



## Bulk Metal® Foil Surface-Mount Resistors for Military, Avionics and Space Applications

### The Key Benefits:

- Offering features a wide range of ultra-high-precision specifications and configurations for optimized performance:
  - TCR from  $\pm 0.2$  ppm/ $^{\circ}\text{C}$  ( $-55$   $^{\circ}\text{C}$  to  $+125$   $^{\circ}\text{C}$ ,  $+25$   $^{\circ}\text{C}$ ) with the Z-Foil technology
  - Long-term load-life stability within a maximum of 0.05 % for 2000 hours under full rated power at  $+70$   $^{\circ}\text{C}$
  - End-of-life tolerance to less than 0.05 %
  - PCR (“ $\Delta R$  due to self heating”) to  $\pm 5$  ppm at rated power with Z-Foil Technology
  - Tight tolerances from 0.01 %
  - Almost instantaneous thermal stabilization time  $< 1$  second
  - Nearly immeasurable 1.0-ns rise time effectively no ringing
  - Thermal EMF of  $< 0.1$   $\mu\text{V}/^{\circ}\text{C}$
- Simplify circuitry and lower system costs
- Feature a non-inductive ( $< 0.08$   $\mu\text{H}$ ), non-capacitive design
- Available with 4-Kelvin connections, wraparound terminations, and flexible terminations (SMRxD series)
- Offer a variety of screening options that are suitable for military, avionics, and space applications according to EEE-INST-002, DSCC, EPPL, and MIL-PRF 55342/55182/49465
- Withstand electrostatic discharges to 25 kV for increased reliability
- Within a resistance range from 2 m $\Omega$ , Vishay Foil resistors are manufactured with any resistance value (e.g. 1 k $\Omega$  or 1.1234 k $\Omega$ ) at no additional cost or lead time effect



### The Key Applications:

- DC/DC converters, feedback circuits, and precision amplifiers in test and measurement instrumentation, medical systems, satellites and aerospace systems, commercial and military avionics, weapons systems, audio systems, and high-temperature systems including down-hole drilling



## The News:

### **Bulk Metal® Foil Surface-Mount Resistors for Military , Avionics and Space Applications Offer TCR From $\pm 0.2$ ppm/°C (-55 C° to +125 C°, +25 C°), Load-Life Stability to 0.005 % (50 ppm), End-of-Life Tolerance to Less Than 0.05 %, and Almost Instantaneous Thermal Stabilization Time < 1 Second**

Vishay Intertechnology, Inc. (NYSE: VSH) now offers a wide variety of surface-mount resistors built on Bulk Metal® Foil technology for high reliability and high stability in demanding military, avionics and space applications. Including the release of the newly improved VSMP (0805 to 2512) series ,VCS1625Z, and CSM2512S, Vishay’s offering features a wide range of ultra-high-precision specifications and configurations for optimized performance.

- Offer designers the complete set of top performance characteristics to simplify circuitry and lower overall system costs by reducing the number of required parts
- Vishay brings foil resistors within reach of designers whose end-of-life tolerance target is 0.05 % or less
- 4-Kelvin connections offer low values, while wraparound terminations ensure safe handling during the manufacturing process, as well as providing stability during multiple thermal cyclings.
- Flexible terminations (SMRxD series) ensure minimal stress transference from the PCB due to a difference in thermal coefficient of expansion (TCE)
- Built to handle unconventional environmental conditions with minimal drift
- Devices are radiation tested, and include short-time overload testing as part of the standard production process

## Key Device Specifications:

Part Number	Construction	Typical TCR	Load-life stability (2000 h)
<b>VSMP (0805 – 2512)</b>	Wraparound terminations	0.2 ppm/°C	0.005 %
<b>VSM (0805 – 2512)</b>	Wraparound terminations	2 ppm/°C	0.005 %
<b>SMR1DZ/3DZ</b>	Flexible terminations	0.2 ppm/°C	0.005 %
<b>SMR1D/3D</b>	Flexible terminations	2 ppm/°C	0.005 %
<b>VCS1625Z</b>	Kelvin connection	0.2 ppm/°C	0.005 %
<b>VCS1625</b>	Kelvin connection	2 ppm/°C	0.005 %
<b>CSM2512/3637 (CSM2512S)</b>	Kelvin connection	15 ppm/°C max. (10 ppm/°C is available)	0.05 %  (typical current sensing resistors offer a load-life stability of $\geq 0.5$ % through a 1000-hour workload)

## The Perspective:

Several factors need to be considered when choosing a resistor for space and military applications, including TCR (ambient temperature), PCR (self heating), load-life stability, end-of-life tolerance, thermal EMF, and ESD. Some precision resistors offer designers tight initial tolerances as low as 0.05 % at the expense of poor load life stability, high end-of-life tolerance, long thermal stabilization, and ESD sensitivity. Others provide low TCR at the expense of poor rise time and uncontrolled drifts during operational life.

Vishay’s Bulk Metal® Foil resistors offer designers the complete set of top performance characteristics to simplify circuitry and lower overall system costs by reducing the number of required parts, while assuring a better end product. Vishay’s devices feature a long-term load-life stability within a maximum of 0.05 % for 2000 hours under



# New Product Info



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**Product Group:** Vishay Foil Resistors

full rated power at + 70 °C. In addition to their low TCR from  $\pm 0.2$  ppm/°C (-55 C° to +125 C°, +25 C°), the devices offer PCR (“ $\Delta R$  due to self heating”) to  $\pm 5$  ppm at rated power; tight tolerances from 0.01 %; and thermal EMF of  $< 0.1$   $\mu\text{V}/^\circ\text{C}$ .

Current design practice has been to overspecify resistors to allow for expected tolerance degradation in service. Vishay offers a new approach with lower prices to bring the foil resistors within reach of designers whose end-of-life tolerance target is 0.05 % or less. Foil resistors exhibit a long-term life and environmental stability that allows the designer to start with looser purchase tolerances and still remain within the total error budget. Conversely, Foil resistors with the same purchase tolerance will remain within a tighter performance envelope. Thus, designers can transfer more error budget to other components where incremental performance improvements are very costly, thereby reducing the overall cost of the system.

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