

## High Power Thin Film Wraparound Chip Resistor



PHP series chip resistors are designed with enlarged backside terminations to reduce the thermal resistance between the topside resistor layer and the solder joint on the end users circuit board.

Actual power handling capability is limited by the end user mounting process. As with any high power chip resistor the ability to remove the generated heat is critical to the overall performance of the device.

### FEATURES

- High purity ceramic substrate
- Power rating to 2.5 W
- Resistance range 10  $\Omega$  to 30.1 k $\Omega$
- Resistor tolerance to  $\pm 0.1$  %
- TCR to  $\pm 25$  ppm/ $^{\circ}$ C
- Flame resistant UL 94 V-0

### APPLICATIONS

- Power supplies
- Power switching
- Braking system
- Test and measurement equipment
- Motor deflection circuits

### TYPICAL PERFORMANCE

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

### STANDARD ELECTRICAL SPECIFICATIONS

| TEST                           | SPECIFICATIONS                                                                   | CONDITIONS                            |
|--------------------------------|----------------------------------------------------------------------------------|---------------------------------------|
| Material                       | Nichrome                                                                         | -                                     |
| Resistance Range               | 10 $\Omega$ to 30.1 k $\Omega$                                                   | -                                     |
| TCR: Absolute                  | 25 ppm/ $^{\circ}$ C, 50 ppm/ $^{\circ}$ C (standard) and, 100 ppm/ $^{\circ}$ C | -55 $^{\circ}$ C to +125 $^{\circ}$ C |
| Tolerance: Absolute            | 0.1 %, 0.5 %, 1.0 % and, 5.0 %                                                   | +25 $^{\circ}$ C                      |
| Power Rating: Resistor         | 0.375 W - 2.5 W <sup>(1)</sup>                                                   | Maximum at +70 $^{\circ}$ C           |
| Stability: Absolute            | $\Delta R$ 0.1 %                                                                 | 2000 h at +70 $^{\circ}$ C            |
| Stability: Ratio               | Not applicable                                                                   | -                                     |
| Voltage Coefficient            | < 0.1 ppm/V                                                                      | -                                     |
| Working Voltage                | 75 V to 200 V                                                                    | -                                     |
| Operating Temperature Range    | -55 $^{\circ}$ C to +125 $^{\circ}$ C                                            | -                                     |
| Storage Temperature Range      | -55 $^{\circ}$ C to +150 $^{\circ}$ C                                            | -                                     |
| Noise                          | < -30 dB                                                                         | -                                     |
| Shelf Life Stability: Absolute | $\pm 0.01$ %                                                                     | 1 year at +25 $^{\circ}$ C            |

### COMPONENT RATINGS

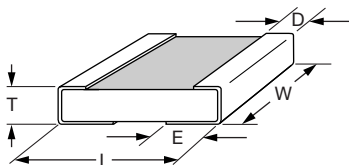
| CASE SIZE | POWER RATING (mW)   | WORKING VOLTAGE (V) | RESISTANCE RANGE ( $\Omega$ ) |
|-----------|---------------------|---------------------|-------------------------------|
| 0603      | 375 <sup>(1)</sup>  | 75                  | 10 to 30.1K                   |
| 0805      | 625 <sup>(1)</sup>  | 100                 | 10 to 30.1K                   |
| 1206      | 1000 <sup>(1)</sup> | 200                 | 10 to 30.1K                   |
| 2512      | 2500 <sup>(1)</sup> | 200                 | 10 to 30.1K                   |

Note

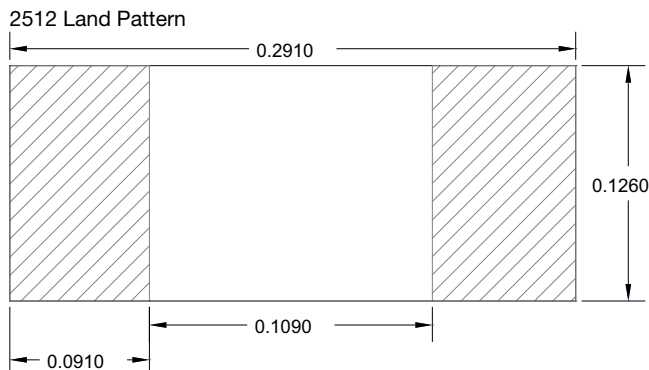
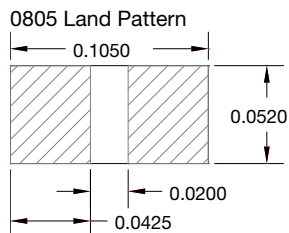
<sup>(1)</sup> Dependent on component mounting by user

### ENVIRONMENTAL TESTS (Vishay Performance vs. MIL-PRF-55342 Requirements)

| ENVIRONMENTAL TEST                            | LIMITS MIL-PRF-55342 CHARACTERISTIC "E" | TYPICAL VISHAY PERFORMANCE |
|-----------------------------------------------|-----------------------------------------|----------------------------|
| Resistance Temperature Characteristic         | $\pm 25$ ppm/ $^{\circ}$ C              | $\pm 15$ ppm/ $^{\circ}$ C |
| Maximum Ambient Temperature at Rated Wattage  | +70 $^{\circ}$ C                        | +70 $^{\circ}$ C           |
| Maximum Ambient Temperature at Power Derating | +150 $^{\circ}$ C                       | +150 $^{\circ}$ C          |
| Thermal Shock                                 | $\pm 0.1$ %                             | $\pm 0.04$ %               |
| Low Temperature Operation                     | $\pm 0.1$ %                             | $\pm 0.001$ %              |
| Short Time Overload                           | $\pm 0.1$ %                             | $\pm 0.003$ %              |
| High Temperature Exposure                     | $\pm 0.1$ %                             | $\pm 0.030$ %              |
| Resistance to Soldering Heat                  | $\pm 0.2$ %                             | $\pm 0.007$ %              |
| Moisture Resistance                           | $\pm 0.2$ %                             | $\pm 0.002$ %              |
| Life at +70 $^{\circ}$ C for 2000 h           | $\pm 0.5$ %                             | $\pm 0.100$ %              |

**DIMENSIONS** in inches


| CASE SIZE | LENGTH                  | WIDTH<br>W ( $\pm 0.005$ ) | THICKNESS<br>MIN./MAX. | TOP PAD<br>D ( $\pm 0.005$ ) | BOTTOM PAD<br>E ( $\pm 0.005$ ) |
|-----------|-------------------------|----------------------------|------------------------|------------------------------|---------------------------------|
| 0603      | $0.064 \pm 0.006$       | 0.032                      | 0.020 max.             | 0.012                        | 0.021                           |
| 0805      | $0.080 \pm 0.006$       | 0.050                      | 0.015/0.033            | 0.016                        | 0.025                           |
| 1206      | $0.126 \pm 0.008$       | 0.063                      | 0.015/0.033            | $0.020 + 0.005/- 0.010$      | 0.040                           |
| 2512      | $0.259 + 0.009/- 0.015$ | 0.124                      | 0.015/0.033            | 0.02                         | 0.050                           |

**LAND PATTERN DIMENSIONS** in inches

**STANDARD MATERIAL SPECIFICATIONS**

|                               |                                                                 |
|-------------------------------|-----------------------------------------------------------------|
| Resistive Element             | Nichrome                                                        |
| Substrate Material            | Alumina ( $Al_2O_3$ )                                           |
| Terminations (Tin/Lead)       | Tin/lead solder over nickel barrier                             |
| Terminations (Lead (Pb)-free) | Tin/silver/copper (Sn96.5Ag3.0Cu0.5) solder over nickel barrier |

**PHP CHIP TEMP. VS. APPLIED POWER**

**Note**

- Chip surface temperature measured using FLIR SC645 thermal imaging system with an approximate test card surface temperature of 85 °C.

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**Notes**

- Chip surface temperature measured using FLIR A40 thermal imaging system with an approximate test card surface temperature of 25 °C.
- Thermal imaging was conducted under ambient conditions resulting in a steady state test card surface temperature of 85 °C over the full range of power levels.
- Thermal imaging and load life testing was conducted mounting one device to 2" x 3" test cards with 2.5 mil copper plating on both surfaces. Thermal vias on 120 mil centers were utilized for heat transfer between surfaces of the test card.

**PHP CHIP TEMP. VS. APPLIED POWER**

**Notes**

- Chip surface temperature measured using FLIR A40 thermal imaging system with an approximate test card surface temperature of 25 °C.

| Case Size        | 2512       | 2512        | 2512        |
|------------------|------------|-------------|-------------|
| Resistance Value | Up to 10 Ω | Up to 10 kΩ | Up to 30 kΩ |
| Temperature      | Power (W)  |             |             |
| 70               | 2.44       | 1.81        | 1.87        |
| 150              | 6.82       | 4.89        | 5.19        |
| 200              | 9.33       | 6.63        | 7.09        |



| GLOBAL PART NUMBER INFORMATION |             |                              |                                                                 |   |                                                                                                                                                                                                        |   |   |                                                                         |   |                                                                                                                      |   |   |                                                                                                                                                                                                                                                                                                                                                                                                   |   |   |   |
|--------------------------------|-------------|------------------------------|-----------------------------------------------------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|-------------------------------------------------------------------------|---|----------------------------------------------------------------------------------------------------------------------|---|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|
| P                              | H           | P                            | 0                                                               | 1 | 2                                                                                                                                                                                                      | 0 | 6 | E                                                                       | 1 | 0                                                                                                                    | 0 | 2 | B                                                                                                                                                                                                                                                                                                                                                                                                 | B | T | 1 |
| GLOBAL MODEL                   | SUBSTRATE   | CASE SIZE                    | TCR                                                             |   | RESISTANCE                                                                                                                                                                                             |   |   | TOLERANCE                                                               |   | TERMINATION                                                                                                          |   |   | PACKAGING                                                                                                                                                                                                                                                                                                                                                                                         |   |   |   |
| PHP                            | 0 = Alumina | 0603<br>0805<br>1206<br>2512 | E =<br>± 25 ppm/°C<br>H =<br>± 50 ppm/°C<br>K =<br>± 100 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>1001 = 1 kΩ |   |   | B = ± 0.1 %<br>D = ± 0.5 %<br>F = ± 1.0 %<br>G = ± 2.0 %<br>J = ± 5.0 % |   | B = Wraparound Sn/Pb solder w/nickel barrier<br><br>S = Wraparound lead (Pb)-free solder SAC-305 RoHS-compliant - e1 |   |   | BS = BULK<br>100 min., 1 mult<br>WS = WAFFLE<br>100 min., 1 mult<br>WI = WAFFLE<br>(item single lot day code)<br>100 min., 1 mult<br><br>TAPE AND REEL<br>T1 = 1000 min., 1000 mult<br>T3 = 300 min., 300 mult<br>T5 = 500 min., 500 mult<br>TF = Full reel<br>TS = 100 min., 1 mult<br>TI = 100 min., 1 mult (item single lot date code)<br>TP = 100 min., 1 mult (package unit single lot date) |   |   |   |