

High Precision Surface Mount Current Sensing Chip Resistor with Power Rating to 1 W, Temperature Coefficient of Resistance of ± 2 ppm/ $^{\circ}\text{C}$ and Load Life Stability of $\pm 0.015\%$



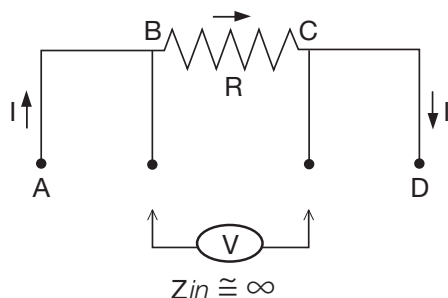
INTRODUCTION

Model VCS1625P is a surface mount resistor designed with 4 pads for Kelvin connection. Utilizing VFR's (Vishay Foil Resistors') Bulk Metal® Foil as the resistance element, it provides performance capabilities far greater than other resistor technologies can supply in a product of comparable size.

The key performance of the new VCS1625P is its high rated power up to 1W. This small device dissipates heat almost entirely through the pads so surface mount users are encouraged to be generous with the board's pads and traces. Gold terminations are available on special order.

The four terminal device separates the current leads from the voltage sensing leads. This configuration eliminates the effect of the lead wire resistance from points A to B and C to D, allowing low TCR current sensing.

VFR's application engineering department is available to advise and to make recommendations. For non-standard technical requirements and special applications, please contact foil@vishaypg.com.



FEATURES

- Temperature coefficient of resistance (TCR): ± 2 ppm/ $^{\circ}\text{C}$ typical (-55°C to $+125^{\circ}\text{C}$, $+25^{\circ}\text{C}$ ref.) (see table 1)
- Resistance range: $0.01\ \Omega$ to $10\ \Omega$ (for higher or lower values, please contact Application Engineering)
- Vishay Foil resistors are not restricted to standard values, we can supply specific "as required" values at no extra cost or delivery (e.g. $1.234\ \Omega$ vs. $1\ \Omega$)
- Resistance tolerance: to $\pm 0.2\%$ (0.05% is also available)
- Load life stability: 0.015% at 70°C , 2000 h at rated power
- Thermal EMF: $0.05\ \mu\text{V}/^{\circ}\text{C}$ typical
- Electrostatic discharge (ESD) at least to $25\ \text{kV}$
- Short time overload $< 0.005\%$
- Thermal stabilization time $< 1\ \text{s}$ (nominal value achieved within 10 ppm of steady state value)
- Power rating: to $1\ \text{W}$ at $+70^{\circ}\text{C}$ (Figure 1)
- Non inductive: non capacitive design
- Rise time: $1\ \text{ns}$ effectively no ringing
- Current rating: $5\ \text{A}$ maximum
- Current noise: $0.010\ \mu\text{V}_{\text{RMS}}/\text{V}$ of applied voltage ($< -40\ \text{dB}$)
- Voltage coefficient: $< 0.1\ \text{ppm}/\text{V}$
- Non inductive: $< 0.08\ \mu\text{H}$
- Non hot spot design
- Prototype quantities available in just 5 working days or sooner
- For better performances, please review the VCS1625ZP (Z-Foil) datasheet

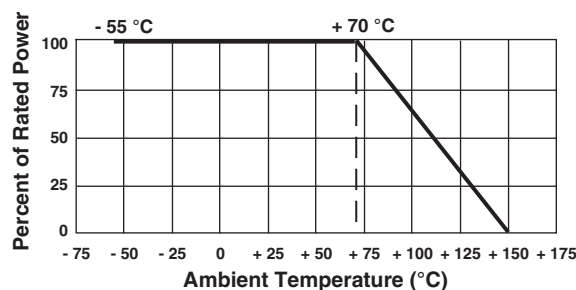


RoHS*
COMPLIANT

TERMINATIONS

- Two lead (Pb)-free options are available:
gold plated or tin plated
- Tin/lead plated

FIGURE 1 - POWER DERATING CURVE



* Pb containing materials are not RoHS compliant, exemptions may apply

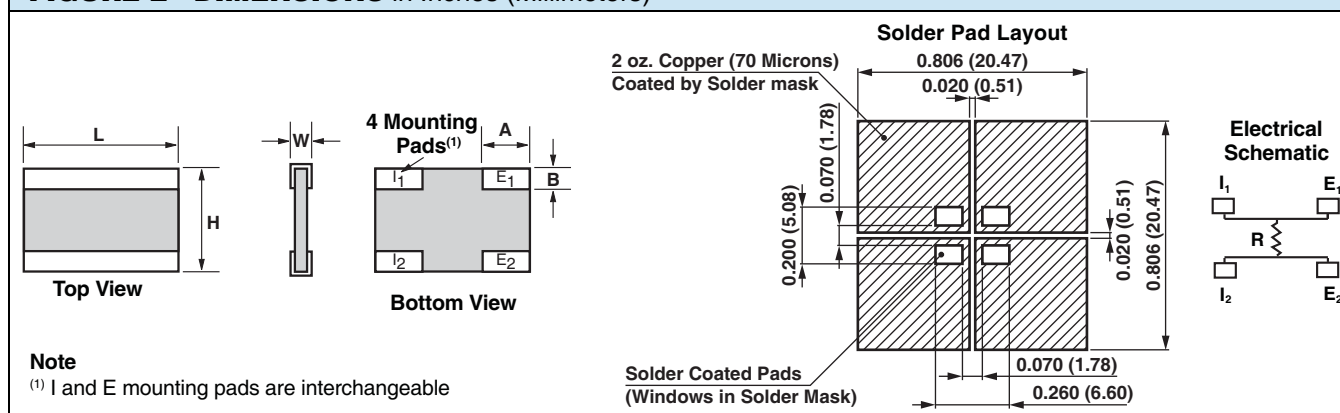
TABLE 1 - TOLERANCE AND TCR VS. RESISTANCE VALUE (- 55 °C to + 125 °C, + 25° Ref.)⁽¹⁾

| VALUE (Ω) | TOLERANCE | TYPICAL TCR | MAXIMUM TCR | POWER RATING at + 70 °C ⁽²⁾ | MAXIMUM CURRENT ⁽²⁾ |
|-------------------|-------------------|-------------|-------------|---|-----------------------------------|
| > 2R000 to 10R000 | 0.2 %, 0.5 %, 1 % | ± 2 ppm/°C | ± 5 ppm/°C | 1 W ⁽³⁾ | 5 A |
| > 0R500 to 2R000 | 0.5 %, 1 % | ± 2 ppm/°C | ± 10 ppm/°C | | |
| > 0R100 to 0R500 | 1 % | ± 2 ppm/°C | ± 15 ppm/°C | | |
| > 0R050 to 0R100 | 1 % | ± 2 ppm/°C | ± 20 ppm/°C | | |
| > 0R030 to 0R050 | 1 % | ± 2 ppm/°C | ± 30 ppm/°C | | |
| > 0R010 to 0R030 | 1 % | ± 2 ppm/°C | ± 50 ppm/°C | | |

Notes(1) Tighter performances are available. Please contact application engineering foil@vishaypg.com

(2) Max Power or Max Current - whichever is lower

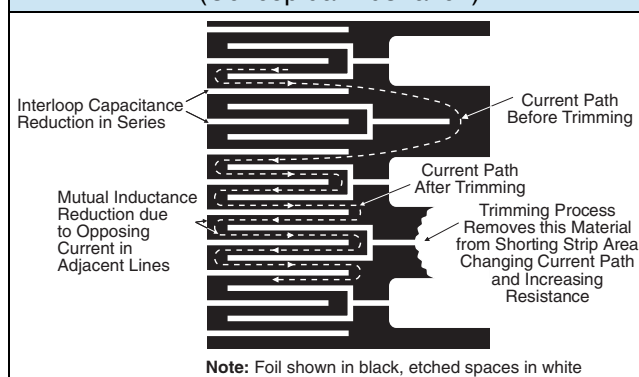
(3) On FR4 PCB with solder pads per fig 2

FIGURE 2 - DIMENSIONS in Inches (Millimeters)

| | INCHES | MILLIMETERS |
|---|---------------|--------------|
| L | 0.250 ± 0.010 | 6.35 ± 0.25 |
| H | 0.160 ± 0.010 | 4.06 ± 0.25 |
| W | 0.040 maximum | 1.02 maximum |
| A | 0.080 ± 0.005 | 2.03 ± 0.13 |
| B | 0.040 ± 0.010 | 1.02 ± 0.25 |

FIGURE 3 - TRIMMING TO VALUES

(Conceptual Illustration)*



* To acquire a precision resistance value, the Bulk Metal® Foil chip is trimmed by selectively removing built-in "shorting bars." To increase the resistance in known increments, marked areas are cut, producing progressively smaller increases in resistance. This method eliminates the effect of "hot spot" and improves the long term stability of the Foil chips.

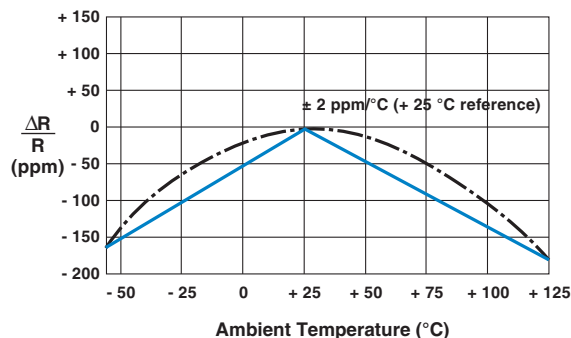
FIGURE 4 - TYPICAL RESISTANCE VERSUS TEMPERATURE CURVE AND ITS CHORD SLOPES (TCR)

TABLE 2 - PERFORMANCE SPECIFICATIONS

| TEST | MIL-PRF-55342 ΔR LIMITS | TYPICAL ΔR LIMITS | MAXIMUM ΔR LIMITS ⁽¹⁾ |
|--|------------------------------------|------------------------------|---|
| Thermal shock 5 x (- 65 °C to + 150 °C) | ± 0.10 % | ± 0.005 % (50 ppm) | ± 0.01 % (100 ppm) |
| Low temperature operation, - 65 °C, 45 min at P _{nom} | ± 0.10 % | ± 0.005 % (50 ppm) | ± 0.01 % (100 ppm) |
| Short time overload, 6.25 x rated power, 5 s | ± 0.10 % | ± 0.005 % (50 ppm) | ± 0.02 % (200 ppm) |
| High temperature exposure, + 150 °C, 100 h | ± 0.10 % | ± 0.01 % (100 ppm) | ± 0.02 % (200 ppm) |
| Resistance to soldering heat | ± 0.2 % | ± 0.01 % (100 ppm) | ± 0.03 % (300 ppm) |
| Moisture resistance | ± 0.2 % | ± 0.01 % (100 ppm) | ± 0.03 % (300 ppm) |
| Load life stability 2000 h at 70 °C at 1 W | ± 0.5 % | ± 0.015 % (150 ppm) | ± 0.025 % (250 ppm) |

Note

⁽¹⁾ Measurement error 0.001R

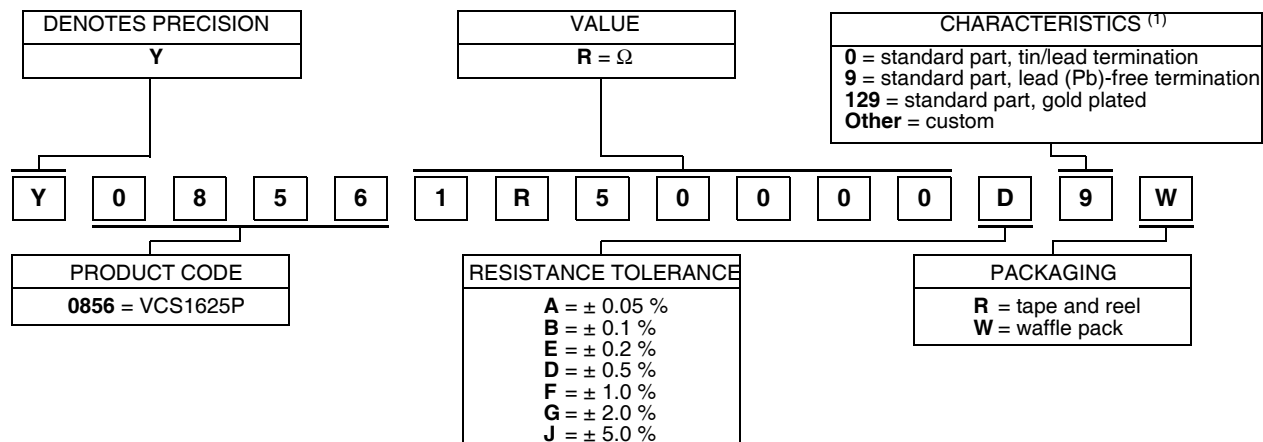
POST MANUFACTURING OPERATIONS OR PMO

Military applications can include requirements for performance under conditions of stress beyond the normal and over extended periods of time. This calls for more than just selecting a standard device and applying it to a circuit. The standard device may turn out to be all that is needed but an analysis of the projected service conditions should be made and it may well dictate a routine of stabilization known as post manufacturing operations or PMO. The PMO operations that will be discussed are only applicable to Foil resistors. They stabilize Foil resistors while they are harmful

to other types. Short time overload, accelerated load life, and temperature cycling are the three PMO exercises that do the most to remove the anomalies down the road. Foil resistors are inherently stable as manufactured. These PMO exercises are only of value on foil resistors and they improve the performance by small but significant amounts. Users are encouraged to contact VFR's application engineering department for assistance in choosing the PMO operations that are right for their application.

TABLE 3 - GLOBAL PART NUMBER INFORMATION

NEW GLOBAL PART NUMBER: Y08561R50000D9W (preferred part number format)



FOR EXAMPLE: ABOVE GLOBAL ORDER Y0856 1R50000 D 9 W:

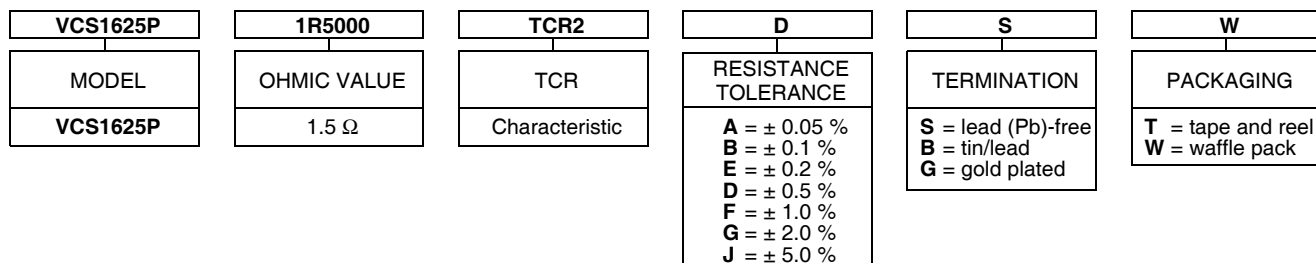
TYPE: VCS1625P

VALUE: 1.5 Ω ABSOLUTE TOLERANCE: $\pm 0.5\%$

TERMINATION: lead (Pb)-free

PACKAGING: waffle pack

HISTORICAL PART NUMBER: VCS1625P 1R5000 TCR2 D S W (will continue to be used)

**Note**⁽¹⁾ Application engineering release: for non-standard requests, please contact application engineering.

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