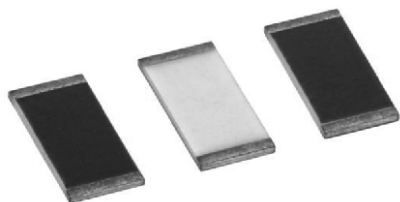
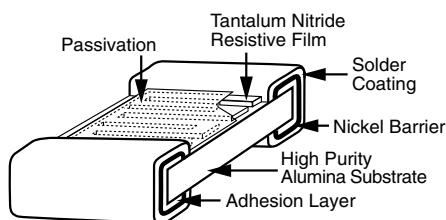


## Precision Automotive Thin Film Chip Resistors, AEC-Q200 Qualified, 2 kV ESD Rating



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 °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

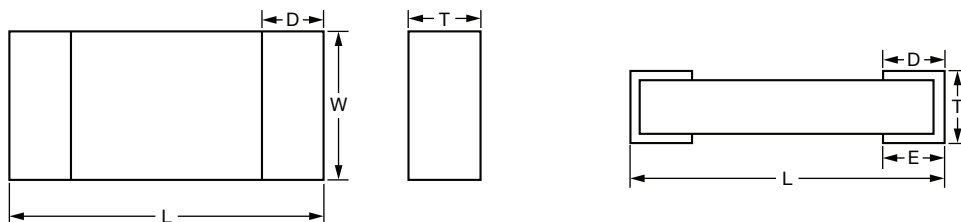
| TEST                           | SPECIFICATIONS                              | CONDITIONS                  |
|--------------------------------|---------------------------------------------|-----------------------------|
| Material                       | Tantalum nitride                            | -                           |
| Resistance Range               | 2.5 $\Omega$ to 3 M $\Omega$ <sup>(1)</sup> | -                           |
| TCR: Absolute                  | $\pm 25$ ppm/°C to $\pm 100$ ppm/°C         | -55 °C to +125 °C           |
| Tolerance: Absolute            | $\pm 0.1$ % to $\pm 1.0$ %                  | +25 °C                      |
| Stability: Absolute            | $\pm 0.05$ %                                | 2000 h at 70 °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 °C to +155 °C                           | -                           |
| Storage Temperature Range      | -55 °C to +155 °C                           | -                           |
| Noise                          | < -30 dB                                    | -                           |
| Shelf Life Stability: Absolute | 100 ppm                                     | 1 year at 25 °C             |

#### Note

<sup>(1)</sup> Resistance values less than 10  $\Omega$  will have TCR  $\pm 100$  ppm/°C.

### COMPONENT RATINGS

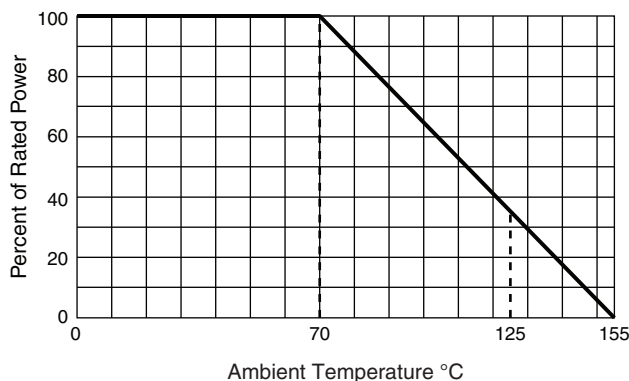
| CASE SIZE | POWER RATING (mW) | WORKING VOLTAGE (V) | RESISTANCE RANGE ( $\Omega$ ) |
|-----------|-------------------|---------------------|-------------------------------|
| 0402      | 50                | 75                  | 20 to 51K                     |
| 0603      | 150               | 75                  | 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      | 0.042 ± 0.008 | 0.022 ± 0.005 | 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 $\Delta R$     | MIL-STD-202, 108, 1000 h at 125 °C                 | ± 0.1 %             | + 0.016 %                  |
| Temperature Cycling $\Delta R$          | JESD22, JA-104, 1000 cycles, -55 °C to +125 °C     | ± 0.15 %            | + 0.013 %                  |
| Moisture Resistance $\Delta R$          | MIL-STD-202, 106                                   | ± 0.20 %            | + 0.0010 %                 |
| Biased Humidity $\Delta R$              | MIL-STD-202, 103, 1000 h at 85 °C, 85 % RH, 10 % P | ± 0.10 %            | + 0.004 %                  |
| Life $\Delta R$                         | MIL-STD-202, 108 at 125 °C, 1000 h                 | ± 0.1 %             | + 0.0220 %                 |
| Mechanical Shock $\Delta R$             | MIL-STD-202, method 213, condition C               | ± 0.1 %             | + 0.004 %                  |
| Vibration $\Delta R$                    | MIL-STD-202 method 204, 10 Hz to 2 kHz             | ± 0.1 %             | + 0.0030 %                 |
| Resistance to Soldering Heat $\Delta R$ | MIL-STD-202 method 210, condition D                | ± 0.10 %            | + 0.0150 %                 |
| Electrostatic Discharge $\Delta R$      | 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 $\Delta R$            | AEC-Q200-006 at 1 kg for 60 s                      | ± 0.10 %            | + 0.009 %                  |
| Flame Retardance Visual                 | AEC-Q200-001 para 4.0                              |                     | Acceptable                 |

**DERATING CURVE**


**GLOBAL PART NUMBER INFORMATION**

New Global Part Numbering: PAT1206E1002BST1

|                     |                                                                                                                      |                                                                                                        |                                                                                                                                                                                                         |          |          |          |                                                                                                            |                                                              |          |          |                                                                                                                |          |          |          |          |
|---------------------|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|----------|----------|----------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|
| <b>P</b>            | <b>A</b>                                                                                                             | <b>T</b>                                                                                               | <b>1</b>                                                                                                                                                                                                | <b>2</b> | <b>0</b> | <b>6</b> | <b>E</b>                                                                                                   | <b>1</b>                                                     | <b>0</b> | <b>0</b> | <b>2</b>                                                                                                       | <b>B</b> | <b>S</b> | <b>T</b> | <b>1</b> |
| <b>GLOBAL MODEL</b> | <b>CASE SIZE</b>                                                                                                     | <b>TCR CHARACTERISTIC</b>                                                                              | <b>RESISTANCE (1)</b>                                                                                                                                                                                   |          |          |          | <b>TOLERANCE</b>                                                                                           | <b>TERMINATION</b>                                           |          |          | <b>PACKAGING</b>                                                                                               |          |          |          |          |
| <b>PAT</b>          | <b>0402</b><br><b>0603</b><br><b>0805</b><br><b>1206</b><br><b>1505</b><br><b>2010</b><br><b>2208</b><br><b>2512</b> | <b>E</b> = ± 25 ppm/°C<br><b>H</b> = ± 50 ppm/°C<br><b>K</b> = ± 100 ppm/°C<br><b>L</b> = ± 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>B</b> = ± 0.1 %<br><b>D</b> = ± 0.5 %<br><b>F</b> = ± 1.0 %<br><b>G</b> = ± 2.0 %<br><b>J</b> = ± 5.0 % | <b>S</b> = wraparound lead (Pb)-free solder w/nickel barrier |          |          | TAPE AND REEL<br><b>T1</b> = 1000 min., 1000 mult (2)<br><b>TF</b> = full reel<br><b>TS</b> = 100 min., 1 mult |          |          |          |          |

**Notes**

(1) Resistance values less than 10 Ω will have TCR ± 100 ppm/°C.

(2) Preferred packaging code

| <b>RESISTANCE</b> | <b>TCR (ppm/°C)</b> | <b>TOLERANCE (%)</b> |
|-------------------|---------------------|----------------------|
| 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              |



## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**