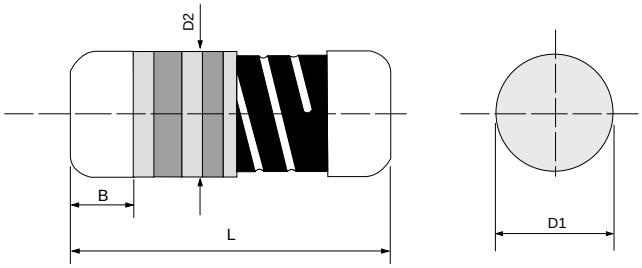
MMP(V) – Metal Film MELF Precision Resistor, Vehicle Grade

Quality • Reliability
Cost-Down via Innovation



Specifications Per

- IEC 60115-1
- EN140401-803
- AEC-Q200 Rev. D

Features

- AEC-Q200 Compliant
- Excellent solderability termination
- Anti-sulfuration test qualified
- Products meet RoHS requirements and do not contain substances of very high concern identified by European Chemicals Agency

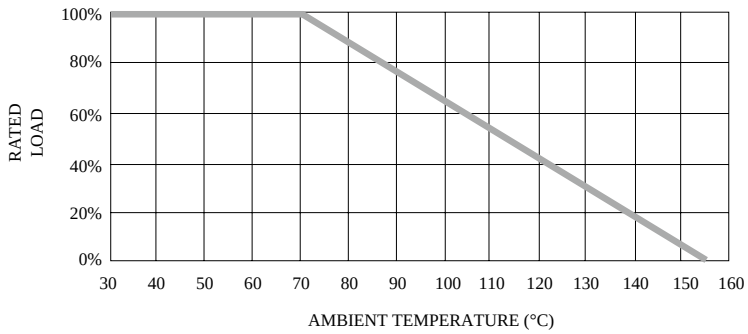
DIMENSIONS

Type	Body Length (L, mm)	Cap Diameter (D1, mm)	Body Diameter (D2, mm)	Soldering Spot (B, mm)	Net Weight Per 1000 pcs
MMP204V	3.52 ± 0.15	1.35 ± 0.1	D1+0.02/ -0.15	0.6 Min.	17 grams
MMP52V	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
MMP204V	1/4W	200V	400V	10Ω	1MΩ	±0.5%	E-24/ E-192
				22Ω	1MΩ	±0.25%	
				43Ω	1MΩ	±0.1%	
MMP52V	1/2W	300V	500V	10Ω	1MΩ	±0.5%	E-24/ E-192
				15Ω	1MΩ	±0.25%	
				33Ω	1MΩ	±0.1%	

POWER DERATING CURVE



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PART NUMBER

Example: MMP52VB2K61TKQTR2K0

MMP52V	B	2K61	TKQ	TR2K0
Type	Tolerance*	Resistance	TC*	Packaging
	B (0.1%) C (0.25%) D (0.5%)	2.61KΩ **4-character code** containing - 3 significant digits 1 letter multiplier OHM MULTIPLIER R = 1 K = 10^3 M = 10^6 G = 10^9	25ppm **3-character code** TKM=±5PPM/°C TKN=±10PPM/°C TKP=±15PPM/°C TKQ=±25PPM/°C TKR=±50PPM/°C	**5-character code** TR = Tape Reel (pieces per reel) MMP204V 3K0 = 3,000 6K0 = 6,000 10K = 10,000 MMP52V 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. Please check with us before placing order. **upon request**

TECHNICAL SUMMARY

Characteristics	Limits	
Operating Temperature Range,°C	-55 ~ +155	
Temperature Coefficient, PPM / °C*	±15, ±25, ±50 (See below for availability)	
Dielectric Withstanding Voltage, VAC or DC	MMP204V	300
	MMP52V	500
Insulation Resistance, MΩ	>10^4	
Film Temperature	155°C	
Failure Rate, pcs/10^9 device hours	<1.5	
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).**

TEMPERATURE COEFFICIENT AVAILABILITY

Specifications			
TC	Tolerance	Resistance Values Available	
		MMP204V	MMP52V
±15 PPM/°C	±0.5%	10Ω-330KΩ	10Ω-680KΩ
	±0.25%	22Ω-330KΩ	15Ω-510KΩ
	±0.1%	43Ω-330KΩ	33Ω-510KΩ
±25, ±50PPM/°C	±0.5%	10Ω-1MΩ	10Ω-1MΩ
	±0.25%	22Ω-1MΩ	15Ω-1MΩ
	±0.1%	43Ω-1MΩ	33Ω-1MΩ

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PERFORMANCE SPECIFICATIONS

Characteristics	Test Conditions	Limits	
High Temperature Exposure (Storage)	**AEC-Q200 REV D. Stress NO.3** **(refer to MIL-STD-202 Method 108)** 1,000 hours at 125°C without load	10Ω to 332KΩ	± 0.5%
		>332KΩ	± 0.75%
Temperature Cycling	**AEC-Q200 REV D. Stress NO.4** **(refer to IEC 60115-1 4.19/ JESD22 Method JA-104)** -55°C 30minutes, +125°C 30minutes, 1,000 cycles	10Ω to 332KΩ	± 0.5%
		>332KΩ	± 0.75%
	Proprietary test speci ication FRC-AECQ-180702 -20°C 30minutes, +120°C 30minutes, 1,000 cycles (Recommended solder paste composition:96.5% Sn, 3% Ag, 0.5% Cu)	Force of 1kg for 10 seconds and without distinct looseness of terminals	
Biased Humidity	**AEC-Q200 REV D. Stress NO.7** **(refer to IEC 60115-1 4.37/ MIL-STD-202 Method 103)** 1,000 hours at 85°C and 85% relative humidity with 10% operating power (not over max. working voltage)	10Ω to < 10KΩ	± 0.75%
		10KΩ to 332KΩ	± 1.5%
		>332KΩ	± 2.5%
Load Life	**IEC 60115-1 4.25.1** Rated load (not over max. working voltage) 1,000 hours with 1.5 hours ON, 0.5 hours OFF, at 70°C	10Ω to 332KΩ	± 0.5%
		>332KΩ	± 0.75%
	AEC-Q200 REV D. Stress NO.8 **(refer to MIL-STD-202 Method 108)** 1,000 hours at 125°C with de-rated continuous working voltage (not over max. working voltage)	10Ω to 332KΩ	± 1.5%
		>332KΩ	± 3%
Resistance to Solvents	**AEC-Q200 REV D. Stress NO.12** **(refer to MIL-STD-202 Method 215)** Add Aqueous wash chemical-OKEM Clean or equivalent. Do not use banned solvents.	No visible damage on appearance and marking	
Mechanical Shock	**AEC-Q200 REV D. Stress NO.13** **(refer to MIL-STD-202 Method 213 Condition C)** Three shocks in each direction shall be applied along the three mutually perpendicular axes of the test specimen. Peak value: 100 g`s, Duration: 6 ms, Velocity change: 12.3 ft/s, Wavefrom: Half sine	±0.5%	
Vibration	**AEC-Q200 REV D. Stress NO.14** **(refer to MIL-STD-202 Method 204)** 5 g`s for 20 min., 12 cycles each of 3 orientations, Test from 10 - 2,000 Hz.	±0.5%	
Resistance to Soldering Heat	**AEC-Q200 REV D. Stress NO.15** **(refer to IEC 60115-1 4.18.2/ MIL-STD-202 Method 210)** Dip the resistor into a solder bath measured (260±5)°C and hold it for a 10±1 seconds)	±0.5%	
Anti-sulfuration test	**EIA-977(conditions B)** 750 hours at (105±2)°C without load	±0.1%	±0.1%
		±0.25%	±0.25%
		±0.5%	±0.5%

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PERFORMANCE SPECIFICATIONS

Characteristics	Test Conditions	Limits	
ESD	**AEC-Q200 REV D. Stress NO.17** **(refer to AEC-Q200-002/ ISO/DIS 10605)** **(150pF/ 2000Ohm discharge network)** Human body model, 1 positive & 1 negative discharges with 2KV source	±0.5%	
Solderability	**AEC-Q200 REV D. Stress NO.18** **(refer to J-STD-002 or IEC 60115-1 4.17)** Solder area covered after (235±3)°C/(2±0.2) seconds with flux applied	95% min. coverage	
Flammability	**AEC-Q200 REV D. Stress NO.20** **(refer to UL-94)** V-0 or V-1 are acceptable. Electrical test not required.	NO flaming	
Board Flex	**AEC-Q200 REV D. Stress NO.21** **(refer to AEC-Q200-005)** 60 sec minimum holding time.	±0.5%	
Terminal Strength	**AEC-Q200 REV D. Stress NO.22** **(refer to AEC-Q200-006)** Force of 1.8kg for 60 seconds	±0.5%	
Short Time Overload	**IEC 60115-1 4.13** 5 seconds 2.5x rated voltage(not over max. overload voltage)	± 0.25%	
Climatic test	**IEC 60115-1 4.23** 4.23.2 - dry heat: 16 hours 155°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 155°C each 1 Min.	±1%	
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	10Ω to 332KΩ	± 0.5%
		>332KΩ	± 0.75%
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.	±0.5%	
	10 pulses of 10/700μs at 10x rated voltage (not over max. overload voltage) with interval of 60 sec.	±0.5%	
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%	

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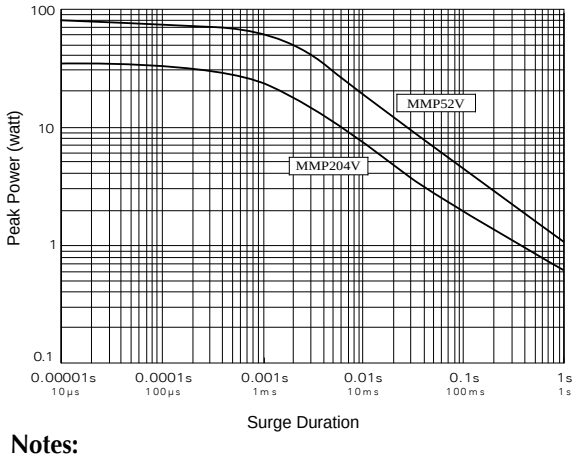
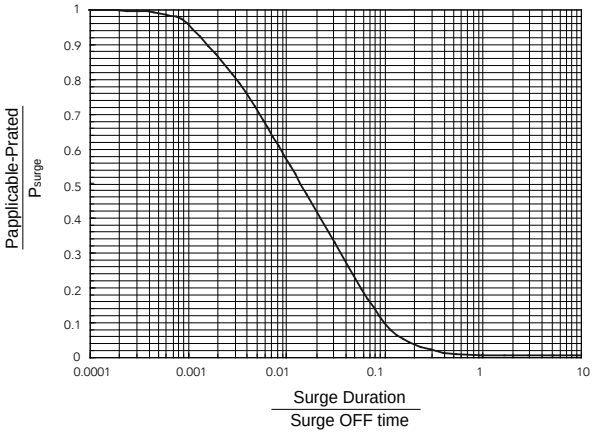
SINGLE SURGE PERFORMANCE



SURGE POWER DERATING CURVE

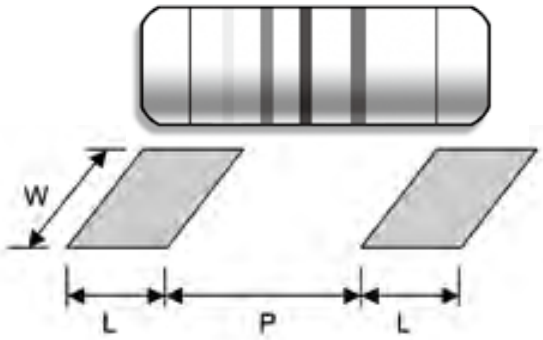


Notes:

- 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 155°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.

SUGGESTED PAD LAYOUT



Type	Soldering Mode	Pad Length (L, mm, Min.)	Pad Spacing (P, mm)	Pad Width (W, mm, Min.)
MMP204V	Reflow	1.3	1.6 ± 0.1	1.6
	Wave	1.5	1.5 ± 0.1	1.8
MMP52V	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: 50gf±5gf