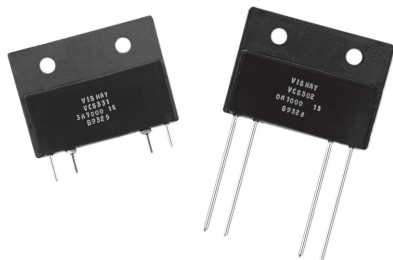


# Bulk Metal® Foil Technology High Precision 4-Terminal Power Current Sensing Resistors with TCR as low as $\pm 1 \text{ ppm}/^\circ\text{C}$ Maximum, Tolerance $\pm 0.1 \%$ and Rise Time $1.0 \text{ ns}$ Effectively No Ringing



## INTRODUCTION

The VCS331 and VCS332 offer precision Bulk Metal® Foil technology resistors as low as  $0.25 \Omega$  with a temperature coefficient down to  $1 \text{ ppm}/^\circ\text{C}$  maximum and unmatched long term stability. The 4 terminal current sensing resistors, when mounted on a heat sink, can sustain  $10 \text{ W}$  continuously without an appreciable change in resistance ( $0.15 \%$  maximum). The typical  $50 \%$  power derating specification associated with other technologies is not necessary. A choice of lead configurations is available.

Our application engineering department is available to advise and make recommendations. For non-standard technical requirements and special applications, please contact us.

## FEATURES

- Temperature coefficient of resistance (TCR): down to  $\pm 1 \text{ ppm}/^\circ\text{C}$  max. (see table 2)
- Tolerance: to  $\pm 0.1 \%$  (see table 1)
- Power rating (heat-sinked):  $10 \text{ W}$
- Load life stability:  $\pm 0.01 \%$  ( $100 \text{ ppm}$ ) at  $25^\circ\text{C}$ ,  $2000 \text{ h}$  at rated power
- Resistance range:  $0.25 \Omega$  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.  $1\text{R}2345$  vs.  $1\text{R}$ )
- Electrostatic discharge (ESD) up to  $25\,000 \text{ V}$
- Non-inductive, non-capacitive design
- Rise time:  $1.0 \text{ ns}$  effectively no ringing
- Current noise:  $0.010 \mu\text{V}_{\text{RMS}}/\text{V}$  of applied voltage ( $< -40 \text{ dB}$ )
- Thermal EMF:  $0.05 \mu\text{V}/^\circ\text{C}$  typical
- Voltage coefficient:  $< 0.1 \text{ ppm}/\text{V}$
- Non-inductive:  $0.08 \mu\text{H}$
- Non hot spot design
- Thermal stabilization time  $< 1 \text{ s}$  (nominal value achieved within  $10 \text{ ppm}$  of steady state value)
- Terminal finish: lead (Pb)-free or tin/lead alloy
- 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 contact application engineering



RoHS\*  
COMPLIANT

TABLE 1 - CHARACTERISTICS

MODEL NUMBER	RESISTANCE RANGE	BEST TOLERANCE (1)	POWER RATING (2) at $+25^\circ\text{C}$	MAXIMUM CURRENT (2)
VCS331, VCS332	$0.25 \Omega < R < 500 \Omega$	$\pm 0.1 \%$	$10 \text{ W}$ on heat sink (3) or $3 \text{ W}$ in free air	$5 \text{ A}$

### Notes

(1) Tighter tolerance is available - for more details contact application engineering

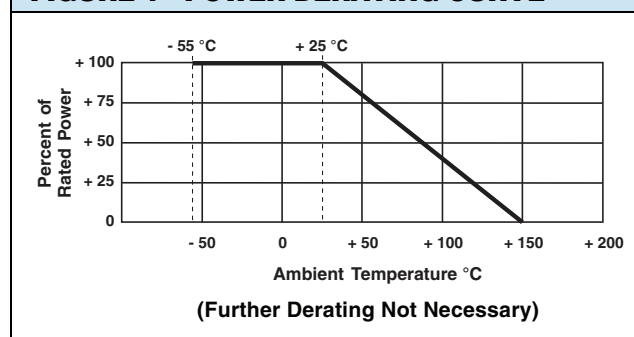
(2) The lower of the two limitations (power or current) is decisive

(3) Heatsink - aluminum ( $6''$  length x  $4''$  width x  $2''$  height x  $0.04''$  thick)

TABLE 2 - TCR CHART (maximum)

(0 $^\circ\text{C}$ TO $+60^\circ\text{C}$ )		
$\geq 0.25 \Omega$	to $< 1 \Omega$	$\pm 3 \text{ ppm}/^\circ\text{C}$
$\geq 1 \Omega$	to $< 10 \Omega$	$\pm 2 \text{ ppm}/^\circ\text{C}$
$\geq 10 \Omega$	to $< 500 \Omega$	$\pm 1 \text{ ppm}/^\circ\text{C}$

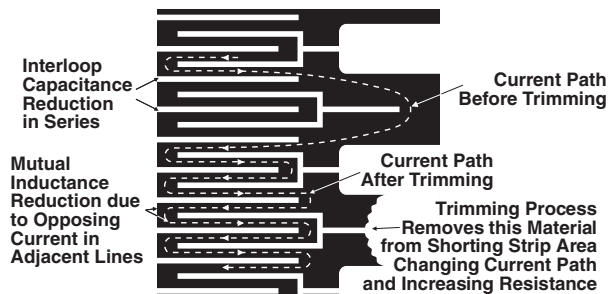
FIGURE 1 - POWER DERATING CURVE



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

**FIGURE 2 - TRIMMING TO VALUES**

(conceptual illustration)

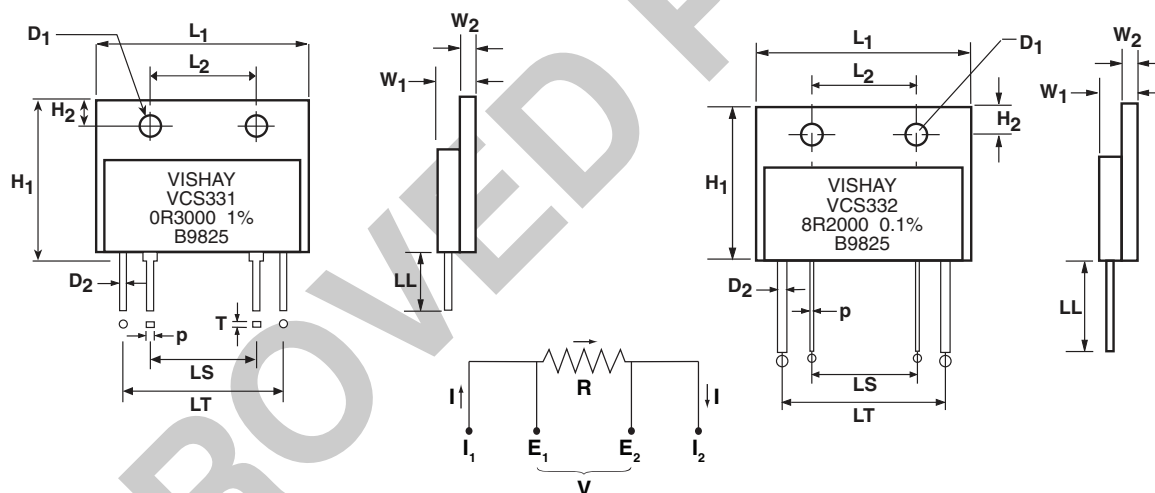


Note: Foil shown in black, etched spaces in white

**FIGURE 3- DIMENSIONS** in inches (millimeters) **AND SCHEMATIC**

Model VCS331 (E Lead Rectangular)

Model VCS332 (Round Leads)



MODEL	$L_1$ $\pm 0.008$ ( $\pm 0.20$ )	$L_2$ $\pm 0.008$ ( $\pm 0.20$ )	$H_1$ MAX.	$H_2$ $\pm 0.008$ ( $\pm 0.20$ )	$W_1$ MAX.	$W_2$ MAX.	LL MIN.	LS $\pm 0.020$ ( $\pm 0.51$ )	LT $\pm 0.020$ ( $\pm 0.51$ )	$D_1$ NOM.	$D_2$ NOM.	P NOM.	T NOM.
VCS331	1.340 (34.04)	0.701 (17.81)	1.063 (27.00)	0.197 (5.00)	0.210 (5.33)	0.087 (2.21)	0.216 (5.49)	0.689 (17.50)	1.083 (27.51)	0.138 (3.51)	0.040 (1.02)	0.040 (1.02)	0.016 (0.41)
VCS332	1.340 (34.04)	0.701 (17.81)	1.024 (26.01)	0.197 (5.00)	0.210 (5.33)	0.087 (2.21)	1.000 (25.40)	0.689 (17.50)	1.083 (27.51)	0.138 (3.51)	0.040 (1.02)	0.032 (0.81)	-

**TABLE 3 - VISHAY VCS331, VCS332 PERFORMANCE**

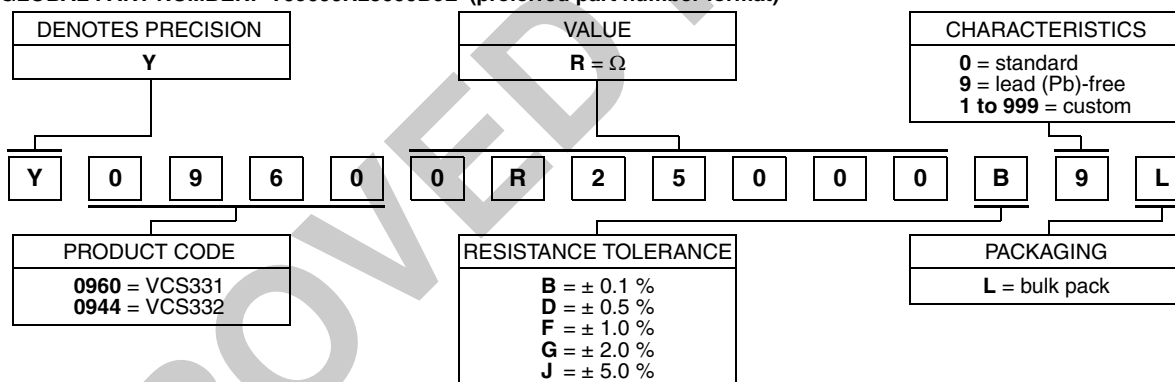
TEST OR CONDITION	VCS331, VCS332 PERFORMANCE <sup>(1)</sup>	
	TYPICAL $\Delta R$ LIMITS	MAXIMUM $\Delta R$ LIMITS
Thermal Shock	0.01 %	0.02 %
Short Time Overload (5 x rated power for 5 s)	0.01 %	0.02 %
Terminal Strength	0.02 %	0.05 %
High Temperature Exposure (2000 h at + 150 °C)	0.02 %	0.05 %
Moisture Resistance	0.03 %	0.05 %
Low Temperature Storage (24 h at - 55 °C)	0.005 %	0.01 %
Shock (specified pulse)	0.01 %	0.02 %
Vibration (high frequency)	0.01 %	0.02 %
Load Life (rated power, + 25 °C, 2000 h)	0.01 %	0.02 %
Resistance Tolerance	0.1 %	1 %
Thermal EMF	0.2 $\mu V/^{\circ}C$ max. (E terminal)	
Weight	8.1 g maximum	

**Notes**

<sup>(1)</sup>  $\Delta R$ 's plus additional 0.0005  $\Omega$  for measurement error

**TABLE 4 - GLOBAL PART NUMBER INFORMATION <sup>(1)</sup>**

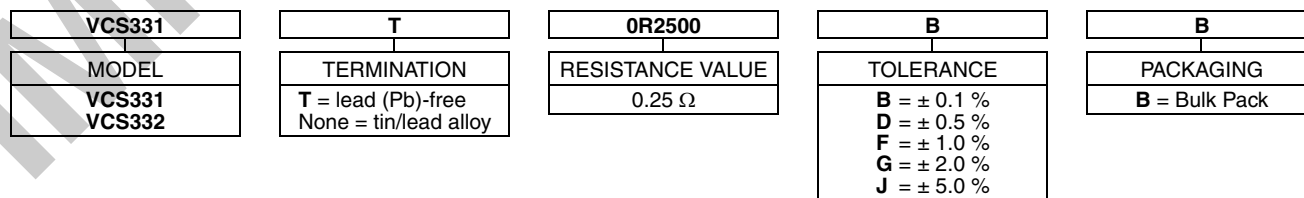
**NEW GLOBAL PART NUMBER: Y09600R25000B9L (preferred part number format)**



FOR EXAMPLE: ABOVE GLOBAL ORDER Y0960 0R25000 B 9 L:

TYPE: VCS331  
VALUE: 0.25  $\Omega$   
ABSOLUTE TOLERANCE:  $\pm 0.1$  %  
TERMINATION: lead (Pb)-free  
PACKAGING: bulk

**HISTORICAL PART NUMBER: VCS331T 0R2500 B B (will continue to be used)**



**Note**

<sup>(1)</sup> For non-standard requests, please contact application engineering

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