# HIGH VOLTAGE DC SWITCHING RELAY
# 1 POLE – 60A

# FTR-E1-HC Series

**RoHS Compliant**

## ■ FEATURES

- 60A 450VDC high voltage DC load switching
- Non polarized contacts. Switchable for charge/discharge circuit.
- Low coil power consumption (1.2W at coil rated voltage)
- High insulation.
  - Between coil and contact: 5,000VAC, 1 minute.
  - Between open contact: 2,500VDC, 1 minute.
- cULus, TUV approved
- Plastic material: UL flammability 94V-0
- Plastic sealed

## ■ APPLICATIONS

Electric vehicles (HEV, PHEV, EV), fast charge stations, photovoltaic power generation systems, hybrid construction machineries, battery systems, etc.

## ■ PART NUMBERS

[Example] FTR-E1 A A 012 Y - HC
(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 (1200mW) |
| (d) | Nominal coil voltage | 012 : 12VDC<br>024 : 24VDC |
| (e) | Contact material | Y : Silver alloy |
| (f) | Special type | HC : High capacity type |

Note: The designation name is stamped on the top of the relay case as follows:
Example: Ordering part number: FTR-E1AA012Y-HC Stamped on part number: E1AA012Y-HC

## ■ SPECIFICATIONS

| Item | | | Specifications | Remarks / Conditions |
|---|---|---|---|---|
| Contact Data | Configuration | | 1a (1 Form X) | |
| | Material | | Silver alloy | |
| | Contact rating | | 60A, 450VDC | Resistive, at 85℃ |
| | Voltage drop | | Max. 0.5V | At 20A |
| | Max. carrying current | | 60A (at 85℃, cable size 14mm$^2$) | |
| | Min. switching load | | 1A 6VDC | Reference*1 |
| Coil | Rated power consumption | | 1200mW | At 20℃ |
| | Operate power consumption | | 588mW | At 20℃ |
| | Operating temperature range | | -40℃ to +85℃ | No frost |
| Time | Operate | | Max. 30ms (without bounce) | At 20℃, at nominal voltage |
| | Release | | Max. 10ms (without diode, without bounce) | |
| Life | Mechanical | | 500 x 10$^3$ operations | 18,000 operations/hour |
| | Electrical | | 500 operations*2 | 60A 450VDC, resistive, with suppression device*2 |
| Insulation | Insulation resistance | | 1,000MΩ | At 1,000VDC |
| | Dielectric withstanding voltage | Open contacts | 2,500VAC (50/60Hz), 1 minute | |
| | | Coil contact | 5,000VAC (50/60Hz), 1 minute | |
| Others | Vibration resistance | Misoperation | 5 to 200Hz, 45m/s², constant acceleration | Sense time 1ms, contact ON/OFF |
| | | Endurance | 5 to 200Hz, 45m/s², constant acceleration | Contact ON/OFF, up/down 4hours, left/right/front/back each 2 hours |
| | Shock resistance | Misoperation | 100m/s$^2$ (11±1ms) | Sense time 1ms |
| | | Endurance | 1,000m/s$^2$ (6±1ms) | Contact ON/OFF total 36 times |
| | Dimensions / Weight | | 28.3 x 43.6 x 36.8 mm / Approx. 80g | |

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 ±10% (Ω) | Must Operate Voltage* (VDC) | Must Release Voltage* (VDC) |
|---|---|---|---|---|
| 012 | 12 | 120 | 8.4 (at 20℃)<br>10.5 (at 85℃) | 1.0 (at 20℃)<br>1.3 (at 85℃) |
| 024 | 24 | 480 | 16.8 (at 20℃)<br>21.2 (at 85℃) | 2.0 (at 20℃)<br>2.6 (at 85℃) |

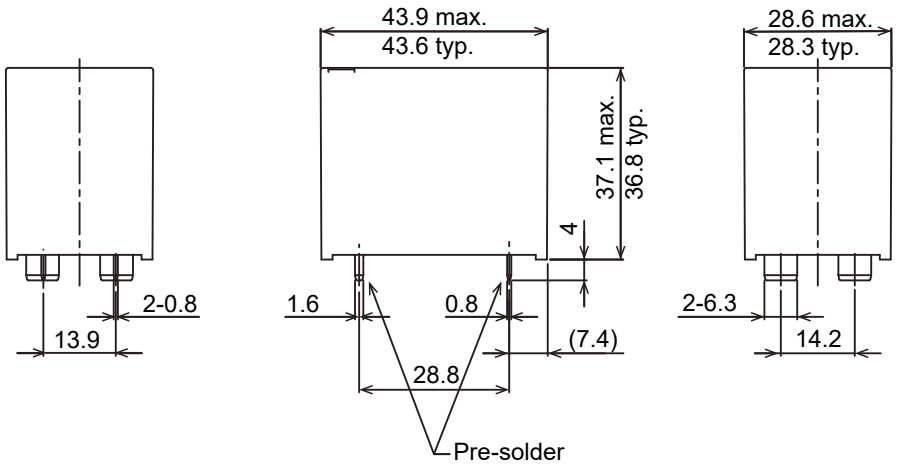
Note: All values in the table are valid at 20℃ and zero contact current unless otherwise specified.
Note: Coil polarity must be applied as specified in schematics.
*: Specified operate values are valid for pulse wave voltage.

## ■ SAFETY STANDARD

| Type | Compliance | Contact Rating |
|---|---|---|
| cULus | UL508<br>C22.2 No. 14-13<br>(File No. E63615) | 40A, 360VDC (resistive) 60℃ |
| TUV | IEC61810-1 | 60A, 450VDC (resistive) 85℃ |

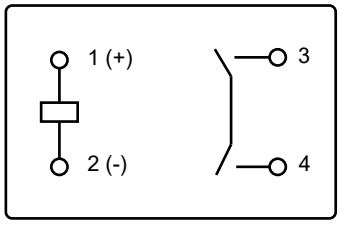
## ■ DIMENSIONS

- Dimensions

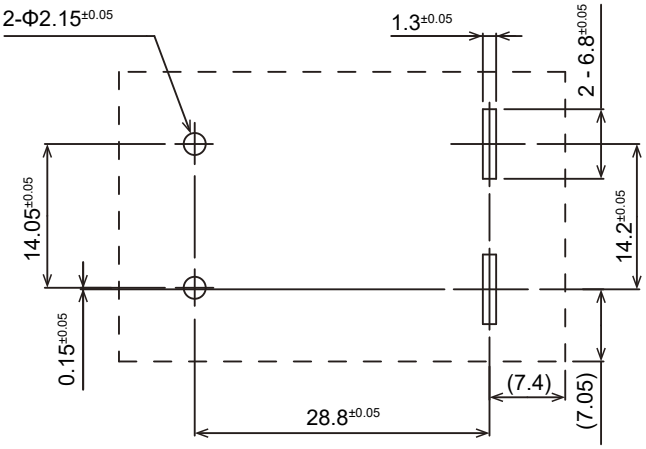



Note: Dimensions of the terminal do not include thickness of pre-solder.

- Schematics
(BOTTOM VIEW)




- PC Board Mounting Hole Layout
(BOTTOM VIEW)




Unit: mm
( ): Reference

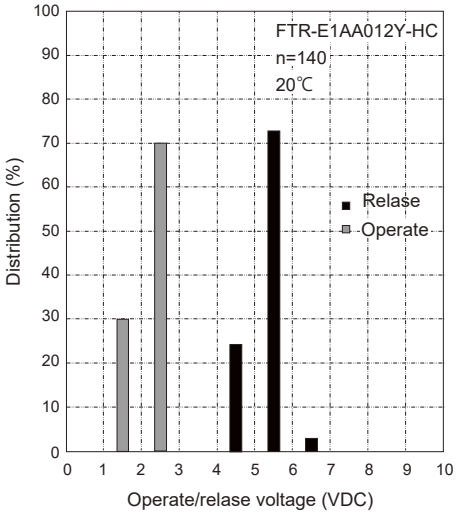
## ■ PART NUMBER LIST

| Part number | Nominal coil voltage | Contact rating | Safety Standard |
|---|---|---|---|
| FTR-E1AA012Y-HC | 12VDC | 60A, 450VDC | cULus<br>TUV |
| FTR-E1AA024Y-HC | 24VDC | | |

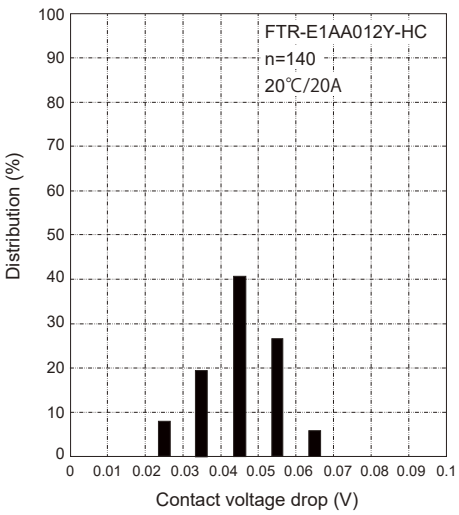
## ■ CHARACTERISTIC DATA

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

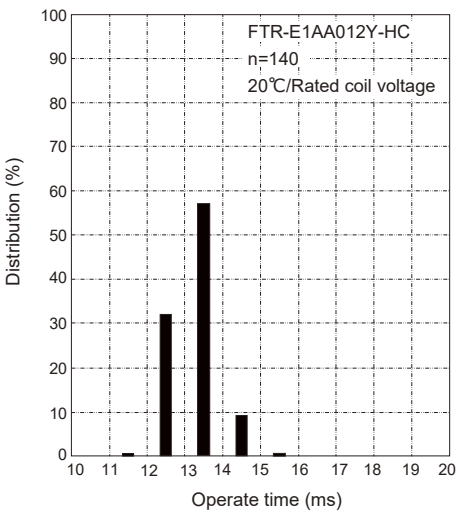
Distribution of operate/relase voltage



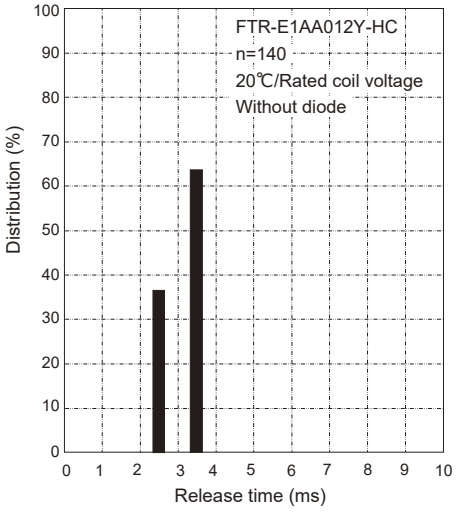

Distribution of voltage drop



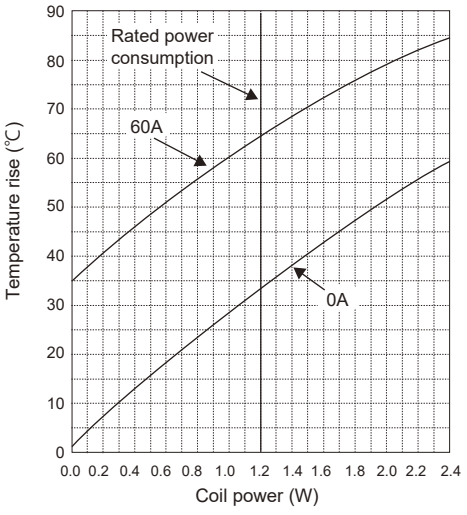

Distribution of operate time



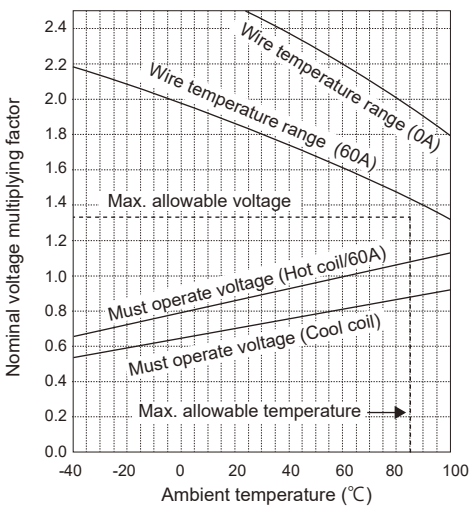

Distribution of release time



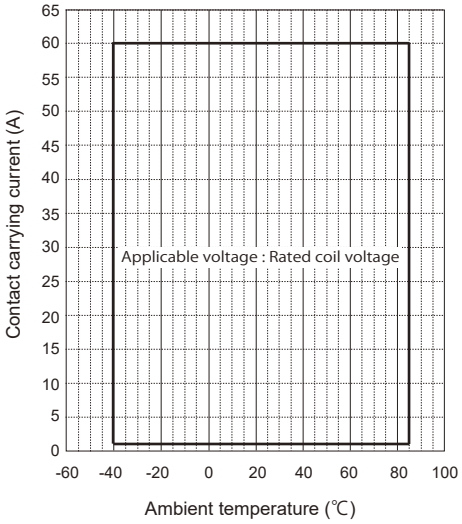

Coil temperature rise



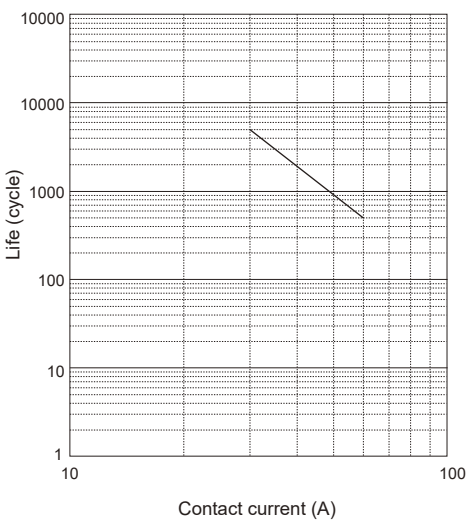

Operating range



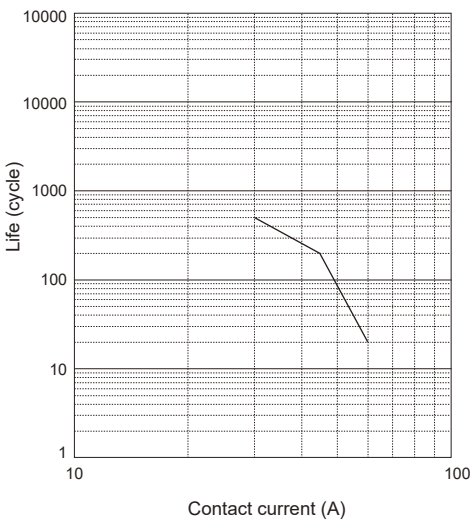

Ambient temperature - contact carrying current




Switching live curve (450VDC, resistive load)



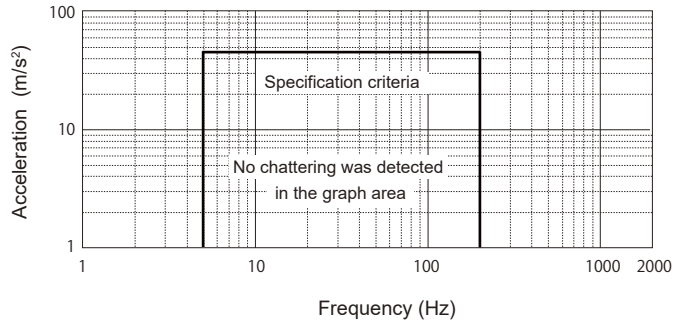

Switching live curve (600VDC, resistive load)



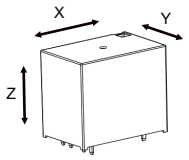
## ■ CHARACTERISTIC DATA

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

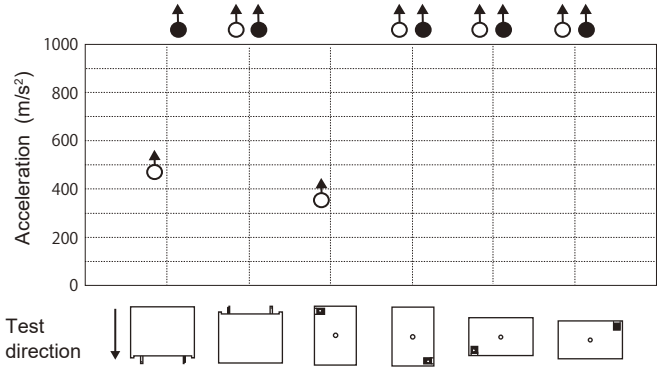
Vibration resistance characteristics




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




Shock resistance characteristics



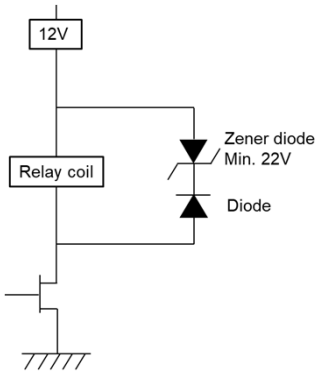

Test material: coil energized and de-energized
Shock duration: 11ms (490m/s² or less)
6ms (more than 490m/s²)
Test direction: see diagram under the graph
Detection level: chatter > 1ms

○ : Coil de-energized
● : Coil energized

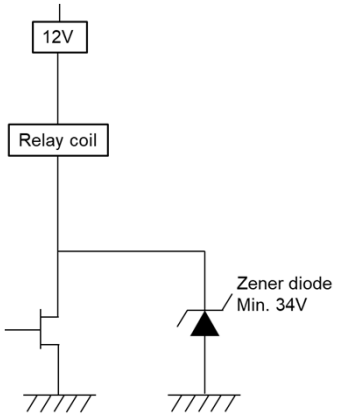
## ■ CIRCUIT DIAGRAM WHEN USING ZENER DIODE (Refer to *3 on page 2)

■ Nominal coil voltage: 12V

1. Using zener diode + diode

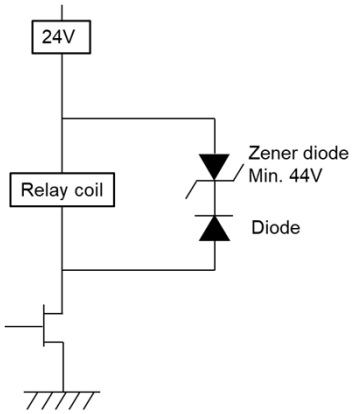



1. Using zener diode

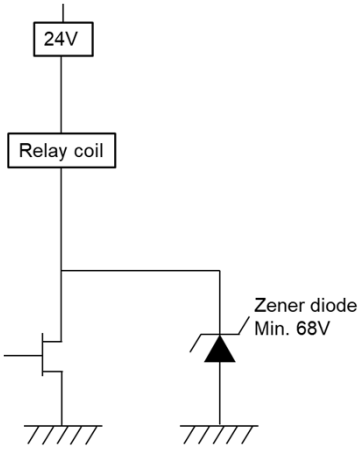



■ Nominal coil voltage: 24V

1. Using zener diode + 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℃
within 90 sec.
Soldering: Dip within 5 sec. at 255℃±5℃ solder bath

Relay must be cooled by air immediately after soldering

**Solder by Solder Iron:**
Soldering Iron: 30-60W
Temperature: Maximum 340-360℃
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: fcai.components@fcl-components.com

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

**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/



FCL Products are intended for general use, including without limitation, in personal, household and office environments, in buildings and for ordinary use in the industry. FCL Products are not intended to be used in applications where extremely high safety is required (”High Safety Required Applications”), such as, but not limited to, applications in nuclear facilities, in aircraft automatic flight control, in air traffic control, in mass transit system control, in missile launch system, in weapon systems, in medical equipment for life support or any application involving a direct serious risk of physical injury or death.
Please do not use FCL Products without securing the sufficient safety and reliability required for the High Safety Required Applications. In addition, FCL shall not be liable against the customer and/or any third party for any claims or damages arising in connection with the use of FCL Products in the High Safety Required Applications.
FCL warrants that its Products, if properly used and services, will conform to their specification and will be free from defects in material and workmanship for twelve months from delivery.
The implied warranties of merchantability and fitness for a particular purpose and all other warranties, representations and conditions, express or implied by statute, trade usage or otherwise, expect as set forth in this warranty, are excluded and shall not apply to the Products delivered.

The contents, data and information in this datasheet are provided by FCL Components Limited as a service only to its user and only for general information purposes. The use of the contents, data and information provided in this datasheet is at the users’ own risk.
FCL has assembled this datasheet with care and will endeavor to keep the contents, data and information correct, accurate, comprehensive, complete and up to date.
FCL Components Limited and affiliated companies do however not accept any responsibility or liability on their behalf, nor on behalf of its employees, for any loss or damage, direct, indirect or consequential, with respect to this datasheet, its contents, data, and information and related graphics and the correctness, reliability, accuracy, comprehensiveness, usefulness, availability and completeness thereof.
Nor do FCL Components Limited and affiliated companies accept on their behalf, nor on behalf of its employees, any responsibility or liability with respect to these datasheets, its contents, data, information and related graphics and the correctness, reliability, accuracy, comprehensiveness, usefulness, availability and completeness thereof. Rev. June 18, 2024.