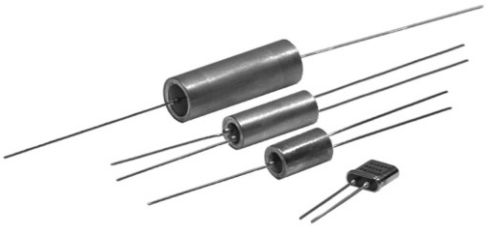
Hermetically Sealed High Precision Bulk Metal® Foil Technology Resistors with TCR of ± 2 ppm/°C, Tolerance of ± 0.001 % and Load Life Stability of ± 0.005 %



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 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.

FEATURES

Pb-free Available

RoHS* COMPLIANT

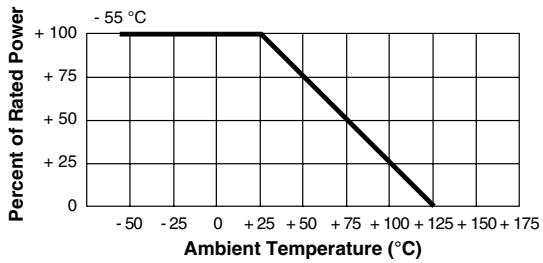
- Temperature coefficient of resistance (TCR): ± 2 ppm/°C typical (- 55 °C to + 125 °C, + 25 °C ref.)
- Power rating: 0.3 to 2.5 W at + 25 °C (depending on model - see table 2)
- Tolerance: to ± 0.001 %
- Load life stability: ± 0.005 % (70 °C for 2000 h at half rated power)
- Shelf life stability: ± 2 ppm for at least 10 years
- Resistance range: 5 Ω to 1.84 MΩ (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 µV/°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)

Note
Load life stability can be considerably improved through in-house oriented tests

TABLE 1 - TOLERANCE AND TCR VERSUS RESISTANCE VALUE

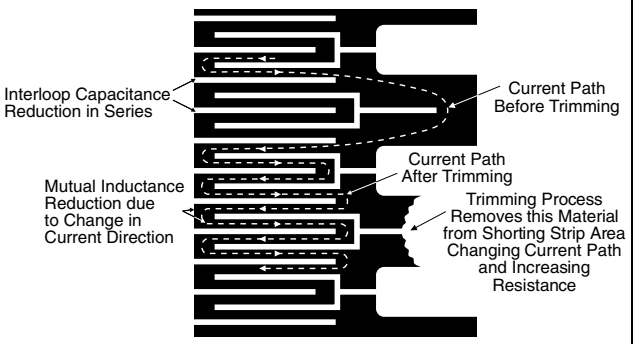
RESISTANCE VALUE (Ω)	TYPICAL TCR AND MAX. SPREAD (- 55 °C to + 125 °C, + 25 °C ref.) (ppm/°C)
80 to < 1M84	± 2 ± 2.5
50 to < 80	± 2 ± 3.5
5 to < 50	± 2 ± 4.5

FIGURE 1 - POWER DERATING CURVE



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

FIGURE 2 - TRIMMING TO VALUES
(Conceptual Illustration)



Note: Foil shown in black, etched spaces in white

FIGURE 3 - FOIL RESISTOR TYPICAL TCR CURVE

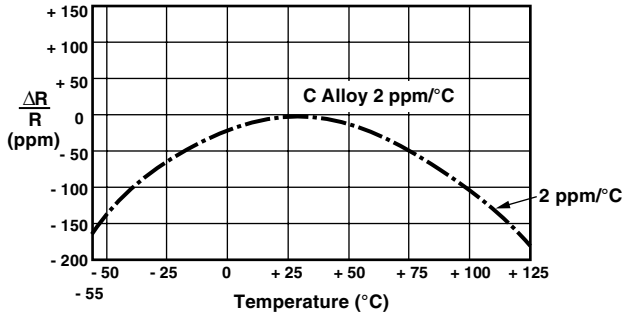


TABLE 2 - MODEL SELECTION

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	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	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	Oil-filled, tinned copper leads, tinned brass shell, kovar and glass end bells	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			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			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* VHA516-5* VHA516-6*	5 to 400K > 400K to 668K 5 to 500K > 500K to 835K 5 to 600K > 600K to 1M			500	1.0 W 0.5 W 1.25 W 0.6 W 1.5 W 0.7 W	9.2		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.
VHA518-7* VHA518-8* VHA518-9* VHA518-10* VHA518-11*	5 to 700K > 700K to 1M17 5 to 800K > 800K to 1M34 5 to 900K > 900K to 1M5 5 to 1.0M > 1.0M to 1M67 5 to 1.0M > 1.0M to 1M84			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
** 0.375 H available
See next page for numbered footnotes

FIGURE 4 - STANDARD IMPRINTING AND DIMENSIONS

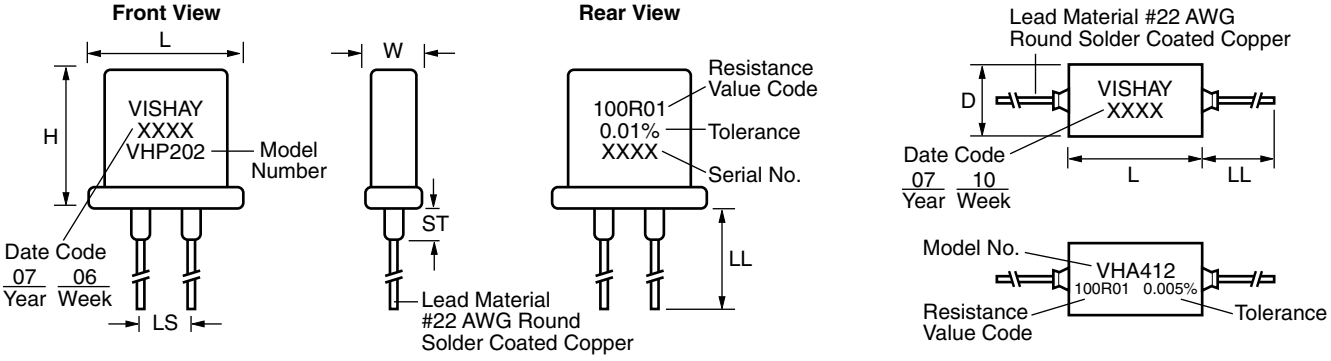


TABLE 3 - "H" SERIES SPECIFICATIONS

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 %) for at least 10 years
Current Noise	< - 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. VHP202; the range is to 150 kΩ; VHA518-10, the range is to 1M67 Ω) per table 2
2. Not to exceed power rating of resistor
3. Insulating sleeve - a special case insulating plastic sleeve is available on VHA models. See table 4 for instructions on how to specify
4. 0.200" (5.08 mm) lead spacing available - specify VH202J
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/°C relates to EMF due to lead temperature difference and µV/W due to power applied to the resistor
8. Load life ΔR maximum. Can be reduced through in-house oriented processes

TABLE 4 - GLOBAL PART NUMBER INFORMATION

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

DENOTES PRECISION	VALUE	AER*
Y	**R** = Ω **K** = kΩ **M** = MΩ	**0** = standard **1** = tin/lead with plastic sleeve **9** = lead (Pb)-free **19** = lead (Pb)-free with plastic sleeves **2 - 999** = custom

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

PRODUCT CODE	RESISTANCE TOLERANCE	PACKAGING
0024 = VHP202 and VH202C **0019** = VHA412 **0025** = VHA414 **0023** = VHA512 **0104** = VHA516-4 **0105** = VHA516-5 **0106** = VHA516-6 **0107** = VHA518-7 **0108** = VHA518-8 **0109** = VHA518-9 **0110** = VHA518-10 **0111** = VHA518-11	**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 Y0019 120K500 V 9 L:

TYPE: VHA412
VALUE: 120.5 kΩ
ABSOLUTE TOLERANCE: ± 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 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

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

Disclaimer

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

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.