Facts in Brief

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Author: Yuval Hernik
Tel: +972-355-70852
E-mail: Yuval.Hernik@vishay.com

Vishay Foil Resistors Division Presents Ultra-High-Precision Resistors to be Used for Secondary Standards and Reference Resistors Which Have Already Been Approved by the World Institute of Standards for this Purpose

Vishay Foil Resistors division announces several series of ultra-high-precision hermetically sealed resistors based on a new design using Z-Foil technology that produces a combination of standard features with new benchmark capabilities for accuracy, stability and speed.

These hermetically sealed units provide a solution for many resistor applications previously thought to be unsolvable, and opens entirely new areas of design where the use of resistors had not been considered.

These hermetically sealed series resistors use the basic Vishay resistance element, which is mounted in a stress isolated manner on a PC board to which axial leads have been anchored. Electrical connections between the resistance element and the leads are made through a special construction with minimum stress. After the assembly is inserted into a tinned brass shell, the unit is filled with oil and solder sealed to permit uniform heat dissipation and minimize the effects of environmental extremes. A ruggedized version is filled with a stress-isolating rubber material for military and space applications.

The hermetic seal prevents the ingress of moisture and oxygen, both of which play a role in the long-term degradation of unsealed resistors.

These parts are sealed in brass tubes or nickel cans employing Kovar eyelets that maintain hermeticity while allowing the copper leads to pass through the seal to the outside of the enclosure. This positions the more malleable solder-coated copper leads on the outside of the package and minimizes the thermal EMF at the internal termination-to-resistor junction assembly. Thermal EMF is an electromotive force (voltage) that is generated at an inter-metallic junction when the junction is heated.

Since the thermal EMF voltages are positive at one termination and negative at the other, they would cancel out each other if at the same temperature – a highly unlikely event considering the numerous factors, both internal and external, that induce different temperatures at the terminations. In addition to the inter-metallic controls, the thermal EMF is further reduced by the thermal efficiency of the oil filling which minimizes the temperature difference across the terminations while enhancing power dissipation through the package.

The application of power and power surges to the device not only affect long-term stability but can also cause an instantaneous rise in temperature on the resistance element that combines with the resistor's inherent TCR (temperature coefficient of resistance) to produce an instantaneous offset error known as power coefficient. The inherently low TCR of Bulk Metal® Foil resistors alone makes the power coefficient extremely low but it is even further reduced by thermal efficiency of the oil fill.

While the hermetically-sealed series of Bulk Metal® Foil resistors is already more stable than other resistor technologies and more stable than any other foil resistors, this stability can be further improved through a specially selected process of stability enhancements. These enhancements may be achieved through special post-manufacturing operations (PMO testing) or they may be implemented at the chip level before the resistors are manufactured. The specific regimen is chosen for the best reliability and performance through the anticipated experience of a specific application.

These resistors provide performance characteristics of 2 ppm possible drift for at least six years shelf life or low power (data available) which cannot be equaled by any conventional resistors, or by bulky units now used as secondary standards. As shown in the specifications below, there is no compromise between precision and speed (as in wirewound and metal film resistors) or between speed and the combination of excellent precision and TCR (as with conventional deposited films).

Every Vishay hermetically-sealed resistor meets all of these specifications. Vishay hermetically sealed resistors can dissipate appreciable power for their size. In these power applications, however, derating is recommended for best stability.

Features:

1. Resistance value: 0R5 to >1M5
2. Configuration: individual resistor or set of resistors to compose R equivalent
3. TCR: to ±0.2 ppm/º C maximum in instrumentation temperature range.
4. TCR tracking in pairs or more: to ±0.1 ppm/º C maximum in instrumentation temperature range.
5. Special stabilization (PMO) to accomplish a low total error budget and low end-of-life tolerance
6. Absolute tolerance: to ±0.001%
7. Tolerance match: to ±0.002%

8. Load-life stability: to 0.005% (50 ppm), 2000 hours at rated power (additional treatments available for ultra-stability)
9. Shelf life stability (or 10 mv power) – 2 ppm for at least 6 years
10. Noise-free (<-40 dB)
11. Thermal stabilization time: < 1 second
12. ESD immunity: > 10KV
13. Rise time: 1 nanosecond (no ringing!)
14. Vishay Foil Resistors are not restricted to standard values; specific “as required” values (e.g. 1.234 kΩ vs. 1 kΩ) can be supplied at no extra cost or delivery lead time

Basic products: VHP100, H Series, HZ series, VHP202Z, VHP203, VHP102Z, VHP102, VHD200

All these products are the foundation for the ultimate secondary standard resistors. Greater stability can be provided through specifically designed enhanced stabilization processes.

Applications include:
1. Resistance standards
2. Feedback devices for operational amplifiers
3. Precision voltage dividers
4. Meter multipliers
5. Precision bridge resistors
6. Decade voltage dividers

Please contact engineering sales for more information:
Foil@vishay.com

The Foil products:
http://www.vishay.com/resistors-discrete/metal-foil/tcr-video-list/

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