

## High Precision Foil Wraparound Surface Mount Chip Resistor with TCR of $\pm 2 \text{ ppm}/^\circ\text{C}$ and Load Life Stability of $\pm 0.01 \%$ (100 ppm)



Top View

### INTRODUCTION

Bulk Metal® Foil (BMF) technology out-performs all other resistor technologies available today for applications that require high precision and high stability, and allows production of customer oriented products designed to satisfy challenging and specific technical requirements.

The BMF provides an inherently low and predictable Temperature Coefficient of Resistance (TCR) and excellent load life stability for high precision analog applications.

Model VSM offers low TCR, excellent load life stability, tight tolerance, excellent shelf life stability, low current noise and low voltage coefficient, all in the same resistor.

The VSM has a full wraparound termination which ensures safe handling during the manufacturing process, as well as providing stability during multiple thermal cyclings.

Our application engineering department is available to advise and make recommendations. For non-standard technical requirements and special applications, please contact us using the e-mail address in the footer below.

| TABLE 1 - TOLERANCE AND TCR VS. RESISTANCE VALUE (1)<br>(- 55 °C to + 125 °C, + 25 °C Ref.) |               |                                      |
|---|---------------|--------------------------------------|
| RESISTANCE VALUE (Ω)  | TOLERANCE (%) | TYPICAL TCR AND MAX. SPREAD (ppm/°C) |
| 250 to 125K   | ± 0.01        | ± 2 ± 2                              |
| 100 to < 250  | ± 0.02        | ± 2 ± 3                              |
| 50 to < 100   | ± 0.05        | ± 2 ± 3                              |
| 25 to < 50  | ± 0.1         | ± 2 ± 4                              |
| 10 to < 25  | ± 0.25        | ± 2 ± 6                              |

#### Note

(1) For tighter performances and non-standard values up to 150K, please contact Vishay application engineering using the e-mail address in the footer below.

### FEATURES

- Temperature coefficient of resistance (TCR):  $\pm 2.0 \text{ ppm}/^\circ\text{C}$  typical (- 55 °C to + 125 °C, + 25 °C ref.) (see table 1)
- Tolerance: to  $\pm 0.01 \%$
- Power rating: to 400 mW at + 70 °C
- Load life stability: to  $\pm 0.01 \%$  at 70 °C, 2000 h at rated power
- Resistance range: 10 Ω to 125 kΩ (for higher and lower values, please contact us)
- Vishay Foil resistors are not restricted to standard values, we can supply specific "as required" values at no extra cost or delivery (e.g. 1K2345 vs. 1K)
- Fast thermal stabilization < 1 s
- **Electrostatic discharge (ESD) up to 25 000 V**
- Short time overload:  $\leq 0.01 \%$
- Non inductive, non capacitive design
- Rise time: 1 ns effectively no ringing
- Current noise: - 42 dB
- Voltage coefficient < 0.1 ppm/V
- Non inductive: < 0.08 μH
- Non hot spot design
- Terminal finishes available: lead (Pb)-free, tin/lead alloy
- Compliant to RoHS directive 2002/95/EC
- Matched sets are available per request
- Prototype quantities available in just 5 working days or sooner. For more information, please contact [foil@vishaypg.com](mailto:foil@vishaypg.com)
- For better performances please review **VSMP** and **VFCP** Series datasheets

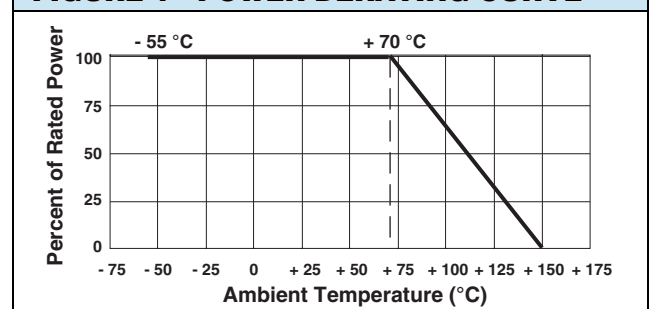


RoHS\*  
COMPLIANT

### APPLICATIONS

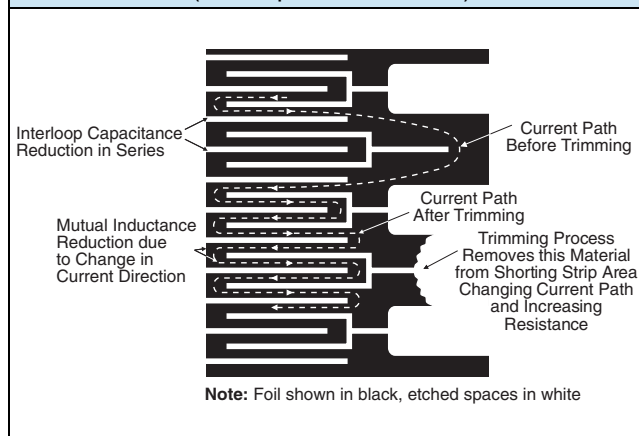
- Automatic test equipment (ATE)
- High precision instrumentation
- Laboratory, industrial and medical
- Audio
- EB applications (electron beam scanning and recording equipment, electron microscopes)
- Down hole instrumentation
- Communication

FIGURE 1 - POWER DERATING CURVE

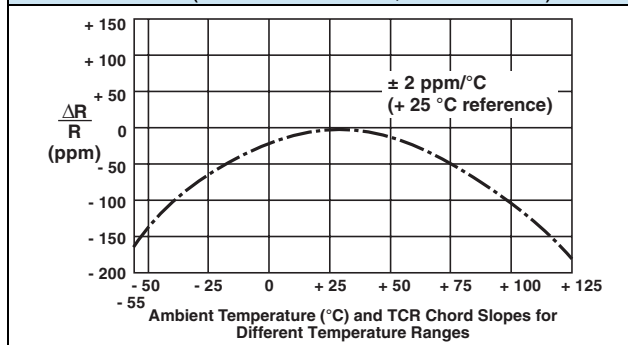


\* Pb containing terminations are not RoHS compliant, exemptions may apply

**FIGURE 2 - TRIMMING TO VALUES**  
(Conceptual Illustration)



**FIGURE 3 - TYPICAL RESISTANCE/TEMPERATURE CURVE**  
(For more Details, see Table 1)



**Note**

- The TCR values for  $< 100 \Omega$  are influenced by the termination composition and result in deviation from this curve.

**TABLE 2 - DIMENSIONS AND LAND PATTERN** in Inches (Millimeters)

| CHIP SIZE | $\pm 0.005$ (0.13) | $\pm 0.005$ (0.13) | THICKNESS<br>MAXIMUM | $\pm 0.005$ (0.13) | Z <sup>(1)</sup> | G <sup>(1)</sup> | X <sup>(1)</sup> |
|-----------|--------------------|--------------------|----------------------|--------------------|------------------|------------------|------------------|
| 0805      | 0.080 (2.03)       | 0.050 (1.27)       | 0.025 (0.64)         | 0.015 (0.38)       | 0.122 (3.10)     | 0.028 (0.71)     | 0.050 (1.27)     |
| 1206      | 0.126 (3.20)       | 0.062 (1.57)       | 0.025 (0.64)         | 0.020 (0.51)       | 0.175 (4.45)     | 0.059 (1.50)     | 0.071 (1.80)     |
| 1506      | 0.150 (3.81)       | 0.062 (1.57)       | 0.025 (0.64)         | 0.020 (0.51)       | 0.199 (5.05)     | 0.083 (2.11)     | 0.071 (1.80)     |
| 2010      | 0.198 (5.03)       | 0.097 (2.46)       | 0.025 (0.64)         | 0.025 (0.64)       | 0.247 (6.27)     | 0.115 (2.92)     | 0.103 (2.62)     |
| 2512      | 0.249 (6.32)       | 0.127 (3.23)       | 0.025 (0.64)         | 0.032 (0.81)       | 0.291 (7.39)     | 0.150 (3.81)     | 0.127 (3.23)     |

**Note**  
(<sup>1</sup>) Land pattern dimensions are per IPC-7351A

**TABLE 3 - SPECIFICATIONS**

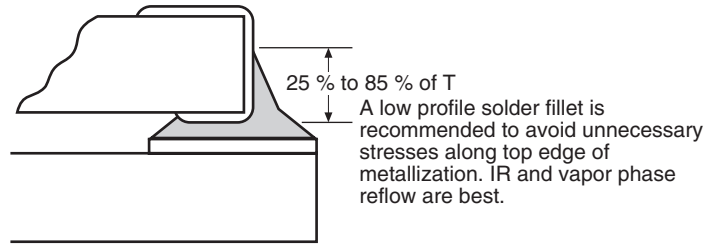
| CHIP SIZE | RATED POWER (mW)<br>at + 70 °C | MAX. WORKING VOLTAGE<br>( $\leq \sqrt{P \times R}$ ) | RESISTANCE RANGE<br>( $\Omega$ ) | MAXIMUM WEIGHT<br>(mg) |
|-----------|--------------------------------|--|----------------------------------|------------------------|
| 0805      | 100                            | 28 V   | 10 to 8K                         | 6                      |
| 1206      | 150                            | 61 V   | 10 to 25K                        | 11                     |
| 1506      | 200                            | 78 V   | 10 to 30K                        | 12                     |
| 2010      | 300                            | 145 V  | 10 to 70K                        | 27                     |
| 2512      | 400                            | 220 V  | 10 to 125K                       | 40                     |

**TABLE 4 - PERFORMANCES**

| TEST OR CONDITIONS   | MIL-PRF-55342<br>CHARACTERISTIC E $\Delta R$ LIMITS | TYPICAL<br>$\Delta R$ LIMITS | MAXIMUM<br>$\Delta R$ LIMITS <sup>(1)</sup> |
|--|---|------------------------------|---|
| Thermal Shock, 100 x (- 65 °C to + 150 °C)                     | $\pm 0.1 \%$  | $\pm 0.005 \%$ (50 ppm)      | $\pm 0.02 \%$ (200 ppm)                     |
| Low Temperature Operation, - 65 °C, 45 min at P <sub>nom</sub> | $\pm 0.1 \%$  | $\pm 0.01 \%$ (100 ppm)      | $\pm 0.02 \%$ (200 ppm)                     |
| Short Time Overload, 6.25 x Rated Power, 5 s                   | $\pm 0.1 \%$  | $\pm 0.01 \%$ (100 ppm)      | $\pm 0.02 \%$ (200 ppm)                     |
| High Temperature Exposure, + 150 °C, 100 h                     | $\pm 0.1 \%$  | $\pm 0.01 \%$ (100 ppm)      | $\pm 0.03 \%$ (300 ppm)                     |
| Resistance to Soldering Heat                                   | $\pm 0.2 \%$  | $\pm 0.005 \%$ (50 ppm)      | $\pm 0.01 \%$ (100 ppm)                     |
| Moisture Resistance  | $\pm 0.2 \%$  | $\pm 0.005 \%$ (50 ppm)      | $\pm 0.03 \%$ (300 ppm)                     |
| Load Life Stability + 70 °C for 2000 h at Rated Power          | $\pm 0.5 \%$  | $\pm 0.005 \%$ (50 ppm)      | $\pm 0.01 \%$ (100 ppm)                     |

**Note**  
(<sup>1</sup>) As shown + 0.01  $\Omega$  to allow for measurement errors at low values.

**FIGURE 4 - RECOMMENDED MOUNTING (1)(2)(3)**

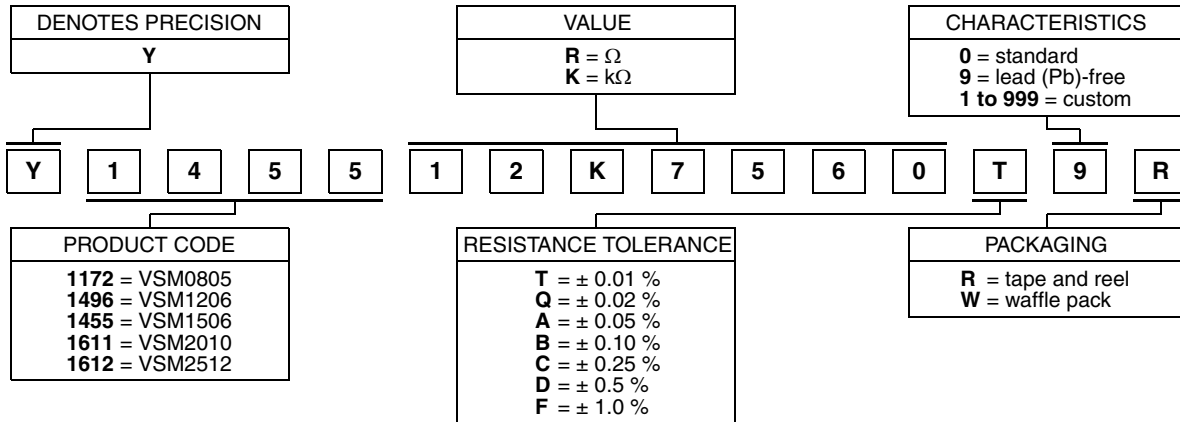


**Notes**

- (1) Avoid the use of cleaning agents which could attack epoxy resins, which form part of the resistor construction
- (2) Vacuum pick up is recommended for handling
- (3) Soldering iron may damage the resistor

**TABLE 5 - GLOBAL PART NUMBER INFORMATION (1)**

**NEW GLOBAL PART NUMBER: Y145512K7560T9R (preferred part number format)**



FOR EXAMPLE: ABOVE GLOBAL ORDER Y1455 12K7565 T 9 R:

TYPE: VSM1506  
VALUES: 12.7560 kΩ  
ABSOLUTE TOLERANCE: 0.01 %  
TERMINATION: lead (Pb)-free  
PACKAGING: tape and reel

**HISTORICAL PART NUMBER: VSM1506 12K756 TCR2 T S T (will continue to be used)**

|   |                  |                     |  |                                    |                                      |
|---|------------------|---------------------|--|------------------------------------|--------------------------------------|
| <b>VSM1506</b>                                      | <b>12K756</b>    | <b>TCR2</b>         | <b>T</b>   | <b>S</b>                           | <b>T</b>                             |
| MODEL   | RESISTANCE VALUE | TCR CHARACTERISTICS | TOLERANCE  | TERMINATION                        | PACKAGING                            |
| VSM0805<br>VSM1206<br>VSM1506<br>VSM2010<br>VSM2512 | 12.756 kΩ        |                     | T = ± 0.01 %<br>Q = ± 0.02 %<br>A = ± 0.05 %<br>B = ± 0.10 %<br>C = ± 0.25 %<br>D = ± 0.5 %<br>F = ± 1.0 % | S = lead (Pb)-free<br>B = tin/lead | T = tape and reel<br>W = waffle pack |

**Note**

- (1) For non-standard requests, please contact application engineering.

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Тел: +7 (812) 336 43 04 (многоканальный)  
Email: org@lifeelectronics.ru