NEC

# Thermal Cutoff SEFUSE™

# SF/E SERIES

## ORGANIC THERMAL SENSITIVE PELLET TYPE
## 10 AMPERES RATED CURRENT

NEC's thermal cutoff SE/E series is small, solid and reliable product which can be used under 10 amperes of rated current. It protects home appliances and industrial equipment from fire by opening of electrical circuit if it senses an abnormal temperature rise.

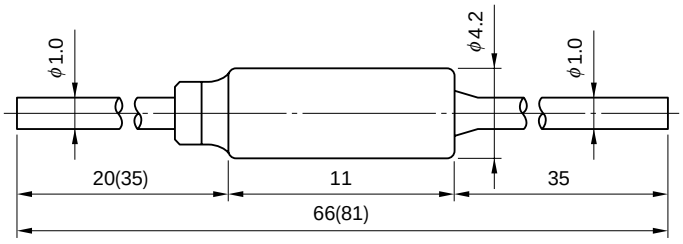
### FEATURES

- ○ Approved by UL(USA), CSA(Canada), VDE(Germany), BEAB(UK), and MITI(Japan)
- ○ Single operation
- ○ Compact, durable and reliable by hermetic seal structure
- ○ Excellent sensitive to abnormal temperature rise and high accuracy in operation
- ○ Stable characteristics in a long-term
- ○ Capable of opening at large cutoff current of AC 10 amperes

### APPLICATIONS

Electric home appliances
Electric industeial equipments
Office automation equipments
Plain paper copiers
Transformers
Motors, etc.

### OUTLINE DIMENSIONS (mm)




**Note:** Dimensions in ( ) are for long lead devices.

**The information in this document is subject to change without notice.**

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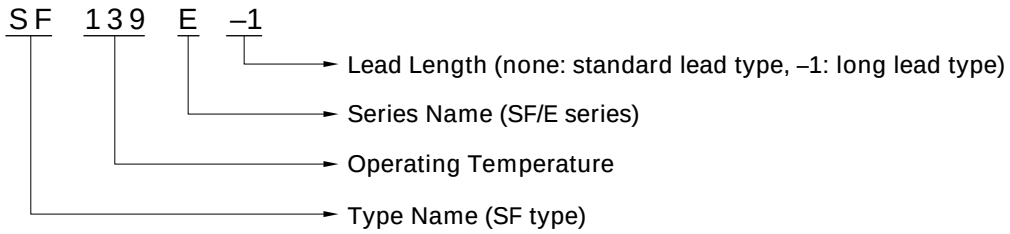
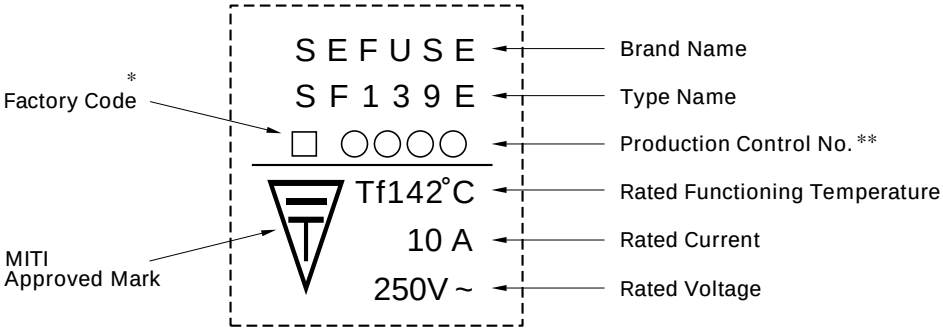
## TYPE NAME DESIGNATION



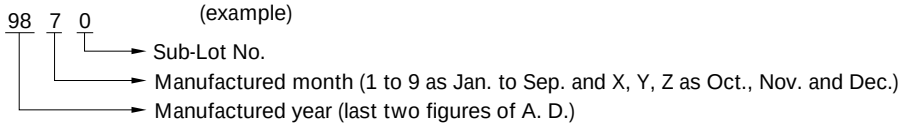

## MARKING




∗ Factory Code represents the manufactured placce as shown below.
Japan : none, Thailand : B

∗∗ Designation of Production Control No.

(example)



## STANDARD RATINGS

| Type Name | Rated Functioning Temperature | Operating Temperature | $T_H$ $T_h$ $T_C$ | $T_M$ Tm | Rated Current 3) | Rated Voltage 3) | Safety Standard | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | UL | CSA | VDE | BEAB | ▽ made in Japan | ▽ made in Thailand |
| SF70E | 73 ˚C | 70±2 ˚C | 45 ˚C | 150 ˚C | 10 Aac (Resistive) | 250 Vac (Resistive) | E71747 | LR 52330 | 6778.2 –4510– 1008 | C0623 | 33–312 | 33–835 |
| SF76E | 77 ˚C | $76^{0}_{\pm 4}$ ˚C | 51 ˚C | 150 ˚C | | | | | | | | |
| SF91E | 94 ˚C | $91^{3}_{\pm 1}$ ˚C | 66 ˚C | 150 ˚C | | | | | | | 33–331 | 33–834 |
| SF96E | 99 ˚C | 96±2 ˚C | 71 ˚C | 150 ˚C | | | | | | | | |
| SF109E | 113 ˚C | $109^{3}_{\pm 1}$ ˚C | 84 ˚C | 150 ˚C | | | | | | | 33–332 | 33–833 |
| SF119E | 121 ˚C | 119±2 ˚C | 94 ˚C | 150 ˚C | | | | | | | 33–333 | 33–832 |
| SF129E | 133 ˚C | 129±2 ˚C | 104 ˚C | 159 ˚C | | | | | | | | |
| SF139E | 142 ˚C | 139±2 ˚C | 114 ˚C | 159 ˚C | | | | | | | 33–334 | 33–831 |
| SF152E | 157 ˚C | 152±2 ˚C | 127 ˚C | 172 ˚C | | | | | | | | |
| SF169E | 172 ˚C | $169^{1}_{\pm 3}$ ˚C | 144 ˚C | 189 ˚C | | | | | | | 33–335 | 33–830 |
| SF188E | 192 ˚C | $188^{3}_{\pm 1}$ ˚C | 164 ˚C | 300 ˚C | | 4) | | | | | 33–336 | |
| SF214E | 216 ˚C | $214^{1}_{\pm 3}$ ˚C | 189 ˚C | 350 ˚C | | | | | | | 33–549 | 33–827 |
| SF226E | 227 ˚C | $226^{1}_{\pm 3}$ ˚C | 190 ˚C | 2) | | | | | | | 33–354 | 33–828 |
| SF240E | 240 ˚C | 237±2 ˚C | 190 ˚C | 350 ˚C | | | | | | | | |

**Notes :** 1) The type are for standard lead. When long lead type is required, add "–1" at the end of type name.

2) The maximum temperature limit of SF226E is partially approved as shown below.

RECOGNIZED MAXIMUM TEMPERATURE LIMIT OF SF226E

| | UL | CSA | VDE | BEAB |
|---|---|---|---|---|
| SF226E | 240˚C * | 330˚C | 300˚C | 300˚C |

* Under application to increase to 300˚C

3) The additional electrical ratings are recognized by UL and CSA as follows.

UL : 277 Vac / 15 A (Resistive), 240 Vac / 15 A (Resistive), 120 Vac / 15 A (Resistive, Inductive),

CSA : 250 Vac max. / 15 A max. (Resistive, Inductive)

4) SF169E, SF188E, SF214E, SF226E and SF240E are recognized the Conductive Heat Aging Test (CH-ratings) of UL.

# Definition of Terms

- **Rated Functioning Temperature**

  Rated functioning temperature is the operating temperature of thermal cutoffs, measured using the method specified in the safety standard. In Electrical Appliance and Material Control Law of Japan, case operation should be within the specified operating temperature range of ± 7 ˚C. In standards that comply with the IEC standard (such as UL, CSA, VDE, BEAB), it is called the rated functioning temperature, and should operate within the prescribed temperature range of +0/–10 C.

  It is represented by the symbol TF in the UL standard, and by the symbol Tf in the CSA, VDE and BEAB standards.

  In SEFUSE, a temperature that complies with both standards is set as the rated functioning temperature, and is indicated on the body of the thermal cutoff.

- **Operating Temperature**

  Operating temperature is the operating temperature range when the thermal cutoff is made to operate inside a constant temperature oven whose temperature is raised at the rate of 1 ˚C/min. while a detection current of 100 mA or lower is applied.

  The operating temperature is a standard set by NEC and is not specified by a safety standard.

- **TH, Th. Tc (Holding Temperature)**

  Holding temperature is the maximum temperature at which, when applying a rated current to the thermal cutoff, the state of conductivity is not changed during 168 hours.

  It is represented by the symbol TH in the UL standard, Th in the CSA standard, and Tc in the VDE and BEAB standards.

- **TM, Tm (Maximum Temperature Limit)**

  Maximum temperature limit is the maximum temperature for which conductivity does not occur again after thermal cutoff operation.

  It is represented by the symbol TM in the UL standard and by Tm in the CSA, VDE and BEAB standards.

- **Rated Current**

  Maximum alternating current that can pass through the thermal cutoff and that the thermal cutoff can cut off in safety and reliability.

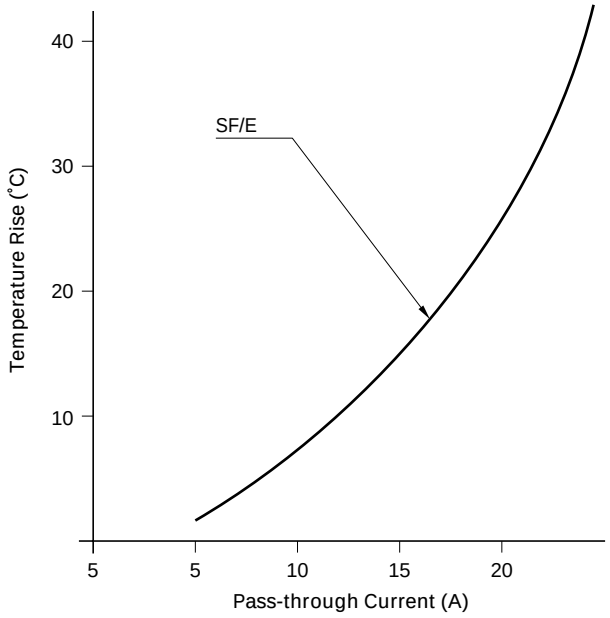
- **Rated Voltage**

  Maximum circuit voltage that the thermal cutoff can cut off in safety and reliability.

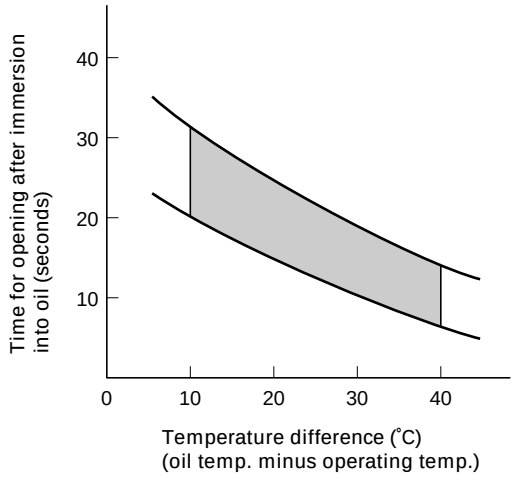
# Performance Data

## SF/E Series

### Temperature Rise



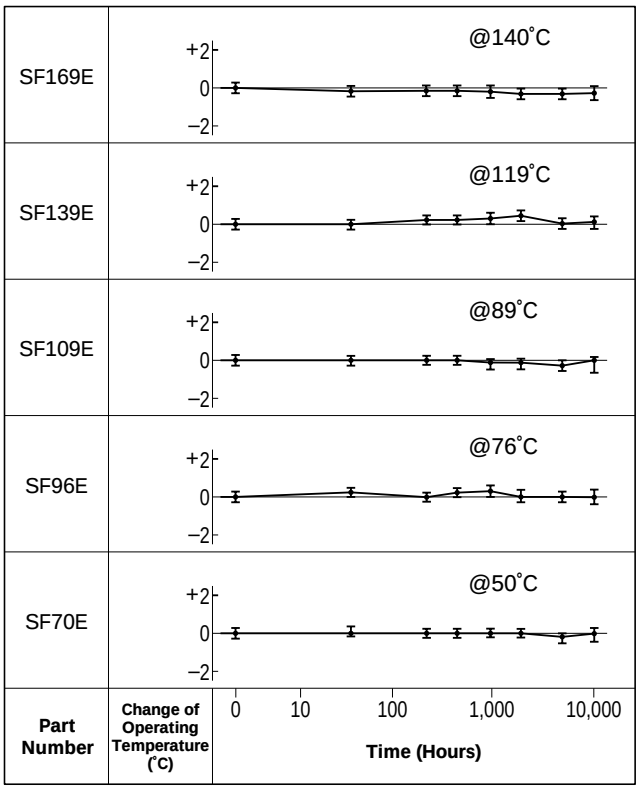

### Response Time




### Initial Characteristics

| Part Number | Operating Temperature (˚C) | Insulation Resistance after Operation (MΩ) | Withstand Voltage after Operation (kV) | Internal Resistance (mΩ/25 mm) |
|---|---|---|---|---|
| SF169E | 169 / 168 / 167 | $10^6$ / $10^5$ / $10^4$ | 2.0 / 1.5 / 1.0 | 1.5 / 1.0 / 0.5 |
| SF139E | 140 / 139 / 138 | $10^6$ / $10^5$ / $10^4$ | 2.0 / 1.5 / 1.0 | 1.5 / 1.0 / 0.5 |
| SF109E | 112 / 111 / 110 | $10^6$ / $10^5$ / $10^4$ | 2.0 / 1.5 / 1.0 | 1.5 / 1.0 / 0.5 |
| SF96E | 97 / 96 / 95 | $10^6$ / $10^5$ / $10^4$ | 2.0 / 1.5 / 1.0 | 1.5 / 1.0 / 0.5 |
| SF70E | 71 / 70 / 69 | $10^6$ / $10^5$ / $10^4$ | 2.0 / 1.5 / 1.0 | 1.5 / 1.0 / 0.5 |

### High Temperature Storage Test




**Note** : The values following @ are the storage temperature.

# Cautions

This section describes cautions designed to protect the performance of the thermal cutoff, Be sure to read and fully understand these cautions.

To obtain full performance from the thermal cutoff, it is necessary for the customer to appropriately store the thermal cutoff, design appropriate circuits for the application, and perform evaluations, mounting and testing as necessary. Problems arising from the inappropriate execution of the above are the responsibility of the customer, and NEC declines any and all responsibility.

## Design Cautions

- Do not use this device for any purpose other than as a thermal cutoff.
  The thermal cutoff is designed to detect abnormal rises in temperature and break circuits if needed. It is not a current fuse that cuts excess current. If used as a current fuse, the SEFUSE may malfunction.

- Do not use this device in aerospace equipment, aeronautical equipment, nuclear reactor control systems, life support equipment or systems, transportation machinery engine control or safety-related equipment.
  This device is designed for use in household electric appliance, office automation equipment, audio and video equipment, computer communications equipment, test and measurement equipment, personal electronic equipment and transportation equipment (excluding engine control).

- The customer should select the proper thermal cutoff device, mounting location, and mounting method as appropriate for each application.
  Verify whether the chosen selections are appropriate by repeatedly testing the final design for thermal cutoff under normal conditions as well as under predicted maximum abnormal conditions.

- Make designs so that the temperature of the body of the thermal cutoff does not exceed the temperatures shown in Table 1.
  If, the temperature is exceeded on a regular basis, the thermal cutoff may start operating only at temperatures lower than the normal operating temperature. Malfunctions may also occur. Even if the thermal cutoff's operating temperature is exceeded, it may malfunction.

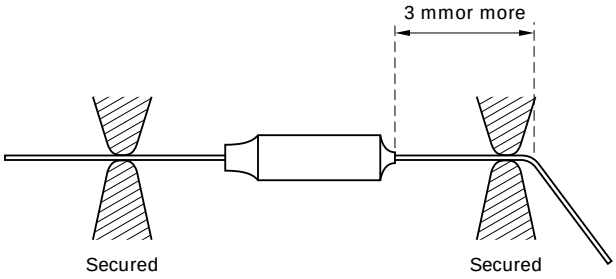
| Type | Body Temperature |
|---|---|
| SF 70E | 50˚C |
| SF 76E | 56˚C |
| SF 91E | 71˚C |
| SF 96E | 76˚C |
| SF109E | 89˚C |
| SF119E | 99˚C |
| SF129E | 109˚C |
| SF139E | 119˚C |
| SF152E | 132˚C |
| SF169E | 140˚C |
| SF188E | 140˚C |
| SF214E | 140˚C |
| SF226E | 140˚C |
| SF240E | 140˚C |

**Table 1.**

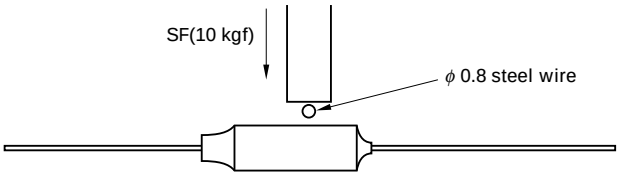
- The body temperature of the thermal cutoff becomes higher as current passes through and might rise higher than the ambient operating temperature (see test data). The temperature may rise even higher depending on the mounting method and other conditions. Therefore, after mounting the thermal cutoff under the same conditions you would use for the actual application, work the final product and measure the body temperature of the thermal cutoff.
- Use the thermal cutoff with a voltage and current level lower than the rated level.
  If the thermal cutoff is used with a voltage or current level higher than the rated level, contacts may melt causing the fuse to malfunction.
- Do not use the thermal cutoff in water, organic solvents or other liquids, or environments containing sulfurous acid gas, nitrous acid gas, or high humidity. Doing so will cause deterioration of the sealing resin, the thermal cutoff may operate at lower than operating temperature, or any other malfunctions may occur. Also, the thermal cutoff may not operate even if its operating temperature is exceeded.

### Lead wire process

- When bending the lead wire, in order to protect the resin seal from excessive pressure, secure the lead wire close to the case and bend the part beyond the secured section.




  The lead wire should be bent at a distance 3 mm or more from the body of the fuse, and should not be twisted.
- The tensile strength applied to the lead wire should be 5 kg or less.
- The strength applied to the body of the thermal cutoff should be 10 kg or less.



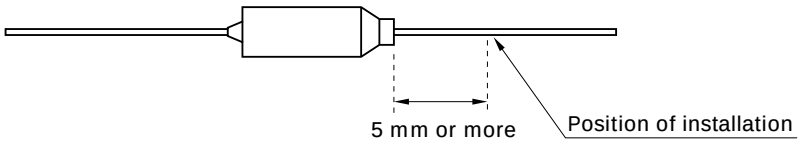

  Deformation of the case may change the location of the moving electrode during operation and may cause the thermal cutoff to operate only at temperatures lower than the normal operating temperature range. The thermal cutoff also may not operate even if the thermal cutoff's operating temperature is exceeded.

### Mounting

SEFUSE can be mounted by soldering, caulking, or welding.

- If soldering, note that the thermal cutoff may not function because of excessive solder temperature.
  To prevent such malfunctions, you can hold the lead near the case using a tool and solder for short intervals at a time, allowing the heat to escape.
  Another effective method is to use a lower solder temperature and to solder at a location that is distant from the case.
- If caulking or welding, be careful to keep the resistance value of the connecting section low.
  If the connecting section has a high resistance value, the passing current may generate an abnormally high temperature that will cause the thermal cutoff to operate (break the circuit).

- It is recommended that the connecting position at the lead of resign-sealed side should be 5 mm or more from the body of the thermal cutoff.




- After mounting the thermal cutoff, be careful not to apply force that may pull, push or twist the lead wires.
- When using an SF type with lead forming, be sure not to make the lead on the resin-sealed side touch the case. This would cause the current to flow from the lead on the resin-sealed side to the opposite lead so that the thermal cutoff cannot break the circuit.
  Note that the body of the SF type is the same in potential as the circuit. Therefore, it must be electrically isolated from the other metalic part.

### Storage

- The body and lead A are silver-plated. Therefore, these parts may discolor because of sulfuration. In the case, the marking of the body will become difficult to discriminate or the solder-ability of lead will decline. To avoid this, the SEFUSE should not keep around materials (such as cardboard or rubber, etc.) which generate sulfurous acid gas.
- When the SEFUSE have to be storaged in a cardboard box, the SEFUSE's packs should be put into other bags (such as polyethylene) and make sure the packs seal.

### Recommendation

- Be careful when mounting the thermal cutoff because external force, heat, or a harmful atmosphere (containing excessive humidity or sulfurous acid gas) may damage the characteristics of the thermal cutoff. If applicable, it is recommended to warn general consumers who are not aware of the usage cautions for the thermal cutoff not to mount, remove or replace the thermal cutoff through a note to this effect in the user's manual and other related material.

**If you desire any clarifications or explanations regarding these cautions, please call an NEC sales representative.**

**The values contained in this document were obtained under certain testing conditions at NEC. They are not guaranteed and are for reference only.**