

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 stabilization 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.

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

FEATURES

- 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

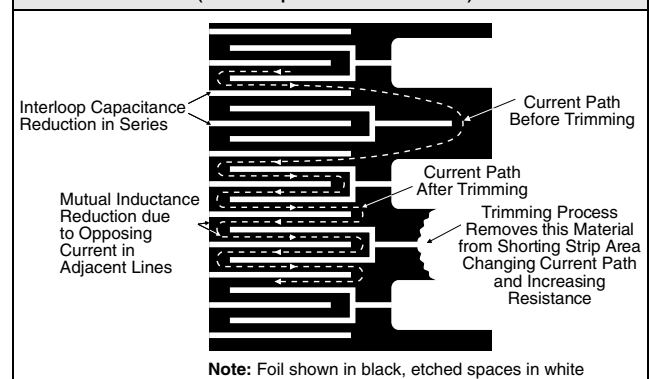


RoHS*
COMPLIANT

APPLICATIONS

- Metrology
- Laboratory
- Industrial
- Measurement

FIGURE 1 - TRIMMING TO VALUES
(Conceptual Illustration)



* 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 $0.05 \text{ ppm/}^\circ\text{C}$, Tolerance of $\pm 0.001 \%$ and
Load Life Stability of $\pm 0.005 \%$, Unaffected by Humidity

TABLE 2 - MODEL SELECTION

MODEL NUMBER	RESISTANCE RANGE (Ω)	MAXIMUM WORKING VOLTAGE ¹⁾	POWER RATING at + 25 $^\circ\text{C}$	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: $0.150 \pm 0.010^{2)}$ 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

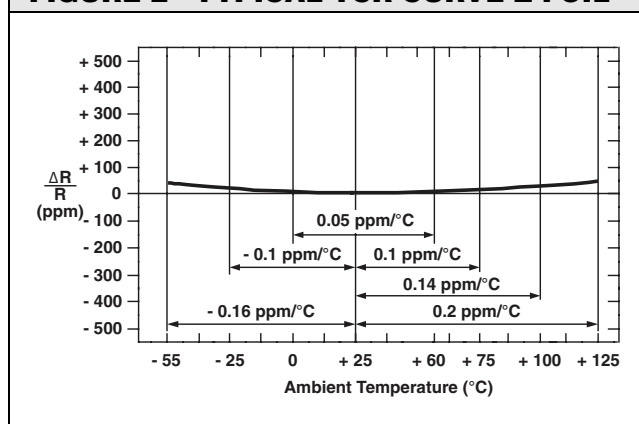


FIGURE 3 - POWER DERATING CURVE

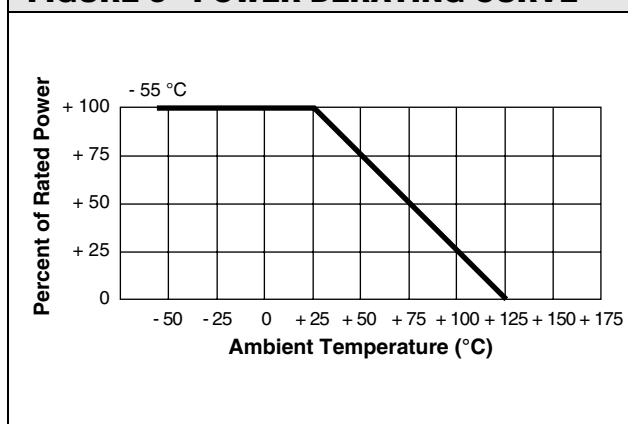
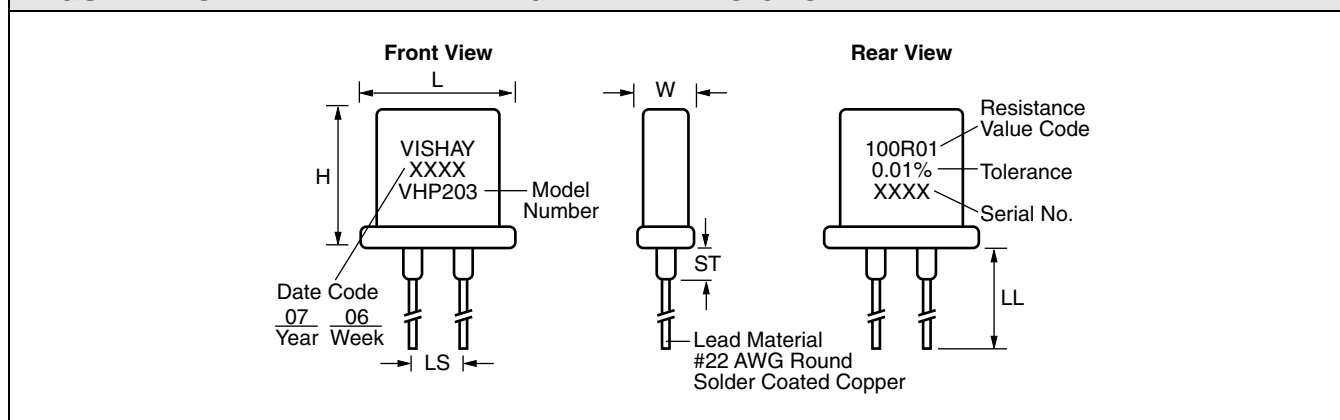


FIGURE 4 - STANDARD IMPRINTING AND DIMENSIONS





Hermetically Sealed Miniature Ultra High Precision Z-Foil Technology Vishay Foil Resistors
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TABLE 3 - "H" SERIES SPECIFICATIONS

Stability⁶⁾ Load life at 2000 h Shelf life	$\pm 0.002 \%$ maximum ΔR at 0.1 W per chip and at $+ 60^{\circ}\text{C}$ $\pm 2 \text{ ppm}$ (0.0002 %) after at least 10 years
Current Noise	$< 0.010 \mu\text{V}$ (RMS)/V of applied voltage (- 40 dB)
High Frequency Operation Rise time Inductance (L) ³⁾ Capacitance (C)	1.0 ns without ringing 0.1 μH maximum; 0.08 μH typical 1.0 pF maximum; 0.5 pF typical
Voltage Coefficient	$< 0.1 \text{ ppm}/\text{V}^{4)}$
Thermal EMF⁵⁾	0.1 $\mu\text{V}/^{\circ}\text{C}$ maximum; 0.05 $\mu\text{V}/^{\circ}\text{C}$ typical; 1 $\mu\text{V}/\text{W}$ 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. $\mu\text{V}/^{\circ}\text{C}$ relates to EMF due to lead temperature difference and $\mu\text{V}/\text{W}$ 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 $^{\circ}\text{C}$ to + 125 $^{\circ}\text{C}$) Short time overload, 6.25 x rated power, 5 s	$\pm 0.2 \%$ $\pm 0.2 \%$	$\pm 0.01 \%$ (100 ppm) $\pm 0.01 \%$ (100 ppm)	$\pm 0.002 \%$ (20 ppm) $\pm 0.003 \%$ (30 ppm)
Test Group II Resistance temperature characteristics Characteristic Low temperature storage (24 h at - 65 $^{\circ}\text{C}$) Low temperature operation (45 min, rated power at - 65 $^{\circ}\text{C}$) Terminal strength	$\pm 25 \text{ ppm}/^{\circ}\text{C}$ $\pm 0.15 \%$ $\pm 0.15 \%$ $\pm 0.2 \%$	table 1 $\pm 0.01 \%$ (100 ppm) $\pm 0.01 \%$ (100 ppm) $\pm 0.01 \%$ (100 ppm)	$\pm 0.05 \text{ ppm}/^{\circ}\text{C}$ $\pm 0.002 \%$ (20 ppm) $\pm 0.002 \%$ (20 ppm) $\pm 0.002 \%$ (20 ppm)
Test Group III DWV Resistance to solder heat, 20 s at + 260 $^{\circ}\text{C}$ Moisture resistance	$\pm 0.15 \%$ $\pm 0.1 \%$ $\pm 0.4 \%$	$\pm 0.01 \%$ (100 ppm) $\pm 0.01 \%$ (100 ppm) $\pm 0.005 \%$ (50 ppm)	$\pm 0.002 \%$ (20 ppm) $\pm 0.005 \%$ (50 ppm) $\pm 0.001 \%$ (10 ppm)
Test Group IV Shock Vibration	$\pm 0.2 \%$ $\pm 0.2 \%$	$\pm 0.01 \%$ (100 ppm) $\pm 0.01 \%$ (100 ppm)	$\pm 0.002 \%$ (20 ppm) $\pm 0.002 \%$ (20 ppm)
Test Group V Life test at 0.3 W at + 25 $^{\circ}\text{C}$ 2000 h	$\pm 0.5 \%$	$\pm 0.008 \%$ (80 ppm)	$\pm 0.002 \%$ (20 ppm)
Test Group Va Life test at 0.1 W at + 60 $^{\circ}\text{C}$	$\pm 0.5 \%$	$\pm 0.008 \%$ (80 ppm)	$\pm 0.002 \%$ (20 ppm)
Test Group VI High temperature exposure (2000 h at + 125 $^{\circ}\text{C}$)	$\pm 2.0 \%$	$\pm 0.02 \%$ (200 ppm)	$\pm 0.005 \%$ (50 ppm)
Test Group VII Voltage coefficient	5 ppm/V	$< 0.1 \text{ ppm}/\text{V}$	$< 0.1 \text{ ppm}/\text{V}$

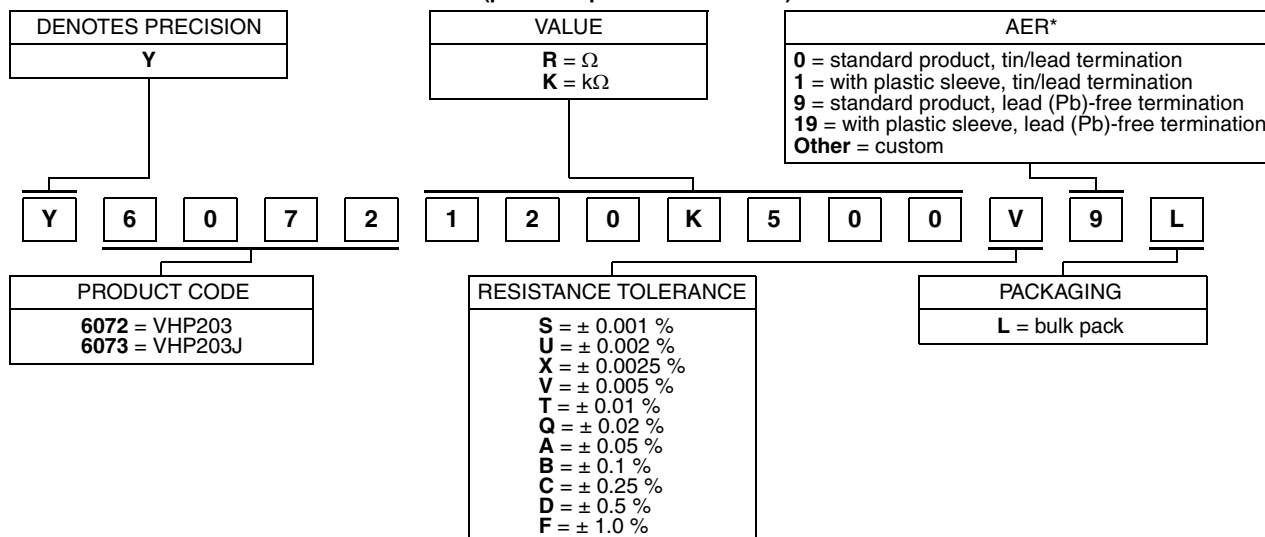
VHP203 (Z-Foil)



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TABLE 5 - GLOBAL PART NUMBER INFORMATION

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



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

TYPE: VHP203

VALUE: $120.5 \text{ k}\Omega$

ABSOLUTE TOLERANCE: $\pm 0.005 \%$

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 = $120.5 \text{ k}\Omega$	S = $\pm 0.001 \%$ U = $\pm 0.002 \%$ X = $\pm 0.0025 \%$ V = $\pm 0.005 \%$ T = $\pm 0.01 \%$ Q = $\pm 0.02 \%$ A = $\pm 0.05 \%$ B = $\pm 0.1 \%$ C = $\pm 0.25 \%$ D = $\pm 0.5 \%$ F = $\pm 1.0 \%$	B = bulk pack

Note

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



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