Facts at a Glance

From: Vishay Foil Resistors
January 1, 2011
FACTS # 111

Original release: December 15, 2009

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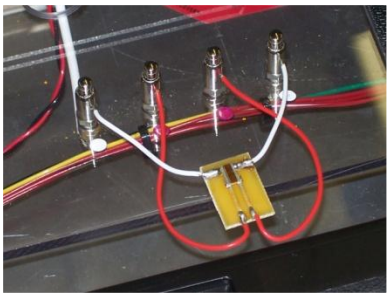
Introducing the New Bulk Metal® Foil Resistors Demo Kit

There is more to resistor precision than meets the eye. Resistors from different technologies may seem alike on the surface and may often have similar published specifications, such as initial TCR and tolerance. However, each is made of a different resistive material and produced differently. Inherent resistive material, design, and processing variations strongly influence electrical performance, leading to different behaviors after mounting.

That is why the Bulk Metal® Foil Resistors Division has introduced a demonstration kit that illustrates the differences between Bulk Metal® Foil, Thin Film, Thick Film and Wirewound resistor technologies in real time.



The purpose of the presentation is to provide a directly perceivable explanation of the primary factors that influence resistor stability in a real environment (compared to the specifications on a datasheet). For example, resistor stability should be judged by performance under load and temperature in short-term and long-term exposure to different electrical thermal or mechanical parameters.

In our presentation, we cover such subjects as temperature (known and unknown), pulse, amplifiers, CTE (coefficient of thermal expansion) of the PCB, ESD, thermal EMF and much more. We can match the demonstration to your needs. Bring your own resistors for testing and discuss your specific application with trained experts.

Ask to experience our new demo presentation at your site today and save on R&D costs while receiving the tools you need to upgrade your circuit design and avoid unexpected parasitic effects.

VISHAY PRECISION GROUP

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The Bulk Metal® Foil resistor is based on a special concept whereby a proprietary bulk metal cold-rolled foil is cemented to a ceramic substrate. It is then photo etched into a resistive pattern. Further, it is laser adjusted to any desired value and tolerance. Because the cemented foil is not stressed in any way during the following manufacturing process, the Bulk Metal® Foil resistor maintains all its design, physical and electrical characteristics while winding of wire or sputtering of thin film does not.

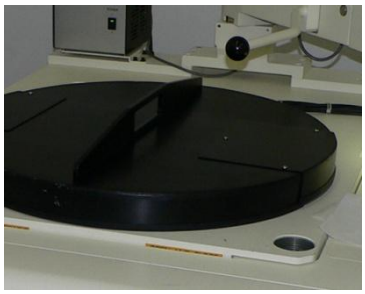
Foil resistors achieve maximum stability and near-zero TCR over a wide temperature range. These performances are built into every unit and do not rely on screening or other artificial means for uniform performance (for a video demonstration, visit http://www.vishaypg.com/landingpage/videos/).

With Vishay Foil Resistors, you can save on prototype costs by ordering just a few resistors in any value. There is no need to stock a wide array of precision resistors at minimum order prices when you can buy only what you need and receive your order within days.

And because this resistor is the most precise resistor available, it will satisfy all your R&D requirements. For applications requiring less precision, convert back to lesser-precision resistors at the production phase when your purchasing dollars can buy the larger quantities at a more economical net cost.

Examples of Applications:

ATE:



Power Supplies:

Scales:

In all the tests below, we compare the performances of Bulk Metal® Foil, Z-Foil, Thin Film and Thick Film resistors with the same size and values under the same conditions.

Test #1: Temperature Coefficient of Resistance (TCR)
TCR is the best-known parameter for specifying a resistor's stability and is used to describe the resistive element's sensitivity to temperature change due to ambient temperature variations. TCR will show how resistors behave under low operating temperatures and high operating temperatures.

In this test, TCR below 0.5 ppm/°C at + 25 °C to + 125 °C will be shown.

Test #2: Power Coefficient of Resistance (PCR)
PCR is a lesser-known parameter, but still extremely important. This parameter quantifies the resistance change due to self heating when power is applied.

Test 2A: PCR for Discrete Resistors
During the test, we apply power and measure the ΔR. The demonstration will illustrate the behavior of the resistors under applied power.

Test 2B: Tracking PCR for Resistor Networks
We apply power to a voltage divider with two equal-value resistors on the same substrate and measure the ΔR2-ΔR1 ratio tracking. The ratio should not change, but it does.

Test #3: Short-Time Overload (STO)
STO occurs when a circuit is subjected to a temporary, unexpected high pulse (or overload) that can result in device failure. We will view how hot spot or current density can end with a failure.

This is also a simulation of load life-stability as a function of power, temperature, and time. STO is an accelerated simulation of load-life stability. We apply high power for a short time, measure the ΔR, and correlate it to load-life stability using the Arrhenius theory based on STO.

Test #4: Electrostatic Discharge (ESD)
ESD damage to electronic devices can occur at any point in the component's life cycle, from manufacturing to field service. Generally, ESD damage is classified as either a catastrophic failure or latent defect. A catastrophic failure can be detected and removed when the resistor is tested prior to shipment; however, in the case of a latent defect, the damage will go undetected until the device fails in operation.

A latent defect is more difficult to identify because a resistor that is exposed to an ESD event may be partially degraded, yet continue to perform its intended function. Premature failure can occur after the resistor is already functioning in the finished product for a period of time.

Vishay Foil Resistors Can Withstand At Least to 25kV

Test #5: Thermal EMF
Thermal EMF, which is negligible in ordinary resistors, may become a significant DC offset error or instability in high-precision resistors for low-value DC applications and is also considered a parasitic effect interfering with pure resistance. It is caused by the dissimilarity of the materials used in the resistor construction, especially at the junction of the element and the lead materials.

The thermal EMF performance of a resistor can be degraded by external temperature differences between the two junctions: dissymmetry of power distribution within the element and the dissimilarity of the molecular activity of the metals involved. We measure the thermal EMF voltage of several types of resistors.

Test #6: Trimmers
Trimmer setability and stability tests are performed in comparison with other trimmer technologies.

6A: Contact Resistance Variation (CRV)
Change in resistance is measured as the trimmer wiper is moved across the element. Significant instantaneous changes in resistance, superimposed on the expected linear output, are observed---the amplitude of which is related to the technology used in the trimmer.

6B: Stability Through the Wiper
Trimmers are set to the middle of wiper travel, then vibration is applied for 30 seconds; we measure the resistance change and display the difference.

6C: Power TCR (ΔR due to power)
PCR is measured through the wiper by applying increasing power and displaying the change in resistance.

Test #7: Thermal Stabilization Speed
Thermal stabilization is an important factor for precision circuits in how quickly a resistor stabilizes at its final value after being subjected to its full rated power. Our demonstration plots the ΔR of a test resistor under full-rated power from 0 to 3 seconds.

Test #8: Board Flexation Simulation
Component failure due to PCB flexing and termination failure is a major reliability issue. The demonstration shows the difference in resistor termination strengths by flexing and measuring mounted resistors.

Test #9: How to Control the Gain on Operational Amplifiers
Amplifier output stability is directly related to the stability of its input/bias/feedback resistors. The demonstration shows amplifier output variations when resistors of different technologies are used as bias resistors.

Test #10: Calibration Station
When you need precision resistors for your prototype, you want them in a hurry. Now Vishay Foil Resistors guarantees a 5-working-day delivery on any value from 0R001 Ω to 1M Ω, and any tolerance down to 0.005%.

This is available through our new “Panic Button” service. For the prototype quantities you need, the very moderate “Panic Button” surcharge is insignificant. What’s really important is that you can put your prototype system together faster than ever before. Check it out and get it into production, with full assurance that your resistor solutions are completely verified. This is a Bulk Metal® Foil spec package that eliminates resistor “trade-off” worries … the only one of its kind.

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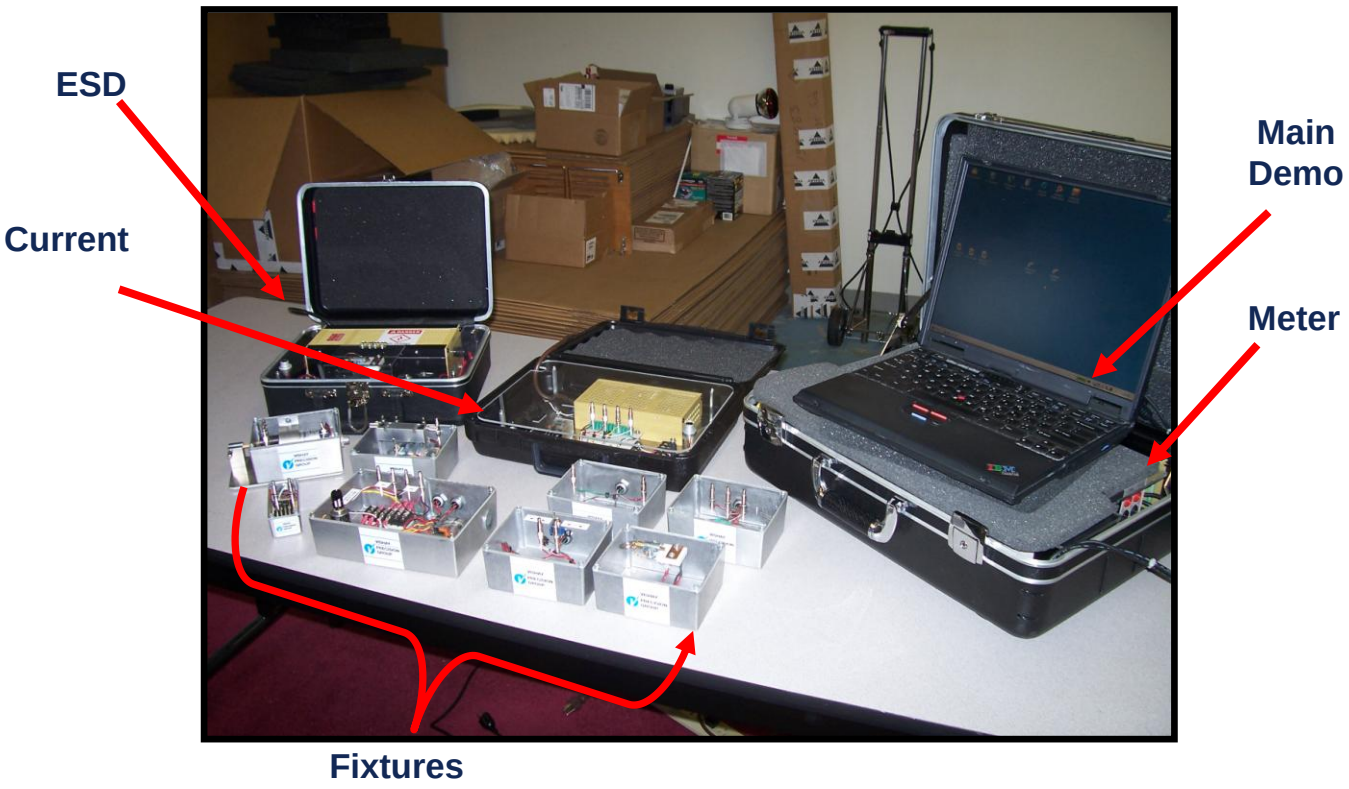

For more information about this product group, please contact us at: **Foil@vishaypg.com**.

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