NEC/SCHOTT

SEFUSE®

THERMAL CUTOFF

NEC SCHOTT Components Corporation is a joint venture company, established in September 2000, between technology group SCHOTT of Germany and NEC of Japan.

In the electronic components field such as glass-to-metal seals, thermal cutoffs and special glass, we will optimize the global know-how of the SCHOTT and NEC groups and continue to provide products and services that satisfy our customers' requirements into the 21st century and beyond.

NEC SCHOTT is the exclusive sales partner of all SCHOTT Electronic Packaging products in Japan.

Contents

Please review the "Cautions" on pages 22 through 25 prior to using SEFUSE®.

Introduction

NEC SCHOTT develops and manufactures thermal cutoff protection devices, widely known as SEFUSE®. These devices are designed to protect industrial and home electrical equipment from catching fire by sensing overheating and cutting off the electrical circuit immediately.

There are three SEFUSE® types, namely, SF, SM and D6, to suit the needs of a wide range of applications. The SF-type uses a thermosensitive material as the thermal pellet, while the SM- and D6-types use a fusible alloy. SEFUSE® meets a number of international industrial safety standards, and is a highly reliable thermal protection device that provides excellent and long-lasting performance.

Features

- The SF-type, except SF/K series, has a ceramic pipe that alleviates any stress that may occur on the sealing resin when the leads are bent, thereby reliably holding the leads in place. In addition, the sliding contact is made of a silver copper oxide (AgCuO) material that is patented worldwide.
- The SEFUSE® D6-type integrates a heater resistance within the thermal cutoff. Hence, the D6-type thermal protection device can be activated either when the abnormal temperature increase is caused by the external environment, or when it is resulted from the heat generation triggered by the external signal.
- Meets many international safety standards such as UL, VDE, CCC, PSE, etc.
- Eco-friendly with no hazardous substances (complies with WEEE and RoHS).

Applications

- Small home appliances, such as coffee makers, electric kettles, rice cookers, bread makers, hot plates, irons and hair dryers
- Large home appliances such as air-conditioners, refrigerators, washing machines, fan heaters, gas boilers
- Office equipment, such as copiers, laser beam printers, facsimile machines and power taps
- Battery devices, such as battery packs and chargers
- Various power supplies, such as transformers, adaptors, invertors and cement resistance
- Car applications, such as automotive air-conditioners, solenoids and motors

Safety standards

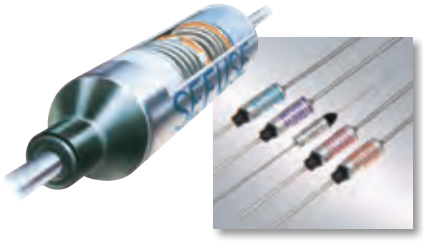
UL (USA) cUL (Canada) CSA (Canada) VDE (Germany) BEAB (UK) CCC (China) KC (Korea) PSE (Japan)

Construction

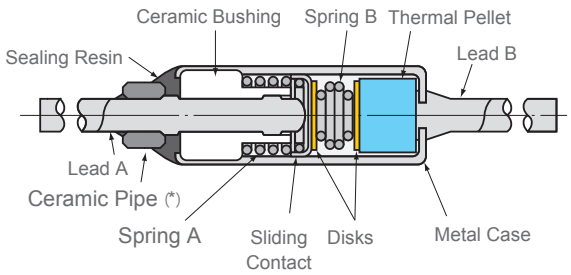
SF Type

Series: SF/R, SFH/R, SF/K, SF/Y

The thermal pellet placed inside the metal case of the SF-type responds to an abnormal temperature situation and triggers the cutoff function. The SF-type features a large rated current of 6A to 15A (AC). Furthermore, the SFH/R series has higher Tm than conventional thermal cutoffs, as well as excellent insulation performance at high temperature conditions.

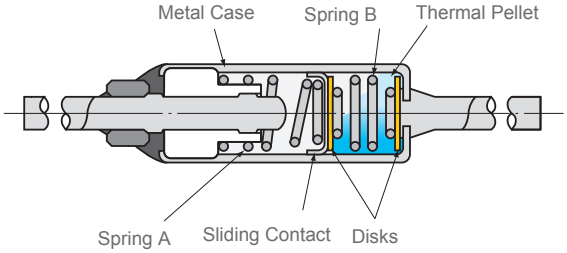


Before operation



The SF-type contains a sliding contact, springs and a thermal pellet inside a metal case. When spring B is compressed, there is firm contact between lead A and the sliding contact. At normal temperatures, current flows from lead A to the sliding contact and then through the metal case to lead B.

After operation



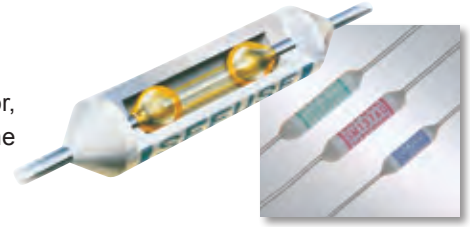
When the ambient temperature rises to the operating temperature of the SF-type, heat is transferred through the metal case and melts the thermal pellet. Springs A and B then stretch and the sliding contact moves away from lead A, thereby opening the electrical circuit.

*Not used in SF/K series.

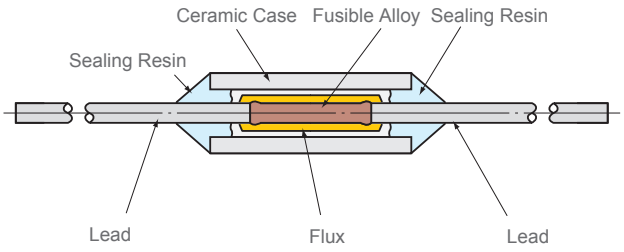
SM Type

Series: SM/A, SM/B, SM/G

The SM-type uses a fusible alloy inside a ceramic case. As ceramic is an insulator, the SM-type can be fixed directly where temperature detection is required. The SM-type has a rated current of 0.5A to 2.0A (AC) / 3.0A to 7.0A (DC).

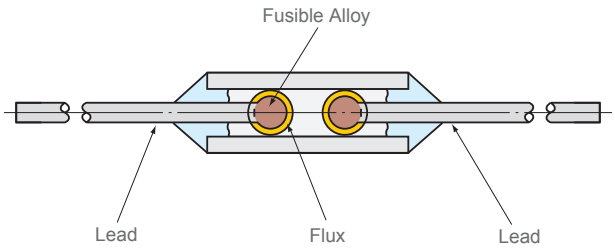


Before operation



The leads of the SM-type are connected by a fusible alloy thereby allowing the current to flow directly from one lead to the other. The fusible alloy is coated with a special flux.

After operation

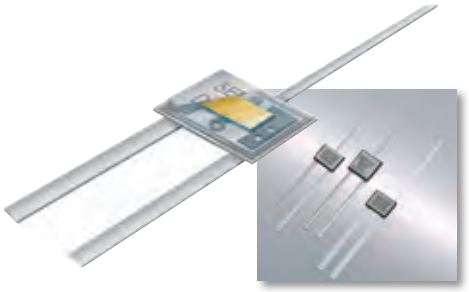


When the ambient temperature rises to the operating temperature of the SM-type, the fusible alloy melts and forms a drop around the end of each lead due to the surface tension and the special flux coating. Without a direct contact between the leads, the electrical circuit is opened.

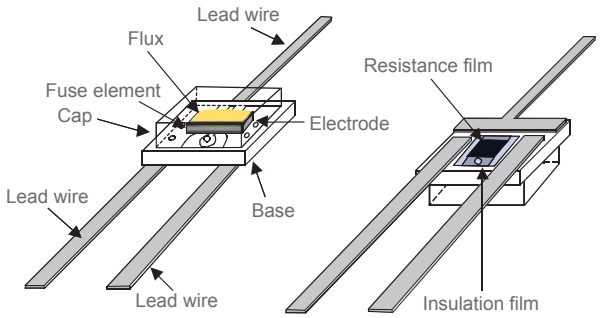
D6 Type

Series: D6T, D6X, D6WX

The D6-type uses a ceramic material for the body (cap and base) and integrates a resistor as a heater inside the thermal cutoff. Hence, the D6-type can be activated either when the abnormal temperature increase is caused by the external environment, or when it is a result of the heat generated by the electrical circuit within the device. This provides a second protection for the electrical equipment in which the D6-type is installed.
The D6-type is available for 12A and 15A (DC).

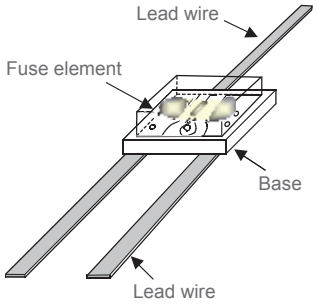


Before operation



The D6-type houses a printed electrode, a fuse element and a special flux material in layers on top of the ceramic base. The current flows from one lead, across the fuse element and then through the second lead.

After operation

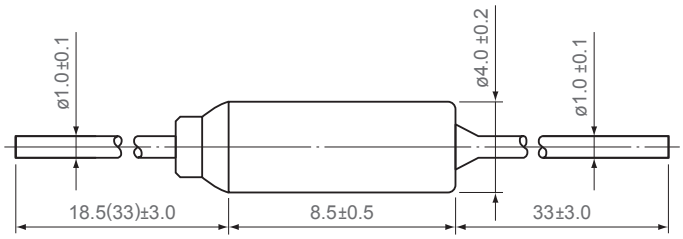


When the ambient temperature rises to the operating temperature of the D6-type, the fuse element melts, and forms a drop around the end of each lead because of surface tension and the special flux coating. This cuts off the electrical circuit. In another scenario, the heater resistance generates heat in response to an external signal, thereby melting the fuse element and cutting off the electrical circuit immediately.

Standard Ratings

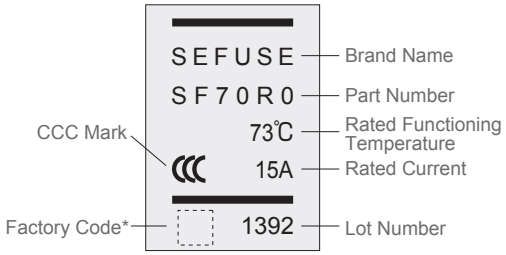
SF/R series

Dimension (Unit: mm)

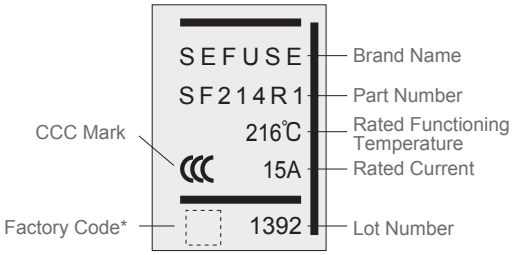


Note: The dimensions for long lead devices are in parentheses.

Marking 1 (SF70R* − SF129R*)



Marking 2 (SF139R* − SF240R*)



* Factory Code represents the factory location as shown below
Thailand : C

How to read a lot number

ex.) 13 9 2
- 2 — Sub-lot number
- 9 — Month
  - X……October
  - Y……November
  - Z……December
- 13 — Last two digit of year

Ratings

1) 2) Part Number * : 0/1 0: standard 1: long	Rated Functioning Temperature Tf (℃)	Operating Temperature (℃)	3) Th (℃)	Tm (℃)	Rated Current	Rated Voltage	UL/cUL Thailand	VDE Thailand	CCC Thailand	KTL Thailand (SU05020 -****)	6) PSE Thailand (JET1974-32001 -****) Rating 15A	Rating 10A
SF70R*	73	70±2	58	165	4) 15A/10A (Resistive)	4) AC250V	E71747	677802 -1171 -0015	20130102 05600209	5004	2001	1003
SF76R*	77	76+0/−4	62									
SF81R*	84	81+3/−1	69								2002	1002
SF90R*	94	90±2	79									
SF94R*	99	94±2	84									
SF113R*	113	108±2	98							5005	2003	1001
SF119R*	121	119±2	106							5006	2004	1004
SF129R*	133	129±2	118	175								
SF139R*	142	139±2	127								2005	1005
SF144R*	144	142±2	129	210								
SF150R*	152	150+1/−3	137									
SF167R*	167	164±2	153	250						5007	2006	1006
SF184R*	184	182±2	174				5)				2007	1007
SF188R*	192	188+3/−1	177	375								
SF214R*	216	214+1/−3	200							5008	2008	1008
SF229R*	229	227±2		380							2009	1009
SF240R*	240	237±2										

Note 1) No use of hazardous substances prescribed by WEEE and RoHS.
All products do not use SVHC prescribed by REACH (144 substances, 20 June 2013).

2) For standard lead length type, add the suffix "0" at the end of the part number.
For long lead length type, add the suffix "1" at the end of the part number.

3) Th is the maximum temperature measured on the thermal cutoff when it continues to conduct a rated current without changing its state of conductivity for 168 hours.

4) The electrical ratings according to the various safety standards are shown in the following table.

Rated Voltage	UL/cUL	VDE	CCC	KTL	PSE 6)
AC120V	20A (Resistive)	—	—	—	—
AC250V	10A (Resistive)	10A	10A	10A	10A
	15A (Resistive)	15A	15A	15A	15A
	16A (Resistive)	—	—	—	—

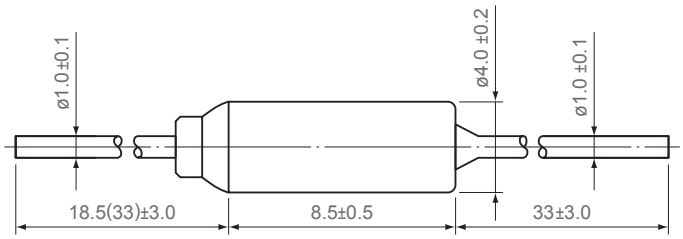
5) The following SF-types have passed the Conductive Heat Aging Test (CHAT) specified by the UL safety standard: SF184R*, SF188*, SF214*, SF229R*, and SF240R*.

6) With respect to the PSE standard, SF/R is separately available for 10A and 15A ratings. Please select the appropriate product rating according to the specifications of the final application.

Standard Ratings

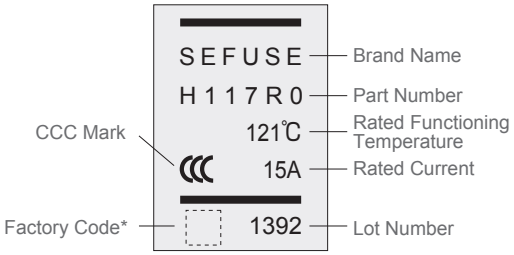
SFH/R series

Dimension (Unit: mm)

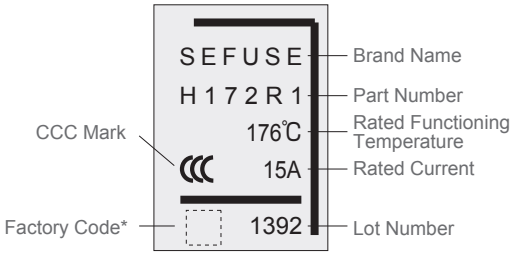


Note: The dimensions for long lead devices are in parentheses.

Marking 1 (SFH106R* − SFH129R*)



Marking 2 (SFH134R* − SFH172R*)



* Factory Code represents the factory location as shown below
Thailand : C

How to read a lot number

ex.) 13 9 2

- 2 — Sub-lot number
- 9 — Month
  - X……October
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  - Z……December
- 13 — Last two digit of year

Ratings

1) 2) Part Number * : 0/1 0: standard 1: long	Rated Functioning Temperature Tf (℃)	Operating Temperature (℃)	3) Th (℃)	Tm (℃)	Rated Current	Rated Voltage	UL/cUL Thailand	VDE Thailand	CCC Thailand	KTL Thailand (SU05020 -****)	6) PSE Thailand (JET1974-32001 -****) Rating 15A	Rating 10A
SFH106R*	110	106±3	99	400	4) 15A/10A (Resistive)	4) AC250V	E71747	677802 -1171 -0016	20130102 05613895	5005	2003	1001
SFH109R*	113	109±3	102									
SFH113R*	117	113±3	106									
SFH117R*	121	117±3	110							5006	2004	1004
SFH124R*	128	124±3	117									
SFH129R*	134	129+3/−2	122									
SFH134R*	139	134+3/−2	127									
SFH152R*	157	152+3/−2	145								2005	1005
SFH162R*	167	162+3/−2	155							5007	2006	1006
SFH172R*	176	172±3	165				5)					

Note 1) No use of hazardous substances prescribed by WEEE and RoHS.
All products do not use SVHC prescribed by REACH (144 substances, 20 June 2013).

2) For standard lead length type, add the suffix "0" at the end of the part number.
For long lead length type, add the suffix "1" at the end of the part number.

3) Th is the maximum temperature measured on the thermal cutoff when it continues to conduct a rated current without changing its state of conductivity for 168 hours.

4) The electrical ratings according to the various safety standards are shown in the following table.

Rated Voltage	UL/cUL	VDE	CCC	KTL	PSE 6)
AC120V	20A (Resistive)	—	—	—	—
AC250V	10A (Resistive)	10A	10A	10A	10A
	15A (Resistive)	15A	15A	15A	15A
	16A (Resistive)	—	—	—	—

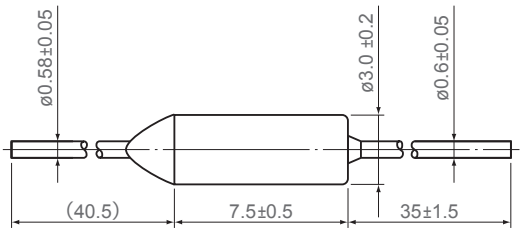
5) The following SF-types have passed the Conductive Heat Aging Test (CHAT) specified by the UL safety standard: SFH172R*.

6) With respect to the PSE standard, SFH/R is separately available for 10A and 15A ratings. Please select the appropriate product rating according to the specifications of the final application.

Standard Ratings

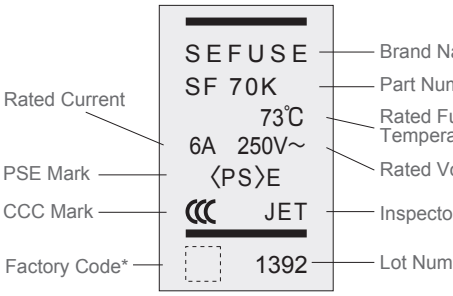
SF/K series

Dimension (Unit: mm)

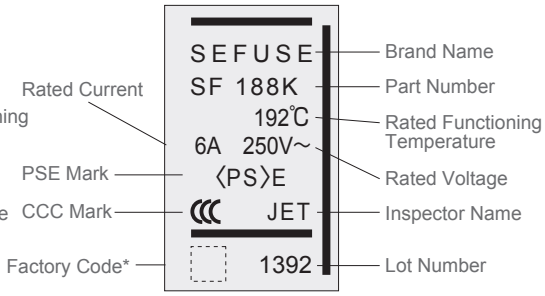


Note: The value in parentheses is a reference value.

Marking 1 (SF70K − SF119K)



Marking 2 (SF188K, SF214K)



How to read a lot number

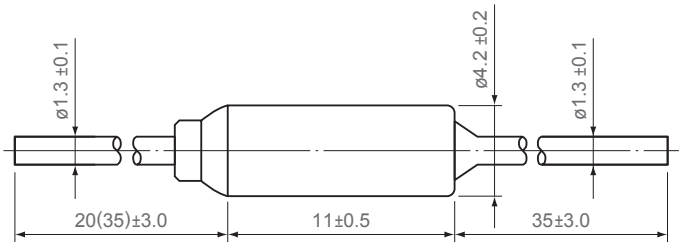
ex.) 13 9 2

- 2 — Sub-lot number
- 9 — Month
  - X……October
  - Y……November
  - Z……December
- 13 — Last two digit of year

* Factory Code represents the factory location as shown next Thailand : C

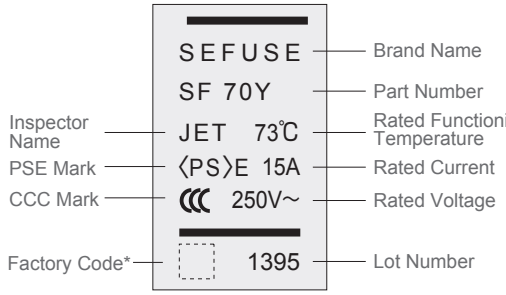
SF/Y Series

Dimension (Unit: mm)

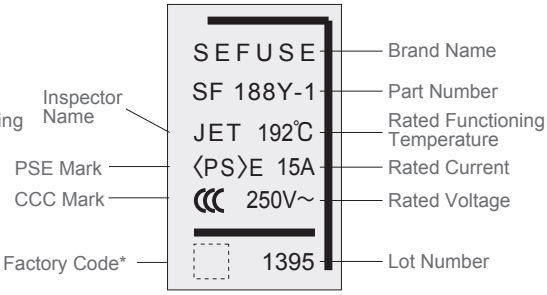


Note: The dimensions for long lead devices are in parentheses.

Marking 1 (SF70Y − SF129Y)



Marking 2 (SF139Y − SF240Y)



How to read a lot number

ex.) 13 9 5

- 5 — Sub-lot number
- 9 — Month
  - X……October
  - Y……November
  - Z……December
- 13 — Last two digit of year

* Factory Code represents the factory location as shown next Japan : none

Ratings

1) Part Number	Rated Functioning Temperature Tf (℃)	Operating Temperature (℃)	2) Th (℃)	Tm (℃)	3) Rated Current	Rated Voltage	UL/cUL	VDE	BEAB	CCC	KTL	PSE
							Thailand	Thailand	Thailand	Thailand	Thailand (SU05020-****)	Thailand (JET1974-32001-****)
SF70K	73	70±2	45	150	6A (Resistive)	AC250V	E71747	677802-1171-0006	C1180	20080102 05282881	5004	1003
SF76K	77	76+0/−4	51									
SF90K	94	90±2	66				5)		—	5)		1002
SF94K	99	94±2	84					5)				
SF96K	99	96±2	71				E71747	677802-1171-0006	C1180	20080102 05282881	5004	
SF119K	121	119±2	94								5006	1004
SF188K	192	188+3/−1	164	300			4)				5007	1007
SF214K	216	214+1/−3	198						—		5008	1008

Note 1) No use of hazardous substances prescribed by WEEE and RoHS.
All products do not use SVHC prescribed by REACH (144 substances, 20 June 2013).

2) Th is the maximum temperature measured on the thermal cutoff when it continues to conduct a rated current without changing its state of conductivity for 168 hours.

3) The following electrical ratings were used for the UL, VDE, and KTL safety standards: 10A (Resistive)/AC 250V.

4) The following SF-types have passed the Conductive Heat Aging Test (CHAT) specified by the UL safety standard: SF188K and SF214K.

5) Pending approval.

Ratings

1) 2) Part Number	Rated Functioning Temperature Tf (℃)	Operating Temperature (℃)	Tm (℃)	Rated Current	Rated Voltage	UL	CCC	PSE
						Japan	Japan	Japan (JET1974-32001-****)
SF70Y	73	70±2	150	15A (Resistive)	AC250V	—	20040102 05122568	1008
SF76Y	77	76+0/−4						
SF90Y	94	90±2	4)				4)	1010
SF94Y	99	94±2						
SF96Y	99	96±2	150				20040102 05122568	
SF113Y	113	110±2	160					1011
SF119Y	121	119±2	150			E71747		1012
SF129Y	133	129±2	159					
SF139Y	142	139±2				—		1013
SF150Y	152	150+1/−3	4)				4)	
SF167Y	167	164±2						1014
SF184Y	184	182±2	210				20040102 05122568	1015
SF188Y	192	188+3/−1	300					
SF214Y	216	214+1/−3	350					1016
SF229Y	229	227±2	4)				4)	1017
SF240Y	240	237±2	350				3)	

Note 1) No use of hazardous substances prescribed by WEEE and RoHS.
All products do not use SVHC prescribed by REACH (144 substances, 20 June 2013).

2) Part number indicates thermal cutoffs with standard lead lengths. For long lead length types, add the suffix "-1" at the end of the part number.

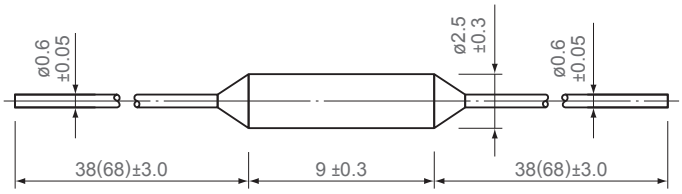
3) 2004010205122568

4) Pending approval.

Standard Ratings

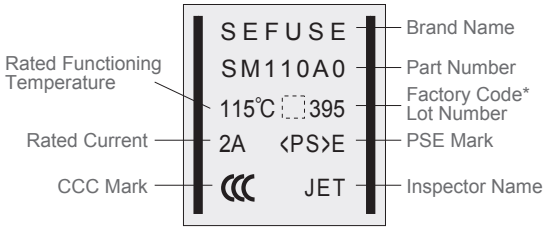
SM/A series

Dimension (Unit: mm)



Note: The dimensions for long lead devices are in parentheses.

Marking



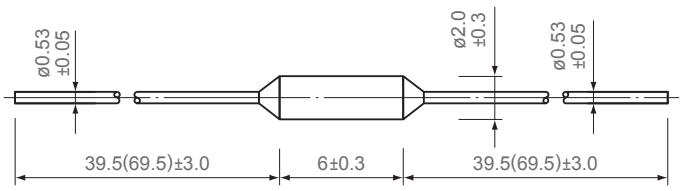
* Factory Code represents the factory location as shown below
Thailand : C

How to read a lot number

ex.) 3 9 5
- 5 — Sub-lot number
- 9 — Month (X……October, Y……November, Z……December)
- 3 — Last one digit of year

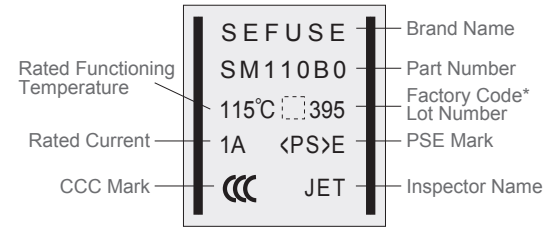
SM/B series

Dimension (Unit: mm)



Note: The dimensions for long lead devices are in parentheses.

Marking



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Thailand : C

How to read a lot number

ex.) 3 9 5
- 5 — Sub-lot number
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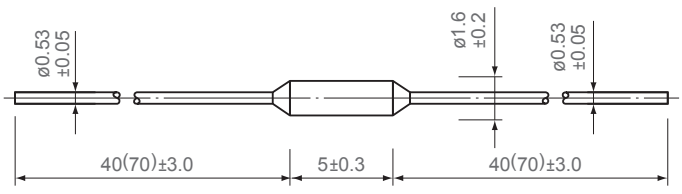
- 3 — Last one digit of year

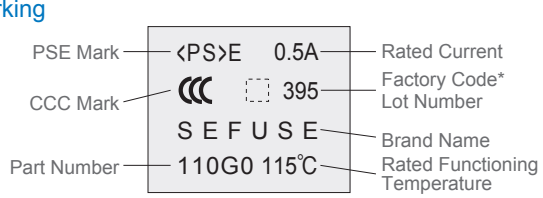
SM/G series

Dimension (Unit: mm)



Note: The dimensions for long lead devices are in parentheses.

Marking



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How to read a lot number

ex.) 3 9 5
- 5 — Sub-lot number
- 9 — Month (X……October, Y……November, Z……December)
- 3 — Last one digit of year

Ratings

1) 2) Part Number * : 0/1 0: standard 1: long	Rated Functioning Temperature Tf (℃)	Operating Temperature (℃)	Tm (℃)	Electrical Ratings AC	Electrical Ratings 3) DC	UL Thailand	CSA Thailand	VDE Thailand	BEAB Thailand	CCC Thailand	KTL Thailand (SU05020 -****)	PSE Thailand (JET1974 -32001-****)
SM072A*	76	72+3/−2	100	2A (Resistive) AC250V	3A/DC50V(UL) 4A/DC50V(VDE)	E71747	4)	677802 -1171 -0001	C1191	20020102 05023067	5009	1017
SM092A*	97	92+3/−2	200		4A/DC50V		172780 (LR52330)					1016
SM110A*	115	110±2	125		7A DC50V						5001	1011
SM125A*	131	126+3/−2	200								5002	1012
SM137A*	142	137+3/−2										1013
SM146A*	151	146+3/−2										
SM150A*	150											

Note 1) No use of hazardous substances prescribed by WEEE and RoHS.
All products do not use SVHC prescribed by REACH (144 substances, 20 June 2013).
2) For standard lead length type, add the suffix "0" at the end of the part number.
For long lead length type, add the suffix "1" at the end of the part number.
3) DC ratings are approved by UL and VDE.
4) SM072A* has c-UL recognition.

Ratings

1) 2) Part Number * : 0/1 0: standard 1: long	Rated Functioning Temperature Tf (℃)	Operating Temperature (℃)	Tm (℃)	Electrical Ratings AC	Electrical Ratings 3) DC	UL Thailand	CSA Thailand	VDE Thailand	BEAB Thailand	CCC Thailand	KTL Thailand (SU05020 -****)	PSE Thailand (JET1974 -32001-****)
SM092B*	97	92+3/−2	200	1A (Resistive) AC250V	3.5A DC50V	E71747	172780 (LR52330)	677802 -1171 -0004	C1169	20020102 05023066	5009	1016
SM110B*	115	110±2	125		6A DC50V						5001	1011
SM125B*	131	126+3/−2	200								5002	1012
SM137B*	142	137+3/−2										1013
SM146B*	151	146+3/−2										
SM150B*	150											

Note 1) No use of hazardous substances prescribed by WEEE and RoHS.
All products do not use SVHC prescribed by REACH (144 substances, 20 June 2013).
2) For standard lead length type, add the suffix "0" at the end of the part number.
For long lead length type, add the suffix "1" at the end of the part number.
3) DC ratings are approved by UL and VDE.

Ratings

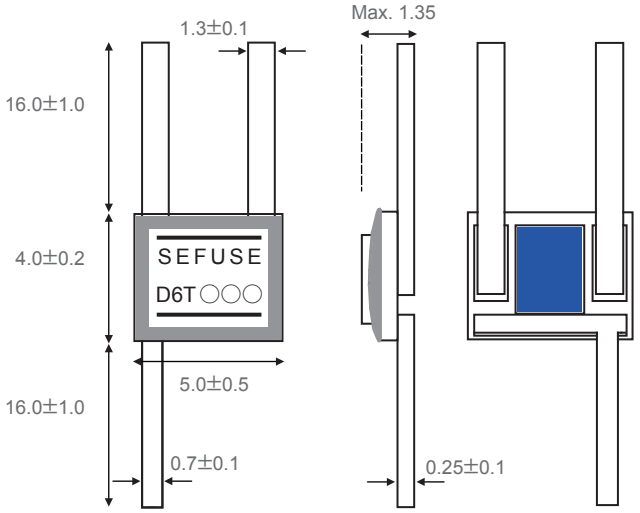
1) 2) Part Number * : 0/1 0: standard 1: long	Rated Functioning Temperature Tf (℃)	Operating Temperature (℃)	Tm (℃)	Electrical Ratings AC	Electrical Ratings 3) DC	UL Thailand	CSA Thailand	VDE Thailand	BEAB Thailand	CCC Thailand	PSE Thailand (JET1974 -32001-****)
SM110G*	115	110±2	125	0.5A (Resistive) AC250V	5A DC50V	E71747	172780 (LR52330)	677802 -1171 -0003	C1157	20120102 05547628	1011
SM137G*	142	137+3/−2	200								1013
SM146G*	151	146+3/−2									

Note 1) No use of hazardous substances prescribed by WEEE and RoHS.
All products do not use SVHC prescribed by REACH (144 substances, 20 June 2013).
2) For standard lead length type, add the suffix "0" at the end of the part number.
For long lead length type, add the suffix "1" at the end of the part number.
3) DC ratings are approved by UL and VDE.

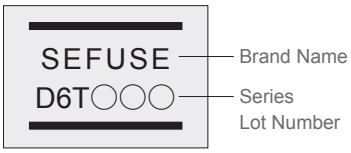
Standard Ratings

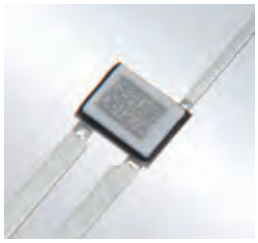
D6T series

Dimension (Unit: mm)

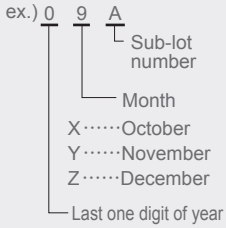


Marking



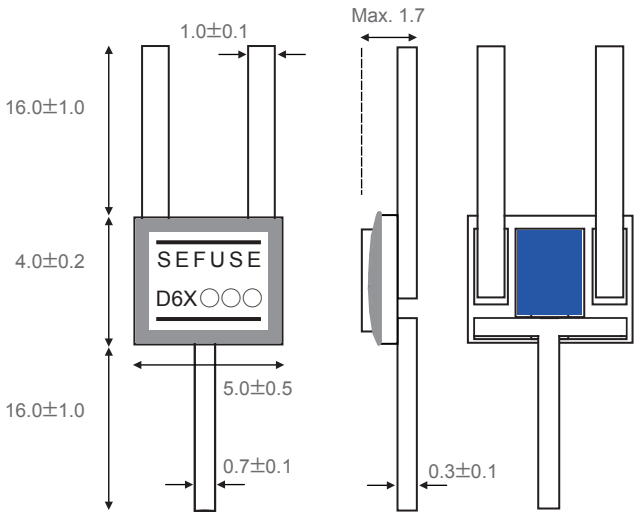


How to read a lot number

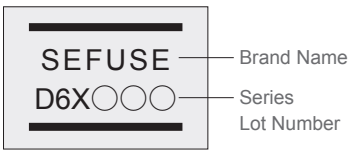


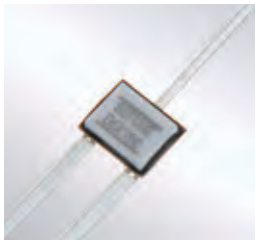
D6X series

Dimension (Unit: mm)

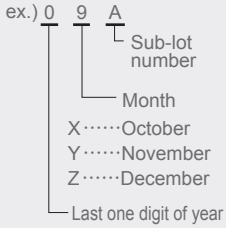


Marking



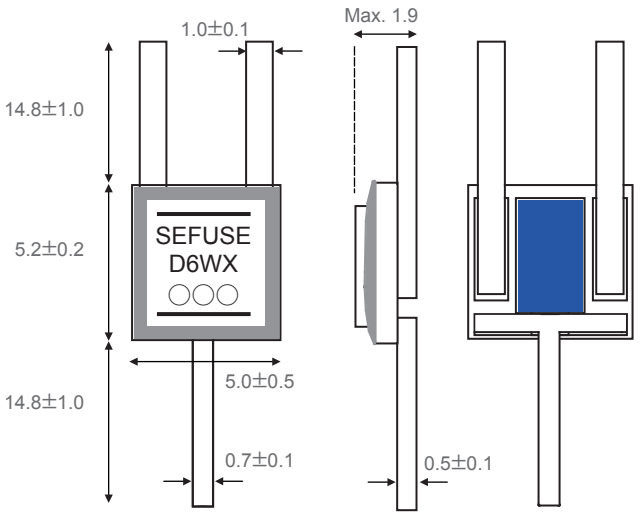


How to read a lot number

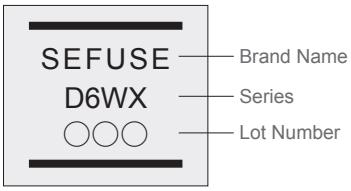


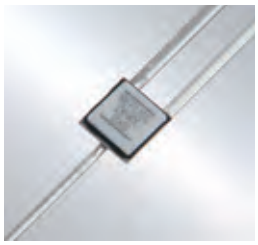
D6WX series

Dimension (Unit: mm)

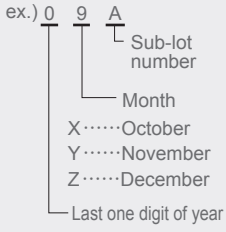


Marking





How to read a lot number



Ratings

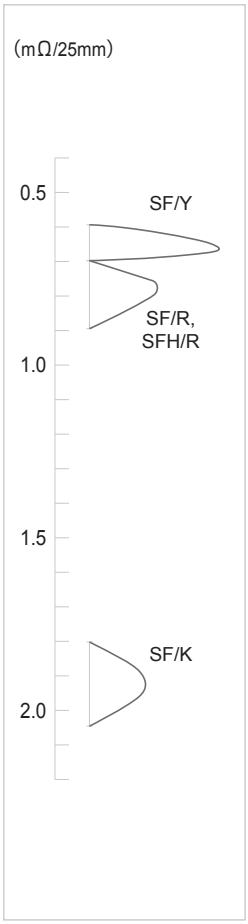
Part Number 1)	Rated Functioning Temperature Tf (℃)	Operating Temperature (℃)	Tm (℃)	Rated Current / Voltage (DC)	Heater Resistance (Ω)	UL/cUL Thailand	VDE Thailand
D6T-S1	139	136±3	180	12A/32V	50.0±20%	E71747	677802 -1171 -0008
D6T-215-S1					21.5±20%		
D6T-050-S1					5.0±20%		
D6X				12A/32V	50.0±20%		
D6X-215					21.5±20%		
D6X-050					5.0±20%		
D6WX				15A/32V	50.0±20%		
D6WX-215					21.5±20%		
D6WX-050					5.0±20%		

Note 1) No use of hazardous substances prescribed by WEEE and RoHS.
All products do not use SVHC prescribed by REACH (144 substances, 20 June 2013).

Performance Data

SF/R series · SFH/R series · SF/K series · SF/Y series

Internal resistance



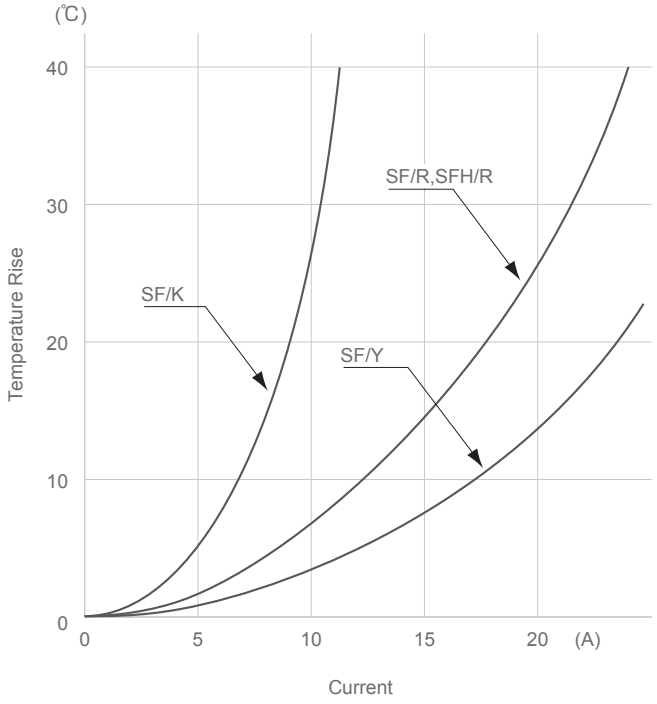
Initial operating temperature (SF/R series · SF/K series · SF/Y series)

Part Number	Operating Temperature (℃)	Part Number	Operating Temperature (℃)	Part Number	Operating Temperature (℃)
SF70R/K/Y	69 70 71	SF119R/K/Y	118 119 120	SF184R/Y	181 182 183
SF76R/K/Y	73 74 75	SF129R/Y	129 130 131	SF188R/K/Y	189 190 191
SF81R	82 83 84	SF139R/Y	138 139 140	SF214R/K/Y	212 213 214
SF90R/K/Y	89 90 91	SF144R	140 141 142	SF229R/Y	227 228 229
SF94R	93 94 95	SF150R/Y	148 149 150	SF240R/Y	235 236 237
SF96K/Y	95 96 97	SF167R/Y	163 164 165		

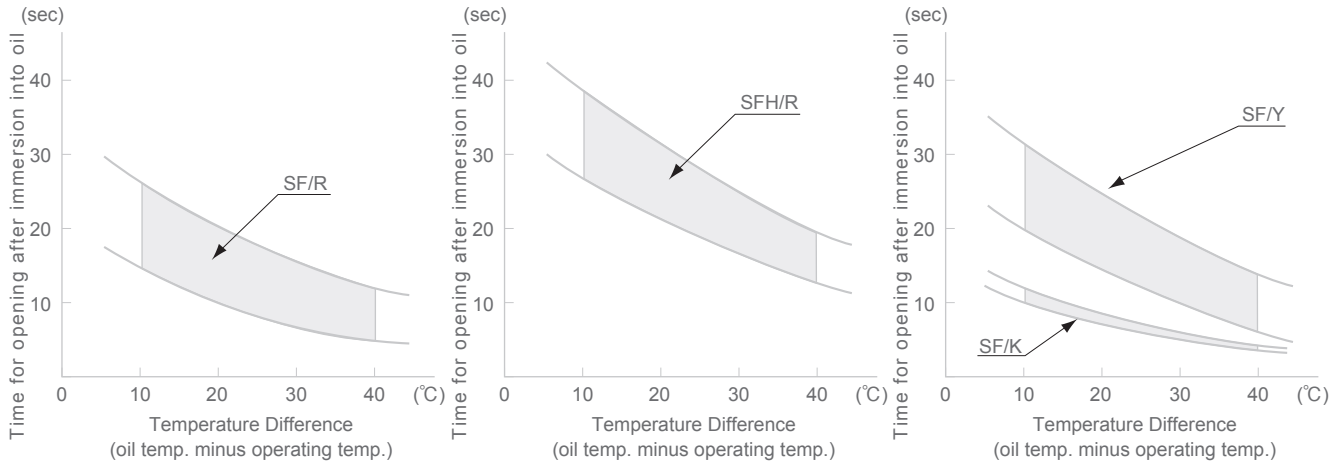
Initial operating temperature (SFH/R series)

Part Number	Operating Temperature (℃)	Part Number	Operating Temperature (℃)	Part Number	Operating Temperature (℃)
SFH106R	105 106 107	SFH124R	123 124 125	SFH162R	161 162 163
SFH109R	108 109 110	SFH129R	128 129 130	SFH172R	171 172 173
SFH113R	112 113 114	SFH134R	133 134 135		
SFH117R	116 117 118	SFH152R	151 152 153		

Temperature Rise

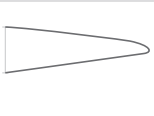
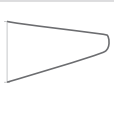
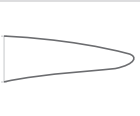
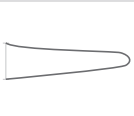
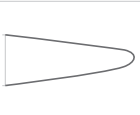
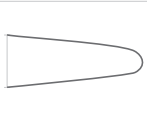
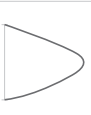
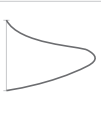
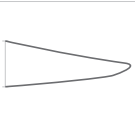
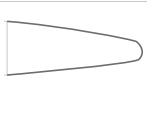
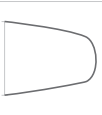
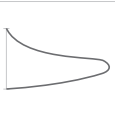


Response Time

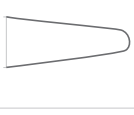
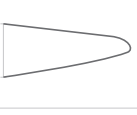
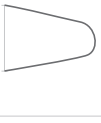
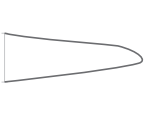
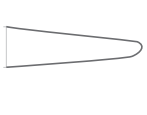
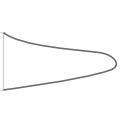
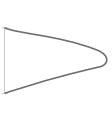
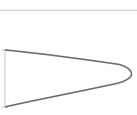


Performance Data

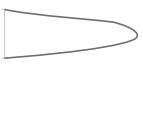
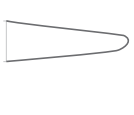
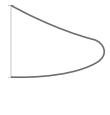
Internal resistance and initial operating temperature

Part Number	Internal Resistance (mΩ/25mm)	Operating Temperature (℃)	Part Number	Internal Resistance (mΩ/25mm)	Operating Temperature (℃)
SM072A	3.7 3.9 4.1 	72 73 74 	SM125A	2.7 2.9 3.1 	124.4 125.4 126.4 
SM092A	5.8 6.3 6.8 	90.6 91.6 92.6 	SM137A	3.8 4.3 4.8 	137 138 139 
SM110A	2.8 3.0 3.2 	110 111 112 	SM146A SM150A	4.4 4.7 5.0 	145 146 147 

Internal resistance and initial operating temperature

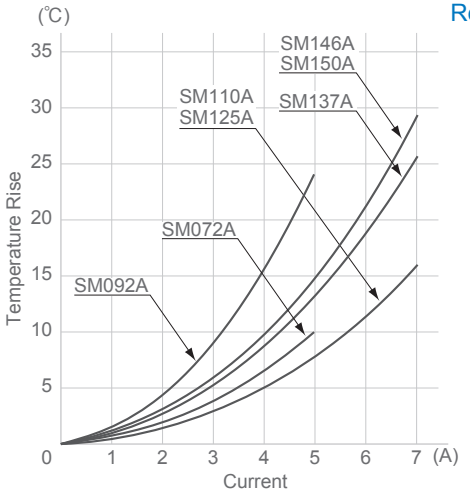
Part Number	Internal Resistance (mΩ/25mm)	Operating Temperature (℃)	Part Number	Internal Resistance (mΩ/25mm)	Operating Temperature (℃)
SM092B	8 9 10 	90.6 91.6 92.6 	SM137B	5.6 6.1 6.6 	137 138 139 
SM110B	4.4 4.6 4.8 	110 111 112 	SM146B SM150B	5.7 6.2 6.7 	145.5 146.5 147.5 
SM125B	3.8 4.2 4.6 	125 126 127 			

Internal resistance and initial operating temperature

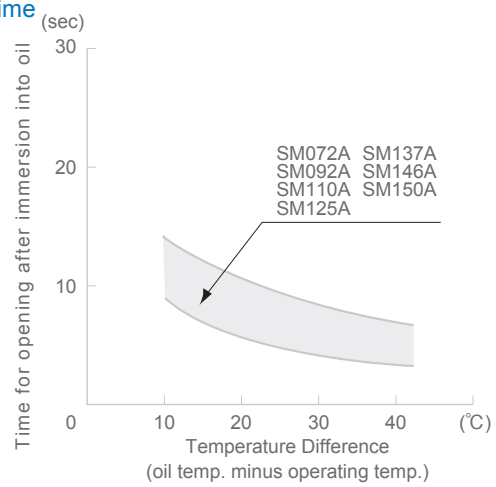
Part Number	Internal Resistance (mΩ/25mm)	Operating Temperature (℃)	Part Number	Internal Resistance (mΩ/25mm)	Operating Temperature (℃)
SM110G	5 6 7 	110 111 112 	SM146G	6.4 7.2 8.0 	145.5 146.5 147.5 
SM137G	6.8 7.6 8.4 	136 137 138 			

SM/A series

Temperature Rise

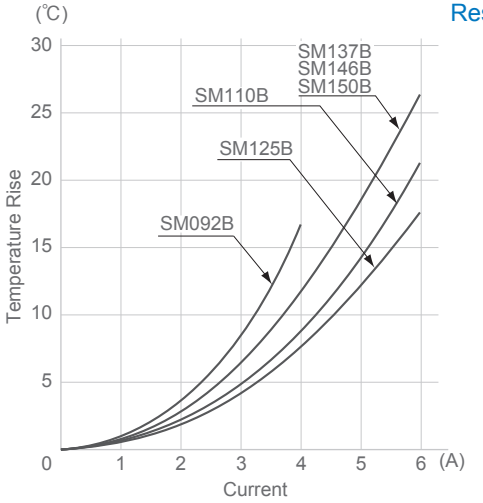


Response Time

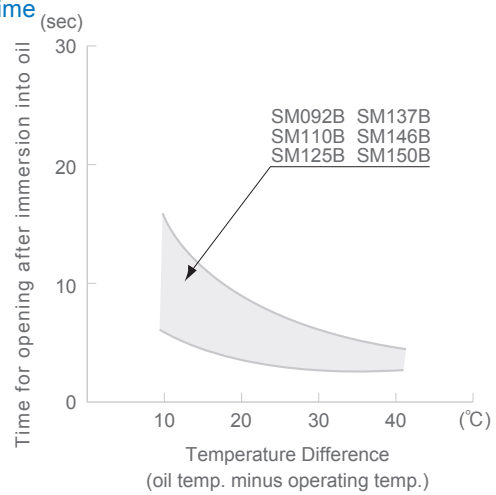


SM/B series

Temperature Rise

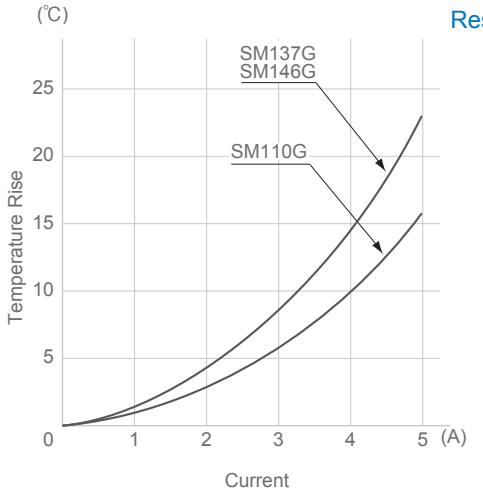


Response Time

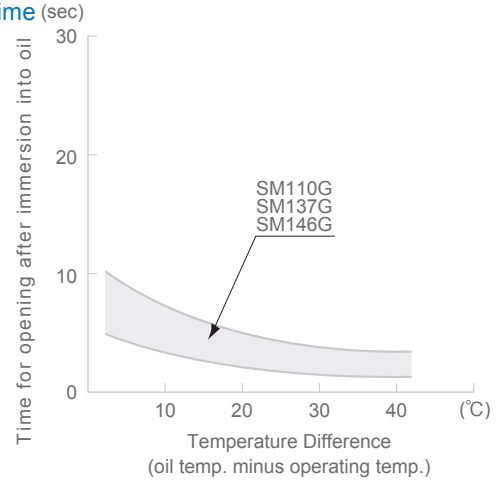


SM/G series

Temperature Rise



Response Time



Definition of Terms

Rated Functioning Temperature (Tf)

Rated functioning temperature is the operating temperature of the thermal cutoff, measured using the method specified in the safety standard.
As stated in the Electrical Appliance and Material Safety Law (PSE) of Japan (Appendix 3, Section 3), the thermal cutoff should operate within ±7°C of the specified operating temperature. In cases where Tf is greater than 200°C, the thermal cutoff should operate within ±10°C of the specified operating temperature.
In standards that comply with the IEC standard, it is indicated that the thermal cutoff should operate within +0/-10°C of the specified temperature range.

Operating Temperature

Operating temperature and tolerance refers to the operating temperature range measured by the following conditions.
A thermal cutoff test sample is placed in the condition where the temperature of a thermostatic oven is raised until 12°C below the rated functioning temperature of the test sample at optionally increasing speed.
Then the temperature of the thermostatic oven is raised at the rate of 0.5-1.0°C a minute.
At this time, the electric current flowing through the test sample for opening confirmation shall be less than 10mA.
Furthermore, the distance between a measuring point and a test sample shall be less than 20 mm.

Th (Holding Temperature)

Th is the maximum temperature measured on the thermal cutoff when it continues to conduct a rated current without changing its state of conductivity for 168 hours.

Tm (Maximum Temperature Limit)

Maximum temperature limit is the maximum temperature for which conductivity does not occur again during the following test.
First, the samples are maintained at Tm for a period of 10 minutes. Then, the withstand voltage test is conducted for 2 minutes with twice the rated voltage. During the test, the thermal cutoff must remain in the functioned state, i.e. open. Hence, no current is allowed to pass through.
(Functioned state of the SF type: not less than 0.2MΩ; SM type: not less than 2MΩ (between body and lead) and not less than 0.2MΩ (between lead and lead)

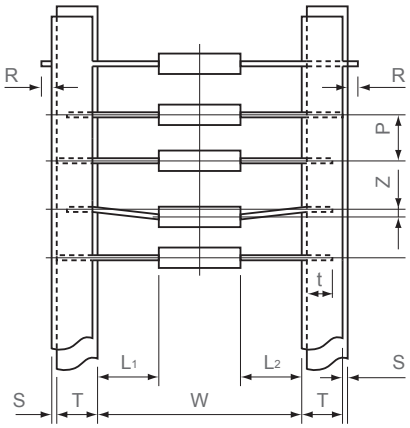
Lead Cutting and Taping

Lead cutting and taping services are available upon request for the following types.

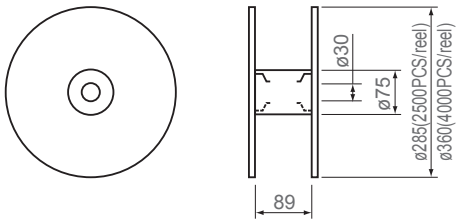
	Standard lead type							Long lead type				
	SF/R0 SFH/R0	SF/K	SF/Y	SM/A0	SM/B0	SM/G0	D6	SF/R1 SFH/R1	SF/Y-1	SM/A1	SM/B1	SM/G1
Taping	–	○	–	○	○	○	–	○	–	–	–	–
Lead Cutting	○	○	–	○	○	○	–	○	–	–	–	–
Lead Forming	○	–	–	–	–	–	○	○	–	–	–	–

○ : available　– : not available

Taping



Reel



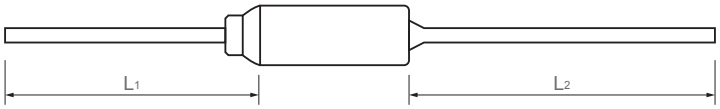
SF/R, SFH/R : 4000PCS/reel
SF/K, SM : 2500PCS/reel

(Unit : mm)

W	P	|L1-L2|	T	Z	R	t	S
52±2 63±2 67±2	5±0.5	≦2.0	6±1	≦2.0	≦0.5	≦3.2	≦0.8

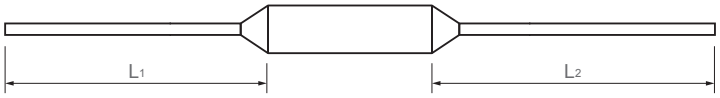
Lead Cutting

●SF Type



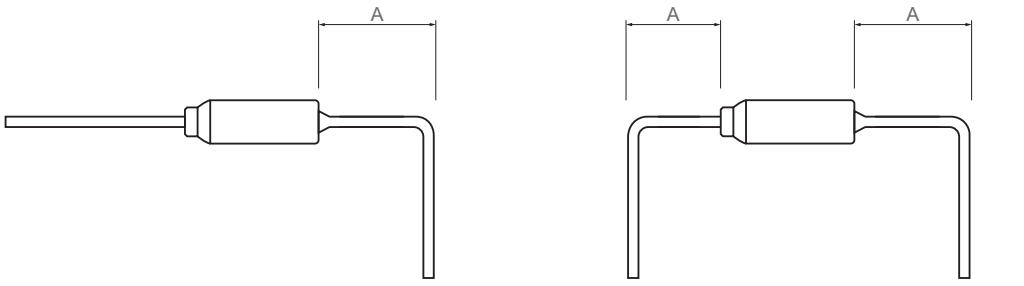
L1 : 9−30
L2 : 7−30 (mm)

●SM Type



L1, L2 : 9−35 (mm)

Lead Forming (SF/R, SFH/R)



A : Should be more than 5mm

●For more information on dimensions not described in diagrams above, please kindly contact us.

Packing Quantity

Series	SF/R, SFH/R, SF/Y	SF/K	SM/A, SM/B, SM/G	D6X, D6T	D6WX
Packing quantity in a carton box	5,000pcs/box	11,200pcs/box	10,000pcs/box	6,400pcs/box	4,800pcs/box

Cautions

This section describes points to note, about the design, installation and storage of NEC SCHOTT SEFUSE® thermal cutoffs, so as to achieve the optimum performance of these thermal protection devices.

For optimal thermal cutoff performance, it is recommended that customers correctly store the thermal protection devices, design appropriate circuits for the appliances and perform evaluations, mounting and testing steps as necessary. Problems arising from the inappropriate execution of the above would be the sole responsibility of the customer, and NEC SCHOTT declines any and all responsibility.

Design

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 open the electrical circuits as required. It is not a current fuse that cuts off excess current. If the thermal cutoff is used as a current fuse, it 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 electrical appliances, office automation equipment, audio and video equipment, computer communications equipment, test and measurement equipment, personal electronic equipment and transportation equipment (excluding engine control).

Decisions regarding the type of thermal cutoff, the installation location and the mounting method should be made by the customers, based upon the requirements of the final application.
It is recommended that designers test the final design with the selected thermal cutoff under both normal conditions as well as predicted worst-case scenarios.

▼Thermal cutoffs should be mounted where it can detect abnormal heat as quickly as possible.
The thermal cutoff operates when the thermal element within melts. Therefore, if the thermal element does not reach the operating temperature, the cutoff will not activate even if the ambient temperature has risen to the operating temperature. In addition, a short lag time might result in the event of a sudden rise in the ambient temperature or if the thermal cutoff only detects part of the temperature increase.

▼Thermal cutoffs* should be mounted such that the temperature gradient is equal throughout the thermal cutoff.
If lead B of the SF-type, which is caulked to the metal case, is mounted in such a way that it only conducts heat to the metal case, the temperature around the thermal pellet would always be higher than other parts in the metal case. This could lead to the thermal cutoff opening prematurely. Hence, it is recommended that lead A, which is the resin-sealed side, be connected nearer to the heat source.
It should also be mentioned that similarly, if lead A is fixed in a location where the temperature it is exposed to is always lower than that of lead B, the thermal cutoff could also be prematurely triggered.
* except SFH-R series

▼Cautions about Tm
Please ensure that the design of the final application does not exceed Tm (the maximum temperature limit) of the thermal cutoff.
If used in conditions beyond the rated temperature, a dielectric breakdown could result and the thermal cutoff could re-conduct even after opening.

▼Cautions about Th (SF type)
Continuous exposure to temperatures close to the Th temperature of the thermal cutoff could result in the thermal pellet reducing in size over time, thereby shortening the lifespan of the thermal cutoff. This change in the pellet size is irreversible. Hence, it is important that designers select and test thermal cutoffs suitable for the temperature zone of the final application, based on the temperature recommendations in Table 1.
Please also note that the Th temperature test is a one-time test, not a cycle test, conducted continuously for 168 hours.

Designers of the final application should take into account the maximum surface temperature of the thermal cutoff as shown in Table 1, and avoid exceeding this level.
If the body temperature of the thermal cutoff is exceeded on a regular basis, the thermal cutoff may start opening at temperatures lower than the normal operating temperature. Malfunctions may also occur. In case of using SM-type in DC rating, please kindly contact NEC SCHOTT.

Table 1

SM Type		SF Type					
		SF/R, SF/K, SF/Y series				SFH/R series	
Part Number	Fuse Body Temperature	Part Number	Fuse Body Temperature	Part Number	Fuse Body Temperature	Part Number	Fuse Body Temperature
SM072A	52℃	SF70R, K, Y	50℃	SF139R, Y	119℃	SFH106R	86℃
SM092A, B	72℃	SF76R, K, Y	56℃	SF144R	122℃	SFH109R	89℃
SM110A, B, G	90℃	SF81R	61℃	SF150R, Y	130℃	SFH113R	93℃
SM125A, B	96℃	SF90R, K, Y	70℃	SF167R, Y	140℃	SFH117R	97℃
SM137A, B, G	117℃	SF94R, K, Y	74℃	SF184R, Y	140℃	SFH124R	104℃
SM146A, B, G	126℃	SF96K, Y	76℃	SF188R, K, Y	140℃	SFH129R	109℃
SM150A, B	126℃	SF113R, Y	88℃	SF214R, K, Y	140℃	SFH134R	114℃
		SF119R, K, Y	99℃	SF229R, Y	140℃	SFH152R	132℃
		SF129R, Y	109℃	SF240R, Y	140℃	SFH162R	140℃
						SFH172R	140℃

Note that the temperature listed in Table 1 refers to the surface temperature of the thermal cutoff, not the ambient temperature.

Thermal cutoffs have a limited life.
The thermal elements used are durable substances designed for long-term use. However, the longevity of the thermal cutoff depends on the conditions in which it is exposed to. This is particularly true if the thermal protection device is frequently exposed to temperatures very close to its operating temperature.
Hence, it is recommended that designers conduct a reliability test by fixing the thermal protection device onto the actual application and simulating the expected operating conditions to assess the lifetime of the device.

The body temperature of the thermal cutoff increases as current passes through it.
The body temperature of the thermal cutoff could rise to levels higher than the ambient temperature current passes through the device. In addition, the body temperature could also increase depending on a number of factors such as the mounting method. Hence, it is recommended that designers measure the body temperature of the thermal cutoff after conducting a reliability test.

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 contacts may be welded together in the SF-type, causing the thermal cutoff to malfunction. In the SM-type and D6-type, the body of the thermal cutoff may rupture.

Do not use the thermal cutoff in an atmosphere out of the standard specifications such as in environments exposed to sulfurous acid gas, nitrogen oxide gas, ammonia gas or conditions that contain formic acid. It is also not suitable for high humidity situations and submersion in a liquid.
The case of the thermal cutoff* is made with a copper alloy. Hence, installing the thermal cutoff in such conditions or similar, could deteriorate the sealing resin or lead to cracks in the case of the thermal cutoff due to corrosion. The thermal cutoff could thus operate at lower than operating temperatures or not activate even if its operating temperature is exceeded.
* SF-K series only

The thermal cutoff corresponds to industrial waste.
The thermal cutoff corresponds to industrial waste, and requires disposal according to governmental and provincial regulations. The services of a licensed disposal contractor could also be engaged.

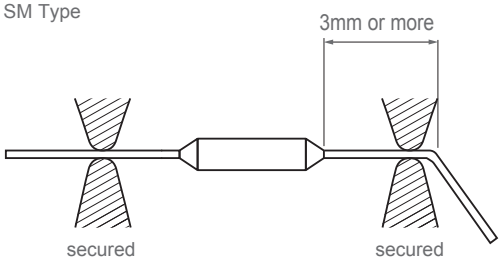
The thermal cutoff is a non-repairable device.
In case of replacement, an equivalent thermal cutoff from the same manufacturer should be used. For general consumers who are not aware of the cautions associated with the thermal cutoff, they should be informed not to mount, remove or replace the thermal cutoff through a note to this effect in the user's manual and other related materials.

Cautions

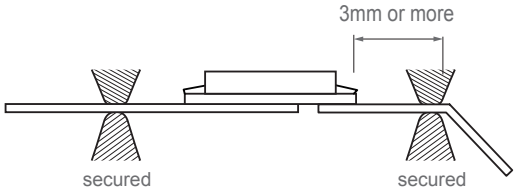
Lead wire process

●When bending the lead wire, it is important not to apply excessive pressure to the root of the lead wire. The lead wire should be secured close to the case and bent (not twisted) at a distance 3 mm or more from the body of the fuse.

SF / SM Type



D6 Type



●The tensile strength applied to the lead wire should be 49N or less for SF-type and 9.8N or less for SM- and D6-types.

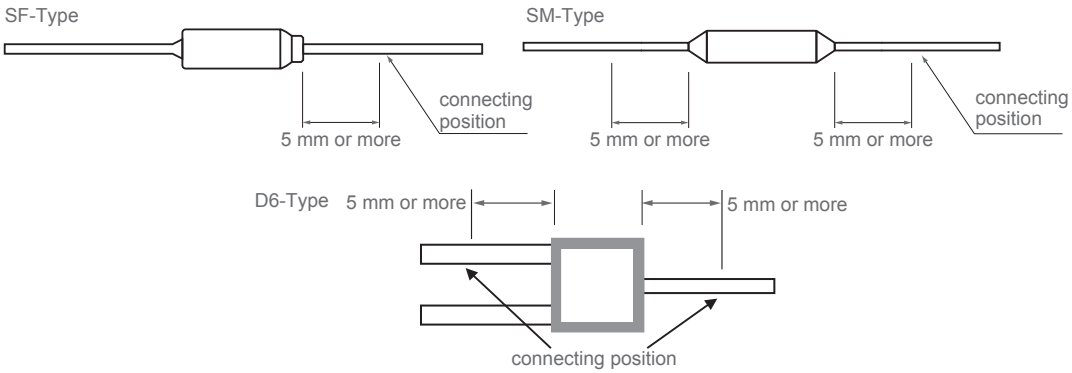
●The strength applied to the body of the thermal cutoff should be 98N or less for SF-type, 49N or less for SM-type, and 4.9N or less for D6 type.

With regards to the SF-type, deformation of the case may change the location of the sliding contact during operation and could lead to the thermal cutoff operating only at temperatures lower than the normal operating temperature range. The thermal cutoff may also not operate even if the thermal cutoff's operating temperature is exceeded.

Mounting

Thermal cutoffs can be mounted by soldering, caulking or welding.

●The connecting position at the lead of the resin-sealed side should be 5 mm or more from the body of the thermal cutoff.



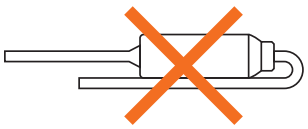
●If soldering, take note that the thermal cutoff may function because of excessive solder temperature. To prevent such malfunctions, for example, holding the lead near the case with a tool is effective for allowing the heat to escape and the soldering should be done in short intervals.

Another effective method is to use a lower solder temperature and to solder at a location that is at a distance 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.

●After mounting the thermal cutoff, be careful not to apply force that may pull, push or twist the lead wires.

●If using a SF-type thermal cutoff, the lead on the resin-sealed side must not be allowed to touch the case. This would cause the current to flow from the lead on the resin-sealed side to the opposite lead resulting in a non-functioning thermal cutoff.



●Note that the body of the SF-type is the same in potential as the circuit. Therefore, it must be electrically isolated from other metallic parts.

Storage

●The body and lead A of the SF-type, and the leads of SM092A and SM092B are silver-plated. Therefore, these parts may discolor because of sulfuration, making the markings on the body illegible or negatively affecting the solder-ability of the lead. To avoid this, the thermal cutoff should not be kept around materials (such as cardboard or rubber, etc.) which generate sulfurous acid gas.

●When storage in cardboard boxes is required, thermal cutoffs should be double packed and sealed in polybags such as polyethylene.

Recommendation

●NEC SCHOTT recommends the following tests upon receipt and after mounting of the thermal cutoff, as it may have undergone some mechanical load or thermal influence during 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 thermal cutoff.

If applicable, it is recommended that the general consumers, who are unaware of the usage cautions for thermal cutoffs, be informed not to mount, remove, or replace the thermal cutoff through a note to this effect in the user's manual and other related material.

All reasonable care has been taken to present the data here and the values contained in this document were obtained under certain testing conditions by us. They are not guaranteed and are for reference only.
For any clarifications or more information about these cautions, please kindly contact NEC SCHOTT Components Corporation.

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Our products are classified into 2 groups: “Standard” and “Special”. The recommended applications of the products according to its quality level are indicated below. If you intend to use our products for applications other than “Standard” level, please consult with our sales representative in advance.

"Standard"

Computers, office equipment, communication equipment, measuring equipment, audio & visual equipment, home electric appliances, machine tools, personal electrical equipment and industrial robots, etc.

"Special"

Transportation equipment (automobiles, trains, ships and others), aircrafts, aerospace equipment, medical equipment for life support, etc.

NEC SCHOTT Components Corporation
TF Division
3-1 Nichiden, Minakuchi-cho, Koka-shi,
Shiga
528-0034, Japan
Phone +81-(0)748-63-6629
Fax +81-(0)748-63-6627
tf.nsc@schott.com
www.nec-schott.co.jp

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