Ultra High Precision Bulk Metal® Z-Foil Surface Mount Power Resistor in TO-220 Configuration with TCR of ± 0.05 ppm/°C, PCR of 4 ppm/W and Load Life Stability of ± 0.005 % (50 ppm)

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.) (see table 1)
- Tolerance: to ± 0.01 %
- Power coefficient "ΔR due to self heating": 4 ppm/W typical
- Rated power: 8 W chassis mounted (MIL-PRF-39009)
- Load life stability: to ± 0.005 % at 25 °C for 2000 h, at 1.5 W
- Resistance range: 0.5 Ω to 500 Ω
- Foil resistors are not restricted to standard values; specific "as requested" values can be supplied at no extra cost or delivery (e.g. 100R2345 vs. 100R)
- Electrostatic discharge (ESD) up to 25 000 V
- Short time overload ≤ 0.001 % (10 ppm)
- Non-inductive, non-capacitive design
- Rise time: 1 ns effectively no ringing
- Current noise: 0.010 μV_{RMS}/V of applied voltage (< - 40 dB)
- Thermal EMF: 0.05 µV/°C typical
- Voltage coefficient < 0.1 ppm/V
- Non-inductive: < 0.08 µH
- Non hot spot design
- Thermal stabilization time < 1 s (nominal value achieved within 10 ppm of steady state value)
- 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
- For better performances please contact us

Pb-free Available

RoHS* COMPLIANT

INTRODUCTION

The Z-Foil technology provides a significant reduction of the resistive component's sensitivity to ambient temperature variations (TCR) and applied power changes (PCR).

Model VPR221SZ is a 4 lead kelvin connected surface mount device which provides high rated power, excellent load life stability, low temperature coefficient (TCR) and low power coefficient (PCR) - all in one resistor. ± 0.05 ppm/°C absolute TCR removes error due to temperature gradients.

By taking advantage of the overall stability and reliability of Bulk Metal® Z-Foil resistors, designers can significantly reduce circuit errors and greatly improve overall circuit performances.

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

TABLE 1 - TCR AND TOLERANCE

RESISTANCE RANGE (Ω)	TIGHTEST RESISTANCE TOLERANCE	TYPICAL TCR AND MAX. SPREAD (1)
0.5 to < 1	± 0.05 %	± 0.2 ppm/°C ± 2.8 ppm/°C
1 to < 10	± 0.02 %	± 0.2 ppm/°C ± 2.3 ppm/°C
10 to 500	± 0.01 %	± 0.2 ppm/°C ± 1.8 ppm/°C

Notes

(1) MIL-range (- 55 °C to + 125 °C, + 25 °C ref.)

- Contact applications engineering for other available values

FIGURE 1 - SCHEMATICS

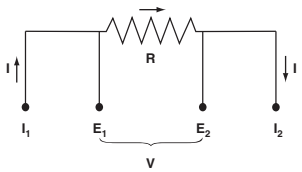
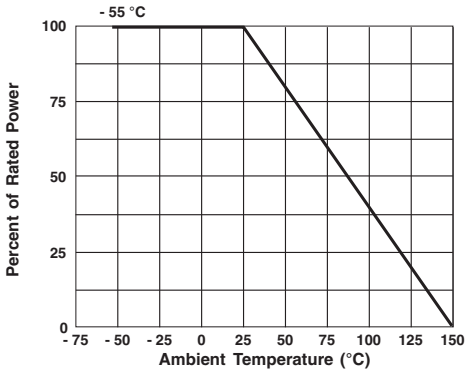
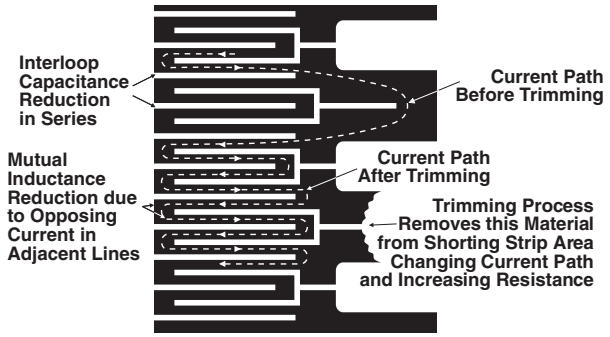


FIGURE 2 - POWER DERATING CURVE



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

FIGURE 3 - TRIMMING TO VALUES
(conceptual illustration)



Note: Foil shown in black, etched spaces in white

FIGURE 4 - TYPICAL RESISTANCE/ TEMPERATURE CURVE
(for more details see table 1)

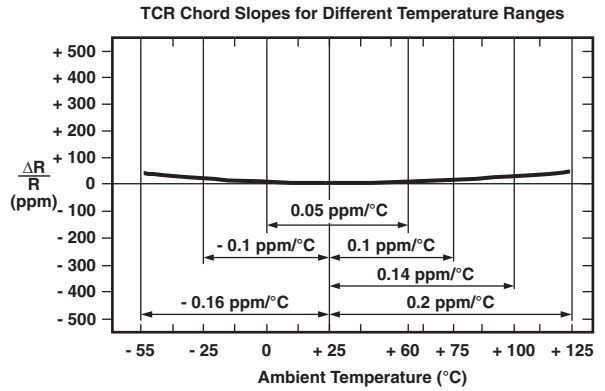


FIGURE 5 - VPR221SZ FORMING DIMENSIONS in inches (millimeters)

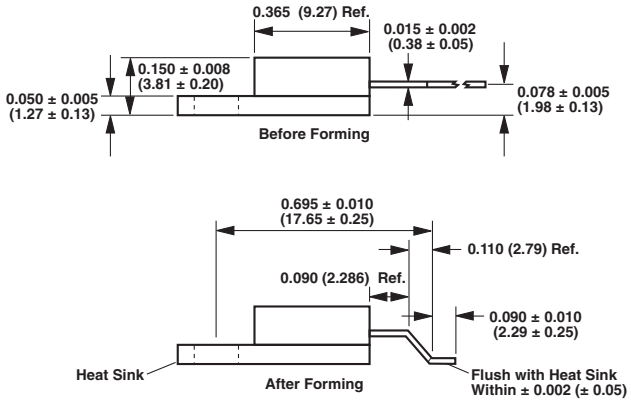


FIGURE 6 - VPR221SZ DIMENSIONS
in inches (millimeters)

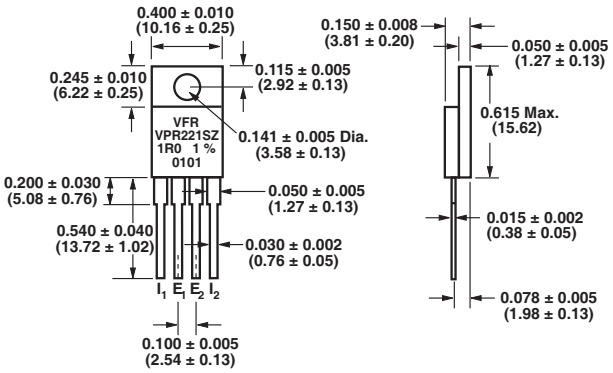


FIGURE 7 - LAND PATTERN DIMENSIONS in inches (millimeters)

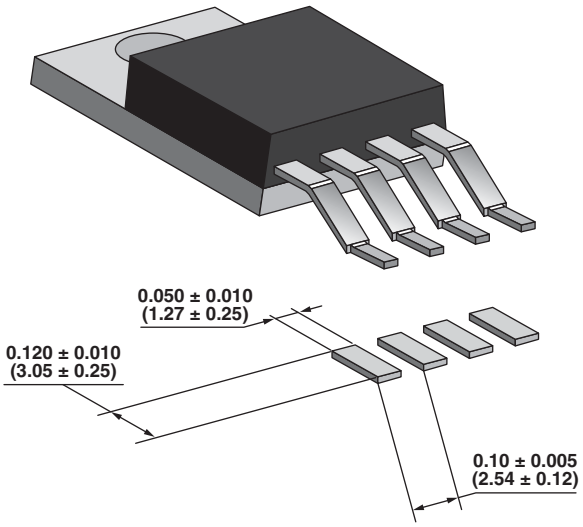


TABLE 2 - SPECIFICATIONS	
Power Rating at + 25 °C	8 W or 3 A (1) on heat sink (2) 1.5 W in free air **Further derating not necessary.**
Current Noise	< 0.010 μV_{RMS}/V of applied voltage (- 40 dB)
High Frequency Operation Rise Time Inductance (L) (3) Capacitance (C)	 0.2 ns at 1 W 0.1 µH maximum: 0.03 µH typical 1.0 pF maximum: 0.5 pF typical
Voltage Coefficient (4)	< 0.1 ppm/V
Operating Temperature Range	- 55 °C to + 150 °C
Maximum Working Voltage	300 V, not to exceed power rating
Thermal EMF (5)	0.15 µV/°C maximum (lead effect)
Weight	1.2 g maximum

Notes

(1) Whichever is lower

(2) Heat sink chassis dimensions are requirements per MIL-R-39009/1B:

DIMENSIONS	inches	mm
L	6.00	152.4
W	4.00	101.6
H	2.00	50.8
T	0.04	1.0

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

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

(5) µV/°C relates to EMF due to lead temperature difference

TABLE 3 - PERFORMANCE SPECIFICATIONS (1) MIL-PRF 39009			
TEST OR CONDITION	**MIL-PRF 39009**	**TYPICAL ΔR**	**MAXIMUM ΔR**
Low temperature storage 24 h at - 55 °C	± 0.3 % + 0.01 Ω	± 0.001 % (10 ppm)	± 0.002 % (20 ppm)
Dielectric withstanding voltage 300 V_{AC} at Atm	± 0.2 % + 0.01 Ω	± 0.001 % (10 ppm)	± 0.002 % (20 ppm)
Dielectric withstanding voltage 200 V_{AC} at Brm	± 0.2 % + 0.01 Ω	± 0.001 % (10 ppm)	± 0.002 % (20 ppm)
Insulation resistance	> 10^4 MΩ		> 10^4 MΩ
Low temperature operation	± 0.3 % + 0.01 Ω	± 0.002 % (20 ppm)	± 0.008 % (80 ppm)
Short time overload 5 x rated power for 5 s (in air)	± 0.3 % + 0.01 Ω	± 0.001 % (10 ppm)	± 0.002 % (20 ppm)
Moisture resistance + 65 °C to - 10 °C, 90 RH to 98 RH, 10 days	± 0.5 % + 0.01 Ω	± 0.005 % (50 ppm)	± 0.015 % (150 ppm)
Terminal strength	± 0.2 % + 0.01 Ω	± 0.001 % (10 ppm)	± 0.002 % (20 ppm)
Load life 8 W at + 25 °C, 2000 h with heat sink	± 1.0 % + 0.01 Ω	± 0.005 % (50 ppm)	± 0.015 % (150 ppm)
Load life 1.5 W at + 25 °C for 2000 h in free air	± 1.0 % + 0.01 Ω	± 0.005 % (50 ppm)	± 0.015 % (150 ppm)
High temperature exposure + 150 °C	± 1.0 % + 0.05 Ω	± 0.005 % (50 ppm)	± 0.01 % (100 ppm)

Note

(1) Measurement error ± 0.001 %

TABLE 4 - GLOBAL PART NUMBER INFORMATION (1)

NEW GLOBAL PART NUMBER: Y2123420R220T9L (preferred part number format)

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

Y	2	1	2	3	4	2	0	R	2	2	0	T	9	L

PRODUCT CODE	RESISTANCE TOLERANCE	PACKAGING
2123 = VPR221SZ	**T** = ± 0.01 % **Q** = ± 0.02 % **A** = ± 0.05 % **B** = ± 0.1 % **C** = ± 0.25 % **D** = ± 0.5 % **F** = ± 1.0 %	**L** = bulk **R** = tape and reel

FOR EXAMPLE: ABOVE GLOBAL ORDER Y2123 420R220 T 9 L:

TYPE: VPR221SZ
VALUE: 420.22 Ω
ABSOLUTE TOLERANCE: ± 0.01 %
TERMINATION: lead (Pb)-free
PACKAGING: bulk

HISTORICAL PART NUMBER: VPR221SZ T 420R22 TCR0.2 T B (will continue to be used)

VPR221SZ	T	420R22	TCR0.2	T	B
MODEL	TERMINATION	OHMIC VALUE	TCR CHARACTERISTIC	ABSOLUTE TOLERANCE	PACKAGING
	T = lead (Pb)-free none = tin/lead	420.22 Ω	**TCR0.2**	**T** = ± 0.01 % **Q** = ± 0.02 % **A** = ± 0.05 % **B** = ± 0.1 % **C** = ± 0.25 % **D** = ± 0.5 % **F** = ± 1.0 %	**B** = bulk **T** = tape and reel

Note

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

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