NRC ELECTRONICS
NATIONAL-FRANCHISED-DISTRIBUTION

Specification for Approval

Spec No. SFA111

SEM

Model: SEM Series

Square Ceramic Surface Mount Fuse

Designed in accordance to UL248 standard

NRC Electronics
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Certified as meeting the requirements of

Your supply chain partner

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History of Change

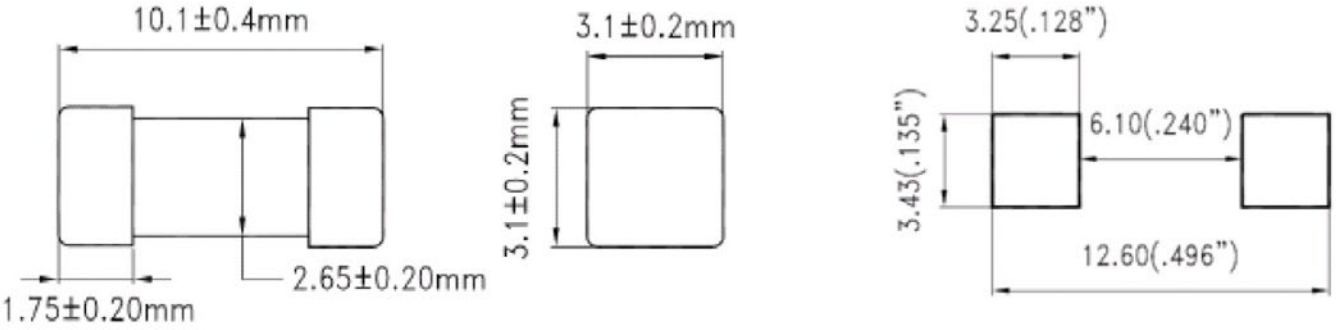
REV.	Description	Date
1.0	(1) Issue	2018.06.08
2.0	(1) 0.5A 2A (2) SEM Series	2018.07.13
3.0	(1) 9 (2) 10 AC Power Fault Test (3) 16 (4) 19	2018.12.14
4.0	(1) (2) 12 (3) 15	2020.02.14

Fuses for Instrument, Power and Telephone (Non-indicating)

1. Applications:

K.21
For protecting instruments, power supplies and telephone sets.
The coordination requirement contained in K.21 may require a series of impedance devices.

2. Shape & Dimensions (mm):



2.1 Structure & Shape: As shown in figure above

2.2 Rated Voltage: 600Vac

2.3 Rated Current: 0.5A / 1.25A / 2A

3. Material:

3.1 Tube (Body): Non-Transparent ceramic tube fuse. No breaking or deformation is allowed.

3.2 Two brass end caps: Made of brass of good conductivity.

3.3 Coating of brass caps: Plating the surface with Gold.

Part Name		Volume
Square Cap	– Gold Plating	2
Square Ceramic Tube	– Non-Transparent Ceramic	1
Fuse Element		1

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4. Electrical Characteristics:

4.1 Loading Capacity:
100% (1.0 x In A) 4
Loading 100% Rated Current (i.e. 1.0 x In A) for flowing, and it's available to let current keep on flowing at least 4 hour without any melting. (Can keep 4 Hour minimum)

4.2 Temperature:
100% (1.0 x In A) 1.5
(Thermocouple method) 175K
Loading the 100 % (1.0 x In A) for 1.5 hours, keep testing it with the original current every 10 minutes. Continue to test it for 3 times. The temperature is not allowed to be higher. The main temperature rise is below 175K by way of thermocouple method.

4.3 Melting due to Overloading:
Details as Follows Table

Operating Characteristics				
Rating	100% Rating		250% Rating	
	Min.	Max.	Min.	Max.
0.5A ~ 2A	4 hr		1 sec	120 sec

5. Mechanical Properties:

Terminal Strength:
1.0kgf
Caps are soldered (adhered) to withstand axial pulling force of 1.0kgf without loosening or any harmfulness to firmly attachment.

6. Pulse Test:

10ms
In order to stand transient current caused by inductive or capacitive, the fuses are designed to have minimum clearing time of 10 millisecond at 1000% rated current.

7. Cycle Test (On-Off Test):

60% 1 ON 2 OFF
1000 20%
This test is designed to assure a reliable fuse, Controls are set giving 60% of rated ampere. 1 minute ON, 2 minutes OFF per time, the fuse will not open before 1000 times and the internal resistance change will be below 20%.

8. Interrupting Rating:

0.5A ~ 2A: 60 amperes at 600Vac
60 amperes at 250Vac
50 amperes at 250Vdc
100 amperes at 125Vdc

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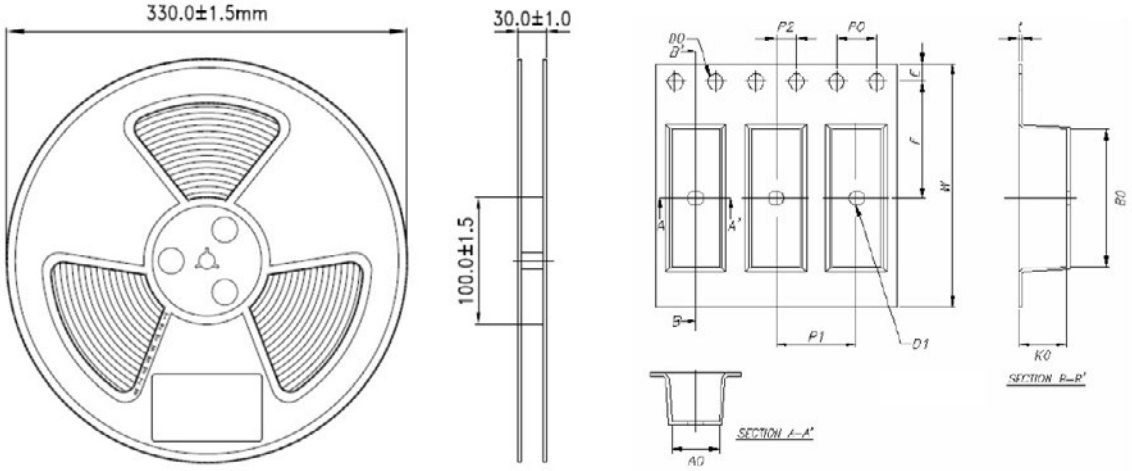
9. Packing:

Tape in reel: SEM Series 2500pcs in a reel (13”) in an inner box, and 10000pcs in an outer box.
The following items indicated on the box.
Mark: Catalog number, ratings (voltage, current, interrupting capacity) and safety mark. The packing material conforms to RoHS or the HF environmental protection request. And the packing material can’t have the chemical reaction with the components.

SEM Series

Item	W	P1	E	F	D0	D1	P0	P2	t	K0	A0	B0
Spec	24.00	8.00	1.75	11.50	1.50	1.50	4.00	2.00	0.30	3.40	3.40	10.40
Tolerance	+0.30 -0.30	+0.10 -0.10	+0.10 -0.10	+0.10 -0.10	+0.10 -0.00	+0.10 -0.00	+0.10 -0.10	+0.10 -0.10	+0.05 -0.05	+0.10 -0.10	+0.10 -0.10	+0.10 -0.10

(Unit: mm)



10. Mark/Label/Agency Approvals:

SEM Series

Approvals Rating		Nominal Cold Resistance (Ohms)	Nominal Melting I²t (A² sec.)	Max. Power Dissipation (W)
0.5 A	*	0.3360-0.6240	1.40	0.4
1.25 A	*	0.0700-0.1300	22.0	0.6
2 A	*	0.0385-0.0715	24.0	0.8

I²t is measured at 10 times of rated current.
*With agency approvals.

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11. Description:

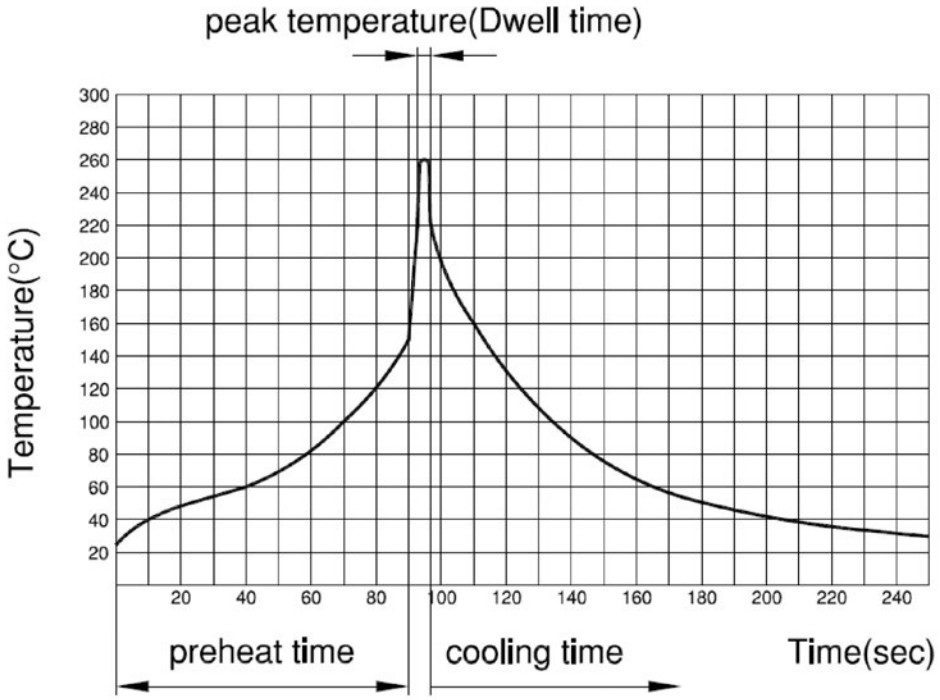
SEM	1.25A	600V
1	2	3

1. Series Model: SEM
2. Ampere Rating: 0.5A / 1.25A / 2A
3. Voltage: 600V

12. Recommended Soldering Method and Process Parameters (for the action to lead-free solder alloy and reflow soldering) :

12.1 Hand Soldering : 350°C, 3sec. max. (Do not touch the terminal cap.)

12.2 Wave Soldering : 260°C, 3sec. max.



Wave Soldering Condition		Lead-free Assembly
Pre-Heat	Temperature Max.	150°C
	Time (Min. to Max.)	60 - 90 sec.
Solder Pot Temperature		260°C max.
Solder Dwell Time		2 - 3 sec.

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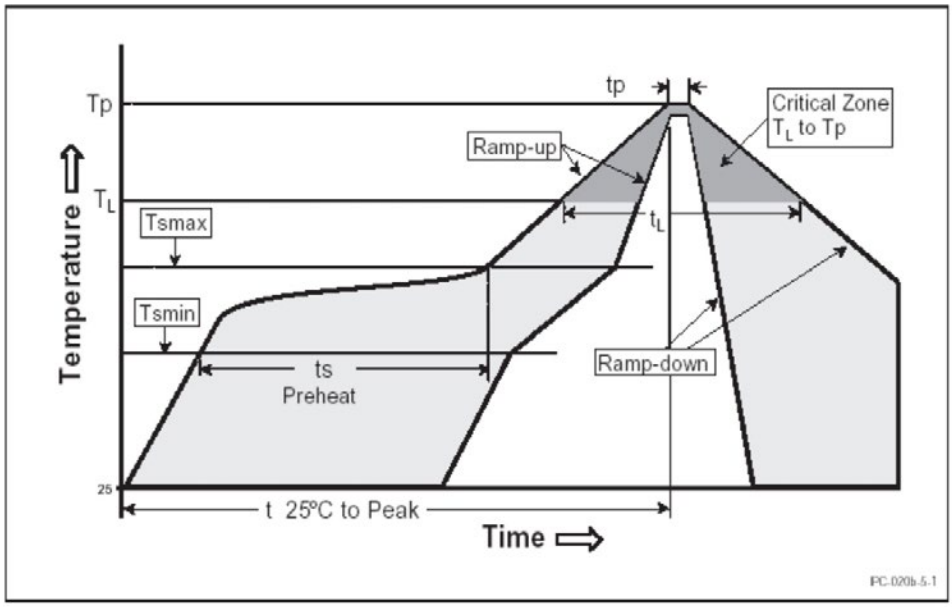
12.3 Reflow Soldering : 260°C, 30sec. max. See detail in the soldering profile.



Reflow Condition		Lead-free Assembly
Pre-Heat	Temperature Min. ($T_{s\ (min)}$)	150°C
	Temperature Max. ($T_{s\ (max)}$)	200°C
	Time (Min to Max) (t_s)	60 - 180 sec.
Average Ramp-up Rate (Liquidus Temp (T_L) to peak)		3°C / sec max.
$T_{s\ (max)}$ to T_L-Ramp-up Rate		5°C / sec max.
Reflow	Temperature (T_L) (Liquidus)	217°C
	Time (t_L)	60 - 150 sec.
Peak Temperature (T_p)		260 +0/-5°C
Time within 5°C of actual peak Temperature (t_p)		10 - 30 sec.
Ramp-down Rate		6°C / sec max.
Time 25°C to peak Temperature (t 25°C to peak)		8 min max.
Do not exceed		260°C

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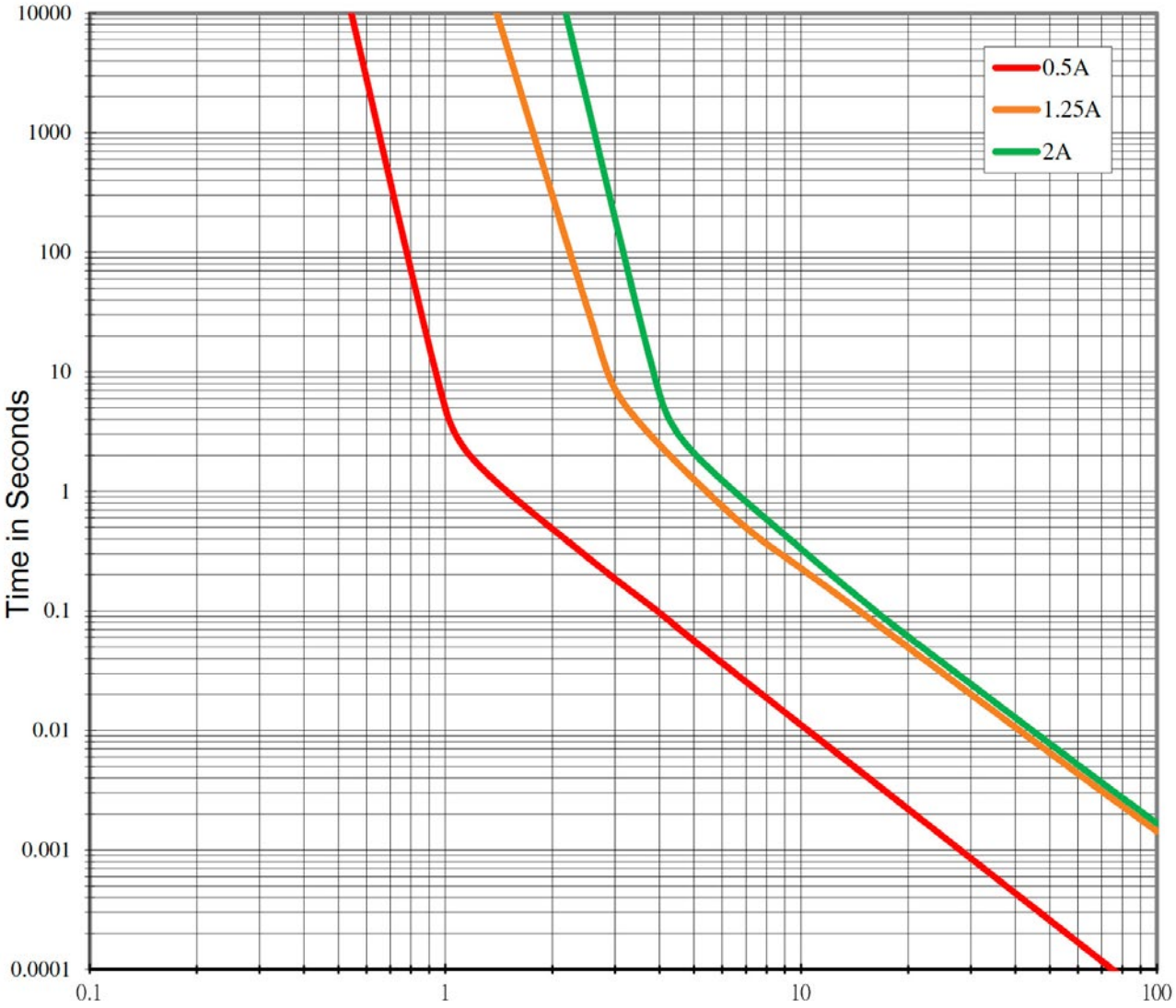
13. Time Current Characteristic Curve(I vs t curve):

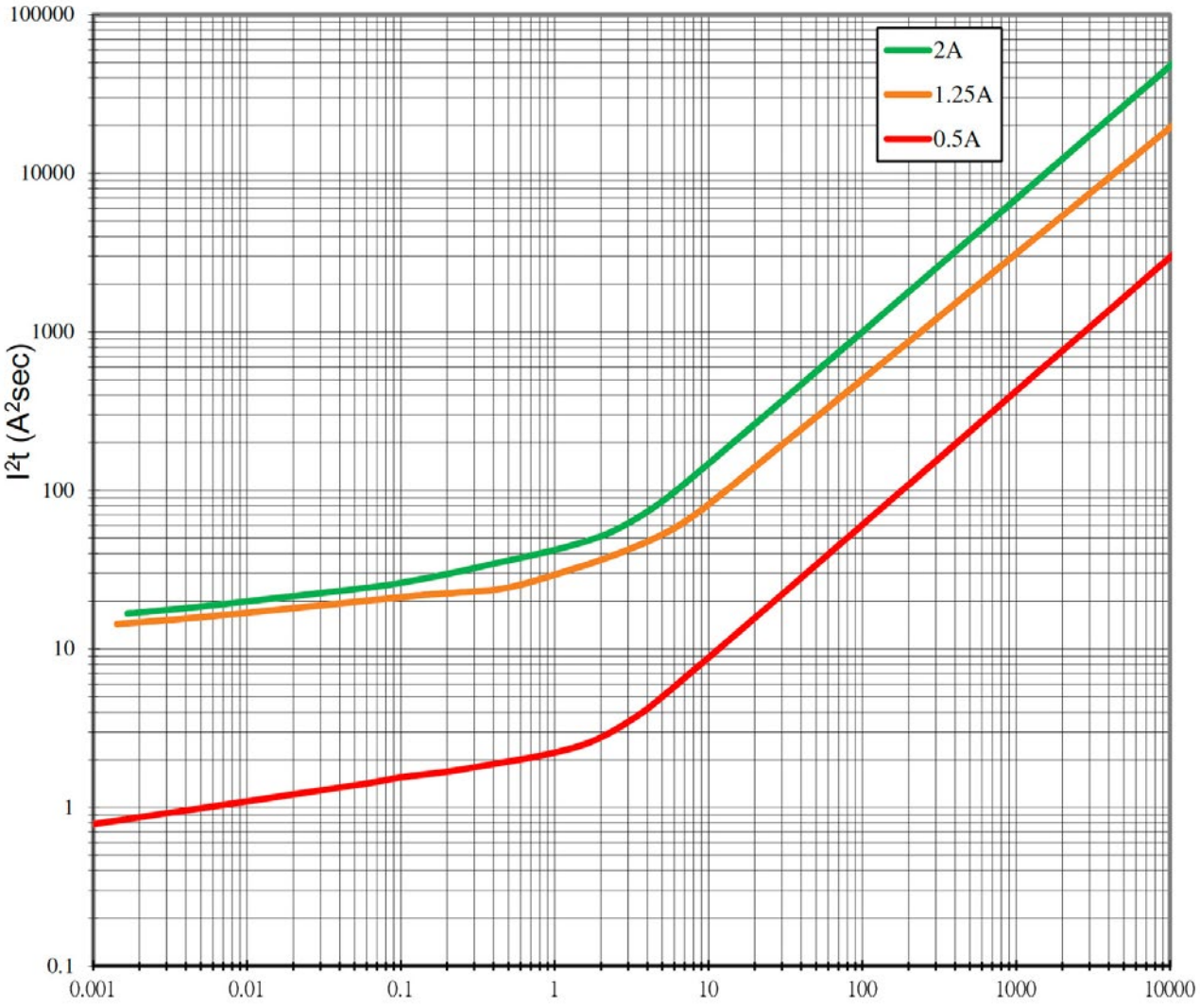
Average Melting It Curves



Current in Amperes

14. I^2t Average Melting I^2t Curves(I^2t vs t curve):

Average Melting I^2t Curves



Time in Seconds

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15. Product Characteristics:

Product Characteristics & Reliability Tests

Test Item	Test Description & Reference
Humidity unload test	MIL-STD-202G • Method 103B • Test Condition A Heat (853 ± .5°C) & High Humidity (85 ± 1% RH), 240 hours, ΔR<15%
Thermal shock test	MIL-STD-202G • Method 107g • Test Condition B Temperature setup: 25°C ~ -65°C ~ 25°C ~ 125°C Time setup: -65°C (30min)~25°C (5min)~125°C (30min)~ 25°C (5min) 5 cycles, ΔR<15%
Vibration test	MIL-STD-202G • Method 201A Frequency setup: 10 ~ 55 ~ 10 Hz Time setup: 1 Minutes/cycle (X-Y-Z, 120 Cycles) 6 hrs, ΔR<15%
Salt spray test	MIL-STD-202G • Method 101E • Test Condition A Salt pray concentration: 5 ± 1% Test liquid temperature : 35 ± 0.5°C 96 hrs, ΔR<15%
Solderability test (for reflow soldering condition)	Reference IEC 60068-2-58 Temperature setup: 235 ± 5°C, IO ± 1 sec After test terminal electrode wetting area must be greater than 95%
Resistance to solder heat test (for reflow soldering condition)	Reference IEC 60068-2-58 Temperature setup: 260 +0/-5°C, 10 sec max. ΔR<15%
Bending test	Reference IEC 60127-4 The board shall be bent by 1mm at a rate of 1mm/sec ΔR<15%

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16. Lightning Surge Specifications: (Fuse can not open)

Surge Specification	Surge	Max. Rise / Min. Decay (µsec.)	Min. Peak Current (A)	Min. Peak Voltage (V)	Repetitions Each Polarity	Recommended Fuse
Telcordia / Bellcore GR-1089	First Level Lightning	10 / 1000	100	600	25	1.25A / 2A
			100	1000	25	1.25A / 2A
			100*	2000	25	1.25A / 2A
		10 / 700	160	4000	5	1.25A / 2A
		10 / 360	100	1000	25	1.25A / 2A
			25	1000	5	0.5A / 1.25A / 2A
		10 / 250	200*	4000	5	1.25A / 2A
		1.2 / 50 Voltage & 8 / 20 Current	600*	6000	5	1.25A / 2A
			300	6000	5	1.25A / 2A
			800*	2000	5	1.25A / 2A
			750	2000	5	1.25A / 2A
			400	800	5	1.25A / 2A
			300	600	5	1.25A / 2A
		2 / 10	500	2500	10	1.25A / 2A
			300	1500	10	1.25A / 2A
			200	1000	5	1.25A / 2A
			100	800	5	1.25A / 2A
	Second Level Lightning	1.2 / 50 Voltage & 8 / 20 Current	750*	6000	1	1.25A / 2A
		2 / 10	500	5000	1	1.25A / 2A

*The test shall be added additional impedance devices.

Surge Specification	Surge	Waveform (µsec.)	Current (A)	Voltage (V)	Repetitions Each	Recommended Fuse
FCC Part 68 (TIA-968-A)	Metallic A	10 x 560	100	800	1	1.25A / 2A
	Longitudinal A	10 x 160	200	1500	1	1.25A / 2A

Surge Specification	Surge	Waveform (µsec.)	Current (A)	Voltage (V)	Repetitions Each	Recommended Fuse
UL / EN 60950 (ITU-T K20)	Non-handheld	10 x 700	37.5	1500	5	0.5A / 1.25A / 2A
	Handheld units		62.5	2500	5	0.5A / 1.25A / 2A

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17. AC Power Fault Tests: (Fuse can not open)

GR-1089 1st Level Test	Voltage (Vrms)	Short Circuit Current (A)	Hits	Duration	Recommended Fuse
1	50	0.33	1	15 min	0.5A / 1.25A / 2A
2	100	0.17	1	15 min	0.5A / 1.25A / 2A
3	600	0.5	1	30 sec	0.5A / 1.25A / 2A
4	1000	1	60	1 sec	0.5A / 1.25A / 2A
5	200	0.47	60	1 sec	0.5A / 1.25A / 2A
6	425	0.71	5	2 sec	0.5A / 1.25A / 2A
7	440	2.2	5	2 sec	1.25A / 2A
8	600	3	1	1.1 sec	1.25A / 2A
9	1000	5	1	0.4 sec	1.25A / 2A

※ These tests can be performed at a higher voltage, but the current is to be as specified.

18. AC Current Limiting Protector Tests / Fusing Coordination Tests:

Voltage (Vac)	Current (A)	Duration	Maximum Time For Fuse To Open (Seconds)		
			0.5A	1.25A	2A
600	2.2	Up to 15 min	1	Will not open	Will not open
600	2.6		0.8	900	Will not open
600	3.0		0.5	20	Will not open
600	3.75		0.3	10	20
600	5.0		0.2	4	10
600	7.0		0.1	2	4
600	10		0.05	1	1.2
600	12.5		0.03	0.40	0.6
600	20		0.01	0.14	0.2
600	25		0.008	0.08	0.14
600	30		0.006	0.04	0.10

19. Other:

19.1 Unless otherwise specified, all tests to be performed at 25±5°C and 35-75% RH.

19.2 After one year's storage under normal condition, this item is guaranteed to meet the requirements mentioned above.

19.3 Because the materials used in these fuses include high melting temperature type solder and this solder contains more than 85% lead (Pb), so these products can conform to the exempts of the requirements of RoHS Directive.