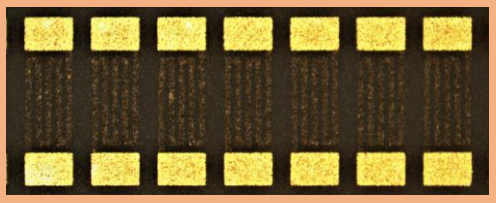
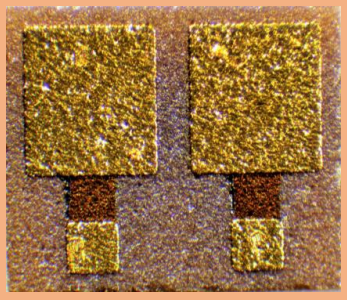
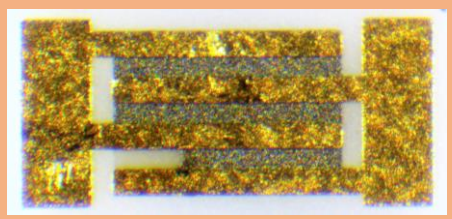
PPI®

THIN FILM COMPONENTS

- Precision Resistors
- Chip Attenuators
- Resistor Arrays
- Patterned Substrates
- Thermal Conductors





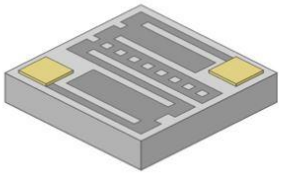


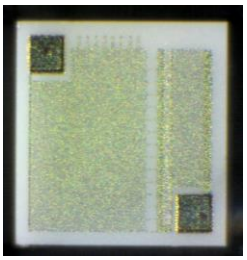
Thin Film Products

Standard Chip Resistors – PR Series

Product Features

- Wire-bondable Thin Film Resistors
- Operating frequencies from DC to 500 MHz
- Can be used in Non-Magnetic Applications



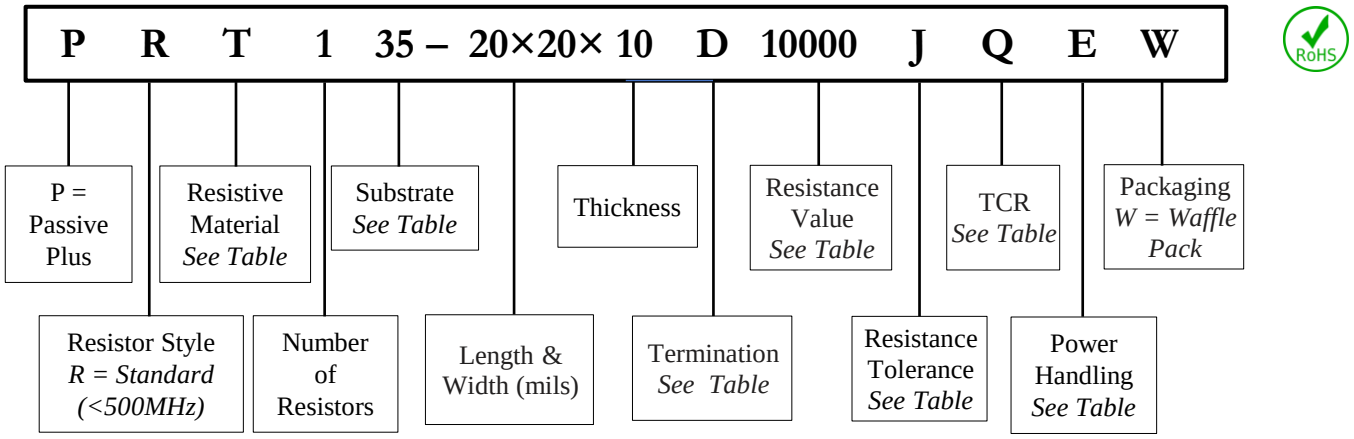


Product Specifications

Resistance Range	0.5Ω to 35MΩ
Resistance Tolerance	±0.01% to ±20%, value dependent

Part Numbering

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



**Flip Chip – wire bondable or solderable*

Resistive Materials

Material	Passivation	Sheet Resistivity (Ω/ Sq)	Abs. Tolerance	Ratio Tolerance
Tantalum Nitride (TaN)	Self Passivating Ta_2O_5	5 to 270	From ±0.01%	From ±0.01%
NiChrome (NiCr)	SiO_2	5 to 250	From ±0.01%	From ±0.01%

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

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

Thin Film Products

Standard Chip Resistors – PR Series

Substrate Materials

Material	Thickness	Surface Finish	Dielectric Constant (@ 1MHz)	Coefficient of Thermal Expansion (x 10^6/ °C)	Thermal Conductivity (W/m*K)	Code
Alumina (Al_2O_3)	0.005" - 0.010"	2µ" - 3µ"	9.9	7 (25°C to < 300°C)	26.9	35
Aluminum Nitride (AlN)	0.005" - 0.010"	6µ“ - 8µ"	8.0 – 9.1	4.6 - 5.7 (25°C to < 1000°C)	170	28
Beryllium Oxide (BeO)	0.005" - 0.010"	< 5µ"	6.76	9 (25°C to < 1000°C)	285	25
Silicon (Si) (with 12kÅ SiO_2)	0.005" - 0.010"	Chemical Polish	N/A (SiO_2 K=1.38)	2.49 - 4.44 (25°C to < 1000°C)	149 (SiO_2 1.38)	22
Quartz (Fused Silica)	0.005" - 0.010"	60/40 Optical Polish	3.826	0.55 (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%

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
50 mW	C	750 mW	J
75 mW	D	1.0 W	K
100 mW	E	1.4 W	U
125 mW	I	2.0 W	L
150 mW	F	2.8 W	Y
200 mW	O	3.0 W	N
250 mW	G	4.0 W	P
350 mW	M	5.0 W	Q
400 mW	R	6.0 W	2
500 mW	H	10 W	S

Temperature Coefficient of Resistance

Material	±150 ppm/°C	±100 ppm/°C	±50 ppm/°C	±25 ppm/°C	±10 ppm/°C	±5 ppm/°C
Tantalum Nitride (TaN)	**Q**	**V**	**W**	**X**	**Y**	**Z**
	Standard	Yes	---	---	---	---
NiChrome (NiCr)	---	---	Yes	Standard	Yes	Yes

Thin Film Products

Standard Chip Resistors – PR Series

Power Handling & Standard Resistance Ranges by Material and Case Size

Power Handling						Resistance Range					
Case Size mils (inches)	Alumina (C35)	Silicon (C-22)	AlN (C-28)	BeO (C-25)	Quartz (C-20)	Min (Ω)	Max (Ω) Alumina (C-35)	Max (Ω) Silicon (C-22)	Max (Ω) AlN (C-28)	Max (Ω) BeO (C-25)	Max (Ω) Quartz (C-20)
12 x 9 (0.012 x 0.009)	50 mW	50 mW	200 mW	400 mW	10 mW	1-3	25K	150K	25K	25K	150K
14 x 12 (0.014 x 0.012)	100 mW	100 mW	400 mW	750 mW	20 mW	1-3	40K	200K	40K	40K	200K
20 x 10 (0.020 x 0.010)	100 mW	100 mW	400 mW	750 mW	20 mW	1-3	60K	250K	60K	60K	250K
15 x 15 (0.015 x 0.015)	100 mW	100 mW	400 mW	750 mW	20 mW	1-2	70K	500K	70K	70K	500K
20 x 20 (0.020 x 0.020)	250 mW	250 mW	1.0 W	2.0 W	50 mW	1-2	125K	750K	125K	125K	750K
30 x 20 (0.030 x 0.020)	250 mW	250 mW	1.0 W	2.0 W	50 mW	1-2	200K	1M	200K	200K	1M
40 x 20 (0.040 x 0.020)	250 mW	250 mW	1.0 W	2.0 W	50 mW	1-2	250K	1.5M	250K	250K	1.5M
30 x 30 (0.030 x 0.030)	250 mW	250 mW	1.0 W	2.0 W	50 mW	1-2	275K	2M	275K	275K	2M
35 x 35 (0.035 x 0.035)	250 mW	250 mW	1.0 W	2.0 W	50 mW	1-2	300K	3M	300K	300K	3M
40 x 40 (0.040 x 0.040)	350 mW	350 mW	1.4 W	2.8 W	70 mW	1-2	500K	5M	500K	500K	5M
50 x 25 (0.050 x 0.025)	350 mW	350 mW	1.4 W	2.8 W	70 mW	1-2	300K	3M	300K	300K	3M
60 x 30 (0.060 x 0.030)	500 mW	500 mW	2.0 W	4.0 W	100 mW	1-2	500K	6M	500K	500K	6M
50 x 50 (0.050 x 0.050)	500 mW	500 mW	2.0 W	4.0 W	100 mW	1-2	700K	7M	700K	700K	7M
60 x 60 (0.060 x 0.060)	500 mW	500 mW	2.0 W	4.0 W	100 mW	1-2	2M	15M	2M	2M	15M
80 x 50 (0.080 x 0.050)	500 mW	500 mW	2.0 W	4.0 W	100 mW	1-2	2M	20M	2M	2M	20M
100 x 50 (0.100 x 0.050)	500 mW	500 mW	2.0 W	4.0 W	100 mW	1-2	2.5M	25M	2.5M	2.5M	25M
120 x 60 (0.120 x 0.060)	750 mW	750 mW	3.0 W	6.0 W	125 mW	1-2	3M	30M	3M	3M	30M
100 x 100 (0.100 x 0.100)	750 mW	750 mW	3.0 W	6.0 W	125 mW	1-2	3.5M	35M	3.5M	3.5M	35M

Typical PPI commercial testing includes 100% visual inspection, 100% electrical testing with short time overload, and TCR sampling.

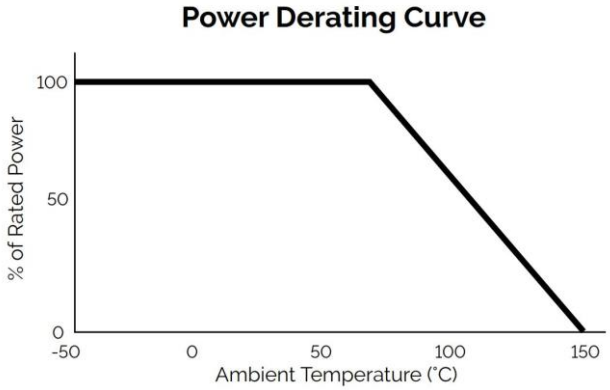
Our parts meet or exceed additional MIL-PRF-55342 and MIL-STD-202 requirements.

Thin Film Products

Standard Chip Resistors – PR Series

General Properties

Operating Temperature	-55°C to +150°C
Storage Temperature	-65°C to +150°C
Operating Frequency	DC to 500 MHz
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 available. Please contact sales@passiveplus.com.

Packaging

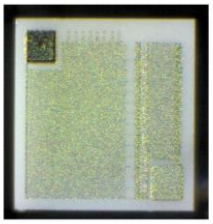
ESD waffle packs are standard. Film rings and gel pack packaging are available upon request.

Thin Film Products

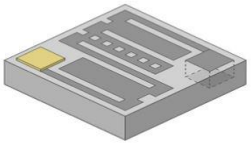
Back Contact Resistors – PR Series

Product Features

- Wire-bondable Thin Film Resistors
- Built to the customer's specifications.
- Operating frequencies from DC to 500 MHz.
- Provides engineers with space saving option.
- One wire bond is required to the top side of the chip, increasing reliability, with the bottom connection made by eutectic or conductive epoxy.
- Custom dual configuration.
- Can be used in Non-Magnetic Applications



30x30 220kΩ
Fine Line
Back Contact Resistor



Product Specifications

Resistance Range	5 Ω to 25MΩ
Resistance Tolerance	±0.01% to ±20%, value dependent
Resistive Material	Tantalum Nitride (TaN)

Part Numbering

P R T 1 22 – 20×20× 10 W 10000 J Q E W

RoHS

P = Passive Plus	Resistive Material *Tantalum Nitride*	Resistor Style *R = Standard (<500MHz)*	Number of Resistors	Substrate *Silicon* (SiO_2)	Length & Width (mils)	Thickness	Termination *See Table*	Resistance Value *See Table*	Resistance Tolerance *See Table*	TCR *See Table*	Power Handling *See Table*	Packaging *W = Waffle Pack*

Resistive Materials

Material	Passivation	Sheet Resistivity (Ω/ Sq)	Abs. Tolerance	Ratio Tolerance
Tantalum Nitride (TaN)	Self Passivating Ta_2O_5	5 to 270	From ±0.01%	From ±0.01%

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

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

Thin Film Products

Back Contact Resistors – PR Series

Substrate Materials

Material	Thickness	Surface Finish	Dielectric Constant (@ 1MHz)	Coefficient of Thermal Expansion (x 10^6/ °C)	Thermal Conductivity (W/m*K)	Code
Silicon (Si) (with 12kÅ SiO_2)	0.005" - 0.010"	Chemical Polish	N/A (SiO_2 K=1.38)	2.49 - 4.44 (25°C to < 1000°C)	149 (SiO_2 1.38)	22

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	
TaN/Pd/Au	Au	W

Power Handling Codes

Watts	Code	Watts	Code
50 mW	C	250 Mw	G
75 mW	D	350 mW	M
100 mW	E	400 mW	R
125 Mw	I	500 mW	H
150 mW	F	750 mW	J
200 mW	O	1.0 W	K

Temperature Coefficient of Resistance

Material	±150 ppm/°C	±100 ppm/°C	±50 ppm/°C	±25 ppm/°C	±10 ppm/°C	±5 ppm/°C
Tantalum Nitride (TaN)	**Q**	**V**	**W**	**X**	**Y**	**Z**
	Standard	Yes	---	---	---	---
NiChrome (NiCr)	---	---	Yes	Standard	Yes	Yes

Thin Film Products

Back Contact Resistors – PR Series

Power Handling & Standard Resistance Ranges by Material and Case Size

Power Handling		Resistance Range	
Case Size mils (inches)	Silicon (C-22)	Min (Ω)	Max (Ω) Silicon (C-22)
12 x 9 (0.012 x 0.009)	50 mW	1-3	150K
14 x 12 (0.014 x 0.012)	100 mW	1-3	200K
20 x 10 (0.020 x 0.010)	100 mW	1-3	250K
15 x 15 (0.015 x 0.015)	100 mW	1-2	500K
20 x 20 (0.020 x 0.020)	250 mW	1-2	750K
30 x 20 (0.030 x 0.020)	250 mW	1-2	1M
40 x 20 (0.040 x 0.020)	250 mW	1-2	1.5M
30 x 30 (0.030 x 0.030)	250 mW	1-2	2M
35 x 35 (0.035 x 0.035)	250 mW	1-2	3M
40 x 40 (0.040 x 0.040)	350 mW	1-2	5M
50 x 25 (0.050 x 0.025)	350 mW	1-2	3M
60 x 30 (0.060 x 0.030)	500 mW	1-2	6M
50 x 50 (0.050 x 0.050)	500 mW	1-2	7M
60 x 60 (0.060 x 0.060)	500 mW	1-2	15M
80 x 50 (0.080 x 0.050)	500 mW	1-2	20M
100 x 50 (0.100 x 0.050)	500 mW	1-2	25M
120 x 60 (0.120 x 0.060)	750 mW	1-2	30M
100 x 100 (0.100 x 0.100)	750 mW	1-2	35M

Typical PPI commercial testing includes 100% visual inspection, 100% electrical testing with short time overload, and TCR sampling.

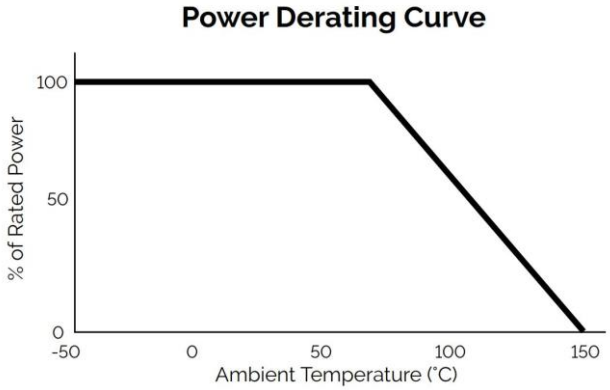
Our parts meet or exceed additional MIL-PRF-55342 and MIL-STD-202 requirements.

Thin Film Products

Back Contact Resistors – PR Series

General Properties

Operating Temperature	-55°C to +150°C
Storage Temperature	-65°C to +150°C
Operating Frequency	DC to 500 MHz
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 available. Please contact sales@passiveplus.com.

Packaging

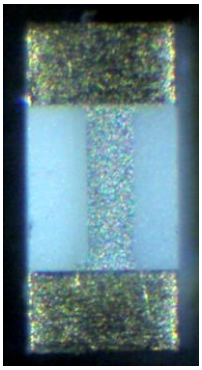
ESD waffle packs are standard. Film rings and gel pack packaging are available upon request.

Thin Film Products

Standard Edge Wrapped Chip Resistors – PR Series

Product Features

- Half wrap style chips have solid gold back contiguous with one pad, therefore eliminating one wirebond
- Full wrap style chips have both pads continue to the back side, allowing elimination of all wirebonds
- Can be used in Non-Magnetic Applications

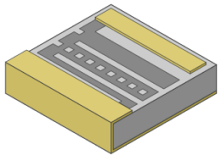


20x10 392Ω
Full Wrap Resistor

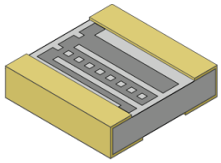
Product Specifications

Resistance Range	1 Ω to 3.5MΩ
Resistance Tolerance	±0.01% to ±20%, value dependent

Half Wrap



Full Wrap



Part Numbering

Example shown below: Standard Resistor, TaN resistive element, AlN substrate, case size 0.040" × 0.020" × 0.010", dual edge wrap, resistance 200Ω ± 2%, 150 ppm TCR, 1.0 W max power handling.

P R T 1 28 – 40×20× 10 N 200R0 G Q K W

RoHS

P = Passive Plus	Resistive Material *See Table*	Substrate *See Table*	Thickness	Resistance Value *See Table*	TCR *See Table*	Packaging *W = Waffle Pack*			
Resistor Style *R = Standard (<500MHz)*	Number of Resistors	Length & Width (mils)	Termination *See Table*	Resistance Tolerance *See Table*	Power Handling *See Table*				

Resistive Materials

Material	Passivation	Sheet Resistivity (Ω/ Sq)	Abs. Tolerance	Ratio Tolerance
Tantalum Nitride (TaN)	Self Passivating Ta_2O_5	5 to 270	From ±0.01%	From ±0.01%
NiChrome (NiCr)	SiO_2	5 to 250	From ±0.01%	From ±0.01%

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

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

Thin Film Products

Standard Edge Wrapped Chip Resistors – PR Series

Substrate Materials

Material	Thickness	Surface Finish	Dielectric Constant (@ 1MHz)	Coefficient of Thermal Expansion (x 10^6/ °C)	Thermal Conductivity (W/m*K)	Code
Alumina (Al_2O_3)	0.005" - 0.010"	2µ" - 3µ"	9.9	7 (25°C to < 300°C)	26.9	35
Aluminum Nitride (AlN)	0.005" - 0.010"	6µ“ - 8µ"	8.0 – 9.1	4.6 - 5.7 (25°C to < 1000°C)	170	28
Beryllium Oxide (BeO)	0.005" - 0.010"	< 5µ"	6.76	9 (25°C to < 1000°C)	285	25

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

Description	Code	Application	Metallization
1 Side Wrap	**H**	Epoxy or Au/Sn	Ta/Pd/Au
1 Side Wrap	**M**	Epoxy, Au/Sn or Sn Solder	TiW/Ni/Au
1 Side Wrap	**S**	Sn Solder Ball	TiW/Ni/Au - solder dipped
2 Side Wrap	**J**	Epoxy or Au/Sn	Ta/Pd/Au
2 Side Wrap	**N**	Epoxy, Au/Sn or Sn Solder	TiW/Ni/Au
2 Side Wrap	**T**	Sn Solder Ball	TiW/Ni/Au - solder dipped

Power Handling Codes

Watts	Code	Watts	Code
50 mW	C	750 mW	J
75 mW	D	1.0 W	K
100 mW	E	1.4 W	U
125 mW	I	2.0 W	L
150 mW	F	2.8 W	Y
200 mW	O	3.0 W	N
250 mW	G	4.0 W	P
350 mW	M	5.0 W	Q
400 mW	R	6.0 W	2
500 mW	H	10 W	S

Temperature Coefficient of Resistance

Material	±150 ppm/°C	±100 ppm/°C	±50 ppm/°C	±25 ppm/°C	±10 ppm/°C	±5 ppm/°C
Tantalum Nitride (TaN)	**Q**	**V**	**W**	**X**	**Y**	**Z**
	Standard	Yes	---	---	---	---
NiChrome (NiCr)	---	---	Yes	Standard	Yes	Yes

Thin Film Products

Standard Edge Wrapped Chip Resistors – PR Series

Power Handling & Standard Resistance Ranges by Material and Case Size

Power Handling						Resistance Range					
Case Size mils (inches)	Alumina (C35)	Silicon (C-22)	AlN (C-28)	BeO (C-25)	Quartz (C-20)	Min (Ω)	Max (Ω) Alumina (C-35)	Max (Ω) Silicon (C-22)	Max (Ω) AlN (C-28)	Max (Ω) BeO (C-25)	Max (Ω) Quartz (C-20)
12 x 9 (0.012 x 0.009)	50 mW	50 mW	200 mW	400 mW	10 mW	1-3	25K	150K	25K	25K	150K
14 x 12 (0.014 x 0.012)	100 mW	100 mW	400 mW	750 mW	20 mW	1-3	40K	200K	40K	40K	200K
20 x 10 (0.020 x 0.010)	100 mW	100 mW	400 mW	750 mW	20 mW	1-3	60K	250K	60K	60K	250K
15 x 15 (0.015 x 0.015)	100 mW	100 mW	400 mW	750 mW	20 mW	1-2	70K	500K	70K	70K	500K
20 x 20 (0.020 x 0.020)	250 mW	250 mW	1.0 W	2.0 W	50 mW	1-2	125K	750K	125K	125K	750K
30 x 20 (0.030 x 0.020)	250 mW	250 mW	1.0 W	2.0 W	50 mW	1-2	200K	1M	200K	200K	1M
40 x 20 (0.040 x 0.020)	250 mW	250 mW	1.0 W	2.0 W	50 mW	1-2	250K	1.5M	250K	250K	1.5M
30 x 30 (0.030 x 0.030)	250 mW	250 mW	1.0 W	2.0 W	50 mW	1-2	275K	2M	275K	275K	2M
35 x 35 (0.035 x 0.035)	250 mW	250 mW	1.0 W	2.0 W	50 mW	1-2	300K	3M	300K	300K	3M
40 x 40 (0.040 x 0.040)	350 mW	350 mW	1.4 W	2.8 W	70 mW	1-2	500K	5M	500K	500K	5M
50 x 25 (0.050 x 0.025)	350 mW	350 mW	1.4 W	2.8 W	70 mW	1-2	300K	3M	300K	300K	3M
60 x 30 (0.060 x 0.030)	500 mW	500 mW	2.0 W	4.0 W	100 mW	1-2	500K	6M	500K	500K	6M
50 x 50 (0.050 x 0.050)	500 mW	500 mW	2.0 W	4.0 W	100 mW	1-2	700K	7M	700K	700K	7M
60 x 60 (0.060 x 0.060)	500 mW	500 mW	2.0 W	4.0 W	100 mW	1-2	2M	15M	2M	2M	15M
80 x 50 (0.080 x 0.050)	500 mW	500 mW	2.0 W	4.0 W	100 mW	1-2	2M	20M	2M	2M	20M
100 x 50 (0.100 x 0.050)	500 mW	500 mW	2.0 W	4.0 W	100 mW	1-2	2.5M	25M	2.5M	2.5M	25M
120 x 60 (0.120 x 0.060)	750 mW	750 mW	3.0 W	6.0 W	125 mW	1-2	3M	30M	3M	3M	30M
100 x 100 (0.100 x 0.100)	750 mW	750 mW	3.0 W	6.0 W	125 mW	1-2	3.5M	35M	3.5M	3.5M	35M

Typical PPI commercial testing includes 100% visual inspection, 100% electrical testing with short time overload, and TCR sampling.

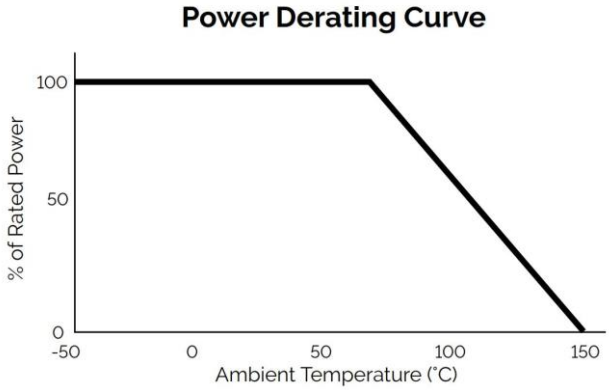
Our parts meet or exceed additional MIL-PRF-55342 and MIL-STD-202 requirements.

Thin Film Products

Standard Edge Wrapped Chip Resistors – PR Series

General Properties

Operating Temperature	-55°C to +150°C
Storage Temperature	-65°C to +150°C
Operating Frequency	DC to 500 MHz
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 available. Please contact sales@passiveplus.com.

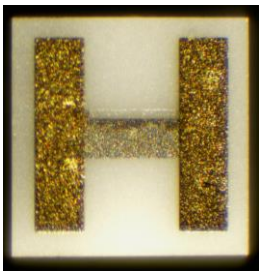
Packaging

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

Thin Film Products

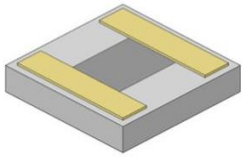
Microwave Chip Resistors – PM Series

Product Features



- 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

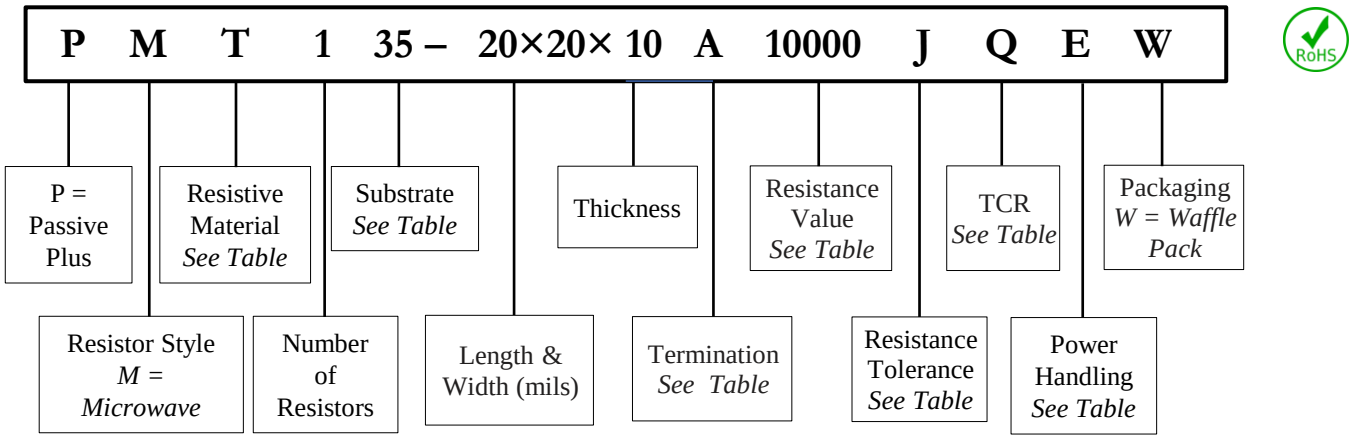
Product Specifications



Resistance Range	2 Ω to 5kΩ		
Resistance Tolerance	±0.01% to ±20%, value dependent		
VSWR	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 1000 Ω ± 5%, 150 ppm TCR, microwave trim, 100 mW max power handling.



Resistive Materials

Code	Material	Passivation	Sheet Resistivity (Ω/ Sq)	Abs. Tolerance	Ratio Tolerance
T	**Tantalum Nitride (TaN)**	Self Passivating Ta_2O_5	5 to 270	From ±0.01%	From ±0.01%
N	**NiChrome (NiCr)**	SiO_2	5 to 250	From ±0.01%	From ±0.01%

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

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

Thin Film Products

Microwave Chip Resistors – PM Series

Substrate Materials

Material	Thickness	Surface Finish	Dielectric Constant (@ 1MHz)	Coefficient of Thermal Expansion (x 10^6/ °C)	Thermal Conductivity (W/m*K)	Code
Alumina (Al_2O_3)	0.005" - 0.010"	2µ" - 3µ"	9.9	7 (25°C to < 300°C)	26.9	35
Aluminum Nitride (AlN)	0.005" - 0.010"	6µ“ - 8µ"	8.0 – 9.1	4.6 - 5.7 (25°C to < 1000°C)	170	28
Beryllium Oxide (BeO)	0.005" - 0.010"	< 5µ"	6.76	9 (25°C to < 1000°C)	285	25
Quartz (Fused Silica)	0.005" - 0.010"	60/40 Optical Polish	3.826	0.55 (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%

Terminations

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

Temperature Coefficient of Resistance

Material	±150 ppm/°C	±100 ppm/°C	±50 ppm/°C	±25 ppm/°C	±10 ppm/°C	±5 ppm/°C
Tantalum Nitride (TaN)	**Q**	**V**	**W**	**X**	**Y**	**Z**
	Standard	Yes	---	---	---	---
NiChrome (NiCr)	---	---	Yes	Standard	Yes	Yes

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	Z
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

Thin Film Products

Microwave Chip Resistors – PM Series

Power Handling & Standard Resistance Ranges by Material and Case Size

Standard Power Handling							High Power Resistor Range				
Case Size mils (inches)	Alumina (C35)	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	750 mW	20 mW	3	750	---	---	---	---	---
20 x 10 (0.020 x 0.010)	100 mW	400 mW	750 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	750 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	15.0W
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 short time overload, and TCR sampling.

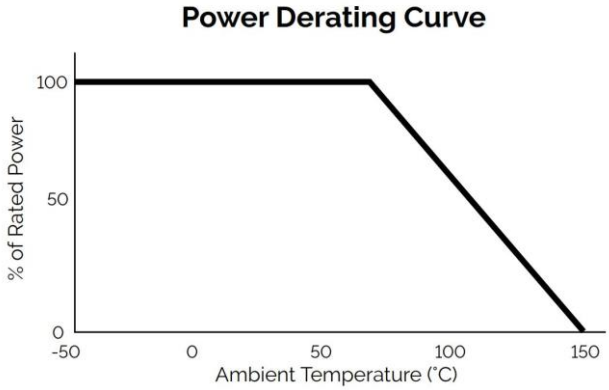
Our parts meet or exceed additional MIL-PRF-55342 and MIL-STD-202 requirements.

Thin Film Products

Microwave Chip Resistors – PM Series

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 available. Please contact sales@passiveplus.com.

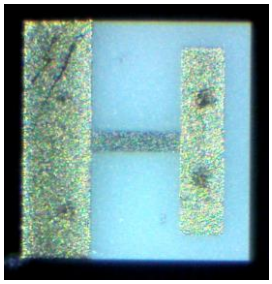
Packaging

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

Thin Film Products

Microwave Edge Wrapped Chip Resistors

Product Features

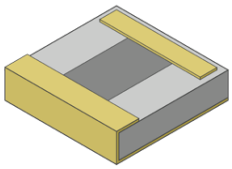


- Edge Wrap similar in construction to our standard surface mount wrap resistors, with half wrap and full wrap styles available.
- The addition of a microwave design allows for operation at frequencies up to 60 GHz.
- Can be used in Non-Magnetic Applications

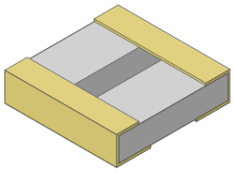
Product Specifications

Resistance Range	2 Ω to 5kΩ
Resistance Tolerance	±0.5% to ±20%, value dependent

Half Wrap



Full Wrap



Part Numbering

Example shown below: Microwave Resistor, TaN resistive element, AlN substrate, case size 0.040" × 0.020" × 0.010", dual edge wrap, resistance 200 Ω ± 2%, 150 ppm TCR, 1.0 W max power handling.

P M T 1 28 – 40×20× 10 N 200R0 G Q K W

RoHS

- P = Passive Plus
- Resistive Material *See Table*
- Substrate *See Table*
- Thickness
- Resistance Value *See Table*
- TCR *See Table*
- Packaging *W = Waffle Pack*
- Resistor Style *M = Microwave*
- Number of Resistors
- Length & Width (mils)
- Termination *See Table*
- Resistance Tolerance *See Table*
- Power Handling *See Table*

Resistive Materials

Code	Material	Passivation	Sheet Resistivity (Ω/ Sq)	Abs. Tolerance	Ratio Tolerance
T	**Tantalum Nitride (TaN)**	Self Passivating Ta_2O_5	5 to 270	From ±0.01%	From ±0.01%
N	**NiChrome (NiCr)**	SiO_2	5 to 250	From ±0.01%	From ±0.01%

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

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

Thin Film Products

Microwave Edge Wrapped Chip Resistors

Substrate Materials

Material	Thickness	Surface Finish	Dielectric Constant (@ 1MHz)	Coefficient of Thermal Expansion (x 10^6/ °C)	Thermal Conductivity (W/m*K)	Code
Alumina (Al_2O_3)	0.005" - 0.010"	2µ" - 3µ"	9.9	7 (25°C to < 300°C)	26.9	35
Aluminum Nitride (AlN)	0.005" - 0.010"	6µ“ - 8µ"	8.0 – 9.1	4.6 - 5.7 (25°C to < 1000°C)	170	28
Beryllium Oxide (BeO)	0.005" - 0.010"	< 5µ"	6.76	9 (25°C to < 1000°C)	285	25

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%

Terminations

Metallization	Application	Code
1 Side Wrap	Epoxy or Au/Sn	H
1 Side Wrap	Epoxy, Au/Sn, or Sn Solder	M
1 Side Wrap	Sn Solder Ball	S
2 Side Wrap	Epoxy or Au/Sn	J
2 Side Wrap	Epoxy, Au/Sn, or Sn Solder	N
2 Side Wrap	Sn Solder Ball	T

Temperature Coefficient of Resistance

Material	±150 ppm/°C	±100 ppm/°C	±50 ppm/°C	±25 ppm/°C	±10 ppm/°C	±5 ppm/°C
Tantalum Nitride (TaN)	Q	V	W	X	Y	Z
	Standard	Yes	---	---	---	---
NiChrome (NiCr)	---	---	Yes	Standard	Yes	Yes

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	Z
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

Thin Film Products

Microwave Edge Wrapped Chip Resistors

Power Handling & Standard Resistance Ranges by Material and Case Size

Standard Power Handling							High Power Resistor Range				
Case Size mils (inches)	Alumina (C35)	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	750 mW	20 mW	3	750	---	---	---	---	---
20 x 10 (0.020 x 0.010)	100 mW	400 mW	750 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	750 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	15.0W
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 short time overload, and TCR sampling.

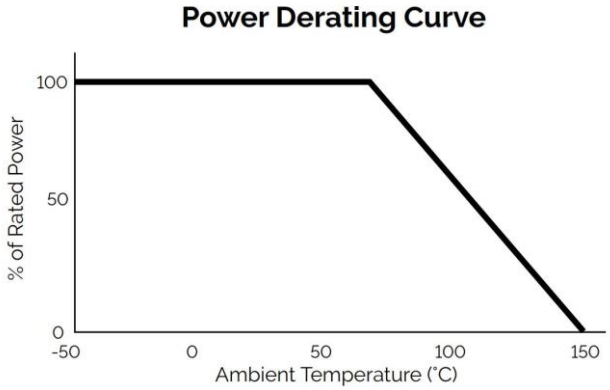
Our parts meet or exceed additional MIL-PRF-55342 and MIL-STD-202 requirements.

Thin Film Products

Microwave Edge Wrapped Chip 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 available. Please contact sales@passiveplus.com.

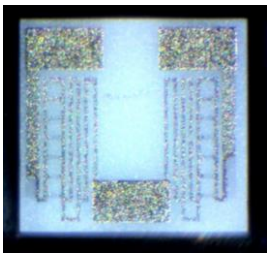
Packaging

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

Thin Film Products

Dual Chip Resistors – PD Series

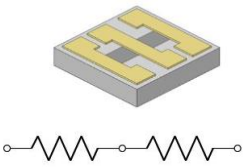
Product Features



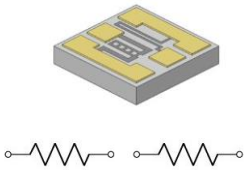
- Two resistors on a single chip area.
- Available styles are common or isolated node.
- The nature of this design lends itself to tightly matched TCR and electrical tolerance, with resistance ratios within 0.01% possible (value dependent).
- Can be used in Non-Magnetic Applications

Product Specifications

Resistance Range	2Ω - 1MΩ per resistor (Silicon or Quartz) 2Ω - 160kΩ per resistor (Al_2O_3, BeO, or AlN)
Resistance Tolerance	±0.01% to ±20% value dependent
Standard Size	30 mil x 30 mil x 10 mil 0.03” x 0.03” x 0.01”



Common Node Configuration



Isolated Node Configuration

Part Numbering

P D T – 35 – 30×30 – 10000–20000 – A J Q K

- P = Passive Plus
- Resistive Material *See Table*
- Length & Width (mils)
- Termination *See Table*
- TCR *See Table*
- Resistor Style *See Table*
- Substrate *See Table*
- Resistance for First & Second Resistors
- Resistance Tolerance *See Table*
- Resistance Ratio

Resistive Style

Code	Style
D	Dual Resistors
I	Isolated Resistors

Resistive Materials

Material	Passivation	Sheet Resistivity (Ω/ Sq)	Abs. Tolerance	Ratio Tolerance
Tantalum Nitride (TaN)	Self Passivating Ta_2O_5	5 to 270	From ±0.01%	From ±0.01%
NiChrome (NiCr)	SiO_2	5 to 250	From ±0.01%	From ±0.01%

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

Thin Film Products

Dual Chip Resistors – PD Series

Substrate Materials

Material	Thickness	Surface Finish	Dielectric Constant (@ 1MHz)	Coefficient of Thermal Expansion (x 10^6/ °C)	Thermal Conductivity (W/m*K)	Code	Power per Resistor
Alumina (Al_2O_3)	0.005" - 0.010"	2µ" - 3µ"	9.9	7 (25°C to < 300°C)	26.9	35	125 mW
Aluminum Nitride (AlN)	0.005" - 0.010"	6µ“ - 8µ"	8.0 – 9.1	4.6 - 5.7 (25°C to < 1000°C)	170	28	500 mW
Beryllium Oxide (BeO)	0.005" - 0.010"	< 5µ"	6.76	9 (25°C to < 1000°C)	285	25	1 W
Silicon (Si) (with 12kÅ SiO_2)	0.005" - 0.010"	Chemical Polish	N/A (SiO_2 K=1.38)	2.49 - 4.44 (25°C to < 1000°C)	149 (SiO_2 1.38)	22	125 mW
Quartz (Fused Silica)	0.005" - 0.010"	60/40 Optical Polish	3.826	0.55 (25°C to < 300°C)	1.38	20	25 mW

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%

Terminations

Metallization		Code
Top Side	Bottom Side	
Pd / Au	–	A
Pd / Au	Ta/Pd/Au	D
Pd/ Au	Au Sputtered	K

Temperature Coefficient of Resistance

Material	±150 ppm/°C	±100 ppm/°C	±50 ppm/°C	±25 ppm/°C	±10 ppm/°C	±5 ppm/°C
Tantalum Nitride (TaN)	Q	V	W	X	Y	Z
	Standard	Yes	---	---	---	---
NiChrome (NiCr)	---	---	Yes	Standard	Yes	Yes

Power Handling Range by Material

Case Size mils (inches)	Alumina (C35)	Silicon (C-22)	AlN (C-28)	BeO (C-25)	Quartz (C-20)
30 x 30 (0.030 x 0.030)	125 mW	125 mW	500 mW	1.0 W	25 mW

Resistance Ratio Codes

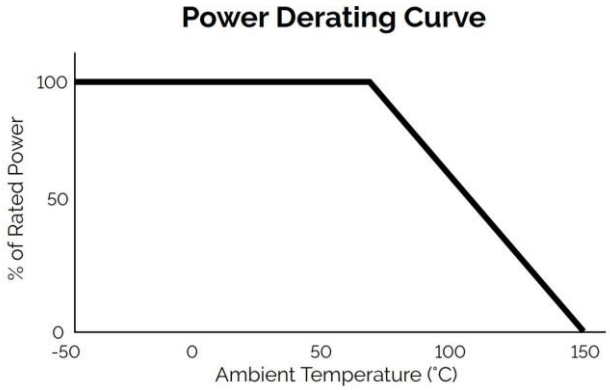
Tolerance To Other Resistors	Code
±0.01%	G
±0.05%	H
±0.10%	J
±0.25%	K
±0.50%	M
±1.00%	N
No Ratio	R

Thin Film Products

Dual Chip Resistors – PD Series

General Properties

Operating Temperature	-55°C to +150°C
Storage Temperature	-65°C to +150°C
Operating Frequency	DC to 500 MHz
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 available. Please contact sales@passiveplus.com.

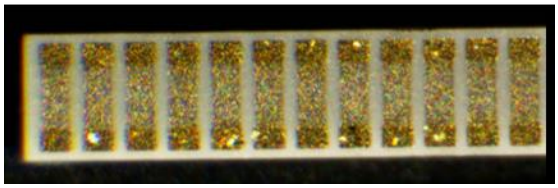
Packaging

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

Thin Film Products

Standard Resistor Array – PS, PB, PI Series

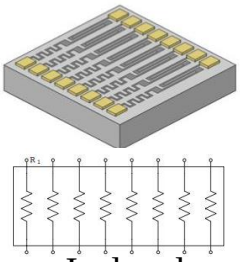
Product Features



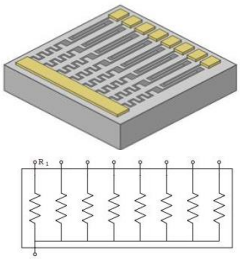
- Configured in 3 to 12 resistor combinations with all resistors at the same value and tolerance.
- Custom arrays can be designed to engineer's specifications.
- Can be used in Non-Magnetic Applications

Product Specifications

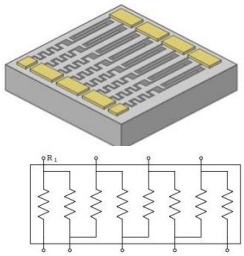
Resistance Range	5Ω to 100 kΩ per resistor (Alumina) 5Ω to 1 MΩ per resistor (Silicon)
Resistive Material	Tantalum Nitride
Ratio Tolerance	To 0.01% value dependent



Isolated



Common



Series

Part Numbering

P I T 12 35 – 130×60× 10 A 200R0 G Q C W

- P = Passive Plus
- Resistive Material *See Table*
- Substrate *See Table*
- Thickness
- Resistance Value
- TCR *See Table*
- Packaging *See Table*
- Resistor Style *See Table*
- Number of Resistors
- Length & Width
- Termination *See Table*
- Resistance Tolerance *See Table*
- Power Handling *See Table*

Resistive Style

Code	Style
I	Isolated Array
B	Common-Bus Array
S	Series Array

Resistive Materials

Material	Code	Passivation	Sheet Resistivity (Ω/ Sq)	Abs. Tolerance	Ratio Tolerance
Tantalum Nitride (TaN)	T	Self Passivating Ta_2O_5	5 to 270	From ±0.01%	From ±0.01%

Thin Film Products

Standard Resistor Array – PS, PB, PI Series

Substrate Materials

Recommended Substrates	Code
99.6% Alumina (Al_2O_3)	35
Silicon (SiO_2)	20

Terminations

Metallization		Code
Top Side	**Bottom Side**	
Pd / Au	–	A
Pd / Au	Ta/Pd/Au	D
Pd/ Au	Au Sputtered	K

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%

Temperature Coefficient of Resistance

Material	±150 ppm/°C	±100 ppm/°C
Tantalum Nitride (TaN)	Q	V
	Standard	Yes

Power Handling

Resistors	3	4	5	6	7	8	9	10	11	12
Length (mils)	40 (0.04")	50 (0.05")	60 (0.06")	70 (0.07")	80 (0.08")	90 (0.09")	100 (0.10")	110 (0.11")	120 (0.12")	130 (0.13")
Width	60 mils (0.06") standard									
Thickness	10 mils (0.01") standard									
Power	50 mW/ Resistor standard									

Packaging

Code	Style
W	Waffle Pack (Standard)
G	Gel Pack

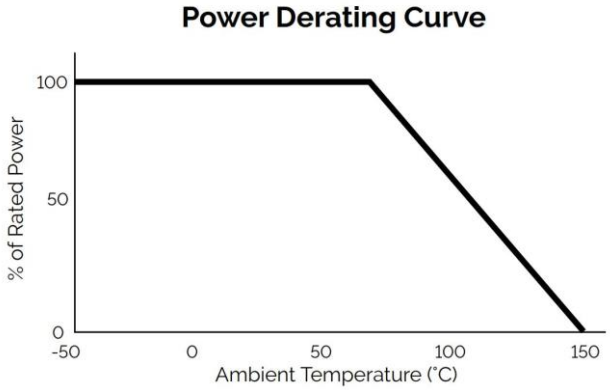
All parts are supplied in waffle packs. Other packaging may be available. Contact PPI for additional packaging options.

Thin Film Products

Standard Resistor Array – PS, PB, PI Series

General Properties

Operating Temperature	-55°C to +150°C
Storage Temperature	-65°C to +150°C
Operating Frequency	DC to 500 MHz
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 available. Please contact sales@passiveplus.com.

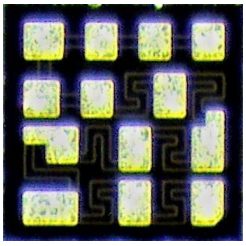
Packaging

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

Thin Film Products

Network Resistor Array – PN Series

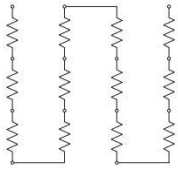
Product Features



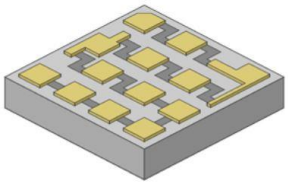
- Multiple resistances in a single, space saving chip.
- Single chip geometry offers excellent TCR tracking and resistance ratio tracking.
- PPI offers chips with 12 or 20 resistive elements as standard.
- Other configurations are available upon request.
- Can be used in Non-Magnetic Applications

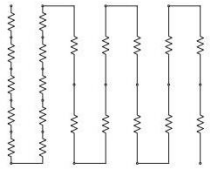
Product Specifications

Resistive Material	Tantalum Nitride
Ratio Tolerance	To 0.01% value dependent



12 Resistor Configuration





20 Resistor Configuration

Part Numbering

P N T 20 35 – 38 × 38 × 10 A 200R0 J Q C W

- P = Passive Plus
- Resistive Material *See Table*
- Substrate *See Table*
- Resistor Style *See Table*
- Number of Resistors *12 or 20*
- Length & Width
- Thickness
- Termination *See Table*
- Resistance Value
- Resistance Tolerance *See Table*
- TCR *See Table*
- Power Handling *See Table*
- Packaging *See Table*

Resistor Style

Code	Style
N	Network Array

Resistive Materials

Code	Material	Passivation	Sheet Resistivity (Ω/ Sq)	Abs. Tolerance	Ratio Tolerance
T	**Tantalum Nitride (TaN)**	Self Passivating Ta_2O_5	5 to 270	From ±0.01%	From ±0.01%

Thin Film Products

Network Resistor Array – PN Series

Substrate Materials

Code	Material	Thickness	Surface Finish	Dielectric Constant (@ 1MHz)	Coefficient of Thermal Expansion (x 10^6/ °C)	Thermal Conductivity (W/m*K)
35	Alumina (Al_2O_3)	0.005" - 0.010"	2µ" - 3µ"	9.9	7 (25°C to < 300°C)	26.9
22	Silicon (Si) (with 12kÅ SiO_2)	0.005" - 0.010"	Chemical Polish	N/A (SiO_2 K=1.38)	2.49 - 4.44 (25°C to < 1000°C)	149 (SiO_2 1.38)

Terminations

Code	Metallization	
	Top Side	Bottom Side
A	Pd / Au	—
D	Pd / Au	Ta/Pd/Au
K	Pd/ Au	Au Sputtered

Resistance Range

Code	Size	Substrate Metallization	Resistance Range	Resistance Distribution
12	30x30 (0.030"x0.030")	Silicon	80Ω to 240kΩ	R_1 to R_7 = Rt/8 R_8 to R_{12} = Rt/40
		Alumina	80Ω to 50kΩ	
20	38x38 (0.038"x0.038")	Silicon	550Ω to 500kΩ	R_1 to R_{10} = Rt/110 R_{11} to R_{20} = Rt/11
		Alumina	550Ω to 50kΩ	

Resistance Tolerance Codes

Code	J	K	M
Tolerance	± 5%	± 10%	± 20%

Temperature Coefficient of Resistance

Code	TC	Material
Q*	±150 ppm/°C	Tantalum Nitride (TaN)
V	±100 ppm/°C	

**Standard*

Power Handling

Code	Rating
C	250mW

Packaging

Code	Style
W	Waffle Pack (Standard)
G	Gel Pack

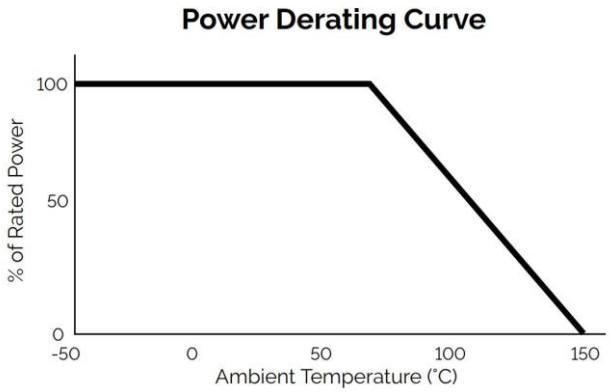
All parts are supplied in waffle packs. Other packaging may be available. Contact PPI for additional packaging options.

Thin Film Products

Network Resistor Array – PN Series

General Properties

Operating Temperature	-55°C to +150°C
Storage Temperature	-65°C to +150°C
Operating Frequency	DC to 500 MHz
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

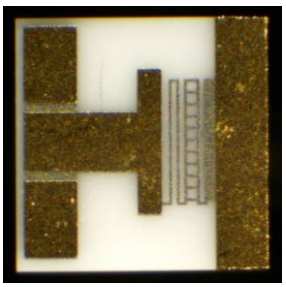
Performance Specifications

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

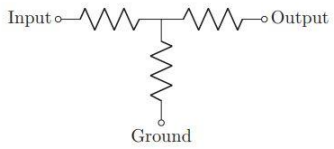
Thin Film Products

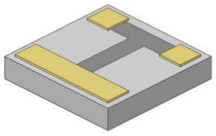
Attenuators – PAT Series

Product Features

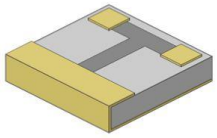


- Reduces amplitude or power of a signal by a known value. This is achieved with very little distortion of the signal, maintaining accuracy up to 40 GHz.
- Attenuators are available with or without center Taps
- Single wraps of the ground pad to a full gold backside available
- Additional Attenuator configurations, including balanced attenuators, are available as custom parts
- Can be used in Non-Magnetic Applications

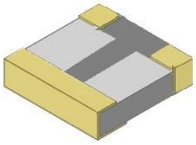




Attenuator Top Contact



Attenuator, Single Pad Wrap



Attenuator, 3-Sided Wrap

Part Numbering

P	A	T	S	35 –	50×50× 10	A	3R00	F	Q	G	W

RoHS

- P = Passive Plus
- Attenuator
- Resistive Metallization *See Table*
- Attenuator Type *See Table*
- Material *See Table*
- Length & Width
- Thickness
- Bond Pad Metallization *See Table*
- Attenuation (dB)
- Attenuation Tolerance *See Table*
- TCR *See Table*
- Power Handling *See Table*
- Packaging *See Table*

Resistive Metallizations

Code	Material	Passivation	Sheet Resistivity (Ω/ Sq)	Abs. Tolerance	Ratio Tolerance
T	**Tantalum Nitride (TaN)**	Self Passivating Ta_2O_5	5 to 270	From ±0.01%	From ±0.01%

Attenuator Type

Code	Description
S	T-Pattern

Thin Film Products

Attenuators – PAT Series

Materials

(LxWxT) Dimensions (mils)	Power (W) Al_2O_3	Power (W) AlN	Power (W) BeO	Value Min	Value Max
CODE	35	28	25		
50x50x10	250mW	1W	2W	0.5dB	24.5dB
80x60x15	250mW	1W	2W	0.5dB	24.5dB
150x120x25	2W	8W	16W	0.5dB	24.5dB

Bond Pad Metallizations

Metallization	Code
Top Only	A
Single Wrap, Full GRD Plane	M
Flip Chip	R
3-sided Wrap	X

Attenuation Tolerance

Tolerance	Code
±0.1dB (-0.5 to -6.0dB)	F
±0.2dB (-6.5 to -24.5dB)	G

Temperature Coefficient of Resistance

TCR	Availability	Code
±150ppm	Standard	Q
±100ppm	Optional	V

Power Handling

Power	Code
250mW	G
1.0W	K
2.0W	L
8.0W	R
16.0W	Y

Power Ratings assume proper heat sinking is used.

Packaging

Code	Style
W	Waffle Pack (Standard)
G	Gel Pack

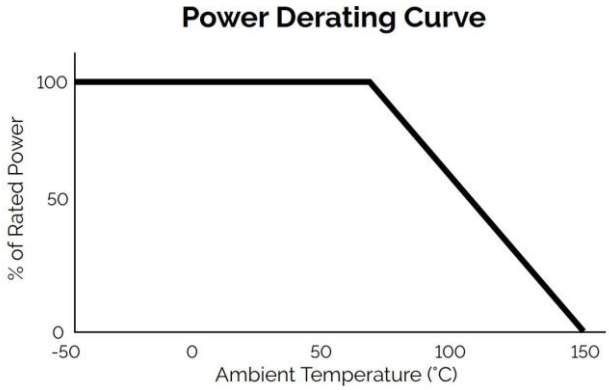
All parts are supplied in waffle packs. Other packaging may be available. Contact PPI for additional packaging options.

Thin Film Products

Attenuators – PAT Series

General Properties

Operating Temperature	-55°C to +150°C
Storage Temperature	-65°C to +150°C
Operating Frequency	DC to 40 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 available. Please contact sales@passiveplus.com.

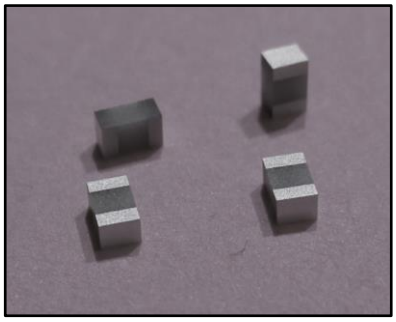
Packaging

ESD waffle packs are standard. Gel pack packaging also available. Film rings are available upon request for Top Contact Attenuators only. Please contact PPI for availability.

Thin Film Products

Thermal Conductors – PTC Series

λ Product Features



With the increase in heat dissipation from microelectronics devices and the reduction in overall form factors, thermal management becomes a more and more important element of electronic product design.

PPI's Thermal conductors are a passive heat exchanger that transfers the heat generated by an electronic device to a thermal ground plane or any specific thermal point where it gets dissipated away from the device.

Our thermal conductors are available in a variety of sizes including standard EIA case sizes and are constructed using Aluminum Nitride (AlN) or Beryllium Oxide (BeO).

λ Product Features

- High Thermal Conductivity
- Low Thermal Resistance
- Low Capacitance
- One piece construction
- RoHS Compliant
- EIA case sizes
- More efficient thermal management

λ Applications

- GaN Power Amplifiers
- High RF Power Amplifiers
- Filters
- Synthesizers
- Switch Mode Power Supplies
- Pin & Laser Diodes

λ Functional Applications

- Between active device & adjacent ground planes
- Specific contact pad to case
- Contact pad to contact pad
- Direct component contact to via pad or trace
- Edges fully metalized

λ Part Numbering

Example shown below: Thermal Conductor, AlN, 1005, thickness (40 mils), Platinum/Gold (Pt/Au), Waffle Pack

P	TC0	28	100×50×40	N	W

RoHS

- P = Passive Plus
- Thermal Conductor
- Material *See Table*
- Length, Width & Thickness *See Parts Characterization Table*
- Metallization *See Table*
- Packaging *See Table*

Thin Film Products

Thermal Conductors – PTC Series

λ Parts Characterizations

Case Size	Length (L) mils / (mm)	Width (W) mils / (mm)	Thickness (T) mils / (mm)	Terminal (t)	Thermal Resistance (°C/W)		Thermal Conductivity (mW/°C)	
					AlN	BeO	AlN	BeO
0302	30 ± 2 (.770 ± .051)	20 ± 2 (.510 ± .0510)	20 (.020 ± .002)	10 -0.25	19	12	53	81
0402	40 ± 2 (1.020 ± .051)	20 ± 2 (.510 ± .0510)	20 (.020 ± .002)	10 -0.25	25	16	40	61
0505	50 ± 2 (1.270 ± .051)	50 ± 2 (1.270 ± .051)	25 (.025 ± .002)	15 -0.38	10	7	100	153
0603	60 ± 2 (1.52 ± .051)	30 ± 2 (.760 ± .051)	25 (.025 ± .002)	15 -0.38	20	13	50	76
0805	80 ± 2 (2.030 ± .051)	50 ± 2 1.270 ± .051)	40 (.040 ± .002)	20 -0.51	10	7	100	153
1005	100 ± 2 (2.54 ± .051)	50 ± 2 (1.27 ± .051)	40 (.040 ± .002)	20 -0.51	13	8	77	122
1020	100 ± 2 (2.540 ± .051)	200 ± 2 (5.080 ± .051)	40 (.040 ± .002)	20 -0.51	3	2	320	508
1111	110 ± 2 (2.790 ± .051)	110 ± 2 (2.790 ± .051)	40 (.040 ± .002)	20 -0.51	7	4	153	240
2010	195 ± 10 (4.950 ± .254)	195 ± 10 (2.410 ± .254)	60 (.060 ± .002)	30 -0.77	10	6	100	159
2525	240 ± 10 (6.100 ± .254)	250 ± 10 (6.350 ± .254)	60 (.060 ± .002)	40 -1.02	4	3	240	380
3725	370 ± 10 (9.400 ± .254)	245 ± 10 (6.220 ± .254)	60 (.060 ± .002)	50 -1.27	6	4	160	254
3737	365 ± 10 (9.270 ± .254)	375 ± 10 (9.530 ± .254)	60 (.060 ± .002)	50 -1.27	4	3	240	380

λ Materials

	AlN	BeO
CODE	**28**	**25**

λ Metallizations

Termination Code	Termination Materials
N*	Platinum/Gold (Pt/Au)
X	Platinum/Silver (Pt/Ag)

**Recommended*

λ Packaging

Code	Style
W	Waffle Pack (Standard)
G	Gel Pack

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

Thin Film Products

Thermal Conductors – PTC Series

λ General Properties

Operating Temperature	-55°C to +150°C
Storage Temperature	-65°C to +150°C
Insulation Resistance	10^{12} Ω min at 25°C

λ 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

λ Performance Specifications

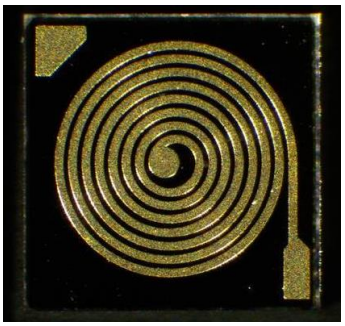
Higher power ratings, additional sizes, and custom resistors available. Please contact sales@passiveplus.com.

Thin Film Products

Spiral Inductors

PPI Spiral Inductors consist of a thin film gold spiral patterned on a substrate for use in a wide variety of uses, including storing electrical energy in the form of magnetic energy, in frequencies from DC to RF.

An optional polyimide coating over the coil is available for increased resistance to scratches or shorts. Non-conductive epoxy is recommended as a mounting method, backside metallization is also available. A second corner pad is provided for easy wire-bonding from the center pad for edge-contact mounting.



50x50 Spiral Inductor

Product Features

- High Thermal Conductivity
- Low Thermal Resistance
- Low Capacitance
- Less Resistive & Capacitive losses
- RoHS Compliant
- EIA case sizes
- More efficient thermal management

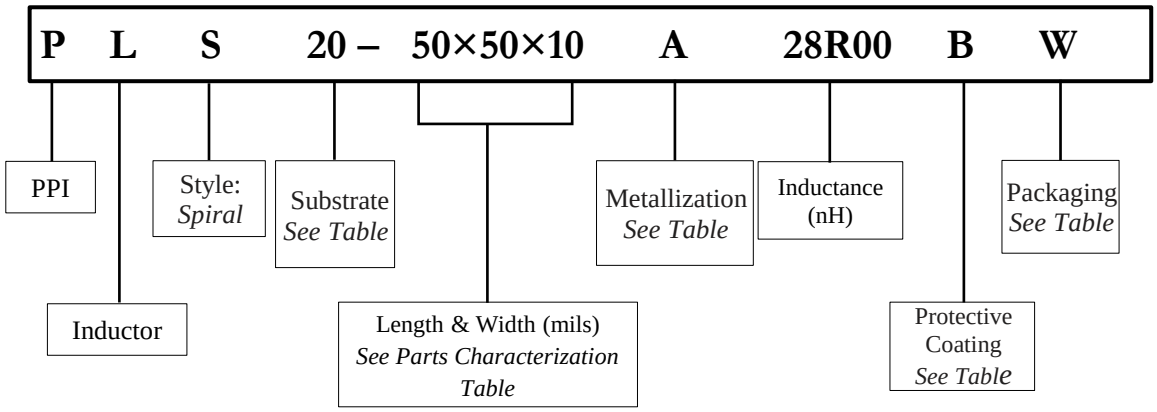
Applications

- Microwave Circuit Resonant elements
- Electrical Power & Electronic Devices

Functional Applications

- Choking, Blocking, Attenuating, or filtering/smoothing high frequency noise
- Storing & transferring energy in power converters
- Creates tuned oscillators or LC "tank" circuits
- Impedance matching

Part Numbering



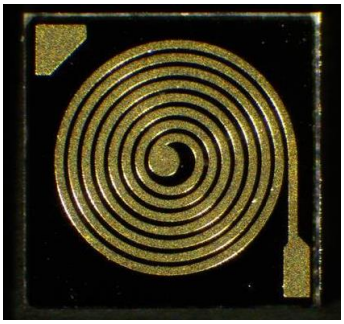
Other inductance values, DC resistance values, substrates, geometries, metallizations, and custom inductors are available.

Thin Film Products

Spiral Inductors

Parts Characterizations

Case Size (Mils)	Inductances	# of Turns	DC Resistance	Q (@ 200MHz)	Q (@ 500MHz)
25 x 25	1.2 nH	1.5	0.6Ω	3	7
25 x 25	2.0 nH	2.0	0.9Ω	3	8
25 x 25	3.0 nH	2.5	1.2Ω	4	9
30 x 30	4.4 nH	3.0	1.5Ω	4	10
30 x 30	6.0 nH	3.5	1.9Ω	4	11
30 x 30	7.9 nH	4.0	2.3Ω	4	11
40 x 40	10 nH	4.5	2.7Ω	5	12
40 x 40	13 nH	5.0	3.2Ω	5	12
40 x 40	16 nH	5.5	3.7Ω	5	13
40 x 40	19 nH	6.0	4.2Ω	6	13
40 x 40	23 nH	6.5	4.7Ω	6	14
50 x 50	28 nH	7.0	5.3Ω	7	14



50x50 Spiral Inductor

Substrates

Code	Substrate
20	Quartz
35	99.6% Alumina (Al_2O_3)

Metallizations

Metallization		Code	Note
Top Side	Bottom Side		
Ta/Pd/Au	–	A	Wirebondable
Ta/Pd/Au	Ta/Pd/Au	D	Wirebond or Epoxy

Other metallizations available. Please contact PPI.

Inductance Codes

Inductance (nH)
Digits 1-4 are significant figures
The "R" is used as a decimal point.
e.g. 28R0 = 28nH, 1R50 = 1.5nH

Inductance values are computed in free air, using a magnetic permeability for free air of $\mu = 4.0 \times 10^{-7}$. DC resistance is based on a gold metallization.

Protective Coating

Code	Polyimide Coating
B	Without Coating
P	With Polyimide Coating

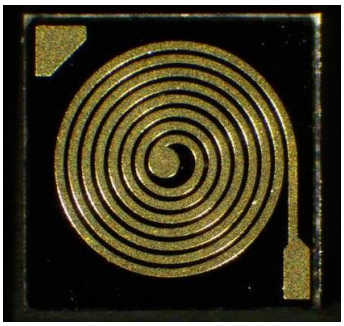
Packaging

Code	Style
W	Waffle Pack (Standard)
G	Gel Pack

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

Thin Film Products

Spiral Inductors



50x50 Spiral Inductor

General Properties

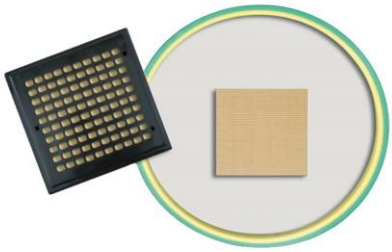
Operating Temperature	-55°C to +150°C
Storage Temperature	-65°C to +150°C
Operating Frequency	DC to 500 MHz
Insulation Resistance	$10^{12}\Omega$ · min at 25°C

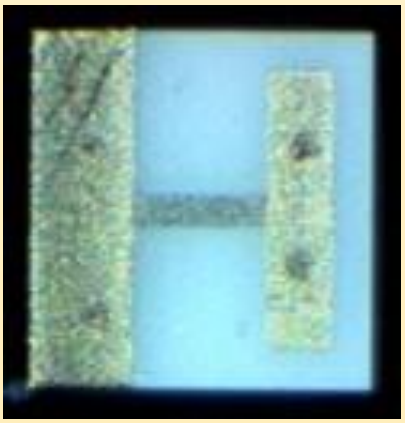
Testing

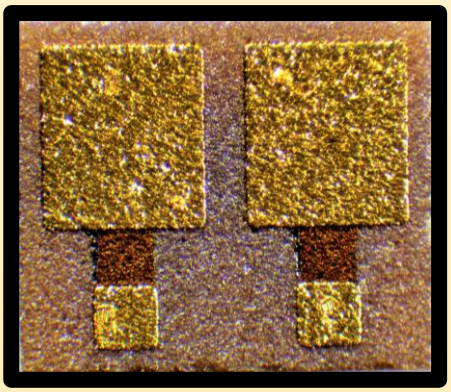
Testing Performed	Specification / Standard
Visual Inspection	MIL-PRF-55342 MIL-STD-883
Mechanical Inspection	MIL-PRF-55342
DC Resistance	MIL-PRF-55342 MIL-STD-202
High Temperature Exposure	MIL-PRF-55342
Thermal Shock	MIL-PRF-55342 MIL-STD-202
Resistance to Bonding Exposure	MIL-PRF-55342
Wire Bonding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

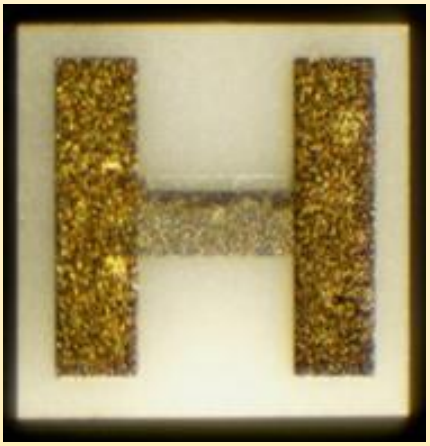
Performance Specifications

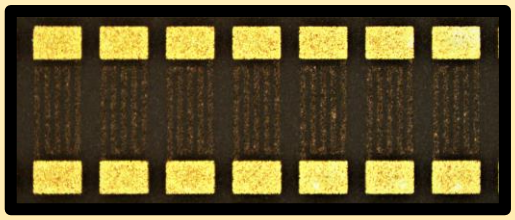
Additional sizes and custom inductors available. Please contact sales@passiveplus.com.

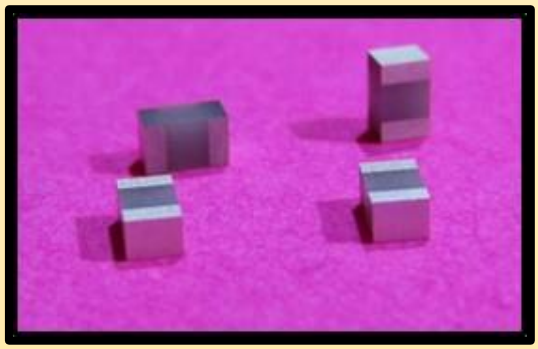


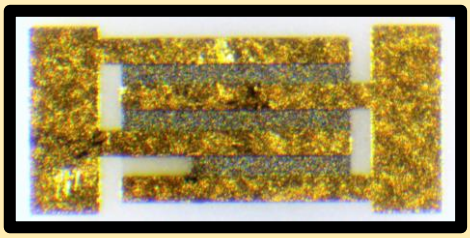


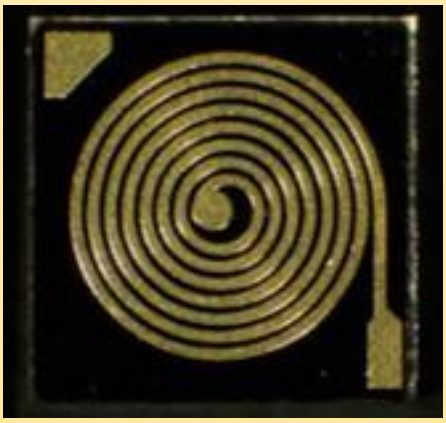


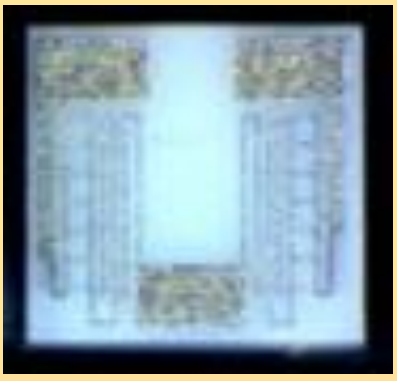


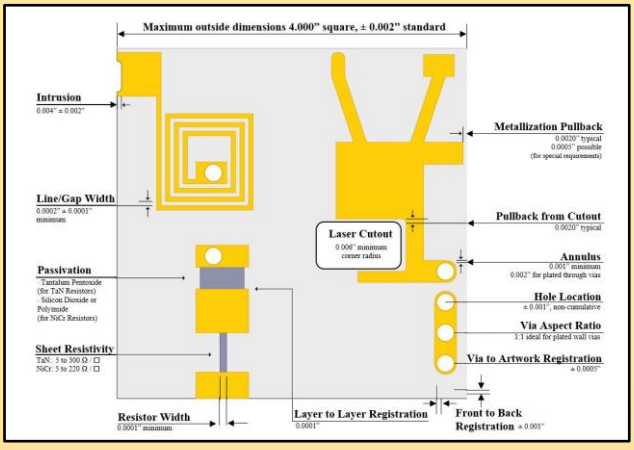


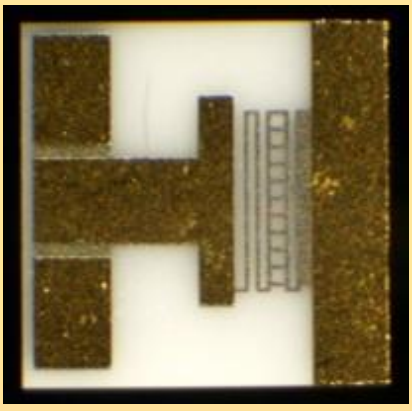












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RF & Microwave Components

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