

## Ultra High Precision Foil Power Current Sensing Resistor with Absolute TCR of $\pm 2 \text{ ppm}/^\circ\text{C}$ , ESD Immunity up to 25 kV and Tolerance of $\pm 0.02 \%$ , Power Rating up to 2 W



### INTRODUCTION

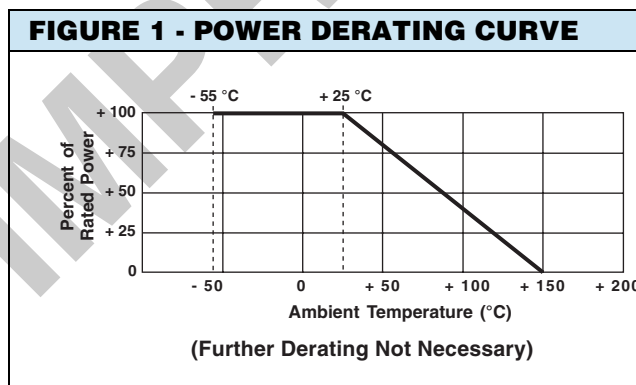
Vishay Foil has developed a new resistor concept, through the use of a proprietary Bulk Metal® Foil and new nanometer-level photo-etching techniques created by the company so that the conductor can closely approximate a flat wire. Because the metals used are not drawn, wound or mistreated in any way during the manufacturing process, Vishay Foil resistors maintain all their design, physical and electrical characteristics. These characteristics are both measurable and predictable before, during and after manufacturing.

Through the entire process, every step is carefully controlled not only to keep the metal in its virgin state, but also to eliminate the effects of any stress that might be imposed either during manufacture or use.

TABLE 1 - TOLERANCE AND TCR		
RESISTANCE RANGE ( $\Omega$ )	TIGHTEST RESISTANCE TOLERANCE (%)	TYPICAL TCR AND MAX. SPREAD ( $\text{ppm}/^\circ\text{C}$ ) <sup>(1)</sup>
0.2 to < 1.0	$\pm 0.05$	$\pm 2 \pm 13$
> 1 to 10	$\pm 0.05$	$\pm 2 \pm 3$
> 10 to 500	$\pm 0.02$	$\pm 2 \pm 3$

#### Notes

- (1) - 55 °C to + 125 °C, + 25 °C ref.  
 • Contact applications engineering for other available values



### FEATURES

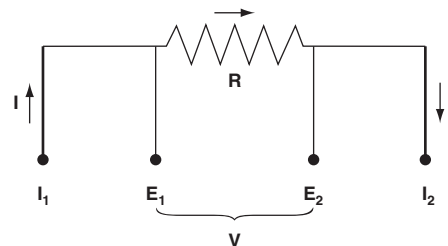
- Temperature coefficient of resistance (TCR):  $\pm 2 \text{ ppm}/^\circ\text{C}$  typical (- 55 °C to + 125 °C, + 25 °C ref.)
- Power rating at + 25 °C: 2 W (free air)
- Tolerance: to  $\pm 0.02 \%$
- Load life stability: to  $\pm 0.01 \%$ , 25 °C for 2000 h at rated power
- Maximum current: 3 A
- Resistance range: 0,2  $\Omega$  to 500  $\Omega$
- Vishay 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  $\Omega$  vs. 100  $\Omega$ )
- Electrostatic discharge (ESD) up to 25 000 V
- Short time overload  $\leq 0.005 \%$
- Non-inductive, non-capacitive design
- Rise time: 1 ns effectively no ringing
- Thermal stabilization < 1 s
- Current noise < - 40 dB
- Thermal EMF: 0.05  $\mu\text{V}/^\circ\text{C}$
- Voltage coefficient < 0.1 ppm/V
- Non-inductive: 0.08  $\mu\text{H}$
- 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](mailto:foil@vishaypg.com)



RoHS\*  
COMPLIANT

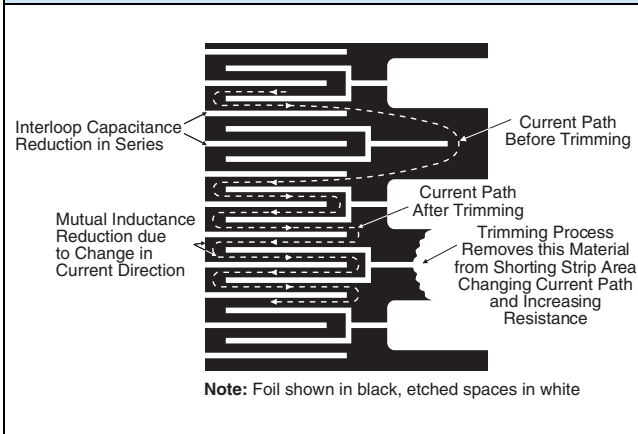
### APPLICATIONS

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

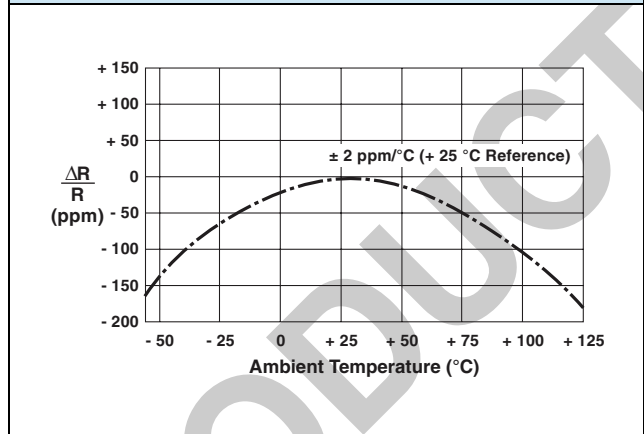


\* Pb containing terminations are not RoHS compliant, exemptions may apply

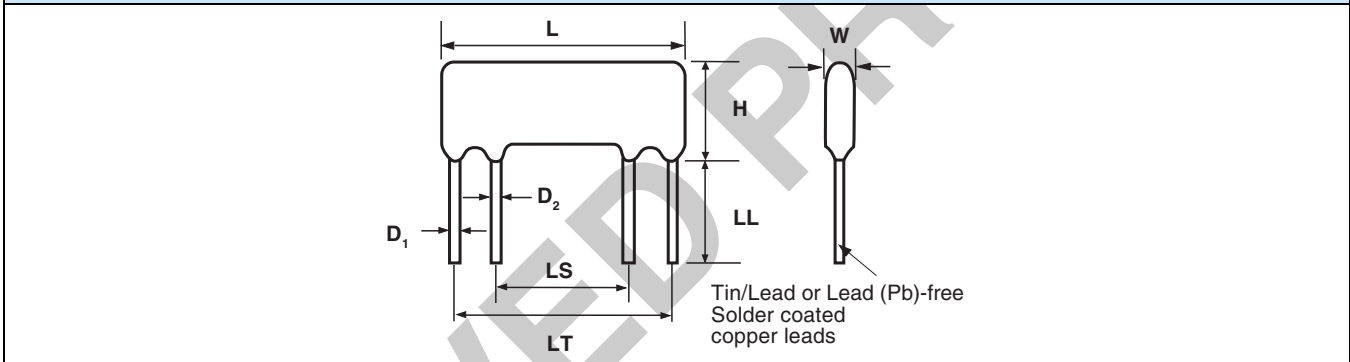
**FIGURE 2 - TRIMMING TO VALUES**  
(Conceptual Illustration)



**FIGURE 3 - TYPICAL RESISTANCE/TEMPERATURE CURVE**



**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 <sub>1</sub> NOM.	D <sub>2</sub> NOM.
VCS232	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 - VCS232 PERFORMANCE SPECIFICATIONS**

TEST (Conditions per MIL-PRF-49465)	CONDITIONS	MIL-PRF-49465B 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)	± 0.01 %	± 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. Vishay 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 Vishay 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: Y094245R2361Q9L (preferred part number format)														
DENOTES PRECISION Y			VALUE R = Ω					CHARACTERISTICS 0 = standard 9 = lead (Pb)-free 1 to 999 = custom						
Y	0	9	4	2	4	5	R	2	3	6	1	Q	9	L
PRODUCT CODE 0942 = VCS232				RESISTANCE TOLERANCE Q = ± 0.02 % A = ± 0.05 % B = ± 0.1 % D = ± 0.5 % F = ± 1.0 % G = ± 2.0 % J = ± 5.0 %					PACKAGING L = bulk					
FOR EXAMPLE: ABOVE GLOBAL ORDER Y0942 45R2361 Q 9 L: TYPE: VCS232 VALUES: 45.2361 Ω ABSOLUTE TOLERANCE: ± 0.02 % TERMINATION: lead (Pb)-free PACKAGING: bulk pack														
HISTORICAL PART NUMBER: VCS232T 45R2361 TCR2 Q B (will continue to be used)														
VCS232		T		45R2361		TCR2		Q		B				
MODEL		TERMINATION		OHMIC VALUE		TCR CHARACTERISTIC		ABSOLUTE TOLERANCE		PACKAGING				
VCS232		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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