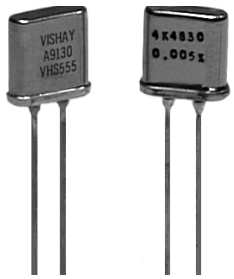
Bulk Metal® Foil Technology
Hermetically Sealed Resistors, Aerospace



Product may not be to scale

The "VH" series of resistors is the hermetic version of several molded "S" series devices. Hermetic sealing eliminates the ingress of both oxygen, which degrades resistors over long periods, and moisture which degrades resistors more quickly. These parts are made with glass to metal seal enclosures employing Kovar eyelets which allow the copper leads to pass through the enclosure to minimize the thermal EMF from the lead junctions. Rubber fill between the metal housing and resistance element acts both as a mechanical damper and thermal transfer path.

VHS102 and VH102K are the hermetically-sealed counterpart of the S102C and S102K high-performance molded resistors. VHS555 is the hermetically-sealed version of the S555, MIL style RNC90Y.

FEATURES

- VH102K Series
  Nominal Temperature Coefficient of Resistance:
  – 0.3ppm/°C (0°C to + 25°C);
  + 0.3ppm/°C (+ 25°C to + 60°C);
  – 1.0ppm/°C (– 55°C to + 25°C);
  + 1.0ppm/°C (+ 25°C to + 125°C)
- VHS102 Series
  Nominal Temperature Coefficient of Resistance:
  + 0.6ppm/°C (0°C to + 25°C);
  – 0.6ppm/°C (+ 25°C to + 60°C);
  + 2.2ppm/°C (– 55°C to + 25°C);
  – 1.8ppm/°C (+ 25°C to + 125°C)
- VHS555 Temperature Coefficient of Resistance:
  ± 5ppm/°C (– 55°C to + 125°C);
- Selected TCR Tracking: to 0.5ppm/°C (matched sets)
- Load-Life Stability: ± 0.0025% maximum ΔR at 0.1 watt, + 60°C, 2,000 hours (VHS555)
- Power Rating: 0.6 Watts at + 70°C; 0.3 Watts at + 125°C
- Resistance Tolerance (Initial Resistance Accuracy):
  ± 0.005% tightest to ± 1.0% loosest
- Resistance Range: 1Ω to 150KΩ

THROUGH HOLE

TABLE 1 - MODEL SELECTION

MODEL NUMBER	RESISTANCE RANGE (Ω)	STANDARD RESISTANCE TOLERANCE[1] %		MAXIMUM WORKING VOLTAGE[2]	AMBIENT POWER RATING[3] ††		AVERAGE WEIGHT (GRAMS)	DIMENSIONS		
		TIGHTEST	LOOSEST		@ + 70°C	@ + 125°C			INCHES	mm
VH102K*	30.1 to 150K	± 0.005	± 1.0					W	0.185 Maximum	4.70 Maximum
	20 to < 30.1	± 0.01	± 1.0					L	0.435 Maximum	11.05 Maximum
VHS102	10 to < 20	± 0.05	± 1.0					H	0.430 Maximum**	10.92 Maximum
	5 to < 10	± 0.10	± 1.0					LL	1 ± 0.125	25.4 ± 3.18
	1 to < 5	± 0.25	± 1.0	300	0.6 W	0.3 W	1.4	LS	0.150 ± 0.010[4]	3.81 ± 0.25
VHS555†	30.1 to 150K	± 0.005	± 1.0					ST	0.095 Maximum	2.41 Maximum
	16.2 to < 30.1	± 0.05	± 1.0							
	4.99 to < 16.2	± 0.10	± 1.0							
	1 to < 4.99	± 0.25	± 1.0							

*Available from 1 ohm to 100K only.
† Contains RNC90Y inside (4.99 ohms to 121 K).
†† Above 100Kohms VHS102 power is derated to 0.4 W @ + 70°C and 0.2 W @ + 125°C
**0.375H available.
See the third page in this datasheet for numbered footnotes.

FIGURE 1 - STANDARD IMPRINTING AND DIMENSIONS

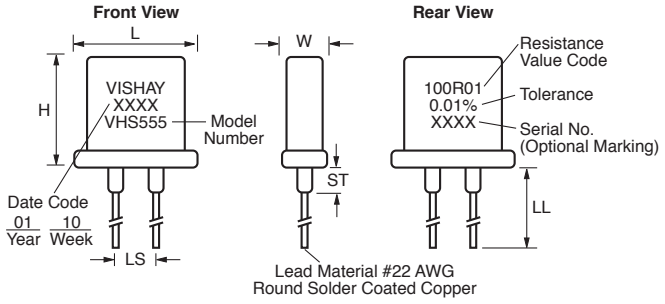


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TABLE 2 - "H" SERIES SPECIFICATIONS[5]

TEMPERATURE COEFFICIENT OF RESISTANCE				
VH102K				
Nominal TCR[6]	– 0.3ppm/°C (0°C to + 25°C)			
(See Fig. 7 and 8 in datasheet "7 Technical Reasons to Specify	+ 0.3ppm/°C (+ 25° to + 60°C)			
Vishay Bulk Metal® Foil Resistive Components.")	– 1.0ppm/°C (– 55°C to + 25°C)			
	+ 1.0ppm/°C (+ 25°C to + 125°C)			
Maximum TCR	± 2.5ppm/°C (0°C to + 25°C and + 25°C to + 60°C)			
(See Fig. 7 and 8 in datasheet "7 Technical Reasons to Specify	± 2.5ppm/°C (– 55°C to + 25°C and + 25°C to + 125°C)			
Vishay Bulk Metal® Foil Resistive Components.")				
Selected[9] TCR Tracking[10]				
(Closest Spread)	0.5ppm/°C			
VHS102				
Nominal TCR[6]	+ 0.6ppm/°C	(0°C to + 25°C)		
(See Fig. 1 and 2 in datasheet "7 Technical Reasons to Specify	– 0.6ppm/°C	(+ 25°C to + 60°C)		
Vishay Bulk Metal® Foil Resistive Components.")	+ 2.2ppm/°C	(– 55°C to + 25°C)		
	– 1.8ppm/°C	(+ 25°C to + 125°C)		
Standard TCR Spread from Nominal[7]	± 1.5ppm/°C	(0°C to + 25°C and + 25°C to + 60°C)		
(See Fig. 5 and 6 in datasheet "7 Technical Reasons to Specify	± 2.0ppm/°C	(– 55°C to + 25°C and + 25°C to + 125°C)		
Vishay Bulk Metal® Foil Resistive Components.")				
Maximum TCR Spread from Nominal[14]	± 2.5ppm/°C	(0°C to + 25°C and + 25°C to + 60°C)		
(See Fig. 5 and 6 in datasheet "7 Technical Reasons to Specify	± 2.3ppm/°C	(– 55°C to + 25°C and + 25°C to + 125°C)		
Vishay Bulk Metal® Foil Resistive Components.")				
Selected[9] TCR Tracking[10]	0.5ppm/°C			
VHS555				
Nominal TCR[6]	+ 0.6ppm/°C	(0°C to + 25°C)		
(See Fig. 1 and 2 in datasheet "7 Technical Reasons to Specify	– 0.6ppm/°C	(+ 25° to + 60°C)		
Vishay Bulk Metal® Foil Resistive Components.")	+ 2.2ppm/°C	(– 55°C to + 25°C)		
Standard TCR Spread from Nominal[7]	– 1.8ppm/°C	(+ 25° to + 125°C)		
(See Fig. 5 and 6 in datasheet "7 Technical Reasons to Specify				
Vishay Bulk Metal® Foil Resistive Components.")	± 1.5ppm/°C	(0°C to + 25°C and + 25°C to + 60°C)		
Maximum TCR Spread from Nominal[8]	± 2.0ppm/°C	(– 55°C to + 25°C and + 25°C to + 125°C)		
(See Fig. 5 and 6 in datasheet "7 Technical Reasons to Specify	± 2.5ppm/°C	(0°C to + 25°C and + 25°C to + 60°C)		
Vishay Bulk Metal® Foil Resistive Components.")	± 2.3ppm/°C	(– 55°C to + 25°C and + 25°C to + 125°C)		
Selected[8] TCR Tracking[10]	0.5ppm/°C			
Stability[14]				
	VH102K	VHS102	VHS555	
Load Life at 2,000 hours.	± 0.025%	± 0.025%	± 0.015%	@ 0.3W/+ 125°C
	± 0.005%	± 0.005%	± 0.0025%	@ 0.1W/+ 60°C
Load Life at 10,000 hours.	± 0.02%	± 0.02%	± 0.01%	@ 0.05W/+ 125°C
Shelf Life Stability	± 5ppm	(0.0005%)	Maximum ΔR after 1 year	
	± 10ppm	(0.001%)	Maximum ΔR after 3 years	
Current Noise	< 0.010μV (RMS)/Volt of applied voltage (– 40dB)			
High Frequency Operation				
Rise/Decay Time	1.0 ns at 1KΩ			
Inductance (L)[11]	0.1μH maximum; 0.08μH typical			
Capacitance (C)	1.0pF maximum; 0.5pF typical			
Voltage Coefficient	< 0.1ppm/V[12]			
Thermal EMF[13]	0.1μV/°C Maximum; 0.05μV/°C Typical 1μV/watt			
Hermeticity	10^{-7} Atmospheric cc/sec Maximum			

NOTES:

1. Standard Resistance Tolerance: ± 0.005%; ± 0.01%; ± 0.02%; ± 0.05%; ± 0.1%; ± 0.25%; ± 0.5%; ± 1.0%.
2. Not to exceed power rating of resistor.
3. See Figure 2 below.
4. 0.200" (5.08 mm) lead spacing available (except VHS555)– specify VH102J (S102C type), VH102L (S102K type).
5. Maximum is 1.0% A.Q.L. standard for all specifications except TCR. (For TCR information see notes 6 -10.) Typical is a designers reference which represents that 85% of the units supplied, over a long period of time, will be at least the figure shown or better.
6. Vishay Nominal TCR is defined as the chord slopes of the relative change of resistance/temperature, expressed in ppm (parts per million), called (RT) curve from 0°C to + 25°C and + 25°C to + 60°C ("Instrument" Range); and from – 55°C to + 25°C and + 25°C to + 125°C ("Military" Range). These specifications and the definition of Nominal TCR apply to all resistance values including low-value resistors.
7. Vishay Standard TCR Spread is defined as a designers reference which represents that at least 92% of the units, and 82% of the lots, supplied by Vishay will be within the stated band centered on the nominal curve. This definition of the Vishay Standard TCR Spread from Nominal applies to all resistance values. However, as the resistance value decreases below 80 ohms, the Vishay Standard TCR Spread from Nominal specification starts to increase. (See Figure 3 in data sheet "7 Technical Reasons to specify BMF Resistive Components.")
8. Vishay Maximum TCR Spread is defined as the 3 σ (Sigma) limit of a normal Gaussian distribution (99.73% of a production lot) which is within a band, centered on the nominal curve. This Vishay Maximum TCR Spread is no greater than ± 2.5ppm/°C from nominal throughout the full temperature range. This definition of the Vishay Maximum TCR Spread from Nominal applies to all resistance values. However, as the resistance value decreases below 80 ohms, the Vishay maximum TCR Spread from Nominal specification starts to increase. (See Figure 3 in datasheet "7 Technical Reasons to Specify Vishay Bulk Metal® Foil Resistive Components.")
9. Selected TCR Tracking is available for specially ordered lots of resistors. The selected TCR tracking can be 3, 2, 1 and as close as 0.5ppm/°C throughout the full temperature range.
10. TCR tracking is a measure of the similarity of resistance value change in two or more resistors which are undergoing the same temperature changes. Tracking could be expressed as the difference in the temperature coefficients of the resistors, expressed in ppm/°C as $(\Delta R_1/R_1 - \Delta R_2/R_2) \times 10^{-6}/\Delta T°C$. When a number of resistors are referenced to a nominal TCR, the spread or envelope around the nominal would be the difference. If the spread is ± 1.5ppm/°C about a nominal, the tracking, as defined above, will be 3ppm/°C.
11. Inductance (L) due mainly to the leads.
12. The resolution limit of existing test equipment (within the measurement capability of the equipment, or "essentially zero.")
13. μV/°C relates to EMF due to lead temperature difference and μV/watt due to power applied to the resistor.
14. Load life ΔR Maximum can be reduced through burn-in procedure.

THROUGH HOLE

FIGURE 2 - POWER DERATING CURVE

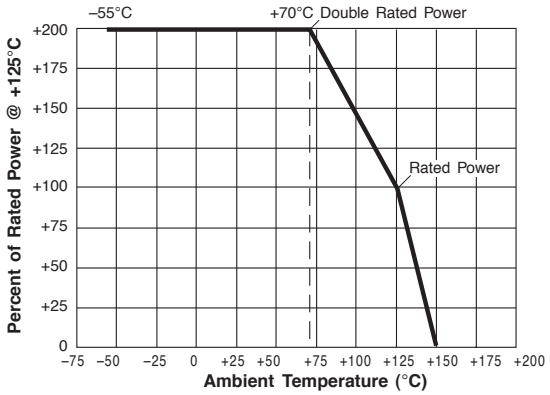

TABLE 3 - ENVIRONMENTAL PERFORMANCE COMPARISON

	MIL-PRF-55182/9 CHARACTERISTIC Y MAXIMUM ΔR	VH102K TYPICAL[5] ΔR	VHS102 TYPICAL[5] ΔR	VHS555 TYPICAL[5] ΔR
Test Group I				
Thermal Shock	± 0.05%	± 0.002%	± 0.002%	± 0.002%
Overload	± 0.05%	± 0.003%	± 0.003%	± 0.003%
Test Group II				
Resistance Temp Char.	± 5ppm/°C	See Figures 7 & 8*	See Figures 1 & 2, and Figures 5 & 6*	
Temp Storage	± 0.05%	± 0.005%	± 0.005%	± 0.0025
Low Temp Operation	± 0.05%	± 0.005%	± 0.005%	± 0.005%
Terminal Strength	± 0.02%	± 0.002%	± 0.002%	± 0.002%
Test Group III				
DWV	± 0.02%	± 0.005%	± 0.005%	± 0.002%
Insulation Resistance	10^4MΩ	40 x 10^5MΩ	40 x 10^5MΩ	40 x 10^5MΩ
Resistance to Solder Heat	± 0.02%	± 0.002%	± 0.002%	± 0.002%
Moisture Resistance	± 0.05%	± 0.005%	± 0.005%	± 0.005%
Test Group IV				
Shock	± 0.01%	± 0.002%	± 0.002%	± 0.002%
Vibration	± 0.02%	± 0.002%	± 0.002%	± 0.002%
Test Group V				
Life Test @ 0.3 W/+ 125°C				
2,000 Hours	± 0.05%	± 0.03%	± 0.03%	± 0.01%
10,000 Hours	± 0.5%	± 0.05%	± 0.05%	± 0.02%
Test Group Va				
+ 70°C Power Rating	± 0.05%	± 0.02%	± 0.02%	± 0.02%
Test Group VI				
High Temp Exposure	± 0.05%	± 0.05%	± 0.05%	± 0.04%
Test Group VII				
Voltage Coefficient	0.0005%/V	< 0.00001%/V	< 0.00001%/V	< 0.00001%/V

See previous page for numbered footnotes.

*These figures can be found in data sheet "7 Technical Reasons to Specify Bulk Metal® Foil Resistive Components."

TABLE 4 - ORDERING INFORMATION

Please specify Vishay VH102K, VHS102 and VHS555 resistors as follows: (See Imprinting Illustration and Table 1, 1st page in this datasheet, for further details).

Example: **VHS555** (MODEL NO.) **100R01** (RESISTANCE VALUE) **0.01%** (TOLERANCE)

Resistance Value, in ohms, is expressed by a series of 6 characters, 5 of which represent significant digits while the 6th is a dual purpose letter that designates both the multiplier and the location of the comma or decimal.

RESISTANCE RANGE**	LETTER DESIGNATOR	MULTIPLIER FACTOR	EXAMPLE
1Ω to < 1KΩ	R	x 1	100R01 = 100.01Ω
1KΩ to < 150KΩ	K	x 10^3	15K231 = 15,231Ω

**Resistance Range limit of 100KΩ for VH102K, 150KΩ for VHS555, 150KΩ for VHS102.

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