NEC / SCHOTT

SEFUSE Thermal Cutoff

NEC SCHOTT Components' SEFUSE is a thermal cutoff designed to protect domestic electrical appliances and industrial electrical equipment from fire. Cutoff occurs and electrical circuit opens when ambient temperature increases to an abnormal level.

SEFUSE is a reliable thermal protection device recognized by many international safety standards and is manufactured in a factory-certified by the International Standards Organization (ISO) for the ISO9001 quality standard.

We provide two types of SEFUSE SF type that uses an organic materials as thermal pellet and SM type that uses fusible alloy.

Application

- **Home Appliances....** ***Irons, Coffee makers, Rice cookers, Bread makers, Toasters, Refrigerators***
- **Comfort Conditioning Appliances....** ***Air conditioners, Fans, Humidifiers, Heaters***
- **Personal Care Appliances....** ***Hair dryers, Hair curlers, Hair setters, shavers***
- **Business Appliances....** ***Copiers, Laser printers, Facsimiles, Power strips***
- **Electric Components....** ***Transformers, solenoids, AC adopters, Li-ion battery***

Features

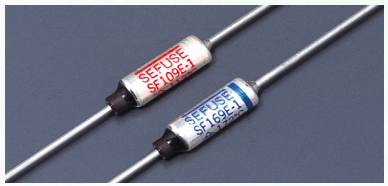
- Excellently sensitive to abnormal temperature rise due to small size
- Reliable and accurate by resin-sealed construction
- One shot operation
- Wide choice of types to suit the application (SF or SM)
- Meets many international safety standards
- Some types of the SEFUSE are complying with the directive on WEEE (ROHS).

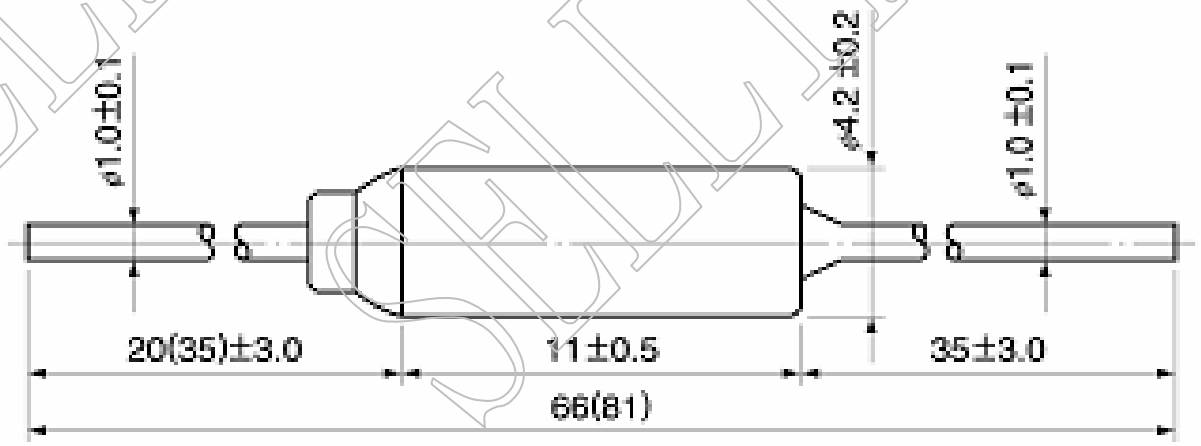
Standard Rating

Electrical Ratings			Opening Temperature	Standard	Series
AC/DC	Current	Voltage			
AC	0.5A	250V	100° C~151° C	UL,CSA,VDE,BEAB,CCC,PSE	SM/G series(AC)
	1A		87° C~151° C	UL,CSA,VDE,BEAB,CCC,PSE	SM/B series(AC)
	2A		76° C~187° C	UL,CSA,VDE,BEAB,CCC,PSE	SM/A series(AC)
	6A		73° C~192° C	UL,cUL,VDE,BEAB,PSE	SF/K series
	10A		73° C~240° C	UL,CSA,VDE,BEAB,CCC,PSE	SF/E series
	15A		73° C~240° C	PSE,(UL),CCC	SF/Y series
DC	3A~5A	50V	100° C~151° C	UL,VDE	SM/G series(DC)
	3.5A~6A		87° C~151° C	UL,VDE	SM/B series(DC)
	3A~7A		76° C~187° C	UL,VDE	SM/A series(DC)

SF/E series

A、Outline dimension (unit:mm)





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

B、Standard rating

Type Name 1)	Rated Functioning Temperature TF.Tf (° C)	Operating Temperature (° C)	TH Th Tc (° C)	TM Tm (° C)	Rated Current	Rated Voltage	PSE	UL	CSA	VDE	BEAB	CCC
SF70E	73	70±2	58	150	15A/10A 3)	250V (AC)	5)	5)	5)	5)	5)	5)
SF76E	77	76+0/-4	62									
SF91E	94	91+3/-1	79									
SF96E	99	96±2	84									
SF109E	113	109+3/-1	98									
SF119E	121	119±2	106									
SF129E	133	129±2	118	159								
SF139E	142	139±2	127									
SF152E	157	152±2	142	172				4)5)				
SF169E	172	169+1/-3	157	189								
SF188E	192	188+3/-1	177	300								
SF214E	216	214+1/-3	200	350								
SF226E	227	226+1/-3		2)								
SF240E	240	237±2		350								

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

TMTm	UL	CSA	VDE	BEAB	CCC
SF226E	240° C	330° C	300° C		

3）、The electrical ratings by safety standard are as follows.

Rated Voltage	UL	CSA	VDE	BEAB	CCC	PSE
AC120V	15A(Inductive)					
	15A(Resistive)					
	20A(Resistive)					
AC240V	15A(Resistive)					
AC250V	10A(Resistive)		10A	10A	10A	10A
	15A(Resistive)	15A(Inductive)	15A	15A	15A	
		15A(Resistive)				
	17A(Resistive)					
AC277V	15A(Resistive)					

4）、 SF169E, SF188E, SF214E, SF226E and SF240E have recognition of CH rating by UL.

5）、o means “approved”.

C、Structure

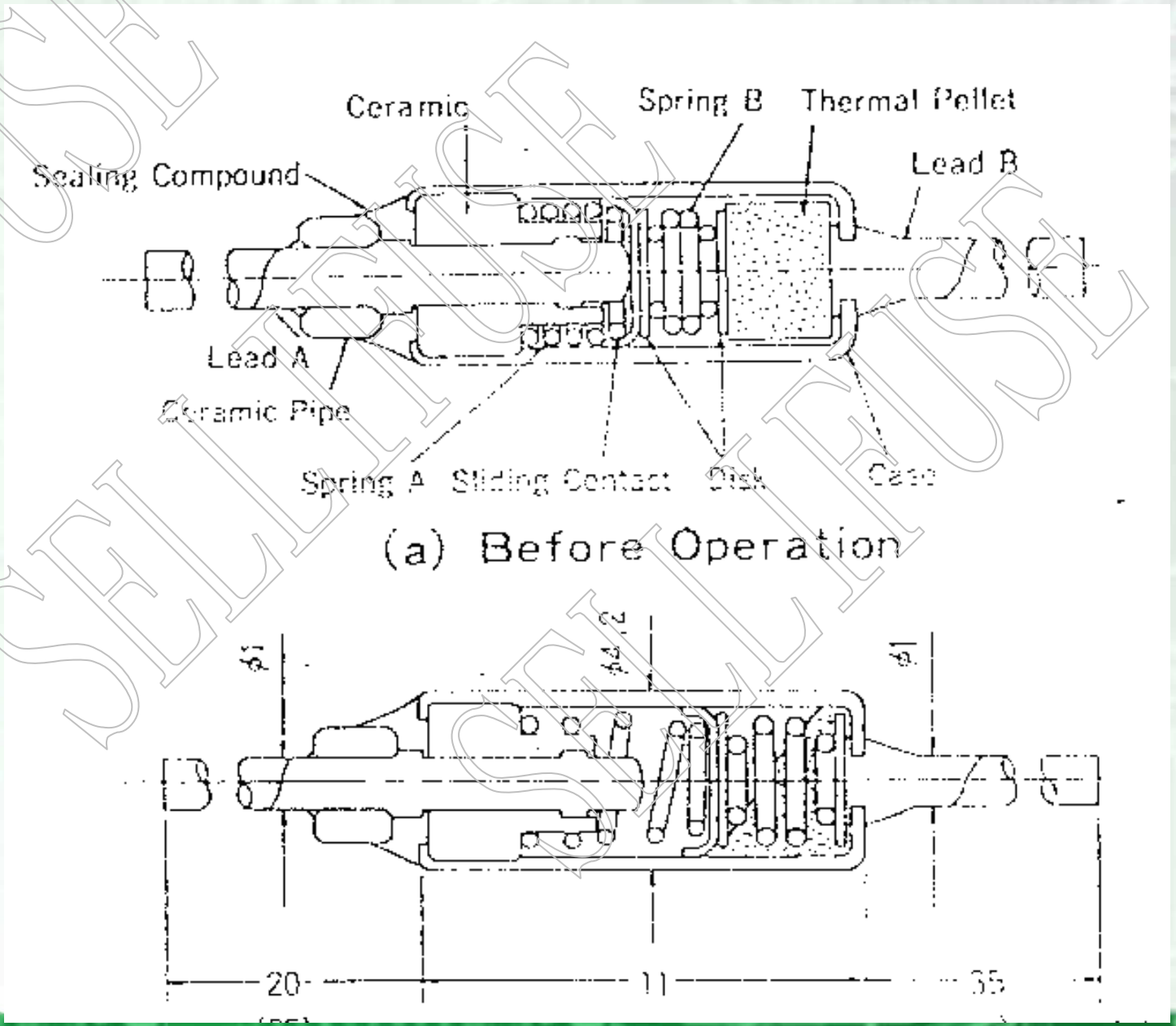
SF TYPE (Thermal pellet type)

Operating Principles

Under normal temperatures, the sliding contact touches top of the lead and then the circuit is closed.

When the ambient temperatures rises to the SEFUSE opening temperature, the thermal pellet melts.

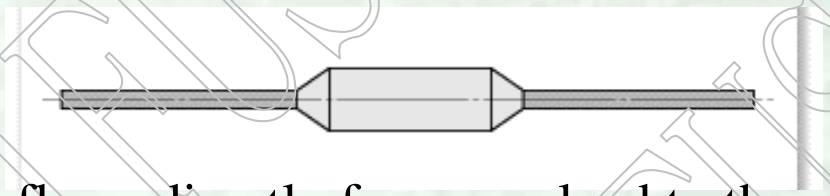
Then the springs moves the sliding contact away and open the circuit.



Features

1. Capability to interrupt large current (6A~15A)
2. Ceramic pipe protects sealing resin from stress to lead wire duri
   [SF/K series do not use the ceramic pipe]
3. An Organic material is used as thermal element.
4. All types are complying with the directive on WEEE (RoHS).
   [except for SF109E(-1) and SF109Y(-1)]

SM TYPE (Fusible alloy type)



Operating Principles

Under normal temperatures, the current flows directly from one lead to the other through the fusible alloy.

When the ambient temperatures rises to the SEFUSE opening temperature, the fusible alloy melts.

Then melted alloy condenses into a drop around the end of each lead by effect of flux.

Features

1. Mountable at where temperature detection is required without insulation.
2. Quick thermal response because of small size
3. An fusible alloy is used as thermal element.
4. Some types are complying with the directive on WEEE (RoHS).
   [for the detail, refer to the page of Standard Ratings]

D、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 SCHOTT Components declines any and all responsibility.

Design Cautions

---Do not use this device for purposes 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.

--Mount the SEFUSE so that it can detect abnormal heat as quick as possible.

The thermal cutoff operates when the inside thermal element melts. Therefore,if the inside thermal element does not reach the operating temperature, the thermal cutoff does not operate, even if the ambient temperature rises to the operating temperature. When the ambient temperature rises suddenly or detect heat partially, it may take time till the SEFUSE operates.

--Mount the SEFUSE so that the temperature of every part become to equal.

If the SF-type lead B, which is caulked to the metal case, is mounted so that it only conducts heat to the body, the temperature around the thermal pellet can be always higher than the other places in the metal case, which can cause the SEFUSE to early open. Be sure to connect the lead A, the resin-sealed side, to the heat source.

Mounting the SEFUSE so that the temperature of the lead A is always lower than that of the lead B can also cause the SEFUSE to early open.

--Make designs so that the temperature of the body of the thermal cutoff does not exceed the temperatures shown in Table 1.

If, these temperatures are 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.

--The SEFUSE has a limited life.

Although the thermal elements are made of durable substances for the long time using. their lifetime varies, depending on using conditions. Especially, the more often the SEFUSE are used at the temperature nearly to the operating temperature, the lifetime may be short, Therefore, We recommend performing a reliability test, with the SEFUSE mounted to the actual application, or under the almost same conditions as the actual ones, and confirming that there is no problem with the lifetime.

--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, run the final product and measure the body temperature of the thermal cutoff.

Table 1

Type Name	Body Temperature
SF70E,K,Y	50° C
SF76E,K,Y	56° C
SF91E,K,Y	71° C
SF96E,K,Y	76° C
SF109E,Y	89° C
SF119E,K,Y	99° C
SF129E,K,Y	109° C
SF139E,K,Y	119° C
SF152E,Y	132° C
SF169E,Y	140° C
SF188E,K,Y	
SF214E,Y	
SF226E,Y	
SF240E,Y	

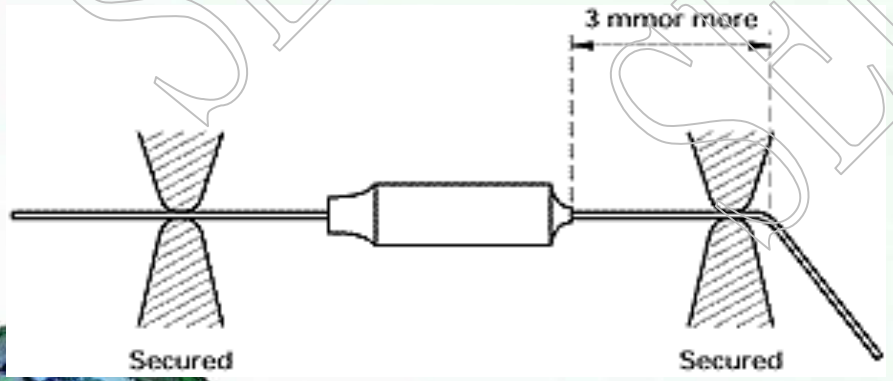
*1) The temperature does not means ambient temperature but surface temperature on thermal cutoff.

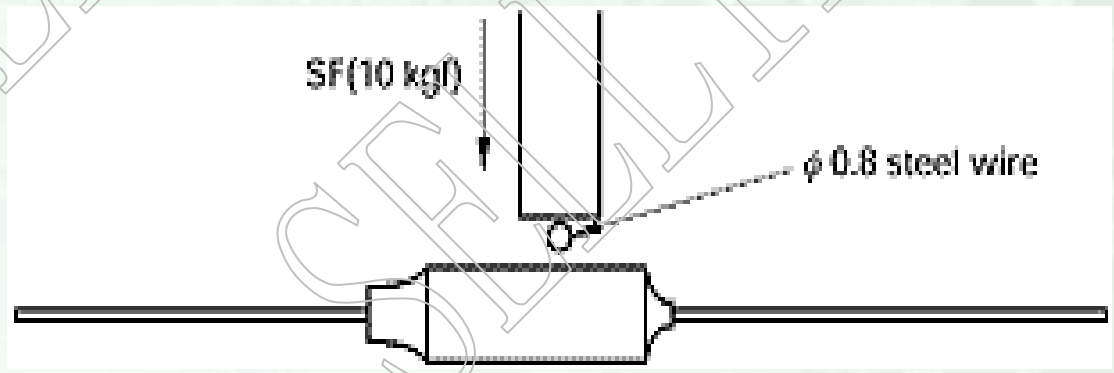
--Use the thermal cutoff with a voltage and current level lower than the rated level.
If the thermal cutoff is used with a voltage or current level higher than the rated level, contacts may melt causing the fuse to malfunction.

--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.

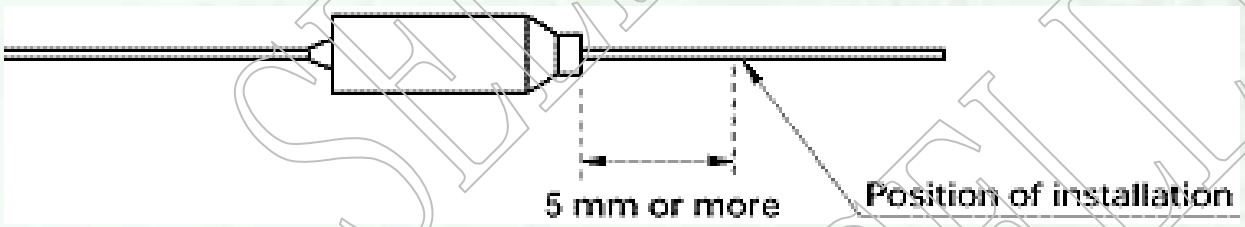




•The tensile strength applied to the lead wire should be 5 kg or less.
•The strength applied to the body of the thermal cutoff should be 10 kg or less.

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, for example, holding the lead near the case by tool is effective for allowing the heat to escape, and the soldering should be done in short interval.
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 metallic 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 store in a cardboard box, the SEFUSE's packs should be put into other bags (such as polyethylene) and make sure the packs seal.

Recommendation

- We recommend the following tests on the receiving of the SEFUSE and after mounting it, as it may have a mechanical load or thermal influence under transportation or when being mounted.

1) Appearance check
2) Resistance check (comparing before with after), or conductive check
3) X-ray inspection
4) Operation check for sampling

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.

D、Definition of term

- **Rated Functioning Temperature**

Rated functioning temperature is the operating temperature of the thermal cutoff, measured using the method specified in the safety standard. In present PSE (Electrical Appliance and Material safety Law) of Japan, the operation should be within the specified operating temperature range of ±7° C. In Various standards such as UL, CSA, VDE, BEAB and CCC which comply with the IEC standard, it is called the rated functioning temperature, and should operate within the prescribed temperature range of ° C.

It is represented by the symbol TF in the UL standard, and by the symbol Tf in the CSA, VDE, BEAB and CCC 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 actual operating temperature range when the thermal cutoff is made to operate inside a constant temperature oven whose temperature is raised at the rate of 0.5 to 1 ° C/min. while a detection current of 10 mA or lower is applied.
  The operating temperature is a standard set by ourself 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 specified time not less than 168 hours (1 week).
  It is represented by the symbol TH in the UL standard, Th in the CSA standard, Tc in the CCC standard, and in the VDE, BEAB standards as an option.

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

  Maximum temperature limit is the temperature up to which thermal cutoffs will not change its state of cutoff without impairing.
  It is represented by the symbol TM in the UL standard and by Tm in the CSA, VDE, BEAB and CCC standard.

Thank You

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