

## Precision Automotive Thin Film Chip Resistors, AEC-Q200 Qualified, 2 kV ESD Rating



These chip resistors are available in wraparound terminations styles in 8 case sizes. They incorporate self passivated enhanced tantalum nitride resistor film to give superior performance on moisture resistance, electrostatic discharge, voltage coefficient, power handling and resistance stability. The terminations consist of an adhesion layer, a leach resistant nickel barrier, and solder coating (lead (Pb)-free). This product will out-perform all requirements of AEC-Q200.

### CONSTRUCTION



### FEATURES

- Resistance range: 2.5  $\Omega$  to 3 M $\Omega$
- AEC-Q200 qualified
- AEC-Q200 ESD rated class 1C (2 kV)
- Laser trimmed to any value
- Moisture resistant to MIL-STD-202, method 202
- Tantalum nitride resistor film on high purity alumina substrate
- 100 % visual inspected per MIL-PRF-55342
- Laser-trimmed tolerances to  $\pm 0.1$  %
- Load life stability < 0.05 % at 1000 h at 70  $^{\circ}$ C
- Very low noise and voltage coefficient (< -30 dB, < 0.1 ppm/V)
- Sulfur resistant (per ASTM B809-95 humid vapor test)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

### TYPICAL PERFORMANCE

|      | ABSOLUTE |
|------|----------|
| TCR  | 25       |
| TOL. | 0.1      |

### STANDARD ELECTRICAL SPECIFICATIONS

| TEST                           | SPECIFICATIONS  | CONDITIONS                            |
|--------------------------------|---|---------------------------------------|
| Material                       | Tantalum nitride  | -                                     |
| Resistance Range               | 2.5 $\Omega$ to 3 M $\Omega$                              | -                                     |
| TCR: Absolute                  | $\pm 25$ ppm/ $^{\circ}$ C to $\pm 100$ ppm/ $^{\circ}$ C | -55 $^{\circ}$ C to +125 $^{\circ}$ C |
| Tolerance: Absolute            | $\pm 0.1$ % to $\pm 1.0$ %                                | +25 $^{\circ}$ C                      |
| Stability: Absolute            | $\pm 0.05$ %  | 2000 h at 70 $^{\circ}$ C rated power |
| Stability: Ratio               | Not applicable  | -                                     |
| Voltage Coefficient            | Less than 0.1 ppm/V                                       | -                                     |
| Working Voltage                | 75 V to 200 V   | -                                     |
| Operating Temperature Range    | -55 $^{\circ}$ C to +155 $^{\circ}$ C                     | -                                     |
| Storage Temperature Range      | -55 $^{\circ}$ C to +155 $^{\circ}$ C                     | -                                     |
| Noise                          | < -30 dB  | -                                     |
| Shelf Life Stability: Absolute | 100 ppm   | 1 year at 25 $^{\circ}$ C             |

### COMPONENT RATINGS

| CASE SIZE | POWER RATING (mW) | WORKING VOLTAGE (V) | RESISTANCE RANGE ( $\Omega$ ) |
|-----------|-------------------|---------------------|-------------------------------|
| 0402      | 50                | 75                  | 20 to 51K                     |
| 0603      | 150               | 75                  | 2.5 to 130K                   |
| 0805      | 200               | 100                 | 10 to 301K                    |
| 1206      | 400               | 200                 | 10 to 1M                      |
| 1505      | 400               | 150                 | 10 to 1M                      |
| 2208      | 750               | 150                 | 10 to 1.75M                   |
| 2010      | 800               | 200                 | 10 to 2M                      |
| 2512      | 1000              | 200                 | 10 to 3M                      |

| DIMENSIONS in inches |               |               |               |                         |                         |
|----------------------|---------------|---------------|---------------|-------------------------|-------------------------|
|                      |               |               |               |                         |                         |
| CASE SIZE            | L             | W             | T             | D                       | E                       |
| 0402                 | 0.041 ± 0.003 | 0.022 ± 0.003 | 0.015 ± 0.003 | 0.010 ± 0.005           | 0.010 ± 0.005           |
| 0603                 | 0.064 ± 0.006 | 0.032 ± 0.005 | 0.015 ± 0.003 | 0.012 ± 0.005           | 0.015 ± 0.005           |
| 0805                 | 0.080 ± 0.006 | 0.050 ± 0.005 | 0.015 ± 0.003 | 0.015 ± 0.005           | 0.015 ± 0.005           |
| 1206                 | 0.126 ± 0.008 | 0.063 ± 0.005 | 0.015 ± 0.003 | 0.020 + 0.005 / - 0.010 | 0.020 + 0.005 / - 0.010 |
| 1505                 | 0.155 ± 0.007 | 0.050 ± 0.005 | 0.015 ± 0.003 | 0.015 ± 0.005           | 0.015 ± 0.005           |
| 2010                 | 0.209 ± 0.009 | 0.098 ± 0.005 | 0.015 ± 0.003 | 0.020 ± 0.005           | 0.020 ± 0.005           |
| 2208                 | 0.230 ± 0.007 | 0.075 ± 0.005 | 0.015 ± 0.003 | 0.020 ± 0.005           | 0.020 ± 0.005           |
| 2512                 | 0.259 ± 0.009 | 0.124 ± 0.005 | 0.015 ± 0.003 | 0.020 ± 0.005           | 0.020 ± 0.005           |

| ENVIRONMENTAL TESTS (Vishay Performance vs. AEC-Q200 Requirements) |        |  |                     |                            |
|--|--------|--|---------------------|----------------------------|
| ENVIRONMENTAL TEST   |        | CONDITIONS   | LIMITS PER AEC-Q200 | TYPICAL VISHAY PERFORMANCE |
| Resistance Temperature Characteristic                              |        | -55 °C to +125 °C                                  | ± 50 ppm/°C         | ± 35 ppm/°C                |
| Max. Ambient Temp. at Rated Wattage                                |        |  | +70 °C              | +70 °C                     |
| Max. Ambient Temp. at Power Derating                               |        |  | +150 °C             | +150 °C                    |
| High Temperature Storage   | ΔR     | MIL-STD-202, 108, 1000 h at 125 °C                 | ± 0.1 %             | + 0.016 %                  |
| Temperature Cycling  | ΔR     | JESD22, JA-104, 1000 cycles, -55 °C to +125 °C     | ± 0.15 %            | + 0.013 %                  |
| Moisture Resistance  | ΔR     | MIL-STD-202, 106                                   | ± 0.20 %            | + 0.0010 %                 |
| Biased Humidity  | ΔR     | MIL-STD-202, 103, 1000 h at 85 °C, 85 % RH, 10 % P | ± 0.10 %            | + 0.004 %                  |
| Life   | ΔR     | MIL-STD-202, 108 at 125 °C, 1000 h                 | ± 0.1 %             | + 0.0220 %                 |
| Mechanical Shock   | ΔR     | MIL-STD-202, method 213, condition C               | ± 0.1 %             | + 0.004 %                  |
| Vibration  | ΔR     | MIL-STD-202 method 204, 10 Hz to 2 kHz             | ± 0.1 %             | + 0.0030 %                 |
| Resistance to Soldering Heat                                       | ΔR     | MIL-STD-202 method 210, condition D                | ± 0.10 %            | + 0.0150 %                 |
| Electrostatic Discharge  | ΔR     | AEC-Q200-002 at 2 kV, human body                   | ± 0.10 %            | - 0.032 %                  |
| Solderability  | Visual | J-STD-002, method B and B1                         | 95 %                | Acceptable                 |
| Terminal Strength  | ΔR     | AEC-Q200-006 at 1 kg for 60 s                      | ± 0.10 %            | + 0.009 %                  |
| Flame Retardance   | Visual | AEC-Q200-001 para 4.0                              |                     | Acceptable                 |





| GLOBAL PART NUMBER INFORMATION              |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |
|---|--|--|---|---|---|---|---|---|---|--|---|---|---|---|---|
| New Global Part Numbering: PAT1206E1002BST1 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |
| P   | A  | T  | 1 | 2   | 0 | 6   | E | 1   | 0 | 0  | 2 | B | S | T | 1 |
| GLOBAL MODEL                                | CASE SIZE  | TCR CHARACTERISTIC   |   | RESISTANCE  |   | TOLERANCE   |   | TERMINATION   |   | PACKAGING  |   |   |   |   |   |
| PAT   | 0402<br>0603<br>0805<br>1206<br>1505<br>2010<br>2208<br>2512 | E = ± 25 ppm/°C<br>H = ± 50 ppm/°C<br>K = ± 100 ppm/°C<br>L = ± 200 ppm/°C |   | The first 3 digits are significant figures and the last digit specifies the number of zeros to follow. "R" designates the decimal point.<br><br>Example:<br>10R0 = 10 Ω<br>1000 = 100 Ω<br>1002 = 10 kΩ |   | B = ± 0.1 %<br>D = ± 0.5 %<br>F = ± 1.0 %<br>G = ± 2.0 %<br>J = ± 5.0 % |   | S = wraparound lead (Pb)-free solder w/nickel barrier |   | TAPE AND REEL<br>T1 = 1000 min., 1000 mult <sup>(1)</sup><br>TF = full reel<br>TS = 100 min., 1 mult |   |   |   |   |   |

**Note**

(1) Preferred packaging code

| RESISTANCE   | TCR (ppm/°C)     | TOLERANCE (%)     |
|--------------|------------------|-------------------|
| 10 Ω to 1 MΩ | 25, 50, 100, 200 | 0.1, 0.5, 1, 2, 5 |
| 5 Ω to 10 Ω  | 100, 200         | 1, 2, 5           |
| 1.0 Ω to 5 Ω | 200              | 1, 2, 5           |



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