

## Ultra High Precision Z-Foil Power Resistor in TO-220 Configuration with TCR of $\pm 0.05$ ppm/ $^{\circ}$ C, Tolerance to $\pm 0.01$ % and Power Rating to 8 W



Vishay Foil Resistors manufacture any resistance value within the given resistance range (e.g. 10  $\Omega$  or 10.1234  $\Omega$ ) without influencing cost or lead time

Model VPR220Z, made from Vishay Bulk Metal<sup>®</sup> Z-foil, offers very low TCR, high stability, tight tolerance, low PCR and fast response time in a small molded resistor.

The Z-foil technology provides a significant reduction of the resistive components sensitivity to ambient temperature variations and applied power changes. Designers now can guarantee a high degree of stability and accuracy in fixed resistor applications using solutions based on Vishay's revolutionary Z-foil technology.

Our application engineering department is available to advise and make recommendations. For non-standard technical requirements and special applications, please contact us.

### FEATURES

- Temperature coefficient of resistance (TCR):  $\pm 0.05$  ppm/ $^{\circ}$ C typical (0  $^{\circ}$ C to + 60  $^{\circ}$ C)  
 $\pm 0.2$  ppm/ $^{\circ}$ C typical (- 55  $^{\circ}$ C to + 125  $^{\circ}$ C, + 25  $^{\circ}$ C ref.)
- Tolerance: to  $\pm 0.01$  %
- Power coefficient of resistance (PCR) "ΔR due to self heating": 4 ppm/W typical
- Electrostatic discharge (ESD) above 25 000 V
- Load life stability:  $\pm 0.005$  % (25  $^{\circ}$ C, 2000 h at rated power)
- Resistance range: 5  $\Omega$  to 10 k $\Omega$  (Any value available within resistance range e.g. 1K2345)
- Power rating: 8 W chassis mounted (per MIL-PRF-39009)
- Thermal stabilization < 1 s
- Rise time: 1 ns without ringing
- Optimized for military and space applications according to EEE-INST-002 screening and MIL-PRF 39009
- Non inductive, non capacitive design
- Current noise: < - 40 dB
- Voltage coefficient: < 0.1 ppm/V
- Non inductive: < 0.08  $\mu$ H
- Non hot spot design
- Thermal EMF: 0.05  $\mu$ V/ $^{\circ}$ C typical
- Terminal finishes available: lead (Pb)-free, tin/lead alloy
- Also available in a surface mount version, the VPR220SZ
- Prototype samples available from 72 h. For more information, please contact [foil@vishaypg.com](mailto:foil@vishaypg.com)
- For higher performances please contact us

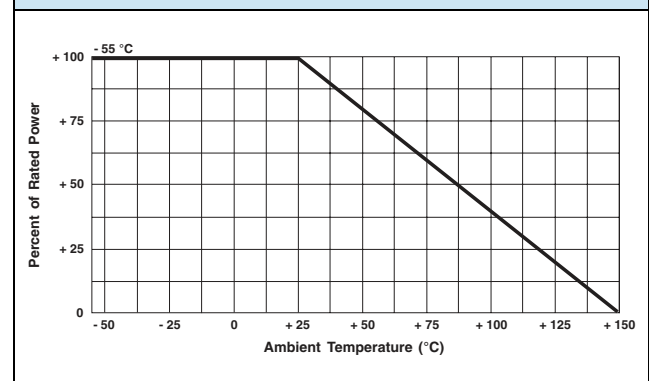


Available  
RoHS\*  
COMPLIANT

| RESISTANCE RANGE ( $\Omega$ ) | TIGHTEST RESISTANCE TOLERANCE | TYPICAL TCR AND MAX. SPREAD (ppm/ $^{\circ}$ C) |
|-------------------------------|-------------------------------|---|
| 50 to 10K                     | $\pm 0.01$ %                  | $\pm 0.2 \pm 2.3$                               |
| 25 to < 50                    | $\pm 0.02$ %                  |   |
| 10 to < 25                    | $\pm 0.05$ %                  |   |
| 5 to < 10                     | $\pm 0.1$ %                   |   |

Weight = 1 g maximum

FIGURE 1 - POWER DERATING CURVE



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

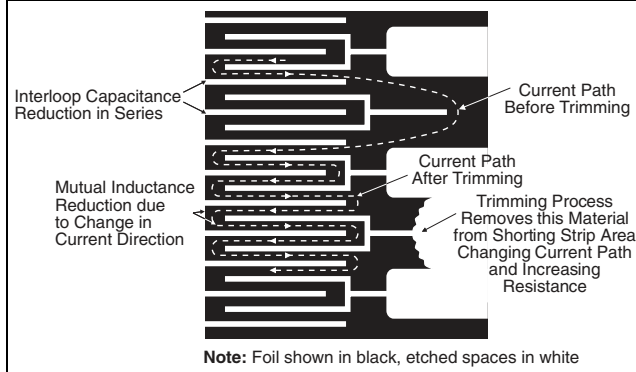
**TABLE 2 - SPECIFICATIONS**

|   |   |
|---|---|
| <b>Load Life Stability at 2000 h</b>  | ± 0.05 % max. ΔR under full rated power at + 25 °C  |
| <b>Power Rating at + 25 °C</b>  | 8 W or 3 A <sup>1)</sup> on heat sink <sup>2)</sup><br>1.5 W or 3 A <sup>1)</sup> in free air<br><b>Further derating not necessary.</b> |
| <b>Current Noise</b>  | < 0.010 μV (rms)/V of applied voltage (- 40 dB)   |
| <b>High Frequency Operation</b><br>Rise time<br>Inductance <sup>3)</sup> (L)<br>Capacitance (C) | 1 ns<br>0.1 μH maximum: 0.03 μH typical<br>1.0 pF maximum: 0.5 pF typical   |
| <b>Voltage Coefficient<sup>4)</sup></b>   | < 0.1 ppm/V   |
| <b>Operating Temperature Range</b>  | - 55 °C to + 150 °C   |
| <b>Maximum Working Voltage</b>  | 300 V. Not to exceed power rating.  |
| <b>Thermal EMF<sup>5)</sup></b>   | 0.15 μV/°C maximum (lead effect)  |

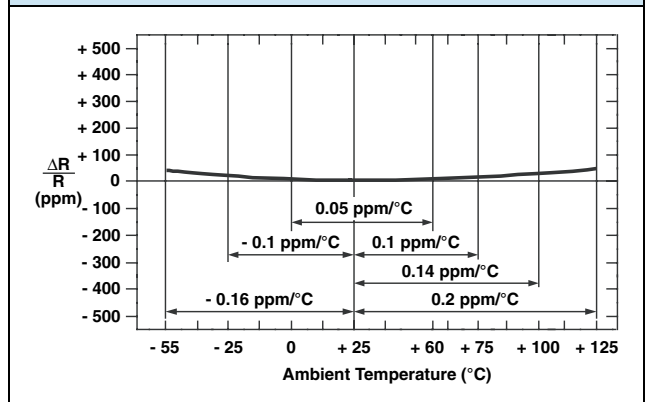
**Notes**

1. Whichever is lower.
  2. Heat sink chassis dimensions and requirements per MIL-PRF-39009:
- | DIMENSION | INCHES | mm    |
|-----------|--------|-------|
| L         | 6.00   | 152.4 |
| W         | 4.00   | 101.6 |
| H         | 2.00   | 50.8  |
| T         | 0.04   | 1.0   |
3. Inductance (L) due mainly to the leads.
  4. The resolution limit of existing test equipment (within the measurement capability of the equipment, or “essentially zero”).
  5. μV/°C relates to EMF due to lead temperature difference.

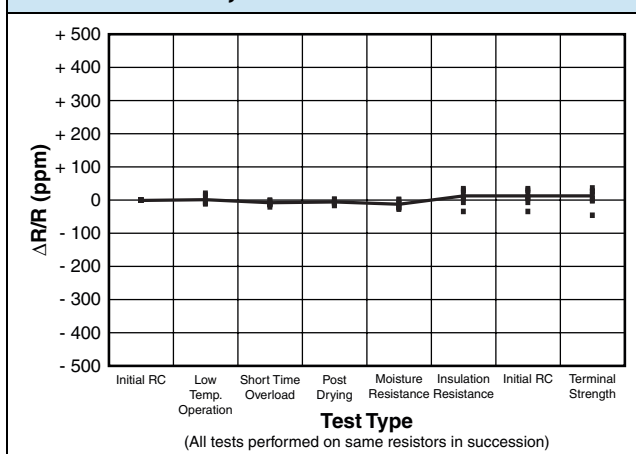
**FIGURE 2 - TRIMMING TO VALUES**  
(conceptual illustration)



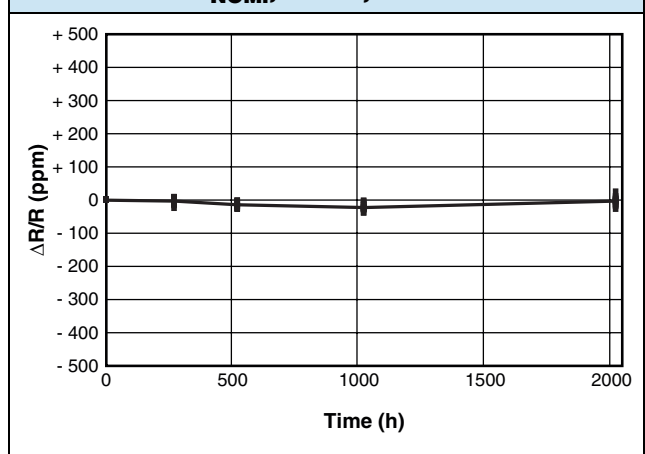
**FIGURE 3 - TYPICAL TCR CURVE Z-FOIL**



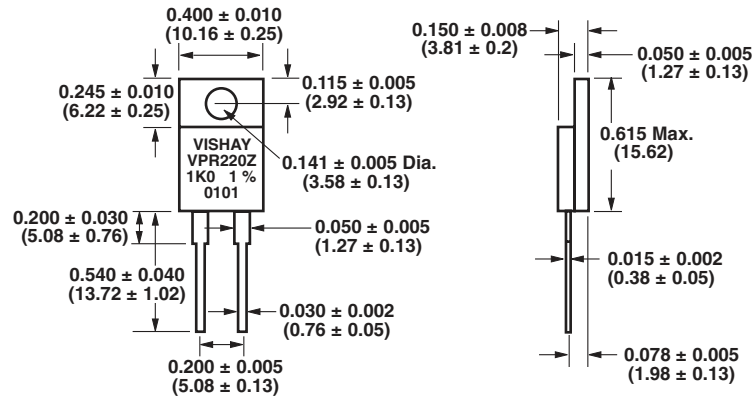
**FIGURE 4 - VPR220Z TESTS:**  
**5R, 10 UNITS**



**FIGURE 5 - VPR220Z LOAD LIFE, 10 kΩ**  
**P<sub>NOM.</sub>, 25 °C, 20 UNITS**

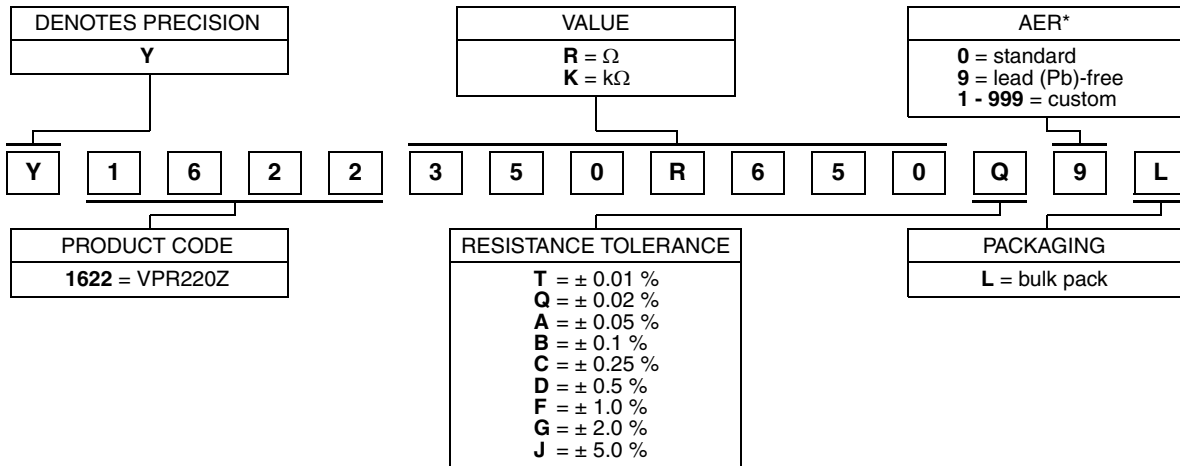


**FIGURE 6 - VPR220Z FORMING DIMENSIONS** in inches (millimeters)



**TABLE 3 - GLOBAL PART NUMBER INFORMATION**

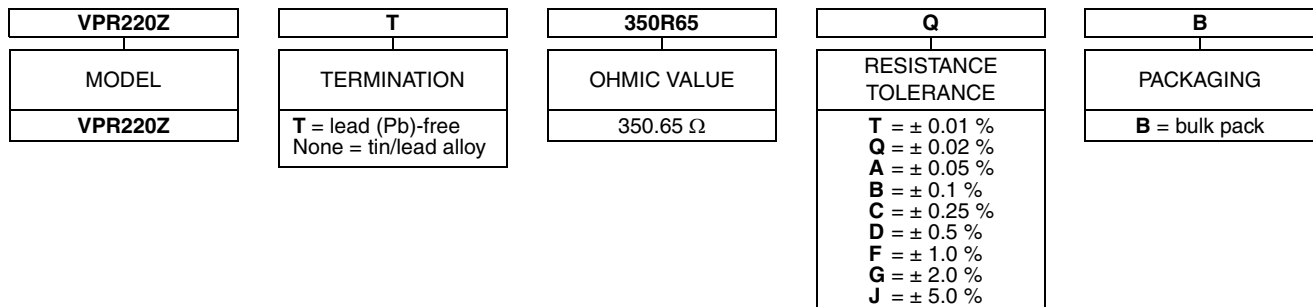
NEW GLOBAL PART NUMBER: Y1622350R650Q9L (preferred part number format)



FOR EXAMPLE: ABOVE GLOBAL ORDER Y1622 350R650 Q 9 L:

TYPE: VPR220Z  
 VALUE: 350.65 Ω  
 ABSOLUTE TOLERANCE: ± 0.02 %  
 TERMINATION: lead (Pb)-free  
 PACKAGING: bulk pack

HISTORICAL PART NUMBER: VPR220ZT 350R65 Q B (will continue to be used)



**Note**

\* For non-standard requests, please contact application engineering.

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