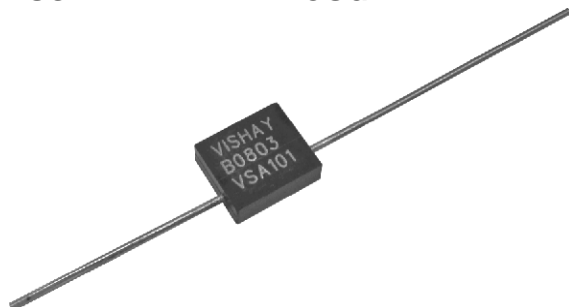


### Ultra High Precision Axial Z-Foil Resistor with TCR of $\pm 0.05 \text{ ppm}/^\circ\text{C}$ , PCR of $5 \text{ ppm}$ at Rated Power, Tolerance of $\pm 0.005 \%$ and Load Life Stability of $\pm 0.005 \%$

#### INDUSTRY BREAKTHROUGH



#### INTRODUCTION

The VSA101 Axial Bulk Metal® Z-foil resistor is Vishay's answer to the industry's demand for ultra-high precision resistors with axial terminations.

The Z-foil technology provides a significant reduction of the resistive component's sensitivity to ambient temperature variations (TCR) and applied power changes (PCR). This, along with all the additional Z-foil benefits presented in the features section, allows designers to guarantee the highest 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 to make recommendations. For non-standard technical requirements and special applications, please contact us.

**TABLE 1 - TOLERANCE AND TCR VS. RESISTANCE**

| VALUE                          | STANDARD TOLERANCE | TYPICAL TCR AND MAXIMUM SPREAD<br>- 55 °C TO + 125 °C<br>(+ 25 °C REF.) |
|--------------------------------|--------------------|-------------------------------------------------------------------------|
| 100 $\Omega$ to 100 k $\Omega$ | $\pm 0.005 \%$     | $\pm 0.2 \pm 1.3 \text{ ppm}/^\circ\text{C}$                            |
| 80 $\Omega$ to < 100 $\Omega$  | $\pm 0.005 \%$     | $\pm 0.2 \pm 1.5 \text{ ppm}/^\circ\text{C}$                            |
| 50 $\Omega$ to < 80 $\Omega$   | $\pm 0.01 \%$      | $\pm 0.2 \pm 1.8 \text{ ppm}/^\circ\text{C}$                            |
| 10 $\Omega$ to < 50 $\Omega$   | $\pm 0.02 \%$      | $\pm 0.2 \pm 2.3 \text{ ppm}/^\circ\text{C}$                            |
| 5 $\Omega$ to < 10 $\Omega$    | $\pm 0.02 \%$      | $\pm 0.2 \pm 2.8 \text{ ppm}/^\circ\text{C}$                            |

#### FEATURES

- Temperature coefficient of resistance (TCR):  
 $\pm 0.05 \text{ ppm}/^\circ\text{C}$  typical (0 °C to + 60 °C)  
 $\pm 0.2 \text{ ppm}/^\circ\text{C}$  typical (- 55 °C to + 125 °C, + 25 °C ref.)
- Power coefficient of resistance "ΔR due to self heating":  $\pm 5 \text{ ppm}$  at rated power
- Rated power: 0.6 W at 70 °C; 0.3 W at 125 °C
- Resistance tolerance: to  $\pm 0.005 \%$
- Load life stability: to  $\pm 0.005 \%$  at 70 °C, 2000 h at rated power
- Resistance range: 5  $\Omega$  to 100 k $\Omega$
- Vishay Foil resistors are not restricted to standard values, we can supply specific "as required" values at no extra cost or delivery (e.g. 100.1234  $\Omega$  vs. 100  $\Omega$ )
- Electrostatic discharge (ESD) up to 25 000 V
- Non inductive, non capacitive design
- Rise time: 1.0 ns effectively no ringing
- Current noise:  $\leq -40 \text{ dB}$
- Thermal EMF: 0.1  $\mu\text{V}/^\circ\text{C}$  maximum; 0.05  $\mu\text{V}/^\circ\text{C}$  typical
- Voltage coefficient: < 0.1 ppm/V
- Non inductive: 0.08  $\mu\text{H}$
- Terminal finishes available: lead (Pb)-free  
tin/lead alloy
- Maximum working voltage: 300 V
- Matched sets are available per request
- For better performances please contact us
- Testing available per EEE-INST002

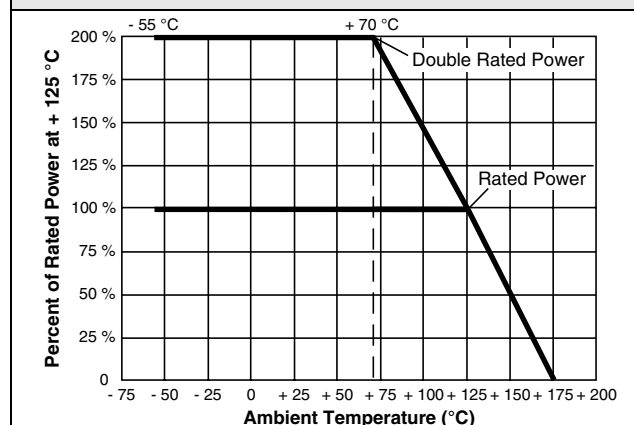


RoHS\*  
COMPLIANT

#### APPLICATIONS

- Precision amplifiers, high precision instrumentation, medical and automatic test equipment
- Laboratory, audio (high end stereo equipment)
- EB applications, military, airborne and space
- Down-hole (high temperature)

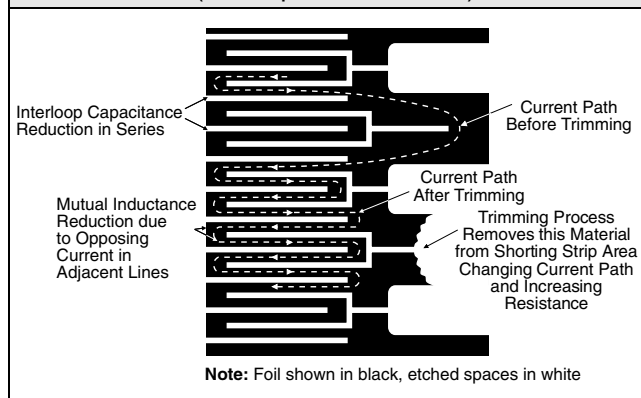
**FIGURE 1 - POWER DERATING CURVE**



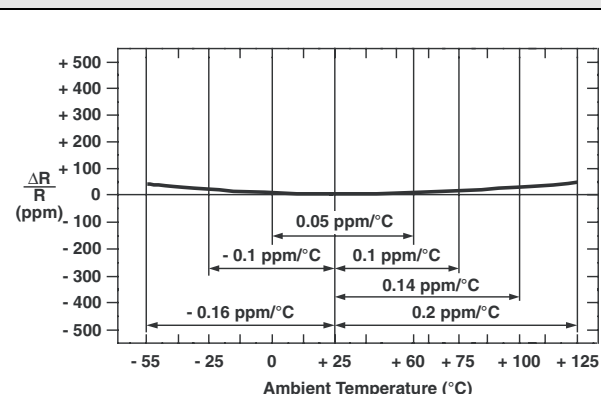
\* Pb containing terminations are RoHS compliant, exemptions may apply

**FIGURE 2 - TRIMMING TO VALUES**

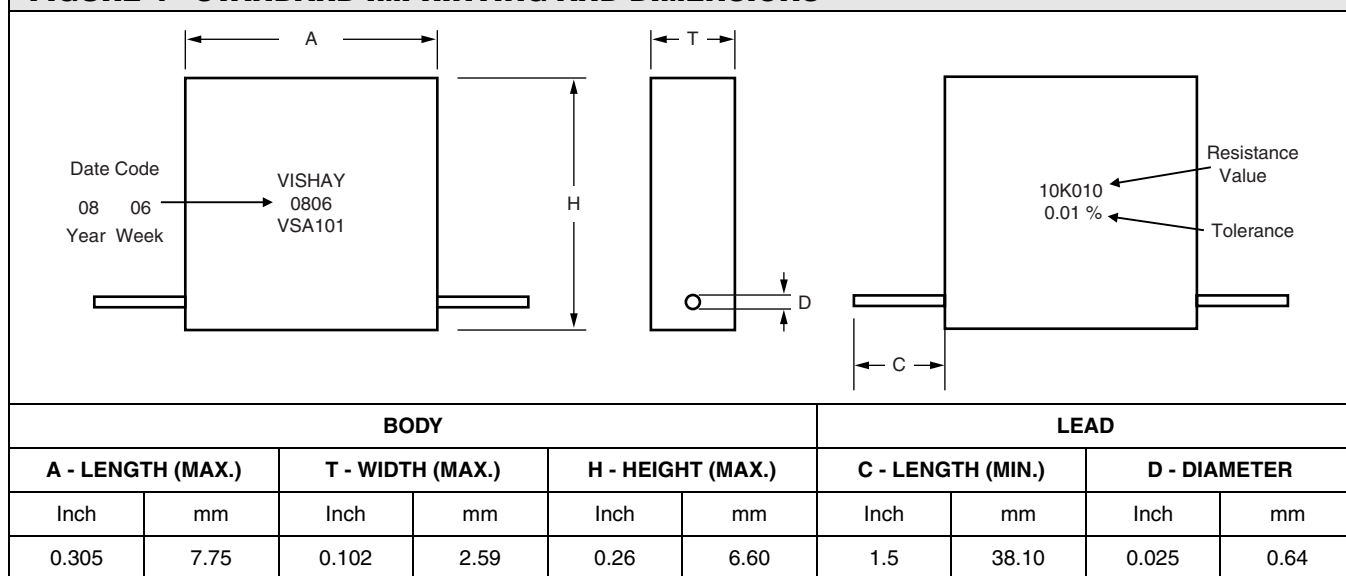
(Conceptual Illustration)



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



**FIGURE 4 - STANDARD IMPRINTING AND DIMENSIONS**



**TABLE 2 - VSA101 SPECIFICATIONS**

| Stability             |                                                                                                                                 |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Load life at 2000 h   | $\pm 0.005 \%$ max. $\Delta R$ at 0.1 W/+ 70 $^\circ\text{C}$<br>$\pm 0.015 \%$ max. $\Delta R$ at 0.3 W/+ 125 $^\circ\text{C}$ |
| Load life at 10 000 h | $\pm 0.01 \%$ max. $\Delta R$ at 0.05 W/+ 125 $^\circ\text{C}$<br>$\pm 0.05 \%$ max. $\Delta R$ at 0.3 W/+ 125 $^\circ\text{C}$ |



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Vishay Foil Resistors

**TABLE 3 - ENVIRONMENTAL PERFORMANCE COMPARISON**

|                                                                                                                                               | MIL-PRF-55182<br>CHAR J                                                               | VISHAY VSA101                                                                                |                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                               |                                                                                       | MAXIMUM $\Delta R$                                                                           | TYPICAL $\Delta R$                                                                                                                                                       |
| <b>Test Group I</b><br>Thermal shock<br>Short time overload                                                                                   | $\pm 0.2 \%$<br>$\pm 0.2 \%$                                                          | $\pm 0.01 \%$ (100 ppm)<br>$\pm 0.01 \%$ (100 ppm)                                           | $\pm 0.002 \%$ (20 ppm)<br>$\pm 0.003 \%$ (30 ppm)                                                                                                                       |
| <b>Test Group II</b><br>Resistance temperature<br>Characteristic<br>Low temperature storage<br>Low temperature operation<br>Terminal strength | $\pm 25 \text{ ppm/}^\circ\text{C}$<br>$\pm 0.15 \%$<br>$\pm 0.15 \%$<br>$\pm 0.2 \%$ | see Table 1<br>$\pm 0.01 \%$ (100 ppm)<br>$\pm 0.01 \%$ (100 ppm)<br>$\pm 0.01 \%$ (100 ppm) | $\pm 0.05 \text{ ppm/}^\circ\text{C}$<br>(0 $^\circ\text{C}$ to + 60 $^\circ\text{C}$ )<br>$\pm 0.002 \%$ (20 ppm)<br>$\pm 0.002 \%$ (20 ppm)<br>$\pm 0.002 \%$ (20 ppm) |
| <b>Test Group III</b><br>DWV<br>Resistance to solder heat<br>Moisture resistance                                                              | $\pm 0.15 \%$<br>$\pm 0.1 \%$<br>$\pm 0.4 \%$                                         | $\pm 0.01 \%$ (100 ppm)<br>$\pm 0.01 \%$ (100 ppm)<br>$\pm 0.05 \%$ (500 ppm)                | $\pm 0.002 \%$ (20 ppm)<br>$\pm 0.005 \%$ (50 ppm)<br>$\pm 0.01 \%$ (100 ppm)                                                                                            |
| <b>Test Group IV</b><br>Shock<br>Vibration                                                                                                    | $\pm 0.2 \%$<br>$\pm 0.2 \%$                                                          | $\pm 0.01 \%$ (100 ppm)<br>$\pm 0.01 \%$ (100 ppm)                                           | $\pm 0.002 \%$ (20 ppm)<br>$\pm 0.002 \%$ (20 ppm)                                                                                                                       |
| <b>Test Group V</b><br>Life test at 0.3 W/+ 125 $^\circ\text{C}$<br>2000 h<br>10 000 h                                                        | $\pm 0.5 \%$<br>$\pm 2.0 \%$                                                          | $\pm 0.015 \%$ (150 ppm)<br>$\pm 0.05 \%$ (500 ppm)                                          | $\pm 0.01 \%$ (100 ppm)<br>$\pm 0.03 \%$ (300 ppm)                                                                                                                       |
| <b>Test Group Va</b><br>Life test at 0.6 W (2 x rated power)/+ 70 $^\circ\text{C}$ , 2000 h                                                   | $\pm 0.5 \%$                                                                          | $\pm 0.015 \%$ (150 ppm)                                                                     | $\pm 0.01 \%$ (100 ppm)                                                                                                                                                  |
| <b>Test Group VI</b><br>High temperature exposure                                                                                             | $\pm 2.0 \%$                                                                          | $\pm 0.1 \%$ (1000 ppm)                                                                      | $\pm 0.05 \%$ (500 ppm)                                                                                                                                                  |
| <b>Test Group VII</b><br>Voltage coefficient                                                                                                  | 0.005 %/V                                                                             | < 0.00001 %/V                                                                                | < 0.00001 %/V                                                                                                                                                            |

**STANDARD MEASUREMENT** (at room temperature)**Standard Test Conditions:**

- Temperature: + 23  $^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$
- Relative humidity: 35 to 65 % RH
- Lead test point: 0.5" (12.7 mm) from resistor body

**IMPROVED PERFORMANCE TESTING**

The preceding information is based on product directly off the production line. Improved performance (meaning increased time stability with load and other stresses) is available through factory conducted "Improved Performance Testing". The test routine is usually tailored to the user's stability objectives. A screened product can be brought down to a potential load life drift of less than 50 ppm.

For example, the data sheet "7 Technical Reasons to Specify BMF Resistive Components" shows the drift characteristics of a standard product.

Various screen test routines are available and all anticipated stresses must be taken into account before settling on one specific test routine. Our Applications Engineering Department is available to discuss and recommend appropriate routines given the full spectrum of anticipated stresses and stability requirements.

# VSA101 (Z-Foil)

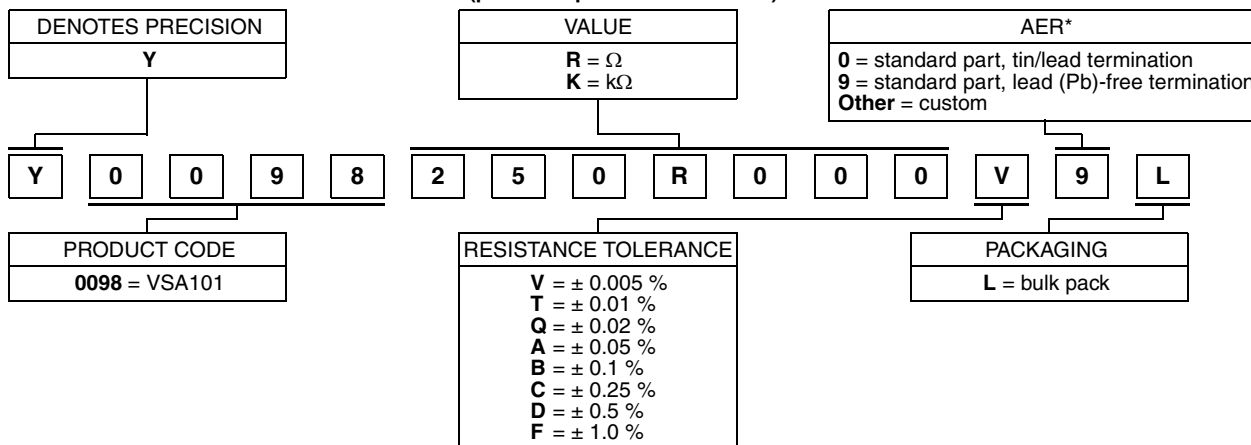


Vishay Foil Resistors

Ultra High Precision Axial Z-Foil Resistor with  
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**TABLE 4 - GLOBAL PART NUMBER INFORMATION**

NEW GLOBAL PART NUMBER: Y0098250R000V9L (preferred part number format)



FOR EXAMPLE: ABOVE GLOBAL ORDER Y0098 250R000 V 9 L:

TYPE: VSA101

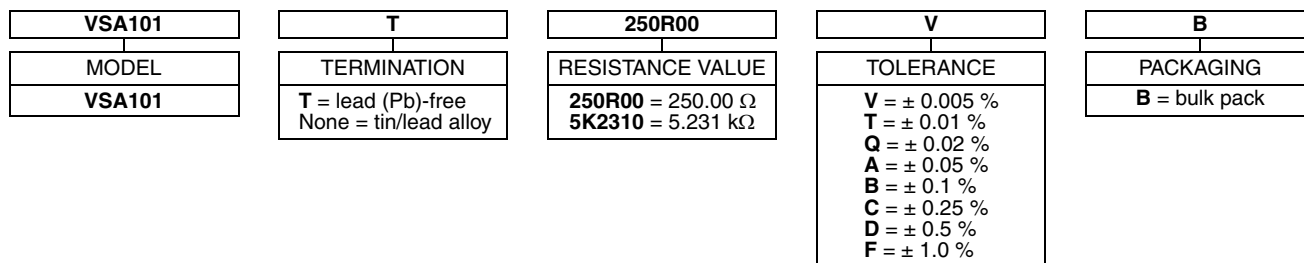
VALUE:  $250.0 \Omega$

ABSOLUTE TOLERANCE:  $\pm 0.005 \%$

TERMINATION: lead (Pb)-free

PACKAGING: bulk pack

HISTORICAL PART NUMBER: VSA101 T 250R00 V B (will continue to be used)



## Note

\* Application engineering release: for non-standard requests, please contact application engineering.



### Disclaimer

All product specifications and data are subject to change without notice.

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