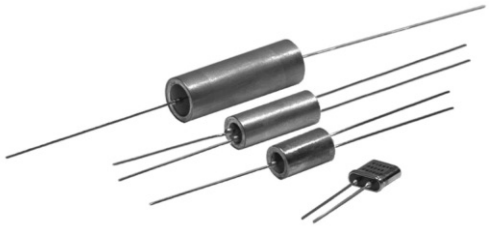
Hermetically Sealed Ultra High Precision Z-Foil Technology Resistors with TCR of ± 0.2 ppm/°C, Tolerance of ± 0.001 % and Load Life Stability of ± 0.005 %



Any value available within resistance range

INTRODUCTION

The Z-foil based oil filled, hermetically sealed HZ-series resistors represent 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 elements of unsealed resistors, while at the same time allowing the device to accept short periods of overload without degradation.

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 H-series resistors become **the most precise and stable resistors available**.

With accuracies of ± 0.001 % and a resistance range from 5 Ω to 1.1 MΩ and long term shelf life of less than 2 ppm, these devices are virtually secondary standards that can be carried in sets for daily or periodic calibration of factory measurement equipment.

The VHA series is also available with laboratory and metrology level precision and long term stability with additional in-house oriented process such as: special TCR plotting, mounted chip stabilization, thermal shock and bake prior to sealing, combined thermal shock and power conditioning on finished product, thermal and power conditioning, component linearity test.

TABLE 1 - TOLERANCE AND 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 < 1M1	± 0.2 ± 2
50 to < 100	± 0.2 ± 3
5 to < 50	± 0.2 ± 4

Note

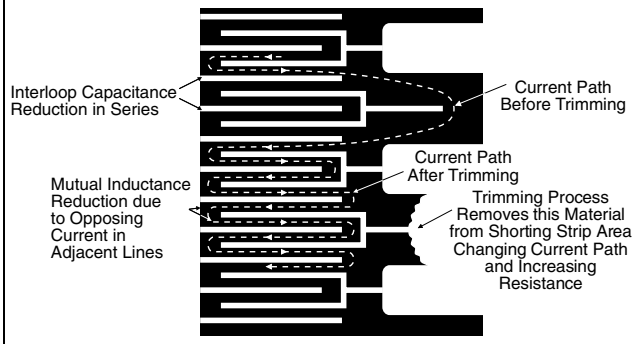
1. For lower TCR and for selected TCR tracking, please contact us

FEATURES

Pb-free Available

- **Temperature coefficient of resistance (TCR):** ± 0.2 ppm/°C typical (- 55 °C to + 125 °C, + 25 °C ref.)
- **Power coefficient "ΔR due to self heating":** 5 ppm at rated power
- **Tolerance:** to ± 0.001 %
- 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: 5 Ω to 1.1 MΩ (higher or lower values of resistance available)
- Power rating: 0.3 to 2.5 W at + 25 °C (depending on model - see table 2)
- 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

FIGURE 1 - TRIMMING TO VALUES
(Conceptual Illustration)



Note: Foil shown in black, etched spaces in white

TABLE 2 - MODEL SELECTION

MODEL NUMBER	RESISTANCE RANGE (Ω)	STANDARD RESISTANCE TOLERANCE		MAXIMUM WORKING VOLTAGE[2]	POWER RATING at + 25 °C	AVERAGE WEIGHT (g)	CONSTRUCTION BRIEF	DIMENSIONS[3]	
		TIGHTEST (Ω)	LOOSEST (%)					INCHES	mm
VHP202Z VHP202ZJ	10 to 66k 66K to 100K			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: 0.430 ± 0.020** LL: 1.000 ± 0.125 LS: 0.150 ± 0.010[4] 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.
VHA412Z	10 to 66K 66K to 100K			250	0.3 W 0.2 W	4.6		L: 0.625 ± 0.031 D: 0.375 ± 0.031 LL: 1.000 Min.	15.88 ± 0.79 9.53 ± 0.79 25.4 Min.
VHA414Z	5 to 120K > 120K to 200K	1K to □[1] 500 to < 1K 50 to < 500 30 to < 50 20 to < 30 10 to < 20 5 to < 10	± 0.001 ± 0.1 ± 0.0025 ± 0.1 ± 0.005 ± 0.1 ± 0.01 ± 0.1 ± 0.02 ± 0.1 ± 0.05 ± 0.1 ± 0.1 ± 0.1	350	0.5 W 0.3 W	7.3		L: 1.000 ± 0.031 D: 0.375 ± 0.031 LL: 1.000 Min.	25.4 ± 0.79 9.53 ± 0.79 25.4 Min.
VHA512Z*	5 to 180K 180K to 300K			350	0.75 W 0.4 W	6.3		L: 0.625 ± 0.031 D: 0.500 ± 0.031 LL: 1.000 Min.	15.88 ± 0.79 12.7 ± 0.79 25.4 Min.
VHA516-4Z* VHA516-5Z* VHA516-6Z*	5 to 240K > 240K to 400K 5 to 300K > 300K to 500K 5 to 360K > 360K to 600K			500	1.0 W 0.5 W 1.25 W 0.6 W 1.5 W 0.7 W	9.2	Oil-filled, tinned copper leads, tinned brass shell, kovar and glass end bells	L: 1.000 ± 0.031 D: 0.500 ± 0.031 LL: 1.000 Min.	25.4 ± 0.79 12.7 ± 0.79 25.4 Min.
VHA518-7Z* VHA518-8Z* VHA518-9Z* VHA518-10Z* VHA518-11Z*	5 to 420K > 420K to 700K 5 to 480K > 480K to 800K 5 to 540K > 540K to 900K 5 to 600K > 600K to 1.0M 5 to 660K > 660K to 1.1M			600	1.75 W 0.8 W 2.0 W 0.9 W 2.25 W 1.0 W 2.5 W 1.1 W 2.5 W 1.2 W	13.5		L: 1.500 ± 0.031 D: 0.500 ± 0.031 LL: 1.000 Min.	38.1 ± 0.79 12.7 ± 0.79 25.4 Min.

Notes

* Available in a 4-lead terminal: VHA512 please use 302073Z
VHA516 please use 302074Z
VHA518 please use 302075Z

** 0.375 H available

See next page for numbered footnotes

FIGURE 2 - TYPICAL TCR CURVE Z-FOIL

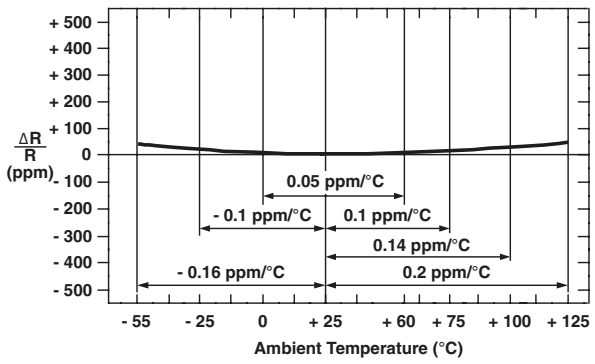


FIGURE 3 - POWER DERATING CURVE

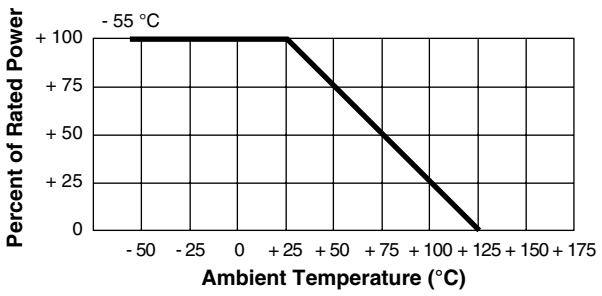


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FIGURE 4 - STANDARD IMPRINTING AND DIMENSIONS

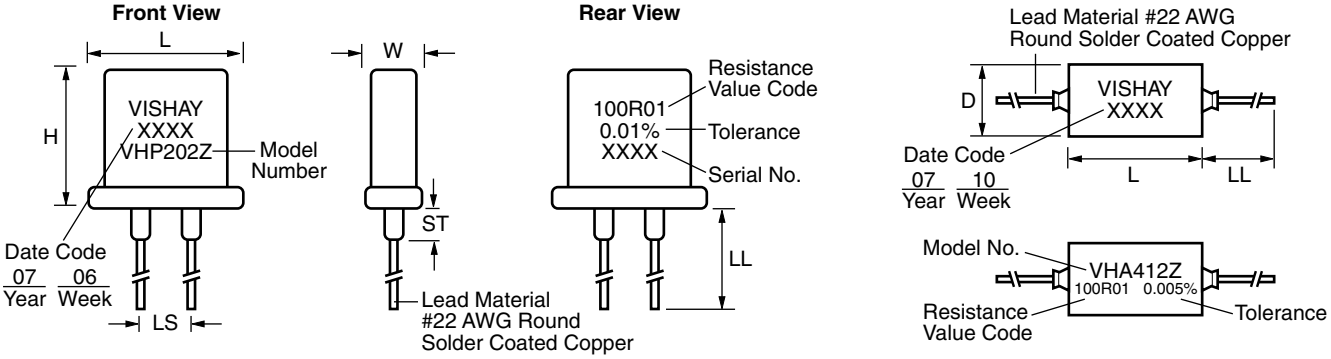

TABLE 3 - "H" SERIES SPECIFICATIONS

Stability[8)]	
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)[5)]	0.1 µH maximum; 0.08 µH typical
Capacitance (C)	1.0 pF maximum; 0.5 pF typical
Voltage Coefficient	< 0.1 ppm/V[6)]
Thermal EMF[7)]	0.1 µV/°C maximum; 0.05 µV/°C typical; 1 µV/W maximum
Hermeticity	10^{-7} atmospheric cc/s maximum

Notes

1. Upper end of resistance range varies with model selected (i.e. VHP202Z; the range is to 100 kΩ; VHA518-10Z, the range is to 1.0 MΩ) per Table 2
2. Not to exceed power rating of resistor
3. Insulating sleeve - a special case insulating plastic sleeve is available on VHAZ models - specify letter "P" as a suffix to model number (i.e. VHA412ZP)
4. 0.200" (5.08 mm) lead spacing available - specify VHP202ZJ
5. Inductance (L) due mainly to the leads
6. The resolution limit of existing test equipment (within measurement capability of the equipment, or "essentially zero")
7. µV/° relates to EMF due to lead temperature difference and µV/watt due to power applied to the resistor
8. Load life ΔR max. can be reduced through in-house oriented processes

TABLE 4 - GLOBAL PART NUMBER INFORMATION

NEW GLOBAL PART NUMBER: Y1750120K500V9L (preferred part number format)

DENOTES PRECISION	VALUE	AER*
Y	**R** = Ω **K** = kΩ **M** = MΩ	**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	1	7	5	0	1	2	0	K	5	0	0	V	9	L

PRODUCT CODE	RESISTANCE TOLERANCE	PACKAGING
6071 = VHP202Z **1748** = VHP202ZJ **1749** = VHA412Z **1751** = VHA414Z **1750** = VHA512Z **1752** = VHA516-4Z **1753** = VHA516-5Z **1754** = VHA516-6Z **1755** = VHA518-7Z **1756** = VHA518-8Z **1757** = VHA518-9Z **1758** = VHA518-10Z **1759** = VHA518-11Z	**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 Y1750 120K500 V 9 L:

TYPE: VHA512Z
VALUE: 120.5 kΩ
ABSOLUTE TOLERANCE: ± 0.005 %
TERMINATION: lead (Pb)-free
PACKAGING: bulk pack

HISTORICAL PART NUMBER: VHA512ZT 120K50 V B (will continue to be used)

VHA512Z	T		120K50	V	B
MODEL	TERMINATION	PLASTIC SLEEVE	OHMIC VALUE	TOLERANCE	PACKAGING
VHP202Z **VHP202ZJ** **VHA412Z** **VHA414Z** **VHA512Z** **VHA516-4Z** **VHA516-5Z** **VHA516-6Z** **VHA518-7Z** **VHA518-8Z** **VHA518-9Z** **VHA518-10Z** **VHA518-11Z**	**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.

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