

Thermal Cutoffs (TCO)/ Thermal-links

- EYP** Series: **N**
 Series: **F**
 Series: **E**
 Series: **H**
 Series: **MP**
 Series: **MU**



Features

- Small and Insulation Type
TCO is compact and insulated, featuring quick temperature response, and mountable in a small space without insulation or protection.
- High Reliability
TCO opens reliably when the equipment becomes abnormal, and is not resettable.
- Solid Structure
Uniquely formed lead provides reliable TCO connection and provides easy assembly handling. (Axial lead type only)
- Thin Type
Thick is less than 0.8 mm (MP series), available for spot welding (MP and MU series)
- Halogen-free (Thin type MP and MU series)
The thin type fuses with a part number listed in this catalog contain no halogen other than any that may exist as an impurity.
- RoHS compliant

Approved Safety Standards

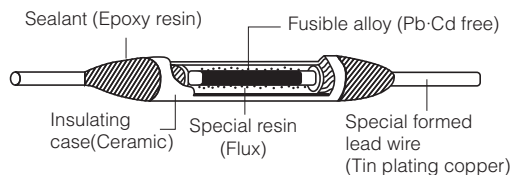
- (Japan) : Approved by JET
 - UL, C-UL (U.S.A.) : E60271
 - CSA (Canada) : 1□□□□□□ (LR67163)
 - VDE (Germany) : 481106-1171-□□□□
 - BEAB (U.K.) : C□□□□
 - CCC (China) : 20020102050042□□
- See Ratings in details.

Recommended Applications

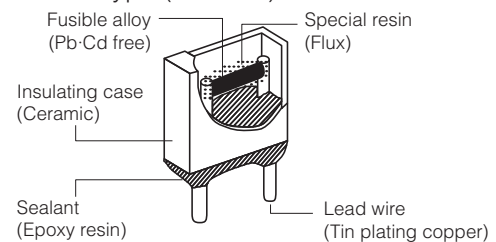
- Transformers, Solenoids, Ventilation fans, Electric fans, Small electric motors, Driers, Gas home appliances, Fluorescent lights, Electric shavers, Adaptors, Heating devices, ICs, Batteries, etc. The TCO can also be used for overheating protection.

Construction

- Axial lead type (N, F and E series)

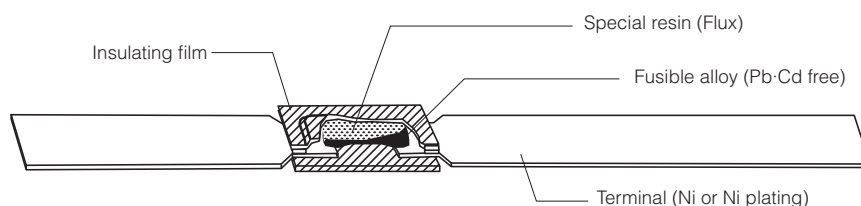


- Radial lead type (H series)



- Thin type (MP and MU series)

* Thin type is not to be soldered.



Ratings

● N series

| Part No. | Type No. of Approved Standards | Rated Functioning Temp. : Tf *1 (°C) | Functioning Temp. *2 (°C) | Electrical Rating | | | Maximum Operating Temp. *3 (°C) | Holding Temp. : Th *4 (°C) | Maximum Temp. Limit : Tm *5 (°C) | Approved Safety Standards | | | | | | |
|-----------|--------------------------------|--------------------------------------|---------------------------------|-------------------|-----------|----------|---------------------------------|----------------------------|----------------------------------|---------------------------|----|-----|-----|------|-----|---|
| | | | | AC/DC | Volt. (V) | Amp. (A) | | | | | UL | CSA | VDE | BEAB | CCC | |
| EYP2BN082 | N082 | 86 | 82±2 | AC | 250 | 2 | 60 | 60 | 200 | | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 3 | 52 | 56 | | — | ○ | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 4 | 45 | 50 | | — | ○ | ○ | ○ | ○ | ○ | — |
| EYP2BN099 | N099 | 102 | 98 ⁺⁴ ₋₃ | AC | 250 | 2 | 65 | 75 | 200 | | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 3 | 60 | 70 | | — | ○ | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 4 | 55 | 65 | | — | ○ | ○ | ○ | ○ | ○ | — |
| EYP2BN109 | N109 | 114 | 110±3 | AC | 250 | 2 | 80 | 90 | 200 | | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 3 | 76 | 86 | | — | ○ | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 5 | 65 | 74 | | — | ○ | ○ | ○ | ○ | ○ | — |
| EYP2BN110 | N110 | 115 | 110 ⁺³ ₋₂ | AC | 250 | 2 | 80 | 90 | 200 | | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 3 | 76 | 86 | | — | ○ | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 5 | 65 | 74 | | — | ○ | ○ | ○ | ○ | ○ | — |
| EYP2BN127 | N127 | 134 | 129±4 | AC | 250 | 2 | 90 | 100 | 200 | | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 3 | 75 | 90 | | — | ○ | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 4 | 65 | 80 | | — | ○ | ○ | ○ | ○ | ○ | — |
| EYP2BN134 | N134 | 139 | 135±3 | AC | 250 | 2 | 100 | 110 | 200 | | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 3 | 85 | 100 | | — | ○ | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 6 | 60 | 70 | | — | ○ | ○ | ○ | ○ | ○ | — |
| EYP2BN143 | N143 | 145 | 141±2 | AC | 250 | 2 | 110 | 120 | 200 | | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 3 | 105 | 115 | | — | ○ | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 6 | 80 | 90 | | — | ○ | ○ | ○ | ○ | ○ | — |

Note: (1) For long lead types add the letter "L" at the end of the part number.

(2) The information of the Approved Safety Standards is furnished as of Jun. 2010.

Approved Safety Standards File No. UL:E60271, CSA:1687496(LR67163), VDE:481106-1171-0001, BEAB:C1144, CCC:2011010205464841

● F series

| Part No. | Type No. of Approved Standards | Rated Functioning Temp. : Tf *1 (°C) | Functioning Temp. *2 (°C) | Electrical Rating | | | Maximum Operating Temp. *3 (°C) | Holding Temp. : Th *4 (°C) | Maximum Temp. Limit : Tm *5 (°C) | Approved Safety Standards | | | | | | |
|-----------|--------------------------------|--------------------------------------|---------------------------------|-------------------|-----------|----------|---------------------------------|----------------------------|----------------------------------|---------------------------|---------|-----|-----|------|-----|---|
| | | | | AC/DC | Volt. (V) | Amp. (A) | | | | | UL C-UL | CSA | VDE | BEAB | CCC | |
| EYP1BF101 | F101 | 102 | 98±3 | AC | 250 | 1 | 65 | 75 | 200 | | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 2 | 60 | 70 | | — | ○ | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 3.5 | 55 | 65 | | — | ○ | ○ | ○ | ○ | ○ | — |
| EYP1BF115 | F115 | 115 | 110 ⁺³ ₋₂ | AC | 250 | 1 | 80 | 90 | 200 | | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 2 | 76 | 90 | | — | ○ | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 4 | 70 | 80 | | — | ○ | ○ | ○ | ○ | ○ | — |
| EYP1BF134 | F134 | 134 | 129 ⁺⁴ ₋₃ | AC | 250 | 1 | 90 | 105 | 200 | | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 2 | 85 | 100 | | — | ○ | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 4 | 65 | 80 | | — | ○ | ○ | ○ | ○ | ○ | — |
| EYP1BF138 | F138 | 139 | 135±3 | AC | 250 | 1 | 100 | 110 | 200 | | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 2 | 90 | 105 | | — | ○ | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 5 | 65 | 70 | | — | ○ | ○ | ○ | ○ | ○ | — |
| EYP1BF145 | F145 | 145 | 141±2 | AC | 250 | 1 | 110 | 125 | 200 | | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 2 | 110 | 125 | | — | ○ | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 5 | 80 | 95 | | — | ○ | ○ | ○ | ○ | ○ | — |


Note: (1) For long lead types add the letter "L" at the end of the part number.

(2) The information of the Approved Safety Standards is furnished as of Jun. 2010.

Approved Safety Standards File No. UL/C-UL:E60271, CSA:1709436(LR67163), VDE:481106-1171-0003, BEAB:C1133, CCC:2011010205464842

Ratings

● E series


| Part No. | Type No. of Approved Standards | Rated Functioning Temp. : Tf *1 (°C) | Functioning Temp. *2 (°C) | Electrical Rating | | | Maximum Operating Temp. *3 (°C) | Holding Temp. : Th *4 (°C) | Maximum Temp. Limit : Tm *5 (°C) | Approved Safety Standards | | | | | |
|------------|--------------------------------|--------------------------------------|-----------------------------------|-------------------|-----------|----------|---------------------------------|----------------------------|----------------------------------|---|---------|-----|-----|------|-----|
| | | | | AC/DC | Volt. (V) | Amp. (A) | | | |  | UL C-UL | CSA | VDE | BEAB | CCC |
| EYP05BE101 | E101 | 102 | 98±3 | AC | 250 | 0.5 | 65 | 75 | 200 | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 1.5 | 60 | 70 | | — | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 3 | 55 | 65 | | — | ○ | ○ | ○ | ○ | — |
| EYP05BE115 | E115 | 115 | 110±2 | AC | 250 | 0.5 | 80 | 95 | 200 | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 1.5 | 76 | 93 | | — | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 3 | 70 | 84 | | — | ○ | ○ | ○ | ○ | — |
| EYP05BE134 | E134 | 134 | 129 ⁺⁴ / ₋₃ | AC | 250 | 0.5 | 90 | 105 | 200 | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 1.5 | 85 | 100 | | — | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 3 | 70 | 85 | | — | ○ | ○ | ○ | ○ | — |
| EYP05BE138 | E138 | 139 | 135±3 | AC | 250 | 0.5 | 100 | 115 | 200 | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 1.5 | 95 | 110 | | — | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 4 | 65 | 80 | | — | ○ | ○ | ○ | ○ | — |
| EYP05BE145 | E145 | 145 | 141±2 | AC | 250 | 0.5 | 110 | 125 | 200 | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 1.5 | 105 | 125 | | — | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 5 | 80 | 95 | | — | ○ | ○ | ○ | ○ | — |

Note: (1) For long lead types add the letter "L" at the end of the part number.

(2) The information of the Approved Safety Standards is furnished as of Jun. 2010.

Approved Safety Standards File No. UL/C-UL:E60271, CSA:1709439(LR67163), VDE:481106-1171-0002, BEAB:C1139, CCC:2011010205464843

● H series

| Part No. | Type No. of Approved Standards | Rated Functioning Temp. : Tf *1 (°C) | Functioning Temp. *2 (°C) | Electrical Rating | | | Maximum Operating Temp. *3 (°C) | Holding Temp. : Th *4 (°C) | Maximum Temp. Limit : Tm *5 (°C) | Approved Safety Standards | | | | | |
|-----------|--------------------------------|--------------------------------------|-----------------------------------|-------------------|-----------|----------|---------------------------------|----------------------------|----------------------------------|---|---------|-----|-----|------|-----|
| | | | | AC/DC | Volt. (V) | Amp. (A) | | | |  | UL C-UL | CSA | VDE | BEAB | CCC |
| EYP2BH101 | H101 | 102 | 98±3 | AC | 250 | 2 | 65 | 75 | 200 | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 3 | 60 | 70 | | — | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 3.5 | 55 | 65 | | — | ○ | ○ | ○ | ○ | — |
| EYP2BH115 | H115 | 115 | 110±2 | AC | 250 | 2 | 80 | 90 | 200 | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 3 | 76 | 86 | | — | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 3.5 | 74 | 84 | | — | ○ | ○ | ○ | ○ | — |
| EYP2BH134 | H134 | 134 | 129 ⁺⁴ / ₋₃ | AC | 250 | 2 | 90 | 95 | 200 | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 3 | 70 | 85 | | — | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 3.5 | 65 | 80 | | — | ○ | ○ | ○ | ○ | — |
| EYP2BH138 | H138 | 139 | 135±3 | AC | 250 | 2 | 100 | 105 | 200 | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 3 | 80 | 95 | | — | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 3.5 | 75 | 90 | | — | ○ | ○ | ○ | ○ | — |
| EYP2BH145 | H145 | 145 | 141±2 | AC | 250 | 2 | 110 | 125 | 200 | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | AC | 125 | 3 | 100 | 115 | | — | ○ | ○ | ○ | ○ | — |
| | | | | DC | 50 | 4.5 | 85 | 100 | | — | ○ | ○ | ○ | ○ | — |

Note: (1) The information of the Approved Safety Standards is furnished as of Jun. 2010.

Approved Safety Standards File No. UL/C-UL:E60271, CSA:1709435(LR67163), VDE:481106-1171-0004, BEAB:C1140, CCC:2011010205464844

Ratings

● MP series

| Part No. | Rated Functioning Temp. : Tf *1 (°C) | Functioning Temp. *2 (°C) | Electrical Rating | | | Maximum Operating Temp. *3 (°C) | Holding Temp. : Th *4 (°C) | Maximum Temp. Limit : Tm *5 (°C) | Approved Safety Standards |
|--------------|--------------------------------------|----------------------------------|-------------------|-----------|----------|---------------------------------|----------------------------|----------------------------------|---------------------------|
| | | | AC/DC | Volt. (V) | Amp. (A) | | | | UL |
| EYP2MP092AFT | 92 | 88 ⁺³ ₋₄ | DC | 32 | 2 | 55 | 60 | 135 | ○ |
| EYP2MP098AFT | 98 | 94 ⁺³ _{-2.5} | DC | 32 | 2 | 60 | 65 | 135 | ○ |

Note: (1) The information of the Approved Safety Standards is furnished as of Jun. 2010.
Approved Safety Standards File No. UL:E60271

● MU series

| Part No. | Rated Functioning Temp. : Tf *1 (°C) | Functioning Temp. *2 (°C) | Electrical Rating | | | Maximum Operating Temp. *3 (°C) | Holding Temp. : Th *4 (°C) | Maximum Temp. Limit : Tm *5 (°C) | Approved Safety Standards |
|--------------|--------------------------------------|--------------------------------|-------------------|-----------|----------|---------------------------------|----------------------------|----------------------------------|---------------------------|
| | | | AC/DC | Volt. (V) | Amp. (A) | | | | UL |
| EYP4MU092GFD | 92 | 89 ⁺³ ₋₄ | DC | 32 | 4 | 55 | 55 | 135 | ○ |

Note: (1) The information of the Approved Safety Standards is furnished as of Jun. 2010.
Approved Safety Standards File No. UL:E60271

*1 Rated Functioning Temperature (Tf)

The temperature at which a TCO changes its state of conductivity to open circuit with loading detection current only.

Tolerance; $\pm 7^{\circ}\text{C}$
UL, CSA, VDE, BEAB, CCC; -10°C

*2 Functioning Temperature (Fusing-off temperature)

The functioning temperature at which a TCO changes its state of conductivity to open circuit in the ambient air oven which increases temperature by 1 °C per minute and with loading the detective current 0.1 A or less.

*3 Maximum Operating Temperature

The maximum temperature at which a TCO can be maintained while conducting rated current for 1000 h.

For details please refer to specification.

*4 Holding Temperature (Th)

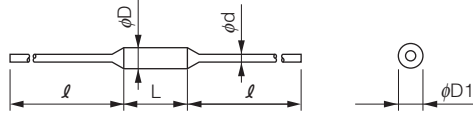
The maximum temperature at which a TCO can be maintained while conducting rated current for 168 h which will not cause a change in state of conductivity to open circuit.

*5 Maximum Temperature Limit (Tm)

The maximum temperature at which a TCO can maintains its mechanical and electrical properties without closing again for 10 minutes after a TCO has changed its state of conductivity.

Dimensions in mm (not to scale)

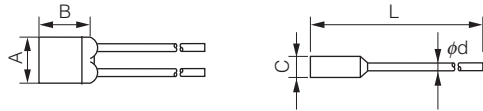
● Axial lead type



| | Dimensions (mm) | | | | |
|----------|-----------------|--|-----------|--------------|-----------|
| | L | ϕD | $\phi D1$ | l | ϕd |
| N Series | 9.0±1.0 | 2.5±0.2 | 3 max. | 38±3 (*78±3) | 0.60±0.05 |
| F Series | 6.0±1.0 | 1.85 ^{+0.20} _{-0.15} | 2.2 max. | 38±3 (*68±3) | 0.53±0.02 |
| E Series | 5.0±0.5 | 1.5±0.1 | 1.8 max. | 38±3 (*68±3) | 0.53±0.02 |

(*) For long lead types add the letter "L" at the end of the part number.

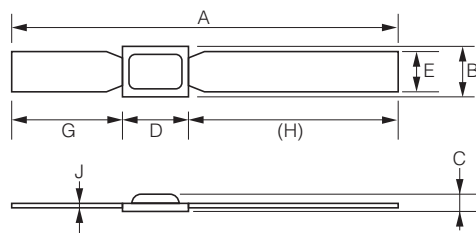
● Radial lead type



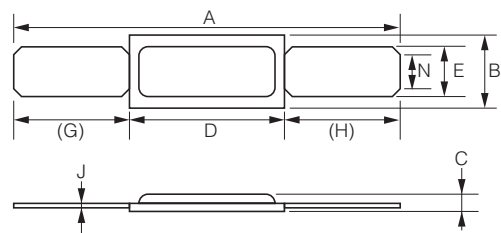
| | Dimensions (mm) | | | | |
|----------|-----------------|---------|---------|------|-----------|
| | A | B | C | L | ϕd |
| H Series | 5.0±0.5 | 4.0±0.5 | 2.2±0.3 | 55±3 | 0.53±0.02 |

● Thin type

EYP2MP□□□AFT



EYP4MU□□□GFD



| | Dimensions (mm) | | | | | | | | | |
|--------------|-----------------|---------|-----------|----------|---------|---------|--------|-----------|---------|--|
| | A | B | C | D | E | G | (H) | J | N | |
| EYP2MP□□□AFT | 24.5±0.5 | 2.7±0.2 | 0.64±0.15 | 4.2±0.5 | 2.3±0.2 | 7.9±0.5 | (12.4) | 0.10±0.02 | - | |
| EYP4MU□□□GFD | 26.5±0.5 | 4.5±0.4 | 1.00±0.15 | 10.5±0.5 | 3.0±0.2 | (8.0) | (8.0) | 0.15±0.02 | 1.8±0.5 | |

Marking

The following items are indicated on TCO.

- N, F, E, H Series : Type No., Date Code, Trade Mark, <PS>E Mark, JET, Rated Functioning Temperature, Rated Current
- MP, MU Series : Type No., Date Code, Trade Mark

Packaging Methods

| Part No. | Standard Quantity | Style | Mass (Weight) [mg/pc.] |
|--------------|-------------------|-------|------------------------|
| EYP2BN□□□ | 2,000 pcs./Box | Bulk | 340 |
| EYP2BN□□□L | 2,000 pcs./Box | | 510 |
| EYP1BF□□□ | 3,000 pcs./Box | | 220 |
| EYP1BF□□□L | 4,000 pcs./Box | | 330 |
| EYP05BE□□□ | 4,000 pcs./Box | | 210 |
| EYP05BE□□□L | 5,000 pcs./Box | | 320 |
| EYP2BH□□□ | 1,500 pcs./Box | | 350 |
| EYP2MP□□□AFT | 2,000 pcs./Box | | 54 |
| EYP4MU□□□GFD | 1,000 pcs./Box | | 130 |

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<Regarding the Certificate of Compliance with the EU RoHS Directive/REACH Regulations>

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⚠ Safety Precautions (Handling Precautions)

The following are precautions for individual products. Please also refer to the common precautions for fuses in this catalog.

● Design Applications

1. Use the TCO within their specified temperature and electrical ratings.
 - 1) Use the TCO under the maximum operating temperature specified in the individual specification.
Using the TCO under a higher temperature than the maximum operating temperature may cause premature opening or opening delay.
 - When the TCO is continuously used at the temperature close to the functioning temperature, the TCO may operate while being used.
 - When the TCO is continuously used at the temperature higher than the maximum operation temperature, the TCO may be degraded and may not operate normally at the specified temperature.
 - 2) The holding temperature is defined as the highest temperature at which the TCO is activated continuously at the rated current for 168 hours. The TCO can not be used over 168 hours exceeding the holding temperature.
 - 3) Equipment should be designed so that its over shoot does not exceed the maximum temperature limit after the TCO operates.
 - 4) If the TCO is activated by voltage higher than the rated voltage or current higher than the rated current, the TCO produces excessive heat, resulting in premature opening. The arc generated in such operating conditions will result in abnormal appearance (crack on body) and insufficient insulation.
 - When TCO is operated in an abnormal mode while the rated voltage and/or the rated current being exceeded, it may not cut off the circuit.
 - 5) Thermal element may be transformed and TCO may open when it is used in the environment from which an excessive temperature change (such as outdoor) is repeated. Investigate the environment where TCO is used.
 - 6) Where transient overload is expected to be applied, repeat the tests under the worst conditions.
 - 7) The TCO cannot be used as a current sensitive fuse.
2. To fully use the function of the TCO, a suitable TCO for each equipment application must be selected.
 - 1) Tests should be repeated for the finished equipment to confirm that the TCO does operate as expected.
 - 2) To improve thermal response of the TCO, put the main body of the TCO and the lead wires(terminals) as close to the heat source as possible and the place where the TCO is evenly heated.
If the temperatures transferred to the main body and to the lead wires(terminals) are largely different from each other, defective operation may occur, causing arcing and deterioration of insulation.
3. Avoid application of excessive vibration and mechanical stress to the TCO. Otherwise, failure of the fusible alloy or lead wires, or damage to the main body may occur.
4. The following 1) and 2) are precautions for thin type TCO (MP and MU series)
 - 1) TCO body and terminals must be properly fixed when the TCO is mounted in the equipment. It may cause breaking of thermal element and/or terminals, or damages of the TCO body, or other failure when the body or terminals is not properly connected. Avoid a transport under the condition with a connection only a single side of terminal and the equipment as it might cause breaking of thermal element and/or terminals, or damages of the TCO body, or other failure due to the vibration or mechanical stress on the transportation.
 - 2) When TCO is mounted in the equipment, terminals must be aligned with the body. If TCO body and terminals are mutually mounted askew, it might cause breaking of thermal element and/or terminals. Also after assembling TCO in the equipment, avoid pulling, bending, pushing stress and twisting stress in the TCO body and terminals in order not to cause breaking of thermal element and/or terminals, or damages of the TCO body.
5. When sealing the TCO with resin, select a resin that does not corrode the seals or the lead wires(terminals). When sealing the overall TCO with resin, determine the fixing conditions by repeating the test using your final product to check whether or not the resin properties (e.g. expansion, contraction, and curing temperature) affect the TCO and whether or not the TCO can operate normally.
6. When immersing equipment with a TCO in varnish or solvent and then drying it, repeat the test to check whether or not the varnish or solvent used dissolved the coating of the TCO or caused damage, such as cracks, before performing the treatment again.
7. Do not use under the following environments.
 - 1) In liquids such as water, oil, chemical and organic solvents
 - 2) In direct sunlight, outdoors or in dusty atmospheres
 - 3) In places where water condensation occurs
 - * Use in the following environments may affect the performance of the TCO; Verify performance and reliability before production use.
 - (1) In places full of corrosive gases such as sea breeze, Cl₂, H₂S, NH₃, SO₂ and NO₂
 - (2) In environments with high static electricity and/or strong electromagnetic waves.
8. Do not use the TCO in aerospace equipment, atomic energy equipment, military weapons, life saving equipment, automobile, etc.

● **Instruction**

1. Forming and Cutting

- 1) Lead wires (terminals) are to be bent or cut at least 3 mm away from the TCO seals to avoid damaging the TCO (axial / radial type) or body (thin type). The TCO seals (axial / radial type) shall not be grasped with any tools or holders. Terminals of thin type TCO are to be grasped before they are bent. (See Fig.1)
- 2) The lead wires and terminals shall not be nicked, fractured or burned. The body and/or seals must not be damaged, burned or overheated.
- 3) It is recommended that experimental assembly trials, should be done so that it can be verified that manufacturing procedures will not exceed the maximum tested "pull" and "push" forces of 20 N (MP series: 5 N, MU series: 10 N) and 5 N respectively on the lead wires (terminals), or induce excessive twisting.
- 4) Do not repeat bending terminals of thin type TCO.

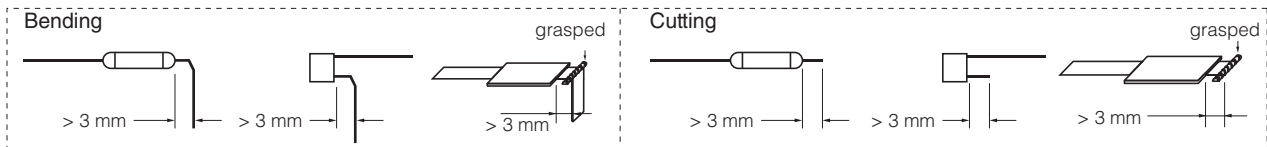


Fig-1

2. Soldering, Welding, Calking

- 1) Lead wires are to be soldered with the standard conditions shown in Table 1. Excessive soldering heat and soldering time may cause damage to a TCO. If higher temperature, longer time or shorter lead length exist rather than the conditions of Table 1, it is recommended to run tests for finding the soldering conditions that do not damage the TCO. Also, use of tools such as pliers are recommended to dissipate the soldering heat by grasping lead wires between the TCO body and soldering point.
- 2) Avoid preheating and gradual cooling as much as possible. However if preheating and gradual cooling is done, set the process conditions after confirming that the TCO is not affected by these procedures.
- 3) Do not use reflow soldering.
- 4) Thin type (MP and MU series) is not to be soldered.
- 5) If water or solvent is used for cleaning flux after soldering, check and confirm the reliability of the agent.
- 6) Lead wires are to be clamped at least 3 mm away from the seals. Improper connections may cause damage to the seals or other parts and may result in nuisance tripping of the devices due to the generation of excessive heat at a faulty high resistance junction.
- 7) Set the conditions for welding and calking only after checking contact resistance and connection strength.
- 8) When resoldering or rewelding, cool the TCO under room conditions.
- 9) When the TCO is heated by soldering or welding, be careful not to pull, push or twist the TCO lead wires.

Table-1 Soldering Conditions

| Temperature of Soldering: 300 °C Time: 3 s | | | | |
|--|------------------|------------------------|------------------|------------------|
| Lead Length (ℓ) | Type No. | | | |
| 30 mm | | F101 | E101 | H101 |
| 25 mm | N082, N099 | | E115, E134, E138 | H115, H134, H138 |
| 20 mm | N109, N110 | F115, F134, F138, F145 | E145 | H145 |
| 15 mm | N127, N134, N143 | | | |

● Soldering point

3. Sufficiently flexible, appropriate free length and proper size wire should be used for splice connection. Connection including connectors used for splicing shall be of the low resistance type, and they shall be made mechanically secure.
4. Where the lead wires of the TCO is tied with string, put them at least 10 mm apart from the seals of the main body of the TCO.
5. Quality control notes
 - 1) Measurement of resistance between lead wires (terminals) and checking of the internal status with X-rays are effective means to confirm the status of the TCO on delivery and after mounting in the equipment.
6. Storage method
 - 1) Store the TCO in packing cases or in polyethylene bags within the temperature range -10 °C to +40 °C and RH of 30 % to 75 %. Store them at a location where no rapid changes of temperature or humidity or no direct sunlight is applied. The location must also be free from vibration and shock .
 - 2) Avoid storage in places containing corrosive gases such as sea breeze, Cl₂, H₂S, NH₃, SO₂ and NO₂.
 - 3) The period of guarantee for performance such as solderability is for one year after our delivery; and this condition applies only where the storage method specified in above has been followed.
7. Do not repair a TCO. Replace it with a new part.

⚠ Safety Precautions (Common precautions for Fuses)

- When using our products, no matter what sort of equipment they might be used for, be sure to make a written agreement on the specifications with us in advance. The design and specifications in this catalog are subject to change without prior notice.
- Do not use the products beyond the specifications described in this catalog.
- This catalog explains the quality and performance of the products as individual components. Before use, check and evaluate their operations when installed in your products under the actual conditions for use.
- Install the following systems for a failsafe design to ensure safety if these products are to be used in equipment where a defect in these products may cause the loss of human life or other significant damage, such as damage to vehicles (automobile, train, vessel), traffic lights, medical equipment, aerospace equipment, electric heating appliances, combustion/gas equipment, rotating equipment, and disaster/crime prevention equipment.
 - * Systems equipped with a protection circuit and a protection device.
 - * Systems equipped with a redundant circuit or other system to prevent an unsafe status in the event of a single fault.
 - * Systems equipped with an arresting the spread of fire or preventing glitch.

(1) Precautions for use

- These products are designed and manufactured for general and standard use in general electronic equipment (e.g. AV equipment, home electric appliances, office equipment, information and communication equipment). For applications in which special quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or cause threat of personal injury (such as for aircraft and aerospace equipment, traffic and transport equipment, combustion equipment, medical equipment, accident prevention and anti-theft devices, and safety equipment), please be sure to consult with our sales representative in advance and to exchange product specifications which conform to such applications.
- These products are not intended for use in the following special conditions. Before using the products, carefully check the effects on their quality and performance, and determine whether or not they can be used.
 1. In liquid, such as water, oil, chemicals, or organic solvent.
 2. In direct sunlight, outdoors, or in dust.
 3. In salty air or air with a high concentration of corrosive gas, such as Cl_2 , H_2S , NH_3 , SO_2 , or NO_3 .
 4. Electric Static Discharge (ESD) Environment.

These components are sensitive to static electricity and can be damaged under static shock (ESD). Please take measures to avoid any of these environments.
Smaller components are more sensitive to ESD environment.
 5. Electromagnetic and Radioactive Environment.

Avoid any environment where strong electromagnetic waves and radiation exist.
 6. In an environment where these products cause dew condensation.
 7. Sealing or coating of these products or a printed circuit board on which these products are mounted, with resin or other materials.
- These products generate Joule heat when energized. Carefully position these products so that their heat will not affect the other components.
- Carefully position these products so that their temperatures will not exceed the category temperature range due to the effects of neighboring heat-generating components. Do not mount or place heat-generating components or inflammables, such as vinyl-coated wires, near these products.
- Note that non-cleaning solder, halogen-based highly active flux, or water-soluble flux may deteriorate the performance or reliability of the products.
- Carefully select a flux cleaning agent for use after soldering. An unsuitable agent may deteriorate the performance or reliability. In particular, when using water or a water-soluble cleaning agent, be careful not to leave water residues. Otherwise, the insulation performance may be deteriorated.
- Do not apply flux to these products after soldering. The activity of flux may be a cause of failures in these products.
- Refer to the recommended soldering conditions and set the soldering condition. High peak temperature or long heating time may impair the performance or the reliability of these products.
- Recommended soldering condition is for the guideline for ensuring the basic characteristics of the products, not for the stable soldering conditions. Conditions for proper soldering should be set up according to individual conditions.

- Do not reuse any products after removal from mounting boards.
- Do not drop these products. If these products are dropped, do not use them. Such products may have received mechanical or electrical damage.
- If any doubt or concern to the safety on these products arise, make sure to inform us immediately and conduct technical examinations at your side.

(2) Precautions for storage

The performance of these products, including the solderability, is guaranteed for a year from the date of arrival at your company, provided that they remain packed as they were when delivered and stored at a temperature of 5 °C to 35 °C and a relative humidity of 45 % to 85 %.

The performance of Thermal Cutoffs is guaranteed for a year after our delivery, provided that they are stored at a temperature of -10 °C to +40 °C and a relative humidity of 30 % to 75 %.

Even within the above guarantee periods, do not store these products in the following conditions.

Otherwise, their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.

1. In salty air or in air with a high concentration of corrosive gas, such as Cl₂, H₂S, NH₃, SO₂, or NO₂.
2. In direct sunlight.

<Package markings>

Package markings include the product number, quantity, and country of origin.

In principle, the country of origin should be indicated in English.