Improved Power Handling in Resistive Devices
Technical Introduction of Components
ESTEC - Space Passive Component Days

Christopher Hawn
October 11, 2018
Product Specialist - Board Level Components
Smiths Interconnect – Board Level Components

- **Smiths Interconnect Stuart, Florida**
  - (EMC Technology & Florida RF Labs)

- **RF/Microwave Board Level Components**
  - Resistors & terminations
  - Fixed attenuators
  - Temperature variable attenuators
  - Signal distribution devices (couplers, power dividers, etc)

- **Primary Focus on High Reliability**
  - In house qualification and screening
  - Extensive space heritage (over 35 years)

- **Notable achievements**
  - Inventor of temperature variable attenuator (Thermopad®)
  - First commercially available CVD Diamond Resistives

- **Key component trends**
  - Higher power, higher frequency and smaller size
Advanced Substrate Material - CVD Diamond

- Chemical Vapor Deposition - Similar properties to “natural” diamond
- Polycrystalline material - Compatible with thin-film process
- High Thermal Conductivity (1000 W/m*K) – Highest power to size ratio and excellent peak power capability
- Low Dielectric Constant (5.7) – Lower shunt capacitance and improved frequency response
- Standard chip package sizes ranging from 0402 (20 Watts) to 2010 (300 Watts)
- Operating frequency up to 30 GHz.
- Space qualified and participated on several key programs with various international space agencies: ESA, JAXA, ISRO, SAC and NASA
Innovative Board Mounted Solution - Outrigger Resistives

- **Smiths Interconnect invented the Outrigger Resistor in 2013** (Patent # 8,994,490)
  - A surface mount chip resistor for increasing power handling capabilities of RF circuits and minimizing parasitic capacitance and inductance effects.

- **Conventional resistor sizes (0402, 0603, TBD) with additional ground pads used for thermal transfer.**

- **Optimized for high frequency operation when matched with coplanar waveguide structures.**

- **Single Outrigger has 4-6X the power handling of an equivalent conventional resistor.**

- **Dual Outrigger has 7-8X the power handling of an equivalent conventional resistor.**

- **Outrigger Termination has 12X the power handling of an equivalent conventional resistor.**

- **Innovative Solution**
  - Eliminates CTE Mismatch issues with flange mounted chip terminations.
  - Improved Reliability – Fatigue Life
  - Tab launch is closer to the board (Reduced Height)
  - Significant Weight Reduction. (Approximately 90%)

- **Available in 3 different sizes and power rating (0.375” SQ, 0.5” SQ and 1.0” SQ Chips)**
  - Uses same footprint and hole spacing as conventional flange mount terminations.
  - Chip to be mounted using suggested thermal grease for maximum power dissipation

---

**Integrated Spring Mount Termination**

**Conventional Flange Mount Termination**