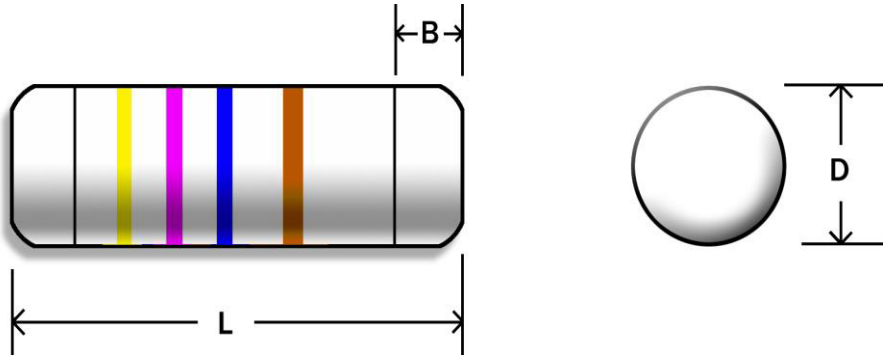
MM102 - Metal Film MELF Resistor

Specifications Per

- IEC 60115-1
- EN140401-803

Features

- SMD enabled structure
- 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)	Body Diameter (D , mm)	Soldering spot (B, mm)	Net Weight Per 1000 pcs
MM102	2.1 ± 0.1	1.1 ± 0.1	0.5 Min.	7 grams

■ GENERAL SPECIFICATIONS

Type	Power Rating at 70℃	Maximum Working Voltage	Maximum Overload Voltage	Minimum Resistance	Maximum Resistance	Resistance Tolerance	Available Resistance Value
MM102	0.2W	150V	300V	0.22Ω	2.2MΩ	±1%	E24 / E96
						±2%, ±5%	E24

Special sizes, values, and specifications not listed available on special order.

FIRST RESISTOR & CONDENSER CO., LTD. 9F, No. 233, Sec. 4, Shinyi Rd., Taipei 106, Taiwan
Telephone : +886-2-27051878 Fax: +886-2-27036701
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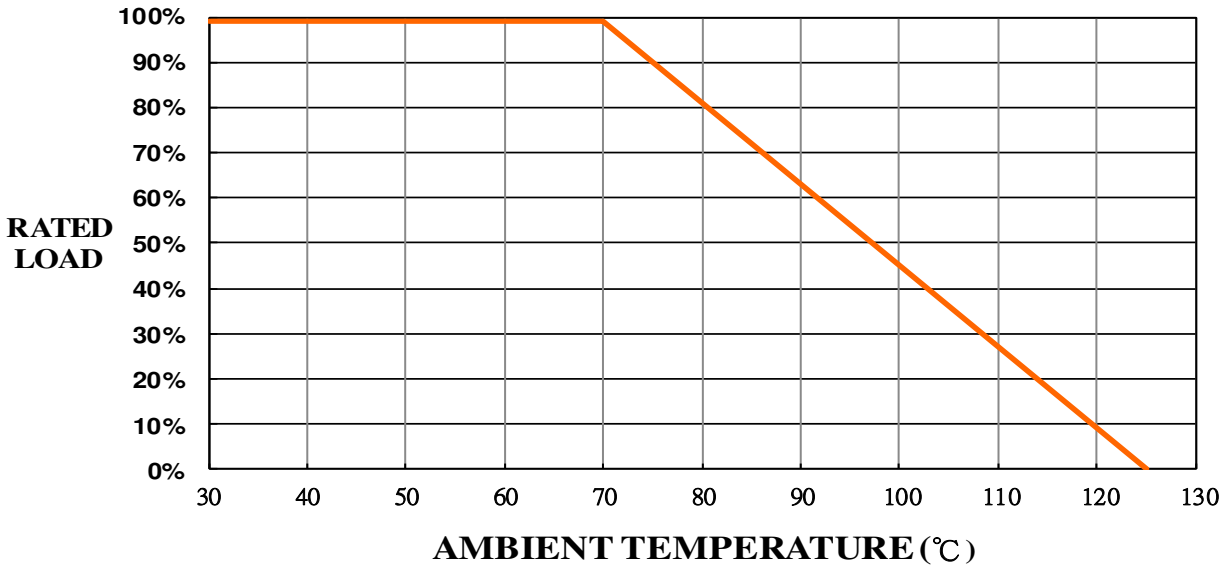
■ POWER DERATING CURVE



■ TECHNICAL SUMMARY

Characteristics	Ranges & Limits	
Operating Temperature Range, ℃	-55 ~ +125	
Temperature Coefficient, PPM / ℃*	±1%, ±2%	±25, ±50, ±100
	±5%	±100
Dielectric Withstanding Voltage, VAC or DC	150	
Insulation Resistance, MΩ	$>10^4$	
Film Temperature, ℃	125	
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).**

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■ PART NUMBER

Example：MM102F162RTKRTR3K0

MM102	F	162R	TKR	TR3K0
Type	Tolerance*	Resistance	TCR	Packaging
MM102	F (1%) G (2%) J (5%)	162Ω **4-character code** containing - 3 significant digits 1 letter multiplier MULTIPLIER R = 1 K = 10^3 M = 10^6 G = 10^9	50ppm **3-character code** Insert the corresponding Code for the temperature coefficient available for the specific product. TKQ = ±25PPM TKR = ±50PPM TKS = ±100PPM	**5-character code** TR=Tape Reel MM102 3K0 = 3,000 6K0 = 6,000 10K = 10,000

*** May not be applicable to all product types or to all resistance values. Please check with us before placing order.**

■ PERFORMANCE SPECIFICATIONS

Test Characteristics	Test Conditions	Limits	
Short Time Overload	**IEC 60115-1 4.13** 5 seconds 2.5x rated voltage (not over max. overload voltage)	0.22Ω to 221KΩ	± 0.5%
		>221KKΩ	± 0.75%
Load Life 1,000 hours	**IEC 60115-1 4.25.1** Rated load (not over max. working voltage) with 1.5 hours ON, 0.5 hours OFF, at (70±2)℃	0.22Ω to 221KΩ	± 2.0%
		>221KΩ	± 3.0%
Load Life In Humidity	**IEC 60115-1 4.24** 56 days rated load (not over max. working voltage) at (40±2)℃ and (93±3)% relative humidity	± 2.0%	
Load Life In Humidity (accelerated mode)	**IEC 60115-1 4.37** 1,000 hours at 85℃ and 85% relative humidity with 0.1x rated voltage (not over 100V)	0.22Ω to < 100KΩ	± 2.0%
		100KΩ to 221K	± 3.0%
		>221KΩ	± 5.0%
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	± 1.5%	
Resistance To Soldering Heat	**IEC 60115-1 4.18.2** Dip the resistor into a solder bath measured (260±5)℃ and hold it for a 10±1 seconds	± 0.5%	
Thermal Endurance	**IEC 60115-1 4.25.3** 1,000 hours at 85℃ without load	0.22Ω to < 10Ω	± 2.0%
		10Ω to 221K	± 1.0%
		>221KΩ	± 1.5%
	1,000 hours at 125℃ without load	0.22Ω to < 10Ω	± 2.0%
		10Ω to 221K	± 1.5%
		>221KΩ	± 2.0%

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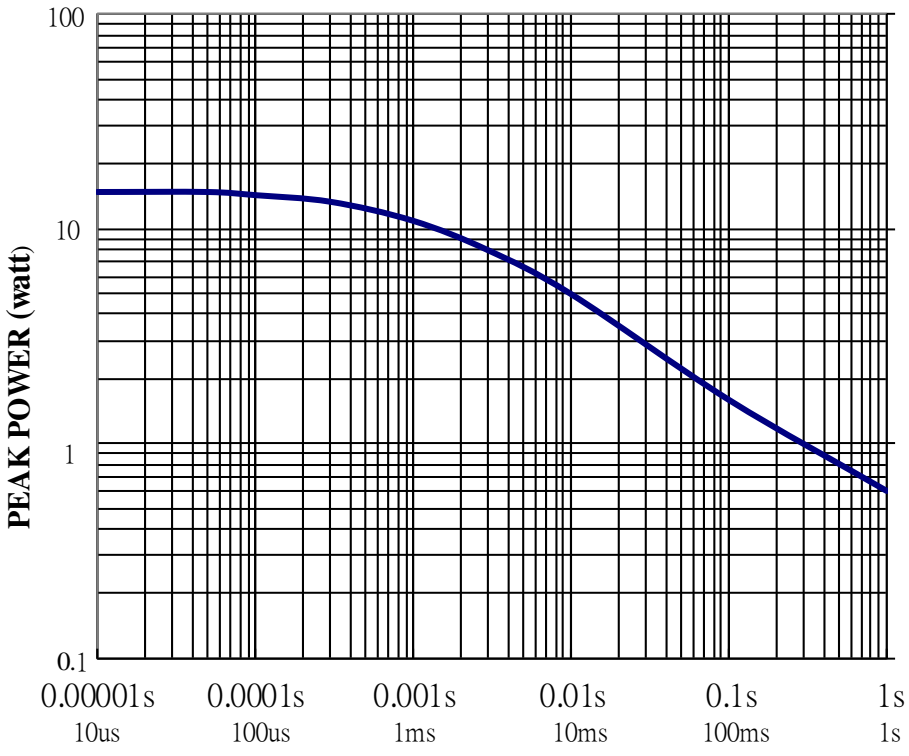
Thermal Shock	**IEC 60115-1 4.19** -55℃ 30minutes, +125℃ 30minutes	5 cycles	± 0.5%
		1,000 cycles	± 1.5%
Single pulse high voltage overload	**IEC 60115-1 4.27** • 5 pulses of 1.2/50μs at 10x rated voltage (not over max. overload voltage) with interval of 12 sec. • 10 pulses of 10/700μs at 10x rated voltage (not over max. overload voltage) with interval of 60 sec.	± 1.0% ± 1.0%	
Electrostatic discharge (Human body model)	**IEC 60115-1 4.38** 3 positive & 3 negative discharges with 1.5KV (For continuous surge application please see Surge Performance paragraph)	± 2.0%	
Climatic test	**IEC 60115-1 4.23** **4.23.2 - dry heat:** 16 hours 125℃ **4.23.3 - damp heat:** 24 hours 55℃ with 95% relative humidity **4.23.4 - cold:** 2 hours -55℃ **4.23.5 - negative air pressure:** 2 hour 8.5KPa at (25±10)℃ **4.23.6 - damp heat cyclic:** 5 days 55℃ with 95% relative humidity **4.23.7 - DC load:** rated voltage at -55℃ and 125℃ each **1 Min.**	± 2.0%	
Solderability	**IEC 60115-1 4.17.2** Solder area covered after (235±3)℃/(2±0.2) seconds with flux applied	> 95% Covered	
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.	± 1.0%	
Bending test	**IEC 60115-1 4.33** Pressing depth 2mm, 3 times	± 0.25%	
Flammability	**IEC 60115-1 4.35** Needle flame test 10s	No burning after 30s	

■ SINGLE SURGE PERFORMANCE



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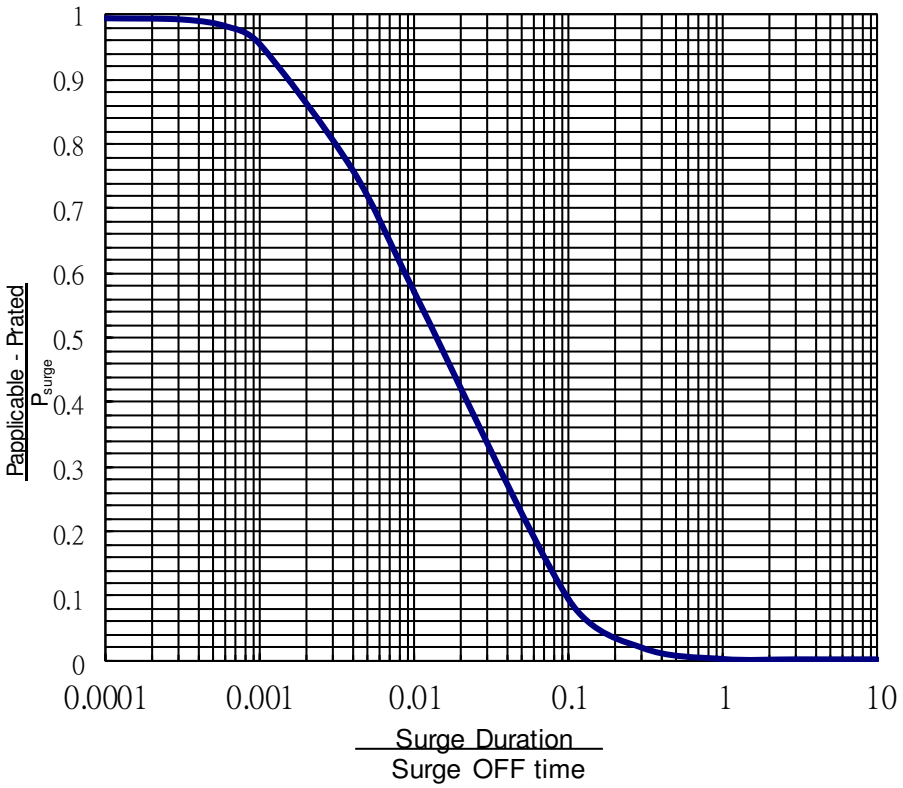
■ SURGE POWER DERATING CURVE



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_{surge} of single surge;
  2. Determine ratio of surge duration/surge OFF time in application;
  3. Calculate $P_{applicable}$ backwardly according to Y-axis of SURGE POWER DERATING CURVE.

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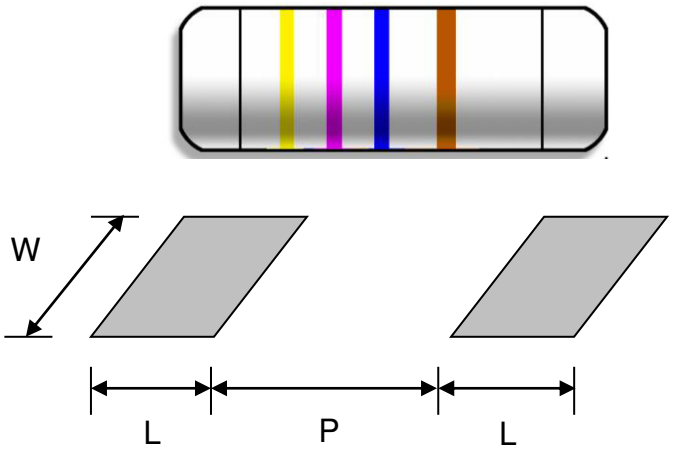
■ SUGGESTED PAD LAYOUT

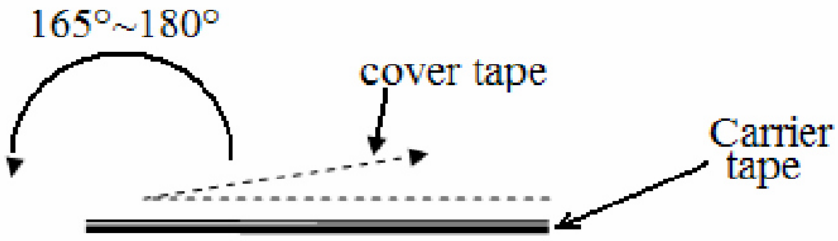


Type	Soldering mode	Pad Length (L, mm, min.)	Pad Spacing (P, mm)	Pad Width (W, mm, Min.)
MM102	Reflow	0.8	1.1 ± 0.2	1.3
	Wave	1.2	0.7 ± 0.2	1.5

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

■ COVER TAPE PEELING SPECIFICATION

Recommended peeling force: 50gf±5gf



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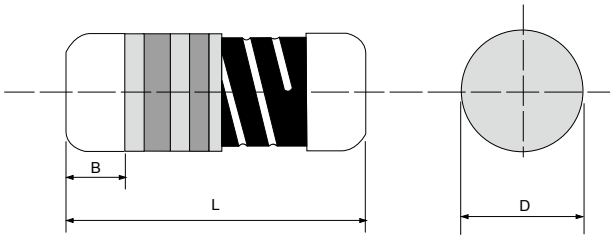
MM
Metal Film MELF Resistor

Quality • Reliability
Cost-Down via Technology



Specifications Per

- IEC 60115-1, IEC 60115-2
- EN140401-803

Features

- SMD enabled structure
- 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)	Body Diameter (D, mm)	Soldering Spot (B, mm)	Net Weight Per 1000 pcs
MM16	3.52 ± 0.08	1.35 ± 0.1	0.6 Min.	17 grams
MM204	3.52 ± 0.08	1.35 ± 0.1	0.6 Min.	17 grams
MM207	5.90 ± 0.20	2.20 ± 0.1	1.0 Min.	66 grams
MM52	5.90 ± 0.20	2.20 ± 0.1	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
MM16	1/6W	200V	400V	0.51Ω	10MΩ	±1%	E-24/E-96
						±2%, ±5%	E-24
MM204	1/4W	200V	400V	0.51Ω	10MΩ	±1%	E-24/E-96
						±2%, ±5%	E-24
MM207	1/3W	300V	500V	0.51Ω	10MΩ	±1%	E-24/E-96
						±2%, ±5%	E-24
MM52	1/2W	300V	500V	0.51Ω	10MΩ	±1%	E-24/E-96
						±2%, ±5%	E-24

For zero-ohm jumper, please see ZMM series. For 1m~510mΩ please see CSM series.
Special sizes and specifications available on request.

PART NUMBER

Example: MM204F162RTKRTR3K0

MM204	F	162R	TKR	TR3K0
Type	Tolerance*	Resistance	TCR*	Packaging
	F (1%) G (2%) J (5%)	162Ω **4-character code** containing - 3 significant digits 1 letter multiplier 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) MM16/MM204 3K0 = 3,000 6K0 = 6,000** 10K = 10,000** MM207/MM52 2K0 = 2,000 6K0 = 6,000** 10K = 10,000**

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

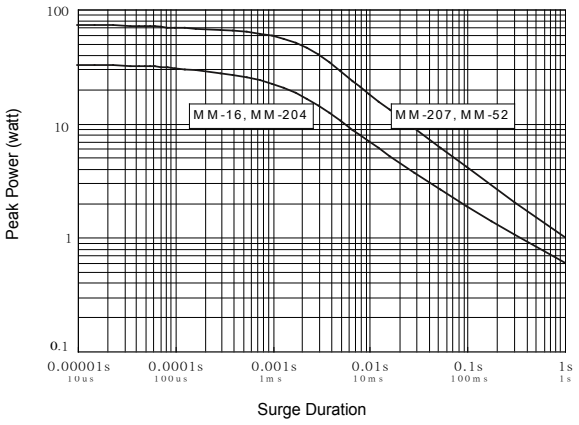
MM
Metal Film MELF Resistor

TECHNICAL SUMMARY

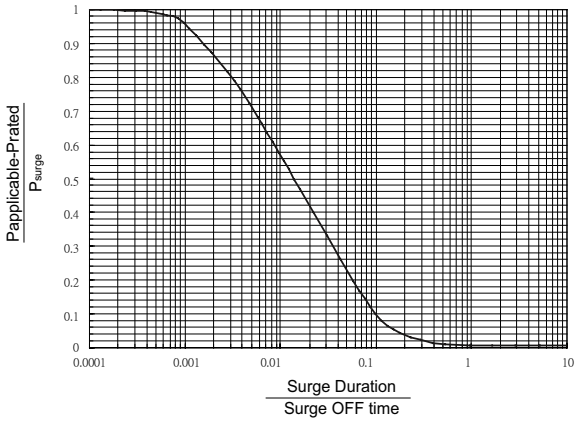
Characteristics	Ranges & Limits	
Operating Temperature Range, °C	-55 ~ +125	
Temperature Coefficient, PPM / °C*	±1%, ±2%	±25, ±50, ±100
	±5%	±100
Dielectric Withstanding Voltage, VAC or DC	MM16, MM204	200
	MM207, MM52	500
Insulation Resistance, MΩ	$>10^4$	
Film Temperature, °C	MM16, MM204, MM207	125
	MM52	140
Power Derating, Linear	100% for temp. < 70 °C down to zero at 125°C	
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



SURGE POWER DERATING CURVE



Notes:

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• To determine applicable surge power in continuous-surge applications:

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

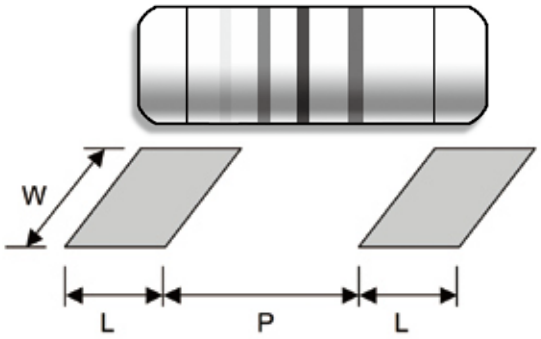
MM
Metal Film MELF Resistor

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	±0.25%
		>332KΩ	±0.5%
Load Life	**IEC 60115-1 4.25.1** Rated load 1,000 hours with 1.5 hours ON, 0.5 hours OFF, at (70±2)°C	0.51Ω to 332KΩ	±0.5%
		>332KΩ	±1.0%
Load Life In Humidity	**IEC 60115-1 4.24** 56 days rated load at (40±2)°C and (93±3)% relative humidity	±1.0%	
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)	0.51Ω to <100KΩ	±1.0%
		100KΩ to 332KΩ	±2.0%
		>332KΩ	±5.0%
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	±1.0%	
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	±0.5%	
Thermal Endurance	**IEC 60115-1 4.25.3** 1,000 hours without load	85°C	±0.25%
		125°C	±0.5%
Thermal Shock	**IEC 60115-1 4.19** -55°C 30minutes, +125°C 30minutes	5 cycles	±0.5%
		1,000 cycles	±1.5%
Single pulse high voltage overload	**IEC 60115-1 4.27** • 5 pulses of 1.2/50μs at 10x rated voltage (not over 400V for 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 ±0.5	
Electrostatic discharge (Human body model)	**IEC 60115-1 4.38** 3 positive & 3 negative discharges with 2KV for MM16 & MM204 or 4KV for MM207 & MM52 (For continuous surge application please see Surge Performance paragraph)	±2.0	
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 1 Min.	±1.0	
Solderability	**IEC 60115-1 4.17.2** Solder area covered after (235±3)°C/(2±0.2) seconds with flux applied	> 95%	
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.	±1.0%	
Bending test	**IEC 60115-1 4.33** Pressing depth 2mm, 3 times	±0.25%	
Flammability	**IEC 60115-1 4.35** Needle flame test 10s	No burning after 30s	

MM
Metal Film MELF Resistor

SUGGESTED PAD LAYOUT



Type	Soldering Mode	Pad Length (L, mm, Min.)	Pad Spacing (P, mm)	Pad Width (W, mm, Min.)
MM16 MM204	Reflow	1.0	2.0 ± 0.2	1.6
	Wave	1.2	2.0 ± 0.2	1.6
MM207 MM52	Reflow	2.0	3.0 ± 0.3	3.0
	Wave	2.5	3.0 ± 0.3	3.0

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

COVER TAPE PEELING SPECIFICATION

Recommended peeling force: 50±5gf