

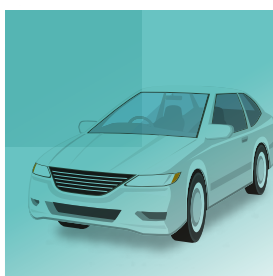
Panasonic

Automation Controls
Group Catalog

Automotive Relays

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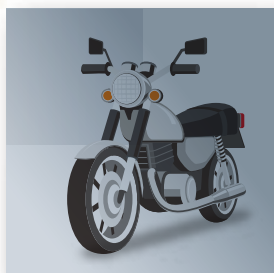
2017-2018



Passenger Car



Commercial Vehicle



Motorcycle



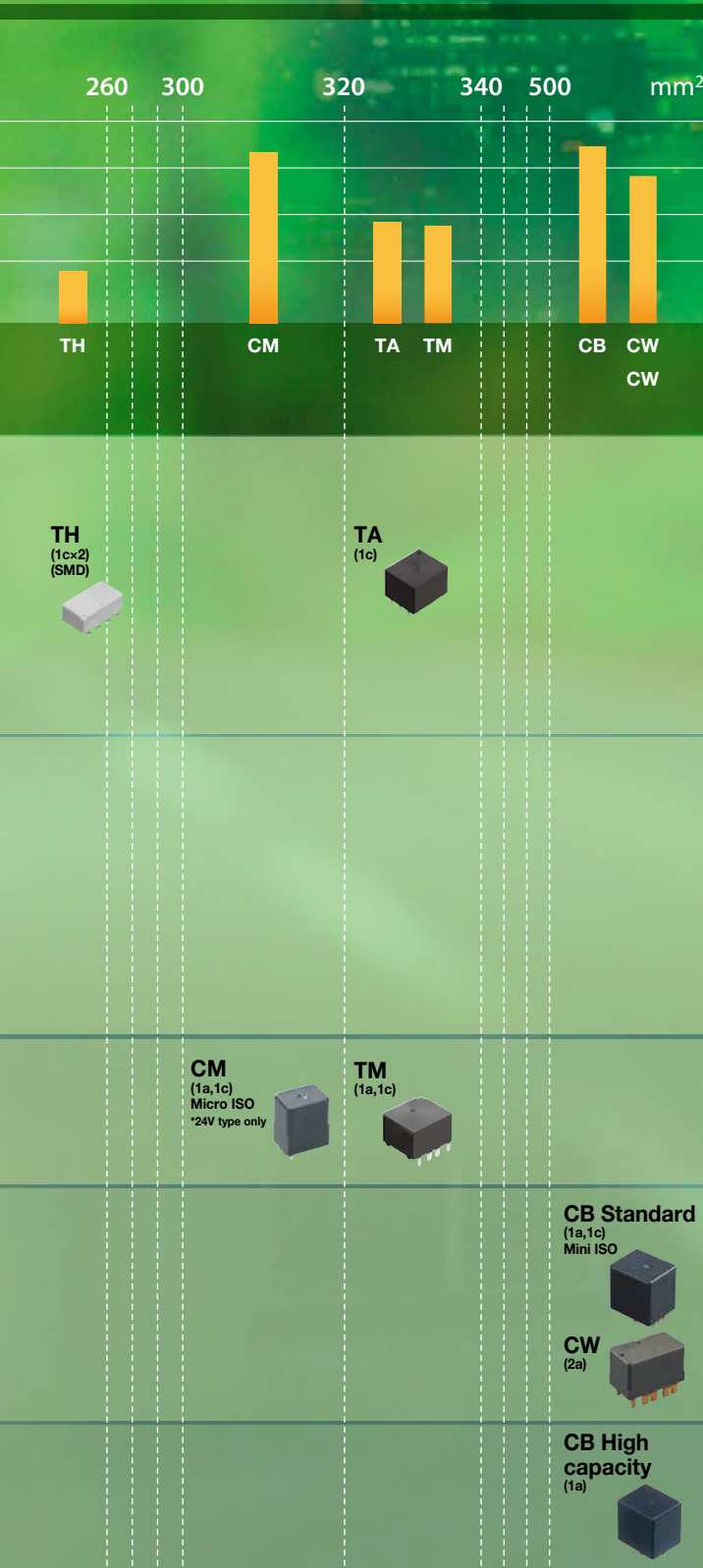
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PC-BOARD



Line up



PLUG-IN

HIGH-VOLTAGE

	10A		EV 10A
	15A		EC-N (1a) DC relay
CA (1a,1b1c) JIS terminal	20A		EV 20A
	30A		
CM (1a,1c) Micro ISO	35A	CV-N (1a) Micro ISO	
CB Standard (1a,1c) Mini ISO	40A		
	60A	EV 60A Compact high short-circuit capacity type	EV 60A Quiet type
CB High capacity (1a) Mini ISO	70A		
	80A		EV 80A
	120A		EV 120A
CN-L (1a) Latching type	150A		
	200A		EV 200A
	300A		EV 300A

Capacity

Safety

Type	Product name	Contact arrangement	Coil voltage	Head lights (incl. HID)	Tail lamps	Fog lamps (Front and rear)	Flashers
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					
	CT/CT-P	1c					
	CJ	1c					
	CP-P	1a, 1c					
	CP	1a, 1c					
	TB	1a, 1c					
	TB-P	1a					
	TC	1a, 1c, Double make contact 2a					
	TE	1c					
	TG	1a, 1c					
	TJ	1c					
	TL	Double make contact 2a					
	TM	1a, 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				

Application: 1

Power Train Control

											Page
	Wipers, Intermittent wipers	Powered mirror (incl. ones with heaters)	Washers	Defogger	Horn	Blower fan	Radiator fan motor	Engine starter motor	EPS (Electrical power steering)	Magnetic clutch	
											77/83
											47
											95
											118
											55
											59
											77/83
											47
										(with Di)	69
										(with Di)	64
										(with Di)	95
										(with Di)	104
											109
											118
											126
											136
											140
											145
											64
										(with Di)	59
											131
											73
											91
											157
											165
											170

Recommended applications
However, certain operating conditions do not allow the recommended applications

Go to Next Page ▶

Comfort

Type	Product name	Contact arrangement	Coil voltage	Powered sunroof	Powered seats	Lift gates	
Twin	CT/CT-P	1c × 2	12V				
	CJ	1c × 2					
	TB	1c × 2					
	TE	1c × 2					
Single	CN-H	1a					
	CN-M	1a, 1c					
	CT/CT-P	1c					
	CJ	1c					
	CP-P	1a, 1c					
	CP	1a, 1c					
	TB	1a, 1c					
	TB-P	1a					
	TC	1a, 1c, Double make contact 2a					
	TE	1c					
	TG	1a, 1c					
	TJ	1c					
	TL	Double make contact 2a					
	TM	1a, 1c					
SMD	CP	1c					
	CN-M	1a, 1c					
	TH	1c, 1c × 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				

Application: 2

	Powered window motor	Answerback lamp for keyless entry	Door lock	Slide door closer	Seat heater	Room lamp	Page
	●		●	●			77/83
	●		●	●			47
	●		●	●			95
	●		●	●			118
					●		55
					●		59
			●	●	●		77/83
			●	●			47
			●	●	●		69
			●	●	●		64
	●		●	●		●	95
					●	●	104
		●			●		109
	●		●	●			118
					●		126
							136
					●		140
							145
			●	●	●		64
					●		59
	●		●	●			131
							73
	●		●	●			91
							157
					●		165
					●		170



Recommended applications

However, certain operating conditions do not allow the recommended applications

Automotive Relays Selector Chart

Type		Automotive relays					
Product name		CJ RELAYS		CN-H RELAYS		CN-M RELAYS	
Appearance configuration (Standoff height included, Unit: mm inch)							
Part No.		ACJ		ACNH		ACNM	
Features		Compact Slim Twin and Single Type Automotive Relay		High Load Relay for Smart J/B		Middle Load Relay for Smart J/B	
Contact data	Contact arrangement	1 Form C, 1 Form Cx2 (8 pins), 1 Form Cx2 (10 pins)		1 Form A		1 Form A, 1 Form C	
	Contact material	Ag alloy		Ag alloy		Ag alloy	
	Rated switching capacity (resistive)	40A			30A 14V DC	30A 14V DC	
		35A					
		30A					
25A							
20A	20A 14V DC				15A 14V DC		
15A		10A 14V DC					
10A							
Min. switching load (resistive)		N.O.	N.C.	N.O.	N.O.	N.C.	
		1A 14V DC		1A 14V DC		1A 14V DC	
Latching type		—		—		—	
Coil data	Rated coil voltage	12V DC		12V DC		12V DC	
	Rated operating power	640mW	800mW	450mW	640mW	640mW	
	Operate (Set) voltage at 20°C 68°F (initial)	Max. 7.2V DC	Max. 6.5V DC	Max. 6.5V DC	Max. 5.5V DC	Max. 7.2V DC	
	Release (Reset) voltage at 20°C 68°F (initial)	Min. 1.0V DC	Min. 0.8V DC	Min. 1.0V DC	Min. 0.8V DC	Min. 1.0V DC	
Operate (Set) time (Rated voltage at 20°C 68°F)		Max. 10ms (without bounce time)		Max. 10ms (without bounce time)		Max. 10ms (without bounce time)	
Release (Reset) time (Rated voltage at 20°C 68°F)		Max. 10ms (without bounce time) (without diode)		Max. 10ms (without bounce time) (without diode)		Max. 10ms (without bounce time) (without diode)	
Expected life	Mechanical	Min. 10 ⁷		Min. 10 ⁷		Min. 10 ⁷	
	Electrical	Min. 2 × 10 ⁶ (at 14 V DC, inrush: 25 A, steady: 5 A) Min. 10 ⁶ (at 14 V DC, 25 A Motor lock)		Min. 3 × 10 ⁶ (at 14 V DC, inrush: 84 A, steady: 18 A) Min. 2 × 10 ⁶ (at 14 V DC, 84 A, steady: 12 A Lamp)		Min. 2 × 10 ⁶ (at 14 V DC, inrush: 80 A, steady: 16 A) Min. 10 ⁶ (at 14 V DC, 84 A steady: 12 A Lamp)	
	Between open contacts (initial)	500 Vrms for 1 min.		500 Vrms for 1 min.		500 Vrms for 1 min.	
	Between contacts and coil (initial)	500 Vrms for 1 min.		500 Vrms for 1 min.		500 Vrms for 1 min.	
Ambient temperature		−40 to +85°C −40 to +185°F		−40 to +110°C −40 to +230°F		Standard type: −40 to +85°C −40 to +185°F High heat-resistant type: −40 to +110°C −40 to +230°F	
Protective construction	Dust cover	—		—		—	
	Flux tight	● (PIP type)		—		—	
	Sealed	●		●		●	
External dimensions	Height (mm inch) Included standoff	13.5 .531/13.8 .543 (PIP type)		18.3 .720		14.4 .567 (Surface-mount: 15.1 .594)	
	Foot print (mm inch)						
PC board pattern							
Weight (approx.)		6.5 g .23 oz (Twin type), 3.5 g .12 oz (1 Form C type)		9 g .32 oz		5.5 g .19 oz	
Remarks		10 pins and PIP types available		—		—	
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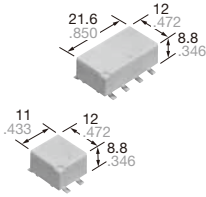
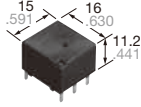
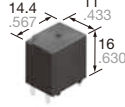
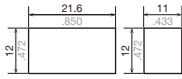
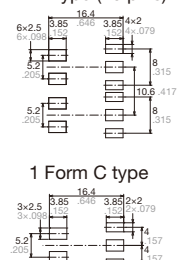
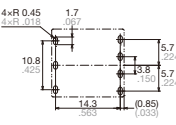
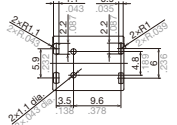
Automotive Relays Selector Chart

Type		Automotive relays		
Product name		CT RELAYS	CT RELAYS POWER TYPE	CW RELAYS
Appearance configuration (Standoff height included, Unit: mm (inch))				
Part No.		ACT	ACTP	ACW
Features		Small & Slim Twin/1 Form C type Automotive Relay	High Carrying Current Type Small & Slim Automotive Relay	Automotive Relay for Failsafe Circuits in High Output Motors (EPS)
Contact data	Contact arrangement	1 Form C, 1 Form C x 2 (8 pins) and 1 Form C x 2 (10 pins)	1 Form C, 1 Form C x 2 (8 pins) and 1 Form C x 2 (10 pins)	2 Form A
	Contact material	Ag alloy	Ag alloy	Ag alloy
	Rated switching capacity (resistive)	40A 35A 30A 25A 20A 15A 10A 	30A 14V DC 	<Max. carrying current> 120A 14V DC 5 s at 20°C 68°F 70A 14V DC 1 min. at 85°C 185°F 45A 14V DC Continuous at 85°C 185°F 1A 14V DC
	Min. switching load (resistive)	1A 14V DC	1A 14V DC	1A 14V DC
	Latching type	—	—	—
Coil data	Rated coil voltage	12V DC	12V DC	12V DC
	Rated operating power	800mW	1,000mW	1.4W
	Operate (Set) voltage at 20°C 68°F (initial)	Max. 7.2V DC	Max. 7.2V DC	Max. 6.2V DC
	Release (Reset) voltage at 20°C 68°F (initial)	Min. 1.0V DC	Min. 1.0V DC	Min. 0.5V DC
Operate (Set) time (Rated voltage at 20°C 68°F)		Max. 10ms (without bounce time)	Max. 10ms (without bounce time)	Max. 20ms (without bounce time)
Release (Reset) time (Rated voltage at 20°C 68°F)		Max. 10ms (without bounce time) (without diode)	Max. 10ms (without bounce time) (without diode)	Max. 20ms (without bounce time) (without diode)
Expected life	Mechanical	Min. 10 ⁷	Min. 10 ⁶	Min. 2 x 10 ⁵
	Electrical	Min. 2 x 10 ⁶ (at 14 V DC, inrush: 25 A, steady: 5 A) Min. 10 ⁵ (at 14 V DC, 25 A motor lock condition)	Min. 10 ⁶ (at 14 V DC, inrush: 30 A, steady: 7 A) Min. 5 x 10 ⁴ (at 14 V DC, 30 A motor lock condition)	—
Electric strength	Between open contacts (initial)	500 Vrms for 1 min.	500 Vrms for 1 min.	500 Vrms for 1 min.
	Between contacts and coil (initial)	500 Vrms for 1 min.	500 Vrms for 1 min.	500 Vrms for 1 min.
Ambient temperature		−40 to +85°C −40 to +185°F	−40 to +85°C −40 to +185°F	−40 to +125°C −40 to +257°F
Protective construction	Dust cover	—	—	—
	Flux tight	—	—	—
	Sealed	●	●	●
External dimensions	Height (mm (inch)) Included standoff	13.5 .531	13.5 .531	19 .748
	Foot print (mm (inch))			
PC board pattern				
Weight (approx.)		8 g .28 oz (Twin type), 4 g .14 oz: (1 Form C type)	8 g .28 oz (Twin type), 4 g .14 oz: (1 Form C type)	26 g .92 oz
Remarks		10 pins type available	10 pins type available	Welding terminal
Page		77	83	88

Type		Automotive relays					
Product name		TA RELAYS		TB RELAYS		TB RELAYS POWER TYPE	
Appearance configuration (Standoff height included, Unit: mm inch)							
Part No.		ACTA		ACTB		ACTBP	
Features		1 Form C Automotive Quiet Relay		Miniature PC Board, Twin/1 Form C Type Automotive Relay		High Carrying Current 1 Form A Type Relay for Miniature PC board	
Contact data	Contact arrangement	1 Form C		1 Form A, 1 Form C, 1 Form C x 2 (8 pins) and 1 Form C x 2 (10 pins)		1 Form A	
	Contact material	Ag alloy		Ag alloy		Ag alloy	
	Rated switching capacity (resistive)	40A 35A 30A 25A 20A 15A 10A		20A 14V DC 10A 14V DC N.O. N.C.		30A 14V DC N.O.	
	Min. switching load (resistive)	1A 14V DC		1A 14V DC		1A 14V DC	
	Latching type	-		-		-	
Coil data	Rated coil voltage	12V DC		12V DC		12V DC	
	Rated operating power	900mW	640mW	1,440mW	900mW	640mW	480mW
	Operate (Set) voltage at 20°C 68°F (initial)	Max. 6.5V DC	Max. 7.7V DC	Max. 5.5V DC	Max. 6.5V DC	Max. 7.7V DC	Max. 7.0V DC
	Release (Reset) voltage at 20°C 68°F (initial)	Min. 0.8V DC		Min. 0.5V DC	Min. 0.8V DC		Min. 0.5V DC
Operate (Set) time (Rated voltage at 20°C 68°F)		Max. 10ms (without bounce time)		Max. 10ms (without bounce time)		Max. 10ms (without bounce time)	
Release (Reset) time (Rated voltage at 20°C 68°F)		Max. 10ms (without bounce time) (without diode)		Max. 10ms (without bounce time) (without diode)		Max. 10ms (without bounce time) (without diode)	
Expected life	Mechanical	Min. 10 ⁷		Min. 10 ⁷		Min. 5 x 10 ⁶	
	Electrical	Min. 10 ⁵		Min. 10 ⁵		Min. 10 ⁵	
Electric strength	Between open contacts (initial)	500 Vrms for 1 min.		500 Vrms for 1 min.		500 Vrms for 1 min.	
	Between contacts and coil (initial)	500 Vrms for 1 min.		500 Vrms for 1 min.		500 Vrms for 1 min.	
Ambient temperature		-40 to +85°C -40 to +185°F		Standard type: -40 to +85°C -40 to +185°F High heat-resistant/Pin in Paste compliant type: -40 to +110°C -40 to +230°F		-40 to +110°C -40 to +230°F	
Protective construction	Dust cover	-		-		-	
	Flux tight	-		● (PIP type)		● (PIP type)	
	Sealed	●		●		●	
External dimensions	Height (mm inch) Included standoff	14 .551		13.5 .531/14.0 .551 (PIP type)		14 .551	
	Foot print (mm inch)						
PC board pattern							
Weight (approx.)		8 g .28 oz		Single type: 5 g .176 oz, Twin type: 9.5 g .335 oz		5 g .176 oz	
Remarks		-		10 pins type available		-	
Page		91		95		104	

Automotive Relays Selector Chart

Type		Automotive relays										
Product name		TC RELAYS				TE RELAYS				TG RELAYS		
Appearance configuration (Standoff height included, Unit: mm (inch))												
Part No.		ACTC				ACTE				ACTG		
Features		High Load Relay for Smart J/B				Miniature PC Board, Twin Type, 1 Form C Automotive Relay				High Load Relay for Smart J/B		
Contact data	Contact arrangement	1 Form A (Standard type), 1 Form C (Standard type), Double make contact 2 Form A (Standard type) and Double make contact 2 Form A (2 coil latching type)				1 Form C, 1 Form C x 2 (8 pins) and 1 Form C x 2 (10 pins)				1 Form A and 1 Form C		
	Contact material	Ag alloy				Ag alloy				Ag alloy		
	Rated switching capacity (resistive)	40A										
		35A										
		30A										
25A												
20A												
15A												
10A												
Min. switching load (resistive)		1A 14V DC				1A 14V DC				1A 14V DC		
Latching type		●				-				-		
Coil data	Rated coil voltage	12V DC				12V DC				12V DC		
	Rated operating power	1,309mW	900mW	640mW	1,920mW	1,309mW	900mW	655mW	640mW	450mW		
	Operate (Set) voltage at 20°C (68°F) (initial)	Max. 6.5 V DC	Max. 7.0 V DC	Max. 7.5 V DC	Max. 7.5 V DC	Max. 5.5V DC	Max. 6.5V DC	Max. 7.7V DC	Max. 6.5V DC	Max. 7.0V DC		
	Release (Reset) voltage at 20°C (68°F) (initial)	Min. 0.5 V DC				Min. 0.6V DC	Min. 0.8V DC		Min. 0.8V DC			
Operate (Set) time (Rated voltage at 20°C (68°F))		Max. 10ms (without bounce time)				Max. 10ms (without bounce time)				Max. 10ms (without bounce time)		
Release (Reset) time (Rated voltage at 20°C (68°F))		Max. 10ms (without bounce time) (without diode)				Max. 10ms (without bounce time) (without diode)				Max. 10ms (without bounce time) (without diode)		
Expected life	Mechanical	Min. 10 ⁷ Min. 10 ⁶ (2 coil latching type)				Min. 10 ⁷				Min. 10 ⁷		
	Electrical	Min. 10 ⁵				Min. 10 ⁵				Min. 10 ⁵		
Electric strength	Between open contacts (initial)	500 Vrms for 1 min.				500 Vrms for 1 min.				500 Vrms for 1 min.		
	Between contacts and coil (initial)	500 Vrms for 1 min.				500 Vrms for 1 min.				500 Vrms for 1 min.		
Ambient temperature		Standard type: -40 to +85°C -40 to +185°F High heat-resistant/Pin in Paste compliant type: -40 to +110°C -40 to +230°F				-40 to +110°C -40 to +230°F				-40 to +110°C -40 to +230°F		
Protective construction	Dust cover	-				-				-		
	Flux tight	● (PIP type)				● (PIP type)				-		
	Sealed	●				●				●		
External dimensions	Height (mm (inch)) Included standoff	16.0 .630/16.4 .646 (PIP type)				13.5 .531/14.0 .551 (PIP type)				18.0 .709		
	Foot print (mm (inch))											
PC board pattern												
Weight (approx.)		10 g .35 oz				Single type: 3.5 g .12 oz, Twin type: 6.5 g .23 oz				12 g .42 oz		
Remarks		-				10 pins type available				-		
Page		109				118				126		

Type		Automotive relays		
Product name		TH RELAYS	TJ RELAYS	TL RELAYS
Appearance configuration (Standoff height included, Unit: mm (inch))				
Part No.		ACTH	ACTJ	ACTL
Features		Miniature PC Board, Twin, 1 Form C, Surface-mount Type Automotive Relay	Middle Load Relay for Smart J/B	High Load Relay for Smart Junction Box
Contact data	Contact arrangement	1 Form C and 1 Form C × 2 (10 pins)	1 Form C	Double make contact 2 Form A
	Contact material	Ag alloy	Ag alloy	Ag alloy
	Rated switching capacity (resistive)	40A 35A 30A 25A 20A 15A 10A 20A 14V DC 10A 14V DC N.O. N.C.	30A 14V DC 15A 14V DC N.O. N.C.	40A 14V DC N.O.
	Min. switching load (resistive)	1A 14V DC	1A 14V DC	1A 14V DC
	Latching type	—	—	—
Coil data	Rated coil voltage	12V DC	12V DC	12V DC
	Rated operating power	900mW 655mW	450mW	640mW
	Operate (Set) voltage at 20°C (68°F) (initial)	Max. 6.5V DC Max. 7.7V DC	Max. 7.0V DC	Max. 6.5V DC
	Release (Reset) voltage at 20°C (68°F) (initial)	Min. 0.6V DC	Min. 0.8V DC	Min. 0.5V DC
Operate (Set) time (Rated voltage at 20°C (68°F))		Max. 10ms (without bounce time)	Max. 10ms (without bounce time)	Max. 10ms (without bounce time)
Release (Reset) time (Rated voltage at 20°C (68°F))		Max. 10ms (without bounce time) (without diode)	Max. 10ms (without bounce time) (without diode)	Max. 10ms (without bounce time) (without diode)
Expected life	Mechanical	Min. 10 ⁷	Min. 10 ⁷	Min. 5 x 10 ⁶
	Electrical	Min. 10 ⁵	Min. 10 ⁵	Min. 10 ⁵
Electric strength	Between open contacts (initial)	500 Vrms for 1 min.	500 Vrms for 1 min.	500 Vrms for 1 min.
	Between contacts and coil (initial)	500 Vrms for 1 min.	500 Vrms for 1 min.	500 Vrms for 1 min.
Ambient temperature		−40 to +110°C −40 to +230°F	−40 to +110°C −40 to +230°F	−40 to +110°C −40 to +230°F
Protective construction	Dust cover	—	—	—
	Flux tight	●	—	● (PIP type)
	Sealed	●	●	●
External dimensions	Height (mm (inch)) Included standoff	Surface mount: 8.8 (346)	11.2 (441)	16 (630)
	Foot print (mm (inch))			
PC board pattern				
Weight (approx.)		1 Form C type: 3 g .106 oz, Twin type: 6 g .21 oz	7 g .25 oz	6.5 g .23 oz
Remarks		—	—	—
Page		131	136	140

Automotive Relays Selector Chart

Type		Automotive relays					
Product name		TM RELAYS		CA RELAYS		CB RELAYS	
Appearance configuration (Standoff height included, Unit: mm inch)							
Part No.		ACTM		ACA		ACB	
Features		High Capacity Relay for Smart Junction Box		Small Size, Light Weight Automotive Power Relays		Mini-ISO Automotive Relay	
Contact data	Contact arrangement	1 Form A and 1 Form C		1 Form A and 1 Form B	1 Form C	1 Form A and 1 Form C	
	Contact material	Ag alloy		Ag alloy		Ag alloy	
	Rated switching capacity (resistive)						
	Min. switching load (resistive)	1A 14V DC		1A 14V DC		1A 14V DC	
	Latching type	-		-		-	
Coil data	Rated coil voltage	12V DC		12, 24V DC		12V DC	24V DC
	Rated operating power	450mW	360mW	1.4W/1.8W	1.8W	Standard: 1.4 W 1 Form A High contact capacity: 1.8 W	1.8W
	Operate (Set) voltage at 20°C 68°F (initial)	Max. 7.0V DC		12V DC: Max. 8.0V DC 24V DC: Max. 16V DC		3.0 to 7.0V DC	6.0 to 14V DC
	Release (Reset) voltage at 20°C 68°F (initial)	Min. 0.5V DC		12V DC: 0.6 to 6.0V DC 24V DC: 1.2 to 12V DC		1.2 to 4.2V DC	2.4 to 8.4V DC
Operate (Set) time (Rated voltage at 20°C 68°F)		Max. 10ms (without bounce time)		Max. 10ms (without bounce time)		Max. 15ms (without bounce time)	
Release (Reset) time (Rated voltage at 20°C 68°F)		Max. 10ms (without bounce time) (without diode)		Max. 10ms (without bounce time) (without diode)		Max. 15ms (without bounce time) (without diode)	
Expected life	Mechanical	Min. 5 x 10 ⁶		Min. 10 ⁶	Min. 5 x 10 ⁵	Min. 10 ⁶	
	Electrical	Min. 10 ⁵		Min. 10 ⁵ 1 Form A 1.8 W type: 2 x 10 ⁴ (at 30 A)		Min. 10 ⁵ (Sealed: Min. 5x10 ⁴)	
	Between open contacts (initial)	500 Vrms for 1 min.		500 Vrms for 1 min.		500 Vrms for 1 min.	
	Between contacts and coil (initial)	500 Vrms for 1 min.		500 Vrms for 1 min.		500 Vrms for 1 min.	
Ambient temperature		-40 to +110°C -40 to +230°F		-30 to +80°C -22 to +176°F		Standard: -40 to +85°C -40 to +185°F Heat resistant: -40 to +125°C -40 to +257°F	
Protective construction	Dust cover	-		●		-	
	Flux tight	-		-		●	
	Sealed	●		●		●	
External dimensions	Height (mm inch) Included standoff	13.6 .535		37 1.457	40 1.575	PC board type: 26 1.024, Plug-in type: 25 .984 Bracket type: 41 1.614	
	Foot print (mm inch)						
PC board pattern				-			
Weight (approx.)		11.6 g .41 oz		Rubber bracket A type: 23 g .81 oz, Screw-mounting type: 19 g .67 oz	31 g 1.09 oz	33 g 1.16 oz	
Remarks		-		Rubber bracket type and screw-mounting type available		PC board type and bracket type available	
Page		145		150		157	

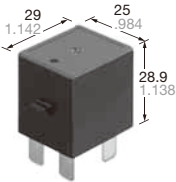
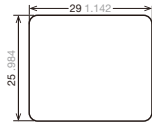
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ASCTB283E 201709-T

Automotive Relays Selector Chart

Type	Automotive relays	
Product name	EC-N RELAYS	
Appearance configuration (Standoff height included, Unit: mm inch)		
Part No.	AECN	
Features	Small, High capacity, High voltage DC Plug in Relay	
Contact data	Contact arrangement	1 Form A
	Contact material	Ag alloy
	Rated switching capacity (resistive)	40A----- 35A----- 30A----- 25A----- 20A----- 15A----- 15A 400V DC 10A-----
	Min. switching load (resistive)	1A 12V DC
	Latching type	—
Coil data	Rated coil voltage	12V DC
	Rated operating power	1.4W
	Operate (Set) voltage at 20°C 68°F (initial)	Max. 6.8V DC
	Release (Reset) voltage at 20°C 68°F (initial)	Min. 0.5V DC
Operate (Set) time (Rated voltage at 20°C 68°F)		Max. 50ms (without bounce time)
Release (Reset) time (Rated voltage at 20°C 68°F)		Max. 30ms (without bounce time) (without diode)
Expected life	Mechanical	Min. 2 x 10 ⁵
	Electrical	15A 400V DC, Min. 100,000 cycles (inrush)
Dielectric strength	Between open contacts (initial)	2,500 Vrms for 1 min.
	Between contacts and coil (initial)	2,500 Vrms for 1 min.
Ambient temperature		−40 to +85°C −40 to +185°F
Protective construction	Dust cover	—
	Flux tight	—
	Sealed	●
External dimensions	Height (mm inch) Included standoff	28.9 1.138
	Foot print (mm inch)	
PC board pattern	—	
Weight (approx.)	40 g 1.41 oz	
Remarks	—	
Page	178	

Type		Automotive relays					
Product name		EV RELAYS					
Appearance configuration (Standoff height included, Unit: mm (inch))							
Part No.		AEV					
Features		Compact and High voltage High capacity DC Cut-off Relays using Capsule Contact Mechanism					
Contact data	Contact arrangement	1 Form A					
	Contact material	Molybdenum	Copper alloy	Tungsten and copper alloy	Copper alloy		
	Rated switching capacity (resistive)	200A			120A 450V DC	200A 450V DC	300A 450V DC
		120A					
		100A					
80A							
Min. switching load (resistive)	60A						
	20A						
	10A						
		10A 450V DC	20A 400V DC	80A 450V DC	120A 450V DC	200A 450V DC	300A 450V DC
Latching type		-					
Coil data	Rated coil voltage	12, 24V DC (Please inquire our sales representative for more information about EV20A with nominal coil voltage of 24V DC.)					
	Rated operating power	1.24W	3.9W	4.2W	4.2W	6.0W	12V: 37.9 W (Inrush), 3.6 W (Stable) 24V: 44.4 W (Inrush), 3.8 W (Stable)
	Operate (Set) voltage at 20°C 68°F (initial)	12V: Max. 9V DC, 24V: Max. 18V DC					
	Release (Reset) voltage at 20°C 68°F (initial)	12V: Min. 1.0V DC 24V: Min. 2.0V DC	12V: Min. 0.5V DC	12V: Min. 1.0V DC, 24V: Min. 2.0V DC			12V: Min. 2.0V DC 24V: Min. 4.0V DC
Operate (Set) time (Rated voltage at 20°C 68°F)		Max. 50ms (without bounce time)					Max. 30ms (without bounce time)
Release (Reset) time (Rated voltage at 20°C 68°F)		Max. 30ms					Max. 10ms
Expected life	Mechanical	Min. 10 ⁵	Min. 2 x 10 ⁵				
	Electrical	10A 450V DC, Min. 30,000 cycles (resistive)	20A 400V DC, Min. 3,000 cycles (resistive)	80A 450V DC, Min. 1,000 cycles (resistive)	30A 450V DC, Min. 1,000 cycles (resistive)	200A 450V DC, Min. 3,000 cycles (resistive)	300A 450V DC, Min. 1,000 cycles (resistive)
Electrical strength	Between open contacts (initial)	2,500 Vrms for 1 min.					
	Between contacts and coil (initial)	2,500 Vrms for 1 min.					
Ambient temperature		-40 to +80°C -40 to +176°F				-40 to +85°C -40 to +185°F	
Protective construction	Dust cover	-					
	Flux tight	-					
	Sealed	● (Power capsule)					
External dimensions	Height (mm (inch)) Included standoff	49.7 1.957	48.1 1.894	79 3.110	80 3.150	86.4 3.402	74.7 2.941
	Foot print (mm (inch))						
Mounting dimensions							
Weight (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
Remarks		-	-	-	-	-	-
Page		183					

Automotive Relays Selector Chart

Type		Automotive relays		Automotive safety switches	
Product name		EV RELAYS Quiet Type		EV Relay Compact High Short-circuit Capacity Type	
EV SWITCHES					
Appearance configuration (Standoff height included, Unit: mm (inch))					
Part No.		AEVS		AEVG	
AEVD					
Features		Unique Silencing Technology and Low Operation Noise		Compact and Short Circuit Capacity 4.5kA	
High voltage DC Cut-off Switches using Capsule Contact Mechanism					
Contact data	Contact arrangement	1 Form A		1 Form A	
	Contact material	Tungsten and copper alloy		Copper alloy	
	Rated switching capacity (resistive)	200A			
		120A			
		100A			
		80A			
Min. switching load (resistive)	60A 450V DC		60A 450V DC		
	1A 12V DC		1A 12V DC		
Latching type		-		-	
Coil data	Rated coil voltage	12V DC		12V DC	
	Rated operating power	4.5W		5.2W	
	Operate (Set) voltage at 20°C 68°F (initial)	Max. 9.0V DC		Max. 9.0V DC	
	Release (Reset) voltage at 20°C 68°F (initial)	Min. 1.0V DC		Min. 0.5V DC	
Operate (Set) time (Rated voltage at 20°C 68°F)		Max. 50ms (without bounce time)		Max. 50ms (without bounce time)	
Release (Reset) time (Rated voltage at 20°C 68°F)		Max. 50ms		Max. 30ms	
Expected life	Mechanical	Min. 2 × 10 ⁵		Min. 2 × 10 ⁵	
	Electrical	60A 450V DC, Min. 800 cycles (resistive)		30A 450V DC (Inrush resistance), Min. 70,000 cycles	
Dielectric strength	Between open contacts (initial)	Vertical type: 2,500 Vrms for 1 min.		2,500 Vrms for 1 min.	
	Between contacts and coil (initial)	Horizontal type: 2,000 Vrms for 1 min.		2,500 Vrms for 1 min.	
Ambient temperature		-40 to +80°C -40 to +176°F		-40 to +80°C -40 to +176°F	
Protective construction	Dust cover	-		-	
	Flux tight	-		-	
	Sealed	● (Power capsule)		● (Power capsule)	
External dimensions	Height (mm (inch)) Included standoff	Vertical type: 72.3 2.846 Horizontal type: 37.7 1.484		52.8 2.079	
	Foot print (mm (inch))				
Mounting dimensions		Vertical type Horizontal type			
Weight (approx.)		Vertical type: 250 g 8.82 oz Horizontal type: 240 g 8.47 oz		165 g 5.82 oz	
Remarks		-		-	
Page		183		201	

Configuration and Construction

PROTECTIVE CONSTRUCTION

1. Flux-Tight

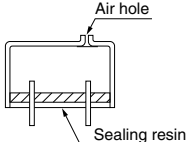
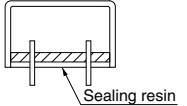
The relay is constructed so that flux will not enter inside the relay during automatic soldering. However, cleaning is not possible.

2. Sealed

Construction is designed to prevent seeping of flux when soldering and cleaning fluid when cleaning.

CONSTRUCTION AND CHARACTERISTIC

(○: Yes, ×: No, △: Care)

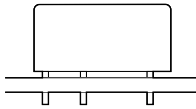
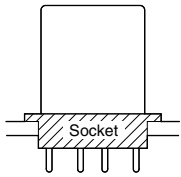
Type	Construction	Characteristics	Automatic Soldering	Automatic Cleaning	Dust Resistance	Harmful Gas Resistance
Flux-Tight		Terminals, case, and base are filled with sealing resin.	○	×	△	×
Sealed		Sealed construction with terminals, case and base sealed shut with sealing resin.	○	○	○	○*

*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 relay, CN-H relay, TB relay	CM relay, CB relay, CV-N relay	EV relay

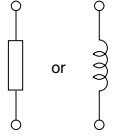
MOUNTING METHOD

Type	Insertion mount	Socket mount
Mounting method		
Typical relay type	CP relay, CN-H relay, TB relay	CM relay, CB relay, 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. Rated Coil Voltage

The voltage applied to the operating coil during normal use of the relay. The expected life and other guaranteed values are based on the rated coil voltage.

3. Rated Operating Current

The value of current flow in the coil when rated voltage is applied on the coil

4. Rated Operating Power

The value of power used by the coil at rated voltage.
(Rated Operating Power = Rated Coil Voltage × Rated Operating 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. Operate (Set) Voltage

As the voltage on an unoperated relay is increased, the value which all contacts must function.

7. Release (Reset) Voltage

As the voltage on an operated relay is decreased, the value which all contacts must revert to their unoperated position. In the catalog, operate voltage and release voltage values are usually indicated for when the temperature condition is 20°C 68°F, however, for some relays, the values are indicated for when the temperature condition is 25°C 77°F.

8. Maximum Applied Voltage

The maximum voltage within the allowable range that can be applied to the operating coil. Continuous operation at this maximum value, however, is not allowable. Since the value depends on the ambient temperature, for each type, please check the value listed in the catalog.

CONTACTS (secondary or output)

1. Contact Arrangement

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 transfer contacts.

3. Rated Switching Capacity

Derived from the contact voltage and contact current, this is the reference value that determines the performance of the switching section.

4. Maximum Carrying Current

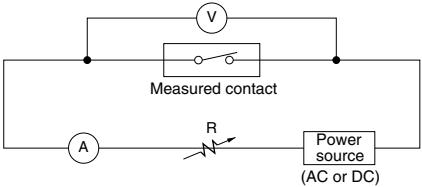
The maximum value for carrying current through the contact section. It is necessary to pay attention to carrying conditions during use.

5. Continuous Carrying Current

The current that, when the contact is closed, without raising beyond the specified limits the temperature of the relay contact and all other parts, can continuously carrying the contact section.

6. 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 resistor

Test Currents

Rated Contact Current or Switching Current (A)	Test Current (mA)
1 or more	1,000

In general, for relays with a contact rating of 1A or more, measure using the voltage-drop method at 1A 6V DC.

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 for the relay alone, and does not take into consideration the solder land on the PC board or other factors.

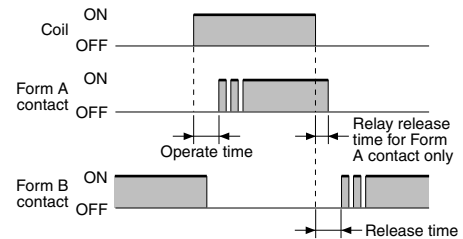
- (1) Between contact and coil: between all contact terminals and coil terminals
- (2) Between open contacts: between open contact terminals
- (3) Between contact sets: between contact sets terminals

2. Dielectric Strength

When a high voltage is applied for 1 minute at the same points where insulated resistance is measured, the limit value for non-occurrence of dielectric breakdown. Leakage current is usually set at 10 mA. In special cases, however, it may be set at 1 mA or 3 mA.

3. Operate (Set) Time

The elapsed time from the initial application of power to the coil, until the closure of the Form A (normally open) contacts. This time does not include any bounce time.



4. Release (Reset) Time

The elapsed time from the initial removal of coil power until the reclosure of the Form B (normally closed) contacts. This time does not include any bounce time. Or, for relays with only Form A contact (1 Form A, 2 Form A), the time taken until the contact opens.

5. 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

Shock resistance is categorized as either functional shock or destructive shock, which are defined below.

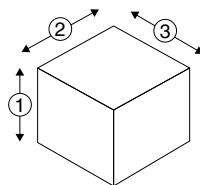
1) Functional

The shock which can be tolerated by the relay during operation, without causing the closed contacts to open for more than the specified time. The contact opening time itself is specified as 10 μ s or less.

2) Destructive

The shock 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.

Testing is carried out with shock forces applied along each of the three axial directions.



2. Vibration Resistance

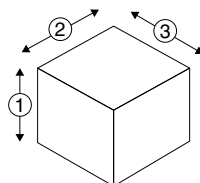
Vibration resistance is categorized as either functional vibration or destructive vibration, which are defined below.

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. Here, the contact opening time value, is the same as for functional shock.

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. Testing is carried out with vibratory forces applied along each of the three axial directions.



3. Mechanical Life

The number of times the relay can be operated under nominal conditions with no load on the contacts.

4. Electrical Life

The 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 JIS standard temperature and humidity (15°C to 35°C 59°F to 95°F, 25 to 85%).
2. The coil applied voltage in the switching tests is a rectangular wave at the rated voltage.

Cautions for Use

1. Before using relays under any operating condition other than those listed in the catalog, please inquire our sales representative. After checking the specifications requested by your company, we will check the operating conditions in an actual environment as required.

2. Before using relays, please check “Automotive Relays Users Guide”.

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, or inquire our sales representative.

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. 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.

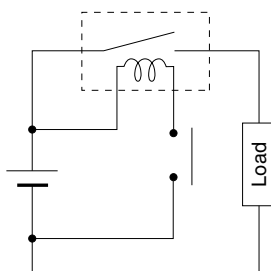
8. Use of relays in normal temperature and humidity conditions with less dust and organic gas is recommended. Use of silicone-based resin around a relay must be absolutely avoided. For more details, please refer to “Automotive Relays Users Guide”.

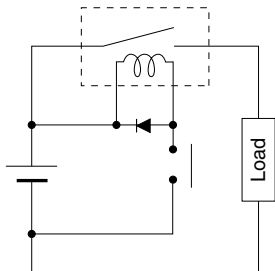
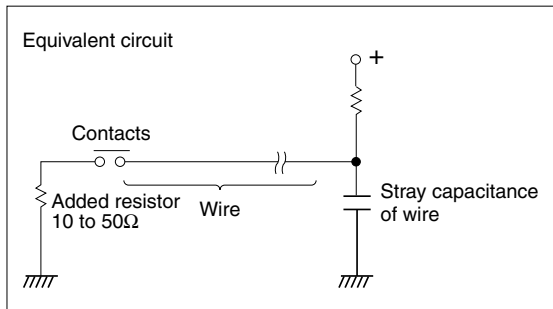
Automotive Relay Users Guide

Please use the check sheet.

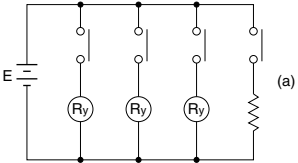
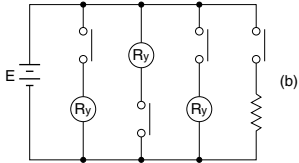
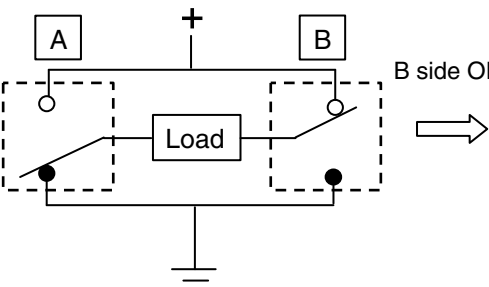
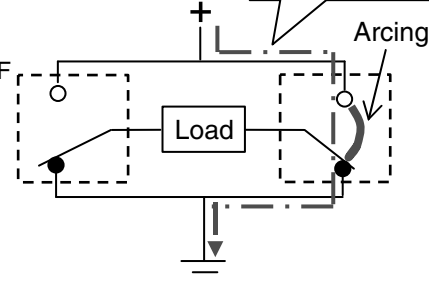
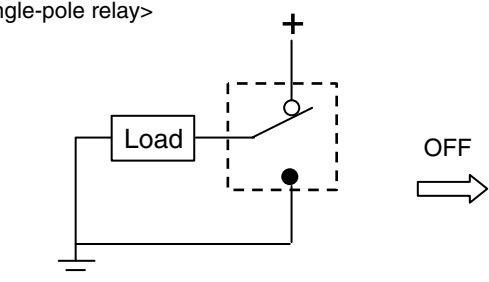
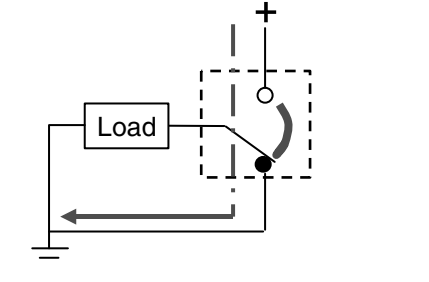
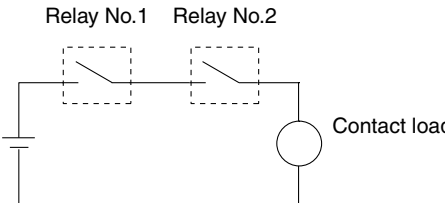
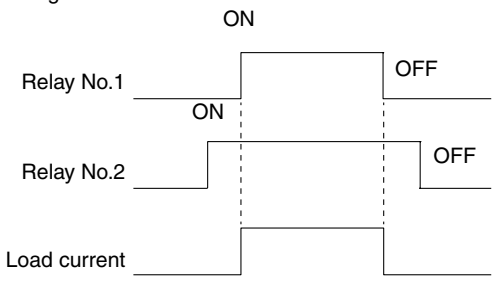
Category	Section	Contents																		
1. Confirmation under the actual use condition	1. Confirmation under the actual use	The rated switching power and life mentioned in the specification and catalog are given only as guides. A relay may encounter a variety of ambient conditions during actual use 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.																		
2. Safety precautions	1. Specification range	Use that exceeds the specification ranges such as the coil rating, contact rating and expected life should be absolutely avoided. Doing so may lead to abnormal heating, smoke, and fire.																		
	2. Installation, maintenance	Never touch energized 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.																		
	3. Connection	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.																		
	4. Fail-safe	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.																		
3. Selection of relay type	1. Selection	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 the consideration points regarding selection of relay.																		
		<table><tr><th colspan="2">Items</th><th>Consideration points regarding selection</th></tr><tr><td rowspan="6">Coil</td><td>a) Rating b) Operate voltage (current) c) Release voltage (current) d) Maximum applied voltage (current) e) Coil resistance f) Temperature rise</td><td>- Select relay with consideration for power source voltage. - Give sufficient consideration to ambient temperature and for the coil temperature rise, and hot start. - When driving the relay with semiconductors, careful with the voltage drop. - When starting up, careful with the voltage drop.</td></tr><tr><td rowspan="5">Contact</td><td>a) Contact arrangement b) Contact rating c) Contact material d) Expected life e) Contact resistance</td><td>- Note that the relay expected 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 expected 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 rowspan="4">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 expected life changes depending on switching frequency.</td></tr><tr><td rowspan="4">Mechanical characteristics</td><td>a) Vibration resistance b) Shock resistance c) Ambient temperature d) Expected 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 rowspan="4">Other items</td><td>a) Dielectric strength 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. In some environments, the sealing performance may fail. Therefore, it is necessary to confirm device performance in actual atmosphere. - Are there any special conditions?</td></tr></table>	Items		Consideration points regarding selection	Coil	a) Rating b) Operate voltage (current) c) Release voltage (current) d) Maximum applied voltage (current) e) Coil resistance f) Temperature rise	- Select relay with consideration for power source voltage. - Give sufficient consideration to ambient temperature and for the coil temperature rise, and hot start. - When driving the relay with semiconductors, careful with the voltage drop. - When starting up, careful with the voltage drop.	Contact	a) Contact arrangement b) Contact rating c) Contact material d) Expected life e) Contact resistance	- Note that the relay expected 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 expected 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.	Operate time	a) Operate time b) Release time c) Bounce time d) Switching frequency	- 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 expected life changes depending on switching frequency.	Mechanical characteristics	a) Vibration resistance b) Shock resistance c) Ambient temperature d) Expected life	- Give consideration to performance under vibration and shock in the use location. - Confirm the allowable ambient temperature of the relay.	Other items	a) Dielectric strength b) Mounting, Connection c) Size d) Protection construction	- 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. In some environments, the sealing performance may fail. Therefore, it is necessary to confirm device performance in actual atmosphere. - Are there any special conditions?
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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. Also, note that the automotive relay cannot be applied AC load.
	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 inquire our sales representative 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 inquire our sales representative 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 inquire our sales representative 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 inquire our sales representative before use.
	6. Other lamp load	Please inquire our sales representative before use of new structured lamp except for halogen, Electric-discharge lamp, and LED.
	7. Motor load	When using of N.C. contact side of 1 Form C contact for the motor brake, electrical life might be affected by the brake current. Therefore, verify in actual use conditions with actual circuit. The larger inductivity of motor may cause contact damage and transfer even the motor load current is same. Therefore, verify in actual use conditions with actual circuit.
	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.
	10. Small electric current load	- Under small current loading, high contact resistance values may result when performing continuity checks of contacts. - If the switching current is small (1A or less), contact reliability decreases since the contact surface is not cleaned by switching arc. Please inquire our sales representative if you are using the above-mentioned use method.
	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. 

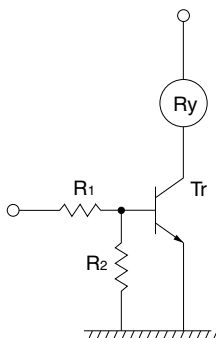
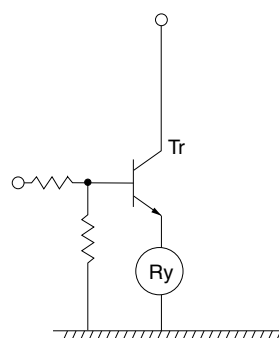
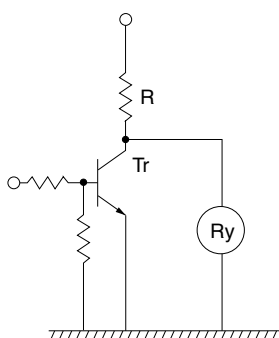
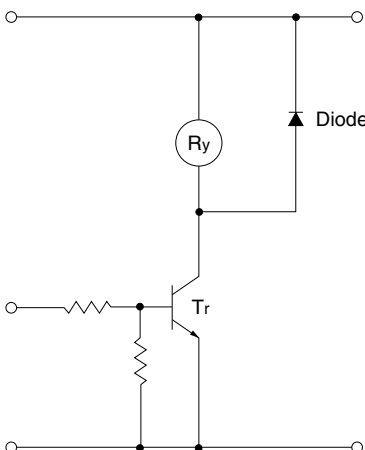
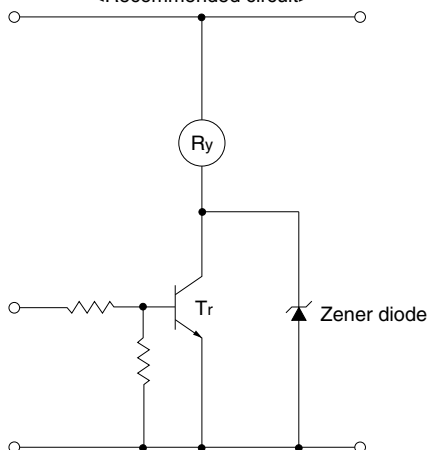
4. Load, Electrical life	13. Load voltage	If the load voltage is high, the arc energy which generated at contact switching increases, which may decrease the electrical life. Therefore, it is necessary to give consideration to the voltage which could occur in actual use condition.
	14. Coil voltage	If 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 the relay coil and 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. 

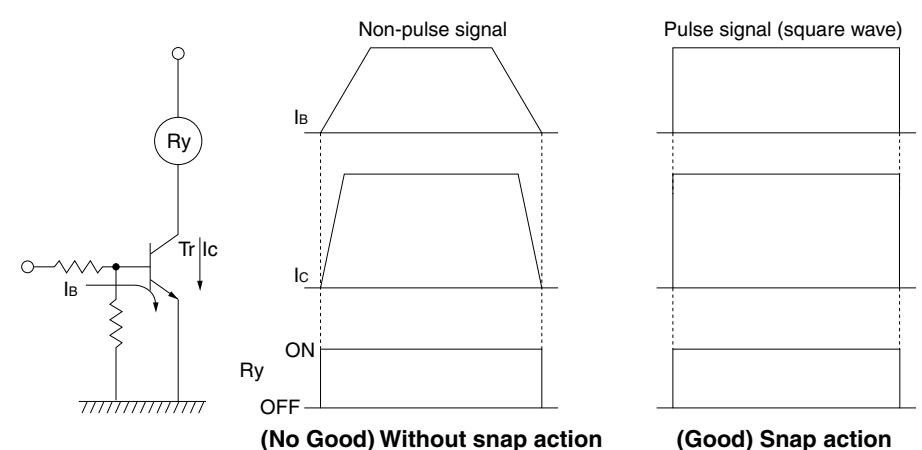
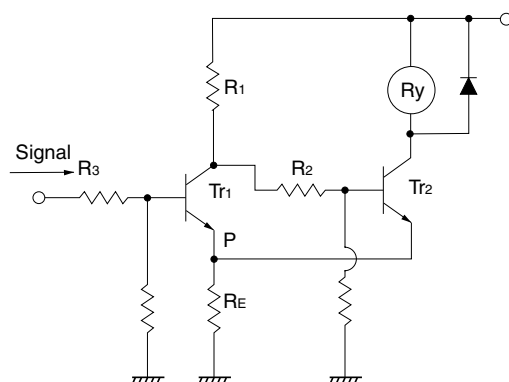
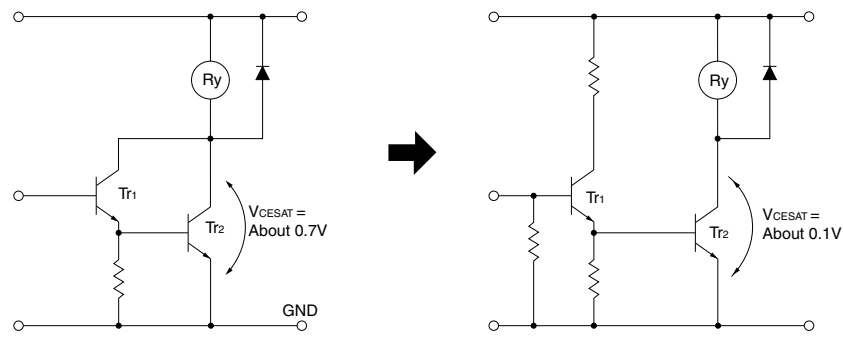
4. Load, electrical life	22. Contact protective circuit	Use of contact protective devices or protection circuits can suppress the counter electromotive force to a low level. However, note that incorrect use will result in an adverse effect. Typical contact protection circuits are given in the table below. 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. 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.

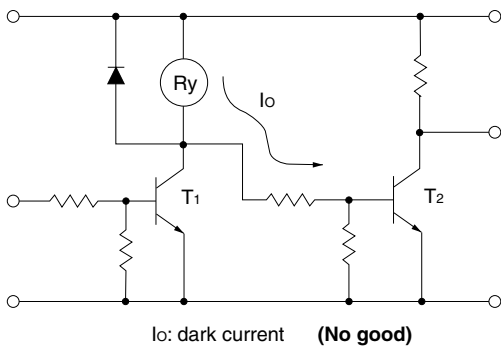
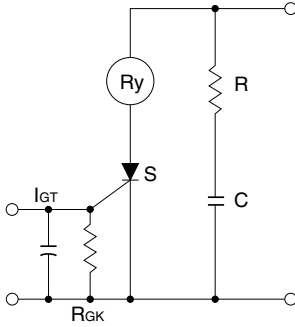
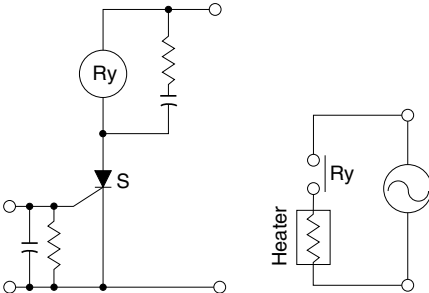
4. Load, electrical life	23. Connection of load	Connect the load to one side of the power supply as shown in Fig. (a). Connect the contacts to the other side. This prevents high voltages from developing between contacts. If contacts are connected to both side of the power supply as shown in Fig. (b), there is a risk of shorting of the power supply when relatively close contacts short.   Fig. (a) Good example (b) Bad example Note that 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. <2-coil relay (twin relay) or two of single-pole relays>   <Single-pole relay>  
	24. Short between inter electrodes	When using of multiple pole relays such as 2-coil relays (twin relays), verify insulation and dielectric strength between contacts in each pole in order to avoid an accident caused by short.
	25. Dry-switching	The two relays are connected in series as shown in the right side figure. When each relay is controlled with a different timing chart (shown in the right side figure bottom), the relay No.2 does not flow the load current during operation and release time. This relay No.2 operation is called "Dry-switching". Dry-switching can reduce the consumption of contact material without current conduction, on the other hand, as the contact cleaning effect disappear, conduction failure may occur. For the abovementioned reasons, note that our relay application in this dry-switching condition is not recommended in applying our relay.  Timing chart: 

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5. Coil operate voltage	1. Hot start voltage	After continuous applying of current to coil and contacts, if the current is turned OFF then immediately turned ON again, coil resistance and operate voltage will increase due to the temperature rise in the coil. 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.
	2. Ambient temperature characteristic	Coil resistance and operate 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 release 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 used operating temperature range, with attention to such temperature characteristic. 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.
	3. Applied voltage	Note that application of a voltage equal to or greater than the maximum applied voltage may cause a temperature rise that could cause coil burning or a layer short. Furthermore, do not exceed the usable ambient temperature range listed in the catalog. Please inquire our sales representative regarding PWM control.
	4. Twin-relay coil simultaneous operation	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 inquire our sales representative before use.
	5. Continuous current	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.

6. Coil operating circuit	1. Relay drive by means of a transistor	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 applied 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 applied 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. 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 dielectric strength 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. Consequently, electrical switching performance of relay may be reduced. If it is need to reduce this time delay, performance will be improved by connecting a Zener diode that is rated for more than double the voltage in the circuit between the transistor's Collector and Emitter.  <Recommended circuit>  Take care of Area of Safe Operation (ASO).
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6. Coil operating 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 apply voltage slowly but to apply 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) When the input signal does not produce a snap action, ordinarily a Schmitt trigger circuit is used to produce safe snap action. - The common emitter resistor RE must have a sufficiently small value compared with the resistance of the relay coil. - Due to the relay coil current, the difference in the voltage between at point P when Tr2 is conducting and at point P when Tr1 is conducting creates hysteresis in the detection capability of Schmitt circuit, and care must be taken in setting the values. - 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. 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.
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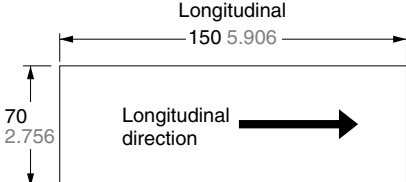
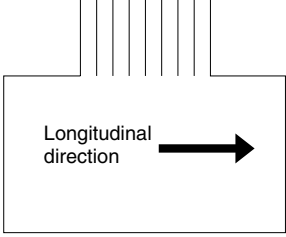
6. Coil operating circuit	1. Relay drive by means of a transistor	6. Residual Coil Voltage In switching operation where a semiconductor (transistor, UJT, etc.) is connected to the coil, a residual voltage is retained at the relay coil which may cause incomplete restoration and faulty operation. Using of DC coils may cause incomplete restoration or reduction in contact pressure and vibration resistance, because its release 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 release 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. 

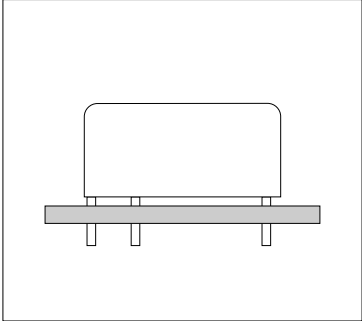
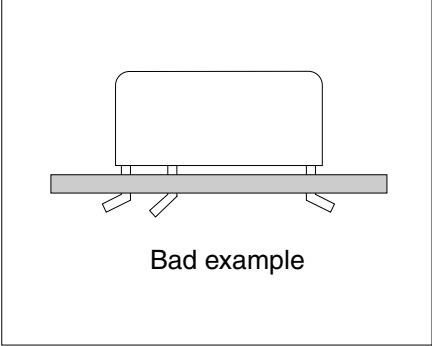
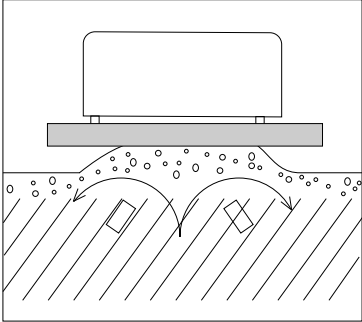
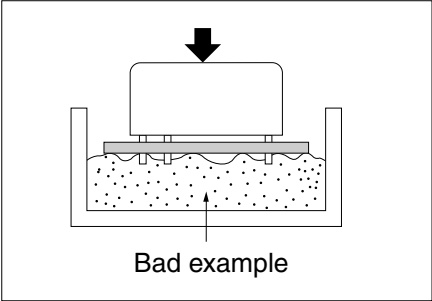
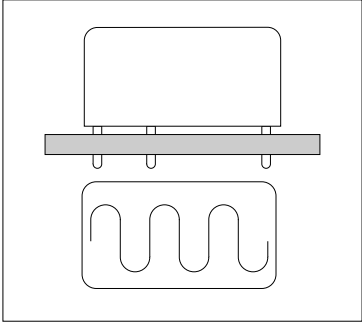
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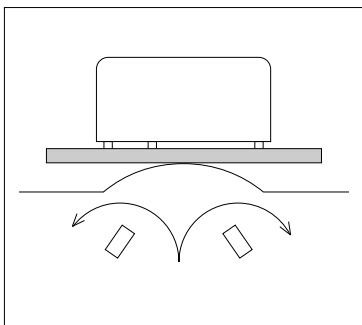
7. Contact reliability	1. Load switching	Note that when switching with a very small load after switching with a large load, contact failure by small load switching may occur due to particles generated during switching of the contact with large load.
	2. Installation condition	Note that if it is connected or installed with a high heat-capacity such as bus 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 inquire our sales representative 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. Note that dynamic contact resistance usually shows a large value due to just after the contact operation.
	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. Operation 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. Operation noise after installation	It is necessary to test relays in actual installation condition because operation 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 may produce small abnormal noise. Please inquire our sales representative 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. If quietness is required, after mounting, please test in the actual use condition.
11. Electrical noise	1. Surge voltage	When the relay turns off, surge voltage is generated from the coil. This surge 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 note that if a resistor and a diode is connected in parallel electrical life may be affected due to slowing down of release time.

12. Usage ambient condition	1. Temperature, humidity, air pressure	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, note that in the case of transporting and storing relays in a tube package, the temperature may differ from the allowable range of the relay. 2. Humidity: 5 to 85% R.H. 3. Pressure: 86 to 106 kPa *1. The humidity range varies with the temperature. So, use relays within the range indicated in the graph below. *2. If products are air freighted, as long as they are kept in a regular air transportation environment (approx. 80 kPa), product quality will not be affected. The graph plots Humidity (%RH) on the y-axis (5 to 85) against Temperature (°C and °F) on the x-axis (-40 to 85). A shaded region labeled 'Tolerance range' is shown. It is a horizontal band from 5% to 85% RH from -40°C to 0°C. From 0°C to 85°C, the upper boundary of the tolerance range decreases from 85% RH to 5% RH, while the lower boundary remains at 5% RH. Annotations indicate to avoid icing at temperatures lower than 0°C (32°F) and to avoid condensation at temperatures higher than 0°C (32°F). (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. - Sealed relays are especially not suited for use in environments which require severe airtight condition. Although there is no problem if they are used at sea level, avoid using them in air pressures beyond 96±10kPa. Also avoid using them in an atmosphere containing flammable or explosive gases.
	2. Dust	It is recommendable to use relays in a normal temperature and humidity with less dust, sulfur gases (SO₂, H₂S), and organic gases. Sealed relays should be considered for applications in an adverse environment.
	3. Silicone	When a source of silicone gas (silicone rubber, silicone oil, silicone coating materials and silicone filling materials etc.) is used around the relay, the silicone gas (low molecular siloxane etc.) may be produced. The produced silicone gas may penetrate the plastic case and enter the inside of the relay. When the relay is kept and used in this condition, silicone compound may adhere to the relay contacts. The silicone compound may be changed to the insulator which may cause the contact failure. Do not use any sources of silicone gas around the relay.
	4. Magnetism	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. Therefore, after mounting, check performance in actual operational conditions.
	5. Vibration	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. N.O. contact is the recommended contact for the use at the vibration-frequent area because the vibration resistance performance of N.C. contact is generally inferior to that of N.O. contact. In addition, owing to adverse effects on the characteristics of the relay, ensure that devices are not exposed to ultrasonic or high frequency vibrations.
	6. Shock	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 N.C. contacts while the coil is not excited is greatly affected by the mounting direction of the relay.

12. Usage ambient condition	7. Dew condensation	Water condensation occurs when the ambient temperature drops suddenly from a high temperature and humidity, or, the relay is suddenly transferred from a low ambient temperature to a high temperature and humidity. Condensation causes the failures like insulation deterioration, wire disconnection and rust etc. Panasonic Corporation does not guarantee the failures caused by condensation. The heat conduction by the equipment may accelerate the cooling of relay itself, and the condensation may occur. Please confirm no condensation in the worst condition of the actual usage. (Special attention should be paid when high temperature heating parts are close to the relay. Also please consider the condensation may occur inside of the relay.) Note that if a relay is connected or installed with a high heat-capacity such as bus 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.
	8. Water resistance	Do not use PC board type in environments where wetting may occur. Since we have different types with various water resistance specifications, please inquire our sales representative.
	9. Icing	Please check the icing when an ambient temperature is lower than 0°C. Water drop adheres to the relay by the condensation or the abnormal high humidity and is frozen to the ice when the ambient temperature becomes lower than 0°C. The icing causes the sticking of movable portion, the operation delay and the contact conduction failure etc. Panasonic Corporation does not guarantee the failures caused by the icing. The heat conduction by the equipment may accelerate the cooling of relay itself and the icing may occur. Please confirm no icing in the worst condition of the actual usage. Note that if a relay is connected or installed with a high heat-capacity such as bus 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 connection	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 mated 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 Operating relays may generate noise that can affect electrical circuits. Therefore, 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. (No good) - Relay currents and electronic circuit currents flow through A and B. (Good) - 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.

14. PC board design	2. Hole and Land diameter	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 border="1"> <thead> <tr> <th>Standard hole</th><th>Tolerance</th><th>Land diameter</th></tr> </thead> <tbody> <tr> <td>0.8 .031</td><td rowspan="4">±0.1 ±.039</td><td rowspan="3">2.0 to 3.0 .079 to .118</td></tr> <tr> <td>1.0 .039</td></tr> <tr> <td>1.2 .047</td></tr> <tr> <td>1.6 .063</td><td>3.5 to 4.5 .138 to .177</td></tr> </tbody> </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.	Standard hole	Tolerance	Land diameter	0.8 .031	±0.1 ±.039	2.0 to 3.0 .079 to .118	1.0 .039	1.2 .047	1.6 .063	3.5 to 4.5 .138 to .177
Standard hole	Tolerance	Land diameter										
0.8 .031	±0.1 ±.039	2.0 to 3.0 .079 to .118										
1.0 .039												
1.2 .047												
1.6 .063		3.5 to 4.5 .138 to .177										
	3. Expansion and shrinkage of copper-clad laminates	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 about 1/15 to 1/2 of that in the lateral, and accordingly, after the punching fabrication, the distortion in the longitudinal direction will be about 1/15 to 1/2 of that in the lateral direction. The mechanical strength in the longitudinal direction is about 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. 										

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.  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 tight type relay.  Bad example				
3. Preheating 	• Be sure to preheat before using automatic soldering. For dust-cover type relays and flux tight type relays, preheating acts to prevent the penetration of flux into the relay when soldering. Solderability also improves. • Preheat according to the following conditions. <table><tr><td>Temperature</td><td>100°C 212°F or less (PCB solder surface)</td></tr><tr><td>Time</td><td>Within 2 minutes</td></tr></table> • 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.	Temperature	100°C 212°F or less (PCB solder surface)	Time	Within 2 minutes
Temperature	100°C 212°F or less (PCB solder surface)				
Time	Within 2 minutes				

4. Soldering**Automatic soldering**

- Wave 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.

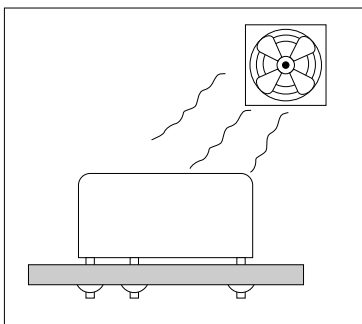
Solder temperature	260°C 500°F or less
Soldering time	Within 5 seconds

Hand soldering

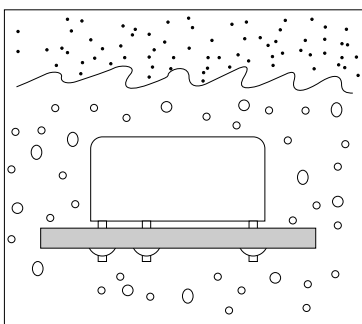
- Keep the tip of the soldering iron clean.

Soldering iron	30W to 60W
Iron tip temperature	300°C 572°F
Soldering time	Within 3 seconds

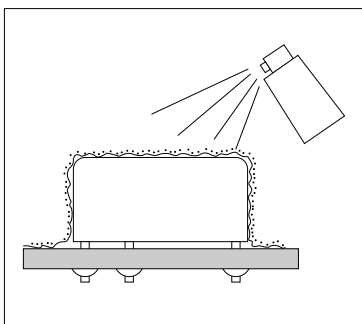
Note: CB and CM relays are not applicable. Please refer to individual product catalog.

5. Cooling

- Immediate air cooling is recommended to prevent deterioration of the relay and surrounding parts due to soldering heat.
- 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

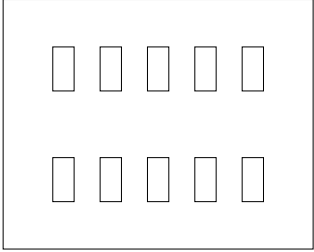
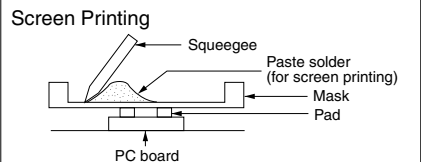
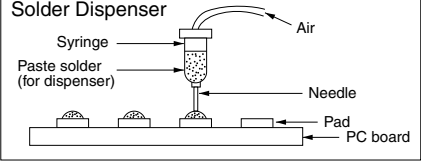
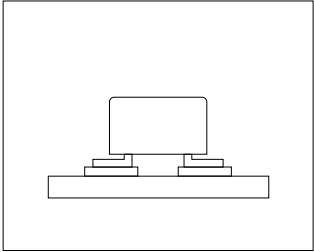
- Do not clean products that are not compatible with cleaning.
- For products that may be cleaned, use alcohol-based cleaning solvent. Use of other cleaning solvents (e.g. Trichlene, chloroethene, thinner, benzyl alcohol, gasoline) may damage the relay case.
- Avoid ultrasonic cleaning on relays. Use 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

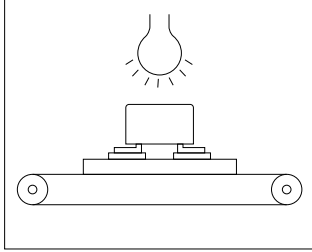
- If the PC board is to be coated to prevent the insulation of the PC board from deteriorating due to corrosive gases and high temperatures, note the following.
- Do not coat dust-cover type relays and flux tight type relays, since the coating material may penetrate the relay and cause contact failure. Or, mount the relay after coating.
- Depending on the type, some coating materials may have an adverse effect 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.
Silicone-base	No Good	Silicone gas becomes the cause of contact failure. Do not use the silicone-base type.

Please inquire our sales representative about coating materials other than those listed above. Also please follow individual specification.

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 inquire our sales representative for or reflow soldering of through-hole terminal type.	
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. Screen Printing  Solder Dispenser 
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 of product 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.)

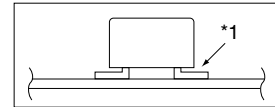
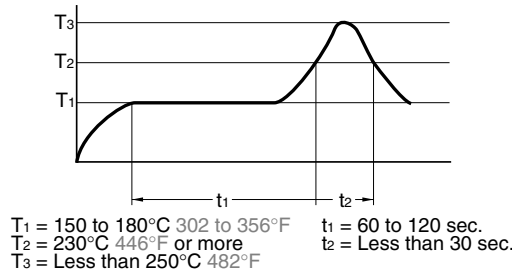
3. Reflow



- Even when highly heat resistance surface mount type relays are used, depending on the product airtight implementation, reflow solder heating method, type of PC board and other factors, the outer casing and internal parts of the relay may reach extremely high temperatures and this may break airtightness. Devices should be thoroughly evaluated in actual operation.

<Example of recommended soldering condition for surface mount relays>

1. IRS profile

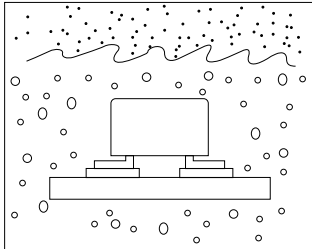


Note: Temperature profile indicates the temperature of the soldered part (*1) of terminals on the surface of a circuit board. The exterior temperature of a relay may be extremely high depending on the component density on the board or the heating method of the reflow oven or circuit board type. Sufficient verification under actual processing conditions is required. Performance-guaranteed temperature varies by product. Please refer to the relevant product catalog.

<Others>

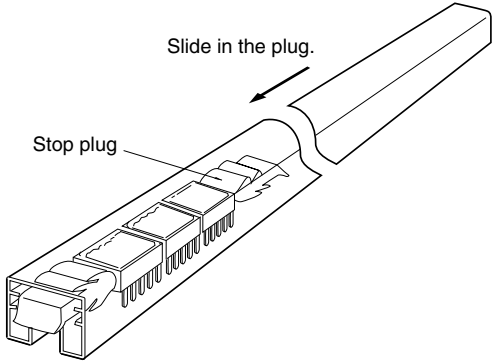
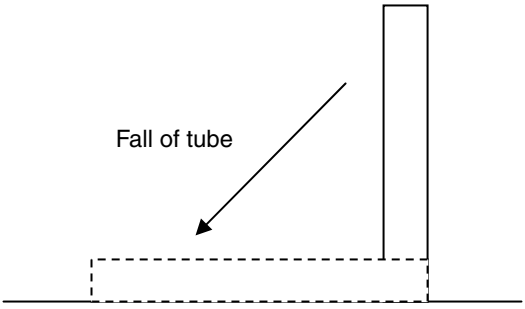
For other solder methods except for the above (such as hot air heating, hot plate heating, laser heating, pulse heating, etc.), please check for mounting and soldering condition before use. It is recommended that the soldered pad be immediately cooled to prevent thermal damage to the relay and its associated 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.

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16. Storage, transportation	1. Transportation	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.
	2. Storage	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.
17. Product handling	1. Tube packing	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.  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. 
	2. Cautions after relay mounting	If PC boards are processed after relays have been mounted on the board, it is possible that swarf or other foreign matter resulting from machining or other processes may get inside the relays and cause malfunctions or contact failure. Pay particular attention if using flux tight relays or relays with vent hole. In addition, take care to avoid vibrations and shocks during PC board processing that may affect the characteristics and structural integrity of the relay.

18. Reliability

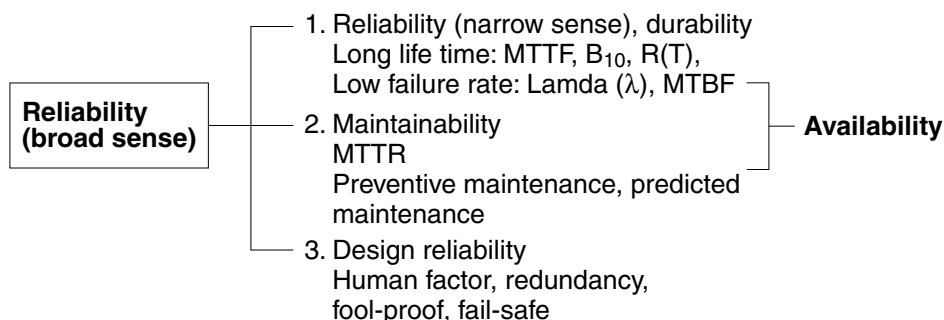
[1] What is Reliability?

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 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.



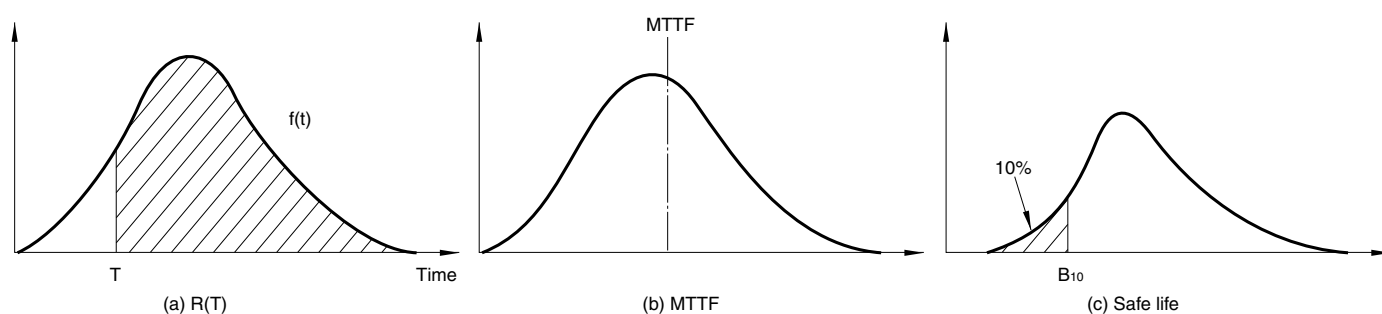
3. Intrinsic Reliability and Reliability of Use

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 lambda	20 fit, 1%/hour
Safe life B_{10}	50 hours



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

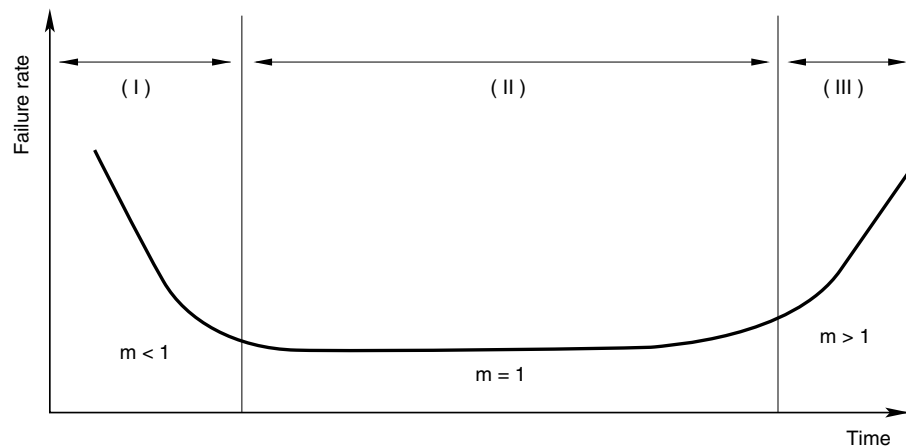
The high failure rate in the initial failure period is derived from latent design errors, process errors, and many other causes. This process is called debugging, performing aging or screening in order to find out initial failures.

(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:

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

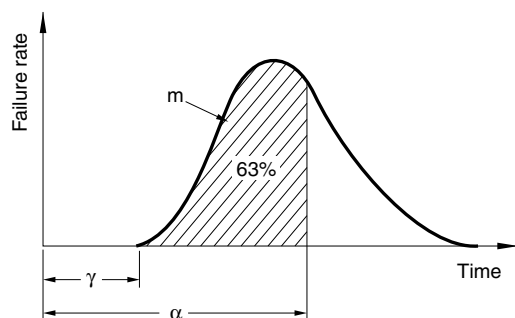
where

m : Figure parameter

α : Measurement parameter

γ : Position 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:

- (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 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 dielectric strength between contacts in each pole when high voltage is applied to a twin relay?	4-24
	☐	Is dry switching occurring?	4-25
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 continuously 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

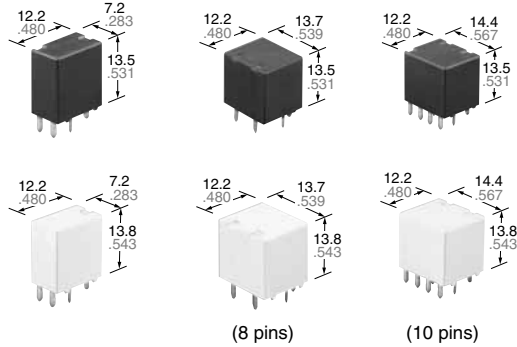
Automotive Relay Users Guide

Category	Check box	Check item	Refer to the following 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?	10-1
Use environmental condition	☐	Is temperature, humidity, atmosphere 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 silicone?	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 mounted on PC board?	12-5, 12-6
	☐	Isn't there a risk of icing 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
	☐	Has there been any warping of the PC board? Force applied on the relay terminals may change the relay characteristics.	15-1, 15-2
	☐	Isn't the unused terminal cut? (Applied force on terminal can change the characteristics.)	12-5, 15-1, 15-2
	☐	Has the relay been applied to ultrasonic vibration during processing?	12-5, 15-1, 15-2
	☐	Is soldering carried out in proper conditions? (temperature duration, etc.)	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 atmosphere free from organic gas and sulfidizing gas?	16-2
Product handling	☐	Aren't dropped or fallen tube packages used?	17-1
	☐	Are processing of PC board or other procedures carried out after relay mounting? If so, are the relays subject to vibration or shock?	12-5, 17-2

Compact Slim Twin and Single Type Automotive Relay

CJ RELAYS

<Protective construction>
Standard type: Sealed
Pin in Paste compliant type: Flux tight



(Unit: mm inch)

RoHS compliant

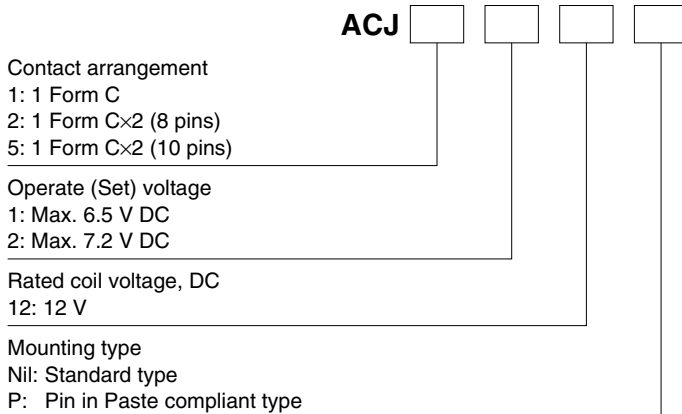
FEATURES

- It is extremely compact at approx. 2/3 the size of previous CT relay.
- Compact and high-capacity 25 A load switching
- Pin in Paste compliant model added

TYPICAL APPLICATIONS

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

ORDERING INFORMATION



TYPES

Contact arrangement	Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Part No.		Packing	
			Standard type	Pin in Paste compliant type	Carton (tube)	Case
1 Form C	12 V DC	Max.6.5 V DC	ACJ1112	ACJ1112P	70 pcs.	2,800 pcs.
		Max.7.2 V DC	ACJ1212	ACJ1212P		
1 Form C × 2 (8 pins)		Max.6.5 V DC	ACJ2112	ACJ2112P	40 pcs.	1,000 pcs.
		Max.7.2 V DC	ACJ2212	ACJ2212P		
1 Form C × 2 (10 pins)		Max.6.5 V DC	ACJ5112	ACJ5112P	35 pcs.	1,400 pcs.
		Max.7.2 V DC	ACJ5212	ACJ5212P		

RATING

1. Coil data

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

Note: *Other usable voltage range types are also available. Please inquire our sales representative for details.

2. Specifications

Item		Specifications
Contact data	Contact arrangement	1 Form C, 1 Form C×2
	Contact resistance (initial)	Max. 50mΩ (N.O.: Typ. 7mΩ, N.C.: Typ. 10mΩ) (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	N.O. side: 20A 14V DC, N.C. side: 10A 14V DC
	Max. carrying current*1	N.O. side: 20 A for 1 hour, 30 A for 2 minutes (Coil applied voltage 14 V DC at 20°C 68°F)
	Min. switching load (resistive)*2	1A 14V DC (at 20°C 68°F)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at Rated voltage)	Max. 10ms (at 20°C 68°F, without bounce time)
	Release (Reset) time (at Rated voltage)	Max. 10ms (at 20°C 68°F, without bounce time) (without diode)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 100 Hz, Min. 44.1m/s ² {approx. 4.5G} (detection time: 10μs)
	Destructive	10 to 500 Hz, Min. 44.1m/s ² {approx. 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 rated 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 compliant type] <Resistive load> Min. 10 ⁵ (at rated 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 usage, transport and storage*3	Ambient temperature: -40 to +85°C -40 to +185°F Humidity: 5 to 85% R.H. (Please avoid icing or condensation)
Weight		1 Form C type: approx. 3.5 g .12 oz, Twin type: approx. 6.5 g .23 oz

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

*2. 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.

*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

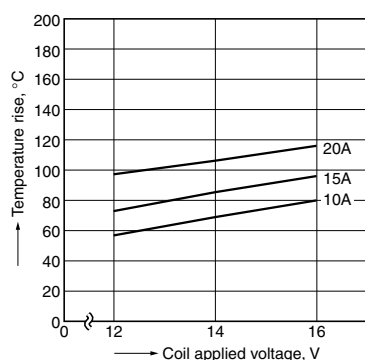
Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).

* 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 our sales representative when using with a circuit that causes an energized condition on both sides simultaneously.

REFERENCE DATA

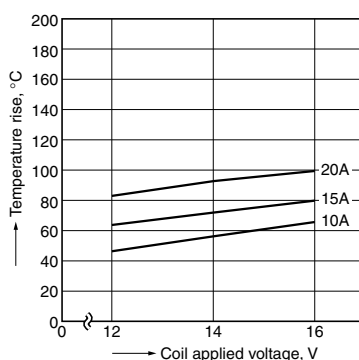
1.-(1) Coil temperature rise (at room temperature)

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



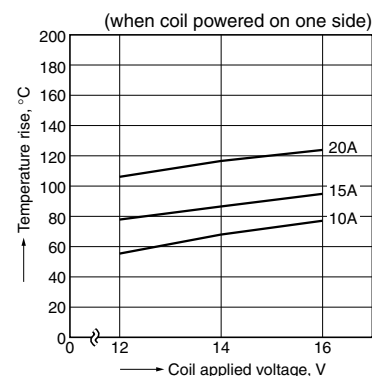
1.-(2) Coil temperature rise (at 85°C 185°F)

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



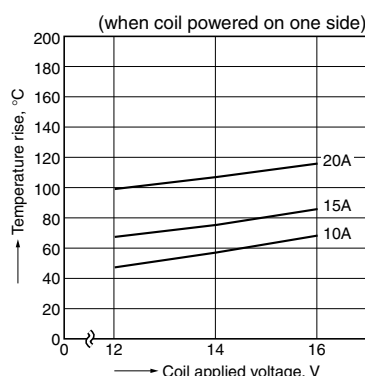
1.-(3) Coil temperature rise (at room temperature)

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



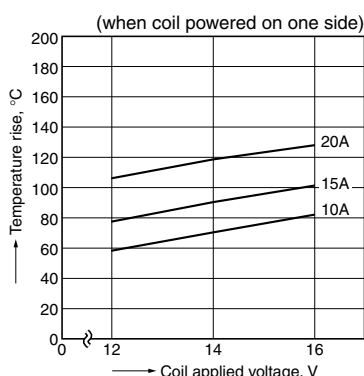
1.-(4) Coil temperature rise (at 85°C 185°F)

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



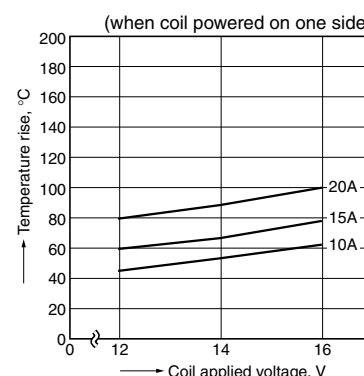
1.-(5) Coil temperature rise (at room temperature)

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

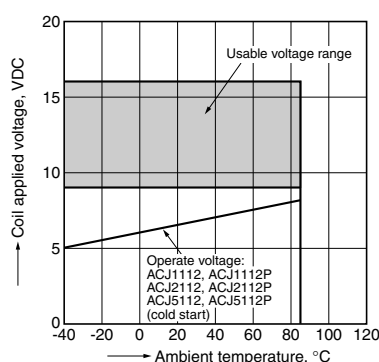


1.-(6) Coil temperature rise (at 85°C 185°F)

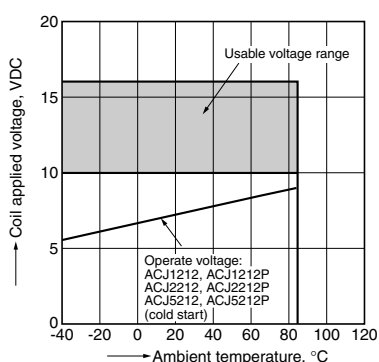
Sample: ACJ5212, 3pcs
Measured portion: Inside the coil
Carrying current: 10A, 15A, 20A
Ambient temperature: 85°C 185°F



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

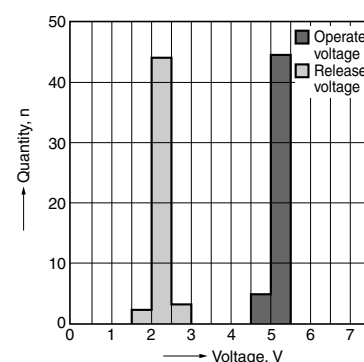


2.-(2) Ambient temperature and usable voltage range



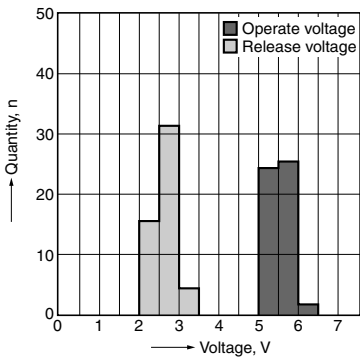
3.-(1) Distribution of operate (set) and release (reset) voltage

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



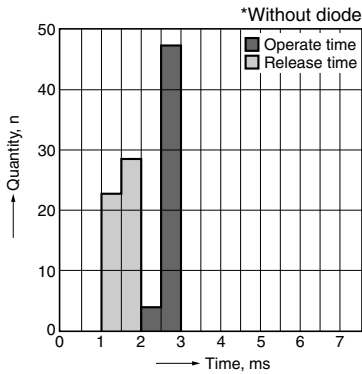
3.-(2) Distribution of operate (set) and release (reset) voltage

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



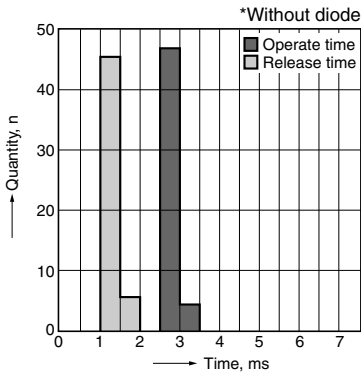
4.-(1) Distribution of operate (set) and release (reset) time

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



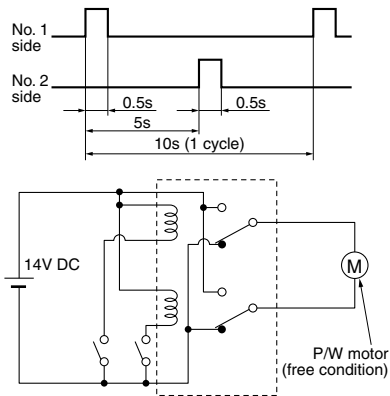
4.-(2) Distribution of operate (set) and release (reset) time

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

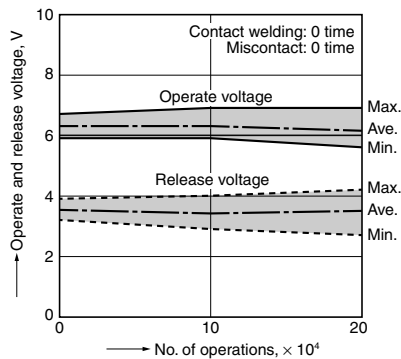


5.-(1) Electrical life test (Motor free)

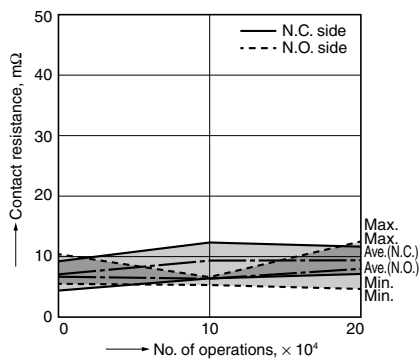
Sample: ACJ2212, 3pcs
Load: Inrush current: 25A, Steady current: 5A,
Power window motor actual load (free condition)
Tested voltage: 14V DC
Switching frequency: ON 0.5s, OFF 9.5s
Switching cycle: 2×10⁵
Ambient temperature: Room temperature
Circuit:



Change of operate (set) and release (reset) voltage

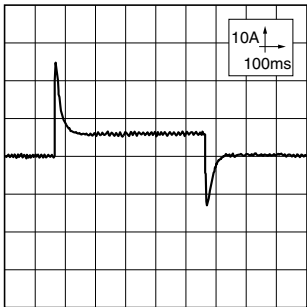


Change of contact resistance



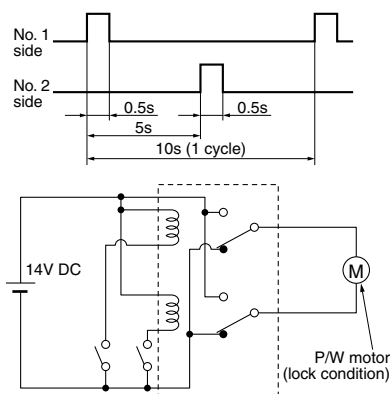
Load current waveform

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

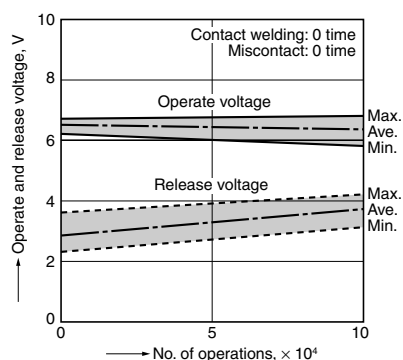


5.-(2) Electrical life test (Motor lock)

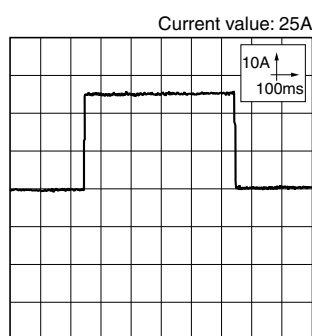
Sample: ACJ2212, 3pcs
 Load: Steady current: 25A, Power window motor
 actual load (lock condition)
 Tested voltage: 14V DC
 Switching frequency: ON 0.5s, OFF 9.5s
 Switching cycle: 10⁵
 Ambient temperature: Room temperature
 Circuit:



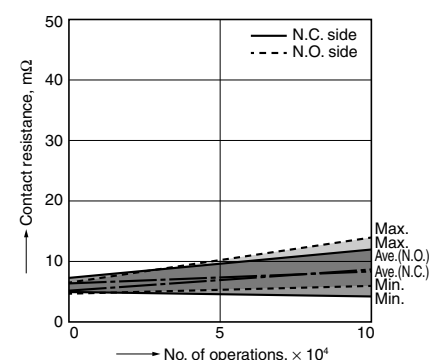
Change of operate (set) and release (reset) voltage



Load current waveform



Change of contact resistance



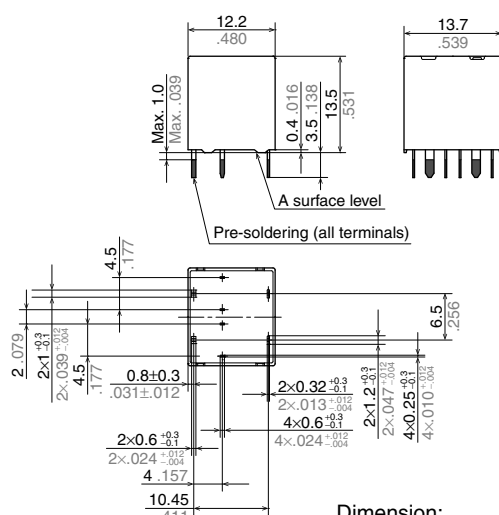
DIMENSIONS (mm inch)

1. Twin type (8-pin)
Standard type

CAD



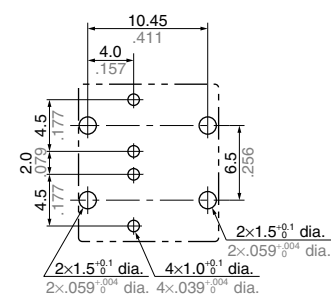
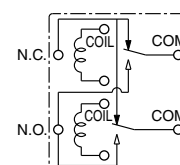
External dimensions



Dimension:
 Max. 1mm .039 inch:
 1 to 3mm .039 to .118 inch:
 Min. 3mm .118 inch:

Tolerance
 $\pm 0.1 \pm .004$
 $\pm 0.2 \pm .008$
 $\pm 0.3 \pm .012$

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

PC board pattern
(Bottom view)Tolerance: $\pm 0.1 \pm .004$ Schematic
(Bottom view)

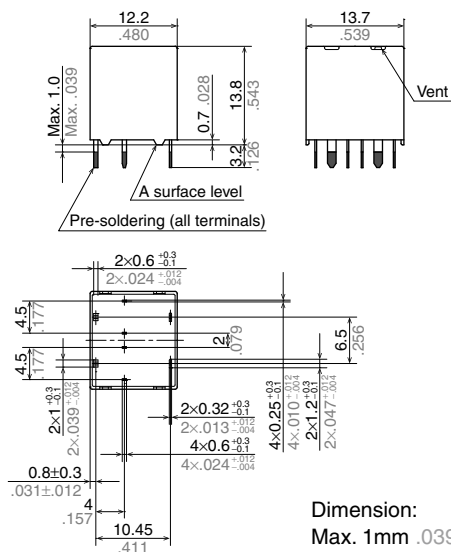
2. Twin type (8-pin)

Pin in Paste compliant type

CAD

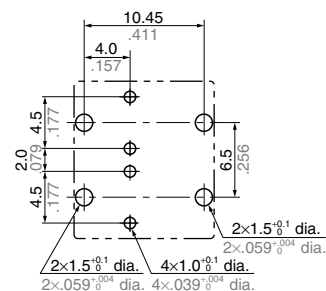


External dimensions



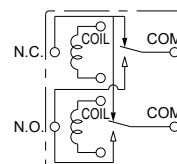
Dimension:	Tolerance
Max. 1mm .039 inch:	$\pm 0.1 \pm .004$
1 to 3mm .039 to .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



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

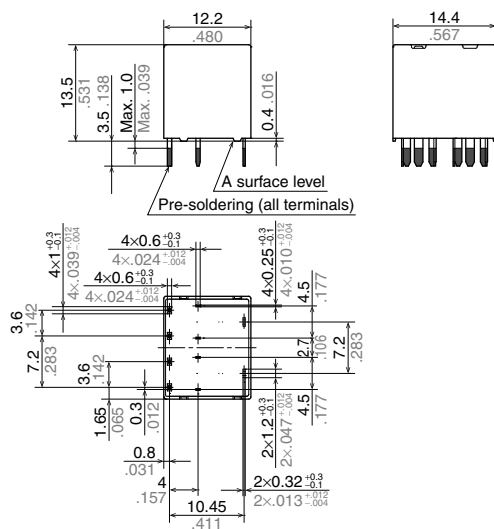
3. Twin type (10-pin)

Standard type

CAD

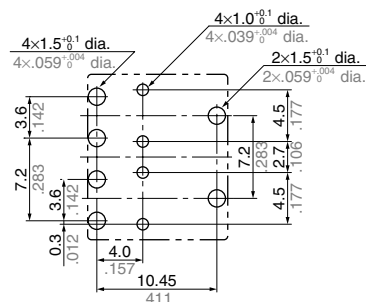


External dimensions



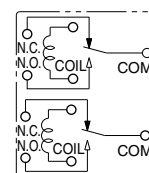
Dimension:	Tolerance
Max. 1mm .039 inch:	$\pm 0.1 \pm .004$
1 to 3mm .039 to .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



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

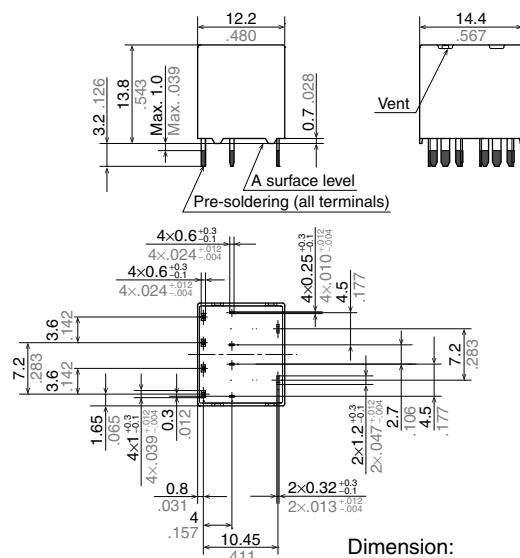
4. Twin type (10-pin)

Pin in Paste compliant type

CAD

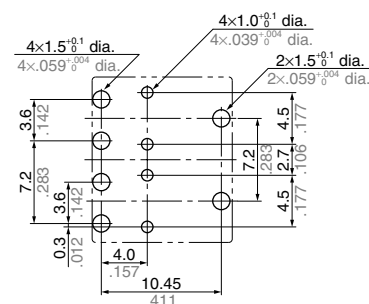


External dimensions



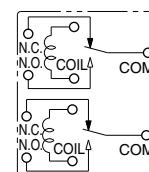
Dimension:	Tolerance
Max. 1mm .039 inch:	$\pm 0.1 \pm .004$
1 to 3mm .039 to .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

PC board pattern
(Bottom view)



Tolerance: ± 0.1 $\pm .004$

Schematic
(Bottom view)



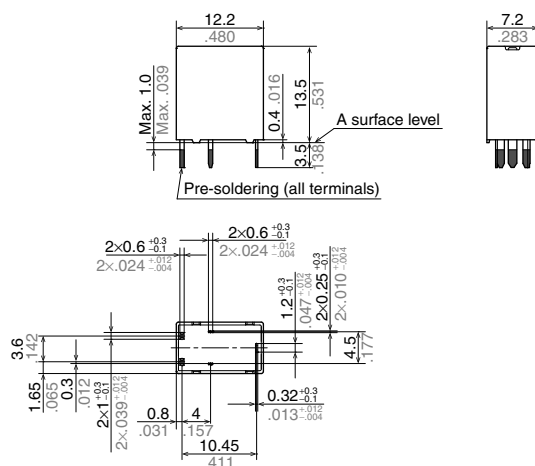
* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

5. Slim 1 Form C Standard type

CAD

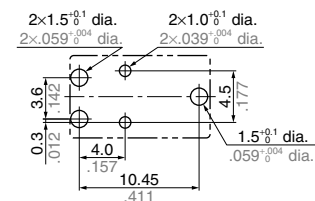


External dimensions



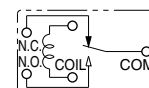
Dimension:	Tolerance
Max. 1mm .039 inch:	$\pm 0.1 \pm .004$
1 to 3mm .039 to .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

PC board pattern
(Bottom view)



Tolerance: ± 0.1 $\pm .004$

Schematic
(Bottom view)



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

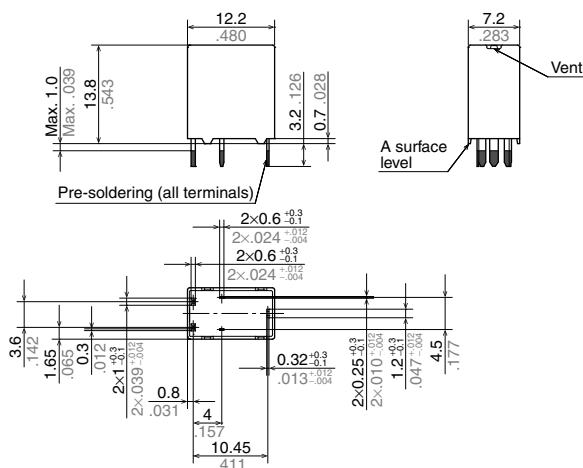
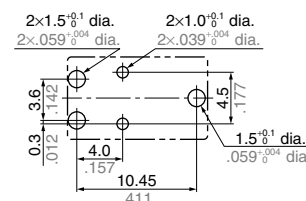
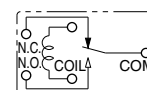
6. Slim 1 Form C

Pin in Paste compliant type

CAD



External dimensions

PC board pattern
(Bottom view)Tolerance: $\pm 0.1 \pm .004$ Schematic
(Bottom view)

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

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

NOTES

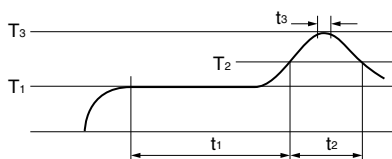
Mounting and cleaning conditions for Pin-in-Paste type

When soldering this relay, please observe the following conditions.

[I.R.S. method (recommended)]

(Recommended number of reflows: 1)

t_1 = 60 to 120 sec.
 t_2 = Less than 30 sec.
 t_3 = Less than 5 sec.
 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



• Cautions for mounting

1. The temperature profile shows the temperature at the soldering portion on the PCB surface.
2. Depending on the mounting density condition, reflow heating method, and PCB type (metal etc.), the relay's exterior and interior temperature may become extremely high.

Therefore, please confirm well under the actual use condition before use.

The other cautions of reflow soldering:

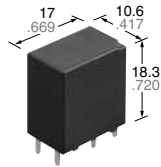
1. When soldering condition is out of recommendation, the relay performance may be adversely affected.
If soldering conditions are out of our recommendation, please contact us before operation.
2. Please check the effect at the actual soldering because heat stress to relay is changed by PCB type and manufacturing process condition.
3. Solder creepage, wettability or soldering strength will be affected by the mounting condition or soldering material.
Please check the actual production condition in detail.
4. Do not wash the relay as failures may occur.
5. This product is not plastic sealed type. Please perform coating with sufficient attention to avoid infiltration of the solvent to the inside. Also, please pay careful attention to use and store them with no contamination of foreign material.

For general cautions for use, please refer to the "Automotive Relay Users Guide".

High Load Relay for Smart J/B

CN-H RELAYS

<Protective construction>
Sealed



(Unit: mm inch)

RoHS compliant

FEATURES

- Space saving most suitable for smart J/B
- Large capacity switching despite small size. Can replace micro ISO terminal type relays.
- Terminals for PC board pattern designs are easily allocated.

TYPICAL APPLICATIONS

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

ORDERING INFORMATION

ACNH

Contact arrangement
3: 1 Form A

Operate (Set) voltage
1: Max. 5.5V DC
2: Max. 6.5V DC

Rated coil voltage (DC)
12: 12V

TYPES

Contact arrangement	Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Part No.	Packing	
				Carton (tube)	Case
1 Form A	12V DC	Max. 6.5 V DC	ACNH3212	50 pcs.	1,000 pcs.
		Max. 5.5 V DC	ACNH3112		

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12 V DC	Max. 6.5 V DC	Min. 1.0 V DC	37.5 mA	320Ω	450 mW	10 to 16 V DC
	Max. 5.5 V DC	Min. 0.8 V DC	53.3 mA	225Ω	640 mW	

2. Specifications

Item		Specifications
Contact data	Contact arrangement	1 Form A
	Contact resistance (initial)	Max. 30mΩ (Typ. 5mΩ) (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	30A 14V DC
	Max. carrying current*1	<450mW> 35A/1 hour, 45A/2 min. (Coil applied voltage 16V DC, at 20°C 68°F) 30A/1 hour, 40A/2 min. (Coil applied voltage 16V DC, at 85°C 185°F) 25A/1 hour, 35A/2 min. (Coil applied voltage 16V DC, at 110°C 230°F) <640mW> 30A/1 hour, 40A/2 min. (Coil applied voltage 16V DC, at 20°C 68°F) 25A/1 hour, 35A/2 min. (Coil applied voltage 16V DC, at 85°C 185°F) 20A/1 hour, 30A/2 min. (Coil applied voltage 16V DC, 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
	Min. switching load (resistive)*2	1A 14V DC (at 20°C 68°F)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at Rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time)
	Release (Reset) time (at Rated voltage)	Max. 10ms (at 20°C 68°F) (without diode)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 100 Hz, Min. 44.1m/s ² {approx. 4.5G} (Detection time: 10μs)
	Destructive	10 to 500 Hz, Min. 44.1m/s ² {approx. 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 rated switching capacity, operating frequency: 1s ON, 1s OFF)
		<Motor load> Min. 3×10 ⁵ (motor free) (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 usage, transport and storage*3	Ambient temperature: -40 to +110°C -40 to +230°F Humidity: 2 to 85% R.H. (Please avoid icing or condensation)
Weight		Approx. 9 g .32 oz

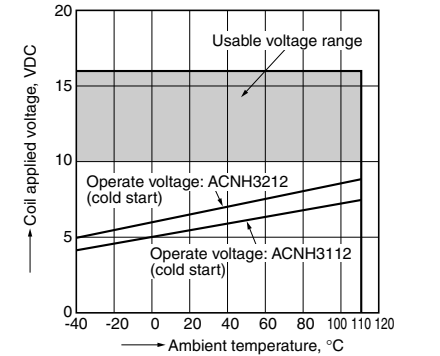
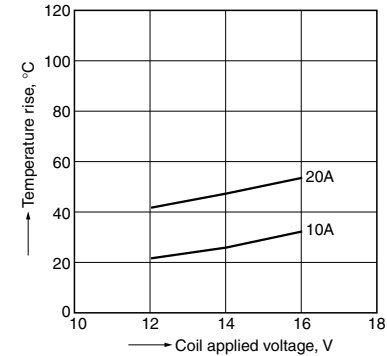
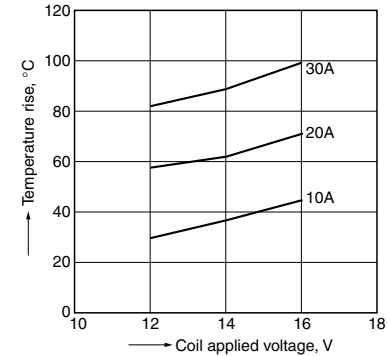
Notes: *1. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
*2. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended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

REFERENCE DATA

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

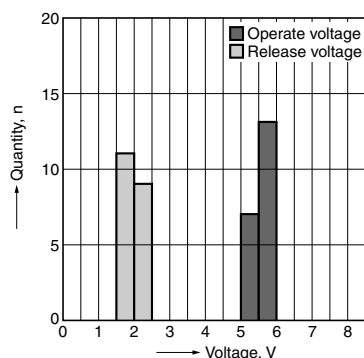
1-(2). Coil temperature rise (at 110°C 230°F)
Sample: ACNH3212, 3pcs
Measured portion: Inside the coil
Carrying current: 10A, 20A
Ambient temperature: 110°C 230°F

2. Ambient temperature and usable voltage range



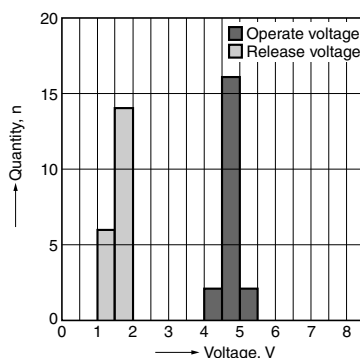
3-(1). Distribution of operate (set) and release (reset) voltage

Sample: ACNH3212, 20pcs.



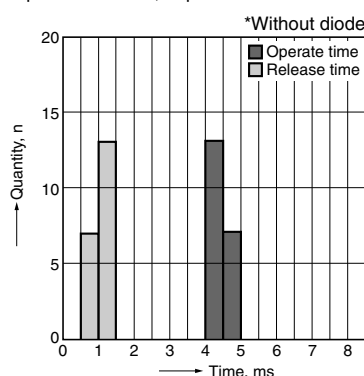
3-(2). Distribution of operate (set) and release (reset) voltage

Sample: ACNH3112, 20pcs.



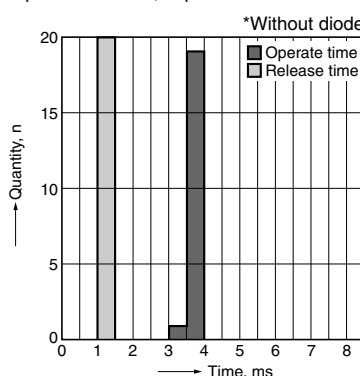
4-(1). Distribution of operate (set) and release (reset) time

Sample: ACNH3212, 20pcs.



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

Sample: ACNH3112, 20pcs.

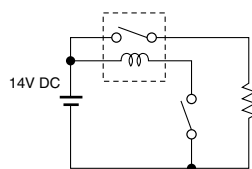


5-(1). Electrical life test (Resistive load)

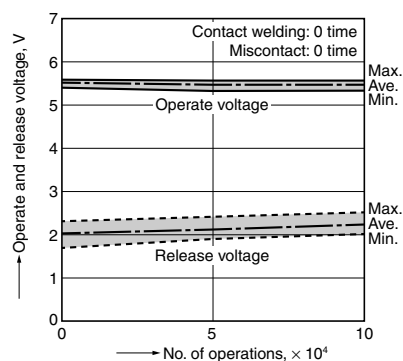
Sample: ACNH3212, 6pcs.

Load: Resistive load: 30A 14V DC
Operating frequency: ON 1s, OFF 1s
Ambient temperature: Room temperature

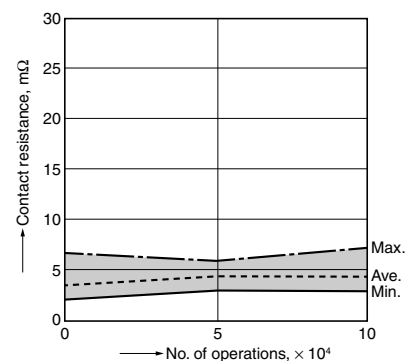
Circuit:



Change of operate (set) and release (reset) voltage



Change of contact resistance

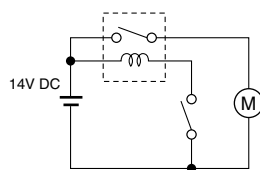


5-(2). Electrical life test (Motor load)

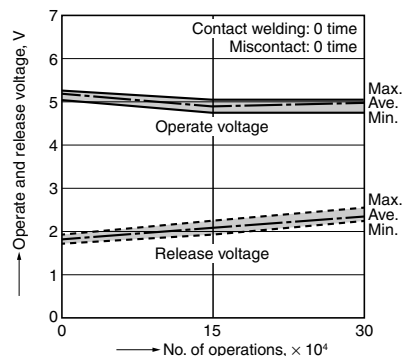
Sample: ACNH3212, 3pcs.

Load: inrush: 84A, steady: 18A,
radiator fan actual load (motor free)
Operating frequency: ON 2s, OFF 5s
Ambient temperature: 110°C 230°F

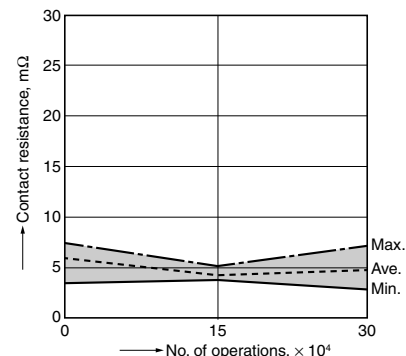
Circuit:



Change of operate (set) and release (reset) voltage

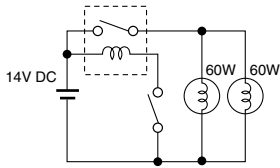


Change of contact resistance

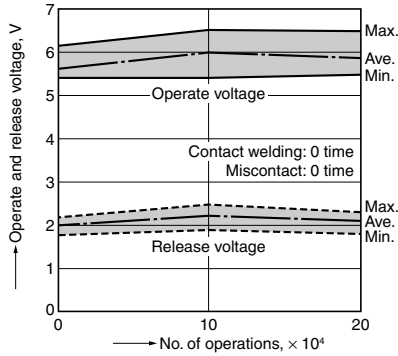


5-(3). Electrical life test (Lamp load)
Sample: ACNH3212, 6pcs.
Load: 60W×2, inrush: 84A, steady: 12A
Operating frequency: ON 1s, OFF 14s
Ambient temperature: Room temperature

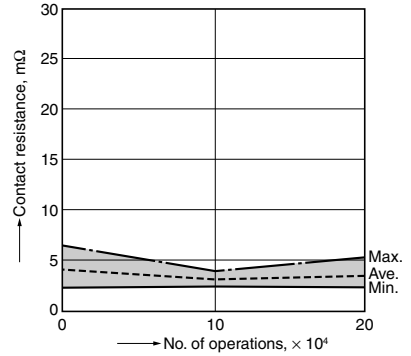
Circuit:



Change of operate (set) and release (reset) voltage



Change of contact resistance

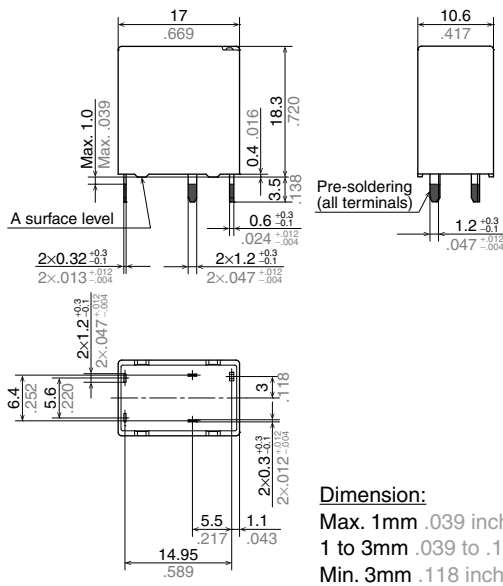


DIMENSIONS (mm inch)

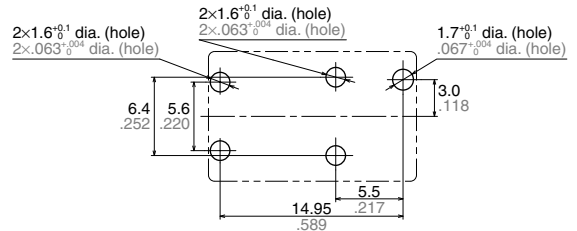
The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

CAD

External dimensions

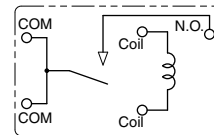


PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm 0.004$

Schematic (Bottom view)



Dimension:	Tolerance
Max. 1mm .039 inch:	$\pm 0.1 \pm 0.004$
1 to 3mm .039 to .118 inch:	$\pm 0.2 \pm 0.008$
Min. 3mm .118 inch:	$\pm 0.3 \pm 0.012$

* 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 air pressure during usage, transport, and storage of the relay:

(1) Temperature:

−40 to +110°C −40 to +230°F

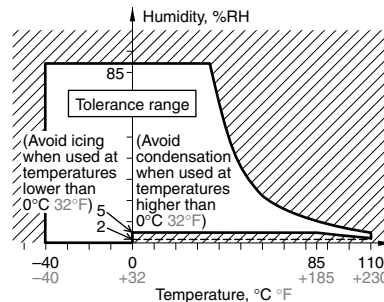
(2) Humidity: 2 to 85% RH

(Avoid icing and condensation.)

(3) Air 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)

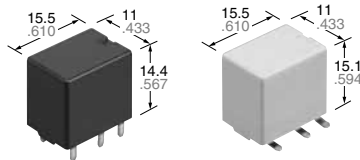


For general cautions for use, please refer to the “Automotive Relay Users Guide”.

Middle Load Relay for Smart J/B

CN-M RELAYS

<Protective construction>
Sealed



(Unit: mm inch)

RoHS compliant

FEATURES

- Space saving most suitable for smart J/B
- 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

Operate (Set) voltage

- 1: Max. 7.2V DC

Rated coil voltage (DC)

- 12: 12V

Terminal shape

- Nil: PC board terminal type
SA: Surface-mount terminal type

Packing style*2

- Nil: Tube packing
X: Tape and reel packing
(Reverse N.O. terminal direction in pull-out direction)
Z: Tape and reel packing
(Normal N.O. 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	Rated coil voltage	Part No.		Packing	
		Standard type	High heat-resistant type	Carton (tube)	Case
1 Form A	12V DC	ACNM3112	ACNM7112	50 pcs.	1,500 pcs.
1 Form C		ACNM1112	ACNM5112		

2. Surface-mount terminal type

Contact arrangement	Rated coil voltage	Part No.	Packing	
		High heat-resistant type	Carton (tube)	Case
1 Form A	12V DC	ACNM7112SAX	200 pcs.	600 pcs.
		ACNM7112SAZ		
1 Form C		ACNM5112SAX		
		ACNM5112SAZ		

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 N.O. terminal direction in pull-out direction.

A "Z" at the end of the part number indicates, for tape and reel packing, normal N.O. terminal direction in pull-out direction.

Tape and reel packing symbol "z" or "x" are not marked on the relay.

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12 V DC	Max. 7.2 V DC	Min. 1.0 V DC	53.3 mA	225Ω	640 mW	10 to 16 V DC

2. Specifications

Item		Specifications
Contact data	Contact arrangement	1 Form A, 1 Form C
	Contact resistance (initial)	Max. 30mΩ (Typ. 5mΩ) (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	N.O. side: 30A 14V DC, N.C. side: 15A 14V DC
	Max. carrying current*1	N.O. side 30A/1 hour, 40A/2 min. (Coil applied voltage 16V DC, at 20°C 68°F) 25A/1 hour, 35A/2 min. (Coil applied voltage 16V DC, at 85°C 185°F) 20A/1 hour, 30A/2 min. (Coil applied voltage 16V DC, at 110°C 230°F) (High heat-resistant type)
	Min. switching load (resistive)*2	1A 14V DC (at 20°C 68°F)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (Initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at Rated voltage)	Max. 10ms (at 20°C 68°F, without bounce time)
	Release (Reset) time (at Rated voltage)	Max. 10ms (at 20°C 68°F, without bounce time) (without diode)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 100 Hz, Min. 44.1m/s ² {approx. 4.5G} (Detection time: 10μs)
	Destructive	10 to 500 Hz, Min. 44.1m/s ² {approx. 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 rated switching capacity, operating frequency: ON 1s, OFF 9s) <Motor load> Min. 2×10 ⁵ (motor free): at 80 A (inrush), 16 A (steady), 14 V DC (Operating frequency: ON 2s, OFF 6s) <Lamp load> Min. 10 ⁵ : at 84 A (inrush), 12 A (steady), 14 V DC (Operating frequency: ON 1s, OFF 14s)
Conditions	Conditions for usage, transport and storage*3	Standard type; Ambient temperature: -40 to +85°C -40 to +185°F, Humidity: 5 to 85% R.H. High heat-resistant type; Ambient temperature: -40 to +110°C -40 to +230°F, Humidity: 2 to 85% R.H. (Please avoid icing or condensation)
Weight		Approx. 5.5 g .19 oz

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

*2. 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.

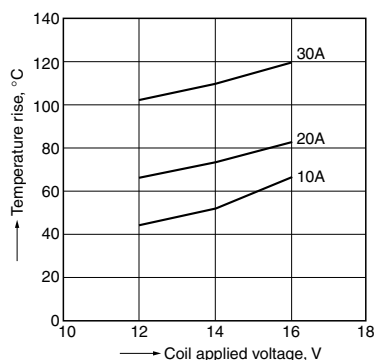
*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).

REFERENCE DATA

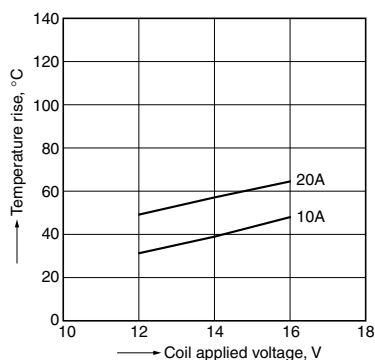
1-(1). Coil temperature rise (at room temperature)

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

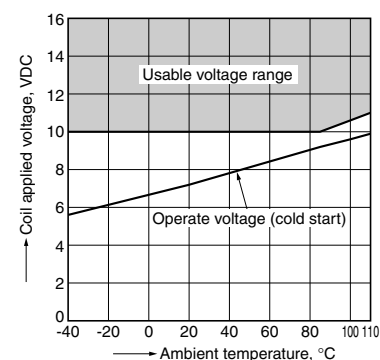


1-(2). Coil temperature rise (at 110°C 230°F)

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

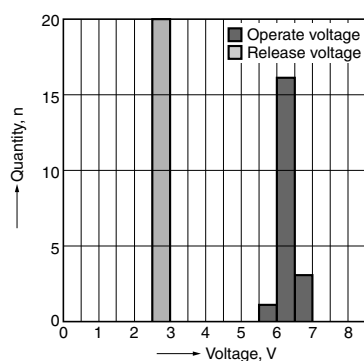


2. Ambient temperature and usable voltage range



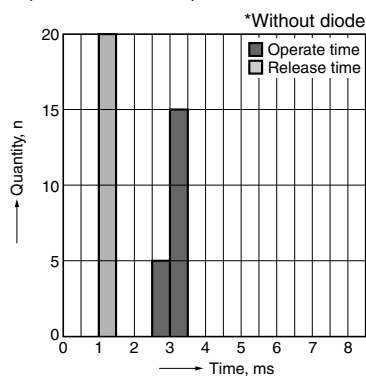
3. Distribution of operate (set) and release (reset) voltage

Sample: ACNM1112, 20pcs.



4. Distribution of operate (set) and release (reset) time

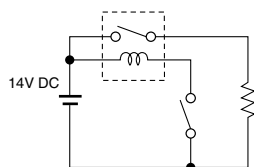
Sample: ACNM1112, 20pcs.



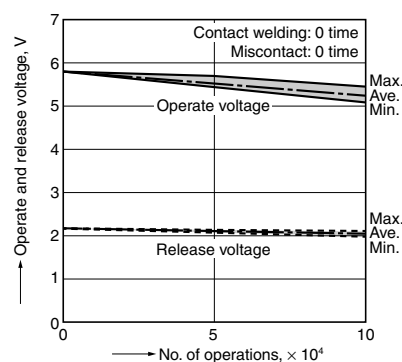
5-(1). Electrical life test (Resistive load)

Sample: ACNM1112, 3pcs.
Load: Resistive load (N.O. side: 30A 14V DC)
Operating frequency: ON 1s, OFF 9s
Ambient temperature: Room temperature

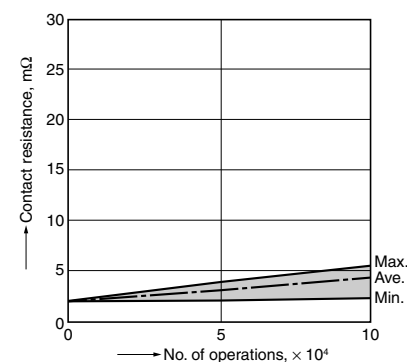
Circuit:



Change of operate (set) and release (reset) voltage



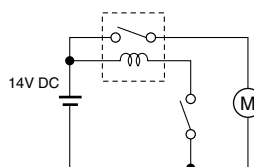
Change of contact resistance



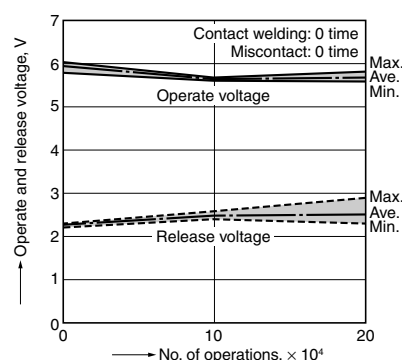
5-(2). Electrical life test (Motor load)

Sample: ACNM7112, 3pcs.
Load: inrush: 80A/steady: 16A (motor free)
Operating frequency: ON 2s, OFF 6s
Ambient temperature: 110°C 230°F

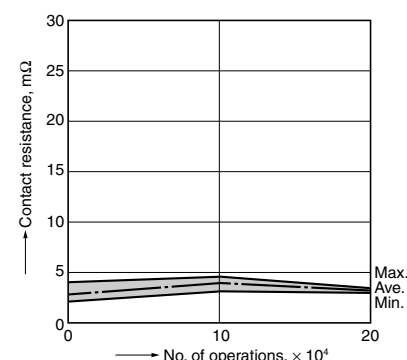
Circuit:



Change of operate (set) and release (reset) voltage



Change of contact resistance



CN-M (ACNM)

5-(3). Electrical life test (Lamp load)

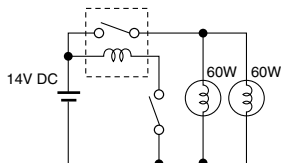
Sample: ACNM3112, 3pcs.

Load: Inrush: 84A/steady: 12A

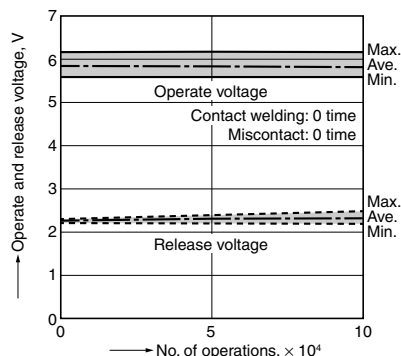
Operating frequency: ON 1s, OFF 14s

Ambient temperature: Room temperature

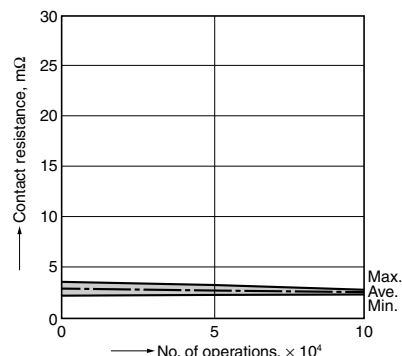
Circuit:



Change of operate (set) and release (reset) voltage



Change of contact resistance



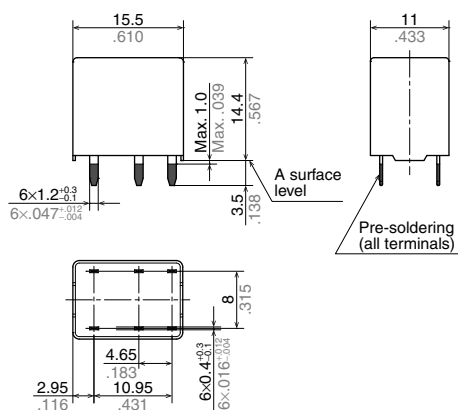
DIMENSIONS (mm inch)

The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

1. PC board terminal type

CAD

External dimensions

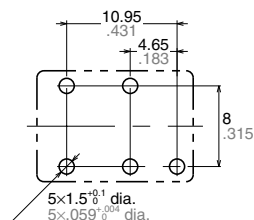


Dimension:	Tolerance
Max. 1mm .039 inch:	$\pm 0.1 \pm 0.004$
1 to 3mm .039 to .118 inch:	$\pm 0.2 \pm 0.008$
Min. 3mm .118 inch:	$\pm 0.3 \pm 0.012$

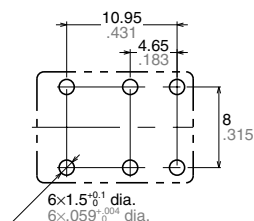
* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern
(Bottom view)

1 Form A



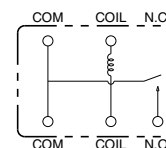
1 Form C



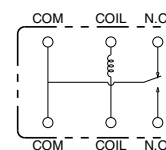
Tolerance: $\pm 0.1 \pm 0.004$

Schematic
(Bottom view)

1 Form A



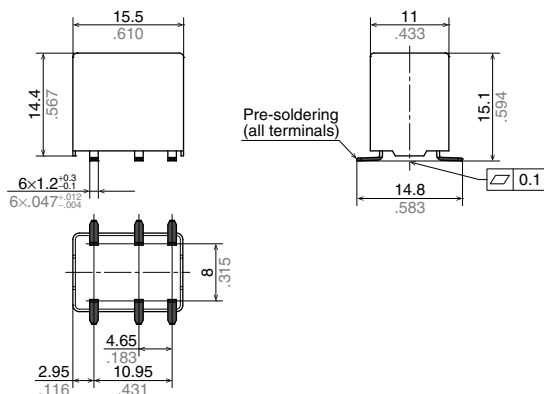
1 Form C



2. Surface-mount terminal type

CAD

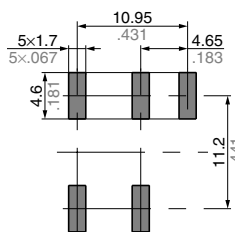
External dimensions



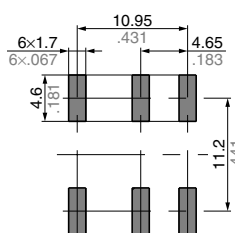
Dimension:	Tolerance
Max. 1mm .039 inch:	$\pm 0.1 \pm 0.004$
1 to 3mm .039 to .118 inch:	$\pm 0.2 \pm 0.008$
Min. 3mm .118 inch:	$\pm 0.3 \pm 0.012$

Recommended mounting pad
(Top view)

1 Form A



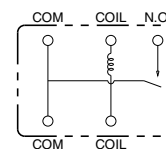
1 Form C



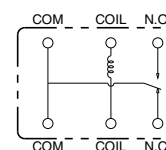
Tolerance: $\pm 0.1 \pm 0.004$

Schematic
(Top view)

1 Form A



1 Form C



NOTES

1. Usage, transport and storage conditions

1) Ambient temperature, humidity, and air 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:

5 to 85% RH (Standard type)

2 to 85% RH (High heat-resistant type)

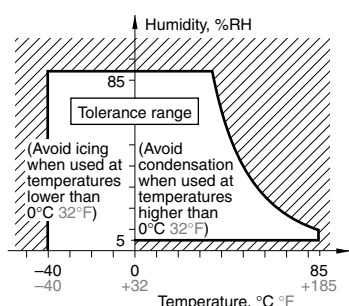
(Avoid icing and condensation.)

(3) Air pressure: 86 to 106 kPa

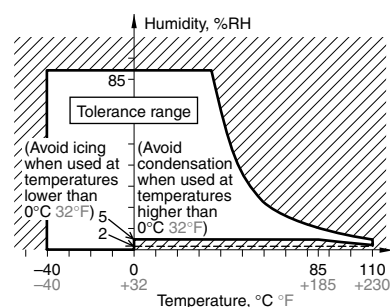
The humidity range varies with the temperature. Use within the range indicated in the graph below.

[Temperature and humidity range for usage, transport, and storage]

Standard type



High heat-resistant type



2. Storage condition after opening a moisture-prevention package

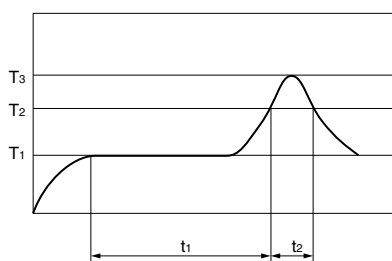
(1) After opening a moisture-prevention package, use the item as soon as possible (within 3 days under an environment of Max. 30°C 86°F, Max. 70% RH).

(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

When soldering this relay, please observe the following conditions.

(Recommended conditions: Number of reflows: 1, Measurement location: terminal temperature)



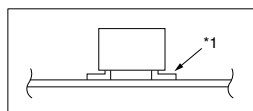
T₁ = 150 to 180°C 302 to 356°F

T₂ = 230°C 446°F or more

T₃ = Less than 250°C 482°F

t₁ = 60 to 120 sec.

t₂ = Less than 30 sec.



Temperature profile indicates the temperature of the soldered part (Note 1) of terminals on the surface of the PC board, however, for other areas such as the surface of relay case, make a setting so that you do not exceed the recommended conditions.

*The temperature of the relay exterior and interior may be extremely high depending on the component density on the board, the heating method of the reflow oven or circuit board type.

Other cautions during reflow soldering

(1) Reflow performance may be affected if you carry out soldering in a way that exceeds the recommended conditions. If you need to exceed the recommended conditions when soldering, please inquire our sales representative before using in an application.

(2) Please confirm the heat stress of relay by using actual board because it may be changed by board condition or manufacturing process condition.

(3) Solder creepage, wettability, or soldering strength will be affected by the changing of soldering condition or used solder type. Please check them under the actual production condition in detail.

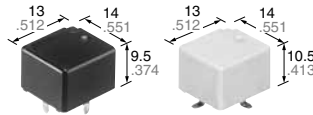
(4) Avoid cleaning (ultrasonic cleaning, boiling cleaning, etc.) and coating in order to prevent negative impacts on relay characteristics.

For general cautions for use, please refer to the “Automotive Relay Users Guide”.

Compact Flat Size Relay for Automotive

CP RELAYS

<Protective construction>
Sealed



(Unit: mm inch)

RoHS compliant

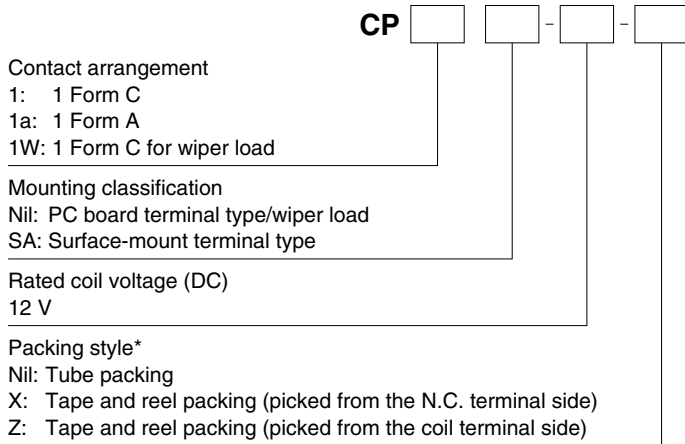
FEATURES

- Compact flat type
<Height> PC board terminal type: 9.5 mm .374 inch
- Compact and High capacity (25A) continuous current (at 20°C 68°F)
- Simple footprint pattern enables ease of PC board layout
- “PC board terminal” and “Surface mount terminal” types available
- Model available for wiper load.

TYPICAL APPLICATIONS

- Powered windows, Automatic door locks, Powered sunroof, Memory seat, Wiper, Defogger, etc.

ORDERING INFORMATION



Note: * Surface mount terminal type is only supplied in tape and reel packaging. Tube packaging is only available for PC board type.

TYPES

1. PC board terminal type

Contact arrangement	Rated coil voltage	Type No.	Packing	
			Carton (tube)	Case
1 Form A	12V DC	CP1a-12V	40 pcs.	1,000 pcs.
1 Form C		CP1-12V		
1 Form C for wiper load		CP1W-12V		

2. Surface mount terminal type

Contact arrangement	Rated coil voltage	Type No.	Packing	
			Carton (tape and reel)	Case
1 Form C	12V DC	CP1SA-12V-X	300 pcs.	900 pcs.
		CP1SA-12V-Z		

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.

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range (at 85°C 185°F)
12V DC	Max. 7.2V DC	Min. 1.0V DC	53.3 mA	225Ω	640 mW	10 to 16V DC

Note: Other operate (set) voltage types are also available. Please inquire our sales representative for details.

2. Specifications

1) Standard CP relay

Item		Specifications
Contact data	Contact arrangement	1 Form A, 1 Form C
	Contact resistance (initial)	Max. 100mΩ (N.O.: Typ. 6mΩ, N.C.: Typ. 8mΩ) (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	N.O. side: 20A 14V DC, N.C. side: 10A 14V DC
	Max. carrying current (initial)*1 *4	N.O. side: 40A for 2 minutes, 30A for 1 hour (Coil applied voltage 12 V DC, at 20°C 68°F) 35A for 2 minutes, 25A for 1 hour (Coil applied voltage 12 V DC, at 85°C 185°F)
	Min. switching load (resistive)*2	1A 14V DC (at 20°C 68°F)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as “Dielectric strength” section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at Rated voltage)	Max. 10ms (at 20°C 68°F, without bounce time)
	Release (Reset) time (at Rated voltage)	Max. 10ms (at 20°C 68°F, without bounce time) (without diode)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 100 Hz, Min. 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)
	Destructive	10 to 500 Hz, Min. 44.1 m/s ² {approx. 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 rated switching capacity, operating frequency: 1s ON, 9s OFF) <Motor load> Min. 2×10 ⁵ (N.O. side, Inrush 25A, steady 5A at 14V DC) Min. 10 ⁵ (N.O. side, 20A 14V DC at motor lock) Min. 2×10 ⁵ (N.C. side, 20A 14V DC at brake current) (Operating frequency: 0.5s ON, 9.5s OFF)
Conditions	Conditions for usage, transport and storage*3	Ambient temperature: -40 to +85°C -40 to +185°F Humidity: 5 to 85% R.H. (Please avoid icing or condensation)
Weight		Approx. 4g .14 oz

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

*2. 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.

*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the “Automotive Relay Users Guide”.

Please inquire if you will be using the relay in a high temperature atmosphere (110°C 230°F).

*4. For wiper motor load, please see the wiper load specifications, below.

2) For wiper load (CP1W-12V)

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

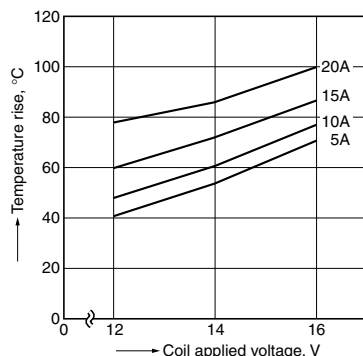
Item		Specifications
Rating	Max. carrying current (initial)*1	N.O. side: 25A for 1 minutes, 15A for 1 hour (coil applied voltage 12 V DC, at 20°C 68°F)
Expected life	Electrical	<Wiper motor load (L = Approx. 1mH) without capacitor> N.O. side: Min. 5×10 ⁵ (Inrush 25A, steady 6A at 14V DC) N.C. side: Min. 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

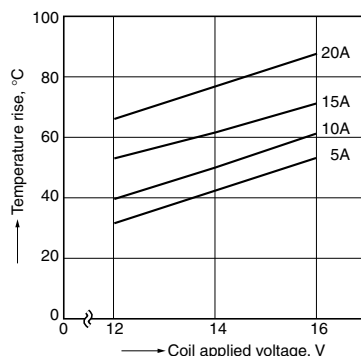
1.-(1) Coil temperature rise (at room temperature)

Sample: CP1-12V, 3pcs
 Point measured: Inside the coil
 Carrying current: 5A, 10A, 15A, 20A
 Ambient temperature 26°C 79°F

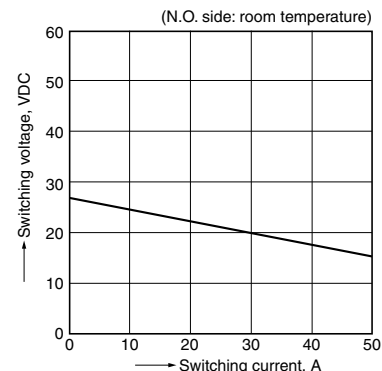


1.-(2) Coil temperature rise (85°C 185°F)

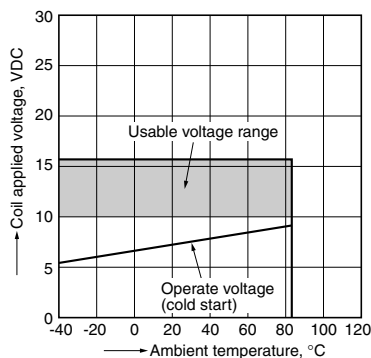
Sample: CP1-12V, 6pcs
 Point measured: Inside the coil
 Carrying current: 5A, 10A, 15A, 20A
 Resistance method, ambient temperature 85°C 185°F



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

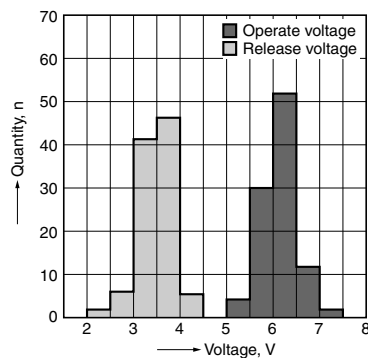


3. Ambient temperature and usable voltage range



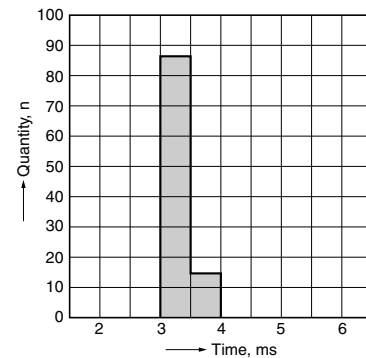
4. Distribution of operate (set) and release (reset) voltage

Sample: CP1-12V, 100pcs
 Ambient temperature: 20°C 68°F



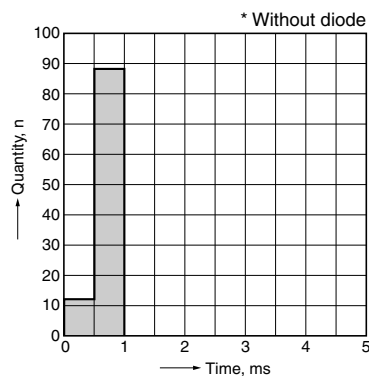
5. Distribution of operate (set) time

Sample: CP1-12V, 100pcs
 Ambient temperature: 20°C 68°F



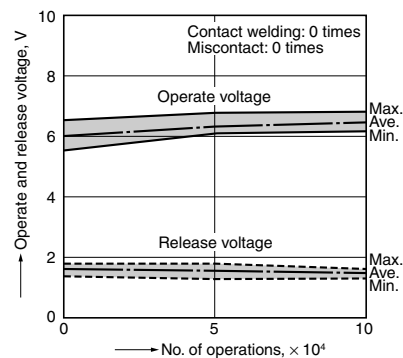
6. Distribution of release (reset) time

Sample: CP1-12V, 100pcs
 Ambient temperature: 20°C 68°F



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

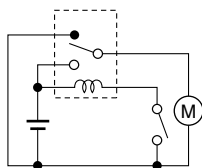
Load: N.O. side: Inrush 25A, steady 6A 14V DC

Load: N.C. side: Brake current 12A 14V DC

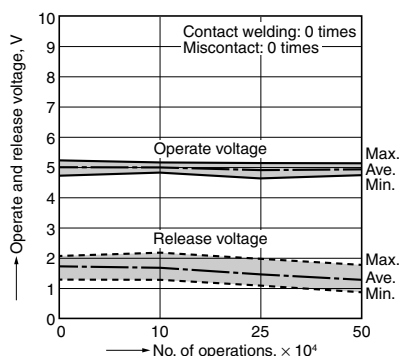
Operating frequency: ON 1s, OFF 9s

Ambient temperature: Room temperature

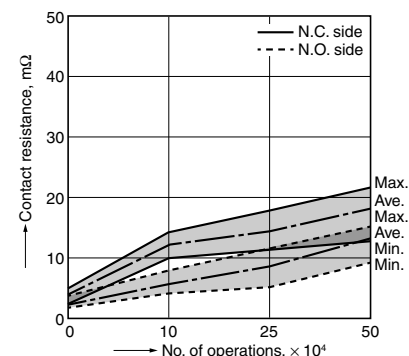
Circuit:



Change of operate (set) and release (reset) voltage



Change of contact resistance



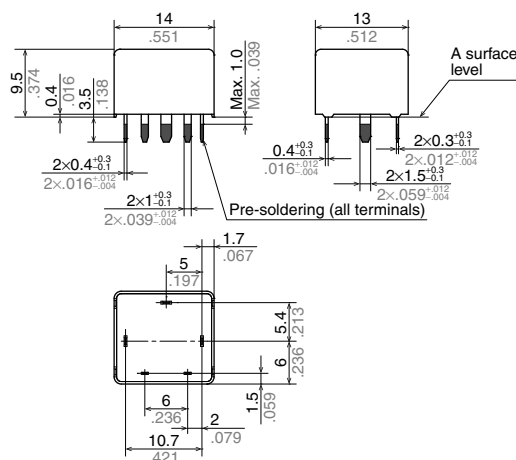
DIMENSIONS (mm inch)

The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

1. PC board terminal type

CAD

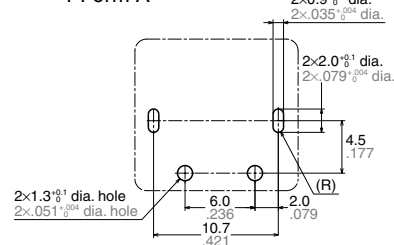
External dimensions



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

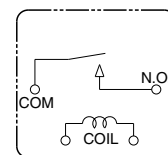
PC board pattern (Bottom view)

1 Form A

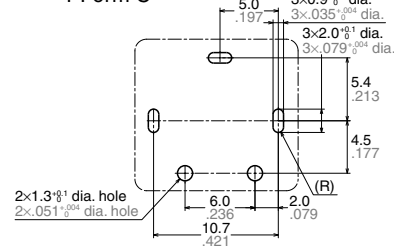


Schematic (Bottom view)

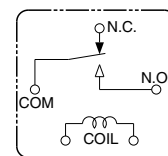
1 Form A



1 Form C



1 Form C

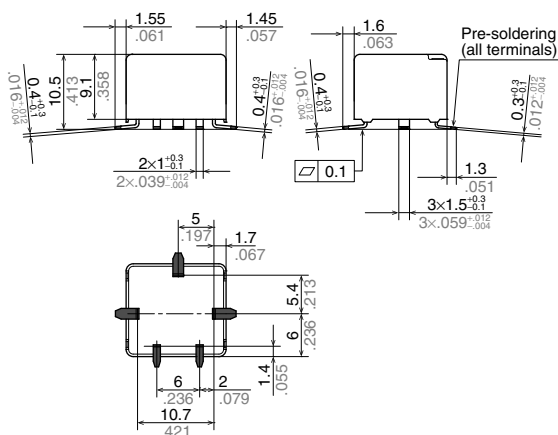
Tolerance: $\pm 0.1 \pm .004$

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

2. Surface mount terminal type

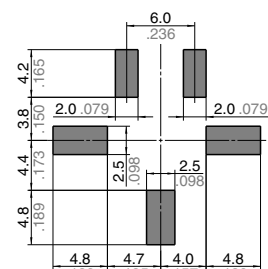
CAD

External dimensions

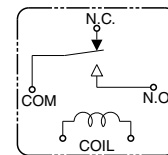


Dimension:	Tolerance
Max. 1mm .039 inch:	$\pm 0.1 \pm .004$
1 to 3mm .039 to .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

Recommendable mounting pad (Top view)

Tolerance: $\pm 0.1 \pm .004$

Schematic (Top view)

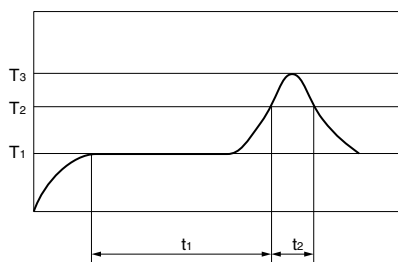


NOTES

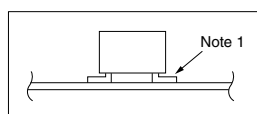
1. Mounting and cleaning conditions for Surface-mount terminal type relays

When soldering this relay, please observe the following conditions.

(Recommended conditions: Number of reflows: 1, Measurement location: terminal temperature)



T₁ = 150 to 180°C 302 to 356°F
 T₂ = 230°C 446°F or more
 T₃ = Less than 250°C 482°F
 t₁ = 60 to 120 sec.
 t₂ = Less than 30 sec.



Temperature profile indicates the temperature of the soldered part (Note 1) of terminals on the surface of the PC board, however, for other areas such as the surface of relay case, make a setting so that you do not exceed the recommended conditions.

*The temperature of the relay exterior and interior may be extremely high depending on the component density on the board, the heating method of the reflow oven or circuit board type.

Other cautions during reflow soldering

- (1) Reflow performance may be affected if you carry out soldering in a way that exceeds the recommended conditions. If you need to exceed the recommended conditions when soldering, please inquire our sales representative before using in an application.
- (2) Please confirm the heat stress of relay by using actual board because it may be changed by board condition or manufacturing process condition.
- (3) Solder creepage, wettability, or soldering strength will be affected by the changing of soldering condition or used solder type. Please check them under the actual production condition in detail.
- (4) 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

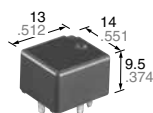
- 1) After opening a moisture-prevention package, use the item as soon as possible (within 4 days under an environment of Max. 30°C 86°F, Max. 70% RH).
- 2) If products are not used within 4 days after opening a moisture-prevention package, store them in a humidity-controlled desiccator or in a storage bag with silica gel.

For general cautions for use, please refer to the “Automotive Relay Users Guide”.

High Carrying Current Type Miniature Low Profile Automotive Relay

CP RELAYS POWER TYPE

<Protective construction>
Sealed



FEATURES

- Maximum carrying current of 35 A (450 mW type, 16 V applied) made possible through using the same size as CP relays
- Supports capacitor loads required for power supply applications

TYPICAL APPLICATIONS

- Defoggers, Ignitions, Heaters, Accessories, Powered windows, etc.

(Unit: mm inch)

RoHS compliant

ORDERING INFORMATION

CP - -

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

Operate (Set) voltage
Nil: Max. 7.2 V DC
N: Max. 6.5 V DC

Rated coil voltage (DC)
12 V

TYPES

Contact arrangement	Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Type No.	Packing	
				Carton (tube)	Case
1 Form C	12 V DC	Max. 7.2 V DC	CP1H-12V	40 pcs.	1,000 pcs.
		Max. 6.5 V DC	CP1H-N-12V		
1 Form A		Max. 7.2 V DC	CP1aH-12V		
		Max. 6.5 V DC	CP1aH-N-12V		

Note: Other operate (set) voltage types are also available. Please inquire our sales representative for details.

RATING

1. Coil data

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

2. Specifications

Item	Specifications
Contact data	Contact arrangement
	1 Form A, 1 Form C
	Contact resistance (initial)
	Max. 100mΩ (N.O.: Typ. 6mΩ, N.C.: Typ. 8mΩ) (By voltage drop 1A 6V DC)
	Contact material
Contact data	Ag alloy
	Rated switching capacity (resistive)
	N.O. side: 20 A 14V DC, N.C. side: 10 A 14V DC
Contact data	Max. carrying current*1
	N.O. side: <For 450 mW> 45 A for 2 minutes, 35 A for 1 hour (Coil applied voltage 16V DC, at 20°C 68°F) 40 A for 2 minutes, 30 A for 1 hour (Coil applied voltage 16V DC, at 85°C 185°F) <For 640 mW> 40 A for 2 minutes, 30 A for 1 hour (Coil applied voltage 16V DC, at 20°C 68°F) 35 A for 2 minutes, 25 A for 1 hour (Coil applied voltage 16V DC, at 85°C 185°F)
Contact data	Min. switching load (resistive)*2
	1 A 14V DC (at 20°C 68°F)
Insulated resistance (initial)	Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts
	500 Vrms for 1 min. (Detection current: 10mA)
Dielectric strength (initial)	Between contacts and coil
	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at Rated voltage)
	Max. 10ms (at 20°C 68°F, without bounce time)
Time characteristics (initial)	Release (Reset) time (at Rated voltage)
	Max. 10ms (at 20°C 68°F, without bounce time) (without diode)
Shock resistance	Functional
	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
Shock resistance	Destructive
	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional
	10 to 100 Hz, Min. 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)
Vibration resistance	Destructive
	10 to 500 Hz, Min. 44.1 m/s ² {approx. 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)
Expected life	Electrical
	<Resistive load> Min. 10 ⁵ (at rated 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 usage, transport and storage*3
Weight	Ambient temperature: -40 to +85°C -40 to +185°F, Humidity: 5 to 85% R.H. (Please avoid icing or condensation)
Weight	Approx. 4.5 g .16 oz

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

*2. 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.

*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).

REFERENCE DATA

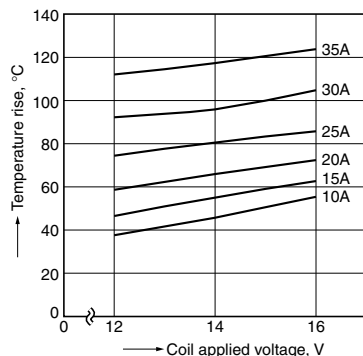
1-(1). Coil temperature rise (at room temperature)

Sample : CP1H-12V, 3pcs

Point measured : Inside the coil

Carrying current: 10A, 15A, 20A, 25A, 30A, 35A

Ambient temperature: 27°C 81°F



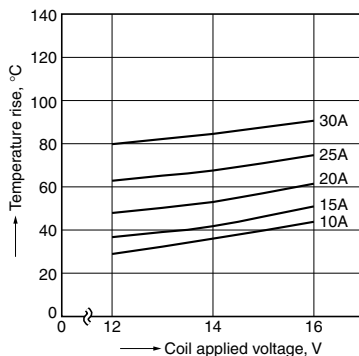
1-(2). Coil temperature rise (at 85°C 185°F)

Sample : CP1H-12V, 3pcs

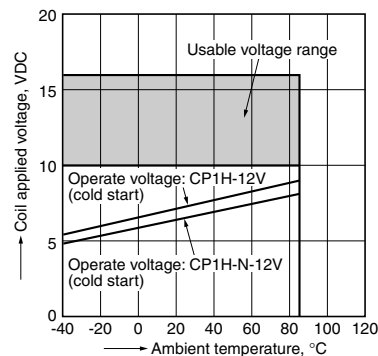
Point measured : Inside the coil

Carrying current: 10A, 15A, 25A, 30A

Ambient temperature: 85°C 185°F

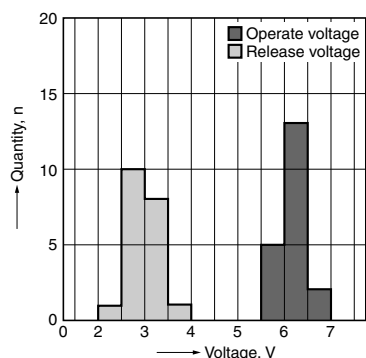


2. Ambient temperature and usable voltage range



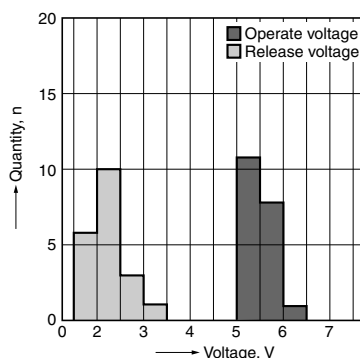
3-(1). Distribution of operate (set) and release (reset) voltage

Sample : CP1H-12V, 20pcs.



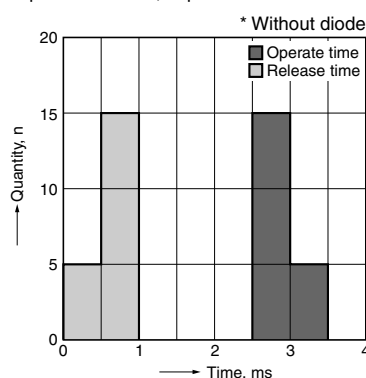
3-(2). Distribution of operate (set) and release (reset) voltage

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



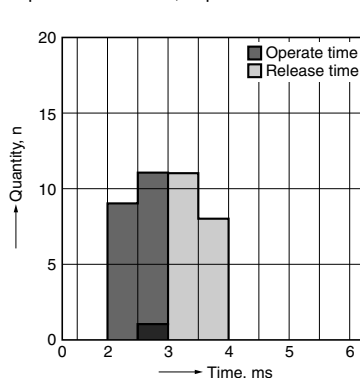
4-(1). Distribution of operate (set) and release (reset) time

Sample : CP1H-12V, 20pcs.



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

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



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

Sample : CP1H-12V

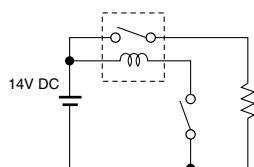
Quantity : n = 6

Load : Resistive load (N.O. side : 20 A 14 V DC)

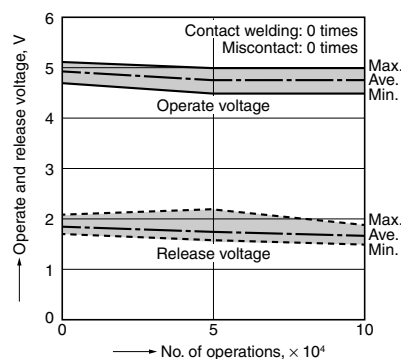
Operating frequency : ON 1s, OFF 9s

Ambient temperature : Room temperature

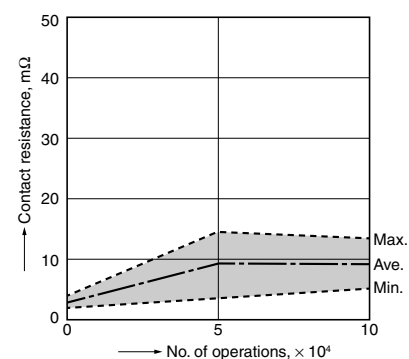
Circuit:



Change of operate (set) and release (reset) voltage



Change of contact resistance



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

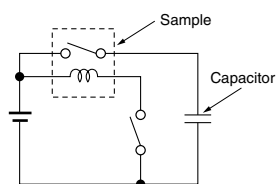
Sample : CP1H-12V, 6pcs.

Load : Inrush current 60A, steady current 1A

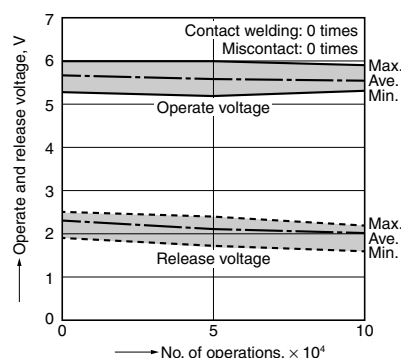
Operating frequency : ON 1s, OFF 9s

Ambient temperature : Room temperature

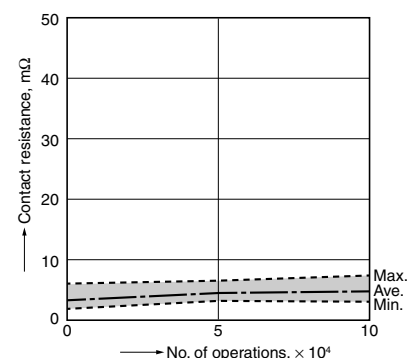
Circuit:



Change of operate (set) and release (reset) voltage



Change of contact resistance



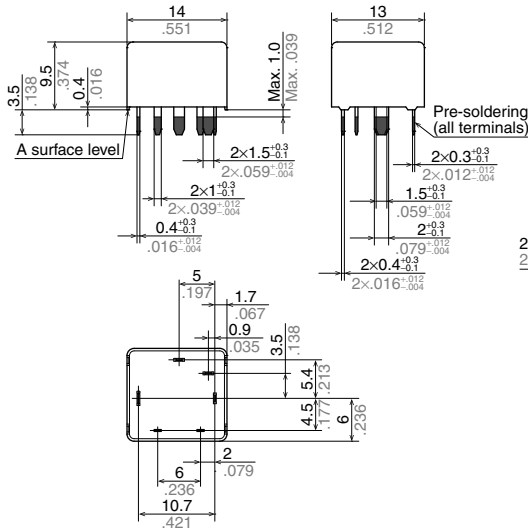
DIMENSIONS (mm inch)

The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

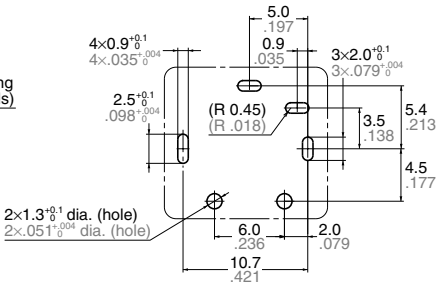
CAD



External dimensions

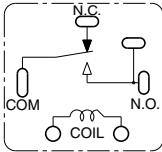


PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm 0.004$

Schematic (Bottom view)



Dimension:	Tolerance
Max. 1mm .039 inch:	$\pm 0.1 \pm 0.004$
1 to 3mm .039 to .118 inch:	$\pm 0.2 \pm 0.008$
Min. 3mm .118 inch:	$\pm 0.3 \pm 0.012$

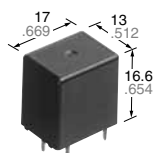
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

For general cautions for use, please refer to the “Automotive Relay Users Guide”.

1 Form C Automotive Quiet Relay

CQ RELAYS

<Protective construction>
Sealed



(Unit: mm inch)

RoHS compliant

FEATURES

- Sound pressure reduced by approx. 20 dB from that of the conventional non-quiet relays
- Space saving
- Adopting standard terminal pitch (for compact relays)
- Wiper load models are listed

TYPICAL APPLICATIONS

- For intermittent wipers and applications requiring quiet operation

ORDERING INFORMATION

	ACQ		3	
Contact arrangement				
1: 1 Form C				
W1: 1 Form C for wiper load				
Protective construction				
3: Sealed				
Rated coil voltage (DC)				
1: 12 V				

TYPES

Contact arrangement	Rated coil voltage	Part No.	Packing	
			Carton (tube)	Case
1 Form C	12V DC	ACQ131	40 pcs.	800 pcs.
1 Form C for wiper load		ACQW131		

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power	Usable voltage range
12V DC	Max. 7.2V DC	Min. 1.0V DC	53.3 mA	225Ω	640 mW	10 to 16V DC

Note: Other operate (set) voltage types are also available. Please inquire our sales representative for details.

2. Specifications

1) Standard CQ relay

Item		Specifications
Contact data	Contact arrangement	1 Form C
	Contact resistance (initial)	Max. 100mΩ (N.O.: Typ. 7mΩ, N.C.: Typ. 8mΩ) (By voltage drop 1A 6V DC)
	Contact voltage drop (initial)	Max. 0.2V (at 10 A 12V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	N.O. side: 20A 14V DC, N.C. side: 10A 14V DC
	Max. carrying current (initial)*1 *4	N.O. side: 35A for 2 minutes, 25A for 1 hour (Coil applied voltage 12V DC, at 20°C 68°F) 30A for 2 minutes, 20A for 1 hour (Coil applied voltage 12V DC, at 85°C 185°F)
	Min. switching load (resistive)*2	1A 14V DC (at 20°C 68°F)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at Rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time)
	Release (Reset) time (at Rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time) (without diode)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 100 Hz, Min. 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)
	Destructive	10 to 500 Hz, Min. 44.1 m/s ² {approx. 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 ⁶ (at rated 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 usage, transport and storage*3	Ambient temperature: -40 to +85°C -40 to +185°F Humidity: 5 to 85% R.H. (Please avoid icing or condensation)
Weight		Approx. 6.5g 23 oz

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

*2. 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.

*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

*4. For wiper motor load, please see the wiper load specifications, below.

2) For wiper load (ACQW131)

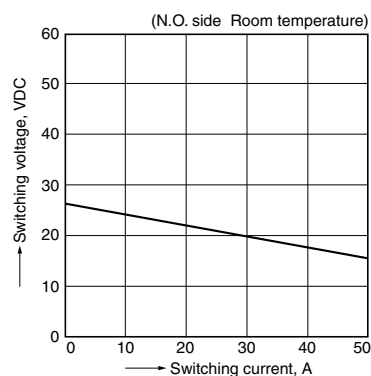
Anything outside of that given below complies with standard CQ relays.

Item		Specifications
Contact data	Max. carrying current (initial)*1	N.O. side: 25A for 1 minutes, 15A for 1 hour (coil applied voltage 12V DC, at 20°C 68°F)
Expected life	Electrical	<Wiper motor load (L = Approx. 1mH) without capacitor> 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)

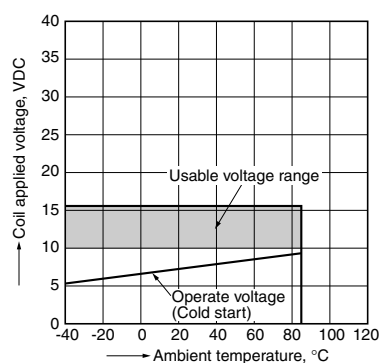
Note: *1. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.

REFERENCE DATA

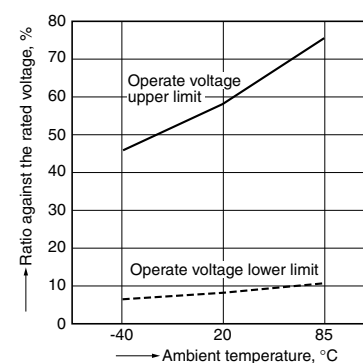
1. Max. switching capability (Resistive load, initial)



2. Ambient temperature and usable voltage range

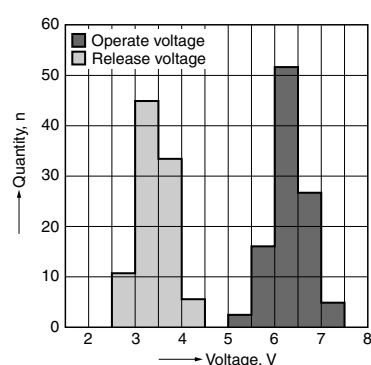


3. Ambient temperature characteristics



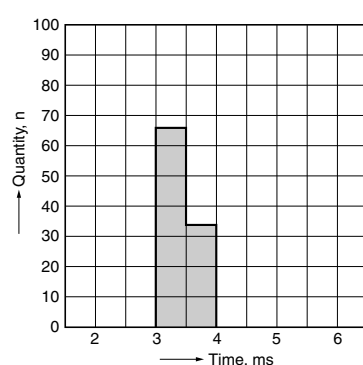
4. Distribution of operate (set) and release (reset) voltage

Sample: ACQ131, 100pcs



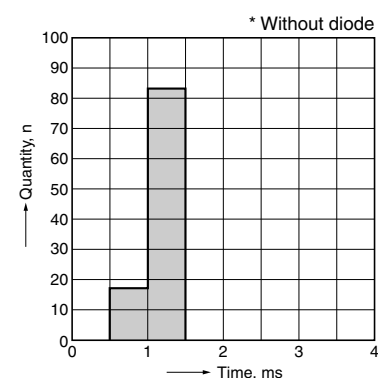
5. Distribution of operate (set) time

Sample: ACQ131, 100pcs



6. Distribution of release (reset) time

Sample: ACQ131, 100pcs



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

Sample: ACQW131

Quantity: n = 3

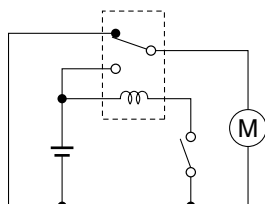
Load: N.O. side: Inrush 25A, steady 6A 14V DC

N.C. side: Brake current 12A 14V DC

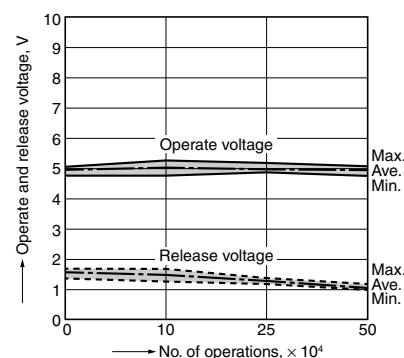
Operating frequency: ON 1s, OFF 9s

Ambient temperature: Room temperature

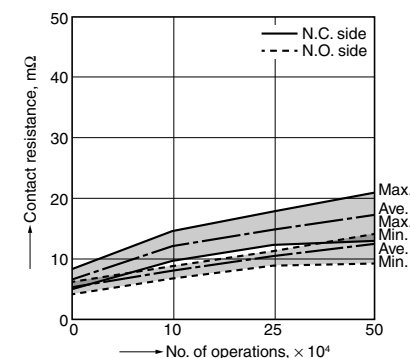
Circuit:



Change of operate (set) and release (reset) voltage

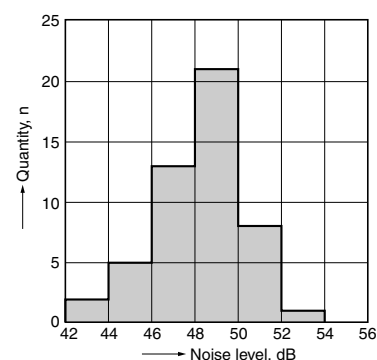


Change of contact resistance



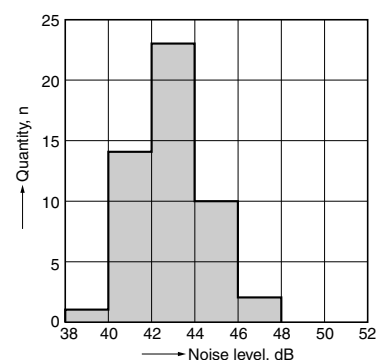
8.-(1) Operation noise distribution

When operate



8.-(2) Operation noise distribution

When release



Measuring conditions

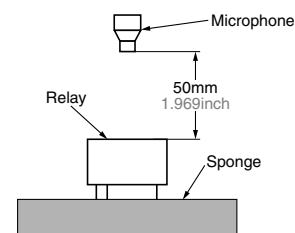
Sample: ACQ131, 50 pcs.

Equipment setting: "A" weighted, Fast, Max. hold

Coil voltage: 12V DC

Coil connection device: Diode

Background noise: Approx. 20dB



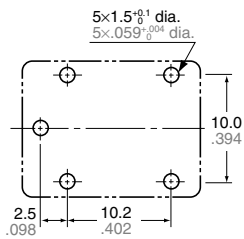
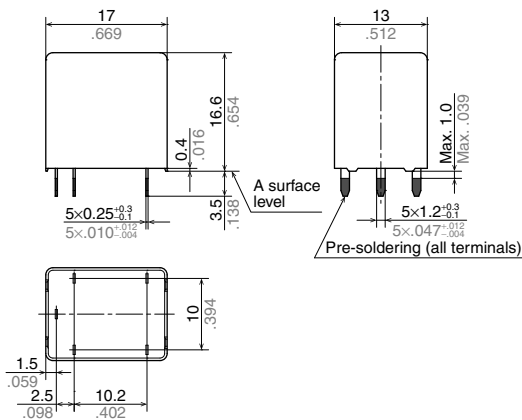
DIMENSIONS (mm inch)

The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

CAD

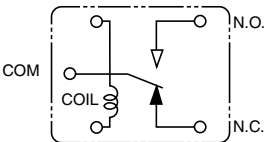
External dimensions

PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



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

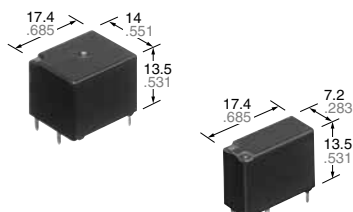
* Dimensions (thickness and width) of terminal is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

For general cautions for use, please refer to the “Automotive Relay Users Guide”.

Small & Slim Twin/1 Form C type Automotive Relay

CT RELAYS

<Protective construction>
Sealed



(Unit: mm inch)

RoHS compliant

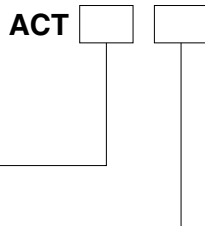
FEATURES

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

TYPICAL APPLICATIONS

- Powered windows, Automatic door locks, Powered mirrors, Powered sunroof, Powered seats, Lift gates, Slide door closers, etc.

ORDERING INFORMATION



Contact arrangement

- 1: 1 Form C
2: 1 Form C×2 (8 pins)
5: 1 Form C×2 (10 pins)

Rated coil voltage, DC
12: 12 V

TYPES

Contact arrangement	Rated coil voltage	Part No.	Packing	
			Carton (tube)	Case
1 Form C	12 V DC	ACT112	30 pcs.	1,500 pcs.
1 Form C × 2 (8 pins)		ACT212	30 pcs.	900 pcs.
1 Form C × 2 (10 pins)		ACT512		

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 7.2 V DC	Min. 1.0 V DC	66.7 mA	180Ω	800 mW	10 to 16V DC

Note: Other operate (set) voltage types are also available. Please inquire our sales representative for details.

2. Specifications

Item		Specifications
Contact data	Contact arrangement	1 Form C × 2, 1 Form C
	Contact resistance (initial)	Max. 100mΩ (N.O.: Typ. 7mΩ, N.C.: Typ. 10mΩ) (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	N.O. side: 20 A 14V DC, N.C. side: 10 A 14V DC
	Max. carrying current*1	N.O. side: 25 A for 1 hour, 35 A for 2 minutes (Coil applied voltage 14V DC, at 20°C 68°F) 20 A for 1 hour, 30 A for 2 minutes (Coil applied voltage 14V DC, at 85°C 185°F)
	Min. switching load (resistive)*2	1 A 14V DC (at 20°C 68°F)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at Rated voltage)	Max. 10ms (at 20°C 68°F, without bounce time)
	Release (Reset) time (at Rated voltage)	Max. 10ms (at 20°C 68°F, without bounce time) (without diode)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 100 Hz, Min. 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)
	Destructive	10 to 500 Hz, Min. 44.1 m/s ² {approx. 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 rated 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 usage, transport and storage*3	Ambient temperature: -40 to +85°C -40 to +185°F, Humidity: 5 to 85% R.H. (Please avoid icing or condensation)
Weight		Twin type: approx. 8 g .28 oz, 1 Form C type: approx. 4 g .14 oz

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

*2. 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.

*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).

* 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 our sales representative when using with a circuit that causes an energized condition on both sides simultaneously.

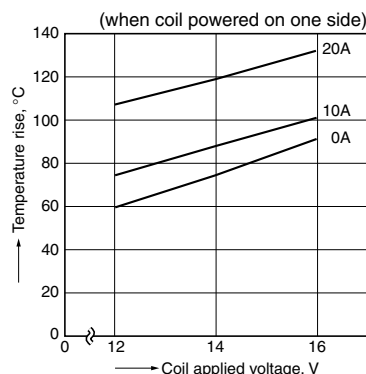
REFERENCE DATA

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

Sample: ACT212, 3pcs.

Carrying current: 0A, 10A, 20A

Ambient temperature: Room temperature

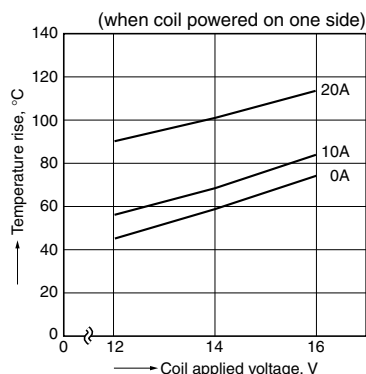


1-(2). Coil temperature rise (at 85°C 185°F)

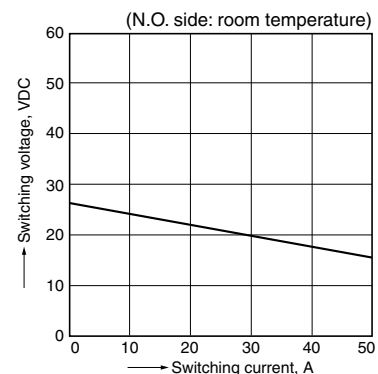
Sample: ACT212, 3pcs.

Carrying current: 0A, 10A, 20A

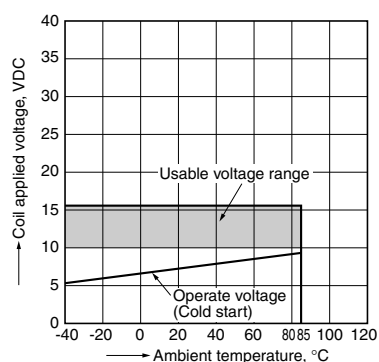
Ambient temperature: 85°C 185°F



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

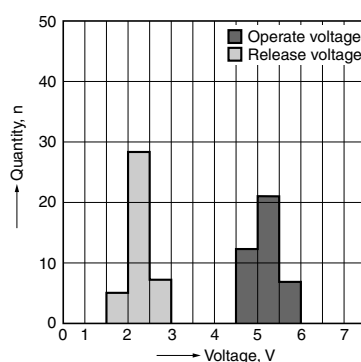


3. Ambient temperature and usable voltage range



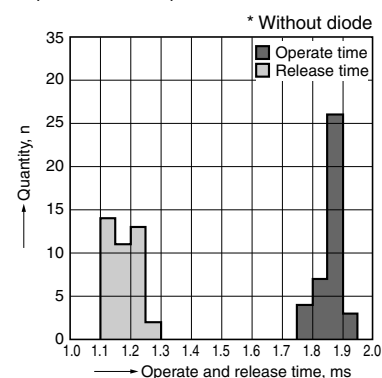
4. Distribution of operate (set) and release (reset) voltage

Sample: ACT212, 40pcs.



5. Distribution of operate (set) and release (reset) time

Sample: ACT212, 40pcs.



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

Sample: ACT212, 3pcs.

Load: Inrush 25A, steady 5A

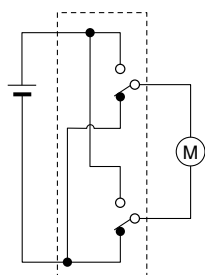
Brake current: 13A 14V DC,

Power window motor actual load (free condition)

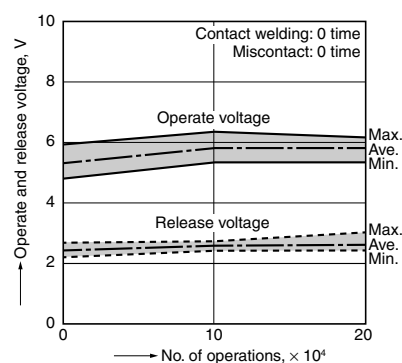
Operating frequency: ON 0.5s, OFF 9.5s

Ambient temperature: Room temperature

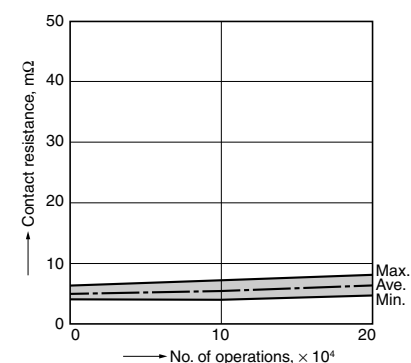
Circuit:



Change of operate (set) and release (reset) voltage



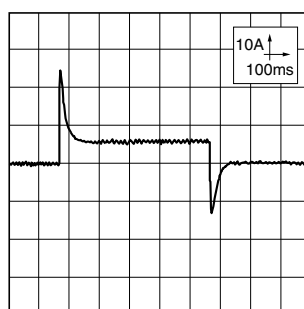
Change of contact resistance



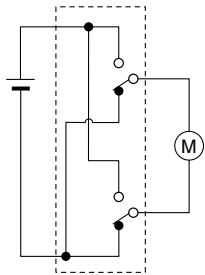
Load current waveform

Load: Inrush current: 25A, Steady current: 6A

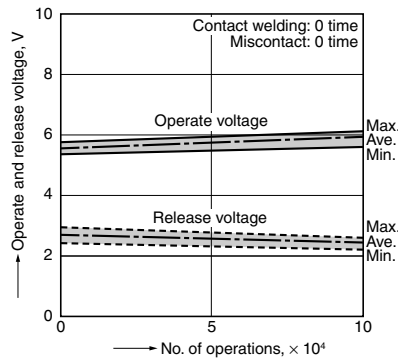
Brake current: 13A



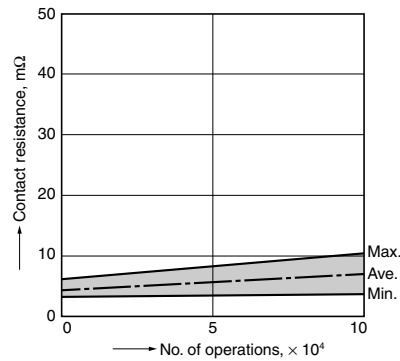
6-(2). Electrical life test (Motor lock)
Sample: ACT212, 3pcs.
Load: 25A 14V DC
Power window motor actual load (lock condition)
Switching frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature
Circuit:



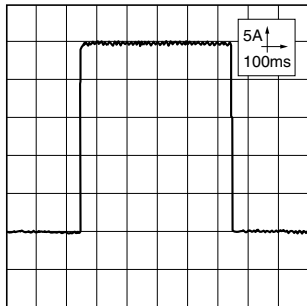
Change of operate (set) and release (reset) voltage



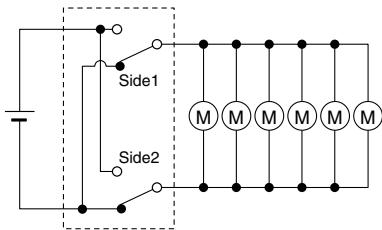
Change of contact resistance



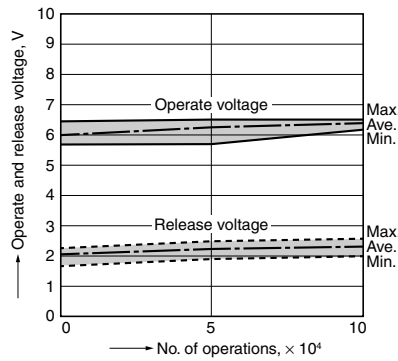
Load current waveform



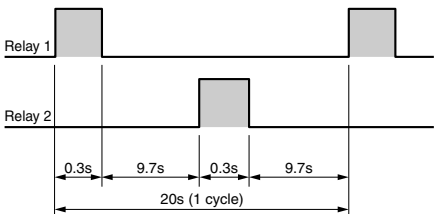
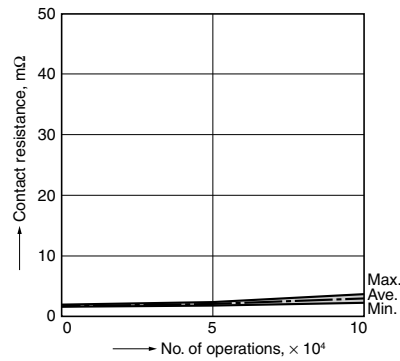
6-(3). Electrical life test (Motor lock)
Sample: ACT212, 3pcs.
Load: 20A 14V DC,
door lock motor actual load (Lock condition)
Switching frequency: ON 0.3s, OFF 19.7s
Ambient temperature: Room temperature
Circuit:



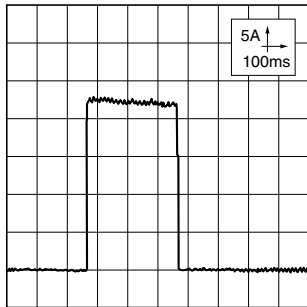
Change of operate (set) and release (reset) voltage



Change of contact resistance



Load current waveform

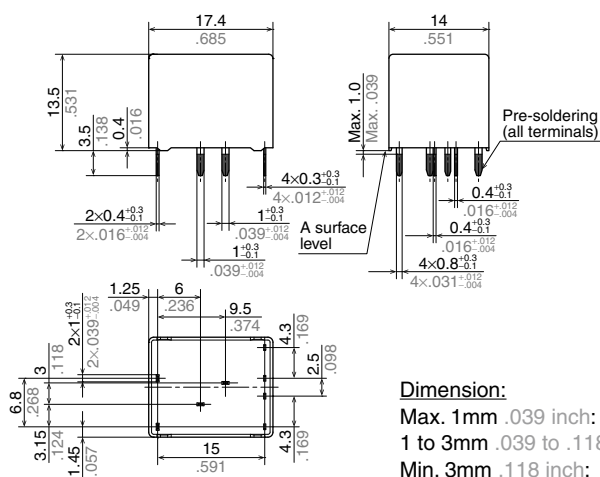


DIMENSIONS (mm inch)

1. Twin type (8 pins)

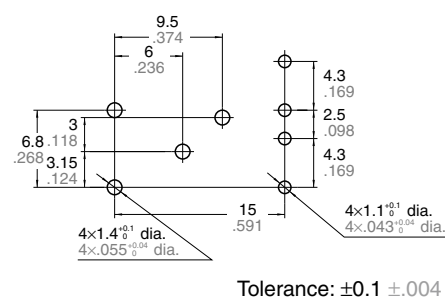


External dimensions



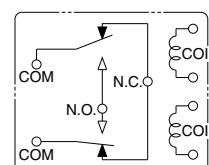
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern
(Bottom view)



Tolerance: $\pm 0.1 \pm .004$

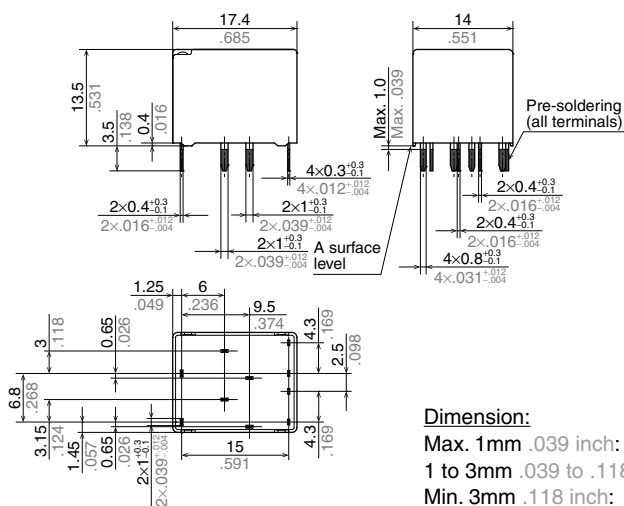
Schematic
(Bottom view)



2. Twin type (10 pins)

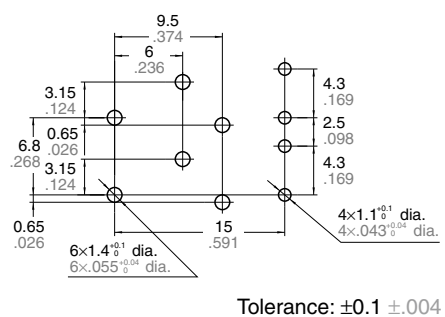


External dimensions



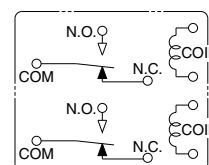
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern
(Bottom view)



Tolerance: ± 0.1 $\pm .004$

Schematic
(Bottom view)



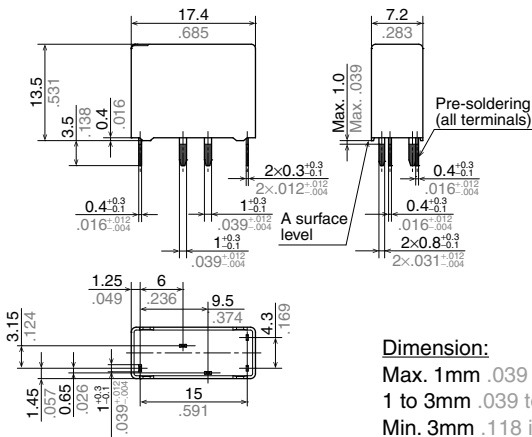
CT (ACT)

3. Slim 1c type (8 pins)

CAD

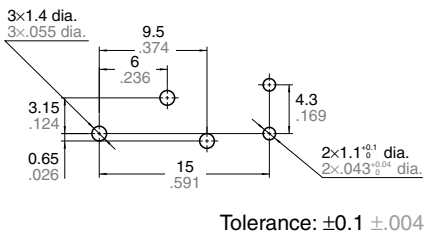


External dimensions

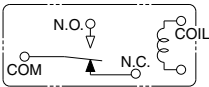


Dimension:	Tolerance
Max. 1mm .039 inch:	$\pm 0.1 \pm .004$
1 to 3mm .039 to .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

PC board pattern (Bottom view)



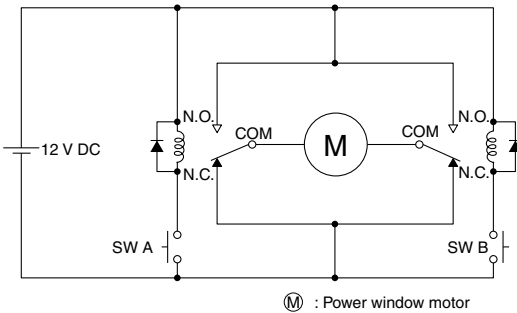
Schematic (Bottom view)



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

EXAMPLE OF CIRCUIT

Forward/reverse control circuits of DC motor for power windows

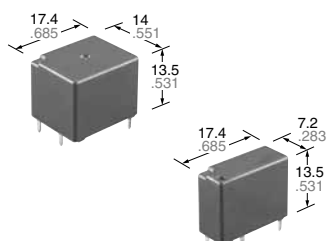


For general cautions for use, please refer to the “Automotive Relay Users Guide”.

High Carrying Current Type Small & Slim Automotive Relay

CT RELAYS POWER TYPE

<Protective construction>
Sealed



(Unit: mm inch)

RoHS compliant

FEATURES

- Maximum carrying current of 35A made possible through using the same size as the CT relays
- Low operational noise

TYPICAL APPLICATIONS

- Powered windows, Automatic door locks, Powered sunroof, Powered seats, Slide door closers, etc.

ORDERING INFORMATION

ACT **P**

P: Power type

Contact arrangement

1: 1 Form C

2: 1 Form C×2 (8 pins)

5: 1 Form C×2 (10 pins)

Rated coil voltage, DC

12: 12 V

TYPES

Contact arrangement	Rated coil voltage	Part No.	Packing	
			Carton (tube)	Case
1 Form C	12 V DC	ACTP112	30 pcs.	1,500 pcs.
1 Form C × 2 (8 pins)		ACTP212	30 pcs.	900 pcs.
1 Form C × 2 (10 pins)		ACTP512		

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 7.2 V DC	Min. 1.0 V DC	83.3 mA	144Ω	1,000 mW	10 to 16V DC

Note: Other operate (set) voltage types are also available. Please inquire our sales representative for details.

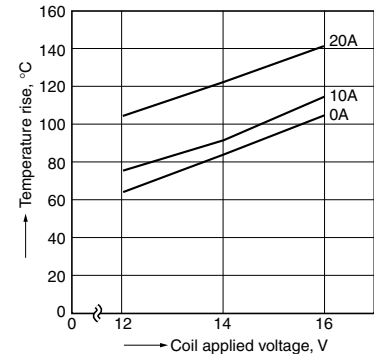
2. Specifications

Item		Specifications
Contact data	Contact arrangement	1 Form C × 2, 1 Form C
	Contact resistance (initial)	Max. 100mΩ (N.O.: Typ. 7mΩ, N.C.: Typ. 10mΩ) (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	N.O. side: 30 A 14V DC, N.C. side: 10 A 14V DC
	Max. carrying current*1	N.O. side: 25 A for 1 hour, 40 A for 2 minutes (Coil applied voltage 14V DC, at 20°C 68°F) 20 A for 1 hour, 35 A for 2 minutes (Coil applied voltage 14V DC, at 85°C 185°F)
	Min. switching load (resistive)*2	1 A 14V DC (at 20°C 68°F)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at Rated voltage)	Max. 10ms (at 20°C 68°F, without bounce time)
	Release (Reset) time (at Rated voltage)	Max. 10ms (at 20°C 68°F, without bounce time) (without diode)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 100 Hz, Min. 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)
	Destructive	10 to 500 Hz, Min. 44.1 m/s ² {approx. 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 rated 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 usage, transport and storage*3	Ambient temperature: -40 to +85°C -40 to +185°F, Humidity: 5 to 85% R.H. (Please avoid icing or condensation)
Weight		Twin type: approx. 8 g .28 oz, 1 Form C type: approx. 4 g .14 oz

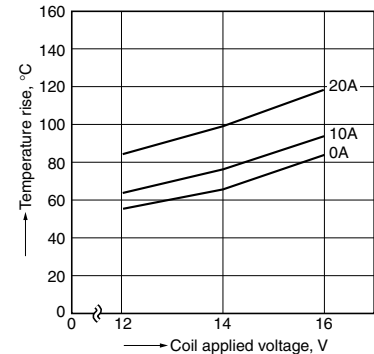
Notes: *1. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
*2. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".
Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).
* 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 our sales representative when using with a circuit that causes an energized condition on both sides simultaneously.

REFERENCE DATA

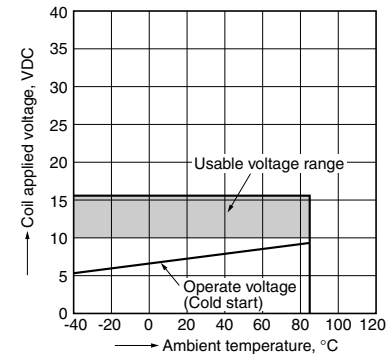
1-(1). Coil temperature rise (at room temperature)
Sample: ACTP212, 3pcs.
Carrying current: 0A, 10A, 20A
Ambient temperature: Room temperature



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

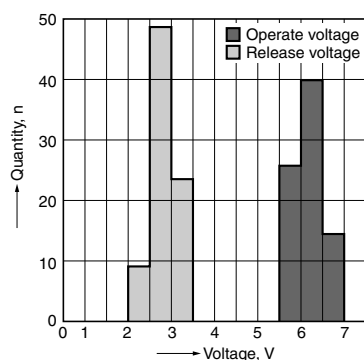


2. Ambient temperature and usable voltage range



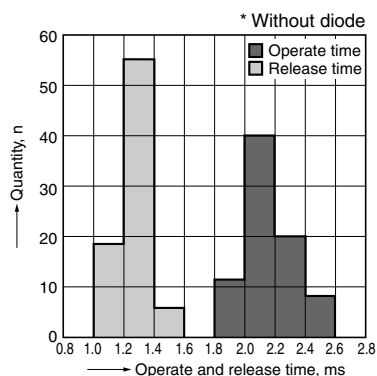
3. Distribution of operate (set) and release (reset) voltage

Sample: ACTP212, 80pcs.



4. Distribution of operate (set) and release (reset) time

Sample: ACTP212, 80pcs.



5. Electrical life test (Motor free)

Sample: ACTP212, 3pcs.

Load: Inrush current: 30A, Steady current: 7A

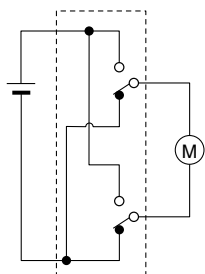
Brake current: 15A 14V DC,

Power window motor actual load

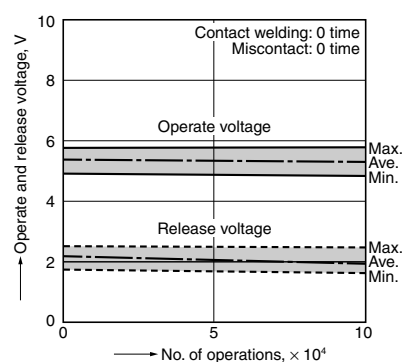
Operating frequency: ON 0.5s, OFF 9.5s

Ambient temperature: Room temperature

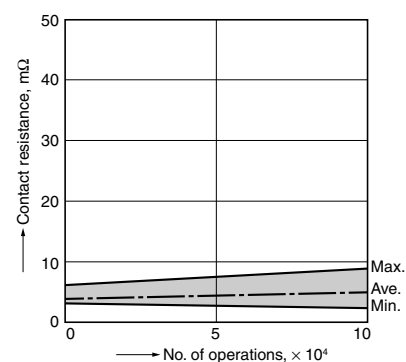
Circuit:



Change of operate (set) and release (reset) voltage



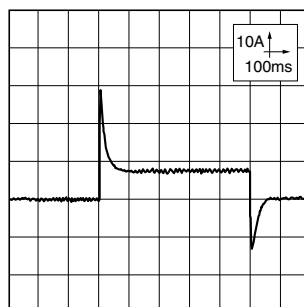
Change of contact resistance



Load current waveform

Load: Inrush current: 30A, Steady current: 7A

Brake current: 15A



6. Electrical life test (Motor lock)

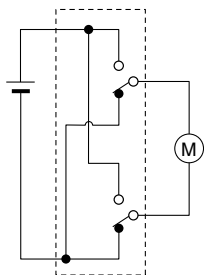
Sample: ACTP212, 3pcs.

Load: 30A 14V DC

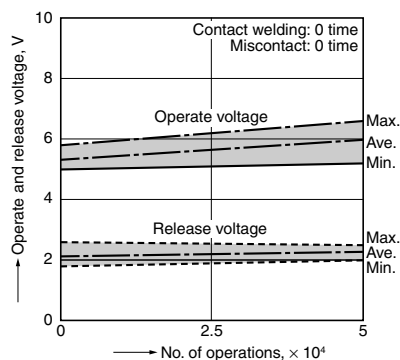
Operating frequency: ON 0.5s, OFF 9.5s

Ambient temperature: Room temperature

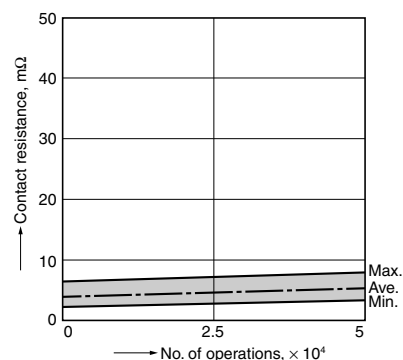
Circuit:



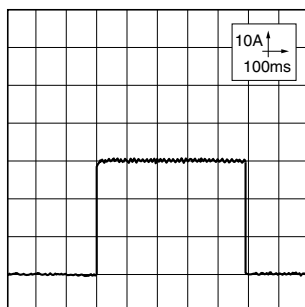
Change of operate (set) and release (reset) voltage



Change of contact resistance



Load current waveform



DIMENSIONS (mm inch)

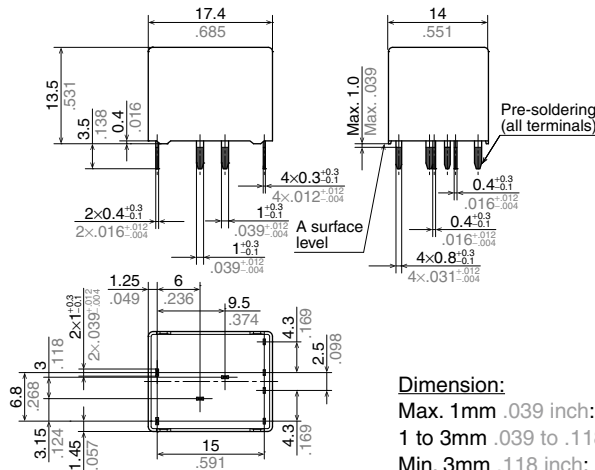
1. Twin type (8 pins)

CAD

The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>



External dimensions



Dimension:

Max. 1mm .039 inch:

1 to 3mm .039 to .118 inch: $\pm 0.2 \pm .008$

Min. 3mm .118 inch: $\pm 0.3 \pm .012$

Tolerance

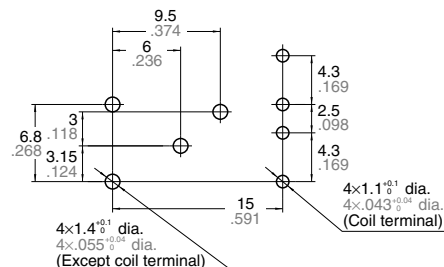
$\pm 0.1 \pm .004$

$\pm 0.2 \pm .008$

$\pm 0.3 \pm .012$

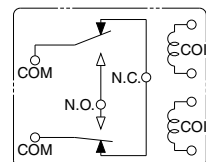
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)

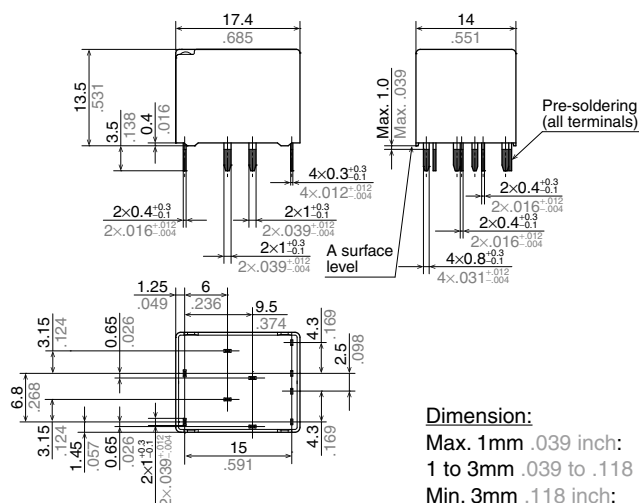


2. Twin type (10 pins)

CAD

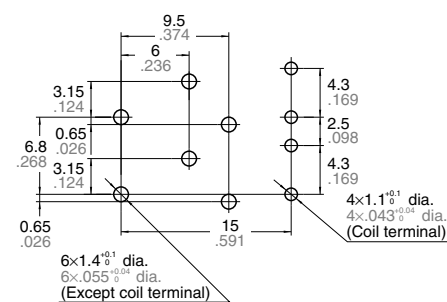


External dimensions



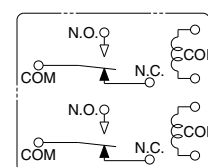
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)

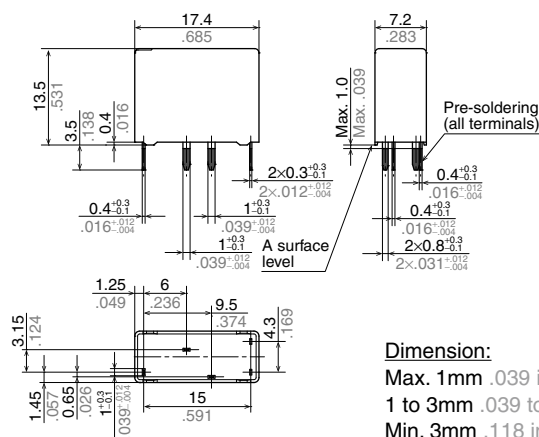


3. Single type (1 Form C)

CAD

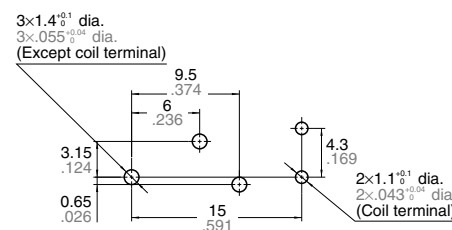


External dimensions



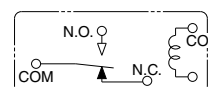
* Dimensions (thickness and width) of is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern (Bottom view)



Tolerance: ± 0.1 $\pm .004$

Schematic (Bottom view)

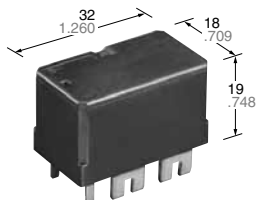


For general cautions for use, please refer to the “Automotive Relay Users Guide”.

Automotive Relay for Failsafe Circuits in High Output Motors (EPS)

CW RELAYS

<Protective construction>
Sealed



(Unit: mm inch)

RoHS compliant

FEATURES

- Ideal relay for high output 3-phase motors
- High current cutoff
- High carrying current and high heat resistance

TYPICAL APPLICATIONS

- 3-phase motor EPS unit, etc. (for failsafe circuit)

ORDERING INFORMATION

ACW **2**

Contact arrangement
2: 2 Form A

Rated coil voltage (DC)
12: 12 V

TYPES

Contact arrangement	Rated coil voltage	Part No.	Packing	
			Carton	Case
2 Form A	12 V DC	ACW212	40 pcs.	160 pcs.

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 6.2 V DC	Min. 0.5 V DC	117 mA	103Ω	1.4 W	10 to 16V DC

2. Specifications

Item		Specifications
Contact data	Contact arrangement	2 Form A
	Contact resistance (initial)	Typ. 1.2 mΩ (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Max. carrying current*1	120 A 14V DC for 5 seconds (Coil applied voltage 14V DC, at 20°C 68°F) 70 A 14V DC for 1 minute (Coil applied voltage 14V DC, at 85°C 185°F) 45 A 14V DC for continuous (Coil applied voltage 14V DC, at 85°C 185°F)
	Min. switching load (resistive)*2	1 A 14V DC (at 20°C 68°F)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at Rated voltage)	Max. 20ms (at 20°C 68°F, without bounce time)
	Release (Reset) time (at Rated voltage)	Max. 20ms (at 20°C 68°F) (without diode)
Shock resistance	Functional	Min. 200 m/s ² {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/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 500 Hz, Min. 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs) (12 V DC applied to the coil, at 20°C 68°F)
	Destructive	10 to 500 Hz, Min. 44.1 m/s ² {approx. 4.5G}, Time of vibration for each direction; X, Y, Z direction: 4 hours
Expected life	Mechanical	Min. 2 × 10 ⁵ (at 60 cpm)
	Electrical (at cut off only)	200 A 14V DC resistive load, Min. 3 times (Without diode)
Conditions	Conditions for usage, transport and storage*3	Ambient temperature: -40 to +125°C -40 to +257°F, Humidity: 2 to 85% R.H. (Please avoid icing or condensation)
Weight		Approx. 26 g .92 oz

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

*2. 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.

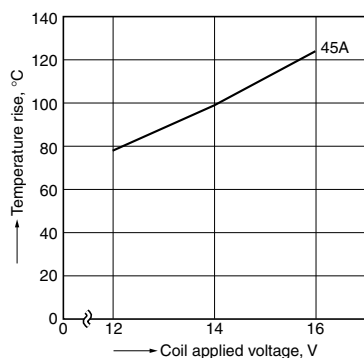
*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).

REFERENCE DATA

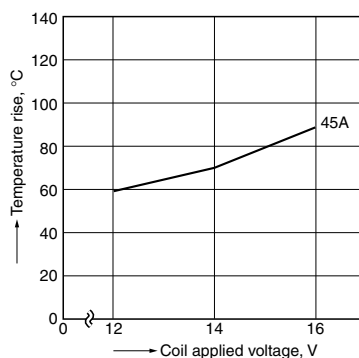
1.-(1) Coil temperature rise (25°C 77°F)

Sample: ACW212, 3pcs
Point measured: Inside the coil
Carrying current: 45A
Ambient temperature: 25°C 77°F



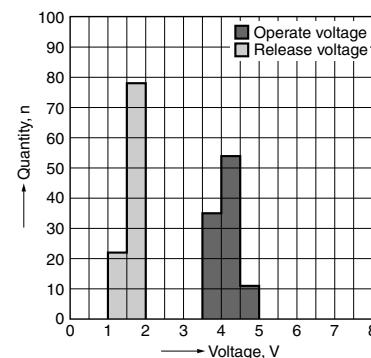
1.-(2) Coil temperature rise (85°C 185°F)

Sample: ACW212, 3pcs
Point measured: Inside the coil
Carrying current: 45A
Ambient temperature: 85°C 185°F



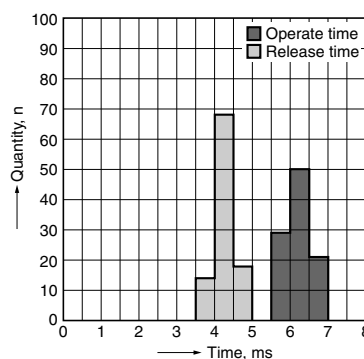
2. Distribution of operate (set) and release (reset) voltage

Sample: ACW212, 100pcs

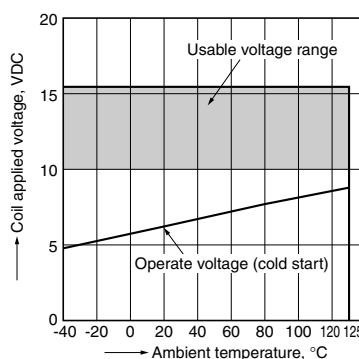


3. Distribution of operate (set) and release (reset) time

Sample: ACW212, 100pcs.



4. Ambient temperature and usable voltage range



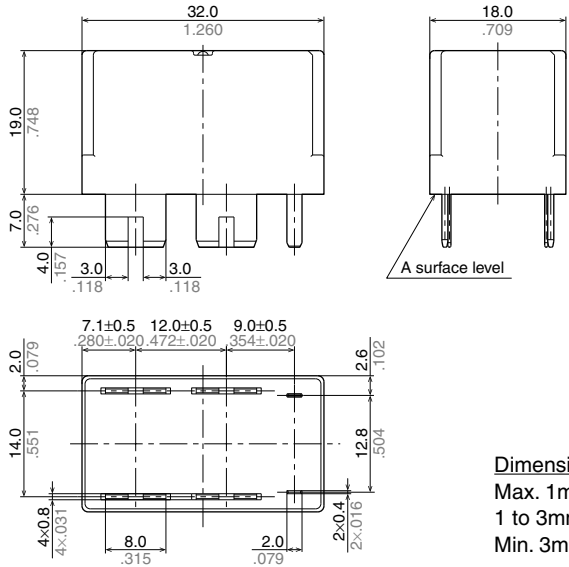
DIMENSIONS (mm inch)

The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

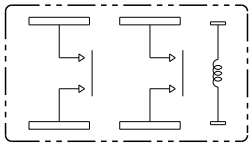
CAD



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

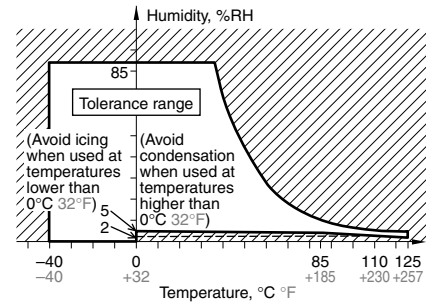
1. Mounting method

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 air 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 icing and condensation.)
 - (3) Air 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]

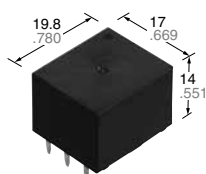


For general cautions for use, please refer to the “Automotive Relay Users Guide”.

1 Form C Automotive Quiet Relay

TA RELAYS

<Protective construction>
Sealed



(Unit: mm inch)

RoHS compliant

FEATURES

- Designed for low operation noise when mounted on PC board
- Flat type

TYPICAL APPLICATIONS

- Intermittent wiper, Cruise control, Powered windows, Automatic door locks, Power supply of car stereo and car air-conditioner, Powered seats, Powered sunroof, etc.

ORDERING INFORMATION

ACTA

Contact arrangement
2: 1 Form C

Contact type
Nil: Standard type

Coil resistance
2: 160Ω
3: 225Ω

TYPES

Contact arrangement	Contact type	Rated coil voltage	Coil resistance	Part No.	Packing	
					Carton (tube)	Case
1 Form C	Standard type	12V DC	160Ω	ACTA22	25 pcs.	1,000 pcs.
			225Ω	ACTA23		

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 6.5V DC	Min. 0.8V DC	75 mA	160Ω	900 mW	10 to 16V DC
	Max. 7.7V DC		53.3 mA	225Ω	640 mW	

2. Specifications

Item		Specifications
Contact data	Contact arrangement	1 Form C
	Contact resistance (initial)	Max. 100mΩ (N.O. side: typ. 5mΩ, N.C. side: typ. 6mΩ) (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	N.O. side: 20A 14V DC, N.C. side: 10A 14V DC
	Max. carrying current (initial)*1	25A for 3 minutes (Coil applied voltage 12V DC, at 20°C 68°F)
	Min. switching load (resistive)*2	1A 14V DC (at 20°C 68°F)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time)
	Release (Reset) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time) (without diode)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 100 Hz, Min. 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)
	Destructive	10 to 100 Hz, Min. 44.1 m/s ² {approx. 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 rated 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 usage, transport and storage*3	Ambient temperature: -40 to +85°C -40 to +185°F, Humidity: 5 to 85% R.H. (Please avoid icing or condensation)
Weight		Approx. 8 g .28 oz

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

*2. 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.

*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).

*4. Do not use for lamp loads, electric discharge lamp loads, any other lamp loads and capacitor loads. Please inquire our sales representative for details.

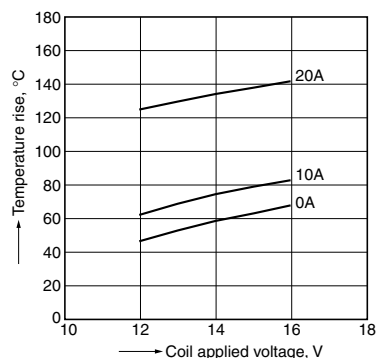
REFERENCE DATA

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

Sample: ACTA23, 3pcs.

Carrying current: 0A, 10A, 20A

Ambient temperature: Room temperature

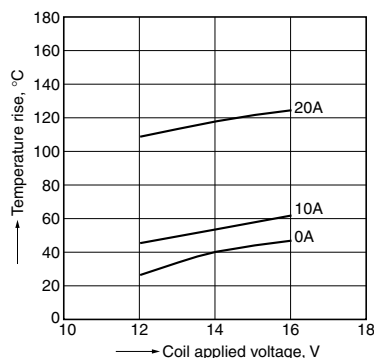


1.-(2) Coil temperature rise (at 85°C 185°F)

Sample: ACTA23, 3pcs.

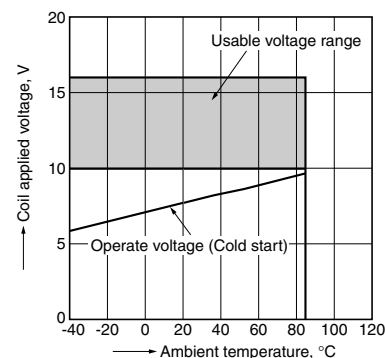
Carrying current: 0A, 10A, 20A

Ambient temperature: 85°C 185°F



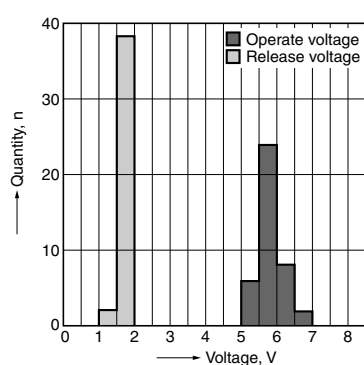
2. Ambient temperature and usable voltage range

Sample: ACTA23



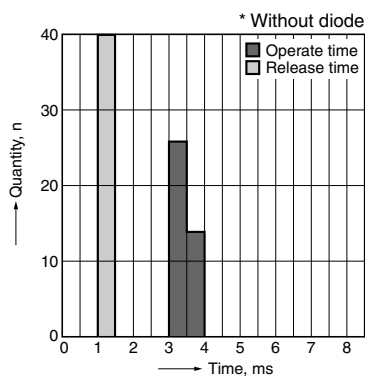
3. Distribution of operate (set) and release (reset) voltage

Sample: ACTA23, 40pcs.



4. Distribution of operate (set) and release (reset) time

Sample: ACTA23, 40pcs.



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

Sample: ACTA23, 3pcs.

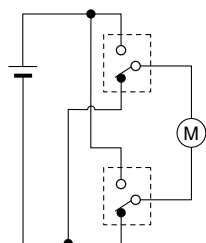
Load: 25A 14V DC

Power window motor actual load (lock condition)

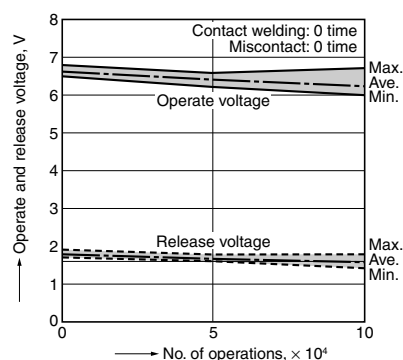
Operating frequency: ON 0.5s, OFF 9.5s

Ambient temperature: Room temperature

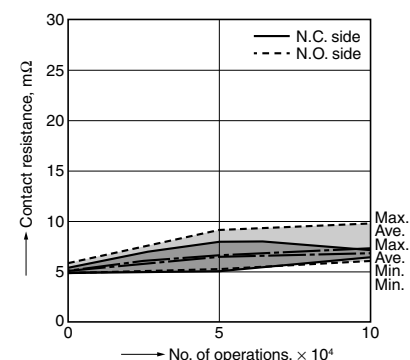
Circuit:



Change of operate (set) and release (reset) voltage

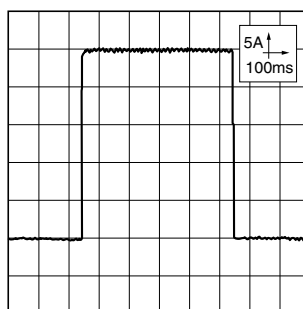


Change of contact resistance



Load current waveform

Current value: 25A



6. Noise pressure characteristics

Measuring conditions

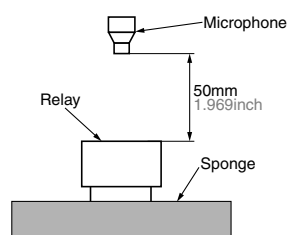
Sample: ACTA23, 50 pcs.

Equipment setting: "A" weighted, Fast, Max. hold

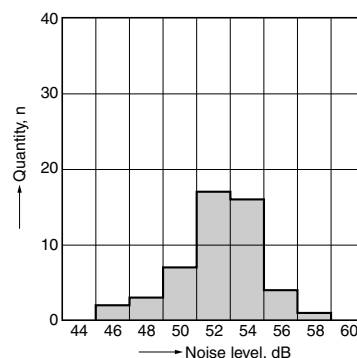
Coil voltage: 12V DC

Coil connection device: Diode

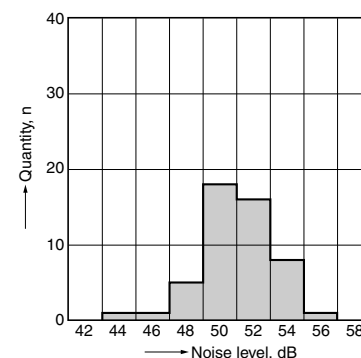
Background noise: approx. 35dB



Operate (set) noise



Release (reset) noise



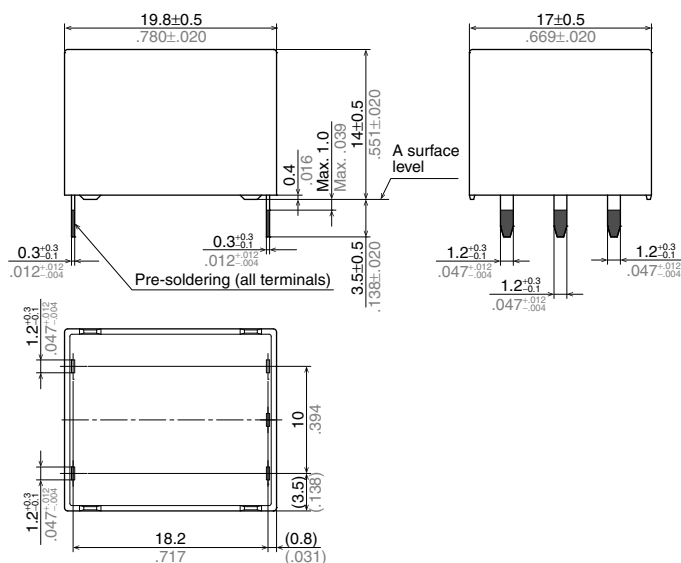
DIMENSIONS (mm inch)

The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

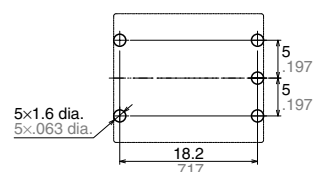
CAD



External dimensions

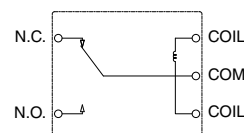


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



Dimension:

Less than 1mm .039inch:

Min. 1mm .039inch less than 3mm .118 inch: ±0.2 ±.008

Min. 3mm .118 inch:

Tolerance

±0.1 ±.004

±0.3 ±.012

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

NOTES

Usage, transport and storage conditions

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

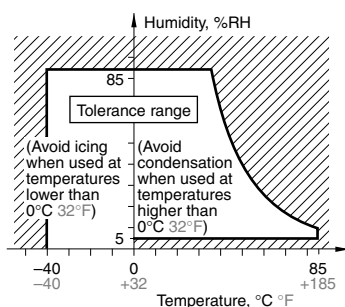
(1) Temperature: -40 to +85°C -40 to +185°F

(2) Humidity: 5 to 85% RH (Avoid icing and condensation.)

(3) Air 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]

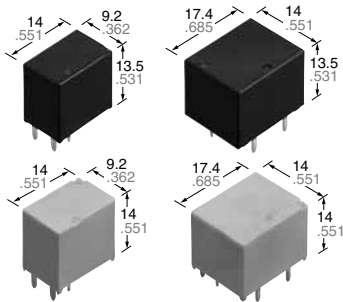


For general cautions for use, please refer to the “Automotive Relay Users Guide”.

Miniature PC Board,
Twin/1 Form C Type
Automotive Relay

TB RELAYS

<Protective construction>
Standard type/High heat-resistant type: Sealed
Pin in Paste compliant type: Flux tight



(Unit: mm inch)

RoHS compliant

FEATURES

- Compact and high-capacity 25 A load switching
- Wide line-up
- Pin in Paste compliant model added

TYPICAL APPLICATIONS

- Powered windows, Automatic door locks, Powered mirrors, Powered sunroof, Powered seats, Lift gates and Slide door closers, etc.

ORDERING INFORMATION

ACTB

Contact arrangement

1: 1 Form A

2: 1 Form C

3: 1 Form C × 2 (8 pins)

5: 1 Form C × 2 (10 pins)

Contact type

Nil: Standard type

L: Lamp control type

C: Standard type (Ag alloy / Cu clad)

Heat resistance/Protective construction

Nil: Standard type/Sealed

H: High heat-resistant type/Sealed

R: Pin in Paste compliant type/Flux tight

Coil resistance

1: 100Ω

2: 160Ω

3: 225Ω

TYPES

Contact arrangement	Contact type	Coil resistance	Part No.			Packing	
			Heat resistance				
			Standard type	High heat-resistant type	Pin in Paste compliant type	Carton (tube)	Case
1 Form A	Standard type	100Ω	ACTB11	ACTB1H1	ACTB1R1	50 pcs.	2,000 pcs.
		160Ω	ACTB12	ACTB1H2	ACTB1R2		
		225Ω	ACTB13	ACTB1H3	ACTB1R3		
	Standard type (Ag alloy / Cu clad)	100Ω	ACTB1C1	ACTB1CH1	ACTB1CR1		
		160Ω	ACTB1C2	ACTB1CH2	ACTB1CR2		
		225Ω	ACTB1C3	ACTB1CH3	ACTB1CR3		
	Lamp control type	100Ω	ACTB1L1	ACTB1LH1	ACTB1LR1		
		160Ω	ACTB1L2	ACTB1LH2	ACTB1LR2		
		225Ω	ACTB1L3	ACTB1LH3	ACTB1LR3		
1 Form C	Standard type	100Ω	ACTB21	ACTB2H1	ACTB2R1	50 pcs.	2,000 pcs.
		160Ω	ACTB22	ACTB2H2	ACTB2R2		
		225Ω	ACTB23	ACTB2H3	ACTB2R3		
	Standard type (Ag alloy / Cu clad)	100Ω	ACTB2C1	ACTB2CH1	ACTB2CR1		
		160Ω	ACTB2C2	ACTB2CH2	ACTB2CR2		
		225Ω	ACTB2C3	ACTB2CH3	ACTB2CR3		
	Lamp control type	100Ω	ACTB2L1	ACTB2LH1	ACTB2LR1		
		160Ω	ACTB2L2	ACTB2LH2	ACTB2LR2		
		225Ω	ACTB2L3	ACTB2LH3	ACTB2LR3		
1 Form C × 2 (8 pins)	Standard type	100Ω	ACTB31	ACTB3H1	ACTB3R1	25 pcs.	1,000 pcs.
		160Ω	ACTB32	ACTB3H2	ACTB3R2		
		225Ω	ACTB33	ACTB3H3	ACTB3R3		
	Standard type (Ag alloy / Cu clad)	100Ω	ACTB3C1	ACTB3CH1	ACTB3CR1		
		160Ω	ACTB3C2	ACTB3CH2	ACTB3CR2		
		225Ω	ACTB3C3	ACTB3CH3	ACTB3CR3		
1 Form C × 2 (10 pins)	Standard type	100Ω	ACTB51	ACTB5H1	ACTB5R1		
		160Ω	ACTB52	ACTB5H2	ACTB5R2		
		225Ω	ACTB53	ACTB5H3	ACTB5R3		
	Standard type (Ag alloy / Cu clad)	100Ω	ACTB5C1	ACTB5CH1	ACTB5CR1		
		160Ω	ACTB5C2	ACTB5CH2	ACTB5CR2		
		225Ω	ACTB5C3	ACTB5CH3	ACTB5CR3		
	Lamp control type	100Ω	ACTB5L1	ACTB5LH1	ACTB5LR1		
		160Ω	ACTB5L2	ACTB5LH2	ACTB5LR2		
		225Ω	ACTB5L3	ACTB5LH3	ACTB5LR3		

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 5.5V DC	Min. 0.5V DC	120 mA	100Ω	1,440 mW	10 to 16V DC
	Max. 6.5V DC	Min. 0.8V DC	75 mA	160Ω	900 mW	
	Max. 7.7V DC		53.3 mA	225Ω	640 mW	

Note: Other operate (set) voltage types are also available. Please inquire our sales representative for details.

2. Specifications

Specifications		
Contact data	Item	
	Contact arrangement	
	Contact resistance (initial)	
	Contact material	
	Rated switching capacity (resistive)	
	Max. carrying current (initial)*1	
Min. switching load (resistive)*2		
Insulated resistance (initial)		
Dielectric strength (initial)	Between open contacts	
	Between contacts and coil	
Time characteristics (initial)	Operate (Set) time (at rated voltage)	
	Release (Reset) time (at rated voltage)	
Shock resistance	Functional	
	Destructive	
Vibration resistance	Functional	
	Destructive	
Expected life	Mechanical	
	Electrical	Standard type
		Lamp control type*4
Conditions	Conditions for usage, transport and storage*3	
Weight		

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

*2. 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.

*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).

*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 inquire our sales representative 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 our sales representative when using with a circuit that causes an energized condition on both sides simultaneously.

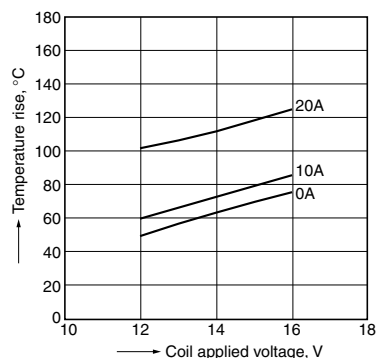
REFERENCE DATA

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

Sample: ACTB32, 3pcs.

Carrying current: 0A, 10A, 20A

Ambient temperature: Room temperature

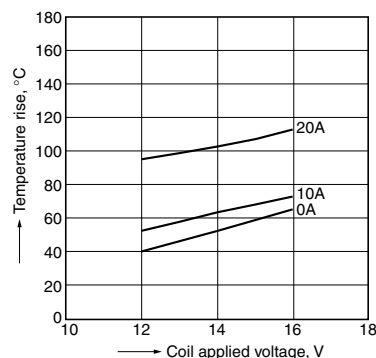


1.-(2) Coil temperature rise (at 85°C 185°F)

Sample: ACTB32, 3pcs.

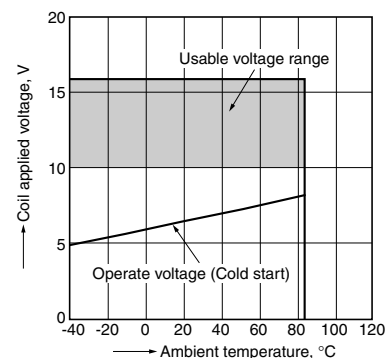
Carrying current: 0A, 10A, 20A

Ambient temperature: 85°C 185°F



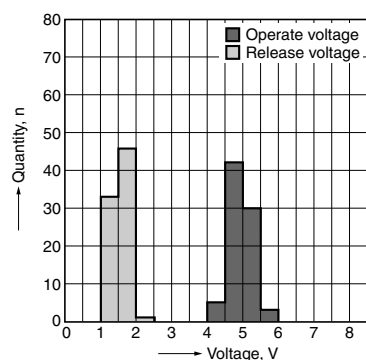
2. Ambient temperature and usable voltage range

Sample: ACTB32



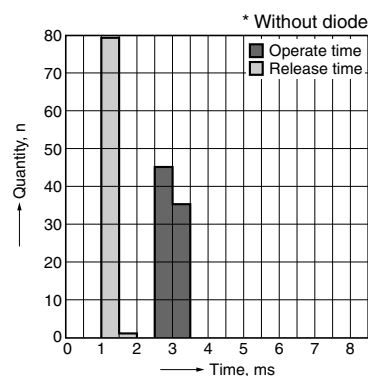
3. Distribution of operate (set) and release (reset) voltage

Sample: ACTB32, 40 × 2pcs.



4. Distribution of operate (set) and release (reset) time

Sample: ACTB32, 40 × 2pcs.



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

Sample: ACTB32, 3pcs.

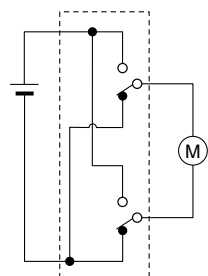
Load: 25A 14V DC

Power window motor actual load (lock condition)

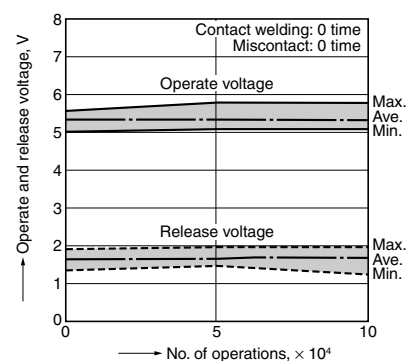
Operating frequency: ON 0.5s, OFF 9.5s

Ambient temperature: Room temperature

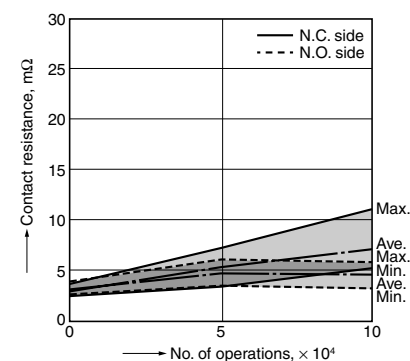
Circuit:



Change of operate (set) and release (reset) voltage

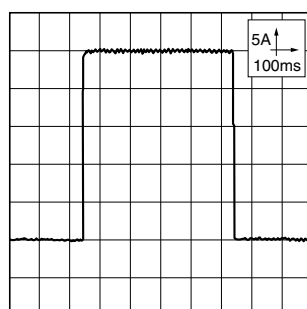


Change of contact resistance



Load current waveform

Current value: 25A



DIMENSIONS (mm inch)

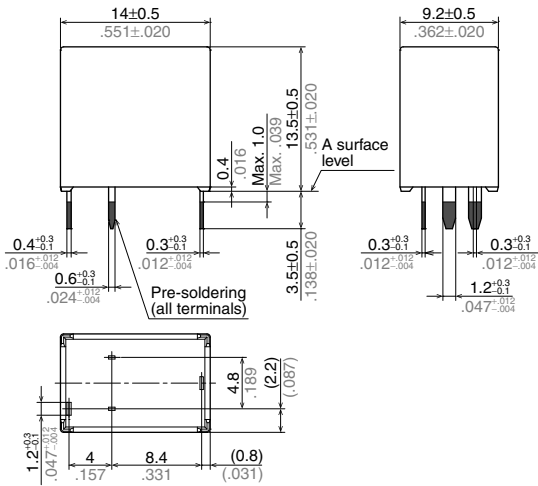
The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

1 Form A type

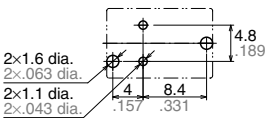
CAD



External dimensions

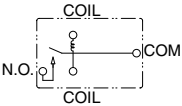


PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



* The lamp control type has polarized contacts. Connect N.O. to the “+ (plus)” side.

Dimension:	Tolerance
Less than 1mm .039inch:	$\pm 0.1 \pm .004$
Min. 1mm .039inch less than 3mm .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

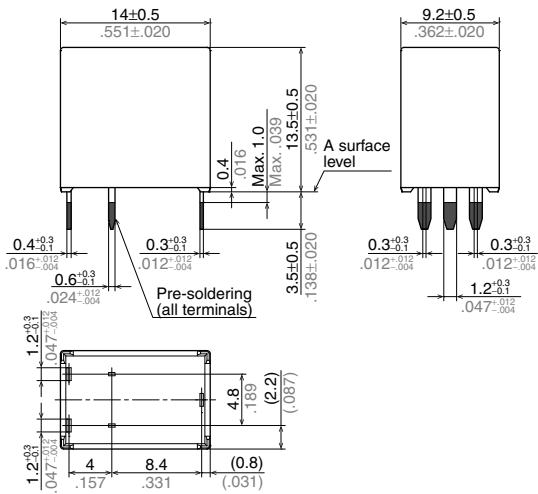
* Dimensions (thickness and width) of terminal is measured after pre-soldering. Intervals between terminals is measured at A surface level.

1 Form C type

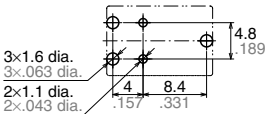
CAD



External dimensions

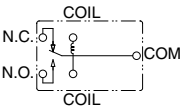


PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



* The lamp control type has polarized contacts. Connect N.O. to the “+ (plus)” side.

Dimension:	Tolerance
Less than 1mm .039inch:	$\pm 0.1 \pm .004$
Min. 1mm .039inch less than 3mm .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

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

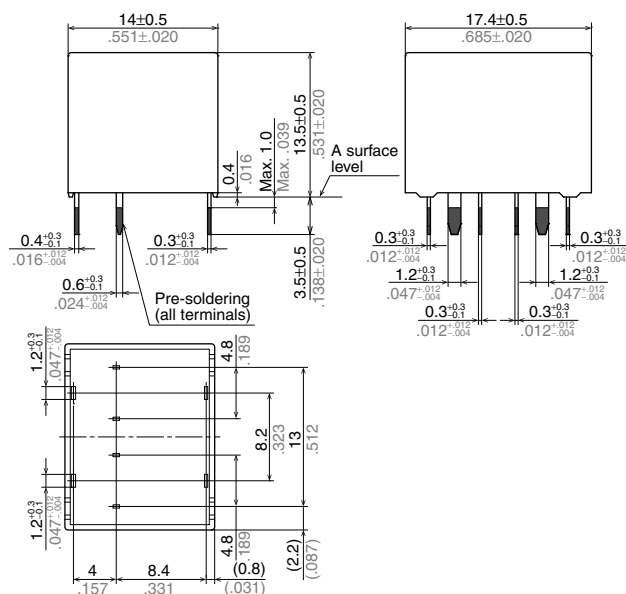
TB (ACTB)

Twin type (8 pins)

CAD



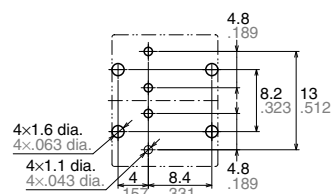
External dimensions



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

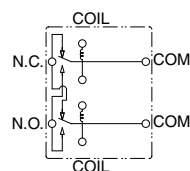
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

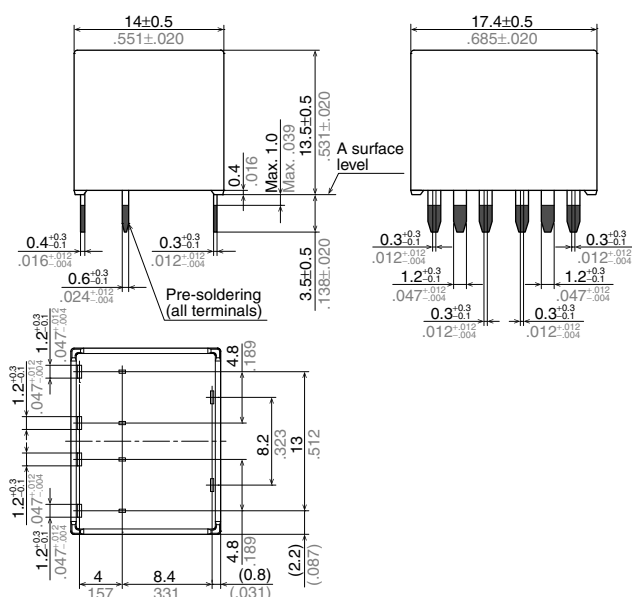


Twin type (10 pins)

CAD



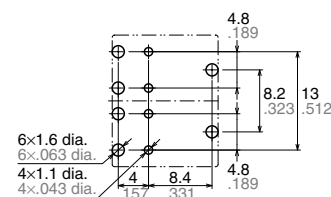
External dimensions



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

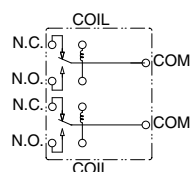
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



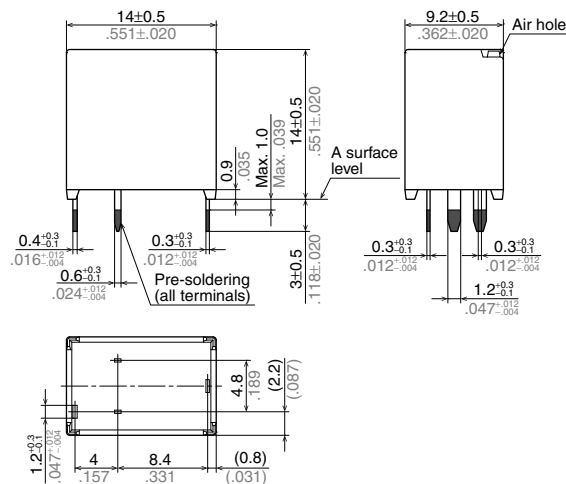
* The lamp control type has polarized contacts.
Connect N.O. to the "+" (plus)" side.

1 Form A type
Pin in Paste compliant type

CAD



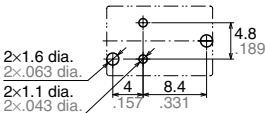
External dimensions



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

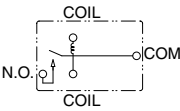
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



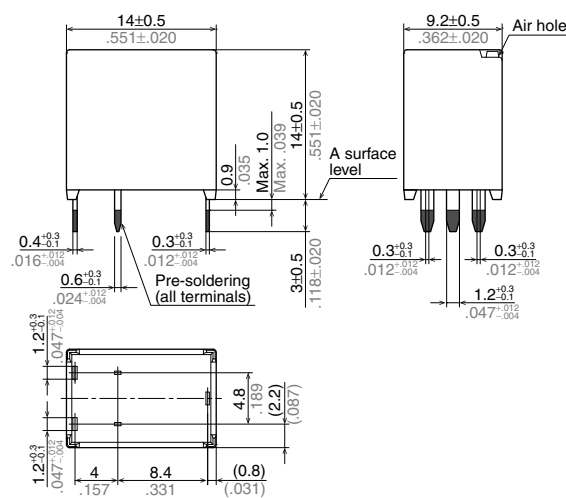
* The lamp control type has polarized contacts.
Connect N.O. to the “+ (plus)” side.

1 Form C type
Pin in Paste compliant type

CAD



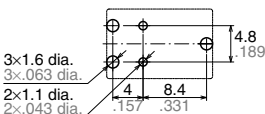
External dimensions



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

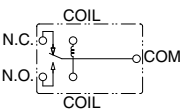
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

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.

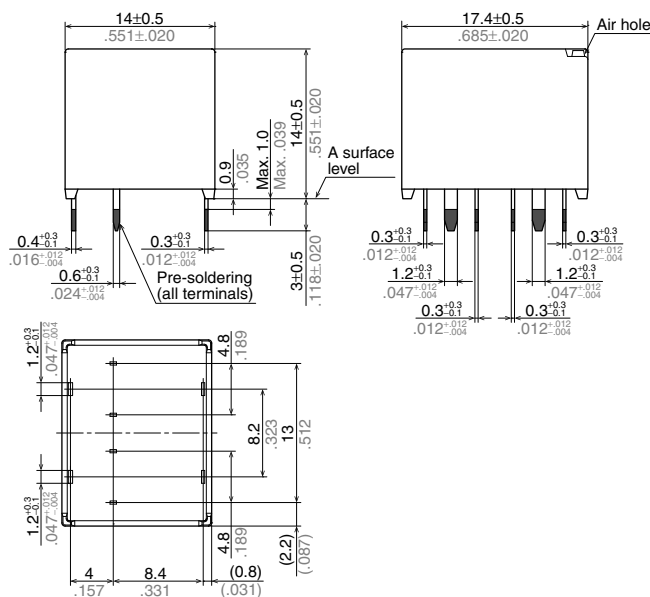
TB (ACTB)

Twin type (8 pins) Pin in Paste compliant type

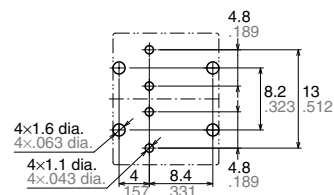
CAD



External dimensions

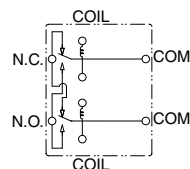


PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



Dimension:	Tolerance
Less than 1mm .039inch:	$\pm 0.1 \pm .004$
Min. 1mm .039inch less than 3mm .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

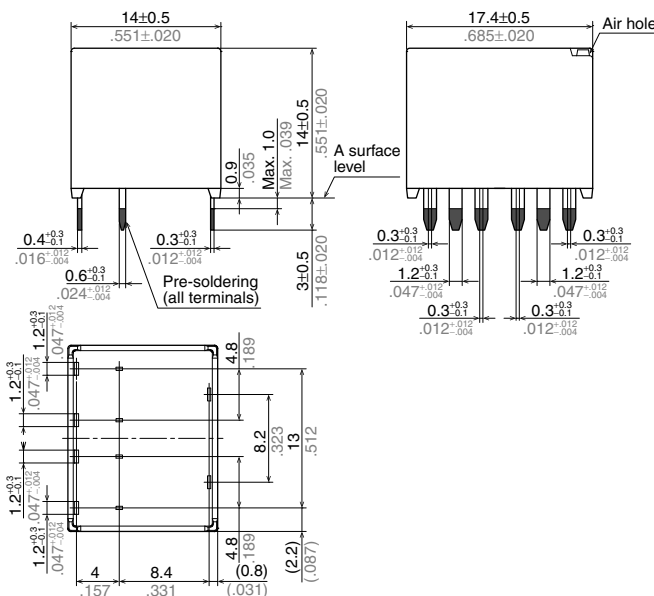
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

Twin type (10 pins) Pin in Paste compliant type

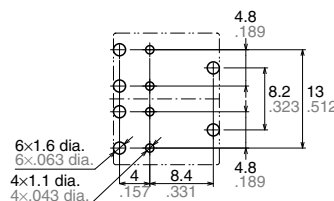
CAD



External dimensions

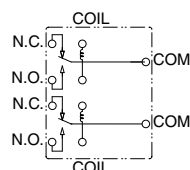


PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



* The lamp control type has polarized contacts.
Connect N.O. to the "+" (plus)" side.

Dimension:	Tolerance
Less than 1mm .039inch:	$\pm 0.1 \pm .004$
Min. 1mm .039inch less than 3mm .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

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

NOTES

Usage, transport and storage conditions

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

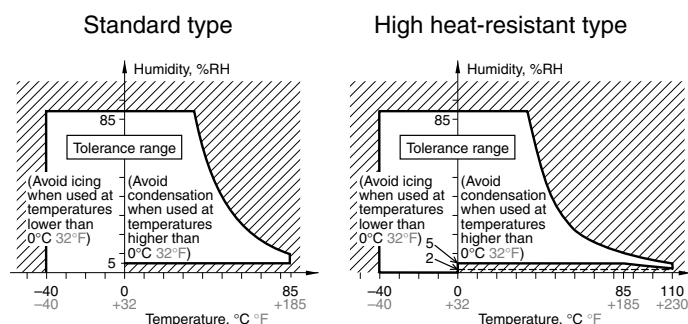
(1) Temperature: -40 to $+85^{\circ}\text{C}$ -40 to $+185^{\circ}\text{F}$ (Standard type)
 -40 to $+110^{\circ}\text{C}$ -40 to $+230^{\circ}\text{F}$ (High heat-resistant type/Pin in Paste compliant type)

(2) Humidity: 2 to 85% RH (Avoid icing and condensation.)

(3) Air 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]



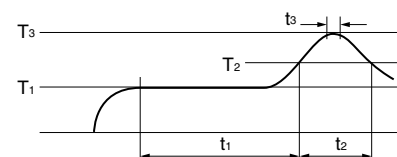
Mounting and cleaning conditions for Pin-in-Paste compliant type

When soldering this relay, please observe the following conditions.

[I.R.S. method (recommended)]

(Recommended number of reflows: 1)

t_1 = 60 to 120 sec.
 t_2 = Less than 30 sec.
 t_3 = Less than 5 sec.
 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



• Cautions for mounting

1. The temperature profile shows the temperature at the soldering portion on the PCB surface.
2. Depending on the mounting density condition, reflow heating method, and PCB type (metal etc.), the relay's exterior and interior temperature may become extremely high.
 Therefore, please confirm well under the actual use condition before use.

The other cautions of reflow soldering:

1. When soldering condition is out of recommendation, the relay performance may be adversely affected.
 If soldering conditions are out of our recommendation, please contact us before operation.
2. Please check the effect at the actual soldering because heat stress to relay is changed by PCB type and manufacturing process condition.
3. Solder creepage, wettability or soldering strength will be affected by the mounting condition or soldering material.
 Please check the actual production condition in detail.
4. Do not wash the relay as failures may occur.
5. This product is not plastic sealed type. Please perform coating with sufficient attention to avoid infiltration of the solvent to the inside. Also, please pay careful attention to use and store them with no contamination of foreign material.

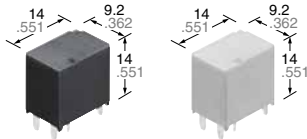
For general cautions for use, please refer to the "Automotive Relay Users Guide".

High Carrying Current
1 Form A Type Relay
for Miniature PC board

TB RELAYS
POWER TYPE

<Protective construction>
High heat-resistant type: Sealed
Pin in Paste compliant type: Flux tight

New



(Unit: mm inch)

RoHS compliant

FEATURES

- Compact, 30A and supports fuse
- Supports capacitor loads and low operating power type
- Pin in Paste compliant model added

TYPICAL APPLICATIONS

- Defoggers, Ignitions, Seat heaters, Powered windows, etc.

ORDERING INFORMATION

ACTB P

P: Power type	
Contact type	
C: Standard type (Ag alloy / Cu clad)	
D: Lamp control type (Ag alloy / Cu clad)	
Heat resistance/Protective construction	
H: High heat-resistant type/Sealed	
R: Pin in Paste compliant type/Flux tight	
Coil resistance	
4: 300Ω	

TYPES

Contact arrangement	Contact type	Rated coil voltage	Coil resistance	Part No.		Packing	
				Heat resistance		Carton	Case
				High heat-resistant type	Pin in Paste compliant type		
1 Form A	Standard type (Ag alloy / Cu clad)	12V DC	300Ω	ACTBPCH4	ACTBPCR4	50 pcs.	2,000 pcs.
	Lamp control type (Ag alloy / Cu clad)			ACTBPDH4	ACTBPDR4		

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 7.0V DC	Min. 0.5V DC	40 mA	300 Ω	480 mW	10 to 16V DC

Note: Other operate (set) voltage types are also available. Please inquire our sales representative for details.

2. Specifications

Specifications			Item	Specifications
Contact data			Contact arrangement	1 Form A
			Contact resistance (initial)	Max. 50mΩ (Typ. 3mΩ) (By voltage drop 1A 6V DC)
			Contact material	Ag alloy
			Rated switching capacity (resistive)	30A 14V DC
			Max. carrying current (initial)*1	30 A for 1 hour (12 V DC at 20°C 68°F)
			Min. switching load (resistive)*2	1A 14V DC (at 20°C 68°F)
Insulated resistance (initial)			Min. 100 MΩ (at 500V DC, Measurement at same location as “Dielectric strength” section.)	
Dielectric strength (initial)	Between open contacts		500 Vrms for 1 min. (Detection current: 10mA)	
	Between contacts and coil		500 Vrms for 1 min. (Detection current: 10mA)	
Time characteristics (initial)	Operate (Set) time (at rated voltage)		Max. 10ms (at 20°C 68°F, without contact bounce time)	
	Release (Reset) time (at rated voltage)		Max. 10ms (at 20°C 68°F, without contact bounce time) (Without diode)	
Shock resistance	Functional		Min. 100 m/s² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)	
	Destructive		Min. 1,000 m/s² {approx. 100G} (Half-wave pulse of sine wave: 6ms)	
Vibration resistance	Functional		10 to 100 Hz, Min. 44.1m/s² {approx. 4.5G} (Detection time: 10μs)	
	Destructive		10 to 500 Hz, Min. 44.1m/s² {approx. 4.5G} Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours	
Expected life	Mechanical		Min. 5×10⁶ (at 120 cpm)	
	Electrical	Standard type	<Resistive load> Min. 10⁵ at rated switching capacity, operating frequency: 1s ON, 9s OFF	
		Lamp control type*4	<Resistive and capacitor loads> Min. 10⁵: at 70 A (inrush), 15 A (steady), 14 V DC Operating frequency: 0.15s ON, 4.85s OFF	
Conditions	Conditions for usage, transport and storage*3		Ambient temperature: -40 to +110°C -40 to +230°F Humidity: 2 to 85% R.H. (Please avoid icing or condensation)	
Weight			approx. 5 g .176 oz	

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

*2. 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.

*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).

*4. Part numbers for electric discharge lamp loads or any other lamp loads and for capacitor loads only consist of "ACTBPD**".
When using the lamp control type, connect N.O. to the "+" (plus)" side. Please inquire our sales representative for details.

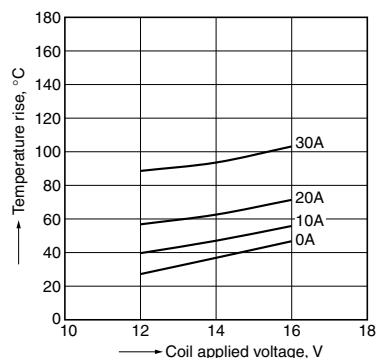
REFERENCE DATA

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

Sample: ACTBPDH4, 3 pcs.

Carrying current: 0A, 10A, 20A, 30A

Ambient temperature: Room temperature

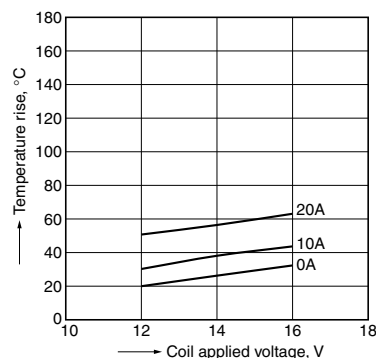


1.-(2) Coil temperature rise (at 110°C 230°F)

Sample: ACTBPDH4, 3 pcs.

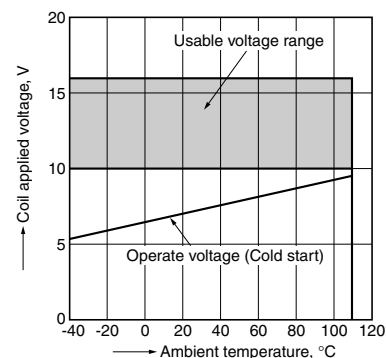
Carrying current: 0A, 10A, 20A

Ambient temperature: 110°C 230°F



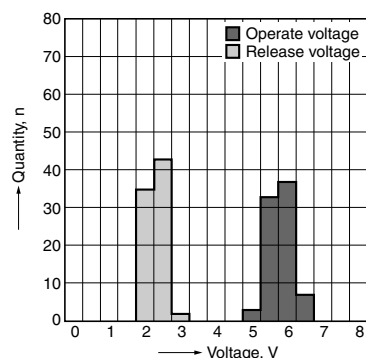
2. Ambient temperature and usable voltage range

Sample: ACTBPDH4



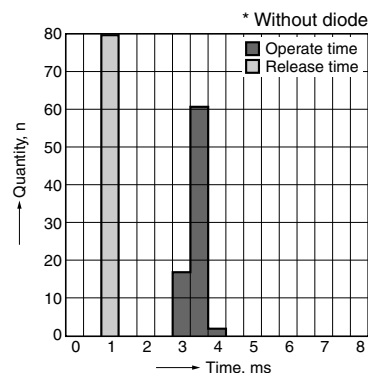
3. Distribution of operate (set) and release (reset) voltage

Sample: ACTBPDH4, 80 pcs.



4. Distribution of operate (set) and release (reset) time

Sample: ACTBPDH4, 80 pcs.



5.-(1) Electrical life test (Resistive and capacitor)

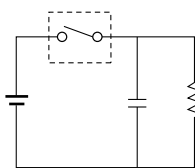
Sample: ACTBPDH4, 6 pcs.

Load: Inrush current: 70A, Steady current: 15A 14V DC

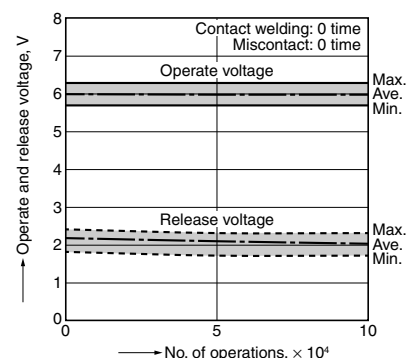
Switching frequency: ON 0.15s, OFF 4.85s

Ambient temperature: Room temperature

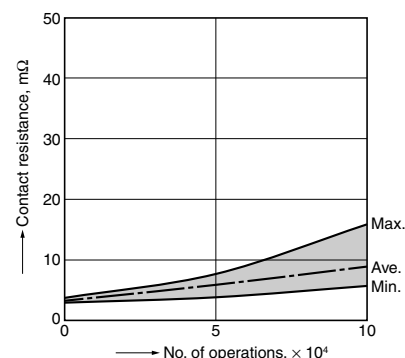
Circuit:



Change of operate (set) and release (reset) voltage



Change of contact resistance



DIMENSIONS (mm inch)

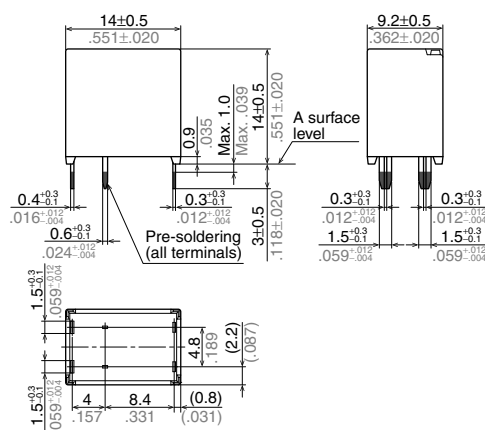
The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

1. 1 Form A type

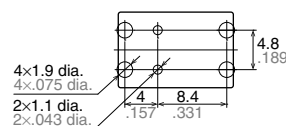
CAD



External dimensions

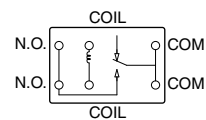


PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



* The lamp control type has polarized contacts. Connect N.O. to the "+" (plus)" side.

Dimension:

Less than 1mm .039inch:

Tolerance

$\pm 0.1 \pm .004$

Min. 1mm .039inch less than 3mm .118 inch: $\pm 0.2 \pm .008$

Min. 3mm .118 inch: $\pm 0.3 \pm .012$

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

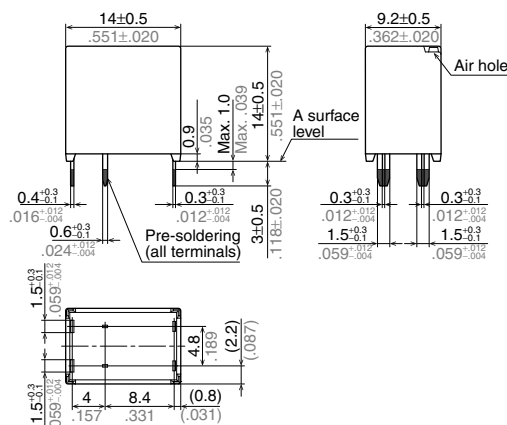
2. 1 Form A type

Pin in Paste compliant type

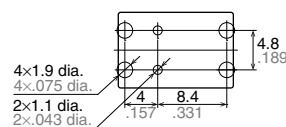
CAD



External dimensions

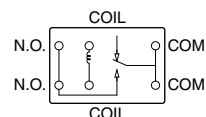


PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



* The lamp control type has polarized contacts. Connect N.O. to the "+" (plus)" side.

Dimension:

Less than 1mm .039inch:

Tolerance

$\pm 0.1 \pm .004$

Min. 1mm .039inch less than 3mm .118 inch: $\pm 0.2 \pm .008$

Min. 3mm .118 inch: $\pm 0.3 \pm .012$

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

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. Also, the power waveform should be rectangular.

2. Coil applied voltage

To ensure proper operation, the voltage applied to the coil should be the rated operating voltage of the coil. Also, be aware that the pick-up and drop-out voltages will fluctuate depending on the ambient temperature and operating conditions.

3. Expected life

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.

4. Soldering

When soldering the relays, ensure conformance with the conditions listed below.

1) Automatic soldering

Preheating soldering: 100°C 212°F, within 2 sec (surface of PC board)

Soldering: 260°C 500°F, within 5 sec

2) Manual soldering

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

Soldering iron: 30 to 60W

Soldering time: within 5 sec

5. Usage, transport and storage conditions

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

(1) Temperature:

–40 to +85°C –40 to +185°F (Standard type)

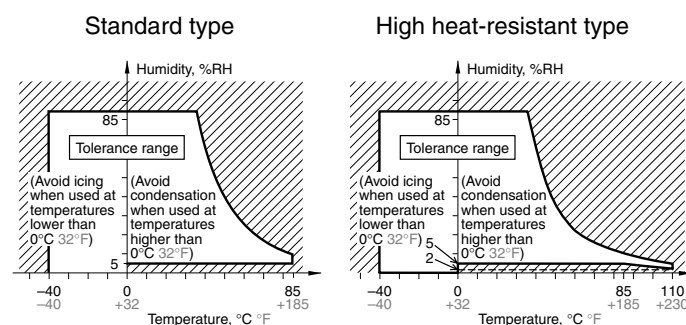
–40 to +110°C –40 to +230°F (High heat-resistant type)

(2) Humidity: 2 to 85% RH (Avoid icing and condensation.)

(3) Air 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.

3) Icing

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

4) Low temperature and low humidity environments

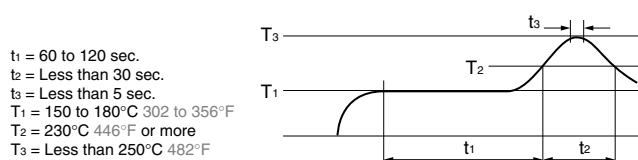
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

6. Mounting and cleaning conditions for Pin-in-Paste compliant type

When soldering this relay, please observe the following conditions.

[I.R.S. method (recommended)]

(Recommended number of reflows: 1)



• Cautions for mounting

1. The temperature profile shows the temperature at the soldering portion on the PCB surface.
2. Depending on the mounting density condition, reflow heating method, and PCB type (metal etc.), the relay's exterior and interior temperature may become extremely high.
Therefore, please confirm well under the actual use condition before use.

The other cautions of reflow soldering:

1. When soldering condition is out of recommendation, the relay performance may be adversely affected.
If soldering conditions are out of our recommendation, please contact us before operation.
2. Please check the effect at the actual soldering because heat stress to relay is changed by PCB type and manufacturing process condition.
3. Solder creepage, wettability or soldering strength will be affected by the mounting condition or soldering material. Please check the actual production condition in detail.
4. Do not wash the relay as failures may occur.
5. This product is not plastic sealed type. Please perform coating with sufficient attention to avoid infiltration of the solvent to the inside. Also, please pay careful attention to use and store them with no contamination of foreign material.

7. Others handling precautions

Do not use relays that have been dropped, because doing so may be a cause of faulty operation.

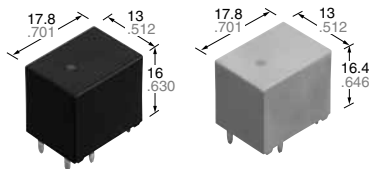
For general cautions for use, please refer to the “Automotive Relay Users Guide”.

High Load Relay for Smart J/B

TC RELAYS

<Protective construction>

Standard type/High heat-resistant type: Sealed
Pin in Paste compliant type: Flux tight



(Unit: mm inch)

RoHS compliant

FEATURES

- Large capacity switching despite small size. Can replace micro ISO terminal type relays.
- Latching type added
- Pin in Paste compliant model added

TYPICAL APPLICATIONS

- Head lamp, Fog lamp, Fan motor, 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

Contact type

- Nil: Standard type
C: Standard type (Ag alloy / Cu clad)

Heat resistance/Protective construction

- Nil: Standard type/Sealed
H: High heat-resistant type/Sealed
R: Pin in Paste compliant type/Flux tight

Coil resistance

- 1: 110Ω
2: 160Ω
3: 225Ω
6: 75Ω

TYPES

Contact arrangement/ Operation function	Contact type	Rated coil voltage	Coil resistance	Part No.			Packing	
				Heat resistance			Carton (tube)	Case
				Standard type	High heat-resistant type	Pin in Paste compliant type		
1 Form A/Standard type	Standard type	12V DC	110Ω	ACTC11	ACTC1H1	ACTC1R1	40 pcs.	800 pcs.
			160Ω	ACTC12	ACTC1H2	ACTC1R2		
			225Ω	ACTC13	ACTC1H3	ACTC1R3		
	Standard type (Ag alloy / Cu clad)		110Ω	ACTC1C1	ACTC1CH1	ACTC1CR1		
			160Ω	ACTC1C2	ACTC1CH2	ACTC1CR2		
			225Ω	ACTC1C3	ACTC1CH3	ACTC1CR3		
1 Form C/Standard type	Standard type		110Ω	ACTC21	ACTC2H1	ACTC2R1		
			160Ω	ACTC22	ACTC2H2	ACTC2R2		
			225Ω	ACTC23	ACTC2H3	ACTC2R3		
	Standard type (Ag alloy / Cu clad)		110Ω	ACTC2C1	ACTC2CH1	ACTC2CR1		
			160Ω	ACTC2C2	ACTC2CH2	ACTC2CR2		
			225Ω	ACTC2C3	ACTC2CH3	ACTC2CR3		
Double make contact 2 Form A/ Standard type	Standard type		110Ω	ACTC31	ACTC3H1	ACTC3R1		
			160Ω	ACTC32	ACTC3H2	ACTC3R2		
	Standard type (Ag alloy / Cu clad)		110Ω	ACTC3C1	ACTC3CH1	ACTC3CR1		
			160Ω	ACTC3C2	ACTC3CH2	ACTC3CR2		
Double make contact 2 Form A/ 2 coil latching type	Standard type		75Ω	ACTC66	ACTC6H6	ACTC6R6		
	Standard type (Ag alloy / Cu clad)		75Ω	ACTC6C6	ACTC6CH6	ACTC6CR6		

RATING

1. Coil data

1) Standard type

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 6.5V DC	Min. 0.5V DC	109 mA		110Ω	1,309 mW	10 to 16V DC
	Max. 7.0V DC		75 mA		160Ω	900 mW	
	Max. 7.5V DC		53.3 mA		225Ω	640 mW	

Note: Other operate (set) voltage types are also available. Please inquire our sales representative for details.

2) 2 coil latching type

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)		Coil resistance [±10%] (at 20°C 68°F)		Rated 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	Max. 7.2V DC	160 mA	160 mA	75Ω	75Ω	1,920 mW	1,920 mW	10 to 16V DC

2. Specifications

Item		Specifications
Contact data	Contact arrangement	1 Form A, 1 Form C, Double make contact 2 Form A
	Contact resistance (initial)	Max. 50mΩ (N.O. side: typ. 3mΩ, N.C. side: typ. 4mΩ) (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	N.O. side: 30A 14V DC, N.C. side: 15A 14V DC
	Max. carrying current (initial)* ¹	35A for 1 hour (Coil applied voltage 12V DC, at 20°C 68°F)
	Min. switching load (resistive)* ²	1A 14V DC (at 20°C 68°F)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time)
	Release (Reset) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time) (without diode)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 100 Hz, Min. 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)
	Destructive	10 to 500 Hz, Min. 44.1 m/s ² {approx. 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* ⁴	<Resistive load> Min. 10 ⁵ at rated 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), 12A (steady), 14 V DC, Operating frequency: 1s ON, 14s OFF
Conditions	Conditions for usage, transport and storage* ³	Standard type Ambient temperature: -40 to +85°C -40 to +185°F, Humidity: 5 to 85% R.H. High heat-resistant/Pin in Paste compliant type Ambient temperature: -40 to +110°C -40 to +230°F, Humidity: 2 to 85% R.H. (Please avoid icing or condensation)
Weight		Approx. 10 g .35 oz

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

*2. 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.

*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).

*4. When using with an electric discharge lamp load or any other lamp load, or a capacitor load, connect COM to the "+" (plus)" side.

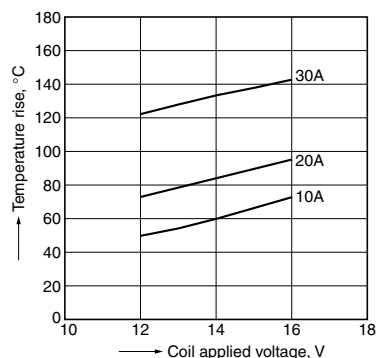
REFERENCE DATA

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

Sample: ACTC12, 3pcs.

Carrying current: 10A, 20A, 30A

Ambient temperature: Room temperature

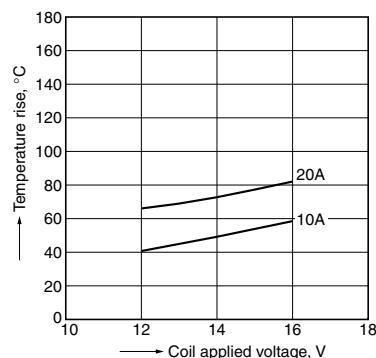


1.-(2) Coil temperature rise (at 85°C 185°F)

Sample: ACTC12, 3pcs.

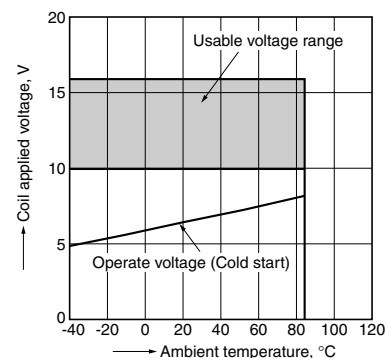
Carrying current: 10A, 20A

Ambient temperature: 85°C 185°F



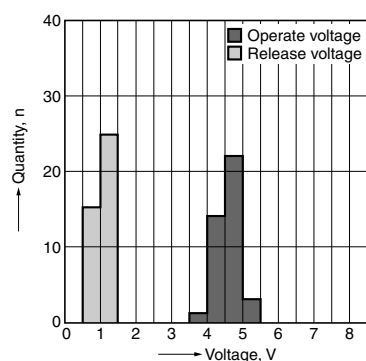
2. Ambient temperature and usable voltage range

Sample: ACTC12



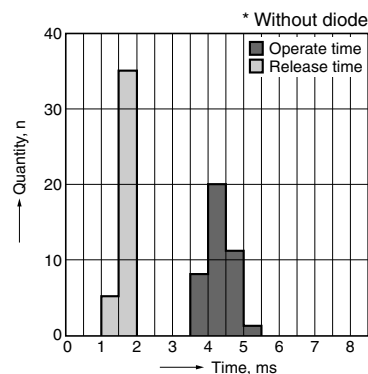
3. Distribution of operate (set) and release (reset) voltage

Sample: ACTC12, 40pcs.



4. Distribution of operate (set) and release (reset) time

Sample: ACTC12, 40pcs.



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

Sample: ACTC12, 6pcs.

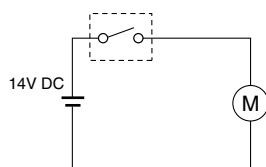
Load: 30A 14V DC

Motor load (lock condition)

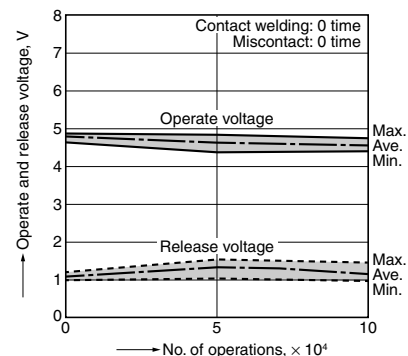
Operating frequency: ON 0.5s, OFF 9.5s

Ambient temperature: Room temperature

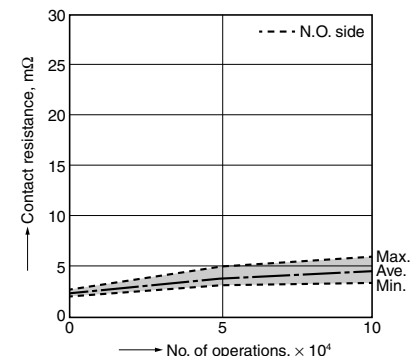
Circuit:



Change of operate (set) and release (reset) voltage



Change of contact resistance



5.-(2) Electrical life test (Lamp load)

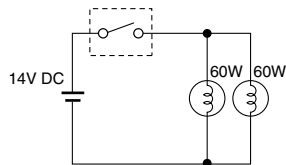
Sample: ACTC12, 6pcs.

Load: inrush current: 84A, steady current: 12A 14V DC

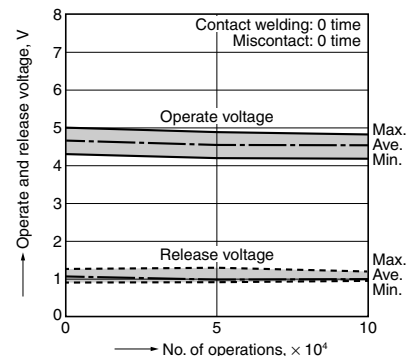
Operating frequency: ON 1s, OFF 14s

Ambient temperature: Room temperature

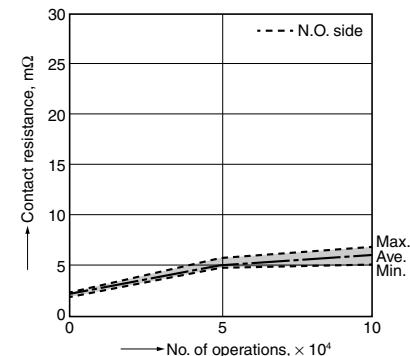
Circuit:

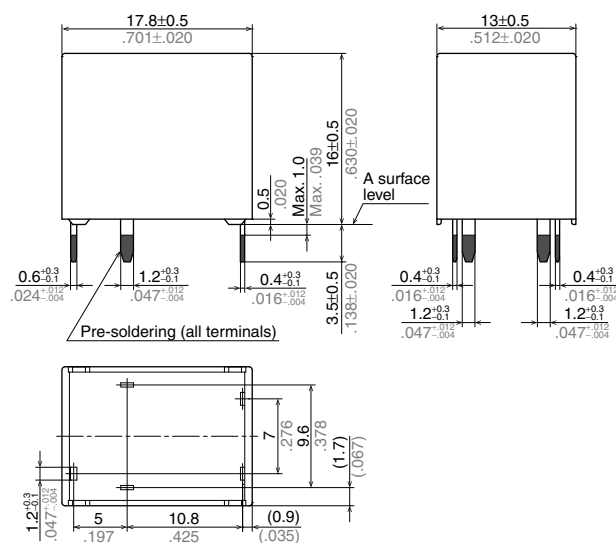
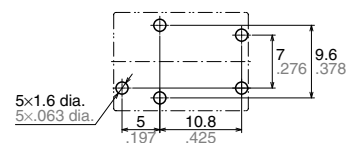
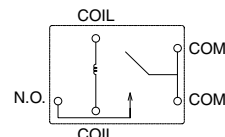


Change of operate (set) and release (reset) voltage



Change of contact resistance



DIMENSIONS (mm inch)The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>**1 Form A type/Standard type****CAD****External dimensions****PC board pattern (Bottom view)**Tolerance: $\pm 0.1 \pm .004$ **Schematic (Bottom view)**

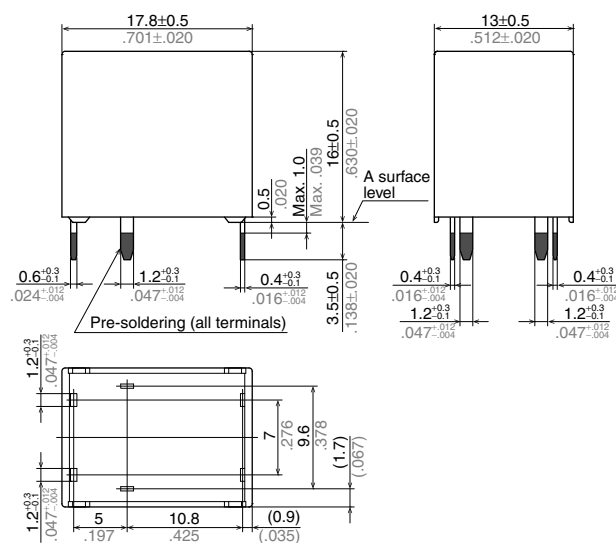
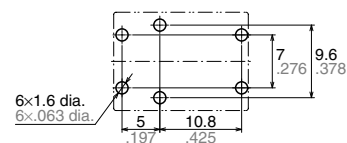
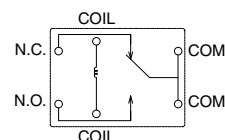
* The lamp control type has polarized contacts. Connect COM to the "+" (plus)" side.

Dimension:

Less than 1mm .039inch:

Tolerance $\pm 0.1 \pm .004$ Min. 1mm .039inch less than 3mm .118 inch: $\pm 0.2 \pm .008$ Min. 3mm .118 inch: $\pm 0.3 \pm .012$

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

1 Form C/Standard type**CAD****External dimensions****PC board pattern (Bottom view)**Tolerance: $\pm 0.1 \pm .004$ **Schematic (Bottom view)**

* The lamp control type has polarized contacts. Connect COM to the "+" (plus)" side.

Dimension:

Less than 1mm .039inch:

Tolerance $\pm 0.1 \pm .004$ Min. 1mm .039inch less than 3mm .118 inch: $\pm 0.2 \pm .008$ Min. 3mm .118 inch: $\pm 0.3 \pm .012$

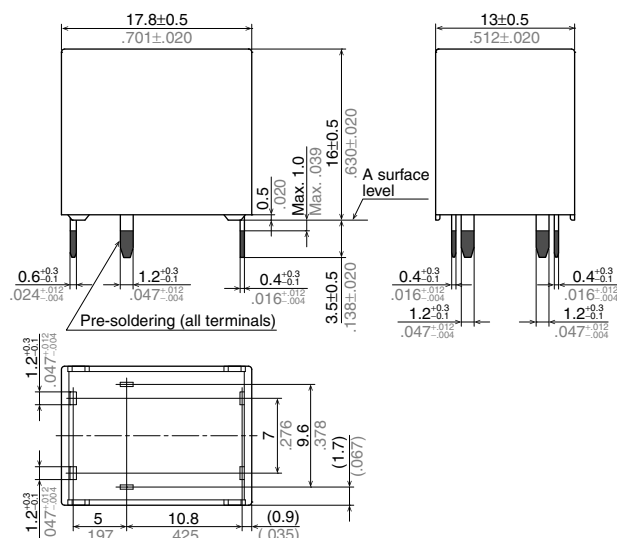
* Dimensions (thickness and width) of terminal is measured after pre-soldering. Intervals between terminals is measured at A surface level.

Double make contact 2 Form A / Standard type

CAD



External dimensions



Dimension:

Less than 1mm .039inch:

Min. 1mm .039inch less than 3mm .118 inch: $\pm 0.2 \pm .008$

Min. 3mm .118 inch:

Tolerance

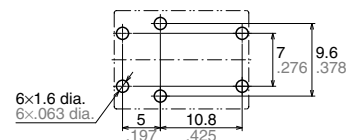
$\pm 0.1 \pm .004$

$\pm 0.2 \pm .008$

$\pm 0.3 \pm .012$

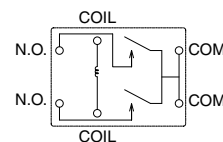
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



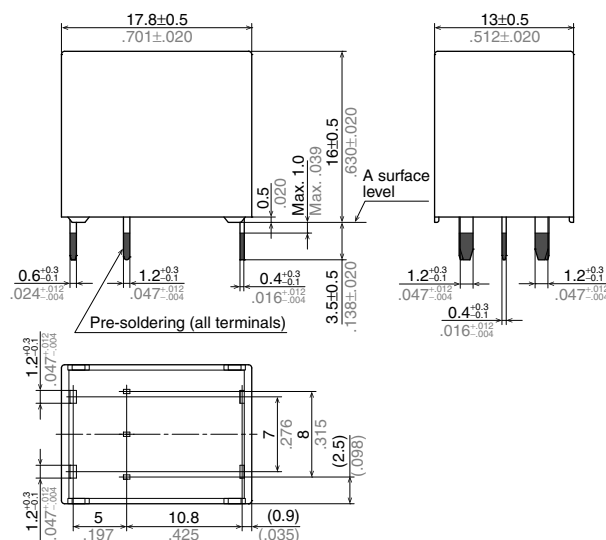
* The lamp control type has polarized contacts.
Connect COM to the "+" (plus)" side.

Double make contact 2 Form A / 2 coil latching type

CAD



External dimensions



Dimension:

Less than 1mm .039inch:

Min. 1mm .039inch less than 3mm .118 inch: $\pm 0.2 \pm .008$

Min. 3mm .118 inch:

Tolerance

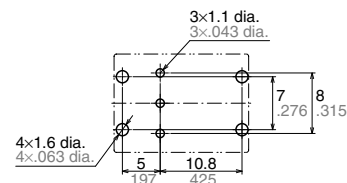
$\pm 0.1 \pm .004$

$\pm 0.2 \pm .008$

$\pm 0.3 \pm .012$

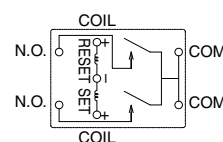
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



* The lamp control type has polarized contacts.
Connect COM to the "+" (plus)" side.

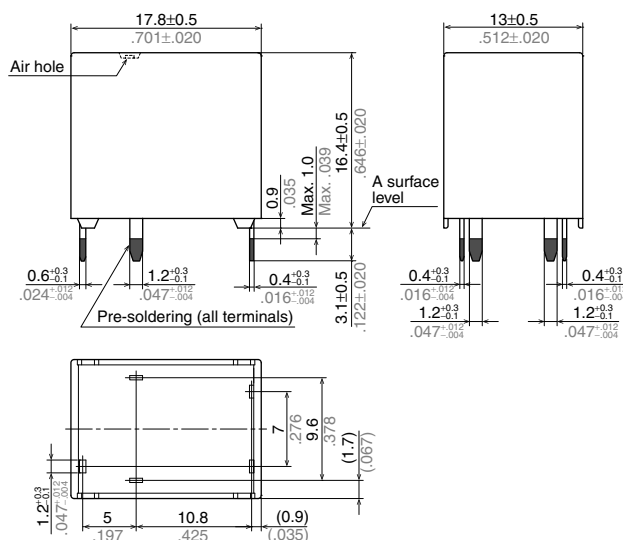
1 Form A / Standard type

Pin in Paste compliant type

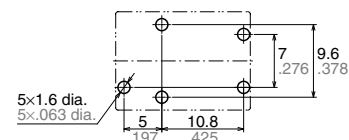
CAD



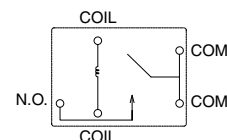
External dimensions



PC board pattern (Bottom view)

Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



* The lamp control type has polarized contacts. Connect COM to the "+" (plus)" side.

Dimension:

Less than 1mm .039inch:

Tolerance

 $\pm 0.1 \pm .004$ Min. 1mm .039inch less than 3mm .118 inch: $\pm 0.2 \pm .008$ Min. 3mm .118 inch: $\pm 0.3 \pm .012$

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

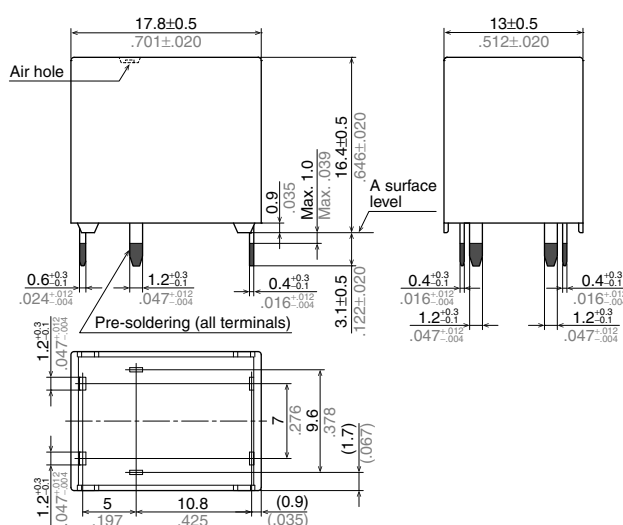
1 Form C / Standard type

Pin in Paste compliant type

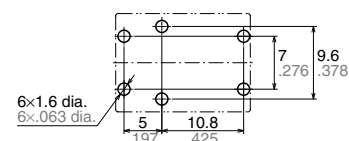
CAD



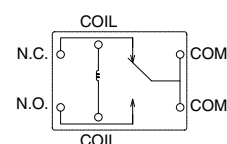
External dimensions



PC board pattern (Bottom view)

Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



* The lamp control type has polarized contacts. Connect COM to the "+" (plus)" side.

Dimension:

Less than 1mm .039inch:

Tolerance

 $\pm 0.1 \pm .004$ Min. 1mm .039inch less than 3mm .118 inch: $\pm 0.2 \pm .008$ Min. 3mm .118 inch: $\pm 0.3 \pm .012$

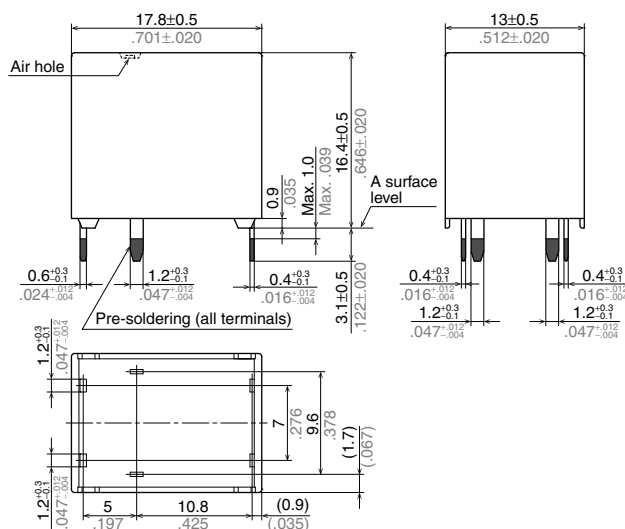
* Dimensions (thickness and width) of terminal is measured after pre-soldering. Intervals between terminals is measured at A surface level.

Double make contact 2 Form A / Standard type Pin in Paste compliant type

CAD



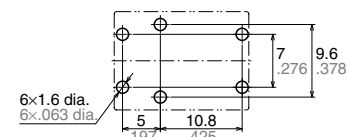
External dimensions



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

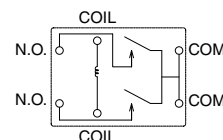
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



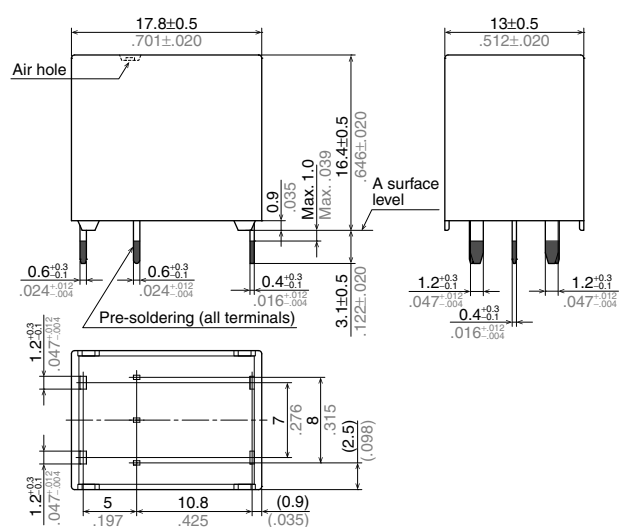
* The lamp control type has polarized contacts.
Connect COM to the "+" (plus)" side.

Double make contact 2 Form A / 2 coil latching type Pin in Paste compliant type

CAD



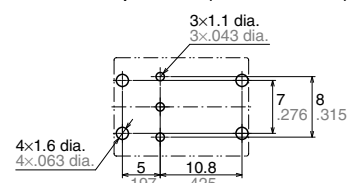
External dimensions



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

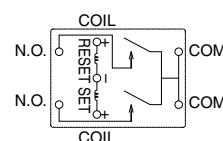
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

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.

NOTES

Usage, transport and storage conditions

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

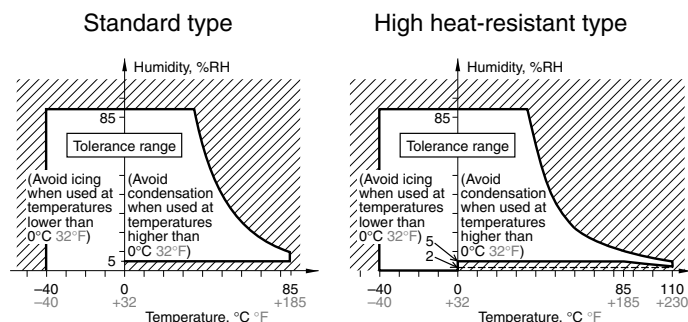
(1) Temperature: -40 to $+85^{\circ}\text{C}$ -40 to $+185^{\circ}\text{F}$ (Standard type)
 -40 to $+110^{\circ}\text{C}$ -40 to $+230^{\circ}\text{F}$ (High heat-resistant type/Pin in Paste compliant type)

(2) Humidity: 2 to 85% RH (Avoid icing and condensation.)

(3) Air 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]

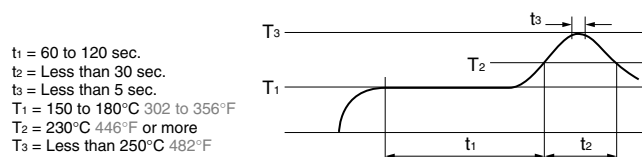


Mounting and cleaning conditions for Pin-in-Paste compliant type

When soldering this relay, please observe the following conditions.

[I.R.S. method (recommended)]

(Recommended number of reflows: 1)



• Cautions for mounting

1. The temperature profile shows the temperature at the soldering portion on the PCB surface.
2. Depending on the mounting density condition, reflow heating method, and PCB type (metal etc.), the relay's exterior and interior temperature may become extremely high.
 Therefore, please confirm well under the actual use condition before use.

The other cautions of reflow soldering:

1. When soldering condition is out of recommendation, the relay performance may be adversely affected.
 If soldering conditions are out of our recommendation, please contact us before operation.
2. Please check the effect at the actual soldering because heat stress to relay is changed by PCB type and manufacturing process condition.
3. Solder creepage, wettability or soldering strength will be affected by the mounting condition or soldering material.
 Please check the actual production condition in detail.
4. Do not wash the relay as failures may occur.
5. This product is not plastic sealed type. Please perform coating with sufficient attention to avoid infiltration of the solvent to the inside. Also, please pay careful attention to use and store them with no contamination of foreign material.

For general cautions for use, please refer to the "Automotive Relay Users Guide".

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 cause setting and resetting of the latching relay, apply the rated square wave voltage using as a guide five times or more for the set time or the reset time of each product. Furthermore, please verify operation.

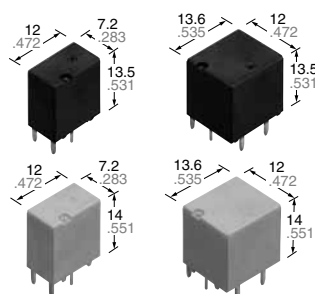
Miniature PC Board, Twin Type, 1 Form C Automotive Relay

TE RELAYS

<Protective construction>

High heat-resistant type: Sealed

Pin in Paste compliant type: Flux tight



(Unit: mm inch)

RoHS compliant

FEATURES

- Compact and high-capacity 25 A load switching
- Pin in Paste compliant model added

TYPICAL APPLICATIONS

- Powered windows, Automatic door locks, Powered mirrors, Powered sunroof, Powered seats, Lift gates and Slide door closers, etc.

ORDERING INFORMATION

ACTE

Contact arrangement

2: 1 Form C

3: 1 Form C × 2 (8 pins)

5: 1 Form C × 2 (10 pins)

Contact type

Nil: Standard type

C: Standard type (Ag alloy / Cu clad)

Heat resistance/Protective construction

H: High heat-resistant type/Sealed

R: Pin in Paste compliant type/Flux tight

Coil resistance

1: 110Ω

2: 160Ω

3: 220Ω

TYPES

Contact arrangement	Contact type	Rated coil voltage	Coil resistance	Part No.		Packing	
				Heat resistance			
				High heat-resistant type	Pin in Paste compliant type	Carton (tube)	Case
1 Form C	Standard type	12V DC	110Ω	ACTE2H1	ACTE2R1	50 pcs.	2,000 pcs.
			160Ω	ACTE2H2	ACTE2R2		
			220Ω	ACTE2H3	ACTE2R3		
	Standard type (Ag alloy / Cu clad)		110Ω	ACTE2CH1	ACTE2CR1		
			160Ω	ACTE2CH2	ACTE2CR2		
			220Ω	ACTE2CH3	ACTE2CR3		
1 Form C × 2 (8 pins)	Standard type		110Ω	ACTE3H1	ACTE3R1	40 pcs.	
			160Ω	ACTE3H2	ACTE3R2		
			220Ω	ACTE3H3	ACTE3R3		
	Standard type (Ag alloy / Cu clad)		110Ω	ACTE3CH1	ACTE3CR1		
			160Ω	ACTE3CH2	ACTE3CR2		
			220Ω	ACTE3CH3	ACTE3CR3		
1 Form C × 2 (10 pins)	Standard type		110Ω	ACTE5H1	ACTE5R1		
			160Ω	ACTE5H2	ACTE5R2		
			220Ω	ACTE5H3	ACTE5R3		
	Standard type (Ag alloy / Cu clad)		110Ω	ACTE5CH1	ACTE5CR1		
			160Ω	ACTE5CH2	ACTE5CR2		
			220Ω	ACTE5CH3	ACTE5CR3		

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 5.5V DC	Min. 0.6V DC	109 mA	110Ω	1,309 mW	10 to 16V DC
	Max. 6.5V DC	Min. 0.8V DC	75 mA	160Ω	900 mW	
	Max. 7.7V DC		54.5 mA	220Ω	655 mW	

2. Specifications

Item		Specifications
Contact data	Contact arrangement	1 Form C, 1 Form C × 2
	Contact resistance (initial)	Max. 50mΩ (N.O. side: typ. 4mΩ, N.C. side: typ. 5mΩ) (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	N.O. side: 20A 14V DC, N.C. side: 10A 14V DC
	Max. carrying current (initial)*1	25A for 2 minutes (Coil applied voltage 12V DC, at 20°C 68°F)
	Min. switching load (resistive)*2	1A 14V DC (at 20°C 68°F)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time)
	Release (Reset) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time) (Without diode)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 100 Hz, Min. 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)
	Destructive	10 to 500 Hz, Min. 44.1 m/s ² {approx. 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 rated 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 usage, transport and storage*3	Ambient temperature: -40 to +110°C -40 to +230°F, Humidity: 2 to 85% R.H. (Please avoid icing or condensation)
Weight		Single type: approx. 3.5 g .12 oz, Twin type: approx. 6.5 g .23 oz

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

*2. 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.

*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

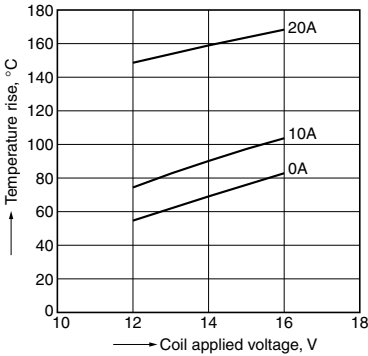
Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).

*4. Do not use for lamp loads, electric discharge lamp loads, any other lamp loads and capacitor loads. Please inquire our sales representative for details.

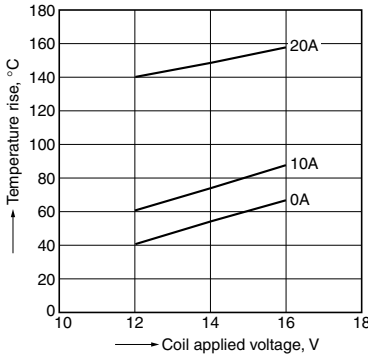
* If the relay is used continuously for long periods of time with coils on both sides in an energized condition, breakdown might occur due to abnormal heating depending on the carrying condition. Therefore, please inquire our sales representative when using with a circuit that causes an energized condition on both sides simultaneously.

REFERENCE DATA

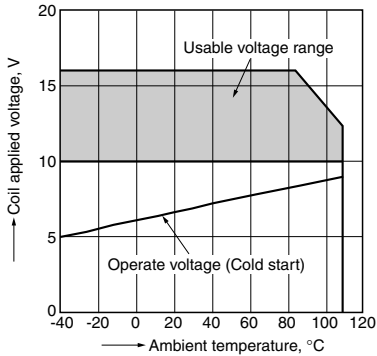
1.-(1) Coil temperature rise (at room temperature)
Sample: ACTE3H2, 3pcs.
Carrying current: 0A, 10A, 20A
Ambient temperature: Room temperature



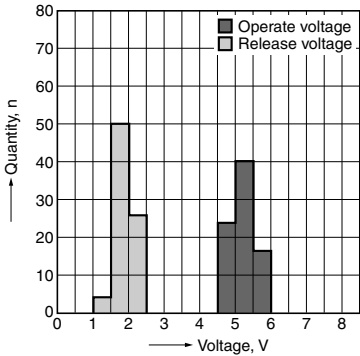
1.-(2) Coil temperature rise (at 110°C 230°F)
Sample: ACTE3H2, 3pcs.
Carrying current: 0A, 10A, 20A
Ambient temperature: 110°C 230°F



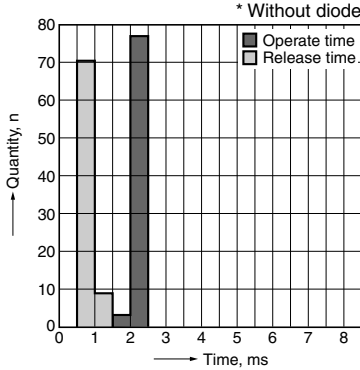
2. Ambient temperature and usable voltage range
Sample: ACTE3H2



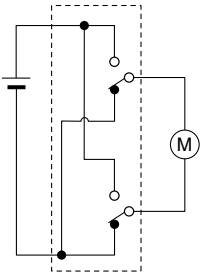
3. Distribution of operate (set) and release (reset) voltage
Sample: ACTE3H2, 40 × 2pcs.



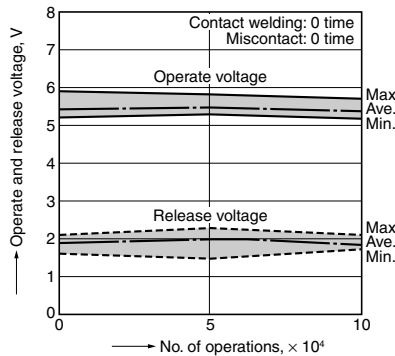
4. Distribution of operate (set) and release (reset) time
Sample: ACTE3H2, 40 × 2pcs.



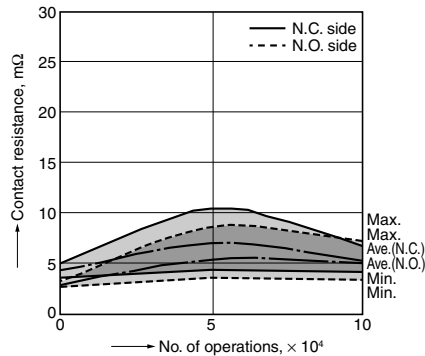
5.-(1) Electrical life test (Motor lock)
Sample: ACTE3H2, 3pcs.
Load: 25A 14V DC
Power window motor actual load (lock condition)
Operating frequency: ON 0.5s, OFF 9.5s
Ambient temperature: Room temperature
Circuit:



Change of operate (set) and release (reset) voltage

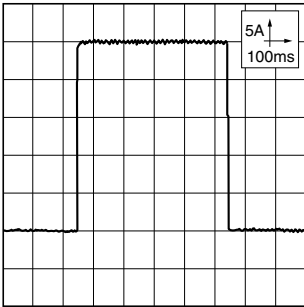


Change of contact resistance



Load current waveform

Current value: 25A



DIMENSIONS (mm inch)

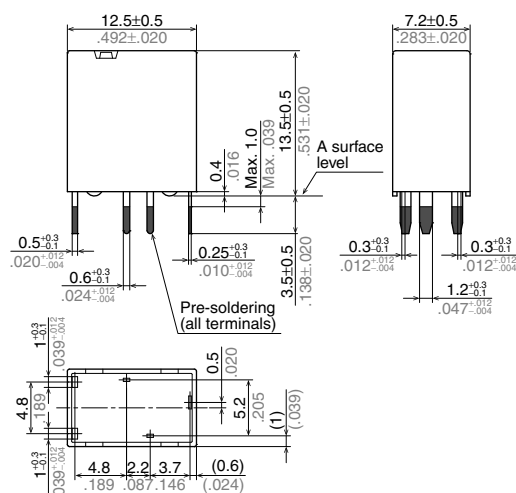
The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

1 Form C type

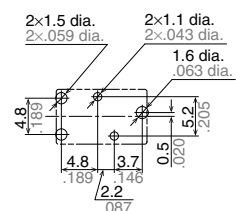
CAD



External dimensions

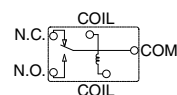


PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



Dimension:	Tolerance
Less than 1mm .039inch:	$\pm 0.1 \pm .004$
Min. 1mm .039inch less than 3mm .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

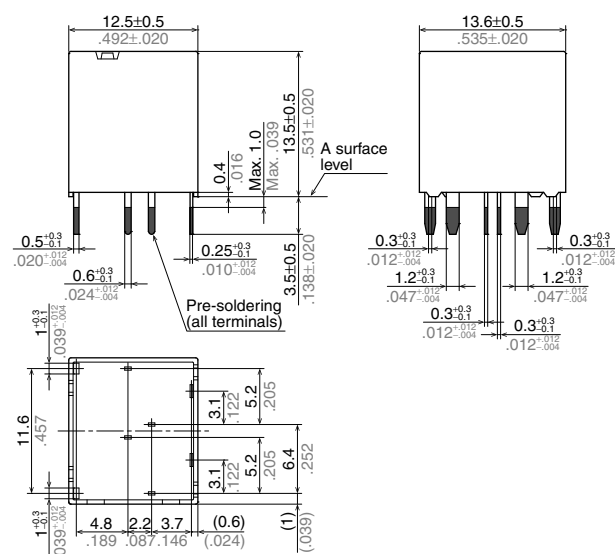
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

Twin type (8 pins)

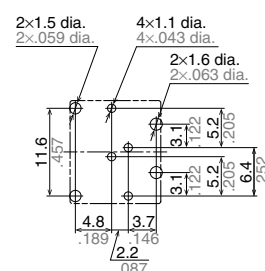
CAD



External dimensions

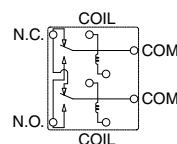


PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



Dimension:	Tolerance
Less than 1mm .039inch:	$\pm 0.1 \pm .004$
Min. 1mm .039inch less than 3mm .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

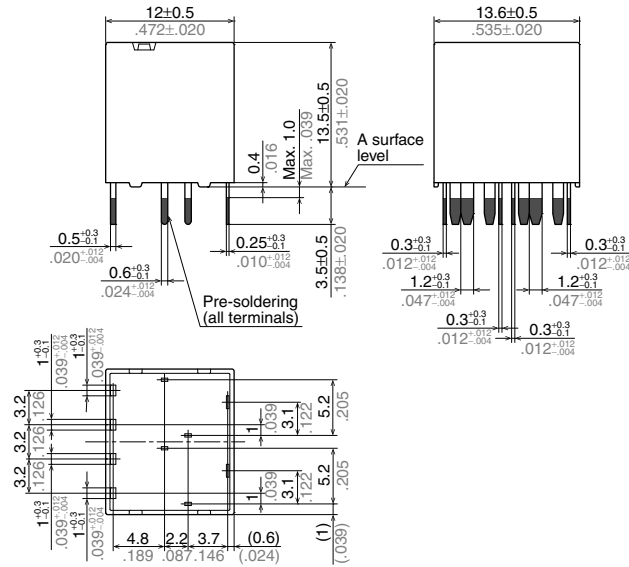
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

Twin type (10 pins)

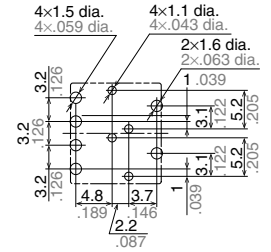
CAD



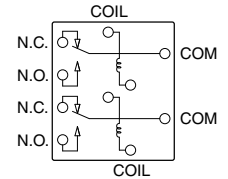
External dimensions



PC board pattern (Bottom view)

Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)

Dimension:

Less than 1mm .039inch:

Min. 1mm .039inch less than 3mm .118 inch:

Min. 3mm .118 inch:

Tolerance $\pm 0.1 \pm .004$ $\pm 0.2 \pm .008$ $\pm 0.3 \pm .012$

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

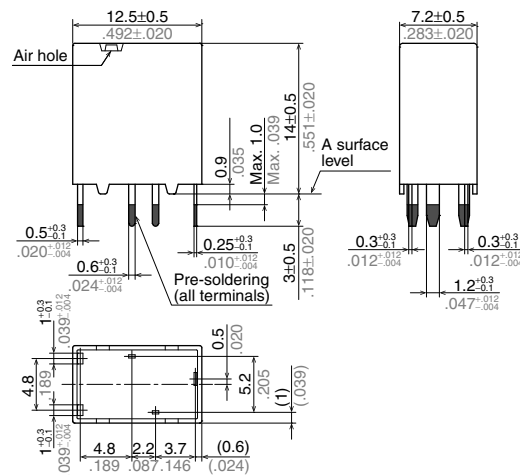
1 Form C type

Pin in Paste compliant type

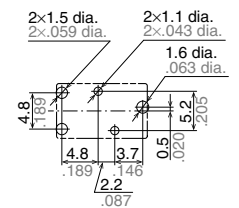
CAD



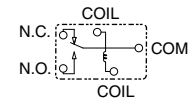
External dimensions



PC board pattern (Bottom view)

Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)

Dimension:

Less than 1mm .039inch:

Min. 1mm .039inch less than 3mm .118 inch:

Min. 3mm .118 inch:

Tolerance $\pm 0.1 \pm .004$ $\pm 0.2 \pm .008$ $\pm 0.3 \pm .012$

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

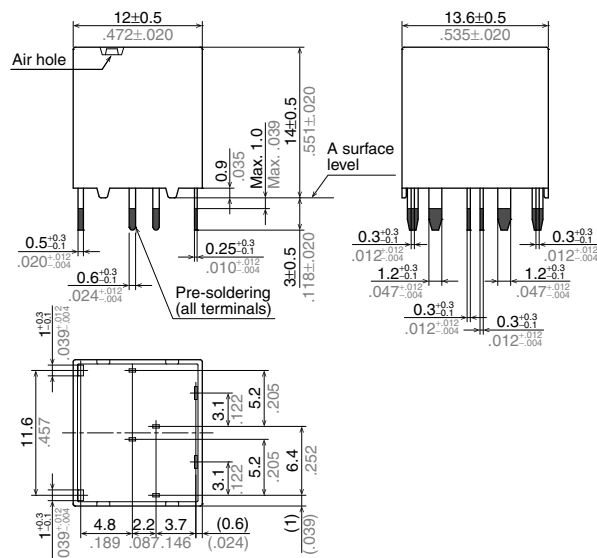
TE (ACTE)

Twin type (8 pins) Pin in Paste compliant type

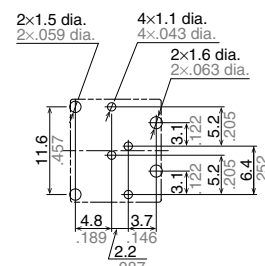
CAD



External dimensions

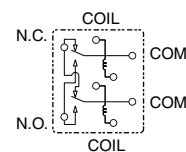


PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



Dimension:	Tolerance
Less than 1mm .039inch:	$\pm 0.1 \pm .004$
Min. 1mm .039inch less than 3mm .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

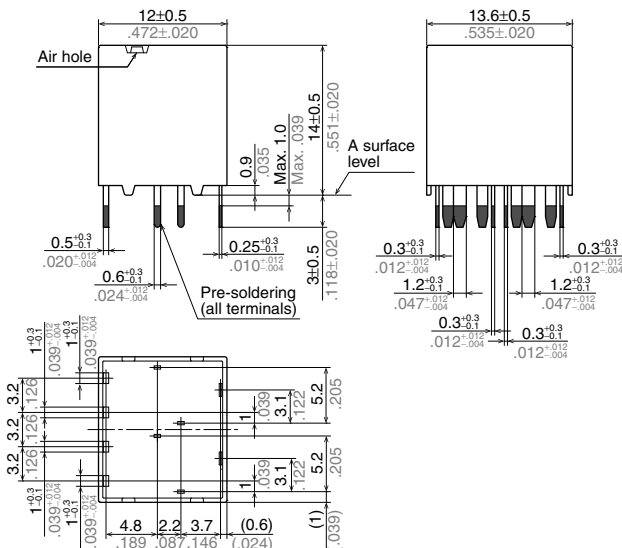
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

Twin type (10 pins) Pin in Paste compliant type

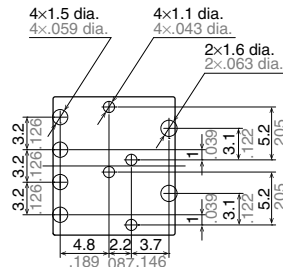
CAD



External dimensions

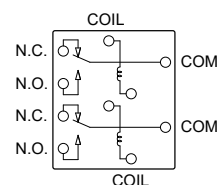


PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



Dimension:	Tolerance
Less than 1mm .039inch:	$\pm 0.1 \pm .004$
Min. 1mm .039inch less than 3mm .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

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

NOTES

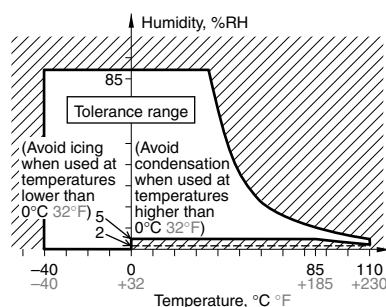
Usage, transport and storage conditions

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

- (1) Temperature: -40 to $+110^{\circ}\text{C}$ -40 to $+230^{\circ}\text{F}$ (High heat-resistant type/Pin in Paste compliant type)
- (2) Humidity: 2 to 85% RH (Avoid icing and condensation.)
- (3) Air 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]



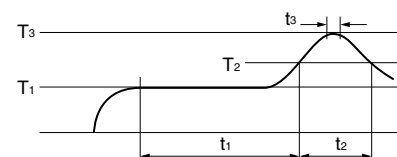
Mounting and cleaning conditions for Pin in Paste compliant type

When soldering this relay, please observe the following conditions.

[I.R.S. method (recommended)]

(Recommended number of reflows: 1)

t_1 = 60 to 120 sec.
 t_2 = Less than 30 sec.
 t_3 = Less than 5 sec.
 T_1 = 150 to 180 $^{\circ}\text{C}$ 302 to 356 $^{\circ}\text{F}$
 T_2 = 230 $^{\circ}\text{C}$ 446 $^{\circ}\text{F}$ or more
 T_3 = Less than 250 $^{\circ}\text{C}$ 482 $^{\circ}\text{F}$



• Cautions for mounting

1. The temperature profile shows the temperature at the soldering portion on the PCB surface.
2. Depending on the mounting density condition, reflow heating method, and PCB type (metal etc.), the relay's exterior and interior temperature may become extremely high.
Therefore, please confirm well under the actual use condition before use.

The other cautions of reflow soldering:

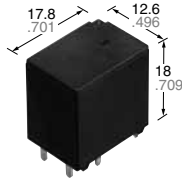
1. When soldering condition is out of recommendation, the relay performance may be adversely affected.
If soldering conditions are out of our recommendation, please contact us before operation.
2. Please check the effect at the actual soldering because heat stress to relay is changed by PCB type and manufacturing process condition.
3. Solder creepage, wettability or soldering strength will be affected by the mounting condition or soldering material.
Please check the actual production condition in detail.
4. Do not wash the relay as failures may occur.
5. This product is not plastic sealed type. Please perform coating with sufficient attention to avoid infiltration of the solvent to the inside. Also, please pay careful attention to use and store them with no contamination of foreign material.

For general cautions for use, please refer to the "Automotive Relay Users Guide".

High Load Relay for Smart J/B

TG RELAYS

<Protective construction>
High heat-resistant type: Sealed



(Unit: mm inch)

RoHS compliant

FEATURES

- Large capacity switching despite small size. Can replace micro ISO terminal type relays.
- Low operating power type

TYPICAL APPLICATIONS

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

ORDERING INFORMATION

ACTG

Contact arrangement

1: 1 Form A
2: 1 Form C

Contact type

Nil: Standard type
C: Standard type (Ag alloy / Cu clad)

Heat resistance/Protective construction

H: High heat-resistant type/Sealed

Coil resistance

3: 225Ω
4: 320Ω

TYPES

Contact arrangement	Contact type	Rated coil voltage	Coil resistance	Part No.	Packing	
				Heat resistance: High heat-resistant type	Carton (tube)	Case
1 Form A	Standard type	12V DC	225Ω	ACTG1H3	40 pcs.	800 pcs.
			320Ω	ACTG1H4		
	Standard type (Ag alloy / Cu clad)		225Ω	ACTG1CH3		
			320Ω	ACTG1CH4		
1 Form C	Standard type		225Ω	ACTG2H3		
			320Ω	ACTG2H4		
	Standard type (Ag alloy / Cu clad)		225Ω	ACTG2CH3		
			320Ω	ACTG2CH4		

Note: Please inquire our sales representative for details about products other than those above.

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 6.5V DC	Min. 0.8V DC	53.3 mA	225Ω	640 mW	10 to 16V DC
	Max. 7.0V DC	Min. 0.8V DC	37.5 mA	320Ω	450 mW	

Note: Other operate (set) voltage types are also available. Please inquire our sales representative for details.

2. Specifications

Item		Specifications
Contact data	Contact arrangement	1 Form A, 1 Form C
	Contact resistance (initial)	Max. 50mΩ (N.O. side: typ. 3mΩ, N.C. side: typ. 4mΩ) (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	N.O. side: 30A 14V DC, N.C. side: 15A 14V DC
	Max. carrying current (initial)*1	35A for 1 hour (Coil applied voltage 12V DC, at 20°C 68°F)
	Min. switching load (resistive)*2	1A 14V DC (at 20°C 68°F)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time)
	Release (Reset) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time) (Without diode)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 100 Hz, Min. 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)
	Destructive	10 to 500 Hz, Min. 44.1 m/s ² {approx. 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 rated 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 usage, transport and storage*3	Ambient temperature: -40 to +110°C -40 to +230°F, Humidity: 2 to 85% R.H. (Please avoid icing or condensation)
Weight		Approx. 12 g .42 oz

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

*2. 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.

*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).

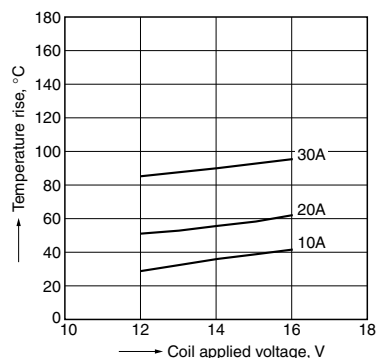
REFERENCE DATA

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

Sample: ACTG1H4, 3pcs.

Carrying current: 10A, 20A, 30A

Ambient temperature: Room temperature

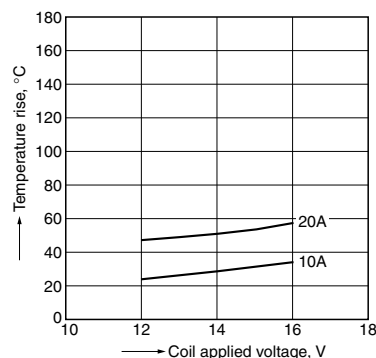


1.-(2) Coil temperature rise (at 110°C 230°F)

Sample: ACTG1H4, 3pcs.

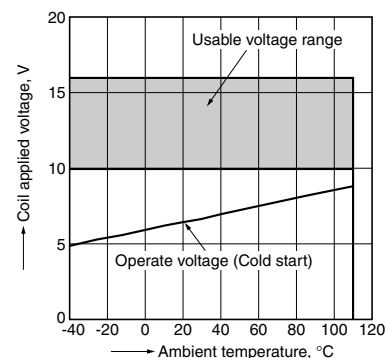
Carrying current: 10A, 20A

Ambient temperature: 110°C 230°F



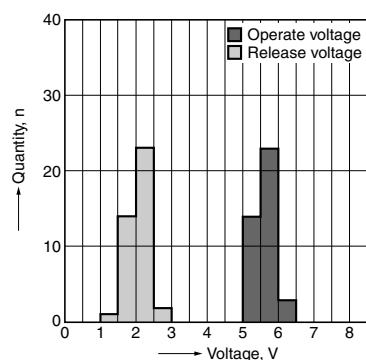
2. Ambient temperature and usable voltage range

Sample: ACTG1H4



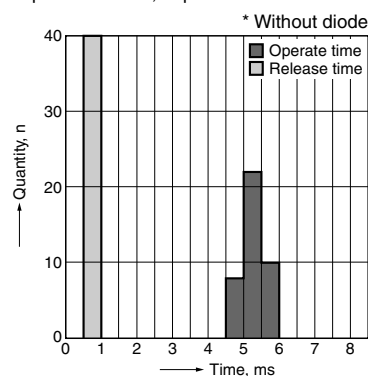
3. Distribution of operate (set) and release (reset) voltage

Sample: ACTG1H4, 40pcs.



4. Distribution of operate (set) and release (reset) time

Sample: ACTG1H4, 40pcs.



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

Sample: ACTG1H4, 6pcs.

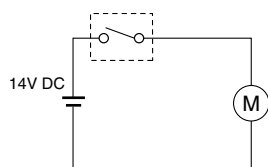
Load: 30A 14V DC

Motor load (lock condition)

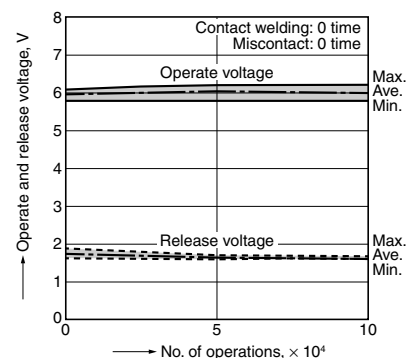
Operating frequency: ON 0.5s, OFF 9.5s

Ambient temperature: Room temperature

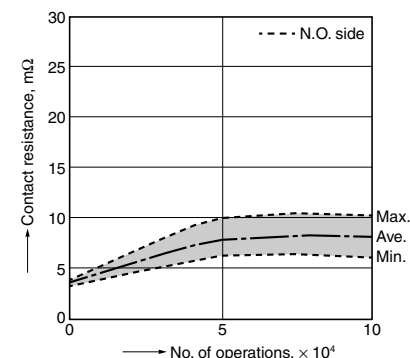
Circuit:



Change of operate (set) and release (reset) voltage



Change of contact resistance



5.-(2) Electrical life test (Lamp load)

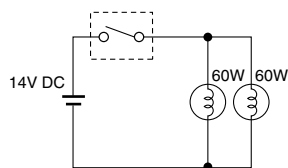
Sample: ACTG1H4, 6pcs.

Load: inrush: 84A, steady: 12A 14V DC

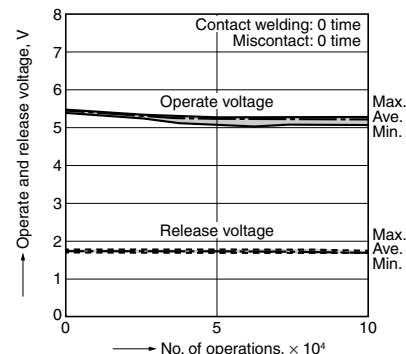
Operating frequency: ON 1s, OFF 14s

Ambient temperature: Room temperature

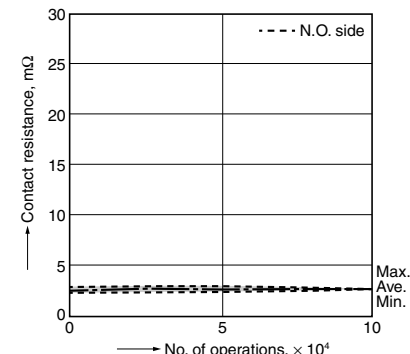
Circuit:

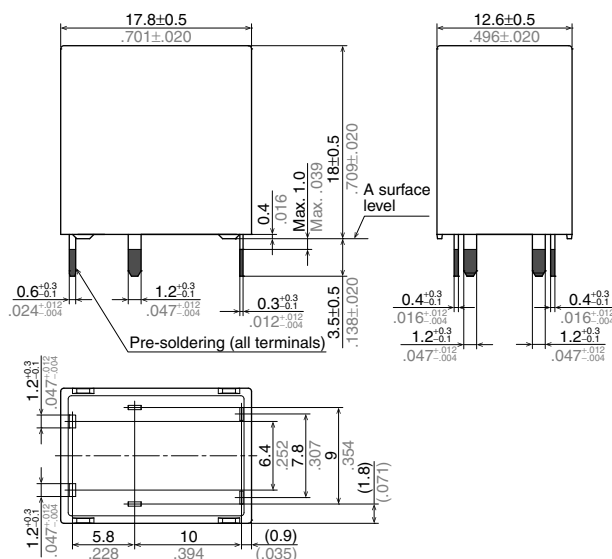
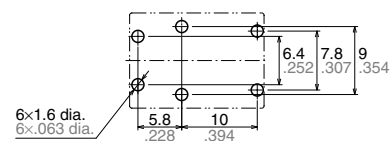
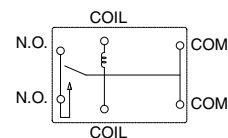


Change of operate (set) and release (reset) voltage



Change of contact resistance

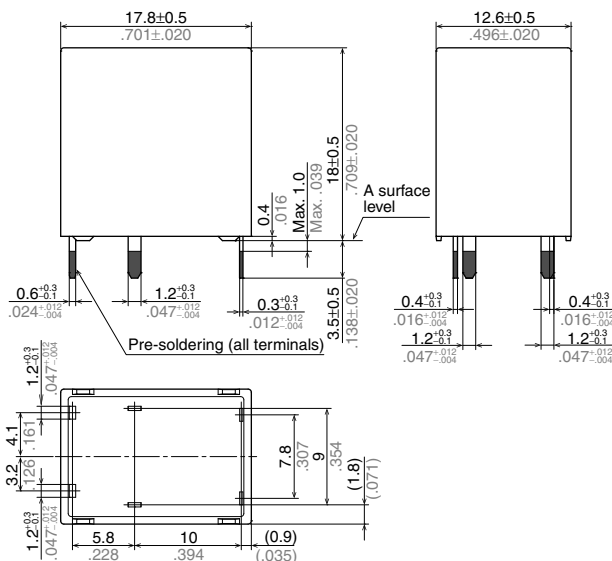
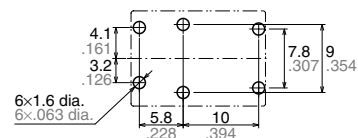
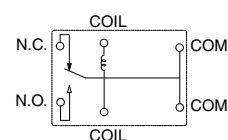


DIMENSIONS (mm inch)The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>**1 Form A type****CAD****External dimensions****PC board pattern (Bottom view)**Tolerance: $\pm 0.1 \pm .004$ **Schematic (Bottom view)****Dimension:**

Less than 1mm .039inch:

Tolerance $\pm 0.1 \pm .004$ Min. 1mm .039inch less than 3mm .118 inch: $\pm 0.2 \pm .008$

Min. 3mm .118 inch:

 $\pm 0.3 \pm .012$ * Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.**1 Form C type****CAD****External dimensions****PC board pattern (Bottom view)**Tolerance: $\pm 0.1 \pm .004$ **Schematic (Bottom view)****Dimension:**

Less than 1mm .039inch:

Tolerance $\pm 0.1 \pm .004$ Min. 1mm .039inch less than 3mm .118 inch: $\pm 0.2 \pm .008$

Min. 3mm .118 inch:

 $\pm 0.3 \pm .012$ * Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

NOTES

Usage, transport and storage conditions

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

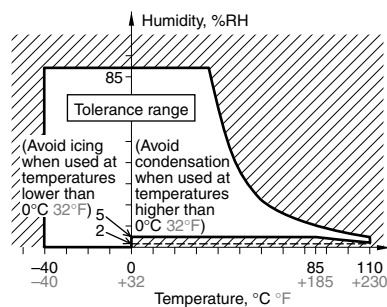
(1) Temperature: -40 to $+110^{\circ}\text{C}$ -40 to $+230^{\circ}\text{F}$ (High heat-resistant type)

(2) Humidity: 2 to 85% RH (Avoid icing and condensation.)

(3) Air 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]

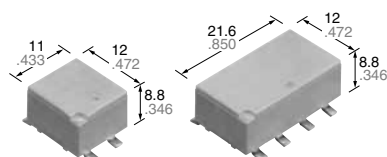


For general cautions for use, please refer to the “Automotive Relay Users Guide”.

Miniature PC Board, Twin, 1 Form C, Surface-mount Type Automotive Relay

TH RELAYS

<Protective construction>
Sealed/Flux tight



(Unit: mm inch)

RoHS compliant

FEATURES

- Compact flat type
<Height> Surface-mount type: 8.8 mm .346 inch
- Compact and high-capacity 25 A load switching

TYPICAL APPLICATIONS

- Powered windows, Automatic door locks, Powered mirrors, Powered sunroof, Powered seats, Lift gates and Slide door closers, etc.

ORDERING INFORMATION

ACTH

Contact arrangement/Terminal shape
5: 1 Form C/Surface-mount terminal type
6: 1 Form C × 2 (10 pins) Surface-mount terminal type

Contact type
Nil: Standard type
C: Standard type (Ag alloy / Cu clad)

Heat resistance/Protective construction
B: Reflow type/Sealed
R: Reflow type/Flux tight

Coil resistance
2: 160Ω
3: 220Ω

TYPES

Contact arrangement	Contact type	Rated coil voltage	Coil resistance	Part No.		Packing	
				Protective construction			
				Sealed type	Flux tight type	Carton (tape and reel)	Case
1 Form C	Standard type	12V DC	160Ω	ACTH5B2	ACTH5R2	500 pcs.	2,000 pcs.
			220Ω	ACTH5B3	ACTH5R3		
	Standard type (Ag alloy / Cu clad)		160Ω	ACTH5CB2	ACTH5CR2		
			220Ω	ACTH5CB3	ACTH5CR3		
1 Form C × 2 (10 pins)	Standard type		160Ω	ACTH6B2	ACTH6R2	400 pcs.	
			220Ω	ACTH6B3	ACTH6R3		
	Standard type (Ag alloy / Cu clad)		160Ω	ACTH6CB2	ACTH6CR2		
			220Ω	ACTH6CB3	ACTH6CR3		

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 6.5V DC Max. 7.7V DC	Min. 0.6V DC	75 mA 54.5 mA	160Ω 220Ω	900 mW 655 mW	10 to 16V DC

2. Specifications

Item	Specifications
Contact data	Contact arrangement
	1 Form C, 1 Form C × 2
	Contact resistance (initial)
	Max. 50mΩ (N.O. side: typ. 4.5mΩ, N.C. side: typ. 5.5mΩ) (By voltage drop 1A 6V DC)
	Contact material
	Ag alloy
Contact data	Rated switching capacity (resistive)
	N.O. side: 20A 14V DC, N.C. side: 10A 14V DC
	Max. carrying current (initial)*1
Contact data	25A for 10 minutes (Coil applied voltage 12V DC, at 20°C 68°F)
	Min. switching load (resistive)*2
Contact data	1A 14V DC (at 20°C 68°F)
	Insulated resistance (initial)
Dielectric strength (initial)	Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
	Between open contacts
Dielectric strength (initial)	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil
Time characteristics (initial)	Operate (Set) time (at rated voltage)
	Max. 10ms (at 20°C 68°F, without contact bounce time)
Time characteristics (initial)	Release (Reset) time (at rated voltage)
	Max. 10ms (at 20°C 68°F, without contact bounce time) (Without diode)
Shock resistance	Functional
	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
Shock resistance	Destructive
	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional
	10 to 100 Hz, Min. 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)
Vibration resistance	Destructive
	10 to 500 Hz, Min. 44.1 m/s ² {approx. 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)
Expected life	Electrical*4
	<Resistive load> Min. 10 ⁵ at rated 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 usage, transport and storage*3
Weight	Ambient temperature: -40 to +110°C -40 to +230°F, Humidity: 2 to 85% R.H. (Please avoid icing or condensation)
Weight	Single type: approx. 3 g .106 oz, Twin type: approx. 6 g .21 oz

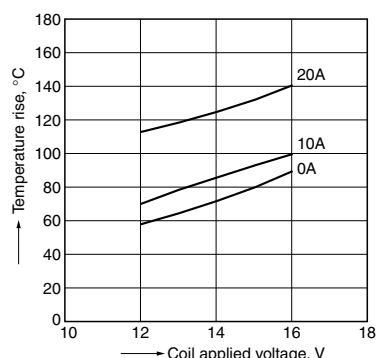
Notes: *1. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
 *2. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
 *3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".
 Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).
 *4. Do not use for lamp loads, electric discharge lamp loads, any other lamp loads and capacitor loads. Please inquire our sales representative 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 our sales representative when using with a circuit that causes an energized condition on both sides simultaneously.

REFERENCE DATA

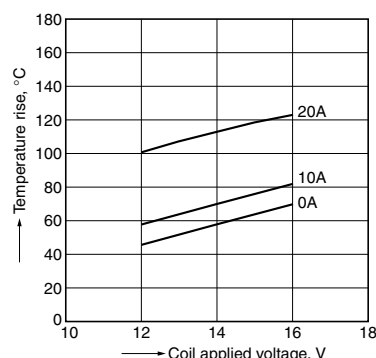
1.-(1) Coil temperature rise (at room temperature)

Sample: ACTH6B2, 3pcs.
 Carrying current: 0A, 10A, 20A
 Ambient temperature: Room temperature



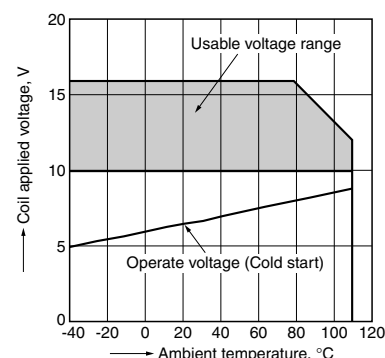
1.-(2) Coil temperature rise (at 110°C 230°F)

Sample: ACTH6B2, 3pcs.
 Carrying current: 0A, 10A, 20A
 Ambient temperature: 110°C 230°F



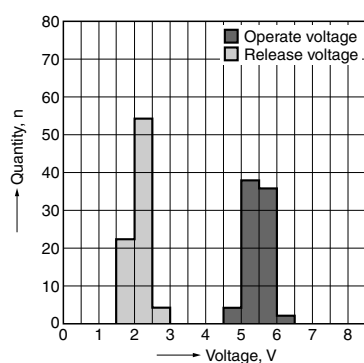
2. Ambient temperature and usable voltage range

Sample: ACTH6B2



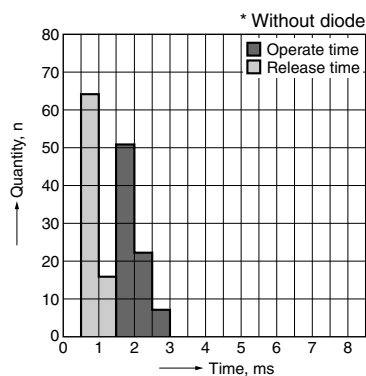
3. Distribution of operate (set) and release (reset) voltage

Sample: ACTH6B2, 40 × 2pcs.



4. Distribution of operate (set) and release (reset) time

Sample: ACTH6B2, 40 × 2pcs.



5. Electrical life test (Motor lock)

Sample: ACTH6B2, 3pcs.

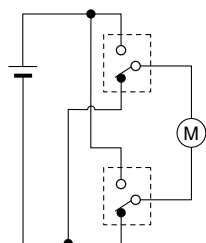
Load: 25A 14V DC

Power window motor actual load (lock condition)

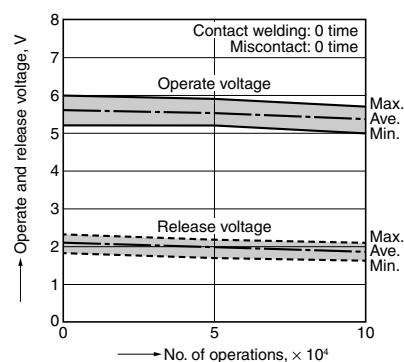
Operating frequency: ON 0.5s, OFF 9.5s

Ambient temperature: Room temperature

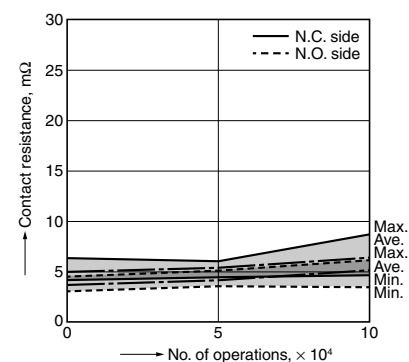
Circuit:



Change of operate (set) and release (reset) voltage

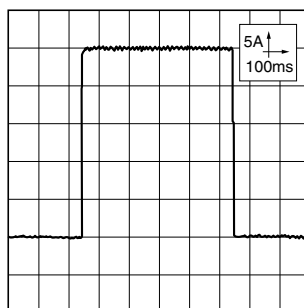


Change of contact resistance



Load current waveform

Current value: 25A



DIMENSIONS (mm inch)

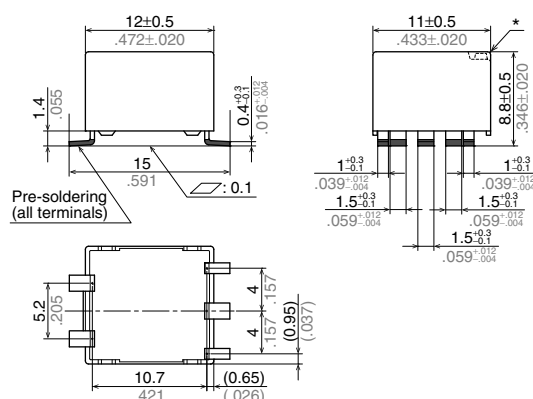
The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

1 Form C type

CAD



External dimensions



Dimension:

Less than 1mm .039inch:

Min. 1 .039 less than 3mm .118 inch: ±0.2 ±.008

Min. 3mm .118 inch:

Tolerance

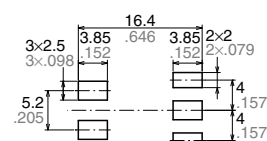
±0.1 ±.004

±0.2 ±.008

±0.3 ±.012

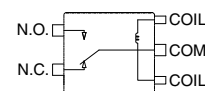
Note: * Flux tight type has air hole.

Recommendable mounting pad (Top view)



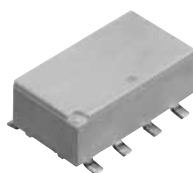
Tolerance: ±0.1 ±.004

Schematic (Top view)

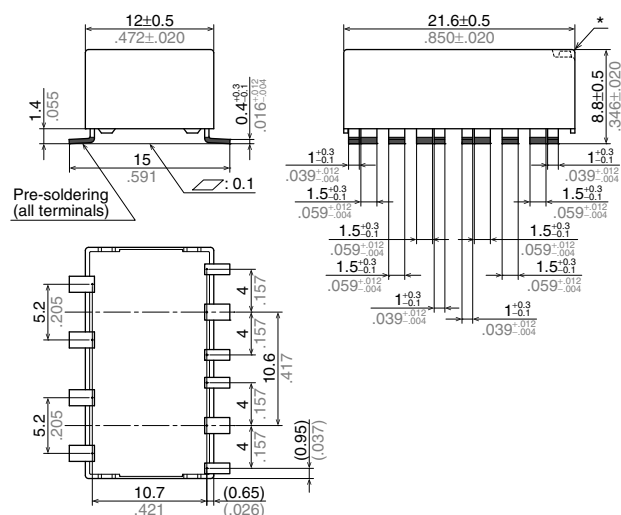


Twin type (10 pins)

CAD



External dimensions



Dimension:

Less than 1mm .039inch:

Min. 1 .039 less than 3mm .118 inch: ±0.2 ±.008

Min. 3mm .118 inch:

Tolerance

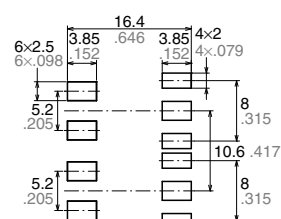
±0.1 ±.004

±0.2 ±.008

±0.3 ±.012

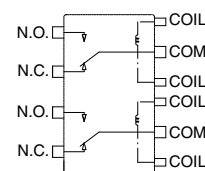
Note: * Flux tight type has air hole.

Recommendable mounting pad (Top view)



Tolerance: ±0.1 ±.004

Schematic (Top view)



NOTES

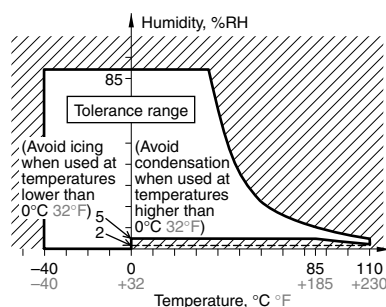
Usage, transport and storage conditions

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

- (1) Temperature: -40 to $+110^{\circ}\text{C}$ -40 to $+230^{\circ}\text{F}$
- (2) Humidity: 2 to 85% RH (Avoid icing and condensation.)
- (3) Air pressure: 86 to 106 kPa

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

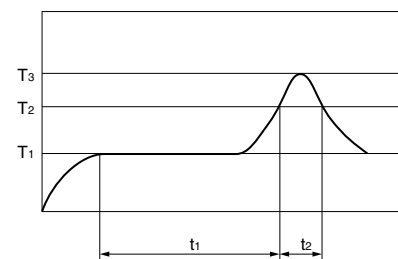
[Temperature and humidity range for usage, transport, and storage]



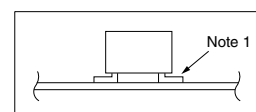
Mounting and cleaning conditions for Surface-mount terminal type relays

When soldering this relay, please observe the following conditions.

(Recommended conditions: Number of reflows: 1, Measurement location: terminal temperature)



$T_1 = 150$ to 180°C 302 to 356°F
 $T_2 = 230^{\circ}\text{C}$ 446°F or more
 $T_3 = \text{Less than } 250^{\circ}\text{C}$ 482°F
 $t_1 = 60$ to 120 sec.
 $t_2 = \text{Less than } 30$ sec.



Temperature profile indicates the temperature of the soldered part (Note 1) of terminals on the surface of a circuit board.

*The temperature of the relay exterior and interior may be extremely high depending on the component density on the board, the heating method of the reflow oven or circuit board type. Sufficient verification under actual processing conditions is required.

Other cautions during reflow soldering

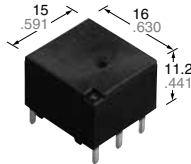
- (1) Reflow performance may be affected if you carry out soldering in a way that exceeds the recommended conditions. If you need to exceed the recommended conditions when soldering, please inquire our sales representative before using in an application.
- (2) Please confirm the heat stress of relay by using actual board because it may be changed by board condition or manufacturing process condition.
- (3) Solder creepage, wettability, or soldering strength will be affected by the changing of soldering condition or used solder type. Please check them under the actual production condition in detail.
- (4) Avoid cleaning (ultrasonic cleaning, boiling cleaning, etc.) and coating in order to prevent negative impacts on relay characteristics.

For general cautions for use, please refer to the “Automotive Relay Users Guide”.

Middle Load Relay for Smart J/B

TJ RELAYS

<Protective construction>
Sealed



(Unit: mm inch)

RoHS compliant

FEATURES

- Compact flat type (Height: 11.2mm .441inch)
- Compact and high-capacity 30A load switching.

TYPICAL APPLICATIONS

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

ORDERING INFORMATION

	ACTJ				
Contact arrangement					
2: 1 Form C					
Contact type					
Nil: Standard type					
Heat resistance/Protective construction					
H: High heat-resistant type/Sealed					
Coil resistance					
4: 320Ω					

TYPES

Contact arrangement	Contact type	Rated coil voltage	Coil resistance	Part No.	Packing	
				High heat-resistant type	Carton (tube)	Case
1 Form C	Standard type	12V DC	320Ω	ACTJ2H4	40 pcs.	800 pcs.

Note: Please inquire our sales representative for details about products other than those above.

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 7.0V DC	Min. 0.8V DC	37.5 mA	320Ω	450 mW	10 to 16V DC

2. Specifications

Item		Specifications
Contact data	Contact arrangement	1 Form C
	Contact resistance (initial)	Max. 50mΩ (N.O. side: typ. 2.5mΩ, N.C. side: typ. 3mΩ) (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	N.O. side: 30A 14V DC, N.C. side: 15A 14V DC
	Max. carrying current (initial)*1	30A for 1 hour (Coil applied voltage 12V DC, at 20°C 68°F)
	Min. switching load (resistive)*2	1A 14V DC (at 20°C 68°F)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time)
	Release (Reset) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time) (Without diode)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 100 Hz, Min. 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)
	Destructive	10 to 500 Hz, Min. 44.1 m/s ² {approx. 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 rated 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 usage, transport and storage*3	Ambient temperature: -40 to +110°C -40 to +230°F, Humidity: 2 to 85% R.H. (Please avoid icing or condensation)
Weight		Approx. 7 g .25 oz

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

*2. 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.

*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).

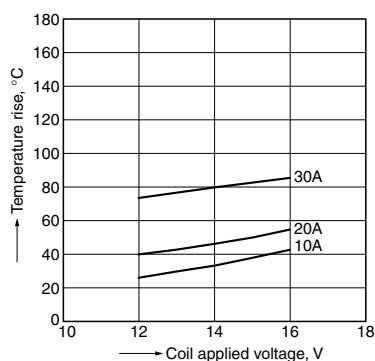
REFERENCE DATA

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

Sample: ACTJ2H4, 3pcs.

Carrying current: 10A, 20A, 30A

Ambient temperature: Room temperature

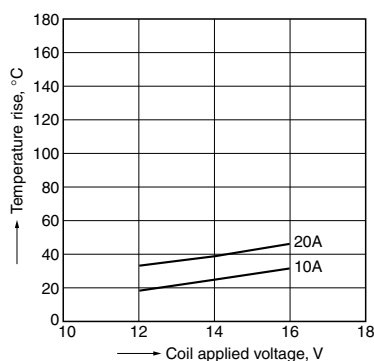


1.-(2) Coil temperature rise (at 110°C 230°F)

Sample: ACTJ2H4, 3pcs.

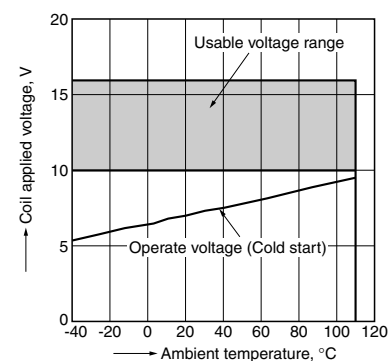
Carrying current: 10A, 20A

Ambient temperature: 110°C 230°F



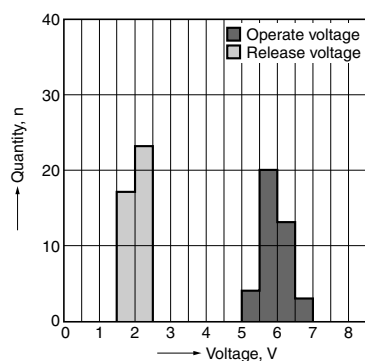
2. Ambient temperature and usable voltage range

Sample: ACTJ2H4



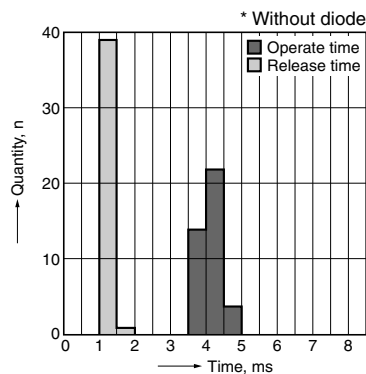
3. Distribution of operate (set) and release (reset) voltage

Sample: ACTJ2H4, 40pcs.



4. Distribution of operate (set) and release (reset) time

Sample: ACTJ2H4, 40pcs.



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

Sample: ACTJ2H4, 6pcs.

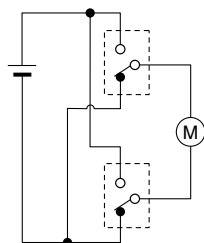
Load: 25A 14V DC

Power window motor actual load (lock condition)

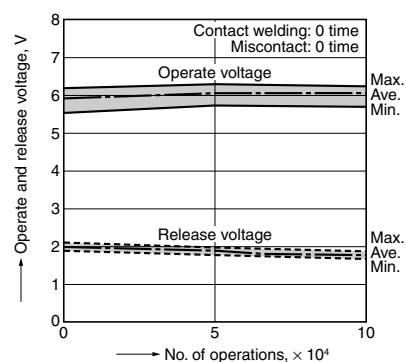
Operating frequency: ON 0.5s, OFF 9.5s

Ambient temperature: Room temperature

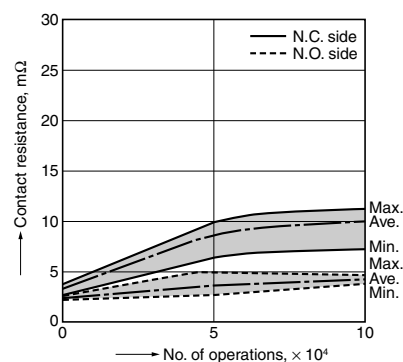
Circuit:



Change of operate (set) and release (reset) voltage

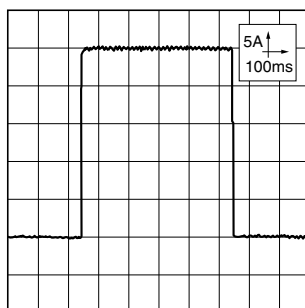


Change of contact resistance



Load current waveform

Current value: 25A



5.-(2) Electrical life test (Lamp load)

Sample: ACTJ2H4, 6pcs.

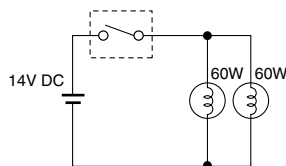
Load: inrush current: 84A, steady current: 12A 14V DC

DC

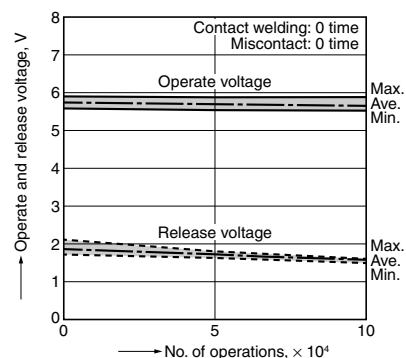
Operating frequency: ON 1s, OFF 14s

Ambient temperature: Room temperature

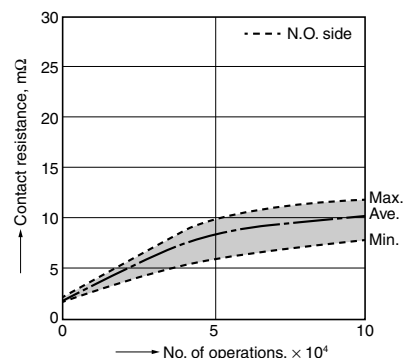
Circuit:

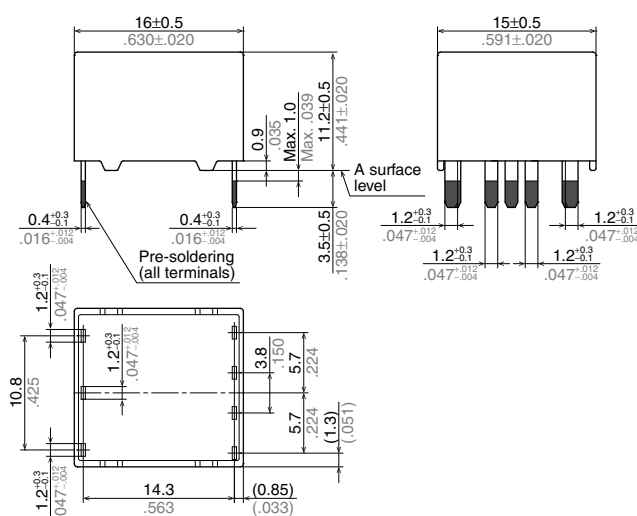
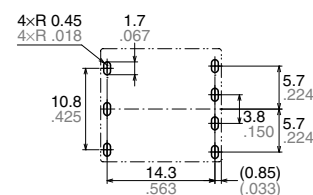
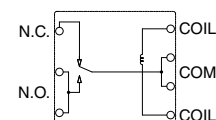


Change of operate (set) and release (reset) voltage



Change of contact resistance



DIMENSIONS (mm inch)The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>**1 Form C type****CAD****External dimensions****PC board pattern (Bottom view)**Tolerance: $\pm 0.1 \pm .004$ **Schematic (Bottom view)****Dimension:**

Less than 1mm .039inch:

Min. 1 .039 less than 3mm .118 inch: $\pm 0.2 \pm .008$

Min. 3mm .118 inch:

Tolerance $\pm 0.1 \pm .004$ $\pm 0.2 \pm .008$ $\pm 0.3 \pm .012$

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

NOTES**Usage, transport and storage conditions**

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

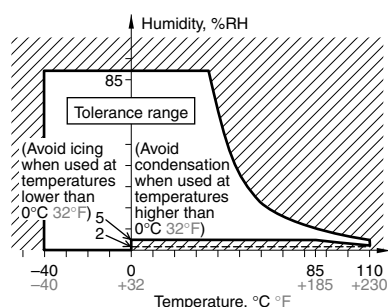
(1) Temperature: -40 to $+110^{\circ}\text{C}$ -40 to $+230^{\circ}\text{F}$

(2) Humidity: 2 to 85% RH (Avoid icing and condensation.)

(3) Air 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]

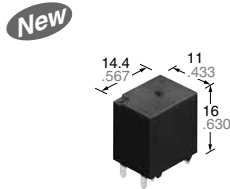


For general cautions for use, please refer to the “Automotive Relay Users Guide”.

High Load Relay for Smart Junction Box

TL RELAYS

<Protective construction>
High heat-resistant type: Sealed
Pin in Paste compliant type: Flux tight



(Unit: mm inch)

RoHS compliant

FEATURES

- Large capacity switching despite small size. Can replace micro ISO terminal type relays.
- 40A and supports fuse
- Pin in Paste compliant model added

TYPICAL APPLICATIONS

- Head lamp, Fog lamp, Fan motor, etc.

ORDERING INFORMATION

	ACTL				
Contact arrangement					
3: Double make contact 2 Form A					
Contact type					
C: Standard type (Ag alloy / Cu clad)					
D: Lamp control type (Ag alloy / Cu clad)					
Heat resistance/Protective construction					
H: High heat-resistant type/Sealed					
R: Pin in Paste compliant type/Flux tight					
Coil resistance					
3: 225Ω					

TYPES

Contact arrangement	Contact type	Rated coil voltage	Coil resistance	Part No.		Packing	
				Heat resistance			
				High heat-resistant type	Pin in Paste compliant type	Carton	Case
Double make contact 2 Form A	Standard type (Ag alloy / Cu clad)	12V DC	225Ω	ACTL3CH3	ACTL3CR3	50 pcs.	2,000 pcs.
	Lamp control type (Ag alloy / Cu clad)			ACTL3DH3	ACTL3DR3		

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12 V DC	Max. 6.5 V DC	Min. 0.5 V DC	53.3 mA	225Ω	640 mW	10 to 16 V DC

Note: Other operate (set) voltage types are also available. Please inquire our sales representative for details.

2. Specifications

Specifications			Item	Specifications
Contact data			Contact arrangement	Double make contact 2 Form A
			Contact resistance (initial)	Max. 50mΩ (Typ. 2mΩ) (By voltage drop 1A 6V DC)
			Contact material	Ag alloy
			Rated switching capacity (resistive)	40A 14V DC
			Max. carrying current (initial)*1	40A/1 hour (14V DC, at 20°C 68°F)
			Min. switching load (resistive)*2	1A 14V DC (at 20°C 68°F)
Insulated resistance (initial)			Min. 100 MΩ (at 500V DC, Measurement at same location as “Dielectric strength” section.)	
Dielectric strength (initial)	Between open contacts		500 Vrms for 1 min. (Detection current: 10mA)	
	Between contacts and coil		500 Vrms for 1 min. (Detection current: 10mA)	
Time characteristics (initial)	Operate (Set) time (at rated voltage)		Max. 10ms (at 20°C 68°F, without contact bounce time)	
	Release (Reset) time (at rated voltage)		Max. 10ms (at 20°C 68°F, without contact bounce time) (Without diode)	
Shock resistance	Functional		Min. 100 m/s² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)	
	Destructive		Min. 1,000 m/s² {approx. 100G} (Half-wave pulse of sine wave: 6ms)	
Vibration resistance	Functional		10 to 100 Hz, Min. 44.1m/s² {approx. 4.5G} (Detection time: 10μs)	
	Destructive		10 to 500 Hz, Min. 44.1m/s² {approx. 4.5G} Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours	
Expected life	Mechanical		Min. 5×10⁶ (at 120 cpm)	
	Electrical	Standard type	<Resistive load> Min. 10⁵ at rated switching capacity, operating frequency: ON 1s, OFF 2s <Resistive and capacitor loads> Min. 10⁵: at 90 A (inrush), 20 A (steady), 14 V DC, Operating frequency: ON 0.15s, OFF 4.85s	
		Lamp control type*4	<Lamp load> Min. 10⁵: at 120 A (inrush), 14 A (steady), 14 V DC, Operating frequency: ON 1s, OFF 14s	
Conditions	Conditions for usage, transport and storage*3		Ambient temperature: -40 to +110°C -40 to +230°F, Humidity: 2 to 85% R.H. (Please avoid icing or condensation)	
Weight			Approx. 6.5 g .23 oz	

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

*2. 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.

*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

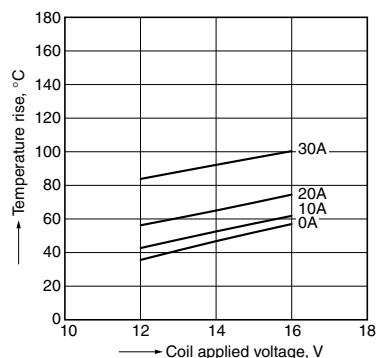
Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).

*4. When using the lamp control type, connect N.O. to the "+" (plus) side. Please inquire our sales representative for details.

REFERENCE DATA

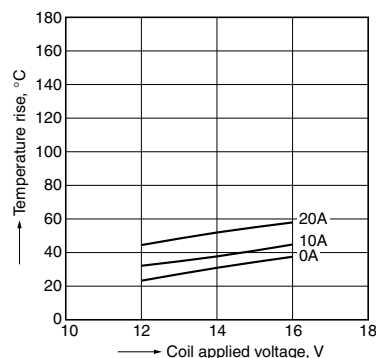
1-(1). Coil temperature rise

Sample: ACTL3CR3, 3pcs
Carrying current: 0A, 10A, 20A, 30A
Ambient temperature: Room temperature



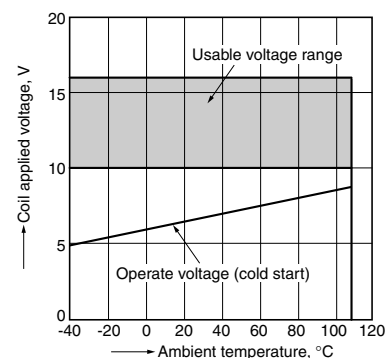
1-(2). Coil temperature rise (110°C 230°F)

Sample: ACTL3CR3, 3pcs
Carrying current: 0A, 10A, 20A
Ambient temperature: 110°C 230°F



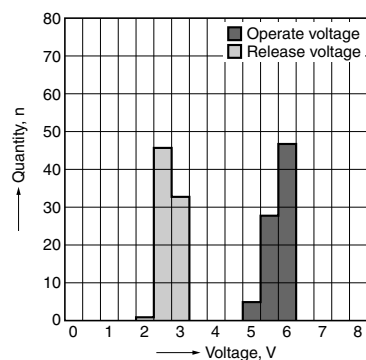
2. Ambient temperature and usable voltage range

Sample: ACTL3CR3



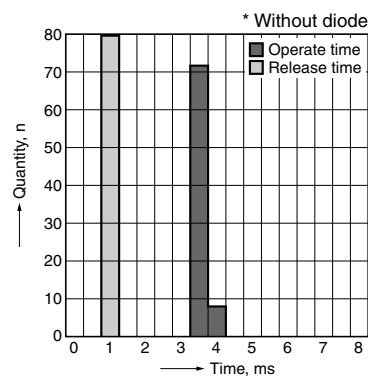
3. Distribution of operate (set) and release (reset) voltage

Sample: ACTL3CR3, 80pcs.



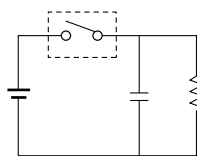
4. Distribution of operate (set) and release (reset) time

Sample: ACTL3CR3, 80pcs.

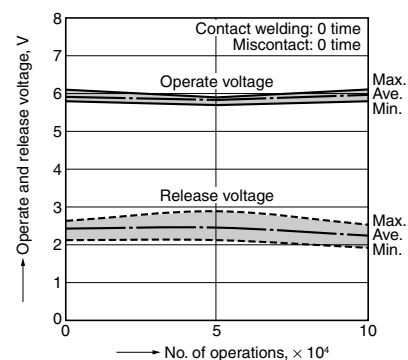


5-(1). Electrical life test (Resistive and capacitor load)

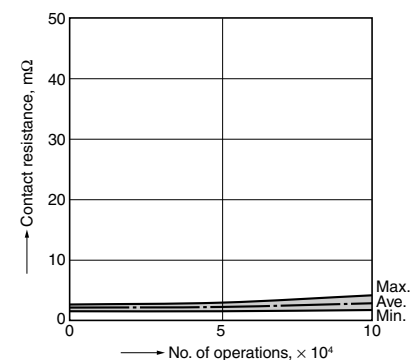
Sample: ACTL3CR3, 6pcs.
Load: Inrush current: 90A, Steady current: 20A 14V DC
Operating frequency: ON 0.15s, OFF 4.85s
Ambient temperature: Room temperature
Circuit:



Change of operate (set) and release (reset) voltage



Change of contact resistance



DIMENSIONS (mm inch)

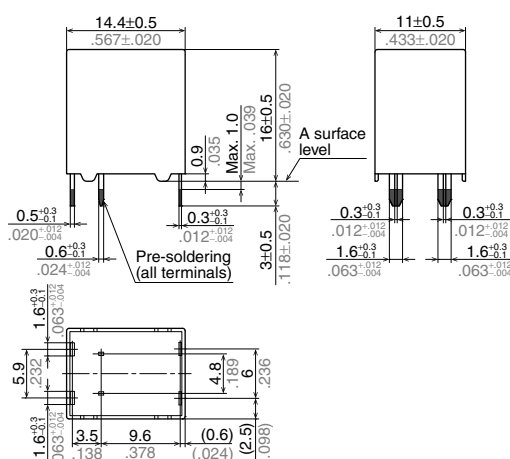
The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

Double make contact 2 Form A type

CAD



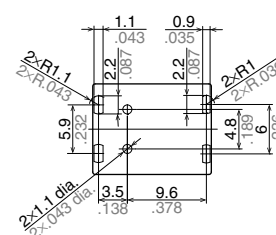
External dimensions



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

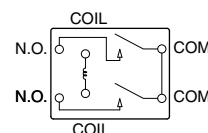
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



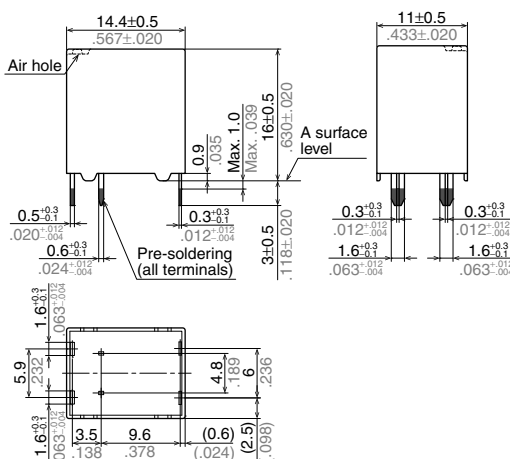
* The lamp control type has polarized contacts.
Connect N.O. to the "+" (plus)" side.

Double make contact 2 Form A type **Pin in Paste compliant type**

CAD



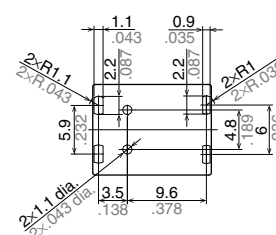
External dimensions



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

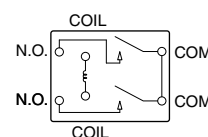
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

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.

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. Also, the power waveform should be rectangular.

2. Coil applied voltage

To ensure proper operation, the voltage applied to the coil should be the rated operating voltage of the coil. Also, be aware that the pick-up and drop-out voltages will fluctuate depending on the ambient temperature and operating conditions.

3. Expected life

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.

4. Soldering

When soldering the relays, ensure conformance with the conditions listed below.

1) Automatic soldering

Preheating soldering: 100°C 212°F, within 2 sec (surface of PC board)

Soldering: 260°C 500°F, within 5 sec

2) Manual soldering

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

Soldering iron: 30 to 60W

Soldering time: within 5 sec

5. Usage, transport and storage conditions

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

(1) Temperature:

–40 to +85°C –40 to +185°F (Standard type)

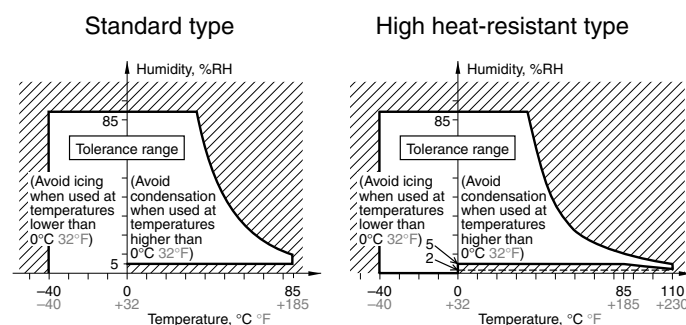
–40 to +110°C –40 to +230°F (High heat-resistant type)

(2) Humidity: 2 to 85% RH (Avoid icing and condensation.)

(3) Air 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.

3) Icing

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

4) Low temperature and low humidity environments

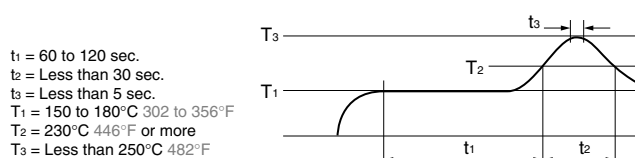
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

6. Mounting and cleaning conditions for Pin-in-Paste compliant type

When soldering this relay, please observe the following conditions.

[I.R.S. method (recommended)]

(Recommended number of reflows: 1)



• Cautions for mounting

1. The temperature profile shows the temperature at the soldering portion on the PCB surface.
2. Depending on the mounting density condition, reflow heating method, and PCB type (metal etc.), the relay's exterior and interior temperature may become extremely high. Therefore, please confirm well under the actual use condition before use.

The other cautions of reflow soldering:

1. When soldering condition is out of recommendation, the relay performance may be adversely affected. If soldering conditions are out of our recommendation, please contact us before operation.
2. Please check the effect at the actual soldering because heat stress to relay is changed by PCB type and manufacturing process condition.
3. Solder creepage, wettability or soldering strength will be affected by the mounting condition or soldering material. Please check the actual production condition in detail.
4. Do not wash the relay as failures may occur.
5. This product is not plastic sealed type. Please perform coating with sufficient attention to avoid infiltration of the solvent to the inside. Also, please pay careful attention to use and store them with no contamination of foreign material.

7. Others handling precautions

Do not use relays that have been dropped, because doing so may be a cause of faulty operation.

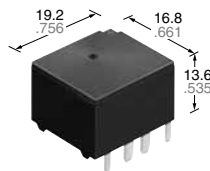
For general cautions for use, please refer to the "Automotive Relay Users Guide".

High Capacity Relay for Smart Junction Box

TM RELAYS

<Protective construction>
Sealed

New



(Unit: mm inch)

RoHS compliant

FEATURES

- Flat type and ideal height (13.6 mm .535 inch) for smart junction box
- High capacity and 35A type

TYPICAL APPLICATIONS

- Fan motor, Defogger, etc.

ORDERING INFORMATION

ACTM

Contact arrangement

1: 1 Form A

2: 1 Form C

Contact type

C: Standard type (Ag alloy / Cu clad)

Heat resistance/Protective construction

H: High heat-resistant type/Sealed

Coil resistance

4: 320Ω

8: 400Ω

TYPES

Contact arrangement	Contact type	Rated coil voltage	Coil resistance	Part No.	Packing	
				High heat-resistant type	Carton	Case
1 Form A	Standard type (Ag alloy / Cu clad)	12V DC	320Ω	ACTM1CH4	50 pcs.	2,000 pcs.
			400Ω	ACTM1CH8		
1 Form C			320Ω	ACTM2CH4		

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12 V DC	Max. 7.0 V DC	Min. 0.5 V DC	37.5 mA	320Ω	450 mW	10 to 16 V DC
	Max. 7.0 V DC	Min. 0.5 V DC	30 mA	400Ω	360 mW	

Note: Other operate (set) voltage types are also available. Please inquire our sales representative for details.

2. Specifications

Item		Specifications
Contact data	Contact arrangement	1 Form A, 1 Form C
	Contact resistance (initial)	Max. 50mΩ (N.O. side: typ. 1.5mΩ, N.C. side: typ. 3mΩ) (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	N.O. side: 35A 14V DC, N.C. side: 15A 14V DC
	Max. carrying current (initial)*1	40A/1 hour (12V DC, at 20°C 68°F)
	Min. switching load (resistive)*2	1A 14V DC (at 20°C 68°F)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time)
	Release (Reset) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time) (Without diode)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 100 Hz, Min. 44.1m/s ² {approx. 4.5G} (Detection time: 10μs)
	Destructive	10 to 500 Hz, Min. 44.1m/s ² {approx. 4.5G} Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Mechanical	Min. 5×10 ⁶ (at 120 cpm)
	Electrical	<Resistive load> Min. 10 ⁵ at rated switching capacity, operating frequency: ON 1s, OFF 9s <Resistive and capacitor loads> Min. 10 ⁵ at 90 A (Inrush), 20 A (Steady), 14 V DC (Operating frequency: ON 0.15s, OFF 4.85s)
Conditions	Conditions for usage, transport and storage*3	Ambient temperature: -40 to +110°C -40 to +230°F, Humidity: 2 to 85% R.H. (Please avoid icing or condensation)
Weight		Approx. 11.6 g .41 oz

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

*2. 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.

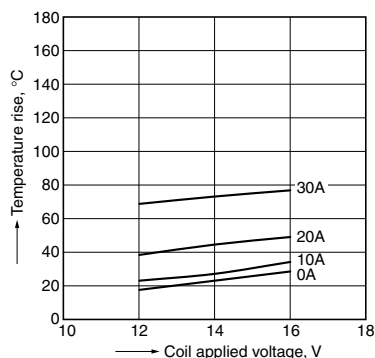
*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F).

REFERENCE DATA

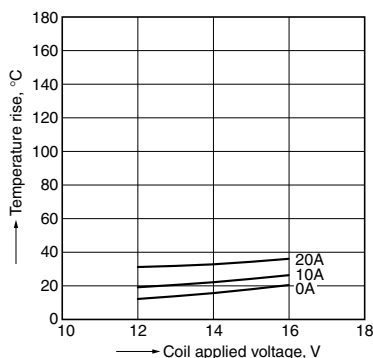
1-(1). Coil temperature rise (Room temperature)

Sample: ACTM1CH8, 6pcs
Carrying current: 0A, 10A, 20A, 30A
Ambient temperature: Room temperature



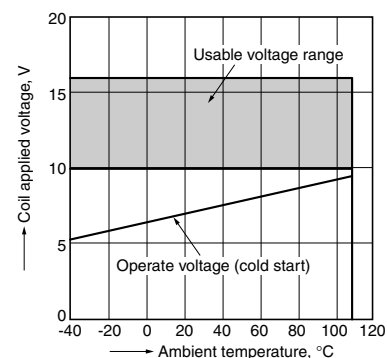
1-(2). Coil temperature rise (110°C 230°F)

Sample: ACTM1CH8, 6pcs
Carrying current: 0A, 10A, 20A
Ambient temperature: 110°C 230°F



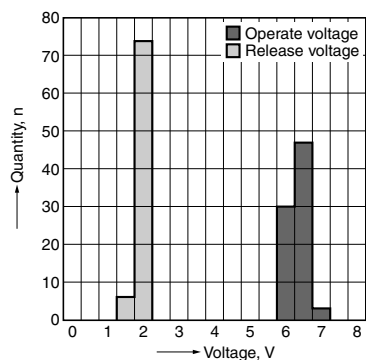
2. Ambient temperature and usable voltage range

Sample: ACTM1CH8



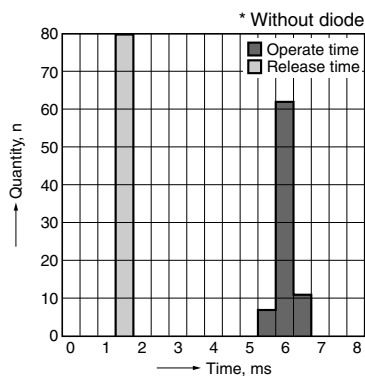
3. Distribution of operate (set) and release (reset) voltage

Sample: ACTM1CH8, 80pcs.



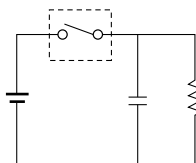
4. Distribution of operate (set) and release (reset) time

Sample: ACTM1CH8, 80pcs.

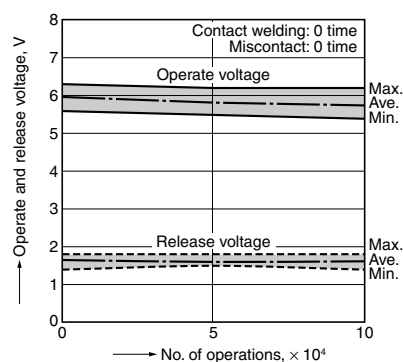


5-(1). Electrical life test (Resistive and capacitor load)

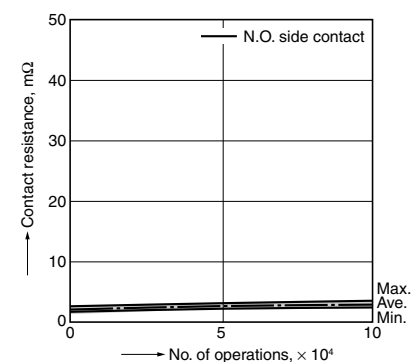
Sample: ACTM1CH8, 6pcs.
Load: Inrush current: 90A, Steady current: 20A 14V DC
Operating frequency: ON 0.15s, OFF 4.85s
Ambient temperature: Room temperature
Circuit:



Change of operate (set) and release (reset) voltage



Change of contact resistance

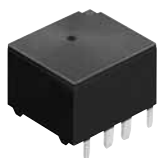


DIMENSIONS (mm inch)

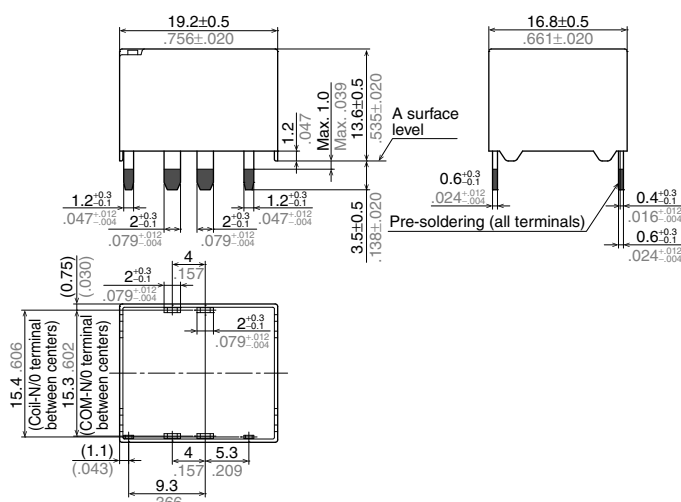
The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

1 Form A type

CAD



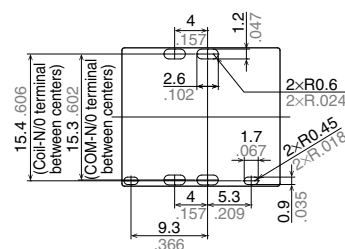
External dimensions



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

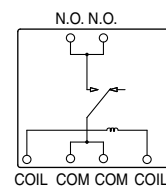
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



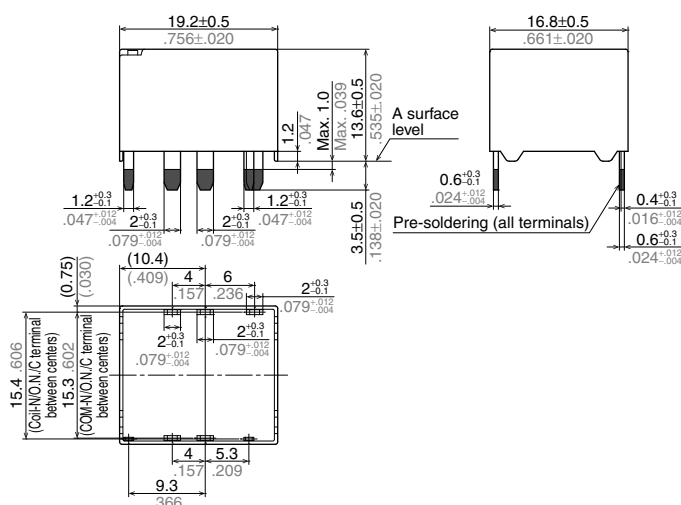
* The lamp control type has polarized contacts.
Connect N.O. to the "+" (plus)" side.

1 Form C type

CAD



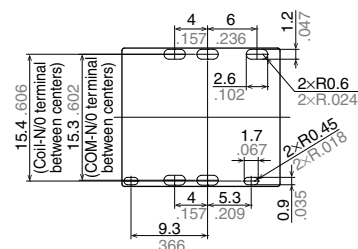
External dimensions



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

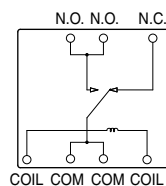
* Dimensions (thickness and width) of terminal is measured after pre-soldering.
Intervals between terminals is measured at A surface level.

PC board pattern (Bottom view)



Tolerance: $\pm 0.1 \pm .004$

Schematic (Bottom view)



* The lamp control type has polarized contacts.
Connect N.O. to the "+" (plus)" side.

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. Also, the power waveform should be rectangular.

2. Coil applied voltage

To ensure proper operation, the voltage applied to the coil should be the rated operating voltage of the coil. Also, be aware that the pick-up and drop-out voltages will fluctuate depending on the ambient temperature and operating conditions.

3. Expected life

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.

4. Soldering

When soldering the relays, ensure conformance with the conditions listed below.

1) Automatic soldering

Preheating soldering: 100°C 212°F, within 2 sec (surface of PC board)

Soldering: 260°C 500°F, within 5 sec

2) Manual soldering

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

Soldering iron: 30 to 60W

Soldering time: within 5 sec

5. Usage, transport and storage conditions

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

(1) Temperature:

–40 to +85°C –40 to +185°F (Standard type)

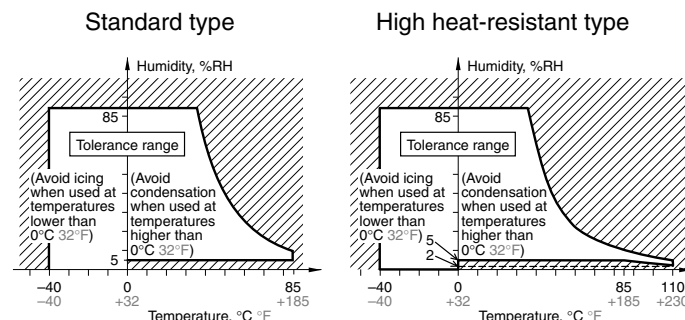
–40 to +110°C –40 to +230°F (High heat-resistant type)

(2) Humidity: 2 to 85% RH (Avoid icing and condensation.)

(3) Air 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) Water condensation

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

3) Icing

Water condensation or other moisture may ice on the relay when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts, operational time lags or poor contact conduction.

4) Low-temperature, low-humidity atmosphere

If the relay is exposed to a low-temperature, low-humidity atmosphere for a long time, its plastic parts may become brittle and fragile.

6. Others handling precautions

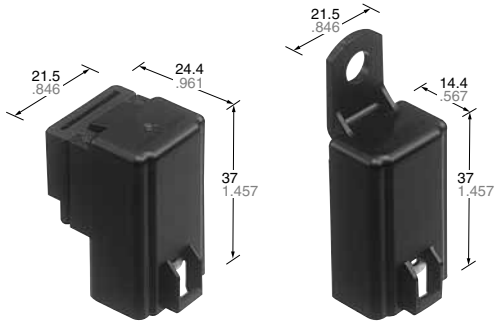
Do not use relays that have been dropped, because doing so may be a cause of faulty operation.

For general cautions for use, please refer to the “Automotive Relay Users Guide”.

Small Size, Light Weight Automotive Power Relays

CA RELAYS

<Protective construction>
Sealed/Dust cover



(Unit: mm inch)

RoHS compliant

FEATURES

- Small size and light weight
- Since the terminal arrangement complies with JIS
- Low operating power (1.4W) type is available (1 Form A, 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

F: Dust cover

Rated 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

R: With resistor inside

Rated 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	Mounting type	Rated coil voltage	Standard type (1.8W)		Low operating power type (1.4W)		Packing	
			Sealed	Dust cover	Sealed	Dust cover	Carton	Case
			Type No.	Type No.	Type No.	Type No.		
1 Form A	Rubber bracket A	12 V DC	CA1a-12V-A-5	CA1aF-12V-A-5	CA1aS-12V-A-5	CA1aFS-12V-A-5	20 pcs.	200 pcs.
	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	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	Screw-mounting	12 V DC	CA1-12V-N	—	—	—		
	Direct coupling		CA1-12V-C	—	—	—		
	Screw-mounting	24 V DC	CA1-24V-N	—	—	—		
	Direct coupling		CA1-24V-C	—	—	—		

Note: Please use "CA**R-**** or CA**SR-****" with resistor inside type. (Asterisks " * " should be filled in from ORDERING INFORMATION.)

RATING

1. Coil data

Contact arrangement	Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power	Usable voltage range
1 Form A and 1 Form B (Standard)	12 V DC	Max. 8 V DC	0.6 to 6 V DC	150 mA	80Ω	1.8 W	10 to 16V DC
1 Form A and 1 Form B (Low operating power)				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		20 to 30V DC

Note: Other operate (set) voltage types are also available. Please inquire our sales representative for details.

2. Specifications

1) 12 V DC type

Item		Specifications		
		1 Form A type	1 Form B type	1 Form C type
Contact data	Contact arrangement	1 Form A	1 Form B	1 Form C
	Contact resistance (initial)	Max. 50mΩ (Typ. 3mΩ) (By voltage drop 1A 6V DC)		
	Contact material	Ag alloy		
	Rated switching capacity (resistive)	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, at 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
	Min. switching load (resistive)*1	1 A 14V DC (at 20°C 68°F)		
	Contact voltage drop (after electrical life test)	Max. 0.3 V [By carrying 20 A 12 V DC (1.4 W type), 30 A 12 V DC (1.8 W type)]	Max. 0.3 V (By carrying 20 A 12 V DC)	Max. 0.4 V (By carrying 20 A 12 V DC)
Insulated resistance (initial)		Min. 10 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)		
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)		
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)		
Time characteristics (initial)	Operate (Set) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time)		
	Release (Reset) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time) (Without diode)		
Shock resistance	Functional	Min. 200 m/s ² {approx. 20G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)	
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)		
Vibration resistance	Functional	Rubber bracket A type: 50 to 500 Hz, Min. 100 m/s ² {approx. 10G} Screw-mounting and direct coupling type: 33 Hz, Min. 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)		
	Destructive	Rubber bracket A type: 50 to 500 Hz, Min. 100 m/s ² {approx. 10G} Screw-mounting and direct coupling type: 33 Hz, Min. 44.1 m/s ² {approx. 4.5G}, Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours		
Expected life	Mechanical	Min. 10 ⁶ (at 120 cpm)		Min. 5 × 10 ⁵ (at 120 cpm)
	Electrical (at rated 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)	
Conditions	Conditions for usage, transport and storage*2	Ambient temperature: -30 to +80°C -22 to +176°F, Humidity: 5 to 85% R.H. (Please avoid icing or condensation)		
Water-proof standard		Sealed: JIS D 0203 S2, Dust cover: JIS D 0203 R2		
Weight		Rubber bracket A type: approx. 23 g .81 oz, Screw-mounting and direct coupling type: approx. 19 g .67 oz		approx. 31 g 1.09 oz

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

*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F)

2) 24 V DC type

Item		Specifications
		1 Form C type
Contact data	Contact arrangement	1 Form C
	Contact resistance (initial)	Max. 50mΩ (Typ. 3mΩ) (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	10 A 24V DC
	Max. carrying current	10 A continuous (At coil applied voltage 28 V DC, 80°C 176°F)
	Min. switching load (resistive)*1	1 A 14V DC (at 20°C 68°F)
	Contact voltage drop (after electrical life test)	Max. 0.4 V (by voltage drop 24 V DC 10 A)
Insulated resistance (initial)		Min. 10 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time)
	Release (Reset) time (at rated voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	JIS D1601 Group 1, B type, Stage 4 (33 Hz, Min. 44.1 m/s ² {approx. 4.5G}) (Detection time: 10μs)
	Destructive	JIS D1601 Group 1, B type, Stage 4 (33 Hz, Min. 44.1 m/s ² {approx. 4.5G}), Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours
Expected life	Electrical (at rated switching capacity)	Min. 10 ⁵ (operating frequency: 2s ON, 2s OFF)
	Mechanical	Min. 5 × 10 ⁵ (at 120 cpm)
Conditions	Conditions for usage, transport and storage*2	Ambient temperature: -30 to +80°C -22 to +176°F, Humidity: 5 to 85% R.H. (Please avoid icing or condensation)
Water-proof standard		JIS D 0203 S2
Weight		approx. 31 g 1.09 oz

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

*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F)

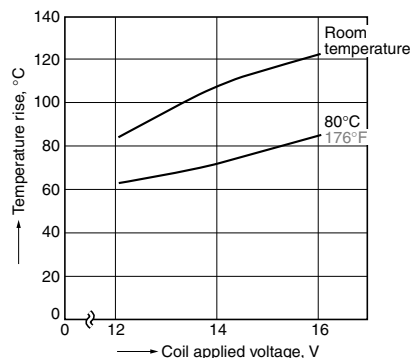
Electrical life

Contact arrangement	Rated coil voltage	Motor load	Halogen lamp load
1 Form A	12 V DC	Operating frequency: 3s ON, 15s OFF 12V DC 30A, Min. 2 × 10 ⁴	—
1 Form B		Operating frequency: 3s ON, 15s OFF 12V DC 20A, Min. 10 ⁵	Operating frequency: 1s ON, 14s OFF 12V DC 20A, Min. 10 ⁵
1 Form C	12 V DC	Operating frequency: 2s ON, 1s OFF 12V DC 20A, Min. 10 ⁵	Operating frequency: 1s ON, 14s OFF 12V DC 20A, Min. 10 ⁵
	24 V DC	Operating frequency: 2s ON, 1s OFF 24V DC 10A, Min. 10 ⁵	Operating frequency: 1s ON, 14s OFF 24V DC 6A, Min. 10 ⁵

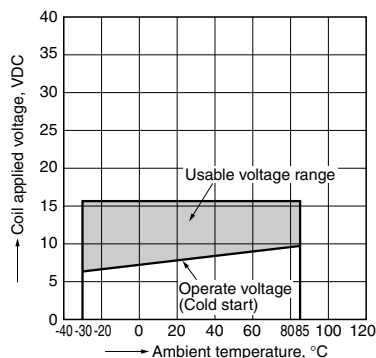
REFERENCE DATA

1. Coil temperature rise

Samples: CA1aS-12V-N-5, 5pcs.
 Measured portion: Inside the coil
 Carrying current: 20A
 Ambient temperature: Room temperature, 80°C
 176°F

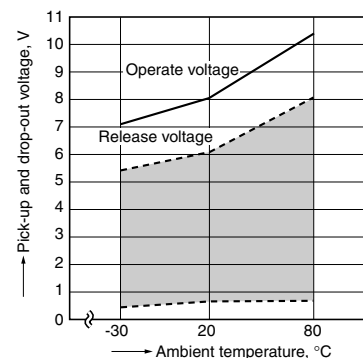


2. Ambient temperature and usable voltage range



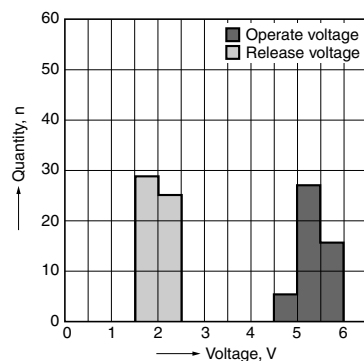
3. Ambient temperature characteristics (Cold start)

Samples: CA1bS-12V-N-5



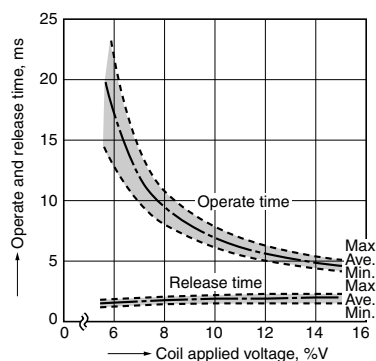
4. Distribution of operate (set) and release (reset) voltage

Quantity: 50pcs.



5. Distribution of operate (set) and release (reset) time

Sample: CA1a-12V-N-5, 10pcs.

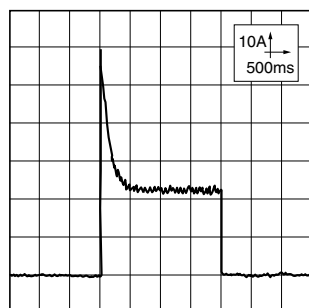


6.-(1) Electrical life test (Motor load)

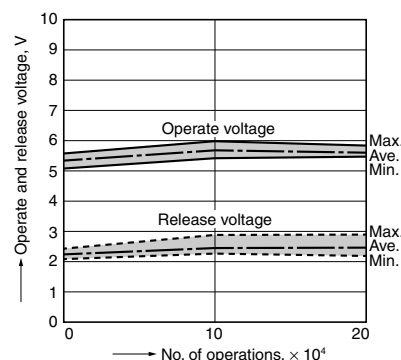
Sample: CA1a-12V-C, 3pcs.
 Load: Inrush current: 63A, steady current: 23A
 Blower fan motor actual load (motor free)
 Operating frequency: ON 2s, OFF 2s
 Ambient temperature: Room temperature

Load current waveform

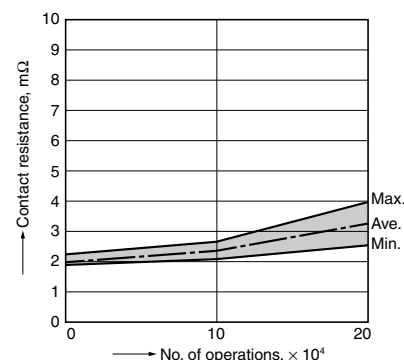
Load: Inrush current: 63A, steady current: 23A,

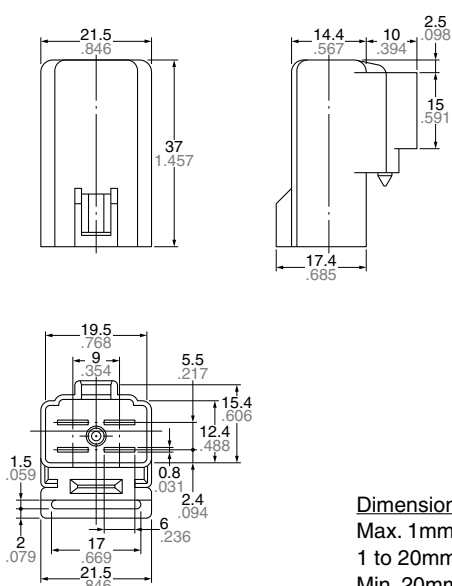
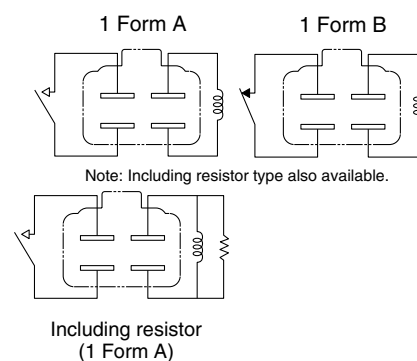


Change of operate (set) and release (reset) voltage

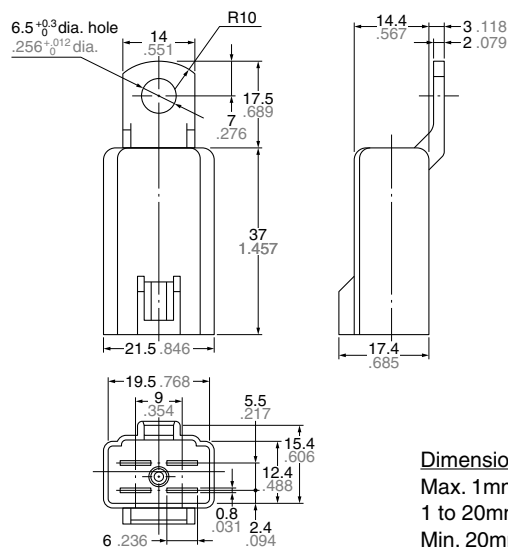
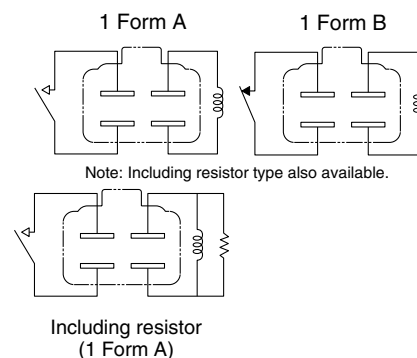


Change of contact resistance



DIMENSIONS (mm inch)The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>**1. 1 Form A / 1 Form B**
Rubber bracket A type**CAD****External dimensions****Schematic (Bottom View)**

Dimension:	Tolerance
Max. 1mm .039inch:	$\pm 0.1 \pm .004$
1 to 20mm .039 to .787inch:	$\pm 0.3 \pm .012$
Min. 20mm .787inch:	$\pm 0.5 \pm .020$

2. 1 Form A / 1 Form B
Screw-mounting type**CAD****External dimensions****Schematic (Bottom View)**

Dimension:	Tolerance
Max. 1mm .039inch:	$\pm 0.1 \pm .004$
1 to 20mm .039 to .787inch:	$\pm 0.3 \pm .012$
Min. 20mm .787inch:	$\pm 0.5 \pm .020$

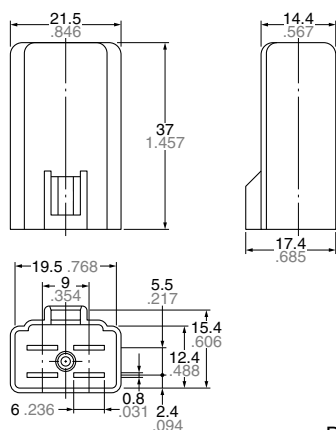
CA (ACA)

3. 1 Form A / 1 Form B Direct coupling type

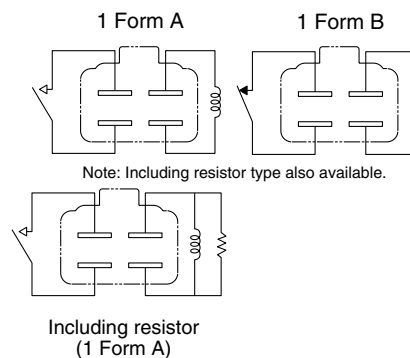
CAD



External dimensions



Schematic (Bottom View)



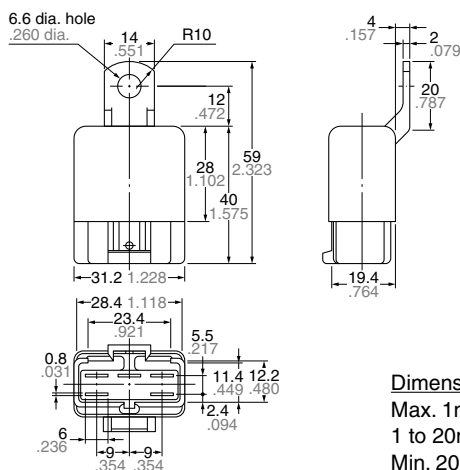
Dimension:	Tolerance
Max. 1mm .039inch:	$\pm 0.1 \pm .004$
1 to 20mm .039 to .787inch:	$\pm 0.3 \pm .012$
Min. 20mm .787inch:	$\pm 0.5 \pm .020$

4. 1 Form C Screw-mounting type

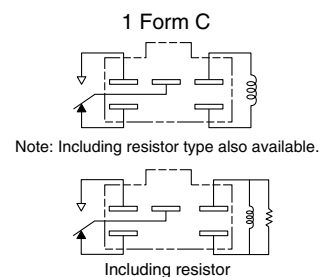
CAD



External dimensions



Schematic (Bottom View)



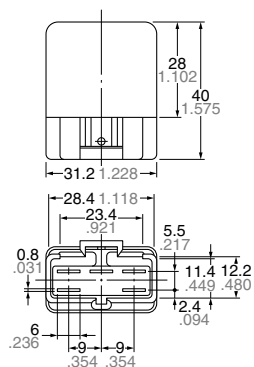
Dimension:	Tolerance
Max. 1mm .039inch:	$\pm 0.1 \pm .004$
1 to 20mm .039 to .787inch:	$\pm 0.2 \pm .008$
Min. 20mm .787inch:	$\pm 0.5 \pm .020$

5. 1 Form C Direct coupling type

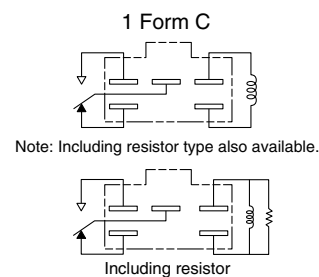
CAD



External dimensions



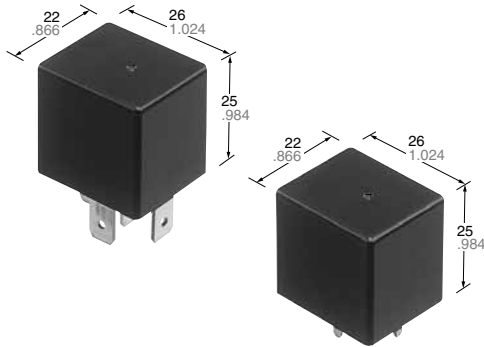
Schematic (Bottom View)



Dimension:	Tolerance
Max. 1mm .039inch:	$\pm 0.1 \pm .004$
1 to 20mm .039 to .787inch:	$\pm 0.2 \pm .008$
Min. 20mm .787inch:	$\pm 0.5 \pm .020$

For general cautions for use, please refer to the “Automotive Relay Users Guide”.

<Protective construction>
Flux tight/Sealed



(Unit: mm inch)

RoHS compliant

FEATURES

- This relay has an Mini-ISO (International Organization for Standardization) terminal arrangement.
- Compact and high capacity
- Features heat resistant type
- Built-in resistor type is also available.

TYPICAL APPLICATIONS

- **Automobiles**
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 H: High contact capacity							
Protective construction Nil: Sealed F: Flux tight							
Heat resistant of types Nil: Standard T: Heat resistant							
Protective element Nil: None R: With resistor inside							
Mounting classification Nil: Plug-in type P: PC board type M: Bracket type							
Rated coil voltage (DC) 12V, 24 V							

TYPES

Contact arrangement	Mounting classification	Rated coil voltage	Standard type		Heat resistant type		Packing	
			Sealed	Flux tight	Sealed	Flux tight	Carton	Case
			Type No.	Type No.	Type No.	Type No.		
1 Form A	PC board type	12V DC	CB1a-P-12V	CB1aF-P-12V	CB1a-T-P-12V	CB1aF-T-P-12V	50 pcs.	200 pcs.
		24V DC	CB1a-P-24V	CB1aF-P-24V	CB1a-T-P-24V	CB1aF-T-P-24V		
	Plug-in type	12V DC	CB1a-12V	CB1aF-12V	CB1a-T-12V	CB1aF-T-12V		
		24V DC	CB1a-24V	CB1aF-24V	CB1a-T-24V	CB1aF-T-24V		
	Bracket type	12V DC	CB1a-M-12V	CB1aF-M-12V	CB1a-T-M-12V	CB1aF-T-M-12V		
		24V DC	CB1a-M-24V	CB1aF-M-24V	CB1a-T-M-24V	CB1aF-T-M-24V		
1 Form C	PC board type	12V DC	CB1-P-12V	CB1F-P-12V	CB1-T-P-12V	CB1F-T-P-12V		
		24V DC	CB1-P-24V	CB1F-P-24V	CB1-T-P-24V	CB1F-T-P-24V		
	Plug-in type	12V DC	CB1-12V	CB1F-12V	CB1-T-12V	CB1F-T-12V		
		24V DC	CB1-24V	CB1F-24V	CB1-T-24V	CB1F-T-24V		
	Bracket type	12V DC	CB1-M-12V	CB1F-M-12V	CB1-T-M-12V	CB1F-T-M-12V		
		24V DC	CB1-M-24V	CB1F-M-24V	CB1-T-M-24V	CB1F-T-M-24V		
1 Form A High contact capacity	PC board type	12V DC	CB1aH-P-12V	CB1aHF-P-12V	CB1aH-T-P-12V	CB1aHF-T-P-12V		
		24V DC	CB1aH-P-24V	CB1aHF-P-24V	CB1aH-T-P-24V	CB1aHF-T-P-24V		
	Plug-in type	12V DC	CB1aH-12V	CB1aHF-12V	CB1aH-T-12V	CB1aHF-T-12V		
		24V DC	CB1aH-24V	CB1aHF-24V	CB1aH-T-24V	CB1aHF-T-24V		
	Bracket type	12V DC	CB1aH-M-12V	CB1aHF-M-12V	CB1aH-T-M-12V	CB1aHF-T-M-12V		
		24V DC	CB1aH-M-24V	CB1aHF-M-24V	CB1aH-T-M-24V	CB1aHF-T-M-24V		

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	Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated 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	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
1 Form A High contact capacity	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 operate (set) voltage types are also available. Please inquire our sales representative for details.

2) With resistor inside

Contact arrangement	Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Equivalent coil resistance [±10%] (at 20°C 68°F)	Rated 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
1 Form A High contact capacity	12V DC	3 to 7V DC	1.2 to 4.2V DC	134mA	89.5Ω	1.6W (PC board type)	10 to 16V DC
				168mA	71.6Ω	2.0W	
	24V DC	6 to 14V DC	2.4 to 8.4V DC	67mA	358Ω	1.6W (PC board type)	20 to 32V DC
				84mA	287.2Ω	2.0W	

2. Specifications

1) Standard type (12 V coil voltage)

Item		Specification		
Contact data	Contact arrangement	1 Form A	1 Form C	1 Form A High contact capacity
	Contact resistance (initial)	Max. 15mΩ (Typ. 2mΩ) (By voltage drop 1A 6V DC)		
	Contact material	Ag alloy		
	Rated switching capacity (resistive)	40A 14V DC	N.O. side: 40A 14V DC N.C. side: 30A 14V DC	70A 14V DC (at 20°C 68°F) 50A 14V DC (at 85°C 185°F)
	Max. carrying current (initial) (coil applied voltage 14V DC, at 85°C 185°F, continuous)	N.O. side: 40A	N.O. side: 40A N.C. side: 30A	N.O. side: 40A
	Min. switching load (resistive)*1	1A 14V DC (at 20°C 68°F)		
Insulated resistance (initial)		Min. 20 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)		
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)		
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)		
Time characteristics (initial)	Operate (Set) time (at rated coil voltage)	Max. 15ms (at 20°C 68°F, without contact bounce time)		
	Release (Reset) time (at rated coil voltage)	Max. 15ms (at 20°C 68°F, without contact bounce time) (Without diode)		
Shock resistance	Functional	Min. 200 m/s ² {approx. 20G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)		
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)		
Vibration resistance	Functional	10 to 500 Hz, Min. 44.1m/s ² {approx. 4.5G} (Detection time: 10μs)		
	Destructive	10 to 2,000 Hz, Min. 44.1m/s ² {approx. 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 rated switching capacity)	Flux tight: Min. 10 ⁵ , Sealed: Min. 5×10 ⁴ (Operating frequency: 2s ON, 2s OFF)		
Conditions	Conditions for usage, transport and storage*2	Standard; Ambient temperature: -40 to +85°C -40 to +185°F, Humidity: 5 to 85% R.H. (Please avoid icing or condensation)		
		Heat resistant; Ambient temperature: -40 to +125°C -40 to +257°F, Humidity: 5 to 85% R.H. (Please avoid icing or condensation)		
Weight		Approx. 33 g 1.16 oz		

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

*2. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

Please inquire our sales representative if you will be using the relay in a high temperature atmosphere (110°C 230°F)

2) Standard type (24 V coil voltage)

Item		Specifications		
Contact data	Contact arrangement	1 Form A	1 Form C	1 Form A High contact capacity
	Contact resistance (initial)	Max. 15mΩ (By voltage drop 1A 6V DC)		
	Contact material	Ag alloy		
	Rated switching capacity (resistive)	20A 28V DC	N.O. side: 20A 28V DC N.C. side: 10A 28V DC	20A 28V DC
	Max. carrying current (initial) (28V DC, at 85°C 185°F, continuous)	20A	N.O. side: 20A N.C. side: 10A	20A

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)

Item		Specifications					
		12V			24V		
Contact data	Contact arrangement	1 Form A	1 Form C	1 Form A High contact capacity	1 Form A	1 Form C	1 Form A High contact capacity
	Contact resistance (initial)	Max. 15mΩ (By voltage drop 1A 6V DC)					
	Contact material	Ag alloy					
	Rated switching capacity (resistive)	40A 14V DC	N.O. side: 40A 14V DC N.C. side: 30A 14V DC	40A 14V DC	20A 28V DC	N.O. side: 20A 28V DC N.C. side: 10A 28V DC	20A 28V DC
	Max. carrying current (initial) (at 85°C 185°F, continuous)*	50A 14V DC	N.O. side: 50A 14V DC N.C. side: 30A 14V DC	45A 14V DC 50A 14V DC	25A 28V DC	N.O. side: 25A 28V DC N.C. side: 10A 28V DC	25A 28V DC

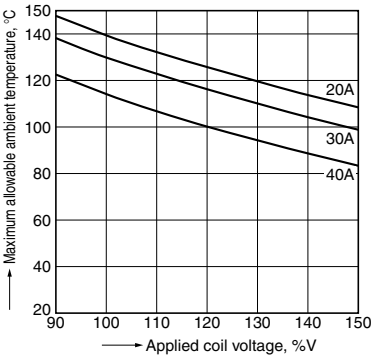
Notes: 1. All other specifications are the same as those of standard type (12 V coil voltage)

2. *Current value in which carry current is possible when the coil temperature is 180°C 356°F

REFERENCE DATA

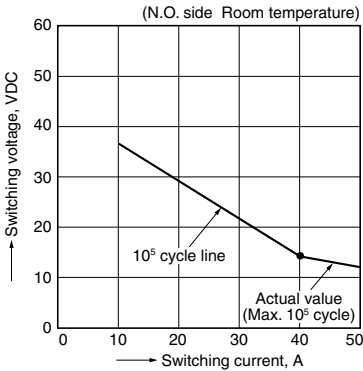
CB RELAYS (Standard)

1. Allowable ambient temperature
(Heat resistant and standard)

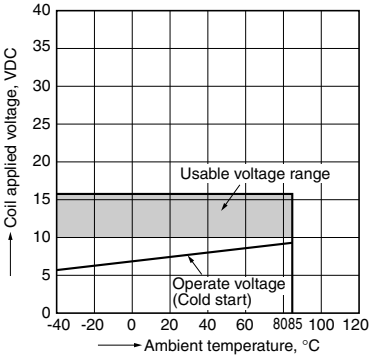


- Notes:
- Maximum mean coil temperature: 180°C 356°F
 - Curves are based on 1.4W (Nominal power consumption of the unsuppressed coil at nominal voltage)

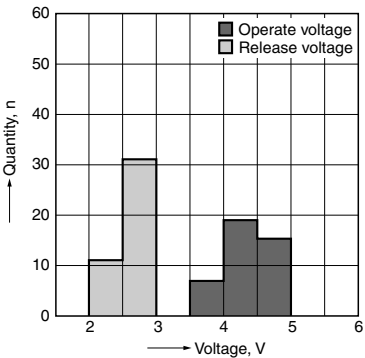
2. Max. switching capability (Resistive)
(Standard)



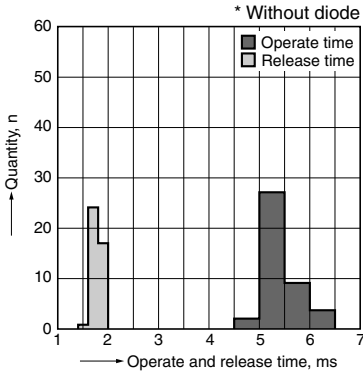
3. Ambient temperature and usable voltage range
(Standard)



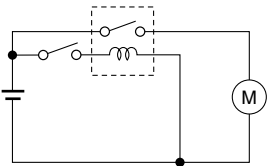
4. Distribution of operate (set) and release (reset) voltage
Sample: CB1-P-12V, 42pcs.



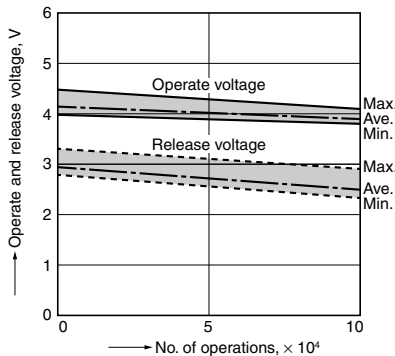
5. Distribution of operate (set) and release (reset) time
Sample: CB1-P-12V, 42pcs.



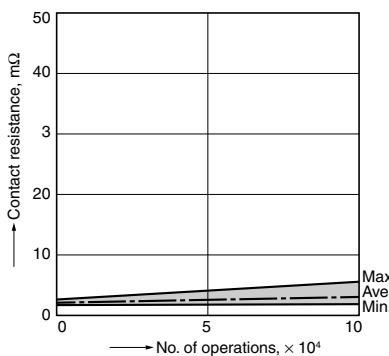
6. Electrical life test (Motor free)
Sample: CB1F-12V, 5pcs.
Load: 25A 14V DC, motor free actual load
Operating frequency: ON 1s, OFF 9s
Ambient temperature: Room temperature
Circuit:



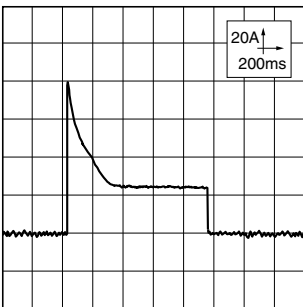
Change of operate (set) and release (reset) voltage

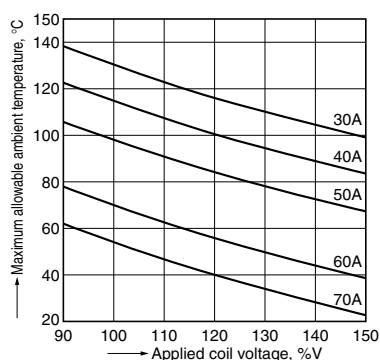


Change of contact resistance



Load current waveform
Load; Inrush current: 80A, Steady current: 25A

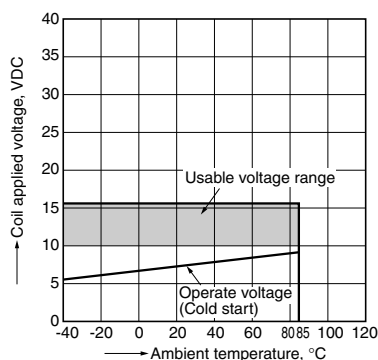


CB RELAYS (High contact capacity)**1. Allowable ambient temperature**
(High resistant and high contact capacity)**Notes:**

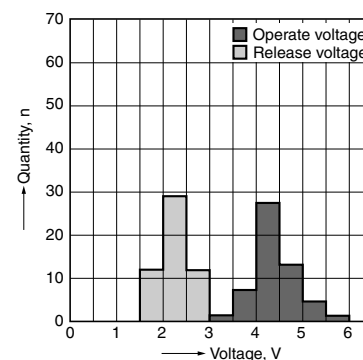
- Maximum mean coil temperature: 180°C 356°F
- Curves are based on 1.4W (Nominal power consumption of the unsuppressed coil at nominal voltage)

2. Ambient temperature and usable voltage range

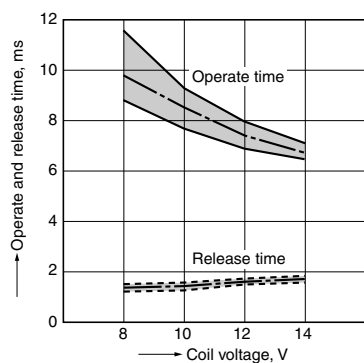
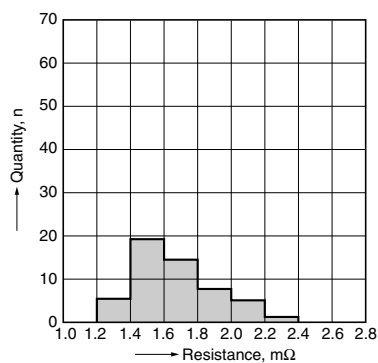
(High contact capacity and standard)

**3. Distribution of operate (set) and release (reset) voltage**

Sample: CB1aHF-12V, 53pcs.

**4. Distribution of operate and release time**

Sample: CB1aHF-12V, 53pcs.

**5. Contact resistance**Sample: CB1aHF-12V, 53pcs.
(By voltage drop 1A 6V DC)**6. Electrical life test (Motor free)**

Sample: CB1aH-12V, 3pcs.

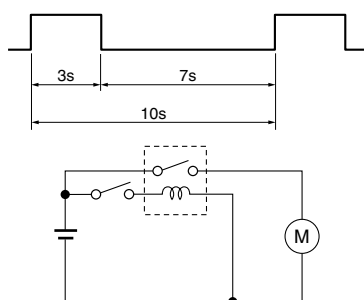
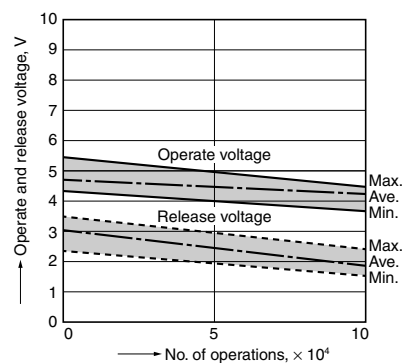
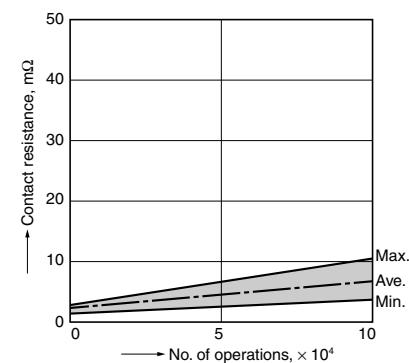
Load: Inrush current: 64A, Steady current: 35A

Fan motor actual load (motor free) 12V DC

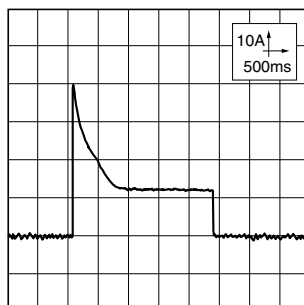
Operating frequency: ON 3s, OFF 7s

Ambient temperature: Room temperature

Circuit:

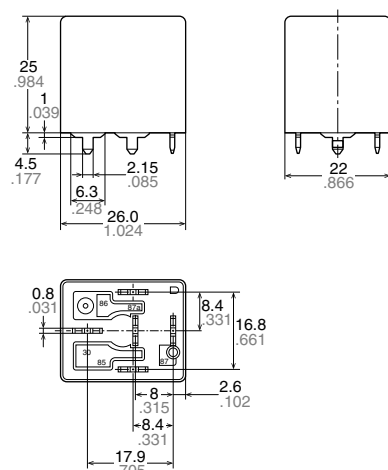
**Change of operate (set) and release (reset) voltage****Change of contact resistance****Load current waveform**

Load; Inrush current: 64A, Steady current: 35A



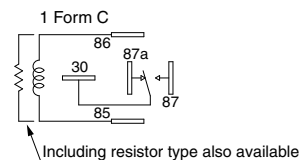
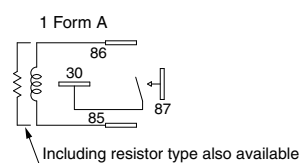
The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

CAD

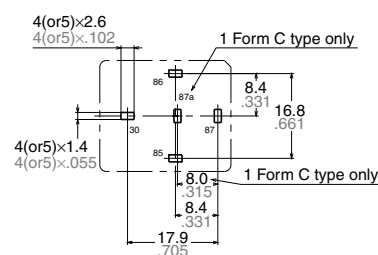


<u>Dimension:</u>	<u>Tolerance</u>
Max. 1mm .039 inch:	$\pm 0.1 \pm .004$
1 to 3mm .039 to .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

Schematic (Bottom view)

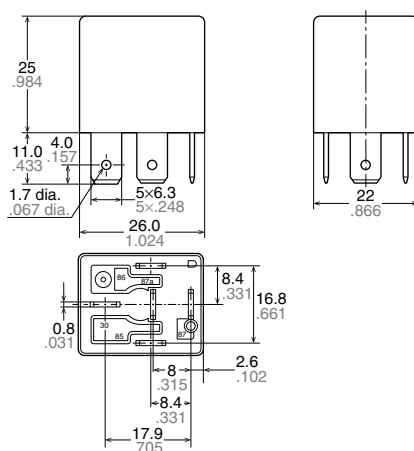
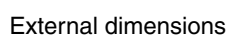


PC board pattern (Bottom view)



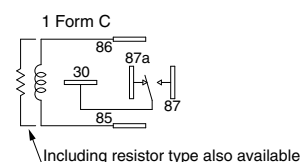
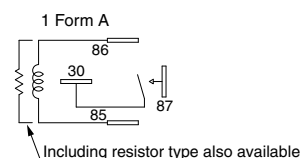
Tolerance: $\pm 0.1 \pm .004$

CAD



<u>Dimension:</u>	<u>Tolerance</u>
Max. 1mm .039 inch:	$\pm 0.1 \pm .004$
1 to 3mm .039 to .118 inch:	$\pm 0.2 \pm .008$
Min. 3mm .118 inch:	$\pm 0.3 \pm .012$

Schematic
(Bottom view)

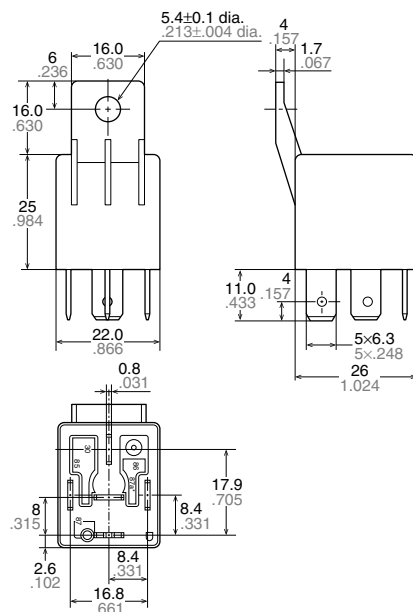


3. Bracket type

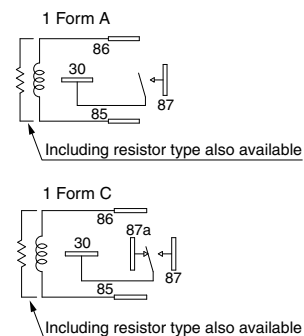
CAD



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

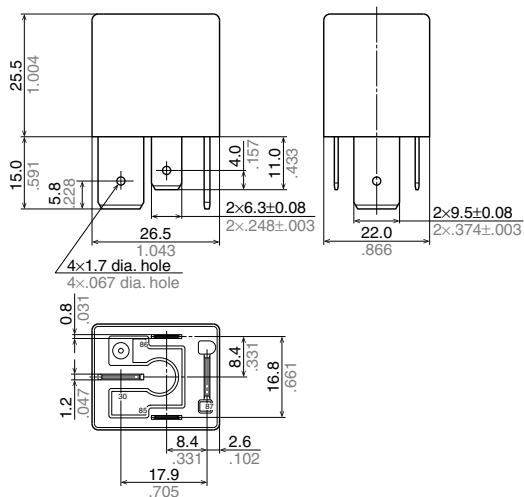
Schematic
(Bottom view)

4. 1 Form A high contact capacity (Plug-in type)

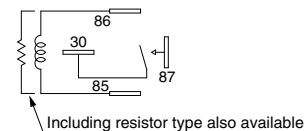
CAD



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

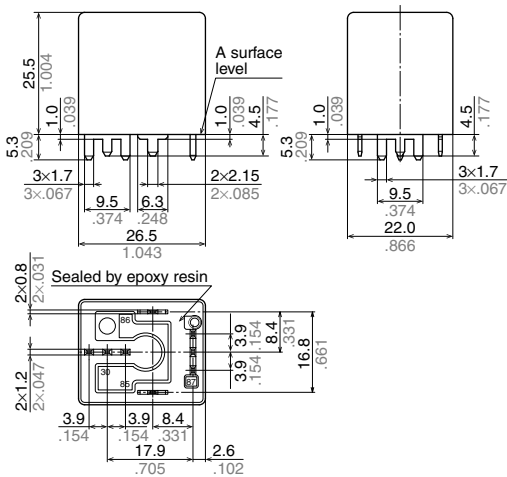
Schematic
(Bottom view)

5. 1 Form A high contact capacity (PC board type)

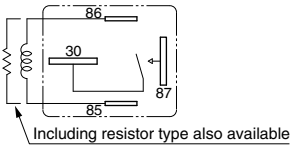
CAD



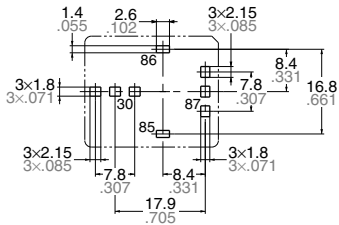
External dimensions



Schematic
(Bottom view)



PC board pattern (Bottom view)



* Intervals between terminals is measured at A surface level.

Tolerance: $\pm 0.1 \pm .004$

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

NOTES

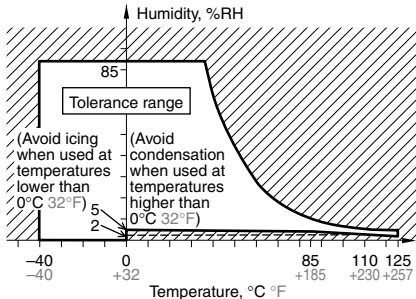
1. Soldering

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

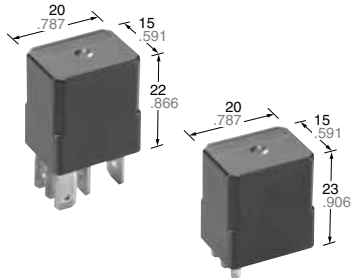
- 1) Ambient temperature, humidity, and air pressure during usage, transport, and storage of the relay:
 - (1) Temperature: -40 to +85°C -40 to +185°F (Standard type)
-40 to +125°C -40 to +257°F (High heat-resistant type)
 - (2) Humidity: 2 to 85% RH (Avoid icing and condensation.)
 - (3) Air pressure: 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 general cautions for use, please refer to the “Automotive Relay Users Guide”.

<Protective construction>
Flux tight/Sealed



(Unit: mm inch)

RoHS compliant

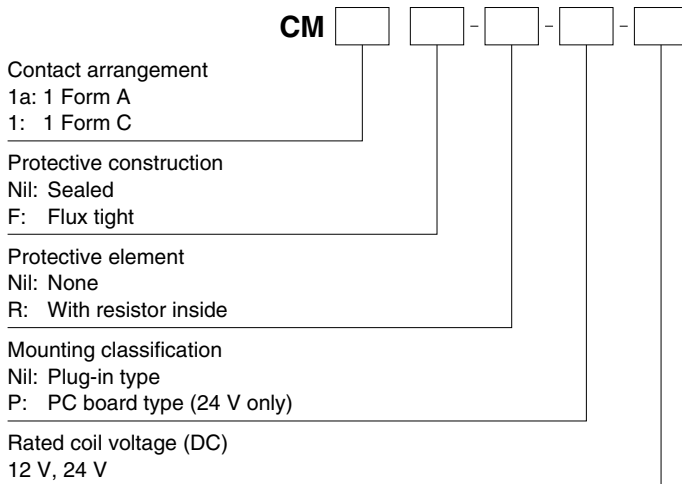
FEATURES

- Micro-ISO type terminals and small size
- Wide line-up
- Compact and high-capacity switching

TYPICAL APPLICATIONS

- Fan motor, Heater, Head lamp, Air compressor, ABS, Blower fan, Defogger, etc.

ORDERING INFORMATION



TYPES

Standard type

Contact arrangement	Rated coil voltage	Plug-in type		PC board type		Packing	
		Sealed	Flux tight	Sealed	Flux tight	Carton	Case
		Type No.	Type No.	Type No.	Type No.		
1 Form A	12 V DC	CM1a-12V	CM1aF-12V	—	—	50 pcs.	200 pcs.
	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		

Note: Please use "CM*-R-*" built-in resistor type. (Asterisks " *" should be filled in from ORDERING INFORMATION.)

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated 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

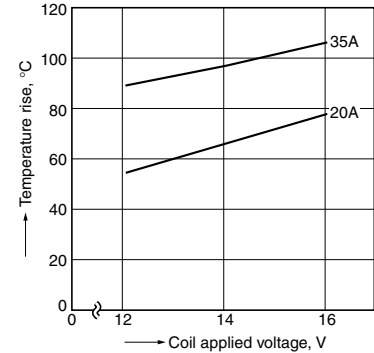
2. Specifications

Item		Specifications			
		12 V DC		24 V DC	
Contact data	Contact arrangement	1 Form A	1 Form C	1 Form A	1 Form C
	Contact resistance (initial)	Max. 15mΩ (Typ. 2mΩ) (By voltage drop 1A 6V DC)			
	Contact material	Ag alloy			
	Rated switching capacity (resistive)	N.O. side: 35 A 14V DC	N.O. side: 35 A 14V DC N.C. side: 20 A 14V DC	N.O. side: 15 A 28V DC	N.O. side: 15 A 28V DC N.C. side: 8 A 28V DC
	Max. carrying current (at 85°C 185°F, continuous)*1	N.O. side: 20 A 14V DC	N.O. side: 20 A 14V DC N.C. side: 10 A 14V DC	N.O. side: 15 A 28V DC	N.O. side: 15 A 28V DC N.C. side: 8 A 28V DC
	Min. switching load (resistive)*2	1 A 14V DC (at 20°C 68°F)		1 A 14V DC (at 20°C 68°F)	
	Contact voltage drop (after electrical life test)	N.O. side: Max. 0.5 V (By voltage drop 35 A 14 V DC)	N.O. side: Max. 0.5 V (By voltage drop 35 A 14 V DC) N.C. side: Max. 0.3 V (By voltage drop 20 A 14 V DC)	N.O. side: Max. 0.3 V (By voltage drop 15 A 28 V DC)	N.O. side: Max. 0.3 V (By voltage drop 15 A 28 V DC) N.C. side: Max. 0.2 V (By voltage drop 8 A 28 V DC)
Insulated resistance (initial)		Min. 20 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)			
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)			
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)			
Time characteristics (initial)	Operate (Set) time (at rated coil voltage)	Max. 10ms (at 20°C 68°F, without bounce time)			
	Release (Reset) time (at rated coil voltage)	Max. 10ms (at 20°C 68°F, without bounce time) (Without diode)			
Shock resistance	Functional	Min. 200 m/s² {approx. 20G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)			
	Destructive	Min. 1,000 m/s² {approx. 100G} (Half-wave pulse of sine wave: 6ms)			
Vibration resistance	Functional	10 to 500 Hz, Min. 44.1 m/s² {approx. 4.5G}			
	Destructive	10 to 2,000 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. 10⁶ (at 120 cpm)			
	Electrical	Flux tight: Min. 10⁵, Sealed: Min. 5 × 10⁴ (Operating frequency: 2s ON, 2s OFF)			
Conditions	Conditions for usage, transport and storage*3	Ambient temperature: -40 to +85°C -40 to +185°F, Humidity: 5 to 85% R.H. (Please avoid icing or condensation)			
Weight		Approx. 20 g .71 oz			

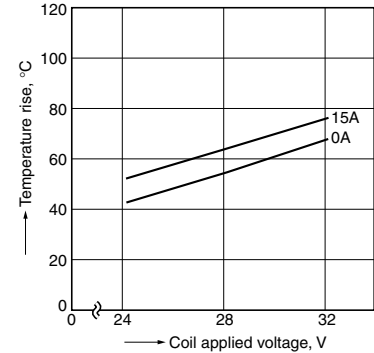
Notes: *1. Depends on connection conditions. Also, this does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.
*2. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended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

REFERENCE DATA

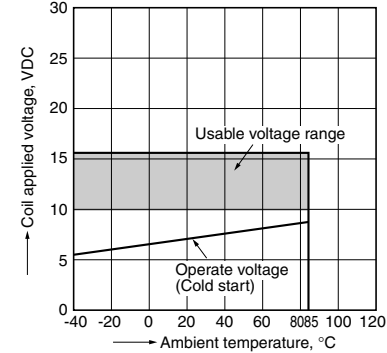
1.-(1) Coil temperature rise (12V type, 85°C 185°F)
Sample: CM1F-12V, 3 pcs.
Measured portion: Inside the coil
Contact carrying current: 20A, 35A
Ambient temperature: 85°C 185°F



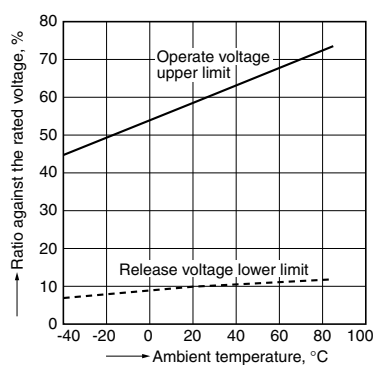
1.-(2) Coil temperature rise (24V type, 85°C 185°F)
Sample: CM1F-24V, 4 pcs.
Measured portion: Inside the coil
Contact carrying current: 0A, 15A
Ambient temperature: 85°C 185°F



2. Ambient temperature and usable voltage range (12V type)

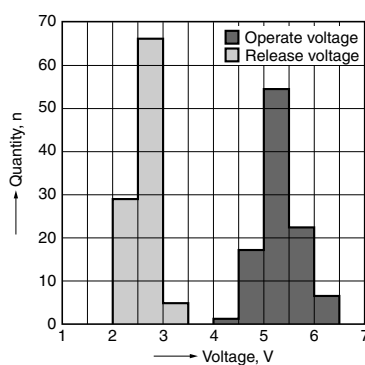


3. Ambient temperature characteristics (Cold/initial)



4. Distribution of operate (set) and release (reset) voltage

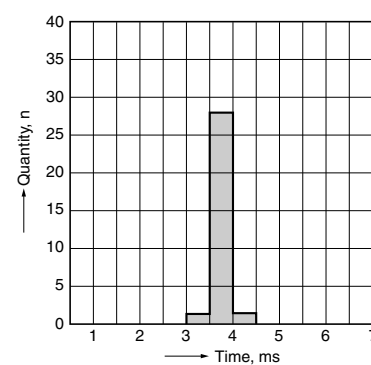
Sample: CM1F-12V, 100pcs.



5. Distribution of operate (set) time

Sample: CM1F-12V, 30pcs.

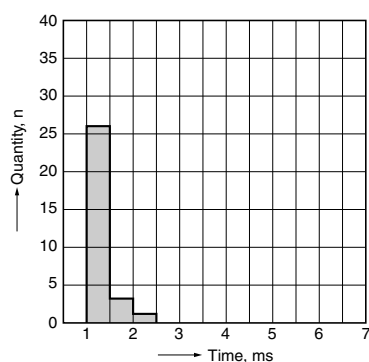
* Max. 10ms standard (excluding contact bounce)



6. Distribution of release (reset) time

Sample: CM1F-12V, 30pcs.

* Max. 10ms standard (excluding contact bounce)



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

Sample: CM1aF-R-12V, 6pcs.

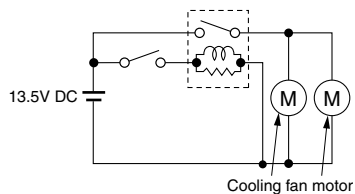
Load: 16 A 13.5 V DC

Cooling fan motor actual load
(free condition)

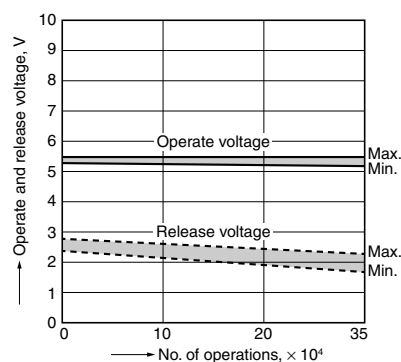
Operating frequency: ON 2s, OFF 6s

Ambient temperature: Room temperature

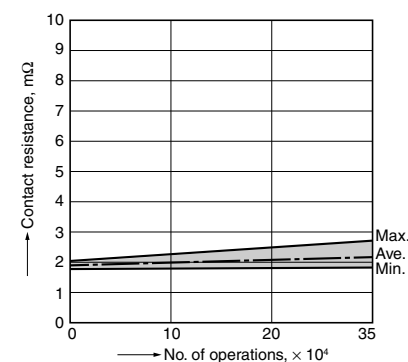
Circuit:



Change of operate (set) and release (reset) voltage

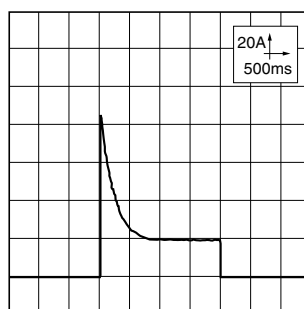


Change of contact resistance



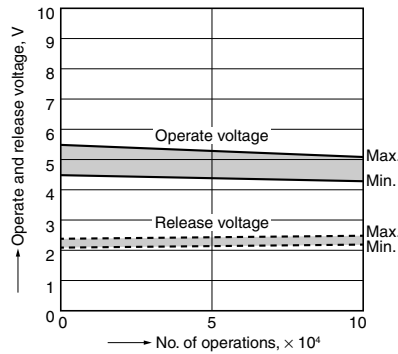
Load current waveform

Load; Inrush current: 85A, Steady current: 18A

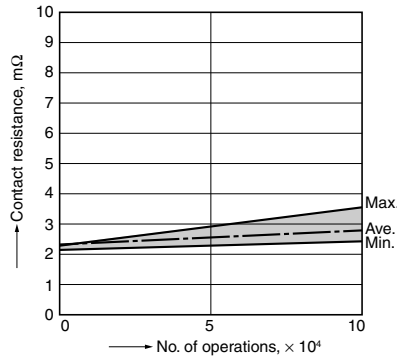


7.-(2) Electrical life test (Halogen lamp load)
Sample: CM1aF-R-12V, 6pcs.
Load: 20A 13.5V DC
Operating frequency: ON 1s, OFF 14s
Ambient temperature: Room temperature

Change of operate (set) and release (reset) voltage



Change of contact resistance



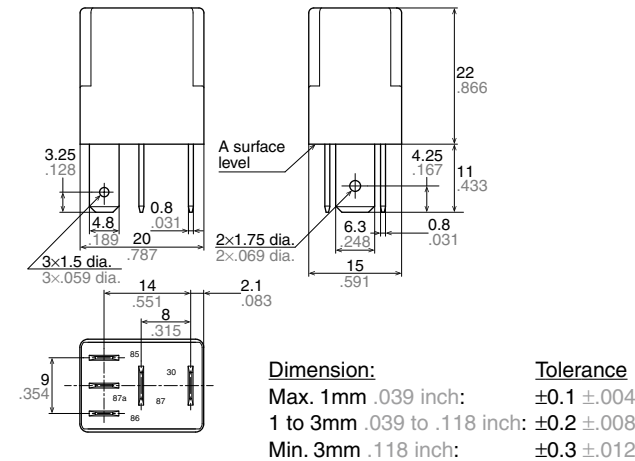
DIMENSIONS (mm inch)

The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

1. Plug-in type (1 Form C)

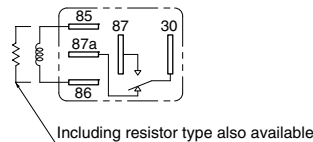
CAD

External dimensions



* Intervals between terminals is measured at A surface level.

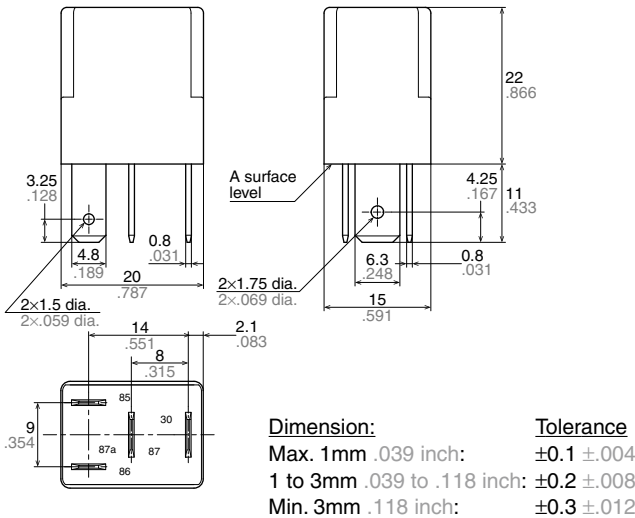
Schematic (Bottom view)



2. Plug-in type (1 Form A)

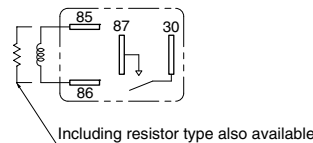
CAD

External dimensions



* Intervals between terminals is measured at A surface level.

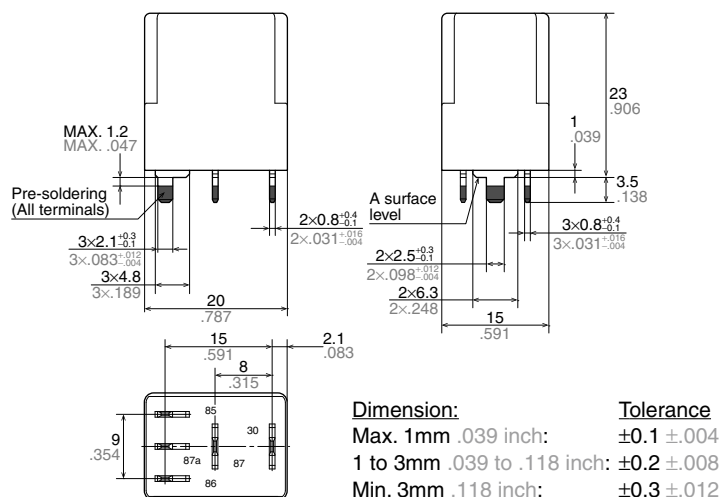
Schematic (Bottom view)



3. PC board type (1 Form C, 24V only)

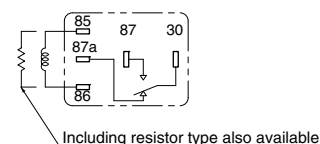
CAD

External dimensions

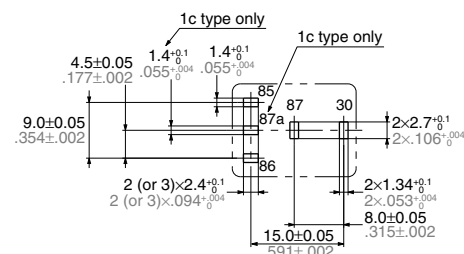


* Dimensions (thickness and width) of terminal is measured after pre-soldering.
 Intervals between terminals is measured at A surface level.

Schematic (Bottom view)



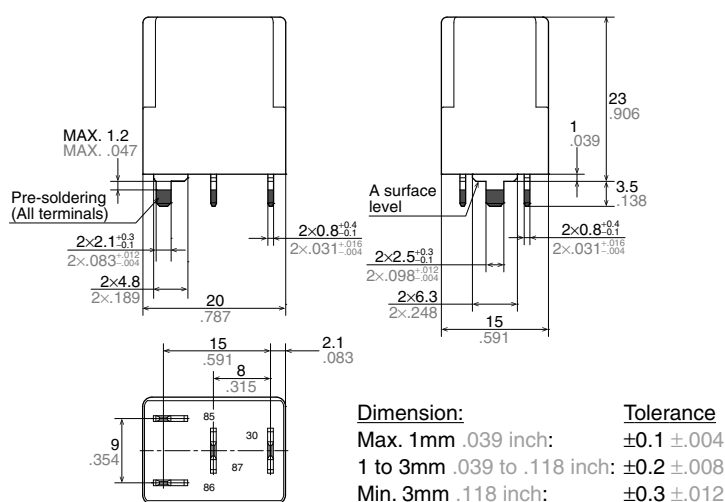
PC board pattern (Bottom view)



4. PC board type (1 Form A, 24V only)

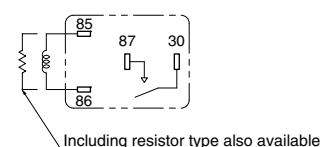
CAD

External dimensions



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

Schematic (Bottom view)



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.

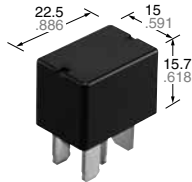
Please verify the PC board to be used.

For general cautions for use, please refer to the "Automotive Relay Users Guide".

Low Profile Micro-ISO Automotive Relay

CV-N RELAYS

<Protective construction>
Sealed



(Unit: mm inch)

RoHS compliant

FEATURES

- Low profile automotive relays for Micro-ISO terminal
- Compact and high-capacity load switching

TYPICAL APPLICATIONS

- Headlights, Magnetic clutches, Radiator fans, Blowers, Fog lamps, Tail lights, Heaters, Defoggers, Condenser fans, etc.

ORDERING INFORMATION

	ACVN				
Contact arrangement	5: 1 Form A				
Mounting classification	1: Micro ISO plug-in type				
Protective element	0: None				
	2: With resistor inside				
Rated coil voltage, DC	12: 12 V				

TYPES

Contact arrangement	Rated coil voltage	Part No.	Packing	
			Carton	Case
1 Form A	12 V DC	ACVN51012	50 pcs.	200 pcs.

Note: Please use "ACVN**2**" to order with resistor inside type. (Asterisks " * " should be filled in from ORDERING INFORMATION.)

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Usable voltage range
12V DC	Max. 7.0 V DC	Min. 0.5 V DC	66.7 mA, 74.7 mA (with resistor inside)	180Ω, 160.7Ω (with resistor inside)	800 mW, 900 mW (with resistor inside)	10 to 16V DC

2. Specifications

Item		Specifications
Contact data	Contact arrangement	1 Form A
	Contact resistance (initial)	Max. 15mΩ (Typ. 3mΩ) (By voltage drop 1A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	N.O. side: 35 A 14V DC
	Max. carrying current*1	N.O. side: 20 A 14V DC (at 85°C 185°F, continuous)
	Min. switching load (resistive)*2	1 A 14V DC (at 20°C 68°F)
	Contact voltage drop (initial)	N.O. side: Max. 0.5 V (By voltage drop 14 V DC 35 A)
Insulated resistance (initial)		Min. 20 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at rated coil voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time)
	Release (Reset) time (at rated coil voltage)	Max. 10ms (at 20°C 68°F, without contact bounce time) (Without diode)
Shock resistance	Functional	Min. 100 m/s ² {approx. 10G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² {approx. 100G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 100 Hz, Min. 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)
	Destructive	10 to 500 Hz, Min. 44.1 m/s ² {approx. 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 rated switching capacity, operating frequency: 2s ON, 2s OFF
		<Motor load> Min. 3 × 10 ⁵ at inrush 84 A, steady 18 A, 14 V DC, Operating frequency: 2s ON, 5s OFF <Lamp load> Min. 2 × 10 ⁵ at inrush 84 A, steady 12 A, 14 V DC, Operating frequency: 1s ON, 14s OFF
Conditions	Conditions for usage, transport and storage*3	Ambient temperature: -40 to +85°C -40 to +185°F*4, Humidity: 5 to 85% R.H. (Please avoid icing or condensation)
Weight		Approx. 12 g .42 oz

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

*2. 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.

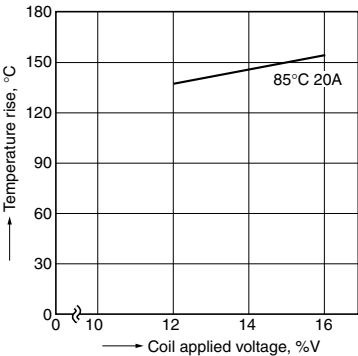
*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

*4. Please inquire our sales representative if you will be using the relay in a high temperature atmosphere.

REFERENCE DATA

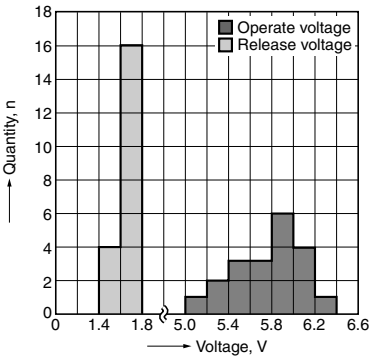
1. Coil temperature rise

Point measured: Inside the coil
Carrying current: 20A
Coil applied voltage: 12V, 14V, 16V
Ambient temperature: 85°C 185°F



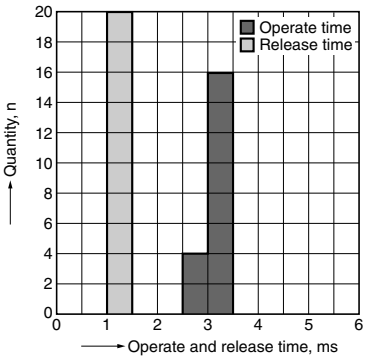
2. Distribution of operate (set) and release (reset) voltage

Sample: ACVN51012, 20pcs

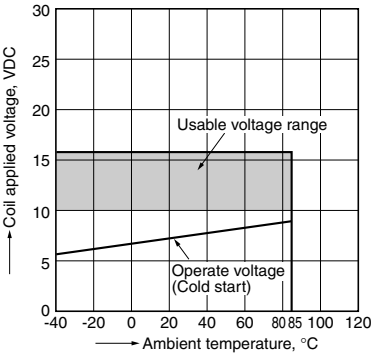


3. Distribution of operate (set) time and release (reset) time

Sample: ACVN51012, 20pcs.

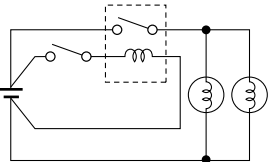


4. Ambient temperature and usable voltage range

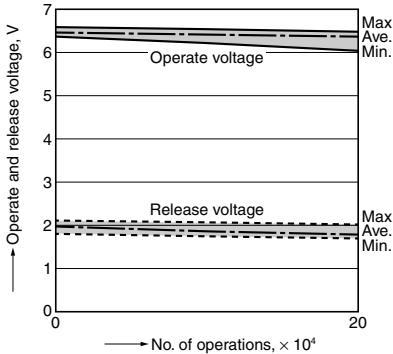


5.-(1) Electrical life test (Lamp load)

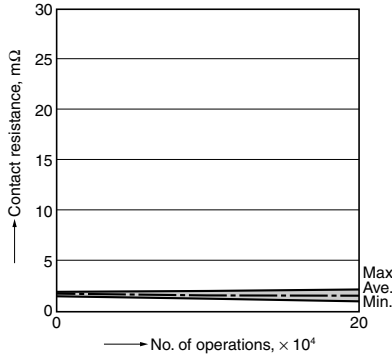
Sample: ACVN51012, 3pcs.
Load: Inrush: 84A, Steady: 12A,
halogen lamp load (60W×2)
Switching frequency: ON 1s, OFF 14s
Ambient temperature: 85°C 185°F
Circuit:



Change of operate (set) and release (reset) voltage

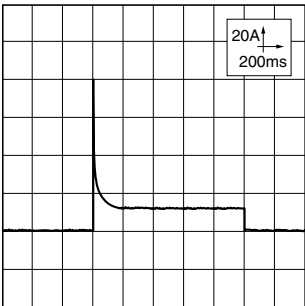


Change of contact resistance



Load current waveform

Load: Inrush current: 84A, steady current: 12A



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

Sample: ACVN51012, 3pcs.

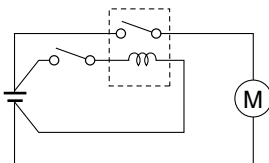
Load: Inrush: 80A, Steady: 18A,

Radiator fan motor (motor free)

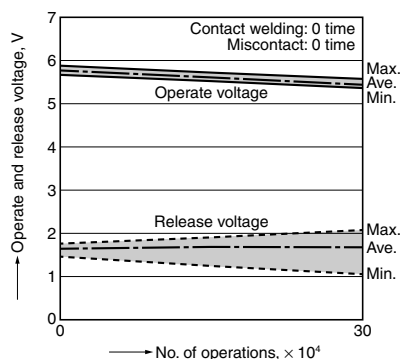
Switching frequency: ON 1s, OFF 4s

Ambient temperature: 85°C 185°F

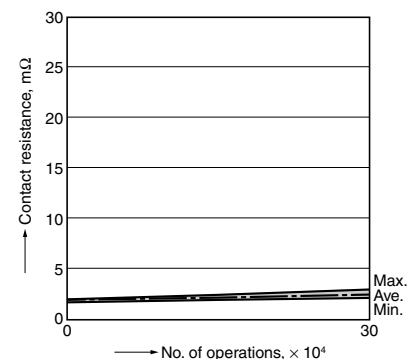
Circuit:



Change of operate (set) and release (reset) voltage

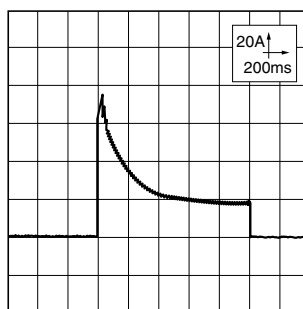


Change of contact resistance



Load current waveform

Load: Inrush current: 80A, Steady current: 18A



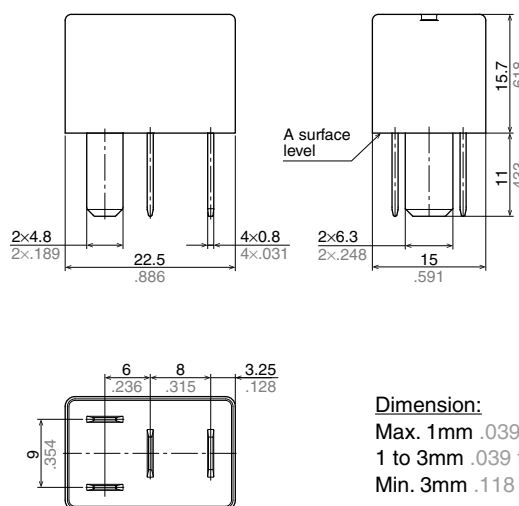
DIMENSIONS (mm inch)

1. Micro ISO plug-in type

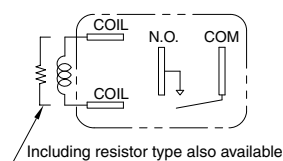
CAD



External dimensions



Schematic (Bottom view)



Dimension:

Max. 1mm .039 inch:

1 to 3mm .039 to .118 inch: ±0.2 ±.008

Min. 3mm .118 inch:

Tolerance

±0.1 ±.004

±0.2 ±.008

±0.3 ±.012

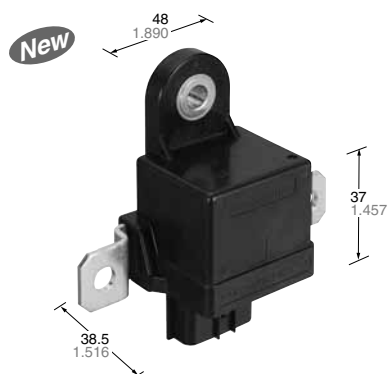
Note: Intervals between terminals is measured at A surface level.

For general cautions for use, please refer to the "Automotive Relay Users Guide".

**Max. 150 A Continuous
Carrying Current
Latching Relay**

CN-L RELAYS

<Protective construction>
Sealed



(Unit: mm inch)

RoHS compliant

FEATURES

- Continuous carrying current possible at 150 A (at 85°C 185°F) or 80 A (at 125°C 257°F)
- Maximum 1,500 A conductivity
- Can be used in environments with 125°C 257°F ambient temperature

TYPICAL APPLICATIONS

- Main relay application for protection of lithium batteries, etc.
- Battery disconnect application (safe circuit shutoff possible during malfunctions)
- Dual power supply switching application

ORDERING INFORMATION

ACNL ☐ ☐ ☐

Contact arrangement

1: 1 Form A (Screw mounting)

Contact capacity

1: 150A

Rated coil voltage (DC)

1: 12V

TYPES

Contact arrangement	Rated coil voltage	Part No.	Packing
			Case
1 Form A (Latching type)	12V DC	ACNL111	25 pcs.

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage* (at 20°C 68°F) (Initial)	Release (Reset) voltage* (at 20°C 68°F) (Initial)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Max. applied voltage
12V DC	Max. 7.0V DC	Max. 7.0V DC	2.5A	4.8Ω	30W	16V DC

* However, Impulse length is 100 ±50 ms (both Operate (Set) and Release (Reset) sides) and operation interval is 5 seconds or higher (Operate (Set)/Release (Reset) switching).

2. Specifications

Item		Specifications
Contact data	Contact arrangement	1 Form A (Latching type)
	Contact resistance (initial)	Max. 1.5mΩ (Typ. 0.4mΩ) (By voltage drop 1A 6V DC) Max. 1.0mΩ (By voltage drop 10A 6V DC)
	Contact material	Ag alloy
	Rated switching capacity (resistive)	150A 14V DC
	Continuous carrying current	150 A (at 85°C 185°F, Connection cable: 38 mm ²) 80 A (at 125°C 257°F, Connection cable: 38 mm ²)
	Max. carrying current* ¹	1,500 A for 0.5 seconds ([at forward direction] at 20°C 68°F, Connection cable: 38 mm ²)
	Max. cut-off current	350 A 14 V DC (1,000 times or more in forward direction, Switching frequency: 1s ON, 9s OFF, at 20°C 68°F, Connection cable: 38 mm ²)
	Min. switching load (resistive)* ²	1 A 14 V DC (at 20°C 68°F)
	Contact voltage drop (initial)	Max. 0.1 V (at 100 A, 12 V DC)
Insulated resistance (initial)		Min. 10 MΩ (at 500 V DC)
Dielectric strength (initial)	Between open contacts	500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at rated coil voltage)	Max. 10ms (at 20°C 68°F, without bounce time)
	Release (Reset) time (at rated coil voltage)	Max. 10ms (at 20°C 68°F) (without diode)
Shock resistance	Functional	Min. 250 m/s ² (N.O. side: closing) Min. 500 m/s ² (N.O. side: open, set/reset reversal) (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 1,000 m/s ² (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 500 Hz, Min. 44.1m/s ² (Detection time: 10μs)
	Destructive	10 to 500 Hz, Min. 44.1m/s ² (Time of vibration for each direction; X, Y direction: 2 hours, Z direction: 4 hours)
Expected life	Mechanical	Min. 3 × 10 ⁵ (Switching frequency: 30 times/min.)
	Electrical	150 A 14 V DC resistive load, Min. 3 × 10 ⁴ (Switching frequency: 1s ON, 9s OFF, at 85°C 185°F, Connection cable: 38 mm ²)
Conditions	Conditions for usage, transport and storage* ³	Ambient temperature: -40 to +125°C -40 to +257°F Humidity: 2 to 85% R.H. (Please avoid icing or condensation)
Weight		Approx. 150 g 5.29 oz

Notes: *1. This does not guarantee repeated switching. We recommend that you confirm operation under actual conditions.

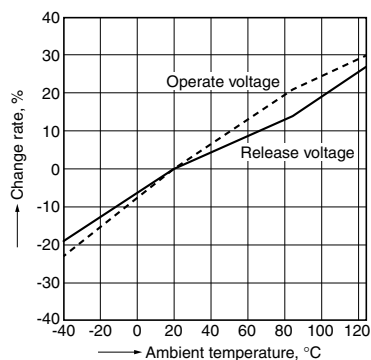
*2. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

REFERENCE DATA

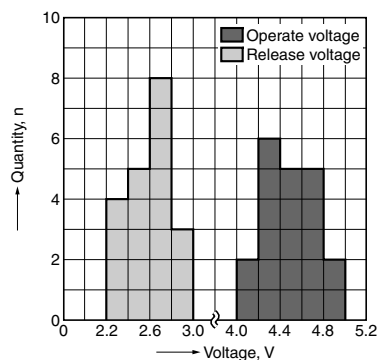
1. Ambient temperature characteristics

Sample: ACNL111, 3pcs.



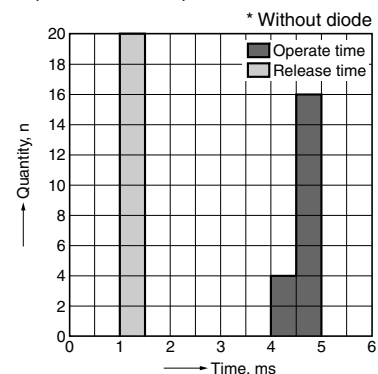
2. Distribution of operate (set) and release (reset) voltage

Sample: ACNL111, 20pcs.



3. Distribution of operate (set) time and release (reset) time

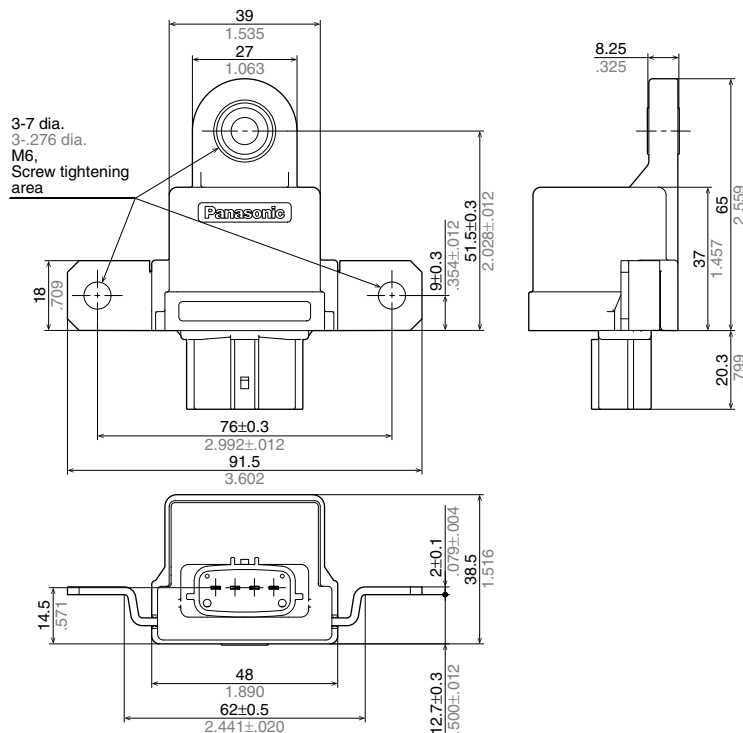
Sample: ACNL111, 20pcs.



DIMENSIONS (mm inch)

The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>**CAD**

External dimensions

Matching female connector:
DL090/6195-0030 (manufactured by Sumitomo)

Dimension:

Max. 10mm .394inch:

10 to 50mm .394 to 1.969 inch:

Min. 50mm 1.969 inch:

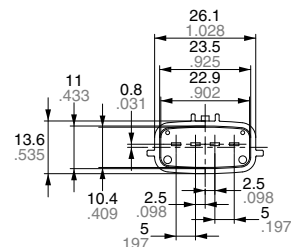
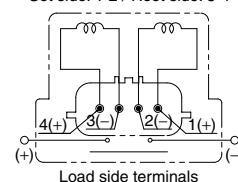
Tolerance

±0.3 ±.012

±0.6 ±.024

±1.0 ±.039

Connector area enlarged view

Connector non-specified general tolerance
Max. 10mm: ±0.15 Max. .394inch: ±.006
10 to 50mm: ±0.2 Max. 1.969inch: ±.008Schematic
(Bottom view)Coil terminals
Set side: 1-2 / Reet side: 3-4

NOTES

Usage, transport and storage conditions

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

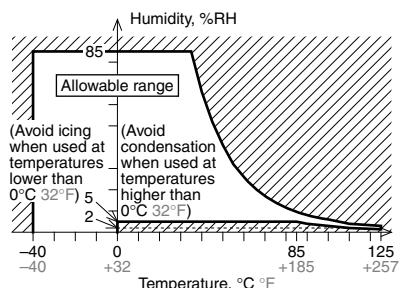
(1) Temperature: -40 to $+125^{\circ}\text{C}$ -40 to $+257^{\circ}\text{F}$

(2) Humidity: 2 to 85% RH (Avoid icing and condensation.)

(3) Air 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 general cautions for use, please refer to the “Automotive Relay Users Guide”.

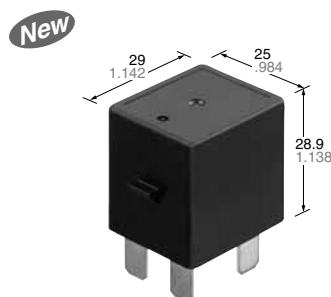
PRECAUTIONS REGARDING LATCHING RELAYS

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

Small, High Capacity, High Voltage DC Plug in Type Relay

EC-N RELAYS

<Protective construction>
Sealed



(Unit: mm inch)

RoHS compliant

FEATURES

- **Small and High capacity**

Use of an arc space and optimal placement of arc extinction parts has enabled extreme form-factor reduction, down to half the size of our previous equivalent product (EC relay).

- **Easy-connect plug in terminal**

Plug in insertion to box and may be locked in with case catches.

TYPICAL APPLICATIONS

- **High voltage pre-charge relay applications for electric vehicles (HEV, PHEV, BEV, FCV), etc.**

ORDERING INFORMATION

AECN

Contact arrangement/terminal shape

1: 1 Form A plug in type

Contact capacity

1: 15 A

Protective construction

0: Sealed

Rated coil voltage

12: 12 V DC

TYPES

Contact arrangement	Rated coil voltage	Part No.	Packing
			Carton
1 Form A plug in type	12 V DC	AECN11012	100 pcs. (Packed with 100 pcs/1 tray)

RATING

1. Coil data

Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (Initial)	Release (Reset) voltage (at 20°C 68°F) (Initial)	Coil resistance [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Max. applied voltage*1
12 V DC	Max. 6.8 V DC	Min. 0.5 V DC	103 Ω	1.4 W	16 V DC

Note: *1. When continually powered, the maximum allowable voltage is 14V DC.

2. Specifications

Item		Specifications
Contact data	Contact arrangement	1 Form A
	Contact material	Ag alloy
	Rated switching capacity (resistive)	15A 400V DC
	Max. allowed current	5A Continuity 10A 5min, 20A 1 min. (2mm ² wire)
	Min. switching load (resistive)*1	1A 12V DC (at 20°C 68°F)
	Contact voltage drop (initial)	Max. 0.5V (10 A carrying current)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)
Dielectric strength (initial)	Between open contacts	2,500 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	2,500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at rated coil voltage)	Max. 50ms (at 20°C 68°F, without bounce time)
	Release (Reset) time (at rated coil voltage)	Max. 30ms (at 20°C 68°F, without bounce time) (Without diode)
Shock resistance	Functional	Min. 196 m/s ² {approx. 20G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
	Destructive	Min. 490 m/s ² {approx. 50G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional	10 to 200 Hz, 44.1m/s ² {approx. 4.5G} (Detection time: 10μs)
	Destructive	10 to 200 Hz, 44.1m/s ² {approx. 4.5G} Time of vibration for each direction; X, Y, Z direction: 4 hours
Expected life	Mechanical	2 × 10 ⁵ (at 60 cpm)
	Switch-off life *2, *3	15A 400V DC, Min. 10 times
	Inrush current (capacitor)	15A 400V DC, Min. 10 ⁵ times
Conditions	Conditions for usage, transport and storage*4	Ambient temperature: -40 to +85°C -40 to +185°F, Humidity: 5 to 85% R.H. (Please avoid icing or condensation)
Weight		approx. 40 g 1.41 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. Switch-off life when a varistor (ZNR) is used to absorb surge from coil. Please be warned that working life will be reduced when a diode is used.

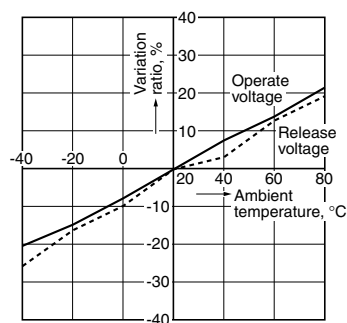
*3. at L/R ≤ 1ms

*4. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

REFERENCE DATA

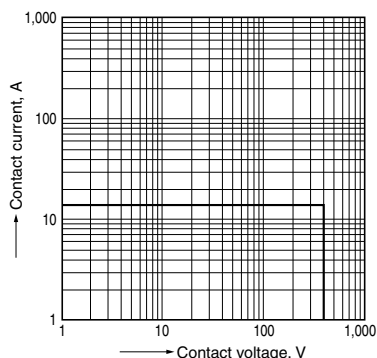
1. Ambient temperature characteristics

Sample: AECN11012, 3 pcs.



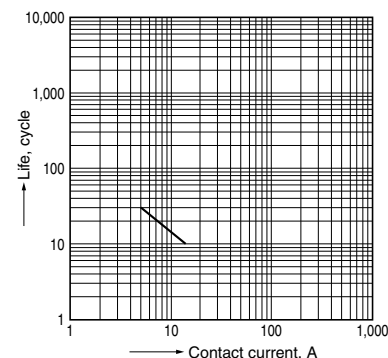
2. Max. value for switching capacity

Sample: AECN11012, 3 pcs.

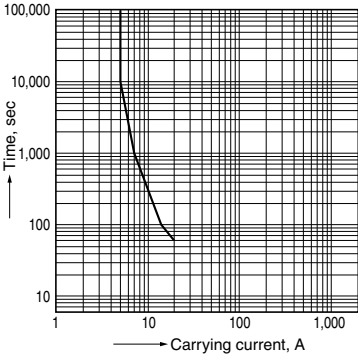


3. Switch-off life curve (Forward direction)

Sample: AECN11012, 3 pcs.



4. Carrying performance curve (85°C 185°F)
Sample: AECN11012, 3 pcs.



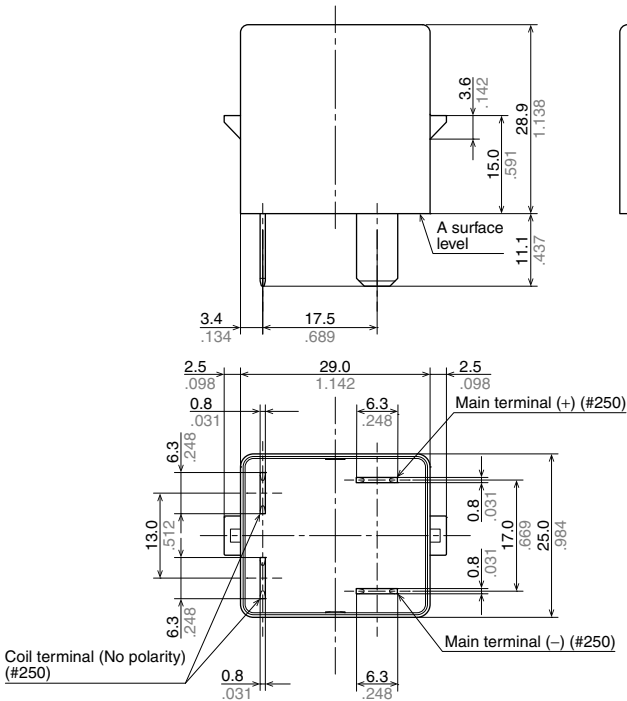
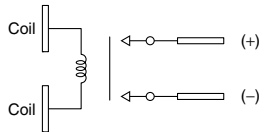
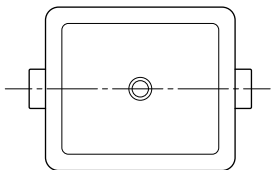
DIMENSIONS (mm inch)

CAD

The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

External dimensions

Schematic (Bottom view)



Tolerance:

Less than 10mm .394inch:	$\pm 0.3 \pm 0.012$
10 to 50mm .394 to 1.969 inch:	$\pm 0.6 \pm 0.024$
More than 50mm 1.969 inch:	$\pm 1.0 \pm 0.039$

* The terminal position or intervals between terminals is measured at A surface level.

1. Usage, transport and storage conditions

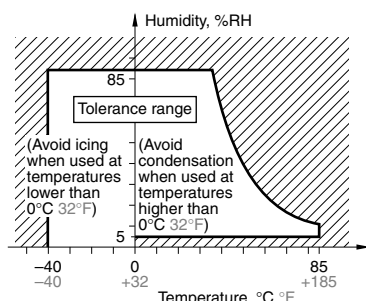
1) Temperature: -40 to $+85^{\circ}\text{C}$ -40 to $+185^{\circ}\text{F}$

2) Humidity: 5 to 85% RH (Avoid icing and condensation.)

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

3) Air pressure: 86 to 106 kPa

[Temperature and humidity range for usage, transport, and storage]



4) Water condensation

Water condensation occurs when the ambient temperature drops suddenly from a high temperature and humidity, or, the relay is suddenly transferred from a low ambient temperature to a high temperature and humidity. Condensation causes the failures like insulation deterioration, wire disconnection and rust etc.

Panasonic Corporation does not guarantee the failures caused by condensation.

5) Low-temperature, low-humidity atmosphere;

If the relay is exposed to a low-temperature, low-humidity atmosphere for a long time, its plastic parts may become brittle and fragile.

6) Icing

Please check the icing when an ambient temperature is lower than 0°C $+32^{\circ}\text{F}$. Water drop adheres to the relay by the condensation or the abnormal high humidity and is frozen to the ice when the ambient temperature becomes lower than 0°C $+32^{\circ}\text{F}$. The icing causes the sticking of movable portion, the operation delay and the contact conduction failure etc.

Panasonic Corporation does not guarantee the failures caused by the icing.

The heat conduction by the equipment may accelerate the cooling of relay itself and the icing may occur. Please confirm no icing in the worst condition of the actual usage.

7) Storage

Do not keep under high-temperature and high-humidity.

2. 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 switch-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 switch-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.

3. The contacts of the relay are polarized, so follow the connection schematic when connecting the contacts.

4. 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.

• Nominal cross-sectional area: Min. 2 mm²

5. As a guide, the insertion strength of the plug-in terminal into the relay tab terminal should be 40 to 80N. Please select a plug-in terminal (flat connection terminal) which comply with JIS C2809-1999.

• Plate thickness 0.8mm and #250 tab terminal

6. Other cautions for use

1) Please make sure to contact our company when the product is used not in accordance with its specifications. Your nearest sales office will review the required specification from your company and perform confirmation tests in actual condition as needed. Please check "Automotive relay user's guide" for use of relays.

2) When the voltage is applied to the relay coil beyond the max. allowable voltage range, the relay operation cannot be assured. Additionally the ambient temperature and condition of your application should be considered under the worst condition of the actual usage because they may change the relay operate and release voltage.

* It is not allowed to apply the continuous maximum voltage to the coil.

In order to obtain the specified performance, please apply the rated voltage.

3) If it includes ripple, the ripple factor should be max. 5%. In addition, do not have a parallel connection with diode for the purpose of coil surge absorber.

If only diode is connected in parallel to the relay coil, break performance of relay cannot be assured because contact release speed becomes slower. So do not use such a circuit. Instead of diode, a Varistor (ZNR) or Zener diode (ZD) when clamp voltage is 1.5 times larger than the rated voltage (Min. 18V for the rated 12V-relay), shall be used for the absorber.

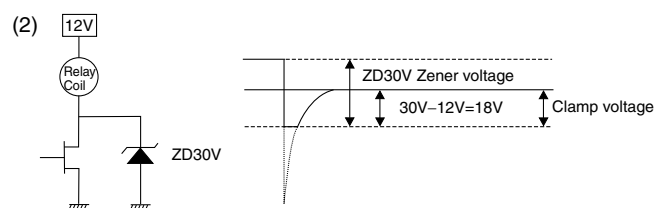
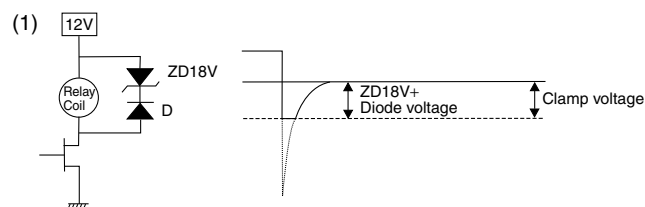
Ex.1 When Varistor (ZNR) is used

Recommended Varistor; Energy capability: Min 1 J

(However, please set up the value with consideration of the worst value in use condition.)

Varistor Voltage: Min. 18V at 12V DC

Ex.2 When Zener diode (circuit) is used



4) Lifetime is specified under the standard test conditions in JIS C 5442. (temperature 15°C to 35°C 59°F to 95°F, humidity 25%RH to 75%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 electrical life would be shortened.

5) If the relay is dropped, it should not be used again.

6) Please contact our sales representative when AC load gets applied to this relay.

Careful handling is required for switching AC load with this relay.

7) Please check the internal connection diagram in the catalog or specification, and connect the terminals correctly.

If any wrong connection is made, it may cause circuit damage by unexpected malfunction, abnormal heat, fire, and so on.

8) Please check the insulation distance between each terminal and ground.

9) Please assure the evaluation of the relay under the actual worst condition to enhance the reliability for the actual usage.

10) Please absolutely avoid the ultrasonic and high frequency vibration to the relay that adversely affects its performance.

11) Minimum switching load is the lower limit switching current under the micro-load. When the relay is used below minimum switching load, reliability becomes lower. Please use the relay beyond minimum switching load.

Additionally, minimum switching load is changed by coil drive circuit, type of load, switching frequency and environment condition.

So please confirm the reliability with actual load under the assumed actual environment.

12) The relay should not be installed near strong magnetic fields (transformers, magnets, etc.) and should not be installed near heat source.

13) If the several relays are mounted closely or a heat-generation object is close to the relay, it may cause troubles the abnormal temperature-rise and the short insulation distance terminals outside of the relay so please assure the evaluation of the relay under the actual worst condition.

14) After that the relay has been applied with the rated voltage and current to the coil continuously and then the relay is once switched off and switched on immediately, the relay coil resistance may be increased due to the coil temperature increase.

This will result in higher operate voltage and the value will surpass the rated operate voltage value. In order to avoid this failure, the following countermeasures are recommended.

- decrease of the load current
- restriction of time to apply voltage
- restriction of operating ambient temperature, etc.

15) If an inductive load ($L/R > 1\text{ms}$) is applied, add surge protection in parallel with the inductive load. If this is not done, the electrical life will be shortened and cut-off failure may occur.

16) 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 15A. The relay may have a contact welding without such countermeasure.

17) Use the suitable wire or bus bar according to the current. If the wire diameter is thin, maximum allowable contact current cannot be assured.

Ex.) Carrying current; 10A: diameter of 2mm² (minimum) (for wire at the load side)

18) Take care to disconnect from the power supply when wiring.

19) The relay satisfies water resistance level of JIS D0203 R2. Please take any countermeasures additionally if it is installed in the place where higher water resistance 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) may be adhered to this product.

21) Be careful that oils and foreign matter do not stick to the main terminal part because it is likely to cause a terminal part to give off unusual heat.

22) Do not make additional manufacturing upon the relay housing.

23) Maximum overcurrent value in this specification is limited as single operation only. In the case of multiple operation, this relay may cause malfunction by heating. So, please confirm the temperature / operation using your application.

In the case of multiple operation, please stop applying the over current to secure the relay's temperature under the maximum ambient temperature.

24) When applying current which includes precipitous changes or ripple, the relay may generate buzzing sound. Therefore, please confirm with the actual load.

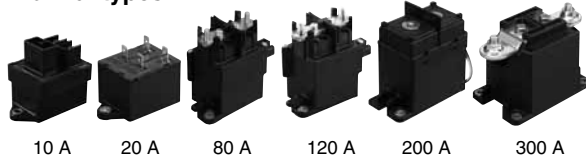
For general cautions for use, please refer to the “Automotive Relay Users Guide”.

High voltage DC, High capacity Cut-off Relays using Capsule Contact Mechanism

EV RELAYS

<Protective construction>
Capsule contact

Normal types



Compact high short-circuit capacity type

New



Quiet types



Vertical type



Horizontal type

RoHS compliant

FEATURES

• Compact, lightweight and safety

To realize quick gap cutoff with high voltage DC, hydrogen gas, which has superior arc cooling capability, is sealed in the capsule contact chamber. At the same time, superior safety is achieved owing to an explosion-proof construction that prevents arc leakage.

• High contact reliability

Since the contact portion is sealed in hydrogen gas, there is no contact oxidation. It is also dustproof and waterproof.

• Richly varied lineup

Types that are quiet in operation types and high short-circuit capacity types are also available. Moreover, the lineup includes plenty of all plug-in types, as well as high carrying current types.

TYPICAL APPLICATIONS

• Electric vehicles (HEV, PHEV, BEV, and FCV)

• Battery charge and discharge systems

• High voltage DC applications such as hybrid construction equipment

EV Relay [Normal type]

ORDERING INFORMATION

AEV 0

Contact arrangement

1: 1 Form A (Screw terminal, 10 A TM type)

5: 1 Form A (20 A TM type)

Contact rating

1: 10 A

2: 20 A

8: 80 A

4: 120 A

7: 200 A

9: 300 A

Rated coil voltage

12: 12 V DC

24: 24 V DC

Coil terminal structure

Nil: Faston terminal (for 20 A type),

Connector (for 80 A, 120 A and 300 A), Lead wire (for 200 A)

2: Faston terminal (for 10 A type with terminal protection cover)

* EV80A, EV120A, and EV200A have vertical type, EV120A has high short-circuit capacity type, and high carrying current type (135A, 200A): please inquire our sales representative for more information.

TYPES

Contact rating	Contact arrangement	Rated coil voltage	Part No.	Packing	
				Carton	Case
10 A	1 Form A	12V DC	AEV110122	25 pcs.	100 pcs.
20 A			AEV52012	25 pcs.	50 pcs.
80 A			AEV18012	1 pc.	20 pcs.
120 A			AEV14012	1 pc.	20 pcs.
200 A			AEV17012	1 pc.	10 pcs.
300 A			AEV19012	1 pc.	5 pcs.
10 A	1 Form A	24V DC	AEV110242	25 pcs.	100 pcs.
80 A			AEV18024	1 pc.	20 pcs.
120 A			AEV14024	1 pc.	20 pcs.
200 A			AEV17024	1 pc.	10 pcs.
300 A			AEV19024	1 pc.	5 pcs.

RATING

1. Coil data

Contact rating	Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (initial)	Release (Reset) voltage (at 20°C 68°F) (initial)	Rated operating current [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Max. allowable voltage*2
10 A	12V DC	Max. 9 V DC	Min. 1 V DC	0.103 A	1.24 W	16V DC
20 A*1			Min. 0.5 V DC	0.327 A	3.9 W	
80 A			Min. 1 V DC	0.353 A	4.2 W	
120 A			Min. 1 V DC	0.353 A	4.2 W	
200 A			Min. 1 V DC	0.5 A	6 W	
300 A			Min. 2 V DC	3.2 A (Inrush)	Inrush: 37.9 W (approx. 0.1 sec.) Stable: 3.6 W	
10 A	24V DC	Max. 18 V DC	Min. 2 V DC	0.052 A	1.24 W	32V DC
80 A			Min. 2 V DC	0.176 A	4.2 W	
120 A			Min. 2 V DC	0.176 A	4.2 W	
200 A			Min. 2 V DC	0.25 A	6 W	
300 A			Min. 4 V DC	1.85 A (Inrush)	Inrush: 44.4 W (approx. 0.1 sec.) Stable: 3.8 W	

Notes: *1. Please inquire our sales representative for more information about EV20A with rated coil voltage of 24V DC.

*2. Max. continuous applied voltage to the coil is the same as max. allowable voltage.

2. Specifications

Item			Specifications	
			10A type	20A type
Contact data	Contact arrangement		1 Form A	
	Contact material		Molybdenum	Copper alloy
	Rated switching capacity (resistive)		10A 450V DC	20A 400V DC
	Max. carrying current		10A Continuity 15A 2 min. 30A 30 sec. (2mm ² wire)	20A Continuity 40A 10 min. 60A 1 min. (3mm ² wire)
	Min. switching load* ¹		1A 12V DC (resistive, at 20°C 68°F)	
	Contact voltage drop (initial)		Max. 0.5V (By voltage drop 10A 6V DC)	Max. 0.2V (By voltage drop 20A 6V DC)
Insulated resistance (initial)			Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)	
Dielectric strength (initial)	Between open contacts		2,500 Vrms for 1 min. (Detection current: 10mA)	
	Between contacts and coil		2,500 Vrms for 1 min. (Detection current: 10mA)	
Time characteristics (initial)	Operate (Set) time (at rated coil voltage)		Max. 50ms (at 20°C 68°F, without contact bounce time)	
	Release (Reset) time (at rated coil voltage)		Max. 30ms (at 20°C 68°F) (Without diode)	
Shock resistance	Functional		For ON: Min. 196m/s ² {approx. 20 G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs) 10A type for OFF: Min. 196m/s ² {approx. 20 G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs) 20A type for OFF: Min. 98m/s ² {approx. 10 G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)	
	Destructive		Min. 490 m/s ² {approx. 50 G} (Half-wave pulse of sine wave: 6ms)	
Vibration resistance	Functional		10 to 200 Hz, acceleration: 43 m/s ² {approx. 4.4G} (Detection time: 10μs)	
	Destructive		10 to 200 Hz, acceleration: 43 m/s ² {approx. 4.4G} X, Y, Z direction: 4 hours	
Expected life	Mechanical life		Min. 10 ⁵ (at 60 cpm)	Min. 2 × 10 ⁵ (at 60 cpm)
	Electrical life (resistive)* ²		10A 400V DC, Min. 75,000 cycles 10A 450V DC, Min. 30,000 cycles	20A 400V DC, Min. 3,000 cycles
	Switch-off life* ^{2, 3}	Forward direction	30A 450V DC, Min. 50 cycles	60A 400V DC, Min. 50 cycles
		Reverse direction	—	—
	Inrush resistance current (capacitor)		30A 400V DC, Min. 50,000 cycles 15A 450V DC, Min. 70,000 cycles	40A 400V DC, Min. 75,000 cycles
Conditions	Conditions for usage, transport and storage* ⁴		Ambient temperature: -40 to +80°C -40 to +176°F (Storage: Max. +85°C +185°F), Humidity: 5 to 85% R.H. (Please avoid icing or condensation)	
Weight			Approx. 90 g 3.17 oz	Approx. 180 g 6.35 oz

Notes: The coil voltage 12V DC type and 24V DC type have the same specifications.

*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 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 $L/R \leq 1\text{ms}$

*4. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

EV (AEV, AEVG, AEVS)

Item		Specifications			
		80A type	120A type	200A type	300A type
Contact data	Contact arrangement	1 Form A			
	Contact material	Tungsten and copper alloys	Copper alloy		
	Rated switching capacity (resistive)	80A 450V DC	120A 450V DC	200A 450V DC	300A 450V DC
	Max. carrying current	80A Continuity 120A 15 min. 180A 2 min. (15mm ² wire)	120A Continuity 225A 3 min. 400A 30 sec. (38mm ² wire)	200A Continuity 300A 15 min. (60mm ² wire)	300A Continuity 400A 10 min. (100mm ² wire)
	Min. switching load (resistive)*1	1A 12V DC (at 20°C 68°F)			1A 24V DC (at 20°C 68°F)
	Contact voltage drop (initial)	Max. 0.067V (By voltage drop 20A 6V DC)	Max. 0.03V (By voltage drop 20A 6V DC)	Max. 0.1V (200A carry current)	Max. 0.06V (300A carry current)
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)			
Dielectric strength (initial)	Between open contacts	2,500 Vrms for 1 min. (Detection current: 10mA)			
	Between contacts and coil	2,500 Vrms for 1 min. (Detection current: 10mA)			
Time characteristics (initial)	Operate (Set) time (at rated coil voltage)	Max. 50ms (at 20°C 68°F, without contact bounce time)			Max. 30ms (at 20°C 68°F, without contact bounce time)
	Release (Reset) time (at rated coil voltage)	Max. 30ms (at 20°C 68°F) (Without diode)			Max. 10ms (at 20°C 68°F)
Shock resistance	Functional	For ON: Min. 196m/s ² {approx. 20 G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs) For OFF: Min. 98m/s ² {approx. 10 G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)			
	Destructive	Min. 490 m/s ² {approx. 50 G} (Half-wave pulse of sine wave: 6ms)			
Vibration resistance	Functional	80A, 120A and 200A type: 10 to 200 Hz: 43 m/s ² {approx. 4.4G} (Detection time: 10μs)			
		300A type: 10 to 200 Hz: 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)			
	Destructive	80A, 120A and 200A type: 10 to 200 Hz: 43 m/s ² {approx. 4.4G} X, Y, Z direction: 4 h			
		300A type: 10 to 200 Hz: 44.1 m/s ² {approx. 4.5G} X, Y, Z direction: 4 h			
Expected life	Mechanical life		Min. 2 × 10 ⁵ (at 60 cpm)		
	Electrical life (resistive)*2		80A 450V DC, Min. 1,000 cycles	30A 450V DC, Min. 1,000 cycles	200A 450V DC, Min. 3,000 cycles
	Switch-off life*2, 3	Forward direction	800A 300V DC, Min. 1 cycle 120A 450V DC, Min. 50 cycles	1,200A 300V DC, Min. 1 cycle 120A 450V DC, Min. 50 cycles	2,000A 350V DC, Min. 1 cycle 400A 450V DC, Min. 50 cycles
		Reverse direction	-120A 200V DC, Min. 50 cycles	-120A 200V DC, Min. 50 cycles	-200A 200V DC, Min. 1,000 cycles
	Inrush resistance current (capacitor)		150A 20V DC, Min. 70,000 cycles	120A 20V DC, Min. 70,000 cycles	140A 20V DC, Min. 70,000 cycles
			240A 20V DC, Min. 70,000 cycles		
Conditions	Conditions for usage, transport and storage*5		Ambient temperature: -40 to +80°C -40 to +176°F Humidity: 5 to 85% R.H. (Please avoid icing or condensation)		Ambient temperature: -40 to +85°C -40 to +185°F Humidity: 5 to 85% R.H. (Please avoid icing or condensation)
Weight		Approx. 400 g 14.11 oz		Approx. 600 g 21.16 oz	Approx. 750 g 26.46 oz

Notes: The coil voltage 12V DC type and 24V DC type have the same specifications.

*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 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. Condition: Nominal switching 10 cycles, each switch-off 2,500A.

*5. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

EV Relay [Compact high short-circuit capacity type]

ORDERING INFORMATION

	AEVG			0		
Contact arrangement						
1: 1 Form A (Screw terminal)						
Contact rating						
6: 60 A						
Rated coil voltage						
12: 12V DC						
Coil terminal structure						
Nil: Lead wire						

* There are also all plug-in types: please inquire our sales representative for more information.

TYPES

Contact rating	Contact arrangement	Rated coil voltage	Part No.	Packing Case
60A	1 Form A	12V DC	AEVG16012	40 pcs (Carton 40 pcs./1 tray)

RATING

1. Coil data

Contact rating	Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (initial)	Release (Reset) voltage (at 20°C 68°F) (initial)	Rated operating current [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Max. allowable voltage*1
60A	12V DC	Max. 9 V DC	Min. 0.5 V DC	0.429A	5.2W	16V DC

Note: *1. When continually powered, the applied voltage is 14 V DC.

2. Specifications

Item	Specifications
Contact data	Contact arrangement
	1 Form A
	Contact material
	Copper alloy
	Rated switching capacity (resistive)
	60A 450V DC
Contact data	Max. carrying current
	60A Continuity, 120A 5 min., 180A 30 sec. (15mm ² wire)
	Min. switching load (resistive)*1
	1A 12V DC (at 20°C 68°F)
Contact data	Contact voltage drop (initial)
	Max. 0.15V (By voltage drop 60A 6V DC)
Contact data	Short circuit capacity
	4,500A (at Max. 10 ms), No smoke and no ignition
Insulated resistance (initial)	
Min. 100 MΩ (at 1,000V DC, Measurement at same location as "Dielectric strength" section.)	
Dielectric strength (initial)	Between open contacts
	2,500 Vrms for 1 min. (Detection current: 10mA)
Dielectric strength (initial)	Between contacts and coil
	2,500 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at rated coil voltage)
	Max. 50ms (at 20°C 68°F, without contact bounce time)
Time characteristics (initial)	Release (Reset) time (at rated coil voltage)
	Max. 30ms (at 20°C 68°F, without contact bounce time) (Without diode)
Shock resistance	Functional
	For ON: Min. 196m/s ² {approx. 20 G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs) For OFF: Min. 98m/s ² {approx. 10 G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)
Shock resistance	Destructive
	Min. 490 m/s ² {approx. 50 G} (Half-wave pulse of sine wave: 6ms)
Vibration resistance	Functional
	10 to 200 Hz, 44.1 m/s ² {approx. 4.5G} (Detection time: 10μs)
Vibration resistance	Destructive
	10 to 200 Hz, 44.1 m/s ² {approx. 4.5G} X, Y, Z direction: 4 hours
Expected life	Mechanical life
	Min. 2 × 10 ⁵ (at 60 cpm)
	Switch-off life*2, 3
Expected life	400A 300V DC, Min. 1 cycles (No polarity)
	Inrush resistance current (capacitor)
	30A 450V DC, Min. 70,000 cycles 120A 20V DC, Min. 70,000 cycles
Conditions	Conditions for usage, transport and storage*4
	Ambient temperature: -40 to +80°C -40 to +176°F Humidity: 5 to 85% R.H. (Please avoid icing or condensation)
Weight	
Approx. 165 g 5.82 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 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. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

EV Relay [Quiet type]

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

Rated coil voltage
12: 12V DC

Coil terminal structure
Nil: Lead wire
2: Faston terminal

* There are also all plug-in types and 150A carry current type: please inquire our sales representative for more information.

TYPES

Contact rating	Contact arrangement	Rated coil voltage	Installation type	Part No.	Packing	
					Carton	Case
60A	1 Form A	12V DC	Vertical type	AEVS16012	1 pc.	20 pcs.
			Horizontal type	AEVS960122		

RATING

1. Coil data

Contact rating	Rated coil voltage	Operate (Set) voltage (at 20°C 68°F) (initial)	Release (Reset) voltage (at 20°C 68°F) (initial)	Rated operating current [±10%] (at 20°C 68°F)	Rated operating power (at 20°C 68°F)	Max. allowable voltage*1
60A	12V DC	Max. 9 V DC	Min. 1 V DC	0.375A	4.5W	16V DC

Note: *1. When continually powered, the applied voltage is 14 V DC (at 65°C 149°F).

2. Specifications

Item		Specifications	
		Vertical type	Horizontal type
Contact data	Contact arrangement	1 Form A	
	Contact material	Tungsten and copper alloys	
	Rated switching capacity (resistive)	60A 450V DC	
	Max. carrying current	60A Continuity, 100A 10 min., 180A 1 min. (15mm ² wire)	
	Min. switching load (resistive)*1	1A 12V DC (at 20°C 68°F)	
	Contact voltage drop (initial)	Max. 0.067V (By voltage drop 20A 6V DC)	
Insulated resistance (initial)		Min. 100 MΩ (at 500V DC, Measurement at same location as "Dielectric strength" section.)	
Dielectric strength (initial)	Between open contacts	2,500 Vrms for 1 min. (Detection current: 10mA)	2,000 Vrms for 1 min. (Detection current: 10mA)
	Between contacts and coil	2,500 Vrms for 1 min. (Detection current: 10mA)	2,000 Vrms for 1 min. (Detection current: 10mA)
Time characteristics (initial)	Operate (Set) time (at rated coil voltage)	Max. 50ms (at 20°C 68°F, without contact bounce time)	
	Release (Reset) time (at rated coil voltage)	Max. 50ms (at 20°C 68°F, without contact bounce time) (Without diode)	
Shock resistance	Functional	For ON: Min. 196m/s ² {approx. 20 G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs) For OFF: Min. 98m/s ² {approx. 10 G} (Half-wave pulse of sine wave: 11ms; detection time: 10μs)	
	Destructive	Min. 490 m/s ² {approx. 50 G} (Half-wave pulse of sine wave: 6ms)	
Vibration resistance	Functional	10 to 100 Hz, acceleration: 43 m/s ² {approx. 4.4G} 10 to 200 Hz, acceleration: 19.6 m/s ² {approx. 2G} (Detection time: 10μs)	
	Destructive	10 to 100 Hz, acceleration: 43 m/s ² {approx. 4.4G} 10 to 200 Hz, acceleration: 19.6 m/s ² {approx. 2G} X, Y, Z direction: 4 hours	
Expected life	Mechanical life	Min. 2 × 10 ⁵ (at 60 cpm)	
	Electrical life (resistive)	60A 450V DC, Min. 800 cycles	
	Switch-off life*2, 3	Forward direction	600A 300V DC, Min. 5 cycles 120A 450V DC, Min. 50 cycles
		Reverse direction	-120A 200V DC, Min. 50 cycles
	Inrush resistance current (capacitor)	60A 20V DC, Min. 70,000 cycles	
Conditions	Conditions for usage*4	Ambient temperature: -40 to +80°C -40 to +176°F (When continuous steady current at 14 V DC: -40 to +65°C -40 to +149°F) Humidity: 5 to 85% R.H. (Please avoid icing or condensation)	
	Conditions for transport and storage	Ambient temperature: -40 to +80°C -40 to +176°F Humidity: 5 to 85% R.H. (Please avoid icing or condensation)	
Weight		Approx. 250 g 5.82 oz	Approx. 240 g 5.82 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 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.

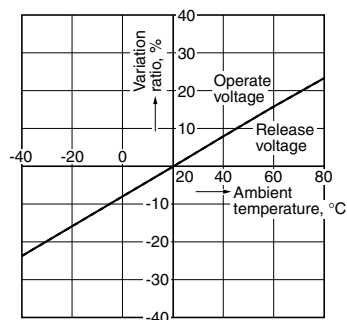
*3. at L/R ≤ 1ms

*4. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. For details, please refer to the "Automotive Relay Users Guide".

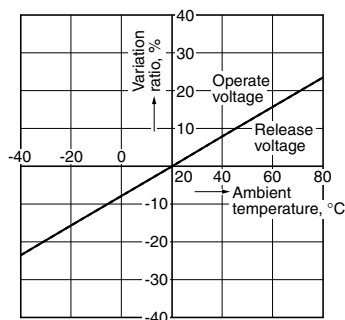
EV Relay [Normal type]

REFERENCE DATA

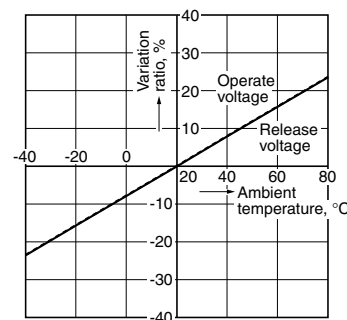
1.-(1) Ambient temperature characteristics
(10A type)
Sample: AEV110122, 3 pcs.



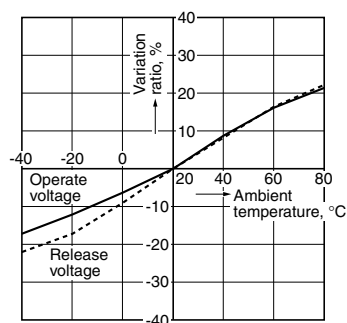
1.-(2) Ambient temperature characteristics
(20A type)
Sample: AEV52012, 3 pcs.



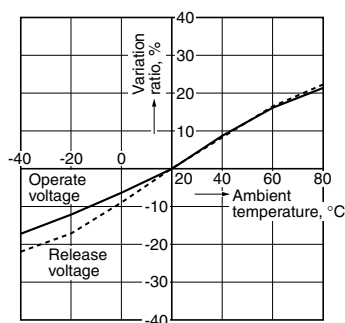
1.-(3) Ambient temperature characteristics
(80A type)
Sample: AEV18012, 3 pcs.



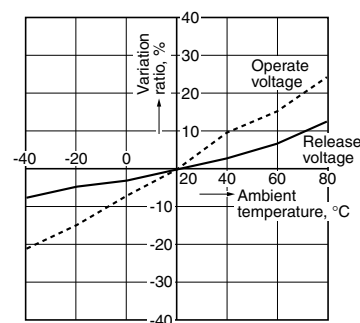
1.-(4) Ambient temperature characteristics
(120A type)
Sample: AEV14012, 3 pcs.



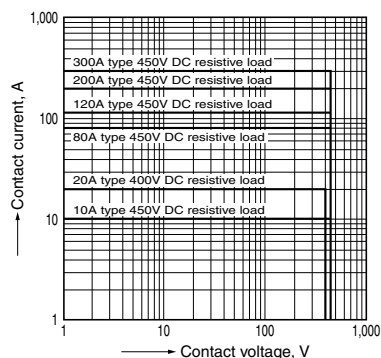
1.-(5) Ambient temperature characteristics
(200A type)
Sample: AEV17012, 3 pcs.



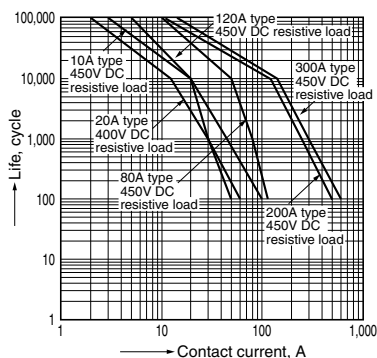
1.-(6) Ambient temperature characteristics
(300A type)
Sample: AEV19012, 3 pcs.



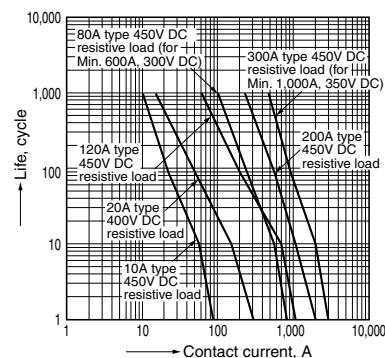
2. Max. value for switching capacity



3. Switching life curve (Forward direction)

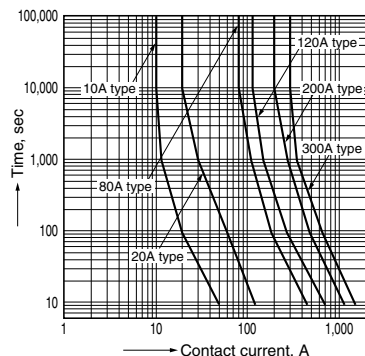


4. Switch-off life curve (Forward direction)



5. Carrying performance curve (85°C 185°F)

*For 200 A and 300 A, at 85°C 185°F

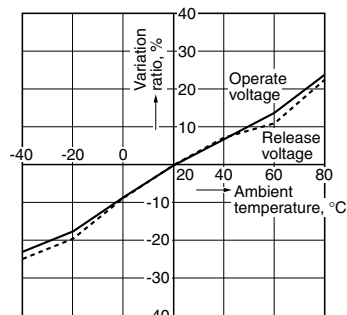


EV Relay [Compact high short-circuit capacity type]

REFERENCE DATA

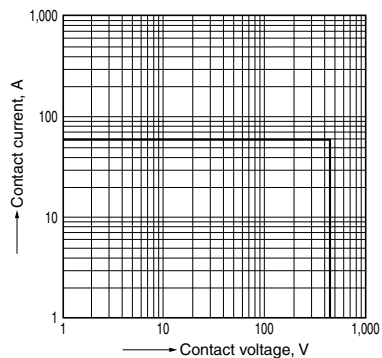
1. Ambient temperature characteristics

Sample: AEVG16012, 3 pcs.



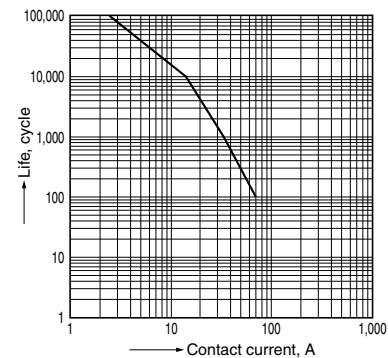
2. Max. value for switching capacity

Sample: AEVG16012, 3 pcs.



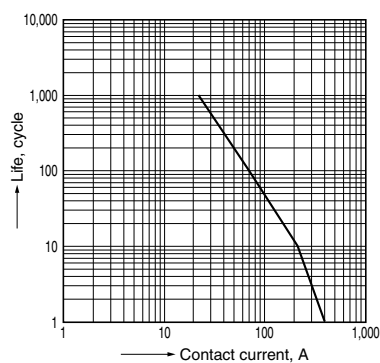
3. Switching life curve (Forward direction)

Sample: AEVG16012, 3 pcs.



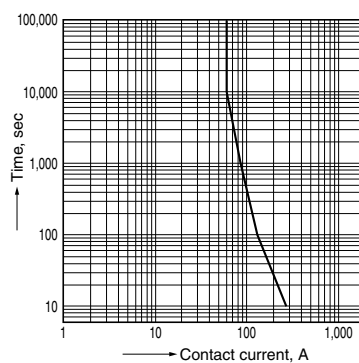
4. Switch-off life curve (Forward direction)

Sample: AEVG16012, 3 pcs.



5. Carrying performance curve (80°C 176°F)

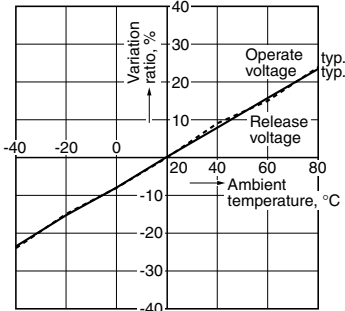
Sample: AEVG16012, 3 pcs.



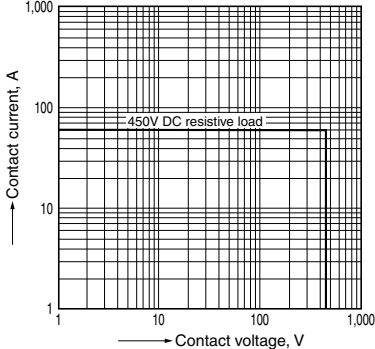
EV Relay [Quiet type]

REFERENCE DATA

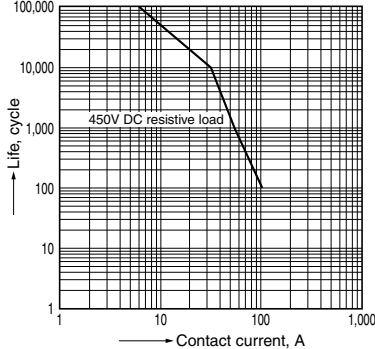
1. Ambient temperature characteristics
Sample: AEVS16012, 3 pcs.



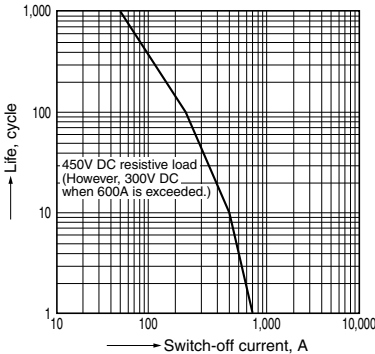
2. Max. value for switching capacity
Sample: AEVS16012, 3 pcs.



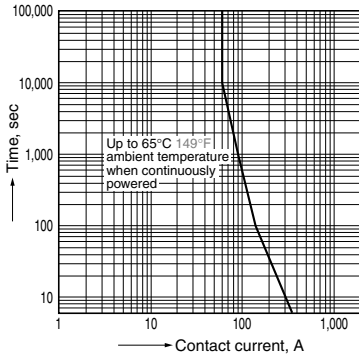
3. Switching life curve
Sample: AEVS16012, 3 pcs.



4. Switch-off life curve (Forward direction)
Sample: AEVS16012, 3 pcs.

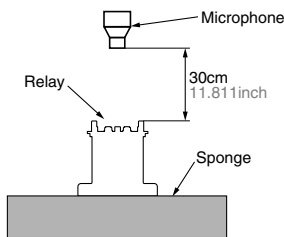


5. Carrying performance curve (80°C 176°F)
Sample: AEVS16012, 3 pcs.

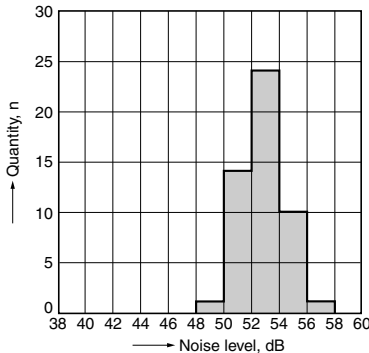


6.-(1)-1 Operation noise distribution (vertical type)

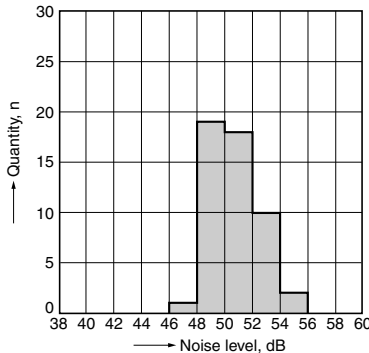
Measuring conditions
Sample: AEVS16012, 50pcs
Equipment setting: "A" weighted, Fast, Max. hold
Coil voltage: 12V DC
Coil connection device: 18V zener diode
Background noise: approx. 20dB



When operate

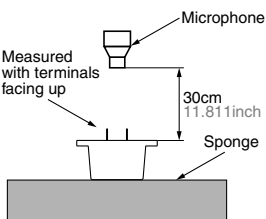


When release

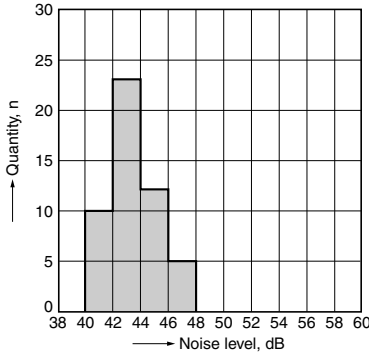


6.-(2)-1 Operation noise distribution (horizontal type)

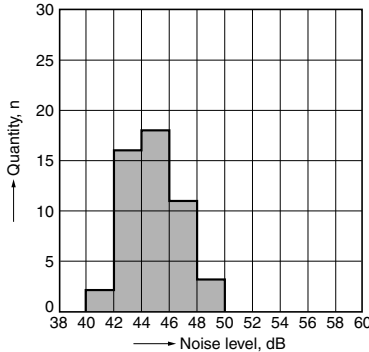
Measuring conditions
Sample: AEVS960122, 50pcs
Equipment setting: "A" weighted, Fast, Max. hold
Coil voltage: 12V DC
Coil connection device: 18V zener diode
Background noise: approx. 20dB



When operate



When release



EV Relay [Normal type]

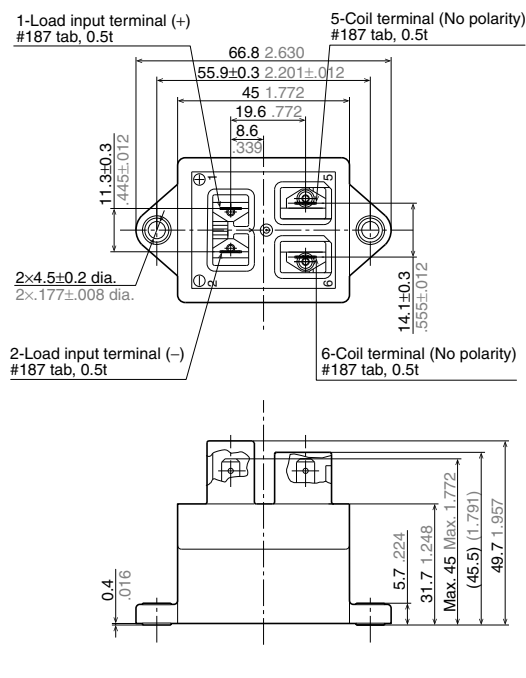
DIMENSIONS (mm inch)

The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

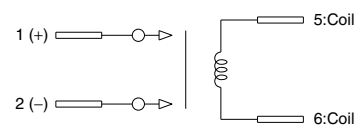
1. 10A type

CAD

External dimensions

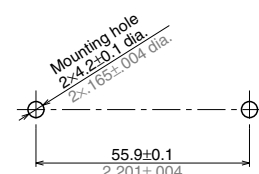


Schematic (TOP VIEW)



Load side has polarities (+) and (-).

Mounting dimensions



Tolerance:

Less than 10mm .394inch: $\pm 0.3 \pm .012$

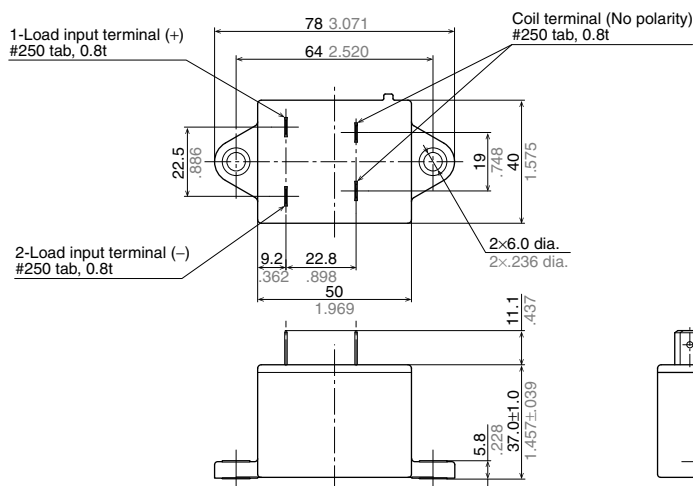
10 to 50mm .394 to 1.969inch: $\pm 0.6 \pm .024$

More than 50mm 1.969inch: $\pm 1.0 \pm .039$

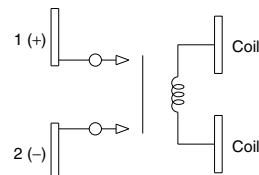
2. 20A type

CAD

External dimensions

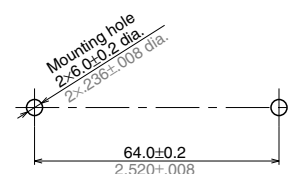


Schematic (TOP VIEW)



Load side has polarities (+) and (-).

Mounting dimensions



Tolerance:

Less than 10mm .394inch: $\pm 0.3 \pm .012$

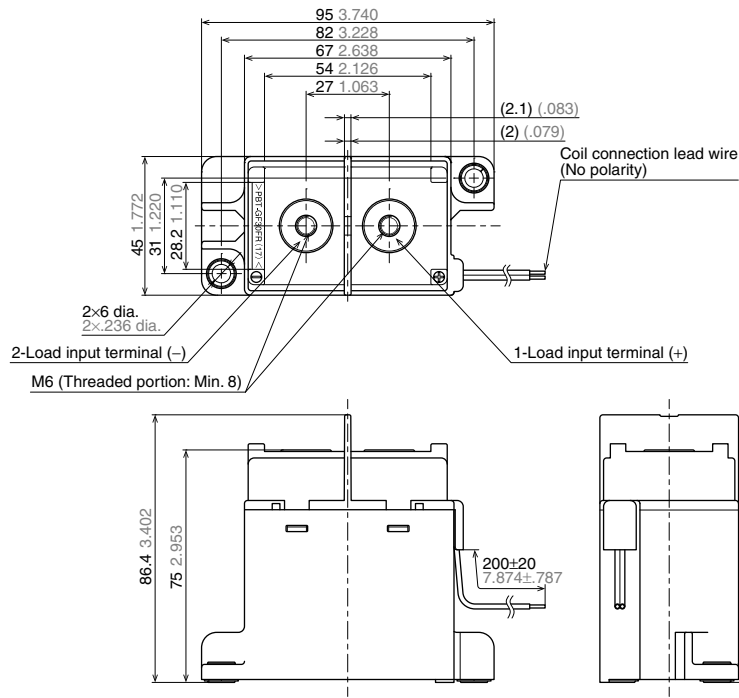
10 to 50mm .394 to 1.969inch: $\pm 0.6 \pm .024$

More than 50mm 1.969inch: $\pm 1.0 \pm .039$

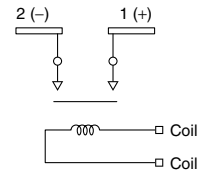
5. 200A type

CAD

External dimensions

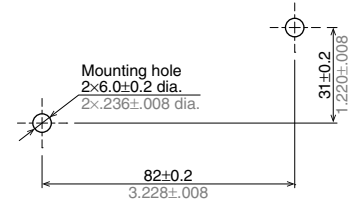


Schematic (TOP VIEW)



Load side has polarities (+) and (-).

Mounting dimensions



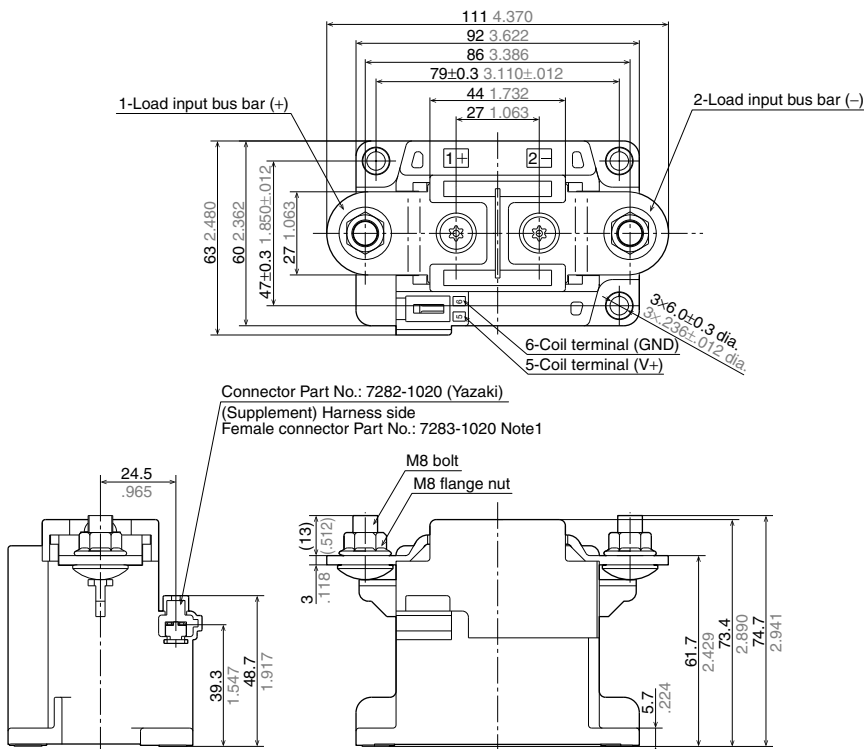
Tolerance:

Less than 10mm .394inch: $\pm 0.3 \pm 0.12$ 10 to 50mm .394 to 1.969inch: $\pm 0.6 \pm 0.24$ More than 50mm 1.969inch: $\pm 1.0 \pm 0.39$

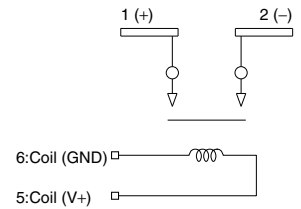
6. 300A type

CAD

External dimensions

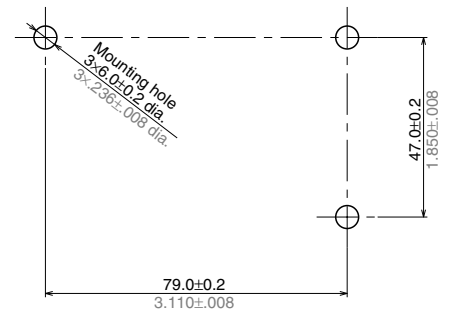


Schematic (TOP VIEW)



Load side has polarities (+) and (-).

Mounting dimensions



Note 1. Separate connection of the terminal and lead wire is required.

Tolerance:

Less than 10mm .394inch: $\pm 0.3 \pm 0.12$ 10 to 50mm .394 to 1.969inch: $\pm 0.6 \pm 0.24$ 50 to 100mm 1.969 to 3.937inch: $\pm 1.0 \pm 0.39$ More than 100mm 3.937inch: $\pm 1.6 \pm 0.63$

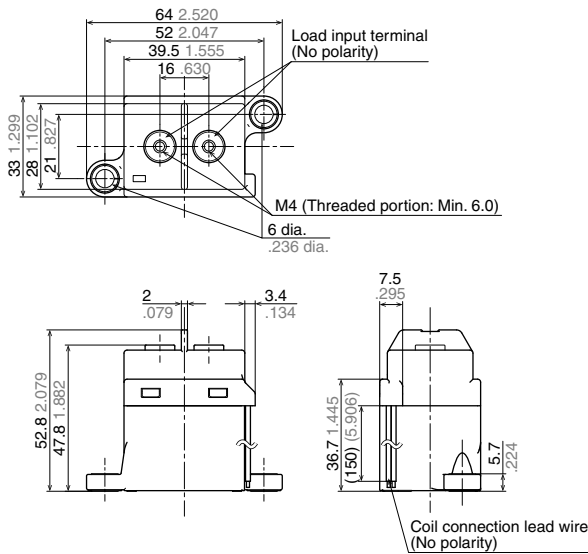
EV Relay [Compact high short-circuit capacity type]

DIMENSIONS (mm inch)

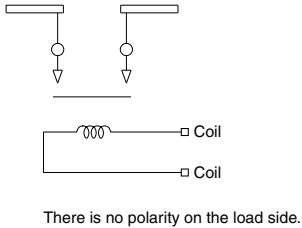
The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

CAD

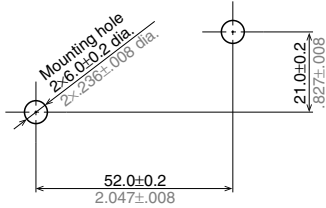
External dimensions



Schematic (TOP VIEW)



Mounting dimensions



Tolerance:
Less than 10mm .394inch: ±0.3 ±.012
10 to 50mm .394 to 1.969inch: ±0.6 ±.024
More than 50mm 1.969inch: ±1.0 ±.039

EV Relay [Quiet type]

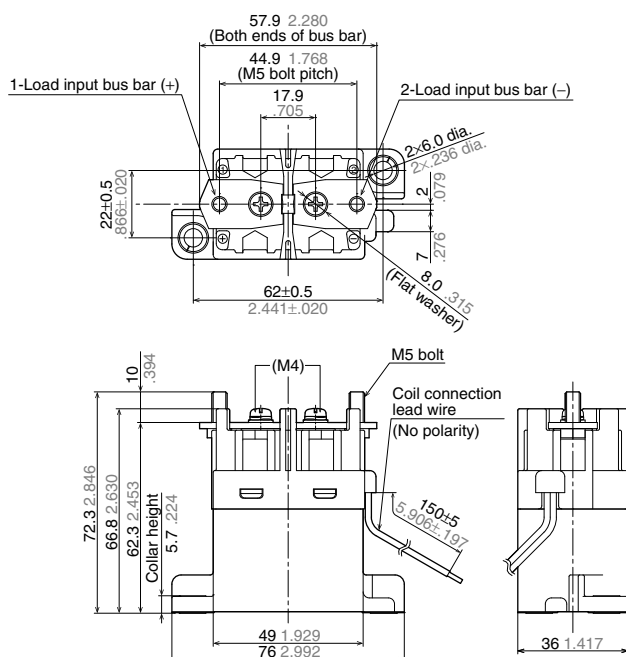
DIMENSIONS (mm inch)

The CAD data of the products with a **CAD** mark can be downloaded from: <http://industrial.panasonic.com/ac/e/>

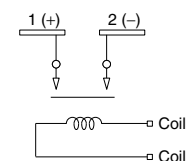
1. 60A Vertical type

CAD

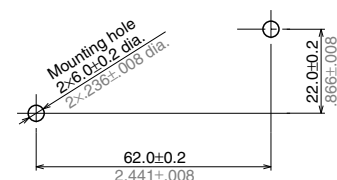
External dimensions



Schematic (TOP VIEW)



Mounting dimensions



Tolerance:

Less than 10mm .394inch: $\pm 0.3 \pm .012$

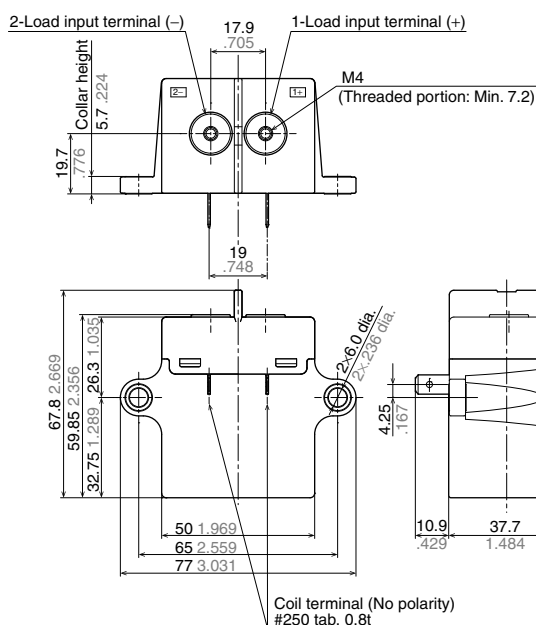
10 to 50mm .394 to 1.969inch: $\pm 0.6 \pm .024$

More than 50mm 1.969inch: $\pm 1.0 \pm .039$

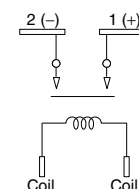
2. 60A Horizontal type

CAD

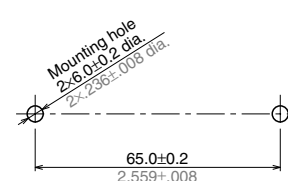
External dimensions



Schematic (TOP VIEW)



Mounting dimensions



Tolerance:

Less than 10mm .394inch: $\pm 0.3 \pm .012$

10 to 50mm .394 to 1.969inch: $\pm 0.6 \pm .024$

More than 50mm 1.969inch: $\pm 1.0 \pm .039$

NOTES

1. Usage, transport and storage conditions

Ambient temperature, humidity, and air pressure during usage, transport, and storage of the relay

1) Temperature: -40 to $+80^{\circ}\text{C}$ -40 to $+176^{\circ}\text{F}$ (200 A and 300 A types: -40 to $+85^{\circ}\text{C}$ -40 to $+185^{\circ}\text{F}$)

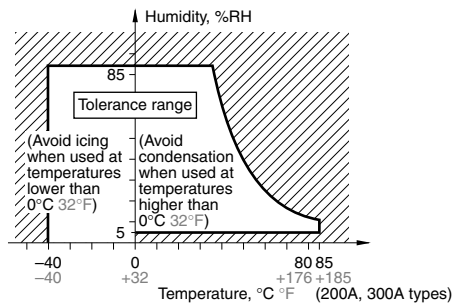
2) Humidity: 5 to 85% RH

(Avoid icing and condensation.)

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

3) Air pressure: 86 to 106 kPa

[Temperature and humidity range for usage, transport, and storage]



4) Water condensation

Water condensation occurs when the ambient temperature drops suddenly from a high temperature and humidity, or, the relay is suddenly transferred from a low ambient temperature to a high temperature and humidity. Condensation causes the failures like insulation deterioration, wire disconnection and rust etc.

Panasonic Corporation*3 does not guarantee the failures caused by condensation.

5) Low-temperature, low-humidity atmosphere;

If the relay is exposed to a low-temperature, low-humidity atmosphere for a long time, its plastic parts may become brittle and fragile.

6) Storage

Do not keep under high-temperature and high-humidity.

2. 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 except 10A type): 3 to 4 N·m

<Main terminal attaching portion>

- M4 bolt (for Compact high short-circuit capacity and Quiet horizontal types): 2.2 to 2.8 N·m
- M5 nut (for 80A and Quiet type): 3 to 4 N·m
- M6 nut (for 120A and 200A type): 6 to 8 N·m
- M8 nut (for 300A type): 10 to 12 N·m

3. 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 switch-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 switch-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.

4. 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 and temperature rise due to flow of electrical current). For this reason, make sure the ambient operating temperature is between -40 and $+80^{\circ}\text{C}$ -40 and $+176^{\circ}\text{F}$ (200A and 300A types: Max. $+85^{\circ}\text{C}$ $+185^{\circ}\text{F}$), and the ambient storage temperature is between -40 and $+85^{\circ}\text{C}$ -40 and $+185^{\circ}\text{F}$.

5. The coils (300A type) and contacts (except compact high short-circuit capacity type) of the relay are polarized, so follow the connection schematic when connecting the coils and contacts.

The 300A type contains a reverse surge voltage absorption circuit; therefore a surge protector is not needed.

6. For the 300A type, drive the coil with a quick startup.

(Built-in one-shot pulse generator circuit)

7. 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.

8. Be careful that foreign matter and oils and fats kind don't stick to the main terminal portion because it is likely to cause terminal portion to give off unusual heat.

Also, please use the following materials for connected harnesses and bus bars.

10A type: Min. 2 mm² nominal cross-sectional area

20A type: Min. 3 mm² nominal cross-sectional area

60A and 80A types: Min. 15 mm² nominal cross-sectional area

120A type: Min. 38 mm² nominal cross-sectional area

200A type: Min. 60 mm² nominal cross-sectional area

300A type: Min. 100 mm² nominal cross-sectional area

9. 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 and Quiet horizontal types). Please select a plug in terminal (flat connection terminal) which comply with JIS C2809-2014.

10A type: for plate thickness 0.5mm .020inch and #187 tab terminal

20A and Quiet horizontal types: for plate thickness 0.8mm .031inch and #250 tab terminal

10. Avoid excessive load applied to the terminal in case of installing such as a bus bar etc., Because it might adversely affect the switching performance.

11. Use the specified connector for the connector terminal connection (80A, 120A and 300A types).

Yazaki Corporation 7283 – 1020 or equivalent

12. Other cautions for use

1) Please make sure to contact our company when the product is used not in accordance with its specifications. Your nearest sales office will review the required specification from your company and perform confirmation tests in actual condition as needed. Please check "Automotive relay user's guide" for use of relays.

2) When the voltage is applied to the relay coil beyond the max. allowable voltage range, the relay operation cannot be assured. Additionally the ambient temperature and condition of your application should be considered under the worst condition of the actual usage because they may change the relay operate and release voltage.

* It is not allowed to apply the continuous maximum voltage to the coil.

In order to obtain the specified performance, please apply the rated voltage.

3) If it includes ripple, the ripple factor should be max. 5%. In addition, do not have a parallel connection with diode for the purpose of coil surge absorber.

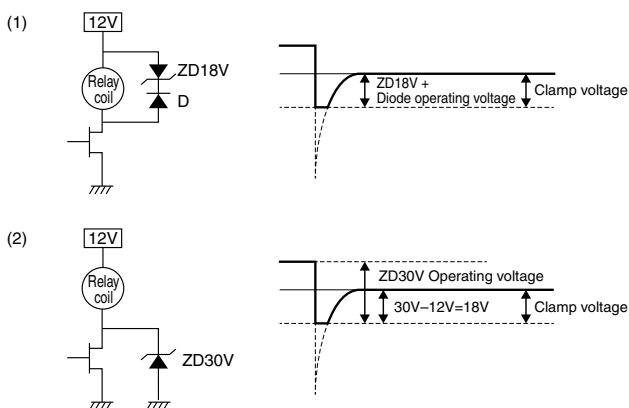
If only diode is connected in parallel to the relay coil, break performance of relay cannot be assured because contact release speed becomes slower. So do not use such a circuit. Instead of diode, a Varistor (ZNR) or Zener diode (ZD) when clamp voltage is 1.5 times larger than the rated voltage (Min. 18V for the rated 12V-relay), shall be used for the absorber.

Ex.1 When Varistor (ZNR) is used

Recommended Varistor; Energy capability: Min 1 J
(However, please set up the value with consideration of the worst value in use condition.)

Varistor Voltage: Min. 18V at 12V DC
Min. 36V at 24V DC

Ex.2 When Zener diode (circuit) is used



4) Lifetime is specified under the standard test conditions in JIS C 5442. (temperature 15°C to 35°C 59°F to 95°F, humidity 25%RH to 75%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 electrical life would be shortened.

5) If the relay is dropped, it should not be used again.

6) Please contact our sales representative when AC load gets applied to this relay.

Careful handling is required for switching AC load with this relay. 7) Please check the internal connection diagram in the catalog or specification, and connect the terminals correctly.

If any wrong connection is made, it may cause circuit damage by unexpected malfunction, abnormal heat, fire, and so on.

8) Please check the insulation distance between each terminal and ground.

9) Please assure the evaluation of the relay under the actual worst condition to enhance the reliability for the actual usage.

10) Please absolutely avoid the ultrasonic and high frequency vibration to the relay that adversely affects its performance.

11) Minimum switching load is the lower limit switching current under the micro-load. When the relay is used below minimum switching load, reliability becomes lower. Please use the relay beyond minimum switching load.

Additionally, minimum switching load is changed by coil drive circuit, type of load, switching frequency and environment condition.

So please confirm the reliability with actual load under the assumed actual environment.

12) As for the screws of fixing relay-body and screws of fixing contact terminal, the tightening torque must be within the specified range.

- The purpose of the tightening torque for the contact terminal is to secure adhesion force (axial force) at the fixing part and provide stable electrical connection.

Therefore, do not use the screws (bolts and nuts) which require rotation torque of locking type (prevailing torque type) because sufficient adhesion force (axial force) may not be secured.

In addition, if the locking type nut is used, an excessive torque may be applied to the case before generating of axial force and may cause breakage of the case.

- Regarding the screw for fixing relay body, please use suitable screws after adequate verification at user's side.

13) The relay should not be installed near strong magnetic fields (transformers, magnets, etc.) and should not be installed near heat source.

14) If the several relays are mounted closely or a heat-generation object is close to the relay, it may cause troubles the abnormal temperature-rise and the short insulation distance terminals outside of the relay so please assure the evaluation of the relay under the actual worst condition.

15) The relay contacts are encapsulated in an inert gas atmosphere. So, please avoid using or storing beyond the allowable ambient temperature range.

16) After that the relay has been applied with the rated voltage and current to the coil continuously and then the relay is once switched off and switched on immediately, the relay coil resistance may be increased due to the coil temperature increase.

This will result in higher operate voltage and the value will surpass the rated operate voltage value. In order to avoid this failure, the following countermeasures are recommended.

- decrease of the load current
- restriction of time to apply voltage
- restriction of operating ambient temperature, etc.

17) If an inductive load ($L/R > 1\text{ms}$) is applied, add surge protection in parallel with the inductive load. If this is not done, the electrical life will be shortened and cut-off failure may occur.

18) 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 performance condition. The relay may have a contact welding without such countermeasure.

19) Use the suitable wire or bus bar according to the current. If the wire diameter is thin, maximum allowable contact current cannot be assured.

Ex.) Carrying current; 120A: diameter of 38mm² (minimum) (for wire at the load side)

20) Take care to disconnect from the power supply when wiring.

EV (AEV, AEVG, AEVS)

- 21) The tension load applied to the coil lead wire when wiring should be max. 10N. In addition, take care not to bend at the lead wire pullout portion when wiring or apply a stationary load to the lead wire after wiring to avoid failure of the relay such as breaking of wire.
- 22) The relay satisfies water resistance level of JIS D 0203 R2. Please take any countermeasures additionally if it is installed in the place where higher water resistance level is required.
- 23) 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) may be adhered to this product.
- 24) Be careful that oils and foreign matter do not stick to the main terminal part because it is likely to cause a terminal part to give off unusual heat.
- 25) Do not make additional manufacturing upon the relay housing.
- 26) Maximum overcurrent value in this specification is limited as single operation only. In the case of multiple operation, this relay may cause malfunction by heating. So, please confirm the temperature / operation using your application.
In the case of multiple operation, please stop applying the over current to secure the relay's temperature under the maximum ambient temperature.
- 27) When applying current which includes precipitous changes or ripple, the relay may generate buzzing sound.
Therefore, please confirm with the actual load.

For general cautions for use, please refer to the “Automotive Relay Users Guide”.

Capsule Contact High Voltage Cut-off Switch

EV SWITCHES

<Protective construction>
Capsule contact



(Unit: mm inch)

RoHS compliant

FEATURES

- **High reliability with capsule contact technology**
Since the contact portion is sealed in hydrogen gas, there is no contact oxidation. It is also dustproof and waterproof.
- **High voltage manual cut-off performance**
To realize manual cutoff with high voltage DC, hydrogen gas, which has superior arc cooling capability, is sealed in the capsule contact chamber. At the same time, superior safety is achieved owing to an explosion-proof construction that prevents arc leakage.
- **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 electric vehicles (HEV, PHEV, BEV), etc.

ORDERING INFORMATION

	AEVD			
Contact arrangement				
1: 1 Form A				
Current carrying capacity				
1: 80 A				
Rated voltage				
1: 400V DC				

EV SWITCHES (AEVD)

TYPES

Contact arrangement	Current carrying capacity	Part No.	Packing
			Case
1 Form A	80 A	AEVD111	20 pcs. (Packed with 20 pcs/1 tray)

RATING

Specifications

Item		Specifications	
		80 A type	
Contact data	Contact arrangement	1 Form A	
	Rated voltage	400 V DC	
	Max. carrying current	80 A continuity 120 A 600s 5,560A 0.03s (20 mm²)	
	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)	
Lever operation force		<OFF ⇒ ON> 10 to 25N (Measurement position: center of lever) <ON ⇒ OFF> 3 to 9N (Measurement position: tip of lever)	
Interlock button operation force (when canceling a lock)		4 ± 1N	
Shock resistance (Switch: ON condition)	Functional	Min. 490 m/s² {approx. 50 G} (Half-wave pulse of sine wave: 11 ms; detection time: 10 μs)	
	Destructive	Min. 790 m/s² {approx. 80.6 G} (Half-wave pulse of sine wave: 6 ms)	
Vibration resistance (Switch: ON condition)	Functional	20 to 200 Hz, acceleration: 44 m/s² {approx. 4.5 G} (Detection time: 10 μs)	
	Destructive	20 to 200 Hz, acceleration: 44 m/s² {approx. 4.5 G} X, Y, Z direction: 4 hours each	
Expected life	Mechanical life		
	Switch-off life*1, 2	Forward direction	400 A 400 V DC, Min. 5 times
		Reverse direction	−120 A 200 V DC, Min. 5 times
Conditions	Conditions for usage, transport and storage	Ambient temperature: −40 to +80°C −40 to +176°F Humidity: 5 to 85% R.H. (Please avoid icing or condensation)	
Weight		Approx. 230 g 8.11 oz	

Notes: *1. No-load application when ON.
*2. at L/R ≤ 1ms

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.

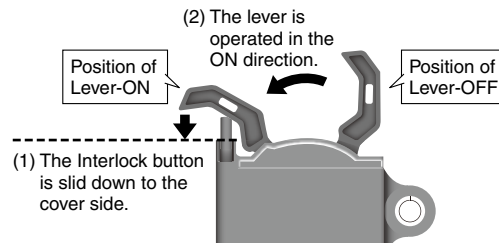
2. How to use

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.



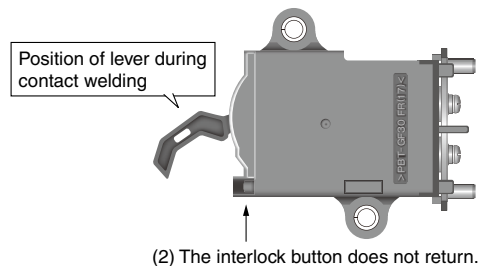
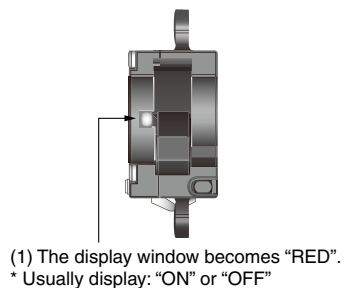
[If contact welding occurs]

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.

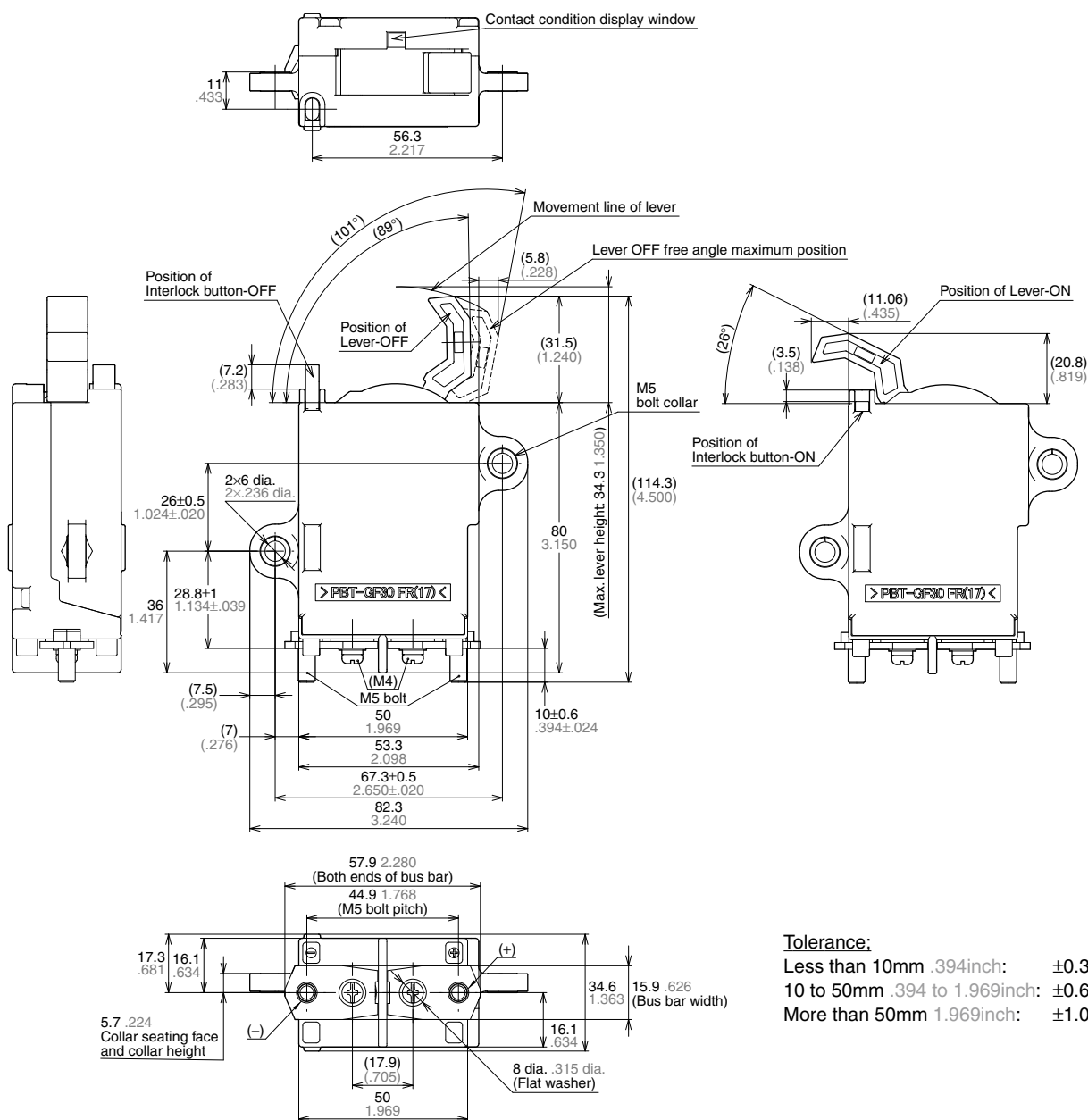


DIMENSIONS (mm inch)

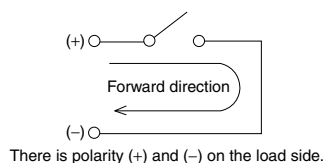
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CAD

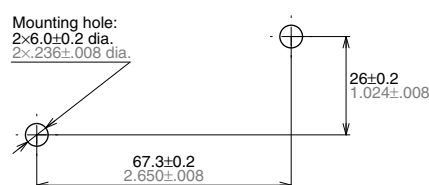
External dimensions



Schematic (TOP VIEW)



(Reference) Mounting dimensions



NOTES

1. Usage, transport and storage conditions

1) Temperature: -40 to $+80^{\circ}\text{C}$ -40 to $+176^{\circ}\text{F}$

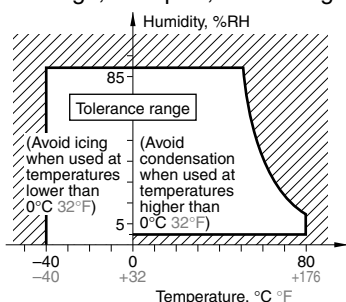
2) Humidity: 5 to 85% RH

(Avoid icing and condensation.)

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

3) Air pressure: 86 to 106 kPa

[Temperature and humidity range for usage, transport, and storage]



4) Water condensation

Water condensation occurs when the ambient temperature drops suddenly from a high temperature and humidity, or, the relay is suddenly transferred from a low ambient temperature to a high temperature and humidity. Condensation causes the failures like insulation deterioration, wire disconnection and rust etc.

Panasonic Corporation*3 does not guarantee the failures caused by condensation.

5) Low-temperature, low-humidity atmosphere;

If the relay is exposed to a low-temperature, low-humidity atmosphere for a long time, its plastic parts may become brittle and fragile.

6) Icing

Please check the icing when an ambient temperature is lower than 0°C $+32^{\circ}\text{F}$. Water drop adheres to the relay by the condensation or the abnormal high humidity and is frozen to the ice when the ambient temperature becomes lower than 0°C $+32^{\circ}\text{F}$. The icing causes the sticking of movable portion, the operation delay and the contact conduction failure etc.

Panasonic Corporation does not guarantee the failures caused by the icing.

The heat conduction by the equipment may accelerate the cooling of relay itself and the icing may occur. Please confirm no icing in the worst condition of the actual usage.

7) Storage

Do not keep under high-temperature and high-humidity.

2. When installing the switch, 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 switch may be broken if users use the nut for EV switch.

Because excessive torque is applied to a case of a switch before generation of contact pressure. (Axial force).

Regarding the torque value for the main body of a switch, please use suitable screw on own verification.

3. 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. ($\text{M5} \times 2$)

Terminal: Fastening and fixing with a nut. ($\text{M5} \times 2$)

<Screw-fastening torque>

Body: $3.5 \pm 0.5 \text{ N}\cdot\text{m}$

Terminal: $3.5 \pm 0.5 \text{ N}\cdot\text{m}$

4. 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.

5. 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.

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 $\text{L/R} > 1\text{ms}$, add surge protection in parallel with the inductive load. If this is not done, the electrical life will decrease and cut-off failure may occur.

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.

EV SWITCHES (AEVD)

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 there is no contact polarity, but confirm the electric life using the actual load.

For general cautions for use, please refer to the "Automotive Relay Users Guide".

ISO14001, ISO9001, ISO/TS16949 Certificate of Approval

ISO14001 Certificate of approval

Panasonic Electromechanical Control Business Division, which develops, manufactures and sells such as relays, switches and sensors is certified according to the ISO 14001 environmental management system standard established by the International Standards for Organization (ISO).

Through our business activities, which objectives are to live in harmony with the global environment and contribute to the realization of a sustainable society, we have been making efforts to reduce greenhouse gases and promote recycling of resources. Furthermore, with due consideration to biodiversity, we have been working for improving the global environment and living in harmony with the international community.



ISO/TS16949 Certificate of approval

Our Electromechanical Control Business Division has been accredited for ISO/TS16949, covering our quality management system for an entire spectrum of automotive products for relays, switches and connectors.

ISO/TS16949 is a standard based on ISO9001 that adds items necessary for the automobile industry.

It calls for a comprehensive quality management system that includes CS, cost performance, ongoing improvement, and many other aspects of quality management.

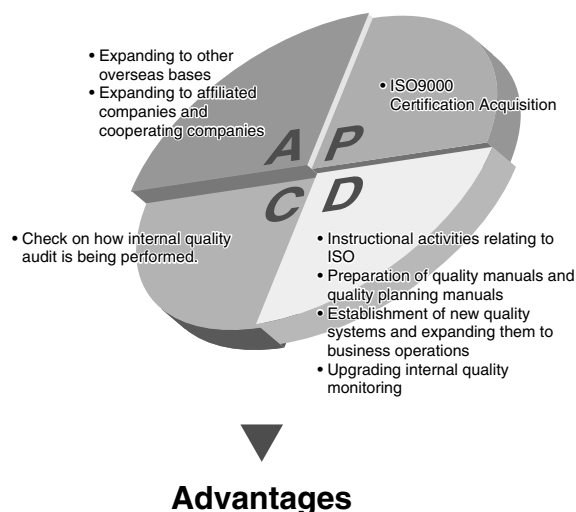


ISO9001 Certificate of approval

Our Electromechanical Control Business Division, which handles from development to production and marketing for relays, switches and sensors, has been approved for certification of the ISO9001 quality assurance standard established by the International Standards for Organization (ISO).



The Necessity and Pursuit of ISO Certification



- Strengthening and upgrading quality assurance organizational structures applicable on an international basis
- Technology can be accumulated and disseminated through documentation and records
- Leads to improved reliability of the manufacturer's quality and improved CS (customer satisfaction)

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