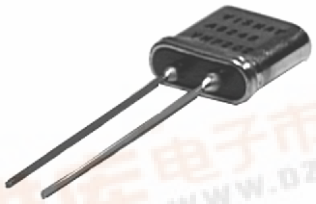
Hermetically Sealed Miniature Ultra High Precision Z-Foil Technology Resistors with TCR of 0.05 ppm/°C, Tolerance of ± 0.001 % and Load Life Stability of ± 0.005 %, Unaffected by Humidity



Any value available within resistance range

INTRODUCTION

The Z-foil based oil filled, hermetically sealed VHP203 resistor represents an industry breakthrough. The hermetic sealing eliminates the ingress of moisture and oxygen, while the oil acts as a thermal conductor, thus eliminating long term degradation of elements of unsealed resistors, while at the same time allowing the device to accept short periods of overload without degradation.

The VHP203 is also available with laboratory and metrology level precision and long term stability with additional inhouse oriented process such as: special TCR plotting, chip stabilitzation inhouse thermal shock and bake prior to sealing, combined thermal shock and power conditioning on finished product, thermal and power conditioning, CLT.

The Z-foil technology provides a significant reduction of the resistive components sensitivity to ambient temperature variations (TCR) and applied power changes (PCR). When combined with the hermetic sealing and oil filling, the VHP203 resistor become **the most precise and stable resistor available**.

The value of the hermetic enclosure over the molded part is in long term performance.

With accuracy of ± 0.001 % (10 ppm) and a resistance range from 10 Ω to 150 kΩ and long term shelf life of less than 2 ppm, this device is virtually a secondary standard that can be carried in sets for daily or periodic calibration of factory measurement equipment.

FEATURES

Pb-free Available

RoHS* COMPLIANT

- **Temperature coefficient of resistance (TCR):** ± 0.05 ppm/°C (0 °C to 60 °C)
- **Power coefficient "ΔR due to self heating":** 5 ppm at rated power
- **Tolerance:** to ± 0.001 % (10 ppm)
- Load life stability: ± 0.002 % maximum ΔR (60 °C for 2000 h at 0.1 W per chip)
- Electrostatic discharge (ESD) > 25 000 V
- Resistance range: 10 Ω to 150 kΩ (higher or lower values of resistance available)
- Power rating: 0.3 W at + 25 °C
- Shelf life stability: **2 ppm for at least 10 years**
- Non inductive, non capacitive design
- Non hot spot design
- Rise time: 1.0 ns without ringing
- Current noise: < - 40 dB
- Thermal EMF: 0.05 µV/°C typical
- Voltage coefficient: < 0.1 ppm/V
- Non inductive: < 0.08 µH
- Terminal finishes available: lead (Pb)-free
  tin/lead alloy
- Impervious to harmful environments - oil filled
- For better performances, please contact us
- Prototype samples available from 24 h. For more information, please contact foil@vishay.com

APPLICATIONS

- Metrology
- Laboratory
- Industrial
- Measurement

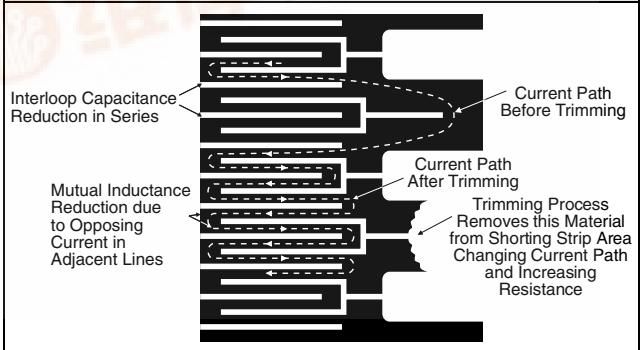
TABLE 1 - TCR VS. RESISTANCE VALUE

RESISTANCE VALUE (Ω)	TYPICAL TCR AND MAX. SPREAD (- 55 °C to + 125 °C, + 25 °C ref.) (ppm/°C)[1)]
100 to < 150K	± 0.2 ± 2
50 to < 100	± 0.2 ± 3
10 to < 50	± 0.2 ± 4

Note

1. For lower TCR and for selected TCR tracking, please contact us

FIGURE 1 - TRIMMING TO VALUES
(Conceptual Illustration)



Note: Foil shown in black, etched spaces in white

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

VHP203 (Z-Foil)

Vishay Foil Resistors Hermetically Sealed Miniature Ultra High Precision Z-Foil Technology
Resistors with TCR of 0.05 ppm/°C, Tolerance of ± 0.001 % and
Load Life Stability of ± 0.005 %, Unaffected by Humidity

TABLE 2 - MODEL SELECTION

MODEL NUMBER	RESISTANCE RANGE (Ω)	MAXIMUM WORKING VOLTAGE[1)]	POWER RATING at + 25 °C	AVERAGE WEIGHT (g)	CONSTRUCTION BRIEF	DIMENSIONS	
						INCHES	mm
VHP203 VHP203J	10 to 66K 66K to 150K	300	0.3 W 0.2 W	1.4	Oil-filled, tinned copper leads, nickel shell, kovar and glass header	W: 0.185 ± 0.020 L: 0.435 ± 0.020 H: 0.375 ± 0.020 LL: 1.000 ± 0.125 LS: 0.150 ± 0.010[2)] ST: 0.095 Max.	4.70 ± 0.51 11.05 ± 0.51 10.92 ± 0.51 25.4 ± 3.18 3.81 ± 0.25 2.41 Max.

Note
- See next page for numbered footnotes

TABLE 3 - STANDARD RESISTANCE TOLERANCE

TIGHTEST (Ω)	LOOSEST (%)
1K to 150K	± 0.001
500R to 1K	± 0.0025
50R to 500R	± 0.005
30R to 50R	± 0.01
20R to 30R	± 0.02
10R to 20R	± 0.05

Note
- See next page for numbered footnotes

FIGURE 2 - TYPICAL TCR CURVE Z-FOIL

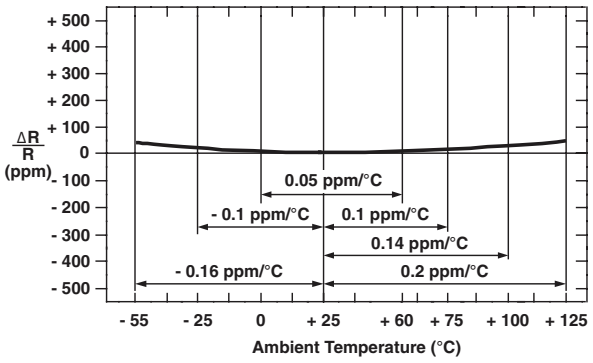


FIGURE 3 - POWER DERATING CURVE

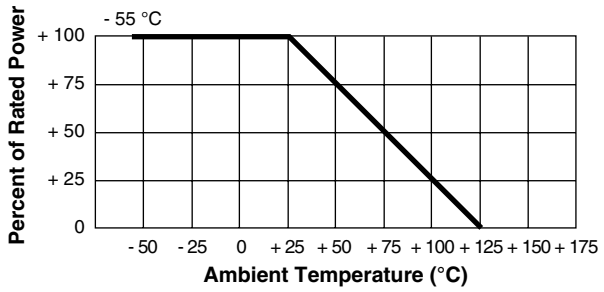


FIGURE 4 - STANDARD IMPRINTING AND DIMENSIONS

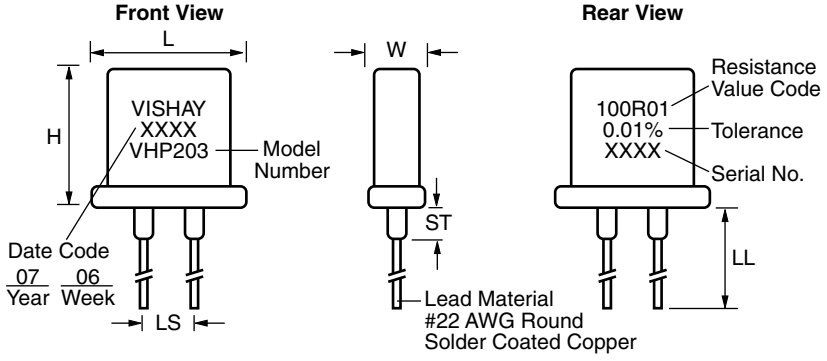


TABLE 3 - "H" SERIES SPECIFICATIONS	
Stability[6)]	
Load life at 2000 h	± 0.002 % maximum ΔR at 0.1 W per chip and at + 60 °C
Shelf life	± 2 ppm (0.0002 %) after at least 10 years
Current Noise	< 0.010 µV (RMS)/V of applied voltage (- 40 dB)
High Frequency Operation	
Rise time	1.0 ns without ringing
Inductance (L)[3)]	0.1 µH maximum; 0.08 µH typical
Capacitance (C)	1.0 pF maximum; 0.5 pF typical
Voltage Coefficient	< 0.1 ppm/V[4)]
Thermal EMF[5)]	0.1 µV/°C maximum; 0.05 µV/°C typical; 1 µV/W maximum
Hermeticity	10^{-7} atmospheric cc/s maximum

Notes

1. Not to exceed power rating of resistor
2. 0.200" (5.08 mm) lead spacing available - specify VHP203J
3. Inductance (L) due mainly to the leads
4. The resolution limit of existing test equipment (within measurement capability of the equipment, or "essentially zero")
5. µV/°C relates to EMF due to lead temperature difference and µV/W due to power applied to the resistor
6. Load life ΔR max. can be reduced through in-house oriented processes

TABLE 4 - ENVIRONMENTAL PERFORMANCE COMPARISON			
	MIL-PRF-55182 CHAR J	**VHP203 MAXIMUM ΔR**	**VHP203 TYPICAL ΔR**
Test Group I			
Thermal shock, 5 x (- 55 °C to + 125 °C)	± 0.2 %	± 0.01 % (100 ppm)	± 0.002 % (20 ppm)
Short time overload, 6.25 x rated power, 5 s	± 0.2 %	± 0.01 % (100 ppm)	± 0.003 % (30 ppm)
Test Group II			
Resistance temperature characteristics	± 25 ppm/°C	table 1	± 0.05 ppm/°C
Characteristic			
Low temperature storage (24 h at - 65 °C)	± 0.15 %	± 0.01 % (100 ppm)	± 0.002 % (20 ppm)
Low temperature operation (45 min, rated power at - 65 °C)	± 0.15 %	± 0.01 % (100 ppm)	± 0.002 % (20 ppm)
Terminal strength	± 0.2 %	± 0.01 % (100 ppm)	± 0.002 % (20 ppm)
Test Group III			
DWV	± 0.15 %	± 0.01 % (100 ppm)	± 0.002 % (20 ppm)
Resistance to solder heat, 20 s at + 260 °C	± 0.1 %	± 0.01 % (100 ppm)	± 0.005 % (50 ppm)
Moisture resistance	± 0.4 %	± 0.005 % (50 ppm)	± 0.001 % (10 ppm)
Test Group IV			
Shock	± 0.2 %	± 0.01 % (100 ppm)	± 0.002 % (20 ppm)
Vibration	± 0.2 %	± 0.01 % (100 ppm)	± 0.002 % (20 ppm)
Test Group V			
Life test at 0.3 W at + 25 °C			
2000 h	± 0.5 %	± 0.008 % (80 ppm)	± 0.002 % (20 ppm)
Test Group Va			
Life test at 0.1 W at + 60 °C	± 0.5 %	± 0.008 % (80 ppm)	± 0.002 % (20 ppm)
Test Group VI			
High temperature exposure (2000 h at + 125 °C)	± 2.0 %	± 0.02 % (200 ppm)	± 0.005 % (50 ppm)
Test Group VII			
Voltage coefficient	5 ppm/V	< 0.1 ppm/V	< 0.1 ppm/V

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TABLE 5 - GLOBAL PART NUMBER INFORMATION

NEW GLOBAL PART NUMBER: Y6072120K500V9L (preferred part number format)

DENOTES PRECISION	VALUE	AER*
Y	**R** = Ω **K** = kΩ	**0** = standard product, tin/lead termination **1** = with plastic sleeve, tin/lead termination **9** = standard product, lead (Pb)-free termination **19** = with plastic sleeve, lead (Pb)-free termination **Other** = custom

Y	6	0	7	2	1	2	0	K	5	0	0	V	9	L

PRODUCT CODE	RESISTANCE TOLERANCE	PACKAGING
6072 = VHP203 **6073** = VHP203J	**S** = ± 0.001 % **U** = ± 0.002 % **X** = ± 0.0025 % **V** = ± 0.005 % **T** = ± 0.01 % **Q** = ± 0.02 % **A** = ± 0.05 % **B** = ± 0.1 % **C** = ± 0.25 % **D** = ± 0.5 % **F** = ± 1.0 %	**L** = bulk pack

FOR EXAMPLE: ABOVE GLOBAL ORDER Y6072 120K500 V 9 L:

TYPE: VHP203
VALUE: 120.5 kΩ
ABSOLUTE TOLERANCE: ± 0.005 %
TERMINATION: lead (Pb)-free
PACKAGING: bulk pack

HISTORICAL PART NUMBER: VHP203T 120K50 V B (will continue to be used)

VHP203	T		120K50	V	B
MODEL	TERMINATION	PLASTIC SLEEVE	OHMIC VALUE	TOLERANCE	PACKAGING
VHP203 **VHP203J**	**T** = lead (Pb)-free **None** = tin/lead	**P** = plastic sleeve **None** = standard	**120K50** = 120.5 kΩ	**S** = ± 0.001 % **U** = ± 0.002 % **X** = ± 0.0025 % **V** = ± 0.005 % **T** = ± 0.01 % **Q** = ± 0.02 % **A** = ± 0.05 % **B** = ± 0.1 % **C** = ± 0.25 % **D** = ± 0.5 % **F** = ± 1.0 %	**B** = bulk pack

Note

* Application engineering release: for non-standard requests, please contact application engineering.

Disclaimer

All product specifications and data are subject to change without notice.

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