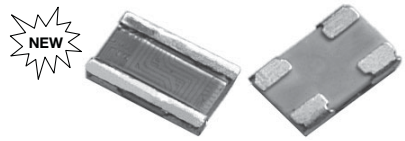
Ultra High Precision Z-Foil Surface Mount Current Sensing Chip Resistor with Power Rating to 1 W and Temperature Coefficient of Resistance of ± 0.05 ppm/°C and Power Coefficient of 5 ppm at Rated Power



INTRODUCTION

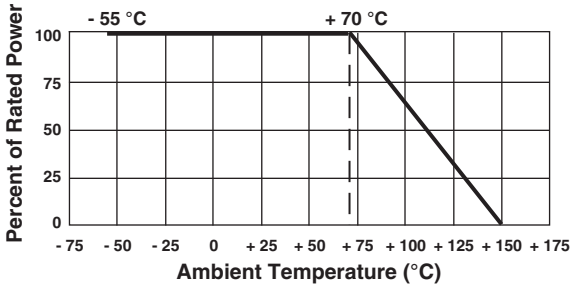
The Z-foil technology provides a significant increase of stability of resistance value's sensitivity to ambient temperature variations (TCR) and applied power changes (PCR). Designers can now guarantee a high degree of stability and accuracy in fixed-resistor applications using solutions based on VPG's revolutionary Z-foil technology.

Model VCS1625ZP is a surface mount chip resistor designed with 4 pads for Kelvin connection. Utilizing VPG's Bulk Metal® Z-foil as the resistance element, it provides performance capabilities far greater than other resistor technologies can supply in a product of comparable size. 0.05 ppm/°C typical TCR removes errors due to temperature gradients.

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.

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.

FIGURE 1 - POWER DERATING CURVE



FEATURES

- Temperature coefficient of resistance (TCR): ± 0.05 ppm/°C typical (0 °C to + 60 °C) ± 0.2 ppm/°C typical (- 55 °C to + 125 °C, + 25 °C ref.) (see table 1)
- Resistance range: 0.3 Ω to 10 Ω (for higher or 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. 1.234 Ω vs. 1 Ω)
- Resistance Tolerance: to ± 0.2% (0.05% and 0.1% are also available)
- Power coefficient "ΔR due to self heating": 5 ppm at rated power
- Load life stability: 0.015 % at 70 °C, 2000 h at rated power
- Electrostatic discharge (ESD) at least to 25 000 V
- Short time overload < 0.005 %
- Thermal stabilization time < 1 s (nominal value achieved within 10 ppm of steady state value)
- Power rating: 1 W at + 70 °C (figure 1)
- Non inductive, non capacitive design
- Rise time: 1 ns effectively no ringing
- Current rating: 1.8 A maximum
- Current noise: 0.010 μV_{RMS}/V of applied voltage(< - 40 dB)
- Voltage coefficient: < 0.1 ppm/V
- Non inductive: < 0.08 μH
- Non hot spot design
- Prototype quantities available in just 5 working days or sooner.
- For higher temperature application above +150 °C and for better performances please contact us.

Pb-free Available

RoHS* COMPLIANT

TERMINATIONS

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

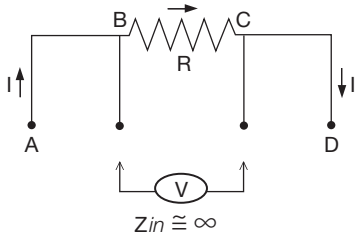


TABLE 1 - SPECIFICATIONS (1)

MODEL NUMBER	RESISTANCE RANGE	RESISTANCE TOLERANCE(4)	TYPICAL TCR and MAX. SPREAD (- 55 °C to + 125 °C, + 25 °C Ref)	POWER RATING at + 70 °C (2)	MAXIMUM CURRENT (2)
VCS1625ZP	> 2.0 Ω to 10 Ω 0.3 Ω to 2.0 Ω	± 0.2 %, ± 0.5 %; ± 1.0 % ± 0.5 %; ± 1.0 %	± 0.2 ± 2.8 ppm/°C	1 W on FR4 PCB(3)	1.8 A

Notes

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

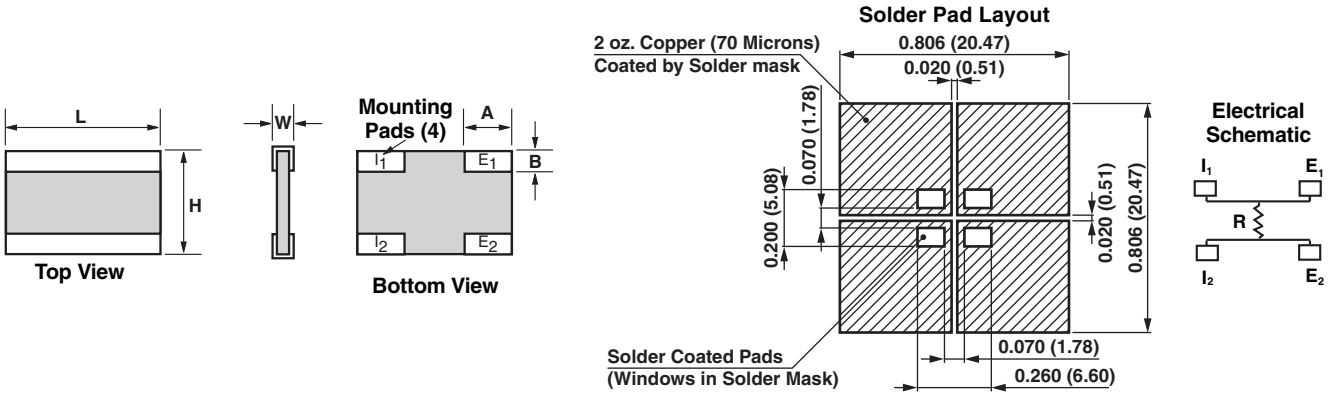
(2) Whichever is lower

(3) See solder pad layout at figure 2

(4) 0.05% and 0.1% are also available per special request

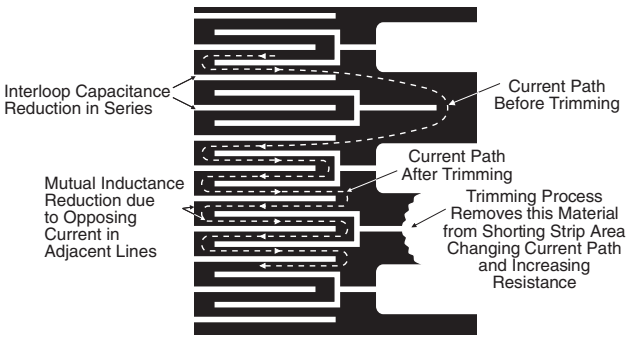
* Pb containing materials are not RoHS compliant, exemptions may apply

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)*



Note: Foil shown in black, etched spaces in white

* 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 hybrid chips.

FIGURE 4 - TYPICAL TCR CURVE Z-FOIL

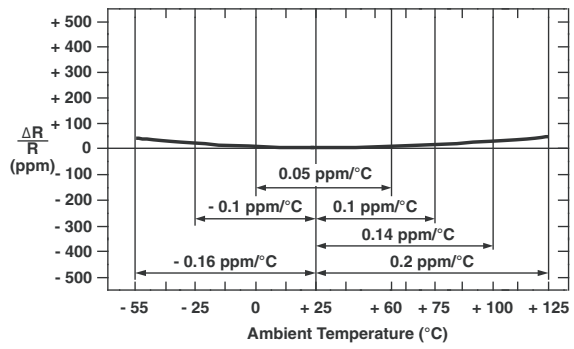


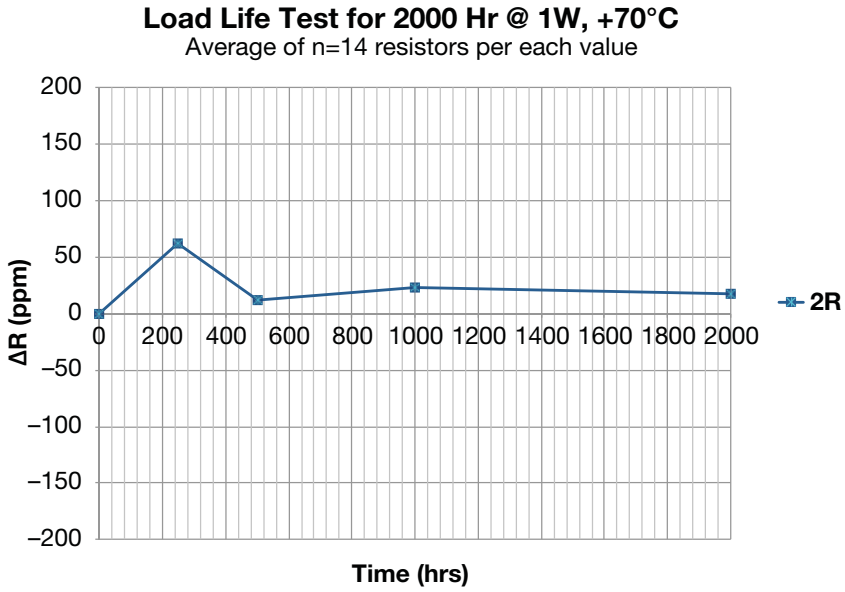
TABLE 2 - PERFORMANCE SPECIFICATIONS

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

FIGURE 5 - LOAD LIFE TEST



POST MANUFACTURING OPERATIONS (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 (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 VPG's Foil applications engineering for assistance in choosing the PMO operations that are right for their application.

FIGURE 6 - COMPARISON OF CURRENT SENSE RESISTORS IN SOLAR PANEL (PRODUCT DEMO)

This video compares the variations in output current of a scaled-down model of a solar panel being monitored by three different current sense resistor technologies as the resistors are heated. All three output signals are displayed together for direct comparison. The next-generation VFR foil resistor is compared to thick film and metal band current sense resistors, all in 4-terminal Kelvin configurations. Each technology has distinctly different patterns of response to the heat source, with the foil having virtually no change and continuing a precise reading of the output current regardless of the heat applied.

TABLE 3 - GLOBAL PART NUMBER INFORMATION

NEW GLOBAL PART NUMBER: Y16061R50000D9W (preferred part number format)

DENOTES PRECISION	VALUE	CHARACTERISTICS (1)
Y	**R** = Ω	**0** = standard part, tin/lead termination **9** = standard part, lead (Pb)-free termination **129** = standard part, gold plated **Other** = custom

Y	1	6	0	6	1	R	5	0	0	0	0	D	9	W

PRODUCT CODE	RESISTANCE TOLERANCE	PACKAGING
1606 = VCS1625ZP	**A** = ± 0.05 % **B** = ± 0.1 % **E** = ± 0.2 % **D** = ± 0.5 % **F** = ± 1.0 % **G** = ± 2.0 % **J** = ± 5.0 %	**R** = tape and reel **W** = waffle pack

FOR EXAMPLE: ABOVE GLOBAL ORDER Y1606 1R50000 D 9 W:

TYPE: VCS1625ZP
VALUE: 1.5 Ω
ABSOLUTE TOLERANCE: ± 0.5 %
TERMINATION: lead (Pb)-free
PACKAGING: waffle pack

HISTORICAL PART NUMBER: VCS1625ZP 1R5000 TCR0.2 D S W (will continue to be used)

VCS1625ZP	1R5000	TCR0.2	D	S	W
MODEL	OHMIC VALUE	TCR	RESISTANCE TOLERANCE	TERMINATION	PACKAGING
VCS1625ZP	1.5 Ω	Characteristic	**A** = ± 0.05 % **B** = ± 0.1 % **E** = ± 0.2 % **D** = ± 0.5 % **F** = ± 1.0 % **G** = ± 2.0 % **J** = ± 5.0 %	**S** = lead (Pb)-free **B** = tin/lead **G** = gold plated	**T** = tape and reel **W** = waffle pack

Note

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

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>>Vishay(威世)