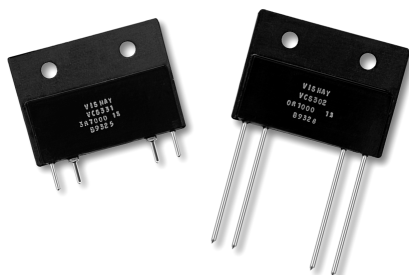


# High Precision 4-Terminal Power Current Sensing Resistors with TCR as low as $\pm 3 \text{ ppm}/^\circ\text{C}$ Maximum, Tolerance to $\pm 0.5 \%$ and Load Life Stability $\pm 0.02 \%$ (200 ppm) at $25^\circ\text{C}$ , 2000 h at Rated Power



## INTRODUCTION

The VCS301 and VCS302 offer precision resistors as low as  $5 \text{ m}\Omega$  with a temperature coefficient down to  $3 \text{ ppm}/^\circ\text{C}$  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  $\pm 3 \text{ ppm}/^\circ\text{C}$  max. (see table 2)
- Tolerance: to  $\pm 0.5 \%$  (see table 1)
- Power rating (heat-sinked):  $10 \text{ W}$
- Load life stability:  $\pm 0.02 \%$  (200 ppm) at  $25^\circ\text{C}$ , 2000 h at rated power
- Resistance range:  $0.005 \Omega$  to  $0.25 \Omega$
- Vishay Foil resistors are not restricted to standard values; specific "as required" values can be supplied at no extra cost or delivery (e.g.  $0\text{R}123$  vs.  $0\text{R}1$ )
- Non inductive, non capacitive design
- Rise time:  $1.0 \text{ ns}$  effectively no ringing
- Thermal EMF:  $0.05 \mu\text{V}/^\circ\text{C}$  typical
- Voltage coefficient:  $< 0.1 \text{ ppm/V}$
- 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
- 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



Available

**RoHS\***  
COMPLIANT

**TABLE 1 - CHARACTERISTICS**

| MODEL NUMBER   | RESISTANCE RANGE                  | TOLERANCE (1) | POWER RATING (2)<br>at $+25^\circ\text{C}$ | MAXIMUM CURRENT (2) |
|----------------|-----------------------------------|---------------|--------------------------------------------|---------------------|
| VCS301, VCS302 | $0.005 \Omega < R < 0.1 \Omega$   | $\pm 1 \%$    | $10 \text{ W}$ on<br>heat sink (3)         | $15 \text{ A}$      |
|                | $0.1 \Omega \leq R < 0.25 \Omega$ | $\pm 0.5 \%$  | or<br>$3 \text{ W}$ in free air            |                     |

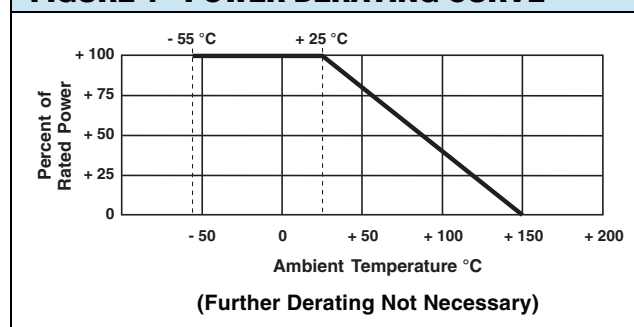
### Notes

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 $+60^\circ\text{C}$ ) |                    |                                     |
|----------------------------------------------|--------------------|-------------------------------------|
| $\geq 0.005 \Omega$                          | to $< 0.01 \Omega$ | $\pm 15 \text{ ppm}/^\circ\text{C}$ |
| $\geq 0.01 \Omega$                           | to $< 0.05 \Omega$ | $\pm 10 \text{ ppm}/^\circ\text{C}$ |
| $\geq 0.05 \Omega$                           | to $< 0.1 \Omega$  | $\pm 5 \text{ ppm}/^\circ\text{C}$  |
| $\geq 0.1 \Omega$                            | to $< 0.25 \Omega$ | $\pm 3 \text{ ppm}/^\circ\text{C}$  |

**FIGURE 1 - POWER DERATING CURVE**

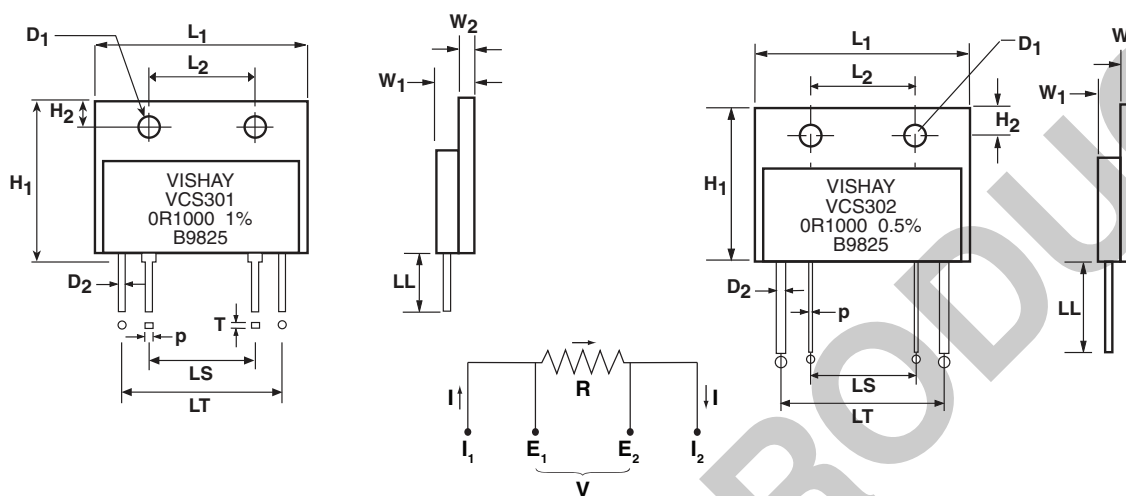


\* Pb containing materials are not RoHS compliant, exemptions may apply

**FIGURE 2 - DIMENSIONS** in inches (millimeters) **AND SCHEMATIC**

Model VCS301 (E lead rectangular)

Model VCS302 (round leads)



| MODEL  | $L_1$<br>$\pm 0.008$<br>( $\pm 0.20$ ) | $L_2$<br>$\pm 0.008$<br>( $\pm 0.20$ ) | $H_1$<br>MAXIMUM | $H_2$<br>$\pm 0.008$<br>( $\pm 0.20$ ) | $W_1$<br>MAXIMUM | $W_2$<br>MAXIMUM | LL<br>MINIMUM    | LS<br>$\pm 0.020$<br>( $\pm 0.51$ ) | LT<br>$\pm 0.020$<br>( $\pm 0.51$ ) | $D_1$<br>NOMINAL | $D_2$<br>NOMINAL | P<br>NOMINAL    | T<br>NO         |
|--------|----------------------------------------|----------------------------------------|------------------|----------------------------------------|------------------|------------------|------------------|-------------------------------------|-------------------------------------|------------------|------------------|-----------------|-----------------|
| VCS301 | 1.340<br>(34.04)                       | 0.701<br>(17.81)                       | 1.063<br>(27.00) | 0.197<br>(5.00)                        | 0.210<br>(5.33)  | 0.087<br>(2.21)  | 0.216<br>(5.49)  | 0.689<br>(17.50)                    | 1.083<br>(27.51)                    | 0.138<br>(3.51)  | 0.040<br>(1.02)  | 0.040<br>(1.02) | 0.016<br>(0.41) |
| VCS302 | 1.340<br>(34.04)                       | 0.701<br>(17.81)                       | 1.024<br>(26.01) | 0.197<br>(5.00)                        | 0.210<br>(5.33)  | 0.087<br>(2.21)  | 1.000<br>(25.40) | 0.689<br>(17.50)                    | 1.083<br>(27.51)                    | 0.138<br>(3.51)  | 0.040<br>(1.02)  | 0.032<br>(0.81) | -               |

**TABLE 3 - VISHAY VCS301, VCS302 PERFORMANCE**

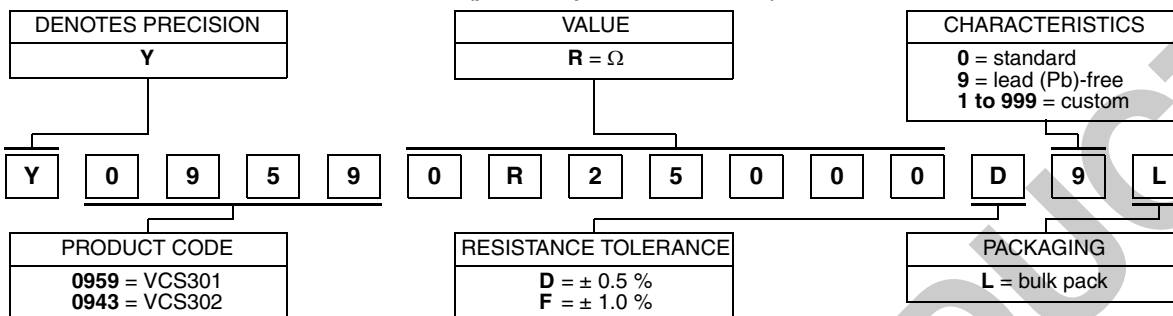
| TEST OR CONDITION                             | VCS301, VCS302 PERFORMANCE <sup>(1)</sup> |                           |
|-----------------------------------------------|-------------------------------------------|---------------------------|
|                                               | TYPICAL $\Delta R$ 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)      | 0.02 %                                    | 0.05 %                    |
| Resistance Tolerance                          | 0.5 %                                     | 1 %                       |
| Thermal EMF                                   | 0.2 $\mu V/^\circ C$ max. (E terminal)    |                           |
| Weight                                        | 8.1 g maximum                             |                           |

**Notes**

- $\Delta R$ 's plus additional 0.0005  $\Omega$  for measurement error
- All measurements done in free air

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

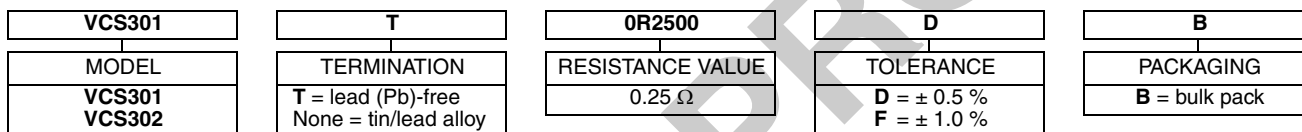
**NEW GLOBAL PART NUMBER: Y09590R25000D9L (preferred part number format)**



FOR EXAMPLE: ABOVE GLOBAL ORDER Y0959 0R25000 D 9 L:

TYPE: VCS301  
VALUE:  $0.25\ \Omega$   
ABSOLUTE TOLERANCE:  $\pm 0.5\%$   
TERMINATION: lead (Pb)-free  
PACKAGING: bulk

**HISTORICAL PART NUMBER: VCS301T 0R2500 D B (will continue to be used)**



**Note**

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

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