

FUSIBLE ALLOY THERMAL SENSITIVE TYPE, 0.5 AMPERES (250 Va.c.) and 3 and 5 AMPERES (50 Vd.c.) Rated Current

The NEC's SEFUSE (SM/G series) is a small, solid and reliable thermal cutoff that can be used under 0.5 A / 250 Vac. 3 and 5 ampere / 50 Vdc. electrical rating type, added to the product line-up lately, is also available. It protects home appliances and industrial equipment from fire and accident by opening of electrical circuit if it senses an abnormal temperature rise.

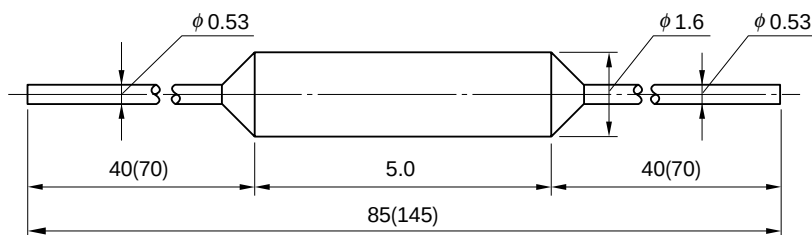
FEATURES

- Approved by UL (USA), CSA (Canada), VDE (Germany), BEAB (UK) and MITI (Japan)
- Very small
- 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 a cutoff current of AC 0.5 amperes and DC 3 and 5 amperes.
- One shot operation.

APPLICATIONS

Transformers
Motors
Battery packs
Electric home appliances
Electric Industrial equipments,
Office automation equipments, etc.

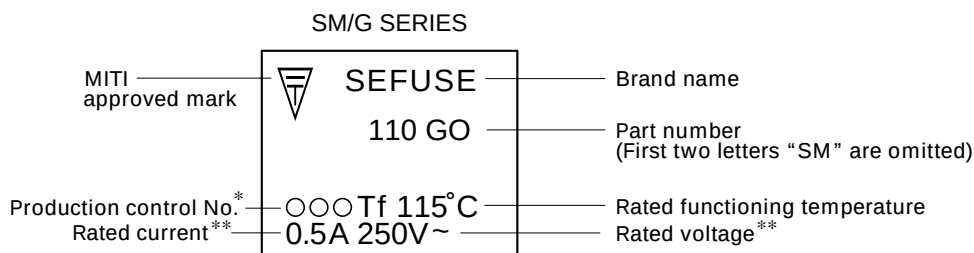
OUTLINE DIMENSIONS (Unit : mm)



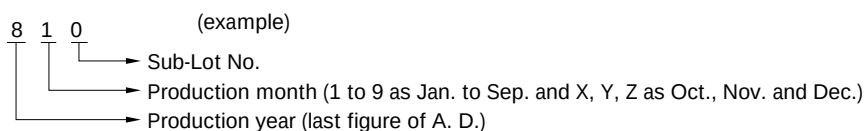
Note: Dimensions in parentheses are for long lead devices.

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

MARKING

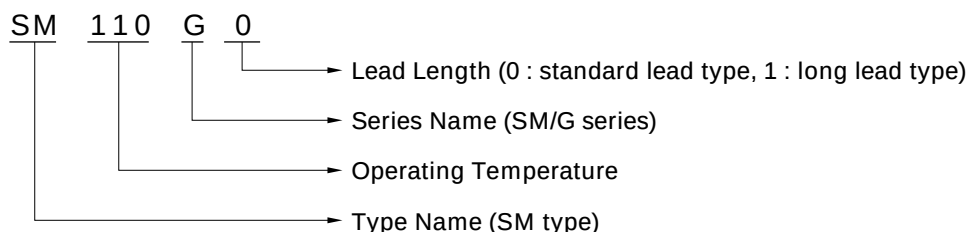


* Designation of Production Control No.



** The marking of electrical ratings is only the AC ratings and the DC ratings is not indicated.

TYPE NAME DESIGNATION



STANDARD RATINGS

(AC Electrical Ratings)

Part Number ¹⁾	Rated Functioning Temperature	Operating Temperature	T _H T _h T _c	T _M T _m	Rated Current	Rated Voltage	Safety Standard				
							UL	CSA	VDE	BEAB	
SM095G0	100 °C	95 ⁺⁵ ₋₀ °C	65 °C	115 °C	0.5 Aac (res.)	250 Vac (res.)	E71747	LR52330	6778.2 -1171 -0003 (6778.2 -4510 -1005) ⁴⁾	C0743	33-466
SM110G0	115 °C	110±2 °C	80 °C	125 °C							33-472
SM126G0	131 °C	126±2 °C	96 °C	140 °C							33-467
SM130G0	135 °C	130±2 °C	100 °C	145 °C							33-468
SM145G0	150 °C	145±2 °C	115 °C	155 °C							33-467
SM134G0	139 °C	134 ⁺³ ₋₂ °C	104 °C	200 °C			2)				33-467

(DC Electrical Ratings)

Part Number ¹⁾	Rated Functioning Temperature	Operating Temperature	T _H T _C	T _M T _m	Rated Current	Rated Voltage	Safety Standard				
							UL	CSA	VDE	BEAB	
SM095G0	100 °C	95 ⁺⁵ ₋₀ °C	65 °C	115 °C	3 Adc	50 Vdc	E71747				3)
SM110G0	115 °C	110±2 °C	80 °C	125 °C	5 Adc						
SM126G0	131 °C	126±2 °C	96 °C	140 °C							
SM130G0	135 °C	130±2 °C	100 °C	145 °C							
SM145G0	150 °C	145±2 °C	115 °C	155 °C							
SM134G0	139 °C	134 ⁺³ ₋₂ °C	104 °C	200 °C	2)						

Notes 1): The type names are for standard lead. When long lead type is required, change the last number "0" to "1".

2): Under application

3): There is no regulation about d.c. electrical ratings in the Electrical Appliance and Material Control Law of Japan.

4): The VDE recognized file number had been changed in February 1998. The number in parentheses are previous file number.

Definition of Terms

- **Rated Functioning Temperature**

Rated functioning temperature is the operating temperature of the thermal cutoff, 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 $\pm 7^{\circ}\text{C}$. 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 $+0/-10^{\circ}\text{C}$.

It is represented by the symbol T_F in the UL standard, and by the symbol T_f 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 $1^{\circ}\text{C}/\text{min}$. 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.

- **T_H , T_h , T_c (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 T_H in the UL standard, T_h in the CSA standard, and T_c in the VDE and BEAB standards.

- **T_M , T_m (Maximum Temperature Limit)**

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

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

- **Rated Current**

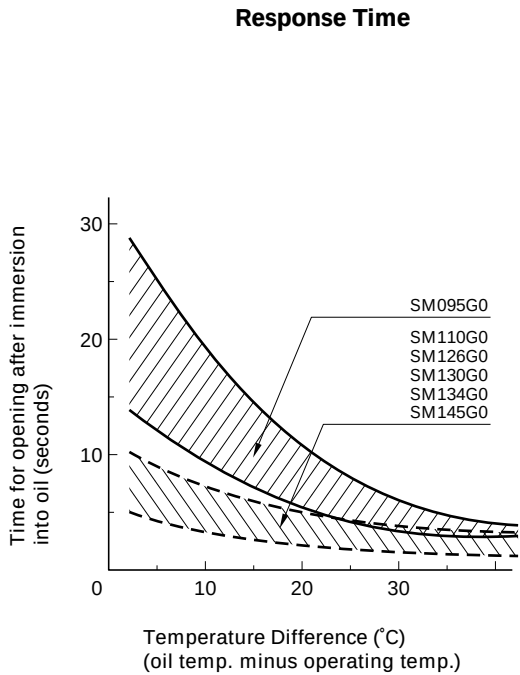
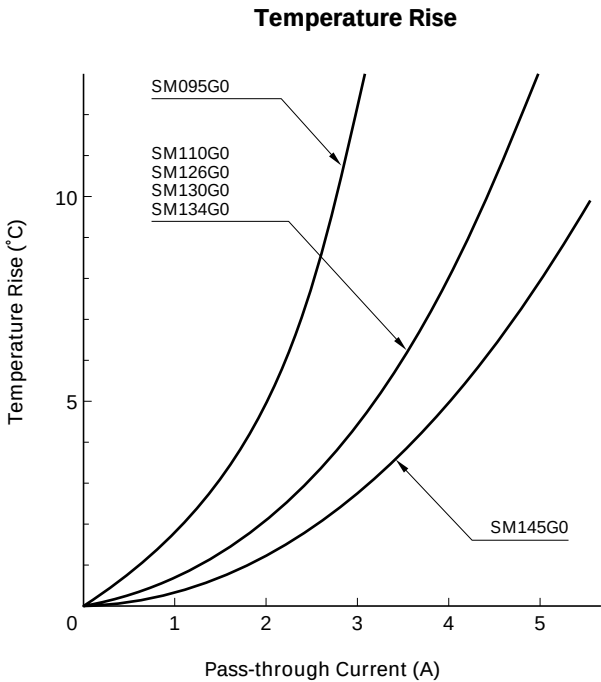
Maximum alternating current that can pass through the thermal cutoff and that the thermal cutoffs can cut off the circuit in safety and reliability.

- **Rated Voltage**

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

Performance Data

SM/G Series



Initial Characteristics

SM145G0	146		10^6		3.0		5.0	
	145		10^5		2.0		4.0	
	144		10^4		1.0		3.0	
SM134G0	135		10^6		3.0		6.0	
	134		10^5		2.0		5.0	
	133		10^4		1.0		4.0	
SM130G0	131		10^6		3.0		6.0	
	130		10^5		2.0		5.0	
	129		10^4		1.0		4.0	
SM126G0	127		10^6		3.0		6.0	
	126		10^5		2.0		5.0	
	125		10^4		1.0		4.0	
SM110G0	112		10^6		3.0		6.0	
	111		10^5		2.0		5.0	
	110		10^4		1.0		4.0	
SM095G0	99		10^6		3.0		13.0	
	98		10^5		2.0		11.0	
	97		10^4		1.0		9.0	
Part Number	Operating Temperature (°C)	Insulation Resistance after Operation (MΩ)	Withstand Voltage after Operation (kV)	Internal Resistance (mΩ/25 mm)				

High Temperature Storage Test

SM145G0	@125°C <table border="1"><thead><tr><th>Time (Hours)</th><th>Change of Operating Temperature (°C)</th></tr></thead><tbody><tr><td>0</td><td>0</td></tr><tr><td>200</td><td>0</td></tr><tr><td>500</td><td>0</td></tr><tr><td>1000</td><td>0</td></tr></tbody></table>	Time (Hours)	Change of Operating Temperature (°C)	0	0	200	0	500	0	1000	0		
Time (Hours)	Change of Operating Temperature (°C)												
0	0												
200	0												
500	0												
1000	0												
SM134G0	@115°C <table border="1"><thead><tr><th>Time (Hours)</th><th>Change of Operating Temperature (°C)</th></tr></thead><tbody><tr><td>0</td><td>0</td></tr><tr><td>200</td><td>0.5</td></tr><tr><td>500</td><td>1.2</td></tr><tr><td>1000</td><td>1.5</td></tr><tr><td>2000</td><td>1.5</td></tr></tbody></table>	Time (Hours)	Change of Operating Temperature (°C)	0	0	200	0.5	500	1.2	1000	1.5	2000	1.5
Time (Hours)	Change of Operating Temperature (°C)												
0	0												
200	0.5												
500	1.2												
1000	1.5												
2000	1.5												
SM130G0	@110°C <table border="1"><thead><tr><th>Time (Hours)</th><th>Change of Operating Temperature (°C)</th></tr></thead><tbody><tr><td>0</td><td>0</td></tr><tr><td>200</td><td>0.2</td></tr><tr><td>500</td><td>0.4</td></tr><tr><td>1000</td><td>0.5</td></tr><tr><td>2000</td><td>0.6</td></tr></tbody></table>	Time (Hours)	Change of Operating Temperature (°C)	0	0	200	0.2	500	0.4	1000	0.5	2000	0.6
Time (Hours)	Change of Operating Temperature (°C)												
0	0												
200	0.2												
500	0.4												
1000	0.5												
2000	0.6												
SM126G0	@106°C <table border="1"><thead><tr><th>Time (Hours)</th><th>Change of Operating Temperature (°C)</th></tr></thead><tbody><tr><td>0</td><td>0</td></tr><tr><td>200</td><td>0.1</td></tr><tr><td>500</td><td>0.2</td></tr><tr><td>1000</td><td>0.3</td></tr><tr><td>2000</td><td>1.0</td></tr></tbody></table>	Time (Hours)	Change of Operating Temperature (°C)	0	0	200	0.1	500	0.2	1000	0.3	2000	1.0
Time (Hours)	Change of Operating Temperature (°C)												
0	0												
200	0.1												
500	0.2												
1000	0.3												
2000	1.0												
SM110G0	@90°C <table border="1"><thead><tr><th>Time (Hours)</th><th>Change of Operating Temperature (°C)</th></tr></thead><tbody><tr><td>0</td><td>0</td></tr><tr><td>200</td><td>0.3</td></tr><tr><td>500</td><td>0.4</td></tr><tr><td>1000</td><td>0.5</td></tr><tr><td>2000</td><td>0.6</td></tr></tbody></table>	Time (Hours)	Change of Operating Temperature (°C)	0	0	200	0.3	500	0.4	1000	0.5	2000	0.6
Time (Hours)	Change of Operating Temperature (°C)												
0	0												
200	0.3												
500	0.4												
1000	0.5												
2000	0.6												
SM095G0	@75°C <table border="1"><thead><tr><th>Time (Hours)</th><th>Change of Operating Temperature (°C)</th></tr></thead><tbody><tr><td>0</td><td>0</td></tr><tr><td>200</td><td>0.2</td></tr><tr><td>500</td><td>0.4</td></tr><tr><td>1000</td><td>0.0</td></tr><tr><td>2000</td><td>0.1</td></tr></tbody></table>	Time (Hours)	Change of Operating Temperature (°C)	0	0	200	0.2	500	0.4	1000	0.0	2000	0.1
Time (Hours)	Change of Operating Temperature (°C)												
0	0												
200	0.2												
500	0.4												
1000	0.0												
2000	0.1												
Part Number	Change of Operating Temperature (°C)												
	Time (Hours)												

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 and 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, 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.

Table 1. Recommended maximum body temperature on a regular basis

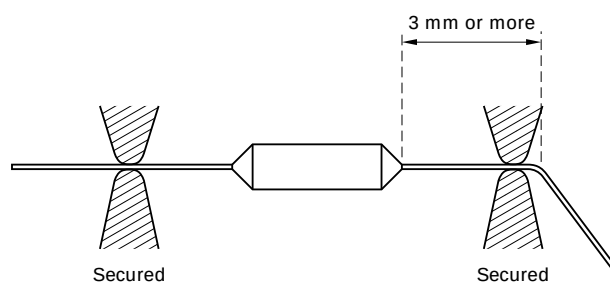
Part Number	Pass-through Current				
	to 1 A	to 2 A	to 3 A	to 4 A	to 5 A
SM095G	75°C	70°C	65°C	—	—
SM110G	90°C	85°C	85°C	80°C	75°C
SM126G	106°C	106°C	100°C	95°C	90°C
SM130G	110°C	110°C	105°C	100°C	95°C
SM134G	114°C	114°C	110°C	105°C	100°C
SM145G	125°C	125°C	120°C	120°C	115°C

- *1) : The temperature does not means ambient temperature but surface temperature on thermal cutoff.
- *2) : When a large current flows through a thermal cutoff, temperature difference occurs between the case and the lead. Therefore, it is recommended to measure some points on the thermal cutoff, and make design so that the highest temperature does not exceed the temperature shown in 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, the body of the thermal cutoff may be destroyed.
- 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 temperatures, or any other malfunctions may occur. Also, the thermal cutoff may not operate even if its operating temperature is exceeded.

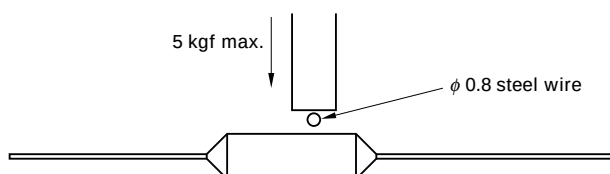
Lead wire process

- 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 1kg or less for the SM type thermal cutoff.
- The strength applied to the body of the thermal cutoff should be 5 kg or less for the SM type thermal cutoff.

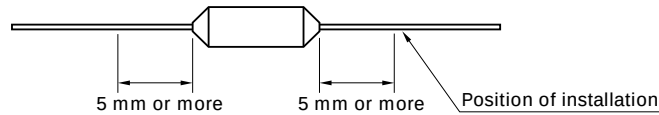


Mounting

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 a 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.

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.

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While NEC Corporation has been making continuous effort to enhance the reliability of its electronic components, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC electronic component, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.