



Texas
Components
Corporation

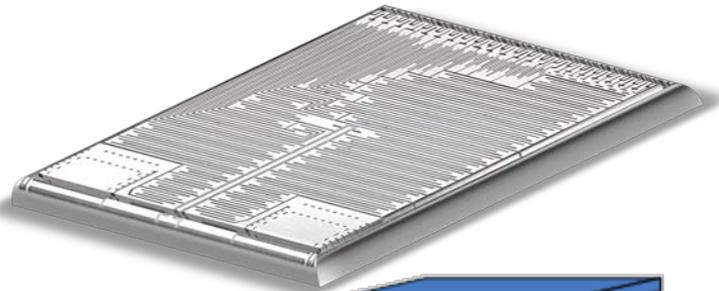
Bulk Metal[®] Foil Resistors Technology Overview

VPG Foil Resistors
Vishay Foil Resistors • Alpha Electronics • Powertron

Company's Key Technology

Bulk Metal[®] Foil resistors are based on a unique concept and special process whereby a proprietary bulk metal cold-rolled foil is cemented to a ceramic substrate.

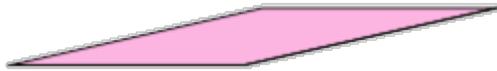
Special Layer Construction



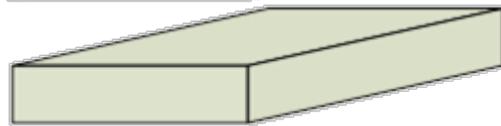
Bulk Metal[®] Foil



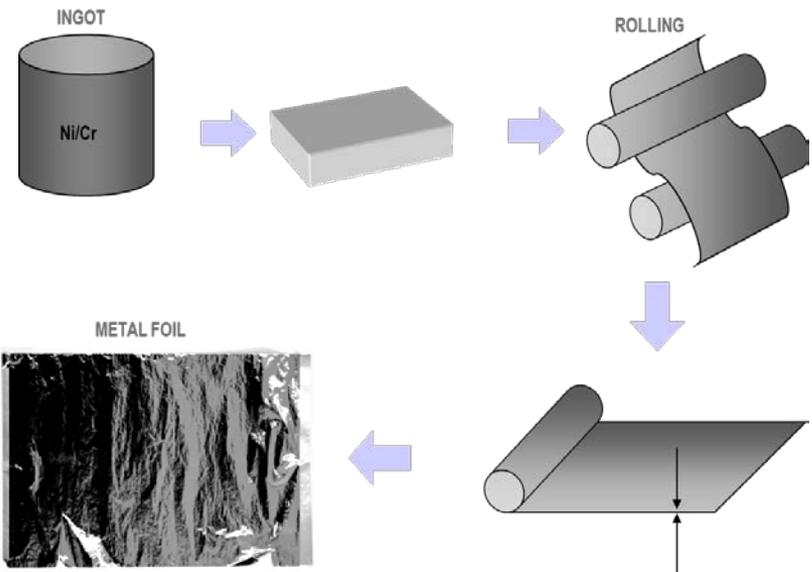
Adhesive



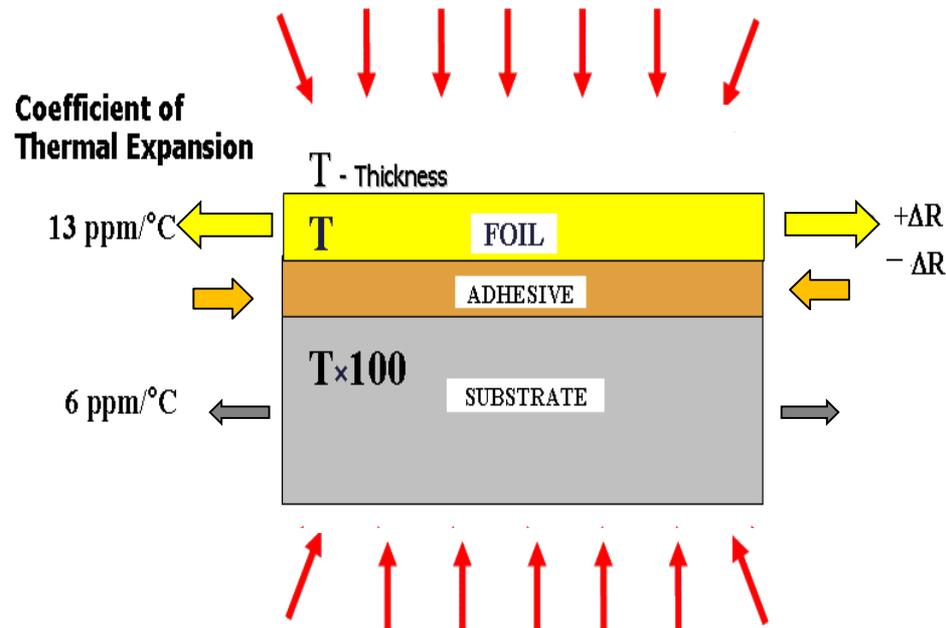
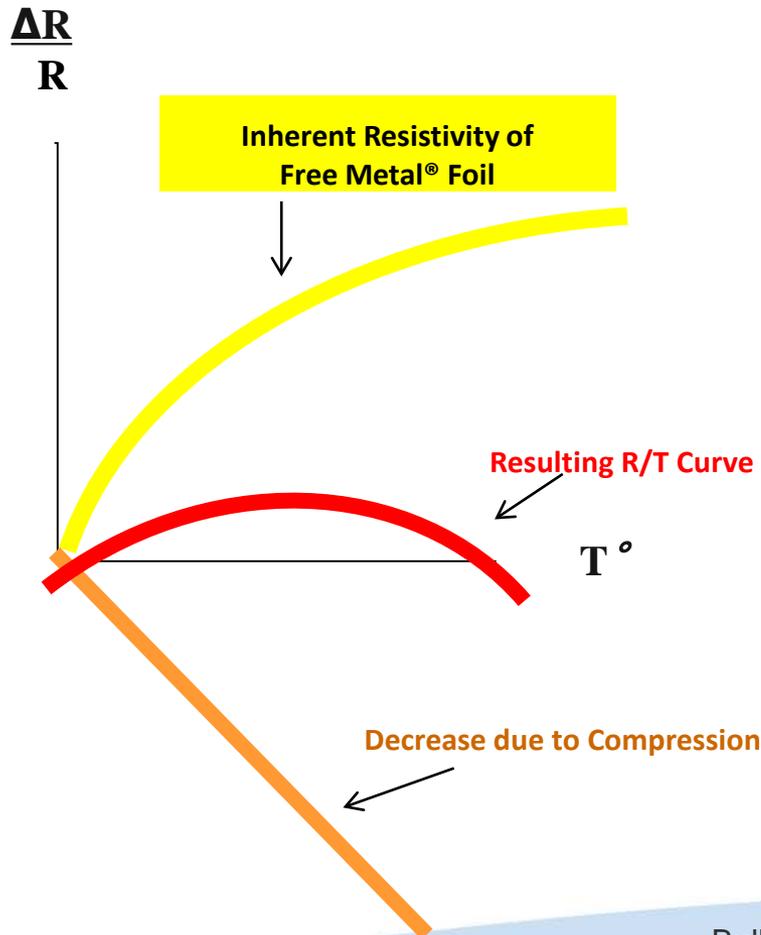
Ceramic Substrate



The Bulk Metal[®] Foil Production



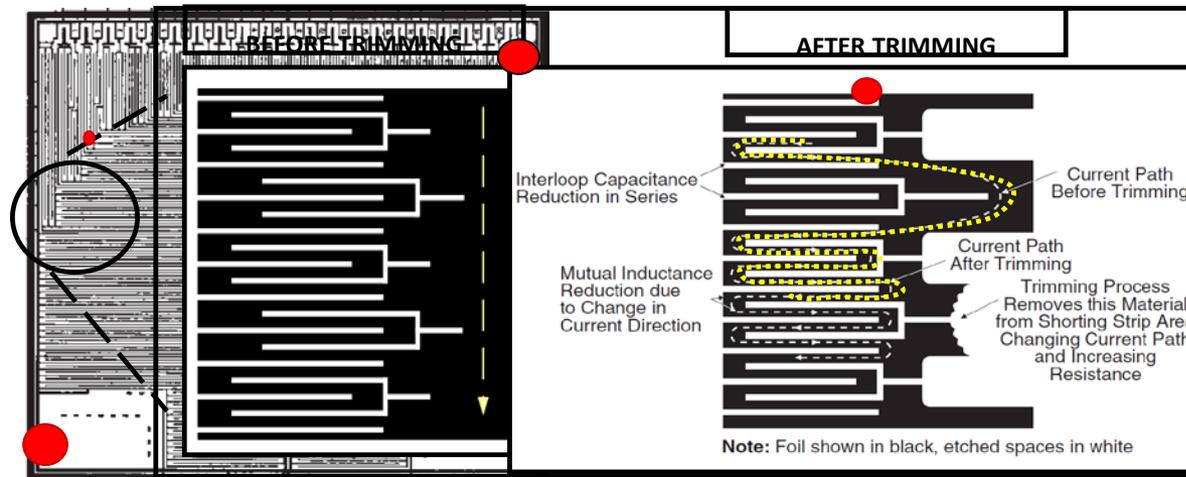
Key Technology: TCR & PCR



Unique Trimming Method

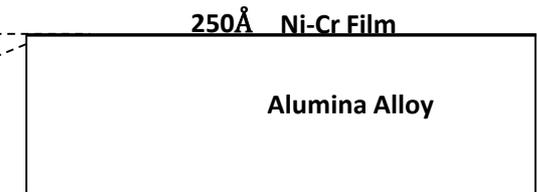
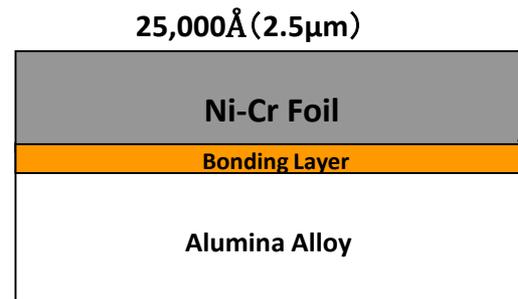
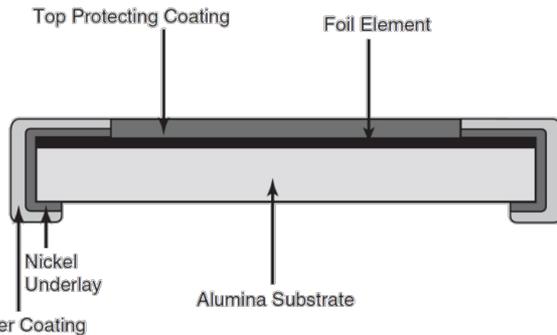
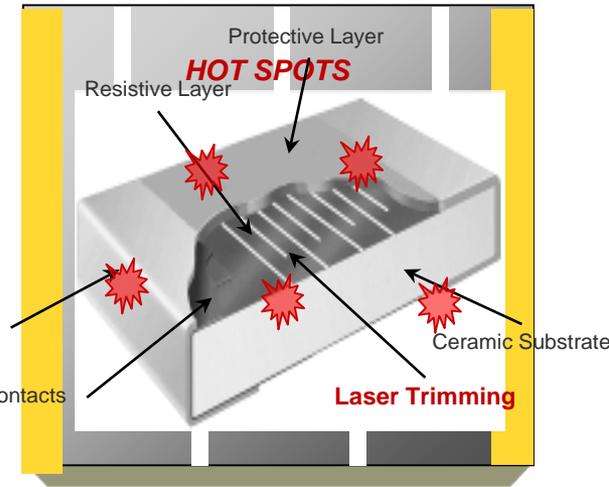
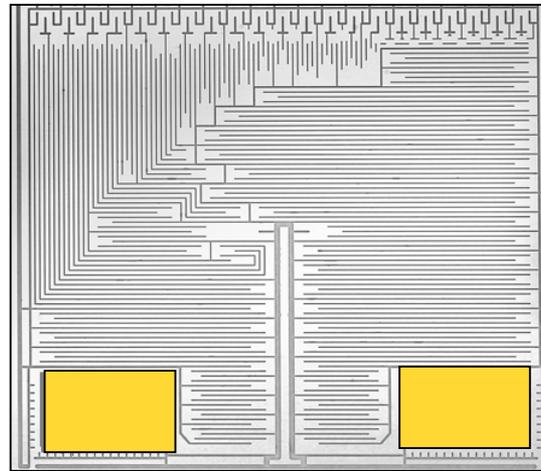
The Bulk Metal[®] Foil is photo etched into a resistive pattern (no mechanical stress introduced). Later, it is adjusted (manually or by laser) to any desired value and tolerance.

Because the resistive metal used is not drawn, wound, or mechanically stressed in any way during manufacturing process, the Bulk Metal[®] Foil resistor design maintains all of its inherent physical and electrical characteristics - while winding of wire, or sputtering of thin films, or thick film glazing do not.



Technology Comparison

Bulk Metal[®] Foil vs. Thin Film Resistor



Why Bulk Metal[®] Foil Resistors?

Stability

- Time=The Lowest Long Term Stability (2 ppm/year for 6 years)
- Temperature=The Lowest TCR (0+/-0.05 ppm/°C possible)

Reliability

- Reliability Tests= According to MIL-PRF-55182/9 & MIL-PRF-55342

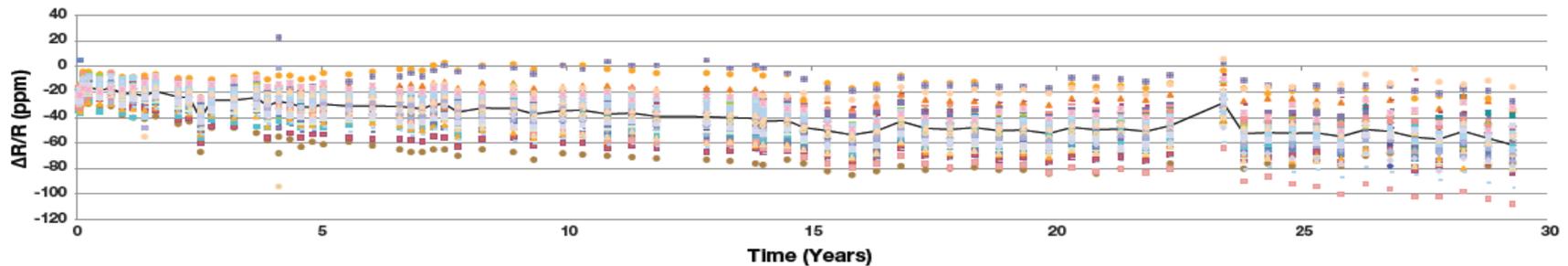
Accuracy

- The Tightest Tolerance (to $\pm 0.001\%$)

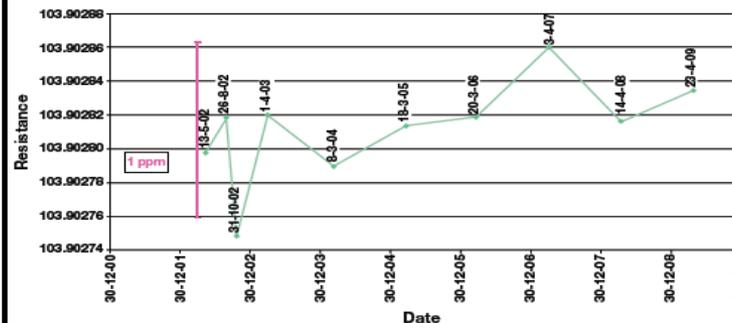


Bulk Metal[®] Foil Resistors Unique Stability

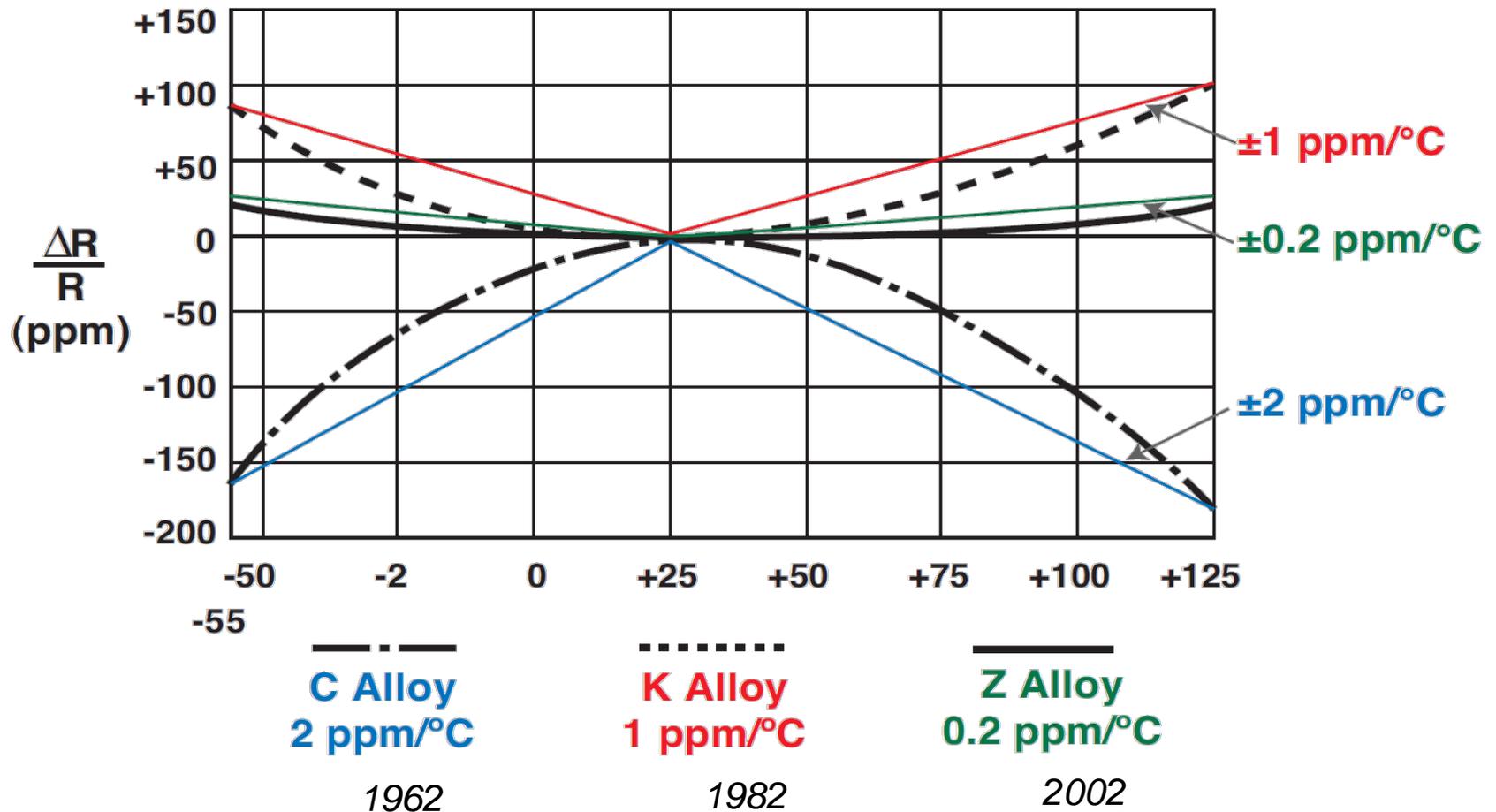
Long –Term Stability over 30 years (0.1 W at 70 ° C 50 samples (S102C, 10KΩ)



Shelf Life test results of hermetically sealed VHP 101 Foil Resistors over 10 years



Bulk Metal[®] Foil capability advances through the years



Typical Applications

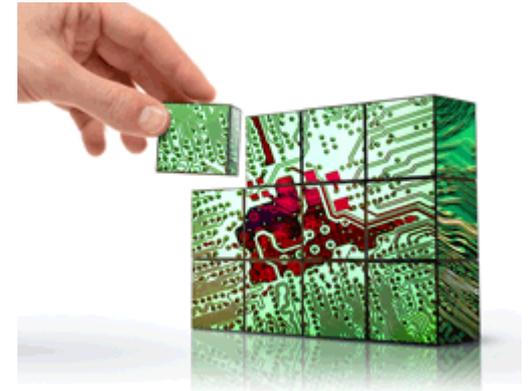
- Measurement systems
- Current sensing
- High-precision amplifiers
- Weighing systems
- Force balance scales
- Differential amplifiers
- Switching power supplies
- Electron microscopes
- Gyro navigation controls
- Pressure sensors
- Motor speed controls
- Telecommunications
- Bridge networks
- Standard Box & Decade
- **Tailored solutions per customer specifications**



Custom Tailored Solutions

The Bulk Metal[®] Foil resistors can be provided even with better specifications than written in the standard datasheets. There are specific cases where some parameters can be maximized/improved beyond the standard performances to suit the customer requirements using special pre and post manufacturing processes.

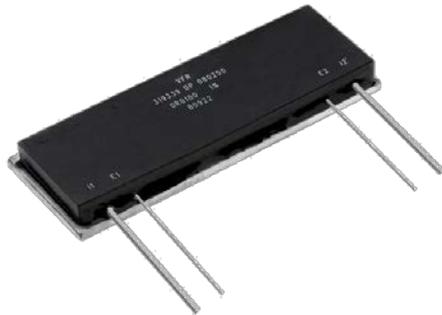
- Examples of parameters that can be controlled or improved with special processing are:
 - Total Error Budget (TEB) or End Of Life (EOL)
 - Long term stability
 - Ultra precision
 - Matched resistors
 - Resistance Value
 - Tolerance - Absolute and matched
 - TCR - Absolute and tracking



For more information please contact us at: resistorinfo@texascomponents.com

Bulk Metal[®] Foil Resistors in Precision Instrumentation

*New Generation Custom Designed Current Sensor is used in
High End Voltage/Current Calibrator*
Value: 10m Ω , TCR <1 ppm/ $^{\circ}$ C



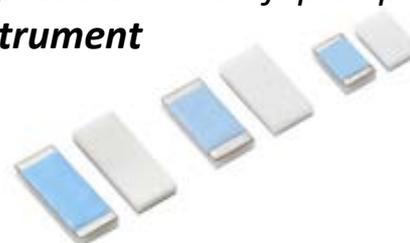
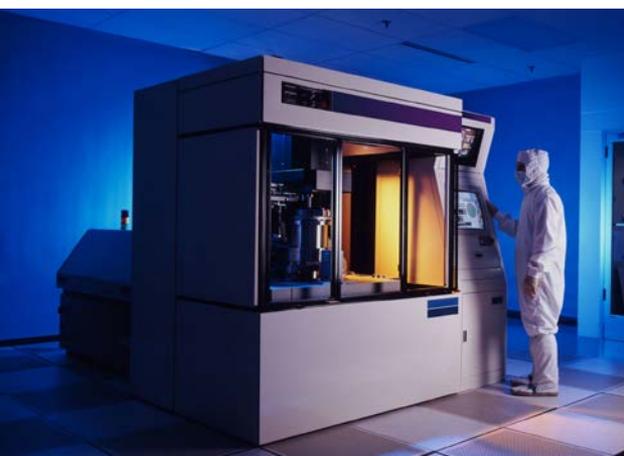
Bulk Metal® Foil Resistors in Precision Instrumentation



Hermetically sealed Ultra High Precision Z-Foil Technology Resistors – H-Series for Electron Beam Microscope



Ultra high-precision Z-Foil flip chip resistor for DC Test Instrument

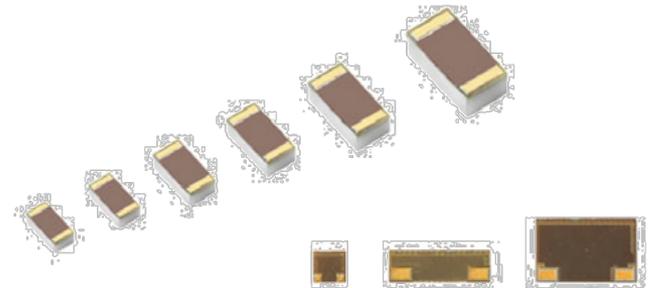


Bulk Metal[®] Foil Resistors in Down Hole Drilling Tool (High Temperature)

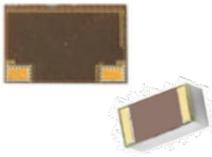
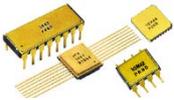
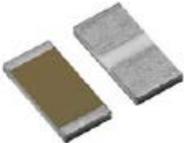


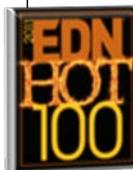
*HTHG series is used for measurement inside of
A Drilling Tool*

*Withstand temperature up to **+240°C***



Ultra High Temp Products – New Generation

Product Name	Product Image	Type		Features	Max working Temperature
HTHG		High Temperature Chip Resistor		Z1- Foil technology Mounting/Connection Method: Face up: Gold wire bonding	+240°C
		Sizes	Mounting		
		5x5,15x5,15x10 0603,0805,1206, 1506,2010,2512	Face up only		
HTHA		High Temperature Chip Resistor		Z1- Foil technology Two Options of Mounting/Connection Methods: 1. Face up: Aluminum wire bonding 2. Face down: Conductive epoxy	+240°C
		Sizes	Mounting		
		0603,0805,1206, 1506,2010,2512	Face up & face down		
PRND		Hermetically Sealed Network		Includes HTHG chips inside	+230°C
FRSH		Sizes	High Temperature/ Power Surface Mount Chip Resistor (Wrap around)	Z1- Foil technology Extended Pads	+225°C
		0603,0805,1206 1506,2010,2512			



Long Term Stability of 0.05%,
TCR to $\pm 1\text{ppm}/^\circ\text{C}$



Bulk Metal® Foil Resistors in Space Application



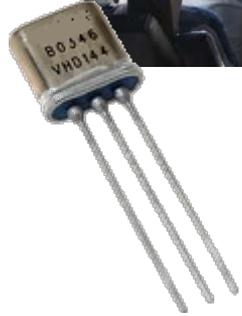
Space Level Resistor per EEE –INST-002

- *CSM Series (current sensors)*
- *VSMP Series (warp around SMD)*
- *SMR series (Molded SMD)*
- *PRND
(Hermetically Sealed Networks)*



Bulk Metal[®] Foil Resistors in AMS and High-Reliability Applications

*VHD200 for high temperature up to +200°C is used in
Brakes Control System of Commercial Airplanes*



*New Generation Current sensor is used to enable
handling of 40A and accuracy of 0.005% in
Submarine Repeater Station*



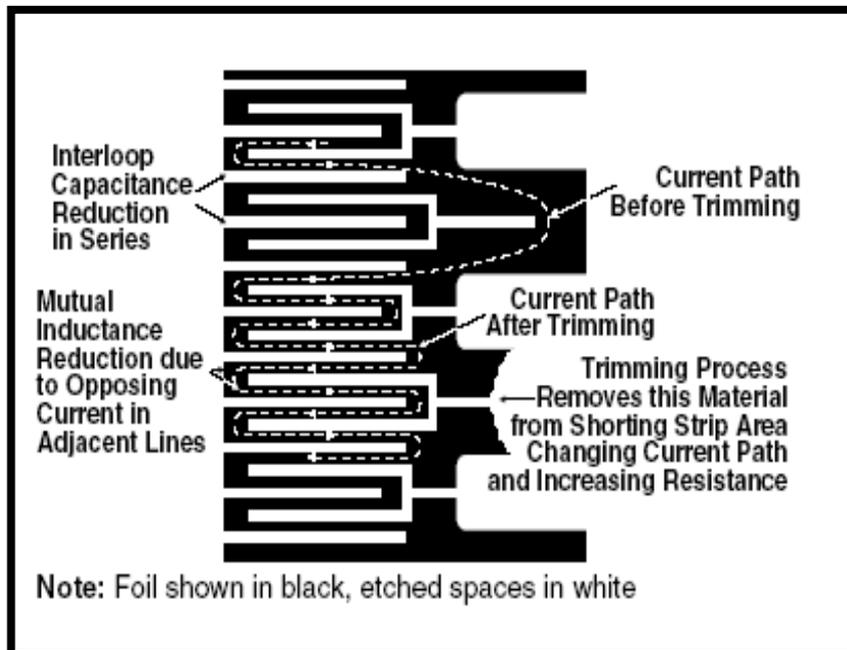
www.shutterstock.com - 115040092

Precision Centers

- Mini-manufacturing facilities (Precision Centers) in strategic locations around the world offering fast support for very precise designs requiring specific engineer selected values/tolerances.
 - Uncalibrated foil chips from VPG are stocked, calibrated, assembled, and finished by the Precision Center – then provided direct to customers.
 - VPG sets quality compliance standards and audits the Precision Center processes to ensure compliance.
- Precision Center also acts as traditional distributor (stock & resale) for finished resistors – which can be further tested, screened, matched, and/or burned-in.

Custom Samples in 1 Week

When you need precision resistors for your prototype, you can't wait weeks or even months to get them, or pay for large minimum order quantities. Bulk Metal[®] Foil resistors make it possible for Precision Centers to deliver small quantities in almost any value and tolerance in about a week.





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For further information please contact us at:

resistorinfo@texascomponents.com

www.texascomponents.com