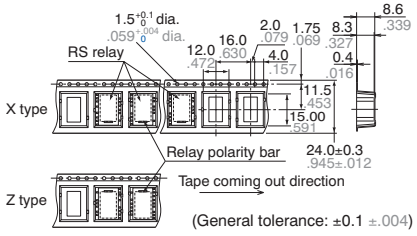
(2) 350°C 662°F for max. 3 seconds

The effect on the relay depends on the actual substrate used. Please verify the substrate to be used.

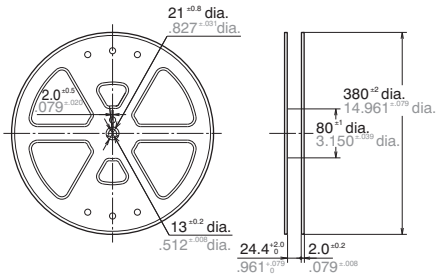
(3) Avoid ultrasonic cleaning. Doing so will adversely affect relay characteristics. Please use alcohol-based cleaning solvents when cleaning relays.

7. Tape and reel packing

1) Tape dimensions

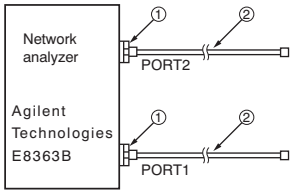


2) Dimensions of plastic reel



8. Measuring method

1) 50Ω type



Connect connectors 1 and 2 respectively to PORT 1 and PORT 2. Perform calibration using the 3.5 mm calibration kit (HP85052B).

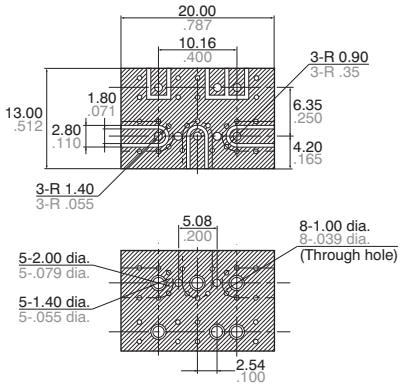
No.	Product name	Contents
1	Agilent 85130-60011	Adapter 2.4mm-3.5mm female .095inch-.138inch female
2	SUHNER SUCOFLEX104	Cable 3.5mm-3.5mm male .138inch-.138inch male

After calibration, connect the D.U.T. board and measure. However, connectors other than those for measurement should be connected with a 50Ω termination resistor.

<Standard PC board terminal>

PC board

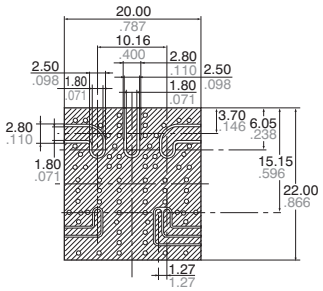
Dimensions (mm inch)



<Surface-mount terminal and E layout>

PC board

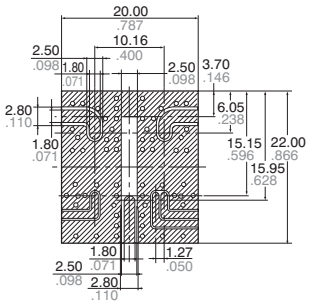
Dimensions (mm inch)



<Surface-mount terminal and Y layout>

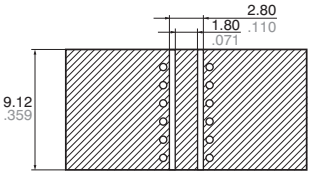
PC board

Dimensions (mm inch)



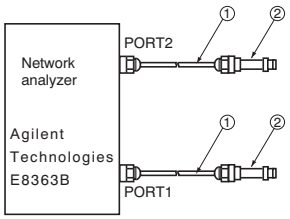
PC board for correction

Dimensions (mm inch)



Material: Glass PTFE double-sided through hole PC board R-4737 (Matsushita Electric Works)
Board thickness: t = 0.8 mm .031 inch
Copper plating: 18 μm
Connector (SMA type receptacle)
Product name: 01K1808-00 (Waka Manufacturing Co., Ltd.)
Insertion loss compensation
The insertion loss of relay itself is given by subtracting the insertion loss of shortcircuit the Com and the NC (or NO). (signal path and two connectors)

2) 75Ω type



Connect connectors 1 and 2 respectively to PORT 1 and PORT 2, and then perform calibration using the 75Ω F type.

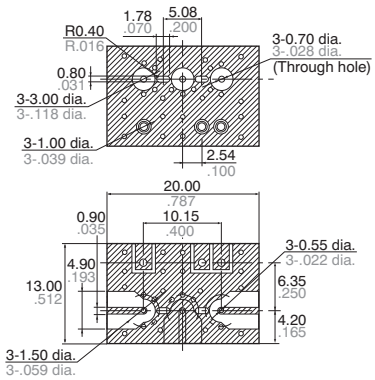
No.	Product name	Contents
1	85134-60003	Test port cable
2	11852B	Conversion adapter; 50Ω N type (female) to 75Ω N type (male)
2	85039-60011	Conversion adapter; 75Ω N type (female) to 75Ω F type (male)

After calibration, connect the D.U.T. board and measure. However, connectors other than those for measurement should be connected with a 75Ω termination resistor.

<Standard PC board terminal>

PC board

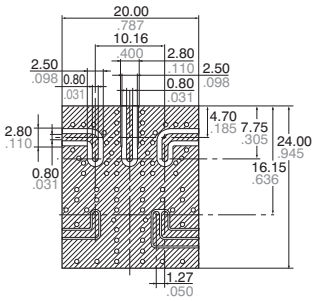
Dimensions (mm inch)



<Surface-mount terminal and E layout>

PC board

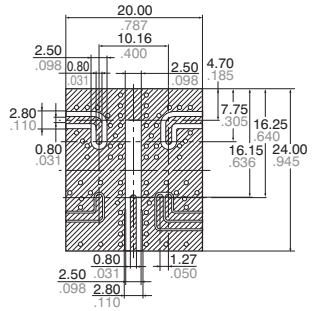
Dimensions (mm inch)



<Surface-mount terminal and Y layout>

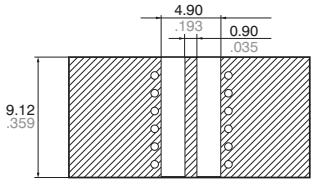
PC board

Dimensions (mm inch)



PC board for correction

Dimensions (mm inch)



Material: Glass PTFE double-sided through hole PC board R-4737 (Matsushita Electric Works)
Board thickness: t = 0.8 mm .031 inch
Copper plating: 18μm
Connector (F type receptacle)
Product name: C05-0236 (Komine Musen Electric Corporation)

Insertion loss compensation
The insertion loss of relay itself is given by subtracting the insertion loss of shortcircuit the COM and the NC (or NO). (signal path and two connectors)

9. Others

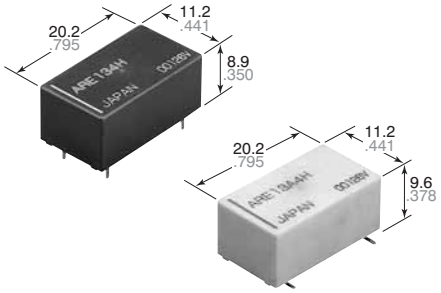
1) The switching lifetime is defined under the standard test condition specified in the JIS* C 5442 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.
Also, be especially careful of loads such as those listed below.
• When used for AC load-operating and the operating phase is synchronous, rocking and fusing can easily occur due to contact shifting.
• When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
(1) Incorporate an arc-extinguishing circuit.
(2) Lower the operating frequency
(3) Lower the ambient humidity
2) Use the relay within specifications such as coil rating, contact rating and on/off service life. If used beyond limits, the relay may overheat, generate smoke or catch fire.
3) Be careful not to drop the relay. If accidentally dropped, carefully check its appearance and characteristics before use.
4) Be careful to wire the relay correctly. Otherwise, malfunction, overheat, fire or other trouble may occur.
5) If a relay stays on in a circuit for many months or years at a time without being activated, circuit design should be reviewed so that the relay can remain non-excited. A coil that receives current all the time heats, which degrades insulation earlier than expected. A latching type relay is recommended for such circuits.
6) To ensure accurate operation of the latching type amidst surrounding temperature changes and other factors that might affect the set and reset pulse times, we recommend a coil impress set and reset pulse width of at least 30 ms at the rated operation voltage.
7) The latching type relay is shipped in the reset position. But jolts during transport or impacts during installation can change the reset position. It is, therefore, advisable to build a circuit in which the relay can be initialized (set and reset) just after turning on the power.
8) If silicone materials (e.g., silicone rubbers, silicone oils, silicone coating agents, silicone sealers) are used in the vicinity of the relay, the gas emitted from the silicone may adhere to the contacts of the relay during opening and closing and lead to improper contact. If this is the case, use a material other than silicone.

For complete “Cautions for Use”, please download the “Relay Technical Information” from our Web site. For instructions on soldering, see page 66. For information on reliability, see page 64.

Panasonic
ideas for life

2.6 GHz small microwave relays

RE RELAYS (ARE)



mm inch

FEATURES

• Excellent high frequency characteristics (to 2.6GHz)

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

• Surface-mount type also available

• Compact and slim size

Size: 20.2(L) × 11.2(W) × 8.9(H)* mm
.795(L) × .441(W) × .350(H) inch
*The height of Surface-mount type is 9.6 mm .378 inch size.

TYPICAL APPLICATIONS

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

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

SPECIFICATIONS

Contact

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

Coil (at 20°C, 68°F)

Nominal operating power	200 mW

Characteristics

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

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Nominal operating voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil: Contact carrying power: 10W, at 2.6GHz, [Impedance 75Ω, V.S.W.R. & 1.5] [Impedance 50Ω, V.S.W.R. & 1.7]
*5 Half-wave pulse of sine wave: 11ms, detection time: 10μs.
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 5. Conditions for operation, transport and storage conditions in NOTES (Page 36).

ORDERING INFORMATION

Ex. ARE 1 ☐ ☐ ☐ ☐

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

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

TYPES AND COIL DATA (at 20°C 68°F)

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

Standard PC board terminal	Surface-mount terminal	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C 140°F)
ARE1003	ARE10A03	3	2.25	0.3	45	66.7	200	3.3
ARE104H	ARE10A4H	4.5	3.375	0.45	101	44.4	200	4.95
ARE1006	ARE10A06	6	4.5	0.6	180	33.3	200	6.6
ARE1009	ARE10A09	9	6.75	0.9	405	22.2	200	9.9
ARE1012	ARE10A12	12	9	1.2	720	16.7	200	13.2
ARE1024	ARE10A24	24	18	2.4	2,880	8.3	200	26.4

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

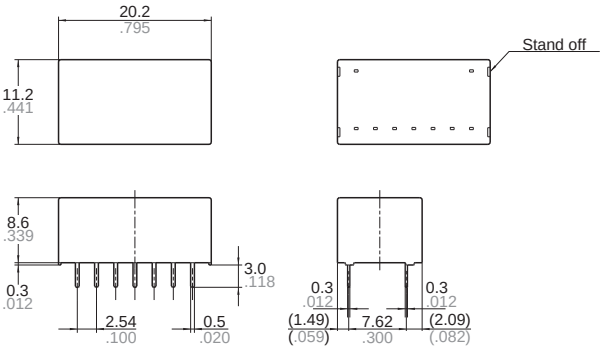
Standard PC board terminal	Surface-mount terminal	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C 140°F)
ARE1303	ARE13A03	3	2.25	0.3	45	66.7	200	3.3
ARE134H	ARE13A4H	4.5	3.375	0.45	101	44.4	200	4.95
ARE1306	ARE13A06	6	4.5	0.6	180	33.3	200	6.6
ARE1309	ARE13A09	9	6.75	0.9	405	22.2	200	9.9
ARE1312	ARE13A12	12	9	1.2	720	16.7	200	13.2
ARE1324	ARE13A24	24	18	2.4	2,880	8.3	200	26.4

DIMENSIONS mm inch

Download CAD Data from our Web site.

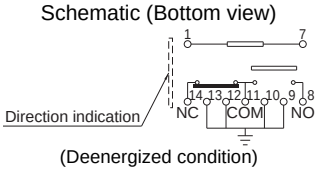
1. Standard PC board terminal (50Ω , 75Ω type)

CAD Data



General tolerance: ±0.3 ±.012

Schematic (Bottom view)



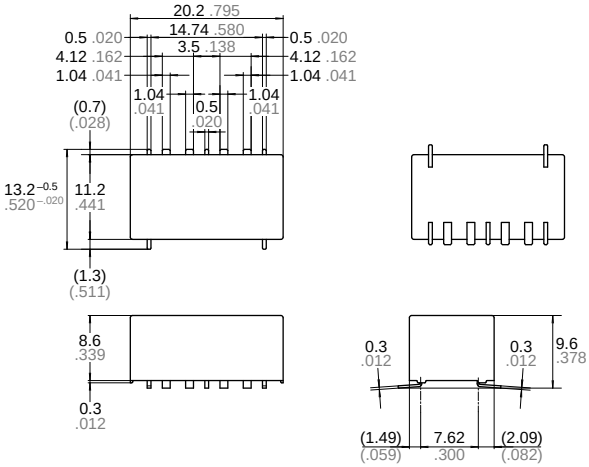
(Deenergized condition)

2. Surface mount terminal

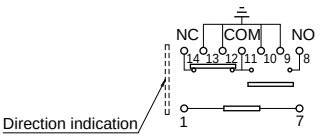
mm inch

CAD Data

• 50Ω type



Schematic (Top view)

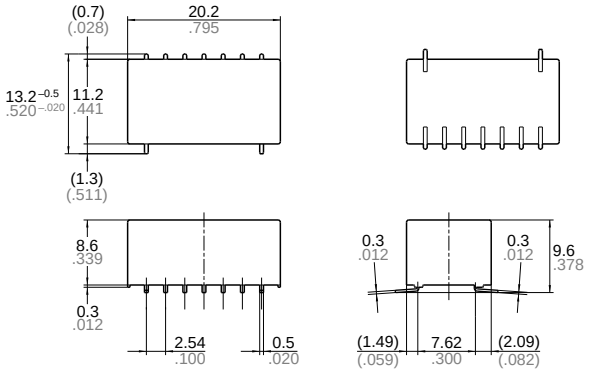


(Deenergized condition)

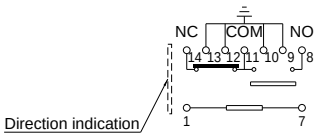
General tolerance: ±0.3 ±.012

• 75Ω type

CAD Data



Schematic (Top view)



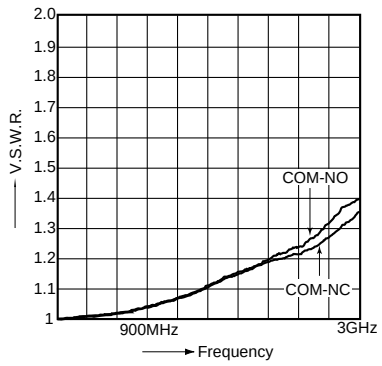
(Deenergized condition)

General tolerance: ±0.3 ±.012

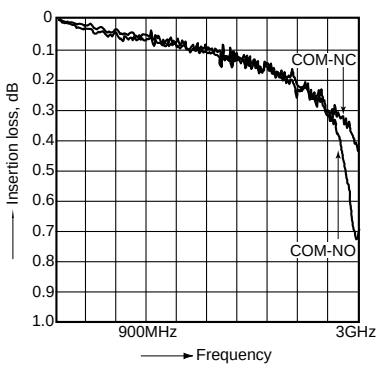
REFERENCE DATA

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

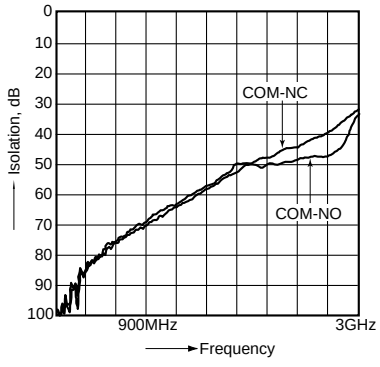
• V.S.W.R. characteristics



• Insertion loss characteristics

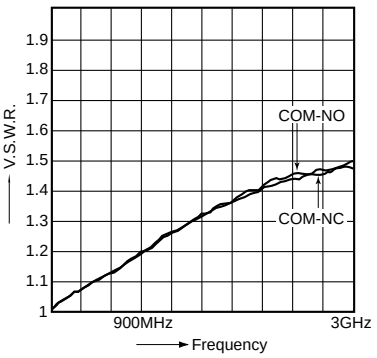


• Isolation characteristics

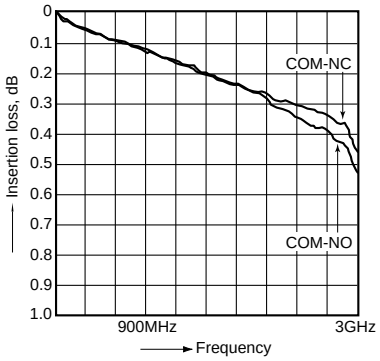


1-(2). High frequency characteristics (Impedance 50Ω) (Standard PC board terminal)

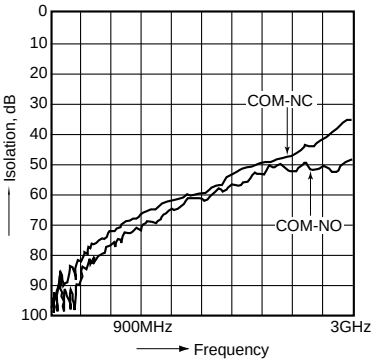
• V.S.W.R. characteristics



• Insertion loss characteristics



• Isolation characteristics



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. Cleaning

For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick.
It is recommended that alcoholic solvents be used.

3. Soldering

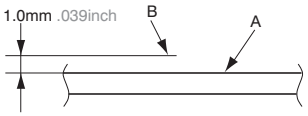
1) The manual soldering shall be performed under following condition.
Max. 260°C 500°F 10s
Max. 350°C 662°F 3s
The affect of the PCB on the relay will differ depending on the type of PCB used. Please verify the type of PCB to be used.
Preheat according to the following conditions.

Temperature	120°C 248°F or less
Time	Within 2 minute

Soldering should be done at 260±5°C 500±9°F within 6 s.

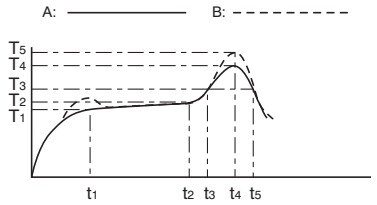
2) In case of automatic soldering, the following conditions should be observed (Surface-mount terminal)

(1) Position of measuring temperature



A: Surface of PC board where relay is mounted.
B: Above the PC board surface.

(2) IR (infrared reflow) soldering method



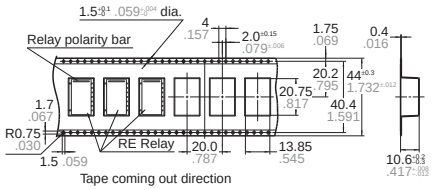
T1=150°C 302°F
T2=160°C 320°F
T3=183°C 361°F
T4=245°C 473°F
T5=270°C 518°F

t2 - t1 = 80 to 120 s
t5 - t3 = 30 to 40 s
t4 = 170 to 190 s

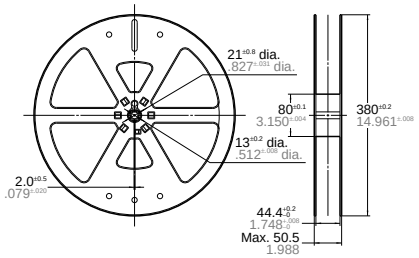
Temperature rise of relay itself may vary according to the mounting level or the heating method of reflow equipment. Therefore, please set the temperature of soldering portion of relay terminal and the top surface of the relay case not to exceed the above mentioned soldering condition.
It is recommended to check the temperature rise of each portion under actual mounting condition before use.

4. Packing style

1) Tape dimensions

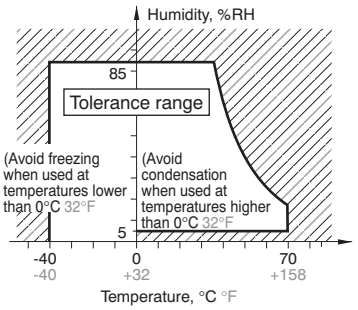


2) Dimensions of plastic reel



5. Conditions for operation, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +70°C –40 to +158°F
(2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage:



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

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

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

For complete "Cautions for Use", please download the "Relay Technical Information" from our Web site. For instructions on soldering, see page 66. For information on reliability, see page 64.

Panasonic
ideas for life

8 GHz*, 150 W carrying power (at 2 GHz) microwave relays

RN RELAYS (ARN)

*Rating is 6 GHz. Please refer to "REFERENCE DATA" regarding usage between 6 and 8 GHz.

Protective construction: Flux-resistant type

FEATURES

1. Miniature design and surface mount (SMD) type
L: 9.6 × W: 14.6 × H:10.0 mm
L: .378 × W: .575 × H: .394 inch

2. High capacity type
150W at 2GHz
80W at 2GHz (hot switching)

3. Excellent ambient temperature profile
up to 85°C 185°F

4. Excellent high frequency characteristics
Impedance: 50Ω

Frequency	up to 1 GHz	1 to 2 GHz	2 to 3 GHz	3 to 6 GHz
V. S. W. R. (Max.)	1.10	1.15	1.20	1.30
Insertion loss (dB, Max.)	0.10	0.12	0.15	0.50
Isolation (dB, Min.)	60	55	45	30

5. Lineup includes reversed contact type
Great design freedom is possible using reversed contact type in which the positions of the N.O. and N.C. contacts are switched.

TYPICAL APPLICATIONS

1. Broadcasting and video equipment markets
- Digital broadcasting equipment

2. Mobile phone base stations

3. Communications market
- Antenna switching
- All types of wireless devices

4. Measurement equipment market
- Spectrum analyzers
- Oscilloscopes
- High frequency amplifiers

If you wish to use in applications with low level loads or with high frequency switching, please consult us.

ORDERING INFORMATION

ARN □ □ **A** □ □

Contact arrangement
1: 1 Form C standard contact type
3: 1 Form C reversed contact type
(single side stable type only)

Operating function
0: Single side stable type
2: 2 coil latching type

Terminal shape
A: Surface mount terminal

Coil voltage, DC*
4H: 4.5 V, 12: 12 V, 24: 24 V (H=0.5)
* For 28 V type, please consult us.

Packing style
Nil: Carton packing
X: Tape and reel packing (picked from 1 pin side)
Z: Tape and reel packing (picked from 13 pin side)

TYPES

1. Single side stable type

Contact arrangement	Nominal coil voltage	Part No.	
		Standard contact type	Reversed contact type
1 Form C	4.5 V DC	ARN10A4H	ARN30A4H
	12 V DC	ARN10A12	ARN30A12
	24 V DC	ARN10A24	ARN30A24

Standard packing: 50 pcs. in an inner package (carton); 500 pcs. in an outer package

2. 2 coil latching type

Contact arrangement	Nominal coil voltage	Part No.
		Standard contact type
1 Form C	4.5 V DC	ARN12A4H
	12 V DC	ARN12A12
	24 V DC	ARN12A24

Standard packing: 50 pcs. in an inner package (carton); 500 pcs. in an outer package

3. Single side stable type

Contact arrangement	Nominal coil voltage	Part No.	
		Standard contact type	Reversed contact type
1 Form C	4.5 V DC	ARN10A4H❑	ARN30A4H❑
	12 V DC	ARN10A12❑	ARN30A12❑
	24 V DC	ARN10A24❑	ARN30A24❑

Standard packing: 400 pcs. in an inner package (tape and reel); 800 pcs. in an outer package
* Please add an X (picked from 1 pin side) or Z (picked from 13 pin side) at the end of the part number when ordering.
* Packing style symbol “X”, “Z” is not marked on the relay.

4. 2 coil latching type

Contact arrangement	Nominal coil voltage	Part No.
		Standard contact type
1 Form C	4.5 V DC	ARN12A4H❑
	12 V DC	ARN12A12❑
	24 V DC	ARN12A24❑

Standard packing: 400 pcs. in an inner package (tape and reel); 800 pcs. in an outer package
* Please add an X (picked from 1 pin side) or Z (picked from 13 pin side) at the end of the part number when ordering.
* Packing style symbol “X”, “Z” is not marked on the relay.

RATING

1. Coil data

1) Single side stable type

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 85°C 185°F)
4.5 V DC	75%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	71.1 mA	63.3Ω	320 mW	110%V of nominal voltage
12 V DC			26.7 mA	450 Ω		
24 V DC			13.3 mA	1,800 Ω		

2) 2 coil latching type

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 85°C 185°F)
4.5 V DC	75%V or less of nominal voltage (Initial)	75%V or less of nominal voltage (Initial)	88.9 mA	50.6Ω	400 mW	110%V of nominal voltage
12 V DC			33.3 mA	360 Ω		
24 V DC			16.7 mA	1,440 Ω		

2. Specifications

Characteristics	Item		Specifications			
Contact	Arrangement		1 Form C			
	Contact material		Gold plating			
	Contact resistance (Initial)		Max. 100 mΩ (By voltage drop 10 V AC 10mA)			
Rating	Nominal switching capacity		80W (at 2 GHz, Impedance 50Ω, V.S.W.R. Max.1.15)			
	Contact carrying power (CW)*1		Max.150W (at 20°C 68°F) (at 2 GHz, Impedance 50Ω, V.S.W.R. Max.1.15, with heat sink) Max.100W (at 20°C 68°F) (at 2 GHz, Impedance 50Ω, V.S.W.R. Max.1.15, without heat sink)			
	Nominal operating power		Single side stable type: 320 mW, 2 coil latching type: 400 mW			
High frequency characteristics (to 6 GHz)			to 1 GHz	1 to 2 GHz	2 to 3 GHz	3 to 6 GHz
	V.S.W.R. (Max.)		1.1	1.15	1.2	1.3
	Insertion loss (without D.U.T. board's loss, dB, Max.)		0.1	0.12	0.15	0.5
	Isolation (dB, Min.)		60	55	45	30
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000 MΩ (at 500V DC, Measurement at same location as "Breakdown voltage" section.)			
	Breakdown voltage (Initial)	Between open contacts	500 AC Vrms for 1min. (Detection current: 10mA)			
		Between contact and earth terminal	500 AC Vrms for 1min. (Detection current: 10mA)			
		Between contact and coil	500 AC Vrms for 1min. (Detection current: 10mA)			
	Operate time [Set time] (at 20°C 68°F)		Max. 5 ms (Nominal voltage applied to the coil, excluding contact bounce time)			
	Release time [Reset time] (at 20°C 68°F)		Single side stable type: Max. 5 ms (Nominal voltage applied to the coil, excluding contact bounce time)*2 2 coil latching type: Max. 5 ms (Nominal voltage applied to the coil, excluding contact bounce time)			
Mechanical characteristics	Shock resistance	Functional	Min. 490 m/s² (Half-wave pulse of sine wave: 11 ms, detection time: 10 μs)			
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms)			
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3 mm .118 inch (Detection time: 10 μs)			
		Destructive	10 to 55 Hz at double amplitude of 5 mm .197 inch			
Expected life	Mechanical life		Min. 1×10^6 (at 180 cpm)			
	Electrical life (at 20 cpm)		• 1×10^6 ope. at 10mA 10 VDC resistive load, • 1×10^6 ope. at 1W High frequency load (at 2 GHz, Impedance 50Ω, V.S.W.R. Max.1.15), • 1×10^3 ope. at 80 W High frequency load, operating frequency 5.0s ON, 5.0s OFF (at 2 GHz, Impedance 50Ω, V.S.W.R. Max.1.15, at 20°C 68°F, with heatsink)			
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40 to +85°C –40 to +185°F, Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)			
Unit weight			Approx. 2.5 g .088 oz			

Notes: *1. Since the design of the PC board and heat dispersion conditions affect contact carrying power, please verify under actual conditions.
*2. Release time will lengthen if a diode, etc., is connected in parallel to the coil. Be sure to verify operation under actual conditions.

REFERENCE DATA

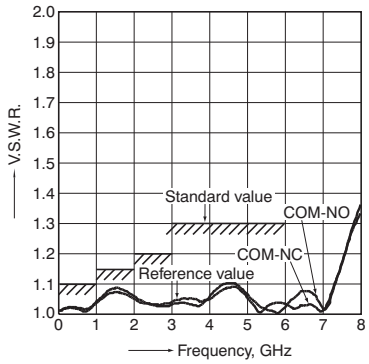
1. High frequency characteristics

Sample: ARN10A12

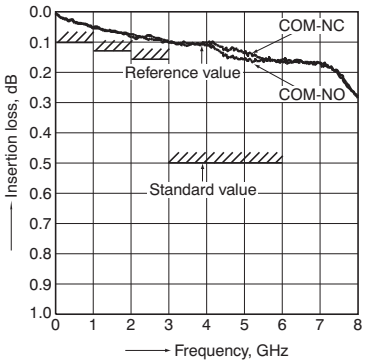
Measuring method: Measured with Agilent Technologies network analyzer (E8363B).

* For details see “8. Measuring method of high frequency characteristics (Impedance 50Ω)“ under “NOTES”.

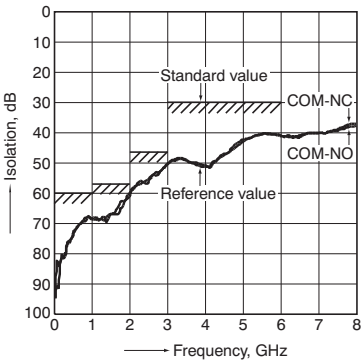
• V.S.W.R. characteristics



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



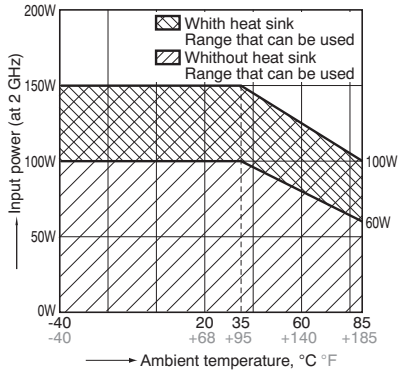
• Isolation characteristics



2. Contact carrying power (CW)

Max. 150 W (whith heat sink) (at 2 GHz, Impedance 50Ω, V.S.W.R. Max. 1.15, at 20°C 68°F)

Max. 100 W (whithout heat sink) (at 2 GHz, Impedance 50Ω, V.S.W.R. Max. 1.15, at 20°C 68°F)

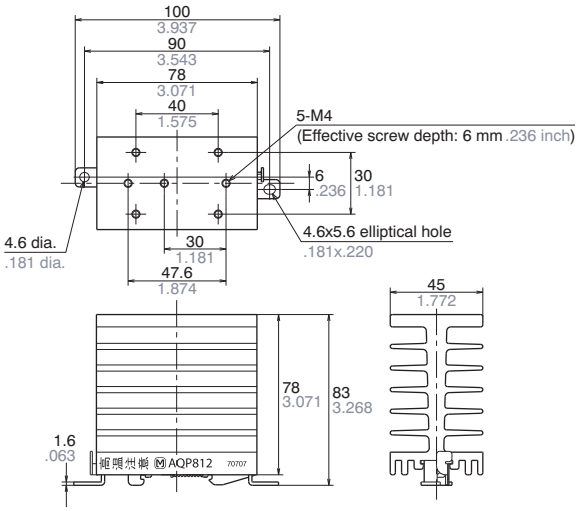


Measuring conditions:

Heat sink (AQP-HS-SJ20A) is used. (Reference: 2.9°C 37.22°F/W)

Heat sink (AQP-HS-SJ20A) (mm inch)

External dimensions

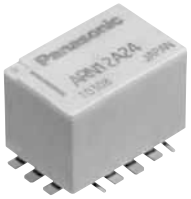


General tolerance: ±0.1 ±.004

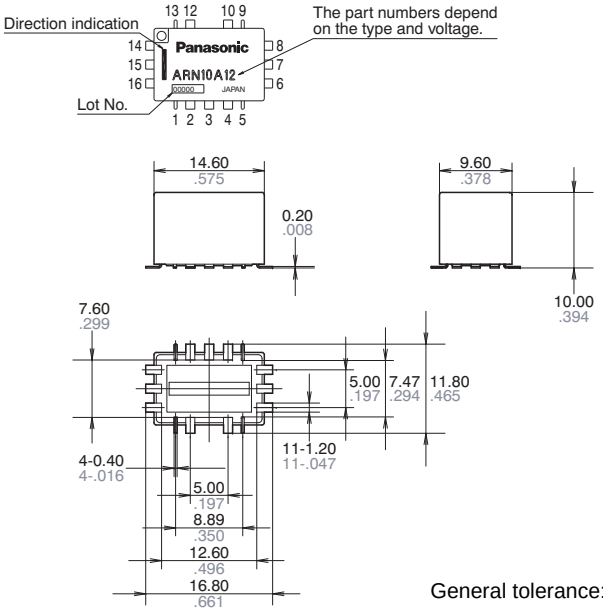
DIMENSIONS (mm inch)

Download CAD Data from our Web site.

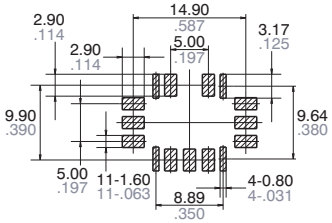
CAD Data



External dimensions



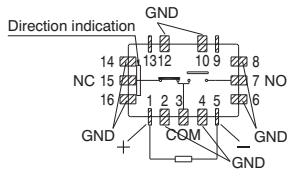
PC board pattern



General tolerance: ±0.3 ±.012

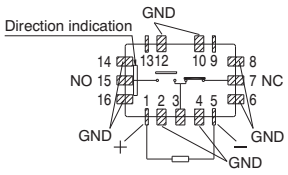
Schematic

Single side stable type/Standard contact type



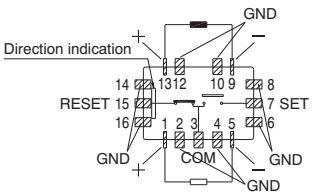
(Deenergized condition)

Single side stable type/Reversed contact type



(Deenergized condition)

2 coil latching type/Standard contact type



(Reset condition)

NOTES

1. Coil operating power

Pure DC current should be applied to the coil. 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. The wave form of power should be rectangular. To ensure accurate operation, the voltage on both sides of the coil should be ±5% (at 20°C 68°F) of the nominal coil voltage. Also, please note that the pick-up and drop-out voltages (set and reset voltages) will change depending on operation temperature and conditions of use.

2. Coil connection

This relay is polarized relay, the coil voltage must be applied with correct polarity.

3. External magnetic field

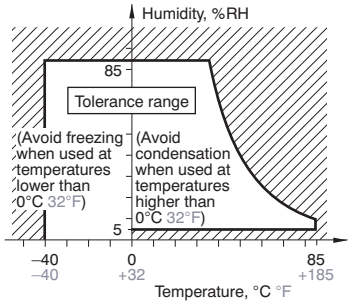
Since RN relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition

4. Cleaning

This product is not sealed type, therefore washing is not allowed.

5. Conditions for operation, transport and storage

1) Temperature: –40 to +85°C –40 to +185°F (But allowable temperature is from –40 to +60°C –40 to +140°F at our standard packing condition.)
2) Humidity: 5 to 85% R.H. (Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage

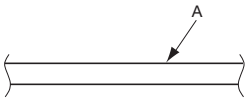


4) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
5) Freezing
Condensation or other moisture may freeze on the relay when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) Low temperature and low humidity environments
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.
7) Storage requirements
Since the relay is sensitive to humidity, it comes in sealed anti-humidity packaging. However, when storing, please be careful of the following.
(1) Please use promptly once the anti-humidity pack is opened.
(2) When storing for a log period after opening the anti-humidity pack, storage in anti-humidity packaging with an antihumidity bag to which silica gel has been added, is recommended.

*Furthermore, if the relay is solder mounted when it has been subjected to excessive humidity, cracks and leaks can occur. Be sure to mount the relay under the required mounting conditions.

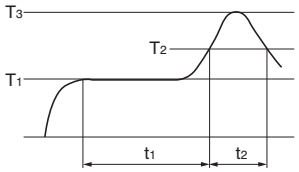
6. Soldering

Please meet the following conditions if this relay is to be automatically soldered.
1) Position of measuring temperature



A: Surface of PC board where relay is mounted.

2) IR (infrared reflow) soldering method

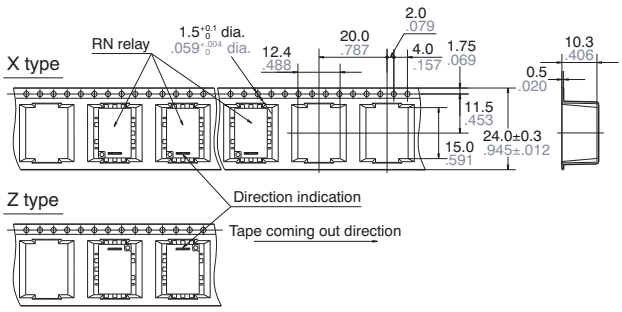


T_1 = 150 to 180°C 302 to 356°F
T_2 = 230°C 446°F and higher
T_3 = 250°C 482°F max.
t_1 = 60s to 120s
t_2 = within 30s

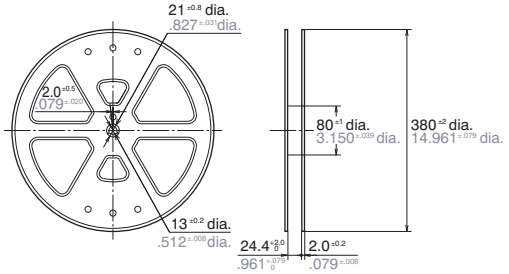
• Mounting cautions
Rise in relay temperature depends greatly on the component mix on a given PC board and the heating method of the reflow equipment. Therefore, please test beforehand using actual equipment to ensure that the temperature where the relay terminals are soldered and the temperature at the top of the relay case are within the conditions given above.
3) Please meet the following conditions if this relay is to be soldered by hand.
(1) Max. 260°C 500°F (solder temperature), within 10 seconds (soldering time)
(2) Max. 350°C 662°F (solder temperature), within 3 seconds (soldering time)
The effect on the relay depends on the actual PC board used. Please verify the PC board to be used.

7. Tape and reel packing

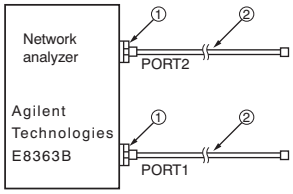
1) Tape dimensions (General tolerance: ±0.1 ±.004)



2) Dimensions of plastic reel



8. Measuring method of high frequency characteristics (Impedance 50Ω)

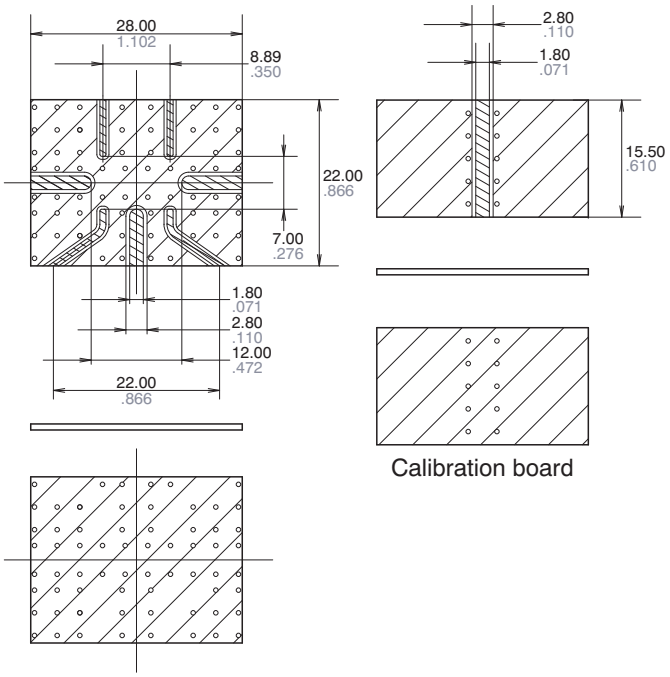


Connect connectors 1 and 2 respectively to PORT 1 and PORT 2. Perform calibration using the 3.5 mm calibration kit (HP85052B).

No.	Product name	Contents
1	Agilent 85130-60011	Adapter 2.4mm-3.5mm female .095inch-.138inch female
2	SUHNER SUCOFLEX104	Cable 3.5mm-3.5mm male .138inch-.138inch male

After calibration, connect the D.U.T. board and measure. However, connectors other than those for measurement should be connected with a 50Ω termination resistor.

D.U.T. board
Dimensions (mm inch)



Calibration board

Material: Glass PTFE (double-sided, through hole PC board) R-4737 (Panasonic)
Board thickness: t = 0.8 mm .031 inch
Copper plating thickness: 18 μm
Connector (SMA type)
Product name: 01K1808-00 (Waka Manufacturing Co., Ltd.)
Insertion loss compensation: The insertion loss of relay itself is given by subtracting the insertion loss of calibration board.

9. Others

1) The switching lifetime is defined under the standard test condition specified in the JIS* C 5442 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%RH). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors. *JIS: Japanese Industrial Standards
Also, be especially careful of loads such as those listed below.
• When used for AC load-operating and the operating phase is synchronous, rocking and fusing can easily occur due to contact shifting.
• When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.
Three countermeasures for these are listed here.
(1) Incorporate an arc-extinguishing circuit.
(2) Lower the operating frequency
(3) Lower the ambient humidity

2) Use the relay within specifications such as coil rating, contact rating and on/off service life. If used beyond limits, the relay may overheat, generate smoke or catch fire.

3) Be careful not to drop the relay. If accidentally dropped, carefully check its appearance and characteristics before use.

4) Be careful to wire the relay correctly. Otherwise, malfunction, overheat, fire or other trouble may occur.

5) If a relay stays on in a circuit for many months or years at a time without being activated, circuit design should be reviewed so that the relay can remain non-excited. A coil that receives current all the time heats, which degrades insulation earlier than expected. A latching type relay is recommended for such circuits.

6) To ensure accurate operation of the latching type amidst surrounding temperature changes and other factors that might affect the set and reset pulse times, we recommend a coil impress set and reset pulse width of at least 30 ms at the rated operation voltage.

7) The latching type relay is shipped in the reset position. But jolts during transport or impacts during installation can change the reset position. It is, therefore, advisable to build a circuit in which the relay can be initialized (set and reset) just after turning on the power.

8) If silicone materials (e.g., silicone rubbers, silicone oils, silicone coating agents, silicone sealers) are used in the vicinity of the relay, the gas emitted from the silicone may adhere to the contacts of the relay during opening and closing and lead to improper contact. If this is the case, use a material other than silicone.

For complete “Cautions for Use”, please download the “Relay Technical Information” from our Web site. For instructions on soldering, see page 66. For information on reliability, see page 64.

Panasonic
ideas for life

8, 18 and 26.5 GHz, compact size, coaxial switch

RV COAXIAL SWITCHES (ARV)

PIN type

SMA type

FEATURES

1. Compact size (Approx. 85% less volume compared to previous product.*)
PIN type size: L 15.9 × W 15.9 × H 11.2 mm L .626 × W .626 × H .441 inch
2. Excellent high frequency characteristics (to 8, 18, 26.5GHz, 50Ω)
3. Terminal shape options available (PIN and SMA)**
4. Contact arrangement: SPDT
5. Failsafe type and latching type (2-coil latching type) that reduces operating power are now available.

*Compared to previous product (RD coaxial switch) and PIN type RV coaxial switch.
**For SMP connector type, please contact us.

TYPICAL APPLICATIONS

Compact wireless devices
Compact measuring instrument
All types of inspection equipment
Digital broadcasting
• Broadcasting relay station
• Broadcasting equipment
Mobile communication
• Cellular phone base station

1) If you consider using applications requiring frequent switching or high number of operations, please contact us.
2) If you consider using applications with low level load, please contact us.

HIGH FREQUENCY CHARACTERISTICS (Impedance 50Ω, Initial)

1. PIN type

Frequency	to 4 GHz	4 to 8 GHz	8 to 12.4 GHz*	12.4 to 18 GHz*
V.S.W.R. (max.)	1.3	1.4	1.5	1.7
Insertion loss (dB. max.)	0.3	0.4	0.5	0.7
Isolation (dB. min.)	70	60	50	40

Note: *8 to 18GHz characteristics can be applied 18GHz type only.

2. SMA type

Frequency	to 8 GHz	8 to 12.4 GHz*	12.4 to 18 GHz*	18 to 26.5 GHz**
V.S.W.R. (max.)	1.35	1.6	1.7	1.8
Insertion loss (dB. max.)	0.3	0.5	0.7	0.8
Isolation (dB. min.)	70	60	60	50

Note: *8 to 18GHz characteristics can be applied 18GHz type and 26.5GHz type only.
**18 to 26.5GHz characteristics can be applied 26.5GHz type only.

ORDERING INFORMATION

ARV □ □ □ □ □ □ □

Frequency
1: to 8GHz
2: to 18GHz
3: to 26.5GHz (SMA type only)

Operating function
0: Failsafe type/Standard contact
2: Latching type/Standard contact
3: Failsafe type/Reverse contact

Terminal shape
N: PIN type
A: SMA type

Nominal operating voltage
4H: 4.5 V DC
12: 12 V DC
24: 24 V DC

Operation terminal
Nil: Solder terminal

HF data attached
Nil: No HF test data attached
Q: HF test data attached (Displayed only on inner and outer packaging)

*Please inquire regarding use with nominal operating voltage of 28 V DC.

TYPES

SPDT

Operating function	Contact terminal shape	Nominal operating voltage	to 8 GHz type		to 18 GHz type		to 26.5 GHz type	
			No HF datasheet attached	HF datasheet attached	No HF datasheet attached	HF datasheet attached	No HF datasheet attached	HF datasheet attached
Failsafe type/ Standard contact	PIN type	4.5 V DC	ARV10N4H	ARV10N4HQ	ARV20N4H	ARV20N4HQ	–	–
		12 V DC	ARV10N12	ARV10N12Q	ARV20N12	ARV20N12Q	–	–
		24 V DC	ARV10N24	ARV10N24Q	ARV20N24	ARV20N24Q	–	–
	SMA type	4.5 V DC	ARV10A4H	ARV10A4HQ	ARV20A4H	ARV20A4HQ	ARV30A4H	ARV30A4HQ
		12 V DC	ARV10A12	ARV10A12Q	ARV20A12	ARV20A12Q	ARV30A12	ARV30A12Q
		24 V DC	ARV10A24	ARV10A24Q	ARV20A24	ARV20A24Q	ARV30A24	ARV30A24Q
Latching type/ Standard contact	PIN type	4.5 V DC	ARV12N4H	ARV12N4HQ	ARV22N4H	ARV22N4HQ	–	–
		12 V DC	ARV12N12	ARV12N12Q	ARV22N12	ARV22N12Q	–	–
		24 V DC	ARV12N24	ARV12N24Q	ARV22N24	ARV22N24Q	–	–
	SMA type	4.5 V DC	ARV12A4H	ARV12A4HQ	ARV22A4H	ARV22A4HQ	ARV32A4H	ARV32A4HQ
		12 V DC	ARV12A12	ARV12A12Q	ARV22A12	ARV22A12Q	ARV32A12	ARV32A12Q
		24 V DC	ARV12A24	ARV12A24Q	ARV22A24	ARV22A24Q	ARV32A24	ARV32A24Q
Failsafe type/ Reverse contact	PIN type	4.5 V DC	ARV13N4H	ARV13N4HQ	ARV23N4H	ARV23N4HQ	–	–
		12 V DC	ARV13N12	ARV13N12Q	ARV23N12	ARV23N12Q	–	–
		24 V DC	ARV13N24	ARV13N24Q	ARV23N24	ARV23N24Q	–	–
	SMA type	4.5 V DC	ARV13A4H	ARV13A4HQ	ARV23A4H	ARV23A4HQ	ARV33A4H	ARV33A4HQ
		12 V DC	ARV13A12	ARV13A12Q	ARV23A12	ARV23A12Q	ARV33A12	ARV33A12Q
		24 V DC	ARV13A24	ARV13A24Q	ARV23A24	ARV23A24Q	ARV33A24	ARV33A24Q

Standard packing: Carton: 5 pcs. Case: 50 pcs.

RATING

1. Coil data

1) Failsafe type (Standard contact and Reverse contact)

Nominal operating voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 85°C 185°F)
4.5 V DC	75%V or less of nominal voltage*1 (Initial)	10%V or more of nominal voltage*1 (Initial)	155.7mA	28.9Ω	700mW	110%V of nominal voltage
12 V DC			58.3mA	205.7Ω		
24 V DC			29.2mA	822.9Ω		

2) Latching type (Standard contact)

Nominal operating voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 85°C 185°F)
4.5 V DC	75%V or less of nominal voltage*1 (Initial)	75%V or less of nominal voltage*1 (Initial)	155.7mA	28.9Ω	700mW	110%V of nominal voltage
12 V DC			58.3mA	205.7Ω		
24 V DC			29.2mA	822.9Ω		

Notes: *1. Pulse drive (JIS C5442)
*2. Please inquire regarding use with nominal operating voltage of 28 V DC.

2. Specifications

Characteristics	Item		Specifications							
Contact	Arrangement		SPDT							
	Contact material		Gold plating							
	Contact resistance (Initial)		Max. 100mΩ (By voltage drop 10V AC 10mA)							
Rating	Contact input power (CW)		Max. 50W (at 3GHz) (V.S.W.R. 1.3 or less, no contact switching, ambient temperature 20°C 68°F)*1							
	Nominal operating power		700mW							
High frequency characteristics (Impedance 50Ω)			PIN type*2				SMA type			
	Frequency		to 4 GHz	4 to 8 GHz	8 to 12.4 GHz*3	12.4 to 18 GHz*3	to 8 GHz	8 to 12.4 GHz*4	12.4 to 18 GHz*4	18 to 26.5 GHz*5
	V.S.W.R. (max.)		1.3	1.4	1.5	1.7	1.35	1.6	1.7	1.8
	Insertion loss (dB, max.)		0.3	0.4	0.5	0.7	0.3	0.5	0.7	0.8
	Isolation (dB, min.)		70	60	50	40	70	60	60	50
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000 MΩ (at 500 V DC) Measurement at same location as “breakdown voltage (Initial)” section.							
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)							
		Between contact and earth terminal	500 Vrms for 1 min. (Detection current: 10mA)							
		Between contact and coil	500 Vrms for 1 min. (Detection current: 10mA)							
		Between coil and earth terminal	500 Vrms for 1 min. (Detection current: 10mA)							
Time characteristics (at 20°C 68°F)	Operate time (Set time)		Max. 15ms (approx. 5ms) (Nominal operating voltage applied to the coil, excluding contact bounce time.)							
	Release time (Reset time)		Max. 15ms (approx. 5ms) (Nominal operating voltage applied to the coil, excluding contact bounce time.) (without diode, only for Release time)							
Mechanical characteristics	Shock resistance	Functional	Min. 500 m/s² (Half-wave pulse of sine wave: 11ms, detection time: 10μs.)							
		Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 6ms.)							
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3mm (Detection time: 10μs.)							
		Destructive	10 to 55 Hz at double amplitude of 5mm/15 to 2,000 Hz [W0 = 2.94 (m/s²)²/Hz]							
Expected life	Mechanical		Min. 10^6 (at 180 cpm)							
	Electrical (Hot switch)		Min. 3×10^5 (1W High frequency load, at 3GHz, impedance 50Ω, V.S.W.R.; max. 1.3) (at 20 cpm)							
Conditions	Conditions for operation, transport and storage*6		Ambient temperature: –55°C to +85°C –67°F to +185°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature) Air pressure: 86 to 106 kPa							
Unit weight			PIN type: Approx. 12g .42oz				SMA type: Approx. 20g .71oz			

Notes: *1. Factors such as heating of the connected terminal influence the high frequency characteristics; therefore, please verify under actual conditions of use.
*2. Measuring method: After installing on dedicated inspection equipment
*3. 8 to 18GHz characteristics can be applied 18GHz type only.
*4. 8 to 18GHz characteristics can be applied 18GHz and 26.5GHz types only.
*5. 18 to 26.5GHz characteristics can be applied 26.5GHz type only.
*6. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “NOTES” on page 49.

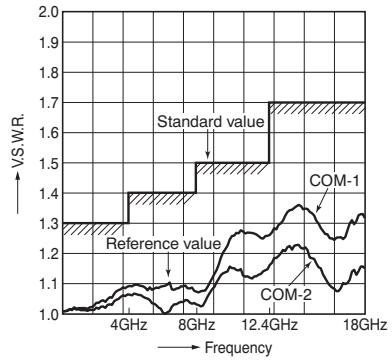
REFERENCE DATA

1-(1). High frequency characteristics (PIN type)

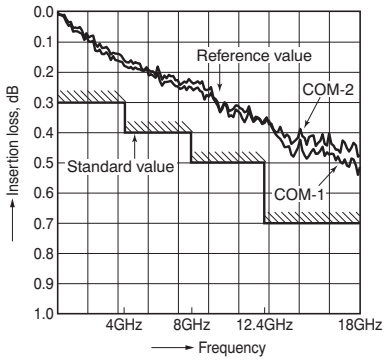
Sample: ARV22N12

Measuring method: Measured with Agilent Technologies network analyzer (E8363B) after installing on dedicated inspection equipment.

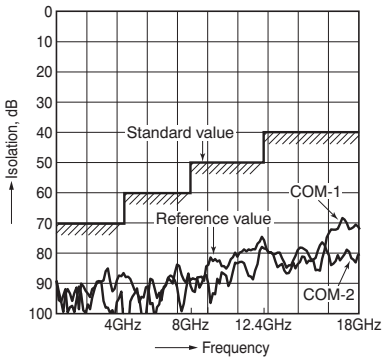
• V.S.W.R.



• Insertion loss



• Isolation

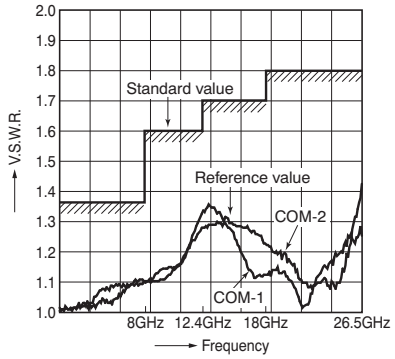


1-(2). High frequency characteristics (SMA type)

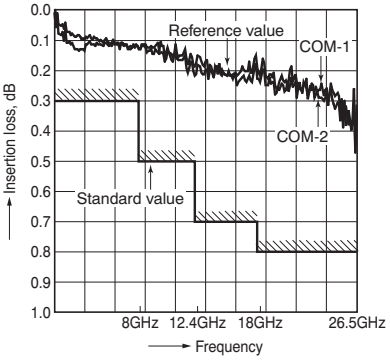
Sample: ARV32A12

Measuring method: Measured with Agilent Technologies network analyzer (E8363B).

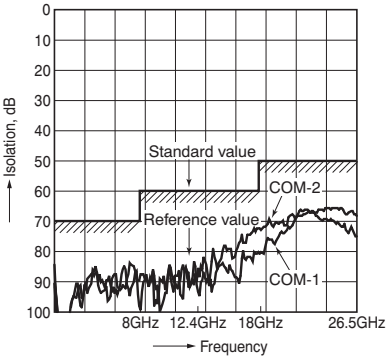
• V.S.W.R.



• Insertion loss



• Isolation



DIMENSIONS (mm inch)

Download CAD Data from our Web site.

1. PIN type

CAD Data

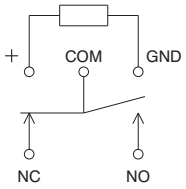
Tolerance: ±0.3 ±.012

Schematic (Top view)

<Standard contact>

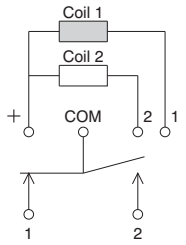
Failsafe type

(Deenergized condition)



Latching type

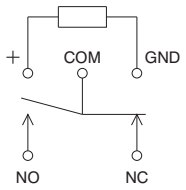
(Reset condition)



<Reverse contact>

Failsafe type

(Deenergized condition)



2. SMA type

CAD Data

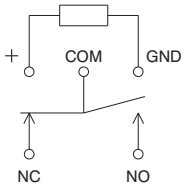
Tolerance: ±0.3 ±.012

Schematic (Top view)

<Standard contact>

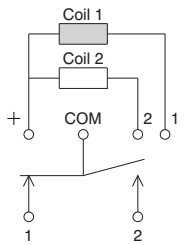
Failsafe type

(Deenergized condition)



Latching type

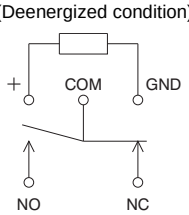
(Reset condition)



<Reverse contact>

Failsafe type

(Deenergized condition)



*For SMP connector type, please consult us.

NOTES

1. For general cautions for use, please refer to the "Cautions for Use" in the "Relay Technical Information".

2. 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. The nominal operating voltage should be applied to the coil for more than 50 ms to set/reset the latching type. Please use the latching type for circuits that are continually powered for long periods of time.

3. Coil connection

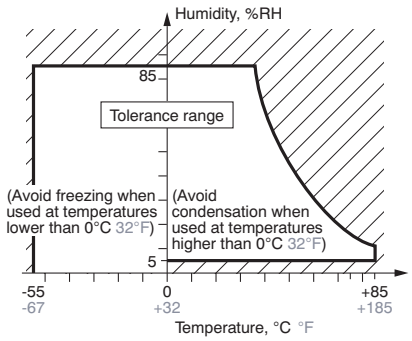
Since this product is polarized, please be aware of the plus/minus polarity of the coil.

4. Connection and washing conditions for coil and PIN type contact terminals

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

5. Conditions for operation, transport and storage conditions

1) Temperature:
–55 to +85°C –67 to +185°F
2) Humidity: 5 to 85% RH
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
3) Atmospheric pressure: 86 to 106 kPa
Temperature and humidity range for usage, transport, and storage:



4) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of coaxial switch insulation.
5) Freezing
Condensation or other moisture may freeze on coaxial switch when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) Low temperature, low humidity environments.
The plastic may become brittle if coaxial switch is exposed to a low temperature, low humidity environment for long periods of time.

6. Other handling precautions.

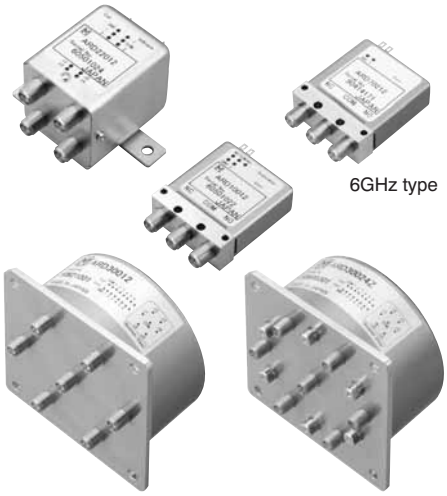
1) Coaxial switch's on/off service life is based on standard test conditions (temperature: 15 to 35°C 59 to 95°F, humidity: 25 to 75%) specified in JIS C5442-1996. Life will depend on many factors of your system: coil drive circuit, type of load, switching intervals, switching phase, ambient conditions, to name a few.
2) Use coaxial switch within specifications such as coil rating, contact rating and on/off service life. If used beyond limits, coaxial switch may overheat, generate smoke or catch fire.
3) Be careful not to drop coaxial switch. If accidentally dropped, carefully check its appearance and characteristics before use.
4) Be careful to wire coaxial switch correctly. Otherwise, malfunction, overheat, fire or other trouble may occur.
5) The latching type product is shipped in the reset position. But jolts during transport or impacts during installation can move it to the set position. It is, therefore, advisable to build a circuit in which coaxial switch can be initialized (set and reset) just after turning on the power.
6) If coaxial switch stays on in a circuit for many months or years at a time without being activated, circuit design should be reviewed so that the coaxial switch can remain deenergized. A coil that receives current all the time heats, which degrades insulation earlier than expected. A latching type is recommended for such circuits.
7) For SMA connectors (SMA type only), we recommend a torque of 0.90±0.1 N·m for installation, which falls within the prescribed torque of MIL-C-39012. Please be aware that conditions might be different depending on the connector materials and how it interacts with surrounding materials.
8) Please do not use silicon based substances such as silicon rubber, silicon oil, silicon coatings and silicon fillings, in the vicinity of the coaxial switch. Doing so may cause volatile silicon gas to form which may lead to contact failure due to the adherence of silicon on the contacts when they open and close in this atmosphere.
9) In order to ensure stable signal communication on contact, it is recommended that the monitoring of contact signal should be started from Min. 100 ms after coil rated voltage is applied.

For complete "Cautions for Use", please download the "Relay Technical Information" from our Web site. For instructions on soldering, see page 66. For information on reliability, see page 64.

Panasonic
ideas for life

Addition of 6 GHz high reliability RD coaxial switch (SPDT) for communications market

RD COAXIAL SWITCHES (ARD)


6GHz type

FEATURES

1. Excellent high frequency characteristics (50Ω, to 26.5Ghz)
2. SPDT, Transfer and SP6T types are available.
3. High sensitivity
Nominal operating power:
840 mW (SPDT/SP6T, Fail-safe type, with indicator)
1,540 mW (Transfer, Fail-safe type, with indicator)
*Without 24V type
4. Long-lasting life: min. 5 × 10^6
5. With termination type is added. (SP6T)
Thanks to the addition of termination, steady high frequency characteristics can be maintained when contacts are either open or closed and this contributes to increase system reliability.
6. + COM type is available.

TYPICAL APPLICATIONS

Wireless and mobile communication
• Cellular phone base station
• Amplifier switching
Digital broadcasting
• Broadcasting relay station
• Broadcasting equipment
Measuring instrument
All types of inspection equipment

Please inquire beforehand if you are thinking of using this product in applications that involve low level load or high frequency of switching.

HIGH FREQUENCY CHARACTERISTICS (Impedance 50Ω)

Frequency	to 1 GHz	1 to 4 GHz	4 to 8 GHz*1	8 to 12.4 GHz	12.4 to 18 GHz	18 to 26.5 GHz*2
V.S.W.R. (max.)	1.1	1.15	1.25	1.35	1.5	1.7
V.S.W.R. (SP6T With termination) (max.)	1.20		1.40	1.50	—	—
Insertion loss (dB. max.)	0.2		0.3	0.4	0.5	0.8
Isolation (dB. min.)	85	80	70	65	60	55

Notes:
*1The 6GHz type only has the above characteristics up to 6GHz.
*218 to 26.5GHz characteristics can be applied 26.5GHz type only (SPDT, Transfer)

ORDERING INFORMATION

ARD □ □□ □□ □ □ □

RD coaxial switches

Frequency
1: to 18GHz (SPDT)
2: to 18GHz (Transfer)
3: to 13GHz (SP6T)
5: to 26.5GHz (SPDT)
6: to 26.5GHz (Transfer)
7: to 6GHz (SPDT)

Operating function
00: Fail-safe (with indicator)
20: Latching (with indicator)
51: Latching with TTL driver (SPDT, Transfer) (with self cut-off function) (with indicator)
02: Fail-safe (without indicator)
22: Latching (without indicator)
53: Latching with TTL driver (SPDT) (with self cut-off function) (without indicator)

Nominal operating voltage, V DC
4H: 4.5 (Fail-safe, Latching type only)
05: 5 (Latching with TTL driver type only)
12: 12
24: 24

Operation terminal
Nil: Solder terminal
C: Connector cable (SPDT type only)

Termination (SP6T type only)
Nil: No termination
Z: With termination

HF data attached
Nil: No HF test data attached
Q: HF test data attached

Note: Sealed types also available, please consult us (SPDT only)

TYPES

1. SPDT

1) Solder terminal

Operating function	Nominal operating voltage, V DC	6GHz type	18GHz type		26.5GHz type	
		No HF datasheet attached	No HF datasheet attached	HF datasheet attached	No HF datasheet attached	HF datasheet attached
Fail-safe (with indicator)	4.5	ARD7004H	ARD1004H	ARD1004HQ	ARD5004H	ARD5004HQ
	12	ARD70012	ARD10012	ARD10012Q	ARD50012	ARD50012Q
	24	ARD70024	ARD10024	ARD10024Q	ARD50024	ARD50024Q
Latching (with indicator)	4.5	ARD7204H	ARD1204H	ARD1204HQ	ARD5204H	ARD5204HQ
	12	ARD72012	ARD12012	ARD12012Q	ARD52012	ARD52012Q
	24	ARD72024	ARD12024	ARD12024Q	ARD52024	ARD52024Q
Latching with TTL driver (with self cut-off function) (with indicator)	5	ARD75105	ARD15105	ARD15105Q	ARD55105	ARD55105Q
	12	ARD75112	ARD15112	ARD15112Q	ARD55112	ARD55112Q
	24	ARD75124	ARD15124	ARD15124Q	ARD55124	ARD55124Q
Fail-safe (without indicator)	4.5	ARD7024H	—	—	—	—
	12	ARD70212				
	24	ARD70224				
Latching (without indicator)	4.5	ARD7224H	—	—	—	—
	12	ARD72212				
	24	ARD72224				
Latching with TTL driver (with self cut-off function) (without indicator)	5	ARD75305	—	—	—	—
	12	ARD75312				
	24	ARD75324				

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

2) Connector cable

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

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

2. Transfer

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

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

3. SP6T

Operating function	Nominal operating voltage, V DC	13GHz type	
		No HF datasheet attached	HF datasheet attached
Fail-safe	4.5	ARD3004H	ARD3004HQ
	12	ARD30012	ARD30012Q
	24	ARD30024	ARD30024Q
Latching	4.5	ARD3204H	ARD3204HQ
	12	ARD32012	ARD32012Q
	24	ARD32024	ARD32024Q

Note: Standard packing; Carton: 1 pc. Case: 5 pcs.

4. SP6T (with termination)

Operating function	Nominal operating voltage, V DC	13GHz type	
		No HF datasheet attached	HF datasheet attached
Fail-safe	4.5	ARD3004HZ	ARD3004HZQ
	12	ARD30012Z	ARD30012ZQ
	24	ARD30024Z	ARD30024ZQ
Latching	4.5	ARD3204HZ	ARD3204HZQ
	12	ARD32012Z	ARD32012ZQ
	24	ARD32024Z	ARD32024ZQ

Note: Standard packing; Carton: 1 pc. Case: 5 pcs.

RATING

1. Coil data

(1) SPDT

1) Fail-safe type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%) (at 20°C 68°F)		Nominal power consumption, mW	
	With indicator	Without indicator	With indicator	Without indicator
4.5	186.7	155.6	840	700
12	70.0	58.3		
24	40.4	29.2	970	

2) Latching type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%) (at 20°C 68°F)		Nominal power consumption, mW	
	With indicator	Without indicator	With indicator	Without indicator
4.5	155.6	111.1	700	500
12	62.5	41.7	750	
24	37.5	16.7	900	

3) Latching with TTL driver type

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

(2) Transfer

1) Fail-safe type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%) (at 20°C 68°F)	Nominal power consumption, mW
4.5	342.2	1540
12	128.3	
24	69.6	1670

2) Latching type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%) (at 20°C 68°F)	Nominal power consumption, mW
4.5	266.7	1200
12	104.2	1250
24	58.3	1400

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

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

(3) SP6T and SP6T (with termination type)

1) Fail-safe type

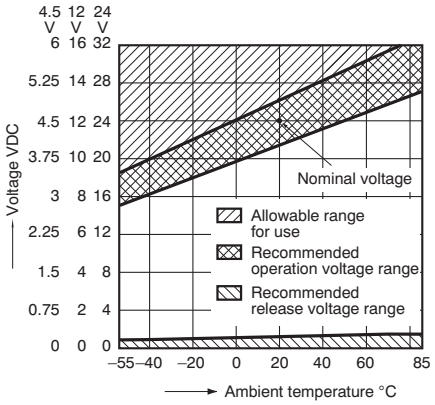
Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%) (at 20°C 68°F)	Nominal power consumption, mW
4.5	186.7	840
12	70.0	
24	40.4	970

2) Latching type

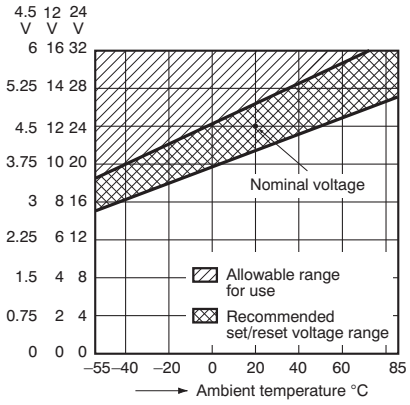
Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%) (at 20°C 68°F)	Nominal power consumption, mW
4.5	SET: 155.6 / RESET (ALL): 933.6	SET: 700 / RESET (ALL): 4,200
12	SET: 62.5 / RESET (ALL): 375.0	SET: 750 / RESET (ALL): 4,500
24	SET: 37.5 / RESET (ALL): 225.0	SET: 900 / RESET (ALL): 5,400

• Operating voltage range

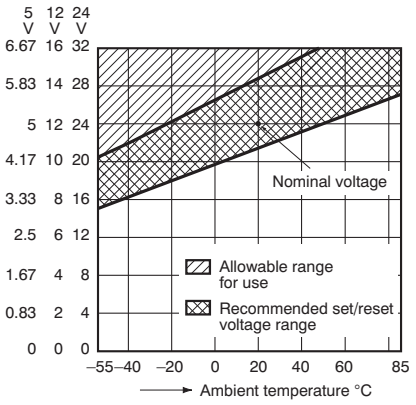
1) Fail-safe type



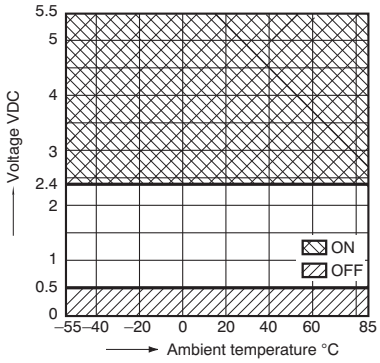
2) Latching type



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



4) TTL Logic level range



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

2. Specifications

1) SPDT/Transfer

Characteristics	Item		Specifications					
Contact	Arrangement		SPDT			Transfer		
	Contact material		Gold plating					
	Initial contact resistance		Max. 100mΩ (By voltage drop 6V DC 1A)					
Rating	Contact input power		120W (at 3GHz) (V.S.W.R. 1.15 or less, no contact switching, ambient temperature 40°C 104°F [SPDT], 25°C 77°F [Transfer])*1					
	Nominal operating power	Fail-safe	840mW (4.5V, 12V DC), 970mW (24V DC)			1,540mW (4.5V, 12V DC), 1,670mW (24V DC)		
		Latching	700mW (4.5V DC), 750mW (12V DC), 900mW (24V DC)			1,200mW (4.5V DC), 1,250mW (12V DC), 1,400mW (24V DC)		
Indicator rating (with indicator type only)	Contact rating		Max. 30V 100mA					
	Initial contact resistance		Max. 1Ω (Measured by 5V 100mA)					
	Min. switching capacity (Reference value)		3V DC, 0.1mA (5×10^6, Reliability level: 10% (3kΩ))					
High frequency characteristics (Impedance 50Ω)			to 1 GHz	1 to 4 GHz	4 to 8 GHz*2	8 to 12.4 GHz	12.4 to 18 GHz	18 to 26.5 GHz*3
	V.S.W.R. (max.)		1.1	1.15	1.25	1.35	1.5	1.7
	Insertion loss (dB, max.)		0.2		0.3	0.4	0.5	0.8
	Isolation (dB, min.)		85	80	70	65	60	55
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000 MΩ (at 500 V DC) Measurement at same location as “breakdown voltage (Initial)” section.					
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)					
		Between contact and coil	500 Vrms for 1 min. (Detection current: 10mA)					
		Between contact and earth terminal	500 Vrms for 1 min. (Detection current: 10mA)					
		Between coil and earth terminal	500 Vrms for 1 min. (Detection current: 10mA)					
Time characteristics (at 20°C 68°F)	Operate time		Max. 15ms (Nominal operating voltage applied to the coil, excluding contact bounce time.)			Max. 20ms (Nominal operating voltage applied to the coil, excluding contact bounce time.)		
Mechanical characteristics	Shock resistance	Functional	Min. 500 m/s² (Half-wave pulse of sine wave: 11ms, detection time: 10μs.)					
		Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 11ms.)					
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3mm (Detection time: 10μs.)					
		Destructive	10 to 55 Hz at double amplitude of 5mm					
Expected life	Mechanical		6GHz type: Min. 10^6 18 and 26.5GHz type: Min. 5×10^6 (All types, at 180 cpm)			Min. 5×10^6 (at 180 cpm)		
	Electrical	High frequency contact (Hot switch)	6GHz type: Min. 10^6 18 and 26.5GHz type: Min. 5×10^6 (All types, 5W to 3GHz, impedance 50Ω, V.S.W.R.; max. 1.2) (at 20 cpm)			Min. 5×10^6 (5W to 3GHz, impedance 50Ω, V.S.W.R.; max. 1.2) (at 20 cpm)		
		Indicator (with indicator type only)	5 V DC, 10 mA, Min. 10^6 (at 20 cpm)					
Conditions	Conditions for operation, transport and storage*4		Ambient temperature: –55°C to +85°C –67°F to +185°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)					
Unit weight			Approx. 50g 1.76oz			Approx. 110g 3.88oz		

*1 Factors such as heating of the connected connector influence the high frequency characteristics; therefore, please verify under actual conditions of use.
*2 The 6GHz type only has the above characteristics up to 6GHz.
*3 18 to 26.5GHz characteristics can be applied 26.5GHz type only (SPDT, Transfer)
*4 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value.

2) SP6T

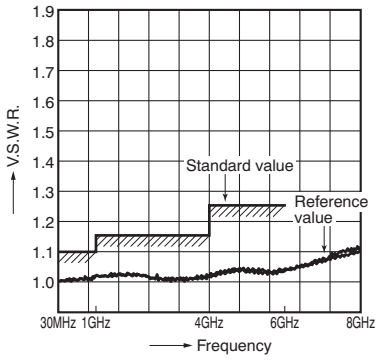
Characteristics	Item		Specifications			
Contact	Arrangement		SP6T			
	Contact material		Gold plating			
	Initial contact resistance		Max. 100mΩ (By voltage drop 6V DC 1A)			
Rating	Contact input power	No termination	120 W (at 3GHz) (V.S.W.R. 1.15 or less, no contact switching, ambient temperature 25°C 77°F)*1			
		With termination	2W (at 3GHz) (V.S.W.R. 1.15 or less, no contact switching, ambient temperature 25°C 77°F)*1			
	Nominal operating power	Fail-safe	840mW (4.5V, 12V DC), 970mW (24V DC)			
		Latching	700mW (4.5V DC), 750mW (12V DC), 900mW (24V DC)			
Indicator rating	Contact rating		Max. 30V 100mA			
	Initial contact resistance		Max. 1Ω (Measured by 5V 100mA)			
	Min. switching capacity (Reference value)		3V DC, 0.1mA (5×10^6, Reliability level: 10% (3kΩ))			
High frequency characteristics (Impedance 50Ω)			to 1 GHz	1 to 4 GHz	4 to 8 GHz	8 to 13 GHz
	V.S.W.R. (max.)	No termination	1.1	1.15	1.25	1.35
		With termination	1.20		1.40	1.50
	Insertion loss (dB, max.)		0.2		0.3	0.4
	Isolation (dB, min.)		85	80	70	65
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000 MΩ (at 500 V DC) Measurement at same location as “breakdown voltage (Initial)” section.			
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)			
		Between contact and coil	500 Vrms for 1 min. (Detection current: 10mA)			
		Between contact and earth terminal	500 Vrms for 1 min. (Detection current: 10mA)			
		Between coil and earth terminal	500 Vrms for 1 min. (Detection current: 10mA)			
Time characteristics (at 20°C 68°F)	Operate time		Max. 20ms (Nominal operating voltage applied to the coil, excluding contact bounce time.)			
Mechanical characteristics	Shock resistance	Functional	Min. 500 m/s² (Half-wave pulse of sine wave: 11ms, detection time: 10μs.)			
		Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 11ms.)			
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3mm (Detection time: 10μs.)			
		Destructive	10 to 55 Hz at double amplitude of 5mm			
Expected life	Mechanical		Min. 5×10^6 (at 180 cpm)			
	Electrical	High frequency contact (Hot switch)	No termination	Min. 5×10^6 (5W to 3GHz, impedance 50¾, V.S.W.R.; max. 1.2) (at 20 cpm)		
			With termination	Min. 5×10^6 (2W to 3GHz, impedance 50¾, V.S.W.R.; max. 1.2) (at 20 cpm)		
		Indicator (with indicator type only)	5 VDC, 10 mA, Min. 10^6 (at 20 cpm)			
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –55°C to +85°C –67°F to +185°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)			
Unit weight			Approx. 320g 11.29oz			

*1 Factors such as heating of the connected connector influence the high frequency characteristics; therefore, please verify under actual conditions of use.
*2 The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value.

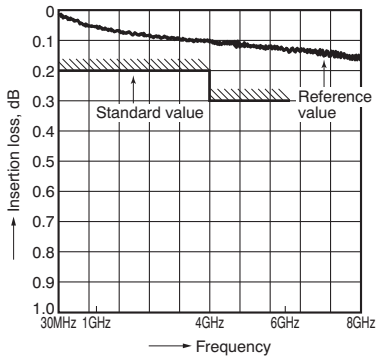
REFERENCE DATA

1-(1). High frequency characteristics (SPDT) 6GHz type
Sample: ARD70012
Measuring method: Measured with Agilent Technologies network analyzer (E8363B).

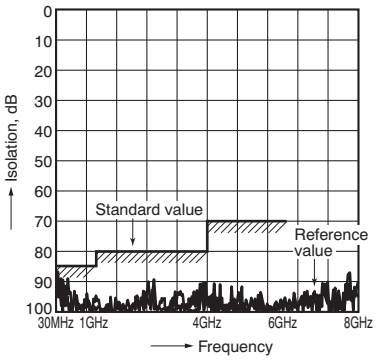
• V.S.W.R.



• Insertion loss

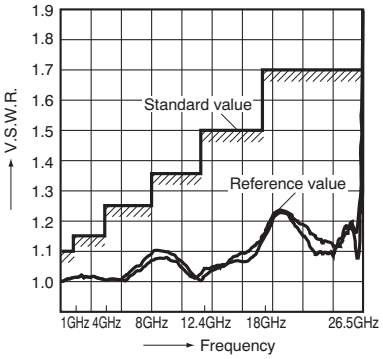


• Isolation

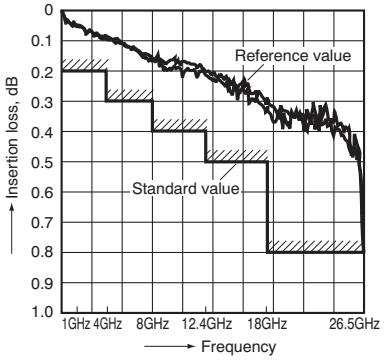


1-(2). High frequency characteristics (SPDT) 18, 26.5GHz type
Sample: ARD10012
Measuring method: Measured with Agilent Technologies network analyzer (HP8510).

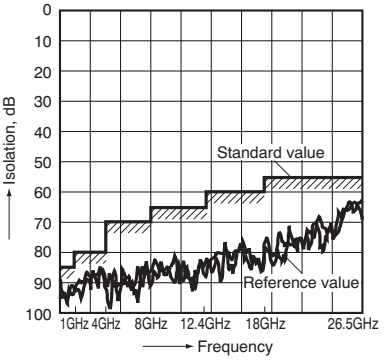
• V.S.W.R.



• Insertion loss

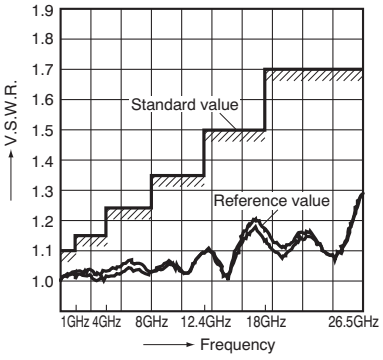


• Isolation

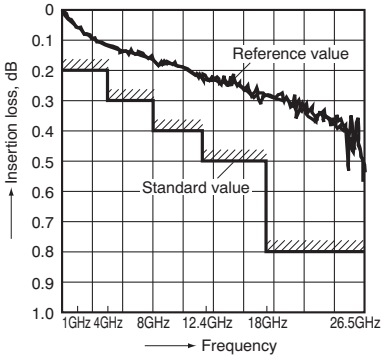


1-(3). High frequency characteristics (Transfer)
Sample: ARD60012
Measuring method: Measured with Agilent Technologies network analyzer (HP8510).

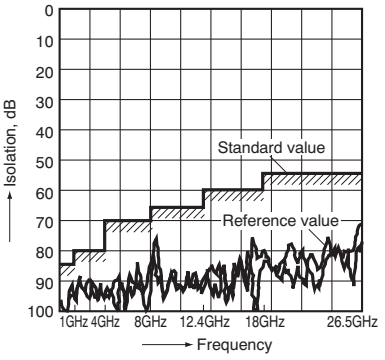
• V.S.W.R.



• Insertion loss



• Isolation

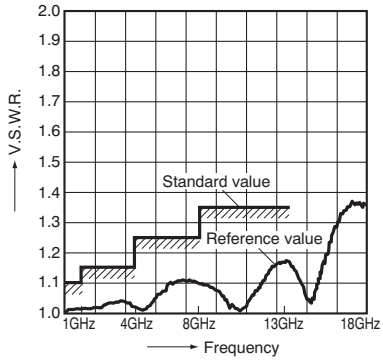


1-(4). High frequency characteristics (SP6T)

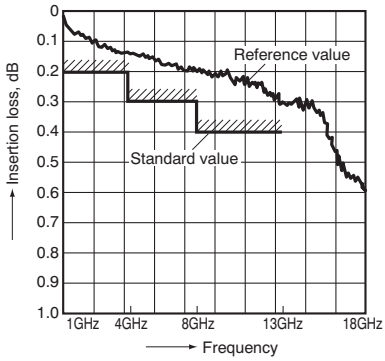
Sample: ARD30012

Measuring method: Measured with Agilent Technologies network analyzer (HP8510).

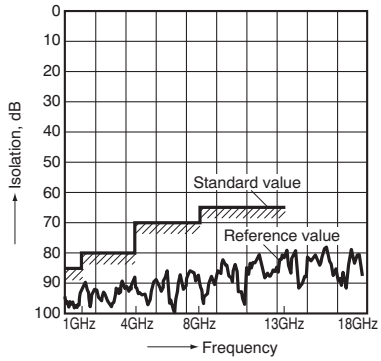
• V.S.W.R.



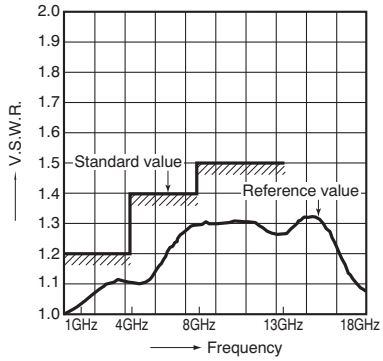
• Insertion loss



• Isolation



• Termination characteristics



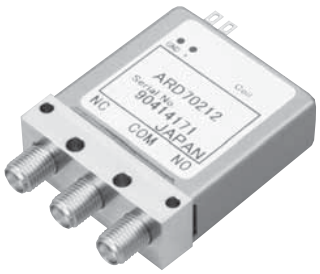
DIMENSIONS (mm inch)

Download CAD Data from our Web site.

1. SPDT

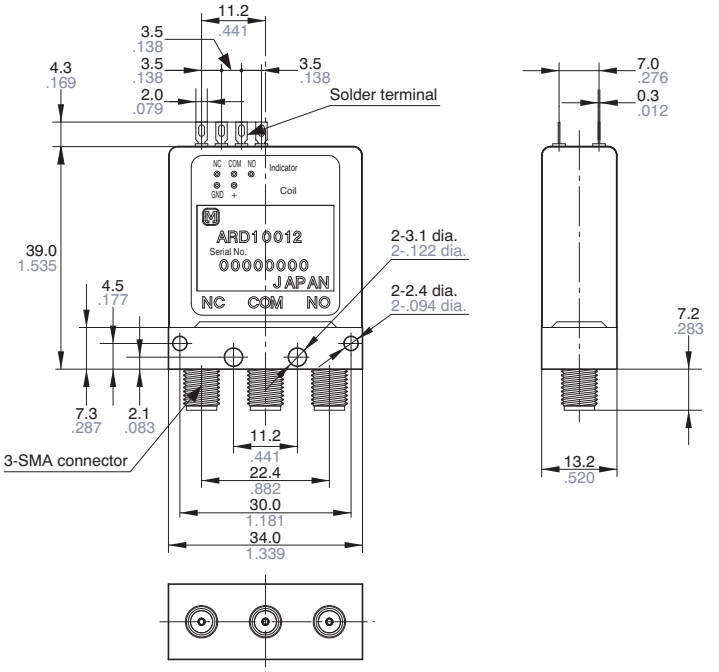
CAD Data

1) Solder terminal



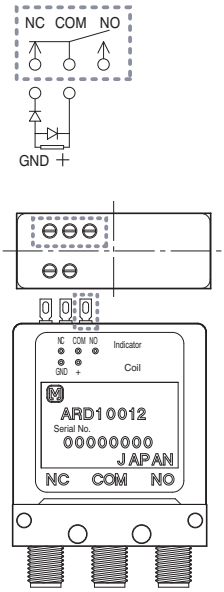
6GHz type

18 and 26.5GHz types

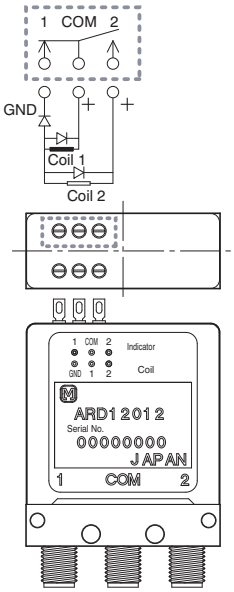


Tolerance: ±0.3 ±.012

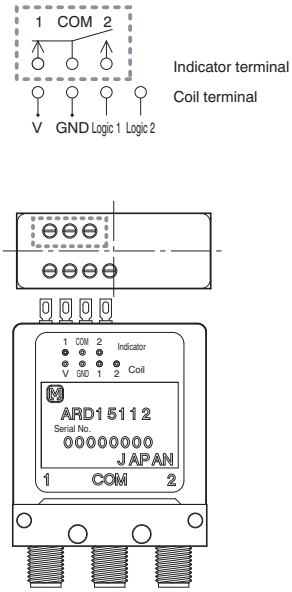
Fail-safe



Latching



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



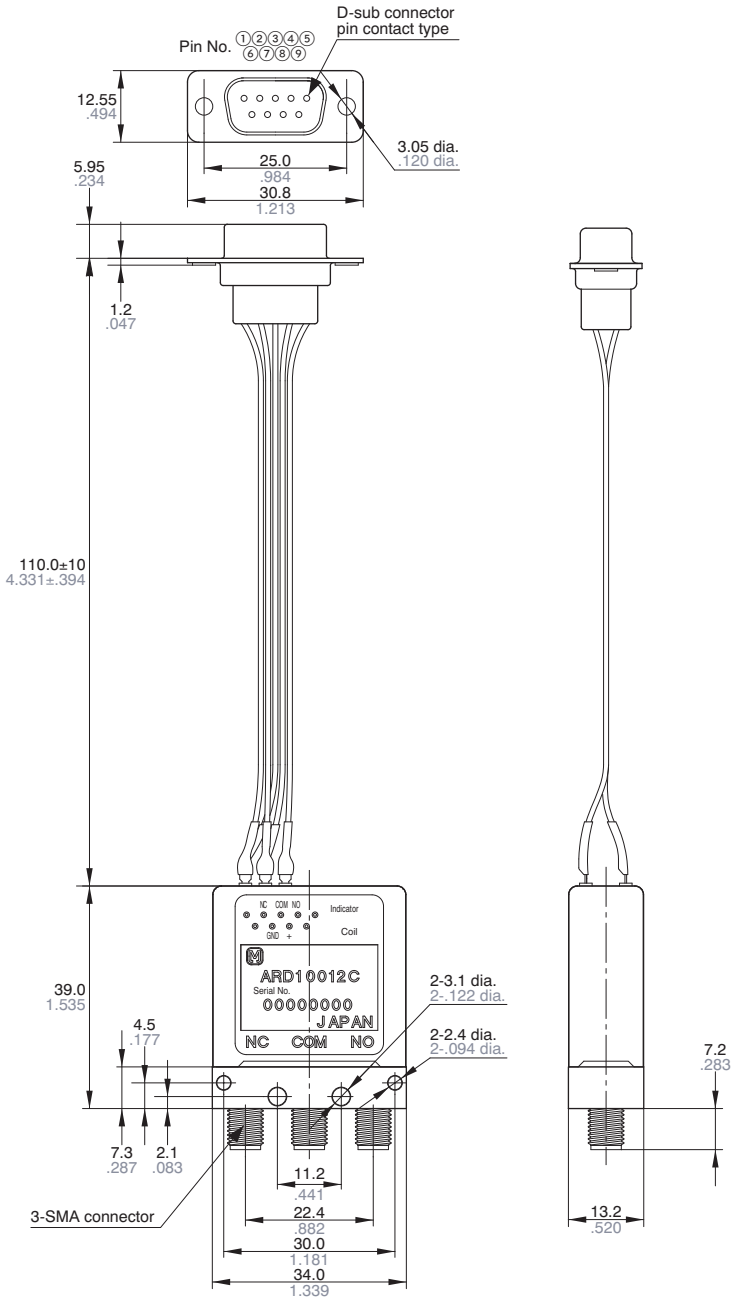
∗ + COM type is available

* The type without indicator terminals will not have the indicator terminals that are marked with the dotted box.

2) Connector cable

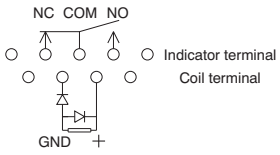
CAD Data

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

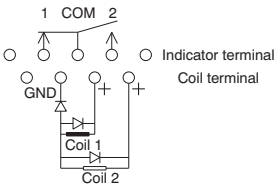


Tolerance: ±0.3 ±.012

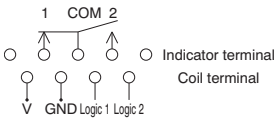
Fail-safe



Latching



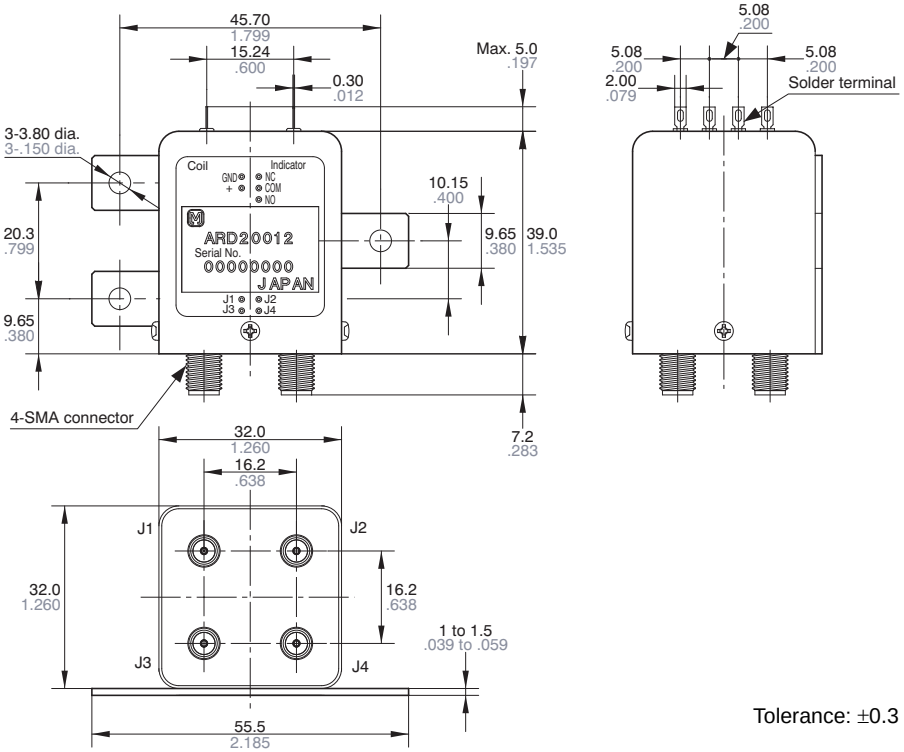
Latching with TTL driver
(with self cut-off function)



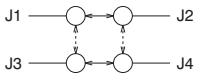
∗ + COM type is available

2. Transfer

CAD Data

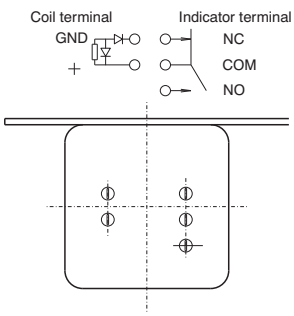


Tolerance: ±0.3 ±.012

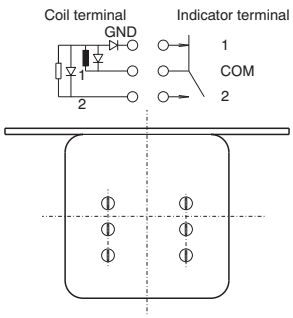


Fail-safe	NC: J1-J2, J3-J4 NO: J1-J3, J2-J4
Latching	POS1: J1-J2, J3-J4 POS2: J1-J3, J2-J4
Latching with TTL driver	POS1: J1-J2, J3-J4 POS2: J1-J3, J2-J4

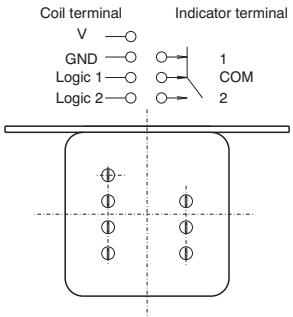
Fail-safe



Latching



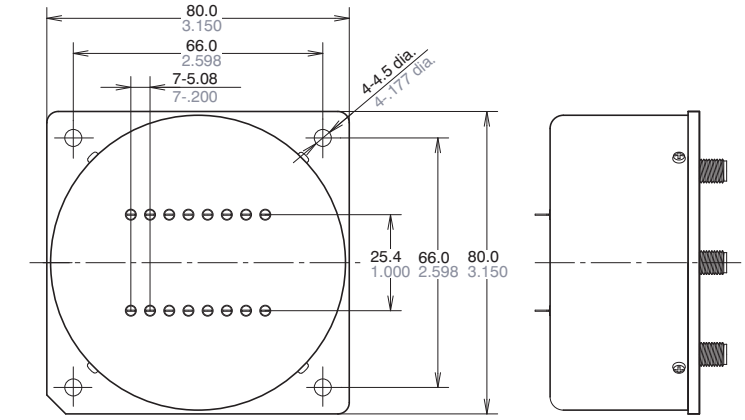
Latching with TTL driver
(with self cut-off function)

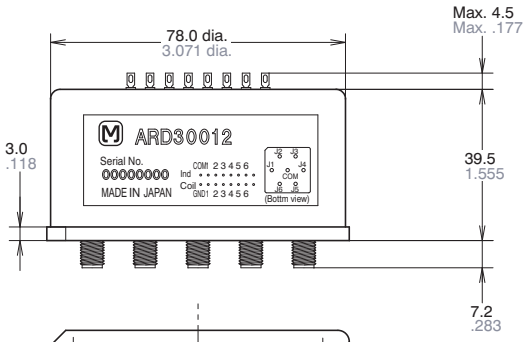


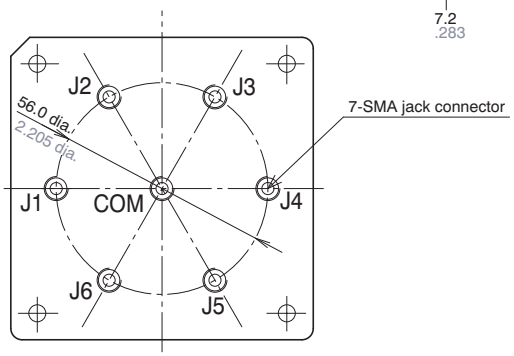
∗ + COM type is available

3. SP6T

CAD Data

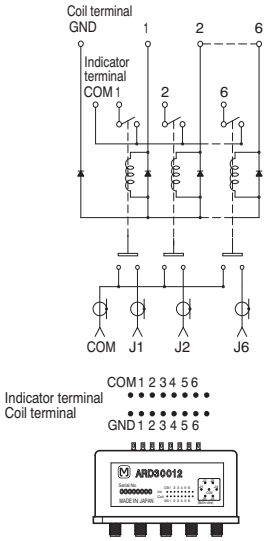




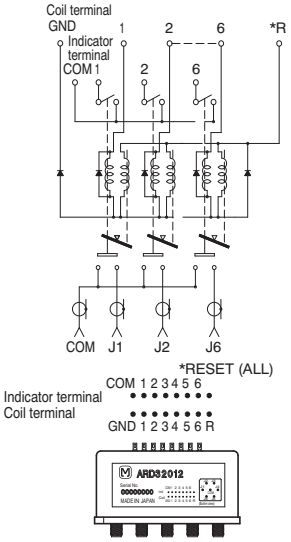


Tolerance: ±0.3 ±.012

Fail-safe type



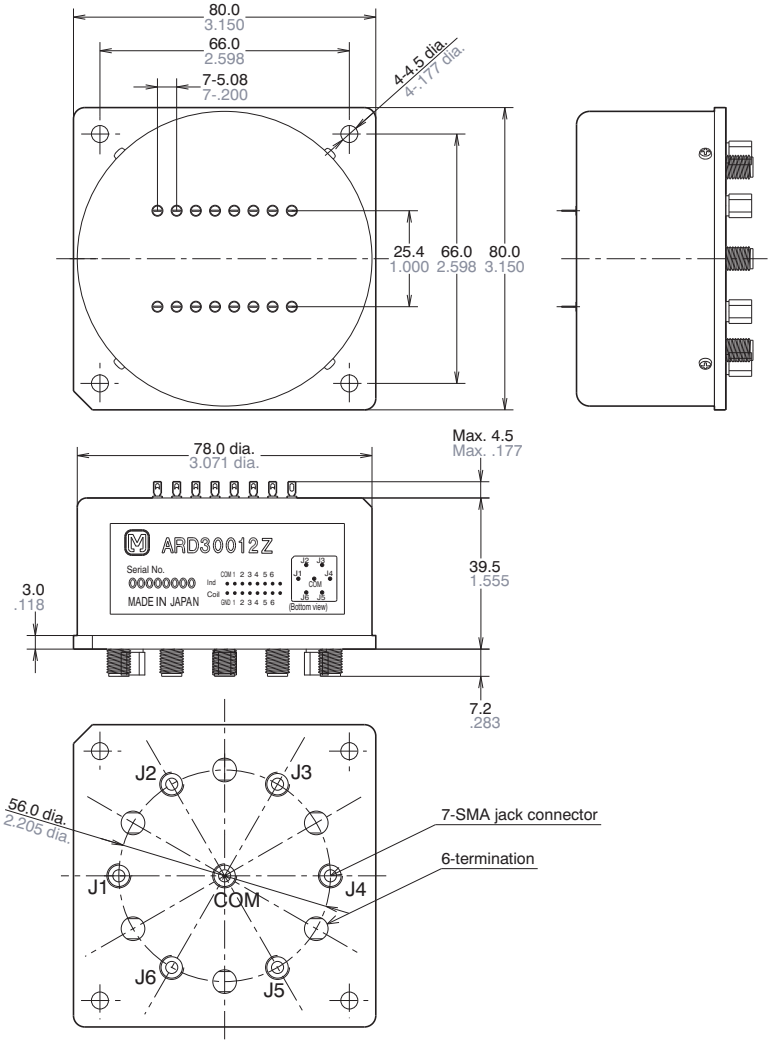
Latching type



∗ + COM type is available.

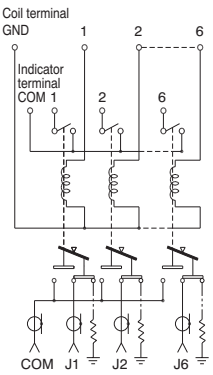
4. SP6T (with termination)

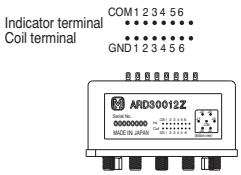
CAD Data



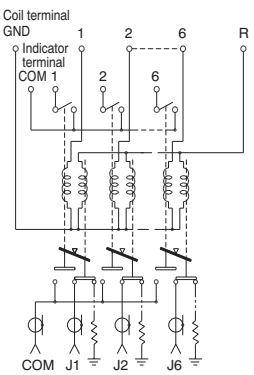
Tolerance: ±0.3 ±.012

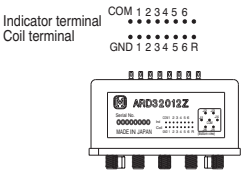
Fail-safe type





Latching type





NOTES

1. For general cautions for use, please refer to the "General Application Guidelines".

2. 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. The nominal operating voltage should be applied to the coil for more than 50 ms to set/reset the latching type relay.

Please use the latching type for circuits that are continually powered for long periods of time.

3. Coil connection

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

4. Connection of coil indicator and washing conditions

1) The connection of coil indicator terminal shall be done by soldering.

Soldering conditions

Max. 260°C 500°F (solder temp) within 10sec (soldering time)

Max. 350°C 662°F (solder temp) within 3sec (soldering time)

2) This product is not sealed type, therefore washing is not allowed.

5. Conditions for operation, transport and storage conditions

1) Temperature:

–55 to +85°C –67 to +185°F

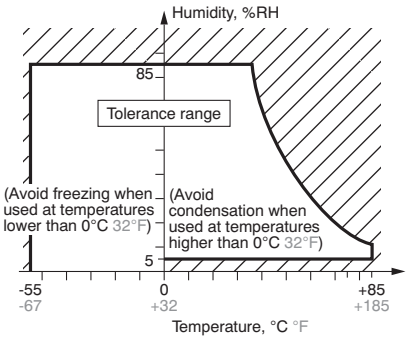
2) Humidity: 5 to 85% RH

(Avoid freezing and condensation.)

The humidity range varies with the temperature. Use within the range indicated in the graph below.

3) Atmospheric pressure: 86 to 106 kPa

Temperature and humidity range for usage, transport, and storage:



4) Condensation

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

5) Freezing

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

6) Low temperature, low humidity environments.

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

6. Other handling precautions

1) The relay's on/off service life is based on standard test conditions (temperature: 15 to 35°C 59 to 95°F, humidity: 25 to 75%) specified in JIS C5442-1996. Life will depend on many factors of your system: coil drive circuit, type of load, switching intervals, switching phase, ambient conditions, to name a few.

2) Use the relay within specifications such as coil rating, contact rating and on/off service life. If used beyond limits, the relay may overheat, generate smoke or catch fire.

3) Be careful not to drop the relay. If accidentally dropped, carefully check its appearance and characteristics before use.

4) Be careful to wire the relay correctly. Otherwise, malfunction, overheat, fire or other trouble may occur.

5) The latching type relay is shipped in the reset position. But jolts during transport or impacts during installation can move it to the set position. It is, therefore, advisable to build a circuit in which the relay can be initialized (set and reset) just after turning on the power.

6) If a relay stays on in a circuit for many months or years at a time without being activated, circuit design should be reviewed so that the relay can remain non-excited. A coil that receives current all the time heats, which degrades insulation earlier than expected. A latching type relay is recommended for such circuits.

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

8) Please do not use silicon based substances such as silicon rubber, silicon oil, silicon coatings and silicon fillings, in the vicinity of the relay. Doing so may cause volatile silicon gas to form which may lead to contact failure due to the adherence of silicon on the contacts when they open and close in this atmosphere.

9) Please note that when switching contacts (latching type only), you must apply reset (ALL) voltage and release all contacts first. (SP6T type)

10) Do not use multiple contacts simultaneously. (SP6T type)

11) The indicator terminal is the terminal that indicates the operation status of the MAIN contact.

12) For details about the drive method of the latching with TTL driver type, please refer to the RD coaxial switch catalog on the website.

For complete "Cautions for Use", please download the "Relay Technical Information" from our Web site. For instructions on soldering, see page 66. For information on reliability, see page 64.

RELIABILITY

[1] WHAT IS RELIABILITY?

1. Reliability in a Narrow Sense of the Term

In the industrial world, reliability is an index of how long a particular product serves without failure.

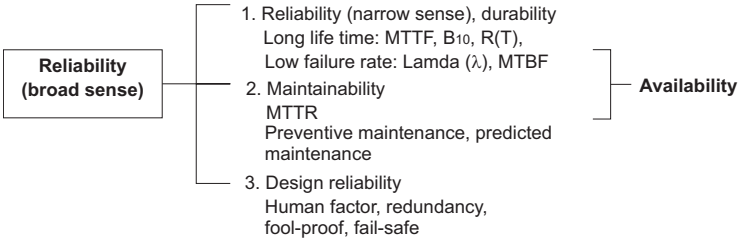
2. Reliability in a Broad Sense of the Term

Every product has a finite service lifetime. This means that no product can continue normal service infinitely. When a product has broken down, the user may throw it away or repair it. The reliability of repairable products is recognized as "reliability in a broad sense of the term". For repairable products, their serviceability or maintainability is another problem. In addition, reliability of product design is becoming a serious concern for the manufacturing industry. In short, reliability has three senses: i.e. reliability of the product itself, serviceability of the product, and reliability of product design.

3. Intrinsic Reliability and Reliability of Use

Reliability is "built" into products. This is referred to as intrinsic reliability which consists mainly of reliability in the narrow sense.

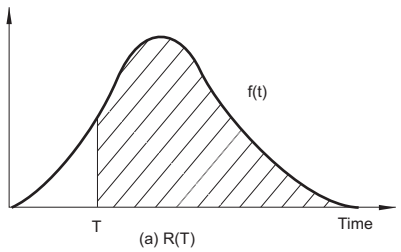
Product reliability at the user's site is called "reliability of use", which consists mainly of reliability in the broad sense. In the relay industry, reliability of use has a significance in aspects of servicing.



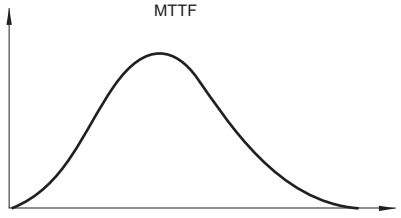
[2] RELIABILITY MEASURES

The following list contains some of the most popular reliability measures:

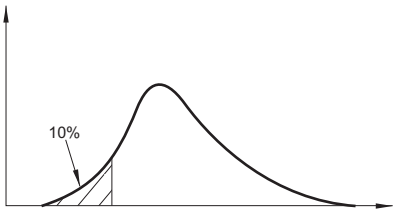
Reliability measure	Sample representation
Degree of reliability R(T)	99.9%
MTBF	100 hours
MTTF	100 hours
Failure rate λ	20 fit, 1%/hour
Safe life B_{10}	50 hours



(a) R(T)



(b) MTTF



(c) Safe life

1. Degree of Reliability

Degree of reliability represents percentage ratio of reliability. For example, if none of 10 light bulbs has failed for 100 hours, the degree of reliability defined in, 100 hours of time is 10/10 = 100%. If only three bulbs remained alive, the degree of reliability is 3/10 = 30%.

The JIS Z8115 standard defines the degree of reliability as follows:

The probability at which a system, equipment, or part provides the specified functions over the intended duration under the specified conditions.

2. MTBF

MTBF is an acronym of mean time between failures. It indicates the mean time period in which a system, equipment, or part operates normally between two incidences of repair. MTBF only applies to repairable products.

MTBF tells how long a product can be used without the need for repair.

Sometimes MTBF is used to represent the service lifetime before failure.

3. MTTF

MTTF is an acronym of mean time to failure. It indicates the mean time period until a product becomes faulty MTTF normally applies to unrepairable products such as parts and materials.

The relay is one of such objective of MTTF.

4. Failure Rate

Failure rate includes mean failure rate and momentary failure rate.

Mean failure rate is defined as follows:

Mean failure rate = Total failure count/ total operating hours

In general, failure rate refers to momentary failure rate. This represents the probability at which a system, equipment, or part, which has continued normal operation to a certain point of time, becomes faulty in the subsequent specified time period.

Failure rate is often represented in the unit of percent/hours. For parts with low failure rates, "failure unit (Fit) = 10^{-9} / hour" is often used instead of failure rate. Percent/count is normally used for relays.

5. Safe Life

Safe life is an inverse of degree of reliability. It is given as value B which makes the following equation true:

$1 - R(B) = t\ \%$

In general, "B[1 – R(B)] = 10%" is more often used. In some cases this represents a more practical value of reliability than MTTF.

[3] FAILURE

1. What is Failure?

Failure is defined as a state of system, equipment, or component in which part of all of its functions are impaired or lost.

2. Bathtub Curve

Product's failure rate throughout its lifetime is depicted as a bathtub curve, as shown below. Failure rate is high at the beginning and end of its service lifetime.

(I) Initial failure period

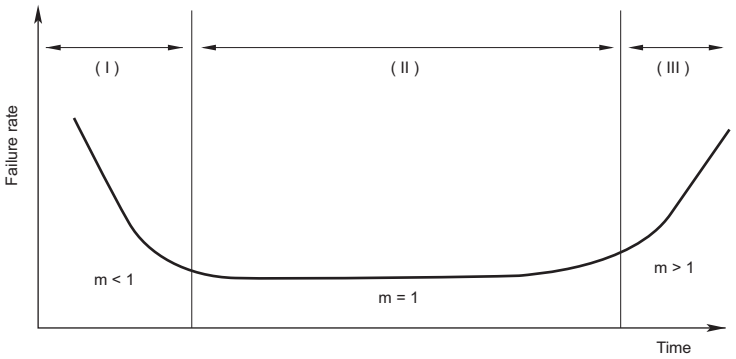
The high failure rate in the initial failure period is derived from latent design errors, process errors, and many other causes. Initial failures are screened at manufacturer's site through burn-in process. This process is called debugging, performing aging or screening.

(II) Accidental failure period

The initial failure period is followed by a long period with low, stable failure rate. In this period, called accidental failure period, failures occurs at random along the time axis. While zero accidental failure rate is desirable, this is actually not practical in the real world.

(III) Wear-out failure period

In the final stage of the product's service lifetime comes the wear-out failure period, in which the life of the product expires due to wear of fatigue. Preventive maintenance is effective for this type of failure. The timing of a relay's wear-out failure can be predicted with a certain accuracy from the past record of uses. The use of a relay is intended only in the accidental failure period, and this period virtually represents the service lifetime of the relay.



3. Weibull Analysis

Weibull analysis is often used for classifying a product's failure patterns and to determine its lifetime. Weibull distribution is expressed by the following equation:

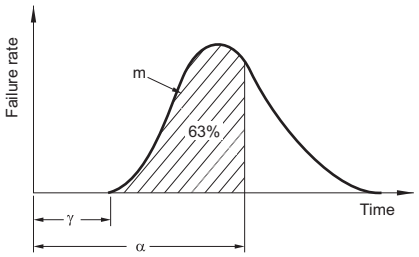
$$f(x) = \frac{m}{\alpha}(\chi-\gamma)^{m-1} e^{-\frac{(\chi-\gamma)^m}{\alpha}}$$

m : Figure parameter

α : Measurement parameter

γ : Position parameter

Weibull distribution can be adopted to the actual failure rate distribution if the three variables above are estimated.



The Weibull probability chart is a simpler alternative of complex calculation formulas. The chart provides the following advantages:

- The Weibull distribution has the closest proximity to the actual lifetime distribution.
- The Weibull probability chart is easy to use.
- Different types of failures can be identified on the chart.

The following describes the correlation with the bathtub curve. The value of the figure parameter "m" represents the type of the failure.

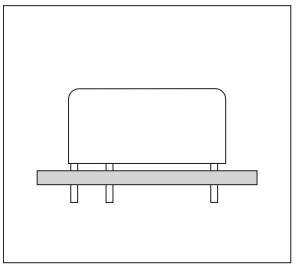
- When m < 1: Initial failures
- When m = 1: Accidental failures
- When m > 1: Wear-out failures

RELAY SOLDERING AND CLEANING GUIDELINES

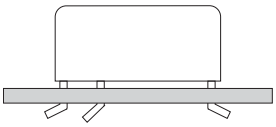
In keeping with making devices compact, it is becoming more common to weld the relay to a PC board along with the semiconductors instead of using the previous plug-in type in which relays were plugged into sockets. With this style, loss of function may occur because of seepage into the relay of flux, which is applied to the PC board. Therefore, the following precautions are provided for soldering a relay onto a PC board. Please refer to them during installation in order to avoid problems.

The type of protective structure will determine suitability for automatic soldering or automatic cleaning. Please review the parts on construction and characteristics. See “Configuration and Construction” on page 72.

1. Mounting of relay

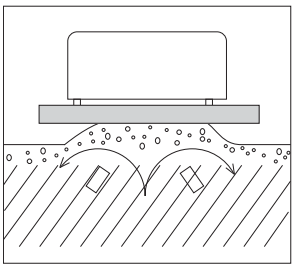


- Avoid bending the terminals to make the relay self-clinching. Relay performance cannot be guaranteed if the terminals are bent. Self-clinching terminal types are available depending on the type of relay.
- Correctly drill the PC board according to the given PC board pattern illustration.
- Stick packaging is also available for automatic mounting, depending on the type of relay. (Be sure that the relays don’t rattle.) Interference may occur internally if the gripping force of the tab of the surface mounting machine is too great. This could impair relay performance.

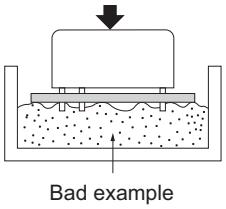


Bad example

2. Flux application

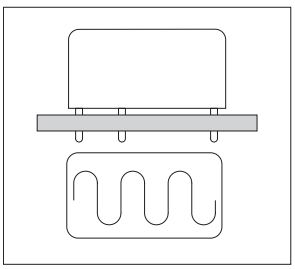


- Adjust the position of the PC board so that flux does not overflow onto the top of it. This must be observed especially for dust-cover type relays.
- Use rosin-based non-corrosive flux.
- If the PC board is pressed down into a flux-soaked sponge as shown on the right, the flux can easily penetrate 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

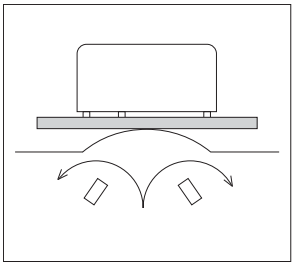


- Be sure to preheat before using automatic soldering. For dust-cover type relays and flux-resistant type relays, preheating acts to prevent the penetration of flux into the relay when soldering. Solderability also improves.
- Preheat according to the following conditions.

Temperature	120°C 248°F or less
Time	Within approx. 2 minutes

- 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.

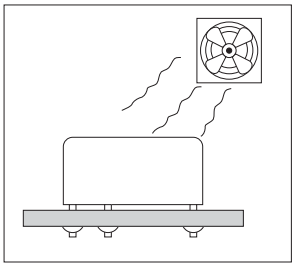
Solder temperature	260°C±5°C 500°F±41°F
Soldering time	Within approx. 6 seconds

- Please take caution with multi-layer boards. Relay performance may degrade due to the high thermal capacity of these boards.
- **Hand soldering**

Keep the tip of the soldering iron clean.

Soldering Iron	30W to 60W
Iron Tip Temperature	350°C 662°F
Soldering Time	Within approx. 3 seconds

5. Cooling

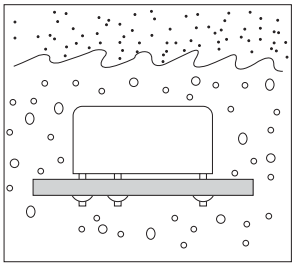


- **Automatic soldering**
- Immediate air cooling is recommend to prevent deterioration of the relay and surrounding parts due of soldering heat.
- Although the environmentally sealed type relay (plastic sealed type, etc.) can be cleaned, avoid immersing the relay into cold liquid (such as cleaning solvent)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

- **Hand soldering**

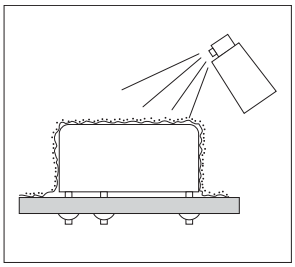
—

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, gasoline) may damage the relay case.
- 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.
- Do not cut the terminals. When terminals are cut, breaking of coil wire and slight sticking of the contacts may occur due to vibration of the cutter.

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.
- 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.
- 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.
- 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.

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.
Silicone-base	No Good	• Silicone gas becomes the cause of contact failure. Do not use the silicone-base type.

SMT SOLDERING GUIDELINES

CAUTIONS FOR SURFACE MOUNT RELAY INSTALLATION

To meet the market demand for downsizing to smaller, lighter, and thinner products, PC boards also need to proceed from Insertion mounting to surface mounting technology. To meet this need, we offer a line of surface mount relays. The following describes some cautions required for surface mount relay installation to prevent malfunction and incorrect operation.

[1] What is a Surface Mount Relay?

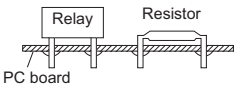
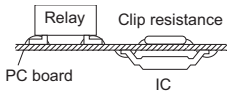
1. From IMT to SMT

Conventional insertion mount technology (IMT) with some 30 years of history is now being replaced with surface mount technology (SMT).

Solid-state components such as resistors, ICs, and diodes can withstand high heat stresses from reflow soldering because they use no mechanical parts. In contrast, the conventional electro-mechanical relays consisting of solenoid coils, springs, and armatures are very sensitive to thermal stress from reflow soldering.

We applied the experience gained from our advanced relay technologies to produce high-performance electromagnetic relays compatible with surface mount technologies such as IRS and VPS.

•Insertion Mount Technology (IMT) vs. Surface Mount Technology (SMT)

Insertion Mounting Technology (IMT)	Components' leads are inserted into lead holes drilled into the PC board and are soldered to copper pads on the other side of the board using flow-soldering techniques.	
Surface Mount Technology (SMT)	Components are placed on copper pads precoated with paste solder and the board assembly is heated to solder the components on the pads (reflow soldering).	

2. Features and Effects

Features	Effects
• Allows high density mounting • Components can be installed on both sides of a board • Ceramic PC boards can be used	System downsizing
• Compatible with automatic placement by robots • Drilling for lead holes is not required • Compact system designs are possible due to high density mounting	Overall cost reduction
• High heat resistance • Anti-gas measures	High reliability

The surface mount relay is manufactured with the following advanced technologies:

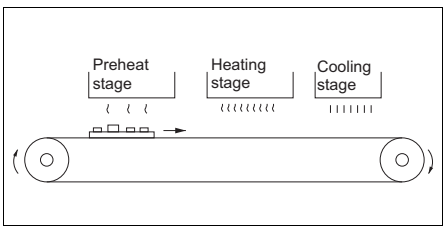
- Heat-resistance encapsulation technique
- Gas analysis
- Reliability assessment
- Precision molding technique for heat-resistant materials

3. Examples of SMT Applications

The following describes some examples of typical SMT applications:

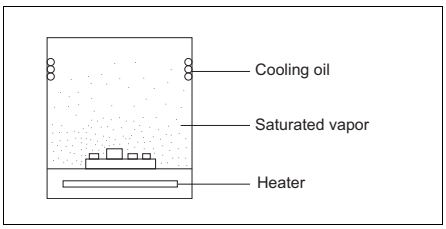
- Infrared Reflow Soldering (IRS)

IRS is the most popular reflow soldering technology now available for surface mounting. It uses a sheath heater or infrared lamp as its heat source. PC board assemblies are continuously soldered as they are transferred through a tunnel furnace comprised of a preheating, heating, and cooling-stages.



- Vapor Phase Soldering (VPS)

With VPS technology, PCB assemblies are carried through a special inactive solvent, such as Fluorinert FC-70, that has been heated to a vapor state. As the saturated vapor condenses on the PC board surface, the resulting evaporation heat provides the energy for reflow soldering.



- Belt conveyer reflow furnace

As PCB assemblies are transferred on a thin, heat-resistant belt conveyer, they are soldered by the heat from hotplates placed begeath the conveyer belt.

- Double Wave Soldering (DWS)

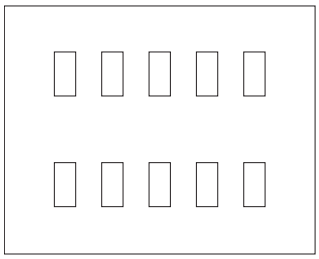
Components are glued to the PC board surface. The board assembly is transferred through a molten solder fountain (with the component side facing down), and the components are soldered to the board.

- Other Technologies

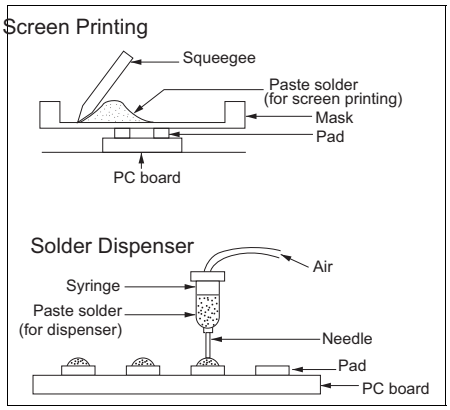
Other reflow soldering technologies include those utilizing lasers, hot air, and pulse heaters.

[2] Cautions for installation

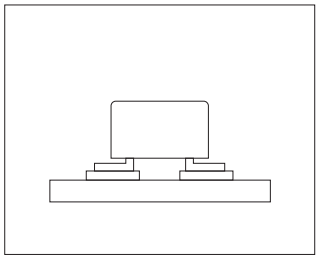
1. Paste Soldering



- Mounting pads on PC boards must be designed to absorb placement errors while taking account of solderability and insulation. Refer to the suggested mounting pad layout in the application data for the required relay product.
- Paste solder may be applied on the board with screen printing or dispenser techniques. For either method, the paste solder must be coated to appropriate thickness and shapes to achieve good solder wetting and adequate insulation.

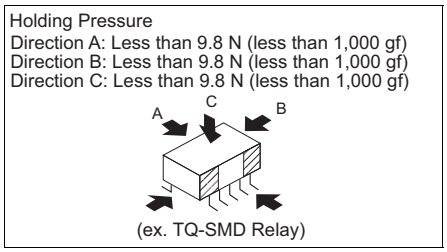


2. Relay Installation

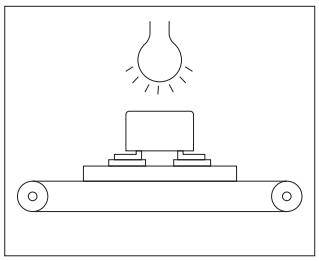


- For small, lightweight components such as chip components, a self-alignment effect can be expected if small placement errors exist. However, this effect is not as expected for electro-mechanical components such as relays, and they require precise positioning on their soldering pads.
- If SMT relays sustain excessive mechanical stress from the placement machine's pickup head, their performance cannot be guaranteed.

- Our SMT relays are supplied in stick packaging compatible with automatic placement processes. We also offer tape packaging at customer request.



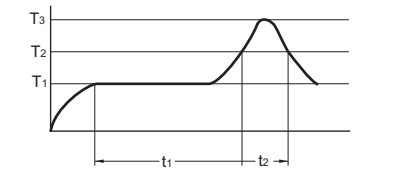
3. Reflow



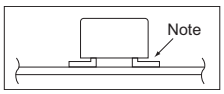
Reflow soldering under inadequate soldering conditions may result in unreliable relay performance or even physical damage to the relay (even if the relay is of surface mount type with high heat resistance).

Example of Recommended Soldering Condition for Surface Mount Relays.

- IRS technique



T_1 = 150 to 180°C 302 to 356°F t_1 = 60 to 120 sec.
T_2 = 230°C 446°F or more t_2 = Less than 30 sec.
T_3 = Less than 250°C 482°F



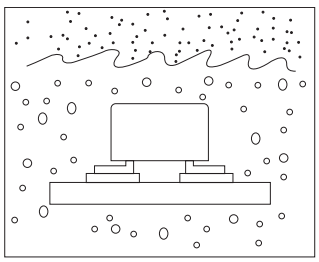
- It is recommended that the soldered pad be immediately cooled to prevent thermal damage to the relay and its associated components.
- While surface mount relays are solvent washable, do not immerse the relay in cold cleaning solvent immediately after soldering.

- Manual soldering
  - Soldering iron tip temperature: 350°C 662°F
  - Soldering iron wattage: 30 to 60 watts
  - Soldering time: Less than 3 sec.
- Others
  When a soldering technique other than above is to be used (hot air, hotplate, laser, or pulse heater technique), carefully investigate the suitability of the technique.

Note:

The soldering temperature profile indicates the pad temperature. In some cases, the ambient temperature may be greatly increased. Check for the specific mounting condition.

4. Cleaning



- The surface mount relays are solvent washable. Use alcohol or an equivalent solvent for cleaning.
- Boiled cleaning is approved for surface mount relays. Ultrasonic cleaning may cause coil damage or light contact sticking.

Notes and Guidelines

Panasonic is part of a large worldwide group selling relays and associated switching products under different brand names in different territories. The conditions of use in some territories may differ from those customary in Europe. In particular there are often major differences in regard to national and international specifications, such as UL, CSA, VDE, SEV, EVE, SEMKO, etc. Thus, when considering contact loads as stated in this catalogue (e.g. 10 A, 30 VDC for the SP relay) it should be understood that these values are not necessarily an absolute maximum but tested ratings. Mostly the stated value has been tested for a certain life expectancy as stated by the manufacturer or the respective test house. 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

A general statement of compliance on data sheets, publicity, etc. concerning industrial standards, approvals or certification may imply compliance to a certain standard is available. However, because of the multiplicity of types available, in general not all types within the product family are covered to the same extent by the standard. Thus, in the event of a specific query regarding a particular product and its compliance with the standard, users are asked to refer to Panasonic for detailed information.

In case of uncertainty, contact should be made with Panasonic locally to ascertain the likelihood of the relay meeting the required life expectancy in the specific planned operational circumstances. It is also pointed out that in this book, and in deviation from EN / IEC 61810-1, operational life data is given under a normal ambient temperature of about 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. Statistical test information covering major operating features is available on request. Panasonic reserves the right to make alterations and changes to specifications without notice from time to time as may be deemed necessary.

Application of the EC Directives to All-or-Nothing Relays

1 EMC Directive

The EMC Directive concerns primarily the finished products. In applying the Directive to components, the Guidelines[1] should be consulted to determine whether the component in question has a “direct function”. Electric motors, power supply units or temperature controls represent examples of such components with “direct function”. These types of components must be provided with a CE marking.

Components which are integrated into a device, such as relays, do not have an independent function of their own. A given relay may perform differing functions in different devices. Consequently, all-or-nothing relays must be considered components without “direct function” which are not subject to the EMC Directive.

All-or-nothing - be they electro-mechanical relays or solid state relays - shall not be labeled with a CE marking nor shall a declaration of conformity be issued within the scope of the EMC Directive.

2 Low Voltage Directive

Relays with terminals for printed boards/plug-and-socket connections do not come within the purview of the Low Voltage Directive.

The Low Voltage Directive concerns electrical equipment intended for incorporation into a device as well as equipment intended for direct use. In the case of electrical equipment which is considered a basic component intended for incorporation into other electrical equipment, the properties and safety of the final product will be largely dependent on how it is integrated: as such, these components do not fall within the Low Voltage Directive and shall not be CE marked. The Guidelines[2] specifically cite electro-mechanical basic components such as connectors, relays with terminals for printed circuit boards and micro switches. They are therefore not subject to the scope of the Low Voltage Directive.

Except for larger relays which may, for example, find application in switching cabinets, the same considerations apply to common-place relays with plug-in connections available also with printed board terminals. Here again, safety is a function of the individual application. In evaluating these relays’ performance from the perspective of the Low Voltage Directive, the same conclusion is reached as with the printed board relay. As such, CE marking is not mandatory for this type of relay.

3 Machinery Directive

The Machinery Directive differentiates between machines, machine parts and safety components. Relays are not part of any of these categories. The listing of safety components in Appendix IV is conclusive and does not include relays.

Consequently, a CE marking shall not be affixed nor shall a declaration of conformity or manufacturer’s declaration be issued under the Machinery Directive.

As of this moment, none of the aforementioned directives require CE marking for all-or-nothing relays[3].

4 RoHS Directive

The substances prohibited by the RoHS Directive (Pb, Hg, Cd, Cr^{+6}, PBB, PBDE) concern 10 categories of devices that are mostly, but not entirely, intended for private use. Components such as relays are not listed in these categories. Therefore they do not directly fall within the scope of this directive. However, if the user employs relays in devices that fall within the scope of this directive, the user must also acknowledge the substances prevented. In order to adapt to this situation in good time, all Panasonic relays are generally RoHS compliant.

---

1. Guidelines (version dated March 22, 2007) for the Application of the Council Directive 2004/108/EC.
2. Guidelines (version dated August 2007) for the Application of the Council Directive 2006/95/EC.
3. This writing deals exclusively with “non-specified-time all-or-nothing relays”. The abbreviated term “all-or-nothing relay” has been introduced merely for purposes of convenience. The term includes solid state all-or-nothing relays.

Global Network

North America | Europe | Asia Pacific | China | Japan

Panasonic Electric Works

Please contact our Global Sales Companies in:

Europe

Headquarters	Panasonic Electric Works Europe AG	Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. +49 (0) 8024 648-0, Fax +49 (0) 8024 648-111, www.panasonic-electric-works.com
Austria	Panasonic Electric Works Austria GmbH	Josef Madersperger Str. 2, 2362 Biedermannsdorf, Tel. +43 (0) 2236-26846, Fax +43 (0) 2236-46133 www.panasonic-electric-works.at
	Panasonic Industrial Devices Materials Europe GmbH	Ennshafenstraße 30, 4470 Enns, Tel. +43 (0) 7223 883, Fax +43 (0) 7223 88333, www.panasonic-electronic-materials.com
Benelux	Panasonic Electric Works Sales Western Europe B.V.	De Rijn 4, (Postbus 211), 5684 PJ Best, (5680 AE Best), Netherlands, Tel. +31 (0) 499 372727, Fax +31 (0) 499 372185, www.panasonic-electric-works.nl
Czech Republic	Panasonic Electric Works Czech s.r.o.	Sales Office Brno, Administrative centre PLATINIUM, Veveri 111, 616 00 Brno, Tel. +420 541 217 001, Fax +420 541 217 101, www.panasonic-electric-works.cz
France	Panasonic Electric Works Sales Western Europe B.V.	Succursale française, 10, rue des petits ruisseaux, 91370 Verrières Le Buisson, Tél. +33 (0) 1 6013 5757, Fax +33 (0) 1 6013 5758, www.panasonic-electric-works.fr
Germany	Panasonic Electric Works Europe AG	Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. +49 (0) 8024 648-0, Fax +49 (0) 8024 648-111, www.panasonic-electric-works.de
Hungary	Panasonic Electric Works Europe AG	Magyarországi Közvetlen Kereskedelmi Képviselet, 1117 Budapest, Neumann János u. 1., Tel. +36 1 999 89 26 www.panasonic-electric-works.hu
Ireland	Panasonic Electric Works UK Ltd.	Irish Branch Office, Dublin, Tel. +353 (0) 14600969, Fax +353 (0) 14601131, www.panasonic-electric-works.co.uk
Italy	Panasonic Electric Works Italia srl	Via del Commercio 3-5 (Z.I. Ferlina), 37012 Bussolengo (VR), Tel. +39 0456752711, Fax +39 0456700444, www.panasonic-electric-works.it
Nordic Countries	Panasonic Electric Works Europe AG	Filial Nordic, Knarrarnäsgatan 15, 164 40 Kista, Sweden, Tel. +46 859476680, Fax +46 859476690, www.panasonic-electric-works.se
	Panasonic Eco Solutions Nordic AB	Jungmansgatan 12, 21119 Malmö, Tel. +46 40 697 7000, Fax +46 40 697 7099, www.panasonic-fire-security.com
Poland	Panasonic Electric Works Polska sp. z o.o	ul. Wołoska 9A, 02-583 Warszawa, Tel. +48 (0) 22 338-11-33, Fax +48 (0) 22 338-12-00, www.panasonic-electric-works.pl
Portugal	Panasonic Electric Works España S.A.	Portuguese Branch Office, Avda Adelino Amaro da Costa 728 R/C J, 2750-277 Cascais, Tel. +351 214812520, Fax +351 214812529
Spain	Panasonic Electric Works España S.A.	Barajas Park, San Severo 20, 28042 Madrid, Tel. +34 913293875, Fax +34 913292976, www.panasonic-electric-works.es
Switzerland	Panasonic Electric Works Schweiz AG	Grundstrasse 8, 6343 Rotkreuz, Tel. +41 (0) 41 7997050, Fax +41 (0) 41 7997055, www.panasonic-electric-works.ch
United Kingdom	Panasonic Electric Works UK Ltd.	Sunrise Parkway, Linford Wood, Milton Keynes, MK14 6LF, Tel. +44 (0) 1908 231555, Fax +44 (0) 1908 231599, www.panasonic-electric-works.co.uk

North & South America

USA	PEW Corporation of America	629 Central Avenue, New Providence, N.J. 07974, Tel. 1-908-464-3550, Fax 1-908-464-8513, www.pewa.panasonic.com

Asia Pacific / China / Japan

China	Panasonic Electric Works (China) Co., Ltd.	Level 2, Tower W3, The Towers Oriental Plaza, No. 2, East Chang An Ave., Dong Cheng District, Beijing 100738, Tel. (010) 5925-5988, Fax (010) 5925-5973
Hong Kong	Panasonic Electric Works (Hong Kong) Co., Ltd.	RM1205-9, 12/F, Tower 2, The Gateway, 25 Canton Road, Tsimshatsui, Kowloon, Hong Kong, Tel. (0852) 2956-3118, Fax (0852) 2956-0398
Japan	Panasonic Corporation	1048 Kadoma, Kadoma-shi, Osaka 571-8686, Japan, Tel. (06) 6908-1050, Fax (06) 6908-5781, www.panasonic.net
Singapore	Panasonic Electric Works Asia Pacific Pte. Ltd.	101 Thomson Road, #25-03/05, United Square, Singapore 307591, Tel. (06255) 5473, Fax (06253) 5689

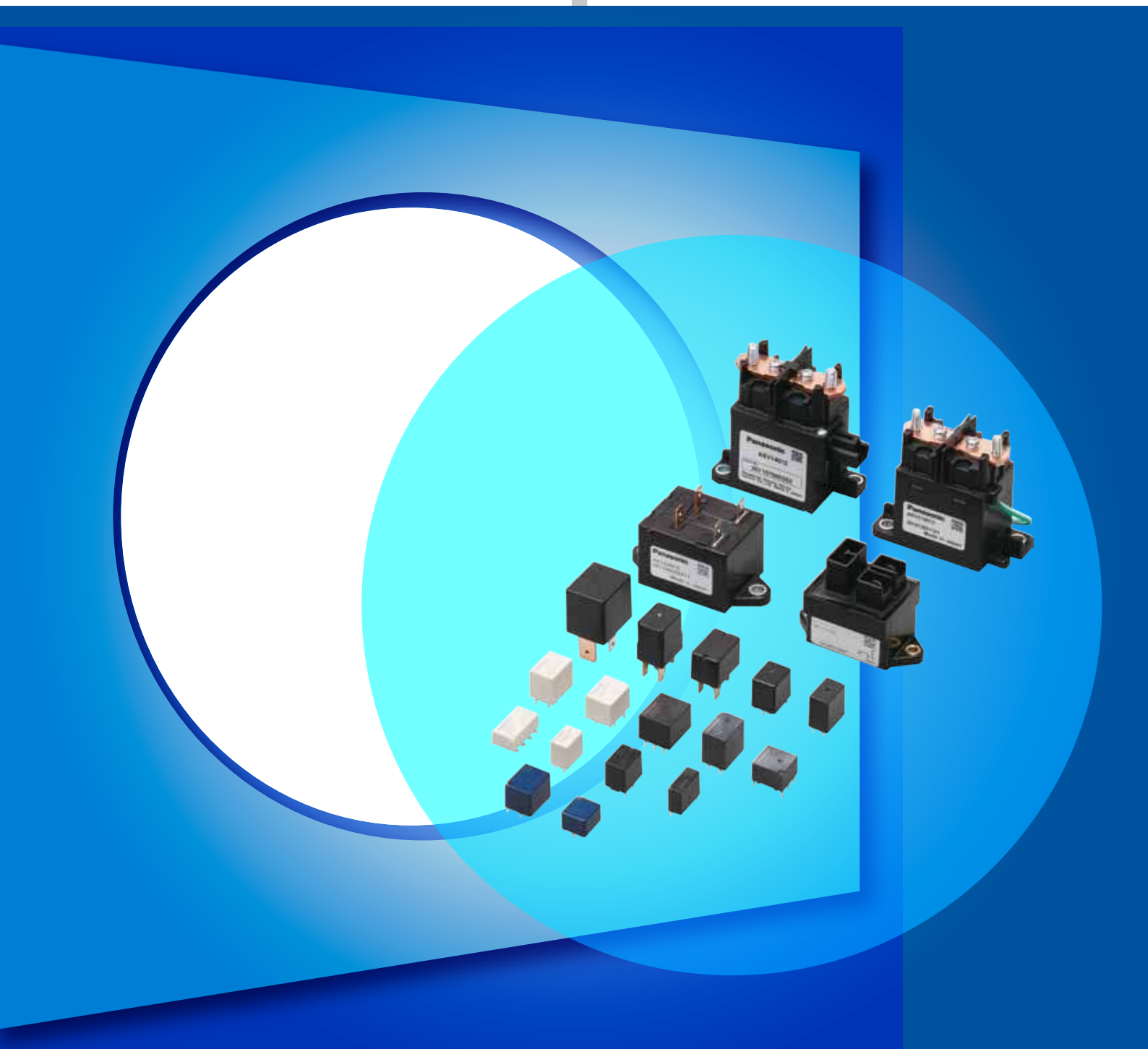
Panasonic®

1183 euen 04/12

Panasonic

GENERAL CATALOG

AUTOMOTIVE RELAYS



Panasonic is part of a large worldwide group selling relays and associated switching products under different brand names in different territories. The conditions of use in some territories may differ from those customary in Europe. In particular there are often major differences in regard to national and international specifications, such as UL, CSA, VDE, SEV, EVE, SEMKO, etc. Thus, when considering contact loads as stated in this catalogue (e.g. 10 A, 30 VDC for the SP relay) it should be understood that these values are not necessarily an absolute maximum but tested ratings. Mostly the stated value has been tested for a certain life expectancy as stated by the manufacturer or the respective test house. 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

A general statement of compliance on data sheets, publicity, etc. concerning industrial standards, approvals or certification may imply compliance to a certain standard is available. However, because of the multiplicity of types available, in general not all types within the product family are covered to the same extent by the standard. Thus, in the event of a specific query regarding a particular product and its compliance with the standard, users are asked to refer to Panasonic for detailed information.

In case of uncertainty, contact should be made with Panasonic locally to ascertain the likelihood of the relay meeting the required life expectancy in the specific planned operational circumstances. It is also pointed out that in this book, and in deviation from EN / IEC 61810-1, operational life data is given under a normal ambient temperature of about 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. Statistical test information covering major operating features is available on request. Panasonic reserves the right to make alterations and changes to specifications without notice from time to time as may be deemed necessary.

1 EMC Directive

The EMC Directive concerns primarily the finished products. In applying the Directive to components, the Guidelines[1] should be consulted to determine whether the component in question has a "direct function". Electric motors, power supply units or temperature controls represent examples of such components with "direct function". These types of components must be provided with a CE marking.

Components which are integrated into a device, such as relays, do not have an independent function of their own. A given relay may perform differing functions in different devices. Consequently, all-or-nothing relays must be considered components without "direct function" which are not subject to the EMC Directive.

All-or-nothing - be they electro-mechanical relays or solid state relays - shall not be labeled with a CE marking nor shall a declaration of conformity be issued within the scope of the EMC Directive.

2 Low Voltage Directive

Relays with terminals for printed boards/plug-and-socket connections do not come within the purview of the Low Voltage Directive.

The Low Voltage Directive concerns electrical equipment intended for incorporation into a device as well as equipment intended for direct use. In the case of electrical equipment which is considered a basic component intended for incorporation into other electrical equipment, the properties and safety of the final product will be largely dependent on how it is integrated: as such, these components do not fall within the Low Voltage Directive and shall not be CE marked. The Guidelines[2] specifically cite electro-mechanical basic components such as connectors, relays with terminals for printed circuit boards and micro switches. They are therefore not subject to the scope of the Low Voltage Directive.

Except for larger relays which may, for example, find application in switching cabinets, the same considerations apply to common-place relays with plug-in connections available also with printed board terminals. Here again, safety is a function of the individual application. In evaluating these relays' performance from the perspective of the Low Voltage Directive, the same conclusion is reached as with the printed board relay. As such, CE marking is not mandatory for this type of relay.

3 Machinery Directive

The Machinery Directive differentiates between machines, machine parts and safety components. Relays are not part of any of these categories. The listing of safety components in Appendix IV is conclusive and does not include relays.

Consequently, a CE marking shall not be affixed nor shall a declaration of conformity or manufacturer's declaration be issued under the Machinery Directive.

As of this moment, none of the aforementioned directives require CE marking for all-or-nothing relays[3].

4 RoHS Directive

The substances prohibited by the RoHS Directive (Pb, Hg, Cd, Cr^{+6}, PBB, PBDE) concern 10 categories of devices that are mostly, but not entirely, intended for private use. Components such as relays are not listed in these categories. Therefore they do not directly fall within the scope of this directive. However, if the user employs relays in devices that fall within the scope of this directive, the user must also acknowledge the substances prevented. In order to adapt to this situation in good time, all Panasonic relays are generally RoHS compliant.

---

1. Guidelines (version dated March 22, 2007) for the Application of the Council Directive 2004/108/EC.
2. Guidelines (version dated August 2007) for the Application of the Council Directive 2006/95/EC.
3. This writing deals exclusively with "non-specified-time all-or-nothing relays". The abbreviated term "all-or-nothing relay" has been introduced merely for purposes of convenience. The term includes solid state all-or-nothing relays.

Table of Contents

About the Selector Chart

This selector chart is designed to help you quickly select a relay best suited for your needs.

Please note: the values given for switching current and switching voltage do not necessarily indicate standard operating conditions. For the nominal switching capacity and other critical values or CAD Data, please refer to the respective data sheet.
In case of doubt, please contact your Panasonic representative.

Line Up

➤ Automotive Relays

Contributing to the ever increasing need for versatility and innovation in car electronics with numerous relays for high voltage-cut-off and space savings.

High Current

High-Voltage

EV 300A

(1a)

EV 200A

(1a)

EV 120A

(1a)

EV 80A

(1a)

Vertical (silent)

EVS 60A

(1a)

EV 20A

(1a)

EV 10A

(1a)

Special Solutions ➤

CW 45A

(2a)

Plug-In

CB high capacity 70A

(1a) Mini ISO

CB standard 40A

(1a, 1c) Mini ISO

CM 35A

(1a, 1c) Micro ISO

CV 20A

(1a, 1c) Micro ISO

CV -N 20A

(1a) Micro ISO

CA 20A to 30A

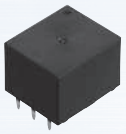
(1a, 1b, 1c) JIS terminal

PC Board

Silent Type

CQ 20A

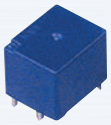
(1c)



TA 20A

(1c)

Twin Type

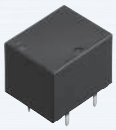


CT-P 30A

(1cx2)

CT 20A

(1cx2)



TB 20A

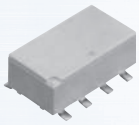
(1cx2)

CJ 20A

(1cx2)

TE 20A

(1cx2)



TH 20A

(1cx2, SMD)

Single Type

CB high capacity 70A

(1a)

CB standard 40A

(1a, 1c)

TG 30A

(1a, 1c)

CN-H 30A

(1a)

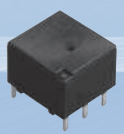
CN-M 30A

(1a, 1c)

Latching type available!

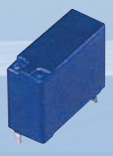
TC 30A

(1a, 1c, 2a 1c/2a latching)



TJ 30A

(1c)



CT-P 30A

(1c)

CT 20A

(1c)

TB 20A

(1a, 1c)

CJ 20A

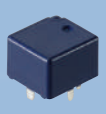
(1c)

TE 20A

(1c)

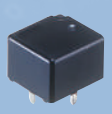
TH 20A

(1c)



CP-P 30A

(1a, 1c)



CP 20A

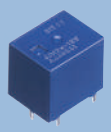
(1a, 1c)

CP-SMD 20A

(1c)

JJM 20A

(1a, 1c)



JJ-M Double make type 12A

(2a)(6Ax2)

Recommended Applications

Highly reliable relays that have proven record when it comes to safety, power train control, comfort and special vehicles.

Safety

Features	Item	Contact arrangement	Coil voltage (DC)	Headlights	Tail lights	Fog lamps (front and rear)	Signal lights	Windshield wipers	Power Mirrors (incl. ones with heaters	
Twin	CT/CT-P	1c x 2	12V						✓	
	CJ	1c x 2	12V						✓	
	TB	1c x 2	12V						✓	
	TE	1c x 2	12V						✓	
Single (Latching type available!)	CN-H	1a	12V	✓	✓	✓				
	TG	1a, 1c	12V	✓	✓	✓		✓		
	CN-M	1a, 1c	12V	✓	✓	✓				
	CW	2a	12V							
	JJ-M	1a, 1c	12V		✓		✓	✓	✓	
	JJ-M Double make contact	2a	12V							
	CT/CT-P	1c	12V		✓				✓	
	TB	1a, 1c	12V		✓		✓	✓	✓	
	TC	1a, 1c, Double make contact 2a latching 2a, 1c	12V	✓	✓	✓	✓	✓		
	TE	1c	12V							
	CJ	1c	12V							
	CP-P	1a, 1c	12V					✓	✓	
	CP	1a, 1c	12V					✓	✓	
	TJ	1c	12V	✓	✓	✓		✓		
SMD	CP	1c	12V					✓	✓	
	CN-M	1a, 1c	12V	✓	✓	✓				
	TH	1c, 1c x 2	12V							
Quiet	CQ	1c	12V					✓	✓	
	TA	1c	12V					✓	✓	
Mini ISO	CB	1a, 1c	Standard: 12V, 24V 1a high capacity: 12V	✓	✓	✓				
Micro ISO	CM	1a, 1c	12V, 24V	✓	✓	✓				
	CV-N	1a	12V	✓	✓	✓				

Power Train Control

	Windshield washers	Defoggers	Horns	Blower fans	Radiator fan motors	Engine starter motors	EPS (electrical power steering)	Magnetic clutches	ABS/TRC	Semi-active suspension
			✓							
			✓							
		✓		✓	✓	✓	✓			
		✓		✓	✓	✓	✓			
		✓		✓	✓	✓				
							✓			
			✓						✓	✓
	✓		✓						✓	✓
	✓		✓					✓ (with Di)		
		✓		✓	✓	✓				
								✓ (with Di)	✓	✓
	✓	✓	✓					✓ (with Di)	✓	✓
	✓	✓	✓					✓ (with Di)	✓	✓
		✓		✓	✓					
	✓	✓	✓					✓ (with Di)	✓	✓
		✓		✓	✓	✓				
			✓							
		✓		✓	✓	✓	✓	✓	✓	
		✓		✓	✓	✓	✓	✓	✓	
		✓		✓	✓	✓		✓		

Recommended Applications

Highly reliable relays that have proven record when it comes to safety, power train control, comfort and special vehicles.

Comfort

Features	Item	Contact arrangement	Coil voltage (DC)	Power sunroofs	Power seats	Lift gate	Power window motor	Keyless entry	Door locks	
Twin	CT/CT-P	1c x 2	12V	✓	✓	✓	✓		✓	
	CJ	1c x 2		✓	✓	✓	✓		✓	
	TB	1c x 2		✓	✓	✓	✓		✓	
	TE	1c x 2		✓	✓	✓	✓		✓	
Single	CN-H	1a								
	CN-M	1a, 1c								
	CW	2a								
	JJ-M	1a, 1c		✓	✓	✓	✓		✓	
	JJ-M Double make contact	2a						✓		
	CT/CT-P	1c			✓				✓	
	TB	1a, 1c		✓	✓	✓	✓	✓	✓	
	CJ	1c			✓				✓	
	TE	1c		✓	✓	✓	✓	✓		
	CP-P	1a, 1c		✓	✓	✓	✓		✓	
	CP	1a, 1c		✓	✓	✓	✓		✓	
	TJ	1c								
SMD	CP	1c		✓	✓	✓	✓		✓	
	CN-M	1a, 1c								
	TH	1c, 1c x 2		✓	✓	✓	✓		✓	
Quiet	CQ	1c		✓	✓		✓		✓	
	TA	1c		✓	✓		✓		✓	
Mini ISO	CB	1a, 1c	Standard: 12V, 24V 1a high capacity: 12V							
Micro ISO	CM	1a, 1c	12V, 24V							
	CV-N	1a	12V							

Special vehicle

	Slide door closer	Car security	Seat heaters	Car stereo	Interior lights	Auto antennae	Cruise control	Motorcycles	Forklifts
	✓					✓			
	✓					✓			
	✓								
	✓								
			✓						
			✓						
	✓			✓	✓	✓	✓		
		✓							
	✓			✓		✓	✓		
	✓				✓	✓	✓		
	✓			✓		✓	✓		
	✓								
	✓		✓	✓		✓	✓		
	✓		✓	✓		✓	✓		
	✓		✓	✓		✓	✓		
			✓						
	✓								
	✓			✓		✓	✓		
	✓						✓		
								✓	✓
			✓					✓	✓
			✓						

Quality Control

ISO/TS16949 Certificate of approval

Our Automation Components Division has been accredited for ISO/TS16949. This covers our quality management system for an entire spectrum of automotive products from mechanical to semiconductor relays. Based on QS9000, a quality management standard employed by the “Big 3” United States automobile manufacturers, ISO/TS16949 is a quality management system standard that also incorporates the requirements put forth by the automobile industries of each European country. It calls for a comprehensive quality management system that includes CS, cost performance, and ongoing improvement.

IMDS (International Material Data System)

Panasonic Electric Works is a registered corporation in the European automotive industry’s International Material Data System.

ISO/TS16949


ISO14001


ISO9001

Certification Status

- Switching Device Division approved.
- Mechatro Device Division approved.
- Panasonic Electric Works Obihiro Co., Ltd. approved.
- Panasonic Electric Works (Thailand), Ltd. approved.
- Panasonic Electric Works Europe AG, German Factory approved.

APQP
Advanced Product Quality Planning & Control Plan

DFMEA
Design Potential Failure Mode & Effects Analysis
PFMEA
Process Potential Failure Mode & Effects Analysis
CONTROL PLAN
PROCESS CAPABILITY
MSA Measurement Analysis etc.

PPAP
Production Part Approval Process

CS
Customer Satisfaction

Global Network

Panasonic Electric Works’ automotive relays meet higher level and ever more complex user needs through new product development, stable quality, speedy customer service, and production on a global scale.

Germany


Panasonic Electric Works Europe AG

Thailand


Panasonic Electric Works (Thailand), Ltd.

China


Panasonic Industrial Device Taiko Shenzen Co, Ltd.

Japan

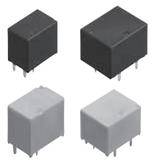
Panasonic Electric Works Obihiro Co., Ltd.

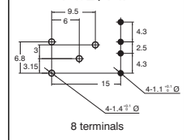
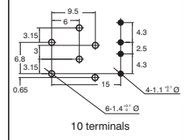
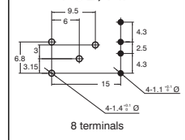
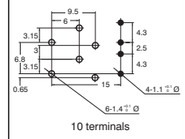
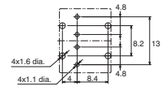
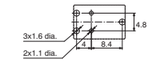

Panasonic Electric Works, Ise plant

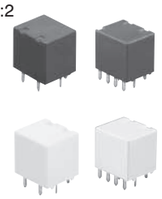
Mexico

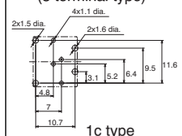
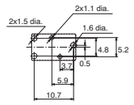
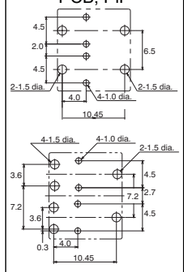
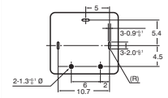
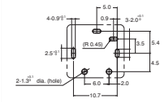
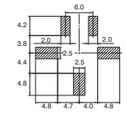

Panasonic Electric Works, Mexicana S.A. de C.V.

Selector Chart

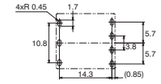
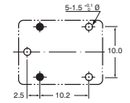
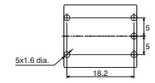
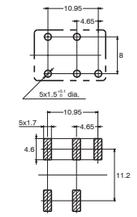
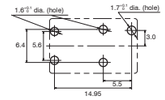
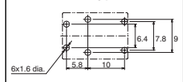
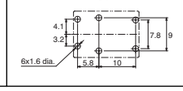
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage
PCB relays					
★**CT** 1:2  Single:17.4 x 7.2 x 13.5mm Twin:17.4 x 14 x 13.5mm	• Super miniature size • Twin (1 Form C x 2) • ACT512 layout = layout of 2 x ACT112 • H-bridge type available (twin relay) • Quiet operation • RTIII (IP67) • Pin in Paste (with vent hole) available	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1c, 1c x 2	(DC) 12V
★**CT POWER** 1:2  Single:17.4 x 7.2 x 13.5mm Twin:17.4 x 14 x 13.5mm	• Super miniature size • Twin (1 Form C x 2) • Footprint same as CT standard type • 30A switching capacity (motor load) • H-bridge type available (twin relay) • RTIII (IP67) • Pin in Paste (with vent hole) available	**Max.:** 30A (N.O.) 30A 10A (N.C.) 10A	• 16V DC	1c, 1c x 2	(DC) 12V
★**TB** 1:2  Single Print: 14 x 9.2 x 13.5mm PiP: 14 x 9.2 x 14.0mm Twin Print: 17.4 x 14 x 13.5mm PiP: 17.4 x 14 x 14.0mm	• Super miniature size • Single (1 Form A, 1 Form C) • Twin (1 Form C x 2) • H-bridge type available (twin relay) • RTIII (IP67) • Pin in Paste (with vent hole) available • Lamp load type available	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1a, 1c 1c x 2 (8 terminals) 1c x 2 (10 terminals)	(DC) 12V

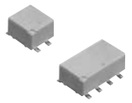
Coil power	Breakdown voltage: Between open contacts	Breakdown voltage: Between contact sets	Breakdown voltage: Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
800mW	500Vrms	—	500Vrms	—	PCB, PiP  8 terminals  10 terminals	56 —
1000mW	500Vrms	—	500Vrms	—	PCB, PiP  8 terminals  10 terminals	62 —
1,440mW (for pick-up voltage max. 5.5V DC) **900mW (for pick-up voltage max. 6.5V DC)** **640mW (for pick-up voltage max. 7.7V DC)**	500Vrms	—	500Vrms	—	PCB, PiP Twin type (8 terminal type)  1c type 	78 —

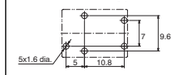
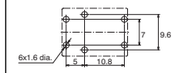
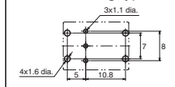
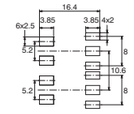
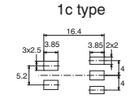
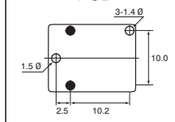
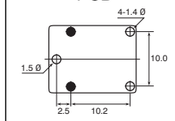
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage
★**TE** 1:2  Single Print: 12 x 7.2 x 13.5mm PiP: 12 x 7.2 x 14.0mm Twin Print: 13.6 x 12 x 13.5mm PiP: 13.6 x 12 x 14.0mm	• Ultra small size • Smallest in its class • High capacity in a compact body • Single (1 Form C) • Twin (1 Form C x 2) • H-bridge type available (twin relay) • RTIII (IP67) • Pin in Paste (with vent hole) available	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1c, 1c x 2 (8 terminals)	(DC) 12V
CJ 1:2  8 Pin Print: 13.7 x 12.2 x 13.5mm PiP: 13.7 x 12.2 x 13.8mm 10 Pin Print: 14.4 x 12.2 x 13.5mm PiP: 14.4 x 12.2 x 13.8mm	• Ultra small size • Twin (1 Form C x 2) • High capacity in a compact body • H-bridge type available (twin relay) • RTIII (IP67) • Pin in Paste (with vent hole) available	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1c, 1c x 2	(DC) 12V
★**CP** 1:2  14 x 13 x 9.5mm	• Very low profile • High capacity • 24V DC type available on request • RTIII (IP67)	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1a, 1c	(DC) 12V, 24V
★**CP POWER** 1:2  14 x 13 x 9.5mm	• Very low profile • High capacity type: 45A maximum carrying current • Improved heat conduction thanks to additional pin • Layout is downward compatible to CP • RTIII (IP67) • Pin in Paste (with vent hole) available	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1a, 1c	(DC) 12V
★**CP (SMD)** 1:2  14 x 13 x 10.5mm	• Very low profile • High capacity • RTIII (IP67)	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1c	(DC) 12V

Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
	Between open contacts	Between contact sets	Contacts to coil			
1,309mW **(for pick-up voltage max. 5.5V DC)** **900mW** **(for pick-up voltage max. 6.5V DC)** **655mW** **(for pick-up voltage max. 7.7V DC)**	500Vrms	—	500Vrms	—	PCB, PiP Twin type (8 terminal type)  1c type 	93 —
Standard: 800mW **High sensitivity:** 640mW	500Vrms	—	500Vrms	—	PCB, PiP 	26 —
640mW	500Vrms	—	500Vrms	—	PCB 	43 —
450mW 640mW	500Vrms	—	500Vrms	—	PCB 	48 —
640mW	500Vrms	—	500Vrms	—	SMT 	43 —

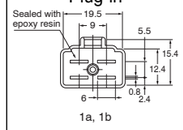
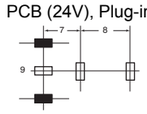
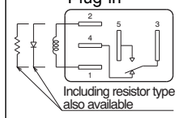
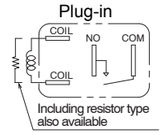
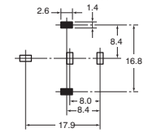
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage
TJ 1:2  15 x 16 x 11.2mm	• Compact flat type (height: 11.2mm) • High capacity switching • Thermal resistant type • RTIII (IP67)	**Max.:** 30A (N.O.) 30A 15A (N.C.) 15A	• 16V DC	1c	(DC) 12V
CQ 1:2  17 x 13 x 16.6mm	• Very quiet operation • Terminal layout identical to JJM • RTIII (IP67)	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1c	(DC) 12V
TA 1:2  19.8 x 17 x 14mm	• Very quiet operation • Flat type • RTIII (IP67)	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1c	(DC) 12V
CN-M 1:2  15,5 x 11 x 14.4mm	• Space-saving design • High switching capacity (up to 30A) • SMD type available • RTIII (IP67) • Pin in Paste (with vent hole) available	**Max.:** 30A (N.O.) 30A 25A (N.C.) 25A	• 16V DC	1a, 1c	(DC) 12V
★**CN-H** 1:2  17 x 10.6 x 18.3mm	• Best space savings in its class • Substitute for Micro-ISO relay • Low operating power type • High current-carrying capacity • RTIII (IP67)	**Max.:** 30A	• 16V DC	1a	(DC) 12V
TG 1:2  17.8 x 12.6 x 18mm	• Large capacity switching despite small size. • Substitute for micro ISO relays • Low operating power type • RTIII (IP67)	**Max.:** 30A (N.O.) 30A 15A (N.C.) 15A	• 16V DC	1a, 1c	(DC) 12V

Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
	Between open contacts	Between contact sets	Contacts to coil			
450mW	500Vrms	—	500Vrms	—	PCB 	107 —
640mW	500Vrms	—	500Vrms	—	PCB 	52 —
640mW (for pick-up voltage max. 7.7V DC) 900mW (for pick-up voltage max. 6.5V DC)	500Vrms	—	500Vrms	—	PCB 	74 —
640mW	500Vrms	—	500Vrms	—	PCB, SMT 	38 —
450mW (for pick-up voltage max. 6.5V DC) 640mW (for pick-up voltage max. 5.5V DC)	500Vrms	—	500Vrms	—	PCB 	34 —
640mW (for pick-up voltage max. 6.5V DC) **450mW (for pick-up voltage max. 7.0V DC)**	500Vrms	—	500Vrms	—	PCB 1a type  1c type 	98 —

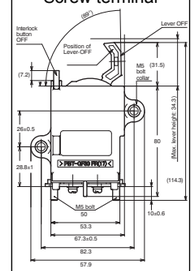
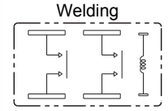
Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage
TC 1:2  Print: 17.8 x 13 x 16.0mm PiP: 17.8 x 13 x 16.4mm	• Large capacity switching despite small size • Substitute for micro ISO relays • Latching type available • High heat resistant type available • Pin in Paste types available	**Max.:** 30A (N.O.) 30A 15A (N.C.) 15A	• 16V DC	1a, 1c, 2a 2a 2 coil latching	(DC) 12V
TH 1:2  Single: 11 x 12 x 8.8mm Twin: 21.6 x 12 x 8.8mm	• Ultra compact flat type • SMD monting type: 8.8mm • High switching capacity (up to 25A) • Single (1 Form C) • Twin (1 Form C x 2)	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1c, 1c x 2 (10 terminals)	(DC) 12V
★**JJM** 1:2  15.5 x 12 x 13.9mm	• Compact size • Best-selling, familiar blinker sound • RTIII (IP67)	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1a, 1c	(DC) 12V
JJM-DM 1:2  15.5 x 12 x 13.9mm	• Small size • Double make contact arrangement • Terminal layout compatible to JJM • RTIII (IP67)	**Max.:** 2 x 6A 6A 6A	• 16V DC	Double make contact	(DC) 12V

Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
	Between open contacts	Between contact sets	Contacts to coil			
1,309mW **(for pick-up voltage max. 6.5V DC)** **900mW** **(for pick-up voltage max. 7.0V DC)** **640mW** **(for pick-up voltage max. 7.5V DC)** **1,920mW** **(2 coil latching type)**	500Vrms	—	500Vrms	—	PCB, PiP 1a standard type  1c/2a standard type  2a latching type 	86 —
900mW **(for pick-up voltage max. 6.5V DC)** **655mW** **(for pick-up voltage max. 7.7V DC)**	500Vrms	—	500Vrms	—	SMT Twin type (10 terminal type)  1c type 	103 —
640mW	500Vrms	—	500Vrms	—	PCB 	67 —
1000mW	500Vrms	—	500Vrms	—	PCB 	71 —

Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage
Plug-in relays					
CA 1:2  21.5 x 14.4 x 37mm	• Small size • Direct plug-in • RTIII (IP67)	**Max.:** 20A (1a, 1.4W type) 20A 30A (1a, 1.8W type) 30A 20A (1b, 1c) 20A	• 15V DC (1c - 12V DC type) • 16V DC (1a, 1b - 12V DC type) • 30V DC (1c - 24V DC type)	1a, 1b, 1c	(DC) 12, 24V
★**CM** 1:2  20 x 15 x 22mm	• Small substitute for Mini-ISO relay • Micro-ISO terminal type • RTIII (IP67) available	**Max.:** 35A (N.O.) 35A 20A (N.C.) 20A	• 16V DC (12V DC type) • 32V DC (24V DC type)	1a, 1c	(DC) 12, 24V
CV 1:2  22.5 x 15 x 15.7mm	• Low profile • 20A Micro-ISO terminal type • RTIII (IP67)	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 16V DC	1a, 1c	(DC) 12V
CV-N 1:2  22.5 x 15 x 15.7mm	• Low profile • Low temperature rise • Low sound pressure level • RTIII (IP67) available	**Max.:** 20A (N.O.) 20A 10A (N.C.) 10A	• 14V DC	1a, 1c	(DC) 12V
CB 1:2  26 x 22 x 25mm	• 40A switching current at 85°C • Mini-ISO type terminals • High shock resistance • High thermal resistance • 1 Form A available with 70A switching current • Broad lineup • RTIII (IP67) available	**Max.:** 70A (N.O. H type) 70A 40A (1a, 1c N.O.) 40A 30A (1c N.C.) 30A	• 16V DC (12V DC type) • 32V DC (24V DC type)	1a, 1c	(DC) 12, 24V

Coil power	Breakdown voltage: Between open contacts	Breakdown voltage: Between contact sets	Breakdown voltage: Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
1800mW 1400mW (type S)	500Vrms	—	500Vrms	—	Plug-in  1a, 1b	112 —
1500mW (12V DC type) 1800mW (24V DC type)	500Vrms	—	500Vrms	—	PCB (24V), Plug-in 	127 —
800mW	500Vrms	—	500Vrms	—	Plug-in  Including resistor type also available	132 —
800mW	500Vrms	—	500Vrms	—	Plug-in  Including resistor type also available	132 —
1400mW (12V DC type) 1800mW (24V DC type) 1800mW (12V DC, H type)	500Vrms	—	500Vrms	—	PCB, Plug-in  (PCB standard type)	119 —

Type ★ = Popular Type (Picture scale: DIN A4)	Features	Switching current (Min.: see data sheet)	Max. switching voltage	Contact arrangement	Coil voltage
High current/ High voltage relays					
EV 1:8  66.8 x 49.7 x 37.9mm  78 x 40 x 48.1mm  82.8 x 40 x 79mm  75.5 x 40 x 80mm  95 x 45 x 86.4mm  111 x 63 x 75mm	• 6 versions available:10, 20, 80, 120, 200A, 300A • DC type with sealed capsule for electric and hybrid vehicles • Compact size • Small arcing space required thanks to blow-out magnets • Safety construction • High contact reliability	**Max.:** 10A (1a)  20A (1a)  80A (1a)  120A (1a)  200A (1a)  300A (1a) 	• 400V DC	1a	(DC) 12, 24V
EV QUIET 1:4  76 x 36 x 72.3mm  77 x 67.8 x 37.7mm	• DC type with sealed capsule, mainly for hybrid vehicles • Very quiet operation • Small size and light weight • Small arcing space required thanks to blow-out magnets • Safety construction • High contact reliability • Standard type for horizontal mounting available	**Max.:** 60A (1a) 	• 400V DC	1a	(DC) 12V
EV SWITCH 1:4  57.9 x 34.6 x 114.3mm	• High performance with capsule contact technology • High carrying current performance • Safety function	**Max.:** 80A (1a) 	• 400V DC	1a	(DC) 12V
CW 1:2  32 x 18 x 26mm	• Ideal relay for high output,3-phase motors (Electric Power Steering) • High cut-off current capability and high carrying current • RTIII (IP67)	**Max.:** 	• 14V DC	2a	(DC) 12V

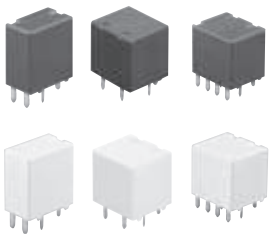
Coil power	Breakdown voltage: Between open contacts	Breakdown voltage: Between contact sets	Breakdown voltage: Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
Stable: • 1240mW (10A, 12/24V) • 3900mW (20A, 12V) • 4200mW (80A/120A, 12/24V) • 6000mW (200A, 12/24V) • 3600mW (300A, 12V) • 3800mW (300A, 24V) **Inrush:** • 37.9W (300A, 12V) • 44.4W (300A, 24V)	2500Vrms	—	2500Vrms	—	Lead wire (200A) Faston terminal (10A, 20A)	145 —
4500mW	Vertical: 2500Vrms Horizontal: 2000Vrms	—	Vertical: 2500Vrms Horizontal: 2000Vrms	—	Vertical type: lead wire Horizontal type: Faston terminal —	154 —
—	2500Vrms	—	2500Vrms	—	Screw terminal 	160 —
1400mW	500Vrms	—	500Vrms	—	Welding 	142 —

Automotive PCB Relays

Panasonic
ideas for life

COMPACT SLIM TWIN AND SINGLE TYPE AUTOMOTIVE RELAY

CJ RELAYS (ACJ)



FEATURES

- **It is extremely compact at approx. 2/3 the size of previous products.**
  Compared to our previous miniature type CT relay, both the 1 Form C and 10-pin and 8-pin twin types take up approx. two-thirds the space and volume. This makes them ideal for relay unit miniaturization.
- **Compact and high-capacity 25 A load switching**
  High capacity control is possible while being compact and capable of motor lock load switching at 25 A, 14 V DC.
- **Pin in Paste* compatible model added**
  Models compatible with the recently increasing Pin in Paste technique (reflow solder mounting) have been added.
  Pin in Paste compatible models are the flux tight type.
  * The Pin in Paste method may sometimes be referred to as THR (Through-hole Reflow).
- **Environmental protection specifications**
  Cadmium-free contacts and use of lead-free solder are standard. Environmental pollutants are not used.

TYPICAL APPLICATIONS

- **Powered windows**
- **Automatic door locks**
- **Electrically powered mirrors**
- **Powered sunroofs**
- **Powered seats**
- **Lift gates**
- **Smart J/B related products, etc.**

ORDERING INFORMATION

ACJ □ □ □ □

Contact arrangement
1: 1 Form C
2: 1 Form C×2 (8 terminal)
5: 1 Form C×2 (10 terminal)

Pick-up voltage
1: Max. 6.5 V DC
2: Max. 7.2 V DC

Coil voltage, DC
12: 12 V

Mounting type
Nil: Standard type
P: Pin in Paste available type

TYPES

Contact arrangement	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Part No.	
			Standard type	Pin in Paste type
1 Form C	12 V DC	Max.6.5 V DC (Initial)	ACJ1112	ACJ1112P
		Max.7.2 V DC (Initial)	ACJ1212	ACJ1212P
1 Form C × 2 (8 terminal)		Max.6.5 V DC (Initial)	ACJ2112	ACJ2112P
		Max.7.2 V DC (Initial)	ACJ2212	ACJ2212P
1 Form C × 2 (10 terminal)		Max.6.5 V DC (Initial)	ACJ5112	ACJ5112P
		Max.7.2 V DC (Initial)	ACJ5212	ACJ5212P

Standard packing; Carton (tube): 70 pcs.; Case: 2,800 pcs. (1 Form C), Carton (tube): 40 pcs.; Case: 1,000 pcs. (8 terminal), Carton (tube): 35 pcs.; Case: 1,400 pcs. (10 terminal)

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range*
12 V DC	Max. 7.2 V DC (Initial)	Min. 1.0 V DC (Initial)	53.3 mA	225Ω	640 mW	10 to 16 V DC
	Max. 6.5 V DC (Initial)	Min. 0.8 V DC (Initial)	66.7 mA	180Ω	800 mW	9 to 16 V DC

* Other usable voltage range types are also available. Please contact us for details.

2. Specifications

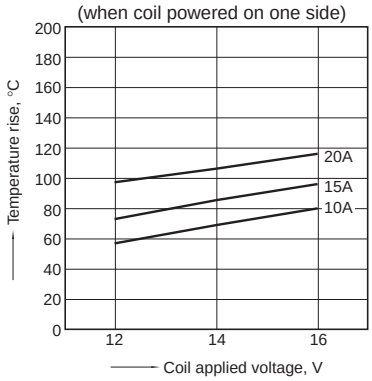
Characteristics	Item		Specifications
Contact	Arrangement		1 Form C, 1 Form C×2
	Contact resistance (Initial)		N.O.: Typ7mΩ, N.C.: Typ10mΩ (By voltage drop 6 V DC 1 A)
	Contact material		Ag alloy (Cadmium free)
Protective construction			Standard type: Sealed type Pin in Paste type: Flux tight type
Rating	Nominal switching capacity (resistive load)		N.O.: 20A 14V DC, N.C.: 10A 14V DC
	Max. carrying current (14V DC)		N.O.: 20 A for 1 hour, 30 A for 2 minutes (at 20°C 68°F) (when coil powered on one side)
	Nominal operating power		640 mW (for pick-up voltage max. 7.2 V DC), 800 mW (for pick-up voltage max. 6.5 V DC)
	Min. switching capacity (resistive load)*1		1A 14V DC
Electrical characteristics	Initial insulation resistance		Min. 100 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1m/s² {4.5G} Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical		[Standard type] <Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 1s ON, 9s OFF) <Motor load> N.O. side: Min. 2×10^5: at 25 A (inrush), 5 A (steady), 14 V DC; Min. 10^5: at 25 A 14 V DC (Motor lock) N.C. side: Min. 2×10^5: at 20 A 14 V DC (brake) (Operating frequency: 0.5s ON, 9.5s OFF) [Pin in Paste type] <Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 1s ON, 9s OFF) <Motor load> N.O. side: Min. 10^5: at 25 A (inrush), 5 A (steady), 14 V DC; Min. 5×10^4: at 25 A 14 V DC (Motor lock) N.C. side: Min. 10^5: at 20 A 14 V DC (brake) (Operating frequency: 0.5s ON, 9.5s OFF)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C –40°F to +185°F Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		6 cpm (at nominal switching capacity)
Mass			1 Form C type: approx. 3.5 g .12 oz, Twin type: approx. 6.5 g .23 oz

Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
∗ If the relay is used continuously for long periods of time with coils on both sides in an energized condition, breakdown might occur due to abnormal heating depending on the carrying condition. Therefore, please inquire when using with a circuit that causes an energized condition on both sides simultaneously.

REFERENCE DATA

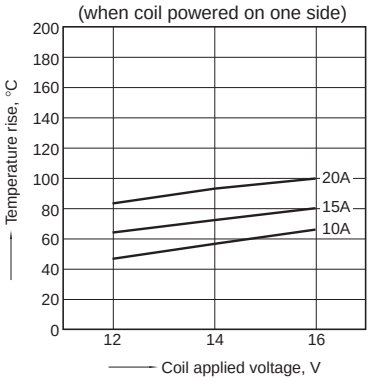
1.-(1) Coil temperature rise (at room temperature)

Sample: ACJ1212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 25°C 77°F



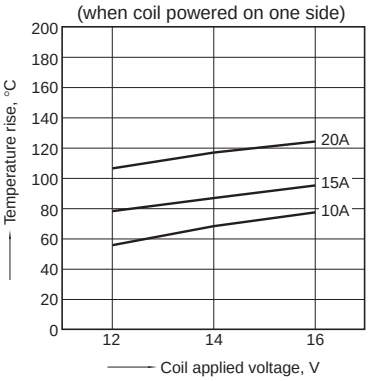
1.-(2) Coil temperature rise (at 85°C 185°F)

Sample: ACJ1212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 85°C 185°F



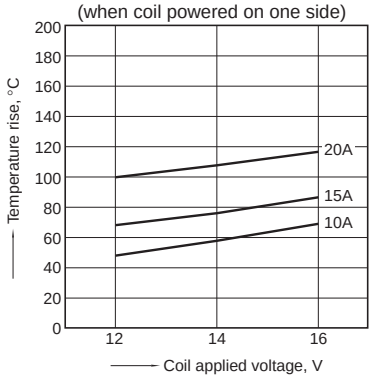
1.-(3) Coil temperature rise (at room temperature)

Sample: ACJ2212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 25°C 77°F



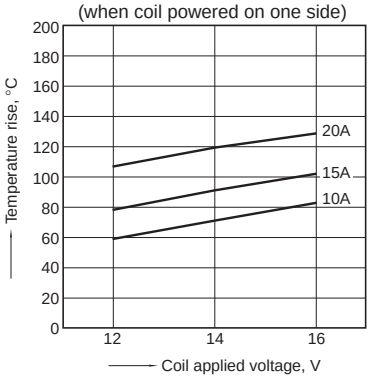
1.-(4) Coil temperature rise (at 85°C 185°F)

Sample: ACJ2212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 85°C 185°F



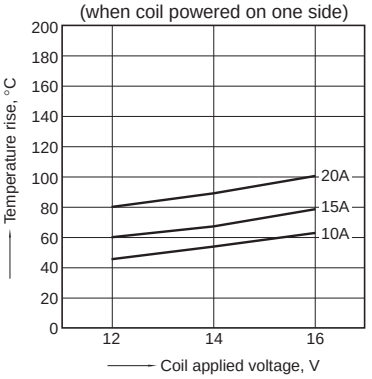
1.-(5) Coil temperature rise (at room temperature)

Sample: ACJ5212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 25°C 77°F

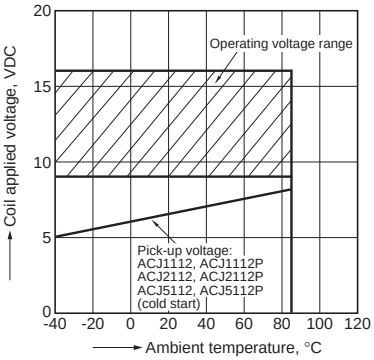


1.-(6) Coil temperature rise (at 85°C 185°F)

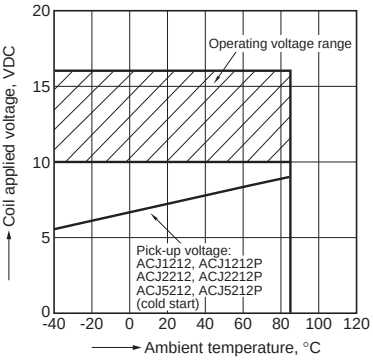
Sample: ACJ5212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 85°C 185°F



2.-(1) Ambient temperature and operating voltage range

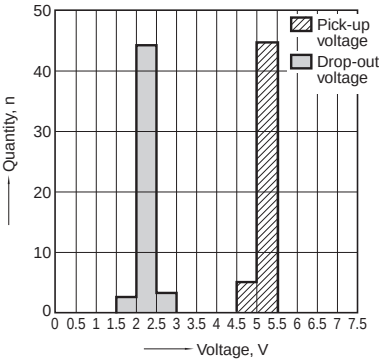


2.-(2) Ambient temperature and operating voltage range



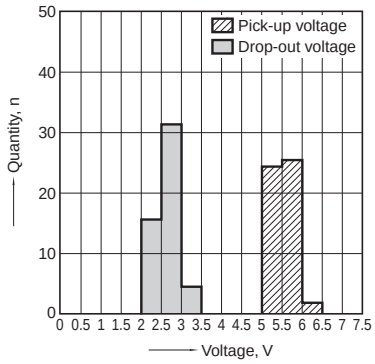
3.-(1) Distribution of pick-up and drop-out voltage

Sample: ACJ2112, 50pcs.
Ambient temperature: Room temperature



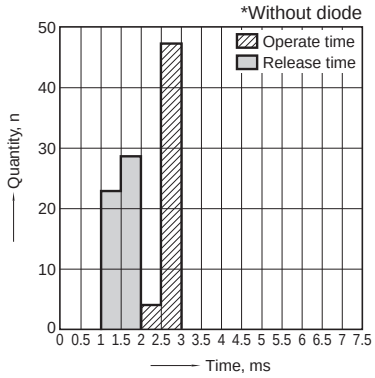
3.-(2) Distribution of pick-up and drop-out voltage

Sample: ACJ2212, 50pcs.
Ambient temperature: Room temperature



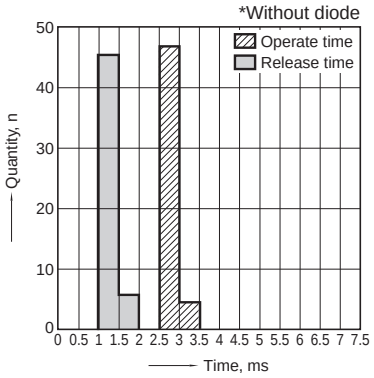
4.-(1) Distribution of operate and release time

Sample: ACJ2112, 50pcs.
Ambient temperature: Room temperature



4.-(2) Distribution of operate and release time

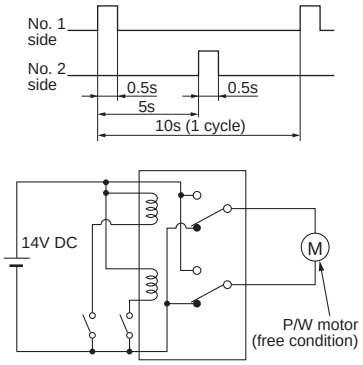
Sample: ACJ2212, 50pcs.
Ambient temperature: Room temperature



5.-(1) Electrical life test (Motor free)

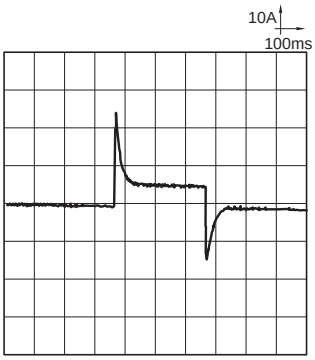
Sample: ACJ2212, 3pcs
Load: Inrush current: 25A/Steady current: 5A,
Power window motor actual load (free condition)
Tested voltage: 14V DC
Switching frequency: ON 0.5s, OFF 9.5s
Switching cycle: 2×10^5
Ambient temperature: Room temperature

Circuit

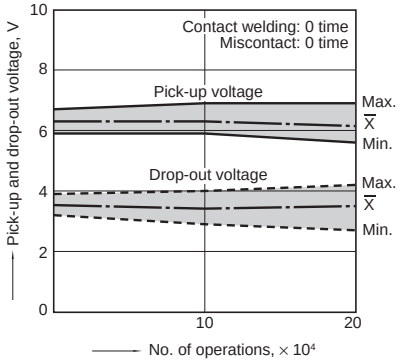


Load current waveform

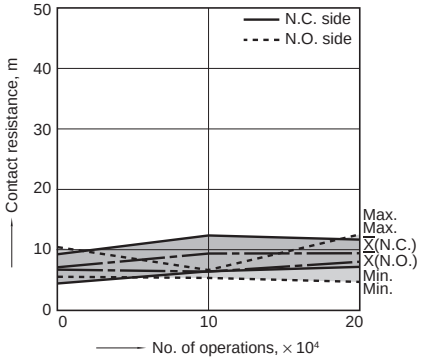
Inrush current: 25A, Steady current: 6A,
Brake current: 13A



Change of pick-up and drop-out voltage



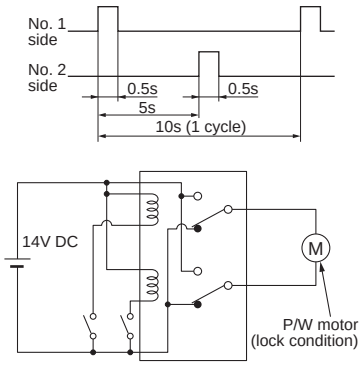
Change of contact resistance



5.-(2) Electrical life test (Motor lock)

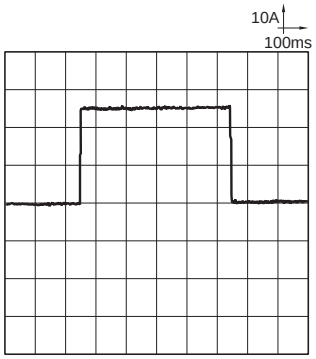
Sample: ACJ2212, 3pcs
Load: Steady current: 25A, Power window motor actual load (lock condition)
Tested voltage: 14V DC
Switching frequency: ON 0.5s, OFF 9.5s
Switching cycle: 10^5
Ambient temperature: Room temperature

Circuit

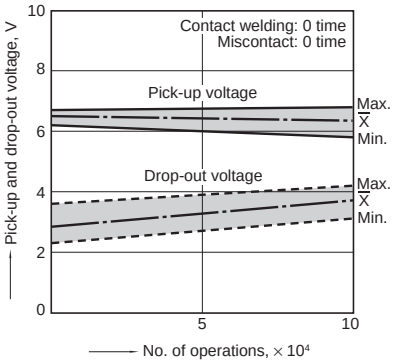


Load current waveform

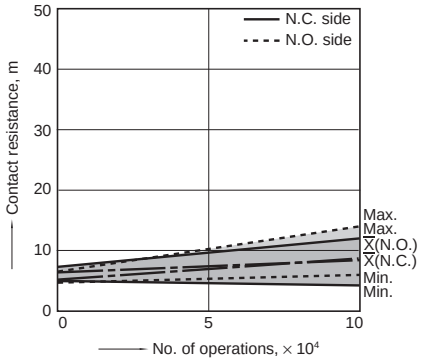
Current value: 25A



Change of pick-up and drop-out voltage



Change of contact resistance



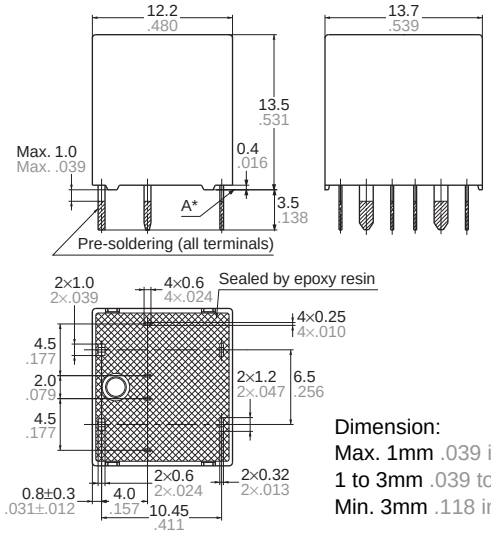
DIMENSIONS (mm inch)

Download **CAD Data** from our Web site.

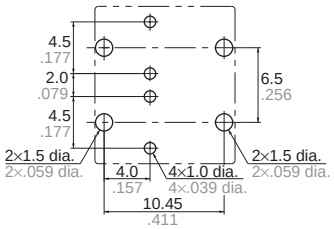
1. Twin type (8-pin)

CAD Data

External dimensions

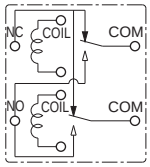


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



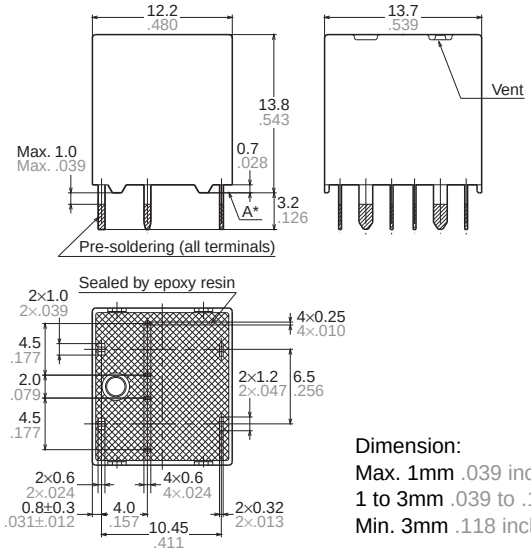
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

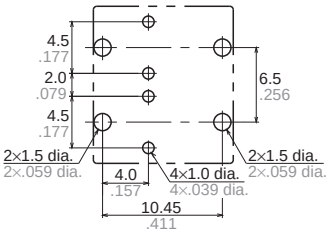
2. Twin type (8-pin)
Pin in Paste type

CAD Data

External dimensions

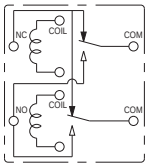


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



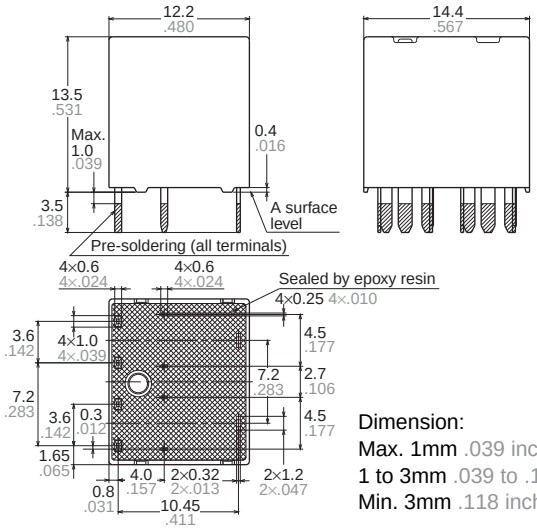
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

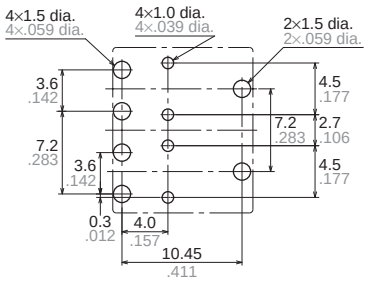
3. Twin type (10-pin)
Standard type

CAD Data

External dimensions

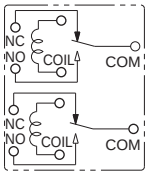


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



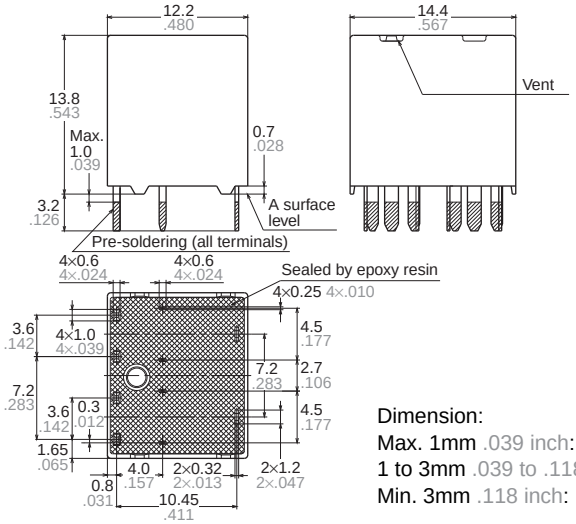
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

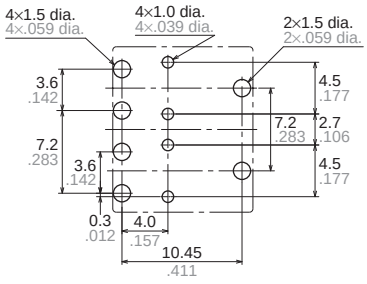
4. Twin type (10-pin)
Pin in Paste type

CAD Data

External dimensions

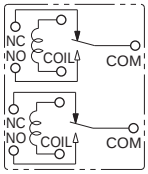


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



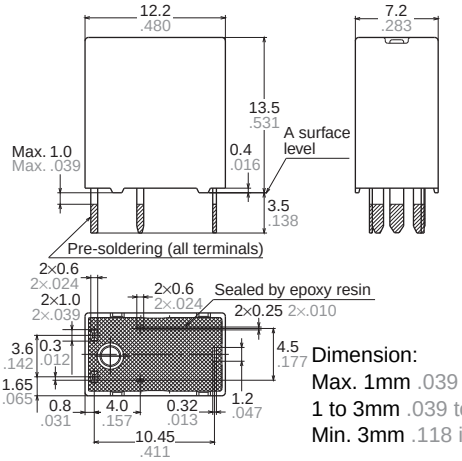
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

5. Slim 1 Form C
Standard type

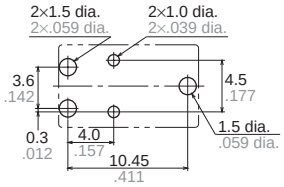
CAD Data

External dimensions



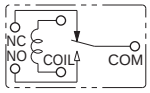
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

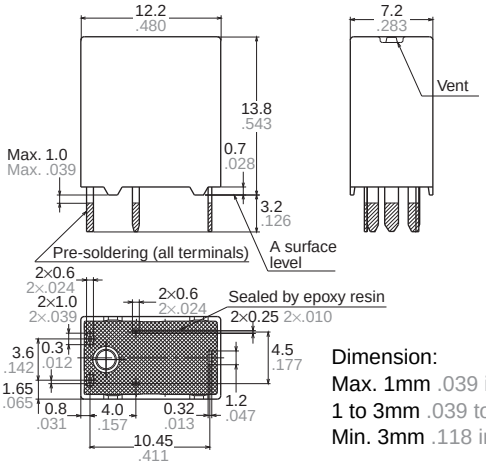


* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

6. Slim 1 Form C
Pin in Paste type

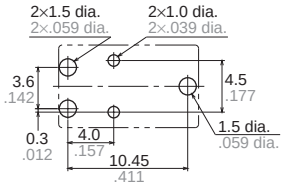
CAD Data

External dimensions



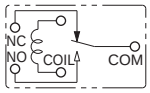
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



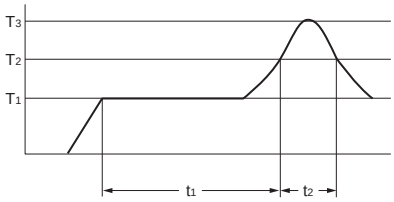
* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

NOTES

Assembly and cleaning conditions for Pin-in-Paste type

1) Example of the recommended conditions for automated assembly is shown below.

• Temperature profile during reflow-soldering (Recommended)



T_1 = 150 to 180°C 302 to 356°F
T_2 = 230°C 446°F or more
T_3 = Less than 260°C 500°F
t_1 = 60 to 120 sec.
t_2 = Less than 40 sec.

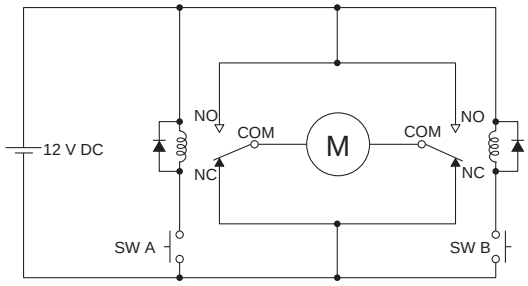
• Cautions for mounting

Temperature rise of relay itself may vary according to the mounting level or the heating method of reflow equipment. Therefore, please set the temperature of soldering portion of relay terminal and the top surface of the relay case not to exceed the above mentioned soldering condition. It is recommended to check the temperature rise of each portion under actual mounting condition before use.

2) Cleaning or coating should be avoided. Because “Pin-in-Paste” type is not a sealed type. Also, use caution for avoiding penetration of soldering flux into the interior of the relay.

EXAMPLE OF CIRCUIT

Forward/reverse control circuits of DC motor (for 1 Form C × 2 (8 terminal) type)



Ⓜ : Power window motor

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

HIGH LOAD RELAY FOR SMART J/B

CN-H RELAYS (ACNH)

FEATURES

- **Best space savings in its class**
- **Large capacity switching despite small size. Can replace micro ISO terminal type relays.**
- **Terminals for PC board pattern designs are easily allocated.**
- **Sealed type**

TYPICAL APPLICATIONS

Head lamp, Fog lamp, Fan motor, EPS, Defogger, Seat heater, etc.

ORDERING INFORMATION

ACNH □ □ □

Contact arrangement
3: 1 Form A

Pick-up voltage
1: Max. 5.5V DC
2: Max. 6.5V DC

Coil voltage (DC)
12: 12V

TYPES

Contact arrangement	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Part No.
1 Form A	12V DC	Max. 6.5 V DC (Initial)	ACNH3212
		Max. 5.5 V DC (Initial)	ACNH3112

Standard packing; Carton (tube): 50 pcs.; Case: 1,000 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12 V DC	Max. 6.5 V DC (Initial)	Min. 1.0 V DC (Initial)	37.5 mA	320¾	450 mW	10 to 16 V DC
	Max. 5.5 V DC (Initial)	Min. 0.8 V DC (Initial)	53.3 mA	225¾	640 mW	

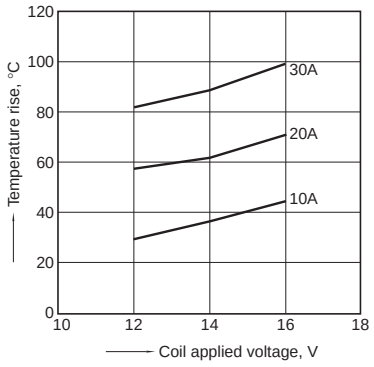
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form A
	Contact resistance (Initial)		Typ5mΩ (By voltage drop 6 V DC 1 A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		30A 14V DC
	Max. carrying current		<450mW> 35A/1 h, 45A/2 min. at 20°C 68°F 30A/1 h, 40A/2 min. at 85°C 185°F 25A/1 h, 35A/2 min. at 110°C 230°F <640mW> 30A/1 h, 40A/2 min. at 20°C 68°F 25A/1 h, 35A/2 min. at 85°C 185°F 20A/1 h, 30A/2 min. at 110°C 230°F
	Continuous carrying current		20A 14V DC (450mW) at 110°C 230°F, 15A 14V DC (640mW) at 110°C 230°F
	Nominal operating power		450 mW (for pick-up voltage max. 6.5 V DC), 640 mW (for pick-up voltage max. 5.5 V DC)
	Min. switching capacity (resistive load)*1		1A 14V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F) (Initial) (without protective element)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1m/s² {4.5G} Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical		<Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 1s ON, 1s OFF) <Motor load> Min. 3×10^5 (at inrush 84 A, steady 18 A, 14 V DC operating frequency: ON 2s, OFF 5s) <Lamp load> Min. 2×10^5 (at inrush 84 A, steady 12 A, 14 V DC operating frequency: ON 1s, OFF 14s)
Conditions	Conditions for operation, transport and storage		Ambient temperature: –40°C to +110°C –40°F to +230°F Humidity: 2% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
Mass			Approx. 9 g .32 oz

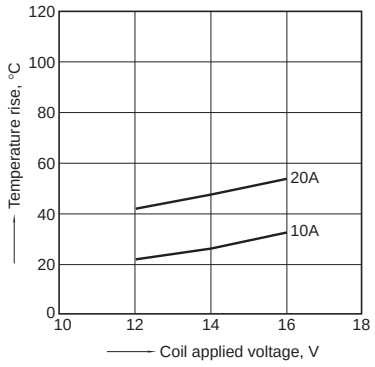
Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

REFERENCE DATA

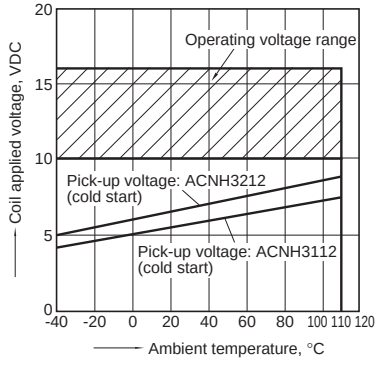
1-(1). Coil temperature rise
Sample: ACNH3212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 20A, 30A
Ambient temperature: 25°C 77°F



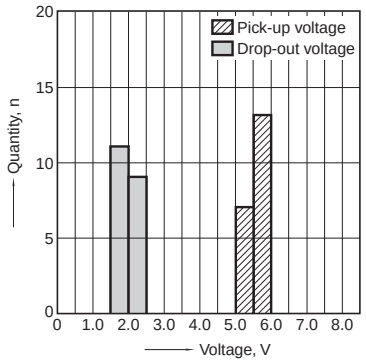
1-(2). Coil temperature rise
Sample: ACNH3212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 20A
Ambient temperature: 110°C 230°F



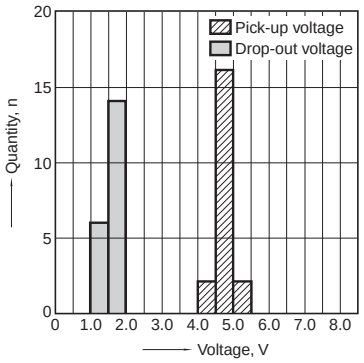
2. Ambient temperature and operating voltage range



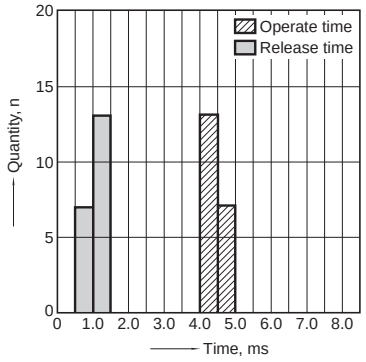
3-(1). Distribution of pick-up and drop-out voltage
Sample: ACNH3212, 20pcs.



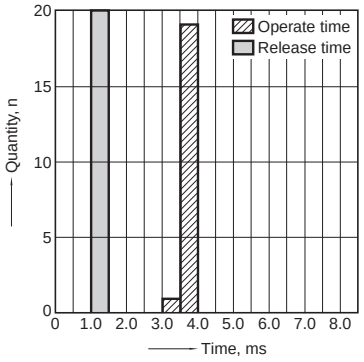
3-(2). Distribution of pick-up and drop-out voltage
Sample: ACNH3112, 20pcs.



4-(1). Distribution of operate and release time
Sample: ACNH3212, 20pcs.

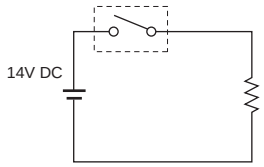


4-(2). Distribution of operate and release time
Sample: ACNH3112, 20pcs.

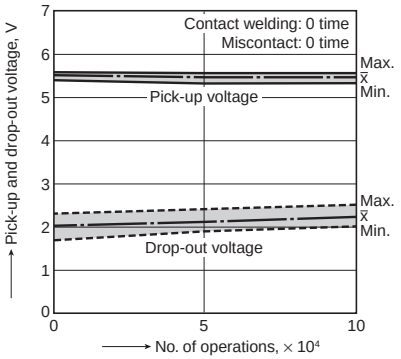


5. Electrical life test (Resistive load)
Sample: ACNH3212, 6pcs.
Load: Resistive load (NO side: 30A 14V DC)
Operating frequency: ON 1s, OFF 1s
Ambient temperature: Room temperature

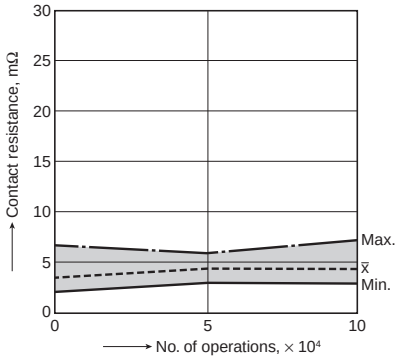
Circuit:



Change of pick-up and drop-out voltage

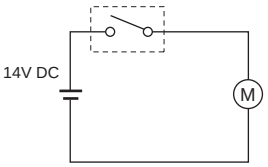


Change of contact resistance

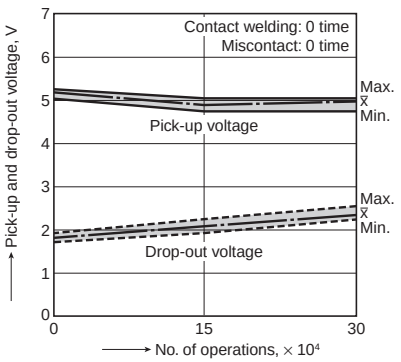


6-(1). Electrical life test (Motor load)
Sample: ACNH3212, 3pcs.
Load: inrush: 84A/steady: 18A,
radiator fan actual load (motor free)
Operating frequency: ON 2s, OFF 5s
Ambient temperature: 110°C 230°F

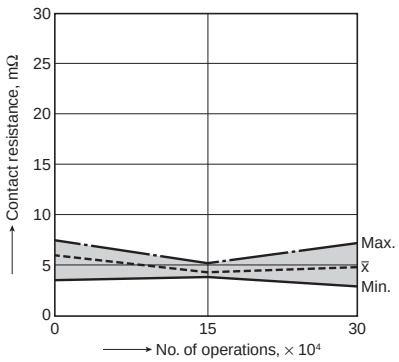
Circuit:



Change of pick-up and drop-out voltage

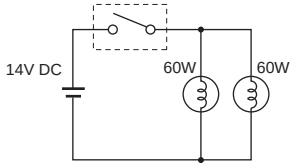


Change of contact resistance

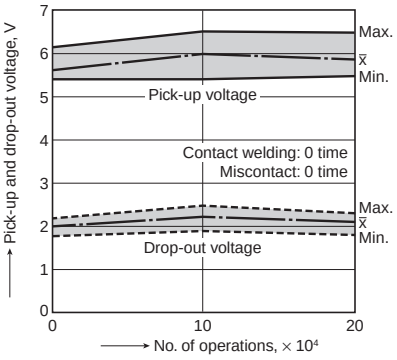


6-(2). Electrical life test (Lamp load)
Sample: ACNH3212, 6pcs.
Load: 60W×2, inrush: 84A/steady: 12A
Operating frequency: ON 1s, OFF 14s
Ambient temperature: Room temperature

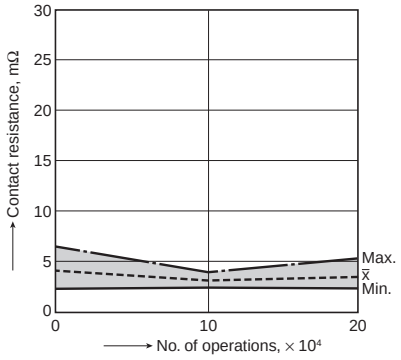
Circuit:



Change of pick-up and drop-out voltage



Change of contact resistance

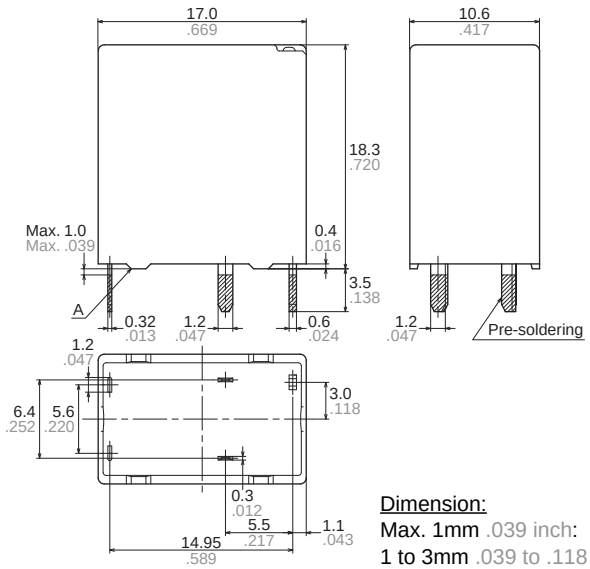


DIMENSIONS (mm inch)

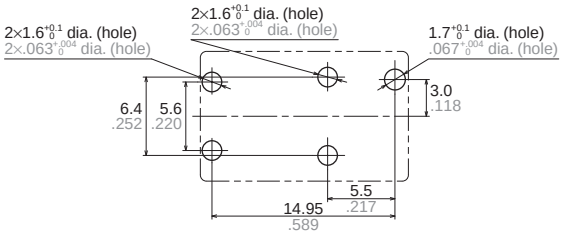
Download CAD Data from our Web site.

CAD Data

External dimensions

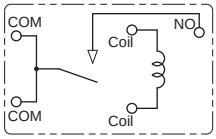


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

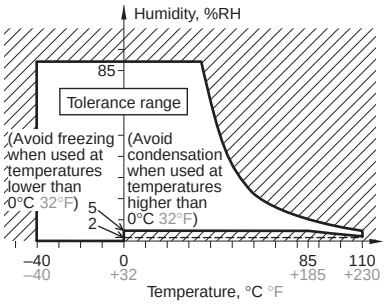
* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

NOTES

Usage, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +110°C –40 to +230°F
(2) Humidity: 2 to 85% RH
(Avoid freezing and condensation.)
(3) Atmospheric pressure: 86 to 106 kPa

The humidity range varies with the temperature. Use within the range indicated in the graph below.
(Temperature and humidity range for usage, transport, and storage)



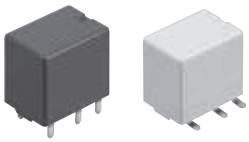
For Cautions for Use, see Relay Technical Information (page 166).

Automotive

Panasonic
ideas for life

MIDDLE LOAD RELAY FOR SMART J/B

CN-M RELAYS (ACNM)



FEATURES

- **Best space savings in its class.**
- **Compact and high-capacity 30A load switching.**
- **Full line up (High heat-resistant type and SMD type)**
- **Terminals for PC board pattern designs are easily allocated.**

TYPICAL APPLICATIONS

Defogger, Seat heater, Head lamp, Fog lamp, Fan motor, etc.

ORDERING INFORMATION

ACNM □ □ □ □ □

Contact arrangement*1
1: 1 Form C
3: 1 Form A
5: 1 Form C high heat-resistant type
7: 1 Form A high heat-resistant type

Pick-up voltage
1: Max. 7.2V DC

Coil voltage (DC)
12: 12V

Terminal shape
Nil: PC board terminal
SA: Surface-mount terminal

Packing style*2
Nil: Tube packing
X: Tape and reel packing
(Reverse NO terminal direction in pull-out direction)
Z: Tape and reel packing
(Normal NO terminal direction in pull-out direction)

Notes: *1. Surface-mount terminal type is available in high heat-resistant type only.
*2. Tube packing: PC board terminal type only
Tape and reel packing: Surface-mount type only

TYPES

1. PC board terminal type

Contact arrangement	Nominal coil voltage	Part No.	
		Standard type	High heat-resistant type
1 Form A	12V DC	ACNM3112	ACNM7112
1 Form C		ACNM1112	ACNM5112

Standard packing; Carton (tube): 50 pcs.; Case: 1,500 pcs.

2. Surface-mount terminal type

Contact arrangement	Nominal coil voltage	Part No.
		High heat-resistant type
1 Form A	12V DC	ACNM7112SAX
		ACNM7112SAZ
1 Form C		ACNM5112SAX
		ACNM5112SAZ

Standard packing; Carton (tape and reel): 200 pcs.; Case: 600 pcs.
Notes: *1.Surface-mount terminal type is available in high heat-resistant type only.
*2.An “X” at the end of the part number indicates, for tape and reel packing, reverse NO terminal direction in pull-out direction.
A “Z” at the end of the part number indicates, for tape and reel packing, normal NO terminal direction in pull-out direction.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12 V DC	Max. 7.2 V DC (Initial)	Min. 1.0 V DC (Initial)	53.3 mA	225Ω	640 mW	10 to 16 V DC

2. Specifications

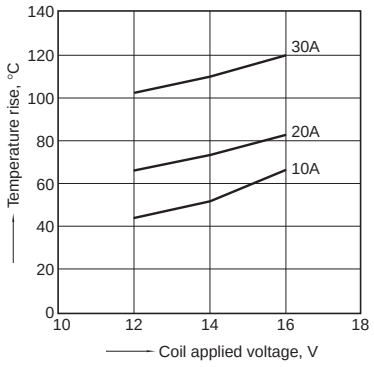
Characteristics	Item		Specifications
Contact	Arrangement		1 Form A, 1 Form C
	Contact resistance (Initial)		Typical 5mΩ (By voltage drop 6 V DC 1 A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 30A 14V DC, N.C.: 15A 14V DC
	Max. carrying current (at 14V DC)		N.O. 30A/1 h, 40A/2 min. at 20°C 68°F 25A/1 h, 35A/2 min. at 85°C 185°F 20A/1 h, 30A/2 min. at 110°C 230°F (High heat-resistant type) N.C. 25A/1 h, 30A/2 min. at 20°C 68°F 20A/1 h, 25A/2 min. at 85°C 185°F 15A/1 h, 20A/2 min. at 110°C 230°F (High heat-resistant type)
	Nominal operating power		640 mW
	Min. switching capacity (resistive load)*		1A 12V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500 V DC)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1m/s² {4.5G} Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical		<Resistive load> Min. 10^5 (At nominal switching capacity, operating frequency: 1s ON, 2s OFF)
			<Motor load> Min. 2×10^5: at 80 A (inrush), 16 A (steady), 14 V DC (Operating frequency: 2s ON, 6s OFF)
			<Lamp load> Min. 10^5: at 84 A (inrush), 12 A (steady), 14 V DC (Operating frequency: 1s ON, 14s OFF)
Conditions	Conditions for operation, transport and storage		Standard type; Ambient temp: –40°C to +85°C –40°F to +185°F, Humidity: 5 to 85% R.H. High heat-resistant type; Ambient temp: –40°C to +110°C –40°F to +230°F, Humidity: 2 to 85% R.H. (Not freezing and condensing at low temperature)
Unit weight			Approx. 5.5 g .19 oz

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

REFERENCE DATA

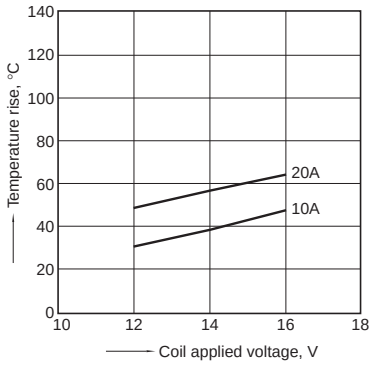
1-(1). Coil temperature rise

Sample: ACNM1112, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 20A, 30A
Ambient temperature: 26°C 78.8°F

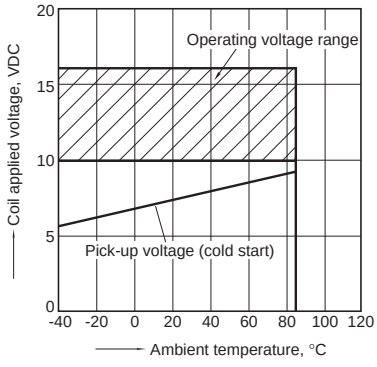


1-(2). Coil temperature rise

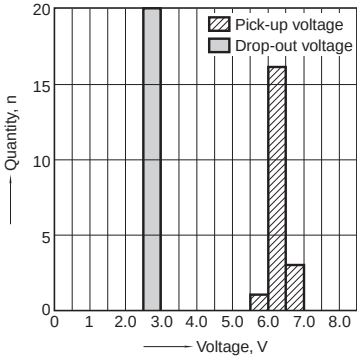
Sample: ACNM7112, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 20A
Ambient temperature: 110°C 230°F



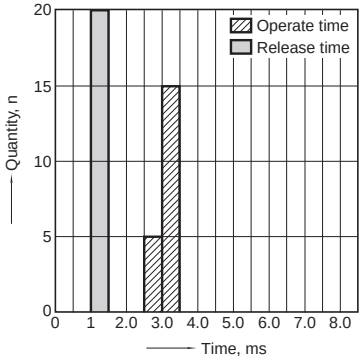
2. Ambient temperature and operating voltage range



3. Distribution of pick-up and drop-out voltage
Sample: ACNM1112, 20pcs.

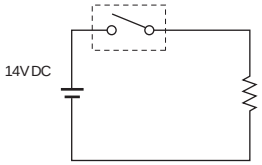


4. Distribution of operate and release time
Sample: ACNM1112, 20pcs.

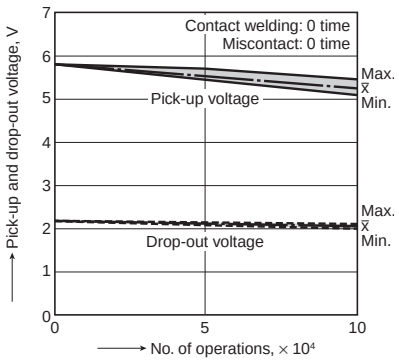


5-(1). Electrical life test (Resistive load)
Sample: ACNM1112, 3pcs.
Load: Resistive load (NO side: 30A 14V DC)
Operating frequency: (ON:OFF = 1s:1s)
Ambient temperature: Room temperature

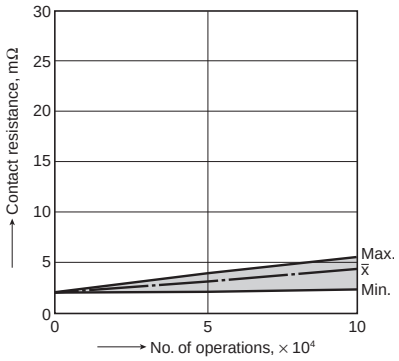
Circuit:



Change of pick-up and drop-out voltage

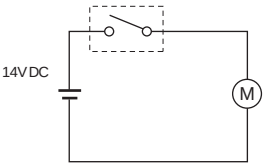


Change of contact resistance

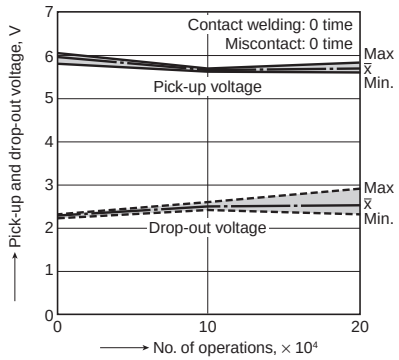


5-(2). Electrical life test (Motor load)
Sample: ACNM7112, 3pcs.
Load: inrush: 80A/steady: 16A,
radiator fan actual load (motor free)
Switching frequency: (ON:OFF = 2s:6s)
Ambient temperature: 110°C 230°F

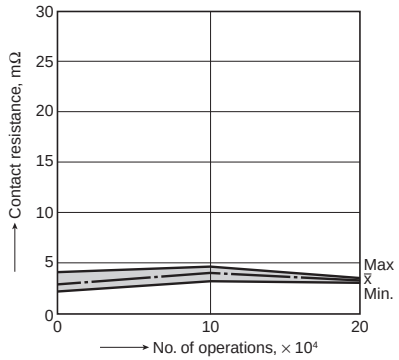
Circuit:



Change of pick-up and drop-out voltage

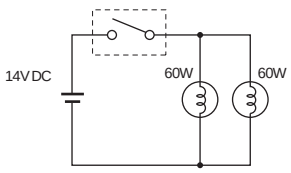


Change of contact resistance

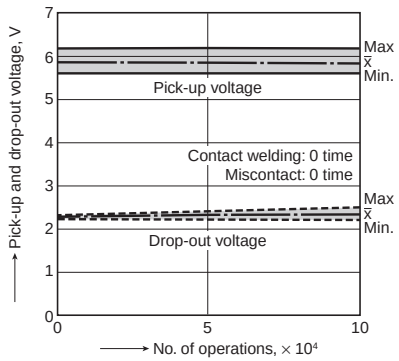


5-(3). Electrical life test (Lamp load)
Sample: ACNM3112, 3pcs.
Load: inrush: 84A/steady: 12A
Switching frequency: (ON:OFF = 1s:14s)
Ambient temperature: Room temperature

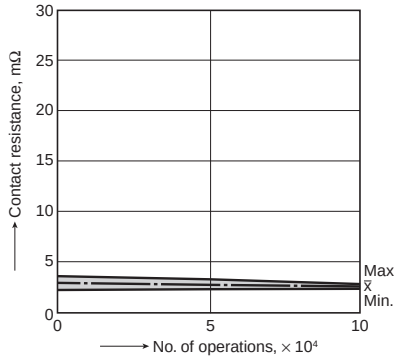
Circuit:



Change of pick-up and drop-out voltage



Change of contact resistance

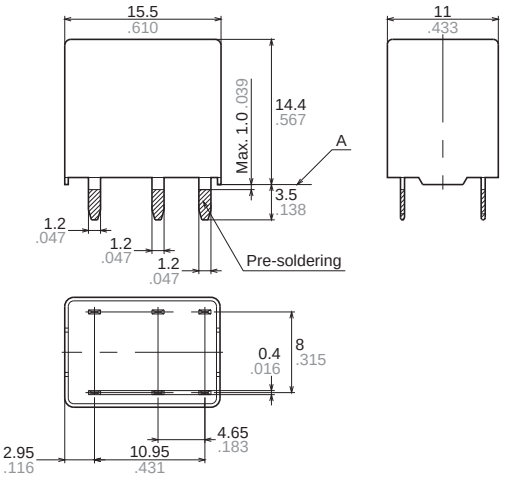


DIMENSIONS (mm inch)

Download **CAD Data** from our Web site.

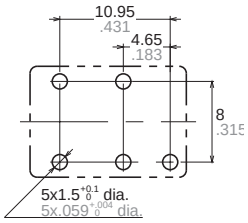
1. PC board terminal type

External dimensions

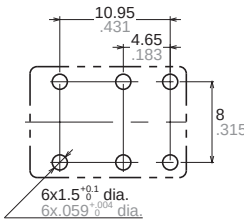


PC board pattern (Bottom view)

1 Form A

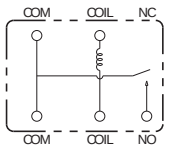


1 Form C

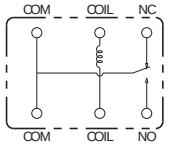


Schematic (Bottom view)

1 Form A



1 Form C



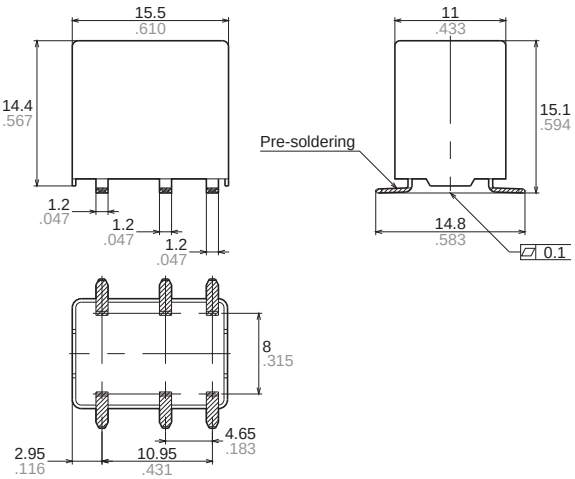
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

Tolerance: ±0.1 ±.004

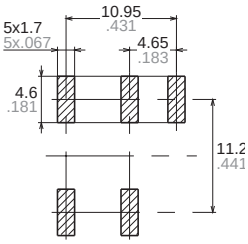
2. Surface-mount terminal type

External dimensions

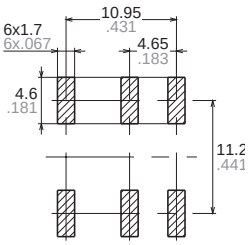


Recommended mounting pad (Top view)

1 Form A

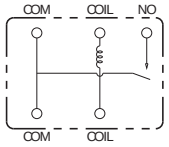


1 Form C

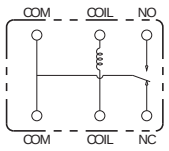


Schematic (Top view)

1 Form A



1 Form C



Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

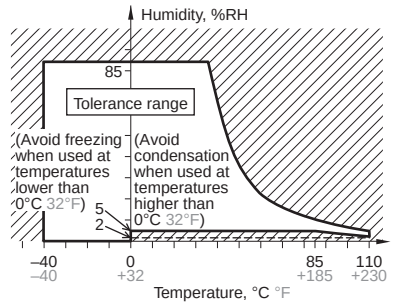
Tolerance: ±0.1 ±.004

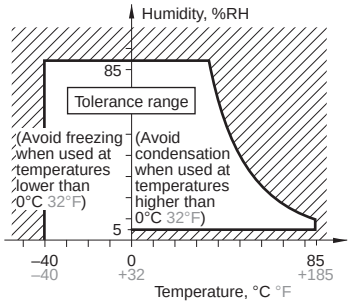
Automotive

NOTES

1. Usage, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +85°C –40 to +185°F
(Standard type)
–40 to +110°C –40 to +230°F
(High heat-resistant type)
(2) Humidity: 2 to 85% RH
(Avoid freezing and condensation.)
(3) Atmospheric pressure: 86 to 106 kPa
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(Temperature and humidity range for usage, transport, and storage)



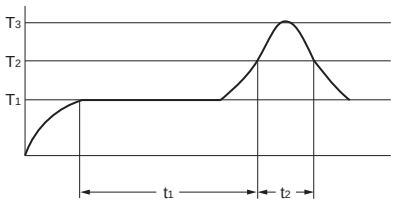


2. Storage condition after opening a moisture-prevention package

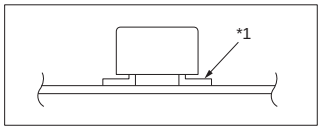
(1) After opening a moisture-prevention package, use the item as soon as possible (within 3 days under an environment of Max. 30°C 86°F, Max. 70% RH).
(2) If products are not used within 3 days after opening a moisture-prevention package, store them in a humidity-controlled desiccator or in a storage bag with silica gel.

3. Mounting and cleaning conditions for surface-mount terminal type relays

1) Recommended reflow condition is:
• Reflow-soldering temperature profile condition (IRS method)



T_1 = 150 to 180°C 302 to 356°F
T_2 = 230°C 446°F or more
T_3 = Less than 250°C 482°F
t_1 = 60 to 120 sec.
t_2 = Less than 30 sec.



• Cautions for mounting operations
Temperature profile indicates the temperature of the soldered part (*1) of terminals on the surface of a circuit board. The exterior temperature of a relay may be extremely high depending on the component density on the board or the heating method of the reflow oven or circuit board type. Sufficient verification under actual processing conditions is required.
2) Avoid cleaning (ultrasonic cleaning, boiling cleaning, etc.) and coating in order to prevent negative impacts on relay characteristics.

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

Compact flat size PC board relay for automotive

CP RELAYS

FEATURES

• Compact flat type
Flat size enables it to be built-in switch units.
<Height>
PC board terminal type:
9.5 mm .374 inch
Surface-mount terminal type:
10.5mm .413inch

• High capacity
CP Relay provides low profile spacesaving advantages while offering high continuous current of 25A (1 hour).

• Simple footprint pattern enables ease of PC board layout
Arrangement of coil and contact terminals designed to withstand large capacity which ensures leeway and facilitates PC board design.

• Sealed construction
Sealed construction suitable for harsh environments

• "PC board terminal" and "Surface mount terminal" types available
SMD automatic mounting is possible for surface mount terminal types because tape and reel packaging is used.

• Model available for wiper load.

TYPICAL APPLICATIONS

For automotive system
Power windows, Auto door lock, Power sunroof, Memory seat, Wiper, Defogger, etc.

ORDERING INFORMATION

CP □ □ - □ - □

Contact arrangement
1: 1 Form C
1a: 1 Form A
1W: 1 Form C for wiper load

Mounting classification
Nil: PC board terminal/wiper load
SA: Surface-mount terminal*1

Coil voltage (DC)
12 V

Packing style*2
Nil: Tube packing
X: Tape and reel packing (picked from the NC terminal side)
Z: Tape and reel packing (picked from the coil terminal side)

TYPES

1. PC board terminal type

Contact arrangement	Coil voltage	Part No.
1 Form A	12V DC	CP1a-12V
1 Form C		CP1-12V
1 Form C for wiper load		CP1W-12V

Standard packing; Carton (tube): 40 pcs.; Case: 1,000 pcs.

2. Surface mount terminal type

Contact arrangement	Coil voltage	Part No.
1 Form C	12V DC	CP1SA-12V-X
		CP1SA-12V-Z

Standard packing; Carton (tape and reel): 300 pcs.; Case: 900 pcs.
Notes:
*1. Surface-mount terminal type is available only for 1 form C contact arrangement.
*2. Surface mount terminal type is only supplied in tape and reel packaging. Tube packaging is only available for PC board type.
Tape and reel packing symbol "-z" or "-x" are not marked on the relay.

Automotive

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range (at 85°C 185°F)
12V DC	Max. 7.2V DC (Initial)	Min. 1.0V DC (Initial)	53.3 mA	225Ω	640 mW	10 to 16V DC

Note: Other pick-up voltage types are also available. Please contact us for details.

2. Specifications

1) Standard CP relay

Characteristics	Item		Specifications	
Contact	Arrangement		1 Form A	1 Form C
	Initial contact resistance (Initial)		N.O.: Typ6mΩ, N.C.: Typ8mΩ (By voltage drop 6V DC 1A)	
	Contact material		Ag alloy (Cadmium free)	
Rating	Nominal switching capacity (resistive load)		20A 14V DC	N.O.: 20A 14V DC, N.C.: 10A 14V DC
	Max. carrying current (12V DC initial)*3		N.O.: 40A for 2 minutes, 30A for 1 hour (at 20°C 68°F) 35A for 2 minutes, 25A for 1 hour (at 85°C 185°F)	
	Nominal operating power		640 mW	
	Min. switching capacity (resistive load)*1		1A 12V DC	
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC)	
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)	
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)	
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)	
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)	
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection: 10μs)	
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)	
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)	
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G} Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours	
Expected life	Mechanical		Min. 10^7 (at 120 cpm)	
	Electrical*4.		<Resistive load> Min. 10^5 (At nominal switching capacity, operating frequency: 1s ON, 9s OFF) <Motor load*> Min. 2×105 (N.O. side, Inrush 25A, steady 5A at 14V DC) Min. 105 (N.O. side, 20A 14V DC at motor lock) Min. 2×105 (N.C. side, 20A 14V DC at brake current) (Operating frequency: 0.5s ON, 9.5s OFF)	
Conditions	Conditions for operation, transport and storage*2		Ambient temp: –40°C to +85°C –40°F to +185°F Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)	
	Max. operating speed		6 cpm (at rated load)	
Mass			Approx. 4g .14 oz	

Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. Refer to “Usage ambient condition“ on page 178.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
*4. Motor load does not apply to wiper load applications.

2) For wiper load (CP1W-12V)

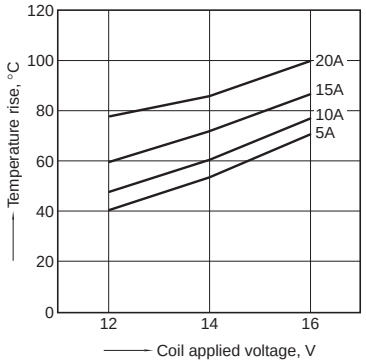
Anything outside of that given below complies with standard CP relays.

Characteristics	Item	Specifications
Rating	Max. carrying current (12V DC initial)	N.O.: 25A for 1 minutes, 15A for 1 hour (at 20°C 68°F)
Expected life	Electrical	<Wiper motor load (L = Approx. 1mH)> N.O. side: Min. 5×10^5 (Inrush 25A, steady 6A at 14V DC) N.C. side: Min. 5×10^5 (12A 14V DC at brake current) (Operating frequency: 1s ON, 9s OFF)

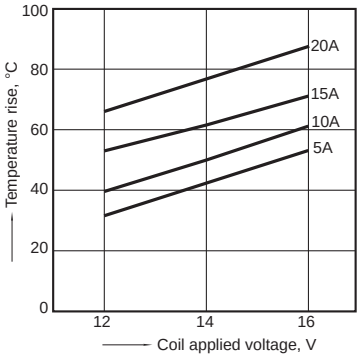
Note:*1. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.

REFERENCE DATA

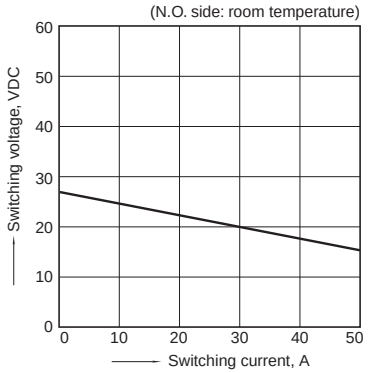
1.-(1) Coil temperature rise (at room temperature)
Sample: CP1-12V, 3pcs
Point measured: Inside the coil
Contact carrying current, 5A, 10A, 15A, 20A
Resistance method, ambient temperature 26°C 79°F



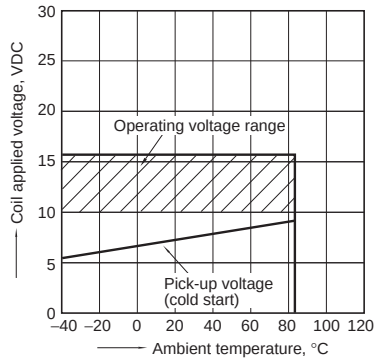
1.-(2) Coil temperature rise
Sample: CP1-12V, 6pcs
Point measured: Inside the coil
Contact carrying current, 5A, 10A, 15A, 20A
Resistance method, ambient temperature 85°C 185°F



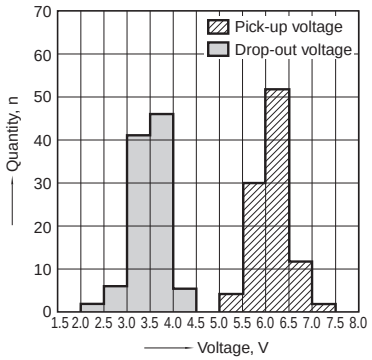
2. Max. switching capability (Resistive load, initial)



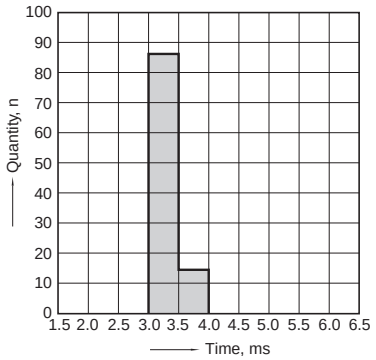
3. Ambient temperature and operating voltage range



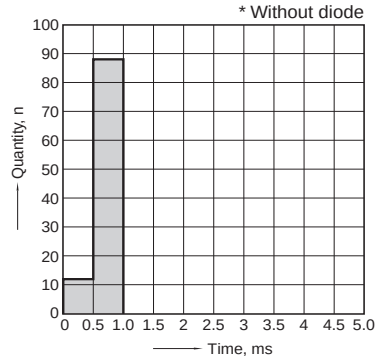
4. Distribution of pick-up and drop-out voltage
Sample: CP1-12V, 100pcs
Ambient temperature: 20°C 68°F



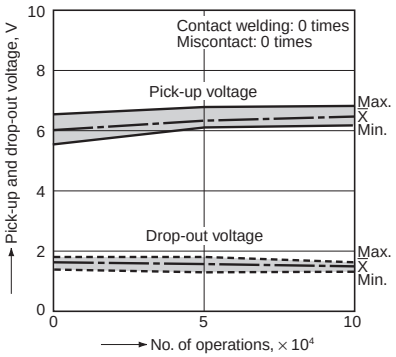
5. Distribution of operate time
Sample: CP1-12V, 100pcs
Ambient temperature: 20°C 68°F



6. Distribution of release time
Sample: CP1-12V, 100pcs
Ambient temperature: 20°C 68°F
* Without diode

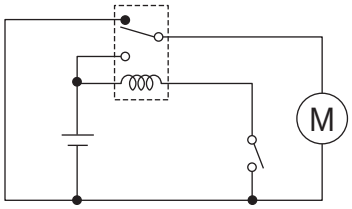


7.-(1) Electrical life test (at resistive load)
Sample: CP1-12V
Quantity: n = 4 (N.C. = 2, N.O. = 2)
Load: Resistive load (N.C. side: 10A 14V DC, N.O. side: 20A 14V DC)
Operating frequency: ON 1s, OFF 9s
Ambient temperature: Room temperature

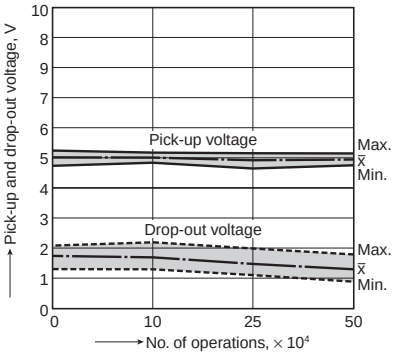


7.-(2) Electrical life test for wiper load (motor free)

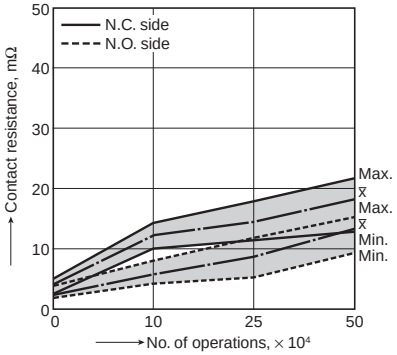
Sample: CP1W-12V
Quantity: n = 5
Load: N.O. side: Inrush 25A, steady 6A 14V DC
Load: N.C. side: Brake current 12A 14V DC
Operating frequency: ON 1s, OFF 9s
Ambient temperature: Room temperature
Circuit



Change of pick-up and drop-out voltage



Change of contact resistance

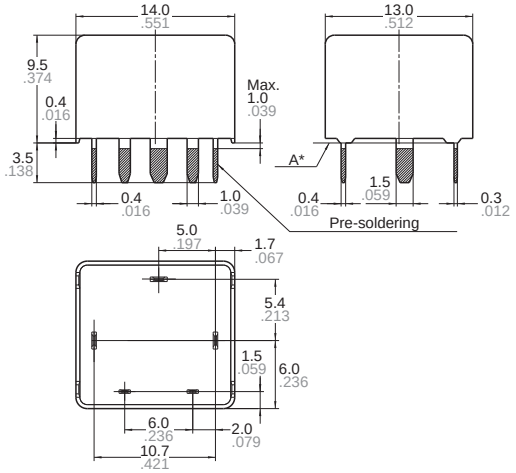


DIMENSIONS (mm inch)

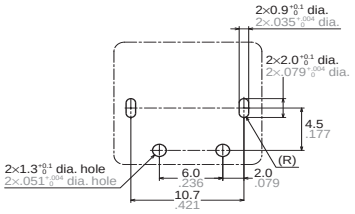
Download **CAD Data** from our Web site.

1. PC board terminal type

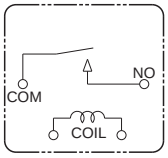
External dimensions



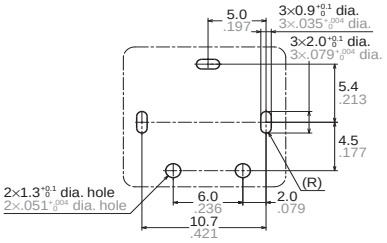
PC board pattern (Bottom view)
1 Form A



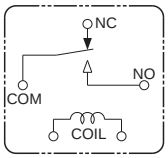
Schematic (Bottom view)
1 Form A



1 Form C



1 Form C

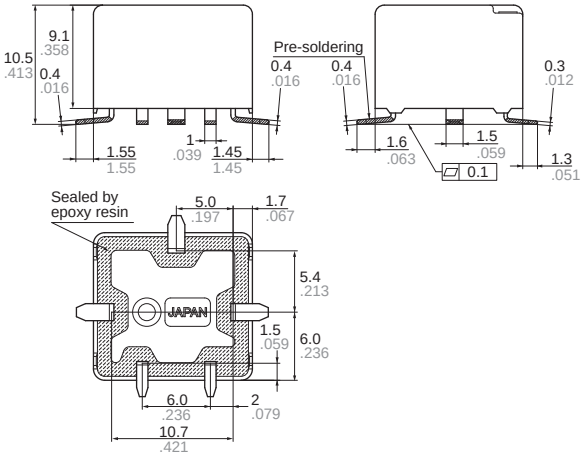


Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

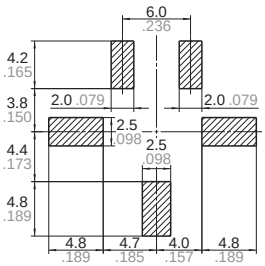
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

2. Surface mount terminal type

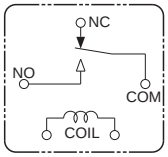
External dimensions



Recommendable mounting pad (Top view)



Schematic (Top view)



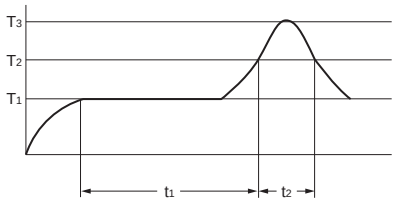
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

NOTES

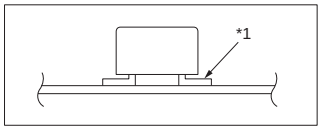
1. Mounting and cleaning conditions for SMT type relays

1) Recommended reflow condition is:

• Reflow-soldering temperature profile condition (IRS method)



T_1 = 150 to 180°C 302 to 356°F
T_2 = 230°C 446°F or more
T_3 = Less than 260°C 500°F
t_1 = 60 to 120 sec.
t_2 = Less than 40 sec.



• Cautions for mounting operations

Temperature profile indicates the temperature of the soldered part (*1) of terminals on the surface of a circuit board. The exterior temperature of a relay may be extremely high depending on the component density on the board or the heating method of the reflow oven or circuit board type. Sufficient verification under actual processing conditions is required.

2) Avoid cleaning (ultrasonic cleaning, boiling cleaning, etc.) and coating in order to prevent negative impacts on relay characteristics.

2. Storage condition after opening a moisture-prevention package

1) After opening a moisture-prevention package, use the item as soon as possible (within 3 days under an environment of Max. 30°C 86°F, Max. 70% RH).

2) If products are not used within 4 days after opening a moisture-prevention package, store them in a humidity-controlled desiccator or in a storage bag with silica gel.

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

HIGH CARRYING CURRENT TYPE MINIATURE LOW PROFILE AUTOMOTIVE RELAY

CP RELAYS
<POWER TYPE>

FEATURES

• Compact flat type
We successfully developed a high carrying current type that is the same size as our CP relay
(14 mm (L) x 13 mm (W) x 9.5 mm (H) .551 inch (L) x .512 inch (W) x .374 inch (H)).

• 35A maximum carrying current
Current carrying of 35 A/1h and 45 A/2 min. at 20°C
(450 W type, 16 V applied) is possible due to use of N.O. double pin terminals and COM terminal width expansion.

• Supports capacitor loads required for power supply applications
Inrush current: 60A, steady-state current: 1A and 10^5 switching times possible.

• Plastic sealed type
This plastic sealed type can be automatically cleaned.

TYPICAL APPLICATIONS

For automotive system
Defoggers, Ignitions, Heaters, Accessories, Power windows, etc.

ORDERING INFORMATION

CP □ - □ - □

Contact arrangement
1H: 1 Form C Power type
1aH: 1 Form A Power type

Pick-up voltage
Nil: Max. 7.2 V DC
N: Max. 6.5 V DC

Coil voltage (DC)
12 V

TYPES

Contact arrangement	Coil voltage	Pick-up voltage (at 20°C 68°F)	Part No.
1 Form C	12 V DC	Max. 7.2 V DC (Initial)	CP1H-12V
		Max. 6.5 V DC (Initial)	CP1H-N-12V
1 Form A		Max. 7.2 V DC (Initial)	CP1aH-12V
		Max. 6.5 V DC (Initial)	CP1aH-N-12V

Standard packing: Carton (Tube): 40 pcs.; Case: 1,000 pcs.
Note: THD type only

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range (at 85°C 185°F)
12V DC	Max. 7.2 V DC (Initial)	Min. 1.0 V DC (Initial)	37.5 mA	320Ω	450 mW	10 to 16V DC
	Max. 6.5 V DC (Initial)		53.3 mA	225Ω	640 mW	10 to 16V DC

2. Specifications

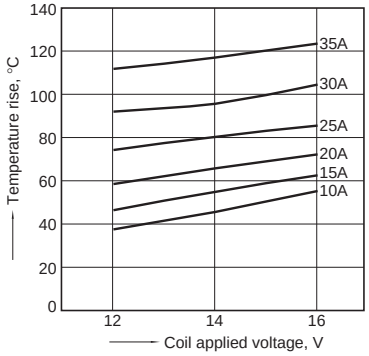
Characteristics	Item		Specifications
Contact	Arrangement		1 Form A, 1 Form C
	Contact resistance (Initial)		N.O.: Typ 6mΩ, N.C.: Typ 8mΩ (By voltage drop 6V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 20 A 14V DC, N.C.: 10 A 14V DC
	Max. carrying current (16V DC)*3		N.O.: <For 450 mW> 45 A for 2 minutes, 35 A for 1 hour at 20°C 68°F 40 A for 2 minutes, 30 A for 1 hour at 85°C 185°F <For 640 mW> 40 A for 2 minutes, 30 A for 1 hour at 20°C 68°F 35 A for 2 minutes, 25 A for 1 hour at 85°C 185°F
	Nominal operating power		450 mW for pick-up voltage 7.2 V DC, 640 mW for pick-up voltage 6.5 V DC
	Min. switching capacity (resistive load)*1		1 A 14V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical		<Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 1s ON, 9s OFF) <Capacitor load> Min. 10^5 (at Inrush 60A, Steady 1A 14 V DC, operating frequency: 1s ON, 9s OFF)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C –40°F to +185°F, Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		6 cpm (at nominal switching capacity)
Mass			Approx. 4.5 g .16 oz

Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.

REFERENCE DATA

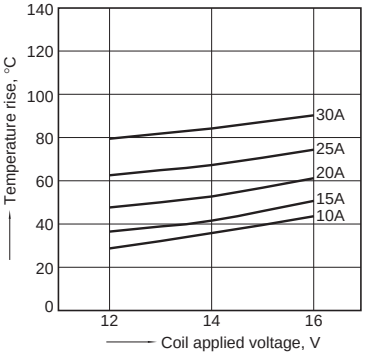
1-(1). Coil temperature rise

Sample : CP1H-12V, 3pcs
Point measured : Inside the coil
Ambient temperature: 27°C 81°F

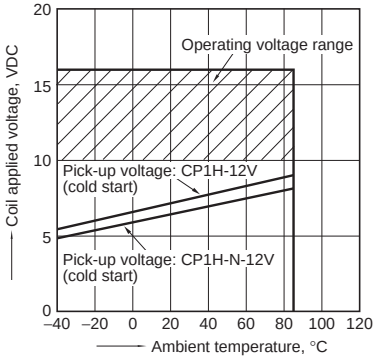


1-(2). Coil temperature rise

Sample : CP1H-12V, 3pcs
Point measured : Inside the coil
Ambient temperature: 85°C 185°F

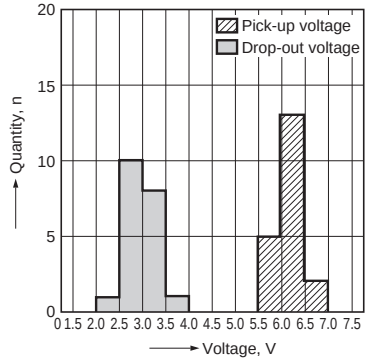


2. Ambient temperature and operating voltage range



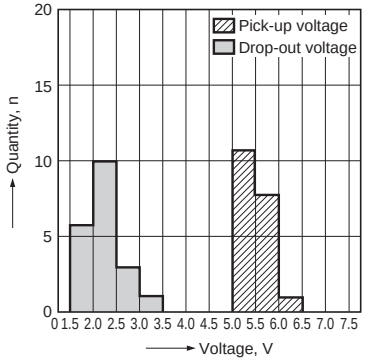
3-(1). Distribution of pick-up and drop-out voltage

Sample : CP1H-12V, 20pcs.



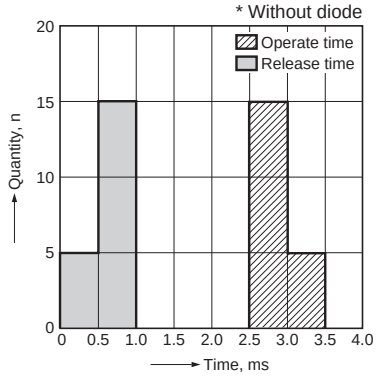
3-(2). Distribution of pick-up and drop-out voltage

Sample : CP1H-N-12V, 20pcs.



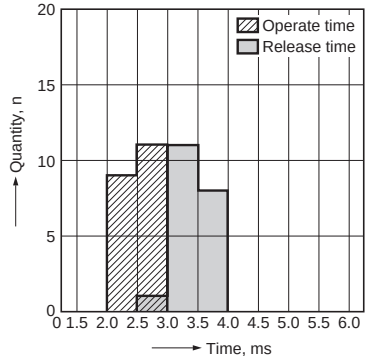
4-(1). Distribution of operate and release time

Sample : CP1H-12V, 20pcs.



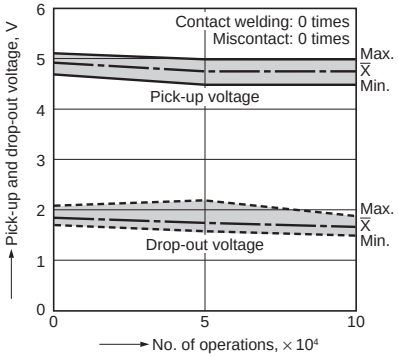
4-(2). Distribution of operate and release time

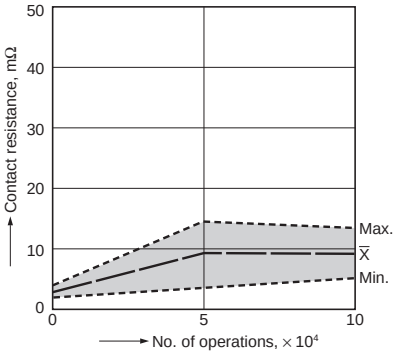
Sample : CP1H-N-12V, 20pcs.



5-(1). Electrical life test (at rated load)

Sample : CP1H-12V
Quantity : n = 6
Load : Resistive load (N.O. side : 20 A 14 V DC)
Operating frequency : ON 1s, OFF 9s
Ambient temperature : Room temperature

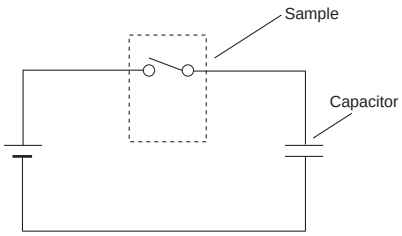


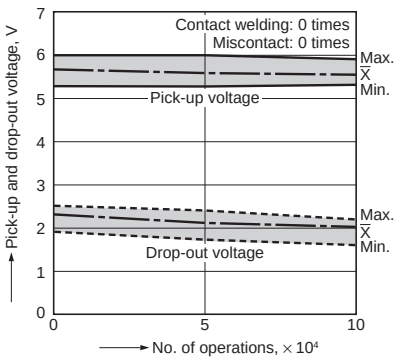


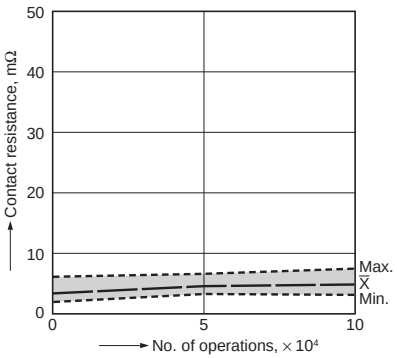
5-(2). Electrical life test (at capacitor load)

Sample : CP1H-12V, 6pcs.
Load : Inrush 60A/steady 1A
Operating frequency : ON 1s, OFF 9s
Ambient temperature : Room temperature

Circuit :





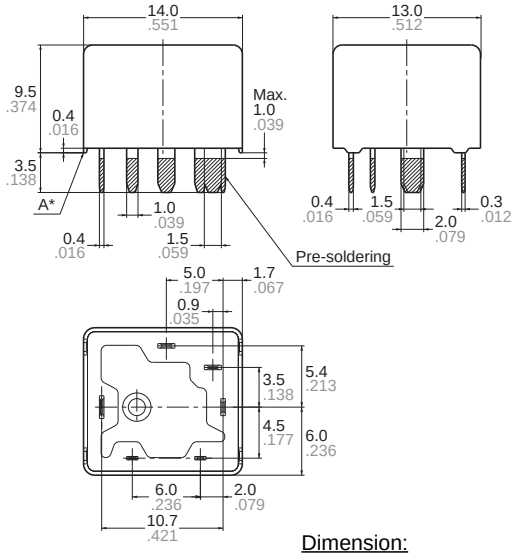


DIMENSIONS (mm inch)

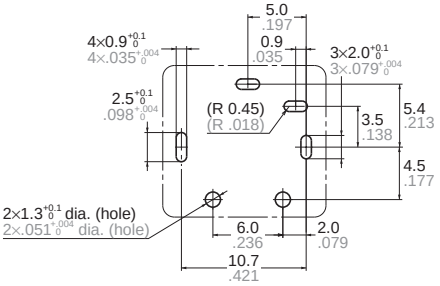
Download CAD Data from our Web site.

CAD Data

External dimensions

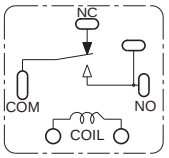


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

For Cautions for Use, see Relay Technical Information (page 166).

Automotive

Panasonic
ideas for life

1 FORM C AUTOMOTIVE SILENT RELAY

CQ RELAYS (ACQ)

FEATURES

- **Sound pressure reduced by approx. 20 dB from that of the company's non-silent relays**
- **Space saving**
- **Adopting standard terminal pitch (for compact relays)**
- **Plastic sealed type**
- **Wiper load models are listed**

TYPICAL APPLICATIONS

For intermittent wipers and applications requiring quiet operation

ORDERING INFORMATION

CQ ☐ - ☐

Contact arrangement
1: 1 Form C
W1: 1 Form C for wiper load

Coil voltage (DC)
12 V

TYPES

Contact arrangement	Coil voltage	Model No.	Part No.
1 Form C	12V DC	ACQ131	CQ1-12V
1 Form C for wiper load		ACQW131	CQ1W-12V

Standard packing; Carton (tube): 40 pcs.; Case: 800 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Usable voltage range
12V DC	Max. 7.2V DC (Initial)	Min. 1.0V DC (Initial)	53.3 mA	225Ω	640 mW	10 to 16V DC

Note: Other pick-up voltage types are also available. Please contact us for details.

2. Specifications

1) Standard CQ relay

Characteristics	Item		Specifications
Contact	Arrangement		1 Form C
	Contact resistance (Initial)		N.O.: Typ7mΩ, N.C.: Typ8mΩ (By voltage drop 6V DC 1A)
	Contact voltage drop		Max. 0.2V (at 10 A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 20A 14V DC, N.C.: 10A 14V DC
	Max. carrying current (12V DC initial)*3		N.O.: 35A for 2 minutes, 25A for 1 hour (at 20°C 68°F) 30A for 2 minutes, 20A for 1 hour (at 85°C 185°F)
	Nominal operating power		640 mW
	Min. switching capacity (resistive load)*1		1A 14V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G} Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical*4		<Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 1s ON, 9s OFF) <Motor load> Min. 3×10^5 (Inrush 30A, steady 5A, 20A 14V DC at brake current) (Operating frequency: 1s ON, 2s OFF)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C –40°F to +185°F Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		6 cpm (at nominal switching capacity)
Mass			Approx. 6.5g .23 oz

Notes:
*1.This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2.The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
*3.Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
*4.Motor load does not apply to wiper load applications.

2) For wiper load (ACQW131)

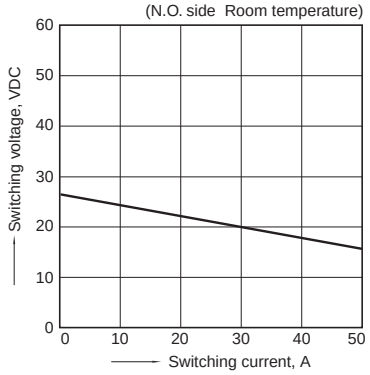
Anything outside of that given below complies with standard CQ relays.

Characteristics	Item	Specifications
Rating	Max. carrying current (12V DC initial)*1	N.O.: 25A for 1 minutes, 15A for 1 hour (at 20°C 68°F)
Expected life	Electrical	<Wiper motor load (L = Approx. 1mH)> N.O. side: Min. 5×10^5 (Inrush 25A, steady 6A 14V DC) N.C. side: Min. 5×10^5 (12A 14V DC at brake current) (Operating frequency: 1s ON, 9s OFF)

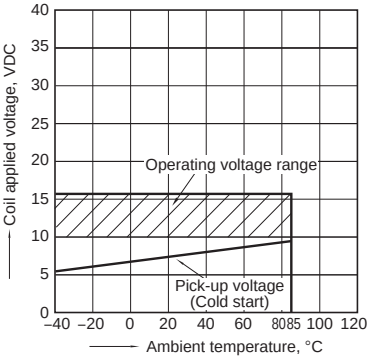
Note: *1. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.

REFERENCE DATA

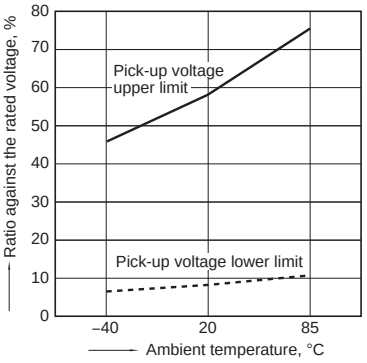
1. Max. switching capability (Resistive load, initial)



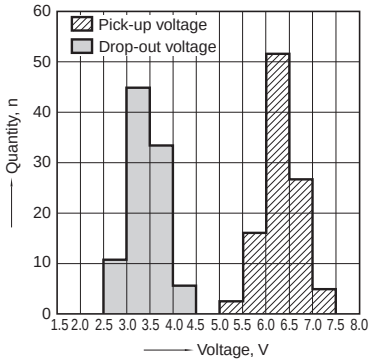
2. Ambient temperature and operating voltage range



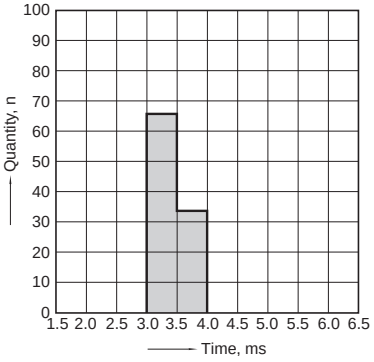
3. Ambient temperature characteristics



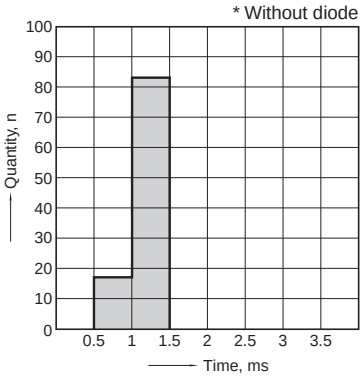
4. Distribution of pick-up and drop-out voltage
Sample: ACQ131, 100pcs



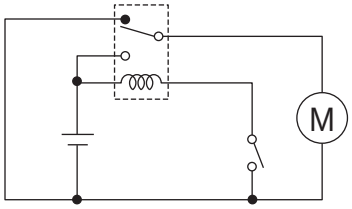
5. Distribution of operate time
Sample: ACQ131, 100pcs



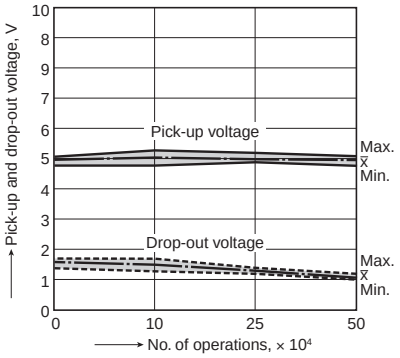
6. Distribution of release time
Sample: ACQ131, 100pcs



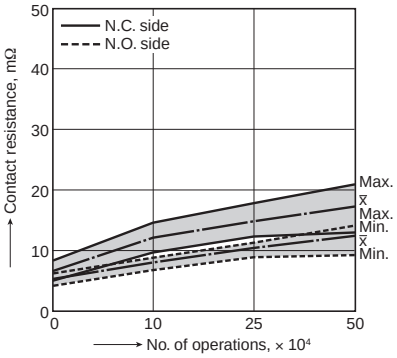
7. Electrical life test for wiper load (motor free)
Sample: ACQW131
Quantity: n = 3
Load: N.O. side: Inrush 25A, steady 6A 14V DC
N.C. side: Brake current 12A 14V DC
Operating frequency: ON 1s, OFF 9s
Ambient temperature: Room temperature
Circuit



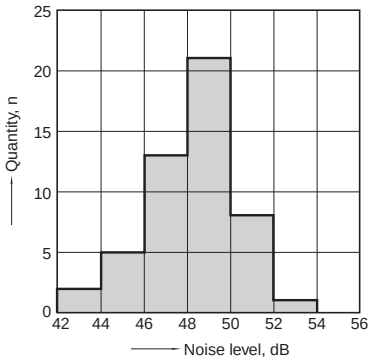
Change of pick-up and drop-out voltage



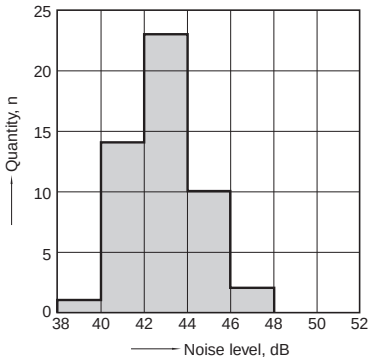
Change of contact resistance



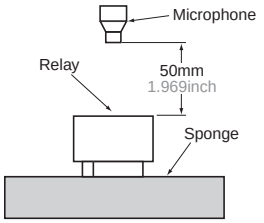
8.-(1) Operation noise distribution
When operate



8.-(2) Operation noise distribution
When release



Measuring conditions
Sample: ACQ131, 50 pcs.
Equipment setting: “A” weighted, Fast, Max. hold
Coil voltage: 12V DC
Coil connection device: Diode
Background noise: Approx. 20dB

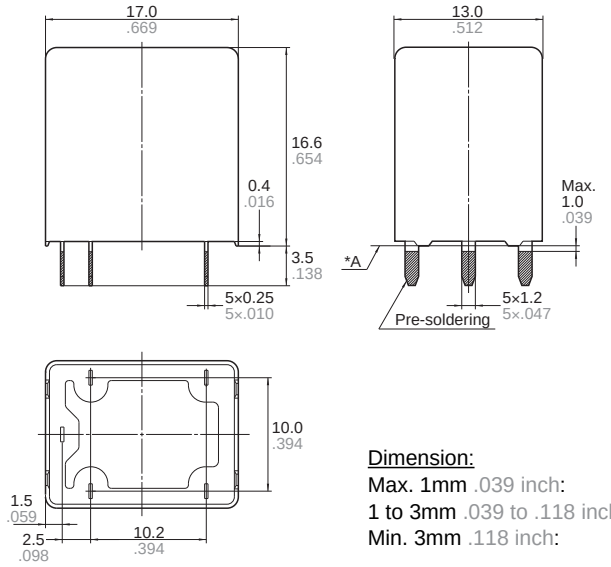


DIMENSIONS (mm inch)

Download CAD Data from our Web site.

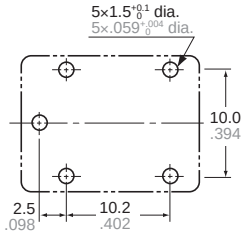
CAD Data

External dimensions



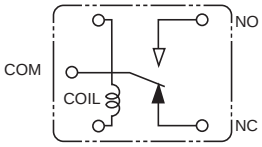
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

SMALL & SLIM AUTOMOTIVE RELAY

CT RELAYS (ACT)

FEATURES

- **Terminal layout for simplifying PC board pattern design**
- **Capable of 25A high-capacity load switching with compact size**
- **Plastic sealed type**

TYPICAL APPLICATIONS

- **Power windows**
- **Auto door lock**
- **Power sunroof**
- **Electrically powered mirrors**
- **Powered seats**
- **Lift gates**
- **Slide door closers, etc. (for DC motor forward/reverse control circuits)**

ORDERING INFORMATION

ACT □ □

Contact arrangement
1: 1 Form C
2: 1 Form C×2 (8 terminal)
5: 1 Form C×2 (10 terminal)

Coil voltage, DC
12: 12 V

TYPES

Contact arrangement	Coil voltage	Part No.
1 Form C	12 V DC	ACT112
1 Form C × 2 (8 terminals type)		ACT212
1 Form C × 2 (10 terminals type)		ACT512

Standard packing; 1 Form C: Carton (tube) 30pcs. Case 1,500pcs.
1 Form C × 2: Carton (tube) 30pcs. Case 900pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 7.2 V DC (Initial)	Min. 1.0 V DC (Initial)	66.7 mA	180Ω	800 mW	10 to 16V DC

Note: Other pick-up voltage types are also available. Please contact us for details.

2. Specifications

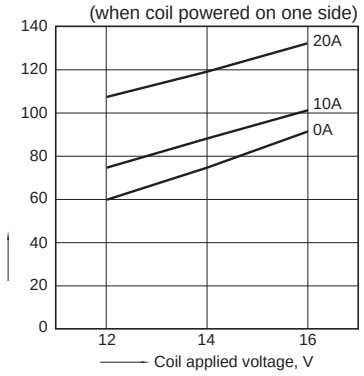
Characteristics	Item		Specifications
Contact	Arrangement		1 Form C × 2, 1 Form C
	Contact resistance (Initial)		N.O.: Typ 7mΩ, N.C.: Typ 10mΩ (By voltage drop 6V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 20 A 14V DC, N.C.: 10 A 14V DC
	Max. carrying current (14V DC)*3		N.O.: 25 A for 1 hour, 35 A for 2 minutes at 20°C 68°F 20 A for 1 hour, 30 A for 2 minutes at 85°C 185°F
	Nominal operating power		800 mW
	Min. switching capacity (resistive load)*1		1 A 14V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical		<Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 1s ON, 9s OFF) <Motor load> N.O. side: Min. 2×10^5 (at Inrush 25A, Steady 5A 14 V DC), Min. 10^5 (at 25A 14 V DC motor lock condition) N.C. side: Min. 2×10^5 (at brake current 20A 14 V DC) (operating frequency: 0.5s ON, 9.5s OFF)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C –40°F to +185°F, Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		6 cpm (at nominal switching capacity)
Mass			Twin type: approx. 8 g .28 oz, 1 Form C type: approx. 4 g .14 oz

Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
∗ If the relay is used continuously for long periods of time with coils on both sides in an energized condition, breakdown might occur due to abnormal heating depending on the carrying condition. Therefore, please inquire when using with a circuit that causes an energized condition on both sides simultaneously.

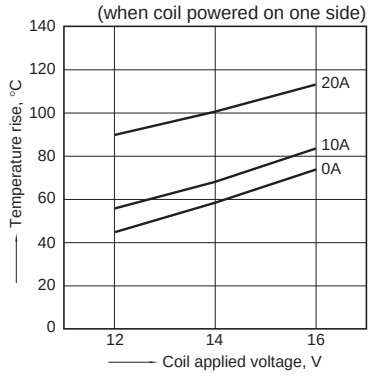
Automotive

REFERENCE DATA

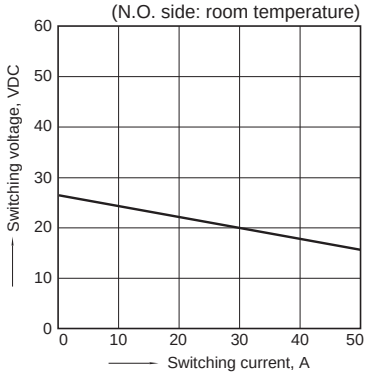
1-(1). Coil temperature rise (at room temperature)
Sample: ACT212, 3pcs.
Contact carrying current: 0A, 10A, 20A
Ambient temperature: Room temperature



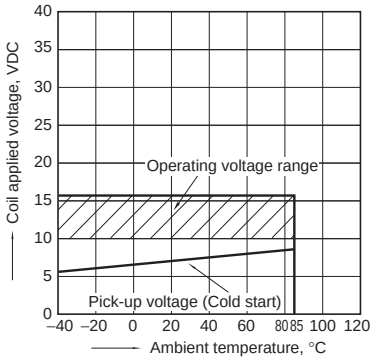
1-(2). Coil temperature rise (at 85°C 185°F)
Sample: ACT212, 3pcs.
Contact carrying current: 0A, 10A, 20A
Ambient temperature: 85°C 185°F



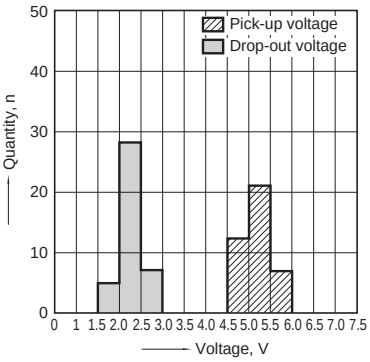
2. Max. switching capability (Resistive load, initial)



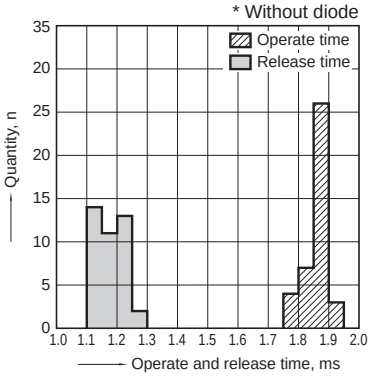
3. Ambient temperature and operating voltage range



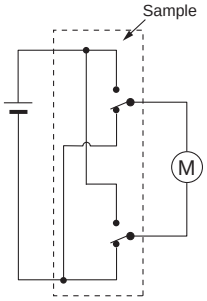
4. Distribution of pick-up and drop-out voltage
Sample: ACT212, 40pcs.



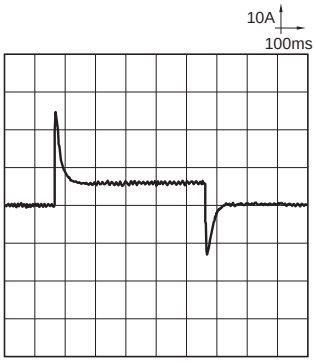
5. Distribution of operate and release time
Sample: ACT212, 40pcs.



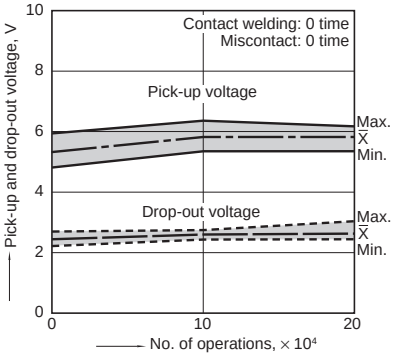
6-(1). Electrical life test (Motor free)
Sample: ACT212, 3pcs.
Load: Inrush 25A, steady 5A
Brake current: 13A 14V DC,
Power window motor actual load (free condition)
Operating frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature
Circuit:



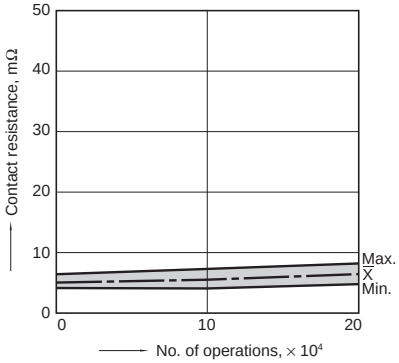
Load current waveform
Inrush current: 25A, Steady current: 6A
Brake current: 13A



Change of pick-up and drop-out voltage

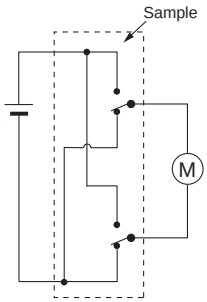


Change of contact resistance

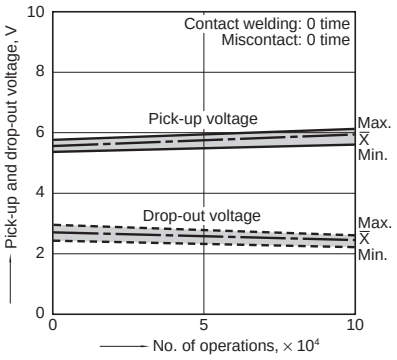


6-(2). Electrical life test (Motor lock)

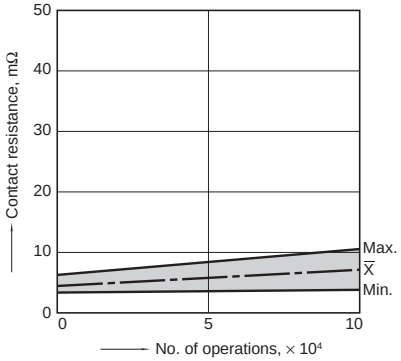
Sample: ACT212, 3pcs.
Load: 25A 14V DC
Power window motor actual load (lock condition)
Switching frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature
Circuit:



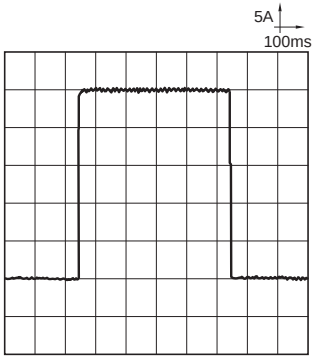
Change of pick-up and drop-out voltage



Change of contact resistance

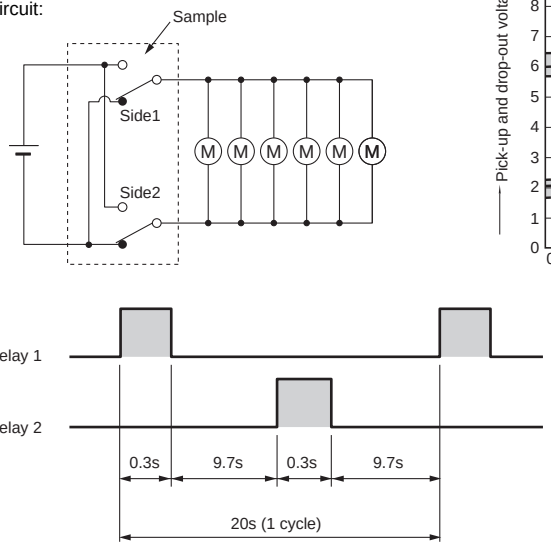


Load current waveform

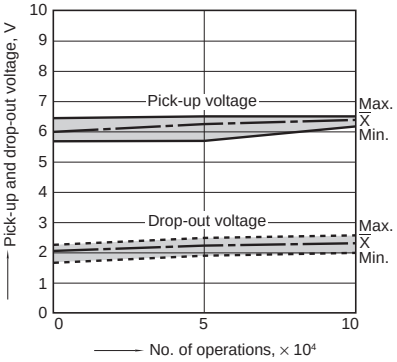


6-(3). Electrical life test (Motor lock)

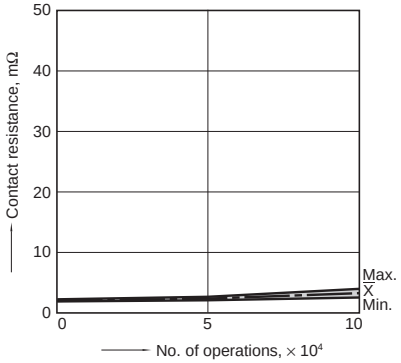
Sample: ACT212, 3pcs.
Load: 20A 14V DC,
door lock motor actual load (Lock condition)
Switching frequency: ON 0.3s, OFF 19.7s
Ambient temperature: Room temperature
Circuit:



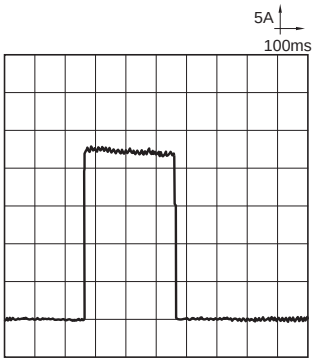
Change of pick-up and drop-out voltage



Change of contact resistance



Load current waveform



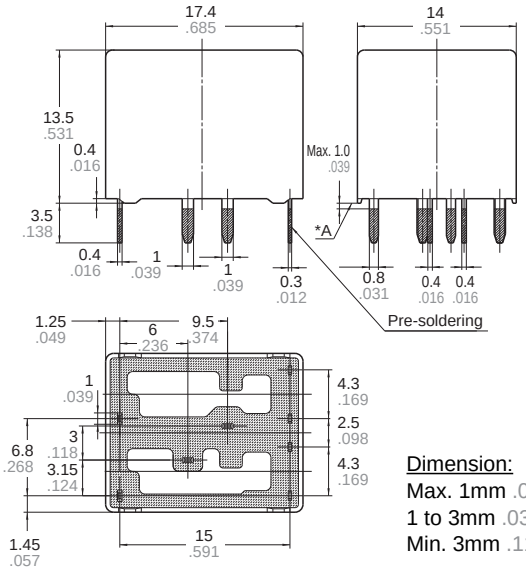
DIMENSIONS (mm inch)

Download CAD Data from our Web site.

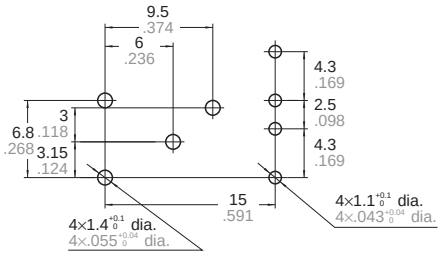
1. Twin type (8 terminals)

CAD Data

External dimensions

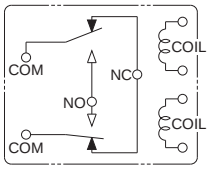


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



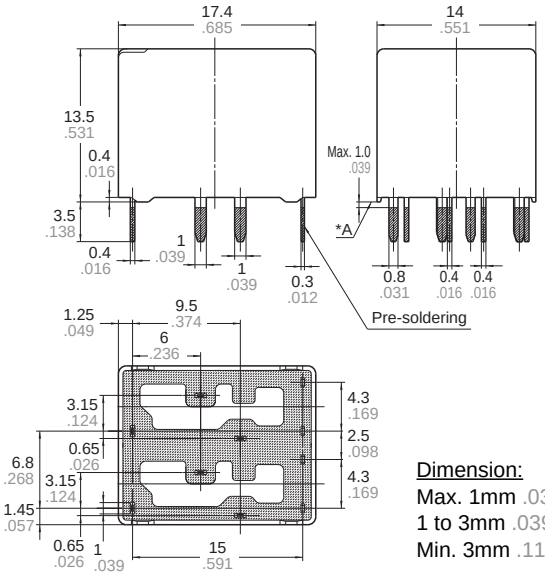
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

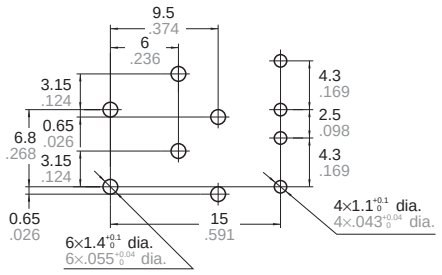
2. Twin type (10 terminals)

CAD Data

External dimensions

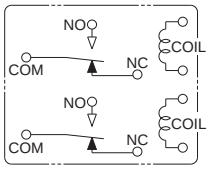


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



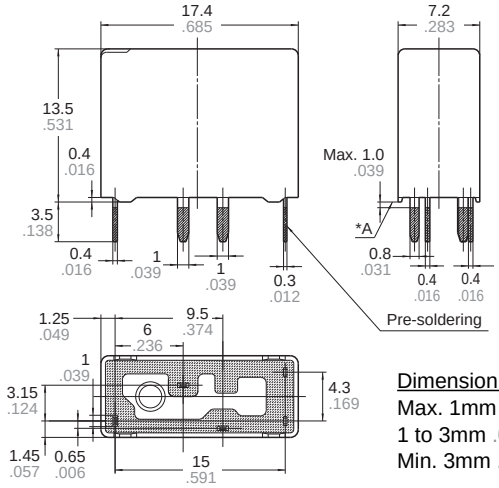
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

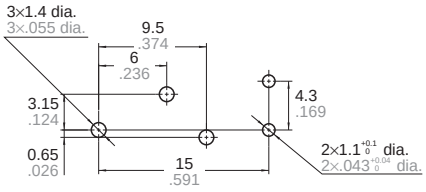
3. Slim 1c type

CAD Data

External dimensions

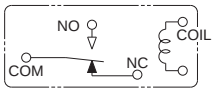


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

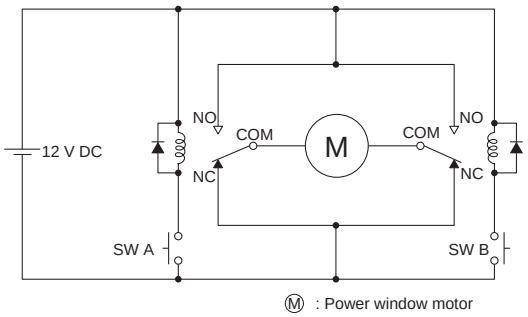


Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

Forward/reverse control circuits of DC motor for power windows



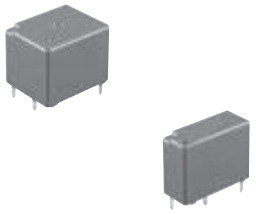
Ⓜ : Power window motor

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

HIGH CARRYING CURRENT TYPE SMALL & SLIM AUTOMOTIVE RELAY

CT RELAYS (ACTP)
<POWER TYPE>



FEATURES

- **Maximum carrying current of 35A made possible through using the same size as the company's CT relays**
- **Plastic sealed type**

TYPICAL APPLICATIONS

- **Power windows**
- **Auto door lock**
- **Power sunroof**
- **Powered seats**
- **Slide door closers, etc. (for DC motor forward/reverse control circuits)**

ORDERING INFORMATION

ACT P ☐ ☐

P: Power type

Contact arrangement
1: 1 Form C
2: 1 Form C×2 (8 terminal)
5: 1 Form C×2 (10 terminal)

Coil voltage, DC
12: 12 V

TYPES

Contact arrangement	Coil voltage	Part No.
1 Form C	12 V DC	ACTP112
1 Form C × 2 (8 terminals type)		ACTP212
1 Form C × 2 (10 terminals type)		ACTP512

Standard packing; 1 Form C: Carton (tube) 30pcs. Case 1,500pcs.; 1 Form C × 2: Carton (tube) 30pcs. Case 900pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 7.2 V DC (Initial)	Min. 1.0 V DC (Initial)	83.3 mA	144Ω	1,000 mW	10 to 16V DC

Note: Other pick-up voltage types are also available. Please contact us for details.

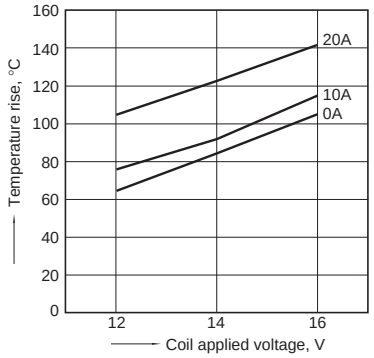
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form C × 2, 1 Form C
	Contact resistance (Initial)		N.O.: Typ 7mΩ, N.C.: Typ 10mΩ (By voltage drop 6V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 30 A 14V DC, N.C.: 10 A 14V DC
	Max. carrying current (14V DC)*3		N.O.: 40 A for 2 minutes, 25 A for 1 hour at 20°C 68°F, 35 A for 2 minutes, 20 A for 1 hour at 85°C 185°F
	Nominal operating power		1,000 mW
	Min. switching capacity (resistive load)*1		1 A 14V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical		<Resistive load> Min. 5×10^4 (at nominal switching capacity, operating frequency: 1s ON, 9s OFF) <Motor load> N.O. side: Min. 10^5 (at Inrush 30A, Steady 7A 14 V DC), Min. 5×10^4 (at 30A 14 V DC motor lock condition) N.C. side: Min. 10^5 (at brake current 15A 14 V DC) (operating frequency: 0.5s ON, 9.5s OFF)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C –40°F to +185°F, Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		6 cpm (at nominal switching capacity)
Mass			Twin type: approx. 8 g .28 oz, 1 Form C type: approx. 4 g .14 oz

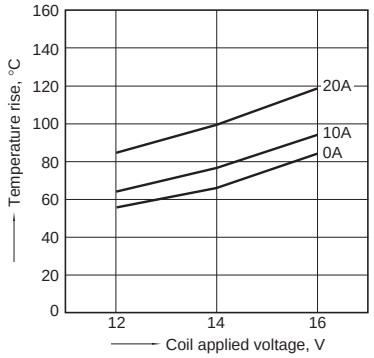
Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
∗ If the relay is used continuously for long periods of time with coils on both sides in an energized condition, breakdown might occur due to abnormal heating depending on the carrying condition. Therefore, please inquire when using with a circuit that causes an energized condition on both sides simultaneously.

REFERENCE DATA

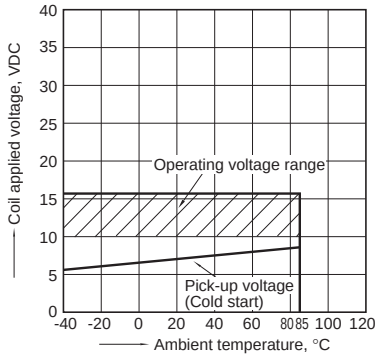
1-(1). Coil temperature rise (at room temperature)
Sample: ACTP212, 3pcs.
Contact carrying current: 0A, 10A, 20A
Ambient temperature: Room temperature



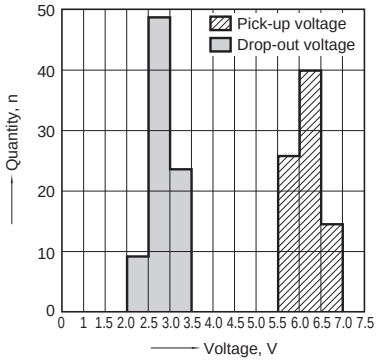
1-(2). Coil temperature rise (at 85°C 185°F)
Sample: ACTP212, 3pcs.
Contact carrying current: 0A, 10A, 20A
Ambient temperature: 85°C 185°F



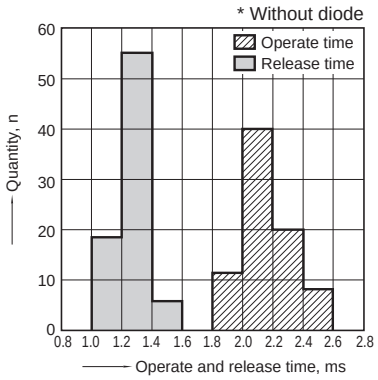
2. Ambient temperature and operating voltage range



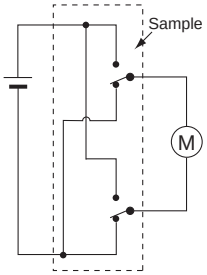
3. Distribution of pick-up and drop-out voltage
Sample: ACTP212, 80pcs.



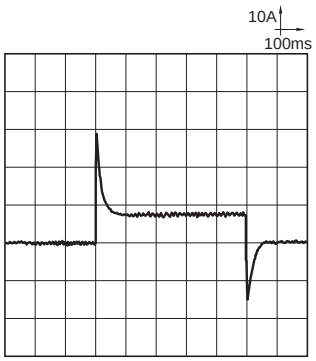
4. Distribution of operate and release time
Sample: ACTP212, 80pcs.



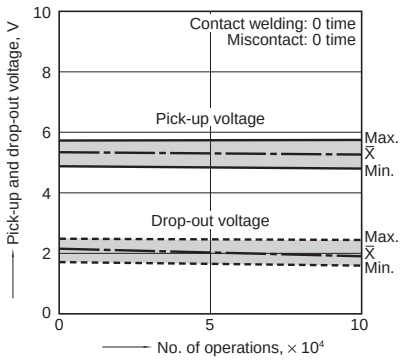
5. Electrical life test (Motor free)
Sample: ACTP212, 3pcs.
Load: Inrush 30A, Steady 7A
Brake current: 15A 14V DC,
Power window motor actual load
Operating frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature
Circuit:



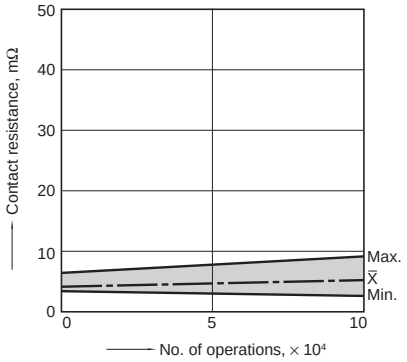
Load current waveform
Inrush current: 30A, Steady current: 7A
Brake current: 15A



Change of pick-up and drop-out voltage



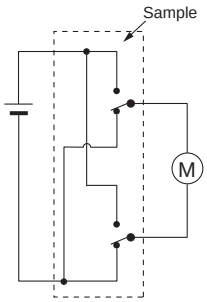
Change of contact resistance



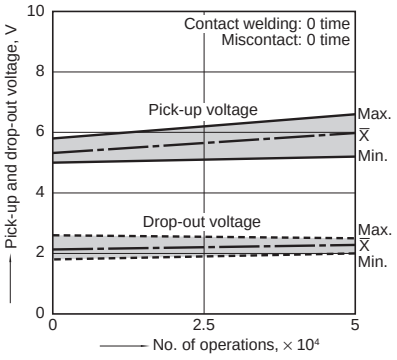
6. Electrical life test (Motor lock)

Sample: ACTP212, 3pcs.
Load: 30A 14V DC
Operating frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature

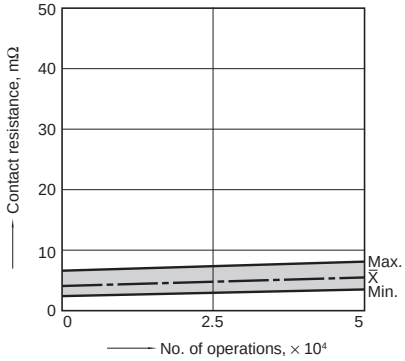
Circuit:



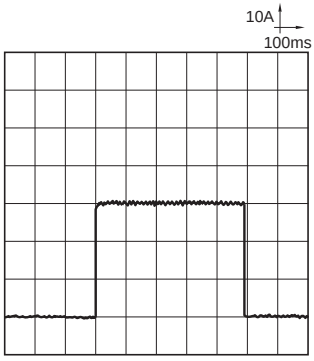
Change of pick-up and drop-out voltage



Change of contact resistance



Load current waveform



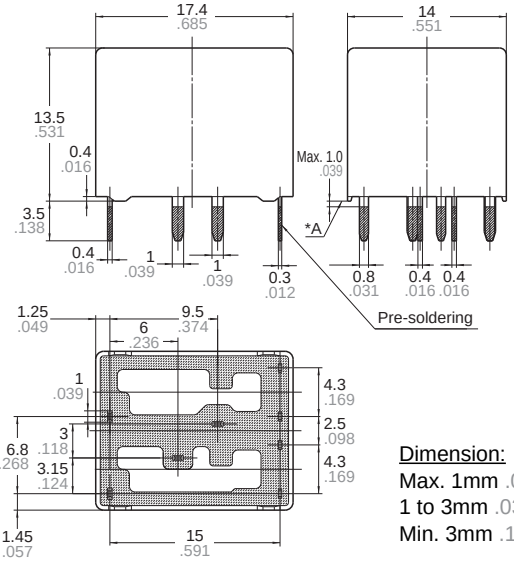
DIMENSIONS (mm inch)

Download CAD Data from our Web site.

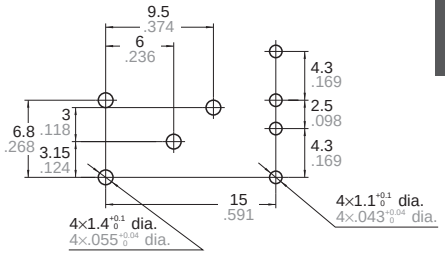
1. Twin type (8 terminals)

CAD Data

External dimensions

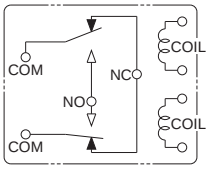


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



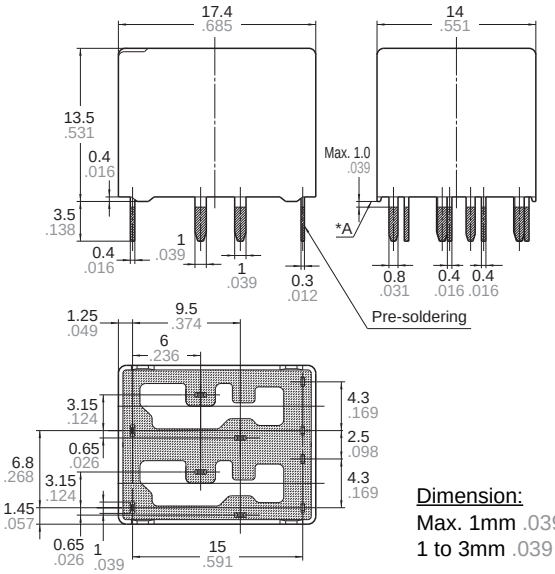
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

Automotive

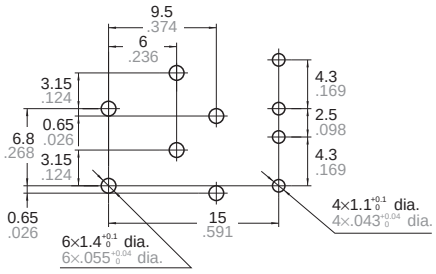
2. Twin type (10 terminals) External dimensions CAD Data

CAD Data



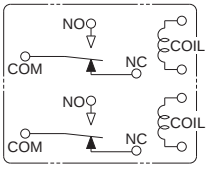
Intervals between terminals is measured at A surface level.

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

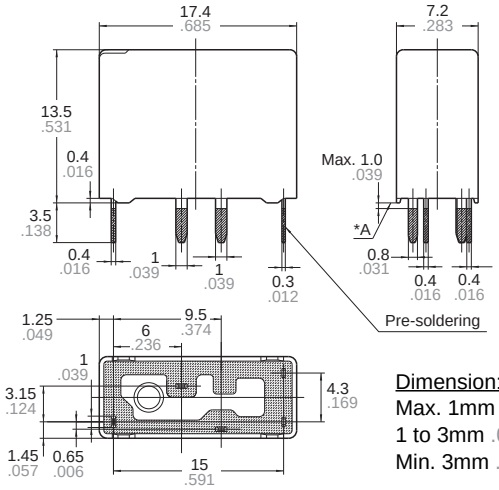


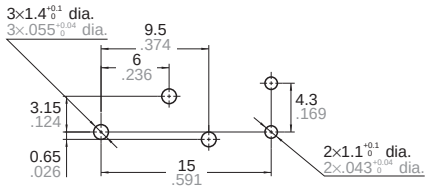
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering.

3. Single type (1 Form C) External dimensions

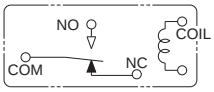
PC board pattern (Bottom view)





Tolerance: ±0.1 ±.004

Schematic (Bottom view)



Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

COMPACT SIZE AUTOMOTIVE RELAY

JJ-M RELAYS

FEATURES

- **Compact size**
- **Perfect for automobile electrical systems**
  Over 2×10^5 openings possible with a 14 V DC motor load, an inrush current of 25 A, and steady state current of 5 A. (N.O. side)
- **Standard terminal pitch employed**
  The terminal array used is identical to that used in small automotive relays.
- **Plastic sealed type.**
  Plastically sealed for automatic cleaning.
- **Line-up of 1 Form A and 1 Form C**

TYPICAL APPLICATIONS

- **Power windows**
- **Auto door lock**
- **Electrically powered sun roof**
- **Electrically powered mirror**
- **Cornerring lamp, etc.**

ORDERING INFORMATION

JJM ☐ - ☐

Contact arrangement
1: 1 Form C
1a: 1 Form A

Coil voltage (DC)
12 V

Automotive

TYPES

Contact arrangement	Coil voltage	Part No.
1 Form A	12 V DC	JJM1a-12V
1 Form C	12 V DC	JJM1-12V

Standard packing; Carton (tube): 50 pcs.; Case: 1,000 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 7.2 V DC (Initial)	Min. 1.0 V DC (Initial)	53.3 mA	225Ω	640 mW	10 to 16V DC

Note: Other pick-up voltage types are also available. Please contact us for details.

2. Specifications

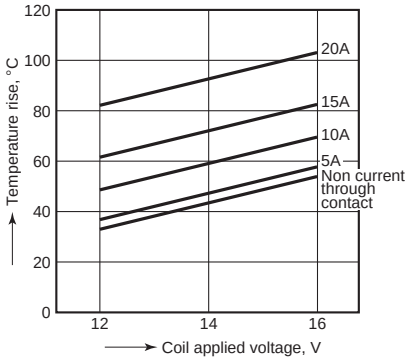
Characteristics	Item		Specifications	
Contact	Arrangement		1 Form A	1 Form C
	Contact resistance (Initial)		Typ 5mΩ (By voltage drop 6V DC 1A)	
	Contact material		Ag alloy (Cadmium free)	
Rating	Nominal switching capacity (resistive load)		20 A 14V DC	N.O.: 20 A 14V DC N.C.: 10 A 14V DC
	Max. carrying current (12V DC)*3		N.O.: 35 A (at 20°C 68°F for 2 minutes), 25 A (at 20°C 68°F for 1 hour), 30 A (at 85°C 185°F for 2 minutes), 20 A (at 85°C 185°F for 1 hour)	
	Nominal operating power		640 mW	
	Min. switching capacity (resistive load)*1		1 A 12V DC	
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as “Break down voltage” section)	
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)	
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)	
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)	
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)	
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)	
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)	
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)	
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours	
Expected life	Mechanical		Min. 10^7 (at 120 cpm)	
	Electrical		<Resistive load> Min. 10^5 (at nominal switching capacity) (operating frequency: 1s ON, 9s OFF) <Motor load> Min. 2×10^5 (at Inrush 25A, Steady 5A 14 V DC) Min. 5×10^4 (at 20A 14 V DC motor lock) (operating frequency: 0.5s ON, 9.5s OFF)	<Resistive load> N.O.: Min. 10^5 (at nominal switching capacity) N.C.: Min. 10^5 (at nominal switching capacity) (operating frequency: 1s ON, 9s OFF) <Motor load> N.O.: Min. 2×10^5 (at Inrush 25A, Steady 5A 14 V DC), Min. 5×10^4 (at 20A 14 V DC motor lock) N.C.: Min. 2×10^5 (at 20A 14 V DC brake currect) (operating frequency: 0.5s ON, 9.5s OFF)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C –40°F to +185°F, Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)	
	Max. operating speed		6 cpm (at nominal switching capacity)	
Mass			Approx. 5g .176 oz	

Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.

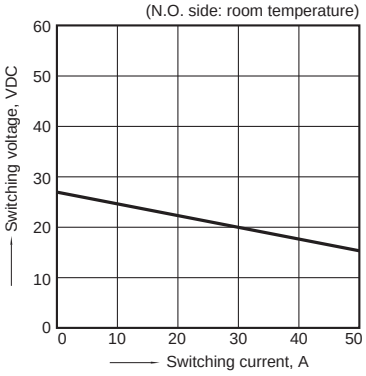
REFERENCE DATA

1. Coil temperature rise

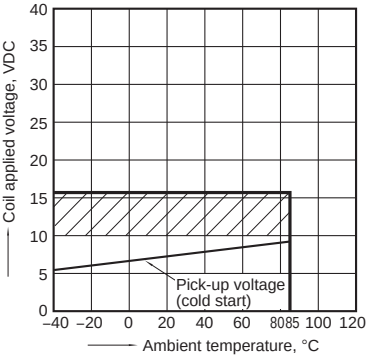
Sample: JJM1-12V, 6pcs
Point measured: Inside the coil
Contact current: Non current through contact, 5A, 10A, 15A, 20A
Resistance method, ambient temperature 85°C 185°F



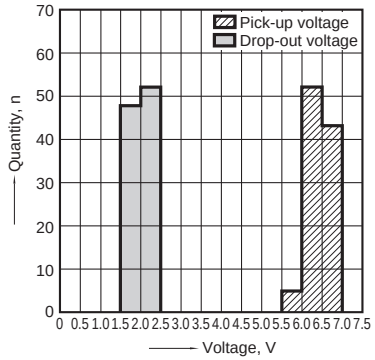
2. Max. switching capability (Resistive load, initial)



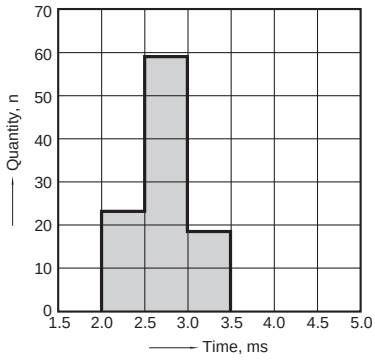
3. Ambient temperature and operating voltage range



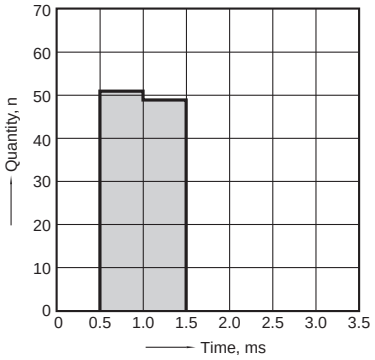
4. Distribution of pick-up and drop-out voltage
Sample: JJM1-12V, 100pcs



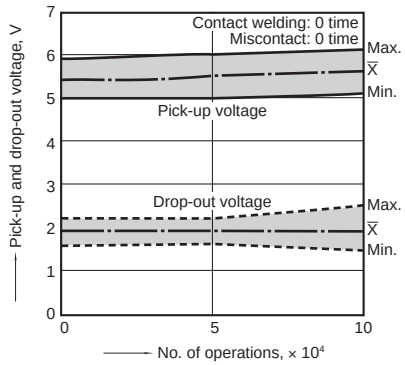
5. Distribution of operate time
Sample: JJM1-12V, 100pcs



6. Distribution of release time
Sample: JJM1-12V, 100pcs
* Without diode

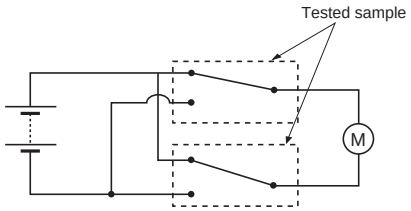


7-(1). Electrical life test (at resistive load)
Sample: JJM1-12V
Quantity: n = 6 (NC = 3, NO = 3)
Load: Resisitive load (NC side: 10A 14 V DC, NO side: 20 A 14 V DC); Operating frequency: ON 1s, OFF 9s
Ambient temperature: Room temperature

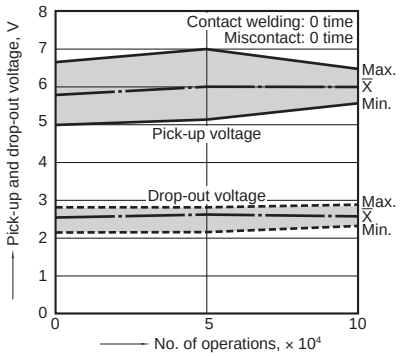


7-(2). Electrical life test (Motor free)
Sample: JJM1-12V, 6pcs.
Load: Inrush 25A, Steady 5A, Brake current 18A 14V DC, Power window motor load (Free condition).
Operating frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature

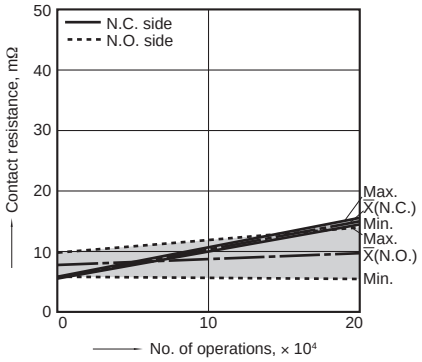
Circuit :



Change of pick-up and drop-out voltage

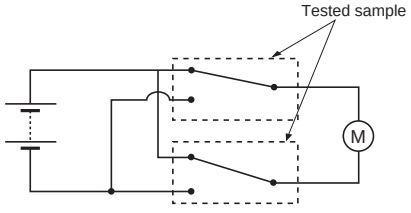


Change of contact resistance

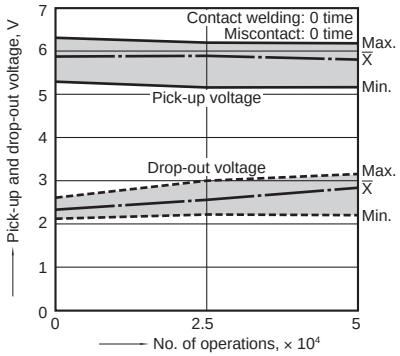


7-(3). Electrical life test (Motor lock)
Sample: JJM1-12V, 6pcs.
Load: 20A, 14VDC,
Power window motor actual load (lock condition).
Operating frequency: ON 1s, OFF 5s
Ambient temperature: Room temperature

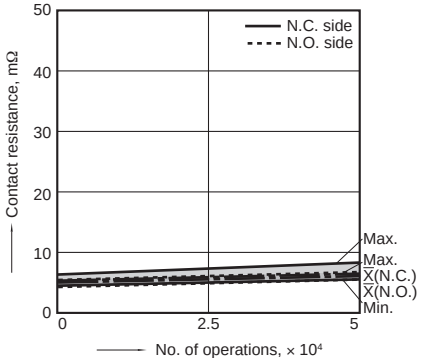
Circuit :



Change of pick-up and drop-out voltage



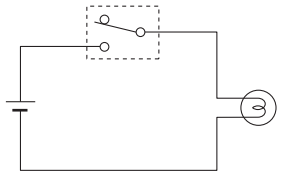
Change of contact resistance



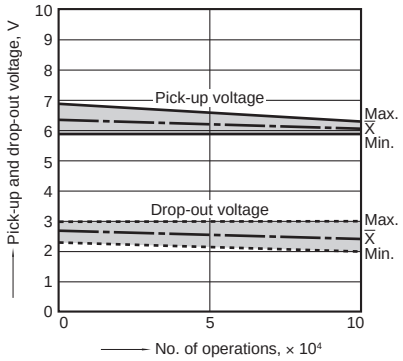
Automotive

7-(4). Electrical life test (Lamp load)
Sample: JJM1-12V, 6pcs.
Load: 27W+21W, steady min. 4A, Lamp actual load
Operating frequency: ON 2s, OFF 13s
Ambient temperature: Room temperature

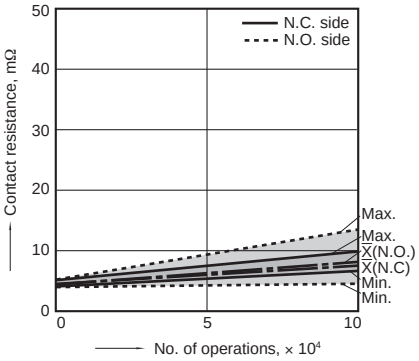
Circuit :



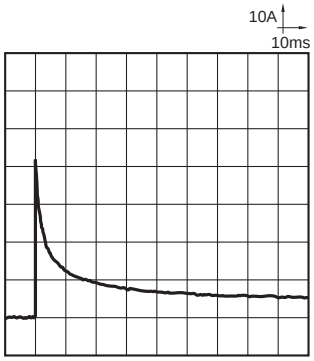
Change of pick-up and drop-out voltage



Change of contact resistance



Load current waveform
Inrush current: 42A, Steady current: 4.4A

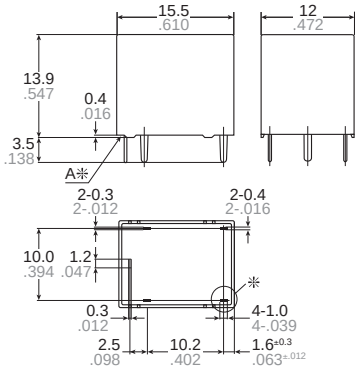


DIMENSIONS (mm inch)

Download CAD Data from our Web site.

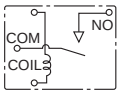
CAD Data

External dimensions

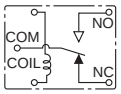


Schematic (Bottom view)

1a

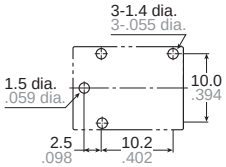


1c

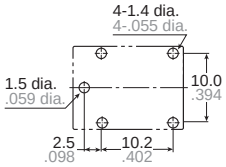


PC board pattern (Bottom view)

1a



1c



* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

Tolerance: ±0.1 ±.004

Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Note: ∗ Marked terminal is only for 1 Form C type

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

DOUBLE MAKE CONTACT AUTOMOTIVE RELAY

JJ-M RELAYS (AJJM)
(Double make type)

FEATURES

• Small size
The smallest double make type relay
12.0(W)×15.5(L)×13.9(H) mm
.472(W)×.610(L)×.547(H) inch

• Pattern design simplification
Simplified pattern design is possible because, while double make construction is employed, the external COM terminal is single.

• Standard terminal pitch employed
The terminal array used is identical to that used in JJM relays(1c type).

• Plastic sealed type
Plastically sealed for automotive cleaning.

TYPICAL APPLICATIONS

Car alarm system flashing lamp etc.

TYPES

Contact arrangement	Coil voltage	Part No.
Double make contact	12 V DC	AJJM831

Standard packing; Carton (tube): 50 pcs.; Case: 1,000 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 6.9 V DC (Initial)	Min. 1.0V DC (Initial)	83.3 mA	144Ω	1,000 mW	10 to 16V DC

Note: Other pick-up voltage types are also available. Please contact us for details.

2. Specifications

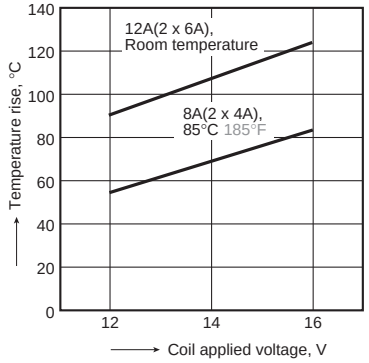
Characteristics	Item		Specifications
Contact	Arrangement		Double make contact
	Contact resistance (Initial)		Typ10mΩ (By voltage drop 6V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (lamp load)		12A 14V DC (at 2 × 6A)
	Max. carrying current (12V DC)*3		2 × 6 A at 20°C 68°F, 2 × 4 A at 85°C 185°F
	Nominal operating power		1,000 mW
	Min. switching capacity (resistive load)*1		1A 12V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical		<Lamp load> Min. 10^5 [21W × 6 lamps (2 × 3 lamps) at 14 V DC, operating frequency: 1s ON, 14s OFF]
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C –40°F to +185°F, Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature), Air pressure: 86k Pa to 106k Pa
Mass			Approx. 5g .176 oz

Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.

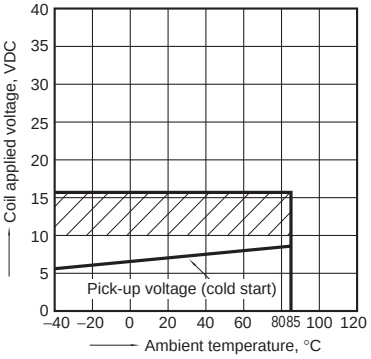
REFERENCE DATA

1. Coil temperature rise

Sample: AJJM831, 6pcs.
Point measured: Inside the coil
Contact carrying current: 2 × 6A, 2 × 4A
Ambient temperature: Room temperature, 85°C 185°F

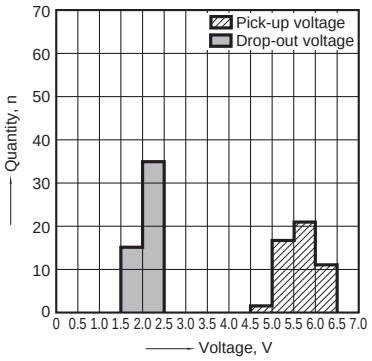


2. Ambient temperature and operating voltage range



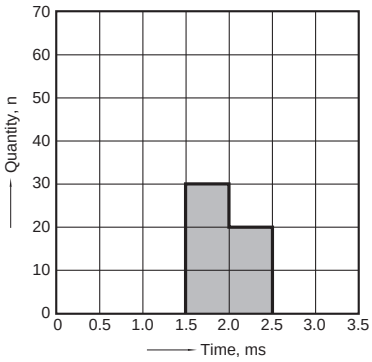
3. Distribution of pick-up and drop-out voltage

Sample: AJJM831, 50pcs.



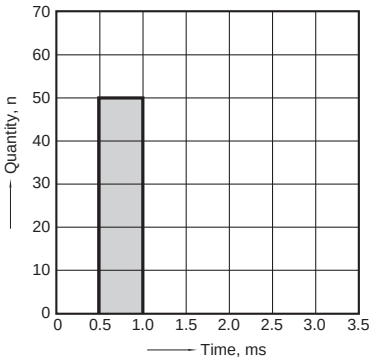
4. Distribution of operate time

Sample: AJJM831, 50pcs.



5. Distribution of release time

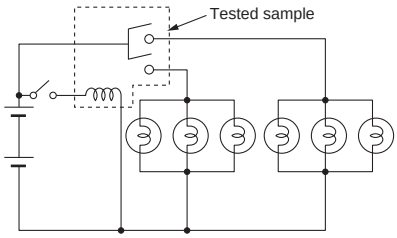
Sample: AJJM831, 50pcs.
* Without diode



6. Electrical life test (Lamp load)

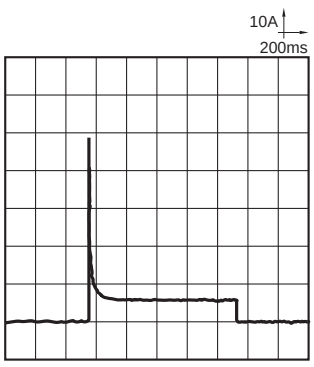
Sample: AJJM831, 6pcs.
Load: 6 × 21W, inrush 48A, steady 5.5A
Operating frequency: (ON 1s, OFF 14s)
Ambient temperature: Room temperature

Circuit:

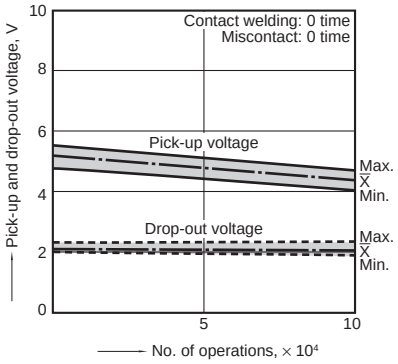


Load current waveform

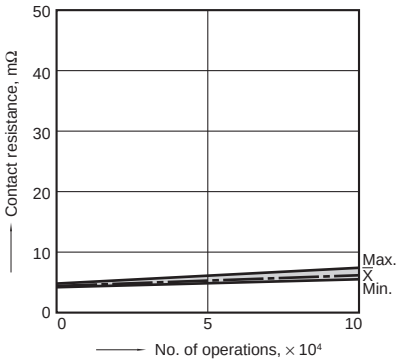
Current value per contact on one side
Inrush current: 48A, Steady current: 5.5A



Change of pick-up and drop-out voltage



Change of contact resistance

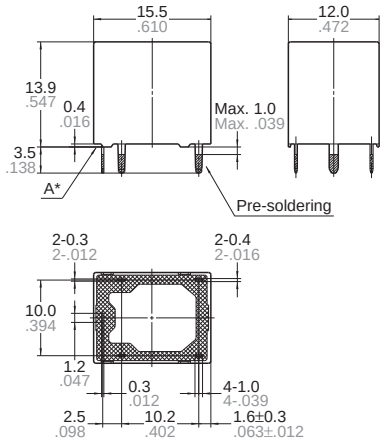


DIMENSIONS (mm inch)

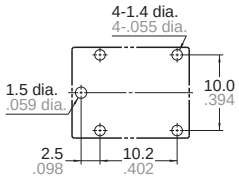
Download CAD Data from our Web site.

CAD Data

External dimensions

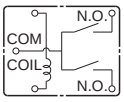


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

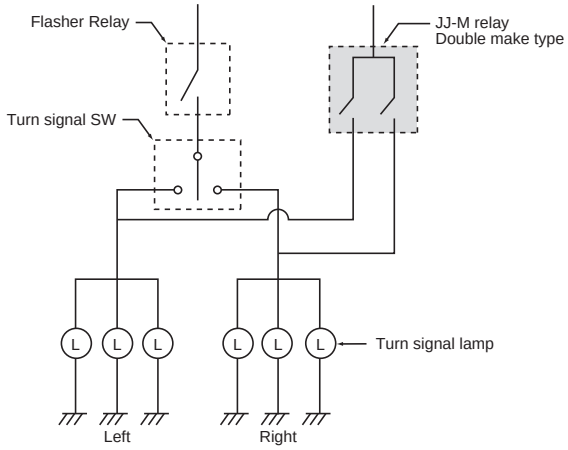


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

Control circuit for turn signal lights (security system)



For Cautions for Use, see Relay Technical Information (page 166).

Automotive

Panasonic
ideas for life

1 FORM C AUTOMOTIVE SILENT RELAY

TA RELAYS (ACTA)

FEATURES

- **Designed for silence when mounted on PC board**
- **Flat type**
- **Sealed type**

TYPICAL APPLICATIONS

Intermittent wiper, Cruise control, Power windows, Auto door lock, Power supply of car stereo and car air-conditioner, Electrically powered seats, Electrically powered sunroof, etc.

ORDERING INFORMATION

ACTA ☐ ☐

Contact arrangement
2: 1 Form C

Coil resistance
2: 160Ω
3: 225Ω

TYPES

Contact arrangement	Nominal coil voltage	Coil resistance	Part No.
1 Form C	12V DC	160Ω	ACTA22
		225Ω	ACTA23

Standard packing; Carton (tube): 25 pcs.; Case: 1,000 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 6.5V DC (Initial)	Min. 0.8V DC (Initial)	75 mA	160Ω	900 mW	10 to 16V DC
	Max. 7.7V DC (Initial)	Min. 0.8V DC (Initial)	53.3 mA	225Ω	640 mW	

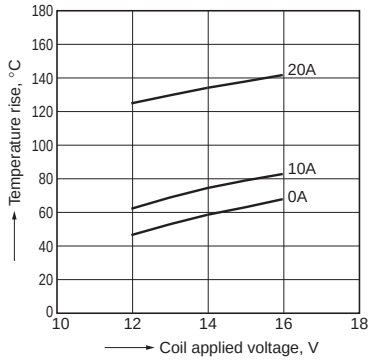
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form C
	Contact resistance (Initial)		N.O.: Typ5mΩ, N.C.: Typ6mΩ (By voltage drop 6V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 20A 14V DC, N.C.: 10A 14V DC
	Max. carrying current (12V DC initial)*3		25A for 3 minutes (at 20°C 68°F)
	Nominal operating power		900 mW (Pick-up voltage 6.5V DC type)
			640 mW (Pick-up voltage 7.7V DC type)
	Min. switching capacity (resistive load)*1		1A 14V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial) (without protective element)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical*4		<Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 1s ON, 9s OFF)
			<Motor load> Min. 10^5 (25 A 14V DC at motor lock condition), operating frequency: 0.5s ON, 9.5s OFF
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C –40°F to +185°F, Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
Mass			Approx. 8 g .28 oz

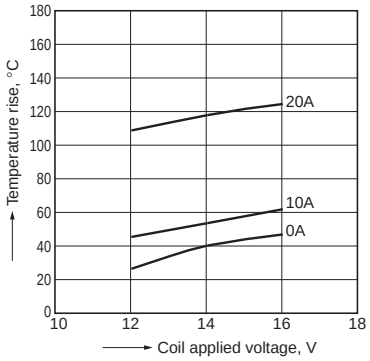
Notes:
*1.This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2.The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3.Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
*4.Do not use for lamp loads, electric discharge lamp loads, any other lamp loads and capacitor loads. Please contact us for details.

REFERENCE DATA

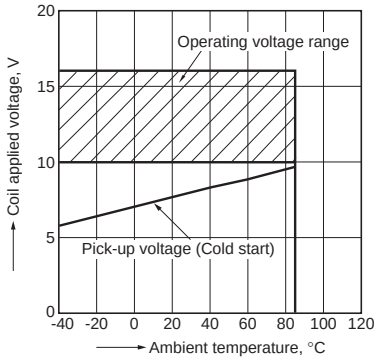
1.-(1) Coil temperature rise (at room temperature)
Sample: ACTA23, 3pcs.
Contact carrying current: 0A, 10A, 20A
Ambient temperature: Room temperature



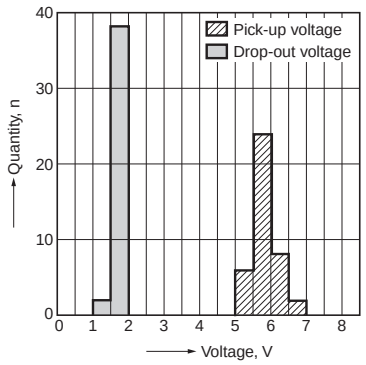
1.-(2) Coil temperature rise (at 85°C 185°F)
Sample: ACTA23, 3pcs.
Contact carrying current: 0A, 10A, 20A
Ambient temperature: 85°C 185°F



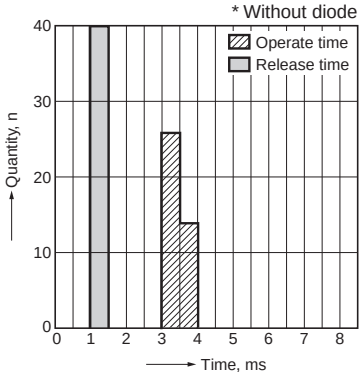
2. Ambient temperature and operating voltage range
Sample: ACTA23



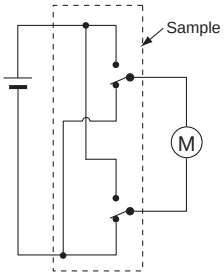
3. Distribution of pick-up and drop-out voltage
Sample: ACTA23, 40pcs.



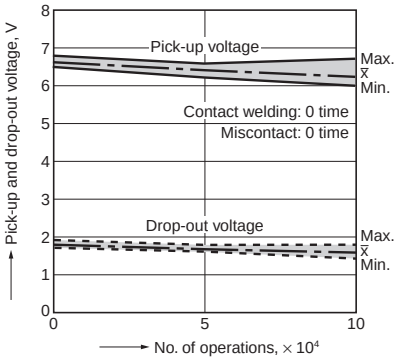
4. Distribution of operate and release time
Sample: ACTA23, 40pcs.



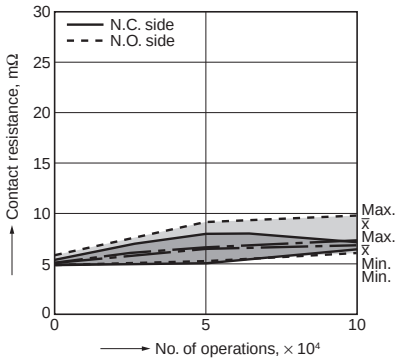
5.-(1) Electrical life test (Motor lock)
Sample: ACTA23, 3pcs.
Load: 25A 14V DC
Power window motor actual load (lock condition)
Operating frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature
Circuit:



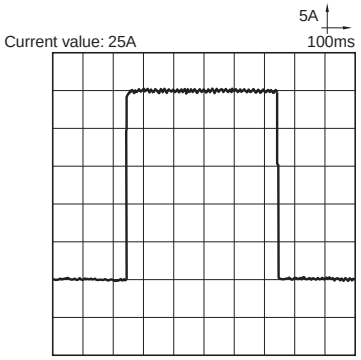
Change of pick-up and drop-out voltage



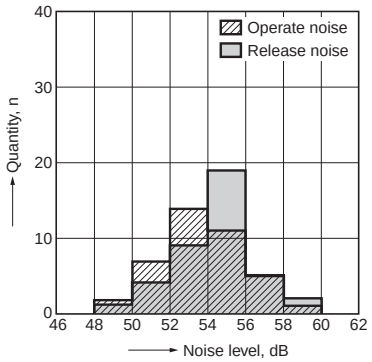
Change of contact resistance



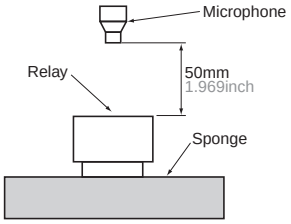
Load current waveform



6. Noise pressure characteristics

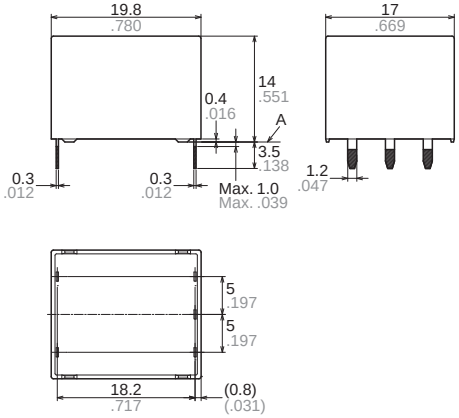


Measuring conditions
Sample: ACTA23, 40 pcs.
Equipment setting: “A” weighted, Impulse holding
Coil voltage: 12V DC
Coil connection device: Diode
Background noise: approx. 35dB

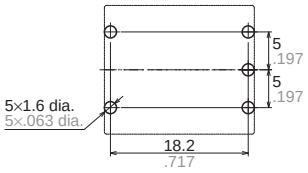


DIMENSIONS (mm inch)

External dimensions

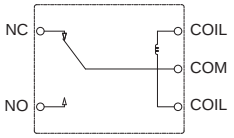


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



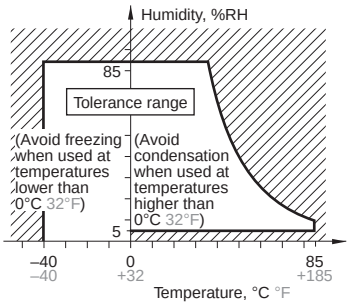
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

NOTES

Usage, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature: –40 to +85°C –40 to +185°F
(2) Humidity: 5 to 85% RH (Avoid freezing and condensation.)
(3) Atmospheric pressure: 86 to 106 kPa
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(Temperature and humidity range forusage, transport, and storage)



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

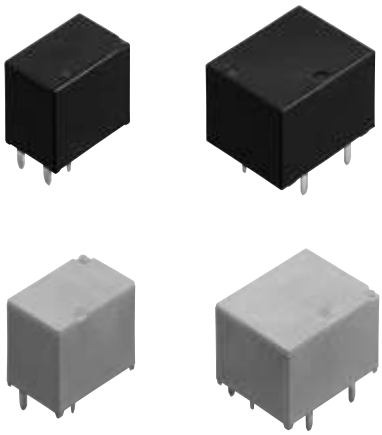
Automotive

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

MINIATURE PC BOARD, TWIN TYPE, 1 FORM C AUTOMOTIVE RELAY

TB RELAYS (ACTB)



FEATURES

- **Compact and high-capacity 25 A load switching**
- **Wide line-up**
- **Pin in Paste compatible model added**

TYPICAL APPLICATIONS

- **Power windows, Auto door lock, Electrically powered mirrors, Power sunroof, Powered seats, Lift gates and Slide door closers, etc. for DC motor forward/reverse control circuits**

ORDERING INFORMATION

ACTB □ □ □ □

Contact arrangement
1: 1 Form A
2: 1 Form C
3: 1 Form C × 2 (8 terminals type)
5: 1 Form C × 2 (10 terminals type)

Contact type
Nil: Standard type
L: Lamp control type

Heat resistance/Protective construction
Nil: Standard type/Sealed type
H: High heat-resistant type/Sealed type
R: Pin in Paste type/Flux tight type

Coil resistance
1: 100Ω
2: 160Ω
3: 225Ω

TYPES

Contact arrangement	Contact type	Coil resistance	Part No.		
			Heat resistance		
			Standard type	High heat-resistant type	Pin in Paste type
1 Form A	Standard type	100Ω	ACTB11	ACTB1H1	ACTB1R1
		160Ω	ACTB12	ACTB1H2	ACTB1R2
		225Ω	ACTB13	ACTB1H3	ACTB1R3
	Lamp control type	100Ω	ACTB1L1	ACTB1LH1	ACTB1LR1
		160Ω	ACTB1L2	ACTB1LH2	ACTB1LR2
		225Ω	ACTB1L3	ACTB1LH3	ACTB1LR3
1 Form C	Standard type	100Ω	ACTB21	ACTB2H1	ACTB2R1
		160Ω	ACTB22	ACTB2H2	ACTB2R2
		225Ω	ACTB23	ACTB2H3	ACTB2R3
	Lamp control type	100Ω	ACTB2L1	ACTB2LH1	ACTB2LR1
		160Ω	ACTB2L2	ACTB2LH2	ACTB2LR2
		225Ω	ACTB2L3	ACTB2LH3	ACTB2LR3
1 Form C × 2 (8 terminals type)	Standard type	100Ω	ACTB31	ACTB3H1	ACTB3R1
		160Ω	ACTB32	ACTB3H2	ACTB3R2
		225Ω	ACTB33	ACTB3H3	ACTB3R3
1 Form C × 2 (10 terminals type)	Standard type	100Ω	ACTB51	ACTB5H1	ACTB5R1
		160Ω	ACTB52	ACTB5H2	ACTB5R2
		225Ω	ACTB53	ACTB5H3	ACTB5R3
	Lamp control type	100Ω	ACTB5L1	ACTB5LH1	ACTB5LR1
		160Ω	ACTB5L2	ACTB5LH2	ACTB5LR2
		225Ω	ACTB5L3	ACTB5LH3	ACTB5LR3

Standard packing; Carton (tube): 50 pcs.; Case: 2,000 pcs. (1 Form C)
Carton (tube): 25 pcs.; Case: 1,000 pcs. (1 Form C × 2)

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 5.5V DC (Initial)	Min. 0.5V DC (Initial)	120 mA	100Ω	1,440 mW	10 to 16V DC
	Max. 6.5V DC (Initial)	Min. 0.8V DC (Initial)	75 mA	160Ω	900 mW	
	Max. 7.7V DC (Initial)	Min. 0.8V DC (Initial)	53.3 mA	225Ω	640 mW	

Note: Other pick-up voltage types are also available. Please contact us for details.

2. Specifications

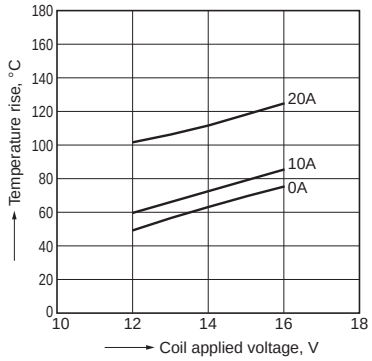
Characteristics	Item		Specifications
Contact	Arrangement		1 Form A, 1 Form C, 1 Form C × 2
	Contact resistance (Initial)		N.O.: Typ3mΩ, N.C.: Typ4mΩ (By voltage drop 6V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 20A 14V DC, N.C.: 10A 14V DC
	Max. carrying current (12V DC initial)*3		25A for 10 minutes (at 20°C 68°F)
	Nominal operating power		1,440 mW (Pick-up voltage 5.5V DC type)
			900 mW (Pick-up voltage 6.5V DC type)
			640 mW (Pick-up voltage 7.7V DC type)
	Min. switching capacity (resistive load)*1		1A 14V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial) (without protective element)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical		<Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 1s ON, 9s OFF)
			<Motor load> Min. 10^5 (25 A 14V DC at motor lock condition), operating frequency: 0.5s ON, 9.5s OFF
			<Lamp load>*4 Min. 10^5 (at 56 A (inrush), 8A (steady), 14 V DC), Operating frequency: 1s ON, 14s OFF Applies only to lamp control type
Conditions	Conditions for operation, transport and storage*2		Standard type Ambient temperature: –40°C to +85°C –40°F to +185°F, Humidity: 5% R.H. to 85% R.H. High heat-resistant/Pin in Paste type Ambient temperature: –40°C to +110°C –40°F to +230°F, Humidity: 2% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
Mass			Single type: approx. 5 g .176 oz, Twin type: approx. 9.5 g .335 oz

Notes:
*1.This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2.The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3.Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
*4.Part numbers for electric discharge lamp loads or any other lamp loads and for capacitor loads only consist of “ACTB∗L∗∗”.
When using the lamp control type, connect N.O. to the “+ (plus)” side. Please contact us for details.

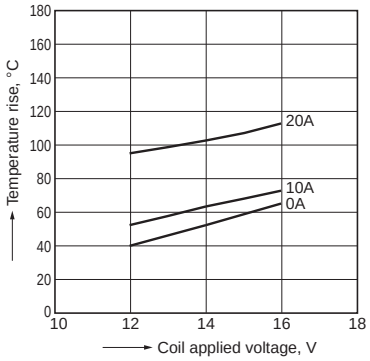
* If the relay is used continuously for long periods of time with coils on both sides in an energized condition, breakdown might occur due to abnormal heating depending on the carrying condition. Therefore, please inquire when using with a circuit that causes an energized condition on both sides simultaneously.

REFERENCE DATA

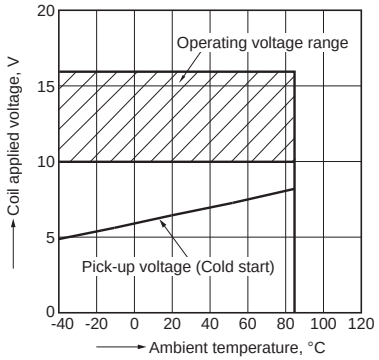
1.-(1) Coil temperature rise (at room temperature)
Sample: ACTB32, 3pcs.
Contact carrying current: 0A, 10A, 20A
Ambient temperature: Room temperature



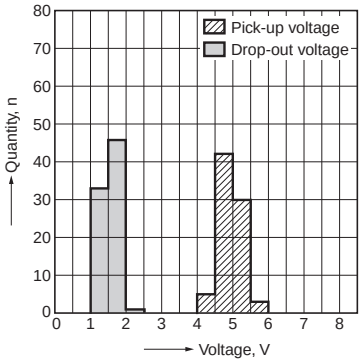
1.-(2) Coil temperature rise (at 85°C 185°F)
Sample: ACTB32, 3pcs.
Contact carrying current: 0A, 10A, 20A
Ambient temperature: 85°C 185°F



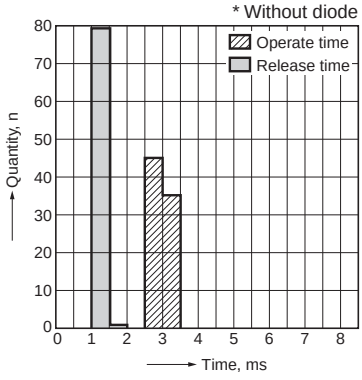
2. Ambient temperature and operating voltage range
Sample: ACTB32



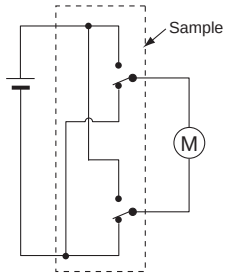
3. Distribution of pick-up and drop-out voltage
Sample: ACTB32, 40 × 2pcs.



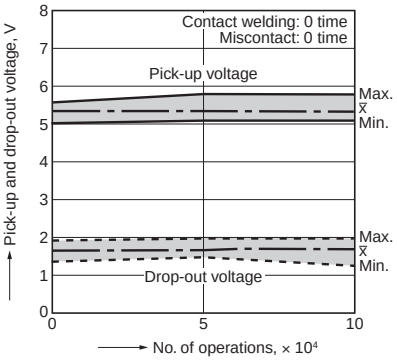
4. Distribution of operate and release time
Sample: ACTB32, 40 × 2pcs.



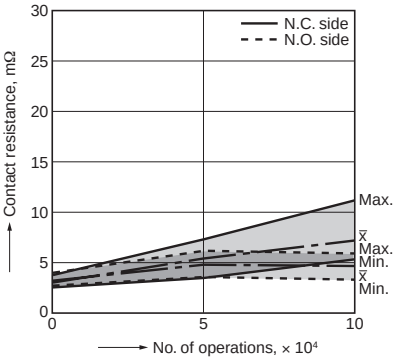
5.-(1) Electrical life test (Motor lock)
Sample: ACTB32, 3pcs.
Load: 25A 14V DC
Power window motor actual load (lock condition)
Operating frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature
Circuit:



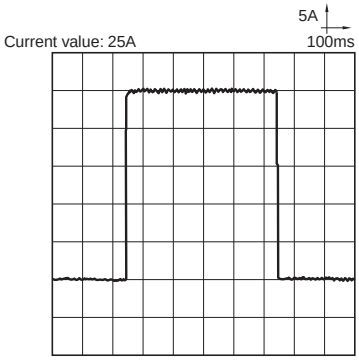
Change of pick-up and drop-out voltage



Change of contact resistance



Load current waveform

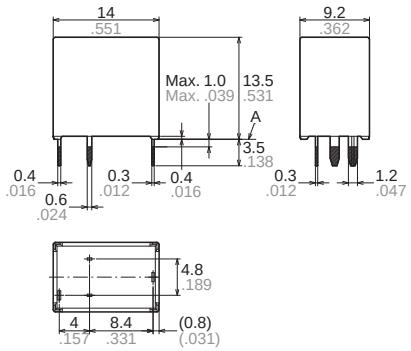


Automotive

DIMENSIONS (mm inch)

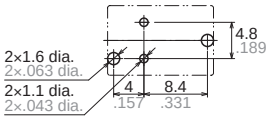
1 Form A type

External dimensions



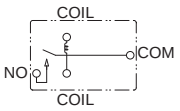
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

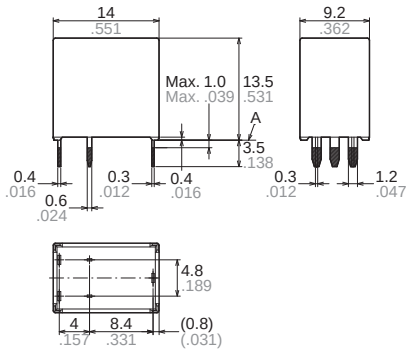


* The lamp control type has polarized contacts. Connect N.O. to the "+ (plus)" side.

* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

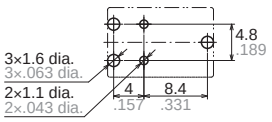
1 Form C type

External dimensions



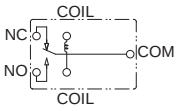
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

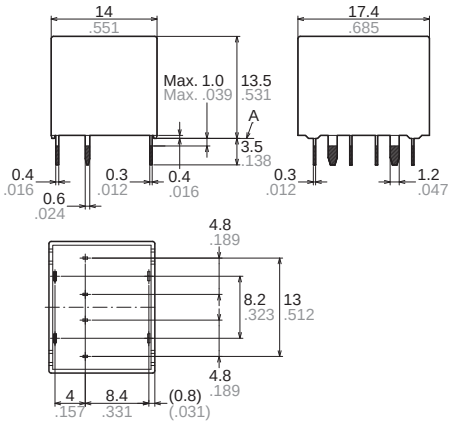


* The lamp control type has polarized contacts. Connect N.O. to the "+ (plus)" side.

* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

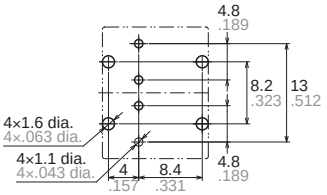
Twin type (8 terminals type)

External dimensions



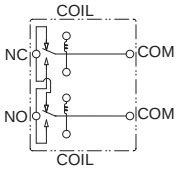
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



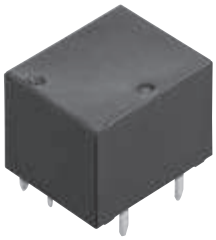
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

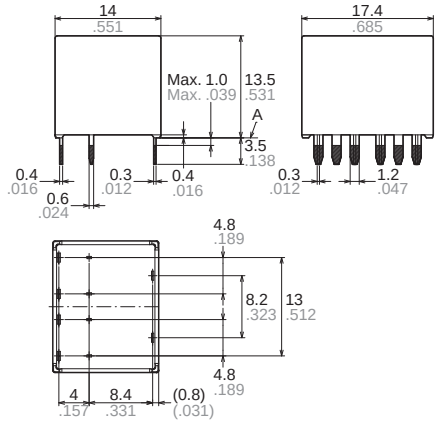


* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

Twin type (10 terminals type)

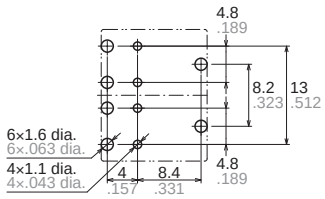


External dimensions



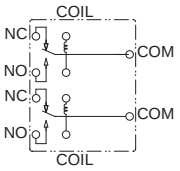
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

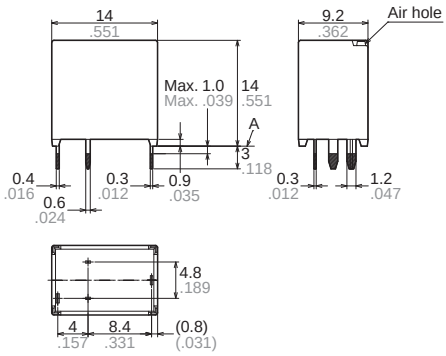


* The lamp control type has polarized contacts. Connect N.O. to the "+ (plus)" side.

* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

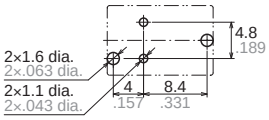
1 Form A type
Pin in Paste type

External dimensions



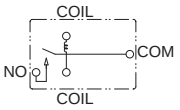
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

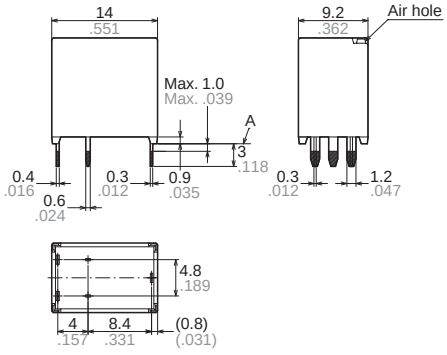


* The lamp control type has polarized contacts. Connect N.O. to the "+ (plus)" side.

* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

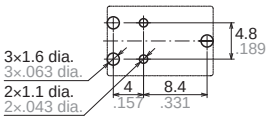
1 Form C type
Pin in Paste type

External dimensions



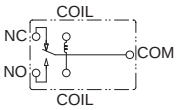
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



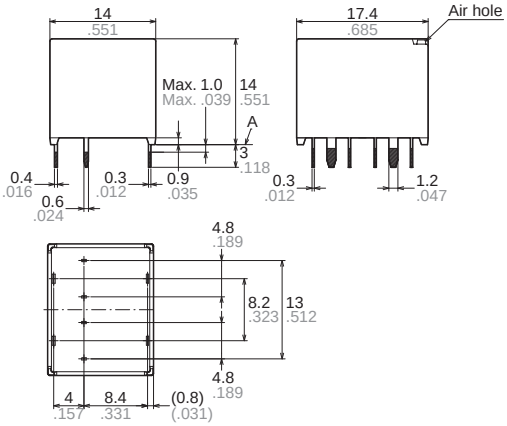
* The lamp control type has polarized contacts. Connect N.O. to the "+ (plus)" side.

* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

TB (ACTB)

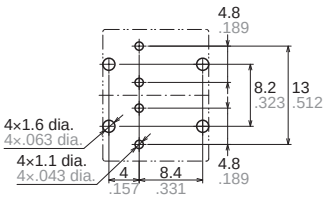
Twin type (8 terminals type)
Pin in Paste type

External dimensions



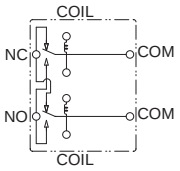
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

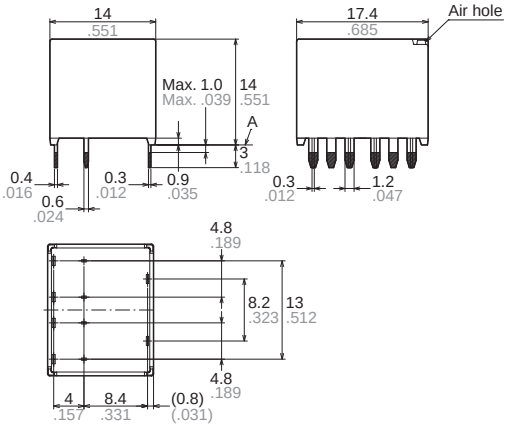
Schematic (Bottom view)



* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

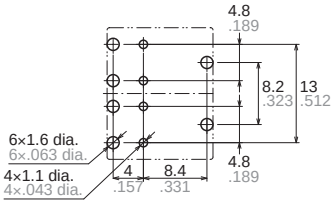
Twin type (10 terminals type)
Pin in Paste type

External dimensions



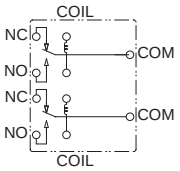
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



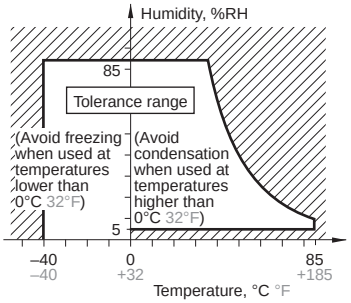
* The lamp control type has polarized contacts. Connect N.O. to the “+ (plus)” side.

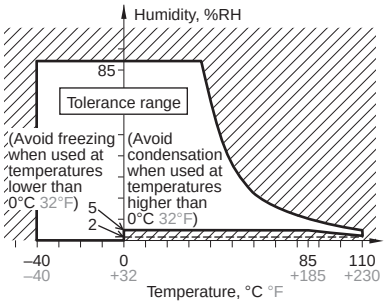
* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

NOTES

Usage, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature: –40 to +85°C –40 to +185°F (Standard type)
–40 to +110°C –40 to +230°F (High heat-resistant type/Pin in Paste type)
(2) Humidity: 2 to 85% RH (Avoid freezing and condensation.)
(3) Atmospheric pressure: 86 to 106 kPa
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(Temperature and humidity range for usage, transport, and storage)





For Cautions for Use, see Relay Technical Information (page 166).

Automotive

Panasonic
ideas for life

HIGH LOAD RELAY FOR SMART J/B

TC RELAYS (ACTC)

FEATURES

- **Large capacity switching despite small size. Can replace micro ISO terminal type relays.**
- **Latching type added**
- **Pin in Paste compatible model added**

TYPICAL APPLICATIONS

Head lamp, Fog lamp, Fan motor, EPS, Defogger, Seat heater, etc.

ORDERING INFORMATION

ACTC ☐ ☐ ☐

Contact arrangement/Operation function*
1: 1 Form A/Standard type
2: 1 Form C/Standard type
3: Double make contact 2 Form A/Standard type
6: Double make contact 2 Form A/2 coil latching type

Heat resistance/Protective construction
Nil: Standard type/Sealed type
H: High heat-resistant type/Sealed type
R: Pin in Paste type/Flux tight type

Coil resistance
1: 110Ω
2: 160Ω
3: 225Ω
6: 75Ω

Note:
*1 Form C/2 coil latching type is available upon request. Please consult our sales office.

TYPES

Contact arrangement/Operation function	Nominal coil voltage	Coil resistance	Part No.		
			Heat resistance		
			Standard type	High heat-resistant type	Pin in Paste type
1 Form A/Standard type	12V DC	110Ω	ACTC11	ACTC1H1	ACTC1R1
		160Ω	ACTC12	ACTC1H2	ACTC1R2
		225Ω	ACTC13	ACTC1H3	ACTC1R3
1 Form C/Standard type		110Ω	ACTC21	ACTC2H1	ACTC2R1
		160Ω	ACTC22	ACTC2H2	ACTC2R2
		225Ω	ACTC23	ACTC2H3	ACTC2R3
Double make contact 2 Form A/ Standard type		110Ω	ACTC31	ACTC3H1	ACTC3R1
		160Ω	ACTC32	ACTC3H2	ACTC3R2
Double make contact 2 Form A/ 2 coil latching type		75Ω	ACTC66	ACTC6H6	ACTC6R6

Standard packing; Carton (tube): 40 pcs.; Case: 800 pcs.

RATING

1. Coil data

1) Standard type

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 6.5V DC (Initial)	Min. 0.5V DC (Initial)	109 mA	110Ω	1,309 mW	10 to 16V DC
	Max. 7.0V DC (Initial)	Min. 0.5V DC (Initial)	75 mA	160Ω	900 mW	
	Max. 7.5V DC (Initial)	Min. 0.5V DC (Initial)	53.3 mA	225Ω	640 mW	

Note: Other pick-up voltage types are also available. Please contact us for details.

2) 2 coil latching type

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Nominal operating power (at 20°C 68°F)		Usable voltage range
			Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
12V DC	Max. 7.2V DC (Initial)	Max. 7.2V DC (Initial)	160 mA	160 mA	75Ω	75Ω	1,920 mW	1,920 mW	10 to 16V DC

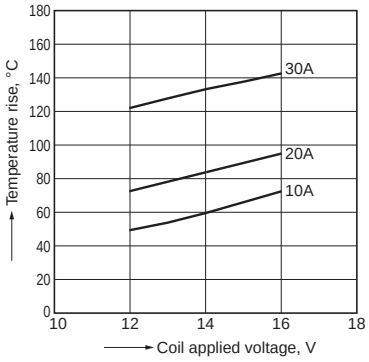
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form A, 1 Form C, Double make contact 2 Form A
	Contact resistance (Initial)		N.O.: Typ3mΩ, N.C.: Typ4mΩ (By voltage drop 6V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 30A 14V DC, N.C.: 15A 14V DC
	Max. carrying current (12V DC initial)*3		35A for 1 hour (at 20°C 68°F)
	Nominal operating power		1,309 mW (Pick-up voltage 6.5V DC type)
			900 mW (Pick-up voltage 7.0V DC type)
			640 mW (Pick-up voltage 7.5V DC type)
			1,920 mW (2 coil latching type)
	Min. switching capacity (resistive load)*1		1A 14V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time [Set time] (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time [Reset time] (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial) (without protective element)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
			Min. 10^6 (at 120 cpm) (2 coil latching type)
	Electrical		<Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 1s ON, 9s OFF)
			<Motor load> Min. 10^5 (30 A 14V DC at motor lock condition), operating frequency: 0.5s ON, 9.5s OFF
			<Lamp load> *4 Min. 2×10^5 (at 84 A (inrush), 12A (steady), 14 V DC), Operating frequency: 1s ON, 14s OFF
Conditions	Conditions for operation, transport and storage*2		Standard type Ambient temperature: –40°C to +85°C –40°F to +185°F, Humidity: 5% R.H. to 85% R.H. High heat-resistant/Pin in Paste type Ambient temperature: –40°C to +110°C –40°F to +230°F, Humidity: 2% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
Mass			Approx. 10 g .35 oz

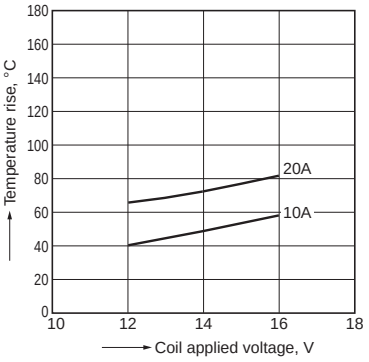
Notes:
*1.This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2.The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
Refer to “Usage ambient condition“ on page 139.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3.Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
*4.When using with an electric discharge lamp load or any other lamp load, or a capacitor load, connect COM to the “+ (plus)” side.

REFERENCE DATA

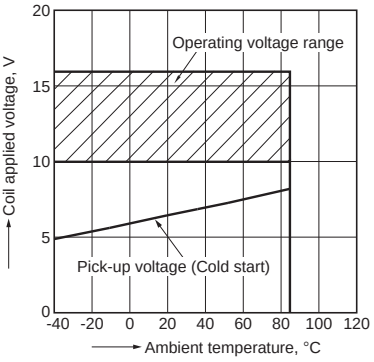
1.-(1) Coil temperature rise (at room temperature)
Sample: ACTC12, 3pcs.
Contact carrying current: 10A, 20A, 30A
Ambient temperature: Room temperature



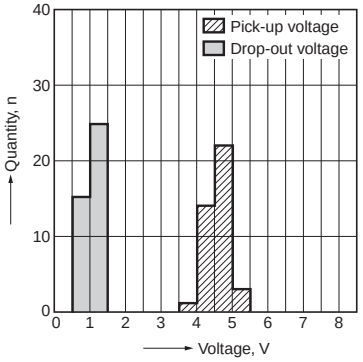
1.-(2) Coil temperature rise (at 85°C 185°F)
Sample: ACTC12, 3pcs.
Contact carrying current: 10A, 20A
Ambient temperature: 85°C 185°F



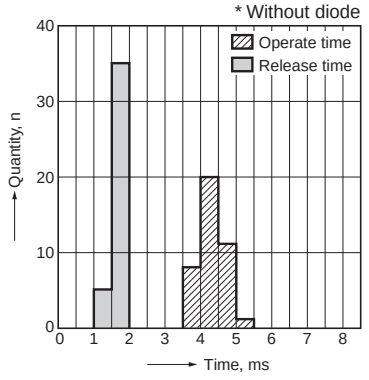
2. Ambient temperature and operating voltage range
Sample: ACTC12



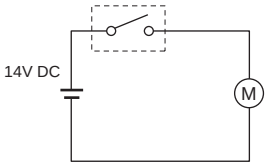
3. Distribution of pick-up and drop-out voltage
Sample: ACTC12, 40pcs.



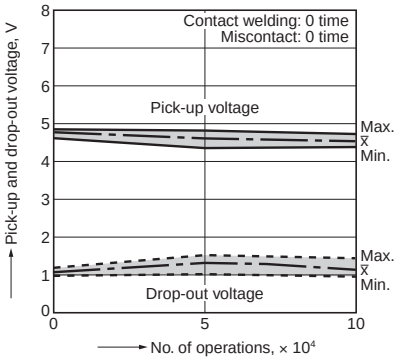
4. Distribution of operate and release time
Sample: ACTC12, 40pcs.



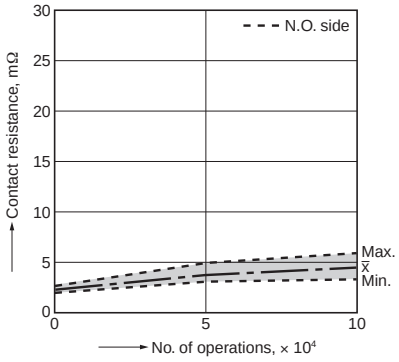
5.-(1) Electrical life test (Motor lock)
Sample: ACTC12, 6pcs.
Load: 30A 14V DC
Power window motor actual load (lock condition)
Operating frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature
Circuit:



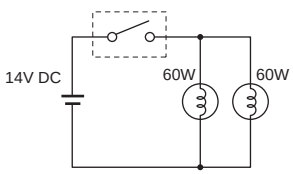
Change of pick-up and drop-out voltage



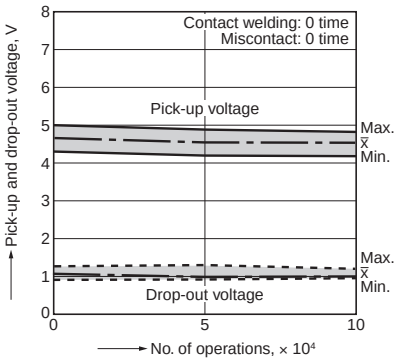
Change of contact resistance



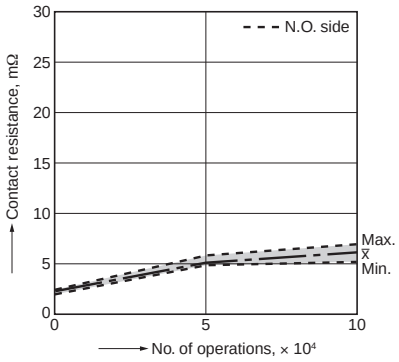
5.-(2) Electrical life test (Lamp load)
Sample: ACTC12, 6pcs.
Load: inrush: 84A/steady: 12A 14V DC
Operating frequency: ON 1s, OFF 14s
Ambient temperature: Room temperature
Circuit:



Change of pick-up and drop-out voltage



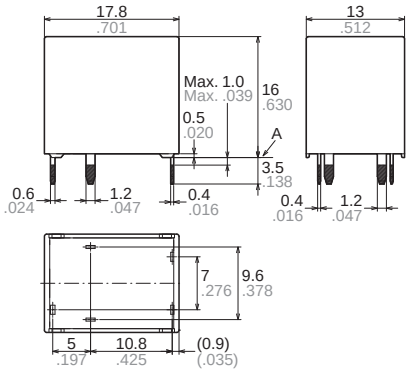
Change of contact resistance



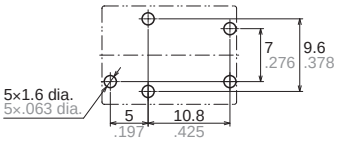
DIMENSIONS (mm inch)

1 Form A type/Standard type

External dimensions

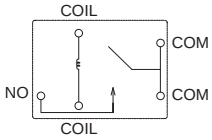


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



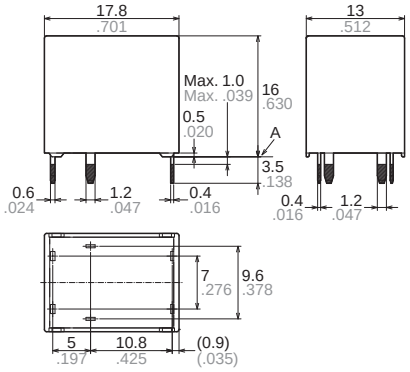
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* The lamp control type has polarized contacts. Connect COM to the "+ (plus)" side.

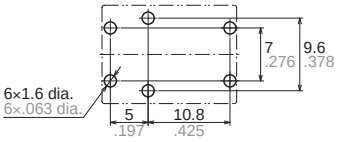
* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

1 Form C/Standard type

External dimensions

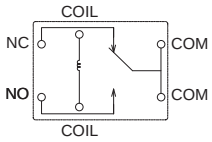


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



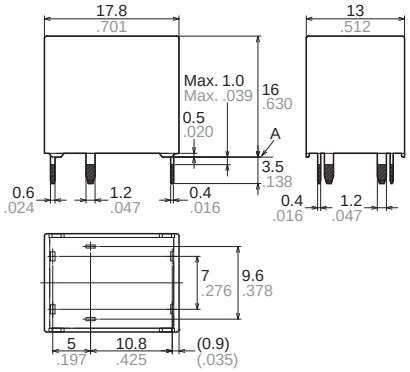
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* The lamp control type has polarized contacts. Connect COM to the "+ (plus)" side.

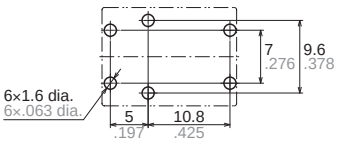
* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

Double make contact 2 Form A type/Standard type

External dimensions

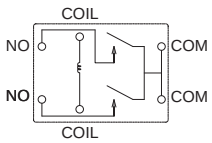


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



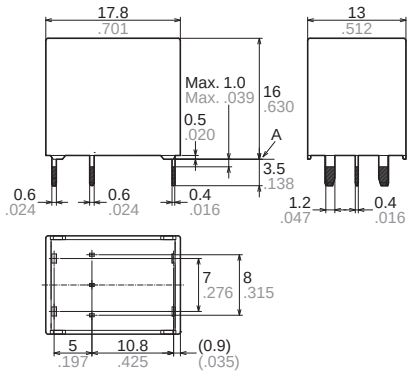
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* The lamp control type has polarized contacts. Connect COM to the "+ (plus)" side.

* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

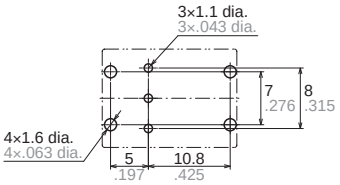
Double make contact 2 Form A type/2 coil latching type

External dimensions



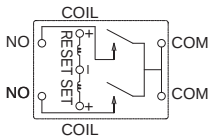
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

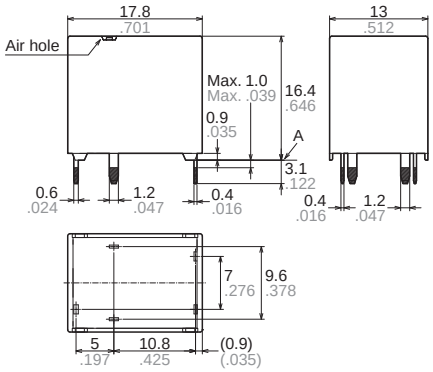


* The lamp control type has polarized contacts. Connect COM to the "+ (plus)" side.

* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

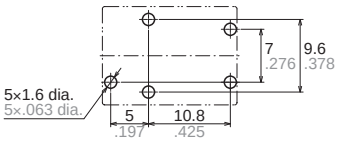
1 Form A/Standard type
Pin in Paste type

External dimensions



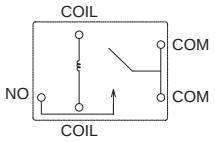
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

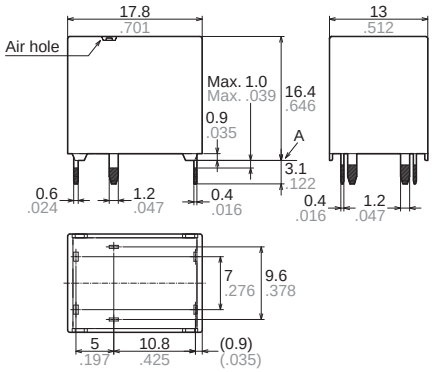


* The lamp control type has polarized contacts. Connect COM to the "+ (plus)" side.

* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

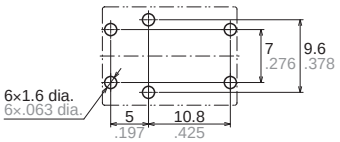
1 Form C/Standard type
Pin in Paste type

External dimensions



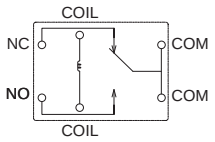
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

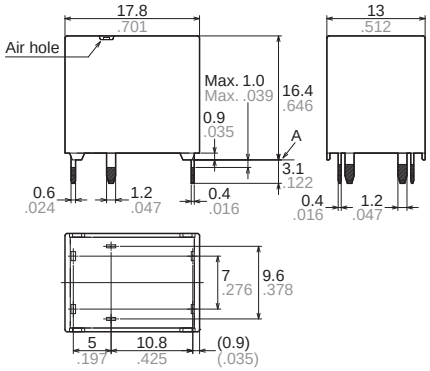


* The lamp control type has polarized contacts. Connect COM to the "+ (plus)" side.

* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

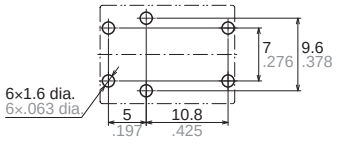
Double make contact 2 Form A type/Standard type
Pin in Paste type

External dimensions



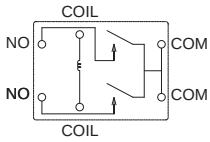
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

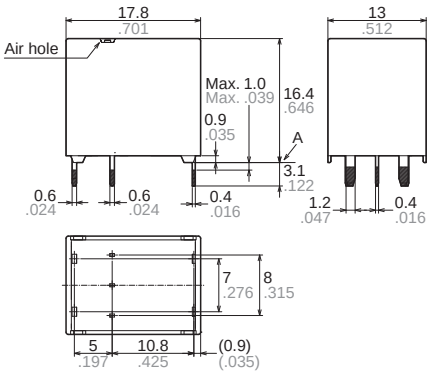


* The lamp control type has polarized contacts. Connect COM to the "+ (plus)" side.

* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

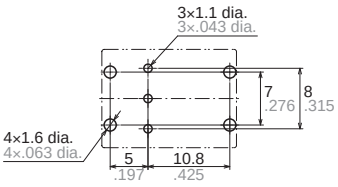
Double make contact 2 Form A type/2 coil latching type
Pin in Paste type

External dimensions



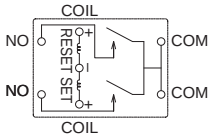
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



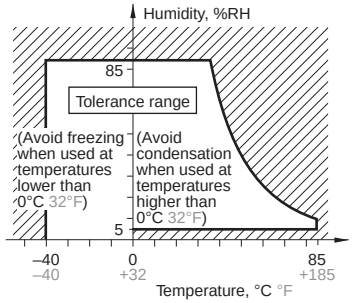
* The lamp control type has polarized contacts. Connect COM to the "+ (plus)" side.

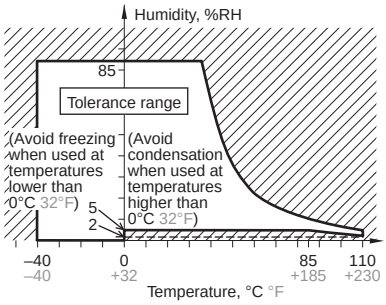
* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

NOTES

Usage, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature: –40 to +85°C –40 to +185°F (Standard type)
–40 to +110°C –40 to +230°F (High heat-resistant type/Pin in Paste type)
(2) Humidity: 2 to 85% RH (Avoid freezing and condensation.)
(3) Atmospheric pressure: 86 to 106 kPa
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(Temperature and humidity range for usage, transport, and storage)





PRECAUTIONS REGARDING LATCHING RELAYS

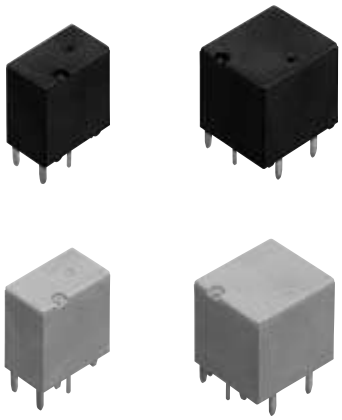
• Latching relays are shipped from the factory in the reset state. A shock to the relay during shipping or installation may cause it to change to the set state. Therefore, it is recommended that the relay be used in a circuit which initializes the relay to the required state (reset) whenever the power is turned on.
• Avoid impressing voltages to the set coil and reset coil at the same time.
• The positive “+” and negative “–” connections to the coil should be done as indicated on the wiring diagram. If connected incorrectly, it may malfunction or fail to operate.
• In order to set or reset a latch relay, as a guide, apply the square wave rated voltage for set time or five times or more of the reset time for each product and then verify operation again.

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

SUPER MINIATURE PC BOARD, TWIN TYPE, 1 FORM C AUTOMOTIVE RELAY

TE RELAYS (ACTE)



FEATURES

- **Smallest in its class**
- **Compact and high-capacity 25 A load switching**
- **Pin in Paste compatible model added**

TYPICAL APPLICATIONS

- **Power windows, Auto door lock, Electrically powered mirrors, Power sunroof, Powered seats, Lift gates and Slide door closers, etc. for DC motor forward/reverse control circuits**

ORDERING INFORMATION

ACTE □ □ □

Contact arrangement
2: 1 Form C
3: 1 Form C × 2 (8 terminals type)

Heat resistance/Protective construction
H: High heat-resistant type/Sealed type
R: Pin in Paste type/Flux tight type

Coil resistance
1: 110Ω
2: 160Ω
3: 220Ω

TYPES

Contact arrangement	Nominal coil voltage	Coil resistance	Part No.	
			Heat resistance	
			High heat-resistant type	Pin in Paste type
1 Form C	12V DC	110Ω	ACTE2H1	ACTE2R1
		160Ω	ACTE2H2	ACTE2R2
		220Ω	ACTE2H3	ACTE2R3
1 Form C × 2 (8 terminals type)		110Ω	ACTE3H1	ACTE3R1
		160Ω	ACTE3H2	ACTE3R2
		220Ω	ACTE3H3	ACTE3R3

Standard packing; Carton (tube): 50 pcs.; Case: 2,000 pcs. (1 Form C)
Carton (tube): 40 pcs.; Case: 2,000 pcs. (1 Form C × 2)

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 5.5V DC (Initial)	Min. 0.6V DC (Initial)	109 mA	110Ω	1,309 mW	10 to 16V DC
	Max. 6.5V DC (Initial)	Min. 0.8V DC (Initial)	75 mA	160Ω	900 mW	
	Max. 7.7V DC (Initial)	Min. 0.8V DC (Initial)	54.5 mA	220Ω	655 mW	

2. Specifications

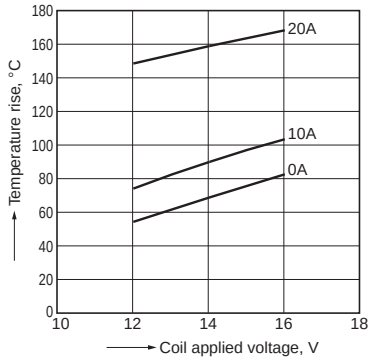
Characteristics	Item		Specifications
Contact	Arrangement		1 Form C, 1 Form C × 2
	Contact resistance (Initial)		N.O.: Typ4mΩ, N.C.: Typ5mΩ (By voltage drop 6V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 20A 14V DC, N.C.: 10A 14V DC
	Max. carrying current (12V DC initial)*3		25A for 2 minutes (at 20°C 68°F)
	Nominal operating power		1,309 mW (Pick-up voltage 5.5V DC type)
			900 mW (Pick-up voltage 6.5V DC type)
			655 mW (Pick-up voltage 7.7V DC type)
	Min. switching capacity (resistive load)*1		1A 14V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial) (without protective element)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical*4		<Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 1s ON, 9s OFF)
			<Motor load> Min. 10^5 (25 A 14V DC at motor lock condition), operating frequency: 0.5s ON, 9.5s OFF
Conditions	Conditions for operation, transport and storage*2		High heat-resistant/Pin in Paste type Ambient temperature: –40°C to +110°C –40°F to +230°F, Humidity: 2% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
Mass			Single type: approx. 3.5 g .12 oz, Twin type: approx. 6.5 g .23 oz

Notes:
*1.This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2.The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3.Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
*4.Do not use for lamp loads, electric discharge lamp loads, any other lamp loads and capacitor loads. Please contact us for details.

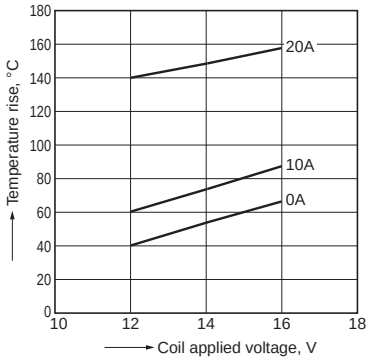
* If the relay is used continuously for long periods of time with coils on both sides in an energized condition, breakdown might occur due to abnormal heating depending on the carrying condition. Therefore, please inquire when using with a circuit that causes an energized condition on both sides simultaneously.

REFERENCE DATA

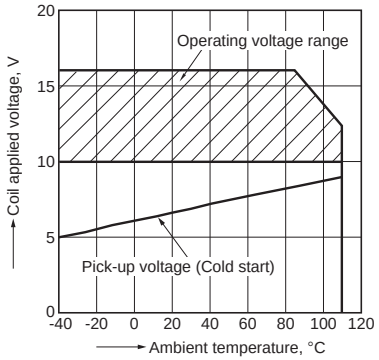
1.-(1) Coil temperature rise (at room temperature)
Sample: ACTE3H2, 3pcs.
Contact carrying current: 0A, 10A, 20A
Ambient temperature: Room temperature



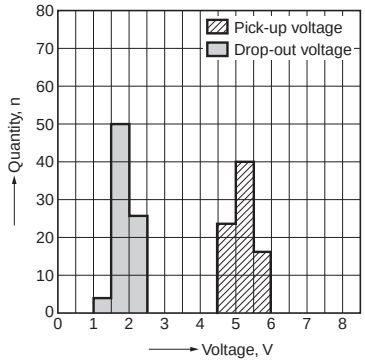
1.-(2) Coil temperature rise (at 110°C 230°F)
Sample: ACTE3H2, 3pcs.
Contact carrying current: 0A, 10A, 20A
Ambient temperature: 110°C 230°F



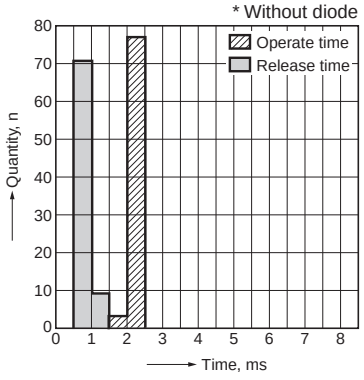
2. Ambient temperature and operating voltage range
Sample: ACTE3H2



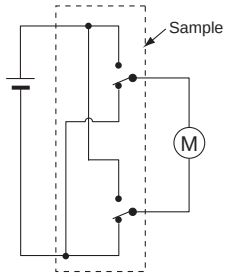
3. Distribution of pick-up and drop-out voltage
Sample: ACTE3H2, 40 × 2pcs.



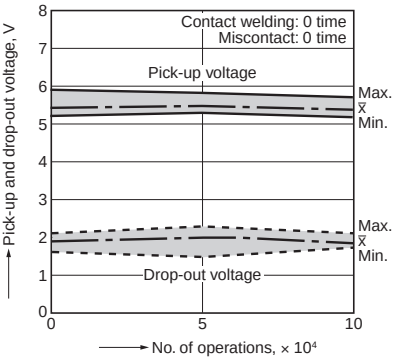
4. Distribution of operate and release time
Sample: ACTE3H2, 40 × 2pcs.



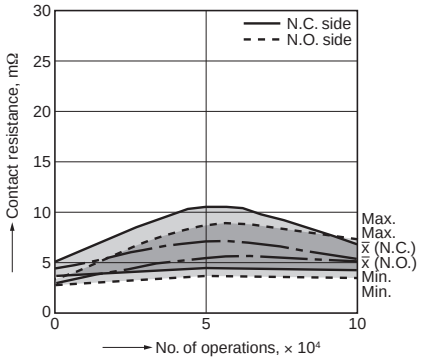
5.-(1) Electrical life test (Motor lock)
Sample: ACTE3H2, 3pcs.
Load: 25A 14V DC
Power window motor actual load (lock condition)
Operating frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature
Circuit:



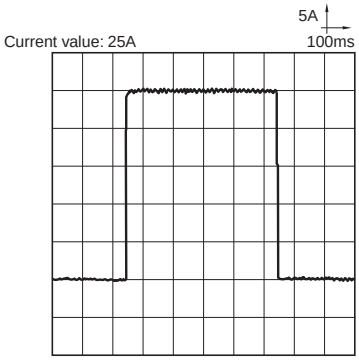
Change of pick-up and drop-out voltage



Change of contact resistance



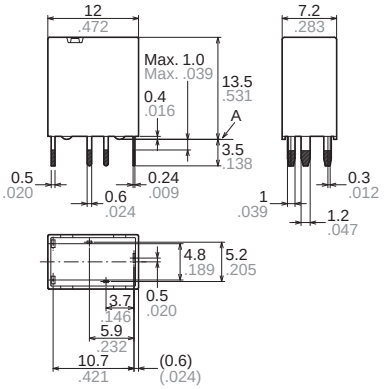
Load current waveform



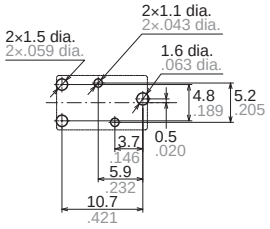
DIMENSIONS (mm inch)

1 Form C type

External dimensions

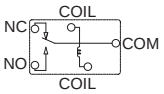


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

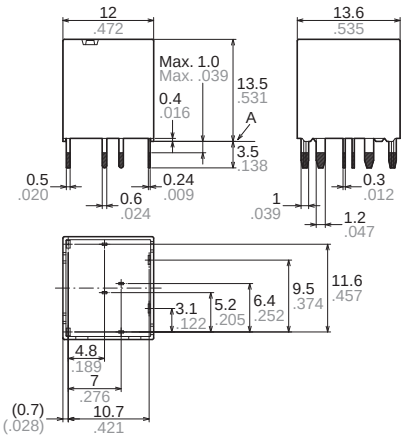


Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

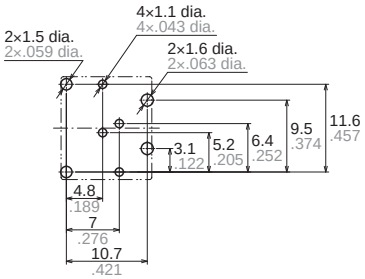
* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

Twin type (8 terminals type)

External dimensions

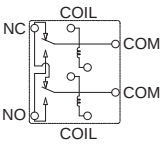


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

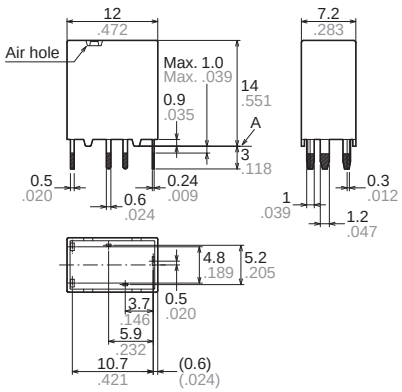


Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

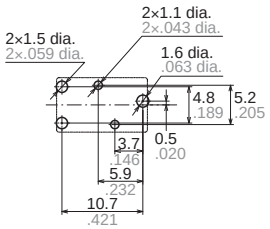
* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

1 Form C type
Pin in Paste type

External dimensions

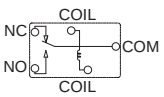


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

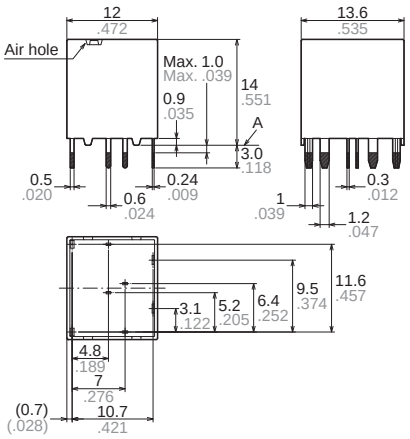


Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

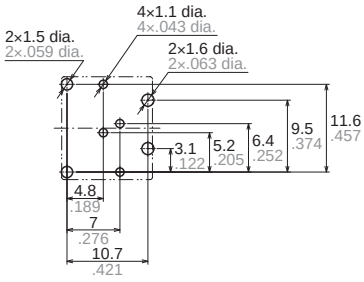
Twin type (8 terminals type)
Pin in Paste type

External dimensions



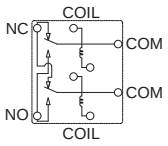
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

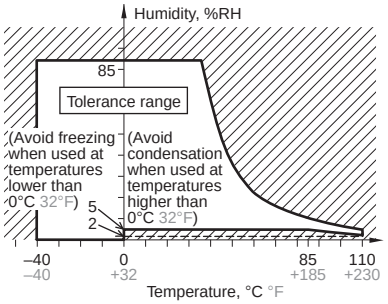


* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

NOTES

Usage, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature: –40 to +110°C –40 to +230°F (High heat-resistant type/Pin in Paste type)
(2) Humidity: 2 to 85% RH (Avoid freezing and condensation.)
(3) Atmospheric pressure: 86 to 106 kPa
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(Temperature and humidity range for usage, transport, and storage)



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

Automotive

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

HIGH LOAD RELAY FOR SMART J/B

TG RELAYS (ACTG)

FEATURES

- **Large capacity switching despite small size. Can replace micro ISO terminal type relays.**
- **Low operating power type**
- **Sealed type**

TYPICAL APPLICATIONS

Head lamp, Fog lamp, Fan motor, EPS, Defogger, Seat heater, etc.

ORDERING INFORMATION

ACTG ☐ ☐ ☐

Contact arrangement
1: 1 Form A
2: 1 Form C

Heat resistance/Protective construction
H: High heat-resistant type/Sealed type

Coil resistance
3: 225Ω
4: 320Ω

TYPES

Contact arrangement	Nominal coil voltage	Coil resistance	Part No.
			Heat resistance: High heat-resistant type
1 Form A	12V DC	225Ω	ACTG1H3
		320Ω	ACTG1H4
1 Form C		225Ω	ACTG2H3
		320Ω	ACTG2H4

Standard packing; Carton (tube): 40 pcs.; Case: 800 pcs.
Note: Please contact us for details about products other than those above.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 6.5V DC (Initial)	Min. 0.8V DC (Initial)	53.3 mA	225Ω	640 mW	10 to 16V DC
	Max. 7.0V DC (Initial)	Min. 0.8V DC (Initial)	37.5 mA	320Ω	450 mW	

Note: Other pick-up voltage types are also available. Please contact us for details.

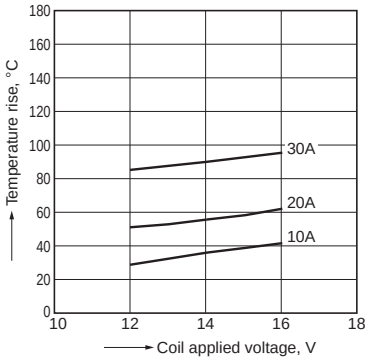
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form A, 1 Form C
	Contact resistance (Initial)		N.O.: Typ3mΩ, N.C.: Typ4mΩ (By voltage drop 6V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 30A 14V DC, N.C.: 15A 14V DC
	Max. carrying current (12V DC initial)*3		35A for 1 hour (at 20°C 68°F)
	Nominal operating power		640 mW (Pick-up voltage 6.5V DC type)
			450 mW (Pick-up voltage 7.0V DC type)
	Min. switching capacity (resistive load)*1		1A 14V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial) (without protective element)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical		<Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 1s ON, 9s OFF)
			<Motor load> Min. 10^5 (30 A 14V DC at motor lock condition), operating frequency: 0.5s ON, 9.5s OFF
			<Lamp load> Min. 2×10^5 (at 84 A (inrush), 12 A (steady), 14 V DC), Operating frequency: 1s ON, 14s OFF
Conditions	Conditions for operation, transport and storage*2		High heat-resistant type Ambient temperature: –40°C to +110°C –40°F to +230°F, Humidity: 2% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
Mass			Approx. 12 g .42 oz

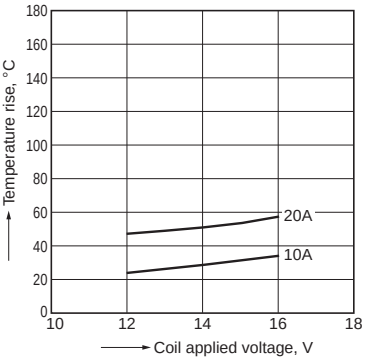
Notes:
*1.This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2.The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3.Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.

REFERENCE DATA

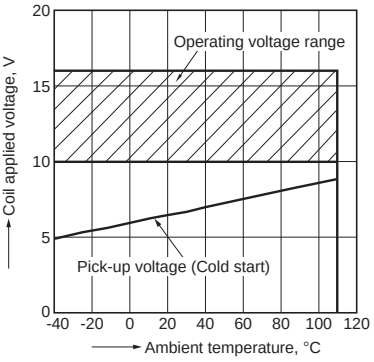
1.-(1) Coil temperature rise (at room temperature)
Sample: ACTG1H4, 3pcs.
Contact carrying current: 10A, 20A, 30A
Ambient temperature: Room temperature



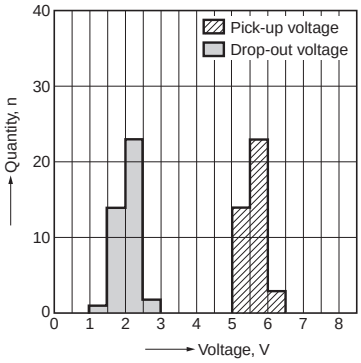
1.-(2) Coil temperature rise (at 110°C 230°F)
Sample: ACTG1H4, 3pcs.
Contact carrying current: 10A, 20A
Ambient temperature: 110°C 230°F



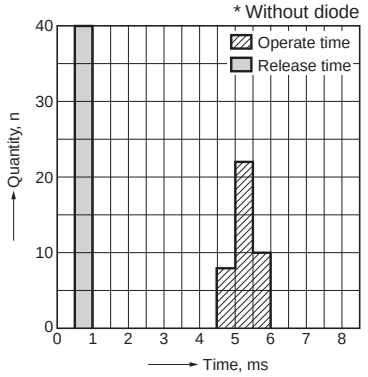
2. Ambient temperature and operating voltage range
Sample: ACTG1H4



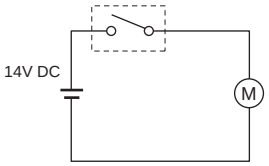
3. Distribution of pick-up and drop-out voltage
Sample: ACTG1H4, 40pcs.



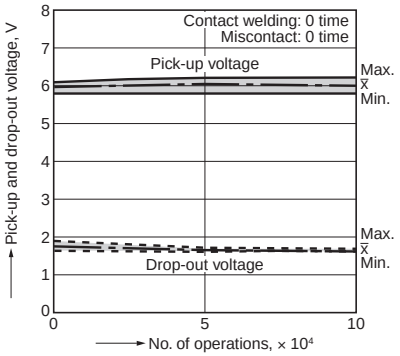
4. Distribution of operate and release time
Sample: ACTG1H4, 40pcs.



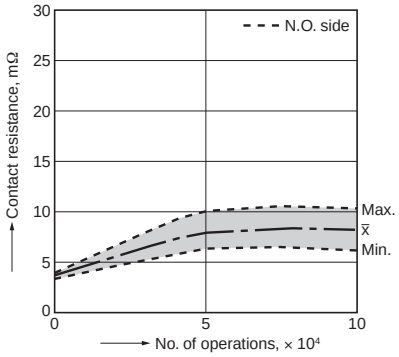
5.-(1) Electrical life test (Motor lock)
Sample: ACTG1H4, 6pcs.
Load: 30A 14V DC
Power window motor actual load (lock condition)
Operating frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature
Circuit:



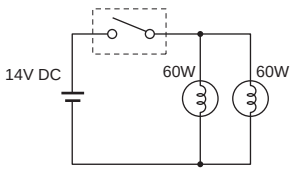
Change of pick-up and drop-out voltage



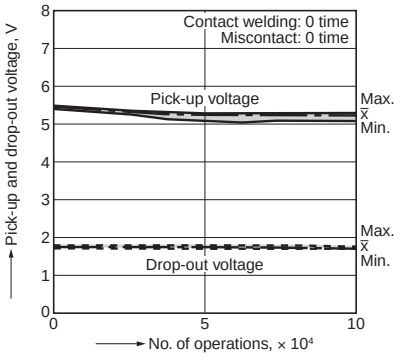
Change of contact resistance



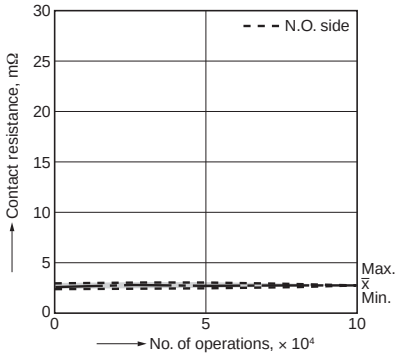
5.-(2) Electrical life test (Lamp load)
Sample: ACTG1H4, 6pcs.
Load: inrush: 84A/steady: 12A 14V DC
Operating frequency: ON 1s, OFF 14s
Ambient temperature: Room temperature
Circuit:



Change of pick-up and drop-out voltage



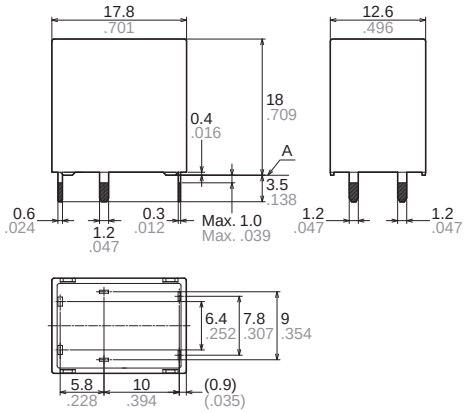
Change of contact resistance



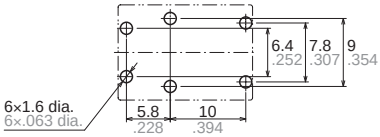
DIMENSIONS (mm inch)

1 Form A type

External dimensions

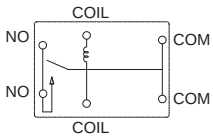


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

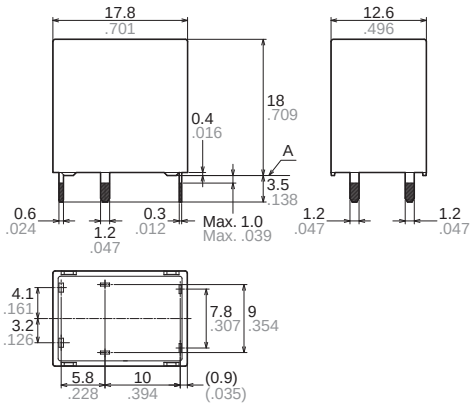


Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

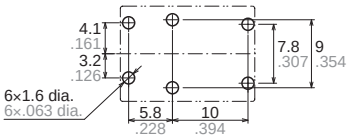
* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

1 Form C type

External dimensions

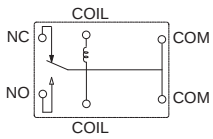


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

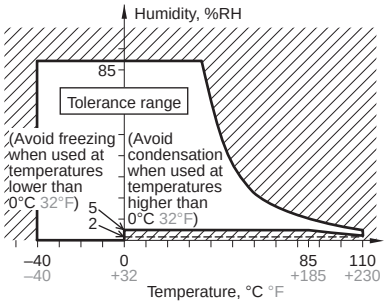
* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

Automotive

NOTES

Usage, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature: –40 to +110°C –40 to +230°F (High heat-resistant type)
(2) Humidity: 2 to 85% RH (Avoid freezing and condensation.)
(3) Atmospheric pressure: 86 to 106 kPa
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(Temperature and humidity range for usage, transport, and storage)

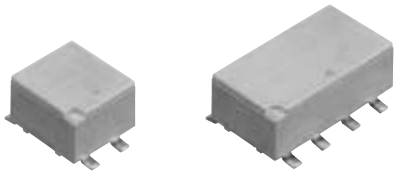


For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

MINIATURE PC BOARD, TWIN, 1 FORM C, SURFACE-MOUNT TYPE AUTOMOTIVE RELAY

TH RELAYS (ACTH)



FEATURES

- **Compact flat type**
  <Height> Surface-mount terminal type: 8.8 mm .346 inch
- **Compact and high-capacity 25 A load switching**

TYPICAL APPLICATIONS

- **Power windows, Auto door lock, Electrically powered mirrors, Power sunroof, Powered seats, Lift gates and Slide door closers, etc. for DC motor forward/reverse control circuits**

ORDERING INFORMATION

ACTH ☐ ☐ ☐

Contact arrangement/Terminal shape
5: 1 Form C/Surface-mount terminal type
6: 1 Form C × 2 (10 terminals type)/
Surface-mount terminal type

Heat resistance/Protective construction
B: Reflow type/Sealed type
R: Reflow type/Flux tight type

Coil resistance
2: 160Ω
3: 220Ω

TYPES

Surface-mount terminal type

Contact arrangement	Nominal coil voltage	Coil resistance	Part No.	
			Protective construction	
			Sealed type	Flux tight type
1 Form C	12V DC	160Ω	ACTH5B2	ACTH5R2
		220Ω	ACTH5B3	ACTH5R3
1 Form C × 2 (10 terminals type)		160Ω	ACTH6B2	ACTH6R2
		220Ω	ACTH6B3	ACTH6R3

Standard packing; 1 Form C Carton (tape and reel): 500 pcs.; Case: 2,000 pcs.
1 Form C × 2 Carton (tape and reel): 400 pcs.; Case: 2,000 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 6.5V DC (Initial)	Min. 0.6V DC (Initial)	75 mA	160Ω	900 mW	10 to 16V DC
	Max. 7.7V DC (Initial)	Min. 0.6V DC (Initial)	54.5 mA	220Ω	655 mW	

2. Specifications

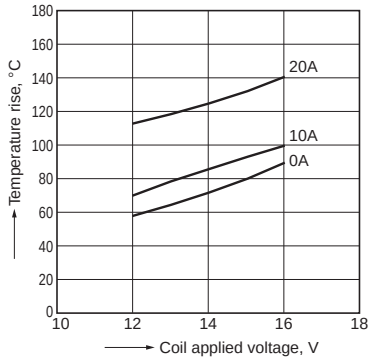
Characteristics	Item		Specifications
Contact	Arrangement		1 Form C, 1 Form C × 2
	Contact resistance (Initial)		N.O.: Typ4.5mΩ, N.C.: Typ5.5mΩ (By voltage drop 6V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 20A 14V DC, N.C.: 10A 14V DC
	Max. carrying current (12V DC initial)*3		25A for 10 minutes (at 20°C 68°F)
	Nominal operating power		900 mW (Pick-up voltage 6.5V DC type)
			655 mW (Pick-up voltage 7.7V DC type)
	Min. switching capacity (resistive load)*1		1A 14V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial) (without protective element)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical*4		<Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 1s ON, 9s OFF)
			<Motor load> Min. 10^5 (25 A 14V DC at motor lock condition), operating frequency: 0.5s ON, 9.5s OFF
Conditions	Conditions for operation, transport and storage*2		Reflow type Ambient temperature: –40°C to +110°C –40°F to +230°F, Humidity: 2% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
Mass			Single type: approx. 3 g .106 oz, Twin type: approx. 6 g .21 oz

Notes:
*1.This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2.The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3.Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
*4.Do not use for lamp loads, electric discharge lamp loads, any other lamp loads and capacitor loads. Please contact us for details.

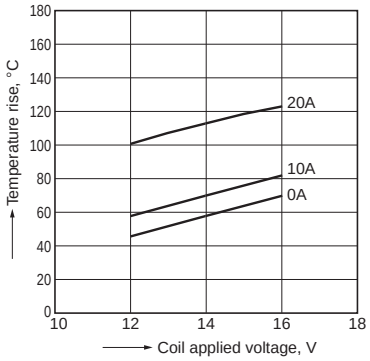
* If the relay is used continuously for long periods of time with coils on both sides in an energized condition, breakdown might occur due to abnormal heating depending on the carrying condition. Therefore, please inquire when using with a circuit that causes an energized condition on both sides simultaneously.

REFERENCE DATA

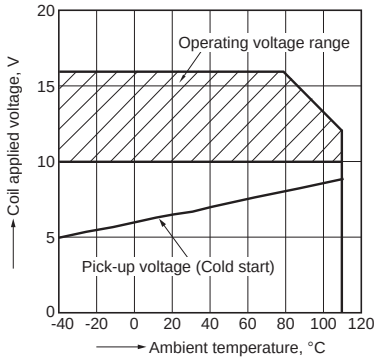
1.-(1) Coil temperature rise (at room temperature)
Sample: ACTH6B2, 3pcs.
Contact carrying current: 0A, 10A, 20A
Ambient temperature: Room temperature



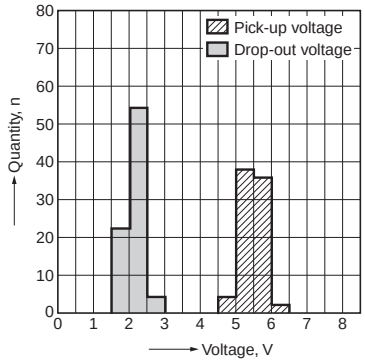
1.-(2) Coil temperature rise (at 110°C 230°F)
Sample: ACTH6B2, 3pcs.
Contact carrying current: 0A, 10A, 20A
Ambient temperature: 110°C 230°F



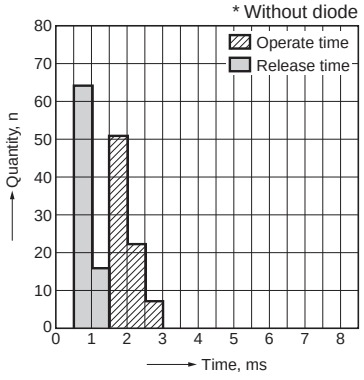
2. Ambient temperature and operating voltage range
Sample: ACTH6B2



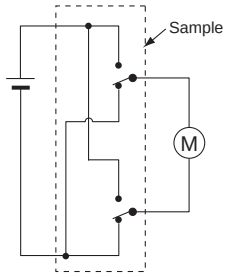
3. Distribution of pick-up and drop-out voltage
Sample: ACTH6B2, 40 × 2pcs.



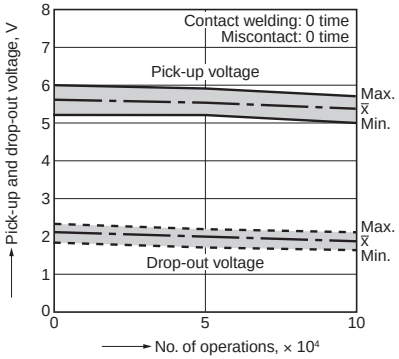
4. Distribution of operate and release time
Sample: ACTH6B2, 40 × 2pcs.



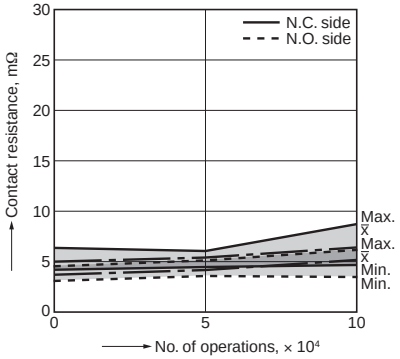
5. Electrical life test (Motor lock)
Sample: ACTH6B2, 3pcs.
Load: 25A 14V DC
Power window motor actual load (lock condition)
Operating frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature
Circuit:



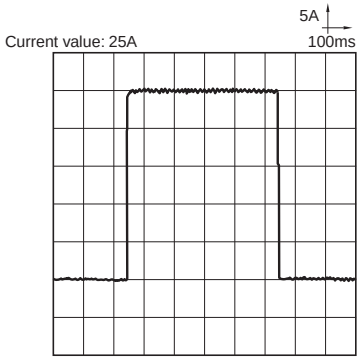
Change of pick-up and drop-out voltage



Change of contact resistance



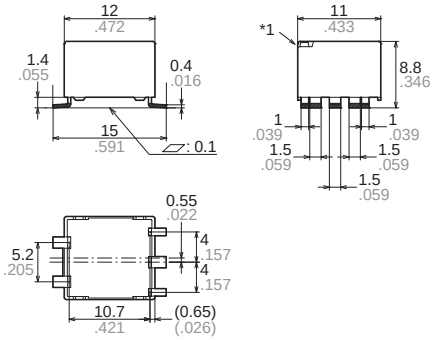
Load current waveform



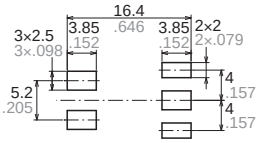
DIMENSIONS (mm inch)

1 Form C type

External dimensions

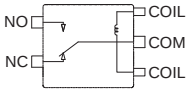


Recommendable mounting pad (Top view)



Tolerance: ±0.1 ±.004

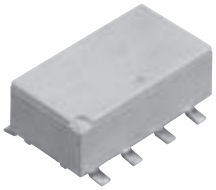
Schematic (Top view)



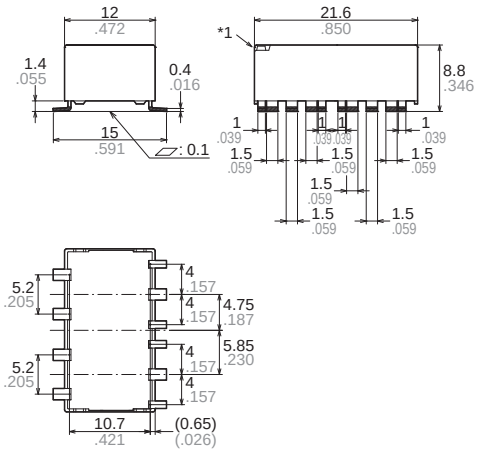
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Note: *1. Flux tight type has air hole.

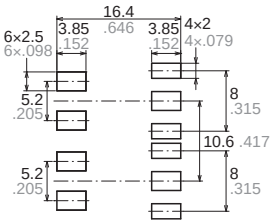
Twin type (10 terminals type)



External dimensions

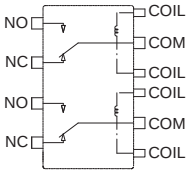


Recommendable mounting pad (Top view)



Tolerance: ±0.1 ±.004

Schematic (Top view)



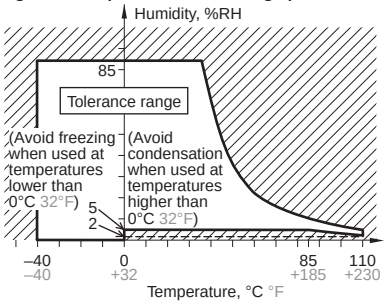
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Note: *1. Flux tight type has air hole.

NOTES

Usage, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature: –40 to +110°C –40 to +230°F (Reflow type)
(2) Humidity: 2 to 85% RH (Avoid freezing and condensation.)
(3) Atmospheric pressure: 86 to 106 kPa
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(Temperature and humidity range for usage, transport, and storage)



For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

MIDDLE LOAD RELAY FOR SMART J/B

TJ RELAYS (ACTJ)

FEATURES

- **Compact flat type (Height: 11.2mm .441inch)**
- **Compact and high-capacity 30A load switching**
- **Sealed type**

TYPICAL APPLICATIONS

Head lamp, Fog lamp, Fan motor, EPS, Defogger, Seat heater, etc.

ORDERING INFORMATION

ACTJ ☐ ☐ ☐

Contact arrangement
2: 1 Form C

Heat resistance/Protective construction
H: High heat-resistant type/Sealed type

Coil resistance
4: 320Ω

TYPES

Contact arrangement	Nominal coil voltage	Coil resistance	Part No.
			Heat resistance: High heat-resistant type
1 Form C	12V DC	320Ω	ACTJ2H4

Standard packing; Carton (tube): 40 pcs.; Case: 800 pcs.
Note: Please contact us for details about products other than those above.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 7.0V DC (Initial)	Min. 0.8V DC (Initial)	37.5 mA	320Ω	450 mW	10 to 16V DC

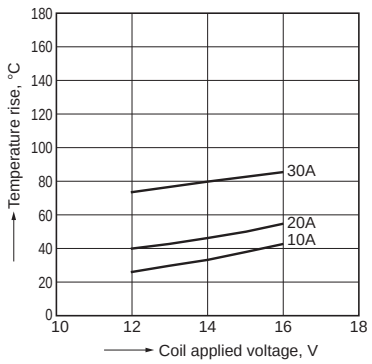
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form C
	Contact resistance (Initial)		N.O.: Typ2.5mΩ, N.C.: Typ3mΩ (By voltage drop 6V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 30A 14V DC, N.C.: 15A 14V DC
	Max. carrying current (12V DC initial)*3		30A for 1 hour (at 20°C 68°F)
	Nominal operating power		450 mW (Pick-up voltage 7.0V DC type)
	Min. switching capacity (resistive load)*1		1A 14V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial) (without protective element)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical		<Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 1s ON, 9s OFF)
			<Motor load> Min. 10^5 (25 A 14V DC at motor lock condition), operating frequency: 0.5s ON, 9.5s OFF
			<Lamp load> Min. 10^5 (at 84 A (inrush), 12 A (steady), 14 V DC), Operating frequency: 1s ON, 14s OFF
Conditions	Conditions for operation, transport and storage*2		High heat-resistant type Ambient temperature: –40°C to +110°C –40°F to +230°F, Humidity: 2% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
Mass			Approx. 7 g .25 oz

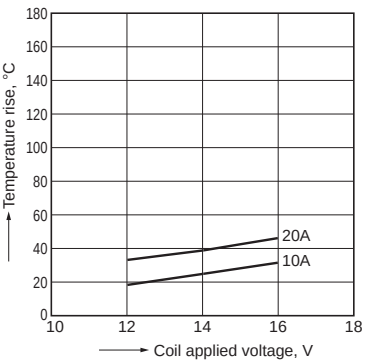
Notes:
*1.This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2.The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3.Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.

REFERENCE DATA

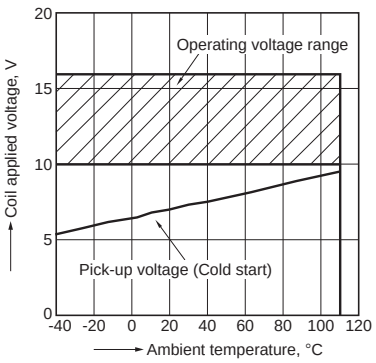
1.-(1) Coil temperature rise (at room temperature)
Sample: ACTJ2H4, 3pcs.
Contact carrying current: 10A, 20A, 30A
Ambient temperature: Room temperature



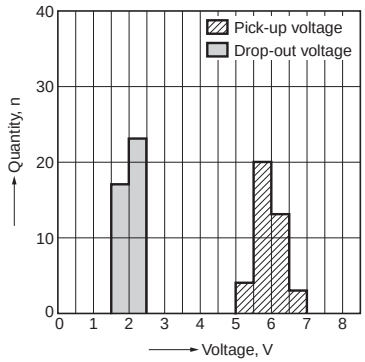
1.-(2) Coil temperature rise (at 110°C 230°F)
Sample: ACTJ2H4, 3pcs.
Contact carrying current: 10A, 20A
Ambient temperature: 110°C 230°F



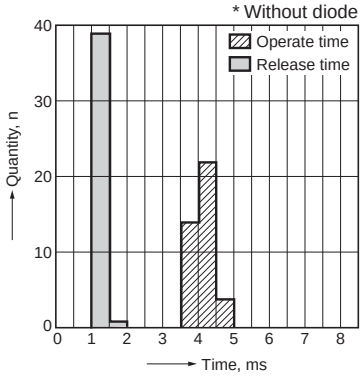
2. Ambient temperature and operating voltage range
Sample: ACTJ2H4



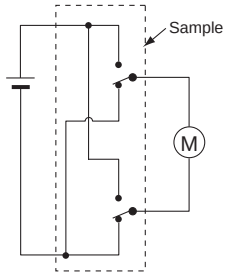
3. Distribution of pick-up and drop-out voltage
Sample: ACTJ2H4, 40pcs.



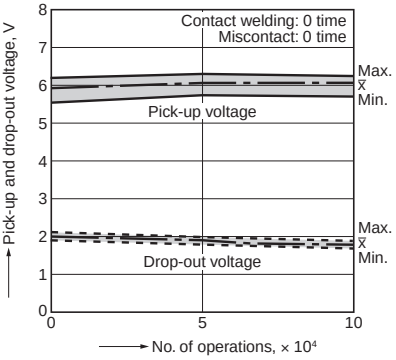
4. Distribution of operate and release time
Sample: ACTJ2H4, 40pcs.



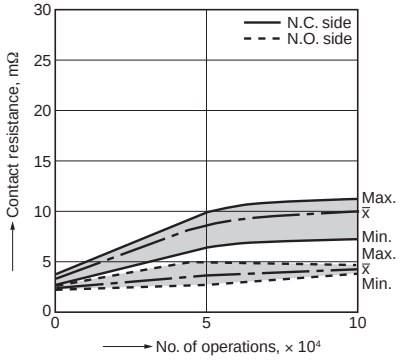
5.-(1) Electrical life test (Motor lock)
Sample: ACTJ2H4, 6pcs.
Load: 25A 14V DC
Power window motor actual load (lock condition)
Operating frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature
Circuit:



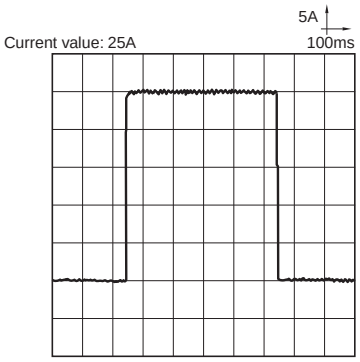
Change of pick-up and drop-out voltage



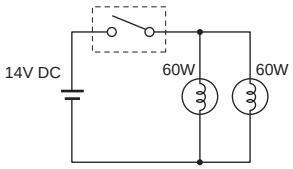
Change of contact resistance



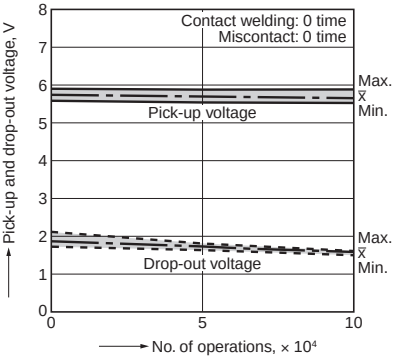
Load current waveform



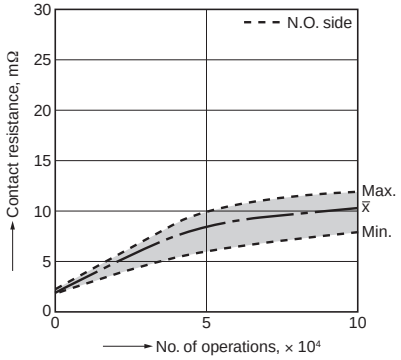
5.-(2) Electrical life test (Lamp load)
Sample: ACTJ2H4, 6pcs.
Load: inrush: 84A/steady: 12A 14V DC
Operating frequency: ON 1s, OFF 14s
Ambient temperature: Room temperature
Circuit:



Change of pick-up and drop-out voltage



Change of contact resistance

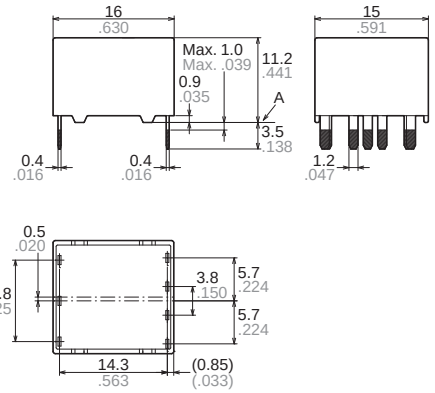


Automotive

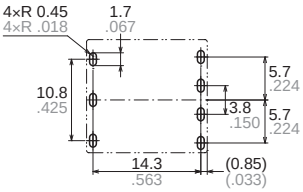
DIMENSIONS (mm inch)

1 Form C type

External dimensions

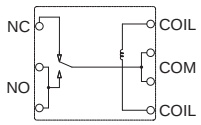


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



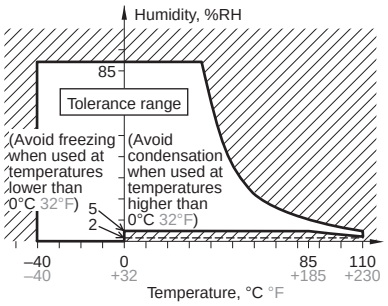
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering. Intervals between terminals is measured at A surface level.

NOTES

Usage, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature: –40 to +110°C –40 to +230°F (High heat-resistant type)
(2) Humidity: 2 to 85% RH (Avoid freezing and condensation.)
(3) Atmospheric pressure: 86 to 106 kPa
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(Temperature and humidity range for usage, transport, and storage)



For Cautions for Use, see Relay Technical Information (page 166).

Automotive Plug-in Relays

Panasonic
ideas for life

AUTOMOTIVE POWER RELAYS — SMALL SIZE, LIGHT WEIGHT

CA RELAYS

FEATURES

• Small size and light weight
For space saving, the outside dimensions of the main body are reduced to be 21.5 mm (length) × 14.4 mm (width) × 37 mm (height) (.846 × .567 × 1.457 inch) and the weight is also reduced to be approx. 19 g .67 oz (direct coupling 1 Form A, 1 Form B type)
• Low operating power (1.4W) type is available (1 Form A, 1 Form B)
• Since the terminal arrangement complies with JIS D5011 B4-M1, commercial connectors are available for these types of relays.
• Superior inrush characteristics
Despite its small size, 120A (max. 0.1 s) capacity has been achieved by using contacts that are good at withstanding inrush currents and because of an ingenious contacting mechanism.
(1 Form A and 1 Form B)

TYPICAL APPLICATIONS

• Motorcycles and automobiles
Motorcycle cell motors, car air conditioners, halogen lamps, etc.
• Agricultural equipment
• Battery equipped devices such as conveyance vehicles

ORDERING INFORMATION

CA □ □ □ □ - □ - □ - □

Contact arrangement
1a: 1 Form A
1b: 1 Form B
1: 1 Form C

Protective construction
Nil: Sealed type
F: Dust cover type

Nominal operating power
Nil: Standard type (1.8 W)
S: Low operating power type (1.4 W) (1 Form A, 1 Form B)

Protective element
Nil: None (Standard type)
R: With resistor inside

Coil voltage (DC)
12 V, 24 V (1 Form C only)

Mounting method
A: Rubber bracket A type (1 Form A, 1 Form B)
N: Screw mounting type
C: Direct coupling type

Classification by type
Nil: 1 Form C
5: 1 Form A or 1 Form B

TYPES

Contact arrangement	Coil voltage	Mounting type	Standard type		Low operating power type	
			Sealed type	Dust cover type	Sealed type	Dust cover type
			Part No.	Part No.	Part No.	Part No.
1 Form A	12 V DC	Rubber bracket A	CA1a-12V-A-5	CA1aF-12V-A-5	CA1aS-12V-A-5	CA1aFS-12V-A-5
		Screw-mounting	CA1a-12V-N-5	CA1aF-12V-N-5	CA1aS-12V-N-5	CA1aFS-12V-N-5
		Direct coupling	CA1a-12V-C-5	CA1aF-12V-C-5	CA1aS-12V-C-5	CA1aFS-12V-C-5
1 Form B	12 V DC	Rubber bracket A	CA1b-12V-A-5	CA1bF-12V-A-5	CA1bS-12V-A-5	CA1bFS-12V-A-5
		Screw-mounting	CA1b-12V-N-5	CA1bF-12V-N-5	CA1bS-12V-N-5	CA1bFS-12V-N-5
		Direct coupling	CA1b-12V-C-5	CA1bF-12V-C-5	CA1bS-12V-C-5	CA1bFS-12V-C-5
1 Form C	12 V DC	Screw-mounting	CA1-12V-N	–	–	–
		Direct coupling	CA1-12V-C	–	–	–
	24 V DC	Screw-mounting	CA1-24V-N	–	–	–
		Direct coupling	CA1-24V-C	–	–	–

Standard packing: Carton: 20 pcs. Case: 200 pcs.
Note: Please use “CA∗∗R-∗-∗-∗ or CA∗∗SR-∗-∗-∗” with resistor inside type. (Asterisks “ ∗ ” should be filled in from ORDERING INFORMATION.)

RATING

1. Coil data

	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Usable voltage range
Standard type 1 Form A and 1 Form B	12 V DC	Max. 8 V DC	0.6 to 6 V DC	150 mA	80Ω	1.8 W	10 to 16V DC
Low operating power type 1 Form A and 1 Form B	12 V DC	Max. 8 V DC	0.6 to 6 V DC	120 mA	100Ω	1.4 W	10 to 16V DC
1 Form C	12 V DC	Max. 8 V DC	Min. 0.6 V DC	150 mA	80Ω	1.8 W	10 to 15V DC
	24 V DC	Max. 16 V DC	Min. 1.2 V DC	75 mA	320Ω	1.8 W	20 to 30V DC

Note: Other pick-up voltage types are also available. Please contact us for details.

2. Specifications

1) 12 V DC type

Characteristics	Item		Specifications		
			1 Form A type	1 Form B type	1 Form C type
Contact	Arrangement		1 Form A	1 Form B	1 Form C
	Contact resistance (Initial)		Typ 3mΩ (By voltage drop 6V DC 1A)		
	Contact voltage drop (after electrical life test)		Max. 0.3 V [by voltage drop 12 V DC 20 A (1.4 W type), 12 V DC 30 A (1.8 W type)]	Max. 0.3 V (by voltage drop 12 V DC 20 A)	Max. 0.4 V (by voltage drop 12 V DC 20 A)
	Contact material		Ag alloy (Cadmium free)		
Rating	Nominal switching capacity (resistive load)		20 A 12V DC (1.4 W type) 30 A 12V DC (1.8 W type)	20 A 12 V DC	
	Max. carrying current (at coil applied voltage 14 V DC, 80°C 176°F)		20 A continuous (1.4 W type) 30 A for 1 min. (1.8 W type)	20 A continuous	20 A continuous
	Nominal operating power		1.4 W/1.8 W		1.8 W
	Min. switching capacity (resistive load)*1		1 A 14V DC		
Electrical characteristics	Insulation resistance (Initial)		Min. 10 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)		Min. 10 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)		
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)		
	Operate time (at 20°C 68°F)		Max. 10ms (at nominal voltage) (excluding contact bounce time) (Initial)		
	Release time (at 20°C 68°F)		Max. 10ms (at nominal voltage) (excluding contact bounce time) (Initial)		
Mechanical characteristics	Shock resistance	Functional	Min. 200 m/s² {20G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)	
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)		
	Vibration resistance	Functional	Rubber bracket A type: 50 Hz to 500 Hz, Min. 100 m/s² {10G} Screw-mounting and direct coupling type: 33 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)		
		Destructive	Rubber bracket A type: 50 Hz to 500 Hz, Min. 100 m/s² {10G} Screw-mounting and direct coupling type: 33 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours		
Expected life	Electrical (at nominal switching capacity)		Min. 10^5 (operating frequency: 2s ON, 2s OFF) (1.4 W and 1.8 W type at 20 A) Min. 2×10^4 (operating frequency: 3s ON, 15s OFF) (1.8 W type at 30 A)	Min. 10^5 (operating frequency: 2s ON, 2s OFF)	
	Mechanical		Min. 10^6 (at 120 cpm)		Min. 5×10^5 (at 120 cpm)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –30°C to +80°C –22°F to +176°F, Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)		
	Max. operating speed		15 cpm (1.4 W type: at nominal load, 1.8 W type: at 20 A)	15 cpm (at nominal switching capacity)	
Water-proof standard	Water-proof standard		Sealed type: JIS D 0203 S2, Dust cover type: JIS D 0203 R2		
Mass			Rubber bracket A type: 23 g .81 oz, Screw-mounting and direct coupling type: 19 g .67 oz		31 g 1.09 oz

Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.

2) 24 V DC type

Characteristics	Item		Specifications
			1 Form C type
Contact	Arrangement		1 Form C
	Contact resistance (Initial)		Typ 3mΩ (By voltage drop 6V DC 1A)
	Contact voltage drop		Max. 0.4 V (after electrical life test, by voltage drop 24 V DC 10 A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load) (operating frequency: 2s ON, 2s OFF)		10 A 24V DC
	Max. carrying current		10 A continuous (at coil applied voltage 28 V DC, 80°C 176°F)
	Nominal operating power		1.8 W
	Min. switching capacity (resistive load)*1		1 A 14V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 10 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage) (at 20°C 68°F)		Max. 10ms (excluding contact bounce time) (Initial)
	Release time (at nominal voltage) (at 20°C 68°F)		Max. 10ms (excluding contact bounce time) (Initial)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	33 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	33 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Electrical (at nominal switching capacity)		Min. 10^5 (operating frequency: 2s ON, 2s OFF)
	Mechanical		Min. 5×10^5 (at 120 cpm)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –30°C to +80°C –22°F to +176°F, Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		15 cpm (nominal switching capacity)
Water-proof standard	Water-proof standard		JIS D 0203 S2
Mass			31 g 1.09 oz

Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 139.

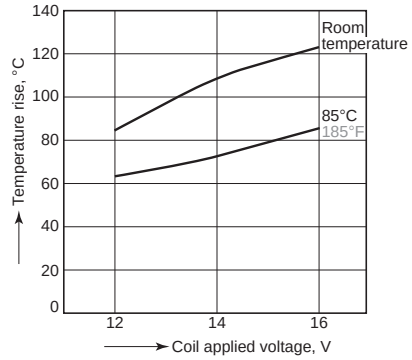
Electrical life

	Nominal coil voltage	Motor load (operating frequency ON: 2 s, OFF: 2 s)	Halogen lamp load (operating frequency ON: 1 s, OFF: 14 s)
1 Form A and 1 Form B type	12 V DC	Min. 10^5, 20 A 12 V DC	Min. 10^5, 20 A 12 V DC
1 Form C type	12 V DC	Min. 10^5, 20 A 12 V DC	Min. 10^5, 20 A 12 V DC
	24 V DC	Min. 10^5, 10 A 24 V DC	Min. 10^5, 6 A 24 V DC

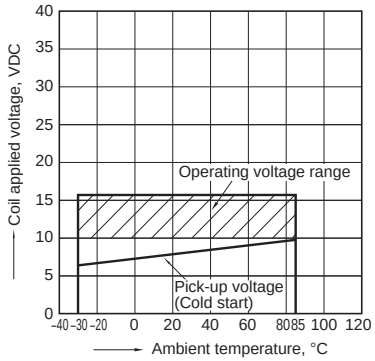
REFERENCE DATA

1. Coil temperature rise

Samples: CA1aS-12V-N-5, 5pcs.
Measured portion: Inside the coil
Contact carrying current: 20A
Ambient temperature: Room temperature, 85°C 185°F

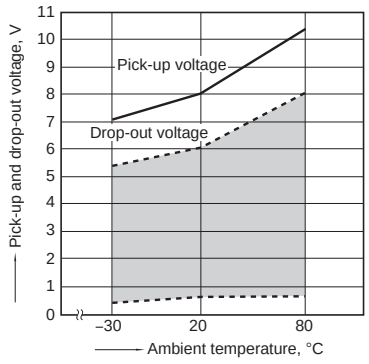


2. Ambient temperature and operating voltage range

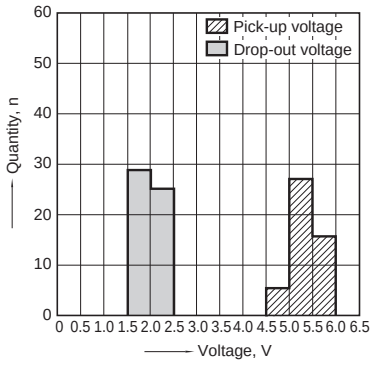


3. Ambient temperature characteristics (Cold start)

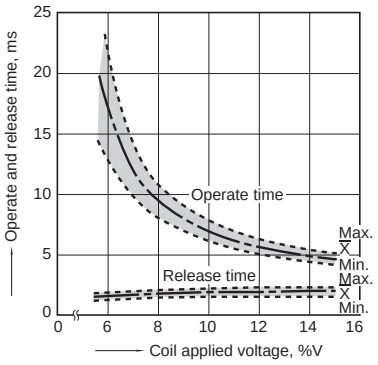
Samples: CA1bS-12V-N-5



4. Distribution of pick-up and drop-out voltage
Quantity: 50pcs.

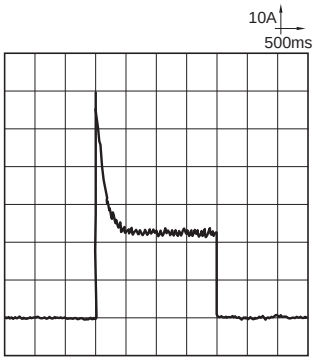


5. Operate and release time characteristics
Sample: CA1a-12V-N-5, 10pcs.

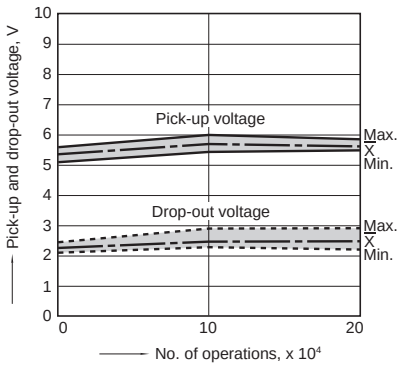


6.-(1) Electrical life test (Motor load)
Sample: CA1a-12V-C, 3pcs.
Load: Inrush current: 63A, steady current: 23A
Blower fan motor actual load (motor free)
Operating frequency: ON 2s, OFF 2s
Ambient temperature: Room temperature

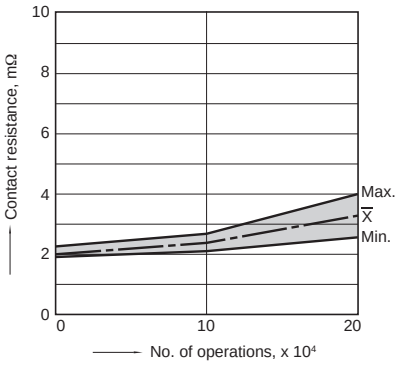
Load current waveform
Load: Inrush current: 63A, steady current: 23A,



Change of pick-up and drop-out voltage

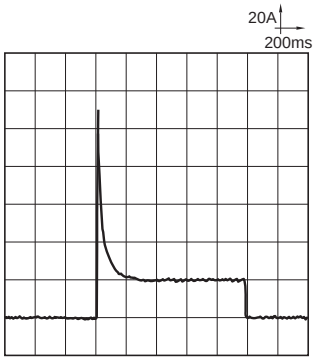


Change of contact resistance

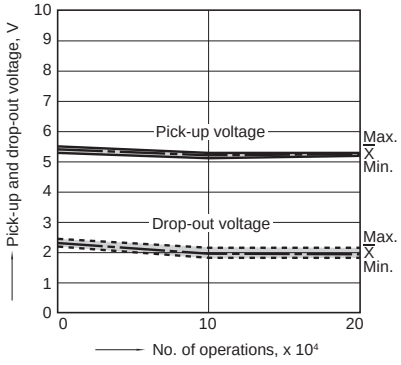


6.-(2) Electrical life test (Lamp load)
Sample: CA1a-12V-C, 3pcs.
Load: 60Wx4, Inrush current: 110A, steady current: 20A
Halogen lamp actual load
Operating frequency: ON 1s, OFF 14s
Ambient temperature: Room temperature

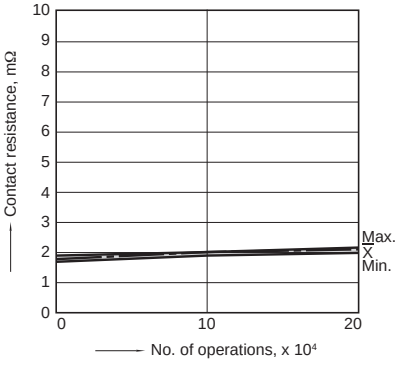
Load current waveform
Load: Inrush current: 110A, steady current: 20A,



Change of pick-up and drop-out voltage



Change of contact resistance

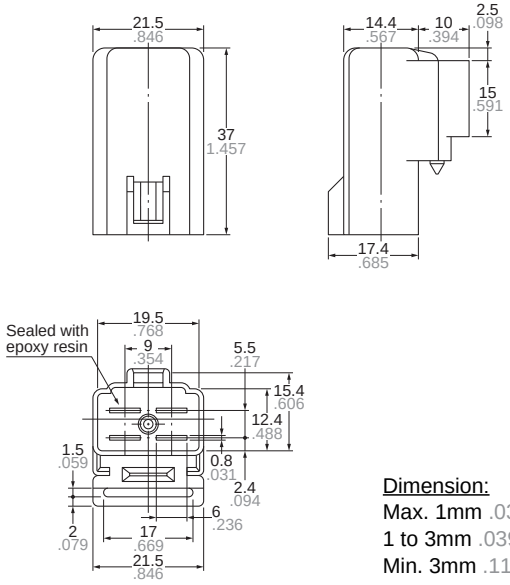


DIMENSIONS (mm inch)

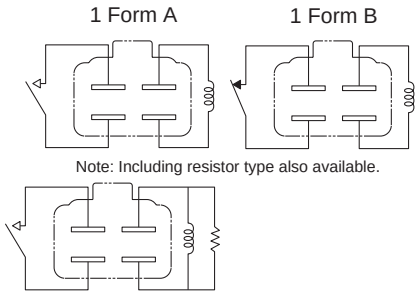
Download **CAD Data** from our Web site.

1. 1 Form A/1 Form B
Rubber bracket A type

External dimensions



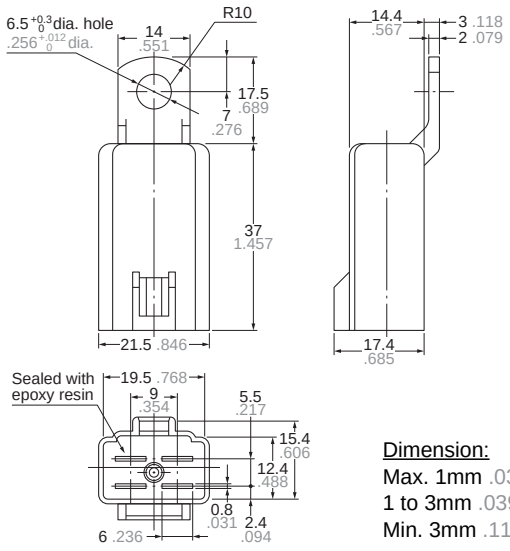
Schematic (Bottom View)



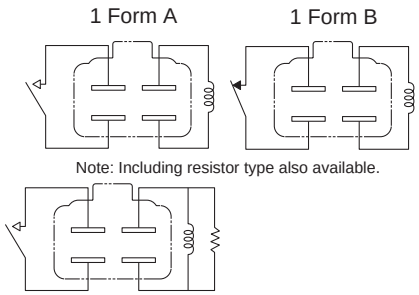
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

2. 1 Form A/1 Form B
Screw-mounting type

External dimensions



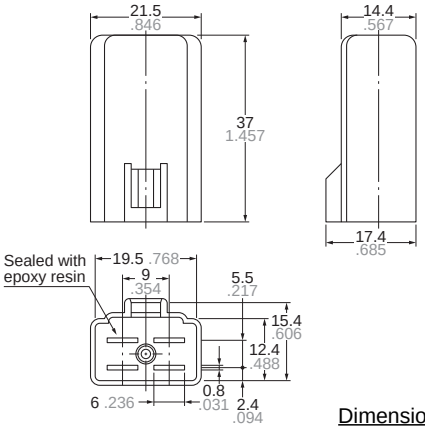
Schematic (Bottom View)



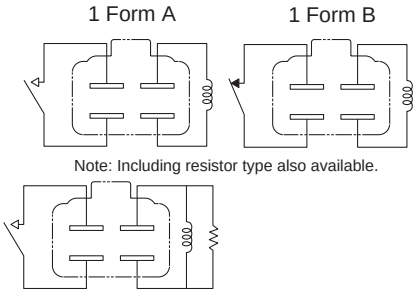
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

3. 1 Form A/1 Form B
Direct coupling type

External dimensions



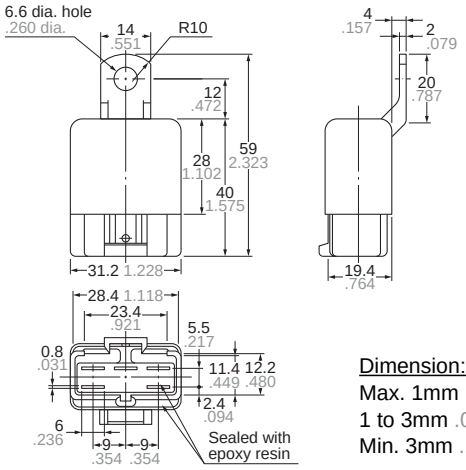
Schematic (Bottom View)



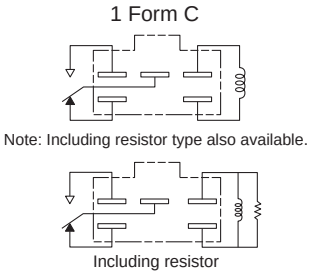
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

4. 1 Form C
Screw-mounting type

External dimensions



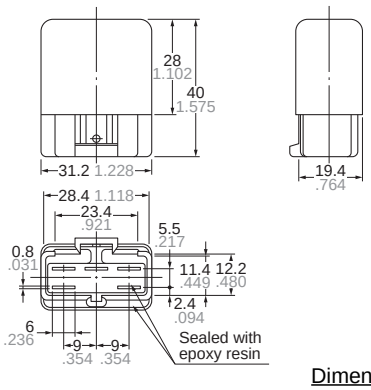
Schematic (Bottom View)



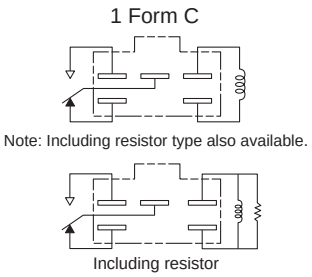
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

5. 1 Form C
Direct coupling type

External dimensions



Schematic (Bottom View)



Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

MINI-ISO AUTOMOTIVE RELAY

CB RELAYS

FEATURES

• This relay has an Mini-ISO (International Organization for Standardization) terminal arrangement.

• Relay is compact and high capacity (40 A).

Compact form factor realized with space saving 22 × 26 mm .866 × 1.024 inch small base area thanks to integrated bobbin and base construction. Features high switching capacity of 40 A

• Features high thermal resistance of 125°C 257°F (heat resistant type).

Heat resistant type is available that can withstand use near engines. (40 A switching capacity)

• Built-in resistor type is also available.

TYPICAL APPLICATIONS

• Automobiles

Headlights, Cell motors, Air conditioners, ABS, EPS, etc.

• Construction equipment

• Agricultural equipment, Conveyor, etc.

ORDERING INFORMATION

CB □ □ □ □ - □ □ - □ - □

Contact arrangement
1a: 1 Form A
1: 1 Form C

Contact rating
Nil: Standard type
H: High contact capacity type

Protective construction
Nil: Sealed type
F: Flux-resistant type

Heat resistant of types
Nil: Standard type
T: Heat resistant type

Protective element
Nil: None
R: with resistor inside

Mounting classification
Nil: Plug-in type
P: PC board type
M: Bracket type

Coil voltage (DC)
12V, 24 V

Automotive

TYPES

1. Standard type

Contact arrangement	Mounting classification	Nominal coil voltage	Sealed type	Flux-resistant type
			Part No.	Part No.
1 Form A	PC board type	12V DC	CB1a-P-12V	CB1aF-P-12V
		24V DC	CB1a-P-24V	CB1aF-P-24V
	Plug-in type	12V DC	CB1a-12V	CB1aF-12V
		24V DC	CB1a-24V	CB1aF-24V
	Bracket type	12V DC	CB1a-M-12V	CB1aF-M-12V
		24V DC	CB1a-M-24V	CB1aF-M-24V
1 Form C	PC board type	12V DC	CB1-P-12V	CB1F-P-12V
		24V DC	CB1-P-24V	CB1F-P-24V
	Plug-in type	12V DC	CB1-12V	CB1F-12V
		24V DC	CB1-24V	CB1F-24V
	Bracket type	12V DC	CB1-M-12V	CB1F-M-12V
		24V DC	CB1-M-24V	CB1F-M-24V
High contact capacity (1 Form A)	PC board type*	12V DC	CB1aH-P-12V	CB1aHF-P-12V
		24V DC	CB1aH-P-24V	CB1aHF-P-24V
	Plug-in type	12V DC	CB1aH-12V	CB1aHF-12V
		24V DC	CB1aH-24V	CB1aHF-24V
	Bracket type	12V DC	CB1aH-M-12V	CB1aHF-M-12V
		24V DC	CB1aH-M-24V	CB1aHF-M-24V

Standard packing; Carton: 50 pcs. Case: 200 pcs.
Note: Please use “CB∗∗∗R∗∗” to order with resistor inside type. (Asterisks “∗” should be filled in from ORDERING INFORMATION.)

2. Heat resistant type

Contact arrangement	Mounting classification	Nominal coil voltage	Sealed type	Flux-resistant type
			Part No.	Part No.
1 Form A	PC board type	12V DC	CB1a-T-P-12V	CB1aF-T-P-12V
		24V DC	CB1a-T-P-24V	CB1aF-T-P-24V
	Plug-in type	12V DC	CB1a-T-12V	CB1aF-T-12V
		24V DC	CB1a-T-24V	CB1aF-T-24V
	Bracket type	12V DC	CB1a-T-M-12V	CB1aF-T-M-12V
		24V DC	CB1a-T-M-24V	CB1aF-T-M-24V
1 Form C	PC board type	12V DC	CB1-T-P-12V	CB1F-T-P-12V
		24V DC	CB1-T-P-24V	CB1F-T-P-24V
	Plug-in type	12V DC	CB1-T-12V	CB1F-T-12V
		24V DC	CB1-T-24V	CB1F-T-24V
	Bracket type	12V DC	CB1-T-M-12V	CB1F-T-M-12V
		24V DC	CB1-T-M-24V	CB1F-T-M-24V
High contact capacity (1 Form A)	PC board type*	12V DC	CB1aH-T-P-12V	CB1aHF-T-P-12V
		24V DC	CB1aH-T-P-24V	CB1aHF-T-P-24V
	Plug-in type	12V DC	CB1aH-T-12V	CB1aHF-T-12V
		24V DC	CB1aH-T-24V	CB1aHF-T-24V
	Bracket type	12V DC	CB1aH-T-M-12V	CB1aHF-T-M-12V
		24V DC	CB1aH-T-M-24V	CB1aHF-T-M-24V

Standard packing; Carton: 50 pcs. Case: 200 pcs.
Note: Please use “CB∗∗∗R∗∗” to order with resistor inside type. (Asterisks “∗” should be filled in from ORDERING INFORMATION.)

RATING

1. Coil data

1) No protective element

Contact arrangement	Nominal coil voltage	Pick-up voltage	Drop-out voltage	Nominal operating current	Coil resistance	Nominal operating power	Usable voltage range
1 Form A, 1 Form C	12V DC	3 to 7V DC	1.2 to 4.2V DC	117mA	103Ω	1.4W	10 to 16V DC
	24V DC	6 to 14V DC	2.4 to 8.4V DC	75mA	320Ω	1.8W	20 to 32V DC
High contact capacity (1 Form A)	12V DC	3 to 7V DC	1.2 to 4.2V DC	117mA	103Ω	1.4W (PC board type)	10 to 16V DC
				150mA	80Ω	1.8W	
	24V DC	6 to 14V DC	2.4 to 8.4V DC	58mA	411Ω	1.4W (PC board type)	20 to 32V DC
				75mA	320Ω	1.8W	

Note: Other pick-up voltage types are also available. Please contact us for details.

2) With resistor inside

Contact arrangement	Nominal coil voltage	Pick-up voltage (Initial, at 20°C 68°F)	Drop-out voltage (Initial, at 20°C 68°F)	Nominal operating current (at 20°C 68°F)	Combined resistance (±10%) (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
1 Form A, 1 Form C	12V DC	3 to 7V DC	1.2 to 4.2V DC	134mA	89.5Ω	1.6W	10 to 16V DC
	24V DC	6 to 14V DC	2.4 to 8.4V DC	84mA	287.2Ω	2.0W	20 to 32V DC

2. Specifications

1) Standard type (12 V coil voltage)

Characteristics	Item		Specification		
Contact	Arrangement		1 Form A	1 Form C	High contact capacity (1 Form A)
	Contact resistance (Initial)		Typ2mΩ (By voltage drop 6 V DC 1 A)		
	Contact material		Ag alloy (Cadmium free)		
Rating	Nominal switching capacity (Initial)		40A 14V DC	N.O.: 40A 14V DC N.C.: 30A 14V DC	70A 14V DC (at 20°C 68°F) 50A 14V DC (at 85°C 185°F)
	Max. carrying current (Initial) (14V DC, at 85°C 185°F, continuous)		N.O.: 40A	N.O.: 40A, N.C.: 30A	N.O.: 40A
	Nominal operating power		1.4W	1.4W	1.8W (1.4W: PC board type)
	Min. switching capacity (resistive load)*1		1A 14V DC		
Electrical characteristics	Insulation resistance (Initial)		Min. 20 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)		
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)		
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)		
	Operate time (at nominal coil voltage) (at 20°C 68°F)		Max. 15ms (excluding contact bounce time) (Initial)		
	Release time (at nominal coil voltage) (at 20°C 68°F)		Max. 15ms (excluding contact bounce time) (Initial)		
Mechanical characteristics	Shock resistance	Functional	Min. 200 m/s² {20G}		
		Destructive	Min. 1,000 m/s² {100G}		
	Vibration resistance	Functional	10 Hz to 500 Hz, Min. 44.1m/s² {4.5G}		
		Destructive	10 Hz to 2,000 Hz, Min. 44.1m/s² {4.5G} Time of vibration for each direction; X. Y. Z direction: 4 hours		
Expected life	Electrical (at nominal switching capacity)		Flux-resistant type: Min. 10^5, Sealed type: Min. 5×10^4 (Operating frequency: 2s ON, 2s OFF)		
	Mechanical		Min. 10^6 (at 120 cpm)		
Conditions	Conditions for operation, transport and storage*2		Standard type; Ambient temperature: –40 to +85°C –40 to +185°F, Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)		
			Heat resistant type; Ambient temperature: –40 to +125°C –40 to +257°F, Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)		
	Max. operating speed		15 cpm (at nominal switching capacity)		
Mass			Approx. 33 g 1.16 oz		

Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.

2) Standard type (24 V coil voltage)

Characteristics	Item	Specifications		
Contact	Arrangement	1 Form A	1 Form C	High contact capacity (1 Form A)
	Contact resistance (Initial)	Max. 15mΩ (By voltage drop 6 V DC 1 A)		
	Contact material	Ag alloy (Cadmium free)		
Rating	Nominal switching capacity (Initial)	20A 28V DC	N.O.: 20A 28V DC N.C.: 10A 28V DC	20A 28V DC
	Max. carrying current (Initial) (28V DC, at 85°C 185°F, continuous)	20A	N.O.: 20A, N.C.: 10A	20A
	Nominal operating power	1.8W	1.8W	1.8W, 1.4W (PC board type)

Note: All other specifications are the same as those of standard type (12 V coil voltage)

3) Heat resistant type (12 V and 24 V coil voltage)

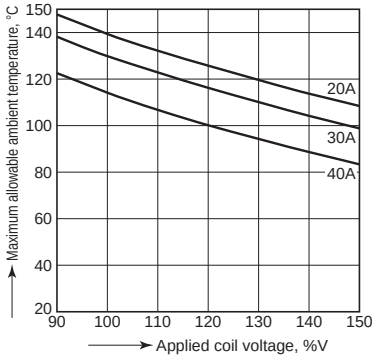
Characteristics	Item	Specifications						
		12V				24V		
Contact	Arrangement	1 Form A	1 Form C	High contact capacity (1 Form A)		1 Form A	1 Form C	High contact capacity (1 Form A)
	Contact resistance (Initial)	Max. 15mΩ (By voltage drop 6 V DC 1 A)						
	Contact material	Ag alloy (Cadmium free)						
Rating	Nominal switching capacity (Initial)	40A 14V DC	N.O.: 40A 14V DC N.C.: 30A 14V DC	40A 14V DC		20A 28V DC	N.O.: 20A 28V DC N.C.: 10A 28V DC	20A 28V DC
	Max. carrying current (Initial) (at 85°C 185°F, continuous)*	50A 14V DC	N.O.: 50A 14V DC N.C.: 30A 14V DC	45A 14V DC	50A 14V DC	25A 28V DC	N.O.: 25A 28V DC N.C.: 10A 28V DC	25A 28V DC
	Nominal operating power	1.4W	1.4W	1.8W	1.4W (PC board type)	1.8W	1.8W	1.8W, 1.4W (PC board type)

Notes: 1. All other specifications are the same as those of standard type (12 V coil voltage)
2. *Current value in which carry current is possible when the coil temperature is 180°C 356°F

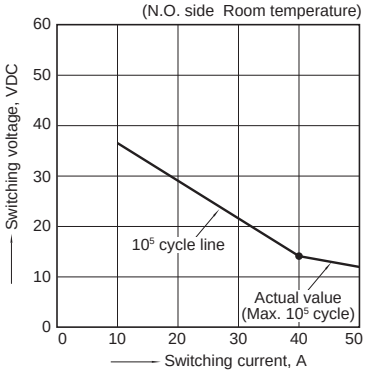
REFERENCE DATA

CB RELAYS (Standard type)

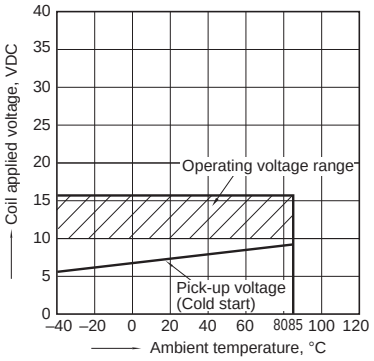
1. Allowable ambient temperature
(Heat resistant standard type)



2. Max. switching capability (Resistive load)
(Standard type)

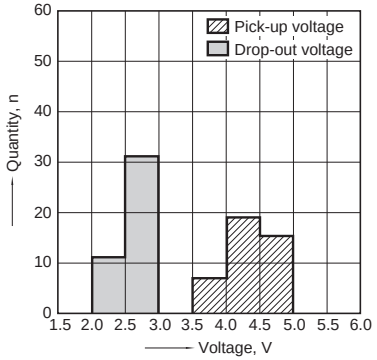


3. Ambient temperature and operating voltage range
(Standard type)

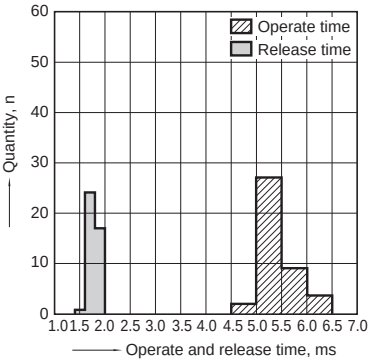


Assumption:
- Maximum mean coil temperature: 180°C
- Curves are based on 1.4W (Nominal power consumption of the unsupprressed coil at nominal voltage)

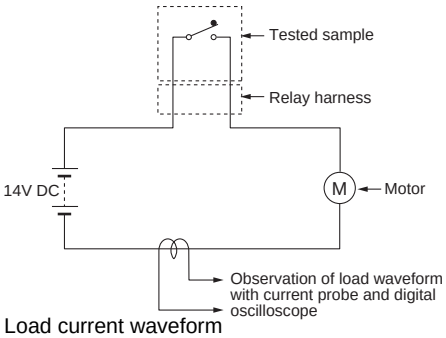
4. Distribution of pick-up and drop-out voltage
Sample: CB1-P-12V, 42pcs.



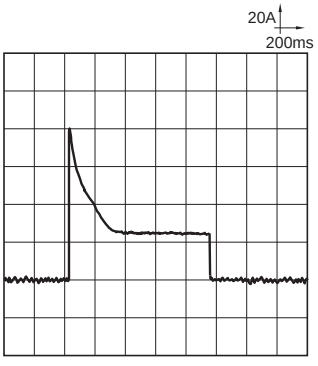
5. Distribution of operate and release time
Sample: CB1-P-12V, 42pcs.



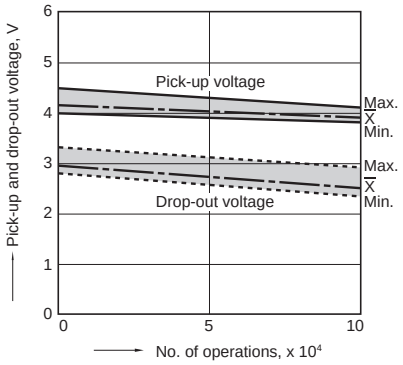
6. Electrical life test (Motor free)
Sample: CB1F-12V, 5pcs.
Load: 25A 14V DC, motor free actual load
Operating frequency: ON 1s, OFF 9s
Ambient temperature: Room temperature
Circuit



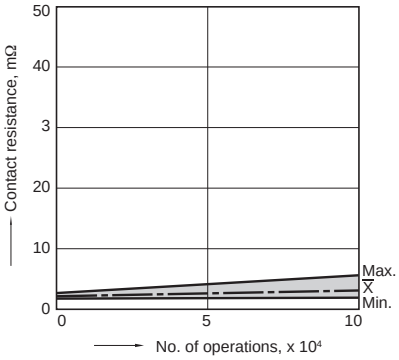
Load current waveform
Inrush current: 80A, Steady current: 25A



Change of pick-up and drop-out voltage

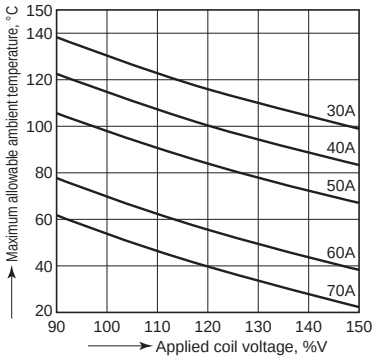


Change of contact resistance

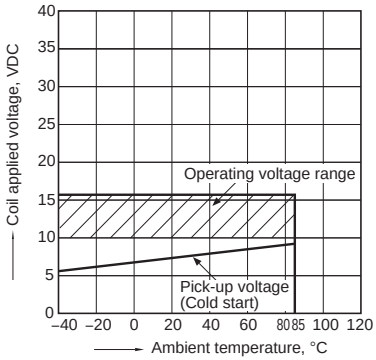


CB RELAYS (High contact capacity type)

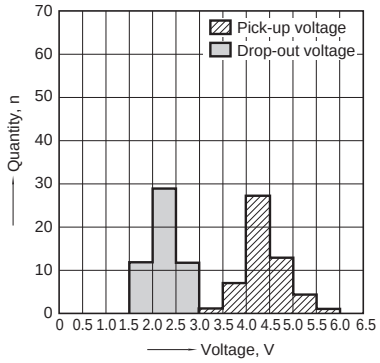
1. Allowable ambient temperature
(High resistant/high contact capacity type)



2. Ambient temperature and operating voltage range
(High contact capacity/standard type)

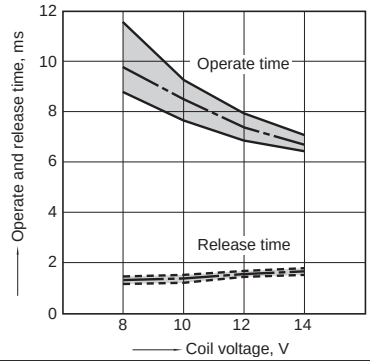


3. Distribution of pick-up and drop-out voltage
Sample: CB1aHF-12V, 53pcs.

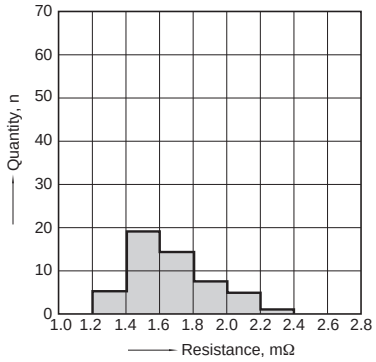


Assumption:
- Maximum mean coil temperature: 180°C
- Curves are based on 1.4W (Nominal power consumption of the unsupprressed coil at nominal voltage)

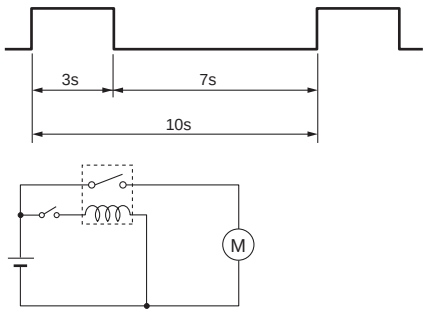
4. Distribution of operate and release time
Sample: CB1aHF-12V, 53pcs.



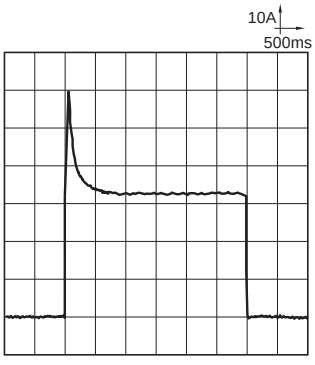
5. Contact resistance
Sample: CB1aHF-12V, 53pcs.
(By voltage drop 6V DC 1A)



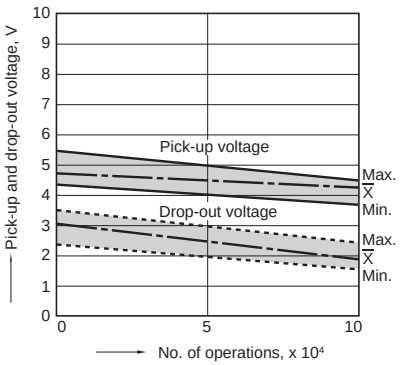
6. Electrical life test (Motor free)
Sample: CB1aH-12V, 3pcs.
Load: Inrush current: 64A/Steady current: 35A
Fan motor actual load (motor free) 12V DC
Operating frequency: ON 3s, OFF 7s
Ambient temperature: Room temperature
Circuit



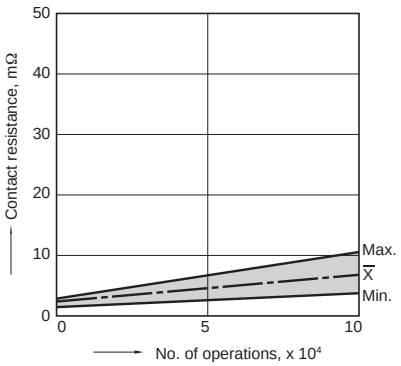
Load current waveform
Inrush current: 64A, Steady current: 35A



Change of pick-up and drop-out voltage



Change of contact resistance

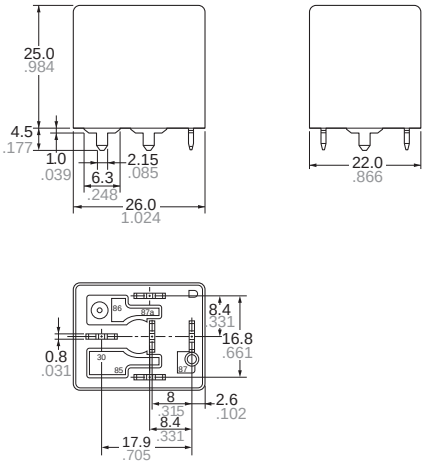


DIMENSIONS (mm inch)

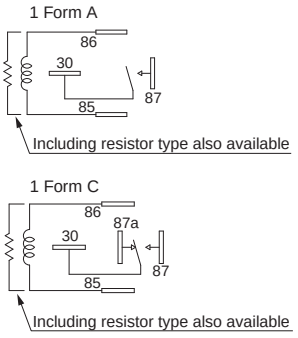
Download **CAD Data** from our Web site.

1. PC board type

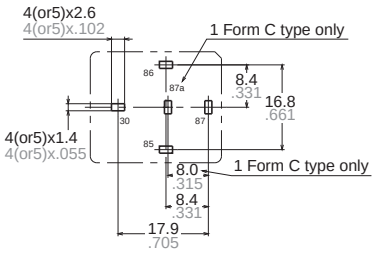
External dimensions



Schematic (Bottom view)



PC board pattern (Bottom view)

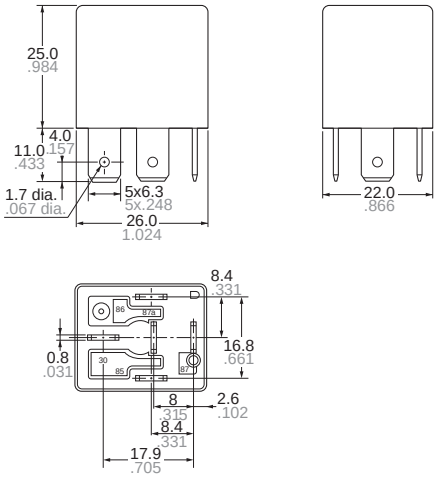


Tolerance: ±0.1 ±.004

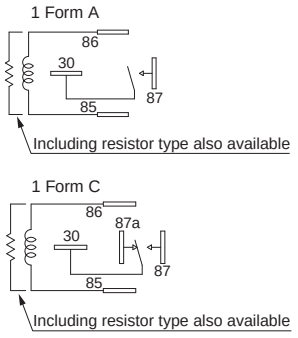
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

2. Plug-in type

External dimensions



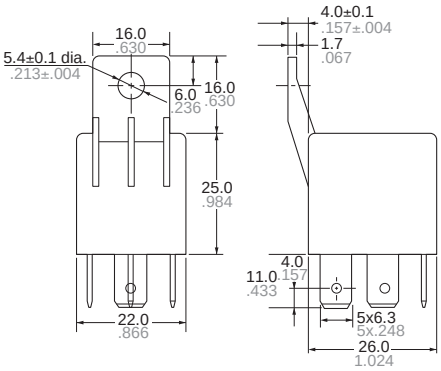
Schematic (Bottom view)

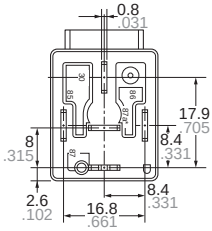


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

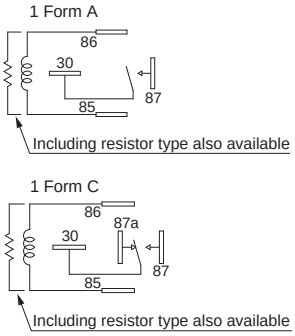
3. Bracket type

External dimensions





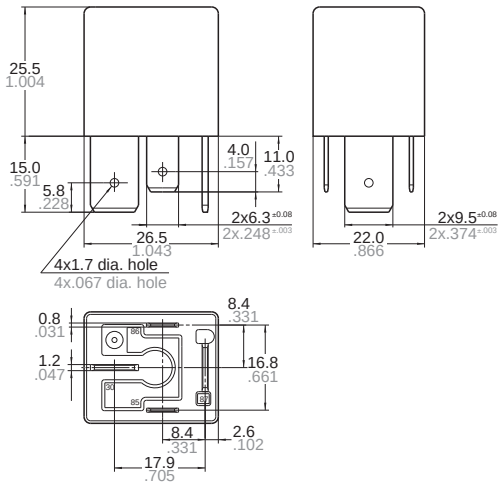
Schematic (Bottom view)



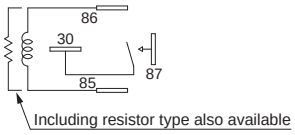
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

4. High contact capacity type (1 Form A) (Plug-in type)

External dimensions



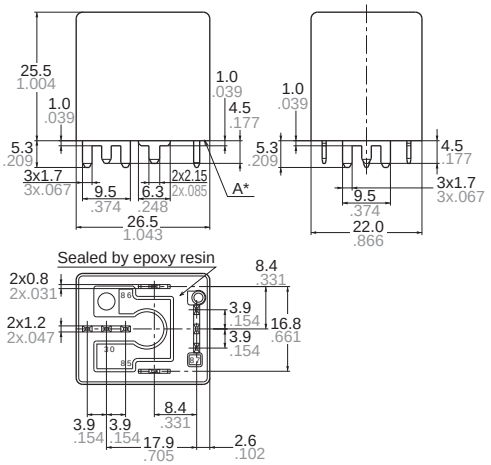
Schematic (Bottom view)



Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

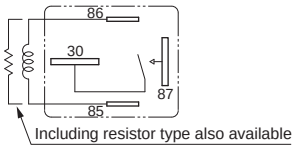
5. High contact capacity type (1 Form A) (PC board type)

External dimensions

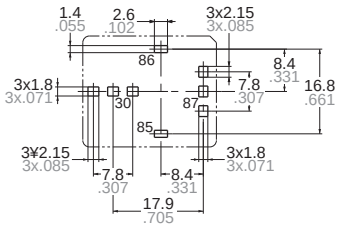


* Intervals between terminals is measured at A surface level.

Schematic (Bottom view)



PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

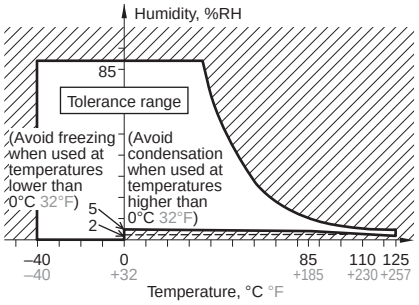
NOTES

1. Soldering

Max. 350°C 662°F (solder temperature), within 3 seconds (soldering time)
The effect on the relay depends on the actual PC board used. Please verify the PC board to be used.

2. Usage, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature: –40 to +85°C –40 to +185°F (Standard type)
–40 to +125°C –40 to +257°F (High heat-resistant type)
(2) Humidity: 2 to 85% RH (Avoid freezing and condensation.)
(3) Atmospheric pressure: 86 to 106 kPa
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(Temperature and humidity range for usage, transport, and storage)



For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

MICRO-ISO AUTOMOTIVE RELAY

CM RELAYS

Plug-in type

PC board type

FEATURES

- **Micro-ISO type terminals**
- **Small size:**
20 mm(L)×15 mm(W)×22 mm(H)
.787 inch(L)×.591 inch(L)×.866 inch(H)
- **Wide line-up**
PC board and Plug-in type, Resistor inside type.
24V DC type is also available.
- **Compact and high-capacity 35A load switching**
N.O.: 35A 14V DC, N.C.: 20A 14V DC (Sealed type)
Min. 5×10^4
N.O.: 35A 14V DC, N.C.: 20A 14V DC (Flux-resistant type)
Min. 10^5 *12V DC type
- **Uses international standard ISO terminal arrangement.**
The ISO international standard terminal arrangement is used.

TYPICAL APPLICATIONS

- **Fan motor**
- **Heater**
- **Head lump**
- **Air Compressor**
- **ABS**
- **Blower fan**
- **Defogger, etc.**

ORDERING INFORMATION

CM □ □ - □ - □ - □

Contact arrangement
1a: 1 Form A
1: 1 Form C

Protective construction
Nil: Sealed type
F: Flux-resistant type

Protective element
Nil: None (Standard type)
R: With resistor inside

Mounting classification
Nil: Plug-in type
P: PC board type (24 V only)

Coil voltage (DC)
12 V, 24 V

TYPES

Standard type

Contact arrangement	Coil voltage	Plug-in type		PC board type	
		Sealed type	Flux-resistant type	Sealed type	Flux-resistant type
		Part No.	Part No.	Part No.	Part No.
1 Form A	12 V DC	CM1a-12V	CM1aF-12V	—	—
	24 V DC	CM1a-24V	CM1aF-24V	CM1a-P-24V	CM1aF-P-24V
1 Form C	12 V DC	CM1-12V	CM1F-12V	—	—
	24 V DC	CM1-24V	CM1F-24V	CM1-P-24V	CM1F-P-24V

Standard packing; Carton: 50 pcs.; Case: 200 pcs.
Note: Please use "CM∗∗-R-∗-∗" built-in resistor type. (Asterisks " ∗ " should be filled in from ORDERING INFORMATION.)

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Usable voltage range
12 V DC	3 to 7 V DC	1.2 to 4.2 V DC	125 mA	96Ω	1.5 W	10 to 16V DC
24 V DC	6 to 14 V DC	2.4 to 8.4 V DC	75 mA	320Ω	1.8 W	20 to 32V DC

2. Specifications

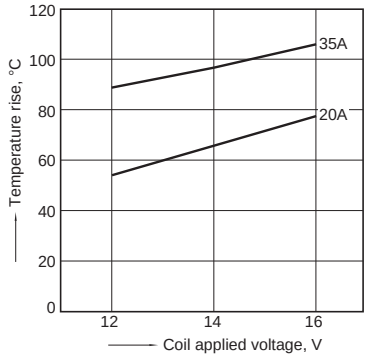
Characteristics	Item		Specifications			
			12 V DC		24 V DC	
Contact	Arrangement		1 Form A	1 Form C	1 Form A	1 Form C
	Contact resistance (Initial)		Typ 2mΩ (By voltage drop 6V DC 1A)			
	Contact voltage drop (after electrical life test)		N.O.: Max. 0.5 V (By voltage drop 14 V DC 35 A)	N.O.: Max. 0.5 V (By voltage drop 14 V DC 35 A) N.C.: Max. 0.3 V (By voltage drop 14 V DC 20 A)	N.O.: Max. 0.3 V (By voltage drop 28 V DC 15 A)	N.O.: Max. 0.3 V (By voltage drop 28 V DC 15 A) N.C.: Max. 0.2 V (By voltage drop 28 V DC 8 A)
	Contact material		Ag alloy (Cadmium free)			
Rating	Nominal switching capacity (resistive load)		N.O.: 35 A 14V DC	N.O.: 35 A 14V DC N.C.: 20 A 14V DC	N.O.: 15 A 28V DC	N.O.: 15 A 28V DC N.C.: 8 A 28V DC
	Max. carrying current (at 85°C 185°F, continuous)		N.O.: 20 A 14V DC	N.O.: 20 A 14V DC N.C.: 10 A 14V DC	N.O.: 15 A 28V DC	N.O.: 15 A 28V DC N.C.: 8 A 28V DC
	Nominal operating power		1.5 W, 1.7 W (with resistor inside type)		1.8 W, 2.0 W (with resistor inside type)	
	Min. switching capacity (resistive load)*1		1 A 12V DC		1 A 24V DC	
Electrical characteristics	Insulation resistance (Initial)		Min. 20 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)			
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)			
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)			
	Operate time (at nominal voltage) (at 20°C 68°F)		Max. 10ms (excluding contact bounce time) (Initial)			
	Release time (at nominal voltage) (at 20°C 68°F)		Max. 10ms (excluding contact bounce time) (Initial)			
Mechanical characteristics	Shock resistance	Functional	Min. 200 m/s² {20G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)			
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)			
	Vibration resistance	Functional	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}			
		Destructive	10 Hz to 2,000 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y, Z direction: 4 hours			
Expected life	Mechanical (at 120 cpm)		Min. 10^6			
	Electrical (operating frequency: 2s ON, 2s OFF)		Flux-resistant type: Min. 10^5, Sealed type: Min. 5×10^4			
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C –40°F to +185°F*3, Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature), Air pressure: 86 to 106 kPa			
Mass			Approx. 20 g .71 oz			

Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
*3. Please inquire if you will be using the relay in a high temperature atmosphere.

REFERENCE DATA

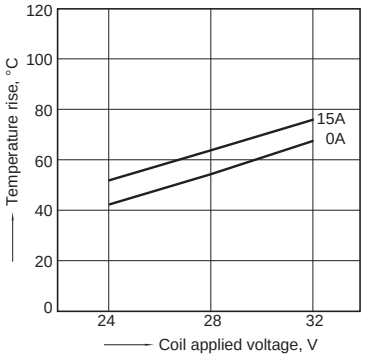
1.-(1) Coil temperature rise (12V type, 85°C 185°F)

Sample: CM1F-12V, 3 pcs.
Measured portion: Inside the coil
Contact carrying current: 20A, 35A
Ambient temperature: 85°C 185°F

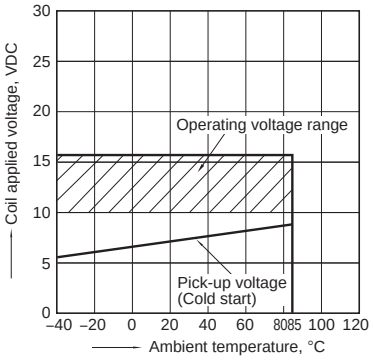


1.-(2) Coil temperature rise (24V type, 85°C 185°F)

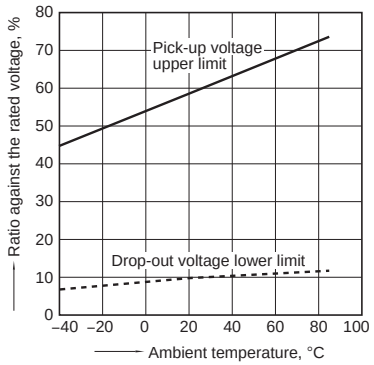
Sample: CM1F-24V, 4 pcs.
Measured portion: Inside the coil
Contact carrying current: 0A, 15A
Ambient temperature: 85°C 185°F



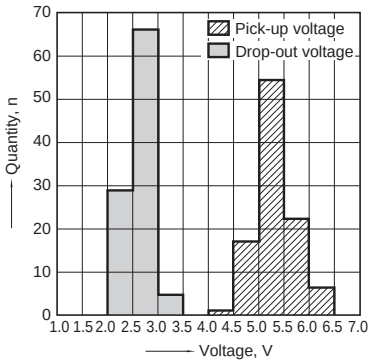
2. Ambient temperature and operating voltage range (12V type)



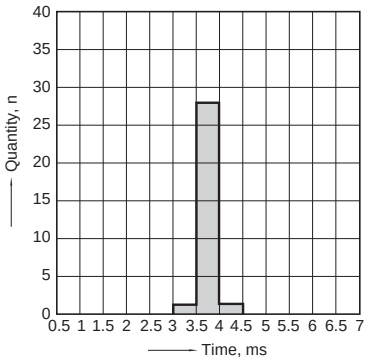
3. Ambient temperature characteristics (Cold/initial)



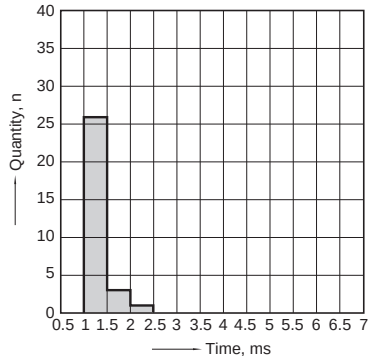
4. Distribution of pick-up and drop-out voltage
Sample: CM1F-12V, 100pcs.



5. Distribution of operate time
Sample: CM1F-12V, 30pcs.
* Max. 10ms standard (excluding contact bounce)

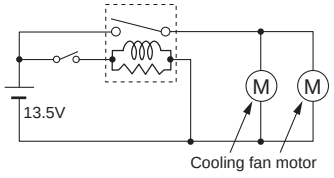


6. Distribution of release time
Sample: CM1F-12V, 30pcs.
* Max. 10ms standard (excluding contact bounce)

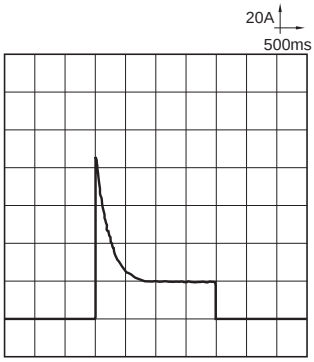


7.-(1) Electrical life test (Motor free)
Sample: CM1aF-R-12V, 6pcs.
Load: 16 A 13.5 V DC
Cooling fan motor actual load (free condition)
Operating frequency: ON 2s, OFF 6s
Ambient temperature: Room temperature

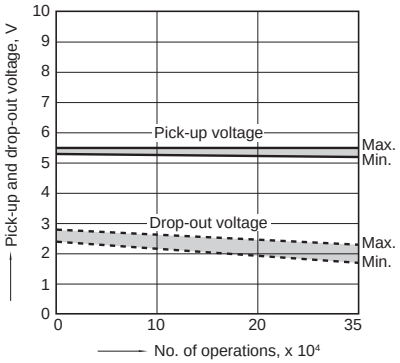
Circuit



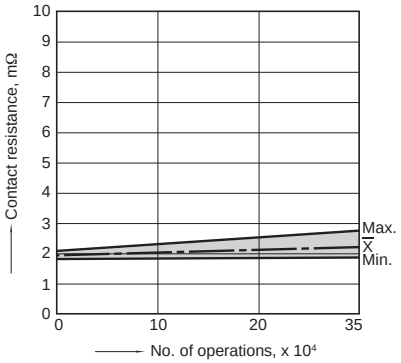
Load current waveform
Inrush current: 85A, Steady current: 18A,



Change of pick-up and drop-out voltage

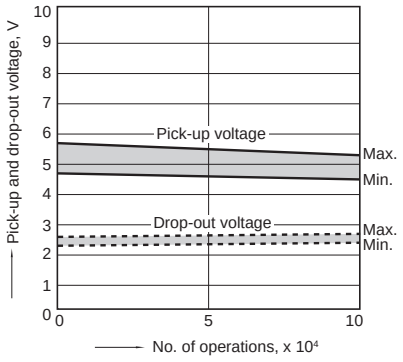


Change of contact resistance

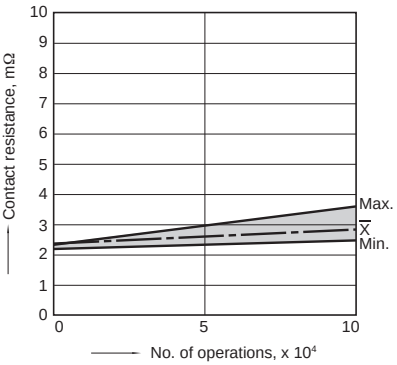


7.-(2) Electrical life test (Halogen lamp load)
Sample: CM1aF-R-12V, 6pcs.
Load: 20A 13.5V DC
Operating frequency: ON 1s, OFF 14s
Ambient temperature: Room temperature

Change of pick-up and drop-out voltage



Change of contact resistance

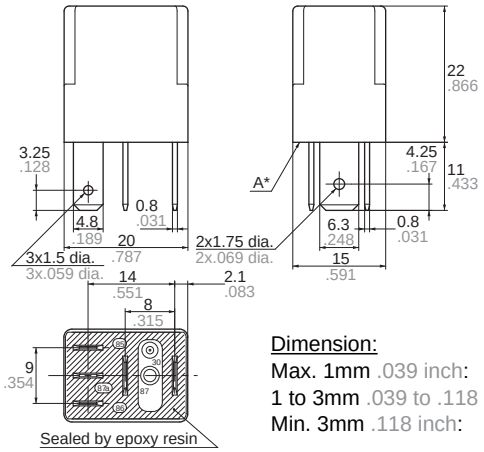


DIMENSIONS (mm inch)

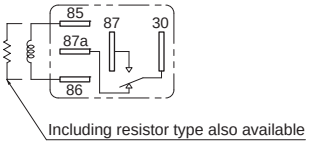
Download **CAD Data** from our Web site.

1. Plug-in type (1 Form C)

External dimensions



Schematic (Bottom view)

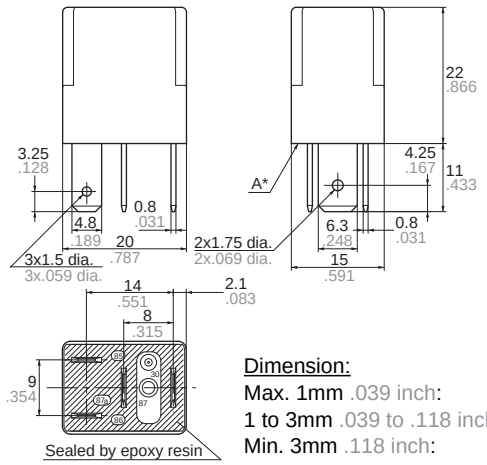


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

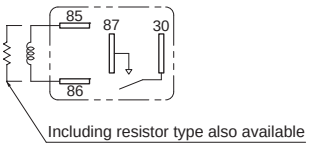
* Intervals between terminals is measured at A surface level.

2. Plug-in type (1 Form A)

External dimensions



Schematic (Bottom view)

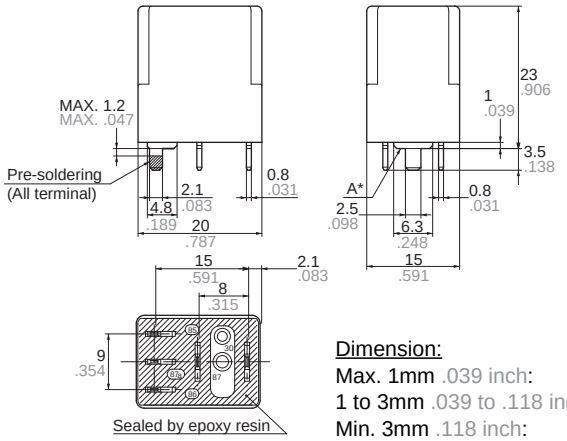


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Intervals between terminals is measured at A surface level.

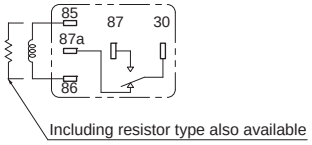
3. PC board type (1 Form C) ∗24V only

External dimensions

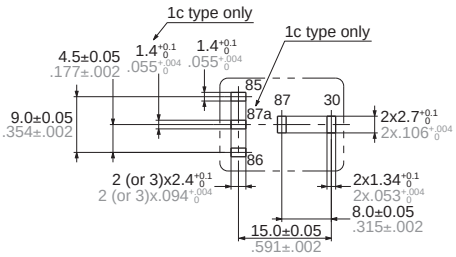


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)



PC board pattern (Bottom view)

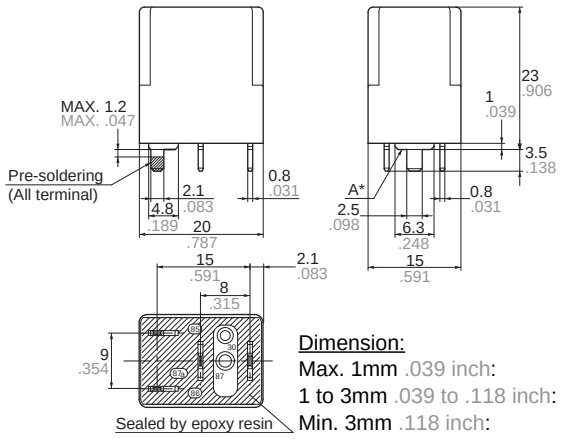


Tolerance: ±0.1 ±.004

∗ Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

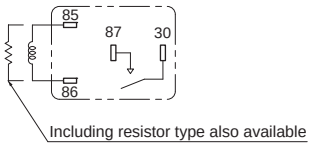
4. PC board type (1 Form A) ∗24V only

External dimensions



Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)



∗ Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

NOTES

1. Soldering

Max. 350°C 662°F (solder temperature),
within 3 seconds (soldering time)
The effect on the relay depends on the
actual PC board used. Please verify the
PC board to be used.

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

AUTOMOTIVE LOW PROFILE MICRO-ISO RELAY

CV RELAYS (ACV)


Micro ISO
1 Form C type


Micro ISO
1 Form A type

FEATURES

- **Low profile:**
22.5 mm(L)×15 mm(W)×15.7 mm(H)
.886 inch(L)×.591 inch(W)×.618 inch(H)
- **Low temperature rise**
Terminal temperature has been reduced compared with using our conventional product
- **Low sound pressure level**
Noise level has been reduced approx.10dB compared with using our conventional product.
- **Wide line-up**
Micro ISO terminal types and resistor inside type.
- **Plastic sealed type**
Plastically sealed for automatic cleaning.
- **Compact and high-capacity 20A load switching**
N.O.: 20A 14V DC, N.C.: 10A 14V DC
(Max. carrying current: at 85°C 185°F)

TYPICAL APPLICATIONS

- **Headlights**
- **Magnetic clutches**
- **Radiator fans**
- **Blowers**
- **Fog lamps**
- **Tail lights**
- **Heaters**
- **Defoggers**
- **Horns**
- **Condenser fans, etc.**

ORDERING INFORMATION

ACV □ □ □ □

Contact arrangement
1: 1 Form C
3: 1 Form A

Mounting classification
1: Micro ISO plug-in type

Protective element
0: None (Standard type)
2: With resistor inside

Coil voltage, DC
12: 12 V

TYPES

Contact arrangement	Coil voltage	Protective construction	Mounting classification	Part No.
1 Form A	12 V DC	Sealed type	Micro ISO plug-in type	ACV31012
1 Form C			Micro ISO plug-in type	ACV11012

Note: Please use "ACV**212" to order built-in resistor type. (Asterisks " * " should be filled in from ORDERING INFORMATION.)
Standard packing; Carton: 50 pcs.; Case: 200 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage* (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range (at 85°C 185°F)
12V DC	Max. 7.0 V DC (Initial)	Min. 0.6 V DC (Initial)	67 mA, 84 mA (with resistor)	180Ω, 142.3Ω (with resistor)	0.8 W, 1.0 W (with resistor)	10 to 16V DC

Note: * Other pick-up voltage types are also available. Please contact us for details.

2. Specifications

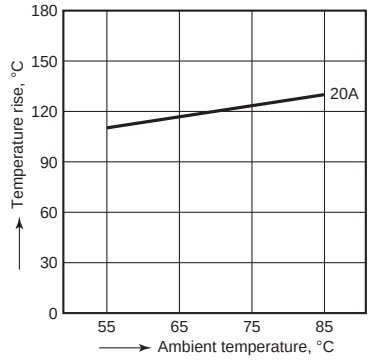
Characteristics	Item		Specifications	
Contact	Arrangement		1 Form A	1 Form C
	Contact resistance (Initial)		Typ 3mΩ (By voltage drop 6V DC 1A)	
	Contact voltage drop (after electrical life test)		N.O.: Max. 0.2 V (By voltage drop 14 V DC 20 A)	N.O.: Max. 0.2 V (By voltage drop 14 V DC 20 A) N.C.: Max. 0.5 V (By voltage drop 14 V DC 10 A)
	Contact material		Ag alloy (Cadmium free)	
Rating	Nominal switching capacity (resistive load)		N.O.: 20 A 14V DC	N.O.: 20 A 14V DC, N.C.: 10 A 14V DC
	Max. carrying current (at 85°C 185°F, continuous)		N.O.: 20 A 14V DC	N.O.: 20 A 14V DC N.C.: 10 A 14V DC
	Nominal operating power		0.8 W, 1.0 W (built-in resistor type)	
	Min. switching capacity (resistive load)*1		1 A 12V DC	
Electrical characteristics	Insulation resistance (Initial)		Min. 20 MΩ (at 500V DC)	
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)	
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)	
	Operate time (at nominal voltage) (at 20°C 68°F)		Max. 10ms (excluding contact bounce time) (Initial)	
	Release time (at nominal voltage) (at 20°C 68°F)		Max. 10ms (excluding contact bounce time) (Initial)	
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)	
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)	
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)	
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y, Z direction: 4 hours	
Expected life	Mechanical		Min. 10^6 (at 120 cpm)	
	Electrical (at nominal switching capacity)		Min. 10^5 (operating frequency: 2s ON, 2s OFF)	
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C –40°F to +185°F*3, Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature), air pressure: 86 to 106kPa	
Mass			Approx. 15 g .53 oz	

Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
*3. Please inquire if you will be using the relay in a high temperature atmosphere.
* Regarding solder, this product is not MIL (Military Standard) compliant. Please evaluate solder mounting by the actual equipment before using.

REFERENCE DATA

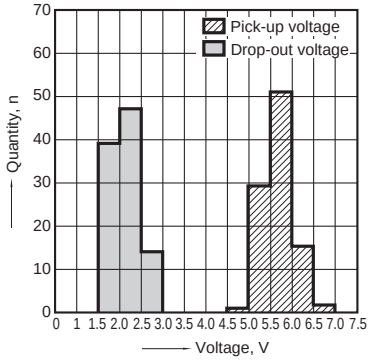
1. Coil temperature rise (20A)

Point measured: Inside the coil
Contact carrying current: 20A
Coil applied voltage: 13.5V



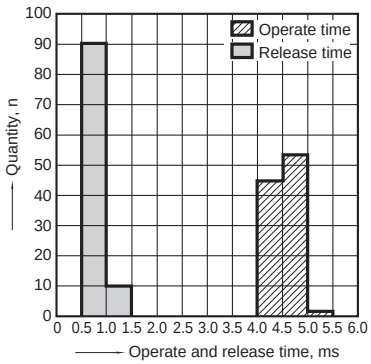
2. Distribution of pick-up and drop-out voltage

Sample: ACV11012, 100pcs

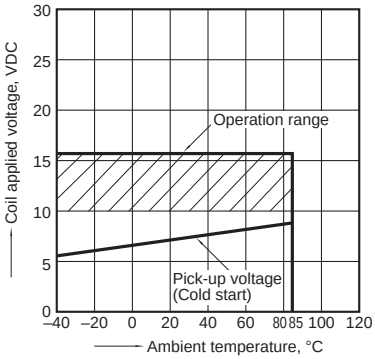


3. Distribution of operate and release time

Sample: ACV11012, 100pcs.



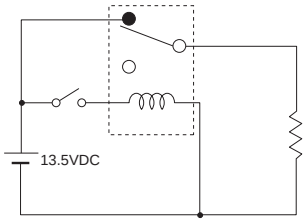
4. Ambient temperature and operating voltage range



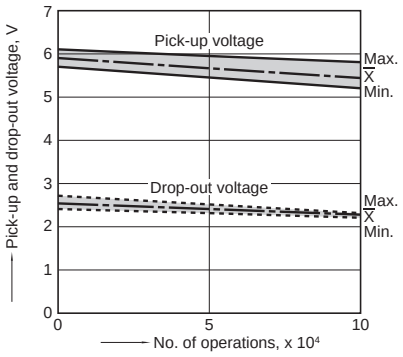
5-(1). Electrical life test (Resistive load)

Sample: ACV11012, 3pcs.
Load: Resistive load (NC switching) 10A
Switching frequency: ON 1s, OFF 1s
Ambient temperature: Room temperature

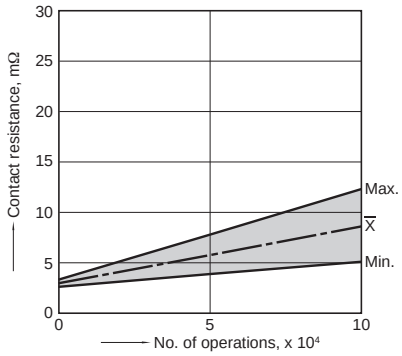
Circuit



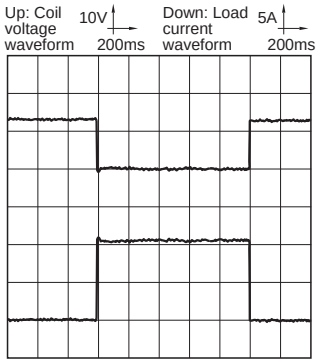
Change of pick-up and drop-out voltage



Change of contact resistance



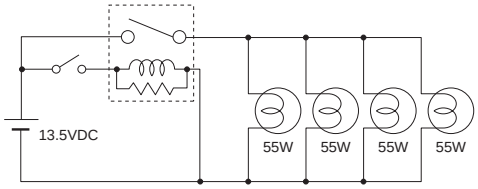
Load current waveform



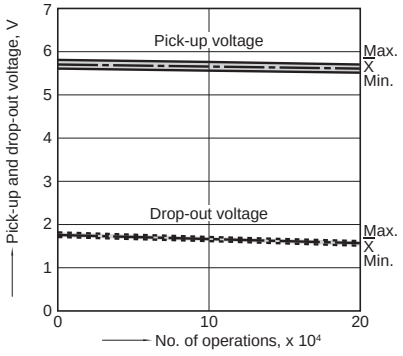
5-(2). Electrical life test (Lamp load)

Sample: ACV31212, 3pcs.
Load: 55Wx4, inrush: 90A/steady: 20A, lamp actual load
Switching frequency: ON 1s, OFF 14s
Ambient temperature: Room temperature

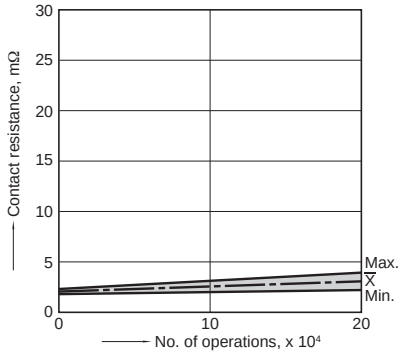
Circuit



Change of pick-up and drop-out voltage

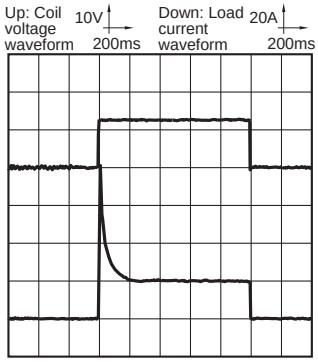


Change of contact resistance



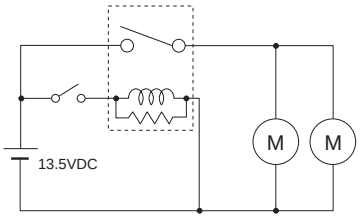
Load current waveform

Inrush current: 90A, steady current: 20A

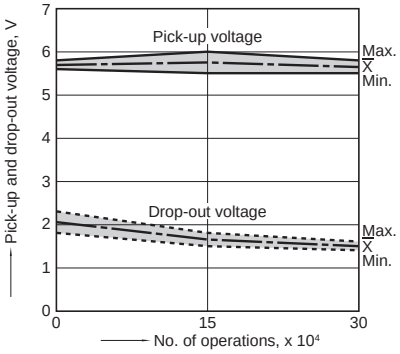


5-(3). Electrical life test (Motor load)
Sample: ACV31212, 3pcs.
Load: inrush: 80A/steady: 18A,
radiator fan actual load (motor free)
Switching frequency: ON 2s, OFF 6s
Ambient temperature: Room temperature

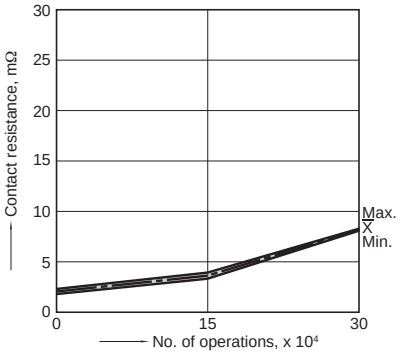
Circuit



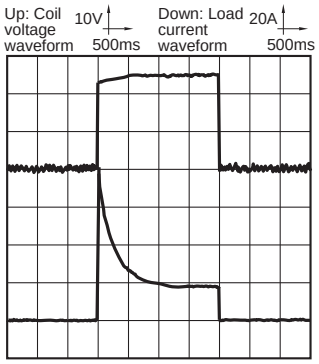
Change of pick-up and drop-out voltage



Change of contact resistance



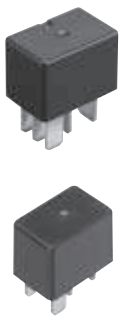
Load current waveform
Inrush current: 80A, steady current: 18A



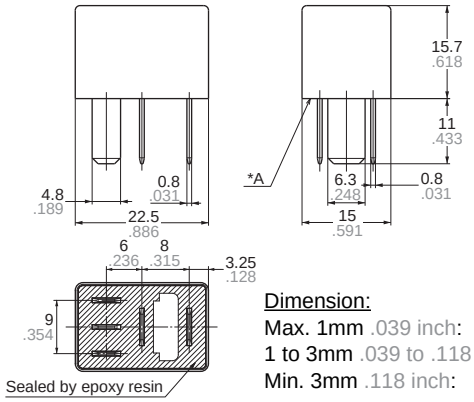
DIMENSIONS (mm inch)

Download CAD Data from our Web site.

1. Micro ISO plug-in type



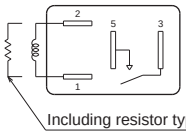
External dimensions



Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

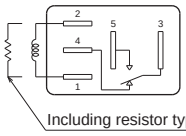
Schematic (Bottom view)

1 Form A



Including resistor type also available

1 Form C



Including resistor type also available

Note: Intervals between terminals is measured at A surface level.

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

MICRO-ISO AUTOMOTIVE LOW PROFILE RELAY

CV-N RELAYS (ACVN)

Micro ISO 1 Form A type

FEATURES

- **Low profile automotive relays for Micro-ISO terminal**
- **Compact and high-capacity load switching**
- **Plastic sealed type**

TYPICAL APPLICATIONS

- **Headlights**
- **Magnetic clutches**
- **Radiator fans**
- **Blowers**
- **Fog lamps**
- **Tail lights**
- **Heaters**
- **Defoggers**
- **Horns**
- **Condenser fans, etc.**

ORDERING INFORMATION

ACVN □ □ □ □

Contact arrangement
5: 1 Form A

Mounting classification
1: Plastic sealed Micro ISO plug-in type

Protective element
0: None
2: With resistor inside

Coil voltage, DC
12: 12 V

TYPES

Contact arrangement	Coil voltage	Protective construction	Mounting classification	Part No.
1 Form A	12 V DC	Plastic sealed type	Micro ISO plug-in type	ACVN51012

Note: Please use “ACVN∗∗2∗∗” to order with resistor inside type. (Asterisks “ ∗ ” should be filled in from ORDERING INFORMATION.)
Standard packing; Carton: 50 pcs.; Case: 200 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage* (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range (at 85°C 185°F)
12V DC	Max. 7.0 V DC (Initial)	Min. 0.5 V DC (Initial)	66.7 mA, 74.7 mA (with resistor)	180Ω, 160.7Ω (with resistor)	0.8 W, 0.9 W (with resistor)	10 to 16V DC

2. Specifications

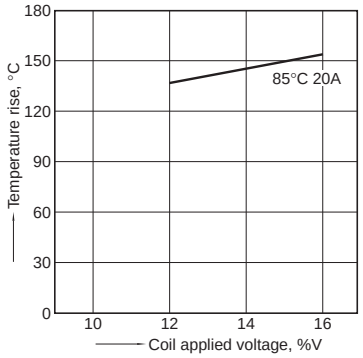
Characteristics	Item		Specifications
Contact	Arrangement		1 Form A
	Contact resistance (Initial)		Typ 3mΩ (By voltage drop 6V DC 1A)
	Contact voltage drop (Initial)		N.O.: Max. 0.5 V (By voltage drop 14 V DC 35 A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 35 A 14V DC
	Max. carrying current (at 85°C 185°F, continuous)		N.O.: 20 A 14V DC
	Nominal operating power (at 20°C 68°F)		0.8 W, 0.9 W (with resistor inside type)
	Min. switching capacity (resistive load)*1 (at 20°C 68°F)		1 A 14V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 20 MΩ (at 500V DC, Measurement at same location as “Breakdown voltage” section.)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage) (at 20°C 68°F)		Max. 10ms (excluding contact bounce time) (Initial)
	Release time (at nominal voltage) (at 20°C 68°F)		Max. 10ms (Initial)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y, Z direction: 4 hours
Expected life	Mechanical		Min. 10^6 (at 120 cpm)
	Electrical		<Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 2s ON, 2s OFF)
			<Motor load> Min. 3×10^5 (at 84 A (inrush), 18 A (steady), 14 V DC), Operating frequency: 2s ON, 5s OFF
			<Lamp load> Min. 2×10^5 (at 84 A (inrush), 12 A (steady), 14 V DC), Operating frequency: 1s ON, 14s OFF
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C –40°F to +185°F*3, Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature), air pressure: 86 to 106kPa
Mass			Approx. 12 g .42 oz

Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.
*3. Please inquire if you will be using the relay in a high temperature atmosphere.

REFERENCE DATA

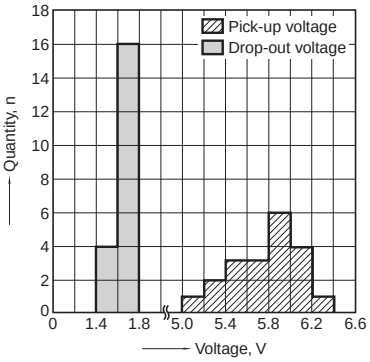
1. Coil temperature rise

Point measured: Inside the coil
Contact carrying current: 20A
Coil applied voltage: 12V, 14V, 16V
Ambient temperature: 85°C 185°F



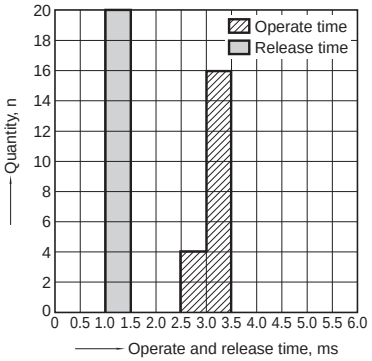
2. Distribution of pick-up and drop-out voltage

Sample: ACVN51012, 20pcs

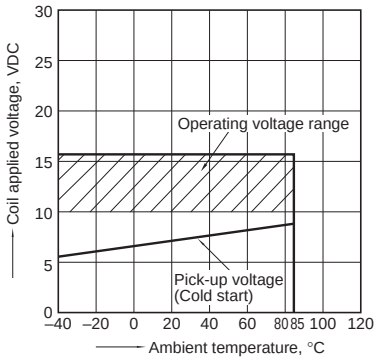


3. Distribution of operate and release time

Sample: ACVN51012, 20pcs.



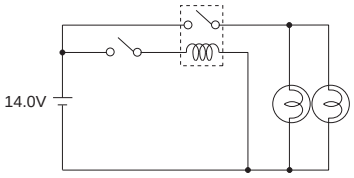
4. Ambient temperature and operating voltage range



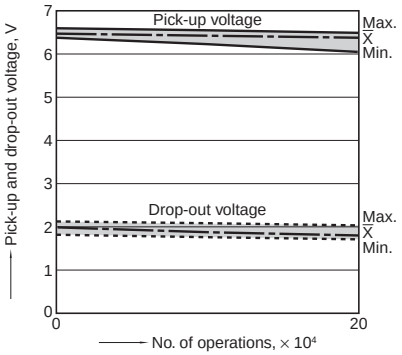
5.-(1) Electrical life test (Lamp load)

Sample: ACVN51012, 3pcs.
Load: 60W×2 (halogen lamp load), Inrush: 84A/ steady: 12A
Switching frequency: ON 1s, OFF 14s
Ambient temperature: 85°C 185°F

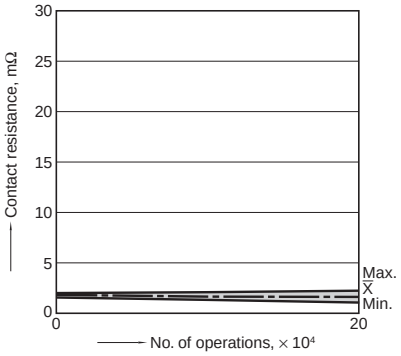
Circuit



Change of pick-up and drop-out voltage

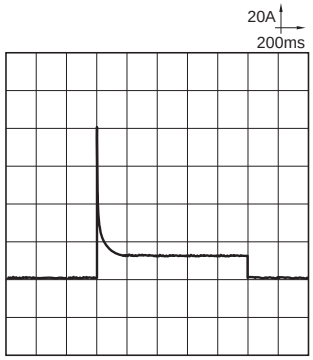


Change of contact resistance



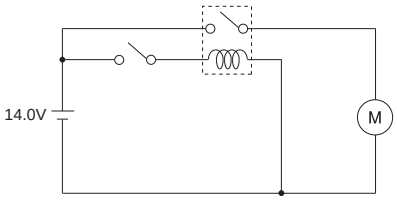
Load current waveform

Inrush current: 84A, steady current: 12A

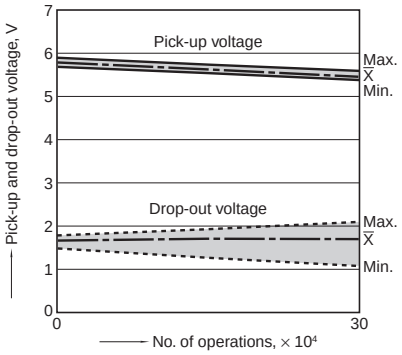


5.-(2) Electrical life test (Motor load)
Sample: ACVN51012, 3pcs.
Inrush: 80A/steady: 18A,
radiator fan motor (motor free)
Switching frequency: ON 1s, OFF 4s
Ambient temperature: 85°C 185°F

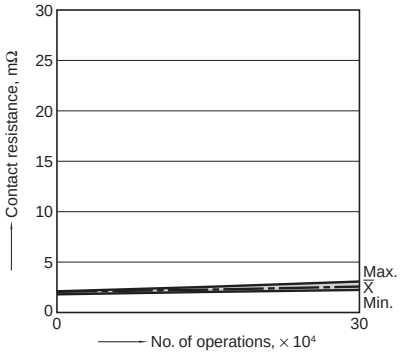
Circuit



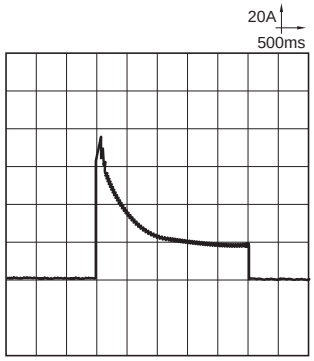
Change of pick-up and drop-out voltage



Change of contact resistance



Load current waveform
Inrush current: 80A, steady current: 18A

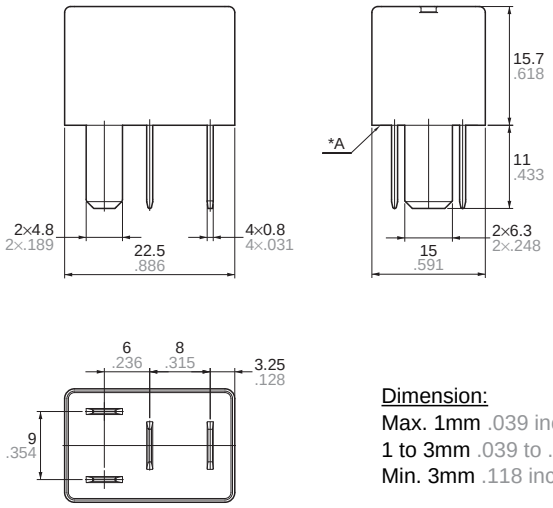


DIMENSIONS (mm inch)

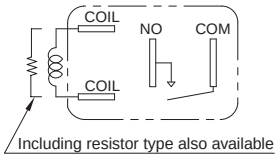
Download **CAD Data** from our Web site.

1. Micro ISO plug-in type

External dimensions



Schematic (Bottom view)



Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Note: Intervals between terminals is measured at A surface level.

For Cautions for Use, see Relay Technical Information (page 166).

CV-N (ACVN)

High Current/ High Voltage Automotive Relays

Panasonic
ideas for life

AUTOMOTIVE RELAY FOR FAILSAFE CIRCUITS IN HIGH OUTPUT MOTORS (EPS)

CW RELAYS (ACW)

FEATURES

• Ideal relay for high output 3-phase motors (EPS)
2-path cut-off (2 Form A) using single coil for 3-phase motors
• High cut-off current capability
High cut-off current performance (12V) using 2-point cut-off configuration
• High carrying current performance
High capacity achieved through use of high conductivity material
• Highly heat resistance properties
High heat resistance (at 125°C 257°F) through use of high heat resistance plastic

TYPICAL APPLICATIONS

• To 3-phase motor EPS unit (for failsafe circuit)

ORDERING INFORMATION

ACW [2] [ ]

Contact arrangement
2: 2 Form A

Coil voltage (DC)
12: 12 V

TYPES

Contact arrangement	Coil voltage	Part No.
2 Form A	12 V DC	ACW212

Standard packing; Carton: 40 pcs.; Case: 160 pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 6.2 V DC (Initial)	Min. 0.5 V DC (Initial)	117 mA	103Ω	1.4 W	10 to 16V DC

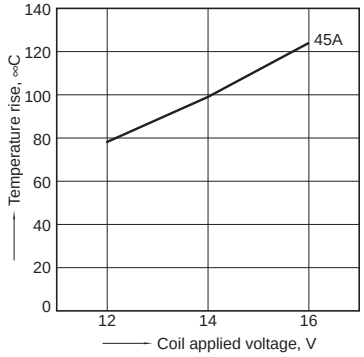
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		2 Form A
	Contact resistance (Initial)		Typ. 1.2 mΩ (By voltage drop 6V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (at carrying current)		120 A 14V DC for 5 seconds (at 20°C 68°F)
			70 A 14V DC for 1 minute (at 85°C 185°F)
			45 A 14V DC for continuous (at 85°C 185°F)
	Nominal operating power		1.4 W
	Min. switching capacity (resistive load)*1		1 A 14V DC (at 20°C 68°F)
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 20ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 20ms (at 20°C 68°F) (Initial) (without protective element)
Mechanical characteristics	Shock resistance	Functional	Min. 200 m/s² {approx. 20G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs) (12 V DC applied to the coil, at 20°C 68°F)
		Destructive	Min. 1,000 m/s² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 500 Hz, Min. 44.1 m/s² {approx. 4.5G} (Detection time: 10μs) (12 V DC applied to the coil, at 20°C 68°F)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {approx. 4.5G}, Time of vibration for each direction; X, Y, Z direction: 4 hours
Expected life	Mechanical		Min. 2 × 10⁵ (at 60 cpm)
	Electrical (at cut off only)		200 A 14V DC (resistive load), Min. 3 times (without diode)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +125°C –40°F to +257°F, Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
Mass			Approx. 26 g .92 oz

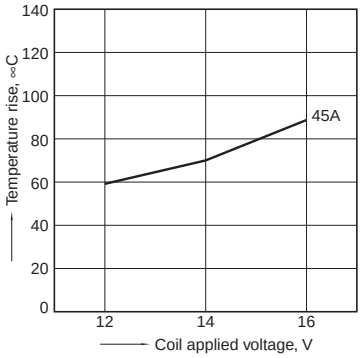
Notes:
*1.This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2.The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage ambient condition“ on page 178.

REFERENCE DATA

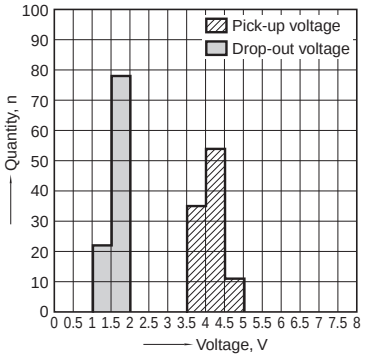
1.-(1) Coil temperature rise (25°C 77°F)
Sample: ACW212, 3pcs
Point measured: Inside the coil
Contact carrying current: 45A
Ambient temperature: 25°C 77°F



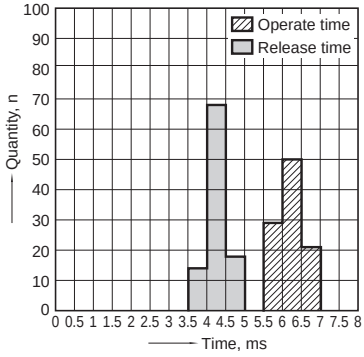
1.-(1) Coil temperature rise (85°C 185°F)
Sample: ACW212, 3pcs
Point measured: Inside the coil
Contact carrying current: 45A
Ambient temperature: 85°C 185°F



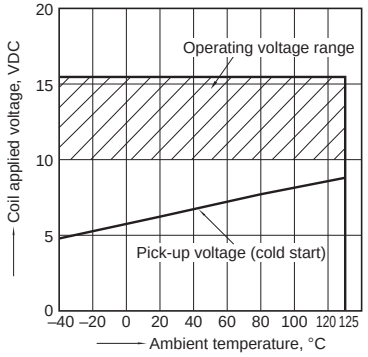
2. Distribution of pick-up and drop-out voltage
Sample: ACW212, 100pcs



3. Distribution of operate and release time
Sample: ACW212, 100pcs.



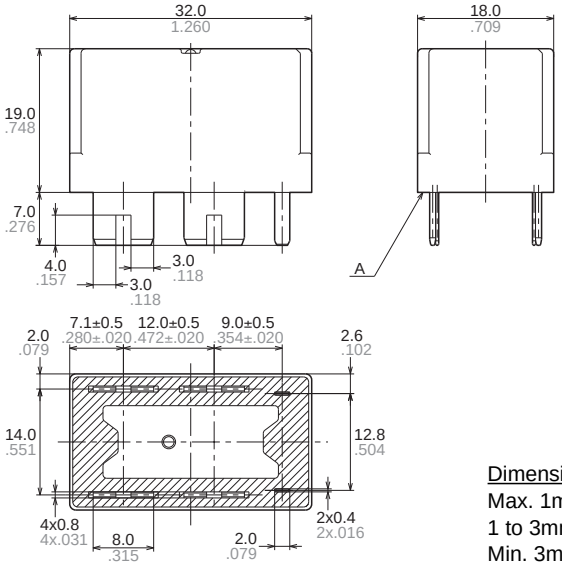
4. Ambient temperature and operating voltage range



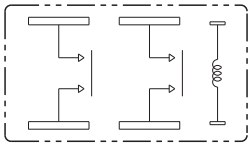
DIMENSIONS (mm inch)

Download **CAD Data** from our Web site.

External dimensions



Schematic (Bottom view)



Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Intervals between terminals is measured at A surface level.

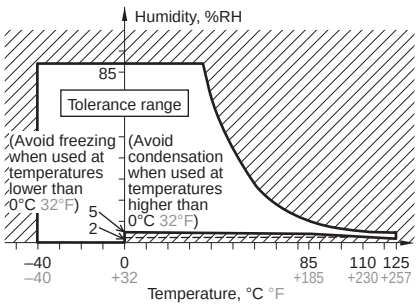
NOTES

1. Mounting method

These relays are designed for mounting by welding. Soldering cannot be used for mounting.

2. Usage, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature:
–40 to +125°C –40 to +257°F
(2) Humidity: 2 to 85% RH (Avoid freezing and condensation.)
(3) Atmospheric pressure: 86 to 106 kPa
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(Temperature and humidity range for usage, transport, and storage)



For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

Capsule contact mechanism and high-capacity cut-off compact relay

EV RELAYS (AEV)


10A


20A


80A


120A


200A


300A

FEATURES

1. Compact and lightweight
Charged with hydrogen gas for high arc cooling capacity, short gap cutoff has been achieved at high DC voltages.

2. Safety
High safety achieved with construction that prevents explosions by keeping the arc from leaking.

3. High contact reliability
Since the contact portion is sealed in hydrogen gas, there is no contact oxidation. The relay is also dustproof.

TYPICAL APPLICATIONS

High DC voltage applications such as

- **Electric vehicle**
- **Hybrid vehicle**
- **Fuel-cell vehicle**
- **Battery charge and discharge systems**
- **Construction equipment**

Automotive

ORDERING INFORMATION

AEV □ □ **0** □ □

Contact arrangement
1: 1 Form A (Screw terminal, 10A TM, with terminal protection cover)
5: 1 Form A (20A TM type)

Contact rating
1: 10 A
2: 20 A
8: 80 A
4: 120 A
7: 200 A
9: 300 A

Coil voltage
12: 12V DC
24: 24V DC

Coil terminal structure
Nil: Plug-in (Faston) (for 20 A type), Connector (for 80 A, 120 A and 300 A), Lead wire (for 200 A)
2: Plug-in (Faston) (for 10 A type with terminal protection cover)

TYPES

Type	Nominal coil voltage	Contact arrangement	Part number
10 A	12 V DC	1 Form A	AEV110122
20 A			AEV52012
80 A			AEV18012
120 A			AEV14012
200 A			AEV17012
300 A			AEV19012
10 A	24 V DC	1 Form A	AEV110242
80 A			AEV18024
120 A			AEV14024
200 A			AEV17024
300 A			AEV19024

Standard packing; Carton: 25pcs. Case: 100pcs (for 10 A type)
Carton: 25pcs. Case: 50pcs (for 20 A type)
Carton: 1pc. Case: 20pcs (for 80 A type)
Carton: 1pc. Case: 20pcs (for 120 A type)
Carton: 1pc. Case: 10pcs (for 200 A type)
Carton: 1pc. Case: 5pcs (for 300 A type)

RATING

1. Coil data

Type	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Max. applied voltage
10 A	12 V DC	Max. 9 V DC	Min. 1 V DC	0.103 A	1.24 W	16 V DC
20 A		Max. 9 V DC	Min. 0.5 V DC	0.327 A	3.9 W	
80 A		Max. 9 V DC	Min. 1 V DC	0.353 A	4.2 W	
120 A		Max. 9 V DC	Min. 1 V DC	0.353 A	4.2 W	
200 A		Max. 9 V DC	Min. 1 V DC	0.500 A	6.0 W	
300 A		Max. 9 V DC	Min. 2 V DC	3.2 A (Inrush)	37.9 W (Inrush, approx. 0.1 sec.) 3.6 W (Stable)	
10 A	24 V DC	Max. 18 V DC	Min. 2 V DC	0.052 A	1.24 W	32 V DC
80 A		Max. 18 V DC	Min. 2 V DC	0.176 A	4.2 W	
120 A		Max. 18 V DC	Min. 2 V DC	0.176 A	4.2 W	
200 A		Max. 18 V DC	Min. 2 V DC	0.250 A	6.0 W	
300 A		Max. 18 V DC	Min. 4 V DC	1.85 A (Inrush)	44.4 W (Inrush, approx. 0.1 sec.) 3.8 W (Stable)	

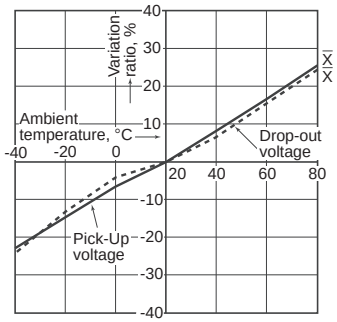
2. Specifications

Characteristics	Item		Specifications					
			10A type	20A type	80A type	120 A type	200 A type	300 A type
Contact rating	Contact arrangement		1 Form A					
	Nominal switching capacity (resistive load)		10A 400V DC	20A 400V DC	80A 400V DC	120A 400V DC (Carry current)	200A 400V DC	300A 400V DC
	Short term current		15A 2min, 30A 30sec ($2mm^2$)	40A 10min, 60A 1min ($3mm^2$)	120A 15min, 180A 2min ($15mm^2$)	225A 3min, 400A 30sec. ($38mm^2$)	300A 15min, ($60mm^2$)	400A 10min, 600A 1min. ($100mm^2$)
	Min. switching capacity (resistive load)*1		1A 12V DC*1	1A 12V DC*1	1A 12V DC*1	1A 12V DC*1	1A 12V DC*1	1A 24V DC*1
	Max. cut-off current*5		—	—	800A 300V DC (Min. 1 cycle)*2, 5	1,200A 300V DC (Min. 1 cycle)*2, 5	2,000A 350V DC (Min. 1 cycle)*2, 5	2,500A 300V DC (Min. 3 cycles)*3, 5
	Overload opening/closing rating*5		30A 400V DC (Min. 50 cycles)*2, 5	60A 400V DC (Min. 50 cycles)*2, 5	120A 400V DC (Min. 50 cycles)*2, 5	800A 300V DC (Min. 5 cycles)*2, 5 120A 400V DC (Min. 50 cycles)*2, 5	—	600A 400V DC (Min. 300 cycles)
	Reverse direction cut-off*5		—	—	–120A 200V DC (Min. 50 cycles)*2, 5	–120A 200V DC (Min. 50 cycles)*2, 5	–200A 200V DC (Min. 1,000 cycles)*2, 5	–300A 200V DC (Min. 100 cycles)
	Contact voltage drop (Initial)		Max. 0.5V (By voltage drop 6 V DC 10A)	Max. 0.2V (By voltage drop 6 V DC 20A)	Max. 0.067V (By voltage drop 6 V DC 20A)	Max. 0.03V (By voltage drop 6 V DC 20A)	Max. 0.1V (200 A Carry current)	Max. 0.06V (300 A Carry current)
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500 V DC, Measurement at same location as “Initial breakdown voltage” section.)					
	Breakdown voltage (Initial)	Between open contacts	2,500Vrms/min. (Detection current: 10mA)					
		Between contact and coil	2,500Vrms/min. (Detection current: 10mA)					
	Operate time (at 20°C 68°F)		Max. 50ms (Nominal coil voltage applied to the coil, excluding contact bounce time.)					Max. 30ms (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time (at 20°C 68°F)		Max. 30ms (Nominal coil voltage applied to the coil, without diode.)					Max. 10ms (Nominal coil voltage applied to the coil, without diode.)
Mechanical characteristics	Shock resistance	Functional	Min. 196m/s² {20 G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)	For ON: Min. 196m/s² {20 G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs) For OFF: Min. 98m/s² {10 G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)				
		Destructive	Min. 490 m/s² {50 G} (Half-wave pulse of sine wave: 6ms)					
	Vibration resistance	Functional	10 to 200 Hz, Min.43 m/s² {4.4 G} (Detection time: 10μs)					10 to 200 Hz, Min. 44 m/s² {4.5 G} (Detection time: 10μs)
		Destructive	10 to 200 Hz, Min.43 m/s² {4.4 G} (Time of vibration for each direction; X, Y, Z direction: 4 hours)					10 to 200 Hz, Min. 44 m/s² {4.5 G} (Time of vibration for each direction; X, Y, Z direction: 4 hours)
Expected life	Mechanical		Min. 10^5	Min. 2×10^5				
	Electrical (resistive load)		10A 400V DC Min. 75,000*2	20A 400V DC Min. 3,000*2	80A 400V DC Min. 1,000*2	30A 400V DC Min. 3,000*2	200A 400V DC Min. 3,000*2	300A 400V DC Min. 1,000
Conditions	Conditions for operation, transport and storage		Ambient temperature: –40 to +80°C –40 to +176°F (Storage: Max. 85°C 185°F), Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)				Ambient temperature: –40 to +85°C –40 to +185°F (Storage: Max.85°C 185°F), Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)	
Mass (Approx.)			90 g 3.17 oz	180 g 6.35 oz	400 g 14.11 oz	400 g 14.11 oz	600 g 21.16 oz	750 g 26.46 oz

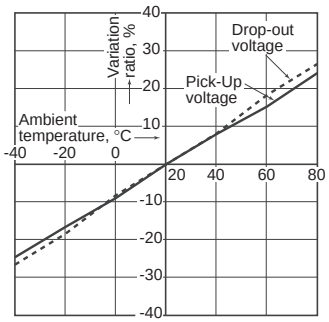
Notes:
*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The electrical load performance value for the 10A, 20A, 80A, 120A and 200A types applies when a varistor is connected in parallel to the coil. Please be warned that working life will be reduced when a diode is used.
*3. Condition: Nominal switching 10 cycles, each cut-off 2,500 A
*4. The coil voltage 12 V DC type and 24 V DC type have the same specifications.
*5. at L/R ≤ 1ms
*6. Refer to “Usage ambient condition“ on page 178.

REFERENCE DATA

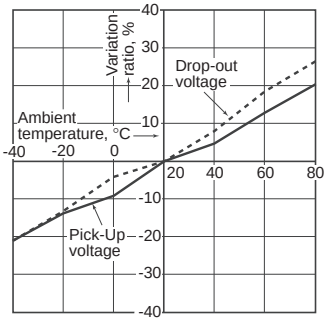
1.-(1) Ambient temperature characteristics (10 A type)
Sample: EV relay 10 A, 3 pcs.



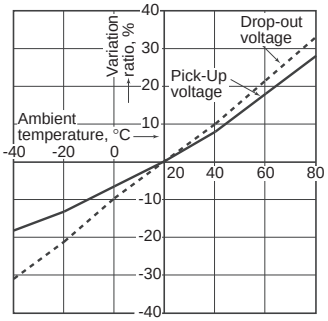
1.-(2) Ambient temperature characteristics (20 A type)
Sample: EV relay 20 A, 3 pcs.



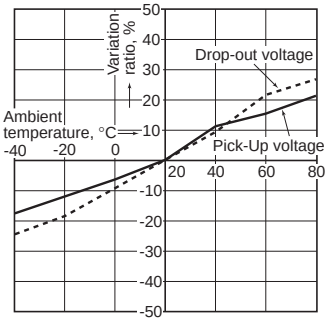
1.-(3) Ambient temperature characteristics (80 A type)
Sample: EV relay 80 A, 3 pcs.



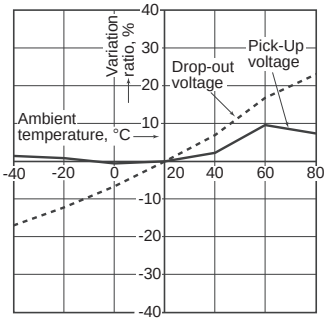
1.-(4) Ambient temperature characteristics (120 A type)
Sample: EV relay 120 A, 3 pcs.



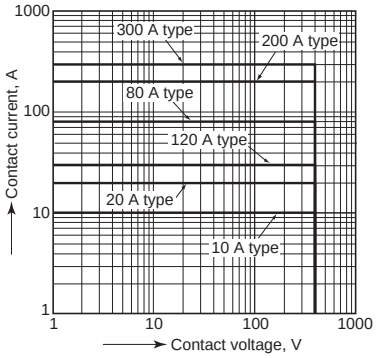
1.-(5) Ambient temperature characteristics (200 A type)
Sample: EV relay 200 A, 3 pcs.



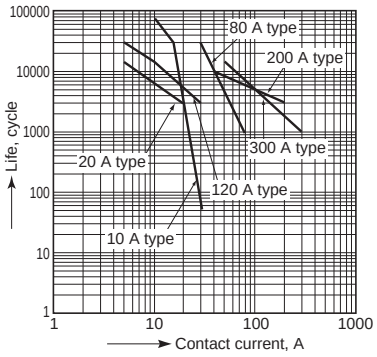
1.-(6) Ambient temperature characteristics (300 A type)
Sample: EV relay 300 A, 3 pcs.



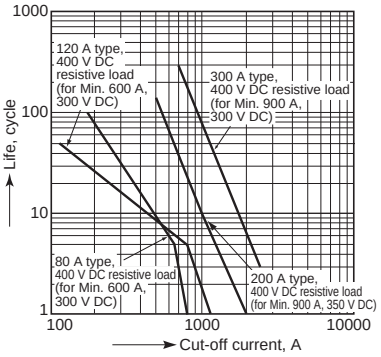
2. Max. value for switching capacity
When 400 V DC resistive load



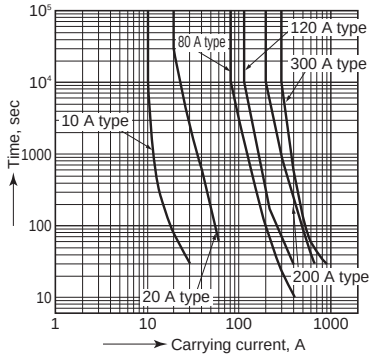
3. Switching life curve (Forward direction)
When 400 V DC resistive load



4. Cut-off life curve (Forward direction)



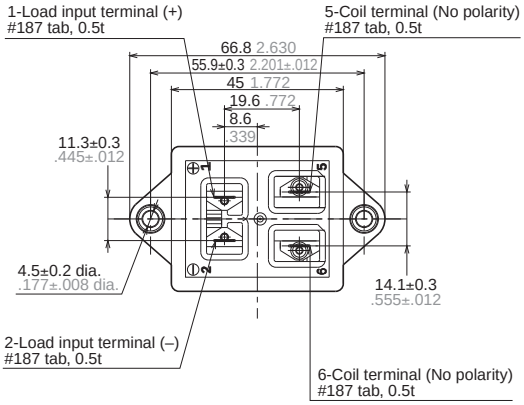
5. Carrying performance curve (80°C 176°F)
*For 300 A, at 85°C 185°F

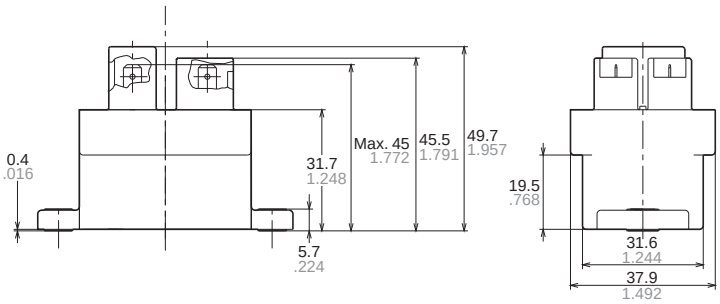


DIMENSIONS (mm inch)

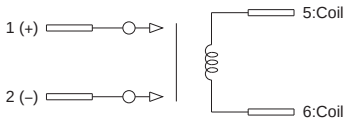
Download **CAD Data** from our Web site.

1. 10 A type



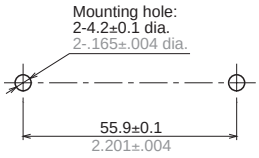


Schematic (TOP VIEW)



Load side has polarities (+) and (–)

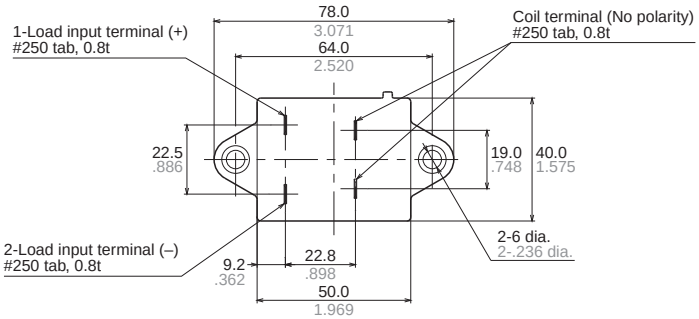
Mounting dimensions

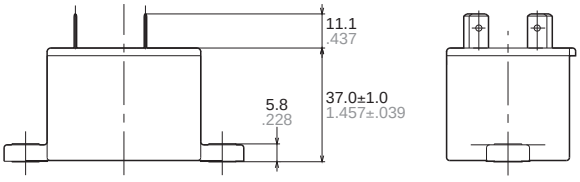


General tolerance:

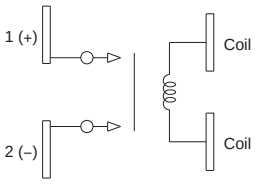
less than 10 .394:	±0.3 ±.012
10 to 50 .394 to 1.969:	±0.6 ±.024
more than 50 1.969:	±1.0 ±.039

2. 20 A type



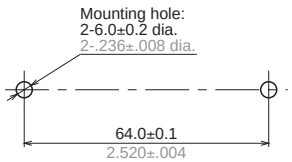


Schematic (TOP VIEW)



Load side has polarities (+) and (–)

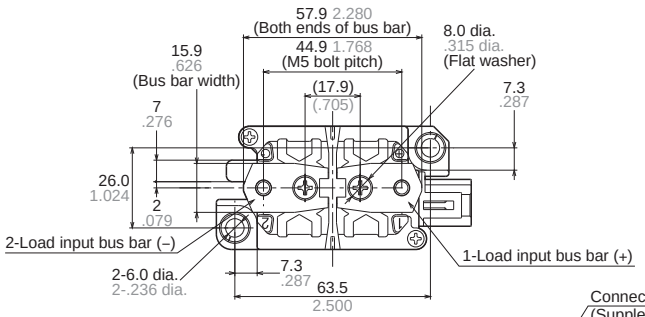
Mounting dimensions

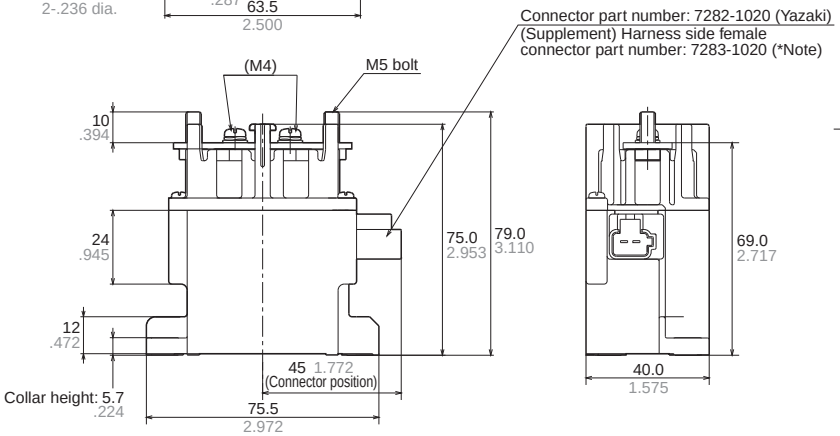


General tolerance:

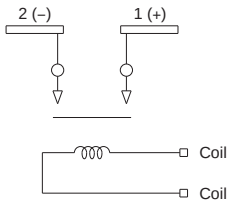
less than 10 .394:	±0.3 ±.012
10 to 50 .394 to 1.969:	±0.6 ±.024
more than 50 1.969:	±1.0 ±.039

3. 80 A type

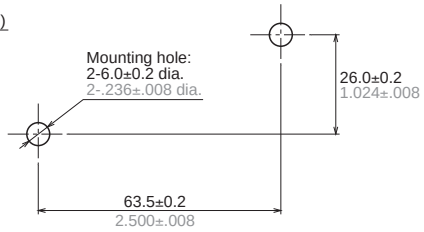




Schematic (TOP VIEW)



Mounting dimensions

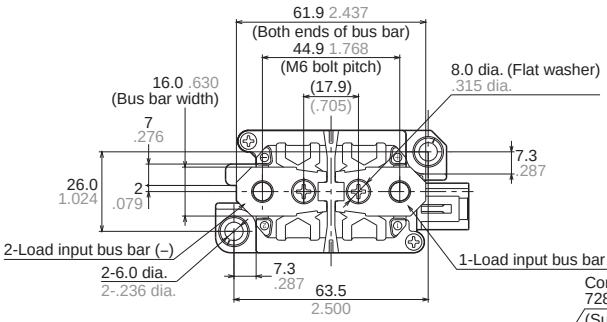


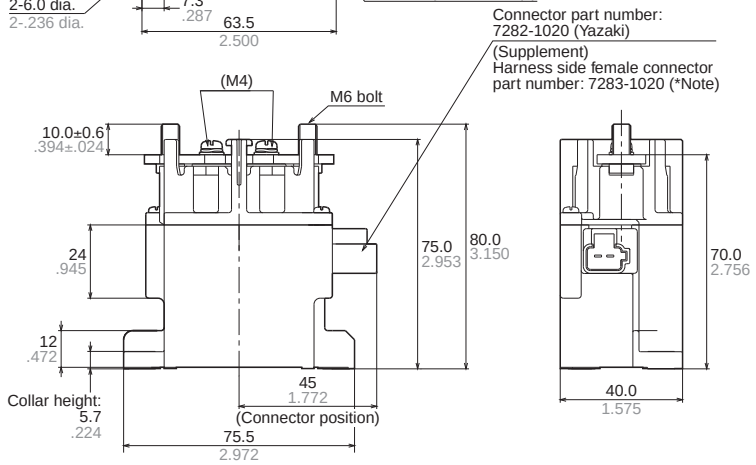
General tolerance:

less than 10 .394:	±0.3 ±.012
10 to 50 .394 to 1.969:	±0.6 ±.024
more than 50 1.969:	±1.0 ±.039

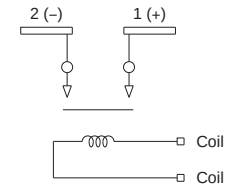
*Note: Separate connection of the terminal and lead wire is required.

4. 120 A type



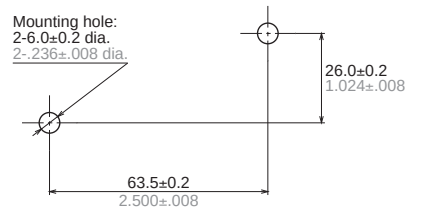


Schematic (TOP VIEW)



Load side has polarities (+) and (–)

Mounting dimensions



General tolerance:

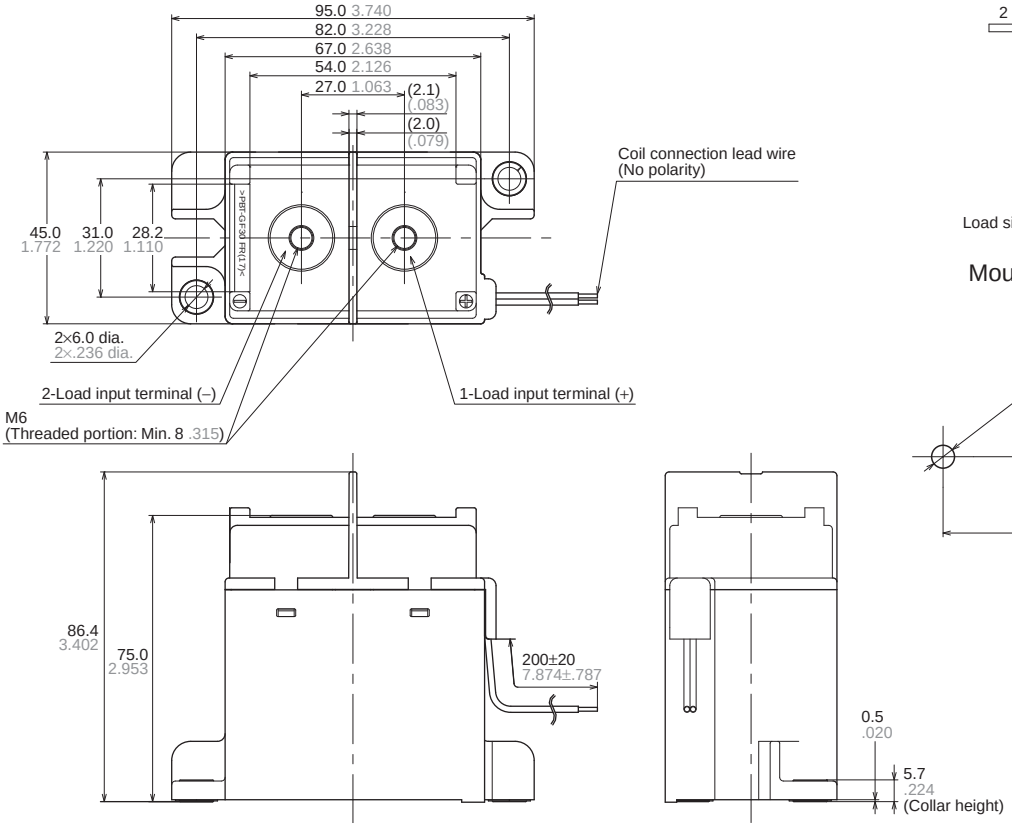
less than 10 .394:	±0.3 ±.012
10 to 50 .394 to 1.969:	±0.6 ±.024
more than 50 1.969:	±1.0 ±.039

*Note: Separate connection of the terminal and lead wire is required.

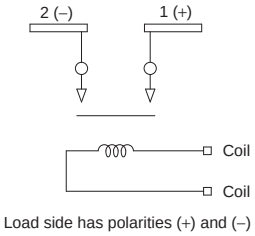
5. 200 A type

CAD Data

External dimensions

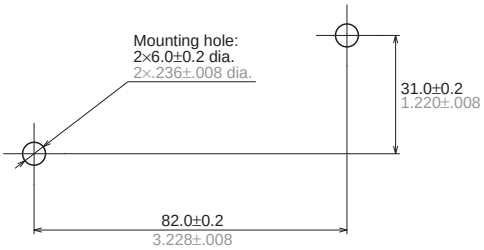


Schematic (TOP VIEW)



Load side has polarities (+) and (–)

Mounting dimensions



General tolerance:

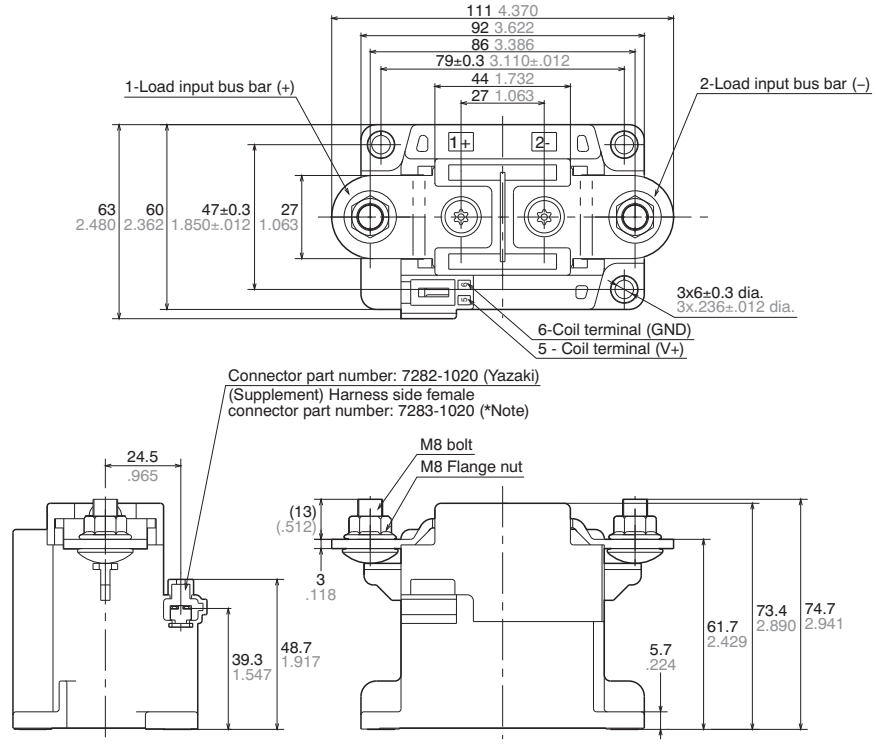
less than 10 .394:	±0.3 ±.012
10 to 50 .394 to 1.969:	±0.6 ±.024
more than 50 1.969:	±1.0 ±.039

*Note: Separate connection of the terminal and lead wire is required.

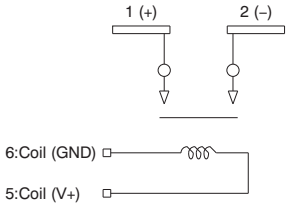
6. 300 A type

CAD Data

External dimensions

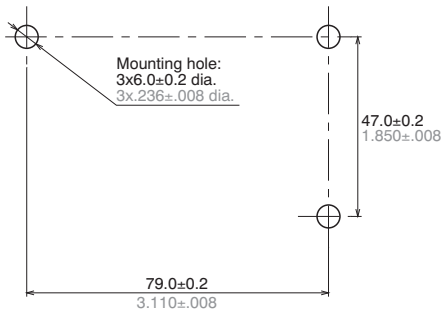


Schematic (TOP VIEW)



Load side has polarities (+) and (–)

Mounting dimensions



General tolerance:

less than 10 .394:	±0.3 ±.012
10 to 50 .394 to 1.969:	±0.6 ±.024
more than 50 1.969:	±1.0 ±.039
more than 100 3.937:	±1.6 ±.063

*Note: Separate connection of the terminal and lead wire is required.

NOTES

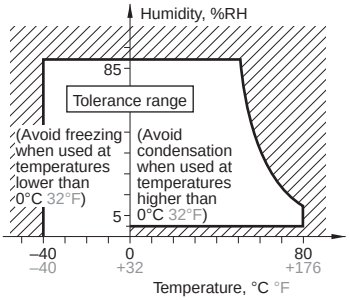
1. Usage, transport and storage conditions

1) Temperature: –40 to +80°C –40 to +176°F

2) Humidity: 5 to 85% RH (Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.

3) Atmospheric pressure: 86 to 106 kPa

Temperature and humidity range for usage, transport, and storage



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

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

2. When installing the relay, always use washers to prevent the screws from loosening.

• Regarding the torque value for contact terminal, it is intended that secure an electrical connection stability by getting enough contact pressure (Axial force) of fixing part.
Therefore, please do not use the screw (a bolt and a nut) preventing looseness needing running torque (Prevailing torque type and Self lock type) because enough tightening force in axial direction may not be secured.
In addition, there is high possibility that a case of a relay may be broken if users use the nut for EV80A and EV120A.
Because excessive torque is applied to a case of a relay before generation of contact pressure. (Axial force).

• Regarding the torque value for the main body of a relay, please use suitable screw on own verification.

3. Condition of tightening screw

Tighten each screw within the rated range given below.
Exceeding the maximum torque may result in breakage.
Mounting is possible in either direction.

<Relay attaching portion>
• M4 screw (for 10A type): 1.8 to 2.7 N·m
• M5 screw (for 20A, 80A, 120A, 200A and 300A types): 3 to 4 N·m

<Main terminal attaching portion>
• M5 (for 80A type): 3 to 4 N·m
• M6 (for 120A and 200A types): 6 to 8 N·m
• M8 (for 300A type): 10 to 12 N·m

4. Electrical life

This relay is a high-voltage direct-current switch. In its final breakdown mode, it may lose the ability to provide the proper cut-off. Therefore, do not exceed the indicated switching capacity and life. (Please treat the relay as a product with limited life and replace it when necessary.)
In the event that the relay loses cut-off ability, there is a possibility that burning may spread to surrounding parts, so configure the layout so that the power is turned off within one second.

5. Permeation life of internal gas

This relay uses a hermetically encased contact (capsule contact) with gas inside. The gas has a permeation life that is affected by the temperature inside the capsule contact (ambient temperature + temperature rise due to flow of electrical current). For this reason, make sure the ambient operating temperature is between –40 and 80°C –40 and +176°F (200A and 300A types: Max. 85°C 185°F), and the ambient storage temperature is between –40 and 85°C –40 and +185°F.

6. The coils (300 A type) and contacts (all type) of the relay are polarized, so follow the connection schematic when connecting the coils and contacts.

Type 300 A contains a reverse surge voltage absorption circuit; therefore a surge protector is not needed.

7. For the 300 A type, drive the coil with a quick startup.

(Built-in one-shot pulse generator circuit)

8. After the ON signal enters the 300A type, automatic coil current switching occurs after approximately 0.1 seconds. Do not repeatedly turn it OFF within that 0.1 seconds interval, as doing so may damage the relay.

9. Be careful that foreign matter and oils and fats kind don't stick to the main terminal parts because it is likely to cause terminal parts to give off unusual heat.
Also, please use the following materials for connected harnesses and bus bars.

10A type: Min. 2 mm^2 nominal cross-sectional area
20A type: Min. 3 mm^2 nominal cross-sectional area
80A type: Min. 15 mm^2 nominal cross-sectional area
120A type: Min. 38 mm^2 nominal cross-sectional area
200A type: Min. 60 mm^2 nominal cross-sectional area
300A type: Min. 100 mm^2 nominal cross-sectional area

10. As a guide, the insertion strength of the plug-in terminal into the relay tab terminal should be 40 to 70N (10A type), 40 to 80N (20A type). Please select a plug-in terminal (flat connection terminal) which comply with JIS C2809-1999.

10A type: for plate thickness 0.5mm and #187 tab terminal
20A type: for plate thickness 0.8mm and #250 tab terminal

11. Avoid excessive load applied to the terminal in case of installing such as a bus bar etc., Because it might adversely affect the opening and closing performance.

12. Use the specified connector for the connector terminal connection (80A, 120A and 300A)

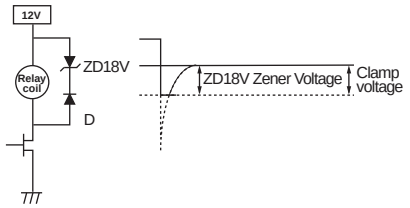
Yazaki Corporation 7283 – 1020 or equivalent

13. Cautions for use

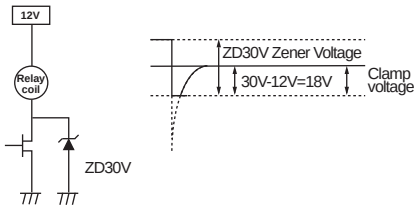
1) Regarding cautions for use and explanation of technical terms, please refer to our “Relay Technical Information”.
2) Additionally the ambient temperature and condition for your application should be considered because pick-up and drop-out voltage will be changed.
3) If it includes ripple, the ripple factor should be less than 5%.
   For coil surge absorption, please use a zener diode or varistor, etc., so that the clamp voltage reaches 1.5 times or more (at least 18 V for rated 12 V type) the rated operation voltage.
   If only a diode is connected in parallel with the relay coil, the contact opening velocity will become slow and sufficient cutoff performance cannot be guaranteed. Please avoid such usage.

Ex. 1: When using a varistor
Recommended Varistor; Maximum Energy: more than 1J
(However, please make settings using values that take into consideration the worst case scenario.)
Varistor voltage: For 12 V DC input, Min. 18 V

Ex. 2: When using a zener diode (circuit)



ZD18V Zener Voltage



ZD30V Zener Voltage

4) Lifetime is specified under the standard test conditions in JIS C 5442. (temperature 15 to 35°C 59 to 95°F, humidity 25%RH to 85%RH)
   Lifetime is dependent on the coil driving circuit, load type, operation frequency and ambient conditions. Check lifetime under the actual condition.
   Especially, Contact terminals have polarity. So if the contact terminals were connected with opposite pole, the electric life would be shorter.
5) When applying current which includes precipitous changes or ripple, the relay may generate buzzing sound. Therefore, please confirm with the actual load.
6) If the relay is used while exceeding the coil rating, contact rating or cycle lifetime, this may result in the risk of overheating.
7) As a general rule, do not use a relay if it has been dropped.
8) Take care to avoid cross connections as they may cause malfunctions or overheating.
9) When the screws for fixing relay-body and for additional terminal are tightened, it should be used within the range of decided torque.
10) Avoid mounting the relay in strong magnetic fields (near a transformer or magnet) or close to an object that radiates heat.
11) If the several relays are mounted closely or a heat-generation object is close to the relay, take care to check the abnormal temperature-rise and the insulation distance between the terminals outside of the relay.
12) The relay contacts are encapsulated in an inert gas atmosphere. Care must be exercised when the relay is to be used or stored at high ambient temperature.
13) If the power is turned off and then immediately on after applying the rated voltage (current) continuously to the relay’s coil and contact, the resistance of the coil will increase due to a rise in the coil temperature.
    This causes the pick-up voltage to rise, and possibly exceed the rated pick-up voltage. In these circumstances, take measures such as reducing the load current, limiting the duration of current flow, and applying a coil voltage higher than the rated operating voltage (quick start).
14) In case using a capacitive load (C-load), please take a countermeasure as pre-charging to the capacitive load so that the inrush current will not surpass 60A.
    The relay might have a contact welding without such countermeasure.
15) If the relay is used for an inductive load (L load) such that L/R > 1ms, add surge protection in parallel with the inductive load. If this is not done, the electrical life will decrease and cut-off failure may occur.
16) Use the suitable wire for wire at the load side according to the current. If the wire diameter is small, the maximum rated contact current cannot be guaranteed.

(Ex.) Carrying current; 60A: diameter of 15mm^2 or more

17) Take care to disconnect to the power supply when wiring.
18) Do not switch the contacts without any load as the contact resistance may become increased rapidly.
19) The relay satisfies the protection level of JIS D 0203 R2 (of waterproof). Please take any countermeasures additionally if it should be installed in the place where higher protection level is required.
20) Do not use this product in such atmosphere where any kind of organic solvent (as benzene, thinner and alcohol) and the strong alkali (as ammonia and caustic soda) might be adhered to this product.
21) Be careful that foreign matter and oils and fats kind don’t stick to the main terminal parts because it is likely to cause terminal parts to give off unusual heat.
22) Do not make additional manufacturing upon the relay housing.
23) For AC shutoff these is no contact polarity, but confirm the electric life using the actual load.

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

Unique silencing technology and low operation noise

EV RELAYS (AEVS)

Quiet Type

Vertical type
(coil: lead wire)

Horizontal type
(coil: faston terminal)

FEATURES

- **Low operation noise**
  Compared to our previous product, ON noise has been reduced approx. 13 dB and OFF noise has been reduced approx. 5 dB.
- **Vertical and horizontal types available**
  Offers freedom of relay layout where space is restricted.
- **Compact and lightweight**
  Charged with hydrogen gas for high arc cooling capacity, short gap cutoff has been achieved at high DC voltages.
- **Capsule contact construction for safety and high contact reliability**
  High safety achieved with construction that prevents explosions by keeping the arc from leaking.
  Since the contact portion is sealed in hydrogen gas, there is no contact oxidation.

TYPICAL APPLICATIONS

- **Hybrid vehicle**
- **Small sized electric vehicle**
- **High DC voltage applications such as battery charge and discharge systems**
- **High-voltage accessories**

ORDERING INFORMATION

AEVS □ □ 0 □ □

Contact arrangement / Installation type
1: 1 Form A (Screw terminal, Vertical type)
9: 1 Form A (Screw terminal, Horizontal type)

Contact rating
6: 60 A

Coil voltage
12: 12V DC

Coil terminal structure
Nil: Lead wire
2: Faston terminal

TYPES

Contact rating	Nominal coil voltage	Contact arrangement	Installation type	Part No.
60 A	12 V DC	1 Form A	Vertical type	AEVS16012
			Horizontal type	AEVS960122

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

RATING

1. Coil data

Type	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Max. allowable voltage*1
60 A	12 V DC	Max. 9 V DC	Min. 1 V DC	0.375A	4.5 W	16 V DC

Note: *1. When continually powered, the maximum allowable voltage is 14 V DC (at 65°C 149°F).

2. Specifications

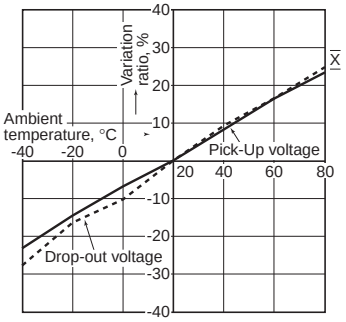
Characteristics	Item		Specifications	
			Vertical type	Horizontal type
Contact rating	Contact arrangement		1 Form A	
	Nominal switching capacity (resistive load)		60A 400V DC	
	Short term carrying current		100A 10 min., 180A 1 min. (15mm² Wire)	
	Min. switching capacity (resistive load)		1A 12V DC*1	
	Max. shutoff current		600A 300V DC (Min. 5 cycles)*2, *3	
	Overload opening/closing rating		120A 400V DC (Min. 50 cycles)*2, *3	
	Reverse direction shutoff		–120A 200V DC (Min. 50 cycles)*2, *3	
	Contact voltage drop (Initial)		Max. 0.067 V (By voltage drop 6 V DC 20A)	
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500 V DC, Measurement at same location as “Initial breakdown voltage” section.)	
	Breakdown voltage (Initial)	Between open contacts	2,500Vrms/min. (Detection current: 10mA)	2,000Vrms/min. (Detection current: 10mA)
		Between contact and coil	2,500Vrms/min. (Detection current: 10mA)	2,000Vrms/min. (Detection current: 10mA)
	Operate time (at 20°C 68°F)		Max. 50ms (Nominal coil voltage applied to the coil, excluding contact bounce time)	
	Release time (at 20°C 68°F)		Max. 50ms (Nominal coil voltage applied to the coil, without diode)	
Mechanical characteristics	Shock resistance	Functional	For ON: Min. 196m/s² {20 G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs) For OFF: Min. 98m/s² {10 G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)	
		Destructive	Min. 490 m/s² {50 G} (Half-wave pulse of sine wave: 6ms)	
	Vibration resistance	Functional	10 to 100 Hz, acceleration: 43 m/s² {4.4 G} 100 to 200 Hz, acceleration: 19.6 m/s² {2 G} (Detection time: 10μs)	
		Destructive	10 to 100 Hz, acceleration: 43 m/s² {4.4 G} 100 to 200 Hz, acceleration: 19.6 m/s² {2 G} (Time of vibration for each direction; X, Y, Z direction: 4 hours)	
Expected life	Mechanical		Min. 2×10⁵ (at 60 cpm)	
	Electrical (resistive load)		60A 400V DC Min. 800 cycles	
Conditions	Conditions for operation		Ambient temperature: –40 to +80°C –40 to +176°F (–40 to +65°C –40 to +149°F when continually powered at 14 V DC.) Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)	
	Conditions for transport and storage		Ambient temperature: –40 to +80°C –40 to +176°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)	
Mass (Approx.)			250 g 8.82 oz	240 g 8.47 oz

Notes:
*1.This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2.The electrical performance value applies when a varistor is connected in parallel to the coil. Please be warned that working life will be reduced when a diode is used.
*3.At L/R ≤ 1ms
*4. Refer to “Usage ambient condition“ on page 178.

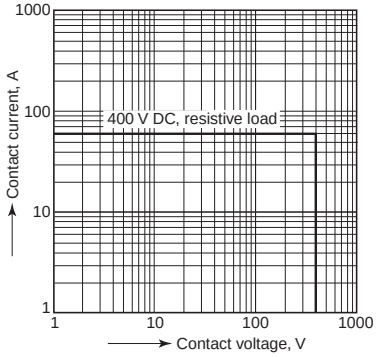
REFERENCE DATA

1. Ambient temperature characteristics

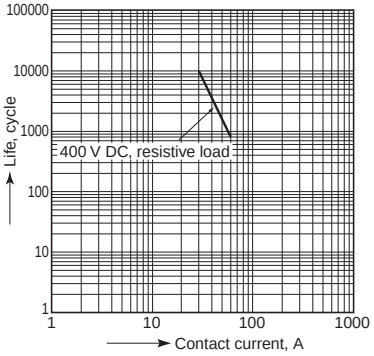
3 pcs.



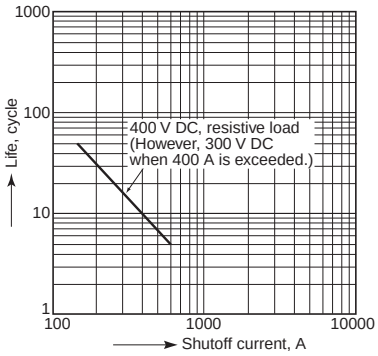
2. Max. value for switching capacity



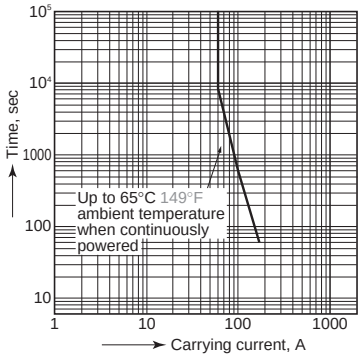
3. Switching life curve



4. Shutoff life curve (forward direction)

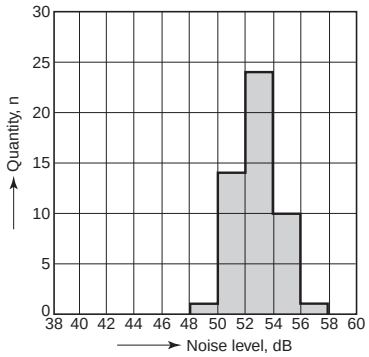


5. Carrying performance curve (80°C 176°F)



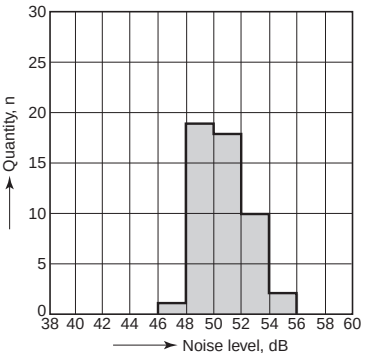
6.-(1)-1 Operation noise distribution (vertical type)

When operate



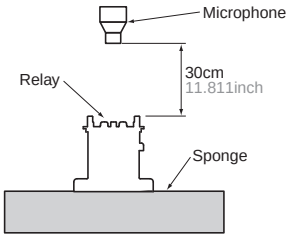
6.-(1)-2 Operation noise distribution (vertical type)

When release



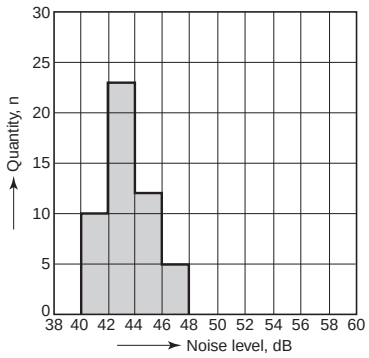
Vertical type

Measuring conditions
Sample: AEVS16012, 50pcs
Equipment setting: “A” weighted, Fast, Max. hold
Coil voltage: 12 V DC
Coil connection device: 18 V zener diode
Background noise: approx. 20dB



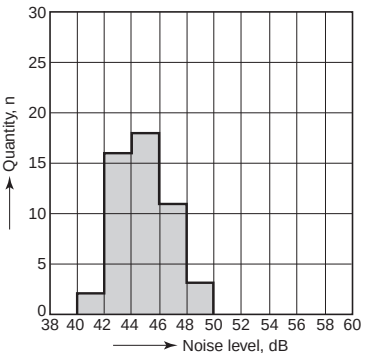
6.-(2)-1 Operation noise distribution (horizontal type)

When operate



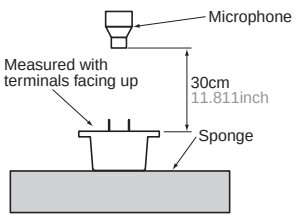
6.-(2)-2 Operation noise distribution (horizontal type)

When release



Horizontal type

Measuring conditions
Sample: AEVS960122, 50pcs
Equipment setting: “A” weighted, Fast, Max. hold
Coil voltage: 12 V DC
Coil connection device: 18 V zener diode
Background noise: approx. 20dB

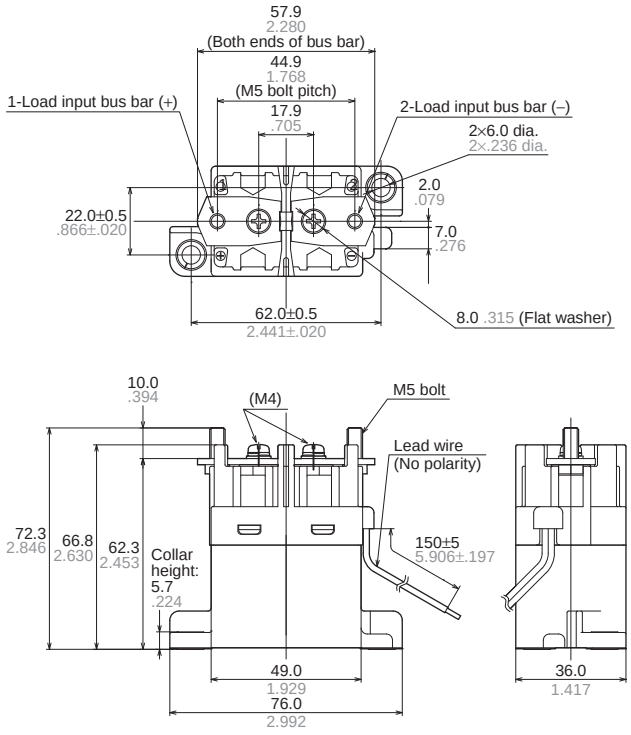


DIMENSIONS (mm inch)

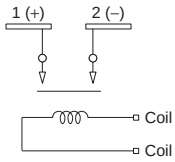
Download **CAD Data** from our Web site.

1. 60 A Vertical type

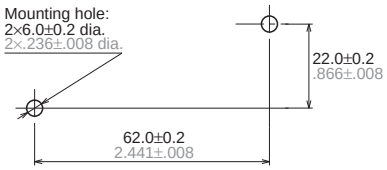
External dimensions



Schematic (TOP VIEW)



Mounting dimensions

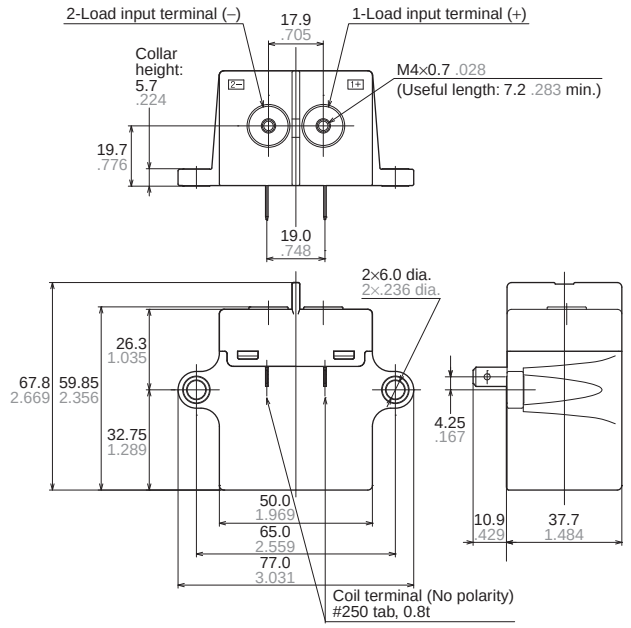


General tolerance;

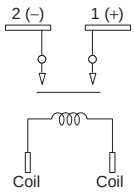
less than 10 .394:	±0.3 ±.012
10 to 50 .394 to 1.969:	±0.6 ±.024
more than 50 1.969:	±1.0 ±.039

2. 60 A Horizontal type

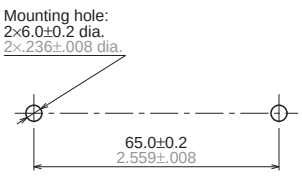
External dimensions



Schematic (TOP VIEW)



Mounting dimensions



General tolerance;

less than 10 .394:	±0.3 ±.012
10 to 50 .394 to 1.969:	±0.6 ±.024
more than 50 1.969:	±1.0 ±.039

NOTES

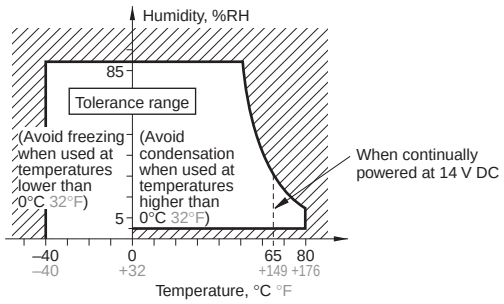
1. Usage, transport and storage conditions

1) Temperature: –40 to +80°C –40 to +176°F (–40 to +65°C –40 to +149°F when continually powered at 14 V DC)

2) Humidity: 5 to 85% RH (Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.

3) Atmospheric pressure: 86 to 106 kPa

Temperature and humidity range for usage, transport, and storage



4) Condensation

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

5) Low temperature, low humidity environments

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

2. Condition of tightening screw

1) Tightening torque for fixing relay-body;
Vertical and Horizontal type (M5 Screw): 3.0 to 4.0 N·m

2) Tightening torque for contact terminal;
Vertical type (M5 screw): 3.0 to 4.0 N·m,
Horizontal type (M4 screw): 2.2 to 2.8 N·m

3. Allowable pulling force for the coil input lead wire: Max.10N (for vertical type)

4. Insertion strength into the tab terminal: Max. 49N (for horizontal type)

Reference: Please select a faston terminal (flat connection terminal) which comply with JIS C2809-1999.
For plate thickness 0.8mm .031inch and #250 tab terminal

5. Cautions for Use

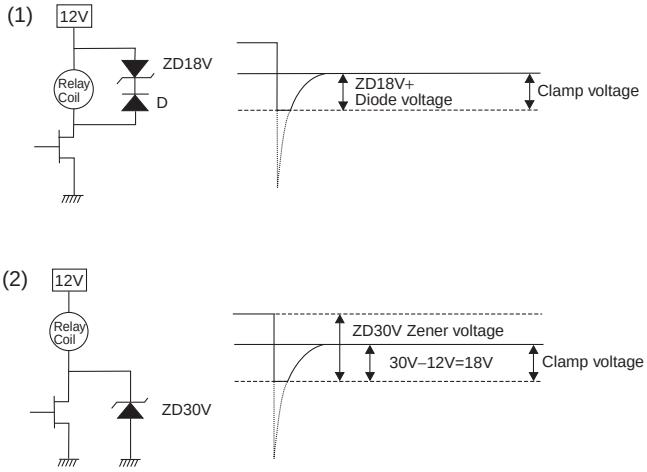
1) Regarding cautions for use and explanation of technical terms, please refer to our general catalog.

2) Additionally the ambient temperature and condition for your application should be considered because pick-up and drop-out voltage will be changed.

3) If it includes ripple, the ripple factor should be less than 5%.
For coil surge absorption, please use a zener diode or varistor, etc., so that the clamp voltage reaches 1.5 times or more (at least 18 V for rated 12 V type) the rated operation voltage.
If only a diode is connected in parallel with the relay coil, the contact opening velocity will become slow and sufficient cutoff performance cannot be guaranteed. Please avoid such usage.

Ex. 1: When using a varistor
Recommended Varistor; Maximum Energy: more than 1J
(However, please make settings using values that take into consideration the worst case scenario.)
Varistor voltage: For 12 V DC input, Min. 18 V

Ex. 2: When using a zener diode (circuit)



4) Lifetime is specified under the standard test conditions in JIS C 5442. (temperature 15 to 35°C 59 to 95°F, humidity 25%RH to 85%RH)
Lifetime is dependent on the coil driving circuit, load type, operation frequency and ambient conditions. Check lifetime under the actual condition.
Especially, Contact terminals have polarity. So if the contact terminals were connected with opposite pole, the electric life would be shorter.

5) When applying current which includes precipitous changes or ripple, the relay may generate buzzing sound. Therefore, please confirm with the actual load.

6) If the relay is used while exceeding the coil rating, contact rating or cycle lifetime, this may result in the risk of overheating.

7) As a general rule, do not use a relay if it has been dropped.

8) Take care to avoid cross connections as they may cause malfunctions or overheating.

9) When the screws for fixing relay-body and for additional terminal are tightened, it should be used within the range of decided torque.

10) Avoid mounting the relay in strong magnetic fields (near a transformer or magnet) or close to an object that radiates heat.

11) If the several relays are mounted closely or a heat-generation object is close to the relay, take care to check the abnormal temperature-rise and the insulation distance between the terminals outside of the relay.

12) The relay contacts are encapsulated in an inert gas atmosphere. Care must be exercised when the relay is to be used or stored at high ambient temperature.

13) If the power is turned off and then immediately on after applying the rated voltage (current) continuously to the relay's coil and contact, the resistance of the coil will increase due to a rise in the coil temperature.
This causes the pick-up voltage to rise, and possibly exceed the rated pick-up voltage. In these circumstances, take measures such as reducing the load current, limiting the duration of current flow, and applying a coil voltage higher than the rated operating voltage (quick start).

14) In case using a capacitive load (C-load), please take a countermeasure as pre-charging to the capacitive load so that the inrush current will not surpass 60A.
The relay might have a contact welding without such countermeasure.
15) If you are using an inductive load (L load) such that L/R > 1ms, add surge protection in parallel with the inductive load. If this is not done, the electrical life will decrease and cut-off failure may occur.
16) Use the suitable wire for wire at the load side according to the current. If the wire diameter is small, the maximum rated contact current cannot be guaranteed.
(Ex.) Carrying current; 60A: diameter of 15mm^2 or more
17) Take care to disconnect to the power supply when wiring.
18) Do not switch the contacts without any load as the contact resistance may become increased rapidly.
19) The relay satisfies the protection level of JIS D 0203 R2 (of waterproof). Please take any countermeasures additionally if it should be installed in the place where higher protection level is required.
20) Do not use this product in such atmosphere where any kind of organic solvent (as benzene, thinner and alcohol) and the strong alkali (as ammonia and caustic soda) might be adhered to this product.
21) Be careful that foreign matter and oils and fats kind don't stick to the main terminal parts because it is likely to cause terminal parts to give off unusual heat.
22) Do not make additional manufacturing upon the relay housing.
23) For AC shutoff these is no contact polarity, but confirm the electric life using the actual load.

For Cautions for Use, see Relay Technical Information (page 166).

Panasonic
ideas for life

Capsule Contact High Voltage Cut-off Switch

EV SWITCHES (AEVD)

FEATURES

• High performance with capsule contact technology
400 A, 400 V DC cut-off
High contact reliability, Dust proof contact
• High carrying current performance
Rated carrying current performance:
80 A, 400 V DC
Maximum contact carrying current:
5,560 A (0.03 sec.)
• Safety function
Designed with interlock button to prevent false energization

TYPICAL APPLICATIONS

This safety switch is for cut-off the battery power from the system circuit when maintaining hybrid cars, plug-in hybrid cars, electric cars, and hybrid construction machinery, etc.

ORDERING INFORMATION

AEVD □ □ □

Contact arrangement
1: 1 Form A

Current carrying capacity
1: 80 A

Rated voltage
1: 400V DC

TYPES

Current carrying capacity	Contact arrangement	Part No.
80 A	1 Form A	AEVD111

Standard packing; Case: 20pcs. (Tray)

RATING

Specifications

Characteristics	Item		Specifications
			80 A type
Contact	Contact arrangement		1 Form A
Rating	Rated voltage		400 V DC
	Rated carrying current		80 A (Wire / Bus bar size is more than 20 mm²)
	Max. carrying current		120 A 600s 5,560A 0.03s (Wire / Bus bar size is more than 20 mm²)
Electrical characteristics	Contact voltage drop (Initial)		Max. 0.16 V (at 80 A)
	Insulation resistance (Initial, Between open contacts, Between contacts and lever surface)		Min. 100 MΩ (at 500 V DC Megger)
	Breakdown voltage (Initial, Between open contacts, Between contacts and lever surface)		2,500 Vrms for 1 min. (Detection current: 10 mA, 50/60Hz)
Mechanical characteristics	Lever operation force		<OFF ⇒ ON> 10N to 25N (Measurement position: center of lever) <ON ⇒ OFF> 3N to 9N (Measurement position: tip of lever)
	Interlock button operation force (when canceling a lock)		4N ± 1N
	Shock resistance (Switch: ON condition)	Functional	490 m/s² {50 G} (Half-wave pulse of sine wave: 11 ms; detection time: 10 μs, 6 detections, 1 time each)
		Destructive	790 m/s² {80.6 G} (Half-wave pulse of sine wave: 6 ms)
	Vibration resistance (Switch: ON condition)	Functional	Acceleration: 44 m/s² {4.5 G} (Detection time: 10 μs)
		Destructive	20 to 200 Hz, acceleration: 44 m/s² {4.5 G} (Sweep time: 15 minutes (log sweep), X, Y, Z direction: 4 hours each)
Expected life	Mechanical life		Min. 100 times (Switching with no current-switching)
	Electrical life (Cut-off performance) * No-load application when ON.	Forward direction (Polarity +)	5 times: 400 A 400 V DC (Resistive load, Time constant: less than 1.0 ms)
		Reverse direction (Polarity –)	5 times: –120 A 200 V DC (Resistive load, Time constant: less than 1.0 ms)
Conditions	Conditions for operation, transport and storage		Ambient temperature: –40 to +80°C –40 to +176°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
Mass (Approx.)			230 g 8.11 oz

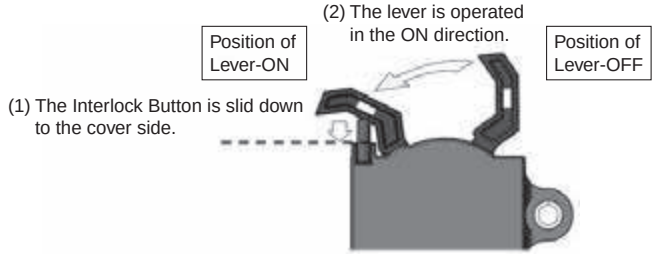
DESCRIPTION OF USAGE

1. Application

EV Switch is a safety Switch for cut-off a battery power supply from a system circuit, in order to protect a human body from the electric shock accidents at the time of a maintenance, etc.

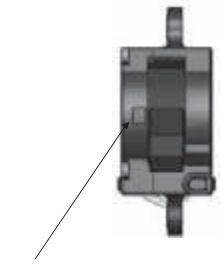
2. How to use

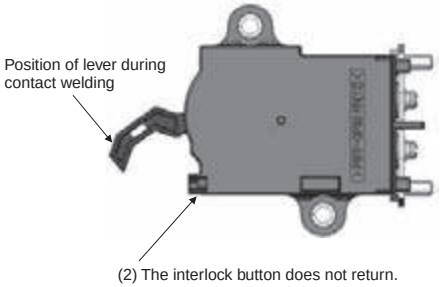
1) When the switch is turned ON and OFF, in principle the battery power is already cut-off by the system side (no current-passing condition). Please turn the lever to the ON side and the OFF side. Do not switch current by contact turning ON. However, the switch can cut-off the power directly, even when power is not cut-off by the system. Please refer to the specification regarding the cut-off performance.
2) When turning the switch ON, the product is designed to prevent malfunction by not allowing it to turn ON unless the interlock button is pressed when the lever is operated.
*1) At the time of OFF operation, the lever can change to OFF position without operation of the interlock button.
*2) Please operate the lever after making the interlock button slide down completely to the side of the cover.



[If contact welding occurs]

Contact welding may occur if current is switched by contact turning ON or if current that exceeds the specifications is continuously applied when the power is ON. This switch indicates contact welding by doing (1) and (2), below.
(1) The lever will not go all the way to the OFF position when you try to turn it off, and when you release the lever it returns to the window that displays red.
(2) The interlock button does not return.
* Please be careful. In this state the switch's contacts are not OFF.

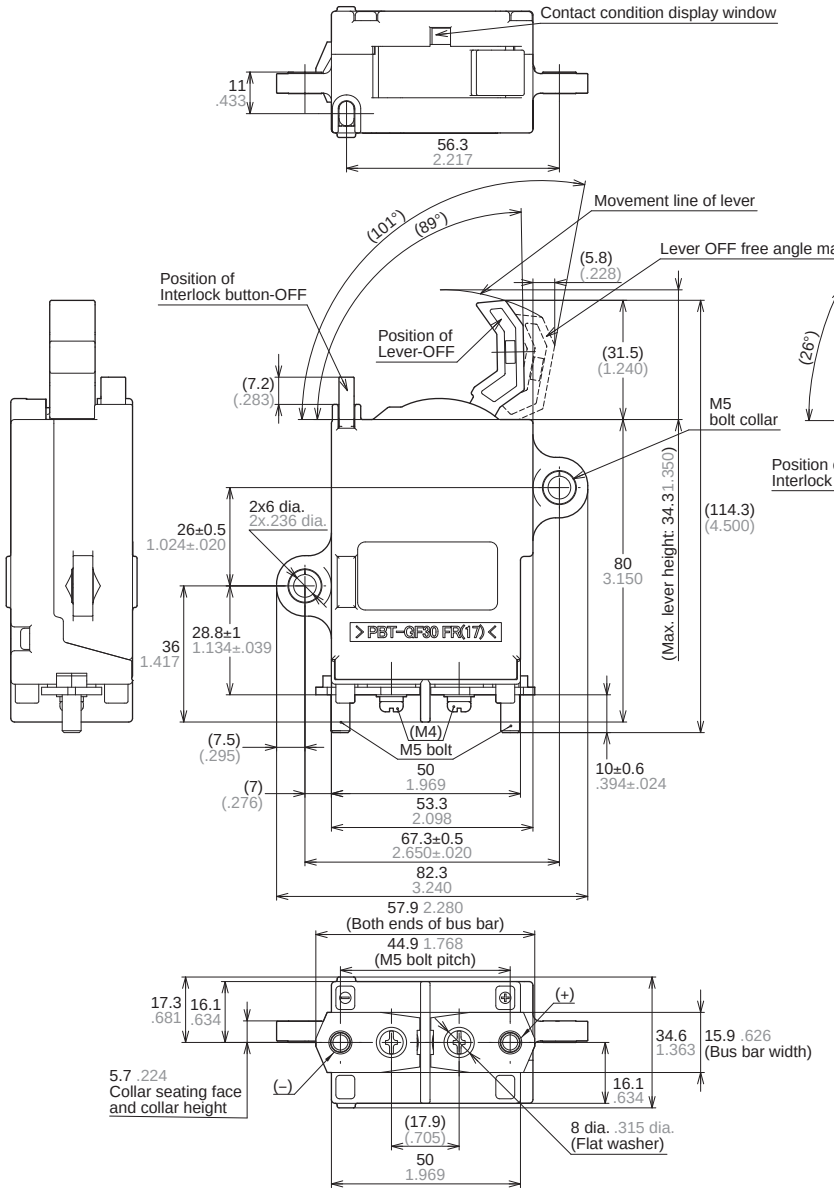




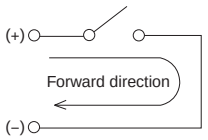
DIMENSIONS (mm inch)

Download **CAD Data** from our Web site.

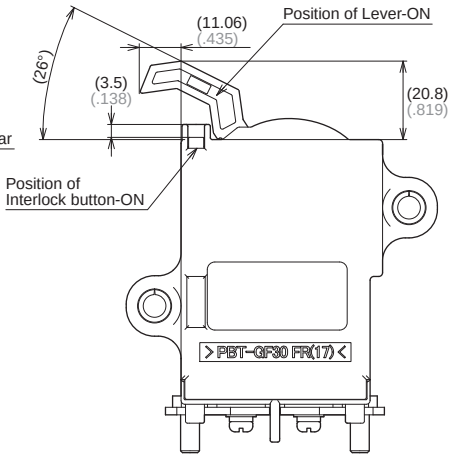
External dimensions



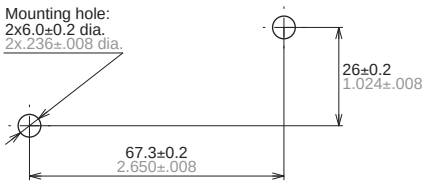
Schematic (TOP VIEW)



There is polarity (+ and –) on the load side.



(Reference) Mounting dimensions



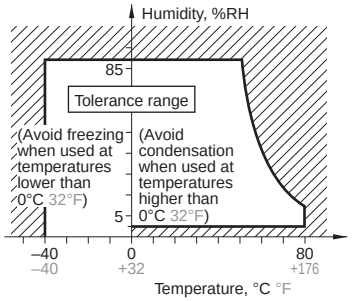
General tolerance:

less than 10 .394:	±0.3 ±.012
10 to 50 .394 to 1.969:	±0.6 ±.024
more than 50 1.969:	±1.0 ±.039

NOTES

1. Usage, transport and storage conditions

1) Temperature: –40 to +80°C –40 to +176°F
2) Humidity: 5 to 85% RH (Avoid freezing and condensation.)
3) Atmospheric pressure: 86 to 106 kPa
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(Temperature and humidity range for usage, transport, and storage)



4) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the switch insulation.
5) Freezing
Condensation or other moisture may freeze on the switch when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) Low temperature, low humidity environments
The plastic becomes brittle if the switch is exposed to a low temperature, low humidity environment for long periods of time.

2. Attachment environment

<Attached position>
• Same as the automotive vehicle interior environment
• Please consider the prevention of dew condensation and dusts.
<Mounting arrangement>
Body: Fastening and fixing with a bolt. (M5 × 2)
Terminal: Fastening and fixing with a nut. (M5 × 2)
<Screw-fastening torque>
Body: 3.5 ±0.5 N·m
Terminal: 3.5 ±0.5 N·m

3. Please do not remove the assembly screw of the switch. Otherwise the performance cannot be guaranteed. Moreover, in order to prevent from removing the assembly screw easily, please attach the assembly screw showing its backside.

4. Please note the polarity of the terminal. Please abide by the connection of polarity described to this catalog. The performance cannot be satisfied when reversely connected. It becomes a cause of the accident.

5. The screws for fixing switch-body and for additional terminal should be tightened with a specified torque.

6. The switch should not be installed near strong magnetic fields (transformers, magnets, etc.) and should not be installed near heat source.

7. If the several switches are mounted closely or a heat-generation object is close to the switch, take care to check the abnormal temperature-rise and the insulation distance between the terminals outside of the switch.

8. The switch contacts are encapsulated type filled with gas. Therefore, care must be exercised when the switch is to be used or stored at high ambient temperature.

9. If the switch is used for an inductive load (L load) such that L/R > 1ms, add surge protection in parallel with the inductive load. If this is not done, the electrical life will decrease and cut-off failure may occur.

10. When the short-circuit current is large, there is possibility that the switch will be destroyed by the time the power supply is intercepted with the fuse. Therefore, please confirm it enough with the system.

11. There is a possibility of performance change due to transfer effect through terminal from connected components and radiation heat (e.g. fuse) around the switch.

12. Please consider the layout which avoids conductive liquid on solvent such as water etc. from the switch for the prevention of electric shock.

13. If the switch is used exceeding the contact rating or cycle lifetime, this may result in the risk of overheating.

14. Contact welding may occur if current is switched by contact turning ON or if current that exceeds the specifications is continuously applied when the power is ON.
The switch indicates 'RED' on the display window if contact welding occur. (Please refer to 'Description of usage') However when abnormalities such as fuse disconnection etc. occurred, even if the display window does not become RED, please check the OFF state of the contact with a tester etc. and be sure to wear protective equipment before operating.

15. Please consider safety measures such as detection of ON/OFF state of a high voltage circuit, earth fault detection, and temperature detection by a system for high voltage circuit. Moreover, please consider safety measures that high voltage part work cannot be performed, if it is not in a high voltage circuit OFF state with a system or structure, when operating high voltage part work.

16. If the switch is dropped, it should not be used again.

17. Take care to avoid cross connections as they may cause malfunctions or overheating.

18. Use the suitable wire/bus bar according to the current.
***Recommendation: more than 20 mm²**
Moreover, please consider the layout that the wire/bus bar can fix to the plate and please do not free the load-side electric wire/bus bar linked to a switch.
When terminal of switch and load-side wire/bus bar have a clearance gap, please do not carry out Screw-fastening with force. Please set up the order of fixation and layout which can make the smallest clearance gap at the time of screw-fastening.

19. Do not use this product in such atmosphere where any kind of organic solvent (as benzene, thinner and alcohol) and the strong alkali (as ammonia caustic soda) might be adhered to this product.

20. Although the gas enclosure type seal contact is used inside the switch (capsule contact), since the product itself is not a seal type, please do not use it under dust environment or the environment where direct water and a solvent adhere to the product.

21. Be careful that oil or foreign matter do not stick to the main terminal part because it is likely to cause the terminal part to give off unusual heat.

22. Do not make additional manufacturing upon the switch housing.

23. For AC cut-off these is no contact polarity, but confirm the electric life using the actual load.

For Cautions for Use, see Relay Technical Information (page 166).

Relay Technical Information

CONFIGURATION AND CONSTRUCTION

PROTECTIVE CONSTRUCTION

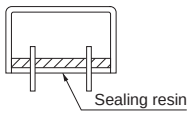
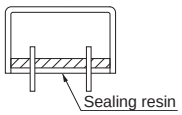
1. Flux-Resistant Type

The relay is constructed so that flux will not enter inside the relay during automatic soldering. However, cleaning is not possible.

2. Sealed Type

Construction is designed to prevent seeping of flux when soldering and cleaning fluid when cleaning.

CONSTRUCTION AND CHARACTERISTIC

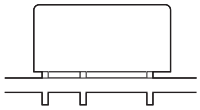
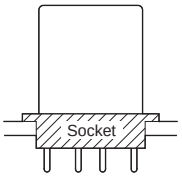
Type	Construction	Characteristics	Automatic Soldering	Automatic Cleaning	Dust Resistance	Harmful Gas Resistance
Flux-Resistant Type		Terminals, case, and base are filled with sealing resin.	Yes	No	Care	No
Sealed Type		Sealed construction with terminals, case and base sealed shut with sealing resin.	Yes	Yes	Yes	Yes*

*Since the plastic breathes, please do not use in an atmosphere that contains silicon.

TERMINAL CONFIGURATION

Type	PC board through hole terminal	Plug-in terminal	Screw terminal
Typical relay			
Terminal configuration			
Typical relay type	CP, CN-H, TB relay	CM, CB, CV-N relay	EV relay

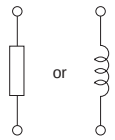
MOUNTING METHOD

Type	Insertion mount	Socket mount
Mounting configuration		
Typical relay type	CP, CN-H, TB relay	CM, CB, CV-N relay

DEFINITION OF RELAY TERMINOLOGY

COIL (also referred to as primary or input)

1. Coil Designation

Single side stable type	
Non-polarized	Polarized
	

2. 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.

3. Nominal Operating Current

The value of current flow in the coil when nominal voltage is impressed on the coil

4. 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.

5. 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.)

6. Pick-Up Voltage

As the voltage on an unoperated relay is increased, the value at or below which all contacts must function (transfer).

7. Drop-Out Voltage

As the voltage on an operated relay is decreased, the value at or above which all contacts must revert to their unoperated position.

8. Maximum Applied 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.

CONTACTS (secondary or output)

1. Contact Forms

Denotes the contact mechanism and number of contacts in the contact circuit.

2. 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.

3. 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 x switching current, and will be lower than the maximum voltage and maximum current product.

4. 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.

5. Maximum Switching Current

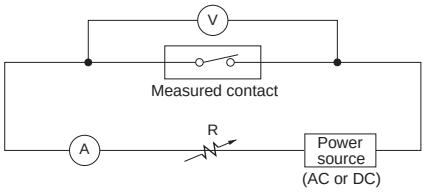
The maximum current which can safely be switched by the contacts. AC and DC current maximums may differ.

6. Maximum Switching Power

The upper limit of power which can be switched by the contacts. Care should be taken not to exceed this value.

7. Contact Resistance

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



Ⓐ: Ammeter Ⓥ: Voltmeter Ⓡ: Variable resister

Test Currents

Rated Contact Current or Switching Current (A)	Test Current (mA)
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.

8. 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.

ELECTRICAL PERFORMANCE

1. 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.

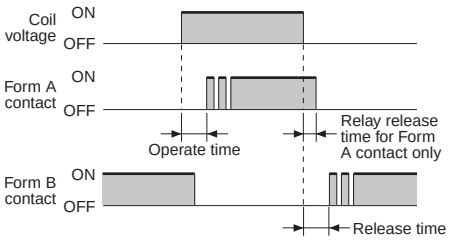
- Between coil and contacts
- Between open contacts
- Between contact sets

2. 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.

4. Operate Time

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



5. Release Time

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

6. Contact Bounce (Time)

Generally expressed in time (ms), 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.

MECHANICAL PERFORMANCE AND LIFE

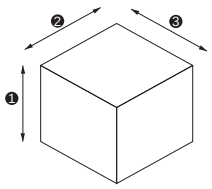
1. Shock Resistance

1) 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. (usually 10 μs)

2) 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. However, test was performed a total of 18 times, six times each in three-axis directions.



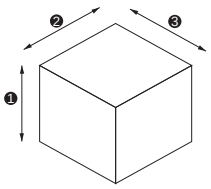
2. Vibration Resistance

1) 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.

2) 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. However, test was performed a total of six hours, two hours each in three-axis directions.



3. 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.

4. Electrical Life

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

5. 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.

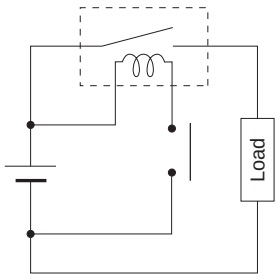
Notes:

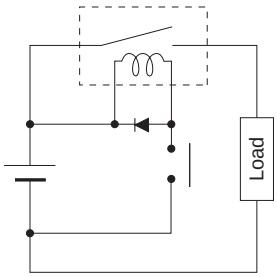
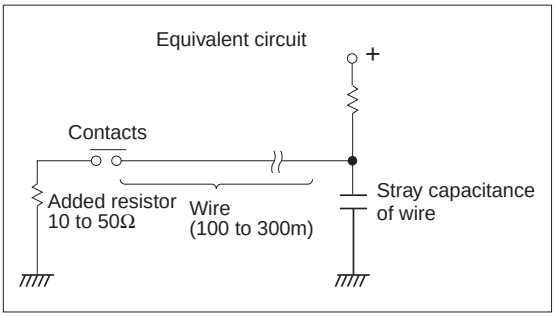
1. Except where otherwise specified, the tests above are conducted under standard temperature and humidity (15°C to 35°C 59°F to 95°F, 25 to 85%).
2. The coil impressed voltage in the switching tests is a rectangular wave at the rated voltage.

AUTOMOTIVE CAUTIONS FOR USE

Please use the check sheet.

<table>
<tr><th>Category</th><th>Section</th><th>Contents</th></tr>
<tr><td>1. Confirmation under the actual use condition</td><td>1. Confirmation under the actual use</td><td>The rated switching power and life mentioned in the specification and catalog are given only as guides. A relay may encounter a variety of ambient conditions during actual use resulting in unexpected failure. Therefore, it is necessary for proper use of the relay to test and review with actual load and actual application under actual operating conditions.</td></tr>
<tr><td rowspan="4">2. Safety precautions</td><td>1. Specification range</td><td>Use that exceeds the specification ranges such as the coil rating, contact rating and switching life should be absolutely avoided. Doing so may lead to abnormal heating, smoke, and fire.</td></tr>
<tr><td>2. Installation, maintenance</td><td>Never touch live parts when power is applied to the relay. Doing so may cause electrical shock. When installing, maintaining, or troubleshooting a relay (including connecting parts such as terminals and sockets), be sure that the power is turned off.</td></tr>
<tr><td>3. Connection</td><td>When connecting terminals, please follow the internal connection diagrams in the catalog to ensure that connections are done correctly. Be warned that an incorrect connection may lead to unexpected operation error, abnormal heating, and fire.</td></tr>
<tr><td>4. Fail-safe</td><td>If there is a possibility that adhesion, contact failure, or breaking of wire could endanger assets or human life, please make sure that a fail-safe system is equipped in the vehicle.</td></tr>
<tr><td>3. Selection of relay type</td><td>1. Selection</td><td>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 specification, contact specification, and the ambient conditions for the relay that is actually used must be fully understood in advance.
In the table below, please refer to a summary of the consideration points regarding selection of relay.
<table>
<tr><th colspan="2">Items</th><th>Consideration points regarding selection</th></tr>
<tr><td>Coil</td><td>a) Rating
b) Pull-in voltage (current)
c) Drop-out voltage (current)
d) Maximum continuous impressed voltage (current)
e) Coil resistance
f) Temperature rise</td><td>- Select relay with consideration for power source ripple.
- Give sufficient consideration to ambient temperature and for the coil temperature rise, and hot start.
- When used in conjunction with semiconductors, careful with the voltage drop.
- When starting up, careful with the voltage drop.</td></tr>
<tr><td>Contact</td><td>a) Contact arrangement
b) Contact rating
c) Contact material
d) Life
e) Contact resistance</td><td>- Note that the relay life is balanced with the life of the device the relay is used in.
- Is the contact material matched to the type of load? It is necessary to take care particularly with low level usage.
- The rated life may become reduced when used at high temperatures. Life should be verified in the actual use atmosphere.
- It is necessary to be tested and reviewed under actual use conditions with actual load and actual application.</td></tr>
<tr><td>Operate time</td><td>a) Operate time
b) Release time
c) Bounce time
d) Switching frequency</td><td>- Note that ambient temperature and applied voltage cause the change of operate time and bounce time.
- Note that operate time and release time do not include bounce time.
- Give consideration that switching life changes depending on switching frequency.</td></tr>
<tr><td>Mechanical characteristics</td><td>a) Vibration resistance
b) Shock resistance
c) Ambient use temperature
d) Life</td><td>- Give consideration to performance under vibration and shock in the use location.
- Confirm the allowable ambient temperature of the relay.</td></tr>
<tr><td>Other items</td><td>a) Breakdown voltage
b) Mounting, Connection
c) Size
d) Protection construction</td><td>- Selection can be made for connection method with plug-in type, printed circuit board type, soldering, and screw fastening type.
- Selection of protection construction can be made for PCB mounting method such as soldering and cleaning.
- For use in an adverse atmosphere, sealed construction type should be selected.
- Are there any special conditions?</td></tr>
</table>
</td></tr>
</table>

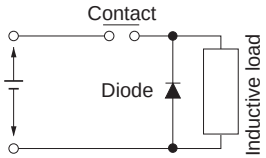
4. Load, Electrical life	1. General	Contact performance is significantly influenced by voltage and current values applied to the contacts (in particular, the voltage and current waveforms at the time of application and release), the type of load, frequency of switching, ambient atmosphere, contact switching speed, and of bounce, which lead the various other damages such as unsuitable operation contact transfer, welding, abnormal wear, increase in contact resistance. Therefore, please confirm that in actual use conditions such as actual circuit and actual load or contact our company.
	2. Inductive load	In the case of switching on and off with inductive loads such as coil, magnet crutch, and solenoid, the arc at switching can cause a severe damage on contacts and greatly shortening of life. In addition, in the case of switching at a high frequency, a blue-green corrosion may be developed. So, please contact our company to use it.
		If the current in the inductive load is relatively small, the arc 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. So, please contact our company to use it.
	3. Lamp load	Large inrush current enhancing contact welding will be impressed. Its current value is greatly affected by wiring resistance, switching frequency and ambient temperature. The load current characteristics in actual circuit and actual use condition must be examined and sufficient margin of safety must be provided in selection of a relay.
		It is dangerous to use a lamp load whose nominal current is small even a large nominal current has been tested beforehand. Please contact us when switching at nominal current with a small lamp load (40W or less), because continuous ON failure may occur due to locking caused by contact-transfer phenomenon when switching arc is locally concentrated.
	4. Electric-discharge lamp load	Its load current tends to cause contact welding easily because its inrush current is larger than that of the regular lamp load. The load current characteristics in actual circuit and actual use condition must be examined and sufficient margin of safety must be provided in selection of a relay.
	5. LED lamp load	It is necessary to check the contact reliability because the load current of the LED load is very small. Please contact us before use.
	6. Other lamp load	Please contact us before use of new structured lamp except for halogen, Electric-discharge lamp, and LED.
	7. Motor load	When using of NC contact side of 1C contact for the motor brake, mechanical life might be affected by the brake current. Therefore, verify in actual use conditions with actual circuit.
		Note that larger inductivity of motor may cause contact damage and transfer even the motor load current is same.
	8. Capacitor load	Note that its load current tends to cause contact welding and contact transfer easily because its inrush current is generally large which has a small break current and a short time period to reach an inrush peak value. Also, inrush current value is influenced by wiring resistance. Therefore, the inrush current in actual circuit must be examined and sufficient margin of safety must be provided in selection of a relay.
	9. Resistance load	This load causes relatively-less contact damage since its inrush current is not large. Select a relay based on the rating control capacity, or contact us.
	10. Small electric current load	If the switching current is small (2A or less), contact reliability decreases since the contact surface is not cleaned by switching arc. So, please contact us for use.
	11. Load polarity	Electrical life may be affected by load polarity (+/-) connecting to relay contacts. So, please verify them in actual use polarity.
	12. Voltage drop of power supply	Under a circuit which inrush current is applied to such as lamps and capacitors, the moment the contact is closed, voltage drop to the coil, return of relay, or chattering may occur. Note that it may remarkably reduce the electrical life. 

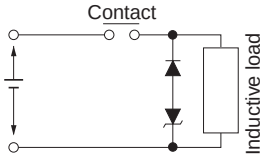
4. Load, Electrical life	13. Load voltage	If the load voltage is high, the arc energy which generated at contact switching increases, which may decrease the electrical life. Therefore, it is necessary to give consideration to the voltage which could occur in actual use condition.
	14. Coil voltage	If coil applied voltage gets higher, the relay operate time gets faster. However, contact bounce gets also larger so that the electrical life may decrease.
	15. Coil short-pulse input	When the short-pulse signal is input to the relay coil, the relay movable part may operate and touch lightly to the contact. Therefore, please avoid short pulse input (100ms or less) since it may cause contact welding due to less contact pressure. Please test adequately, for example when a relay is operated by external manual switch (such as key switch.)
	16. High-frequency of switching	When the switching frequency is high, the electrical life may decrease. Please confirm if there is a high-frequent switching caused by abnormal mode in actual use condition.
	17. Low-frequency of switching	Note that if the contact has not been switched for a long time period, organic film tends to be generated on the contact surface, which may cause contact instability.
	18. Ambient temperature	Verify in the actual use condition since electrical life may be affected by use at high temperatures.
	19. Connection of coil surge absorption circuit	If resistor, diode, zener diode are connected parallel to decrease the surge voltage when the relay coil being turned off, the relay release time will get longer and may decrease the electrical life or cause light-welding.  Recommended zener diode • Zener voltage 24V or higher (12V rating) • Zener voltage 48V or higher (24V rating) Recommended resistor • 680Ω to 1000Ω (12V rating) • 2800Ω to 4700Ω (24V rating)
	20. Sneak or remaining current	Please test a relay in actual vehicle condition since there is a risk of deterioration at relay function or switching performance such as slower release time which is caused by sneak current due to diode, zener diode, capacitor mounted on a vehicle or by remaining current soon after a motor is turned off.
	21. Wire length	If long wires (a few ten meters) are to be used in a relay contact circuit, inrush current may become a problem due to the stray capacitance existing between wires. In such case, add a resistor in series with the contacts. 

4. Load, electrical life

22. Contact protective circuit

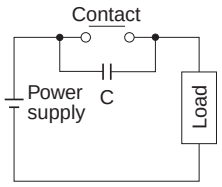
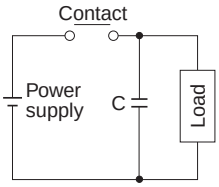
Use of contact protective devices or protection circuits can suppress the counter emf to a low level. However, note that incorrect use will result in an adverse effect. Typical contact protection circuits are given in the table below.
Also, note that release time will slow down due to sneak in the circuit and may cause the electrical life to shorten and slight-welding.

Diode circuit	
Circuit	
Features/Others	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 delays the release time.
Devices Selection	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 or larger. 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	
Circuit	
Features/Others	It is effective in the diode circuit when the release time is too long.
Devices Selection	Use a zener diode with a zener voltage about the same as the power supply voltage

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

Avoid using the protection circuits shown in the figures below.
Although it is usually more difficult to switch with DC inductive loads compared to resistive loads, use of the proper protection circuit will raise the characteristics to that for resistive loads.

No good 	No good 
Although it is 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 it is 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.

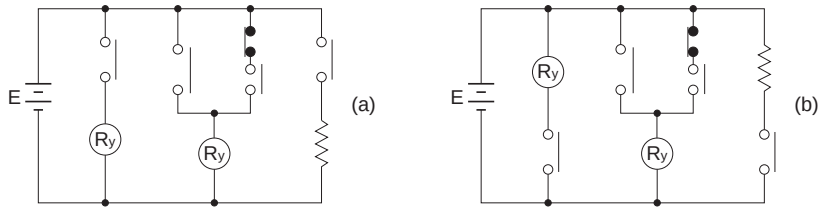
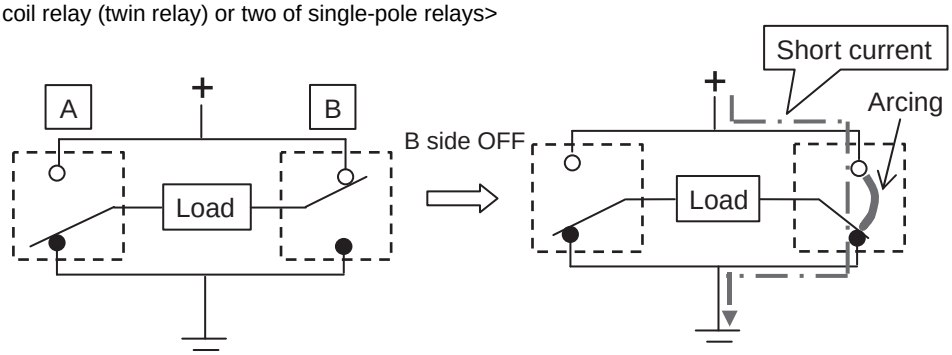
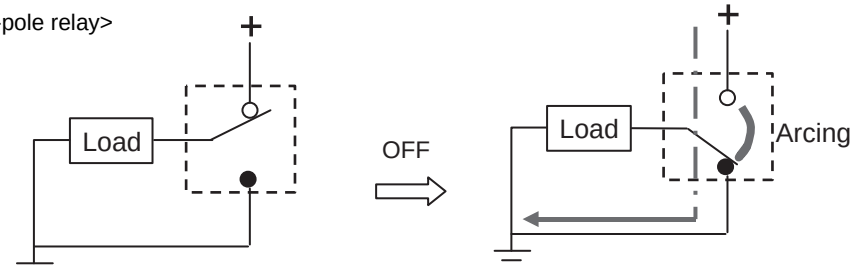
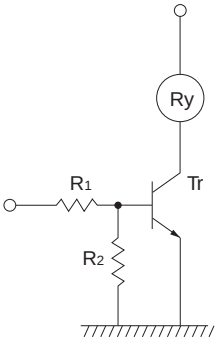
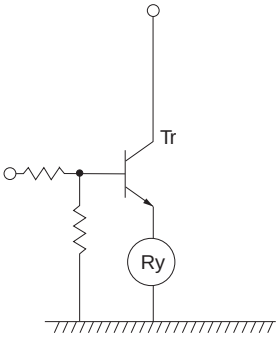
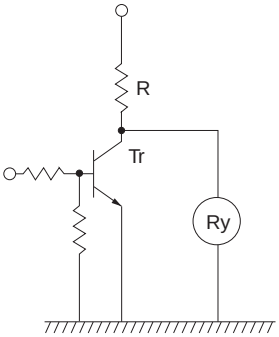
<table>
<tr><td rowspan="3">4. Load, electrical life</td><td>23. Connection of load</td><td>Connect the load to one side of the power supply as shown in Fig. (a). Connect the contacts to the other side. This prevents high voltages from developing between contacts. If contacts are connected to both side of the power supply as shown in Fig. (b), there is a risk of shorting of the power supply when relatively close contacts short.
 

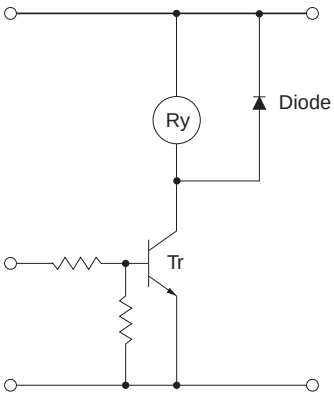
Fig. (a) Good example (b) Bad example</td></tr>
<tr><td></td><td>Regarding the following circuit constructions with 2-coil relays (twin relays) or single-pole relays, an arc between contacts may be generated when breaking of load current depending on the type of load current, voltage, and load. Please note that or contact us.
<2 coil relay (twin relay) or two of single-pole relays>
 

<Single-pole relay>
 
</td></tr>
<tr><td>24. Short between inter electrodes</td><td>When using of multiple relays such as 2-coil relays (twin relays), verify insulation and breakdown voltage between contacts in each pole in order to avoid an accident caused by short.</td></tr>
<tr><td rowspan="6">5. Coil impressed voltage</td><td rowspan="2">1. Hot start voltage</td><td>After continuous applying of current to coil and contacts, if the current is turned OFF then immediately turned ON again, coil resistance and the pick-up voltage will increase due to the temperature rise in the coil.</td></tr>
<tr><td>Temperature rise value of coil is greatly affected by circuit board, connected harness, connected connector, heat dissipation of system/modules, and heat source around relay. Please verify whether it is operating properly or inoperative under actual vehicle and actual use conditions.</td></tr>
<tr><td rowspan="2">2. Ambient temperature characteristic</td><td>Coil resistance and the pick-up voltage will increase when the relay is used in a higher temperature atmosphere. The resistance/temperature coefficient of copper wire is about 0.4% for 1°C, and the coil resistance increases with this ratio. On the other hand, coil resistance and the drop-out voltage will decrease at lower temperature. Coil resistance change decreases with the same ratio at higher temperature, about 0.4% for 1°C.
Therefore, please confirm the relay operation in every operating temperature range, with attention to such temperature characteristic.</td></tr>
<tr><td>The ambient usage temperature should be set as around the relay inside the box because a heat generated by a relay itself or other instruments causes increase of temperature inside the box.</td></tr>
<tr><td>3. Applied voltage</td><td>Note that a coil impression with a voltage greater than or equal to the maximum continuous impressed voltage may cause temperature rise which could cause coil burning or layer short. Furthermore, do not exceed the usable ambient temperature range listed in the catalog. Please contact us regarding PWM control.</td></tr>
</table>

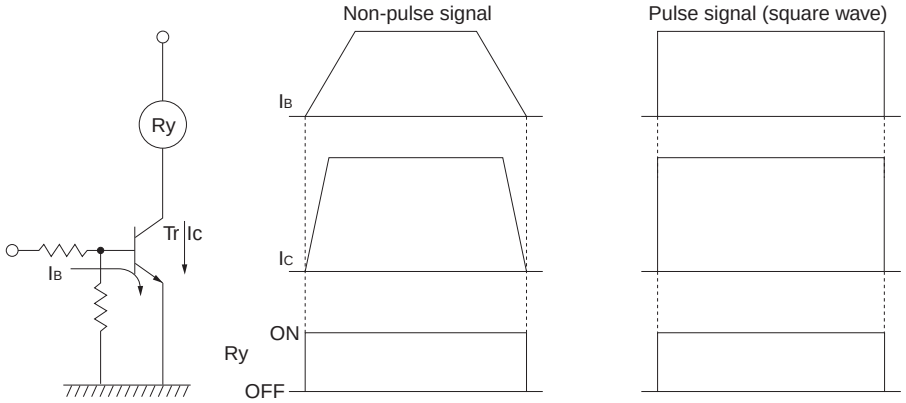
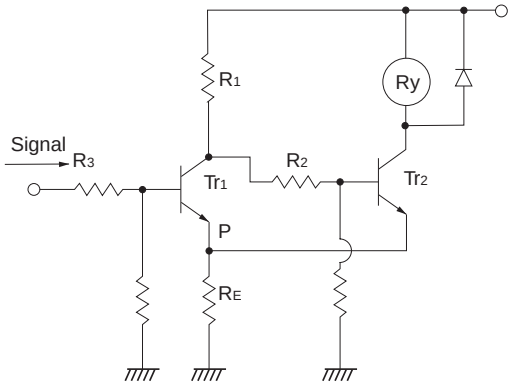
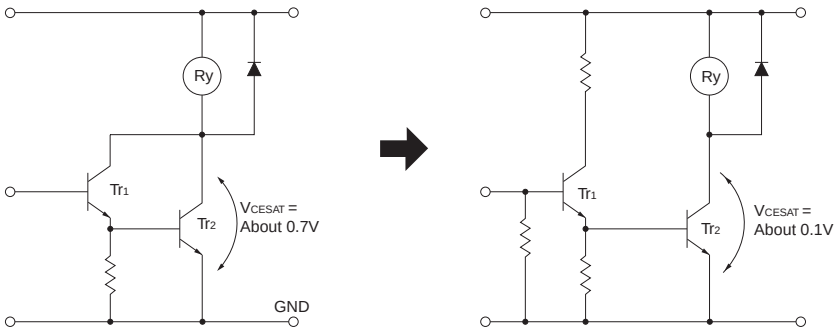
<table>
<tr><td rowspan="2">5. Coil impressed voltage</td><td>4. Twin-relay coil simultaneous operation</td><td>For relays which have multiple coils such as twin relay for forward-reverse operation of motor, if the coils are continuously turned on at the same time, the coil temperature may exceed the tolerance in a short time due to heat generation of each coil. Please contact us before use.</td></tr>
<tr><td>5. Continuous current</td><td>Coil heating due to continuous current applying to coil for extensive time periods will cause deterioration in insulation performance for coil.
For such circuit types, please consider the fail-safe circuit design in case of contact failure or breaking of coil.</td></tr>
<tr><td rowspan="2">6. Coil impressed circuit</td><td rowspan="2">1. Relay drive by means of a transistor</td><td>1. Connection method
<u>Collector connection method is the most recommendable when the relay is driven by means of a transistor.</u>
To avoid troubles in use, the rated voltage should always be impressed on the relay in the ON time and zero voltage be done in the OFF time.
 

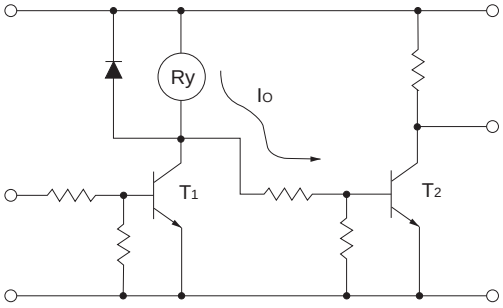
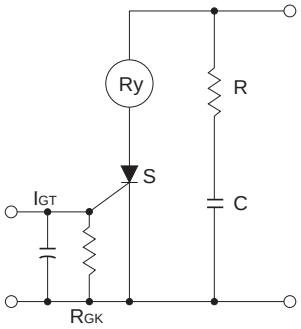
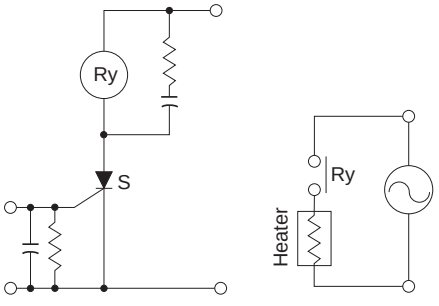
(Good) Collector connection
This is the most common connection, which operation is usually stable with.
 

(Care) Emitter connection
When the circumstances make the use of this connection unavoidable, the voltage may not be completely impressed on the relay and the transistor would not conduct completely.
 

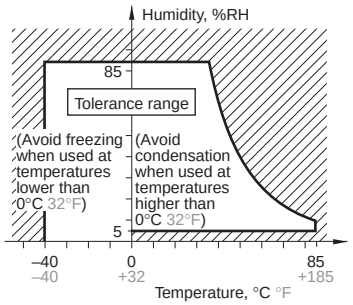
(Care) Parallel connection
As the power consumption of the entire circuit increases, the relay voltage should be considered.</td></tr>
<tr><td>2. Countermeasures for surge voltage of relay control transistor
If the coil current is suddenly interrupted, a sudden high voltage pulse is developed in the coil. If this voltage exceeds the breakdown voltage 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. In case of DC relay, connection of Diode is effective. As suitable ratings for this diode, the average rectified current should be equivalent to the coil current, and the reverse blocking voltage should be about 3 times the value of the power source voltage. Connection of a diode is an excellent way to prevent voltage surges, but there will be a considerable time delay when the relay is open. If you need to reduce this time delay you can connect between the transistor's Collector and Emitter with a Zener diode that will make the Zener voltage somewhat higher than the supply voltage.
 

Take care of Area of Safe Operation (ASO).</td></tr>
</table>

6. Coil impressed circuit	1. Relay drive by means of a transistor	**3. Snap action (Characteristic of relay with voltage rise and fall)** It is necessary for the relay coil not to impress voltage slowly but to impress the rated voltage in a short time and also to drop the voltage to zero in a short time.  **(No Good) Without snap action** **(Good) Snap action** **4. Schmitt circuit (Snap action circuit) (Wave shaping circuit)** When the input signal does not produce a snap action, ordinarily a Schmitt trigger circuit is used to produce safe snap action. 1. The common emitter resistor RE must have a sufficiently small value compared with the resistance of the relay coil. 2. Due to the relay coil current, the difference in the voltage between at point P when T2is conducting and at point P when T1is conducting creates hysteresis in the detection capability of 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 CR time constant circuit should be inserted in the stage before the Schmitt trigger circuit. (However, the response speed drops.)  **5. Avoid Darlington circuit connections. (High amplification)** Care must be taken in this circuit due to increase of VCESAT. It does not cause a failure immediately, but it may lead to troubles by using for a long period or by operating with many units.  **(No good) Darlington connection** Due to excessive consumption of power, heat is generated. A strong Tr1 is necessary. **(Good) Emitter connection** Tr2 conducts completely. Tr1 is sufficient for signal use.

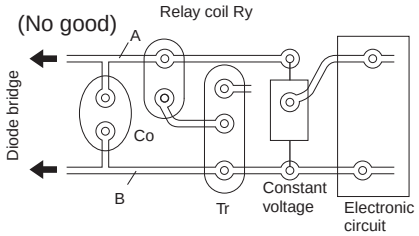
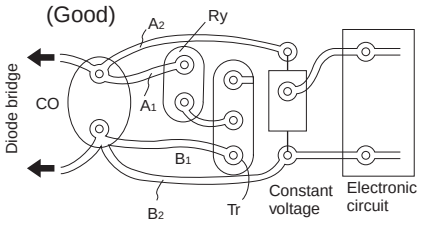
6. Coil impressed circuit	1. Relay drive by means of a transistor	**6. Residual Coil Voltage** In switching applications where a semiconductor (transistor, UJT, etc.) is connected to the coil, a residual voltage is retained at the relay coil which may cause incomplete restoration and faulty operation. Using of DC coils may cause incomplete restoration or reduction in contact pressure and vibration resistance, because its drop-out voltage is lower than that of AC coil (10% or more of the rated voltage) also because 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 as follows, a minute dark current flows to the relay even if the transistor is off. This may also cause the problems described above. Connection to the next stage through collector  Io: dark current **(No good)**
	2. Relay drive by means of SCR	**1. Ordinary drive method** For SCR drive, it is necessary to take particular care with regard to gate sensitivity and erroneous operation due to noise.  IGT : There is no problem even with more than 3 times the rated current. RGK : 1K ohms must be connected. RC : This is for prevention of switching error due to a sudden rise in the power source or to noise. **2. Cautions regarding ON/OFF control circuits** **(when used for temperature control circuits or similar one)** Care must be taken because the electrical life suffers extreme shortening when the relay contacts close simultaneously with an AC single phase power source. 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. In case of the load for temperature control whose load is a high current load such as a heater, some relays switch only peak values and some other relays switch only zero phase values as a phenomenon of this type of control. (Depending upon the sensitivity and response speed of the relay) 4. Accordingly, it causes either an extremely long life or an extremely short life resulting in wide variation. So, it is necessary to take care with the initial device quality check. 

7. Contact reliability	1. Load switch	When switching with a very small load after switching with a large load, contact failure by small load switching may occur due to particles generated during switching of the contact with large load. Please note that or contact us.
	2. Installation condition	Note that if it is connected or installed with a high heat-capacity such as bas bar, connector, harness, and PCB, heat removal phenomenon at low temperature will make relay terminals and contacts cool and condensate a small amount of organic gas inside the relay, which may cause a contact failure. So, please contact us before use.
8. Contact resistance	1. Transient state	Contact resistance consists of dynamic and static contact resistance. Contact resistance on the catalogue and the specifications refers to static contact resistance. Dynamic contact resistance usually shows a large value due to just after the contact operation. Please contact us if a stable contact resistance is necessary soon after a relay is turned on.
	2. Contact voltage, current	Note that if the contact-applied voltage is small (at 6V or less) and contact-applied current is small (at 1A or less), contact resistance may become a larger value due to a small amount of film on a contact surface.
9. Operate noise	1. Coil applied voltage	Mechanical relays produce an operational noise at operate and release time. Note that if the coil-applied voltage is higher at operate time, the noise becomes larger.
	2. Operate noise at installation	It is necessary to test relays in actual installation condition because operate noise may become larger in the installation condition than with a relay by itself due to resonance and sympathetic vibrations of installation PCB and system module.
10. Mechanical noise	1. Abnormal noise	Note that if a large current is applied to the contact, electromagnetic repulsion makes contact vibrate and produces an abnormal noise. Please contact us if quietness is required.
		Note that if an external vibration and shock are applied to a relay while the relay turns off, a movable part of the relay may vibrate and produce a noise. So, please test in the actual use condition if quietness is required.
11. Electrical noise	1. Surge voltage	When the relay turns off, surge voltage is generated from the coil. This serge voltage can be reduced if a resistor is connected in parallel to the coil. Likewise, it can be reduced more if a diode instead of resistor is connected in parallel. However, please contact us or note that if a resistor or a diode is connected in parallel electrical life may be affected due to slowing down of release time.

<table>
<tr><td rowspan="9">12. Usage ambient condition</td><td>1. Temperature, humidity, air pressure</td><td>During usage, storage, or transportation, avoid locations subject to direct sunlight and maintain normal temperature, humidity, and pressure conditions.
The allowable specifications for environments suitable for usage, storage, and transportation are given below.
1. Temperature: The allowable temperature range differs with each relay, so refer to the relay's individual specifications. In addition, in the case of transporting and storing relays in a tube package, the temperature may differ from the allowable range of the relay. So, please contact us for individual specifications.
2. Humidity: 5 to 85% R.H.
3. Pressure: 86 to 106 kPa
Furthermore, the humidity range varies with the temperature. So, use relays within the range indicated in the graph below.
 

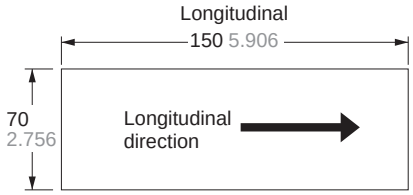
(The allowable temperature range differs for each relay.)

- Be sure the usage ambient temperature does not exceed the value listed in the catalog.
- When switching with a load which easily generates arc in high-humidity environment, the NOx generated 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 using them at an ambient humidity of 85%RH or higher (at 20°C). If it is unavoidable to use them in such environment, please consult us.
- 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 using them in atmospheric pressures beyond 96±10kPa. Also avoid using them in an atmosphere containing flammable or explosive gases.</td></tr>
<tr><td>2. Dust</td><td>It is recommendable to use relays in a normal temperature and humidity with less dust, sulfur gases (SO_2, H_2S), and organic gases.
Sealed types (plastic sealed type) should be considered for applications in an adverse environment.</td></tr>
<tr><td>3. Silicon</td><td>Silicon-based substances (silicon rubber, silicon oil, silicon-based coating material, silicon caulking compound, etc.) emit volatile silicon gas. Note that when silicon is used near relay, switching the contacts in the presence of its gas causes silicon to adhere to the contacts and may result in contact failure.
Therefore, please use a substitute that is not silicon-based. Plastic also has air permeability so please avoid using them in a silicone atmosphere.</td></tr>
<tr><td>4. Magnetism</td><td>If relays are proximately installed each other or installed near highly-magnetized parts such as motor and speaker, the relay may change its operational characteristics or cause malfunction. So, please verify in actual installation and operational condition.</td></tr>
<tr><td>5. Vibration</td><td>Vibration of the area where relay is installed may be enhanced more than expected depending on installation condition of PCB. So, please verify in actual use condition. NO contact is the recommended contact for the use at the vibration-frequent area because the vibration resistance performance of NC contact is generally inferior to that of NO contact.</td></tr>
<tr><td>6. Shock</td><td>It is ideal for mounting of relay 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 NC contacts while the coil is not excited is greatly affected by the mounting direction of the relay.</td></tr>
<tr><td rowspan="2">7. Dew condensation</td><td>Condensation forms when vapors when there is a sudden change in temperature under high temperature, high humidity conditions. Note that condensation may cause deterioration of the insulation, breaking of coil, and rusting.</td></tr>
<tr><td>Note that if a relay is connected or installed with a high heat-capacity such as bas bar, connector, harness, and PCB, heat removal phenomenon will accelerate cooling of the relay inside and promote condensation. So, please verify in actual installation condition.</td></tr>
</table>

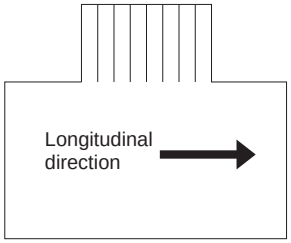
12. Usage ambient condition	8. Water resistance	Select the sealed-type for exposure to water. In the case of water exposure in severe conditions or immersion, please verify water resistance of the relay or contact us. Even for sealed-type relays, its terminals are not waterproof, so please avoid a failure such as terminal corrosion.
	9. Freezing	Note that moisture adhered on relay in a due condensation or a high humidity condition freezes when the temperature is lower than 0°C. This may cause problems such as sticking of movable parts or operational time lags, or poor contact conduction. Therefore, please test them in actual use environment.
		Note that if a relay is connected or installed with a high heat-capacity such as bas bar, connector, harness, and PCB, heat removal phenomenon will accelerate cooling of the relay inside and promote freezing. So, please verify in actual installation condition.
	10. Low temperature, low humidity	The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.
13. Installation	1. Connector installation	Please consider the vibration at installation area to avoid loosely-contact. Also, note that even a microscopic vibration may cause contact failure at the contact area of relay terminal and connector.
		Decrease of fitting performance of connector may cause abnormal heat at connector contact area depending on use temperature and applying heat. Sufficient margin of safety must be provided in selection of a connector.
		Please select the proper material of connector and surface treatment to avoid corrosion at the contact area of relay terminal and connector and increase of resistance at connecting area which may be caused depending on ambient environment.
14. PC board design	1. PC board design consideration	**1. Cautions regarding 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 with the shortest length. • Place the surge absorber (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 sealing failure. • Even for the same circuit, it is necessary to consider the pattern design in order to minimize the influence of the on/off operations of the relay coil and lamp on other electronic circuits, as shown in the figure below.  - Relay currents and electronic circuit currents flow together through A and B.  - Relay coil currents consist only of A1 and B1. - Electronic circuit currents consist only of A2 and B2. A simple design can change safety of the operation.

<table>
<tr>
<td>14. PC board design</td>
<td>2. Hole and Land diameter</td>
<td>
The Hole and Land diameter 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 the Hole and Land diameter
Unit: mm inch
<table>
<tr><th>Standard hole</th><th>Tolerance</th><th>Land diameter</th></tr>
<tr><td>0.8 .031</td><td rowspan="4">±0.1 ±.039</td><td rowspan="2">2.0 to 3.0 .079 to .118</td></tr>
<tr><td>1.0 .039</td></tr>
<tr><td>1.2 .047</td><td rowspan="2">3.5 to 4.5 .138 to .177</td></tr>
<tr><td>1.6 .063</td></tr>
</table>
Remarks
• The Hole diameter is made 0.2 to 0.5 mm .008 to .020 inch larger than the lead diameter. However, if the jet method (wave type, jet type) of soldering is used, solder may pass through to the component side. Therefore, it is more suitable to make the Hole diameter equal to the lead diameter +0.2 mm.
• The Land diameter should be 2 to 3 times the Hole diameter.
• Do not put more than 1 lead in one hole.
</td>
</tr>
<tr>
<td></td>
<td>3. Expansion and shrinkage of copper-clad laminates</td>
<td>
Because copper-clad laminates have a longitudinal and lateral direction, the manner of punching fabrication and layout must be observed with care. Expansion and shrinkage in the longitudinal direction due to heat is 1/15 to 1/2 of that in the lateral, and accordingly, after the punching fabrication, the distortion in the longitudinal direction will be 1/15 to 1/2 of that in 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. (The figure below)
Example: As shown in the drawing below, the 150 mm 5.906 inch direction is taken in 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.

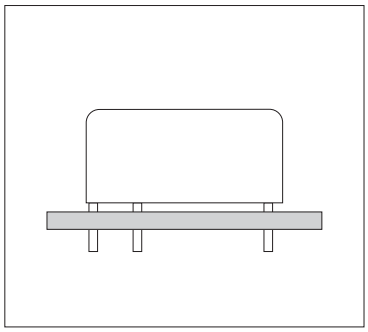


</td>
</tr>
</table>

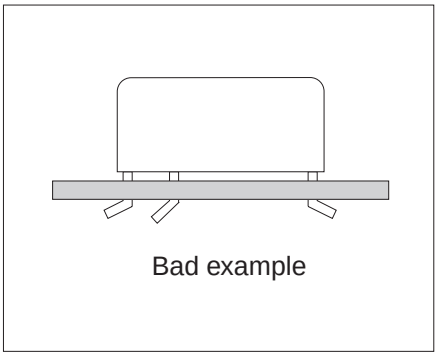
15. PCB mounting	1. Through-hole type

In keeping with making devices compact, it is becoming more common to solder the relay to a PC board along with the semiconductors instead of using the previous plug-in type in which relays were plugged into sockets.
With this style, loss of function may occur because of seepage into the relay of flux, which is applied to the PC board. Therefore, the following precautions are provided for soldering a relay onto a PC board. Please refer to them during installation in order to avoid problems. The type of protective structure will determine suitability for automatic soldering or automatic cleaning. Therefore, please review the parts on construction and characteristics.

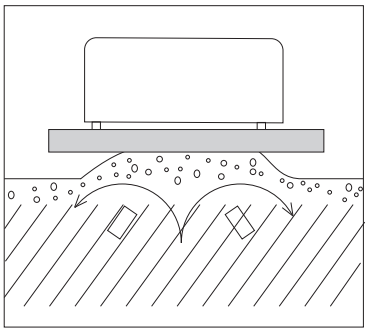
1. Mounting of Relay



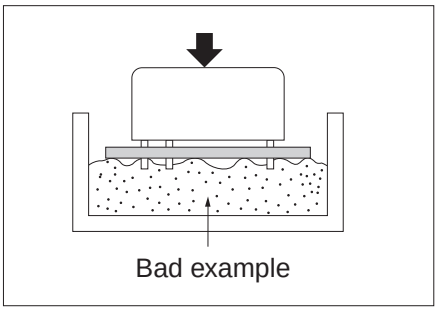
- Avoid bending the terminals to make the relay self-clinching. Relay performance cannot be guaranteed if the terminals are bent.
- Correctly make the PC board according to the given PC board pattern illustration.
- Tube packaging for automatic mounting is available depending on the type of relay. (Be sure that the relays don't rattle.) Interference may occur internally if the gripping force of the tab of the surface mounting machine is too great. This could impair relay performance.



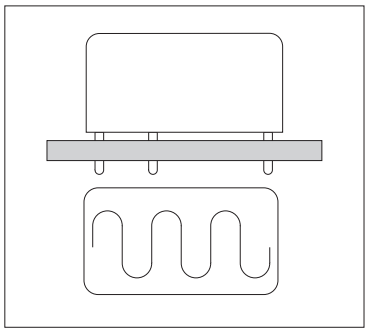
2. Flux Application



- 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.



3. Preheating



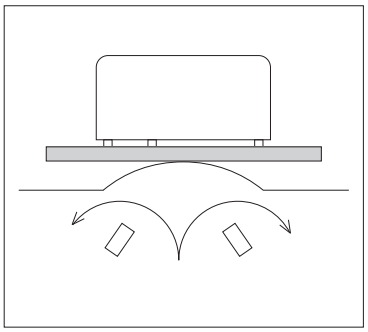
- Be sure to preheat before using automatic soldering. For dust-cover type relays and flux-resistant type relays, preheating acts to prevent the penetration of flux into the relay when soldering. Solderability also improves.
- Preheat according to the following conditions.

Temperature	100°C 212°F or less (PCB solder surface)
Time	Within approx. 2 minute

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

Note: CB and CM relays are not applicable. Please refer to individual product catalog.

4. Soldering



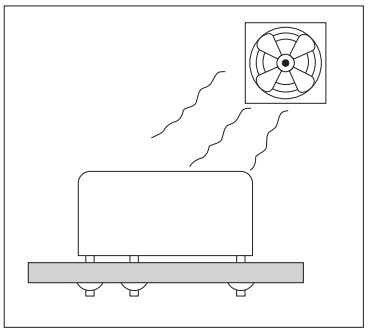
Automatic soldering	Hand soldering
• Flow solder is the optimum method for soldering. • Adjust the level of solder so that it does not overflow onto the top of the PC board. • Unless otherwise specified, solder under the following conditions depending on the type of relay.	• Please take caution with multi-layer boards. Relay performance may degrade due to the high thermal capacity of these boards. • Keep the tip of the soldering iron clean.

Solder temperature	Approx. 260°C±5°C 500°F±41°F
Soldering time	Within approx. 5 seconds

Soldering iron	30W to 60W
Iron tip temperature	Approx. 300°C 572°F
Soldering time	Within approx. 3 seconds

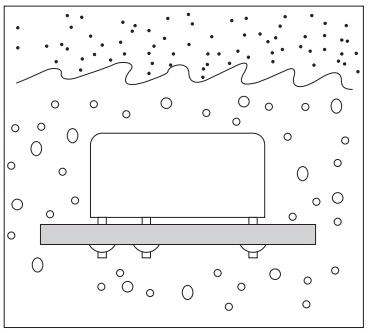
Note: CB and CM relays are not applicable. Please refer to individual product catalog.

5. Cooling



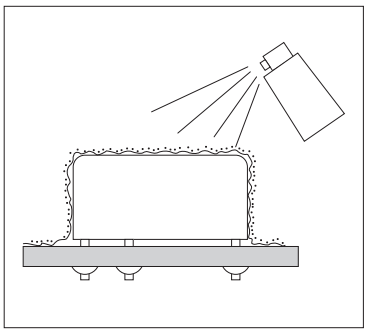
- Immediate air cooling is recommend to prevent deterioration of the relay and surrounding parts due of soldering heat.
- Although environmentally the sealed type relay (plastic sealed type, etc.) can be cleaned, avoid immersing the relay into cold liquid (such as cleaning solvent and coating material) 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 an alcohol-based cleaning solvent. Use of other cleaning solvents (e.g. Trichlene, chloroethene, thinner, benzyl alcohol, gasoline) may damage the relay case.
- 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.
- Do not cut the terminals. When terminals are cut, breaking of coil wire and slight sticking of the contacts may occur due to vibration of the cutter.

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, some 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.
- 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.

Coating material 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	No Good	Silicon gas becomes the cause of contact failure. Do not use the silicon-base type.

15. PCB mounting	2. SMD type

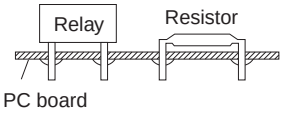
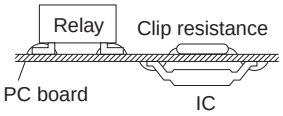
To meet the market demand for downsizing to smaller, lighter, and thinner products, PC boards also need to proceed from insertion mounting to surface mounting technology.
To meet this need, we offer a line of surface mount relays. The following describes some cautions required for surface mount relay installation to prevent malfunction and incorrect operation.
*Please contact us for or reflow soldering of through-hole terminal type.

[1] What is a Surface Mount Relay?

1. From IMT to SMT

Conventional insertion mount technology (IMT) with some 30 years of history is now being replaced with surface mount technology (SMT). Solid-state components such as resistors, ICs, and diodes can withstand high heat stresses from reflow soldering because they use no mechanical parts. In contrast, the conventional electro-mechanical relays consisting of solenoid coils, springs, and armatures are very sensitive to thermal stress from reflow soldering.
We applied the experience gained from our advanced relay technologies to produce high-performance electromagnetic relays compatible with surface mount technologies such as IRS and VPS.

Insertion Mount Technology & Surface Mount Technology

Insertion Mounting Technology (IMT)	Components' terminals are inserted into terminal holes of PC board and are soldered to copper pads on the other side of the board. (flow-soldering)	
Surface Mounting Technology (SMT)	Components are placed on copper pads pre-coated with paste solder and the board assembly is heated to solder the components on the pads. (reflow soldering)	

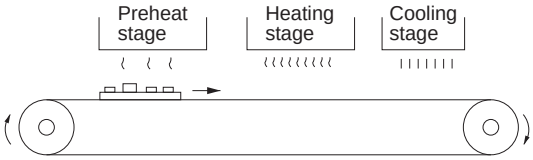
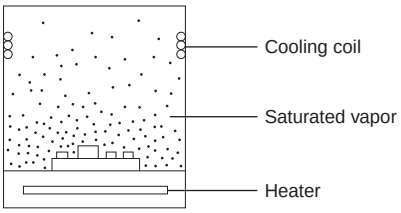
2. Features and Effects

Features	Effects
Allows high density mounting Components can be installed on both sides of a board Ceramic PC boards can be used	System downsizing
Compatible with automatic placement by robots Drilling for lead holes is not required Compact system designs are possible due to high density mounting	Overall cost reduction
High heat resistance Anti-gas measures	High reliability

The surface mount relay is realized with the following advanced technologies:

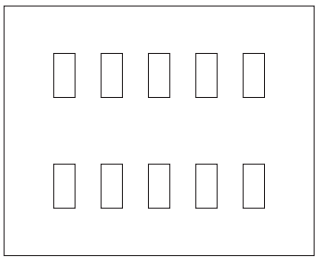
- Heat-resistance encapsulation technique
- Gas analysis
- Reliability assessment
- Precision molding technique for heat-resistant materials

3. Examples of SMT Applications

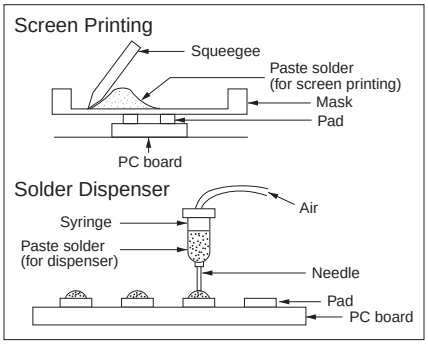
1. Infrared Reflow Soldering (IRS)	IRS is the most popular reflow soldering technology now available for surface mounting. It uses a sheath heater or infrared lamp as its heat source. PC board assemblies are continuously soldered as they are transferred through a tunnel furnace comprised of a preheating, heating, and cooling-stages. 
2. Vapor Phase Soldering (VPS)	With VPS technology, PCB assemblies are carried through a special inactive solvent, such as Fluorinert FC-70, that has been heated to a vapor state. As the saturated vapor condenses on the PC board surface, the resulting evaporation heat provides the energy for reflow soldering. 
3. Belt conveyer reflow oven	As PCB assemblies are transferred on a thin, heat-resistant belt conveyer, they are soldered by the heat from hotplates placed beneath the conveyer belt.
4. Double Wave Soldering (DWS)	After components are glued to the PC board surface, the board assembly is transferred through a molten solder fountain (with the component side facing down). Then, the components are soldered to the board.
5. Other Technologies	Other reflow soldering technologies include those of utilizing lasers, hot air, and pulse heaters.

[2] Cautions for installation

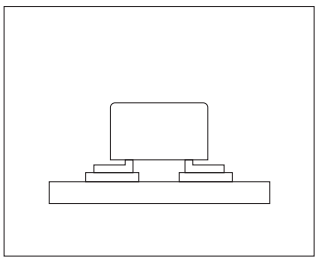
1. Paste Soldering



- Mounting pads on PC boards must be designed to absorb placement errors while taking account of solderability and insulation. Refer to the suggested mounting pad layout in the application data for the required relay product.
- Paste solder may be applied on the board with screen printing or dispenser techniques. For either method, the paste solder must be coated to appropriate thickness and shapes to achieve good solder wetting and adequate insulation.

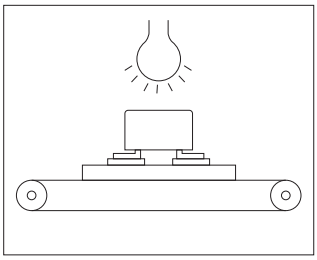


2.Relay mounting



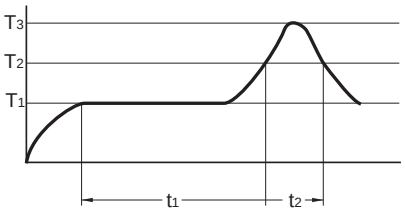
- A self-alignment effect is expected during soldering of small and lightweight (approx. 100 mg or less) components such as chip components but such effect cannot be expected for electro-mechanical components such as relays. Positional alignment of a relay and lands on a circuit board requires precise positioning on its soldering pads.
- Excessive pickup force exerted by a placement machine could cause internal damage, and performance of the relay cannot be warranted.
- Component taping compatible with automated placement is adopted for this product.
- Once the humidity controlled package is opened, relays should be used promptly. (For possible storage period after opening a package, please refer to the catalog for the product concerned. If products are not used within the possible storage period, they should be stored in a humidity-controlled desiccator or in a moisture-prevention bag with silica gel.)

3. Reflow



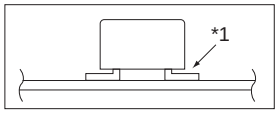
• Reflow soldering under inadequate soldering conditions may result in unreliable relay performance or even physical damage to the relay (even if the relay is of surface mount type with high heat resistance).

1. IRS profile



T_1 = 150 to 180°C 302 to 356°F
T_2 = 230°C 446°F or more
T_3 = Less than 250°C 482°F

t_1 = 60 to 120 sec.
t_2 = Less than 30 sec.

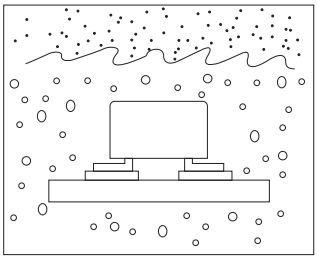


Note: Temperature profile indicates the temperature of the soldered part (*1) of terminals on the surface of a circuit board. The exterior temperature of a relay may be extremely high depending on the component density on the board or the heating method of the reflow oven or circuit board type. Sufficient verification under actual processing conditions is required. Performance-guaranteed temperature varies by product. Please refer to the relevant product catalog.

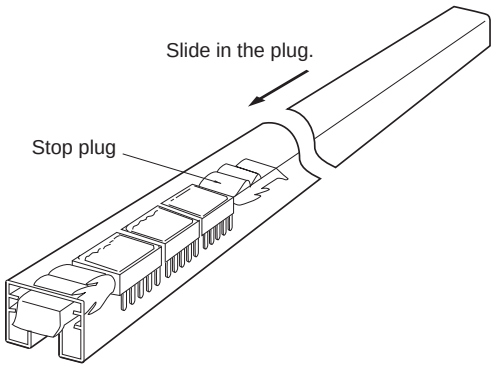
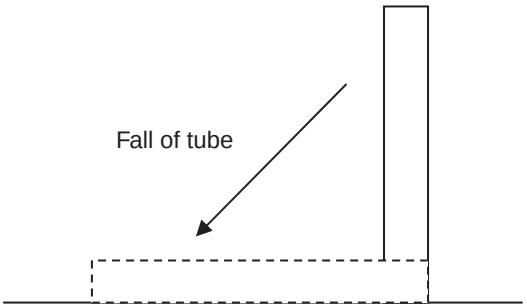
<Others>
For other solder methods except for the above (such as hot air heating, hot plate heating, laser heating, pulse heating, etc.), please check for mounting and soldering condition before use.

• It is recommended that the soldered pad be immediately cooled to prevent thermal damage to the relay and its associated components.

4. Cooling / Cleaning



• In order to avoid deterioration of relays and other components caused by soldering heat, immediate air cooling is recommended.
• Avoid cleaning (ultrasonic cleaning, boiling cleaning, etc.) and coating in order to prevent negative impacts on relay characteristics.

<table>
<tr><td rowspan="2">16. Storage, transportation</td><td>1. Transportation</td><td>Relay's functional damage may occur if strong vibration, shock or heavy weight is applied to a relay during transportation of a device in which a relay is installed. Therefore, please pack them in a way, using shock-absorbing material, so that the allowable range for vibration and shock is not exceeded.</td></tr>
<tr><td>2. Storage</td><td>If the relay is stored for extended periods of time (including transportation period) at high temperatures or high humidity levels or in atmospheres with organic gas or sulfide gas, sulfide film or oxide film may be formed on surface of the contacts, which may cause contact instability, contact failure and functional failure. Please check the atmosphere in which the units are to be stored and transported.</td></tr>
<tr><td rowspan="2">17. Product handling</td><td rowspan="2">1. Tube packing</td><td>Some types of relays are supplied with tube packaging. If you remove some relays from the tube, be sure to slide a stop plug into one end of a tube to hold the remaining relays firmly and avoid rattling of relay inside the tube. Note that rattling may cause a damage on appearance and/or performance.
 
</td></tr>
<tr><td>Do not use the relays if they were dropped or fallen down in a tube packing condition because there is a risk of characteristic failure.
 
</td></tr>
</table>

18. Reliability

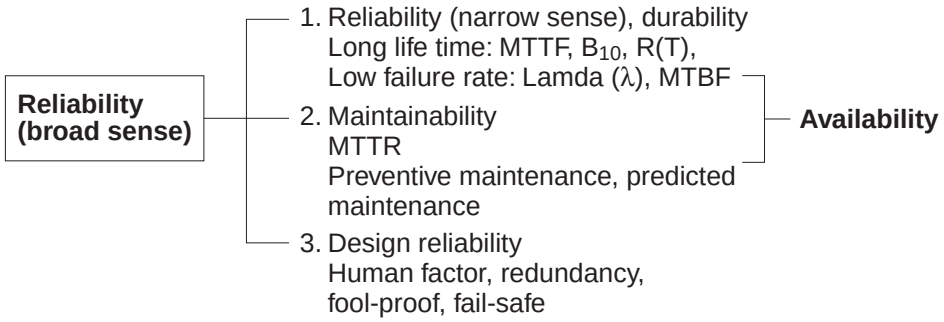
[1] What is Reliability?

1. Reliability in a Narrow Sense of the Term

In the industrial world, reliability is an index of how long a particular product serves without failure during use period.

2. Reliability in a Board Sense of the Term

Every product has a finite service lifetime. This means that no product can continue normal service infinitely. When a product has broken down, the user may throw it away or repair it. The reliability of repairable products is recognized as “reliability in a broad sense of the term.” For repairable products, their serviceability or maintainability is another problem. In addition, reliability of product design is becoming a serious concern for the manufacturing industry. In short, reliability has three senses: i.e. reliability of the product itself, serviceability of the product, and reliability of product design.



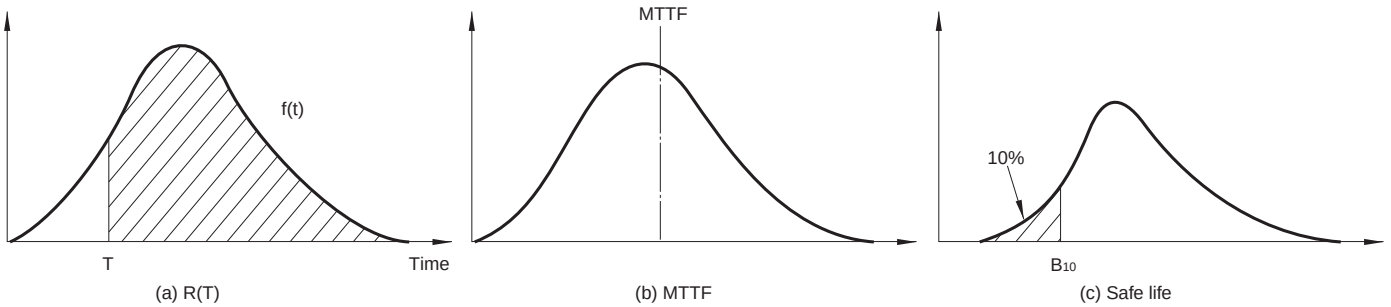
3. Intrinsic Reliability and Reliability of Use

Reliability is “built” into products. This is referred to as intrinsic reliability which consists mainly of reliability in the narrow sense. Product reliability at the user’s site is called “reliability of use,” which consists mainly of reliability in the broad sense. In the relay industry, reliability of use has a significance in aspects of servicing.

[2] Reliability Measures

The following list contains some of the most popular reliability measures:

Reliability measure	Sample representation
Degree of reliability R(T)	99.9%
MTBF	100 hours
MTTF	100 hours
Failure rate lambda	20 fit, 1%/hour
Safe life B10	50 hours



AUTOMOTIVE CAUTIONS FOR USE

1. Degree of Reliability

Degree of reliability represents percentage ratio of reliability. For example, if none of 10 light bulbs has failed for 100 hours, the degree of reliability defined in, 100 hours of time is 10/10 = 100%. If only three bulbs remained alive, the degree of reliability is 3/10 = 30%. The JIS Z8115 standard defines the degree of reliability as follows: The probability at which a system, equipment, or part provides the specified functions over the intended duration under the specified conditions.

2. MTBF

MTBF is an acronym of Mean Time Between Failures. It indicates the mean time period in which a system, equipment, or part operates normally between two incidences of repair. MTBF only applies to repairable products.
MTBF tells how long a product can be used without the need for repair. Sometimes MTBF is used to represent the service lifetime before failure.

3. MTTF

MTTF is an acronym of Mean Time To Failure. It indicates the mean time period until a product becomes faulty MTTF normally applies to unrepairable products such as parts and materials.
The relay is one of such objective of MTTF.

4. Failure Rate

Failure rate includes mean failure rate and momentary failure rate. Mean failure rate is defined as follows: Mean failure rate = Total failure count/total operating hours
In general, failure rate refers to momentary failure rate. This represents the probability at which a system, equipment, or part, which has continued normal operation to a certain point of time, becomes faulty in the subsequent specified time period.
Failure rate is often represented in the unit of percent/hours. For parts with low failure rates, “failure unit (Fit) = 10-9 /hour” is often used instead of failure rate. Percent/count is normally used for relays.

5. Safe Life

Safe life is an inverse of degree of reliability. It is given as value B which makes the following equation true:

1 - R(B) = t%

In general, “B[1 - R(B)] = 10%” is more often used. In some cases this represents a more practical value of reliability than MTTF.

[3] Failure

1. What is Failure?

Failure is defined as a state of system, equipment, or component in which part of all of its functions are impaired or lost.

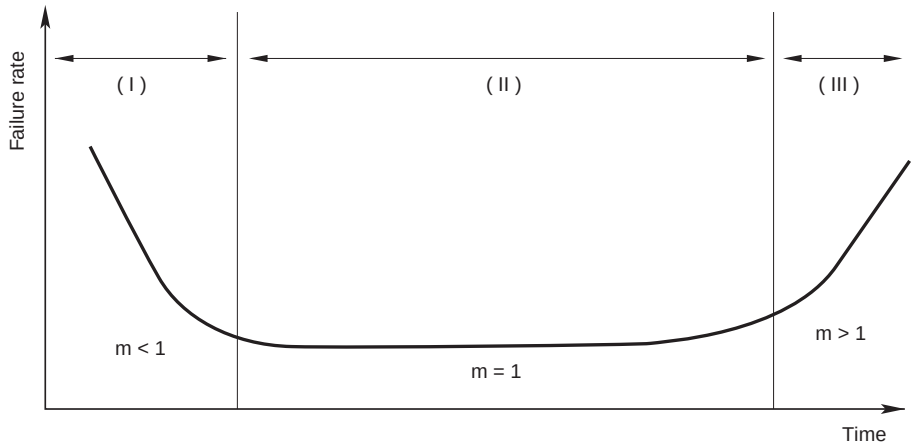
2. Bathtub Curve

Product's failure rate throughout its lifetime is depicted as a bathtub curve, as shown below. Failure rate is high at the beginning and end of its service lifetime.

(I) Initial failure period
The high failure rate in the initial failure period is derived from latent design errors, process errors, and many other causes. This process is called debugging, performing aging or screening in order to find out initial failures.

(II) Accidental failure period
The initial failure period is followed by a long period with low, stable failure rate. In this period, called accidental failure period, failures occurs at random along the time axis. While zero accidental failure rate is desirable, this is actually not practical in the real world.

(III) Wear-out failure period
In the final stage of the product's service lifetime comes the wear-out failure period, in which the life of the product expires due to wear of fatigue. Preventive maintenance is effective for this type of failure. The timing of a relay's wear-out failure can be predicted with a certain accuracy from the past record of uses. The use of a relay is intended only in the accidental failure period, and this period virtually represents the service lifetime of the relay.



3. Weibull Analysis

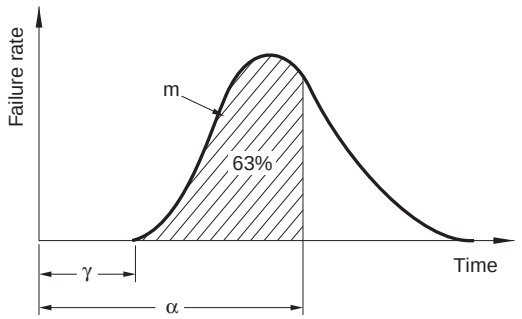
Weibull analysis is often used for classifying a product's failure patterns and to determine its lifetime.
Weibull distribution is expressed by the following equation:

$$f(x) = \frac{m}{\alpha}(\chi-\gamma)^{m-1} e^{-\frac{(\chi-\gamma)^m}{\alpha}}$$

where

m : Figure parameter
α : Measurement parameter
γ : Position prameter

Weibull distribution can be adopted to the actual failure rate distribution if the three variables above are estimated.



The Weibull probability chart is a simpler alternative of complex calculation formulas. The chart provides the following advantages:
(1) The Weibull distribution has the closest proximity to the actual failure rate distribution.
(2) The Weibull probability chart is easy to use.
(3) Different types of failures can be identified on the chart.

The following describes the correlation with the bathtub curve. The value of the parameter "m" represents the type of the failure.
(1) When m < 1: Initial failures
(2) When m = 1: Accidental failures
(3) When m > 1: Wear-out failures

CHECK SHEET

Category	Check box	Check item	Refer to the following item in Category - Section
Safety	☐	Does the vehicle system have a fail-safe in case of a relay failure?	1-1, 2-4
Load/ Electrical life	☐	Has it been confirmed by testing under actual load, actual circuit, and actual condition?	4-1
	☐	Have load type, load current characteristic, and current value been checked?	4-2 to 4-9
	☐	Isn't the applied contact current too small? (Small current is likely to decrease the contact reliability.)	4-10
	☐	Has connecting load polarity been checked?	4-11
	☐	Is the load likely to cause instant voltage drop?	4-12
	☐	Isn't the applied contact voltage too high? (High voltage decreases electrical life.)	4-13
	☐	Isn't applied coil voltage too high? (High voltage affects electrical life.)	4-14
	☐	Isn't short pulse applied to coil?	4-15
	☐	Isn't the switching frequency too high even including at abnormality?	4-16
	☐	Doesn't switching continue for a long time?	4-17
	☐	Does it switch under high temperature?	4-18
	☐	Have precautions been checked for using of coil surge absorption circuit?	4-19
	☐	Have you checked there is no sneak current or voltage to the relay coil?	4-20
	☐	Is there stray capacitance between lead wires?	4-21
	☐	Have precautions been checked for using of contact protective circuit?	4-22
	☐	Is there a risk of dead short in the power supply?	4-23
	☐	Is there a risk of short circuit in the power supply at load rejection?	4-23
	☐	Is there a risk of insulation and breakdown voltage between contacts in each pole when high voltage is applied to a twin relay?	4-24
Coil operation voltage	☐	Has hot start been considered?	5-1
	☐	Is the ambient temperature within the range of use? Also, is the ambient temperature characteristics considered?	5-2
	☐	Is the applied voltage below the maximum continuous applied voltage?	5-3
	☐	Is there a risk of using PWM control? (PWM control requires careful attention.)	5-3
	☐	Doesn't coil of twin relay operate at the same time?	5-4
	☐	Hasn't the current continuou sly applied to coil over a long period?	5-5
Coil operation circuit	☐	In case of relay operation by electric circuit, is the circuit designed in consideration of mal-function?	6-1, 6-2
	☐	Doesn't the surge voltage of relay cause mal-function or destruction of transistor circuit?	6-1, 6-2
	☐	When relay is applied to an electric circuit, has voltage drop caused by other electric components on the circuit been considered?	6-1, 6-2

AUTOMOTIVE CAUTIONS FOR USE

Category	Check box	Check item	Refer to the following item in Category - Section
Contact reliability	☐	Have precautions been checked in the case of switching with both high and low loads by the same contact?	7-1
	☐	Doesn't heat dissipation occur under low temperature?	7-2
Contact resistance	☐	Has transient state of contact resistance been considered?	8-1
	☐	Are contact voltage and current 6V 1A or higher?	8-2
Operating sound	☐	Are there any problems regarding operating sound of relay?	9-1, 9-2
Mechanical noise	☐	Are there any problems regarding abnormal weak noise of relay?	p177/10-1
Use environmental condition	☐	Is temperature, humidity, atomosphere pressure within the range of use?	12-1
	☐	Have precautions been checked in the case of switching under high humidity?	12-1
	☐	Is the ambient environment free from particles, dusts, sulfidizing gas, organic gas?	12-2
	☐	Is the ambient environment free from silicon?	12-3
	☐	Is the ambient environment free from high-field magnetic instruments such as speaker?	12-4
	☐	Are the ambient vibration and shock below the relay's vibration and impact characteristics? Also, is there no resonance after the relay is	12-5, 12-6
	☐	Isn't there a risk of freezing and dewing of relay?	7-2, 12-7, 12-9
	☐	Isn't there a risk of water or oil adhesion?	12-8
Mounting	☐	Doesn't vibration or shock cause poor connection between a relay and a connector?	13-1
PCB mounting	☐	Have precautions been checked for operating of flux applying and automatic soldering?	15-1, 15-2
	☐	Have precautions been checked for cleaning operation of print board?	15-1, 15-2
	☐	Isn't glass shot performed for flux cleaning? (Particle of the glass may get inside the relay and cause operation failure.)	15-1, 15-2
	☐	Does significant warping of print board occur, which applies a force on a relay teminal and changes the relay characteristics?	15-1, 15-2
	☐	Isn't the unused terminal cut? (Applied force on terminal can change the characteristics.)	15-1, 15-2
Storage, transportation	☐	Aren't load, shock, or vibration which is out of the allowable range applied during transportation?	16-1
	☐	Are temperature and humidity within the allowable range?	16-2
	☐	Is the ambient atomosphere free from organic gas and sulfidizing gas?	16-2
Product handling	☐	Aren't dropped or fallen tube packages used?	17-1

CAUTIONS FOR PROTECTIVE ELEMENTS

1. Part numbers without protective elements

1) 12 V models

When connecting a coil surge protection circuit to these relays, we recommend a Zener diode of at least 24 V or a resistor (680Ω to 1,000Ω).

When the diode is connected in parallel to the coil, the reset time will slow down, which may lead to shortening of expected life. Please check the circuit and make sure the diode is not connected in parallel with the coil drive circuit.

2) 24 V models

When connecting a coil surge protection circuit to these relays, we recommend a Zener diode of at least 48 V or a resistor (2,800Ω to 4,700Ω).

When the diode is connected in parallel to the coil, the reset time will slow down, which may lead to shortening of expected life. Please check the circuit and make sure the diode is not connected in parallel with the coil drive circuit.

2. Part numbers with diodes

Since these relays use a diode in the coil surge protective element, the reset time is slower and a reduction in expected life is possible compared to part numbers without protective elements and part numbers with resistors.

Please be sure not to use the product until you have evaluated it under actual load conditions.

3. Part numbers with resistors

Since these part numbers use a resistor in the coil surge protection circuit, an external surge protection element is not required. Please note that connecting a diode in parallel with the coil will decrease the reset time and possibly reduce the expected life of the product.

GENERAL CAUTIONS FOR USE

1. Before using relays under any operating condition other than those listed in the catalog, please consult us. After checking the specifications requested by your company, we will check the operating conditions in a vehicle environment as required.

2. Before using relays, please check “Cautions for Use of Automotive Relays”.

3. Switching life data are based on the standard testing condition (temperature 15°C to 35°C 59°F to 95°F, humidity 25%RH to 85%RH) specified by JIS C 5442. Switching life varies by coil drive circuit, load type, ambient environment, etc. Please check performance using an actual presumptive operating environment of a vehicle, or consult us.

4. Dropping a relay could cause a functional disorder. Do not use a relay that has been dropped.

5. Coil drive current must be pure DC current, as a rule. If the current includes ripples, the ripple factor should be less than 5%. However, check it with an actual circuit since the characteristics may differ slightly. Relay performance must be verified with the actual operating circuit. Power waveform must be rectangular, as a rule.

6. The case is designed not to be removed in normal handling. Do not remove the case for product performance maintenance.

7. Relays generate failures with certain probability. Durability also varies by operating environment and condition. When using relays, always check performance with an actual circuit and operating environment. Continued operation with deteriorated performance could generate abnormal heat, smoke, or fire due to deteriorated insulation. In order to avoid human accident, fire accident or public harm as a result of a product failure or end-of-life performance, appropriate safety designs such as redundant design, fire spread prevention design and malfunction prevention design must be implemented together with scheduled maintenance.

8. Use of relays in normal temperature and humidity conditions with limited dust and organic gas is recommended. Use of silicone-based resin around a relay must be absolutely avoided. For more details, please refer to “Cautions for Use of Automotive Relays”.

Global Network

North America | Europe | Asia Pacific | China | Japan

Panasonic Electric Works

Please contact our Global Sales Companies in:

Europe

Headquarters	Panasonic Electric Works Europe AG	Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. +49 (0) 8024 648-0, Fax +49 (0) 8024 648-111, www.panasonic-electric-works.com
Austria	Panasonic Electric Works Austria GmbH	Josef Madersperger Str. 2, 2362 Biedermannsdorf, Tel. +43 (0) 2236-26846, Fax +43 (0) 2236-46133 www.panasonic-electric-works.at
	Panasonic Industrial Devices Materials Europe GmbH	Ennshafenstraße 30, 4470 Enns, Tel. +43 (0) 7223 883, Fax +43 (0) 7223 88333, www.panasonic-electronic-materials.com
Benelux	Panasonic Electric Works Sales Western Europe B.V.	De Rijn 4, (Postbus 211), 5684 PJ Best, (5680 AE Best), Netherlands, Tel. +31 (0) 499 372727, Fax +31 (0) 499 372185, www.panasonic-electric-works.nl
Czech Republic	Panasonic Electric Works Europe AG	Organizační složka, Administrative centre PLATINIUM, Veveri 111, 616 00 Brno, Tel. +420 541 217 001, Fax +420 541 217 101, www.panasonic-electric-works.cz
France	Panasonic Electric Works Sales Western Europe B.V.	Succursale française, 10, rue des petits ruisseaux, 91370 Verrières Le Buisson, Tél. +33 (0) 1 6013 5757, Fax +33 (0) 1 6013 5758, www.panasonic-electric-works.fr
Germany	Panasonic Electric Works Europe AG	Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. +49 (0) 8024 648-0, Fax +49 (0) 8024 648-111, www.panasonic-electric-works.de
Hungary	Panasonic Electric Works Europe AG	Magyarországi Közvetlen Kereskedelmi Képviselet, 1117 Budapest, Neumann János u. 1., Tel. +36 1 999 89 26 www.panasonic-electric-works.hu
Ireland	Panasonic Electric Works UK Ltd.	Irish Branch Office, Dublin, Tel. +353 (0) 14600969, Fax +353 (0) 14601131, www.panasonic-electric-works.co.uk
Italy	Panasonic Electric Works Italia srl	Via del Commercio 3-5 (Z.I. Ferlina), 37012 Bussolengo (VR), Tel. +39 0456752711, Fax +39 0456700444, www.panasonic-electric-works.it
Nordic Countries	Panasonic Electric Works Europe AG	Filial Nordic, Knarrarnäsgatan 15, 164 40 Kista, Sweden, Tel. +46 859476680, Fax +46 859476690, www.panasonic-electric-works.se
	Panasonic Eco Solutions Nordic AB	Jungmansgatan 12, 21119 Malmö, Tel. +46 40 697 7000, Fax +46 40 697 7099, www.panasonic-fire-security.com
Poland	Panasonic Electric Works Polska sp. z o.o	ul. Wołoska 9A, 02-583 Warszawa, Tel. +48 22 338-11-33, Fax +48 22 338-12-00, www.panasonic-electric-works.pl
Portugal	Panasonic Electric Works España S.A.	Portuguese Branch Office, Avda Adelino Amaro da Costa 728 R/C J, 2750-277 Cascais, Tel. +351 214812520, Fax +351 214812529
Spain	Panasonic Electric Works España S.A.	Barajas Park, San Severo 20, 28042 Madrid, Tel. +34 913293875, Fax +34 913292976, www.panasonic-electric-works.es
Switzerland	Panasonic Electric Works Schweiz AG	Grundstrasse 8, 6343 Rotkreuz, Tel. +41 (0) 41 7997050, Fax +41 (0) 41 7997055, www.panasonic-electric-works.ch
United Kingdom	Panasonic Electric Works UK Ltd.	Sunrise Parkway, Linford Wood, Milton Keynes, MK14 6LF, Tel. +44 (0) 1908 231555, Fax +44 (0) 1908 231599, www.panasonic-electric-works.co.uk

North & South America

USA	Panasonic Industrial Devices Sales Company of America	629 Central Avenue, New Providence, N.J. 07974, Tel. 1-908-464-3550, Fax 1-908-464-8513, www.pewa.panasonic.com

Asia Pacific/China/Japan

China	Panasonic Electric Works Sales (China) Co. Ltd.	Level 2, Tower W3, The Towers Oriental Plaza, No. 2, East Chang An Ave., Dong Cheng District, Beijing 100738, Tel. +86-10-5925-5988, Fax +86-10-5925-5973
Hong Kong	Panasonic Industrial Devices Automation Controls Sales (Hong Kong) Co., Ltd.	RM1205-9, 12/F, Tower 2, The Gateway, 25 Canton Road, Tsimshatsui, Kowloon, Hong Kong, Tel. +852-2956-3118, Fax +852-2956-0398
Japan	Panasonic Corporation	1048 Kadoma, Kadoma-shi, Osaka 571-8686, Japan, Tel. +81-6-6908-1050, Fax +81-6-6908-5781, www.panasonic.net
Singapore	Panasonic Industrial Devices Automation Controls Sales Asia Pacific	300 Beach Road, #16-01 The Concourse, Singapore 199555, Tel. +65-6390-3811, Fax +65-6390-3810

Panasonic®

1172 euen 02/13

Taiko Device ⇒ Panasonic Part Numbers

Taiko Device type	Taiko Device part no.		Panasonic type	Panasonic part no.							
				A	C	T					
TB Single			**ACTB Single**								
TB1	TB1-100M	⇒	**ACTB**	A	C	T	B	1			1
TB1	TB1-160M	⇒	**ACTB**	A	C	T	B	1			2
TB1	TB1-225M	⇒	**ACTB**	A	C	T	B	1			3
TB1	HTB1-100M	⇒	**ACTB**	A	C	T	B	1		H	1
TB1	HTB1-160M	⇒	**ACTB**	A	C	T	B	1		H	2
TB1	HTB1-225M	⇒	**ACTB**	A	C	T	B	1		H	3
TB1	RTB1-100MT	⇒	**ACTB**	A	C	T	B	1		R	1
TB1	RTB1-160MT	⇒	**ACTB**	A	C	T	B	1		R	2
TB1	RTB1-225MT	⇒	**ACTB**	A	C	T	B	1		R	3
TB1	TB1-100ML	⇒	**ACTB**	A	C	T	B	1	L		1
TB1	TB1-160ML	⇒	**ACTB**	A	C	T	B	1	L		2
TB1	TB1-225ML	⇒	**ACTB**	A	C	T	B	1	L		3
TB1	HTB1-100ML	⇒	**ACTB**	A	C	T	B	1	L	H	1
TB1	HTB1-160ML	⇒	**ACTB**	A	C	T	B	1	L	H	2
TB1	HTB1-225ML	⇒	**ACTB**	A	C	T	B	1	L	H	3
TB1	RTB1-100MLT	⇒	**ACTB**	A	C	T	B	1	L	R	1
TB1	RTB1-160MLT	⇒	**ACTB**	A	C	T	B	1	L	R	2
TB1	RTB1-225MLT	⇒	**ACTB**	A	C	T	B	1	L	R	3
TB1	HTB1-100	⇒	**ACTB**	A	C	T	B	2		H	1
TB1	HTB1-225	⇒	**ACTB**	A	C	T	B	2		H	3
TB1	RTB1-100T	⇒	**ACTB**	A	C	T	B	2		R	1
TB1	RTB1-225T	⇒	**ACTB**	A	C	T	B	2		R	3
TB1	TB1-100L	⇒	**ACTB**	A	C	T	B	2	L		1
TB1	TB1-160L	⇒	**ACTB**	A	C	T	B	2	L		2
TB1	TB1-225L	⇒	**ACTB**	A	C	T	B	2	L		3
TB1	HTB1-100L	⇒	**ACTB**	A	C	T	B	2	L	H	1
TB1	HTB1-160L	⇒	**ACTB**	A	C	T	B	2	L	H	2
TB1	HTB1-225L	⇒	**ACTB**	A	C	T	B	2	L	H	3
TB1	RTB1-100LT	⇒	**ACTB**	A	C	T	B	2	L	R	1
TB1	RTB1-160LT	⇒	**ACTB**	A	C	T	B	2	L	R	2
TB1	RTB1-255LT	⇒	**ACTB**	A	C	T	B	2	L	R	3
TB1	TB1-160	⇒	**ACTB**	A	C	T	B	2			2
TB1	TB1-225	⇒	**ACTB**	A	C	T	B	2			3
TB1	HTB1-160	⇒	**ACTB**	A	C	T	B	2		H	2
TB1	HTB1-160T	⇒	**ACTB**	A	C	T	B	2		A	2
TB1	RTB1-160T	⇒	**ACTB**	A	C	T	B	2		R	2

Automotive Relays: Taiko Device ⇒ Panasonic

Taiko Device type	Taiko Device part no.		Panasonic type	Panasonic part no.							
				A	C	T					
TB Twin			**ACTB Twin**								
TB2	TB2-100	⇒	**ACTB**	A	C	T	B	3			1
TB2	TB2-160	⇒	**ACTB**	A	C	T	B	3			2
TB2	TB2160Z	⇒	**ACTB**	A	C	T	B	5			2
TB2	TB2-225	⇒	**ACTB**	A	C	T	B	3			3
TB2	HTB2-100	⇒	**ACTB**	A	C	T	B	3		H	1
TB2	HTB2-225	⇒	**ACTB**	A	C	T	B	3		H	3
TB2	RTB2-100T	⇒	**ACTB**	A	C	T	B	3		R	1
TB2	RTB2-225T	⇒	**ACTB**	A	C	T	B	3		R	3
TB2	TB2-100Z	⇒	**ACTB**	A	C	T	B	5			1
TB2	TB2-225Z	⇒	**ACTB**	A	C	T	B	5			3
TB2	HTB2-100Z	⇒	**ACTB**	A	C	T	B	5		H	1
TB2	HTB2-160Z	⇒	**ACTB**	A	C	T	B	5		H	2
TB2	HTB2-225Z	⇒	**ACTB**	A	C	T	B	5		H	3
TB2	RTB2-100ZT	⇒	**ACTB**	A	C	T	B	5		R	1
TB2	RTB2-160ZT	⇒	**ACTB**	A	C	T	B	5		R	2
TB2	RTB2-225ZT	⇒	**ACTB**	A	C	T	B	5		R	3
TB2	TB2-100LZ	⇒	**ACTB**	A	C	T	B	5	L		1
TB2	TB2-160LZ	⇒	**ACTB**	A	C	T	B	5	L		2
TB2	TB2-225LZ	⇒	**ACTB**	A	C	T	B	5	L		3
TB2	HTB2-100LZ	⇒	**ACTB**	A	C	T	B	5	L	H	1
TB2	HTB2-160LZ	⇒	**ACTB**	A	C	T	B	5	L	H	2
TB2	HTB2-225LZ	⇒	**ACTB**	A	C	T	B	5	L	H	3
TB2	RTB2-100LZT	⇒	**ACTB**	A	C	T	B	5	L	R	1
TB2	RTB2-160LZT	⇒	**ACTB**	A	C	T	B	5	L	R	2
TB2	RTB2-225LZT	⇒	**ACTB**	A	C	T	B	5	L	R	3
TB2	HTB2-160	⇒	**ACTB**	A	C	T	B	3		H	2
TB2	HTB2-160T	⇒	**ACTB**	A	C	T	B	3		A	2
TB2	HTB2-160ZT	⇒	**ACTB**	A	C	T	B	3		A	2
TB2	RTB2-160T	⇒	**ACTB**	A	C	T	B	3		R	2
TA Single			**ACTA Single**								
TA1	TA1-160	⇒	**ACTA**	A	C	T	A	2			2
TA1	TA1-225	⇒	**ACTA**	A	C	T	A	2			3
TA1	TA1-225PD	⇒	**ACTA**	A	C	T	A	2	W		3
TA Twin			**ACTA Twin**								
TA2	TA2-160	⇒	**ACTA**	A	C	T	A	4			2

Taiko Device type	Taiko Device part no.		Panasonic type	Panasonic part no.							
				A	C	T					
TC Single			**ACTC Single**								
TC1	TC1-110-A(S)	⇒	**ACTC**	A	C	T	C	1			1
TC1	TC1-110-C(S)	⇒	**ACTC**	A	C	T	C	2			1
TC1	TC1-110-U(S)	⇒	**ACTC**	A	C	T	C	3			1
TC1	TC1-160-A(S)	⇒	**ACTC**	A	C	T	C	1			2
TC1	TC1-160-C(S)	⇒	**ACTC**	A	C	T	C	2			2
TC1	TC1-160-U(S)	⇒	**ACTC**	A	C	T	C	3			2
TC1	TC1-225-A(S)	⇒	**ACTC**	A	C	T	C	1			3
TC1	TC1-225-C(S)	⇒	**ACTC**	A	C	T	C	2			3
TC1	HTC1-110-A(S)	⇒	**ACTC**	A	C	T	C	1		H	1
TC1	HTC1-110-C(S)	⇒	**ACTC**	A	C	T	C	2		H	1
TC1	HTC1-110-U(S)	⇒	**ACTC**	A	C	T	C	3		H	1
TC1	HTC1-160-A(S)	⇒	**ACTC**	A	C	T	C	1		H	2
TC1	HTC1-160-C(S)	⇒	**ACTC**	A	C	T	C	2		H	2
TC1	HTC1-160-U(S)	⇒	**ACTC**	A	C	T	C	3		H	2
TC1	HTC1-225-A(S)	⇒	**ACTC**	A	C	T	C	1		H	3
TC1	HTC1-225-C(S)	⇒	**ACTC**	A	C	T	C	2		H	3
TC1	RTC1-110-A(S)	⇒	**ACTC**	A	C	T	C	1		R	1
TC1	RTC1-110-CT(S)	⇒	**ACTC**	A	C	T	C	2		R	1
TC1	RTC1-110-UT(S)	⇒	**ACTC**	A	C	T	C	3		R	1
TC1	RTC1-160-AT(S)	⇒	**ACTC**	A	C	T	C	1		R	2
TC1	RTC1-160-CT(S)	⇒	**ACTC**	A	C	T	C	2		R	2
TC1	RTC1-160-UT(S)	⇒	**ACTC**	A	C	T	C	3		R	2
TC1	RTC1-225-AT(S)	⇒	**ACTC**	A	C	T	C	1		R	3
TC1	RTC1-225-CT(S)	⇒	**ACTC**	A	C	T	C	2		R	3
TC1	TC1L-75-UH(S)	⇒	**ACTC**	A	C	T	C	6			6
TC1	HTC1L-75-UH(S)	⇒	**ACTC**	A	C	T	C	6		H	6
TC1	RTC1L-75-UH(S)	⇒	**ACTC**	A	C	T	C	6		R	6
TE Single			**ACTE Single**								
TE1	TE1-110	⇒	**ACTE**	A	C	T	E	2		H	1
TE1	TE1-160	⇒	**ACTE**	A	C	T	E	2		H	2
TE1	TE1-220	⇒	**ACTE**	A	C	T	E	2		H	3
TE1	RTE1-110T	⇒	**ACTE**	A	C	T	E	2		R	1
TE1	RTE1-160T	⇒	**ACTE**	A	C	T	E	2		R	2
TE1	RTE1-220T	⇒	**ACTE**	A	C	T	E	2		R	3
TE Twin			**ACTE Twin**								
TE2	TE2-110	⇒	**ACTE**	A	C	T	E	3		H	1
TE2	TE2-160	⇒	**ACTE**	A	C	T	E	3		H	2
TE2	TE2-220	⇒	**ACTE**	A	C	T	E	3		H	3
TE2	RTE2-110T	⇒	**ACTE**	A	C	T	E	3		R	1
TE2	RTE2-160T	⇒	**ACTE**	A	C	T	E	3		R	2
TE2	RTE2-220T	⇒	**ACTE**	A	C	T	E	3		R	3

Automotive Relays: Taiko Device ⇒ Panasonic

Taiko Device type	Taiko Device part no.		Panasonic type	Panasonic part no.							
				A	C	T					
TG Single			**ACTG Single**								
TG1	HTG1-225ML	⇒	**ACTG**	A	C	T	G	1		H	3
TG1	HTG1-225L	⇒	**ACTG**	A	C	T	G	2		H	3
TG1	HTG1-320ML	⇒	**ACTG**	A	C	T	G	1		H	4
TG1	HTG1-320L	⇒	**ACTG**	A	C	T	G	2		H	4
TG1	RTG1-225MLT	⇒	**ACTG**	A	C	T	G	1		R	3
TH Single			**ACTH Single**								
TH1	RTH1-160-S	⇒	**ACTH**	A	C	T	H	5		B	2
TH1	RTH1-220-S	⇒	**ACTH**	A	C	T	H	5		B	3
TH1	RTH1-160T-S	⇒	**ACTH**	A	C	T	H	5		R	2
TH1	RTH1-220T-S	⇒	**ACTH**	A	C	T	H	5		R	3
TH Twin			**ACTH Twin**								
TH2	RTH2-160-S	⇒	**ACTH**	A	C	T	H	6		B	2
TH2	RTH2-220-S	⇒	**ACTH**	A	C	T	H	6		B	3
TH2	RTH2-160T-S	⇒	**ACTH**	A	C	T	H	6		R	2
TH2	RTH2-220T-S	⇒	**ACTH**	A	C	T	H	6		R	3
TJ Single			**ACTJ Single**								
TJ1	HTJ1-320	⇒	**ACTJ**	A	C	T	J	2		H	4

Global Network

North America | Europe | Asia Pacific | China | Japan

Panasonic Electric Works

Please contact our Global Sales Companies in:

Europe

Headquarters	Panasonic Electric Works Europe AG	Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. +49 (0) 8024 648-0, Fax +49 (0) 8024 648-111, www.panasonic-electric-works.com
Austria	Panasonic Electric Works Austria GmbH	Josef Madersperger Str. 2, 2362 Biedermannsdorf, Tel. +43 (0) 2236-26846, Fax +43 (0) 2236-46133 www.panasonic-electric-works.at
	Panasonic Industrial Devices Materials Europe GmbH	Ennshafenstraße 30, 4470 Enns, Tel. +43 (0) 7223 883, Fax +43 (0) 7223 88333, www.panasonic-electronic-materials.com
Benelux	Panasonic Electric Works Sales Western Europe B.V.	De Rijn 4, (Postbus 211), 5684 PJ Best, (5680 AE Best), Netherlands, Tel. +31 (0) 499 372727, Fax +31 (0) 499 372185, www.panasonic-electric-works.nl
Czech Republic	Panasonic Electric Works Europe AG	Organizační složka, Administrative centre PLATINIUM, Veveri 111, 616 00 Brno, Tel. +420 541 217 001, Fax +420 541 217 101, www.panasonic-electric-works.cz
France	Panasonic Electric Works Sales Western Europe B.V.	Succursale française, 10, rue des petits ruisseaux, 91370 Verrières Le Buisson, Tél. +33 (0) 1 6013 5757, Fax +33 (0) 1 6013 5758, www.panasonic-electric-works.fr
Germany	Panasonic Electric Works Europe AG	Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. +49 (0) 8024 648-0, Fax +49 (0) 8024 648-111, www.panasonic-electric-works.de
Hungary	Panasonic Electric Works Europe AG	Magyarországi Közvetlen Kereskedelmi Képviselet, 1117 Budapest, Neumann János u. 1., Tel. +36 1 999 89 26 www.panasonic-electric-works.hu
Ireland	Panasonic Electric Works UK Ltd.	Irish Branch Office, Dublin, Tel. +353 (0) 14600969, Fax +353 (0) 14601131, www.panasonic-electric-works.co.uk
Italy	Panasonic Electric Works Italia srl	Via del Commercio 3-5 (Z.I. Ferlina), 37012 Bussolengo (VR), Tel. +39 0456752711, Fax +39 0456700444, www.panasonic-electric-works.it
Nordic Countries	Panasonic Electric Works Europe AG	Filial Nordic, Knarrarnäsgatan 15, 164 40 Kista, Sweden, Tel. +46 859476680, Fax +46 859476690, www.panasonic-electric-works.se
	Panasonic Eco Solutions Nordic AB	Jungmansgatan 12, 21119 Malmö, Tel. +46 40 697 7000, Fax +46 40 697 7099, www.panasonic-fire-security.com
Poland	Panasonic Electric Works Polska sp. z o.o	ul. Wołoska 9A, 02-583 Warszawa, Tel. +48 22 338-11-33, Fax +48 22 338-12-00, www.panasonic-electric-works.pl
Portugal	Panasonic Electric Works España S.A.	Portuguese Branch Office, Avda Adelino Amaro da Costa 728 R/C J, 2750-277 Cascais, Tel. +351 214812520, Fax +351 214812529
Spain	Panasonic Electric Works España S.A.	Barajas Park, San Severo 20, 28042 Madrid, Tel. +34 913293875, Fax +34 913292976, www.panasonic-electric-works.es
Switzerland	Panasonic Electric Works Schweiz AG	Grundstrasse 8, 6343 Rotkreuz, Tel. +41 (0) 41 7997050, Fax +41 (0) 41 7997055, www.panasonic-electric-works.ch
United Kingdom	Panasonic Electric Works UK Ltd.	Sunrise Parkway, Linford Wood, Milton Keynes, MK14 6LF, Tel. +44 (0) 1908 231555, Fax +44 (0) 1908 231599, www.panasonic-electric-works.co.uk

North & South America

USA	Panasonic Industrial Devices Sales Company of America	629 Central Avenue, New Providence, N.J. 07974, Tel. 1-908-464-3550, Fax 1-908-464-8513, www.pewa.panasonic.com

Asia Pacific/China/Japan

China	Panasonic Electric Works Sales (China) Co. Ltd.	Level 2, Tower W3, The Towers Oriental Plaza, No. 2, East Chang An Ave., Dong Cheng District, Beijing 100738, Tel. +86-10-5925-5988, Fax +86-10-5925-5973
Hong Kong	Panasonic Industrial Devices Automation Controls Sales (Hong Kong) Co., Ltd.	RM1205-9, 12/F, Tower 2, The Gateway, 25 Canton Road, Tsimshatsui, Kowloon, Hong Kong, Tel. +852-2956-3118, Fax +852-2956-0398
Japan	Panasonic Corporation	1048 Kadoma, Kadoma-shi, Osaka 571-8686, Japan, Tel. +81-6-6908-1050, Fax +81-6-6908-5781, www.panasonic.net
Singapore	Panasonic Industrial Devices Automation Controls Sales Asia Pacific	300 Beach Road, #16-01 The Concourse, Singapore 199555, Tel. +65-6390-3811, Fax +65-6390-3810

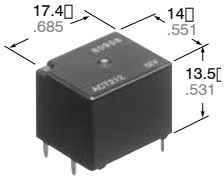
Panasonic®

1172 euen 02/13

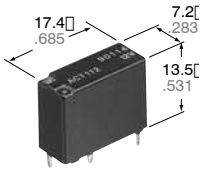
Panasonic
ideas for life

SUPER MINIATURE TWIN TYPE AUTOMOTIVE RELAY

CT RELAYS (ACT)



Twin type (8 terminals)



mm inch

Slim 1c type

FEATURES

• Small & slim size

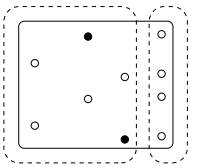
Twin type: 17.4(L)×14.0(W)×13.5(H)mm
.685(L)×.551(W)×.531(H)inch
Slim 1c type: 17.4(L)×7.2(W)×13.5(H)mm
.685(L)×.283(W)×.531(H)inch

• Twin (1 Form C × 2)

Forward/reverse motor control is possible with a single relay.

• Simple footprint enables ease of PC board layout

※10 terminals layout



○ = 8 terminals

TYPICAL APPLICATIONS

- Power windows
- Auto door lock
- Power sunroof
- Electrically powered mirrors
- Powered seats
- Lift gates
- Slide door closers, etc.
  (for DC motor forward/reverse control circuits)

SPECIFICATIONS

Contact

Arrangement			1 Form C×2, 1 Form C
Contact material			$AgSnO_2$ type
Initial contact resistance (By voltage drop 6 V DC 1 A)			Max. 100mΩ
Initial contact voltage drop			Max. 0.2 V (at 10 A)
Rating	Nominal switching capacity		N.O.: 20 A 14 V DC N.C.: 10 A 14 V DC
	Max. carrying current		35 A for 2 minutes, 25 A for 1 hour (14 V, at 20°C 68°F) 30 A for 2 minutes, 20 A for 1 hour (14 V, at 85°C 185°F)
	Min. switching capacity#1		1 A 12 V DC
Expected life (min. operation)	Mechanical (at 120 cpm)		Min. 10^7
	Electrical	Resistive load	Min. 10^5*1
		Motor load	Min. $2×10^5$*2 (free)
			Min. 10^5*3 (lock)

Coil

Nominal operating power	800 mW

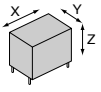
#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at nominal switching capacity)		6 cpm
Initial insulation resistance*4		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*5	Between open contacts	500 Vrms for 1 min.
	Between contacts and coil	500 Vrms for 1 min.
Operate time*6 (at nominal voltage) (at 20°C 68° F)		Max. 10ms (Initial)
Release time*6 (at nominal voltage) (at 20°C 68° F)		Max. 10ms (Initial)
Shock resistance	Functional*7	Min. 100 m/s² {10G}
	Destructive*8	Min. 1,000 m/s² {100G}
Vibration resistance	Functional*9	10 Hz to 100 Hz, Min. 44.1m/s² {4.5G}
	Destructive*10	10 Hz to 500 Hz, Min. 44.1m/s² {4.5G}
Conditions for operation, transport and storage*11 (Not freezing and condensing at low temperature)	Ambient temp	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 8.0g .28oz (Twin type) Approx. 4.0g .14oz (Slim 1c type)

Remarks

*1 At nominal switching capacity, operating frequency: 1s ON, 9s OFF
*2 N.O.: at 5 A (steady), 25 A (inrush)/N.C.: at 20 A (brake) 14 V DC, operating frequency: 0.5s ON, 9.5s OFF
*3 At 25A 14 V DC (Motor lock), operating frequency: 0.5s ON, 9.5s OFF
*4 Measurement at same location as "Initial breakdown voltage" section
*5 Detection current: 10mA
*6 Excluding contact bounce time
*7 Half-wave pulse of sine wave: 11ms; detection: 10μs
*8 Half-wave pulse of sine wave: 6ms
*9 Detection time: 10μs
*10 Time of vibration for each direction;



X, Y, direction: 2 hours
Z direction: 4 hours

*11 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (p. 19, Relay Technical Information).

ORDERING INFORMATION

Ex. A CT 1 12

Product name	Contact arrangement	Coil voltage (V DC)
CT	1: 1 Form C 2: 1 Form C × 2 (8 terminals type) 5: 1 Form C × 2 (10 terminals type)	12: 12

Standard packing; 1 Form C: Carton(tube package) 30pcs. Case 1,500pcs.
1 Form C × 2: Carton(tube package) 30pcs. Case 900pcs.

TYPES AND COIL DATA (at 20°C 68°F)

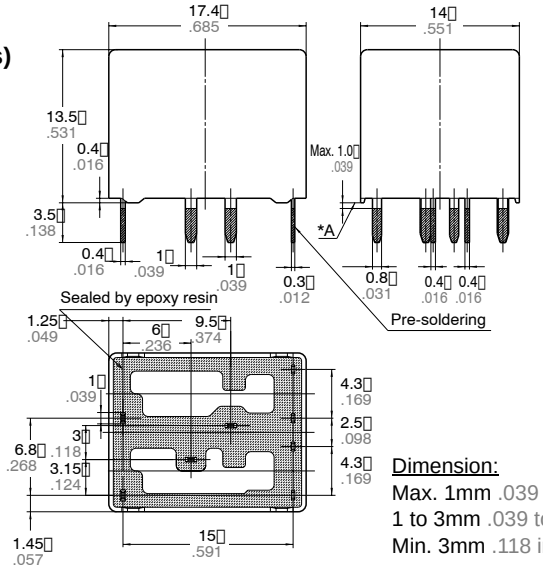
Contact arrangement	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance, Ω	Nominal operating current, mA	Nominal operating power, mW	Usable voltage range, V DC
1c	ACT112	12	Max. 7.2	Min. 1.0	180±10%	66.7±10%	800	10 to 16
1c × 2 (8 terminals type)	ACT212	12	Max. 7.2	Min. 1.0	180±10%	66.7±10%	800	10 to 16
1c × 2 (10 terminals type)	ACT512	12	Max. 7.2	Min. 1.0	180±10%	66.7±10%	800	10 to 16

* Other pick-up voltage types are also available. Please contact us for details.

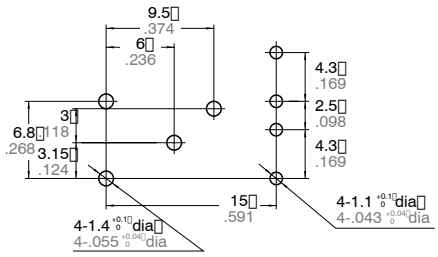
DIMENSIONS

mm inch

1. Twin type (8 terminals)

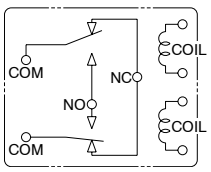


PC board pattern (Bottom view)



Tolerance: ±0.1±.004

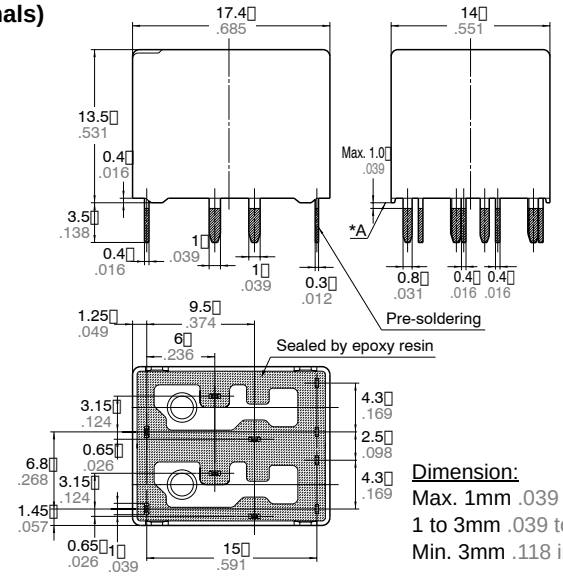
Schematic (Bottom view)



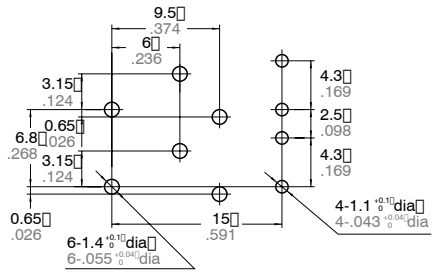
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

2. Twin type (10 terminals)

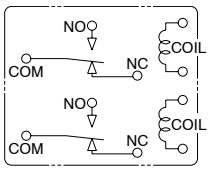


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

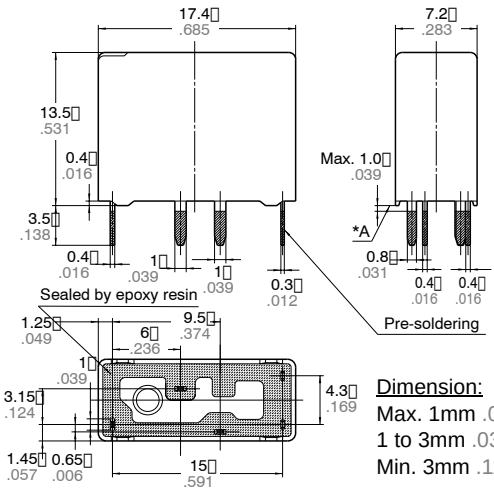


Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

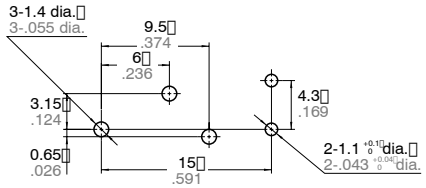
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

3. Slim 1c type

mm inch



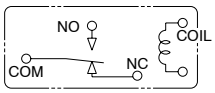
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

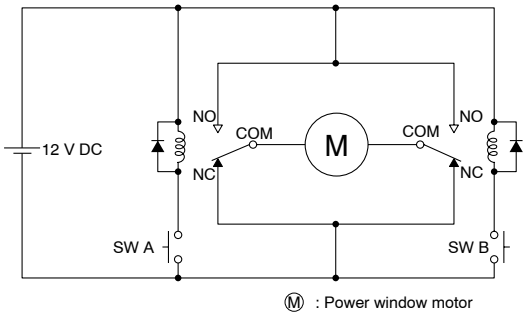
Schematic (Bottom view)



* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

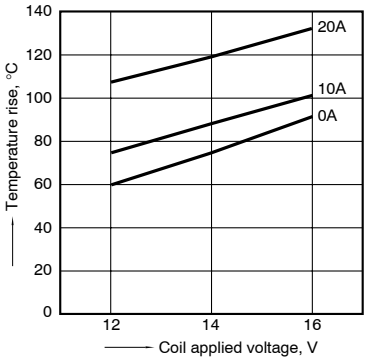
Forward/reverse control circuits of DC motor for power windows



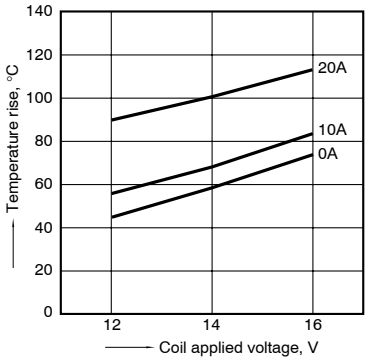
Ⓜ : Power window motor

REFERENCE DATA

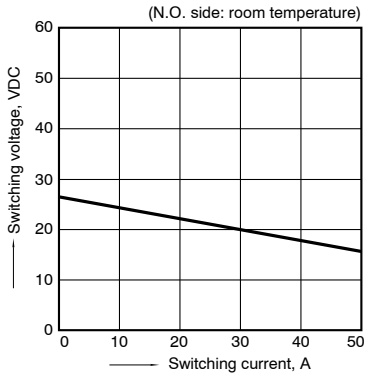
1-(1). Coil temperature rise (at room temperature)
Sample: ACT212, 3pcs.
Contact carrying current: 0A, 10A, 20A



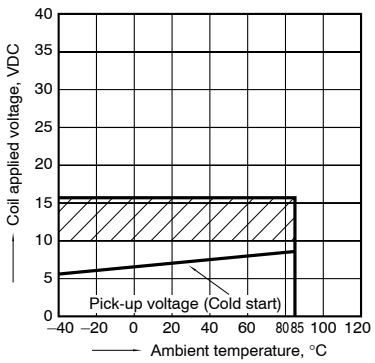
1-(2). Coil temperature rise (at 85°C 185°F)
Sample: ACT212, 3pcs.
Contact carrying current: 0A, 10A, 20A



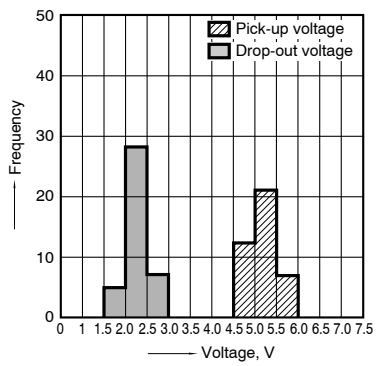
2. Max. switching capability (Resistive load)



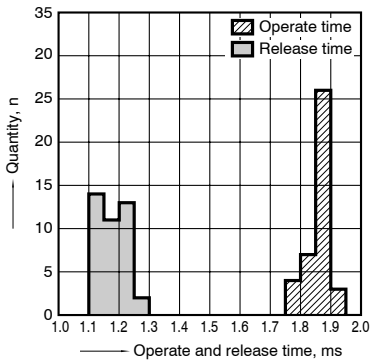
3. Ambient temperature and operating voltage range



4. Distribution of pick-up and drop-out voltage
Sample: ACT212, 40pcs.



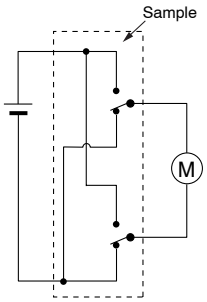
5. Distribution of operate and release time
Sample: ACT212, 40pcs.
* Without diode



6-(1). Electrical life test (Motor free)

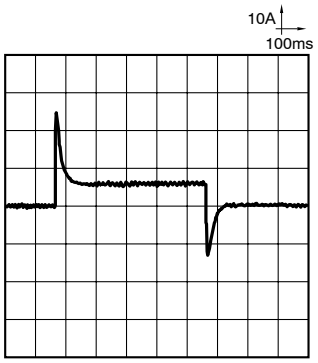
Sample: ACT212, 3pcs.
Load: 5A steady, Inrush 25A, 14V DC
Brake current: 13A 14V DC,
Power window motor actual load (free condition)
Operating frequency: (ON : OFF = 0.5s : 9.5s)
Ambient temperature: Room temperature

Circuit:

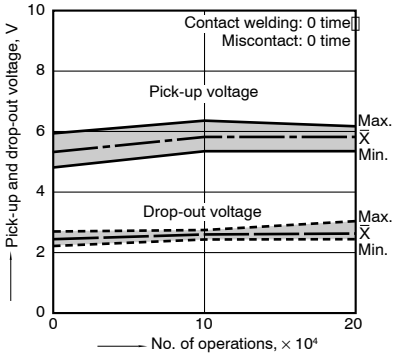


Load current waveform

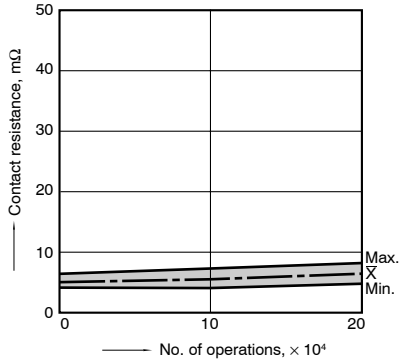
Inrush current: 25A, Steady current: 6A
Brake current: 13A



Change of pick-up and drop-out voltage



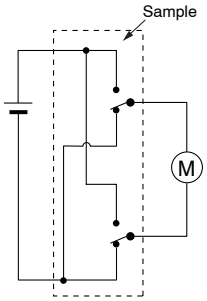
Change of contact resistance



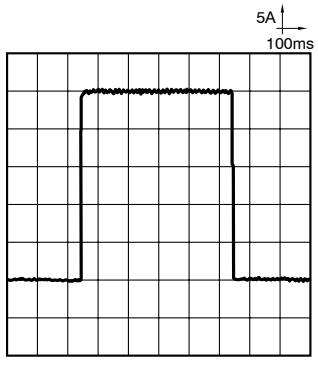
6-(2). Electrical life test (Motor lock)

Sample: ACT212, 3pcs.
Load: 25A 14V DC
Switching frequency: (ON : OFF = 0.5s : 9.5s)
Ambient temperature: Room temperature

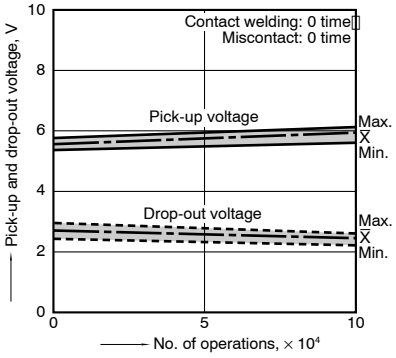
Circuit:



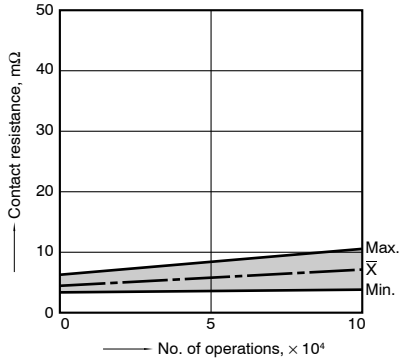
Load current waveform



Change of pick-up and drop-out voltage



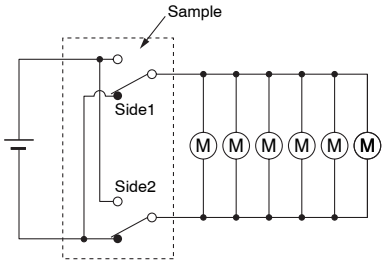
Change of contact resistance

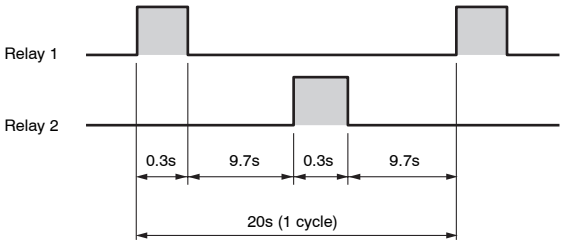


6-(3). Electrical life test (Motor lock)

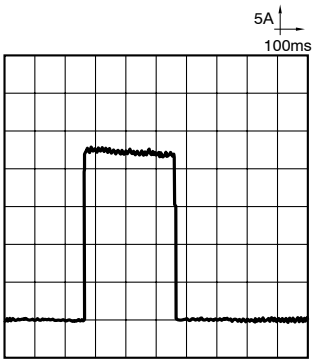
Sample: ACT212, 3pcs.
Load: 20A 14V DC,
door lock motor actual load (Lock condition)
Switching frequency: (ON : OFF = 0.3s : 19.7s)
Ambient temperature: Room temperature

Circuit:

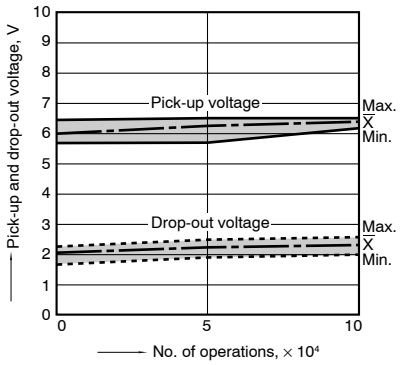




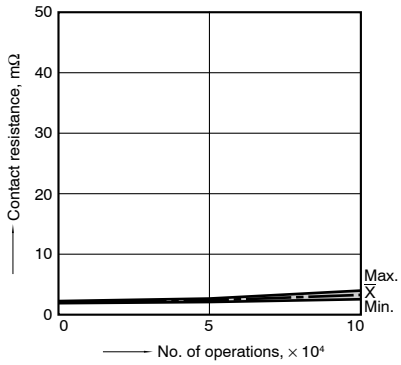
Load current waveform



Change of pick-up and drop-out voltage



Change of contact resistance



For Cautions for Use, see Relay Technical Information.

Panasonic
ideas for life

SUPER MINIATURE TWIN TYPE AUTOMOTIVE RELAY

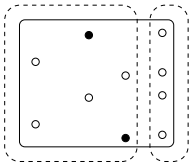
CT RELAYS (ACT)

RoHS compliant

FEATURES

• Small & slim size
Twin type: 17.4(L)×14.0(W)×13.5(H)mm
.685(L)×.551(W)×.531(H)inch
Slim 1c type: 17.4(L)×7.2(W)×13.5(H)mm
.685(L)×.283(W)×.531(H)inch
• Twin (1 Form C × 2)
Forward/reverse motor control is possible with a single relay.
• Simple footprint enables ease of PC board layout

※10 terminals layout



○ = 8 terminals

TYPICAL APPLICATIONS

• Power windows
• Auto door lock
• Power sunroof
• Electrically powered mirrors
• Powered seats
• Lift gates
• Slide door closers, etc. (for DC motor forward/reverse control circuits)

TYPES

Contact arrangement	Coil voltage	Part No.
1 Form C	12 V DC	ACT112
1 Form C × 2 (8 terminals type)		ACT212
1 Form C × 2 (10 terminals type)		ACT512

Standard packing; 1 Form C: Carton (tube) 30pcs. Case 1,500pcs.
1 Form C × 2: Carton (tube) 30pcs. Case 900pcs.

RATING

1. Coil data

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 7.2 V DC (Initial)	Min. 1.0 V DC (Initial)	66.7 mA	180Ω	800 mW	10 to 16V DC

Note: Other pick-up voltage types are also available. Please contact us for details.

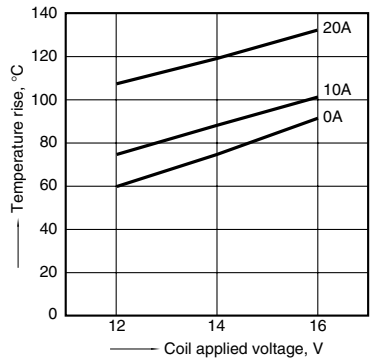
2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		1 Form C × 2, 1 Form C
	Contact resistance (Initial)		N.O.: Typ 7mΩ, N.C.: Typ 10mΩ (By voltage drop 6V DC 1A)
	Contact material		Ag alloy (Cadmium free)
Rating	Nominal switching capacity (resistive load)		N.O.: 20 A 14V DC, N.C.: 10 A 14V DC
	Max. carrying current (14V DC)*3		N.O.: 35 A for 2 minutes, 25 A for 1 hour at 20°C 68°F 30 A for 2 minutes, 20 A for 1 hour at 85°C 185°F
	Nominal operating power		800 mW
	Min. switching capacity (resistive load)*1		1 A 12V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100 MΩ (at 500V DC)
	Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
		Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
	Operate time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
	Release time (at nominal voltage)		Max. 10ms (at 20°C 68°F, excluding contact bounce time) (Initial)
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² {10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s² {100G} (Half-wave pulse of sine wave: 6ms)
	Vibration resistance	Functional	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G} (Detection time: 10μs)
		Destructive	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical		Min. 10^7 (at 120 cpm)
	Electrical		<Resistive load> Min. 10^5 (at nominal switching capacity, operating frequency: 1s ON, 9s OFF) <Motor load> N.O. side: Min. 2×10^5 (at Inrush 25A, Steady 5A 14 V DC), Min. 10^5 (at 25A 14 V DC motor lock condition) N.C. side: Min. 2×10^5 (at brake current 20A 14 V DC) (operating frequency: 0.5s ON, 9.5s OFF)
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +85°C –40°F to +185°F, Humidity: 5% R.H. to 85% R.H. (Not freezing and condensing at low temperature)
	Max. operating speed		6 cpm (at nominal switching capacity)
Mass			Twin type: approx. 8 g .28 oz, 1 Form C type: approx. 4 g .14 oz

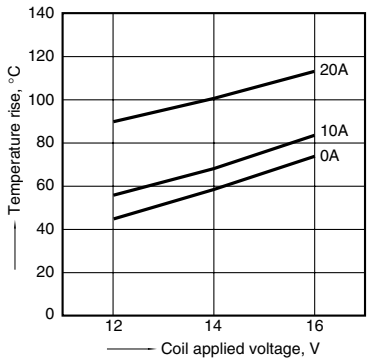
Notes: *1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Please refer to "Usage ambient condition" in CAUTIONS FOR USE OF AUTOMOTIVE RELAYS.
Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).
*3. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
* If the relay is used continuously for long periods of time with coils on both sides in an energized condition, breakdown might occur due to abnormal heating depending on the carrying condition. Therefore, please inquire when using with a circuit that causes an energized condition on both sides simultaneously.

REFERENCE DATA

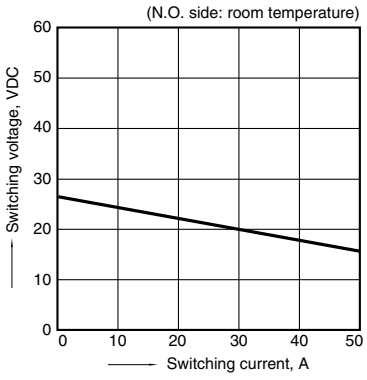
1-(1). Coil temperature rise (at room temperature)
Sample: ACT212, 3pcs.
Contact carrying current: 0A, 10A, 20A
Ambient temperature: Room temperature



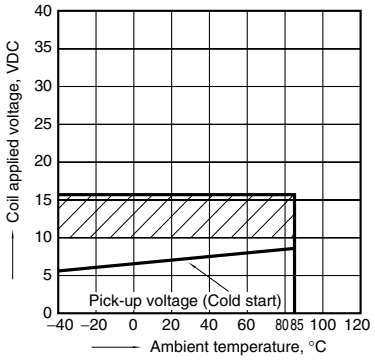
1-(2). Coil temperature rise (at 85°C 185°F)
Sample: ACT212, 3pcs.
Contact carrying current: 0A, 10A, 20A
Ambient temperature: 85°C 185°F



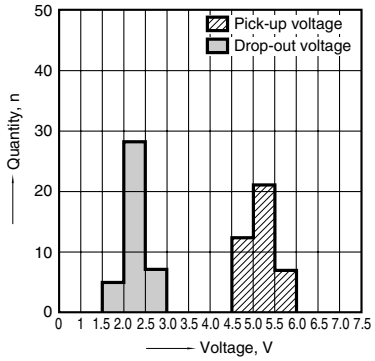
2. Max. switching capability (Resistive load, initial)



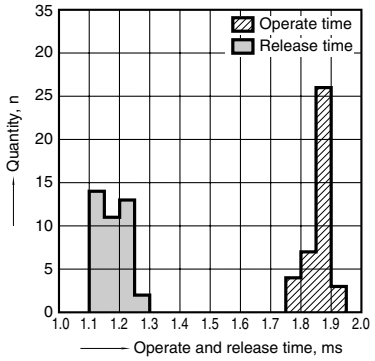
3. Ambient temperature and operating voltage range



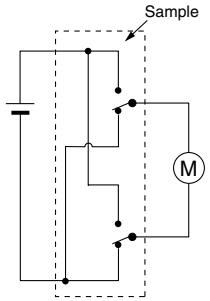
4. Distribution of pick-up and drop-out voltage
Sample: ACT212, 40pcs.



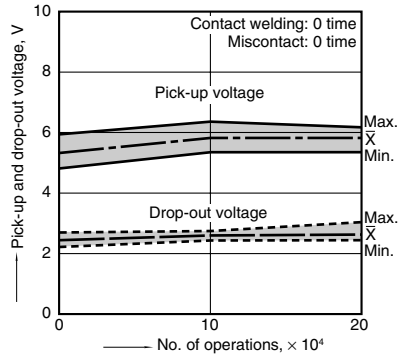
5. Distribution of operate and release time
Sample: ACT212, 40pcs.
* Without diode



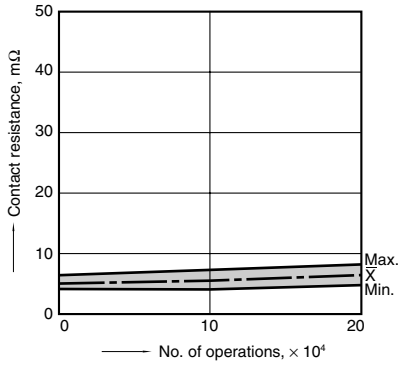
6-(1). Electrical life test (Motor free)
Sample: ACT212, 3pcs.
Load: Inrush 25A, steady 5A
Brake current: 13A 14V DC,
Power window motor actual load (free condition)
Operating frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature
Circuit:



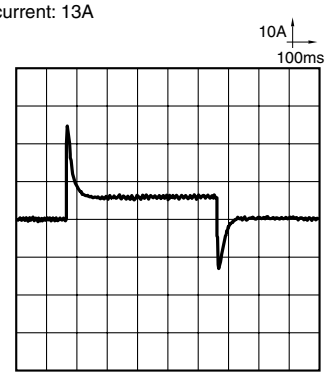
Change of pick-up and drop-out voltage



Change of contact resistance

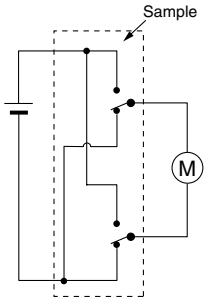


Load current waveform
Inrush current: 25A, Steady current: 6A
Brake current: 13A

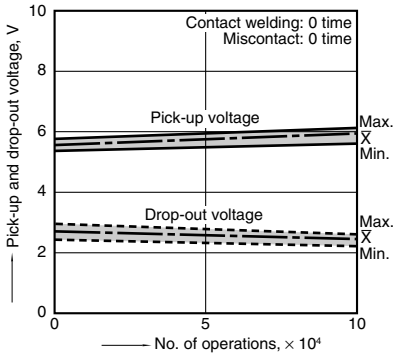


6-(2). Electrical life test (Motor lock)

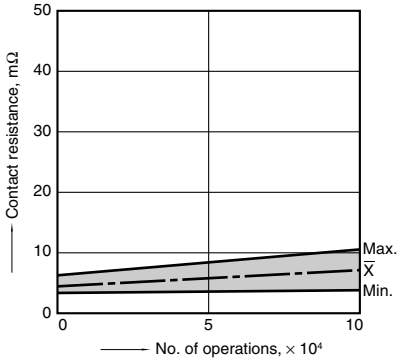
Sample: ACT212, 3pcs.
Load: 25A 14V DC
Power window motor actual load (lock condition)
Switching frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature
Circuit:



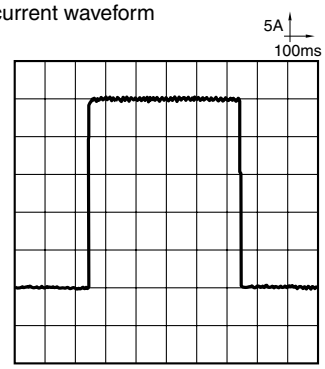
Change of pick-up and drop-out voltage



Change of contact resistance

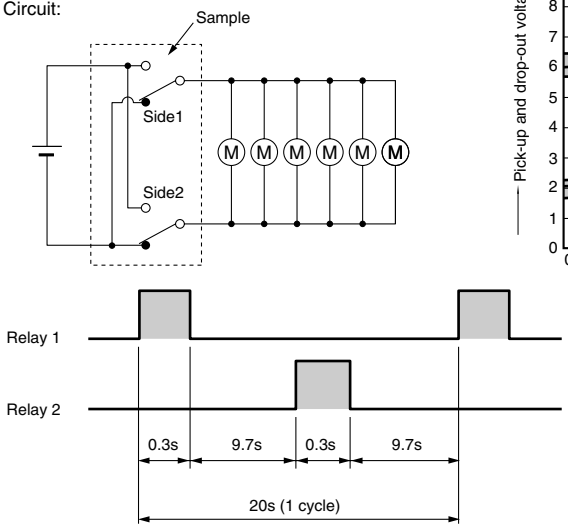


Load current waveform

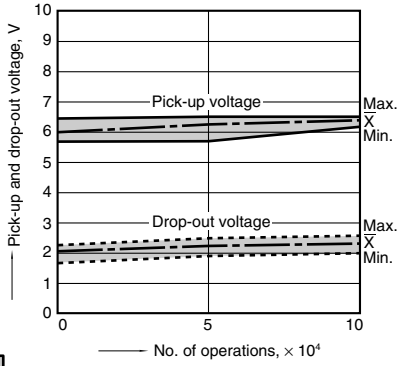


6-(3). Electrical life test (Motor lock)

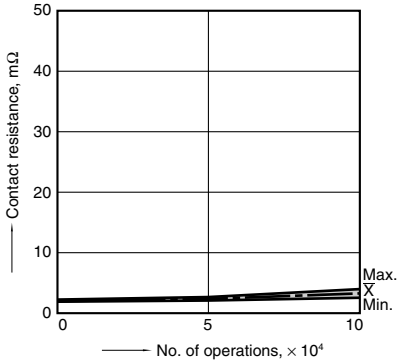
Sample: ACT212, 3pcs.
Load: 20A 14V DC,
door lock motor actual load (Lock condition)
Switching frequency: ON 0.3s, OFF 19.7s
Ambient temperature: Room temperature
Circuit:



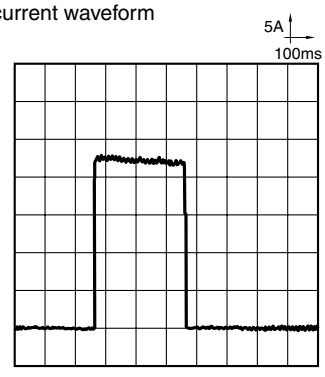
Change of pick-up and drop-out voltage



Change of contact resistance



Load current waveform



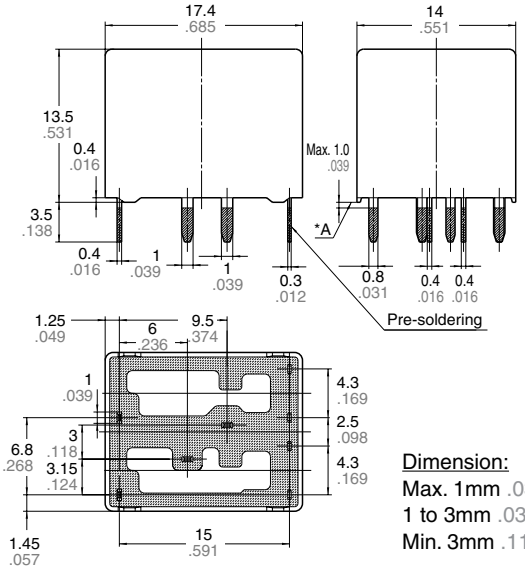
DIMENSIONS (mm inch)

The CAD data of the products with a **CAD Data** mark can be downloaded from: http://industrial.panasonic.com/ac/e

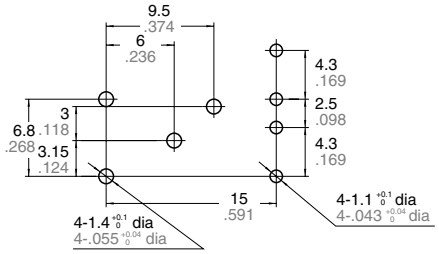
1. Twin type (8 terminals)

CAD Data

External dimensions

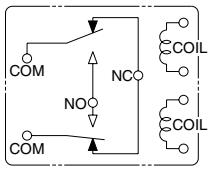


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



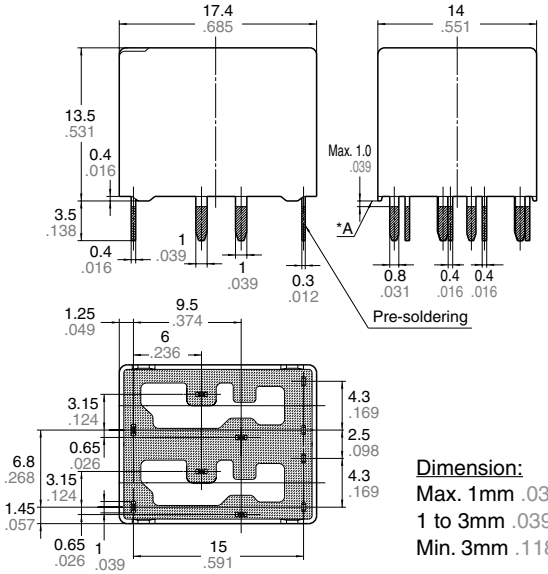
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

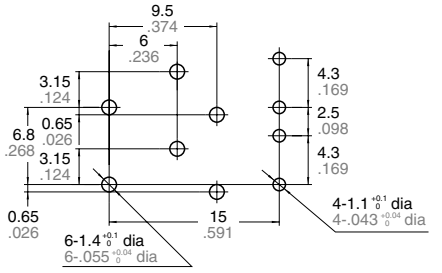
2. Twin type (10 terminals)

CAD Data

External dimensions

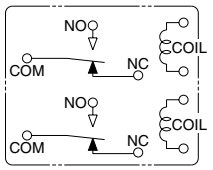


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



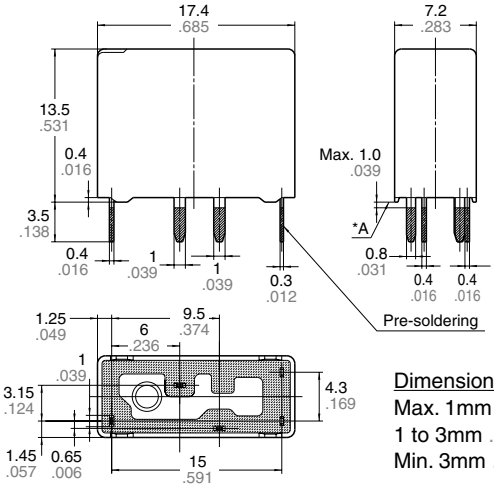
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

3. Slim 1c type

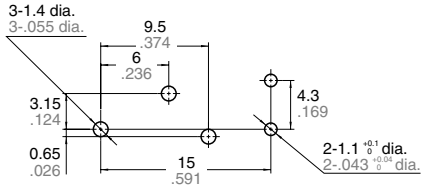
CAD Data

External dimensions



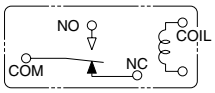
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1±.004

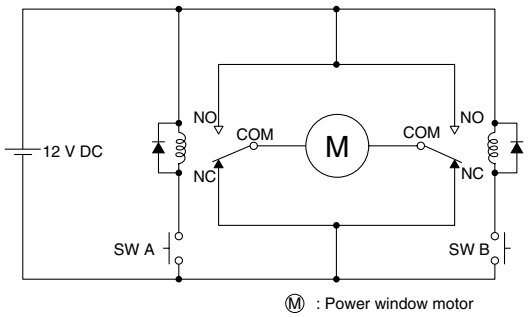
Schematic (Bottom view)



* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

Forward/reverse control circuits of DC motor for power windows



Ⓜ : Power window motor

For Cautions for Use, see Relay Technical Information.

Taiko Device ⇒ Panasonic Part Numbers

Taiko Device type	Taiko Device part no.		Panasonic type	Panasonic part no.							
				A	C	T					
TB Single			**ACTB Single**								
TB1	TB1-100M	⇒	**ACTB**	A	C	T	B	1			1
TB1	TB1-160M	⇒	**ACTB**	A	C	T	B	1			2
TB1	TB1-225M	⇒	**ACTB**	A	C	T	B	1			3
TB1	HTB1-100M	⇒	**ACTB**	A	C	T	B	1		H	1
TB1	HTB1-160M	⇒	**ACTB**	A	C	T	B	1		H	2
TB1	HTB1-225M	⇒	**ACTB**	A	C	T	B	1		H	3
TB1	RTB1-100MT	⇒	**ACTB**	A	C	T	B	1		R	1
TB1	RTB1-160MT	⇒	**ACTB**	A	C	T	B	1		R	2
TB1	RTB1-225MT	⇒	**ACTB**	A	C	T	B	1		R	3
TB1	TB1-100ML	⇒	**ACTB**	A	C	T	B	1	L		1
TB1	TB1-160ML	⇒	**ACTB**	A	C	T	B	1	L		2
TB1	TB1-225ML	⇒	**ACTB**	A	C	T	B	1	L		3
TB1	HTB1-100ML	⇒	**ACTB**	A	C	T	B	1	L	H	1
TB1	HTB1-160ML	⇒	**ACTB**	A	C	T	B	1	L	H	2
TB1	HTB1-225ML	⇒	**ACTB**	A	C	T	B	1	L	H	3
TB1	RTB1-100MLT	⇒	**ACTB**	A	C	T	B	1	L	R	1
TB1	RTB1-160MLT	⇒	**ACTB**	A	C	T	B	1	L	R	2
TB1	RTB1-225MLT	⇒	**ACTB**	A	C	T	B	1	L	R	3
TB1	HTB1-100	⇒	**ACTB**	A	C	T	B	2		H	1
TB1	HTB1-225	⇒	**ACTB**	A	C	T	B	2		H	3
TB1	RTB1-100T	⇒	**ACTB**	A	C	T	B	2		R	1
TB1	RTB1-225T	⇒	**ACTB**	A	C	T	B	2		R	3
TB1	TB1-100L	⇒	**ACTB**	A	C	T	B	2	L		1
TB1	TB1-160L	⇒	**ACTB**	A	C	T	B	2	L		2
TB1	TB1-225L	⇒	**ACTB**	A	C	T	B	2	L		3
TB1	HTB1-100L	⇒	**ACTB**	A	C	T	B	2	L	H	1
TB1	HTB1-160L	⇒	**ACTB**	A	C	T	B	2	L	H	2
TB1	HTB1-225L	⇒	**ACTB**	A	C	T	B	2	L	H	3
TB1	RTB1-100LT	⇒	**ACTB**	A	C	T	B	2	L	R	1
TB1	RTB1-160LT	⇒	**ACTB**	A	C	T	B	2	L	R	2
TB1	RTB1-255LT	⇒	**ACTB**	A	C	T	B	2	L	R	3
TB1	TB1-160	⇒	**ACTB**	A	C	T	B	2			2
TB1	TB1-225	⇒	**ACTB**	A	C	T	B	2			3
TB1	HTB1-160	⇒	**ACTB**	A	C	T	B	2		H	2
TB1	HTB1-160T	⇒	**ACTB**	A	C	T	B	2		A	2
TB1	RTB1-160T	⇒	**ACTB**	A	C	T	B	2		R	2

Automotive Relays: Taiko Device ⇒ Panasonic

Taiko Device type	Taiko Device part no.		Panasonic type	Panasonic part no.							
				A	C	T					
TB Twin			**ACTB Twin**								
TB2	TB2-100	⇒	**ACTB**	A	C	T	B	3			1
TB2	TB2-160	⇒	**ACTB**	A	C	T	B	3			2
TB2	TB2160Z	⇒	**ACTB**	A	C	T	B	5			2
TB2	TB2-225	⇒	**ACTB**	A	C	T	B	3			3
TB2	HTB2-100	⇒	**ACTB**	A	C	T	B	3		H	1
TB2	HTB2-225	⇒	**ACTB**	A	C	T	B	3		H	3
TB2	RTB2-100T	⇒	**ACTB**	A	C	T	B	3		R	1
TB2	RTB2-225T	⇒	**ACTB**	A	C	T	B	3		R	3
TB2	TB2-100Z	⇒	**ACTB**	A	C	T	B	5			1
TB2	TB2-225Z	⇒	**ACTB**	A	C	T	B	5			3
TB2	HTB2-100Z	⇒	**ACTB**	A	C	T	B	5		H	1
TB2	HTB2-160Z	⇒	**ACTB**	A	C	T	B	5		H	2
TB2	HTB2-225Z	⇒	**ACTB**	A	C	T	B	5		H	3
TB2	RTB2-100ZT	⇒	**ACTB**	A	C	T	B	5		R	1
TB2	RTB2-160ZT	⇒	**ACTB**	A	C	T	B	5		R	2
TB2	RTB2-225ZT	⇒	**ACTB**	A	C	T	B	5		R	3
TB2	TB2-100LZ	⇒	**ACTB**	A	C	T	B	5	L		1
TB2	TB2-160LZ	⇒	**ACTB**	A	C	T	B	5	L		2
TB2	TB2-225LZ	⇒	**ACTB**	A	C	T	B	5	L		3
TB2	HTB2-100LZ	⇒	**ACTB**	A	C	T	B	5	L	H	1
TB2	HTB2-160LZ	⇒	**ACTB**	A	C	T	B	5	L	H	2
TB2	HTB2-225LZ	⇒	**ACTB**	A	C	T	B	5	L	H	3
TB2	RTB2-100LZT	⇒	**ACTB**	A	C	T	B	5	L	R	1
TB2	RTB2-160LZT	⇒	**ACTB**	A	C	T	B	5	L	R	2
TB2	RTB2-225LZT	⇒	**ACTB**	A	C	T	B	5	L	R	3
TB2	HTB2-160	⇒	**ACTB**	A	C	T	B	3		H	2
TB2	HTB2-160T	⇒	**ACTB**	A	C	T	B	3		A	2
TB2	HTB2-160ZT	⇒	**ACTB**	A	C	T	B	3		A	2
TB2	RTB2-160T	⇒	**ACTB**	A	C	T	B	3		R	2
TA Single			**ACTA Single**								
TA1	TA1-160	⇒	**ACTA**	A	C	T	A	2			2
TA1	TA1-225	⇒	**ACTA**	A	C	T	A	2			3
TA1	TA1-225PD	⇒	**ACTA**	A	C	T	A	2	W		3
TA Twin			**ACTA Twin**								
TA2	TA2-160	⇒	**ACTA**	A	C	T	A	4			2

Taiko Device type	Taiko Device part no.		Panasonic type	Panasonic part no.							
				A	C	T					
TC Single			**ACTC Single**								
TC1	TC1-110-A(S)	⇒	**ACTC**	A	C	T	C	1			1
TC1	TC1-110-C(S)	⇒	**ACTC**	A	C	T	C	2			1
TC1	TC1-110-U(S)	⇒	**ACTC**	A	C	T	C	3			1
TC1	TC1-160-A(S)	⇒	**ACTC**	A	C	T	C	1			2
TC1	TC1-160-C(S)	⇒	**ACTC**	A	C	T	C	2			2
TC1	TC1-160-U(S)	⇒	**ACTC**	A	C	T	C	3			2
TC1	TC1-225-A(S)	⇒	**ACTC**	A	C	T	C	1			3
TC1	TC1-225-C(S)	⇒	**ACTC**	A	C	T	C	2			3
TC1	HTC1-110-A(S)	⇒	**ACTC**	A	C	T	C	1		H	1
TC1	HTC1-110-C(S)	⇒	**ACTC**	A	C	T	C	2		H	1
TC1	HTC1-110-U(S)	⇒	**ACTC**	A	C	T	C	3		H	1
TC1	HTC1-160-A(S)	⇒	**ACTC**	A	C	T	C	1		H	2
TC1	HTC1-160-C(S)	⇒	**ACTC**	A	C	T	C	2		H	2
TC1	HTC1-160-U(S)	⇒	**ACTC**	A	C	T	C	3		H	2
TC1	HTC1-225-A(S)	⇒	**ACTC**	A	C	T	C	1		H	3
TC1	HTC1-225-C(S)	⇒	**ACTC**	A	C	T	C	2		H	3
TC1	RTC1-110-A(S)	⇒	**ACTC**	A	C	T	C	1		R	1
TC1	RTC1-110-CT(S)	⇒	**ACTC**	A	C	T	C	2		R	1
TC1	RTC1-110-UT(S)	⇒	**ACTC**	A	C	T	C	3		R	1
TC1	RTC1-160-AT(S)	⇒	**ACTC**	A	C	T	C	1		R	2
TC1	RTC1-160-CT(S)	⇒	**ACTC**	A	C	T	C	2		R	2
TC1	RTC1-160-UT(S)	⇒	**ACTC**	A	C	T	C	3		R	2
TC1	RTC1-225-AT(S)	⇒	**ACTC**	A	C	T	C	1		R	3
TC1	RTC1-225-CT(S)	⇒	**ACTC**	A	C	T	C	2		R	3
TC1	TC1L-75-UH(S)	⇒	**ACTC**	A	C	T	C	6			6
TC1	HTC1L-75-UH(S)	⇒	**ACTC**	A	C	T	C	6		H	6
TC1	RTC1L-75-UH(S)	⇒	**ACTC**	A	C	T	C	6		R	6
TE Single			**ACTE Single**								
TE1	TE1-110	⇒	**ACTE**	A	C	T	E	2		H	1
TE1	TE1-160	⇒	**ACTE**	A	C	T	E	2		H	2
TE1	TE1-220	⇒	**ACTE**	A	C	T	E	2		H	3
TE1	RTE1-110T	⇒	**ACTE**	A	C	T	E	2		R	1
TE1	RTE1-160T	⇒	**ACTE**	A	C	T	E	2		R	2
TE1	RTE1-220T	⇒	**ACTE**	A	C	T	E	2		R	3
TE Twin			**ACTE Twin**								
TE2	TE2-110	⇒	**ACTE**	A	C	T	E	3		H	1
TE2	TE2-160	⇒	**ACTE**	A	C	T	E	3		H	2
TE2	TE2-220	⇒	**ACTE**	A	C	T	E	3		H	3
TE2	RTE2-110T	⇒	**ACTE**	A	C	T	E	3		R	1
TE2	RTE2-160T	⇒	**ACTE**	A	C	T	E	3		R	2
TE2	RTE2-220T	⇒	**ACTE**	A	C	T	E	3		R	3

Automotive Relays: Taiko Device ⇒ Panasonic

Taiko Device type	Taiko Device part no.		Panasonic type	Panasonic part no.							
				A	C	T					
TG Single			**ACTG Single**								
TG1	HTG1-225ML	⇒	**ACTG**	A	C	T	G	1		H	3
TG1	HTG1-225L	⇒	**ACTG**	A	C	T	G	2		H	3
TG1	HTG1-320ML	⇒	**ACTG**	A	C	T	G	1		H	4
TG1	HTG1-320L	⇒	**ACTG**	A	C	T	G	2		H	4
TG1	RTG1-225MLT	⇒	**ACTG**	A	C	T	G	1		R	3
TH Single			**ACTH Single**								
TH1	RTH1-160-S	⇒	**ACTH**	A	C	T	H	5		B	2
TH1	RTH1-220-S	⇒	**ACTH**	A	C	T	H	5		B	3
TH1	RTH1-160T-S	⇒	**ACTH**	A	C	T	H	5		R	2
TH1	RTH1-220T-S	⇒	**ACTH**	A	C	T	H	5		R	3
TH Twin			**ACTH Twin**								
TH2	RTH2-160-S	⇒	**ACTH**	A	C	T	H	6		B	2
TH2	RTH2-220-S	⇒	**ACTH**	A	C	T	H	6		B	3
TH2	RTH2-160T-S	⇒	**ACTH**	A	C	T	H	6		R	2
TH2	RTH2-220T-S	⇒	**ACTH**	A	C	T	H	6		R	3
TJ Single			**ACTJ Single**								
TJ1	HTJ1-320	⇒	**ACTJ**	A	C	T	J	2		H	4

каталог, описание, технические, характеристики, datasheet, параметры, маркировка,габариты, фото

QR код