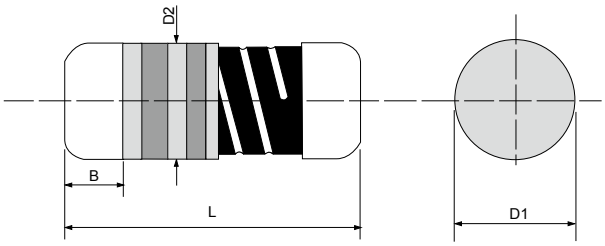
SM – Stabilized Metal Film MELF Resistor

Quality • Reliability
Cost-Down via Innovation



Specifications Per

• IEC 60115-1 60115-2 • EN 140401-803

Features

- Excellent in heat dissipation than chip resistor
- Stronger mechanical structure to endure vibration and thermal shock
- SMD enabled Structure with excellent solderability
- Excellent solderability termination
- Products meet RoHS requirements and do not contain substances of very high concern identified by European Chemicals Agency

DIMENSIONS

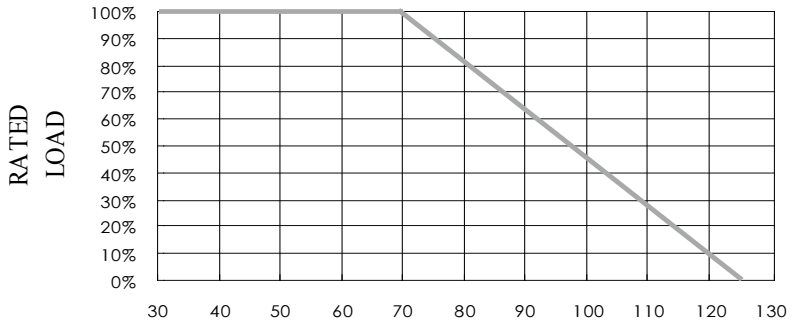
Type	Body Length (L, mm)	Cap Diameter (D1, mm)	Body Diameter (D2, mm)	Soldering Spot (B, mm)	Net Weight Per 1000 pcs
SM16	3.52 ± 0.15	1.35 ± 0.1	D1+0.02/ -0.15	0.6 Min.	17 grams
SM204	3.52 ± 0.15	1.35 ± 0.1	D1+0.02/ -0.15	0.6 Min.	17 grams
SM207	5.90 ± 0.20	2.20 ± 0.1	D1+0.02/ -0.2	1.0 Min.	66 grams
SM52	5.90 ± 0.20	2.20 ± 0.1	D1+0.02/ -0.2	1.0 Min.	66 grams

GENERAL SPECIFICATIONS

Type	Power Rating (at 70°C)	Maximum Working Voltage	Maximum Overload Voltage	Minimum Resistance	Maximum Resistance	Resistance Tolerance	Available Resistance Values
SM16	1/6W	200V	400V	0.51Ω	10MΩ	±1%	E-96
						±2%, ±5%	E-48/E-24
SM204	1/4W	200V	400V	0.51Ω	10MΩ	±1%	E-96
						±2%, ±5%	E-48/E-24
SM207	1/3W	250V	500V	0.51Ω	10MΩ	±1%	E-96
						±2%, ±5%	E-48/E-24
SM52	1/2W	250V	500V	0.51Ω	10MΩ	±1%	E-96
						±2%, ±5%	E-48/E-24

For zero-ohm jumper, please see ZMM series. For 10m~510mΩ, please see CSM series. Special sizes, values, and specifications not listed available on special order.

POWER DERATING CURVE



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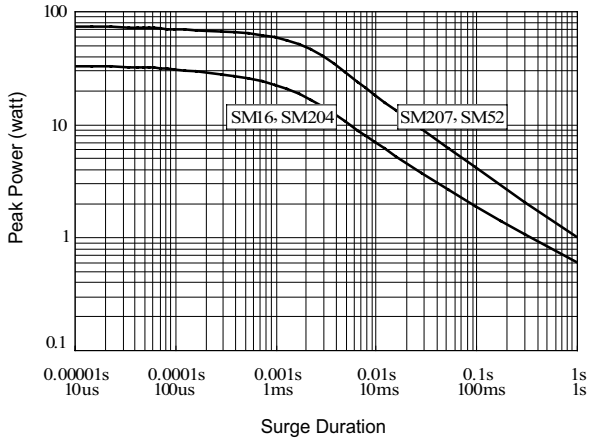
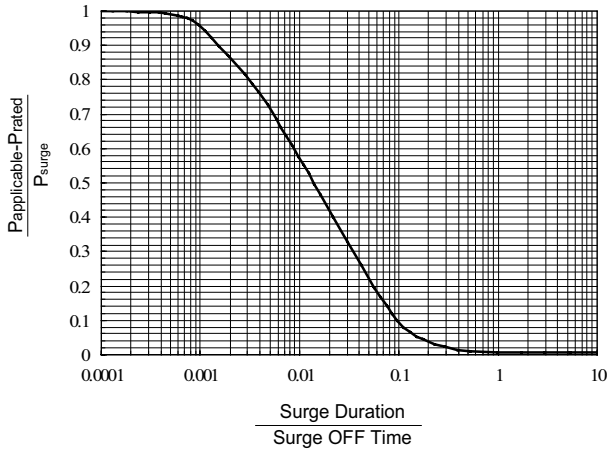
TECHNICAL SUMMARY

Characteristics	Ranges & Limits	
Operating Temperature Range, °C	-55 ~ +125	
Temperature Coefficient, PPM / °C*	±1%, ±2%	±25, ±50, ±100
	±5%	±100
Dielectric Withstanding Voltage, VAC or DC	SM16, SM204	200
	SM207, SM52	500
Insulation Resistance, MΩ	$>10^4$	
Failure Rate, pcs/10^9 device hours	<0.1	
Thermal Resistance, K/W	<220	
Tin Whisker (JESD201 Temperature Cycling & High Temp./Humidity Storage), μm	<5	

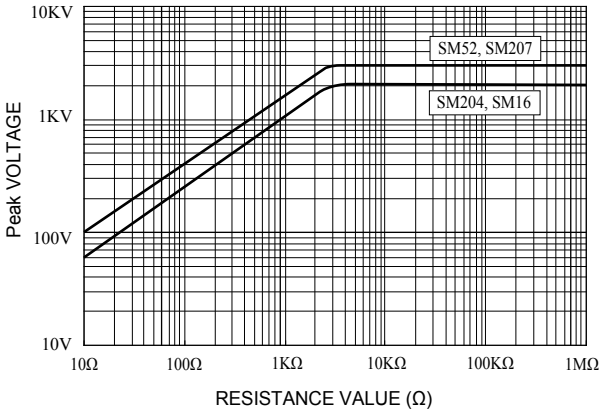
*** Not applicable to all resistance values. Please check with us regarding the PPM of specific resistance value(s).**

SINGLE SURGE PERFORMANCE





Pulse load rating in accordance with IEC 60115-1, 4.27
1.2μs/50μs ; 5 pulses at 12s interval for ±0.5% resistance change



Notes:

1. SINGLE SURGE PERFORMANCE graph is good for NON REPETITIVE applications operating in an ambient temperature of 70°C or less.
   For temperatures above 70°C, the graph power must be derated further linearly down to zero at 125°C.

2. To determine applicable surge power in continuous-surge applications:
   - Identify allowable duration and peak power P_{surge} of single surge;
   - Determine ratio of surge duration/surge OFF time in application;
   - Calculate $P_{applicable}$ backwardly according to Y-axis of SURGE POWER DERATING CURVE.

SM – Stabilized Metal Film MELF Resistor

PERFORMANCE SPECIFICATIONS

Characteristics	Test Conditions		Limits		
Short Time Overload	**IEC 60115-1 4.13** 5 seconds 2.5x rated voltage (not over max. overload voltage)		0.51Ω to 332KΩ		±0.15%
			>332KΩ		±0.35%
Load Life	**IEC 60115-1 4.25.1** Rated load (not over max. working voltage) 1000 hrs with 1.5 hours ON, 0.5 hours OFF, at (70±2)°C	1,000 hours	±0.5%		
		8,000 hours	<10Ω		±1%
			10Ω to <10KΩ		±0.75%
			10KΩ to 332KΩ		±1.5%
			>332KΩ		±2.5%
Load Life In Humidity	**IEC 60115-1 4.24** 56 days rated load (not over max. working voltage) at (40±2)°C and (93±3)% relative humidity		<1Ω		±1%
			1Ω to 332KΩ		±0.5%
			>332KΩ		±2%
Load Life In Humidity (accelerated mode)	**IEC 60115-1 4.37** 1,000 hours at 85°C and 85% relative humidity with 0.1x rated voltage (not over 100V)		<1Ω		±1%
			1Ω to <10KΩ		±0.5%
			10KΩ to 332KΩ		±2%
			>332KΩ		±3.5%
Periodic Electric Overload	**IEC 60115-1 4.39** 3.9x rated voltage (not over max. overload voltage) with 0.1s ON, 2.5s OFF for 1,000 cycles		±0.5%		
Resistance To Soldering Heat	**IEC 60115-1 4.18.2** Dip the resistor into a solder bath measured (260±5)°C and hold it for a 10±1 seconds		<1Ω		±0.25%
			1Ω to 332KΩ		±0.15%
			>332KΩ		±0.35%
Thermal Endurance	**IEC 60115-1 4.25.3** 1,000 hours without load	85°C	<1Ω		±0.25%
			1Ω to 100Ω		±0.1%
			>100Ω to 332KΩ		±0.3%
			> 332KΩ		±0.75%
		125°C	<1Ω		±0.5%
			1Ω to 100Ω		±0.25%
			>100Ω to 332KΩ		±0.5%
			> 332KΩ		±1.0%
Thermal Shock	**IEC 60115-1 4.19** -55°C 30minutes, +125°C 30minutes	5 cycles	<1Ω		±0.15%
			1Ω to 332KΩ		±0.05%
			> 332KΩ		±0.15%
		1,000 cycles	<1Ω		±0.5%
			1Ω to 332KΩ		±0.2%
			> 332KΩ		±0.5%
Single pulse high voltage overload	**IEC 60115-1 4.27** • 5 pulses of 1.2/50μs at 10x rated voltage (not over 400V for SM16 & SM204; not over 500V for SM207 & SM52) with interval of 12 sec. • 10 pulses of 10/700μs at 10x rated voltage (not over 400V for SM16 & SM204; not over 500V for SM207 & SM52) with interval of 60 sec.		±0.25% ±0.25%		
Electrostatic discharge (Human body model)	**IEC 60115-1 4.38** 3 positive & 3 negative discharges with 2KV for SM16 & SM204 or 4KV for SM207 & SM52 (For continuous surge application please see Surge Performance paragraph)		±0.15%		
Climatic test	**IEC 60115-1 4.23** 4.23.2 - dry heat: 16 hours 125°C 4.23.3 - damp heat: 24 hours 55°C with 95% relative humidity 4.23.4 - cold: 2 hours -55°C 4.23.5 - negative air pressure: 2 hour 8.5KPa at (25±10)°C 4.23.6 - damp heat cyclic: 5 days 55°C with 95% relative humidity 4.23.7 - DC load: rated voltage at -55°C and 125°C each for 1 min.		±0.5%		
Solderability	**IEC 60115-1 4.17.2** Solder area covered after (235±3)°C/(2±0.2) seconds with flux applied		95% min.coverage		
Vibration	**IEC 60115-1 4.22** Six hours in each parallel and axial direction with a simple harmonic motion having an amplitude of 1.52mm and 10 to 2,000 Hz.		±0.15%		
Bending test	**IEC 60115-1 4.33** Pressing depth 2mm, 3 times		±0.15%		
Flammability	**IEC 60115-1 4.35** Needle flame test 10s		No burning after 30s		

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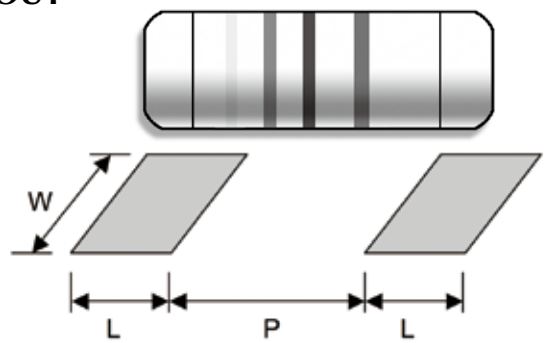
PART NUMBER

Example: SM204F84K5TKRTR3K0

SM204	F	84K5	TKR	TR3K0
Type	Tolerance*	Resistance	TCR*	Packaging
	F (1%) G (2%) J (5%)	84.5KΩ **4-character code** containing - 3 significant digits 1 letter multiplier OHM MULTIPLIER R = 1 K = 10^3 M = 10^6 G = 10^9	50ppm **3-character code** TKQ = ± 25ppm TKR = ± 50ppm TKS = ± 100ppm	**5-character code** TR = Tape Reel (pieces per reel) SM16/SM204 3K0 = 3,000 6K0 = 6,000** 10K = 10,000** SM207/SM52 2K0 = 2,000 6K0 = 6,000** 10K = 10,000**

*** For the availabilities of non-default temperature coefficient, please check with us. Reference for TCR letter codes can be found in section (4) of Part Number Construction in the Appendices.**

SUGGESTED PAD LAYOUT



Type	Soldering Mode	Pad Length (L, mm, Min.)	Pad Spacing (P, mm)	Pad Width (W, mm, Min.)
SM16 SM204	Reflow	1.3	1.6 ± 0.1	1.6
	Wave	1.5	1.5 ± 0.1	1.8
SM207 SM52	Reflow	2.0	3.0 ± 0.1	3.0
	Wave	2.5	3.0 ± 0.1	3.0

For better heat dissipation / lower heat resistance, increase W & L.

COVER TAPE PEELING SPECIFICATION

Recommended peeling force: 50±5gf