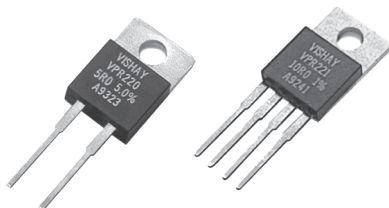


# Bulk Metal® Foil Technology Precision Foil Power Resistors in TO-220 Configuration with TCR of $\pm 2 \text{ ppm/}^\circ\text{C}$ , Tolerance of to $\pm 0.01 \%$ and Power Rating to 8 W



**Any value at any tolerance within resistance range**

Models VPR220 AND VPR221, made from Vishay Bulk Metal® Foil, offer low TCR, high stability, tight tolerance and fast response time in a small, molded resistor. Model VPR220 is a 2 lead device. Model VPR221 is a 4 lead Kelvin connected device. The 4 lead version is highly recommended for precision applications requiring ohmic values of 100R or less.

**TABLE 1 - VPR220**

| RESISTANCE RANGE ( $\Omega$ ) <sup>(1)</sup> | TIGHTEST TOLERANCE | TYPICAL TCR <sup>(2)</sup> | MAXIMUM TCR <sup>(2)</sup>          |
|----------------------------------------------|--------------------|----------------------------|-------------------------------------|
| 50 to 10K                                    | $\pm 0.01 \%$      | $\pm 2$                    | $\pm 5 \text{ ppm/}^\circ\text{C}$  |
| 25 to < 50                                   | $\pm 0.02 \%$      | $\pm 2$                    | $\pm 7 \text{ ppm/}^\circ\text{C}$  |
| 10 to < 25                                   | $\pm 0.05 \%$      | $\pm 2$                    | $\pm 10 \text{ ppm/}^\circ\text{C}$ |
| 5 to < 10                                    | $\pm 0.1 \%$       | $\pm 2$                    | $\pm 13 \text{ ppm/}^\circ\text{C}$ |

weight = 1 g maximum

**Notes**

(1) Lower or high values available upon request

(2) - 55 °C to + 125 °C, + 25 °C ref.

**TABLE 2 - VPR221**

| RESISTANCE RANGE ( $\Omega$ ) <sup>(1)</sup> | TIGHTEST TOLERANCE | TYPICAL TCR <sup>(2)</sup>         | MAXIMUM TCR <sup>(2)</sup>         |
|----------------------------------------------|--------------------|------------------------------------|------------------------------------|
| 10 to < 500                                  | $\pm 0.01 \%$      | $\pm 2 \text{ ppm/}^\circ\text{C}$ | $\pm 5 \text{ ppm/}^\circ\text{C}$ |
| 1 to < 10                                    | $\pm 0.02 \%$      | $\pm 2 \text{ ppm/}^\circ\text{C}$ | $\pm 5 \text{ ppm/}^\circ\text{C}$ |
| 0.5 to < 1                                   | $\pm 0.05 \%$      | $\pm 2 \text{ ppm/}^\circ\text{C}$ | $\pm 5 \text{ ppm/}^\circ\text{C}$ |

weight = 1.2 g maximum

**Notes**

(1) Lower or high values available upon request

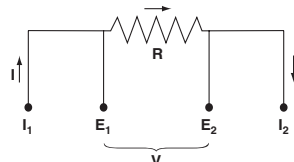
(2) - 55 °C to + 125 °C, + 25 °C Ref.

**FEATURES**

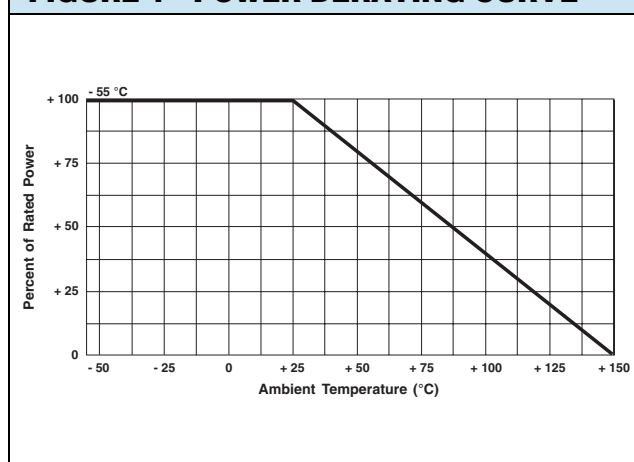
- Temperature coefficient of resistance (TCR):  $\pm 2 \text{ ppm/}^\circ\text{C}$  typical (- 55 °C to + 125 °C, + 25 °C ref.)
- Tolerance: to  $\pm 0.01 \%$  (see tables 1 and 2)
- Electrostatic discharge (ESD): above 25 000 V
- Load life stability:  $\pm 0.005 \%$  (25 °C, 2000 h at rated power)
- Resistance range: 0.5  $\Omega$  to 10 k $\Omega$
- Power rating: 8 W chassis mounted (per MIL-PRF-39009)
- Non-inductive, non-capacitive design
- Rise time: 1 ns without ringing
- Current noise: < - 40 dB
- Voltage coefficient: < 0.1 ppm/V
- Non inductive: < 0.08  $\mu\text{H}$
- Non hot spot design
- Thermal EMF: 0.05  $\mu\text{V/}^\circ\text{C}$  typical
- Terminal finishes available: lead (Pb)-free or tin/lead alloy
- Any value available within resistance range (e.g. 1K234)
- Prototype samples available from 48 h. For more information, please contact [foil@vishaypg.com](mailto:foil@vishaypg.com)
- For better performances, please see VPR220Z and VPR221Z datasheets
- Compliant to RoHS directive 2002/95/EC



Available  
**RoHS\***  
COMPLIANT

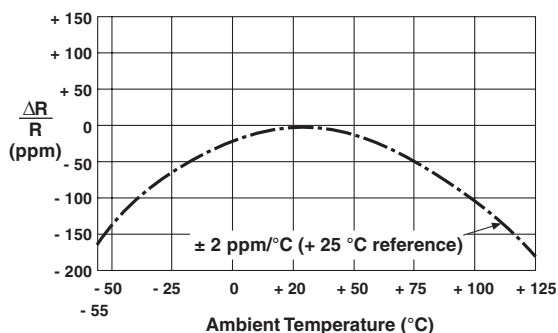


**FIGURE 1 - POWER DERATING CURVE**



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

### FIGURE 2 - TYPICAL TCR CURVE



### TABLE 3 - 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> |
|                                           | 1.5 W or 3 A <sup>(1)</sup> in free air               |
|                                           | Further derating not necessary                        |
| <b>Current Noise</b>                      | < 0.010 μV (rms)/V of applied voltage (- 40 dB)       |
| <b>High Frequency Operation</b>           |                                                       |
| Rise time                                 | 1 ns without ringing                                  |
| Inductance <sup>(3)</sup> (L)             | 0.1 μH maximum: 0.03 μH typical                       |
| Capacitance (C)                           | 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-R-39009/1B:

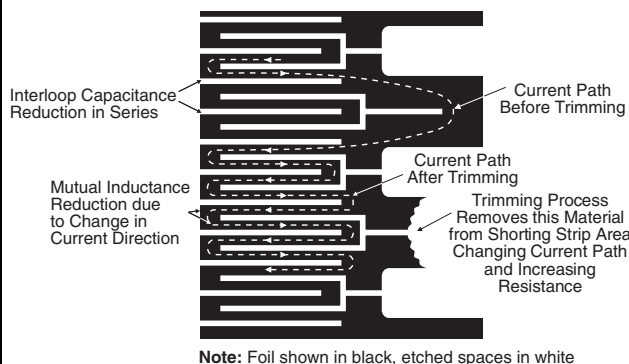
| DIMENSION | INCHES | mm    |
|-----------|--------|-------|
| L         | 6.00   | 152.4 |
| W         | 4.00   | 101.6 |
| H         | 2.00   | 50.8  |
| T         | 0.04   | 1.0   |

(3) Inductance (L) due mainly to the leads

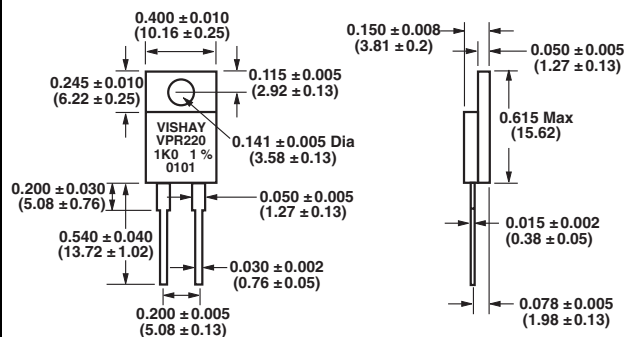
(4) The resolution limit of existing test equipment (within the measurement capability of the equipment, or "essentially zero")

(5)  $\mu\text{V}/^{\circ}\text{C}$  relates to EMF due to lead temperature difference

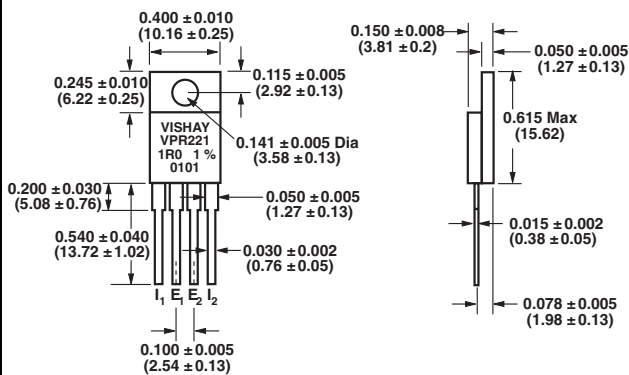
**FIGURE 3 - TRIMMING TO VALUES**  
(conceptual illustration)



**FIGURE 4 - VPR220 DIMENSIONS**  
in inches (millimeters)



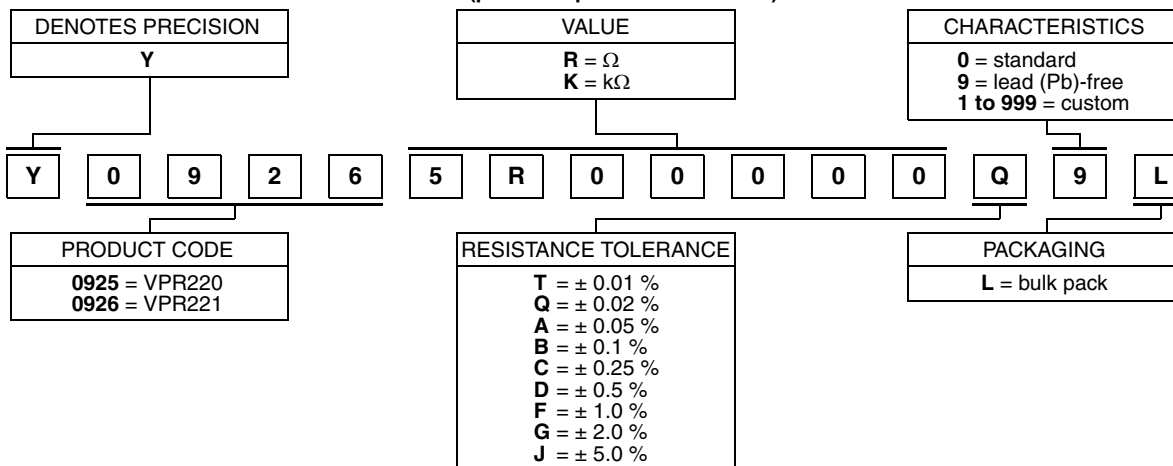
**FIGURE 5 - VPR221 DIMENSIONS**  
in inches (millimeters)



Surface mount versions of these products are available. See datasheets for VPR220S, VPR 221S.

**TABLE 4 - GLOBAL PART NUMBER INFORMATION <sup>(1)</sup>**

**NEW GLOBAL PART NUMBER: Y09265R0000Q9L (preferred part number format)**



FOR EXAMPLE: ABOVE GLOBAL ORDER Y0926 5R00000 Q 9 L:

TYPE: VPR221

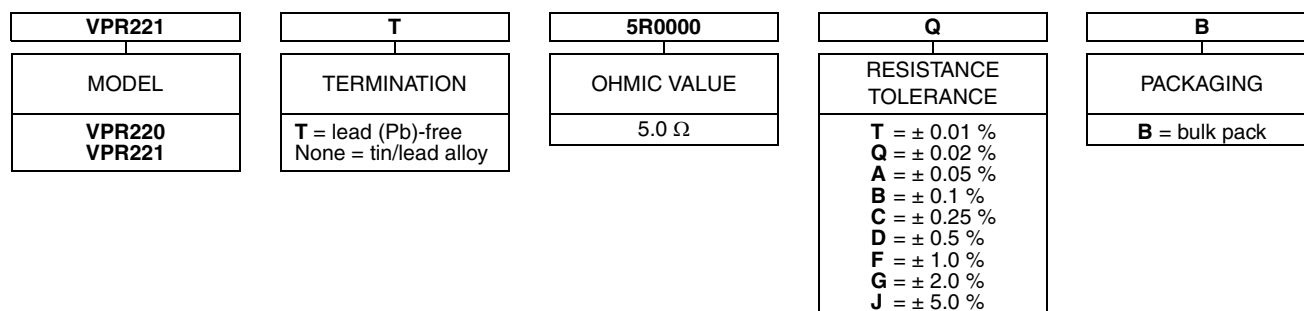
VALUE:  $5.0\ \Omega$

ABSOLUTE TOLERANCE:  $\pm 0.02\%$

TERMINATION: lead (Pb)-free

PACKAGING: bulk

**HISTORICAL PART NUMBER: VPR221T 5R0000 Q B (will continue to be used)**



**Note**

<sup>(1)</sup> For non-standard requests, please contact application engineering

## Disclaimer

ALL PRODUCTS, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE.

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

The product specifications do not expand or otherwise modify VPG's terms and conditions of purchase, including but not limited to, the warranty expressed therein.

VPG makes no warranty, representation or guarantee other than as set forth in the terms and conditions of purchase.

**To the maximum extent permitted by applicable law, VPG 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.**

Information provided in datasheets and/or specifications may vary from actual results in different applications and performance may vary over time. Statements regarding the suitability of products for certain types of applications are based on VPG's knowledge of typical requirements that are often placed on VPG products. 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. You should ensure you have the current version of the relevant information by contacting VPG prior to performing installation or use of the product, such as on our website at [vpgsensors.com](http://vpgsensors.com).

No license, express, implied, or otherwise, to any intellectual property rights is granted by this document, or by any conduct of VPG.

The products shown herein are not designed for use in life-saving or life-sustaining applications unless otherwise expressly indicated. Customers using or selling VPG products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify VPG for any damages arising or resulting from such use or sale. Please contact authorized VPG personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.

Copyright Vishay Precision Group, Inc., 2014. All rights reserved.