ESA SPCD 2018, THE NETHERLANDS Vishay Precision Group (VPG) Foil Resistors

VPG Foil Resistors

Vishay Foil Resistors • Alpha Electronics • Powertron

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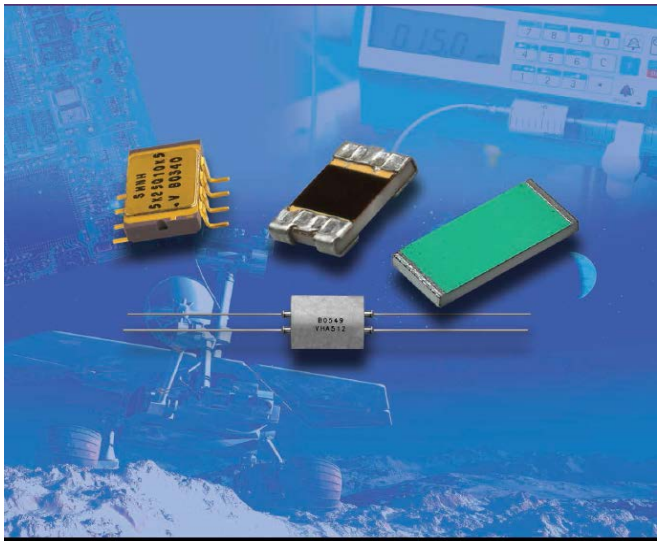
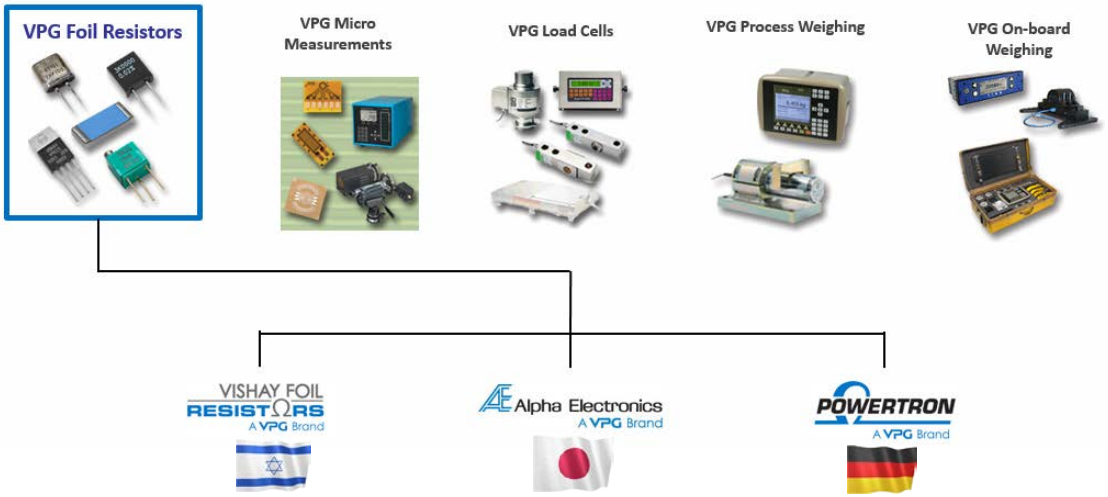
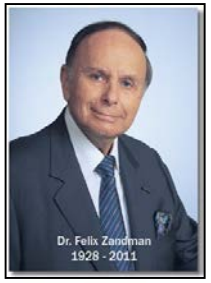


VPG and VPG Foil Resistors

- VPG is a global resistive sensor technology solutions provider in mission-critical applications.
- VPG spun-off from Vishay Intertechnology in 2010.
- Approximately 2,250 VPG employees worldwide now consolidated into 8 main manufacturing facilities.
- VPG Foil Resistors division includes 3 manufacturing facilities and above 600 employees.

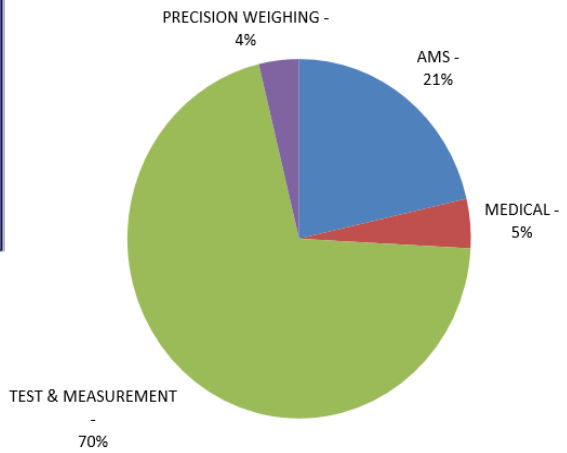


- Physicist Dr. Felix Zandman introduced in 1962 the Bulk Metal® Foil (BMF) technology which is still unparalleled for applications that require precision, stability and reliability.



Vishay Foil Resistors - IL

Market Sectors

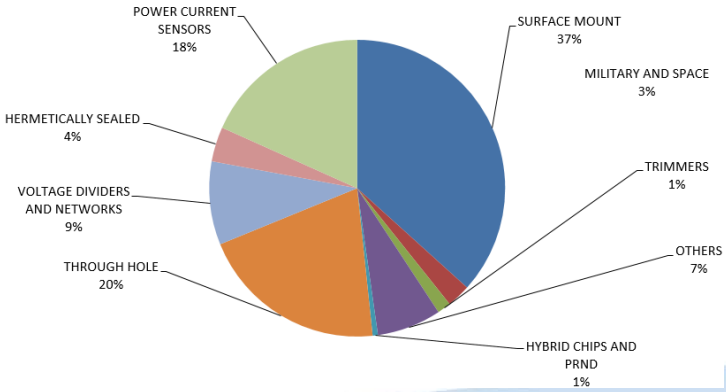


- Principal plant – Vishay Foil Resistors product line located in Holon, Israel
- **ISO 9001:2015/AS9100D**
- Total employees: 452 (31-Jul-2018)
- 3 resistor models with Mil. QPL qualification
- 8 resistor families in compliance with EEE-INST-002
- 14 DLA drawings

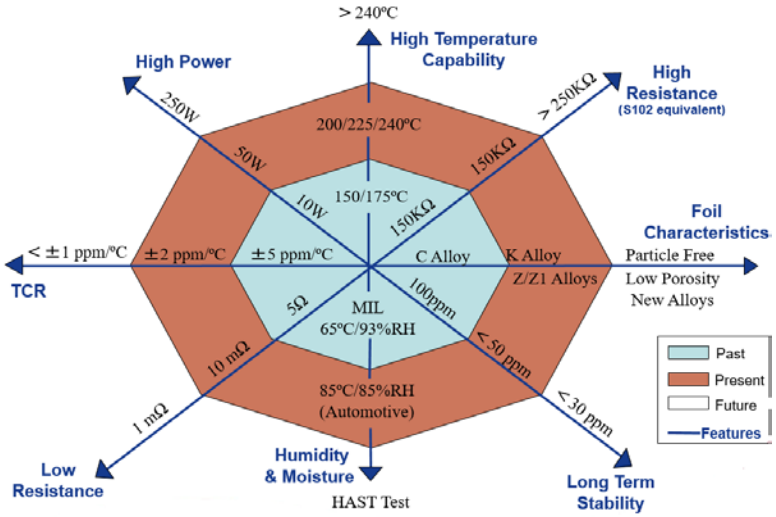
- Above 20% of revenues from Avionics, Military and Space (AMS) market sector

Portfolio and Roadmap VPG Foil Resistors Division

- Extremely low TCR: 0.2 ppm/ºC typical
- TCR tracking available to 0.1 ppm/ºC
- Excellent load-life stability/ratio stability: ±0.002% max ΔR per MIL standard; ultra long term stability: <1 ppm/year
- Very low resistance values from 0.0005 Ω
- Any 6-digit value in the resistance range available at no additional cost with any tolerance (to 0.001%)
- High power up to 2500 W (Per special customer request)
- Rapid thermal stabilization: <1 s
- Thermal EMF: 0.05 µV/ºC
- Electrostatic discharge (ESD): to at least 25 kV
- Non-inductive: < 0.08 µH
- Certification to NIST standards
- Special design to meet high temperature application requirements up to +240ºC ambient temperature



Technology Roadmap

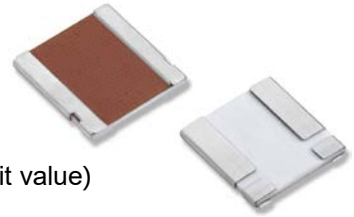


Ultra-High Precision Z Foil Current Sense Resistors for Space Applications

Industry-exclusive ultra-high precision current sense resistors

- Based on Bulk Metal® Foil resistive element.
- 4 terminal Kelvin configuration for precision current sensing.
- Highly precise voltage directly proportional to measured current levels.
- Screening and testing in accordance with NASA Goddard EEE-INST-002 ((Tables 2A and 3A, Film/Foil, Level 1).

Resistor model CSM3637F (V/N 303337)



Features

- Resistance range: 20 mΩ to 200 mΩ (any 6 digit value)
- Resistance tolerance: to ±0.1%
- Temperature coefficient of resistance (TCR):
  to 10 ppm/ºC (–55ºC to +125ºC, +25ºC ref.)
  For tighter TCR please contact us.
- Power rating: to 4 W at 70ºC
- Load-life stability: to ±0.02% (70ºC, 2000 hours at rated power)
- Short-time overload: 0.02%
- Electrostatic discharge (ESD): at least to 25kV
- Solderable terminations

Resistor model VCS1625Z (V/N 303119Z)

Features

- Resistance range: 0.3Ω to 10 Ω (any 6 digit value)
- Resistance tolerance: to ±0.5%
- Temperature coefficient of resistance (TCR):
  to 3ppm/ºC max.(–55ºC to +125ºC, +25ºC ref.)
- Power rating: to 0.5 W at 70ºC
- Load-life stability: to ±0.05% (70ºC, 2000 hours at rated power)
- Short-time overload: 0.02%
- Electrostatic discharge (ESD): at least to 25kV
- Solderable terminations

Surface-Mount Current Sense Performance Specifications

Bulk Metal Foil CSM3637F Performance Specifications			
Test/Condition	**Resistance Value**	**Typical ΔR % Limits(1)**	**Max ΔR % Limits(1)**
Load-life stability 2000 h, +70°C at rated power	≥100 mΩ	0.05%	0.5%
	20 mΩ to <100 mΩ	0.05%	0.1%
Short-time overload 5 x rated power, 5 s	20 mΩ to 200 mΩ	0.02%	0.05%
High temperature exposure 1000 h, 170°C	20 mΩ to 200 mΩ	0.2%	0.3%
Moisture resistance MIL-STD-202, method 106, 0 power, 7a and 7b not required	20 mΩ to 200 mΩ	0.005%	0.02%
Shock 100 g, 6 ms, 5 pulses	20 mΩ to 200 mΩ	0.02%	0.05%
Vibration 10 Hz to 2000 Hz, 20G 2 axes, 6 h per axis	20 mΩ to 200 mΩ	0.02%	0.05%
Resistance to soldering heat 10 s to 12 s at +260°C	20 mΩ to 200 mΩ	0.03%	0.05%
Note (1) Measurement error allowed for ΔR limits: 0.0005 Ω			

EEE-INST-002 (Table 2A Film/Foil, Level 1) 100% Tests/Inspections(1)	
RC Record	In tolerance
Thermal Shock	25×(–65°C to +150°C)
RC Record	ΔR = 0.1%
High Temperature Exposure	+170°C, 100 h, no power
RC Record	In tolerance ΔR = 0.1%
Final Inspection	5% PDA on ΔR, 10% PDA on out of tolerance
Visual Inspection	Magnification 30× to 60×
Mechanical Inspection	Dimensions, workmanship, 3 units sample size
Note (1) Vishay Foil Resistors will perform a pre-cap visual inspection 100% in the production flow prior to overcoating	