Ultra High Precision Z-Foil Power Current Sensing Resistor with Absolute TCR of ± 0.05 ppm/°C, ESD Immunity up to 25 kV and Tolerance of ± 0.02 %, Power Rating up to 2 W

INTRODUCTION

Today, designers of analog circuits are demanding discrete power current sense resistors that approach the ideal in performance … stable, high speed, high accuracy components that will operate with assured, predictable reliability for years in a variety of environments. Foil is meeting those demands with the VCS232Z of unequalled performances.

These four fundamental factors determine how "ideal" a precision power current sense resistor will be:

1. Initial resistance value or how closely the absolute resistance value can be achieved
2. How precisely the value of individual resistors can be controlled
3. How precisely the end of life tolerance is maintained under a wide range of operating conditions and stress factors (temperature, humidity, load, etc.)
4. Fast response without ringing and fast thermal stabilization - and the ability of the resistor to react to rapid switching without adversely affecting the circuit function.

Until the development of Foil resistors, precise control of all four factors was virtually impossible.

Foil VCS232Z resistor containing the latest version of Z-foil achieves maximum stability, a near zero temperature coefficient and the ability to remove errors due to temperature gradients. This superior performance is built-in for every unit and does not rely on culling or other artificial means for uniform excellence.

TABLE 1 - TOLERANCE AND TCR

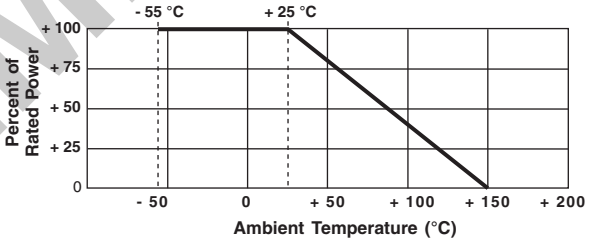
RESISTANCE RANGE (Ω)	TIGHTEST RESISTANCE TOLERANCE	TYPICAL TCR AND MAX. SPREAD (ppm/°C) (1)
0.25 to < 10	± 0.05 %	± 0.2 ± 2.8
10 to 500	± 0.02 %	± 0.2 ± 1.8

Notes

(1) - 55 °C to + 125 °C, + 25 °C ref.

- Contact applications engineering for other available values

FIGURE 1 - POWER DERATING CURVE



(Further Derating Not Necessary)

FEATURES

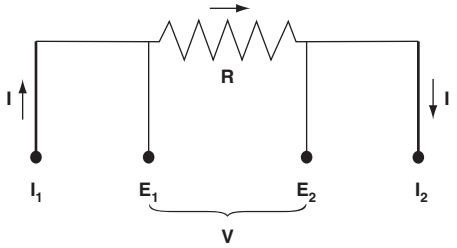
- Temperature coefficient of resistance (TCR): ± 0.05 ppm/°C typical (0 °C to 60 °C) ± 0.2 ppm/°C typical (- 55 °C to + 125 °C, + 25 °C ref.)
- Power coefficient "ΔR due to self heating": 4 ppm/W typical
- Power rating at + 25 °C: 2 W (free air)
- Tolerance: to ± 0.02 %
- Load life stability: to ± 0.005 %, 25 °C for 2000 h at rated power
- Maximum current: 3 A
- Resistance range: 0.25 Ω to 500 Ω
- Foil resistors are not restricted to standard values; specific "as required" values can be supplied at no extra cost or delivery (e.g 100.234 Ω vs. 100 Ω)
- Electrostatic discharge (ESD) up to 25 000 V
- Short time overload ≤ 0.005 %
- Non inductive, non capacitive design
- Rise time: 1 ns effectively no ringing
- Thermal stabilization time < 1 s
- Current noise < - 40 dB
- Thermal EMF: 0.05 µV/°C
- Voltage coefficient < 0.1 ppm/V
- Non inductive: 0.08 µH
- Non hot spot design
- Terminal finish: lead (Pb)-free or tin/lead alloy
- Compliant to RoHS directive 2002/95/EC
- For better performances please contact us
- Prototype quantities available in just 5 working days or sooner. For more information, please contact foil@vishaypg.com

Pb-free Available

RoHS* COMPLIANT

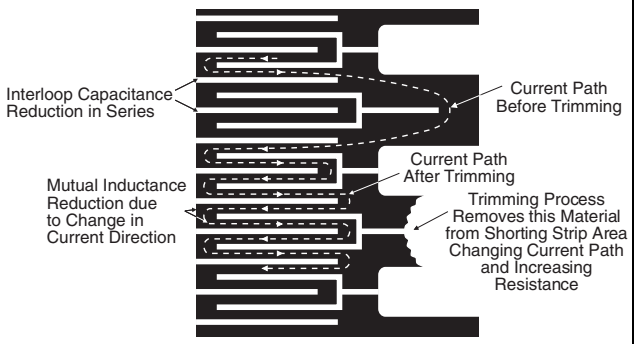
APPLICATIONS

- Automatic test equipment (ATE)
- High precision instrumentation
- Electron beam application
- Medical
- Current sensing applications
- Pulse applications
- Military
- Power amplifier
- Power supplies



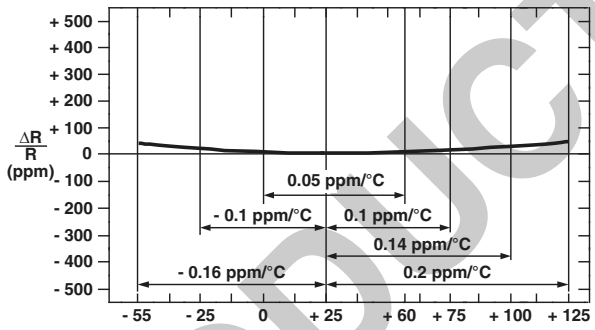
* Pb containing terminations are not RoHS compliant, exemptions may apply

FIGURE 2 - TRIMMING TO VALUES
(conceptual illustration)



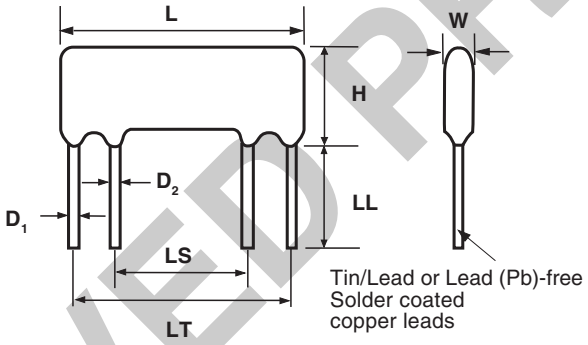
Note: Foil shown in black, etched spaces in white

FIGURE 3 - TYPICAL RESISTANCE/ TEMPERATURE CURVE
(for more details, see table 1)



Ambient Temperature (°C) and TCR Chord Slopes for Different Temperature Ranges

FIGURE 4 - DIMENSIONS in inches (millimeters)



MODEL	L MAX.	H MAX.	W MAX.	LL MIN.	LS ± 0.20 (± 0.5)	LT ± 0.20 (± 0.5)	D_1 NOM.	D_2 NOM.
VCS232Z	1.240 (31.50)	0.512 (13.00)	0.177 (4.50)	0.500 (12.70)	0.688 (17.48)	1.083 (27.51)	0.040 (1.02)	0.032 (0.81)

TABLE 2 - VCS232Z PERFORMANCE SPECIFICATIONS

TEST (Conditions per MIL-PRF-49465)	CONDITIONS	MIL-PRF-49465C ΔR LIMITS	TYPICAL ΔR LIMITS	MAXIMUM ΔR LIMITS
Thermal Shock	- 55 °C to + 125 °C, 5 cycles	± (0.5 % + 0.0005R)	± 0.01 %	± 0.02 %
Short Time Overload	5 x rated power for 5 s	± (0.5 % + 0.0005R)	± 0.005 %	± 0.01 %
Resistance to Soldering Heat	10 s to 12 s at + 260 °C	± (0.25 % + 0.0005R)	± 0.01 %	± 0.02 %
Terminal Strength	Pull test at 5 lb	± (1.0 % + 0.0005R)	± 0.002 %	± 0.005 %
High Temperature Exposure	2000 h, + 150 °C	± (1.0 % + 0.0005R)	± 0.01 %	± 0.02 %
Low Temperature Storage	MIL-PRF-49465, 24 h at - 55 °C	± (0.5 % + 0.0005R)	± 0.002 %	± 0.005 %
Moisture Resistance	MIL-STD-202, method 106, + 65 °C to - 10 °C, 90 % to 98 % RH, rated power, 240 h	± (0.5 % + 0.0005R)	± 0.01 %	± 0.02 %
Shock (Specified Pulse)	100 g, 6 ms	± (0.1 % + 0.0005R)	± 0.01 %	± 0.02 %
Vibration (High Frequency)	(10 Hz to 2000 Hz) 20 g	± (0.1 % + 0.0005R)	± 0.01 %	± 0.02 %
Load Life Stability	2000 h, + 25 °C at rated power	± (1.0 % + 0.0005R)	± 0.005 %	± 0.02 %
Solderability	MIL-STD-202	95 % coverage	-	-

POST MANUFACTURING OPERATIONS OR PMO FOR IMPROVED EOL

Many analog applications can include requirements for performance under conditions of stress beyond the norm 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 Bulk Metal Foil resistors. They stabilize Bulk Metal Foil resistors while they may be harmful to other types. Short time overload, accelerated load life, and temperature cycling are the three PMO methods that do the most to remove the anomalies down the road. Bulk Metal Foil resistors are inherently stable as manufactured. These PMO methods are only of value on Bulk Metal Foil resistors and they improve the performance by small but significant amounts. Users are encouraged to contact Foil applications engineering for assistance in choosing the PMO operations that are right for their application.

TABLE 3 - GLOBAL PART NUMBER INFORMATION (1)

NEW GLOBAL PART NUMBER: Y160845R2361Q9L (preferred part number format)

DENOTES PRECISION	VALUE	CHARACTERISTICS
Y	**R** = Ω	**0** = standard **9** = lead (Pb)-free **1 to 999** = custom

Y	1	6	0	8	4	5	R	2	3	6	1	Q	9	L

PRODUCT CODE	RESISTANCE TOLERANCE	PACKAGING
1608 = VCS232Z	**Q** = ± 0.02 % **A** = ± 0.05 % **B** = ± 0.1 % **D** = ± 0.5 % **F** = ± 1.0 % **G** = ± 2.0 % **J** = ± 5.0 %	**L** = bulk

FOR EXAMPLE: ABOVE GLOBAL ORDER Y1608 45R2361 Q 9 L:

TYPE: VCS232Z
VALUES: 45.2361 Ω
ABSOLUTE TOLERANCE: ± 0.02 %
TERMINATION: lead (Pb)-free
PACKAGING: bulk pack

HISTORICAL PART NUMBER: VCS232ZT 45R2361 TCR0.2 Q B (will continue to be used)

VCS232Z	T	45R2361	TCR0.2	Q	B
MODEL	TERMINATION	OHMIC VALUE	TCR CHARACTERISTIC	ABSOLUTE TOLERANCE	PACKAGING
VCS232Z	**T** = lead (Pb)-free None = tin/lead	45.2361 Ω		**Q** = ± 0.02 % **A** = ± 0.05 % **B** = ± 0.1 % **D** = ± 0.5 % **F** = ± 1.0 % **G** = ± 2.0 % **J** = ± 5.0 %	**B** = bulk

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

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