

## Specifications Per

- IEC 60115-1
- EN140401-803

## Features

- SMD enabled structure
- Anti-sulfuration test qualified
- Excellent solderability termination
- Excellent in heat dissipation than chip resistor
- Stronger mechanical structure to endure vibration and thermal shock
- 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
MM16	3.52 ± 0.15	1.35 ± 0.1	D1+0.02/ -0.15	0.6 Min.	17 grams
MM204	3.52 ± 0.15	1.35 ± 0.1	D1+0.02/ -0.15	0.6 Min.	17 grams
MM207	5.90 ± 0.20	2.20 ± 0.1	D1+0.02/ -0.2	1.0 Min.	80 grams
MM52	5.90 ± 0.20	2.20 ± 0.1	D1+0.02/ -0.2	1.0 Min.	80 grams

## ■ GENERAL SPECIFICATIONS

Type	Power Rating At 70°C	Maximum Working Voltage*	Maximum Overload Voltage**	Minimum Resistance	Maximum Resistance	Resistance Tolerance	Available Resistance Values
MM16	1/6W	200V	400V	0, 0.51Ω	10MΩ	±1%	E-96
						±2%, ±5%	E-48/E-24
MM204	1/4W	200V	400V	0, 0.51Ω	10MΩ	±1%	E-96
						±2%, ±5%	E-48/E-24
MM207	1/3W	300V	500V	0, 0.51Ω	10MΩ	±1%	E-96
						±2%, ±5%	E-48/E-24
MM52	1/2W	300V	500V	0, 0.51Ω	10MΩ	±1%	E-96
						±2%, ±5%	E-48/E-24

For a better life cycle under normal usage, 50% of the rated power is recommended.

For zero-ohm jumper, please see ZMM series. For 1m~510mΩ please see CSM series.

Special sizes and specifications available on request.

\* Rated Continuous Maximum Working Voltage (RCWV) should be determined from  $RCWV = \sqrt{\text{Power Rating} \times \text{Resistance Values Max.}}$  RCWV listed above.

\*\* Short-time Overload (STOL) test should be determined from  $STOL = 2.5 \times \sqrt{\text{Power Rating} \times \text{Resistance Values}}$  or maximum overload voltage listed above, whichever is lower.

# MM Metal Film MELF Resistor

Quality • Reliability  
Cost-Down via Innovation

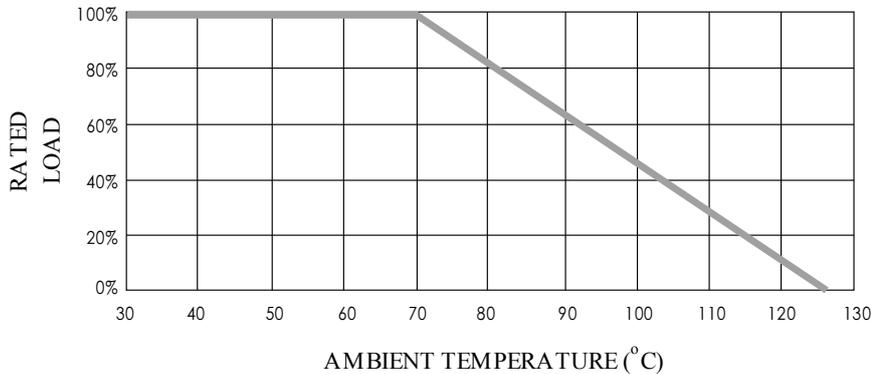
## ■ PART NUMBER

Example: MM204F162RTKRTR3K0

MM204	F	162R	TKR	TR3K0
Type	Tolerance*	Resistance	TCR*	Packaging
	Z (Jumper) F (1%) G (2%) J (5%)	162Ω <b>4-character code</b> containing - 3 significant digits 1 letter multiplier  <b>OHM MULTIPLIER</b> R = 1 K = 10 <sup>3</sup> M = 10 <sup>6</sup> G = 10 <sup>9</sup>	50ppm <b>3-character code</b>  TKP = ± 15ppm TKQ = ± 25ppm TKR = ± 50ppm TKS = ± 100ppm	<b>5-character code</b> TR = Tape Reel (pieces per reel)  <u>MM16/MM204</u> 3K0 = 3,000 pcs 6K0 = 6,000 pcs** 10K = 10,000 pcs**  <u>MM207/MM52</u> 2K0 = 2,000 pcs 6K0 = 6,000 pcs** 10K = 10,000 pcs**

\* Listed values may not be applicable across product types or to all resistance values. Please check with us before placing order. \*\*upon request

## ■ POWER DERATING CURVE



## ■ TECHNICAL SUMMARY

Characteristics	Ranges & Limits	
Operating Temperature Range, °C	-55 ~ +125	
Temperature Coefficient, PPM / °C*	±1%, ±2%	±15, ±25, ±50, ±100
	±5%	±100
Dielectric Withstanding Voltage, VAC or DC	MM16, MM204	200
	MM207, MM52	500
Insulation Resistance, MΩ	>10 <sup>4</sup>	
Tin Whisker (JESD201 Temperature Cycling & High Temp. / Humidity Storage), μm	<5	
Failure Rate in Time, pcs / 10 <sup>9</sup> device hours	<1	

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

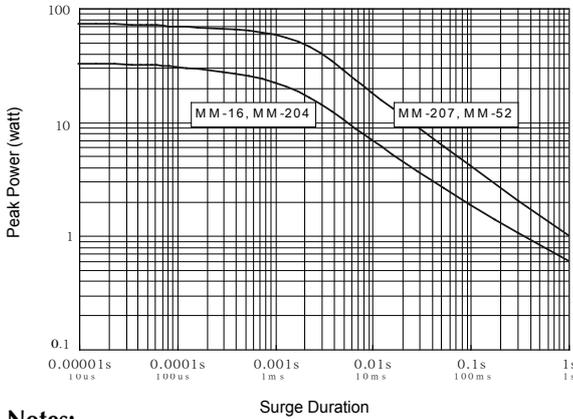
## PERFORMANCE SPECIFICATIONS

Characteristics	Test Conditions	Limits	
Short Time Overload	<b>IEC 60115-1 4.13</b> 5 seconds 2.5x rated voltage (not over max. overload voltage)	0.51Ω to 332KΩ	±(0.25%+0.01Ω)
		>332KΩ	±(0.5%+0.01Ω)
Load Life	<b>IEC 60115-1 4.25.1</b> Rated load (not over max. working voltage) 1,000 hours with 1.5 hours ON, 0.5 hour OFF, at (70±2)°C	0.51Ω to 332KΩ	±(0.75%+0.01Ω)
		>332KΩ	±(1%+0.01Ω)
Load Life In Humidity	<b>IEC 60115-1 4.24</b> 56 days rated load (not over max. working voltage) at (40±2)°C and (93±3)% relative humidity	0.51Ω to 332KΩ	±(1%+0.01Ω)
		>332KΩ	±(2%+0.01Ω)
Load Life In Humidity (accelerated mode)	<b>IEC 60115-1 4.37</b> 1,000 hours at 85°C and 85% relative humidity with 0.1x rated voltage (not over 100V)	0.51Ω to <100KΩ	±(1%+0.01Ω)
		100KΩ to 332KΩ	±(2.5%+0.01Ω)
		>332KΩ	±(3.5%+0.01Ω)
Periodic Electric Overload	<b>IEC 60115-1 4.39</b> 3.9x rated voltage (not over max. overload voltage) with 0.1s ON, 2.5s OFF for 1,000 cycles	±(0.5%+0.01Ω)	
Resistance To Soldering Heat	<b>IEC 60115-1 4.18.2</b> Dip the resistor into a solder bath measured (260±5)°C and hold it for a 10±1 seconds	±(0.5%+0.01Ω)	
Thermal Endurance	<b>IEC 60115-1 4.25.3</b> 1,000 hours without load	85°C	±(0.5%+0.01Ω)
		125°C	±(1%+0.01Ω)
Thermal Shock	<b>IEC 60115-1 4.19</b> -55°C 30minutes, +125°C 30minutes	5 cycles	±(0.25%+0.01Ω)
		1,000 cycles	±(0.75%+0.01Ω)
Single pulse high voltage overload	<b>IEC 60115-1 4.27</b> • 5 pulses of 1.2/50μs at 10x rated voltage (not over 400V for MM16 & MM204; not over 500V for MM207 & MM52) with interval of 12 sec. • 10 pulses of 10/700μs at 10x rated voltage (not over 400V for MM16 & MM204; not over 500V for MM207 & MM52) with interval of 60 sec.	±(0.5%+0.01Ω)	
Electrostatic discharge (Human body model)	<b>IEC 60115-1 4.38</b> 3 positive & 3 negative discharges with 2KV for MM16 & MM204 or 4KV for MM207 & MM52 (For continuous surge application please see Surge Performance paragraph)	±(0.5%+0.01Ω)	
Climatic test	<b>IEC 60115-1 4.23</b> 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 1 Min.	±1.0%+0.01Ω	
Solderability	<b>IEC 60115-1 4.17.2</b> Solder area covered after (235±3)°C/(2±0.2) seconds with flux applied	95% min.coverage	
Vibration	<b>IEC 60115-1 4.22</b> 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.	±0.25%+0.01Ω	
Bending test	<b>IEC 60115-1 4.33</b> Pressing depth 2mm, 3 times	±0.25%+0.01Ω	
Flammability	<b>IEC 60115-1 4.35</b> Needle flame test 10s	No burning after 30s	

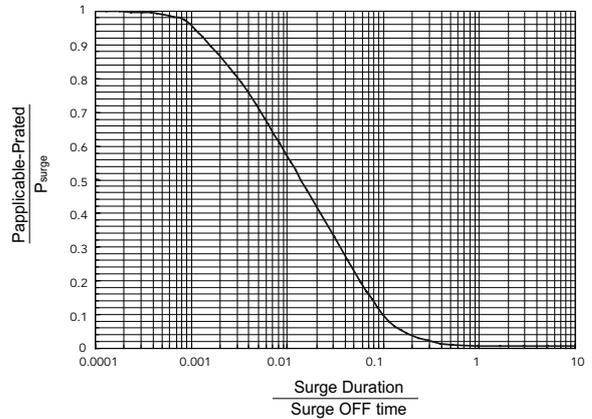
# MM Metal Film MELF Resistor

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## ■ SINGLE SURGE PERFORMANCE



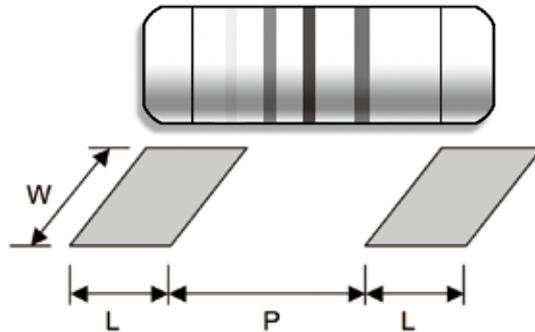
## ■ SURGE POWER DERATING CURVE



### Notes:

- 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.
- To determine applicable surge power in continuous-surge applications:
  1. Identify allowable duration and peak power P<sub>surge</sub> of single surge;
  2. Determine ratio of surge duration/surge OFF time in application;
  3. Calculate P<sub>applicable</sub> backwardly according to Y-axis of SURGE POWER DERATING CURVE.

## ■ SUGGESTED PAD LAYOUT



Type	Soldering Mode	Pad Length (L, mm, Min.)	Pad Spacing (P, mm)	Pad Width (W, mm, Min.)
MM16 MM204	Reflow	1.3	1.6 ± 0.1	1.6
	Wave	1.5	1.5 ± 0.1	1.8
MM207 MM52	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

