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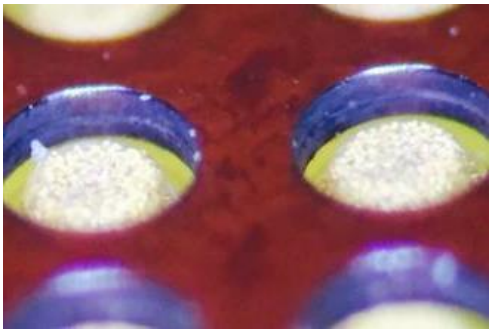
Elastomer Extended Duration Contact Cycle Qualification Case Study

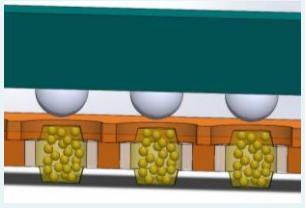
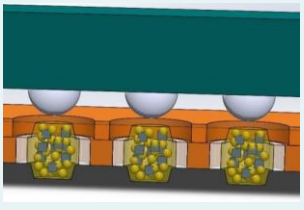
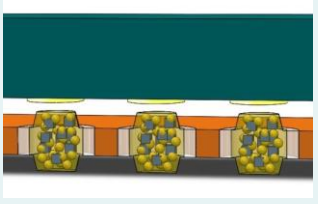
BJ Lee & Mike Dell — ISC Co.
Emad al-Momani — Intel Corp

Challenge: Elastomers are common high-performance/low-cost sockets applied for device characterization and validation. Some test specifications can require device socketing for several weeks or months. Long duration compression, especially with associated thermal cycles, can cause an increase in contact resistance leading to interconnect reliability problems.

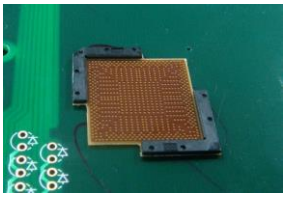


ISC Validation Socket for BGA with Ball Guide Film and Top Extrusion.

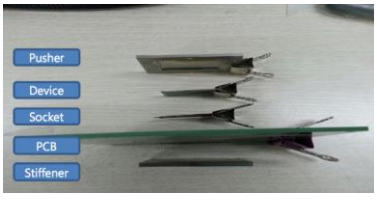
Case Study Process: Apply different elastomer construction and setup configurations to optimize elastomer sockets for long duration compression cycles. Intel and ISC performed several different test configurations to understand failure mechanisms, elastomer constructions, and setup conditions to achieve improved results.

Case 1: Au-Powder with BGA Device	Case 2: Au-Hybrid with BGA Device	Case 3: Au-Hybrid with LGA Device
		
• **Socket:** Homogenous Au Powder with and w/o Ball Guide Film. • **Setup:** Force-Control and Hard-Stop Control Compression.	• **Socket:** Hybrid Au Powder with and w/o Ball Guide Film. • **Setup:** Hard-Stop Control Compression.	• **Socket:** Hybrid Au Powder with and w/o Hard Stop Film. • **Setup:** Hard-Stop Control Compression.

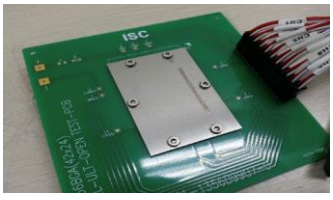
Testing Setup (All Cases):



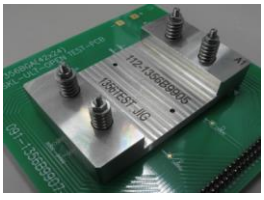
Typical BGA Validation Socket



Exploded View of Testing Setup



Sample With Hard Stop Pusher



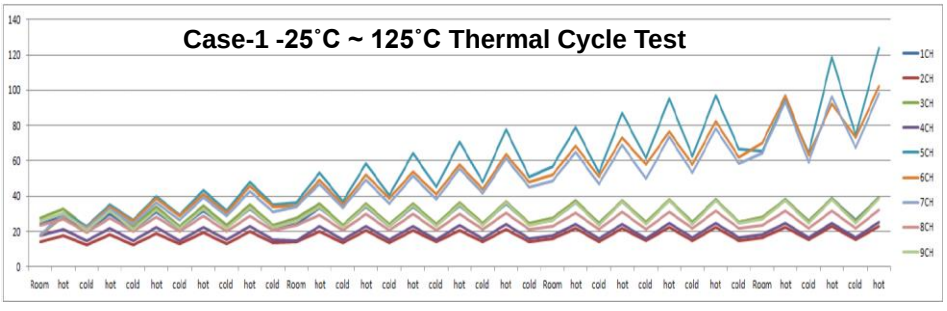
Sample with Force Control Pusher

Thermal Chamber

Test Samples in Chamber

Resistance Capture System

Case Study #1: Initial study work was done with ISC's "Normal" Validation Socket using Force Control and Fixed Pushers. Samples were checked with the ball guide film and without the ball guide film.



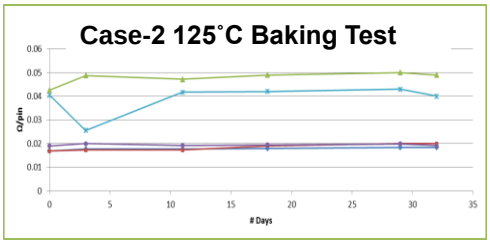
Case-1 Thermal Testing results. Resistance on several channels remained very constant, but some channels showed resistance climbing.

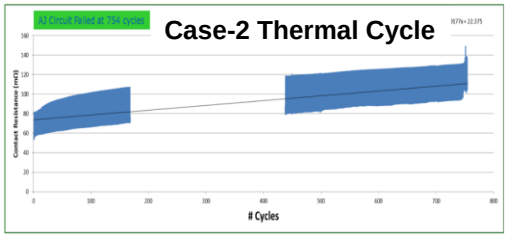
Lessons Learned Case-1:

• Ambient testing was stable	• Thermal Cycling caused resistance Rise
• Ball Guide improved stability	• BGA Oxidation may be a problem
• Fixed Pusher improved stability	• Pusher design is critical

Conclusion Case-1: Initial testing identified problems for Intel and ISC to study and work to improve. Case-1 setup was not suitable for long-term compression cycles. More qualification testing was needed.

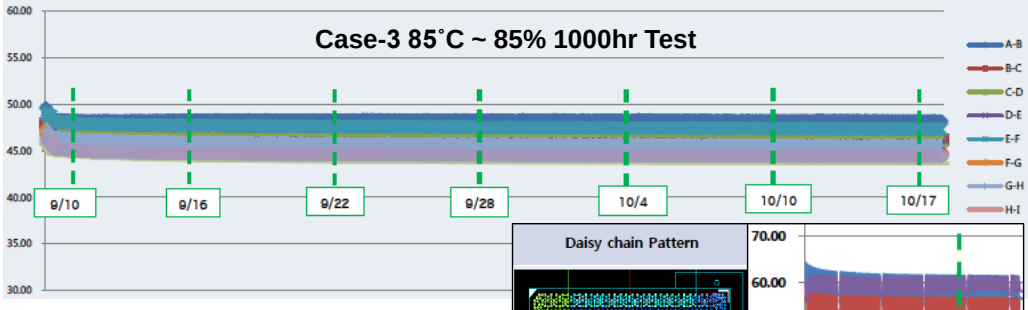
Case Study #2: Au-Hybrid Elastomer construction with Ball Guide for BGA Device. Baking at 125˚C & Thermal Cycling -20˚C to 120˚C, 2 hr cycle.

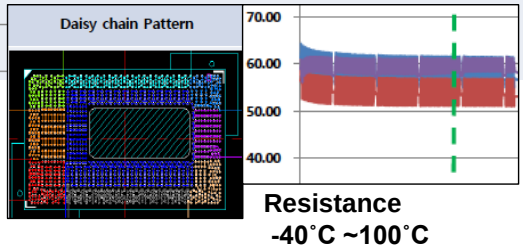




Lessons Learned Case-2: Sockets were stable over 35 days of continuous baking at 125˚C. Sockets showed a slight slope of increasing resistance under thermal cycling but was gradual, contact resistance was < 120mΩ after 750 cycles.

Case Study #3: Au-Hybrid Elastomer construction with Hard Stop Film for LGA Device. -40˚C ~ 100˚C Thermal Cycles and 85˚C/85%H Testing was done to confirm reliability.





Resistance -40˚C ~100˚C

Lessons Learned Case-3:
LGA Contact with Hybrid Elastomer proved very stable for Thermal Cycles and Heat/Humidity Testing.

Conclusions: Progression of Case Study Work was very effective. Confidence in using elastomer for very long term high performance socketing is high. Some key considerations:

• Hybrid Elastomer provides improved contact and lower resistance in all configurations	• Uniform compression is critical. PCB and Device MUST be flat and co-planer
• Alignment is very critical: Ball/Pad to Contact & Contact to PCB Pad	• LGA contact is more stable than BGA
• Hard Stop Pusher improves stability	• Proper setup provides stable contact