Panasonic ideas for life

UP TO 8GHz SMALL MICROWAVE RELAYS

RJ RELAYS (ARJ)



FEATURES

• Excellent high frequency characteristics (50 Ω , at 5GHz)

V.S.W.R.: Max. 1.25 Insertion loss: Max. 0.5dB Isolation: Min. 35dB

(Between open contacts)

Min. 30dB

(Between contact sets)

Surface mount terminal

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

Small size

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

TYPICAL APPLICATIONS

• Measuring equipment market
Attenuator circuits, spectrum analyzer,
oscilloscope, Telecommunication
equipment and tester inspection.

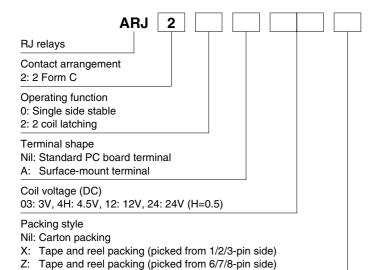
• Network communications market Microwave communication

Medical instrument market

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

RoHS compliant

ORDERING INFORMATION



TYPES

1. Standard PC board terminal

Contact	Nominal coil voltage	Part No.		
arrangement		Single side stable	2 coil latching	
	3 V DC	ARJ2003	ARJ2203	
0 Form C	4.5V DC	ARJ204H	ARJ224H	
2 Form C	12 V DC	ARJ2012	ARJ2212	
	24 V DC	ARJ2024	ARJ2224	

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

2. Surface-mount terminal

1) Carton packing

1) Out for packing						
Contact	Nominal coil voltage	Part No.				
arrangement		Single side stable	2 coil latching			
	3 V DC	ARJ20A03	ARJ22A03			
2 Form C	4.5V DC	ARJ20A4H	ARJ22A4H			
2 FOITH C	12 V DC	ARJ20A12	ARJ22A12			
	24 V DC	ARJ20A24	ARJ22A24			

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

2) Tape and reel packing

Contact	Nominal coil voltage	Part No.		
arrangement		Single side stable	2 coil latching	
	3 V DC	ARJ20A03Z	ARJ22A03Z	
2 Form C	4.5V DC	ARJ20A4HZ	ARJ22A4HZ	
2 FOITI C	12 V DC	ARJ20A12Z	ARJ22A12Z	
	24 V DC	ARJ20A24Z	ARJ22A24Z	

Standard packing: 500 pcs. in an inner package; 1,000 pcs. in an outer package

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

RATING

1. Coil data

1) Single side stable

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 70°C 158°F)
3 V DC			66.6mA	45 Ω		
4.5V DC	75%V or less of	10%V or more of	44.4mA	101.2Ω	200mW	110%V of nominal
12 V DC	nominal voltage (Initial)	nominal voltage (Initial)	16.6mA	720 Ω	20011100	voltage
24 V DC	((8.3mA	2,880 Ω		

2) 2 coil latching

Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 70°C 158°F)
3 V DC			50 mA	60 Ω		
4.5V DC	75%V or less of	75%V or less of	33.3mA	135 Ω	150mW	110%V of nominal
12 V DC	nominal voltage (Initial)	nominal voltage (Initial)	12.5mA	960 Ω	ISUIIVV	voltage
24 V DC	((6.3mA	3,840 Ω		

2. Specifications

Characteristics	Item		Specifications		
	Arrangement		2 Form C		
Contact	Contact material		Gold plating		
	Initial contact	resistance, max.	Max. 150mΩ (By voltage drop 10V DC 10mA)		
	Contact rating	1	1W (at 5GHz, Impedance 50Ω, V.S.W.R. ≦ 1.25) 10mA 10V DC (resistive load)		
	Contact carry	ing power	1W (at 5GHz, Impedance 50Ω, V.S.W.R. ≦ 1.25)		
Rating	Max. switching	g voltage	30V DC		
	Max. switching	g current	0.3A DC		
	Nominal opera	ating power	Single side stable: 200mW, 2 coil latching: 150mW		
	V.S.W.R.		Max. 1.25		
High frequency	Insertion loss	(without D.U.T. board's loss)	Max. 0.5dB		
characteristics (Initial) (~5GHz,	la alasia a	Between open contacts	Min. 35dB		
Impedance 50Ω)	Isolation	Between contact sets	Min. 30dB		
,	Input power		1W (at 5GHz, impedance 50Ω, V.S.W.R. ≦ 1.25, at 20°C)		
	Insulation resi	stance (Initial)	Min. $500M\Omega$ (at $500V$ DC) Measurement at same location as "Initial breakdown voltage" section.		
		Between open contacts	500 Vrms for 1min. (Detection current: 10mA)		
	Brookdown	Breakdown Between contact sets		500 Vrms for 1min. (Detection current: 10mA)	
	voltage Between contact and coil		500 Vrms for 1min. (Detection current: 10mA)		
Electrical	(Initial)	Between coil and earth terminal	500 Vrms for 1min. (Detection current: 10mA)		
characteristics		Between contact and earth terminal	500 Vrms for 1min. (Detection current: 10mA)		
	Temperature rise (at 20°C)		Max. 50°C (By resistive method, nominal voltage applied to the coil, 5GHz, V.S.W.R. ≦ 1.25)		
	Operate time [Set time] (at 20°C)		Max. 5ms (Nominal operating voltage applied to the coil, excluding contact bounce time		
	Release time [Reset time] (at 20°C)		Max. 5ms (Nominal operating voltage applied to the coil, excluding contact bounce time.) (without diode)		
	Shock	Functional	Min. 500 m/s² (Half-wave pulse of sine wave: 6ms; detection time: 10µs.)		
Mechanical	resistance	Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 11ms.)		
characteristics	Vibration	Functional	10 to 55 Hz at double amplitude of 3mm (Detection time: 10μs.)		
	resistance	Destructive	10 to 55 Hz at double amplitude of 5mm		
	Mechanical		Min. 10 ⁷ (at 180 cpm)		
Expected life	Electrical		Min. 10 ⁶ (at 20 cpm) (1W, at 5GHz, V.S.W.R. ≦ 1.25) Min. 10 ⁶ (at 20 cpm) (10mA 10V DC resistive load)		
Conditions	Conditions for operation, transport and storage*		Ambient temperature: -30°C to +70°C -22°F to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)		
Unit weight			Approx. 3 g .11 oz		

Note: * The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to [6] AMBIENT ENVIRONMENT in GENERAL APPLICATION GUIDELINES.

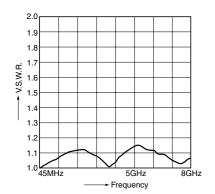
REFERENCE DATA

1. High frequency characteristics

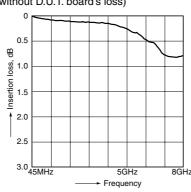
Sample: ARJ20A12

Measuring method: Measured with HP network analyzer (HP8510C).

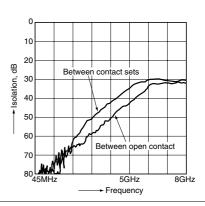
• V.S.W.R. characteristics



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



Isolation characteristics



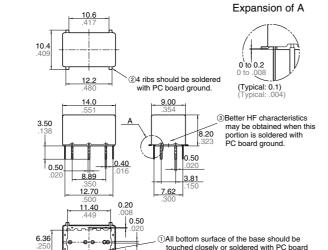
DIMENSIONS (mm inch)

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

1. Standard PC board terminal



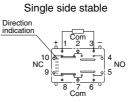
CAD Data



ground

0.15

Schematic (Bottom view)
Single side stable 2 coil latching



(Deenergized condition)

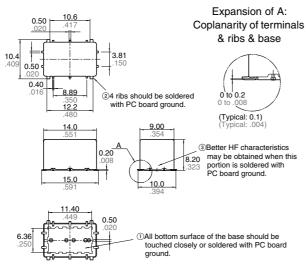
(Reset condition)

General tolerance: ±0.3 ±.012

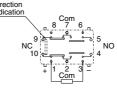
2. Surface mount terminal

CAD Data





Schematic (Top view)
Single side stable 2 coil latching



(Deenergized condition)

(Reset condition)

General tolerance: ±0.3 ±.012

Note: Please consult us regarding recommended PC board patterns

NOTES

1. Coil operating power

Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%.

However, check it with the actual circuit since the characteristics may be slightly different. The nominal operating voltage should be applied to the coil for more than 20 ms to set/reset the latching type relay.

2. Coil connection

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

3. External magnetic field

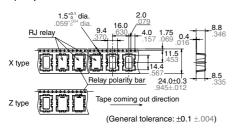
Since RJ relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

4. Cleaning

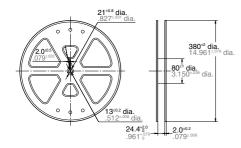
For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick. It is recommended that alcoholic solvents be used.

5. Tape and reel packing

1) Tape dimensions

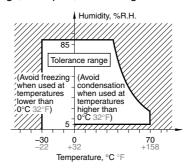


2) Dimensions of plastic reel



6. Conditions for operation, transport and storage conditions

- 1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
- (1) Temperature:
- -30 to +70°C -22 to +158°F
- (However, tolerance range is -30 to +60°C -22 to +140°F if package is carried as is.)
- (2) Humidity: 5 to 85% RH (Avoid freezing and condensation.) The humidity range varies with the temperature. Use within the range indicated in the graph below.
- (3) Atmospheric pressure: 86 to 106 kPa Temperature and humidity range for usage, transport, and storage:



2) Condensation

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

3) Freezing

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

4) Low temperature, low humidity environments

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

5) Storage procedures for surface-mount terminal types

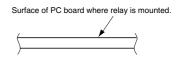
Since the relay is very sensitive to humidity, it is packed in humidity-free, hermetically sealed packaging. When storing the relay, be careful of the following points:

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

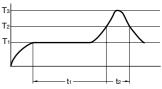
occur. Be sure to mount the relay under the required mounting conditions.

7. Soldering

1) Surface-mount terminal In case of automatic soldering, the following conditions should be observed (1) Position of measuring temperature



(2) IR (infrared reflow) soldering method



 $\begin{array}{ll} T_1 = 150 \text{ to } 180^{\circ}\text{C } 302 \text{ to } 356^{\circ}\text{F} & t_1 = 60 \text{ to } 120 \text{ sec.} \\ T_2 = 230^{\circ}\text{C } 446^{\circ}\text{F } \text{ and } \text{higher} & t_2 = \text{Within } 30 \text{ sec.} \\ T_3 = \text{Within } 250^{\circ}\text{C } 482^{\circ}\text{F} & t_3 = 0.5 \text{ to } 120 \text{ sec.} \\ T_3 = W_3 =$

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

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

- 2) Standard PC board terminal Please meet the following conditions if this relay is to be automatically soldered.
- (1) Preheating: Max. 120°C 248°F (terminal solder surface) for max. 120 seconds
- (2) Soldering: Max. 260±5°C 500±9°F for max. 6 seconds

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

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

Please contact us in the case of reflow soldering considerations.

3) Hand soldering

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

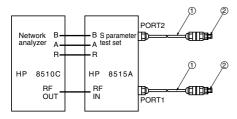
(1) Wattage: 30 to 60 W

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

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

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

8. Measuring method (Impedance 50Ω)



Connector

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

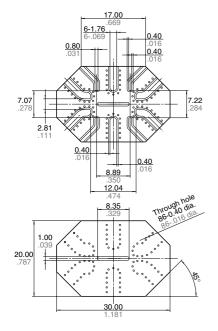
- (Step 1) Calibrate the test system with HP calibration kit [HP85052B]
- (Step 2) After calibration, connect the D.U.T. board and measure. Connect 50 Ω terminals on connectors other than those for measurement.

Notes:

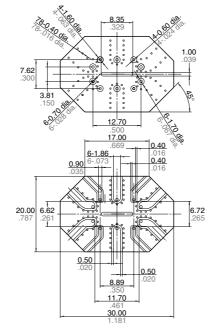
- 1. All bottom surface of the base should be touched closely or soldered with PC board ground.
- 2. 4 ribs should be soldered with PC board ground.

Measuring board

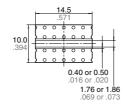
- 1) Dimensions
- <Surface mount terminal>



<Standard PC board terminal>



<Calibration board>



- 2) Material: Glass PTFE double-sided through hole PC board R-4737 (Panasonic Corporation)
- 3) Board thickness: t = 0.8 mm
- 4) Copper plating: $18\mu m$
- Connector (SMA type receptacle)
 Product name: R125 510 (RADIALL)
 Insertion loss compensation

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

9. Others

1) The switching lifetime is defined under the standard test condition specified in the JIS* C 5442-1996 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.

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

- When used for AC load-operating and the operating phase is synchronous. Rocking and fusing can easily occur due to contact shifting.
- High-frequency load-operating When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO₃ is formed. This can corrode metal materials.

Three countermeasures for these are listed here.

- (1) Incorporate an arc-extinguishing circuit.
- (2) Lower the operating frequency
- (3) Lower the ambient humidity
- 2) Use the relay within specifications such as coil rating, contact rating and on/ off service life. If used beyond limits, the relay may overheat, generate smoke or catch fire.
- 3) Be careful not to drop the relay. If accidentally dropped, carefully check its appearance and characteristics before use.
- 4) Be careful to wire the relay correctly. Otherwise, malfunction, overheat, fire or other trouble may occur.
- 5) If a relay stays on in a circuit for many months or years at a time without being activated, circuit design should be reviewed so that the relay can remain non-excited. A coil that receives current all the time heats, which degrades insulation earlier than expected. A latching type relay is recommended for such circuits.
- 6) The latching type relay is shipped in the reset position. But jolts during transport or impacts during installation can change the reset position. It is, therefore, advisable to build a circuit in which the relay can be initialized (set and reset) just after turning on the power.
- 7) If silicone materials (e.g., silicone rubbers, silicone oils, silicone coating agents, silicone sealers) are used in the vicinity of the relay, the gas emitted from the silicone may adhere to the contacts of the relay during opening and closing and lead to improper contact. If this is the case, use a material other than silicone.
- 8) We recommend latching type when using in applications which involve lengthy duty cycles.
- * Japanese Industrial Standards

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

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