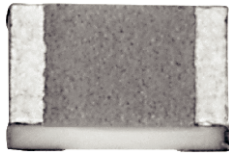


High Precision Wraparound - Wide Ohmic Value Range Thin Film Chip Resistors



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 °C) down to $\pm 5 \text{ ppm}/^\circ\text{C}$ (- 55 °C; + 155 °C).

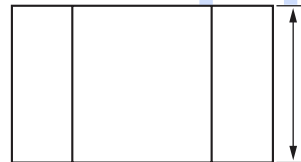
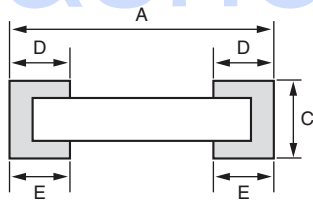
FEATURES

- Load life stability at $\pm 70 \text{ }^\circ\text{C}$ for 2000 h:
0.1 % under Pn/0.05 % under Pd
- Low temperature coefficient down to **5 ppm/°C**
(- 55 °C; + 155 °C)
- Very low noise < 35 dB and voltage coefficient
< 0.01 ppm/V
- Wide resistance range: 10 Ω to 50 M Ω
depending on size
- Tolerances to **$\pm 0.01 \%$**
- In lot tracking $\leq 5 \text{ ppm}/^\circ\text{C}$
- Termination: thin film technology
- Gold plated or pre-tinned terminations over nickel barrier
- Short circuits (jumpers) $r < 50 \text{ m}\Omega$, $I < 2 \text{ A}$
- SMD wraparound terminations
- Withstand moisture resistance test of AEC-Q200
- Compliant to RoHS directive 2002/95/EC



Available
RoHS*
COMPLIANT
GREEN
(5-2009)**
Available

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) | | | | |
| 0705/0805 | 1.91 (0.075) | | 1.27 (0.050) | | | | |
| 1005 | 2.54 (0.100) | | 1.27 (0.050) | | | 0.40 (0.016) | |
| 1206 | 3.06 (0.120) | | 1.60 (0.063) | | | 0.48 (0.019) | |
| 1505 | 3.81 (0.150) | | 1.32 (0.052) | | | | |
| 2010 | 5.08 (0.200) | | 2.54 (0.100) | | | | |

Note

- Case size 2512 under development. Please consult Vishay Sfernice.

* Pb containing terminations are not RoHS compliant, exemptions may apply

** Please see document "Vishay Material Category Policy": www.vishay.com/doc?99902

High Precision Wraparound - Wide Ohmic Value Range Vishay Sfernice Thin Film Chip Resistors

SUGGESTED LAND PATTERN (to IPC-7351A)



| CHIP SIZE | DIMENSIONS (in millimeter) | | |
|-----------|----------------------------|-------------------|-------------------|
| | Z _{max.} | G _{min.} | X _{max.} |
| 0302 | 1.30 | 0.14 | 0.73 |
| 0402 | 1.55 | 0.15 | 0.73 |
| 0505 | 1.82 | 0.10 | 1.40 |
| 0603 | 2.37 | 0.35 | 0.98 |
| 0705/0805 | 2.76 | 0.74 | 1.40 |
| 1005 | 3.39 | 1.37 | 1.40 |
| 1206 | 3.91 | 1.85 | 1.73 |
| 1505 | 4.66 | 2.44 | 1.45 |
| 2010 | 5.93 | 3.71 | 2.67 |

Note

- Case size 2512 under development. Please consult Vishay Sfernice.

ELECTRICAL SPECIFICATIONS

| CASE SIZE | POWER RATING mW | | LIMITING ELEMENT VOLTAGE V | RESISTANCE RANGE ⁽²⁾ |
|-----------|-------------------------------|-------------------------------|-------------------------------|---------------------------------|
| | P _n ⁽¹⁾ | P _d ⁽¹⁾ | | |
| 0302 | 40 | 30 | 25 | 10 Ω to 500 kΩ |
| 0402 | 63 | 40 | 50 | 10 Ω to 1.5 MΩ |
| 0505 | 125 | 50 | 50 | 10 Ω to 4 MΩ |
| 0603 | 125 | 100 | 75 | 10 Ω to 2.5 MΩ |
| 0705/0805 | 200 | 125 | 150 | 10 Ω to 10 MΩ |
| 1005 | 250 | 125 | 75 | 10 Ω to 5 MΩ |
| 1206 | 330 | 250 | 200 | 10 Ω to 35 MΩ |
| 1505 | 350 | 175 | 75 | 10 Ω to 10 MΩ |
| 2010 | 1000 | 500 | 300 | 10 Ω to 50 MΩ |

Notes

- Case size 2512 under development. Please consult Vishay Sfernice.
- ⁽¹⁾ P_n = Nominal power - P_d = Derated power intended to improve stability.
- ⁽²⁾ For ohmic range versus tolerance and TCR see detailed table page 62.

Vishay Sfernice High Precision Wraparound - Wide Ohmic Value Range Thin Film Chip Resistors

ELECTRICAL SPECIFICATIONS

| | |
|---------------------------------|---|
| Resistance Range: | 10 Ω to 50 M Ω |
| Resistance Tolerance: | $\pm 0.1\%$ to $\pm 1\%$ $\pm 0.01\%$ to $\pm 0.05\%$ on Y type |
| Power Dissipation: | Pn: 40 mW to 1 W Pd: 40 mW to 500 mW on tolerance tighter than $\pm 0.05\%$ |
| Temperature Coefficient: | 5 ppm (0 °C; 70 °C); 10 ppm (- 55 °C; + 155 °C) |

CLIMATIC SPECIFICATIONS

Operating Temp. Range: - 55 °C to + 155 °C
For temperature up to 215 °C, please consult factory

MECHANICAL SPECIFICATIONS

| | |
|----------------------|--|
| Substrate: | Alumina |
| Technology: | Thin film |
| Film: | Nickel chromium with mineral passivation or CrSi |
| Protection: | 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 |

TEMPERATURE COEFFICIENT

| TCR | CODE | FILM |
|----------------------------------|------|--------------|
| ± 5 ppm/°C ⁽¹⁾⁽²⁾ | Z | NiCr |
| ± 10 ppm/°C ⁽²⁾ | Y | NiCr |
| ± 25 ppm/°C | E | NiCr |
| ± 50 ppm/°C | H | NiCr or CrSi |
| ± 100 ppm/°C | K | NiCr or CrSi |

Notes

⁽¹⁾ Reduced temperature operating range:
[0 °C; + 70 °C] option available for (- 25 °C; + 85 °C): 0027
and [- 55 °C; + 155 °C]: 0079

⁽²⁾ R > 39 Ω on request for lower values.

POWER DERATING CURVE



TOLERANCE AND TCR VERSUS OHMIC VALUE

| SIZE | VALUE RANGE | TIGHTEST TOLERANCE % | BEST TCR (ppm/°C) |
|--------------|--------------|-----------------------|-----------------------|
| P0302 | 10R to 500K | 0.1 | 50 |
| | 10R to 75K | 0.1 | 25 |
| | 39R to 75K | 0.05 | 25 |
| | 39R to 50K | 0.05 | 10 (5) ⁽³⁾ |
| | 100R to 50K | 0.02 | 10 (5) ⁽³⁾ |
| 250R to 50K | 0.01 | 10 (5) ⁽³⁾ | |
| P0402 | 10R to 1M5 | 0.1 | 50 |
| | 10R to 150K | 0.1 | 25 |
| | 39R to 150K | 0.05 | 25 |
| | 39R to 100K | 0.05 | 10 (5) ⁽³⁾ |
| | 100R to 100K | 0.02 | 10 (5) ⁽³⁾ |
| 250R to 100K | 0.01 | 10 (5) ⁽³⁾ | |
| P0505 | 10R to 4M | 0.1 | 50 |
| | 10R to 300K | 0.1 | 25 |
| | 39R to 300K | 0.05 | 25 |
| | 39R to 260K | 0.05 | 10 (5) ⁽³⁾ |
| | 100R to 260K | 0.02 | 10 (5) ⁽³⁾ |
| 250R to 260K | 0.01 | 10 (5) ⁽³⁾ | |
| P0603 | 10R to 2M5 | 0.1 | 50 |
| | 10R to 500K | 0.1 | 25 |
| | 39R to 500K | 0.05 | 25 |
| | 39R to 332K | 0.05 | 10 (5) ⁽³⁾ |
| | 100R to 332K | 0.02 | 10 (5) ⁽³⁾ |
| 250R to 332K | 0.01 | 10 (5) ⁽³⁾ | |
| P0705/0805 | 10R to 10M | 0.1 | 50 |
| | 10R to 750K | 0.1 | 25 |
| | 39R to 750K | 0.05 | 25 |
| | 39R to 511K | 0.05 | 10 (5) ⁽³⁾ |
| | 100R to 511K | 0.02 | 10 (5) ⁽³⁾ |
| 250R to 511K | 0.01 | 10 (5) ⁽³⁾ | |
| P1005 | 10R to 5M | 0.1 | 50 |
| | 10R to 750K | 0.1 | 25 |
| | 39R to 750K | 0.05 | 25 |
| | 39R to 500K | 0.05 | 10 (5) ⁽³⁾ |
| | 100R to 500K | 0.02 | 10 (5) ⁽³⁾ |
| 250R to 500K | 0.01 | 10 (5) ⁽³⁾ | |
| P1206 | 10R to 35M | 0.1 | 50 |
| | 10R to 3M5 | 0.1 | 25 |
| | 39R to 3M5 | 0.05 | 25 |
| | 39R to 1M8 | 0.05 | 10 (5) ⁽³⁾ |
| | 100R to 1M8 | 0.02 | 10 (5) ⁽³⁾ |
| 250R to 1M8 | 0.01 | 10 (5) ⁽³⁾ | |
| P1505 | 10R to 10M | 0.1 | 50 |
| | 10R to 1M | 0.1 | 25 |
| | 39R to 1M | 0.05 | 25 |
| | 39R to 750K | 0.05 | 10 (5) ⁽³⁾ |
| | 100R to 750K | 0.02 | 10 (5) ⁽³⁾ |
| 250R to 750K | 0.01 | 10 (5) ⁽³⁾ | |
| P2010 | 10R to 50M | 0.1 | 50 |
| | 10R to 6M | 0.1 | 25 |
| | 39R to 6M | 0.05 | 25 |
| | 39R to 3M | 0.05 | 10 (5) ⁽³⁾ |
| | 100R to 3M | 0.02 | 10 (5) ⁽³⁾ |
| 250R to 3M | 0.01 | 10 (5) ⁽³⁾ | |

Note

- Size 2512 under development. Please consult Vishay Sfernice.
- ⁽³⁾ 5 ppm/°C in a reduced operating range (0 °C; + 70 °C). Options available for operating range (- 25 °C; + 85 °C) and (- 55 °C; + 155 °C) upon request with price adder.

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).

DIMENSIONS (Option 0063) in millimeters

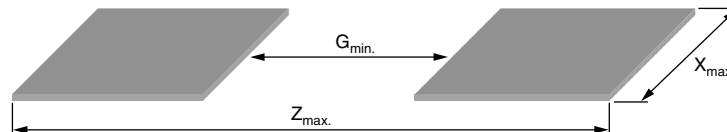


| CASE SIZE | A | B | E | D | F | | |
|-----------|--|--|--|--|---------|------|------|
| | MAX. TOL. + 0.152 MIN. TOL. - 0.152 | MAX. TOL. + 0.127 MIN. TOL. - 0.127 | MAX. TOL. + 0.13 MIN. TOL. - 0.13 | MAX. TOL. + 0.13 MIN. TOL. - 0.13 | | | |
| | NOMINAL | NOMINAL | NOMINAL | NOMINAL | NOMINAL | MIN. | 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 | | 2.25 | | | |

Note

- Case size 2512 under development. Please consult Vishay Sfernice.

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 |

Note

- Case size 2512 under development. Please consult Vishay Sfernice.

Vishay Sfernice High Precision Wraparound - Wide Ohmic Value Range
Thin Film Chip Resistors

Option: Tightest Temperature Coefficient on Extended Temperature Range

Option to order 0027:

TCR: 5 ppm/°C in [- 25 °C; + 85 °C] temperature range. Price adder will apply. Please consult Vishay Sfernice.

Option to order 0079:

TCR: 5 ppm/°C in [- 55 °C; + 155 °C] temperature range. Price adder will apply. Please consult Vishay Sfernice.

Option: High Temperature

For applications such as down hole drilling, high temperature withstanding is required. Vishay Sfernice offers an option for utilization on extended temperature range: [- 55 °C; + 215 °C] powered (and up to 230 °C unpowered).

For guidance in designs, please refer to application note: 53047 Power Dissipation Considerations in High Precision Vishay Sfernice Thin Film Chip Resistors and Arrays (P, PRA etc.) (High Temperature Application) www.vishay.com/doc?53047.

Option to order 0031:

Recommended terminations: Gold (< 1 μ)

Performances:

Best temperature coefficient:

5 ppm/°C in [0 °C; + 70 °C]

10 ppm/°C [- 55 °C; + 155 °C]

15 ppm/°C [- 55 °C; + 185 °C]

25 ppm/°C [- 55 °C; + 215 °C]

Power rating: 0.1 x Pn

Best tolerance after high temperature assembly: 0.1 %

Long term stability: 0.5 % after 1000 h at 215 °C (ambient temperature) at 0.1 Pn

Caution:

Performances obtained with following mounting conditions:

PCB: Polyimide

Solder paste: PbSnAg (93.5/5/1.5)

Stability after 4000 h unpowered





High Precision Wraparound - Wide Ohmic Value Range Vishay Sfernice Thin Film Chip Resistors

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 2010: 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 2010: 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 moisture resistance

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 (ESD only).

| SIZE | MOQ | NUMBER OF PIECES PER PACKAGE | | TAPE WIDTH | |
|------|-----|------------------------------|---------------|------------|---------------------|
| | | WAFFLE PACK 2" x 2" | TAPE AND REEL | | |
| | | | MIN. | MAX. | |
| 0302 | 100 | 100 | 100 | 4000 | 8 mm |
| 0402 | | | | | |
| 0505 | | | | | |
| 0603 | | | | | |
| 0805 | | | | | |
| 0705 | | | | | |
| 1005 | | | | | |
| 1206 | | | | | |
| 1505 | | | | | |
| 2010 | | | | | |
| | | 60 | 100 | 2000 | 8 mm ⁽¹⁾ |

Note

⁽¹⁾ 12 mm on request

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

Can be filled up to maximum quantity indicated in the table here above, taking into account the minimum order quantity. When quantity ordered is between the MOQ and the maximum reel capacity, only one reel is provided.

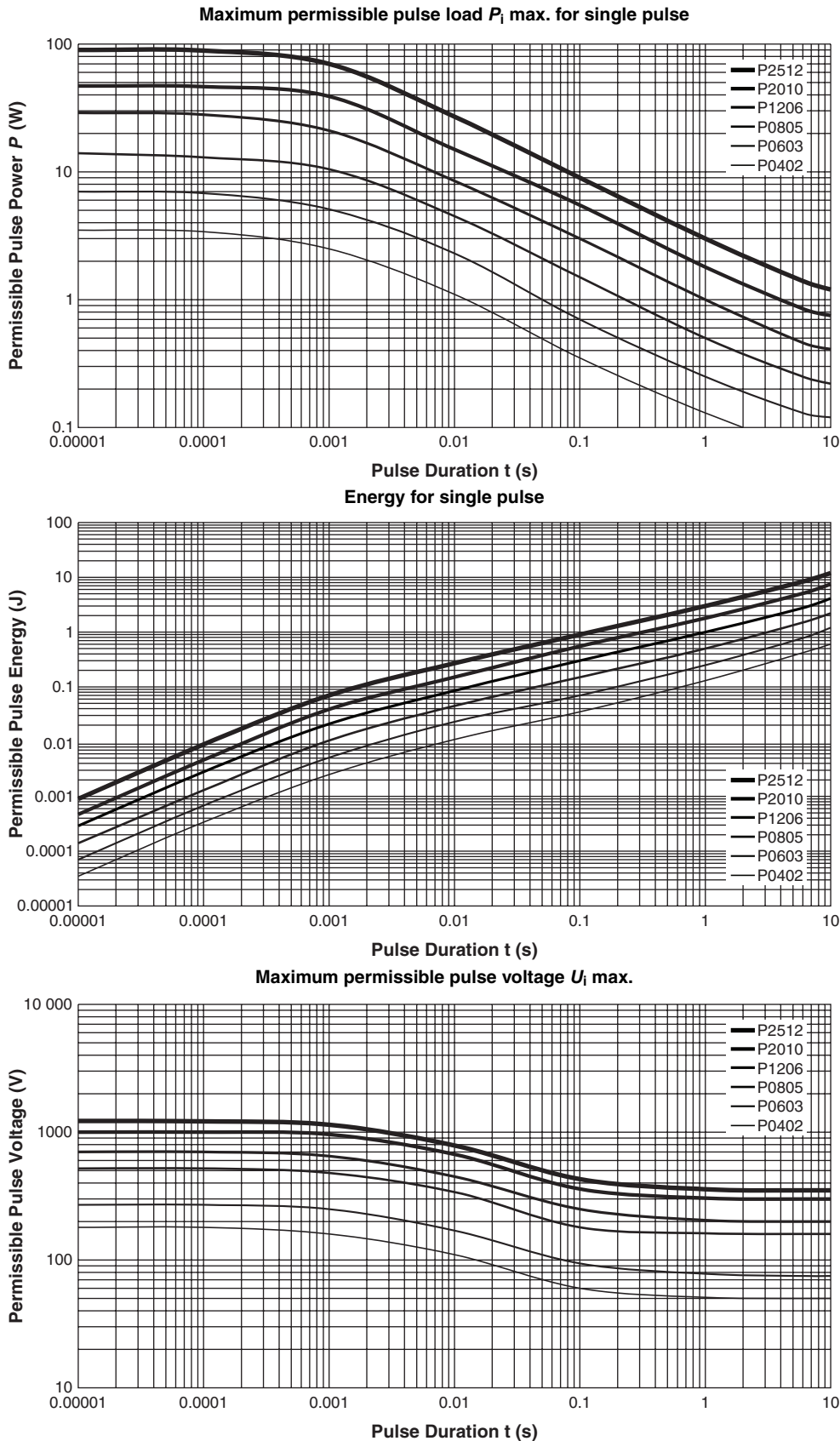
When several reels are needed for ordered quantity within MOQ and maximum reel capacity: Please consult Vishay Sfernice for specific ordering code

| 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 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 2000 h Pn at 70 °C MIL-STD-202 F-Method 108 A | ± 0.5 % | ± 0.10 % ⁽²⁾ |

Notes

⁽²⁾ 0.05 % under Pd

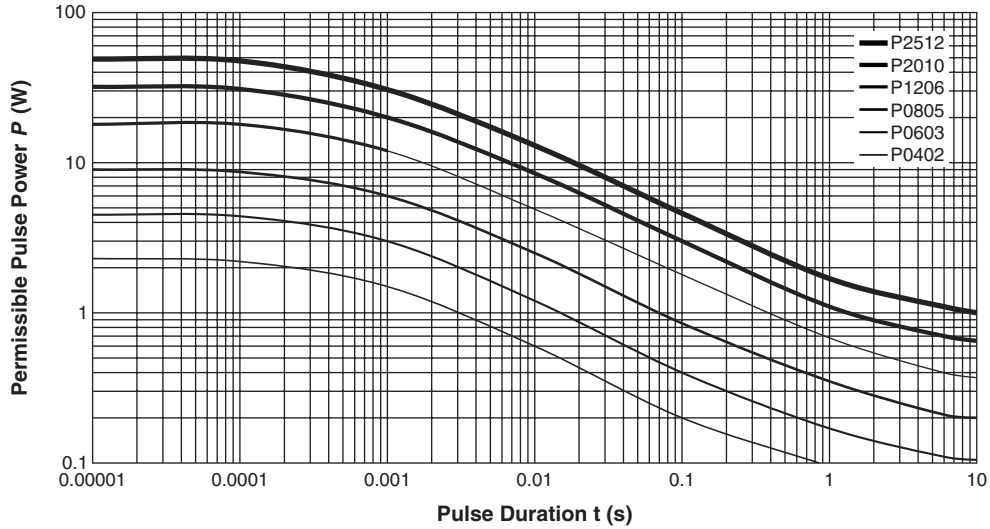
⁽³⁾ Option to order



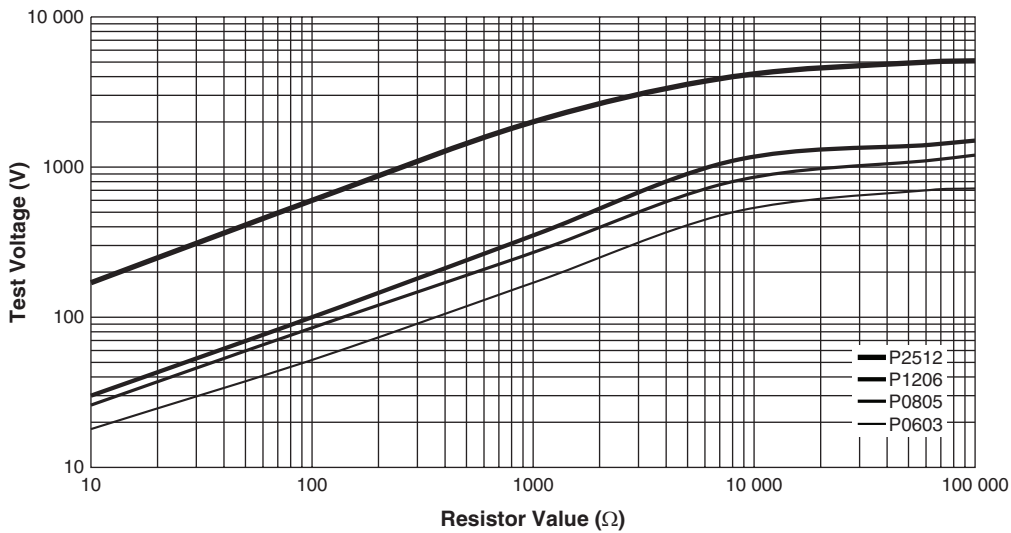


High Precision Wraparound - Wide Ohmic Value Range Vishay Sfernice Thin Film Chip Resistors

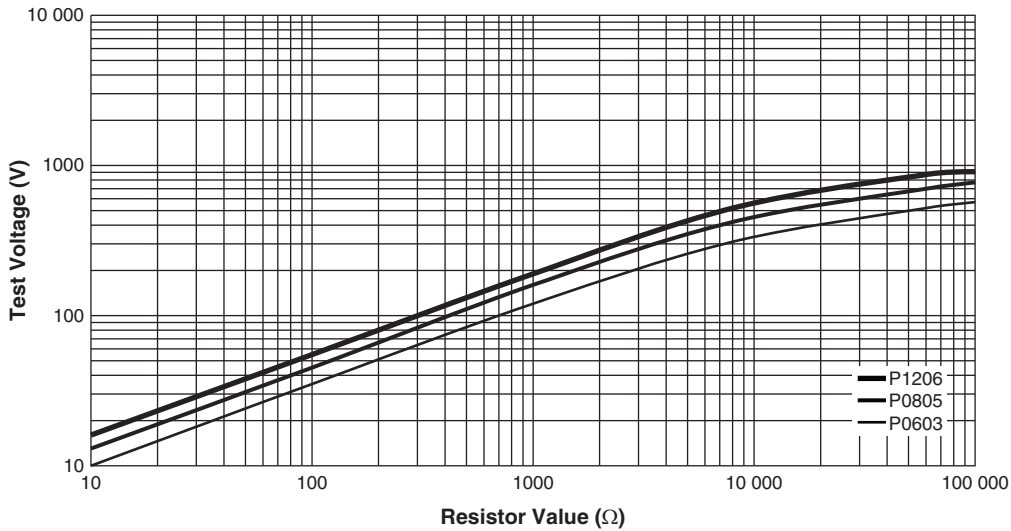
Maximum permissible pulse load P_i max.



1.2/50 μ s lightning surge



10/70 μ s lightning surge



Vishay Sfernice High Precision Wraparound - Wide Ohmic Value Range
Thin Film Chip Resistors

| GLOBAL PART NUMBER INFORMATION | | | | | | | | | | | | | | | | |
|---|--|--|---|---|---|---|--|--|--------------------------|---|---|---|---|---|---|---|
| New Global Part Numbering: P0505Y1003BBT0933 | | | | | | | | | | | | | | | | |
| P | 0 | 5 | 0 | 5 | Y | 1 | 0 | 0 | 3 | B | B | T | 0 | 9 | 3 | 3 |
| GLOBAL MODEL | SIZE | TCR | VALUE | | | TOLERANCE | TERMINATION | PACKAGING | OPTION | | | | | | | |
| P | 0302 0402 0505 0603 0705 0805 1005 1206 1505 2010 | K = ± 100 ppm/°C H = ± 50 ppm/°C E = ± 25 ppm/°C Y = ± 10 ppm/°C X = Jumper Z = ± 5 ppm (0.70 °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 0R00 = Jumper | | | L = ± 0.01 % P = ± 0.02 % W = ± 0.05 % B = ± 0.1 % C = ± 0.25 % D = ± 0.5 % F = ± 1 % G = ± 2 % J = ± 5 % X = Jumper | B: SnPb over nickel barrier N: SnAg over nickel barrier G: Gold over nickel barrier B: Lead bearing version N and G: Lead (Pb)-free/ RoHS version | Blank = Waffle pack T = Tape (1) PT = Paper tape (2) | Leave blank if no option | | | | | | | |
| Historical Part Number example: P 0505 Y 1003 B B TR R0933 e2 | | | | | | | | | | | | | | | | |
| HISTORICAL MODEL | SIZE | TCR | VALUE | | | TOLERANCE | TERMINATION | PACKAGING | OPTION | RoHS | | | | | | |
| P | 0302 0402 0505 0603 0705 0805 1005 1206 1505 2010 | K = ± 100 ppm/°C H = ± 50 ppm/°C E = ± 25 ppm/°C Y = ± 10 ppm/°C X = Jumper Z = ± 5 ppm (0.70 °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 0R00 = Jumper | | | L = ± 0.01 % P = ± 0.02 % W = ± 0.05 % B = ± 0.1 % C = ± 0.25 % D = ± 0.5 % F = ± 1 % G = ± 2 % J = ± 5 % X = Jumper | B: SnPb over nickel barrier N: SnAg over nickel barrier G: Gold over nickel barrier B: Lead bearing version N and G: Lead (Pb)-free/ RoHS version | Blank = Waffle pack TR = Tape (1) | Leave blank if no option | e2: Tin/silver e4: Gold blank: SnPb | | | | | | |

Notes

- Chips ready to be trimmed available. (P_{trim}) - Please consult Vishay Sfernice.
- (1) For specific quantity of parts per packaging please consult Vishay Sfernice.
- (2) For paper tape please consult Vishay Sfernice.

QUICK PROTOTYPING

Vishay Sfernice can offer quick prototyping service in 3 weeks production time for most popular case sizes: 0603, 0805, 1206 (Best tolerance: 0.05 %, best TCR: 10 ppm/°C) - Premium will apply - Check availability



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