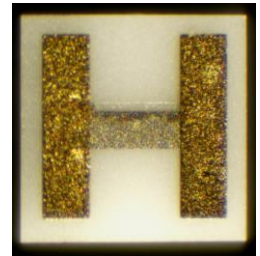


## Microwave Resistors

## PM Series

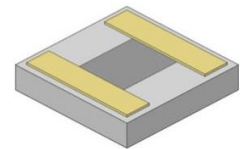
- Special microwave laser-trimming to ensure a tight tolerance at high frequencies
- Compatible with flip-chip configurations
- Operating frequencies up to 60 GHz; higher frequencies are available
- Can be used in Non-Magnetic Applications



20x20 100Ω  
Microwave Resistor

### ◆ Product Specifications

<b>Resistance Range</b>	2Ω to 5kΩ		
<b>Resistance Tolerance</b>	±0.1% to ±20% value dependent		
<b>VSWR</b>	DC to 10 GHz	10 to 20 GHz	20 to 60 GHz
	1.2:1	1.3:1	1.5:1



### ◆ Part Numbering

Example shown: Microwave Resistor, TaN resistive element, alumina substrate, case size 0.020" × 0.020" × 0.010", PdAu bonding pad, bottom side bare, resistance 1000Ω ± 5%, 150 ppm TCR, microwave trim, 100 mW max power handling.

**P M T 1 35 - 20×20× 10 A 10000 J Q E W**

**P = Passive Plus**

**Resistor Style**

M = Microwave

**Resistive Material**

T = Tantalum Nitride

N = NiChrome

**Number of Resistors**

**Substrate**

See Charts on next page

**Length and Width**

See Charts on following pages

**Thickness**

10 mils standard

(5 mils standard for size 12x9)

**Packaging**

W = Waffle Pack (Standard)\*

**Power Handling**

See Charts on next page

**TCR**

See Charts on next page

**Resistance Tolerance**

See Charts on next page

**Resistance Value**

Digits 1-4 are significant figures

Digit 5 is the number of zeros to follow

When required, the "R" is used as a decimal point and the exponent is omitted.

e.g. 100R5 = 100.5Ω, 10000 = 1000Ω, 10001 = 10000Ω

**Termination**

See Charts on next page

\* All parts are supplied in waffle packs. Other packaging may be available. Contact PPI for additional packaging options.

The standard dimensional tolerance for length and width is ± 2 mils. The standard dimensional tolerance for thickness is ± 1 mil.

## Microwave Resistors

### ◆ Resistive Materials & Temperature Coefficient of Resistance (TCR)

Resistive Materials					TCR					
Material	Passivation	Sheet Resistivity (Ω/ Sq)	Abs. Tolerance	Ratio Tolerance	±150 ppm/°C	±100 ppm/°C	±50 ppm/°C	±25 ppm/°C	±10 ppm/°C	±5 ppm/°C
Tantalum Nitride (TaN)	Self Passivating Ta <sub>2</sub> O <sub>5</sub>	5 to 270	From ±0.01%	From ±0.01%	Q	V	W	X	Y	Z
					Standard	Yes	---	---	---	---
NiChrome (NiCr)	SiO <sub>2</sub>	5 to 240	From ±0.01%	From ±0.01%	---	---	Yes	Standard	Yes	Yes

### ◆ Substrate Materials

Material	Thickness	Surface Finish	Dielectric Constant (@ 1MHz)	Coefficient of Thermal Expansion (x 10 <sup>6</sup> / °C)	Thermal Conductivity (W/m*K)	Code
Alumina (Al <sub>2</sub> O <sub>3</sub> )	0.005" - 0.010"	2μ" - 3μ"	9.9	<sup>7</sup> (25°C to < 300°C)	26.9	35
Aluminum Nitride (AlN)	0.005" - 0.010"	6μ" - 8μ"	8.0 - 9.1	<sup>4.6 - 5.7</sup> (25°C to < 1000°C)	170	28
Beryllium Oxide (BeO)	0.005" - 0.010"	< 5μ"	6.76	<sup>9</sup> (25°C to < 1000°C)	285	25
Quartz (Fused Silica)	0.005" - 0.010"	60/40 Optical Polish	3.826	<sup>0.55</sup> (25°C to < 300°C)	1.38	20

### ◆ Resistance Tolerance Codes

Tolerance*	B	D	F	G	H	J	K	L	M	Q	S
Code	± 0.1%	± 0.5%	± 1%	± 2%	± 3%	± 5%	± 10%	± 15%	± 20%	± 0.05%	± 0.01%

\* Limit of ± 50mΩs

### ◆ Terminations

Metallization		Code
Top Side	Bottom Side	
Pd/Au	—	A
Flip Chip (Ti/Pt/Au)		R
Pd/Au	Ta/Pd/Au	D

### ◆ Power Handling Codes

Watts	Code	Watts	Code	Watts	Code
10 mW	A	350 mW	M	4.0 W	P
20 mW	B	400 mW	R	5.0 W	Q
50 mW	C	500 mW	H	6.0 W	2
75 mW	D	750 mW	J	10 W	S
100 mW	E	1.0 W	K	15 W	T
125 mW	I	1.4 W	U	20 W	V
150 mW	F	2.0 W	L	25 W	W
200 mW	O	2.8 W	Y	30 W	Z
250 mW	G	3.0 W	N	50 W	X
				40 W	1

## Microwave Resistors

### ◆ Power Handling & Microwave Resistance Ranges by Material and Case Size

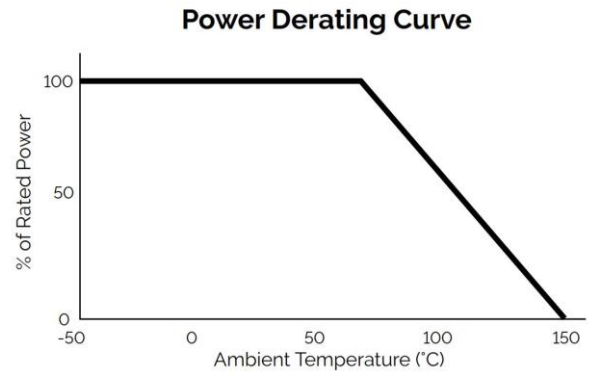
Case Size mils (inches)	Standard Power Handling						High Power Resistor Range				
	Alumina (C-35)	AlN (C-28)	BeO (C-25)	Quartz (C-20)	Min (Ω)	Max (Ω)	Min (Ω)	Max (Ω)	Max (Ω) Alumina (C-35)	Max (Ω) AlN (C-28)	Max (Ω) BeO (C-25)
12 x 9 (0.012 x 0.009)	50 mW	200 mW	400 mW	10 mW	4	500	---	---	---	---	---
14 x 12 (0.014 x 0.012)	100 mW	400 mW	800 mW	20 mW	3	750	---	---	---	---	---
20 x 10 (0.020 x 0.010)	100 mW	400 mW	800 mW	20 mW	3	1000	2	1000	250 mW	1.0 W	2.0 W
15 x 15 (0.015 x 0.015)	100 mW	400 mW	800 mW	20 mW	4	1000	2	1000	250 mW	1.0 W	2.0 W
20 x 20 (0.020 x 0.020)	250 mW	1.0 W	2.0 W	50 mW	2	1250	2	1000	500 mW	2.0 W	4.0 W
30 x 20 (0.030 x 0.020)	250 mW	1.0 W	2.0 W	50 mW	2	2500	2	1000	500 mW	2.0 W	4.0 W
40 x 20 (0.040 x 0.020)	250 mW	1.0 W	2.0 W	50 mW	2	3750	2	1000	750 mW	3.0 W	6.0 W
30 x 30 (0.030 x 0.030)	250 mW	1.0 W	2.0 W	50 mW	2	2500	2	1000	750 mW	2.0 W	6.0 W
35 x 35 (0.035 x 0.035)	250 mW	1.0 W	2.0 W	50 mW	2	3000	2	1000	1.0 W	4.0 W	6.0 W
40 x 40 (0.040 x 0.040)	350 mW	1.4 W	2.8 W	70 mW	2	3750	2	1000	1.0 W	4.0 W	6.0 W
50 x 25 (0.050 x 0.025)	350 mW	1.4 W	2.8 W	70 mW	3	5000	2	1000	1.0 W	4.0 W	6.0 W
60 x 30 (0.060 x 0.030)	500 mW	2.0 W	4.0 W	100 mW	3	5000	2	1000	1.4 W	5.0 W	10.0 W
50 x 50 (0.050 x 0.050)	500 mW	2.0 W	4.0 W	100 mW	2	5000	2	1000	1.4 W	5.0 W	10.0 W
60 x 60 (0.060 x 0.060)	500 mW	2.0 W	4.0 W	100 mW	2	5000	2	1000	1.4 W	5.0 W	10.0 W
80 x 50 (0.080 x 0.050)	500 mW	2.0 W	4.0 W	100 mW	2	5000	2	1000	2.8 W	10.0 W	15.0 W
100 x 50 (0.100 x 0.050)	500 mW	2.0 W	4.0 W	100 mW	2	5000	2	1000	2.8 W	10.0 W	15.0 W
120 x 60 (0.120 x 0.060)	750 mW	3.0 W	6.0 W	125 mW	2	5000	2	1000	2.8 W	10.0 W	15.0 W
100 x 100 (0.100 x 0.100)	750 mW	3.0 W	6.0 W	125 mW	2	5000	2	1000	2.8 W	10.0 W	15.0 W

Typical PPI commercial testing includes 100% visual inspection, 100% electrical testing with TCR sampling. Our parts meet or exceed additional MIL-PRF-55342 and MIL-STD-202 requirements.

**Microwave Resistors**

◆ **General Properties**

Operating Temperature	-55°C to +150°C
Storage Temperature	-65°C to +150°C
Operating Frequency	DC to 60 GHz
Voltage Rating	100V maximum
Power Derating (See Chart at Right)	Full power up to 70°C Derated linearly to zero power at 150°C



◆ **Testing**

Testing Performed	Specification / Standard
Visual Inspection	MIL-PRF-55342 MIL-STD-883
Mechanical Inspection	MIL-PRF-55342
DC Resistance	MIL-PRF-55342 MIL-STD-202
Resistance Temperature Characteristics (TCR)	MIL-PRF-55342
Short Time Overload	MIL-PRF-55342
High Temperature Exposure	MIL-PRF-55342
Thermal Shock	MIL-PRF-55342 MIL-STD-202
Resistance to Bonding Exposure	MIL-PRF-55342
Wire Bonding Integrity	MIL-PRF-55342
Life Test	MIL-PRF-55342 MIL-STD-202

◆ **Performance Specifications**

Higher power ratings, additional sizes, and custom resistors may be available. Please contact sales@passiveplus.com.

◆ **Packaging**

ESD waffle packs are standard. Film rings and gel pack packaging may be available upon request.

