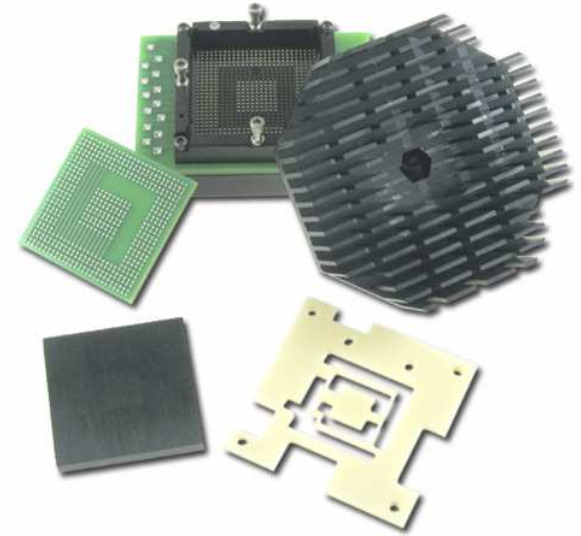




**Ironwood
Electronics, Inc.**



**SM/SMP – Embedded
Silver Ball Elastomer
Matrix Technology
Socket for Semiconductor Test**

**High Performance
IC Sockets And
Test Adaptors**

Problem

Prototype and Production Test Applications demand high bandwidth followed by high compliance, low resistance and high temperature.

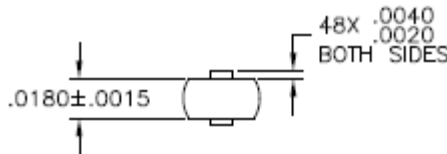
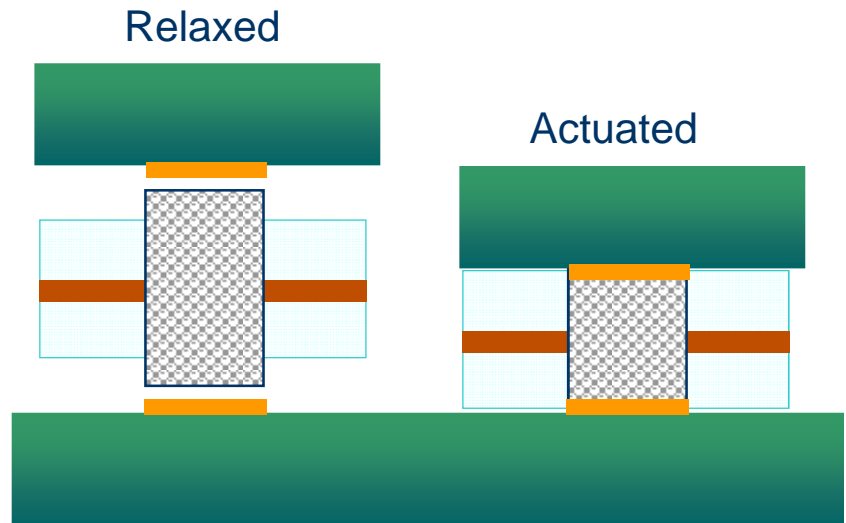
- *Elastomers have high bandwidth*
- *Elastomers have low resistance*
- *Elastomers have low compliance*
 - *Due to small thickness and mechanical coupling*
- *Elastomers have limited temperature range*
 - *Due to the inherent process of silicone rubber*

Solution - SM Contact

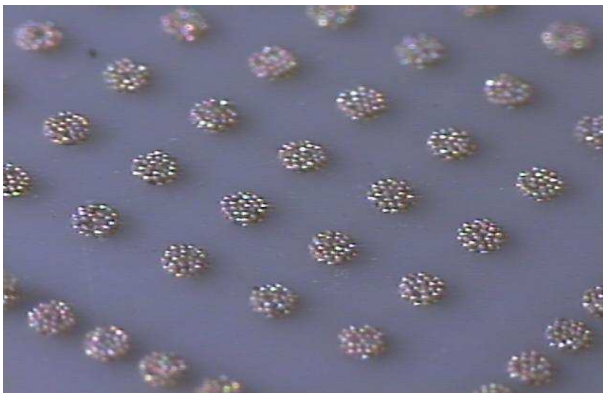


SM is a new elastomer technology that has silver balls held in a conductive column like buttons which are embedded in a non-conductive silicone rubber on a proper pitch that provides high compliance and extreme temperature ranges. The non-conductive rubber has a core in the middle to enable compression stop feature. SM is available for BGA, LGA, QFN, PoP and other packages from 0.25mm to 1.27mm.

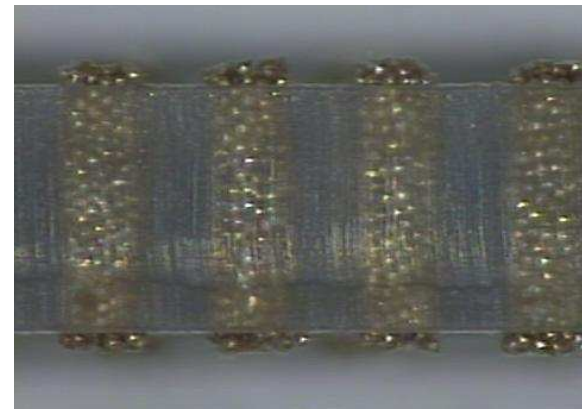
Socket with
Elastomer Matrix



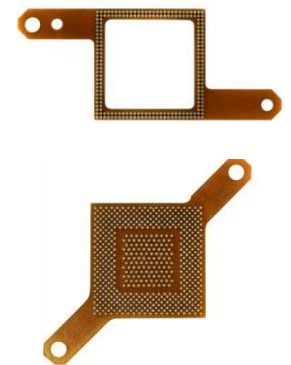
Array of Columns - Elastomer Matrix



Cross Section - Silver Particles

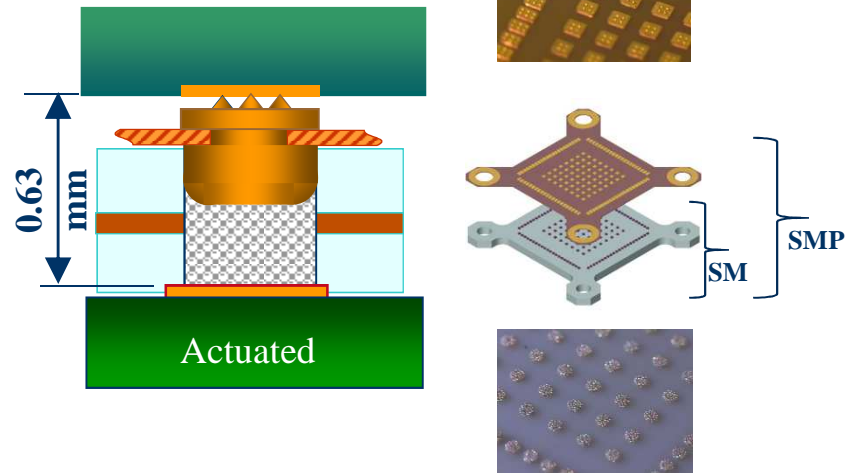
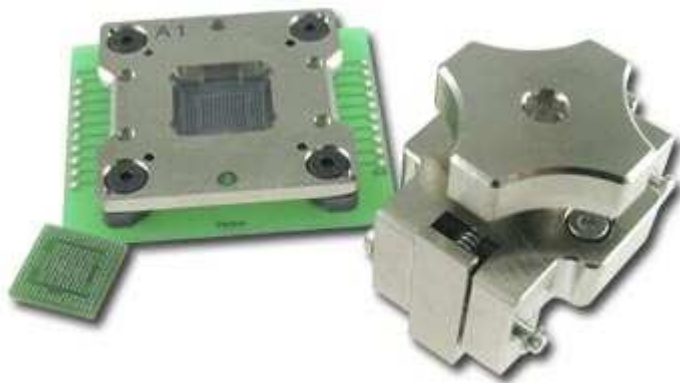


POP Interposers



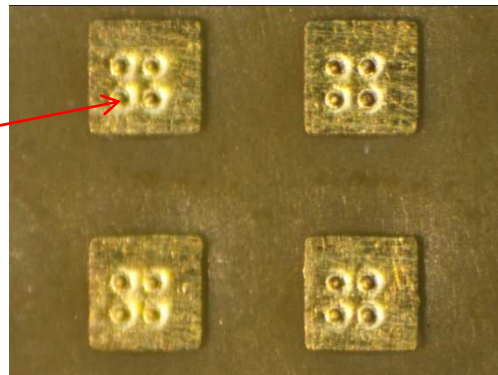
Solution - SMP Contact

The silver ball matrix contact technology is also available with a protective plunger matrix (a gold plated copper cylinder) that sits on top of the conductive columns. This plunger matrix protects the conductive column from contamination from various solder ball interfaces. A quickly replaceable plunger matrix enables minimal downtime during final production test. The product family code for this line of sockets is SMP. SMP is for ATE production test and is available for BGA, LGA, QFN, PoP and other packages from 0.25mm to 1.27mm.



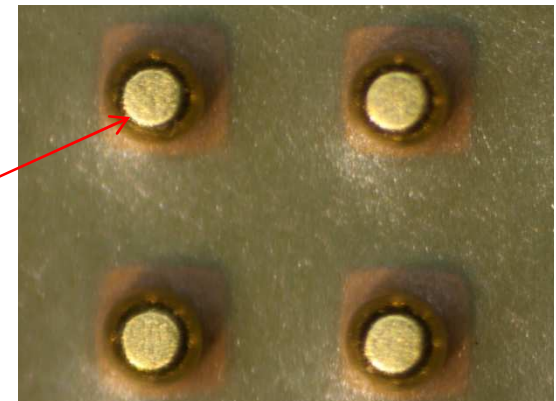
Top Side

Tips Pierce
DUT



Bottom Side

Tails Compress
SM Columns



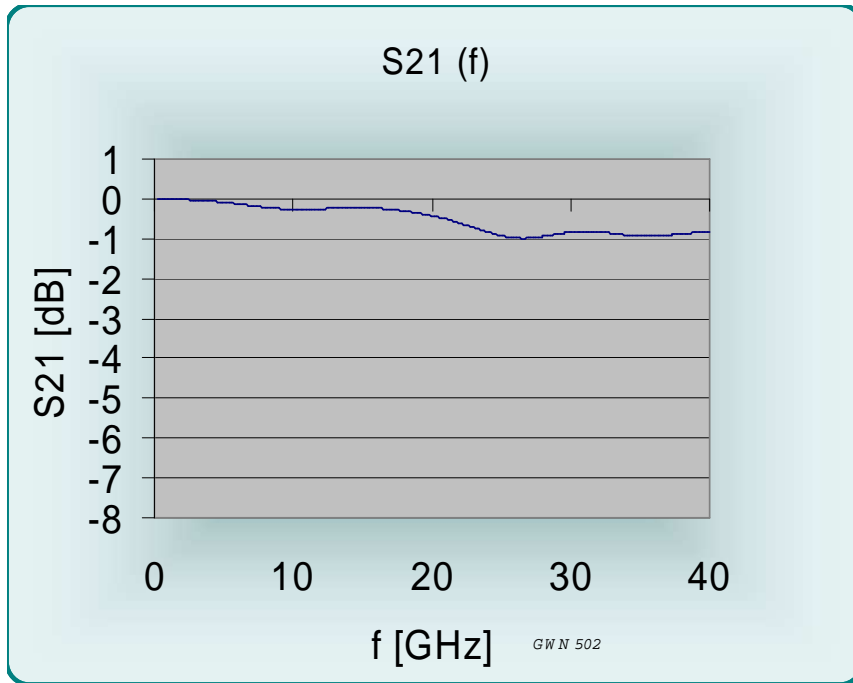
SM/SMP Contact - Typical Characteristics

- Contact resistance <15 mOhms
- Bandwidth >40GHz @-1dB
- Self Inductance <0.21nH @ 10GHz
- Mutual inductance <0.10nH
- Capacitance to ground <0.15pF
- Mutual capacitance <0.04pF
- Force 25-45grams per contact
- Operating temperature -55 to +155° C
- Insertion/Extraction cycles >500,000
- Current rating >4A per contact
- Contact length (compressed): 0.45mm
- Compliance: 0.25mm

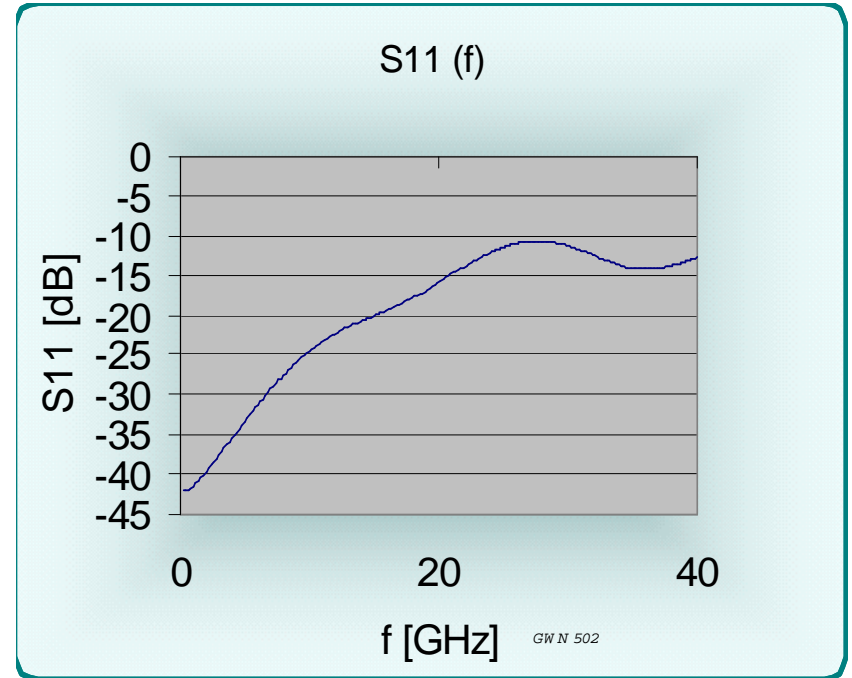
SM Contact



Bandwidth Data – 0.5mm Pitch



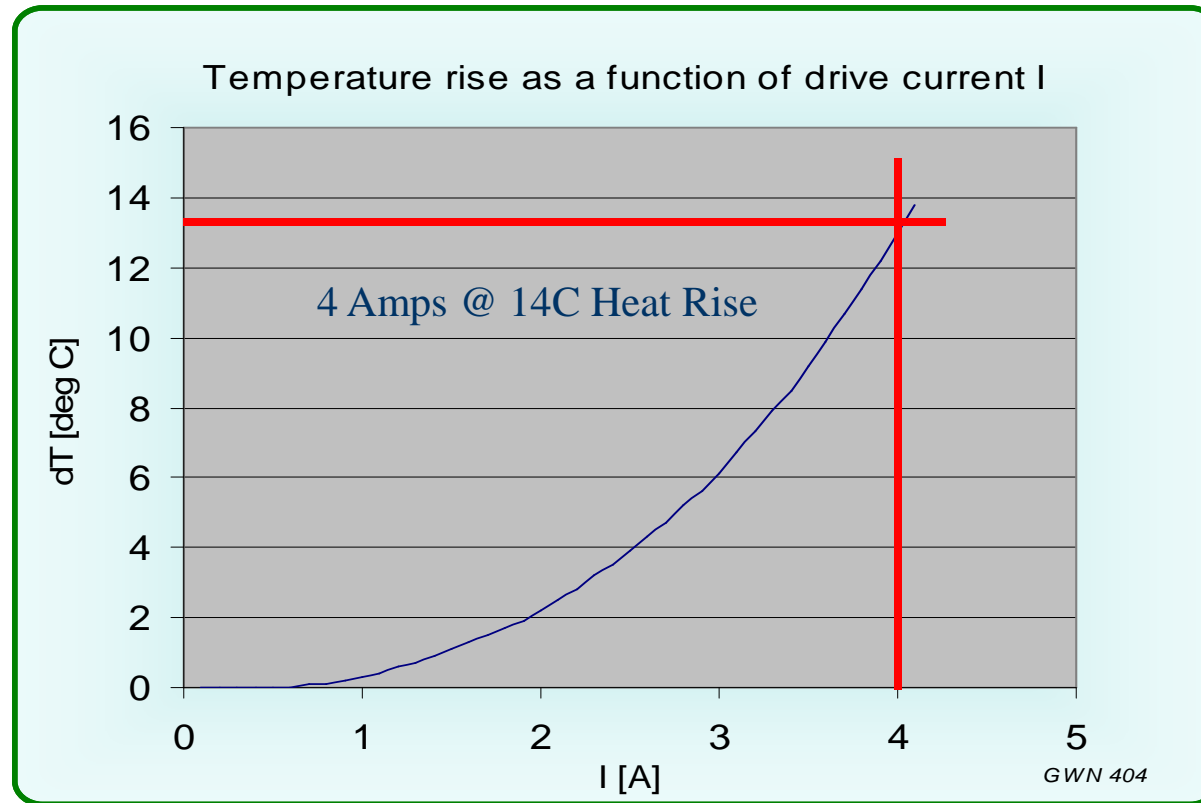
Insertion Loss -1dB @ 40GHz



Return Loss -15dB @ 22GHz

Note: 0.5mm MLF Electrical Characterization Performed with previous version SM contact

Current Data – 0.5mm Pitch

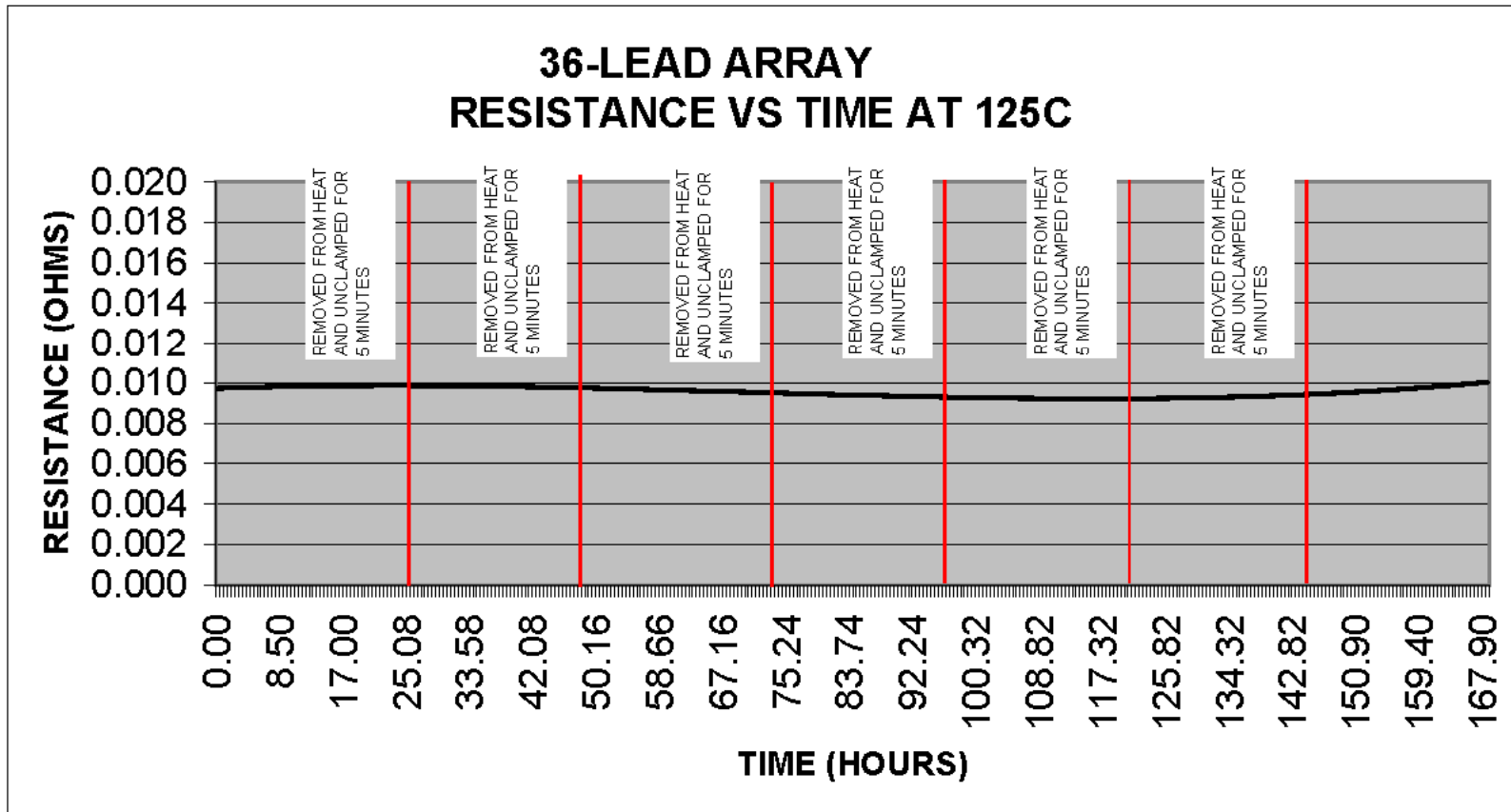


Note: 0.5mm MLF Electrical Characterization Performed with previous version SM contact

SM Contact



Temperature Data – 1.27mm LGA



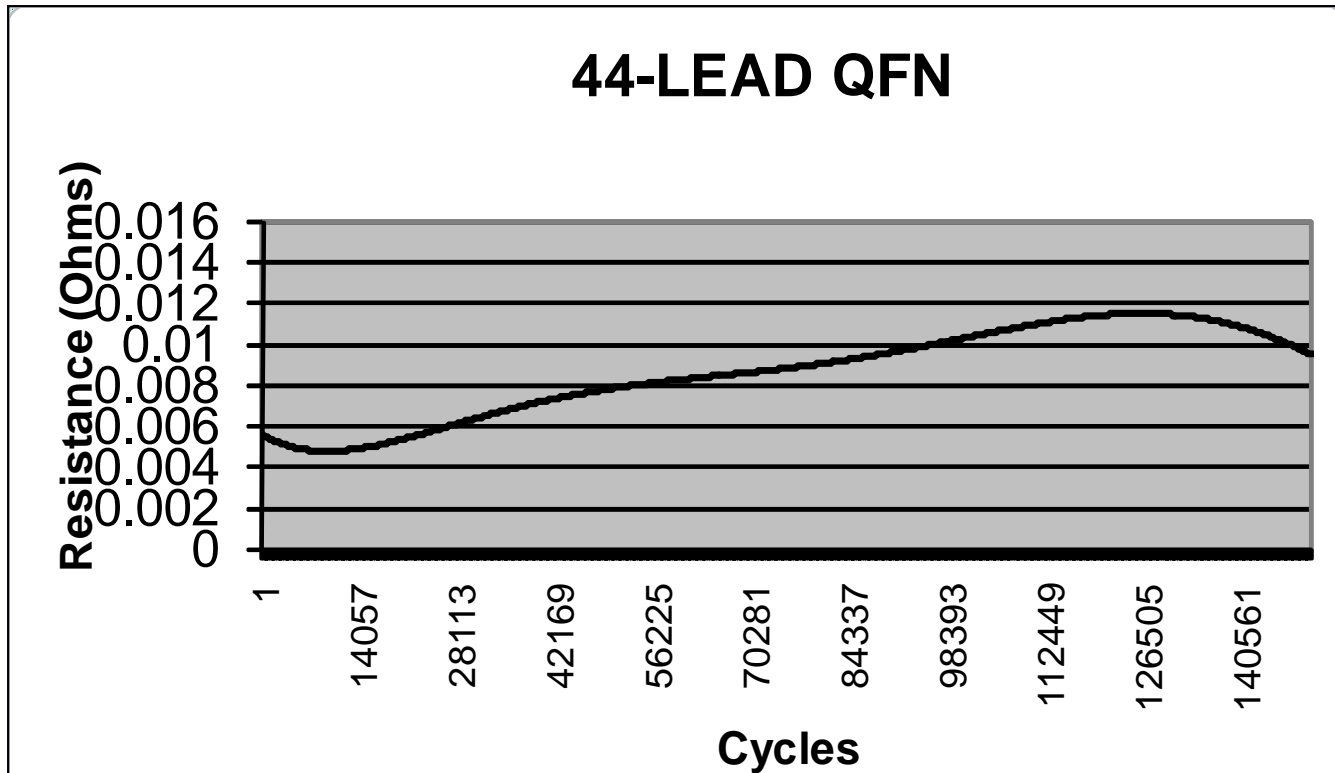
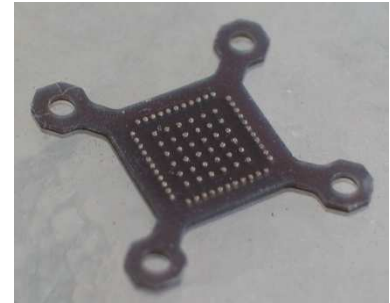
Note: Temperature Specifications for SM contact is -55C to +155C

SM Contact



Endurance Data – 0.5mm QFN

0.5mm Pitch QFN
Vertical Plunge Cycler, Gold plated device
simulator and Gold plated load board
@ Room Temp (Ambient)

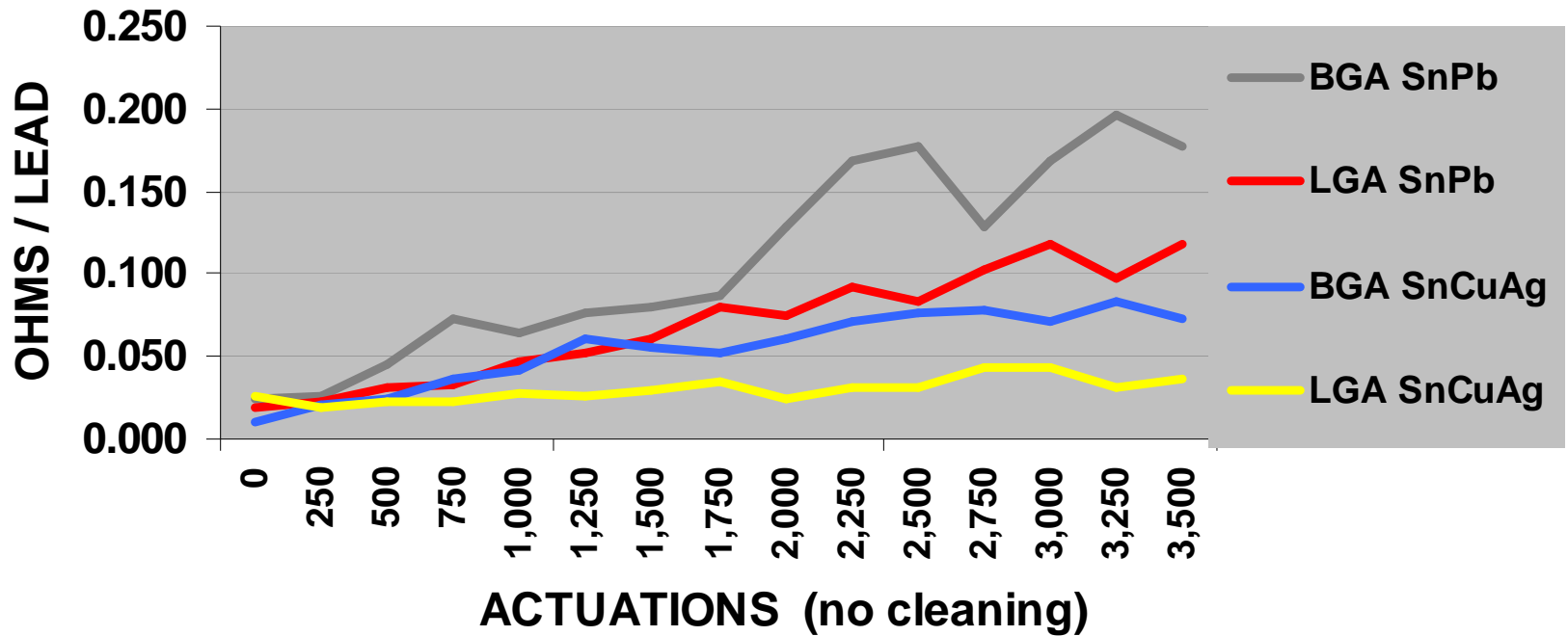


SM Contact



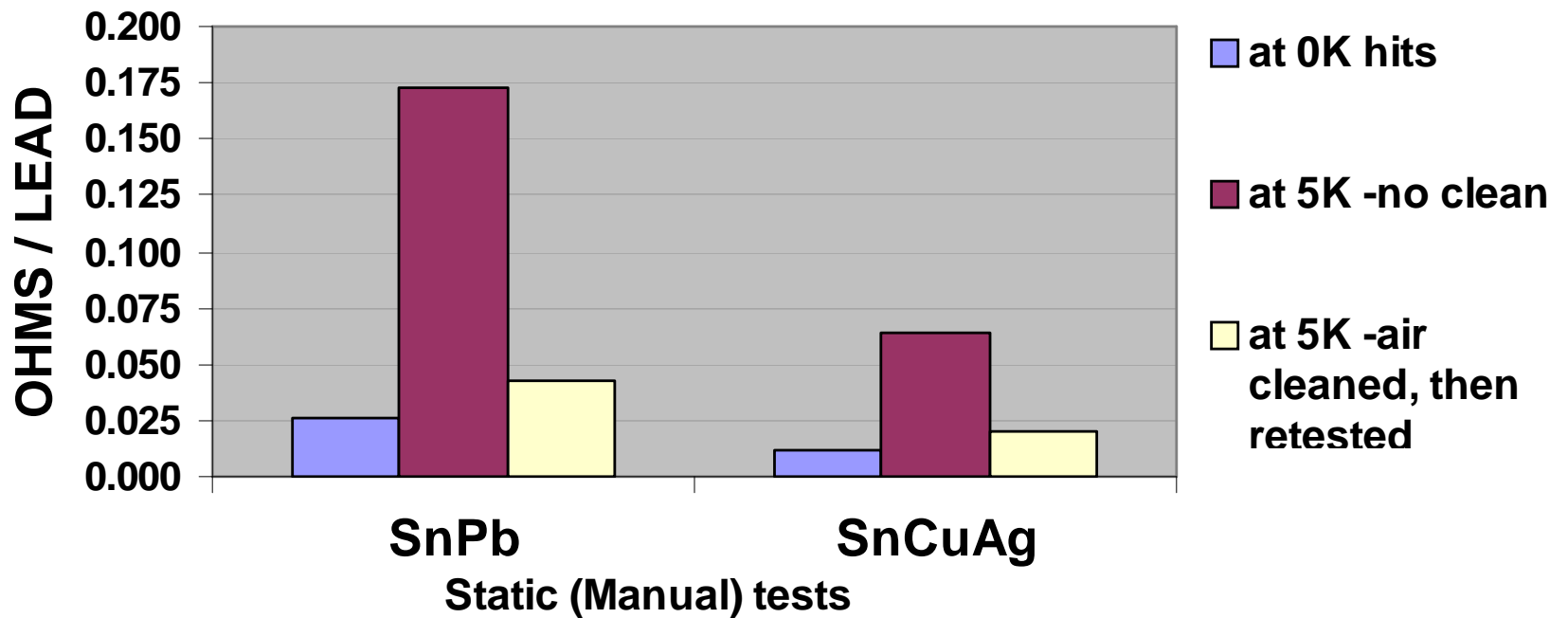
Endurance data with real devices to understand contact resistance without cleaning

BGA / LGA: SnCuAg vs. SnPb Plating



5K Endurance data with real devices showing the effects of cleaning

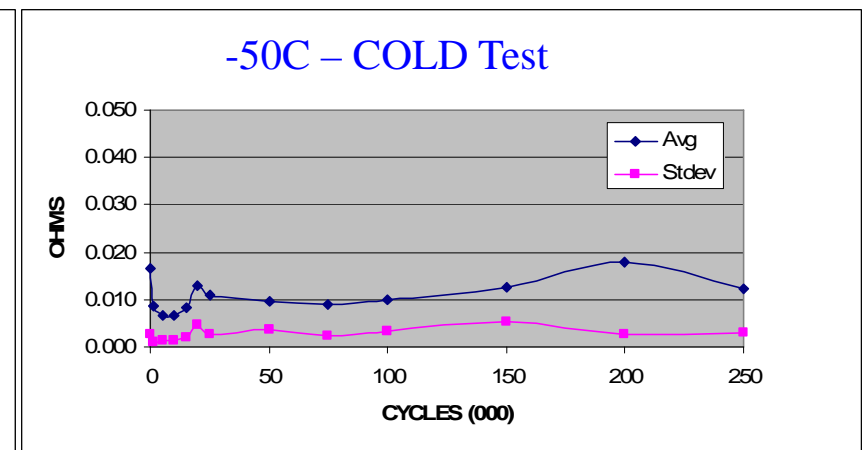
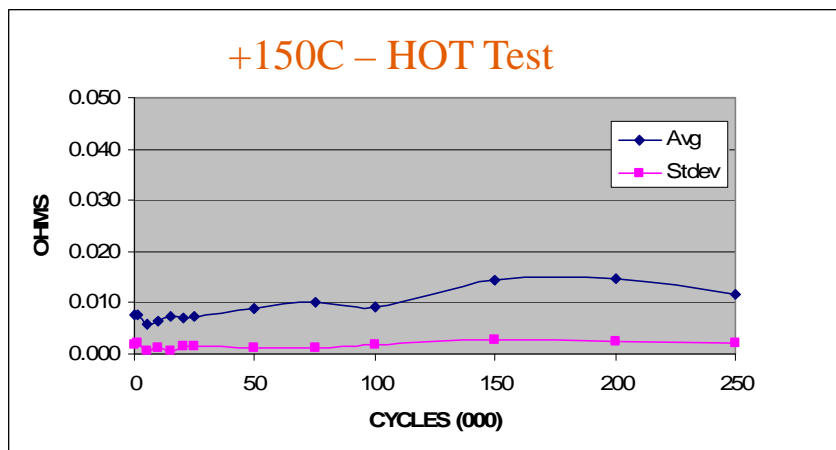
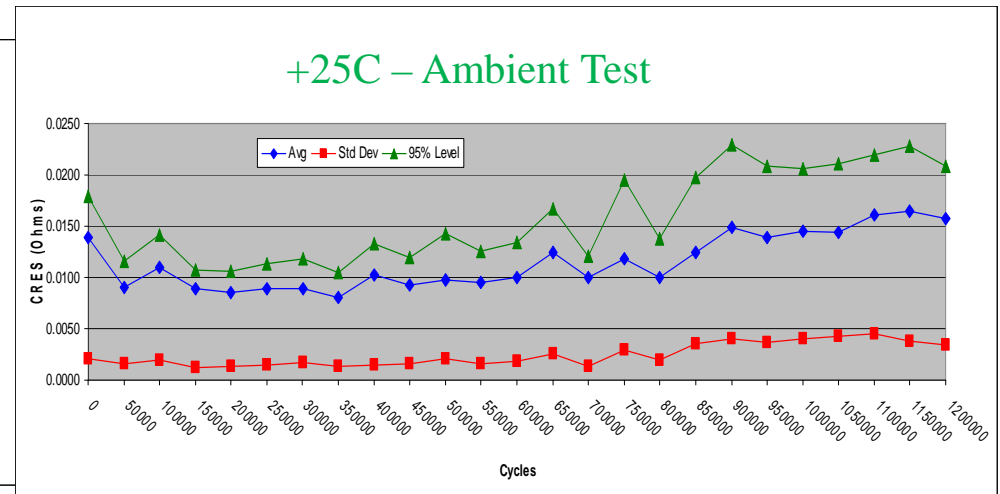
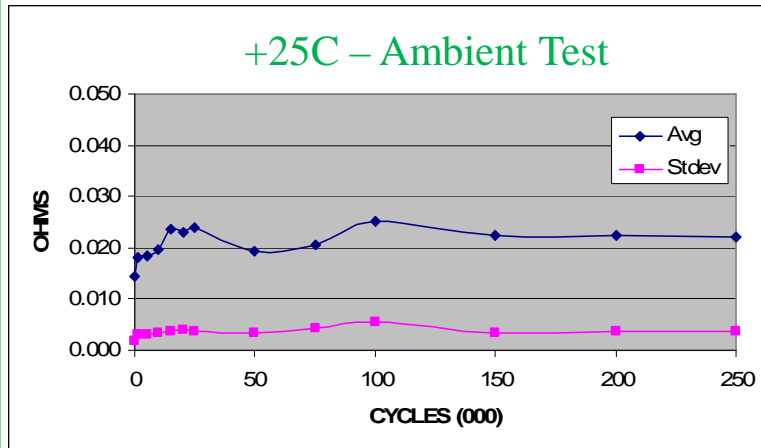
BGA (Effect of Cleaning)



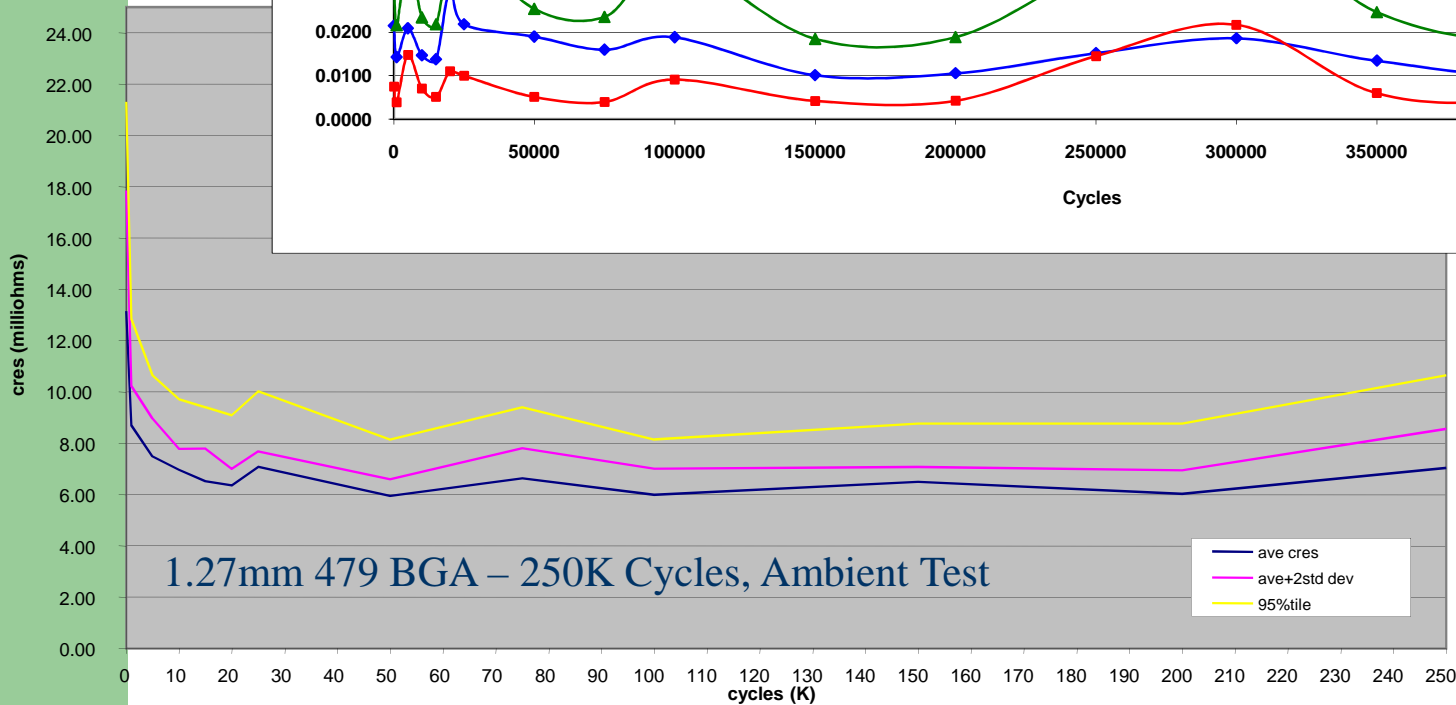
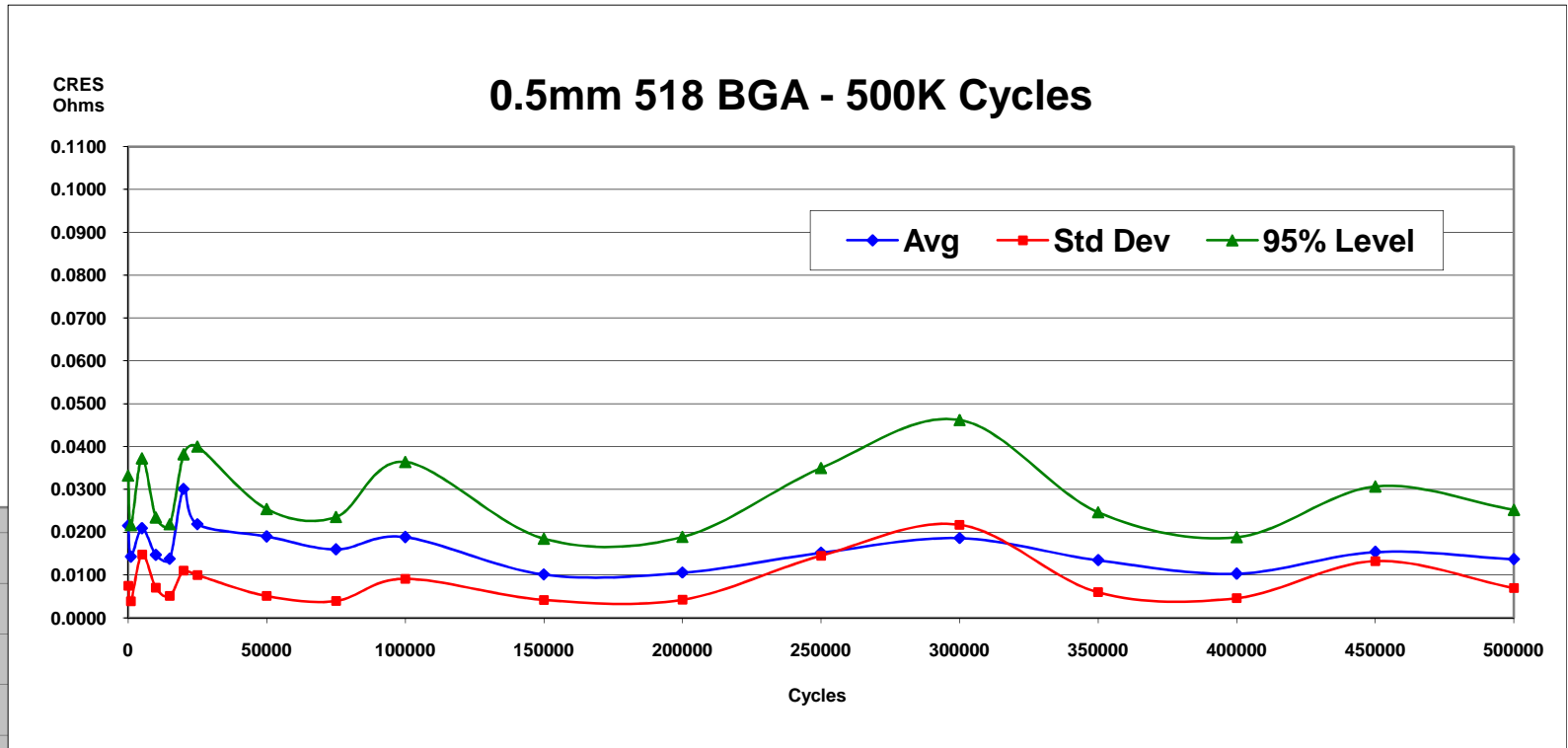
SMP QFN Contact – Temperature Data



0.5mm Pitch, 44QFN + 16 GND, Delta RFS Handler
Tri-Temp Cycling, (Ambient, +150°C, -50°C)



SMP BGA Contact – Endurance Data



SM/SMP Value Proposition



- Low cost elastomer solution for 0.25mm to 1.27mm pitch devices
- Extreme temperature solutions (-55 to +155C)
- High power applications (excellent current rating of 4A @ 14C rise)
- High speed digital and RF applications (excellent bandwidth >40GHz)
- Reliable test data due to stable contact resistance throughout life cycle
- High compliancy for large package warpage
- Mixed pitch and non-conventional array solutions for densely populated devices at low cost
- SM contact provides superior compliance in all lab and evaluation applications due to individual button technology at affordable cost
- SM sockets with wide temperature range are available in same footprint as other Ironwood sockets
- Custom test socket can be produced using SM contact in less than 3 weeks when standard socket is not available
- SM sockets are robust and can be used in demonstration products for multiple handling process without contact degradation
- SMP sockets are proven in ATE applications