Bulk Metal® Foil Technology

Hermetically Sealed Power and Current Sensing Resistor with TCR of 2 ppm/°C and Power up to 10 Watts

FEATURES

- Temperature coefficient of resistance TCR: ±2 ppm/°C typical (–55°C to +125°C, +25°C ref.)
- Tolerance: to ±0.01%
- Power rating (heat-sinked): 10 W
- Load life stability: ±0.01% at 25°C, 2000 h at rated power
- Resistance range: 0.05 Ω to 80 kΩ
- Electrostatic discharge (ESD) up to 25,000 V
- Non inductive, non capacitive design

Pb-free Available

RoHS* COMPLIANT

VHP-3[1] Specifications			
RESISTANCE RANGE (Ω)	TIGHTEST TOLERANCE	TYPICAL TCR[3]	MAXIMUM TCR[3]
50 to 80K	±0.01%	±2 ppm/°C	±5 ppm/°C
25 to <50	±0.02%		±7 ppm/°C
10 to <25	±0.05%		±10 ppm/°C
5 to <10	±0.1%		±13 ppm/°C
2 to <5	±0.25%		±20 ppm/°C
1 to <2	±0.5%		±25 ppm/°C
0.5 to <1	±1.0%		±50 ppm/°C
0.25 to <0.5	±2.0%		
0.1 to <0.25	±5.0%		

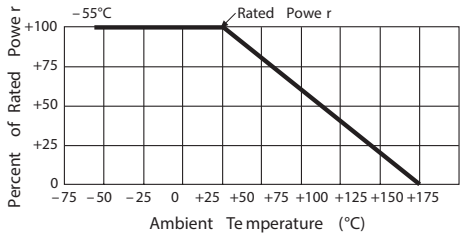
VHP-4 And VPR247 Specifications[1],[2]			
RESISTANCE RANGE (Ω)	TIGHTEST TOLERANCE	TYPICAL TCR[3]	MAXIMUM TCR[3]
10 to 500	±0.01%	±2 ppm/°C	±5 ppm/°C
5 to <10	±0.02%		±6 ppm/°C
2 to <5	±0.05%		±8 ppm/°C
1 to <2	±0.1%		±10 ppm/°C
0.5 to <1	±0.25%		±15 ppm/°C
0.25 to <0.5	±0.5%		±20 ppm/°C
0.1 to <0.25	±1.0%		±25 ppm/°C
0.05 to <0.1	±2.0%		±30 ppm/°C

Notes

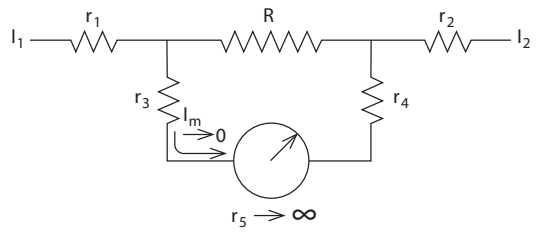
(1) Weight of VHP-3 and VHP-4 = 15 g maximum VPR247 = 7 g maximum
(2) Available up to 500 Ω
(3) –55°C to +125°C, +25°C ref.

General Specifications	
Stability Load life 2000 h Shelf life	 ±0.05% maximum ΔR, 3 W in still air at +25°C ±0.05% maximum ΔR under full rated power (10 W at +25°C on heat sink) ±0.0005% (5 ppm) maximum ΔR/year
Power Rating At +25°C	 10 W or 3 A – heat sink[2] 3 W or 3 A – free air
Current Noise	<0.010 μV_{RMS}/V of applied voltage (–40 dB)
High Frequency Operation Rise time Inductance (L)[3] Capacitance (C)	 1.0 ns at 1 kΩ without ringing 0.1 µH maximum; 0.08 µH typical 1.0 pF maximum; 0.5 pF typical
Voltage Coefficient	<0.1 ppm/V
Operating Temperature Range	–55°C to +150°C
Hermeticity	10^{-7} Atmospheric cc/s maximum
Maximum Working Voltage[7]	600 V
Thermal EMF[8]	0.1 µV/°C maximum (lead effect) 2.5 µV/W maximum (power effect)

Power Derating Curve



Kelvin Connection



Kelvin (4-terminal) connections are used for these low ohmic value products to measure a precise voltage drop across the resistive element. In these applications the contact resistance, lead resistance, and their TCR effect may be greater than that of the element itself and could cause significant errors if the standard 2-terminal connection is used. Figure 2 shows a high impedance measurement system where r_5 approaches infinity and I_m approaches zero resulting in negligible IR drop through r_3 and r_4 which negates their lead resistance and TCR effect. With the voltage sense leads E_1 and E_2 inside of r_1 and r_2 the resistance and TCR effect of the current leads, I_1 and I_2 are negated and only the resistance and TCR of the element R are sensed. This method of measurement is essential for precise current sensing.

Environmental Performance			
	METHOD PARAGRAPH[6]	MIL-PRF-39009 ΔR LIMITS	VHP-3, VHP-4 AND VPR247 TYPICAL ΔR TEST DATA[9]
Test Group I Conditioning	4.8.2	±0.2%+0.01 Ω	±0.03%
Test Group II Resistance temperature Characteristic (–55°C to +125°C)	4.8.4	<1 Ω ±100 ppm/°C; 1 Ω to 19.6 Ω: ±50 ppm/°C; ≥ 20 Ω: ±30 ppm/°C	See tables 1 and 2, page 1
Low temperature storage	4.8.16	±0.3%+0.01 Ω	±0.005%
DWV (300 V at atmospheric pressure)	4.8.5	±0.2%+0.01 Ω	±0.005%
Insulation resistance	4.8.6	10^4 MΩ	>10^4 MΩ
Low temperature operation	4.8.7	±0.3%+0.01 Ω	±0.01%
Short time overload[8] (5 s at 15 W)	4.8.8	±0.3%+0.01 Ω	±0.03%
Moisture resistance	4.8.9	±0.5%+0.01 Ω	±0.02%
Terminal strength	4.8.10	±0.2%+0.01 Ω	±0.005%
Test Group III Shock – specified pulse (Post-test DWV at 300 V) Vibration – high frequency (Post-test DWV at 300 V)	4.8.11 4.8.12	±0.2%+0.01 Ω ±0.2%+0.01 Ω	±0.005%±0.005%
Test Group IV Life test 10 W at 25°C for 2,000 h 80% power at +70°C for 2,000 h	4.8.13 –	±1.0%+0.01 Ω –	±0.01%±0.04%
Test Group V High temperature exposure 2,000 h at +150°C	4.8.14	±1.0%+0.05 Ω	±0.05%

Notes

(1) Whichever is lower.

(2) Heat sink chassis dimensions and requirements per MIL-PRF-39009/1:

	INCHES	MILLIMETERS
L	6.00	152.4
W	4.00	101.6
H	2.00	50.8
T	0.04	1.0

(3) Inductance (L) due mainly to the leads.

(4) The resolution limit of existing test equipment (within the measurement capability of the equipment, or “essentially zero”).

(5) Not to exceed power rating of resistor.

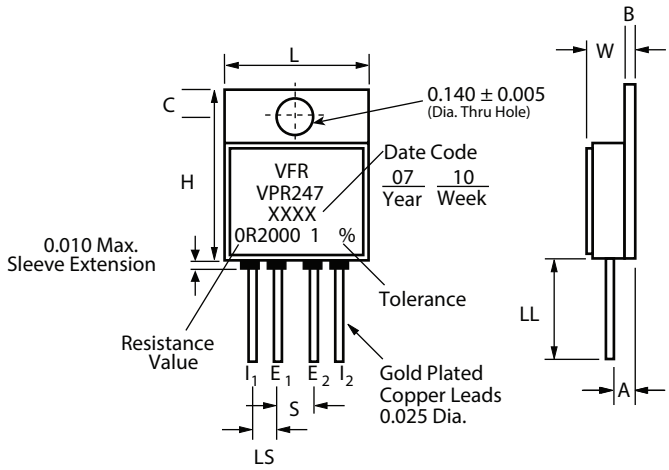
(6) VFR test data as compared to MIL-PRF-39009 is shown for illustration purposes, VFR test conditions that deviate from the Mil test method are noted within parentheses.

(7) Maximum ambient temperature rating is +150°C.

(8) Maximum overload rating is 15 W (5× rated power in free air; 1.5× rated power on heatsink), with applied voltage not to exceed 750 V.

(9) ΔR’s are as shown plus 0.001 Ω to allow for measurement errors at low resistance values.

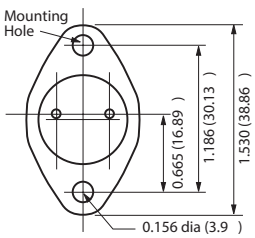
VPR247 Standard Imprinting and Dimensions



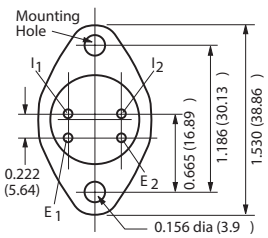
DIMENSION	INCHES	MM
L	0.690±0.005	17.53±0.13
H	0.820±0.005	20.83±0.13
W	0.215±0.005	5.46±0.13
LL	0.500 minimum	12.70 minimum
LS	0.100±0.005	2.54±0.13
S	0.200±0.005	5.08±0.13
A	0.120±0.005	3.05±0.13
B	0.040±0.005	1.02±0.13
C	0.120±0.005	3.05±0.13

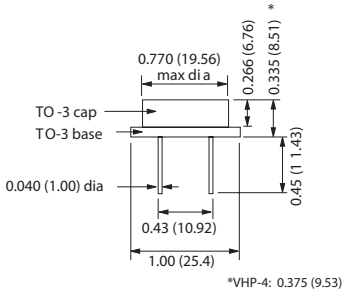
VHP-3, VHP-4 Standard Imprinting and Dimensions in inches (millimeters)

VHP- 3

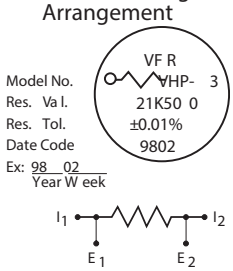


VHP-4 (4 terminal)





Standard Marking Arrangement



Case not active; insulators not required; mounting hardware not supplied.

Global Part Number Information[1]

NEW GLOBAL PART NUMBER : Y0065500R000T9L (preferred part number format)

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

Y	0	0	6	5	5	0	0	R	0	0	0	T	9	L

PRODUCT CODE	RESISTANCE TOLERANCE	PACKAGING
0065 = VHP-3 0066 = VHP-4 0830 = VPR247	T = ±0.01% Q = ±0.02% A = ±0.05% B = ±0.1% C = ±0.25% D = ±0.5% F = ±1.0% G = ±2.0% J = ±5.0%	L = bulk pack

FOR EXAMPLE: ABOVE GLOBAL ORDER Y0065 500 R000 T 9 L:
TYPE: VHP-3
VALUE: 500.0 Ω
ABSOLUTE TOLERANCE: ±0.01%
TERMINATION: lead (Pb)-free
PACKAGING: bulk pack

HISTORICAL PART NUMBER: VHP-3 T 500R00 T B (will continue to be used)

VHP-3	T	500R00	T	B
MODEL	TERMINATION	OHMIC VALUE	RESISTANCE TOLERANCE	PACKAGING
VHP-3 VHP-4 VPR247	T = lead (Pb)-free None = tin/lead alloy	500 Ω	T = ±0.01% Q = ±0.02% A = ±0.05% B = ±0.1% C = ±0.25% D = ±0.5% F = ±1.0% G = ±2.0% J = ±5.0%	B = bulk pack

Note
[1] For non-standard requests, please contact application engineering.