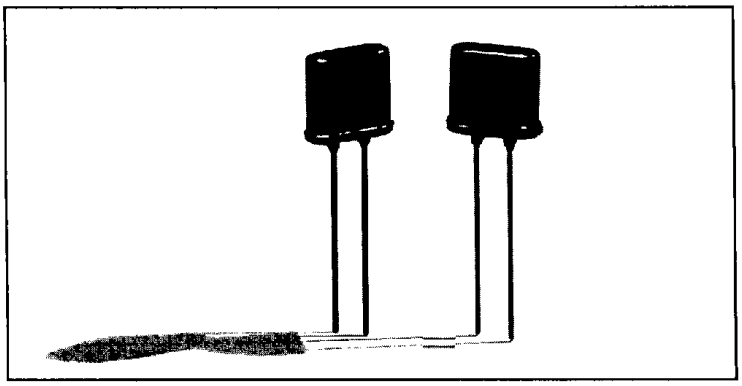
VISHAY RESISTORS

VISHAY "H" SERIES

Hermetically Sealed Resistors, Aerospace



The "H" series of resistors is the hermetic version of several non-hermetic "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
  Maximum Temperature Coefficient of Resistance:
  ±2.5 ppm/°C (0°C to +25°C and +25°C to +60°C)
  ±2.5 ppm/°C (–55°C to +25°C and +25°C to +125°C)
- VH102C Series
  Nominal Temperature Coefficient of Resistance:
  +0.6 ppm/°C (0°C to +25°C); –0.6 ppm/°C (+25°C to +60°C);
  +2.2 ppm/°C (–55°C to +25°C); –1.8 ppm/°C (+25°C to +125°C)
- VHS555 Temperature Coefficient of Resistance
  ±5 ppm/°C (–55°C to +125°C);
- Selected TCR Tracking: to 0.5 ppm/°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: 1 Ω to 250K Ω

TABLE 1 - MODEL SELECTION

Model Number	Resistance Range (Ω)	Standard Resistance Tolerance[1] %		Max Working Voltage[2]	Ambient Power Rating[3] ††		Average Weight (Grams)	Dimensions	
		Tightest	Loosest		@ +70°C	@ +125°C		Inches	mm
VH102K*	30 to 250K	±0.005	±1.0	300	0.6 W	0.3 W	1.4	W: 0.185 Max	4.70 Max
	20 to <30	±0.02	±1.0					L: 0.435 Max	11.05 Max
VHS102	10 to <20	±0.05	±1.0					H: 0.430 Max***	10.92 Max
	5 to <10	±0.10	±1.0					LL: 1.000 ±0.125	25.4 ±3.18
VHS555**†	1 to <5	±0.25	±1.0					LS: 0.150 ±0.010[4]	3.81 ±0.25
								ST: 0.095 Max	2.41 Max

* Available from 1 Ω to 100K only.
** Available from 1 Ω to 150K only.
*** 0.375 H available.
† Contains RNC90Y inside (4.99 Ω to 121K).
†† Above 100K Ω VHS102 power is derated to 0.4 W @ +70°C and 0.2 W @ +125°C.
See page 18 for numbered footnotes.

FIGURE 1 - STANDARD IMPRINTING AND DIMENSIONS

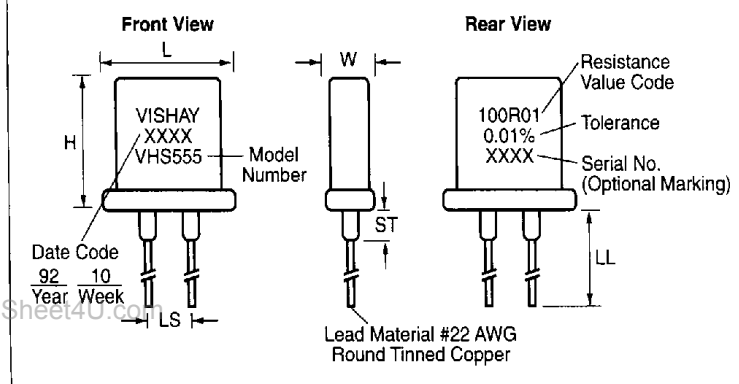
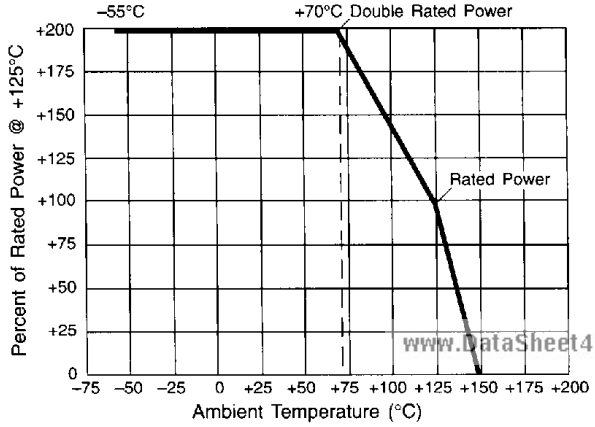


FIGURE 2 - POWER DERATING CURVE



VISHAY RESISTORS

VISHAY "H" SERIES

Hermetically Sealed Resistors, Aerospace

TABLE 2 - "H" SERIES SPECIFICATIONS[5]

Temperature Coefficient of Resistance	
VH102K	
Nominal TCR[6] *(See Fig. 7 and 8, Page 3)*	–0.3 ppm/°C (0°C to +25°C) +0.3 ppm/°C (+25° to +60°C) –1.0 ppm/°C (–55°C to +25°C) +1.0 ppm/°C (+25°C to +125°C)
Maximum TCR *(See Fig. 7 and 8, Page 3)*	±2.5 ppm/°C (0°C to +25°C and +25°C to +60°C) ±2.5 ppm/°C (–55°C to +25°C and +25°C to +125°C)
Selected[9] TCR Tracking[10] *(Closest Spread)*	0.5 ppm/°C
VHS102	
Nominal TCR[6] *(See Fig. 1 and 2, Page 1)*	+0.6 ppm/°C (0°C to +25°C) –0.6 ppm/°C (+25°C to +60°C) +2.2 ppm/°C (–55°C to +25°C) –1.8 ppm/°C (+25°C to +125°C)
Standard TCR Spread from Nominal[7] *(See Fig. 5 and 6, Page 2)*	±1.5 ppm/°C (0°C to +25°C and +25°C to +60°C) ±2.0 ppm/°C (–55°C to +25°C and +25°C to +125°C)
Maximum TCR Spread from Nominal[14] *(See Fig. 5 and 6, Page 2)*	±2.5 ppm/°C (0°C to +25°C and +25°C to +60°C) ±2.3 ppm/°C (–55°C to +25°C and +25°C to +125°C)
Selected[9] TCR Tracking[10]	0.5 ppm/°C
VHS555	
Nominal TCR[6] *(See Fig. 1 and 2, Page 1)*	+0.6 ppm/°C (0°C to +25°C) –0.6 ppm/°C (+25° to +60°C) +2.2 ppm/°C (–55°C to +25°C) –1.8 ppm/°C (+25° to +125°C)
Standard TCR Spread from Nominal[7] *(See Fig. 5 and 6, Page 2)*	±1.5 ppm/°C (0°C to +25°C and +25°C to +60°C) ±2.0 ppm/°C (–55°C to +25°C and +25°C to +125°C)
Maximum TCR Spread from Nominal[8] *(See Fig. 5 and 6, Page 2)*	±2.5 ppm/°C (0°C to +25°C and +25°C to +60°C) ±2.3 ppm/°C (–55°C to +25°C and +25°C to +125°C)
Selected[8] TCR Tracking[10]	0.5 ppm/°C
Stability[14]	VH102K VHS102 VHS555
Load Life at 2,000 hrs.	±0.0025% ±0.0025% ±0.015% @ 0.3 W/+125°C ±0.0005% ±0.0005% ±0.0025% @ 0.1 W/+60°C
Load Life at 10,000 hrs.	±0.02% ±0.02% ±0.01% @ 0.05 W/+125°C
Shelf Life Stability	±5 ppm/yr (0.0005%) Max Δ R after 1 year ±10 ppm/yr (0.001%) Max Δ R after 3 years
Current Noise	<0.010 µV (RMS)/Volt of applied voltage (–40 dB)
High Frequency Operation	
Rise/Decay Time	1.0 ns at 1K Ω
Inductance (L)[11]	0.1 µH maximum; 0.08 µH typical
Capacitance (C)	1.0 pF maximum; 0.5 pF typical
Voltage Coefficient	<0.1 ppm/V[12]
Thermal EMF[13]	0.1 µV/°C Max; 0.05 µV/°C Typical 1 µV/watt
Hermeticity	10^{-7} Atmospheric cc/sec Max

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, Page 17.
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 60 Ω, the Vishay Standard TCR Spread from Nominal specification starts to increase. (See Figure 3, Page 2.)
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 ±2.5 ppm/°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 Ω, the Vishay maximum TCR Spread from Nominal specification starts to increase. (See Figure 3, Page 2.)
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 0.5 ppm/°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 ±1.5 ppm/°C about a nominal, the tracking, as defined above, will be 3 ppm/°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 Δ R Maximum can be reduced through burn-in procedure.

VISHAY RESISTORS

VISHAY "H" SERIES

Hermetically Sealed Resistors, Aerospace

TABLE 3 - ENVIRONMENTAL PERFORMANCE COMPARISON

	MIL-R-55182/9 Char Y Max ΔR	VH102K Typ[5] ΔR	VHS102 Typ[5] ΔR	VHS555 Typ[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.	±5 ppm/°C	See Fig 7 & 8, Pg 3	See Fig 1 & 2, Pg 1 and Fig 5 & 6, Pg 2	
Low 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	10^4M Ω	40 x 10^5M Ω	40 x 10^5M Ω	40 x 10^5M Ω
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 page 18 for numbered footnotes.

HOW TO ORDER VH102K, VHS102 AND VHS555 PARTS:

Please specify Vishay VH102K, VHS102 and VHS555 resistors as follows: (See Imprinting Illustration and Table 1, Page 17 for further details).

Example:

VHS555	100R01	0.01%
Model No.	Resistance Value	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 point.

Resistance Range*	Letter Designator	Multiplier Factor	Example
1 Ω to <1K Ω	R	x1	100R01 = 100.01 Ω
1K Ω to 250 K Ω	K	x10^3	15K231 = 15,231 Ω

*Resistance Range limit of 100K Ω for VH102K, 150K Ω for VHS555, 250K Ω for VHS102.