

# HIGH VOLTAGE DC SWITCHING RELAY

## MAX. 1,000VDC BREAK HIGH CAPACITY DC POWER RELAY

### FTR-E1 SERIES

ROHS COMPLIANT

#### ■ FEATURES

- 20/30A 450VDC, 20A 800VDC and 10A 1,000VDC high voltage DC load switching.
- Non polarized contacts. Switchable for charge/discharge circuit.
- Low coil power consumption (0.9W at coil rated voltage)
- High insulation.
  - Between coil and contact: 5,000VAC, 1 minute.
  - Between open contact: 2,500VDC, 1 minute.
- cULus recognized types are available.
- Plastic material: UL flammability 94V-0.
- Plastic sealed.



#### ■ APPLICATIONS

- On board electrical vehicles charger system and plug-in hybrid vehicles
- String disconnecting of photovoltaics systems
- Charge and discharge of power storage system
- High voltage DC load control system
- Electric vehicles pre-charge
- Vehicle to Home

#### ■ PART NUMBERS

[Example] FTR-E1   A   A   012   Y   -   MF  
                   (a)       (b)   (c)   (d)   (e)   (f)

|     |                       |                                                                                   |
|-----|-----------------------|-----------------------------------------------------------------------------------|
| (a) | Relay type            | FTR-E1 series                                                                     |
| (b) | Contact configuration | A : 1a (1 Form X)                                                                 |
| (c) | Power consumption     | A : Standard (900mW)                                                              |
| (d) | Nominal coil voltage  | 12 : 12VDC<br>24 : 24VDC                                                          |
| (e) | Contact material      | Y : Silver alloy                                                                  |
| (f) | Special type          | MF : Standard (20A)<br>GR : cULus recognized (20A)<br>HA : cULus recognized (30A) |

Note: The designation name is stamped on the top of the relay case as follows:

Example: Ordering part number: FTR-E1AA012Y-MF Stamped on part number: E1AA012Y-MF

## ■ SPECIFICATIONS

| Item         |                                   | Specifications                                                                                                                     |                                                                                       | Remarks/Conditions                                                 |
|--------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------|
|              |                                   | 20A type (-MF, -GR)                                                                                                                | 30A type (-HA)                                                                        |                                                                    |
| Contact Data | Configuration                     | 1a (1 Form X)                                                                                                                      |                                                                                       |                                                                    |
|              | Material                          | Silver alloy                                                                                                                       |                                                                                       |                                                                    |
|              | Construction                      | Single contact                                                                                                                     |                                                                                       |                                                                    |
|              | Contact rating                    | 20A, 450VDC<br>20A, 800VDC<br>10A, 1,000VDC                                                                                        | 30A, 450VDC<br>20A, 800VDC<br>10A, 1,000VDC                                           | Resistive                                                          |
|              | Voltage drop                      | Max. 0.5V                                                                                                                          |                                                                                       | At 20°C                                                            |
|              | Continuous carrying current       | 25A (85°C, cable size 5.5mm <sup>2</sup> )<br>30A (70°C, cable size 8mm <sup>2</sup> )<br>40A (40°C, cable size 8mm <sup>2</sup> ) |                                                                                       | Please refer to characteristic data                                |
|              | Max. carrying current             | 40A / 1 hour (85°C, cable size 8mm <sup>2</sup> )                                                                                  |                                                                                       |                                                                    |
|              | Min. switching load <sup>*1</sup> | 1A 6VDC                                                                                                                            |                                                                                       | Reference                                                          |
| Coil         | Rated power consumption           | 900mW                                                                                                                              |                                                                                       | At 20°C                                                            |
|              | Operate power consumption         | 324mW                                                                                                                              |                                                                                       | At 20°C                                                            |
|              | Operating temperature range       | -40°C to +85°C                                                                                                                     |                                                                                       | No frost                                                           |
| Time         | Operate                           | Max. 30ms (without bounce)                                                                                                         |                                                                                       | At 20°C, nominal voltage                                           |
|              | Release                           | Max. 10ms (without diode, without bounce)                                                                                          |                                                                                       | At 20°C, nominal voltage                                           |
| Life         | Mechanical                        | 1 x 10 <sup>6</sup> operations                                                                                                     |                                                                                       | 18,000 operations / hour                                           |
|              | Electrical (resistive)            | 75 x 10 <sup>3</sup> operations                                                                                                    |                                                                                       | 10A, 450VDC resistive, with suppression device <sup>*2</sup>       |
|              |                                   | 10 x 10 <sup>3</sup> operations                                                                                                    |                                                                                       | 20A, 450VDC resistive, with suppression device <sup>*2</sup>       |
|              |                                   | -                                                                                                                                  | 5 x 10 <sup>3</sup> operations                                                        | 30A, 450VDC resistive, with suppression device <sup>*2</sup>       |
|              |                                   | 10 operations                                                                                                                      |                                                                                       | 20A, 800VDC resistive, with suppression device <sup>*2</sup>       |
|              |                                   | 50 operations                                                                                                                      |                                                                                       | 10A, 1,000VDC resistive, with suppression devices <sup>*2</sup>    |
|              |                                   | 200 operations                                                                                                                     |                                                                                       | 5A, 1,000VDC resistive, with suppression devices <sup>*2</sup>     |
|              |                                   | 100 x 10 <sup>3</sup> operations                                                                                                   |                                                                                       | 20A, 450VDC inrush only (without break)                            |
|              |                                   | 100 x 10 <sup>3</sup> operations                                                                                                   |                                                                                       | 20A, 800VDC inrush only (without break)                            |
| Insulation   | Insulation resistance             | 1,000MΩ                                                                                                                            |                                                                                       | At 1,000VDC                                                        |
|              | Dielectric withstanding voltage   | Open contacts                                                                                                                      | 2,500VAC(50/60Hz), 1 minute                                                           |                                                                    |
|              |                                   | Coil to contacts                                                                                                                   | 5,000VAC(50/60Hz), 1 minute                                                           |                                                                    |
| Others       | Vibration resistance              | Misoperation                                                                                                                       | 5 to 200Hz, 45m/s <sup>2</sup> , constant acceleration                                | Sense time 1ms, contact ON/OFF                                     |
|              |                                   | Endurance                                                                                                                          | to 200Hz, 45m/s <sup>2</sup> , constant acceleration                                  | Contact ON/OFF, up/down 4hours, left/right/front/back each 2 hours |
|              | Shock resistance                  | Misoperation                                                                                                                       | 300m/s <sup>2</sup> (11±1ms, contact ON)<br>200m/s <sup>2</sup> (11±1ms, contact OFF) | Sense time 1ms                                                     |
|              |                                   | Endurance                                                                                                                          | 1,000m/s <sup>2</sup> (6±1ms)                                                         | Contact ON/OFF total 36 times                                      |
|              | Dimensions / Weight               | 28.3×43.6×36.8 mm / approx. 75g                                                                                                    |                                                                                       |                                                                    |

Note: Electrical characteristics mentioned above are the values at JIS standard condition (temperature 15 to 35degC, relative humidity 25 to 75%, atmospheric pressure 86k to 106kPa) unless otherwise specified.

Note: Care shall be taken on the heat generated on PC board when maximum carrying current exceeds 10A. Please perform the confirmation test with actual conditions.

\*1: Minimum switching loads mentioned above are reference values. Please perform the confirmation test with actual load before production since reference values may vary according to switching frequencies, environmental conditions and expected reliability levels.

\*2: Electrical life at resistive load mentioned above are the values when a varistor or zener diode or zener diode+diode is used as coil suppression device. Using protection device other than these, the contact life expectancy may decrease drastically. When using a varistor as a suppression device, varistor voltage shall be approximately twice the voltage applied to the coil and connect it in parallel with the coil. When using a zener diode or zener diode+diode as a suppression device, please refer to the CIRCUIT DIAGRAM WHEN USING ZENER DIODE.

## ■ COIL DATA

| Coil Code | Nominal Coil Voltage (VDC) | Coil Resistance $\pm 10\%$ ( $\Omega$ ) | Must Operate Voltage <sup>*1</sup> (VDC) | Must Release Voltage <sup>*1</sup> (VDC) |
|-----------|----------------------------|-----------------------------------------|------------------------------------------|------------------------------------------|
| 012       | 12                         | 160                                     | 7.2 (at 20°C)<br>9.0 (at 85°C)           | 1.0 (at 20°C)<br>1.3 (at 85°C)           |
| 024       | 24                         | 640                                     | 14.4 (at 20°C)<br>18.0 (at 85°C)         | 2.0 (at 20°C)<br>2.6 (at 85°C)           |

Note: All values in the table are valid at 20°C and zero contact current unless otherwise specified.

Note: Coil polarity must be applied as specified in schematics.

\*1: Specified operate values are valid for pulse wave voltage.

## ■ SAFETY STANDARDS

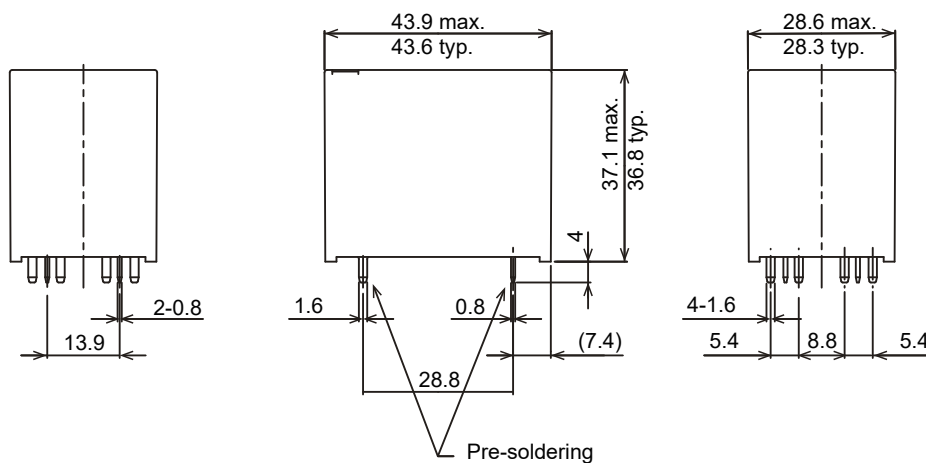
| Type  | Compliance                                   | Contact Rating                                                                                                                                                                                                       |
|-------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| cULus | UL508<br>C22.2 No.14-13<br>(File No. E63615) | <b>[FTR-E1AA***Y-GR]</b><br>10A, 450VDC (resistive) 85°C<br>20A, 450VDC (resistive) 85°C<br><b>[FTR-E1AA***Y-HA]</b><br>10A, 450VDC (resistive) 85°C<br>20A, 450VDC (resistive) 85°C<br>30A, 450VDC (resistive) 85°C |

## ■ PART NUMBER LIST

| Part Number     | Nominal Coil Voltage | Contact Rating                       | Safety Standard     |
|-----------------|----------------------|--------------------------------------|---------------------|
| FTR-E1AA012Y-MF | 12VDC                | 20A 450VDC, 20A 800VDC, 10A 1,000VDC | -                   |
| FTR-E1AA012Y-GR |                      | 20A 450VDC, 20A 800VDC, 10A 1,000VDC | cULus (450VDC only) |
| FTR-E1AA012Y-HA |                      | 30A 450VDC, 20A 800VDC, 10A 1,000VDC | cULus (450VDC only) |
| FTR-E1AA024Y-MF | 24VDC                | 20A 450VDC, 20A 800VDC, 10A 1,000VDC | -                   |
| FTR-E1AA024Y-GR |                      | 20A 450VDC, 20A 800VDC, 10A 1,000VDC | cULus (450VDC only) |
| FTR-E1AA024Y-HA |                      | 30A 450VDC, 20A 800VDC, 10A 1,000VDC | cULus (450VDC only) |

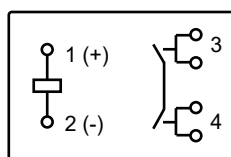
## ■ DIMENSIONS

### • Dimensions

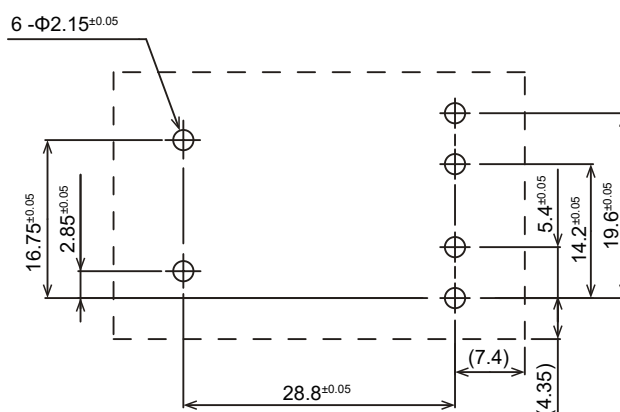


Note: Dimensions of the terminals do not include thickness of pre-soldering.

### • Schematics (BOTTOM VIEW)



### • PC Board Mounting Hole Layout (BOTTOM VIEW)

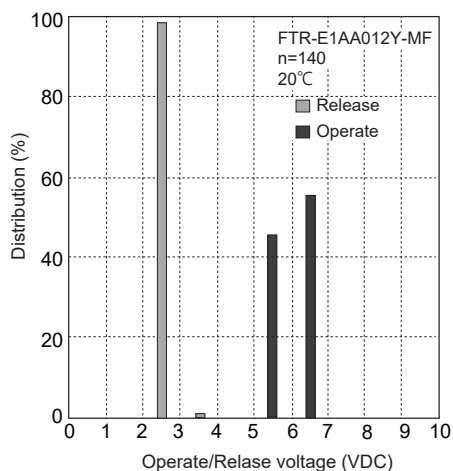


( ): Reference  
Unit: mm

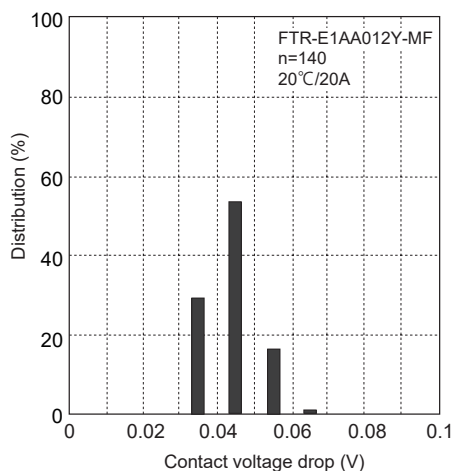
## CHARACTERISTIC DATA

(Characteristic data is not guaranteed value but measured values of samples from production line.)

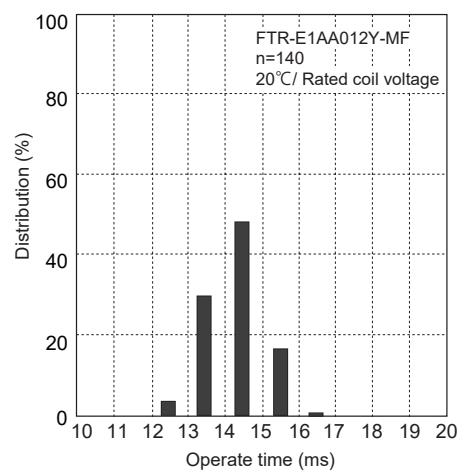
Distribution of operate/release voltage



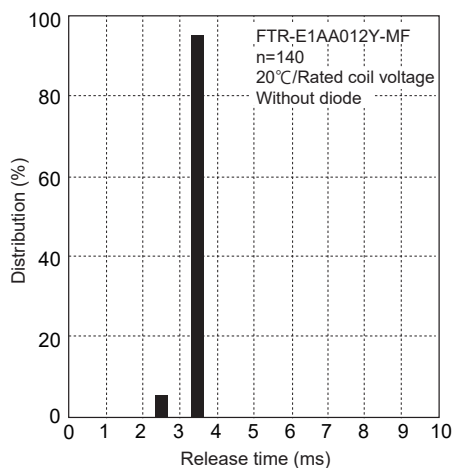
Distribution of voltage drop



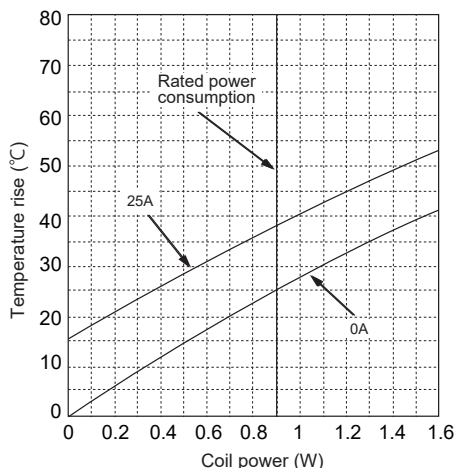
Distribution of operate time



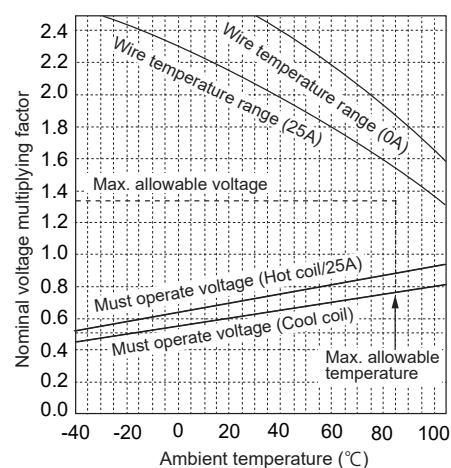
Distribution of release time



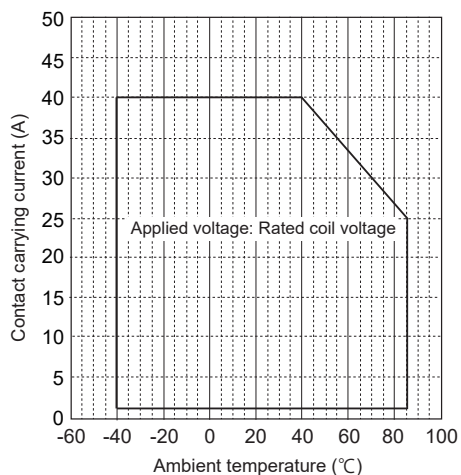
Coil temperature rise



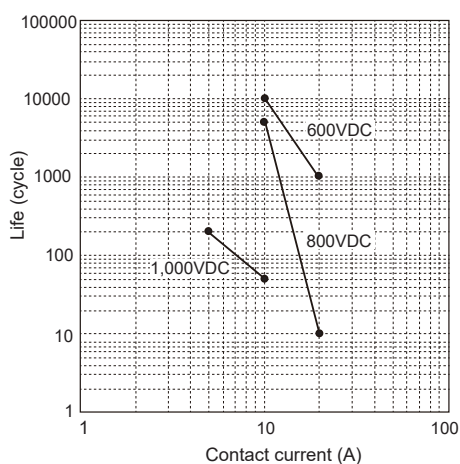
Operating range



Ambient temperature - contact carrying current



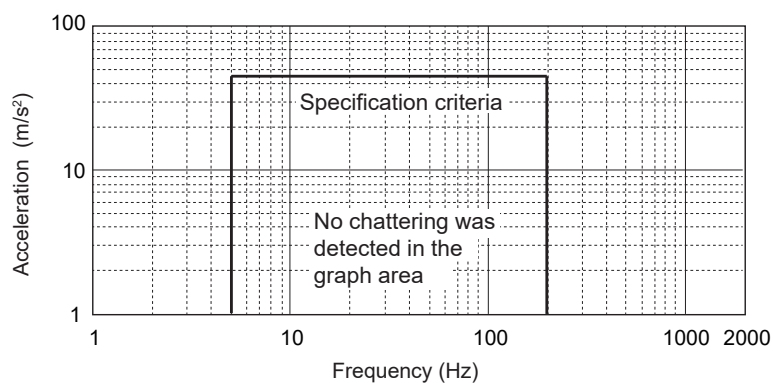
Switching life curve



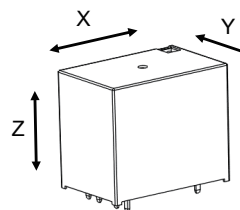
## ■ CHARACTERISTIC DATA

(Characteristic data is not guaranteed value but measured values of samples from production line.)

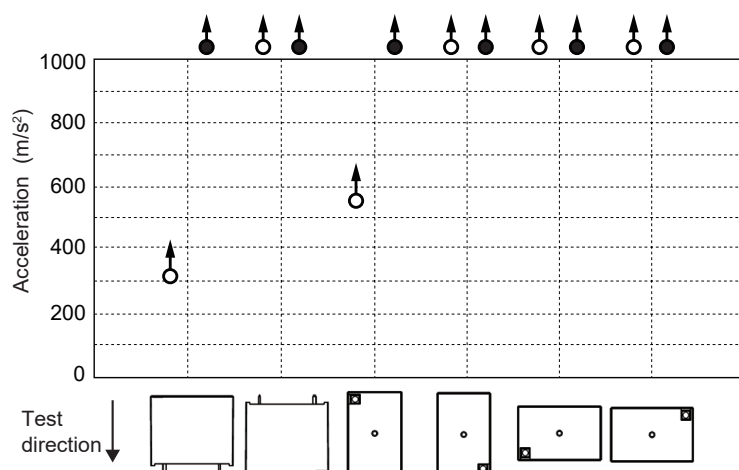
### Vibration resistance characteristics



Test material: coil energized and de-energized  
Direction of vibration: see diagram below  
Detection level: chatter > 1 ms



### Shock resistance characteristics

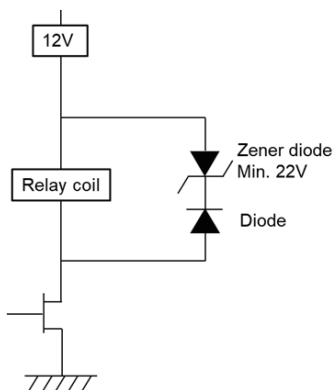


Test material: coil energized and de-energized  
Shock duration: 11ms (490m/s<sup>2</sup> or less)  
6ms (more than 490m/s<sup>2</sup>)  
Test direction: see diagram under the graph  
Detection level: chatter > 1ms

○ : Coil de-energized  
● : Coil energized

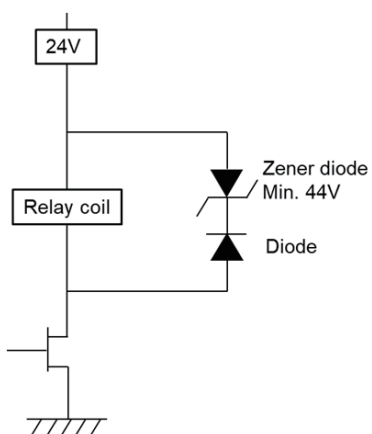
## ■ CIRCUIT DIAGRAM WHEN USING ZENER DIODE (Refere to \*2 on page 2)

1. Using zener diode + diode

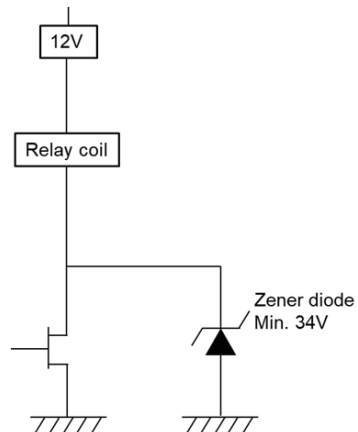


■ Nominal coil voltage: 24V

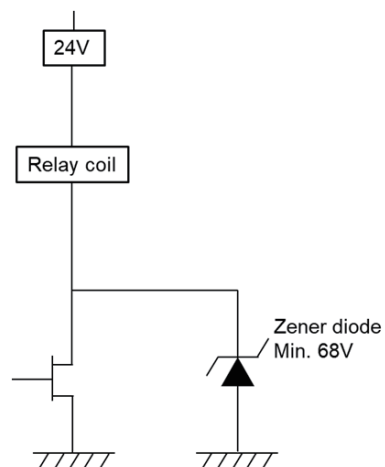
1. Using zener diode + diode



1. Using zener diode



2. Using zener diode



## CAUTIONS

- All values mentioned in this datasheet are provided under ideal conditions. Please perform the confirmation test before actual use.
- Reflow soldering is prohibited.
- Do not use relays in the atmosphere with sulfide gas, chloride gas or nitric oxide. Contact resistance may increase.
- Do not use silicon or silicon-containing product or materials near relays. It may cause contact failure.
- Please connect relay coils according to specified polarity.

### Cautions for high voltage DC switching relays

- There is a possibility that the relay is not able to switch off the load at high voltage DC load. Fail safe circuit must be provided to prevent injury, fire or other harms resulting from failure occurred on relays.
- Relays are periodic maintenance parts. Do not exceed the specified life time and/or switching conditions.

## GENERAL INFORMATION

### 1. ROHS Compliance

- All relays produced by FCL Components are compliant with RoHS directive 2011/65/EU, including commission delegated directive 2015/863.

### 2. Recommended lead free solder condition

- Lead free solder plating on relay terminals is Sn-3.0Ag-0.5Cu, unless otherwise specified. This material has been verified to be compatible with PbSn assembly process.
- Recommended solder for assembly: Sn-3.0Ag-0.5Cu.

#### Flow Solder Condition:

Pre-Heating: Maximum 120°C  
within 90 sec.  
Soldering: Dip within 5 sec. at 255°C±5°C solder bath

Relay must be cooled by air immediately after soldering

#### Solder by Soldering Iron:

Soldering Iron: 30-60W  
Temperature: maximum 340-360°C  
Duration: maximum 3 sec.

**We highly recommend that you confirm your actual solder conditions**

### 3. Moisture Sensitivity

- Moisture Sensitivity Level standard is not applicable to electromechanical relays, unless otherwise indicated.

### 4. Tin Whiskers

- Dipped SnAgCu solder is known as presenting a low risk to tin whisker development. No considerable length whisker was found by our in house test.

## Contact

### Japan

FCL COMPONENTS LIMITED  
Shinagawa Seaside Park Tower  
12-4, Higashi-shinagawa 4-chome,  
Tokyo 140 0002, Japan  
Tel: +81-3-3450-1682  
Email: fcl-contact@cs.fcl-components.com

### North and South America

FCL COMPONENTS AMERICA, INC.  
2055 Gateway Place Suite 480,  
San Jose, CA 95110 USA  
Tel: +1-408-745-4900  
Email: fcmai.components@fcl-components.com

### Europe

FCL COMPONENTS EUROPE B.V.  
Diamantlaan 25  
2132 WV Hoofddorp, Netherlands  
Tel: +31-23-556-0910  
Email: info@fcl-components.eu

### Asia Pacific

FCL COMPONENTS ASIA PTE LTD.  
No. 20 Harbour Drive, #07-01B  
Singapore 117612  
Tel: +65-6375-8560  
Email: fcal@fcl-components.com

### China

FCL COMPONENTS (SHANGHAI) CO.,LTD.  
Unit 1105, Central Park - Jing An,  
No.329 Heng Feng Road, Shanghai  
200070, China  
Tel: +86-21-3253 0998  
Email: fcsh@fcl-components.com

### Hong Kong

FCL COMPONENTS HONG KONG CO.,  
LIMITED  
Unit 2313, Seapower Tower, Concordia  
Plaza, No.1 Science Museum Road,  
TST, Kowloon, Hong Kong  
Tel: +852-2881-8495  
Email: fcal@fcl-components.com

Web: [www.fcl-components.com/en/](http://www.fcl-components.com/en/)

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