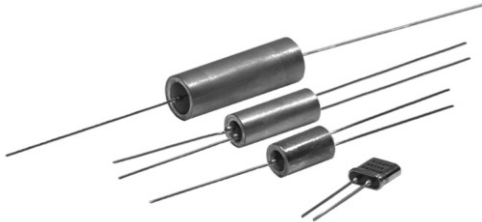


Hermetically Sealed High Precision Bulk Metal[®] Foil Technology Resistors with TCR of $\pm 2 \text{ ppm}/^\circ\text{C}$, Tolerance of $\pm 0.001 \%$ and Load Life Stability of $\pm 0.005 \%$



Any value at any tolerance available within resistance range

INTRODUCTION

The H series resistors are oil-filled, hermetically sealed ultra precision resistors.

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.

Vishay's Bulk Metal[®] Foil outperforms all other resistor technologies available today for applications that require precision and stability. When combined with the hermetic sealing and oil filling, the H series resistors become **one of the most precise and stable resistors available.**

With accuracies of 0.001 %, a resistance range from 5 Ω to 1.84 M Ω , 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.

FEATURES

- Temperature coefficient of resistance (TCR): $\pm 2 \text{ ppm}/^\circ\text{C}$ typical (- 55 $^\circ\text{C}$ to + 125 $^\circ\text{C}$, + 25 $^\circ\text{C}$ ref.)
- Power rating: 0.3 to 2.5 W at + 25 $^\circ\text{C}$ (depending on model - see table 2)
- Tolerance: to $\pm 0.001 \%$
- Load life stability: $\pm 0.005 \%$ (70 $^\circ\text{C}$ for 2000 h at half rated power)
- Shelf life stability: $\pm 2 \text{ ppm}$ for at least 10 years
- Resistance range: 5 Ω to 1.84 M Ω (higher or lower values of resistance available)
- Electrostatic discharge (ESD) above 25 000 V
- Rise time: 1.0 ns without ringing
- Current noise: < - 40 dB
- Thermal EMF: 0.05 $\mu\text{V}/^\circ\text{C}$ typical
- Voltage coefficient: < 0.1 ppm/V
- Non inductive: < 0.08 μH
- Non inductive, non capacitive design
- Non hot spot design
- Terminal finishes available: lead (Pb)-free tin/lead alloy
- Impervious to harmful environments - oil-filled
- Any value available within resistance range (e.g. 1K234)
- Prototype samples available from 48 h. For more information, please contact foil@vishay.com
- For better performances, please see H series (Z)

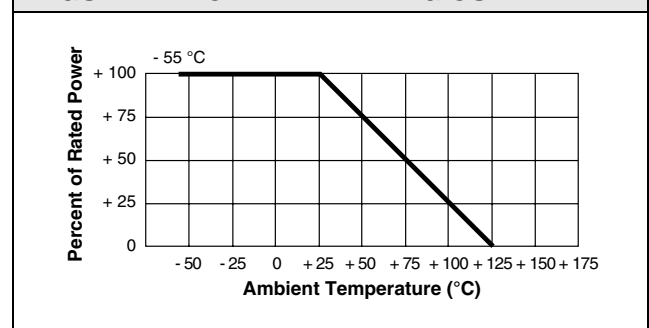


RoHS*
COMPLIANT

TABLE 1 - TOLERANCE AND TCR VERSUS RESISTANCE VALUE

RESISTANCE VALUE (Ω)	TYPICAL TCR AND MAX. SPREAD (- 55 $^\circ\text{C}$ to + 125 $^\circ\text{C}$, + 25 $^\circ\text{C}$ ref.) (ppm/ $^\circ\text{C}$)
80 to < 1M84	$\pm 2 \pm 2.5$
50 to < 80	$\pm 2 \pm 3.5$
5 to < 50	$\pm 2 \pm 4.5$

FIGURE 1 - POWER DERATING CURVE



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

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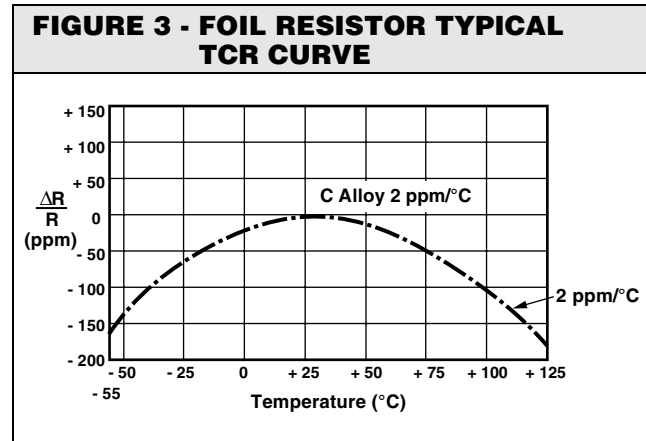
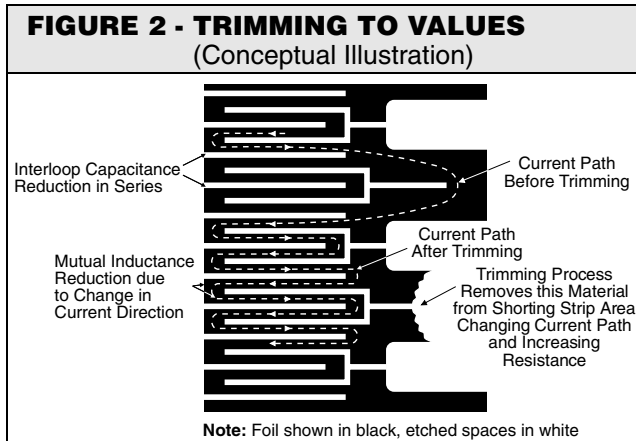


TABLE 2 - MODEL SELECTION										
MODEL NUMBER	RESISTANCE RANGE (Ω)	STANDARD RESISTANCE TOLERANCE		MAXIMUM WORKING VOLTAGE ²⁾	POWER RATING at + 25 °C	AVERAGE WEIGHT (g)	CONSTRUCTION BRIEF	DIMENSIONS ³⁾		
		TIGHTEST (Ω)	LOOSEST (%)					INCHES	mm	
VHP202	5 to 100K > 100K to 150K			300	0.3 W 0.2 W	1.4	Oil-filled, tinned copper leads, nickel shell, kovar and glass header	W: 0.185 ± 0.020 L: 0.435 ± 0.020 H: 0.430 ± 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.	
VHA412	5 to 100K > 100K to 150K			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.	
VHA414	5 to 200K > 200K to 335K	1K to □ ¹⁾	± 0.001 ± 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.	
VHA512*	5 to 300K > 300K to 500K	500 to < 1K	± 0.0025 ± 0.1	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.	
VHA516-4*	5 to 400K > 400K to 668K	20 to < 30	± 0.02 ± 0.1	500	1.0 W 0.5 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.
VHA516-5*	5 to 500K > 500K to 835K	10 to < 20	± 0.05 ± 0.1		1.25 W 0.6 W					
VHA516-6*	5 to 600K > 600K to 1M	5 to < 10	± 0.1 ± 0.1		1.5 W 0.7 W					
VHA518-7*	5 to 700K > 700K to 1M17			600	1.75 W 0.8 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.
VHA518-8*	5 to 800K > 800K to 1M34				2.0 W 0.9 W					
VHA518-9*	5 to 900K > 900K to 1M5				2.25 W 1.0 W					
VHA518-10*	5 to 1.0M > 1.0M to 1M67				2.5 W 1.1 W					
VHA518-11*	5 to 1.0M > 1.0M to 1M84				2.5 W 1.2 W					

Notes

* Available in a 4-lead terminal

** 0.375 H available

See next page for numbered footnotes

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Vishay Foil Resistors

FIGURE 4 - STANDARD IMPRINTING AND DIMENSIONS

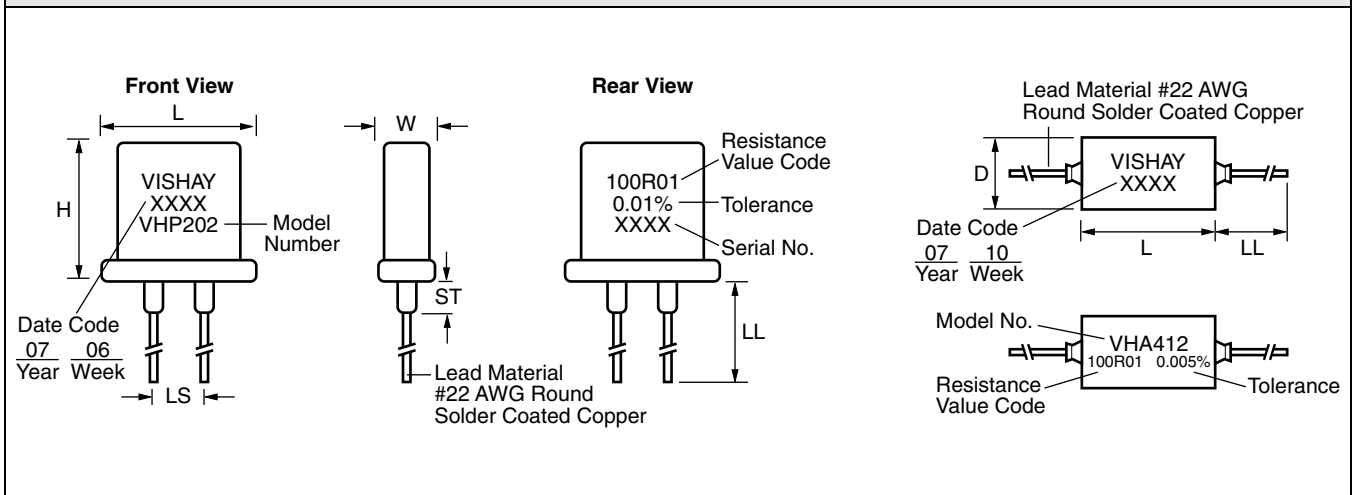


TABLE 3 - "H" SERIES SPECIFICATIONS

Stability⁸⁾	
Load life at 2000 h	$\pm 0.002 \%$ maximum ΔR at 0.1 W per chip and at $+ 60 \text{ }^\circ\text{C}$
Shelf life	$\pm 2 \text{ ppm}$ (0.0002 %) for at least 10 years
Current Noise	$< -40 \text{ dB}$
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	$< 0.1 \text{ ppm}/\text{V}^{6)}$
Thermal EMF⁷⁾	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

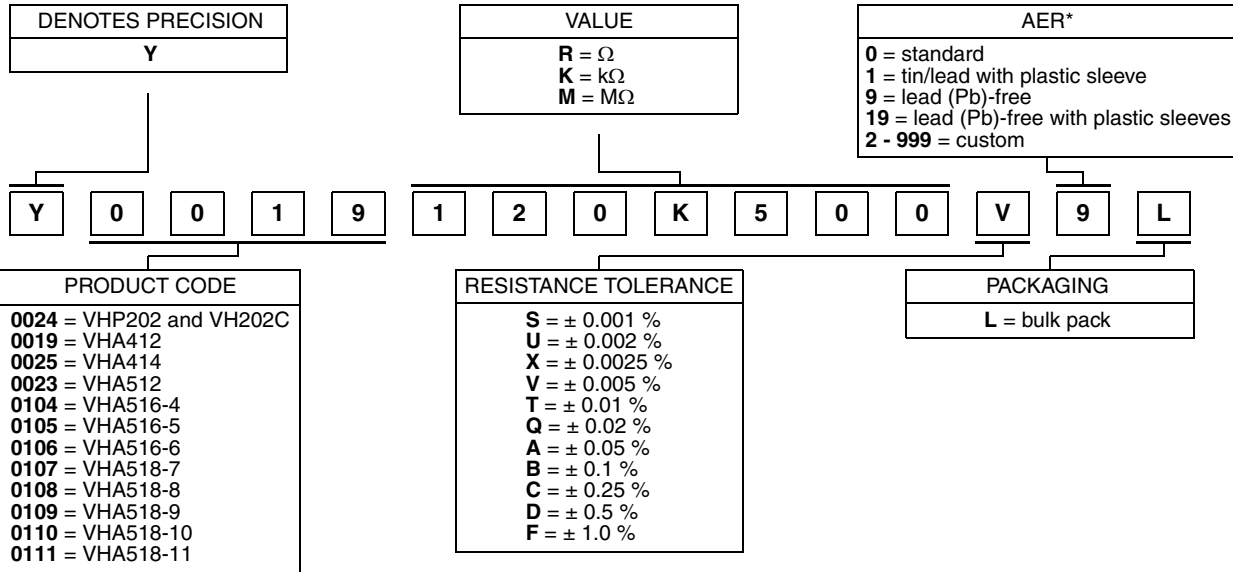
Notes

- Upper end of resistance range varies with model selected (i.e. VHP202; the range is to 150 k Ω ; VHA518-10, the range is to 1M67 Ω) per table 2
- Not to exceed power rating of resistor
- Insulating sleeve - a special case insulating plastic sleeve is available on VHA models. See table 4 for instructions on how to specify
- 0.200" (5.08 mm) lead spacing available - specify VH202J
- Inductance (L) due mainly to the leads
- The resolution limit of existing test equipment (within measurement capability of the equipment, or "essentially zero")
- $\mu\text{V}/^\circ\text{C}$ relates to EMF due to lead temperature difference and $\mu\text{V}/\text{W}$ due to power applied to the resistor
- Load life ΔR maximum. Can be reduced through in-house oriented processes

Vishay Foil Resistors Hermetically Sealed High Precision Bulk Metal® Foil Technology Resistors with TCR of $\pm 2 \text{ ppm}/^\circ\text{C}$, Tolerance of $\pm 0.001 \%$ and Load Life Stability of $\pm 0.005 \%$

TABLE 4 - GLOBAL PART NUMBER INFORMATION

NEW GLOBAL PART NUMBER: Y0019120K500V9L (preferred part number format)



FOR EXAMPLE: ABOVE GLOBAL ORDER Y0019 120K500 V 9 L:

TYPE: VHA412

VALUE: 120.5 $k\Omega$

ABSOLUTE TOLERANCE: $\pm 0.005 \%$

TERMINATION: lead (Pb)-free

PACKAGING: bulk pack

HISTORICAL PART NUMBER: VHA412T 120K50 V B (will continue to be used)

VHA412	T		120K50	V	B
MODEL	TERMINATION	PLASTIC SLEEVE	OHMIC VALUE	TOLERANCE	PACKAGING
VHP202 and VH202C VHA412 VHA414 VHA512 VHA516-4 VHA516-5 VHA516-6 VHA518-7 VHA518-8 VHA518-9 VHA518-10 VHA518-11	T = lead (Pb)-free None = tin/lead	P = plastic sleeve None = standard	120K50 = 120.5 $k\Omega$	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

* For non-standard requests, please contact application engineering.



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