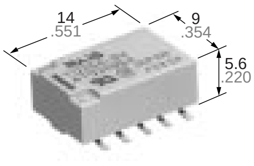
NAiS

ULTRA LOW-PROFILE SURFACE-MOUNT RELAY

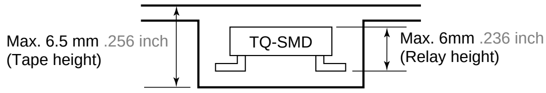
TQ-SMD RELAYS

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



mm inch

- **Ultra low-profile: 6 mm .236 inch in height comforming to EIA standards (Tape height: max. 6.5 mm .256 inch)**



- **Tape and reel package is available as standard packing style**
- **Surge withstand between contacts and coil: 2,500 V**
- **Breakdown voltage between contacts and coil: 1,500 V**
- **2 Amp. high capacity**
- **High sensitivity:**
  2 Form C; 140 mW power consumption (Single side stable type)
- **Surge voltage withstand: 1,500 V FCC Part 68**

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1A)			75 mΩ
Contact material			Gold-clad silver alloy
Rating	Nominal switching capacity (resistive load)		2 A 30 V DC, 0.5 A 125 V AC
	Max. switching power (resistive load)		60 W, 62.5 VA
	Max. switching voltage		220 V DC, 125 V AC
	Max. switching current		2 A
	Min. switching capacity		10 μA 10 mV DC
Nominal operating power	Single side stable		140 mW (1.5 to 12 V DC) 200 mW (24 V DC) 300 mW (48 V DC)
	1 coil latching		70 mW (1.5 to 12 V DC) 100 mW (24 V DC)
	2 coil latching		140 mW (1.5 to 12 V DC) 200 mW (24 V DC)
UL/CSA rating			2 A 30 V DC 0.3 A 110 V DC 0.5 A 125 V AC
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8
	Electrical (at 20 cpm)	2 A 30 V DC resistive	10^5
		1 A 30 V DC resistive	2×10^5
		0.5 A 125 V AC resistive	10^5

Characteristics

Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1min. (Detection current : 10 mA)
	Between contact sets	1,500 Vrms for 1min. (Detection current : 10 mA)
	Between contact and coil	1,500 Vrms for 1min. (Detection current : 10 mA)
Initial surge voltage	Between open contacts (10×160 μs)	1,500 V (FCC Part 68)
	Between contacts and coil (2×10 μs)	2,500 V (Bellcore)
Operate time [Set time]*3 (at 20°C)		Max. 4 ms (Approx. 2 ms) [Max. 4 ms (Approx. 2 ms)]
Release time (without diode) [Reset time]*3 (at 20°C)		Max. 4 ms (Approx. 1 ms) [Max. 4 ms (Approx. 2 ms)]
Temperature rise*4 (at 20°C)		Max. 50°C
Shock resistance	Functional*5	Min. 750 m/s² {75 G}
	Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*7	200 m/s² {20 G}, 10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	294 m/s² {30 G}, 10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +85°C –40°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 2 g .071 oz

Remarks:
*1 Measurement at same location as “Initial breakdown voltage” section.
*2 Detection current: 10mA
*3 Nominal voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil; contact carrying current: 2 A.
*5 Half-wave pulse of sine wave: 6 ms; detection time: 10 μs.
*6 Half-wave pulse of sine wave: 6 ms.
*7 Detection time: 10 μs.
*8 Refer to 4. Conditions for operation, transport and storage mentioned in Cautions for use (Page 108)

ORDERING INFORMATION

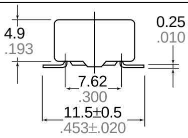
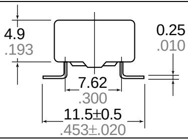
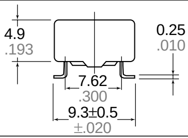
Ex. TQ 2 SA – L – 3V – Z

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

*48 V coil type: Single side stable only

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

Surface-mount terminal variation

Variation	Terminal style	Ambient environment	
		Normal environments(indoor)	Drastic temperature fluctuations(outdoor)
SA type (Standard surface-mount terminal type)		Recommended	—
SL type (Highly connection reliability surface-mount terminal type)		Recommended	Recommended
SS type (Space saving surface-mount terminal type)		Recommended	Recommended

TYPES

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

Operating function	Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
1 coil latching	TQ2S❍-L-1.5 V	1.5	1.13	1.13	46.9	32	70	2.2
	TQ2S❍-L-3 V	3	2.25	2.25	23.3	128.6	70	4.5
	TQ2S❍-L-4.5 V	4.5	3.38	3.38	15.6	289.3	70	6.7
	TQ2S❍-L-5 V	5	3.75	3.75	14	357	70	7.5
	TQ2S❍-L-6 V	6	4.5	4.5	11.7	514	70	9
	TQ2S❍-L-9 V	9	6.75	6.75	7.8	1,157	70	13.5
	TQ2S❍-L-12 V	12	9	9	5.8	2,057	70	18
	TQ2S❍-L-24 V	24	18	18	4.2	5,760	100	36
2 coil latching	TQ2S❍-L2-1.5 V	1.5	1.13	1.13	93.8	16	140	2.2
	TQ2S❍-L2-3 V	3	2.25	2.25	46.7	64.3	140	4.5
	TQ2S❍-L2-4.5 V	4.5	3.38	3.38	31	145	140	6.7
	TQ2S❍-L2-5 V	5	3.75	3.75	28.1	178	140	7.5
	TQ2S❍-L2-6 V	6	4.5	4.5	23.3	257	140	9
	TQ2S❍-L2-9 V	9	6.75	6.75	15.5	579	140	13.5
	TQ2S❍-L2-12 V	12	9	9	11.7	1,028	140	18
	TQ2S❍-L2-24 V	24	18	18	8.3	2,880	200	36

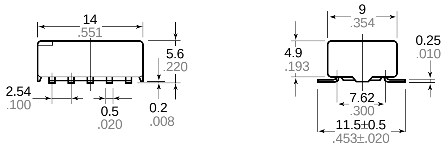
❍: For each surface-mounted terminal variation, input the follwing letter.
SA type: A, SL type: L, SS type: S

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

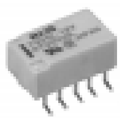
DIMENSIONS

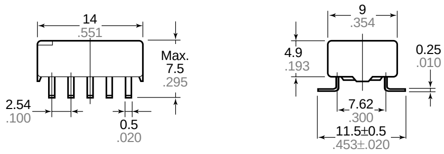
mm inch

SA type

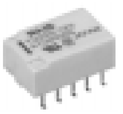


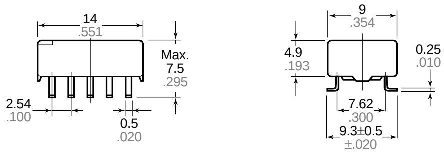
SL type





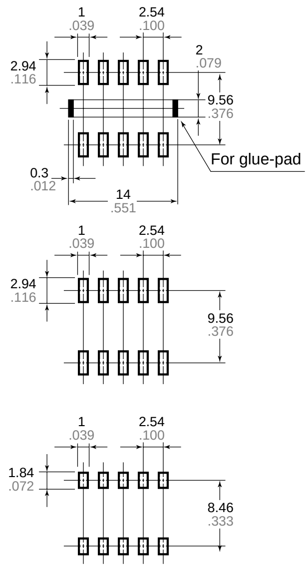
SS type





General tolerance: ±0.3 ±.012

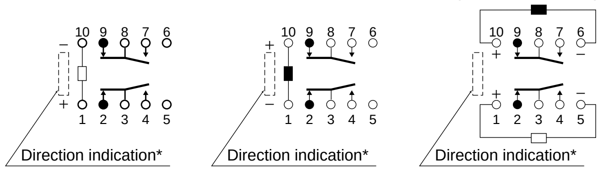
Recommendable mounting pad (Top view)



Tolerance: ±0.1 ±.004

Schematic (Top view)

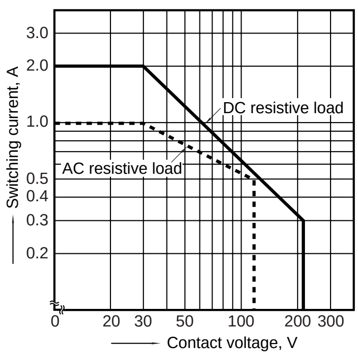
- Single side stable (Deenergized condition)
- 1-coil latching (Reset condition)
- 2-coil latching (Reset condition)



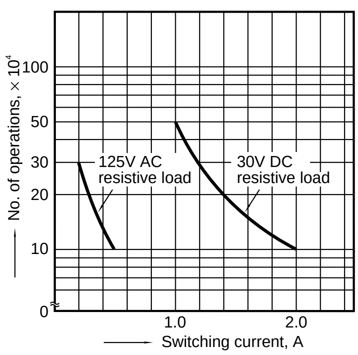
* Orientation stripe located on top of relay

REFERENCE DATA

1. Maximum switching capacity

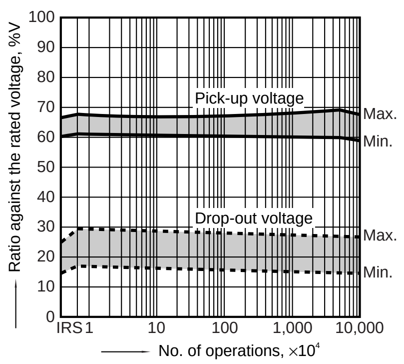


2. Life curve



3. Mechanical life (mounting by IRS methad)

Tested sample: TQ2SA-12V, 10 pcs.

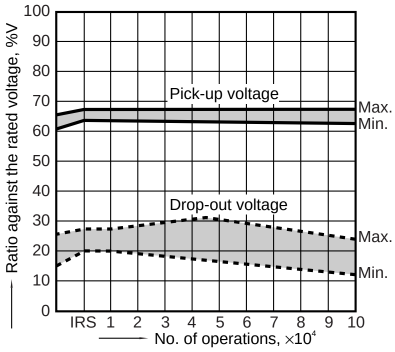


4-.(1) Electrical life
(2 A 30 V DC resistive load)

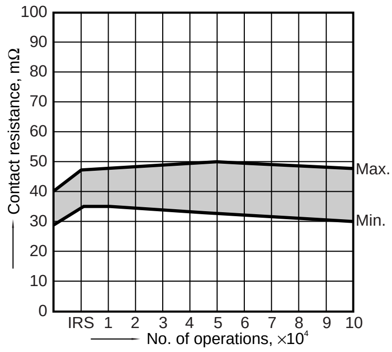
Tested sample: TQ2SA-12V, 6 pcs.

Operating frequency: 20 cpm

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



Change of contact resistance (mounting by IRS method)

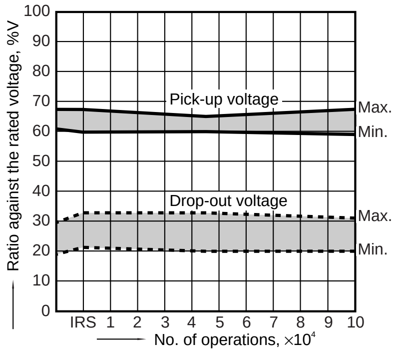


4.-(2) Electrical life
(0.5 A 125 V AC resistive load)

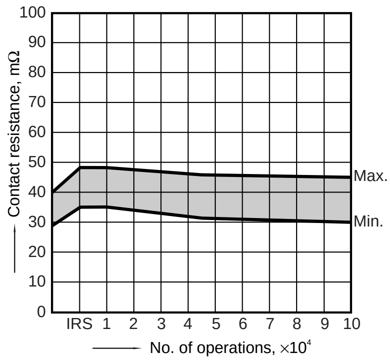
Tested sample: TQ2SA-12V, 6 pcs.

Operating frequency: 20 cpm

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

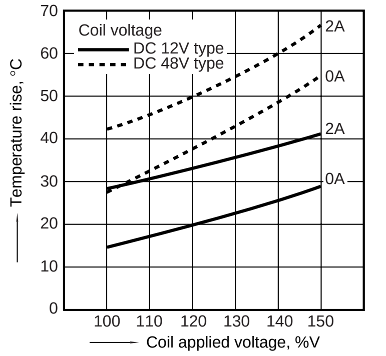


Change of contact resistance (mounting by IRS method)



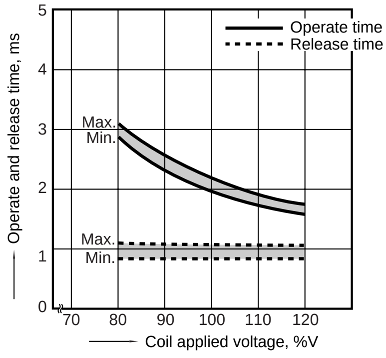
5. Coil temperature rise

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



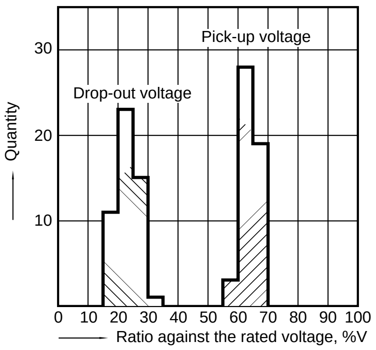
6. Operate/release time

Tested sample: TQ2SA-12V, 6 pcs.



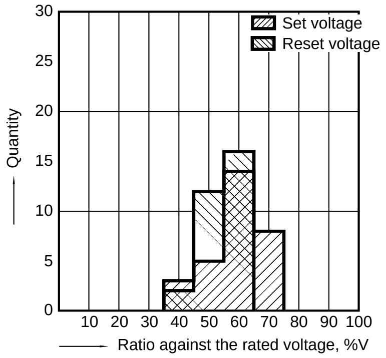
7. Distribution of pick-up and drop-out voltage

Tested sample: TQ2SA-12V, 50 pcs.



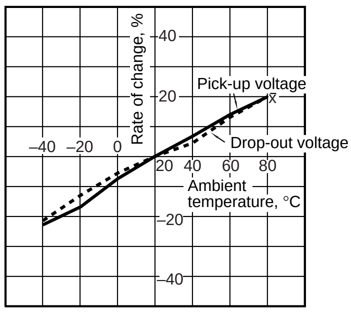
8. Distribution of set and reset voltage

Tested sample: TQ2SA-L-12V, 30 pcs.



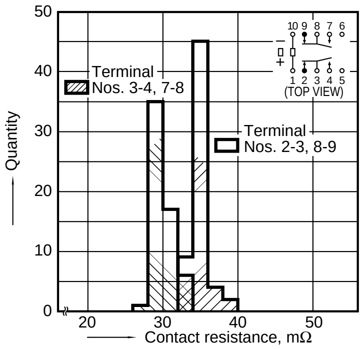
9. Ambient temperature characteristics

Tested sample: TQ2SA-12V, 5 pcs.



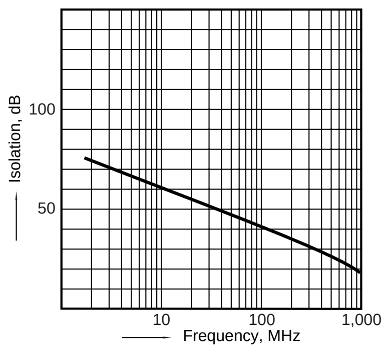
10. Distribution of contact resistance

Tested sample: TQ2SA-5V, 30 pcs. (30×4 contacts)



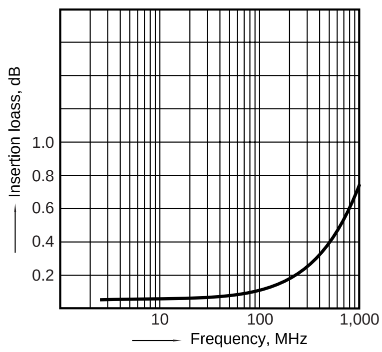
11.-(1) High frequency characteritics

Isolation characteristics



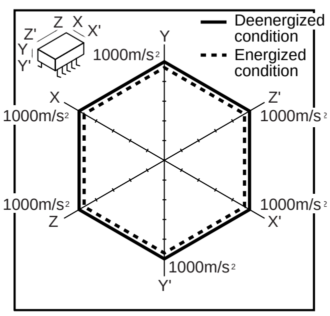
11.-(2) High frequency characteristics

Insertion loss characteristics



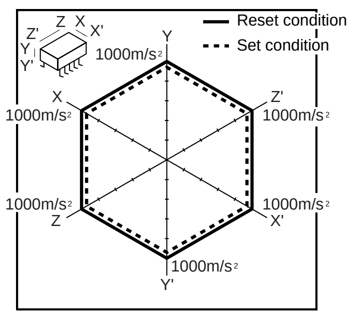
12.-(1) Malfunctional shock (single side stable)

Tested sample: TQ2SA-12V, 6 pcs.

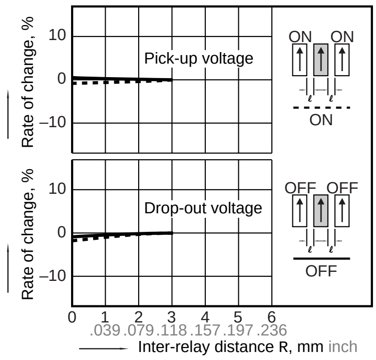


12.-(2) Malfunctional shock (latching)

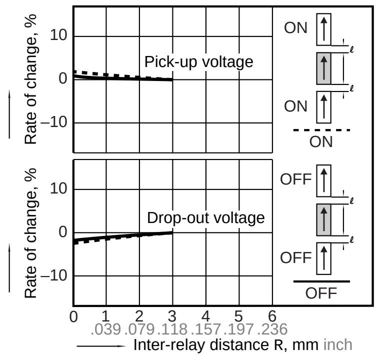
Tested sample: TQ2SA-L2-12V, 6 pcs.



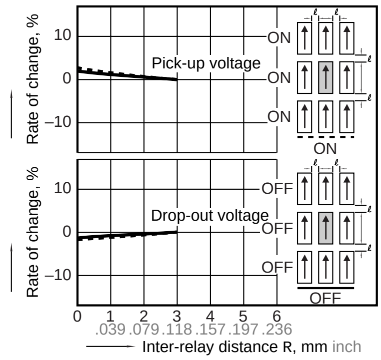
13.-(1) Influence of adjacent mounting
Tested sample: TQ2SA-12V, 5 pcs.



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

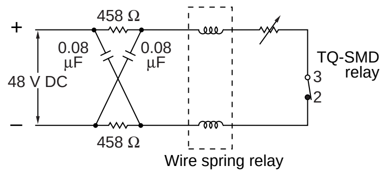


13.-(3) Influence of adjacent mounting
Tested sample: TQ2SA-12V, 6 pcs.

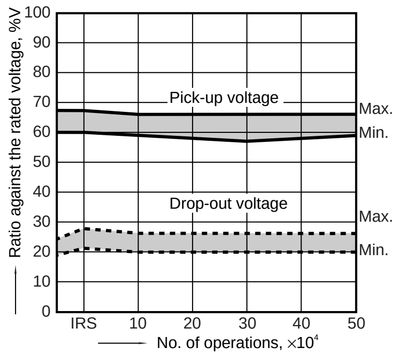


14. Pulse dialing test
Tested sample: TQ2SA-12V, 6 pcs.
(35 mA 48 V DC wire spring relay load)

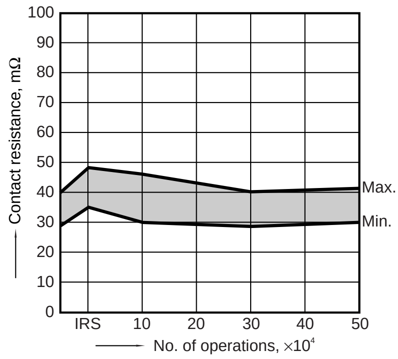
Circuit



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



Change of contact resistance (mounting by IRS method)



NOTES

1. Coil operating power

Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%. However, check it with the actual circuit since the characteristics may be slightly different. The nominal operating voltage should be applied to the coil for more than 10 ms to set/reset the latching type relay.

2. Coil connection

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

3. External magnetic field

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

4. Conditions for operation, transport and storage

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

TX(-SMD) / TX-D(-SMD) / TQ-SMD

(1) Temperature:
–40 to +85°C –40 to +185°F.
The temperature range is
–40 to +70°C –40 to +158°F for the packaged relay.

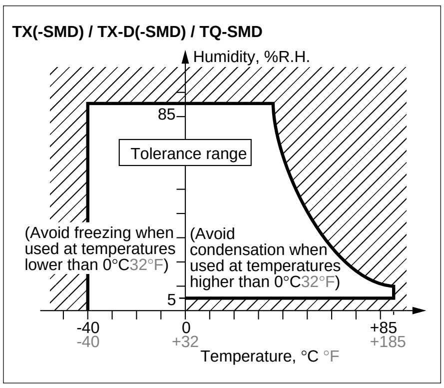
TX-S(-SMD)

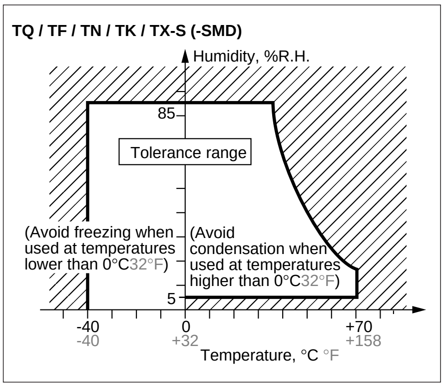
(1) Temperature:
–40 to +70°C –40 to +158°F.
for the package/non-package relay.

TQ / TF / TN / TK

(1) Temperature: –40 to +70°C –40 to +158°F
The temperature range is –40 to +60°C –40 to +140°F for the packaged relay.
(2) Humidity: 5 to 85% R.H.
(Avoid freezing and condensation.)
The humidity range varies with the temperature. Use within the range indicated in the graph below.
(3) Atmospheric pressure: 86 to 106 kPa

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





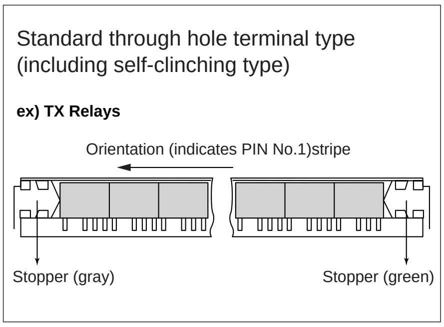
2) Condensation
Condensation forms when there is a sudden change in temperature under high temperature, high humidity conditions. Condensation will cause deterioration of the relay insulation.
3) Freezing
Condensation or other moisture may freeze on the relay when the temperature is lower than 0°C 32°F. 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.

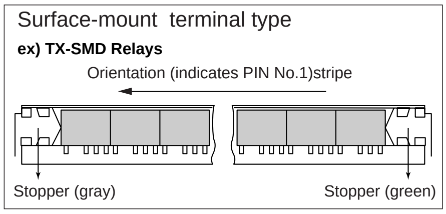
5. M.B.B. contact relays

A small OFF time may be generated by the contact bounce during contact switching. Check the actual circuit carefully.
If the relay is dropped accidentally, check the appearance and characteristics including M.B.B. time before use.

6. Packing style

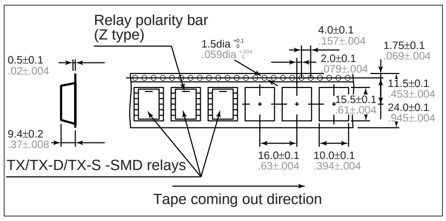
1) Tube orientation for both standard through hole terminal type (including self-clinching type) and surface-mount terminal type.
The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.
Take note of the relay orientation when mounting relays on the printed circuit board.





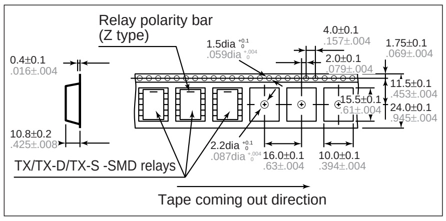
(2) Tape and reel packing (surface-mount terminal type)
(1) Tape dimensions
①TX / TX-D / TX-S -SMD Relays
(i) SA type

mm inch



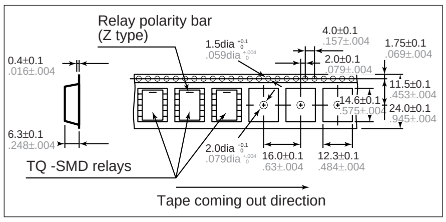
(ii) SL, SS type

mm inch



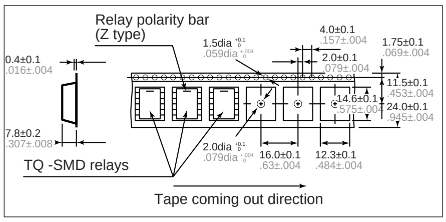
②TQ -SMD Relays
(i) SA type

mm inch



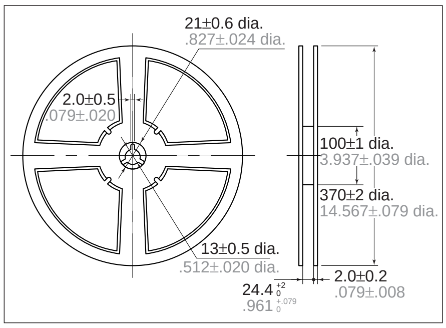
(ii) SL,SS type

mm inch



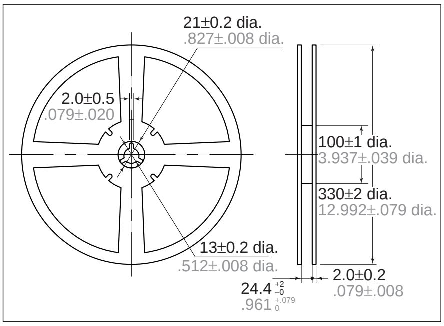
(2) Dimensions of plastic reel
(i) TX / TX-D / TX-S -SMD Relays

mm inch



(ii)TQ -SMD Relays

mm inch



7. Automatic insertion

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

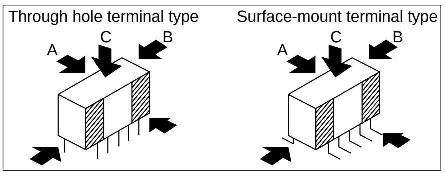
1) TX(-SMD) / TX-D(-SMD) / TQ / TF

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

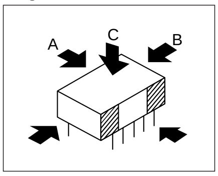
Chucking pressure in the direction B:
9.8 N {1 kg} or less

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

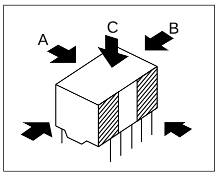
TX(-SMD)/TX-D(-SMD) / TX-S(-SMD)



TQ



TF



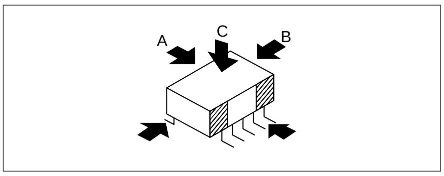
Please chuck the portion.
Avoid chucking the center of the relay.

2) TQ-SMD

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

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

Mountimg pressure in the direction C:
9.8 N {1 kg} or less



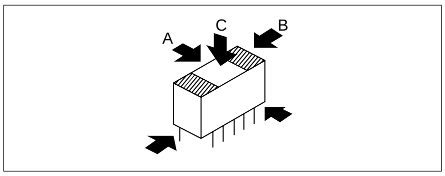
Please chuck the portion.
Avoid chucking the center of the relay.

3) TN

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

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

Chucking pressure in the direction C:
4.9 N {500 g} or less



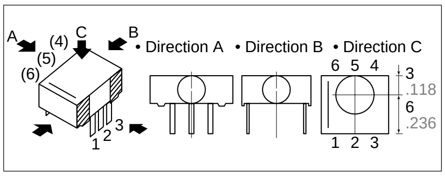
Please chuck the portion.
Avoid chucking the center of the relay.

4) TK

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

Chucking pressure* in the direction B:
29.4 N {3 kg} or less

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



Please chuck the portion.
Avoid chucking the center of the relay.

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

8. Soldering

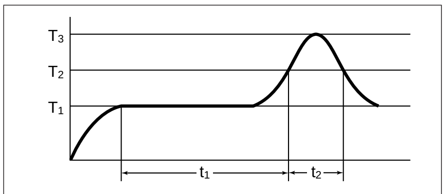
1) Preheat according to the following conditions.

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

When soldering standard PC board terminals or self-clinching terminals, soldering should be done at 250°C 482°F within 5 sec.

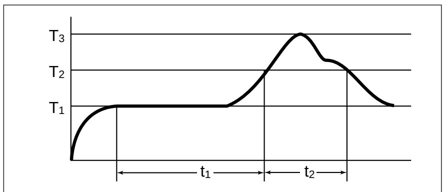
2) When soldering surface-mount terminals, the following conditions are recommended.

(1) IR (Infrared reflow) soldering method



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

(2) Vapor phase soldering method



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

(3) Soldering iron method

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

Wattage: 30 to 60 W

Soldering time: within 5 sec.

(4) Other soldering methods

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

Remarks

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

• The conditions for the infrared reflow soldering apply when preheating using the VPS method.

9. Cleaning

In automatic cleaning, cleaning with the boiling method is recommended. Avoid ultrasonic cleaning which subject the relay to high frequency vibrations. It may cause the contacts to stick.

It is recommended that a fluorinated hydrocarbon or other alcoholic solvents be used.

10. Others

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

2) The cycle lifetime is defined under the standard test condition specified in the JIS* C 5442-1986 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 85%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase,ambient conditions and other factors.

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

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

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

*Japanese Industrial Standards