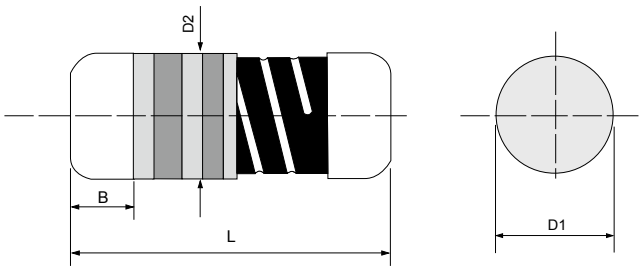
REFP Series

Enhanced Film Power MELF Resistor



1.Specifications Per

• IEC 60115-1

2 . Features

• High power handling

• Superior reliability and stability

• SMD enabled structure with excellent solderability

• Products meet RoHS requirements and do not contain substances of very high concern identified by European Chemicals Agency

DIMENSIONS

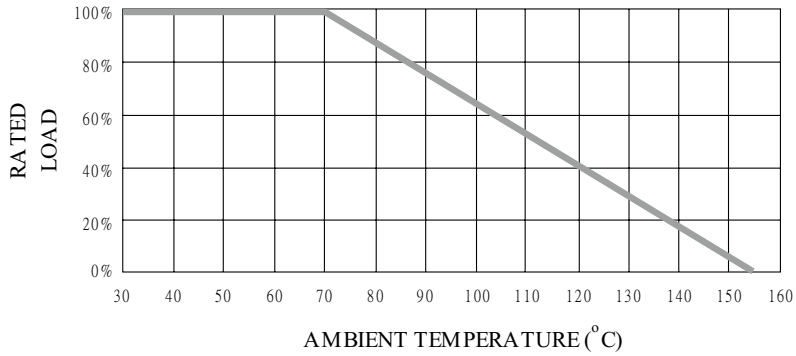
Type	Body Length (L, mm)	Cap Diameter (D1, mm)	Body Diameter (D2, mm)	Soldering Spot (B, mm)	Net Weight Per 1000 pcs
REFP204	3.52 ± 0.15	1.35 ± 0.1	D1+0.02/ -0.15	0.6 Min.	17 grams
REFP101	5.90 ± 0.2	2.20 ± 0.1	D1+0.02/ -0.2	1.0 Min.	66 grams
REFP201	8.50 ± 0.5	3.00 ± 0.2	D1+0.05/ -0.35	1.3 Min.	186 grams
REFP301	10.5 ± 0.5	4.00 ± 0.5	D1+0.05/ -0.45	1.6 Min.	446 grams
REFP401	12.6 ± 0.6	4.60 ± 0.5	D1+0.05/ -0.50	1.8 Min.	750 grams
REFP501	14.6 ± 0.6	5.10 ± 0.5	D1+0.05/ -0.50	2.0 Min.	1000 grams

GENERAL SPECIFICATIONS

Type	Power Rating (at 70°C)	Maximum Working Voltage	Maximum Overload Voltage	Minimum Resistance	Maximum Resistance	Resistance Tolerance	Available Resistance Values
REFP204	1/2W	250V	500V	0, 0.51Ω	1MΩ	±0.5%~5%	E-24 / E-96
REFP101	1W	300V	600V	0, 0.51Ω	1MΩ	±0.5%~5%	E-24 / E-96
REFP201	2W	350V	700V	0, 0.51Ω	4.7MΩ	±0.5%~5%	E-24 / E-96
REFP301	3W	400V	800V	0, 0.51Ω	6.8MΩ	±0.5%~5%	E-24 / E-96
REFP401	4W	400V	800V	0, 0.51Ω	8.2MΩ	±0.5%~5%	E-24 / E-96
REFP501	5W	450V	900V	0, 0.51Ω	10MΩ	±0.5%~5%	E-24 / E-96

Special sizes, values, and specifications not listed available on special order.
For values between 10mΩ & 510mΩ, please see RCSM series.

POWER DERATING CURVE



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TECHNICAL SUMMARY

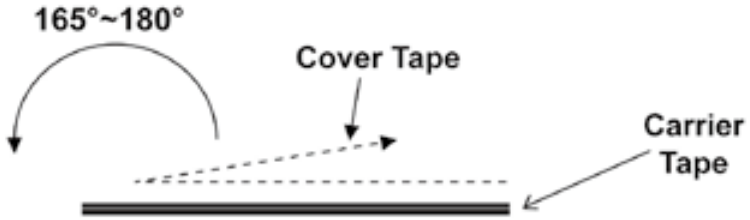
Characteristics	Limits
Dielectric Withstanding Voltage, VAC or VDC	REFP204: 300 REFP101: 500 REFP201: 700 REFP301, REFP401, REFP501: 1000
Temperature Coefficient, PPM / °C*	±200, ±400, ±600, ±800
Operating Temperature Range, °C	-55 ~ +155
Insulation Resistance, MΩ	$>10^4$
Failure Rate in Time, pcs / 10^9 device hours	<1
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).**

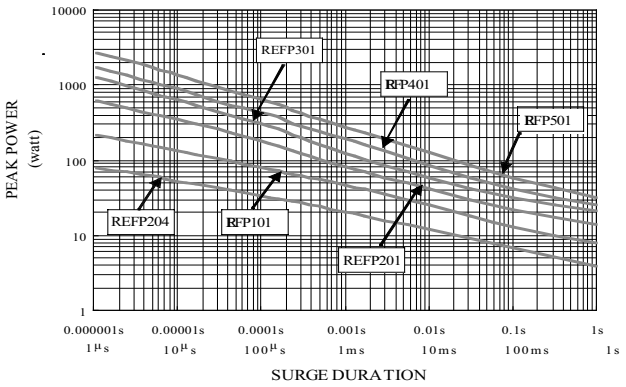
COVER TAPE PEELING SPECIFICATION

Recommended peeling force:

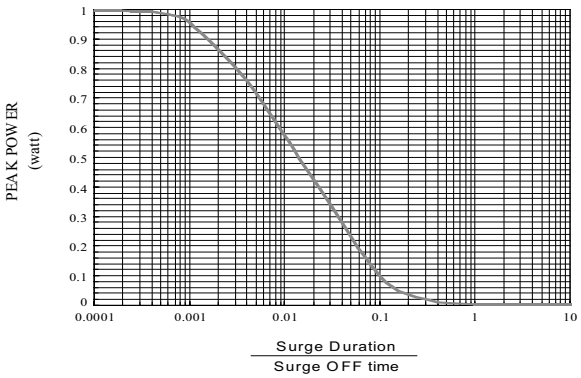
REFP204, REFP101: 50±5gf REFP201, REFP301: 70±10gf REFP401, REFP501: 80±10gf



SINGLE SURGE PERFORMANCE



SURGE POWER DERATING CURVE



Notes:

1. Above graph is accurate 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 by 1.18% per °C.
2. For applicable surge power in continuous-surge applications please see SURGE POWER DERATING CURVE above.

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PERFORMANCE SPECIFICATIONS

Characteristics	Test Conditions	Limits	
Short Time Overload	**IEC 60115-1 4.13** 2 seconds 2.5x rated voltage (not over max. working voltage)	±0.5%, 1%: ± 2%: ±5%:	±0.5% ±0.8% ±2%
Load Life	**IEC 60115-1 4.25.1** Rated load (not over max. working voltage) 1,000 hrs with 1.5 hours ON, 0.5 hours OFF, at (70±2)°C	±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	±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	±1%	
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	±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	
Thermal Endurance	**IEC 60115-1 4.25.3** 1,000 hours at 155°C without load	±2%	
Thermal Shock	**IEC 60115-1 4.19** -55°C 30minutes, +155°C 30minutes, 5 cycles	±2%	
Single pulse high voltage overload	**IEC 60115-1 4.27** 10 pulses of 10/700μs at 10x rated voltage (not over max. overload voltage) with interval of 60 sec.	±2%	
Electrostatic discharge (Human body model)	**IEC 60115-1 4.38** 3 positive & 3 negative discharges with 2KV for EFP204 or 4KV for EFP101, EFP201, EFP301, EFP401 & EFP501 (For continuous surge application please see Surge Performance paragraph)	±5%	
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.	±2%	
Flammability	**IEC 60115-1 4.35** Needle flame test 10s	No burning after 30s	
Vibration	**IEC 60115-1 4.22** Six hours in each parallel and axial direction with a simple harmonic motion having an amplitude of 0.75mm and 10 to 500 Hz.	±1%	
Bending test	**IEC 60115-1 4.33** Pressing depth 2mm, 3 times	±1%	

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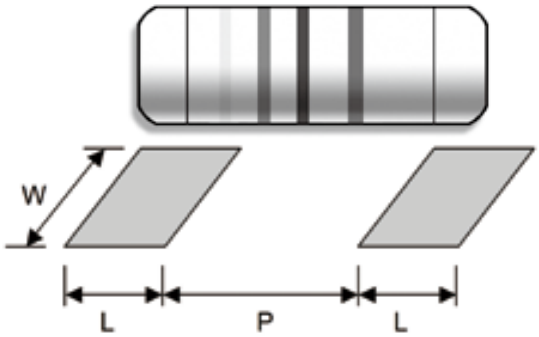
SUGGESTED PAD LAYOUT



Type	Soldering Mode	Pad Length (L, mm, Min.)	Pad Spacing (P, mm)	Pad Width (W, mm, Min.)
REFP204	Reflow	1.3	1.6 ± 0.1	1.6
	Wave	1.5	1.5 ± 0.1	1.8
REFP101	Reflow	2.0	3.0 ± 0.1	3.0
	Wave	2.5	3.0 ± 0.1	3.0
REFP201	Reflow	3.0	4.9 ± 0.3	3.7
	Wave	3.5	4.8 ± 0.3	4.0
REFP301	Reflow	4.0	6.2 ± 0.4	5.0
	Wave	4.5	6.0 ± 0.4	5.0
REFP401	Reflow	4.5	8.0 ± 0.4	5.5
	Wave	5.0	7.7 ± 0.4	5.5
REFP501	Reflow	5.0	9.3 ± 0.4	6.5
	Wave	5.0	9.0 ± 0.4	6.0

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

PART NUMBER

Example: **REFP2041/2W22RK300ppmNIL**

REFP204	**1/2W**	**22R**	**K**	**300ppm**	**NIL**
Type	**Power**	Resistance	Tolerance	TCR	Packaging
	1/2W	22R=22Ω 22K=22KΩ 1M=1MΩ R = 1 K = 10^3 M = 10^6 G = 10^9	J (5%) K (10%) M (20%)	**3-7-character code** **TYL=Typical** ± 5 ppm=5ppm ± 1000ppm=1000ppm	Nil = Bulk **T/R = Tape and Reel** **T/B = Tape and Box**