

High Precision Wraparound - Wide Ohmic Value Range Thin Film Chip Resistors, Sulfur Resistant



DESIGN SUPPORT TOOLS

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3D
Models
Available

For low noise and precision applications, superior stability, low temperature coefficient of resistance, and low voltage coefficient, Vishay Sfernice's proven precision thin film wraparound resistors exceed requirements of MIL-PRF-55342G characteristics $Y \pm 10 \text{ ppm/}^\circ\text{C}$ (-55°C ; $+155^\circ\text{C}$) down to $\pm 5 \text{ ppm/}^\circ\text{C}$ (-55°C ; $+155^\circ\text{C}$).

FEATURES

- Load life stability 0.02 % typical at 8000 h at 70°C under Pd (0.033 % maximum)
- Low temperature coefficient down to **5 ppm/°C** (-55°C ; $+155^\circ\text{C}$)
- Very low noise < -35 dB and voltage coefficient < 0.01 ppm/V
- Wide resistance range: 10 Ω to 86 M Ω depending on size
- Tolerances to **$\pm 0.01 \%$**
- In lot tracking $\leq 5 \text{ ppm/}^\circ\text{C}$
- Termination: Thin film technology
- Short circuits (jumpers) $r < 50 \text{ m}\Omega$, $I < 2 \text{ A}$, see PZR datasheet (www.vishay.com/doc?53053)
- Withstand moisture resistance test of AEC-Q200
- Sulfur resistant (per ASTM B809-95 humid vapor test)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS*
Available

HALOGEN
FREE
Available

GREEN
(5-2008)
Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	SIZE	RESISTANCE RANGE (2)	RATED POWER W Pn (1)	RATED POWER W Pd (1)	LIMITING ELEMENT VOLTAGE V	TOLERANCE $\pm \%$	TEMPERATURE COEFFICIENT $\pm \text{ppm/}^\circ\text{C}$
P0302	0302	10 to 420K	0.040	0.030	25	0.01, 0.02, 0.05, 0.1, 0.25, 0.5, 1, 2, 5	5, 10, 25, 50, 100
P0402	0402	10 to 1M	0.063	0.040	50	0.01, 0.02, 0.05, 0.1, 0.25, 0.5, 1, 2, 5	5, 10, 25, 50, 100
P0505	0505	10 to 4M	0.125	0.050	50	0.01, 0.02, 0.05, 0.1, 0.25, 0.5, 1, 2, 5	5, 10, 25, 50, 100
P0603	0603	10 to 3.2M	0.125	0.100	75	0.01, 0.02, 0.05, 0.1, 0.25, 0.5, 1, 2, 5	5, 10, 25, 50, 100
P0805 (3)	0805	10 to 8M	0.200	0.125	150	0.01, 0.02, 0.05, 0.1, 0.25, 0.5, 1, 2, 5	5, 10, 25, 50, 100
P1005	1005	10 to 7.5M	0.250	0.125	75	0.01, 0.02, 0.05, 0.1, 0.25, 0.5, 1, 2, 5	5, 10, 25, 50, 100
P1206	1206	10 to 22M	0.330	0.250	200	0.01, 0.02, 0.05, 0.1, 0.25, 0.5, 1, 2, 5	5, 10, 25, 50, 100
P1505	1505	10 to 13.8M	0.350	0.175	200	0.01, 0.02, 0.05, 0.1, 0.25, 0.5, 1, 2, 5	5, 10, 25, 50, 100
P2010	2010	10 to 62M	1 (4)	0.500	300	0.01, 0.02, 0.05, 0.1, 0.25, 0.5, 1, 2, 5	5, 10, 25, 50, 100
P2512	2512	10 to 86M	2 (4)	1	300	0.01, 0.02, 0.05, 0.1, 0.25, 0.5, 1, 2, 5	5, 10, 25, 50, 100

Notes

- (1) Pn = nominal power : Pd = derated power intended to improve stability
- (2) **For ohmic range versus tolerance and TCR see detailed table on next page**
- (3) Model P0805 having the same size than P0705 and the same performances, only codification of P0805 remains
- (4) With special assembly care

CLIMATIC SPECIFICATIONS

Operating temperature range	-55°C ; $+155^\circ\text{C}$
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Note

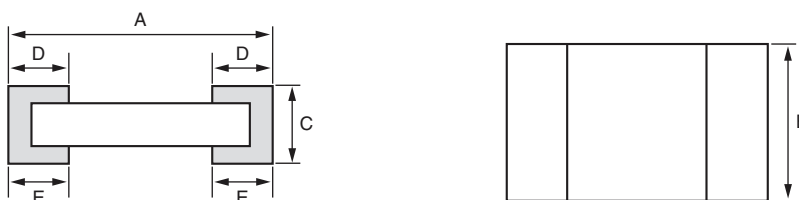
- For temperature up to 230°C , see PHT datasheet (www.vishay.com/doc?53050)

PERFORMANCE VS. HUMID SULFUR VAPOR

Test conditions	$50^\circ\text{C} \pm 2^\circ\text{C}$, 85 % ± 4 % RH, exposure time 500 h
Test results	Resistance drift < (0.05 % $R + 0.05 \Omega$), no corrosion products observed

MECHANICAL SPECIFICATIONS

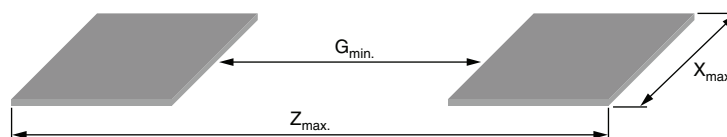
Substrate	Alumina
Technology	Thin film
Film	Nickel chromium with mineral passivation or CrSi
Protection	Epoxy + silicone
Terminations	B type: SnPb over nickel barrier for solder reflow N type: SnAg over nickel barrier G type: gold over nickel barrier for other applications

DIMENSIONS in millimeters (inches)


CASE SIZE	A	B	C	D/E	
	MAX. TOL. +0.152 (+0.006) MIN. TOL. -0.152 (-0.006)	MAX. TOL. +0.127 (+0.005) MIN. TOL. -0.127 (-0.005)		NOMINAL	TOLERANCE
	NOMINAL	NOMINAL			
0302	0.75 (0.029)	0.60 (0.024)	0.5 (0.02) ± 0.127 (0.005)	0.15 (0.006)	0.08 (0.003)
0402	1.00 (0.039)	0.60 (0.024)		0.25 (0.010)	0.1 (0.004)
0505	1.27 (0.005)	1.27 (0.050)		0.38 (0.015)	0.13 (0.005)
0603	1.52 (0.060)	0.85 (0.033)			
0805	1.91 (0.075)	1.27 (0.050)			
1005	2.54 (0.100)	1.27 (0.050)			
1206	3.06 (0.120)	1.60 (0.063)		0.40 (0.016)	
1505	3.81 (0.150)	1.32 (0.052)		0.48 (0.019)	
2010	5.08 (0.200)	2.54 (0.100)		0.48 (0.019)	
2512	6.30 (0.248)	3.30 (0.130)			

Note

- Model P0805 having the same size than P0705 and the same performances, only codification of P0805 remains

SUGGESTED LAND PATTERN (to IPC-7351A)


CHIP SIZE	DIMENSIONS in millimeters (inches)		
	Z _{max.}	G _{min.}	X _{max.}
0302	1.30 (0.051)	0.15 (0.006)	0.73 (0.029)
0402	1.55 (0.061)	0.15 (0.006)	0.73 (0.029)
0505	1.82 (0.072)	0.10 (0.004)	1.40 (0.055)
0603	2.37 (0.093)	0.35 (0.014)	0.98 (0.039)
0805	2.76 (0.109)	0.74 (0.029)	1.40 (0.055)
1005	3.39 (0.133)	1.37 (0.054)	1.40 (0.055)
1206	3.91 (0.154)	1.85 (0.073)	1.73 (0.068)
1505	4.66 (0.183)	2.44 (0.096)	1.45 (0.057)
2010	5.93 (0.233)	3.71 (0.146)	2.67 (0.105)
2512	7.15 (0.281)	4.93 (0.194)	3.43 (0.135)

**TEMPERATURE COEFFICIENT**

TCR	CODE	FILM
± 5 ppm/°C	C (-55 °C; +155 °C)	NiCr
± 5 ppm/°C	Z (0 °C; +70 °C)	NiCr
± 10 ppm/°C	Y	NiCr
± 25 ppm/°C	E	NiCr
± 50 ppm/°C	H	NiCr or CrSi
± 100 ppm/°C	K	NiCr or CrSi

POWER DERATING CURVE**BEST TOLERANCE AND TCR VS. OHMIC VALUE**

STYLE	RANGE (Ω)	TOLERANCE (± %)	TCR CODE
0302	10 to < 50	0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	50 to < 100	0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	100 to < 250	0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	250 to 30K	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	> 30K to 40K	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	Z; Y; E; H; K
	> 40K to 65K	0.05; 0.1; 0.25; 0.5; 1; 2; 5	E; H; K
	> 65K to 420K	0.1; 0.25; 0.5; 1; 2; 5 ⁽¹⁾	H; K
0402	10 to < 50	0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	50 to < 100	0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	100 to < 250	0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	250 to 67K	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	> 67K to 100K	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	Z; Y; E; H; K
	> 100K to 150K	0.05; 0.1; 0.25; 0.5; 1; 2; 5	E; H; K
	> 150K to 1M	0.1; 0.25; 0.5; 1; 2; 5 ⁽¹⁾	H; K
0505	10 to < 50	0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	50 to < 100	0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	100 to < 250	0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	250 to 187K	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	> 187K to 260K	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	Z; Y; E; H; K
	> 260K to 400K	0.05; 0.1; 0.25; 0.5; 1; 2; 5	E; H; K
	> 400K to 4M	0.1; 0.25; 0.5; 1; 2; 5 ⁽¹⁾	H; K
0603	10 to < 50	0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	50 to < 100	0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	100 to < 250	0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	250 to 160K	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	> 160K to 332K	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	Z; Y; E; H; K
	> 332K to 500K	0.05; 0.1; 0.25; 0.5; 1; 2; 5	E; H; K
	> 500K to 3M2	0.1; 0.25; 0.5; 1; 2; 5 ⁽¹⁾	H; K

**BEST TOLERANCE AND TCR VS. OHMIC VALUE**

STYLE	RANGE (Ω)	TOLERANCE ($\pm$ %)	TCR CODE
0805	10 to < 50	0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	50 to < 100	0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	100 to < 250	0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	250 to 360K	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	> 360K to 511K	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	Z; Y; E; H; K
	> 511K to 750K	0.05; 0.1; 0.25; 0.5; 1; 2; 5	E; H; K
	> 750K to 8M	0.1; 0.25; 0.5; 1; 2; 5 ⁽¹⁾	H; K
1005	10 to < 50	0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	50 to < 100	0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	100 to < 250	0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	250 to 400K	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	> 400K to 550K	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	Z; Y; E; H; K
	> 550K to 810K	0.05; 0.1; 0.25; 0.5; 1; 2; 5	E; H; K
	> 810K to 7M5	0.1; 0.25; 0.5; 1; 2; 5 ⁽¹⁾	H; K
1206	10 to < 50	0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	50 to < 100	0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	100 to < 250	0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	250 to 1M3	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	> 1M3 to 2M	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	Z; Y; E; H; K
	> 2M to 3M5	0.05; 0.1; 0.25; 0.5; 1; 2; 5	E; H; K
	> 3M5 to 22M	0.1; 0.25; 0.5; 1; 2; 5 ⁽¹⁾	H; K
1505	10 to < 50	0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	50 to < 100	0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	100 to < 250	0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	250 to 720K	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	> 720K to 1M	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	Z; Y; E; H; K
	> 1M to 1M5	0.05; 0.1; 0.25; 0.5; 1; 2; 5	E; H; K
	> 1M5 to 13M8	0.1; 0.25; 0.5; 1; 2; 5 ⁽¹⁾	H; K
2010	10 to < 50	0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	50 to < 100	0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	100 to < 250	0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	250 to 3M8	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	> 3M8 to 5M	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	Z; Y; E; H; K
	> 5M to 7M5	0.05; 0.1; 0.25; 0.5; 1; 2; 5	E; H; K
	> 7M5 to 62M	0.1; 0.25; 0.5; 1; 2; 5 ⁽¹⁾	H; K
2512	10 to < 50	0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	50 to < 100	0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	100 to < 250	0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	250 to 6M4	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	C; Z; Y; E; H; K
	> 6M4 to 8M6	0.01; 0.02; 0.05; 0.1; 0.25; 0.5; 1; 2; 5	Z; Y; E; H; K
	> 8M6 to 12M9	0.05; 0.1; 0.25; 0.5; 1; 2; 5	E; H; K
	> 12M9 to 86M	0.1; 0.25; 0.5; 1; 2; 5 ⁽¹⁾	H; K

Note⁽¹⁾ Tolerance 0.05 % on request

POPULAR OPTIONS

For any option it is recommended to consult Vishay Sfernice for availability first.

Option: Enlarged Terminations

For stringent and special power dissipation requirements, the thermal resistance between the resistive layer and the solder joint can be reduced using enlarged terminations chip resistors which are soldered on large and thick copper pads acting as heatsink (see application note: 53048 Power Dissipation in High Precision Vishay Sfernice Chip Resistors and Arrays (P Thin Film, PRA Arrays, CHP Thick Film) www.vishay.com/doc?53048.

Option to order 0063: (applies to size 1206 / 1505 / 2010 / 2512).

DIMENSIONS (Option 0063) in millimeters



CASE SIZE	A	B	E	D	F		
	MAX. TOL. +0.152 MIN. TOL. -0.152	MAX. TOL. +0.127 MIN. TOL. -0.127	MAX. TOL. +0.13 MIN. TOL. -0.13	MAX. TOL. +0.13 MIN. TOL. -0.13			
	NOMINAL	NOMINAL	NOMINAL	NOMINAL	NOMINAL	MIN.	MAX.
1206	3.06	1.60	0.40	1.215	0.63	0.50	0.76
1505	3.81	1.32	0.48	1.59			
2010	5.08	2.54		2.215			
2512	6.30	3.30		2.835			

SUGGESTED LAND PATTERN (Option 0063)



CHIP SIZE	DIMENSIONS (IN MILLIMETER)		
	Z _{max.}	G _{min.}	X _{max.}
1206	3.91	0.50	1.73
1505	4.66		1.45
2010	5.93		2.67
2512	7.15		3.43

**Option: Marking**Option to order 0013:

Marking of ohmic value and tolerance:

Sizes: 0805 to 1005: 3 digits marking (according to EIA-96)

Sizes: 1206 to 2512: 4 digits marking (same codification than in the ordering procedure)

Tolerance indicated by a color dot.

Option to order 0014:

Marking of ohmic value:

Sizes: 0805 to 1005: 3 digits marking (according to EIA-96)

Sizes: 1206 to 2512: 4 digits marking (same codification than in the ordering procedure)

No standard marking available for smaller sizes.

A price adder will apply to the unit price of the parts for options 0013 and 0014.

Option: AEC-Q200

For moisture resistance test only.

Option to Order 0058:

Specific production process to withstand 85 °C/85 % at Pn/10

PACKAGING

ESD packaging available: waffle-pack and plastic tape and reel (low conductivity). Paper tape available upon request (for sizes 0402, 0603, 0805 and 1206).

SIZE	MOQ	NUMBER OF PIECES PER PACKAGE			TAPE WIDTH
		WAFFLE PACK 2" x 2"	TAPE AND REEL		
			MIN.	MAX.	
0302	250	340	100	5000	8 mm
0402	100			100	
0505		5000			
0603		100		4000	
0805					
1005					
1206		221		1000	12 mm
1505		140			
2010		60			
2512		50		2000	

PACKAGING RULES**Waffle Pack**

Can be filled up to maximum quantity indicated in the table here above, taking into account the minimum order quantity. When quantity ordered exceeds maximum quantity of a single waffle pack, the waffle packs are stacked up on the top of each other and closed by one single cover.

To get "not stacked up" waffle pack in case of ordered quantity > maximum number of pieces per package: Please consult Vishay Sfernice for specific ordering code.

Tape and Reel

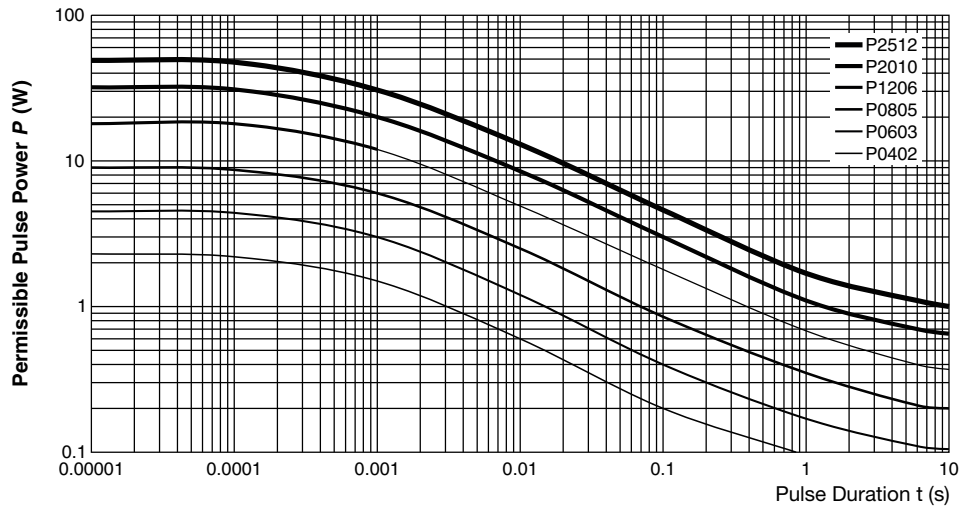
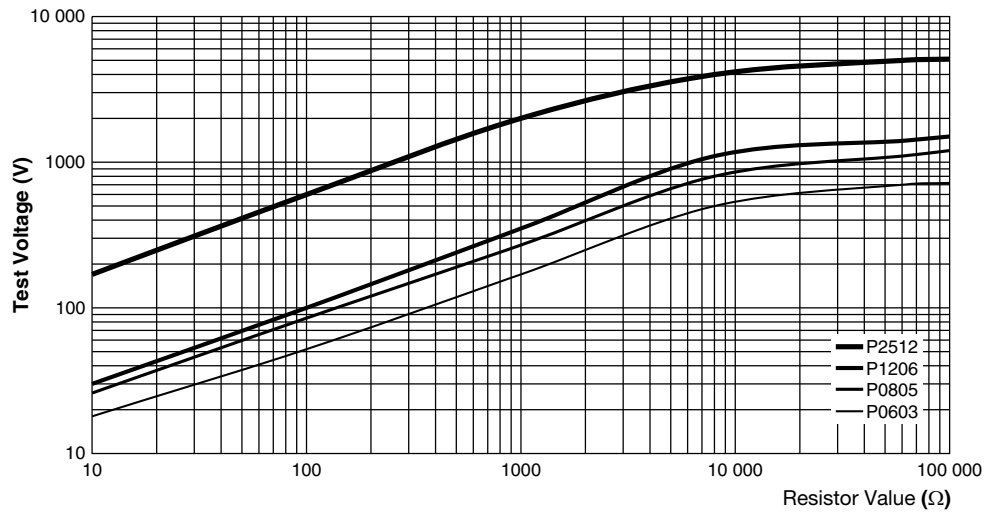
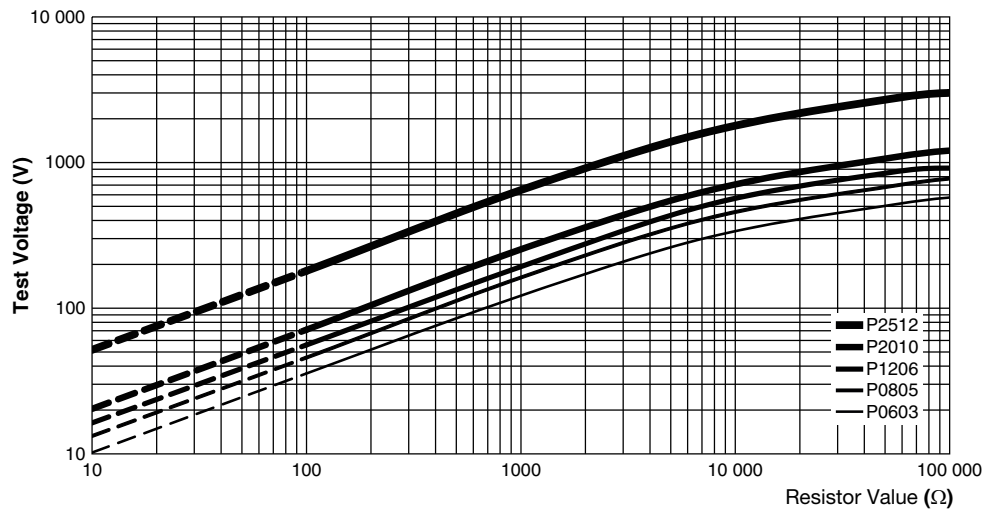
See Part Numbering information to get the quantity desired by tape.

PERFORMANCE			
TESTS	CONDITIONS	MIL OR CECC REQUIREMENTS	TYPICAL PERFORMANCES
Thermal shock	MIL-PRF-55342G MIL-STD-202 F-Method 107 F	± 0.05 %	± 0.02 %
Short time overload	MIL-PRF-55342G PARA 3.10.4.7.5	± 0.05 %	± 0.01 %
Low temperature operation	MIL-PRF-55342G PARA 3.9 and 4.7.4	± 0.05 %	± 0.01 %
Resistance to solder heat	MIL-PRF-55342G PARA 3.12, 4.7.7, 4.7.1.2	± 0.05 %	± 0.03 %
Moisture resistance	MIL-PRF-55342G PARA 3.13 and 4.7.8 MIL-STD-202 F-Method 106 E	± 0.10 %	± 0.01 %
	CECC 56 days/40 °C/93 % RH	± 0.10 %	± 0.01 %
	AEC-Q200 ⁽¹⁾ 85 °C/85 % RH/Pn/10, 1000 h	± 0.5 % + 0.05 Ω	Max. < 0.3 % + 0.05 Ω
High temperature	MIL-PRF-55342G PARA 3.11 and 4.7.6	± 0.05 %	± 0.05 %
Load life	MIL-PRF-55342G 8000 h Pn at 70 °C MIL-STD-202 F-Method 108 A	± 0.5 %	± 0.1 % ⁽²⁾

Notes⁽¹⁾ Option to order 0058⁽²⁾ Typical drift ± 0.02 % at Pd


Note

⁽¹⁾ One should apply the datas mentioned on the 3 curves together to get the right performances

Maximum permissible pulse load P_i max.

1.2/50 μ s lightning surge

10/700 μ s lightning surge


**GLOBAL PART NUMBER INFORMATION**

New Global Part Numbering: P0505Y1003BBT999

P	0	5	0	5	Y	1	0	0	3	B	B	T		9	9	9
GLOBAL MODEL		SIZE	TCR	VALUE			TOLERANCE		TERMINATION		PACKAGING		OPTION			
P		0302 0402 0505 0603 0805 1005 1206 1505 2010 2512	K = ± 100 ppm/°C H = ± 50 ppm/°C E = ± 25 ppm/°C Y = ± 10 ppm/°C Z = ± 5 ppm (0 °C; +70 °C) C = ± 5 ppm (- 55 °C; + 155 °C)	The first three digits are significant figures and the last digit specifies the number of zeros to follow, R designates decimal point 10R0 = 10 Ω 3901 = 3900 Ω 1004 = 1 MΩ			L = ± 0.01 % P = ± 0.02 % W = ± 0.05 % B = ± 0.1 % C = ± 0.25 % D = ± 0.5 % F = ± 1 % G = ± 2 % J = ± 5 %		B: SnPb over nickel barrier N: SnAg over nickel barrier G: gold over nickel barrier		For more information see “Codification of packaging” table		From 1 to 3 digits, leave blank if no option			
									B: lead bearing version N and G: lead (Pb)-free/RoHS version							

Historical Part Number examples:

P1206Y1001LNT100 (tapes of 100 pieces)
P1206H7151FBT250 (tapes of 250 pieces)
P1206Y1503WNT1K032 (tapes of 1000 pieces and option 32)
P1206Y2372BG (waffle pack)

Historical part numbers are not recommended, but can still be used for ordering.

CODIFICATION OF PACKAGING

CODE 18	PACKAGING
WAFFLE PACK	
W	100 min., 1 mult
WA	100 min., 100 mult (available only in size 1206)
PLASTIC TAPE (in standard for all sizes)	
T	100 min., 1 mult
TA	100 min., 100 mult
TB	250 min., 250 mult
TC	500 min., 500 mult
TD	1000 min., 1000 mult
TE	2500min., 2500 mult
TF	Full tape (quantity depending on size of chips)
PAPER TAPE (available for 0402, 0603, 0805, and 1206. Please consult Vishay Sfernice for other sizes)	
PT	100 min., 1 mult
PA	100 min., 100 mult
PB	250 min., 250 mult
PC	500 min., 500 mult
PD (not available for size 0402)	1000 min., 1000 mult
PE (not available for size 0402)	2500min., 2500 mult
PF (not available for size 0402)	Full tape (quantity depending on size of chips)

Notes

- For CECC qualified, see RV datasheet (www.vishay.com/doc?60022)
- For ESCC qualified, see PHR datasheet (www.vishay.com/doc?53037) or PFR datasheet (www.vishay.com/doc?53046)
- For high temperature (230 $^{\circ}$ C), see PHT datasheet (www.vishay.com/doc?53050)
- For very high temperature (270 $^{\circ}$ C), see PVHT datasheet (www.vishay.com/doc?53060)
- For strap (0 Ω), see PZR datasheet (www.vishay.com/doc?53053)



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