

**SEVENTEENTH ANNUAL**

**BiTS**

**Burn-in & Test Strategies Workshop**

TM

**March 6 - 9, 2016**

**Hilton Phoenix / Mesa Hotel  
Mesa, Arizona**

**Archive- Session 7**

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## Session 7

Mike Ramsey  
Session Chair

BiTS Workshop 2016 Schedule

## Solutions Day

Wednesday March 9 - 8:00 am

### Very Touching

#### "Implementation of MEMS Particles Dramatically Improves Conventional Rubber Sockets"

Dave OH, Justin Yun, Kanghee Kim - TSE Co., Ltd.

#### "Contacting DC - 40GHz and beyond"

Tony Tiengtum - Xcerra Corporation

#### "Small Form Factor Sockets and Circuits for Silicon and Platform Validation"

James Rathburn - HSIO Technologies, LLC

#### "Prediction of Contact Mark for QFN package"

Yuanjun Shi - Twin Solution

# Small Form Factor Sockets and Circuits for Silicon and Platform Validation

**James Rathburn**  
**HSIO Technologies**



2016 BiTS Workshop  
March 6 - 9, 2016



## Topics

- Intro – Challenges
- System Level Approach
- The Grypper Product & Copper Pillars
- Performance Enhancing Spring Pin Sockets
- Multi-Point Ultra Low Profile SMT BGA
- Dual Purpose Platform Validation – OEM HVM Socket
- Summary

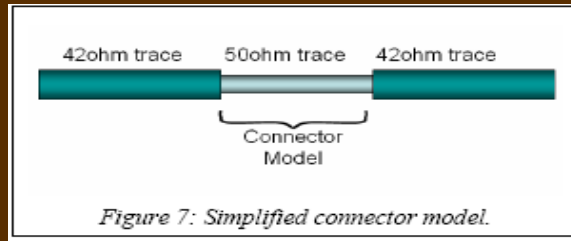
## Platform and Silicon Validation Challenges

- As systems and silicon becomes more complex with density and performance increases, it has become increasingly difficult to validate silicon with conventional means.
- Historically, a custom platform is developed to predict silicon performance while the custom platform looks nothing like the end product system.
- Traditional sockets using compression mount hardware and alignment through holes dictates a custom platform with routing issues.
- The ability to solder a socket directly to the device site on an actual platform approaches real world validation capability.
- Sockets and Circuits have been developed to allow the user to solder the socket onto the same device footprint as the actual device using conventional reflow processing and optical or stencil alignment of the socket with no through holes.
- In some cases, external device retention is required with no through holes.

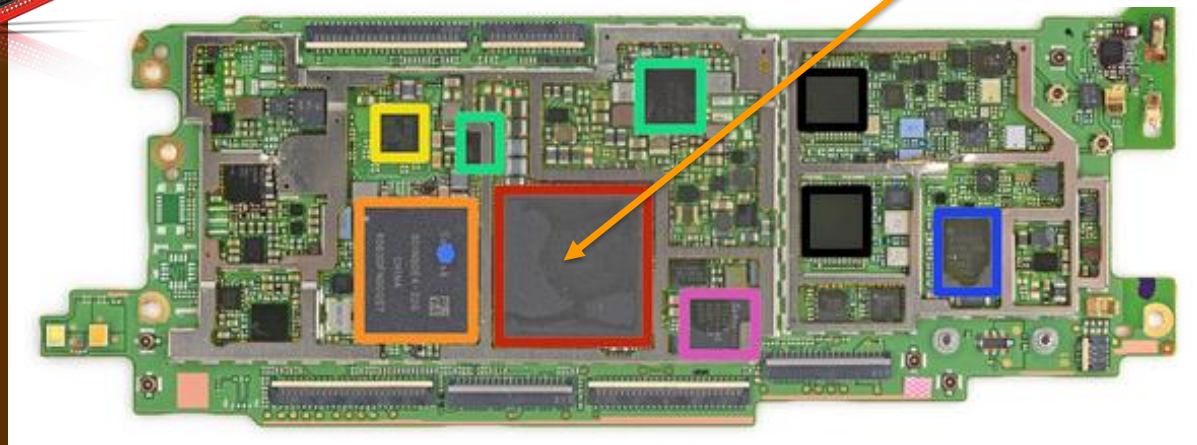
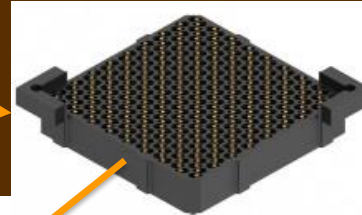


## System Level Approach

Technology aimed at each point within the signal channel – tuned high speed products to reduce parasitic effects for connectors, sockets, circuit boards and packaging



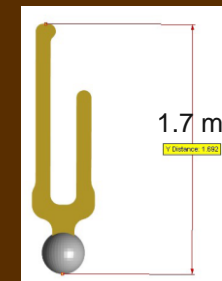
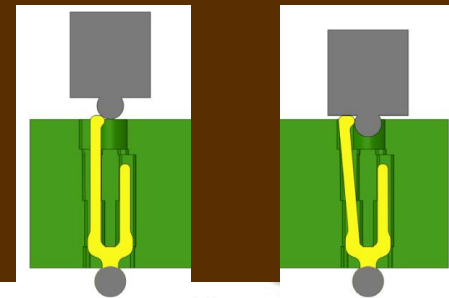
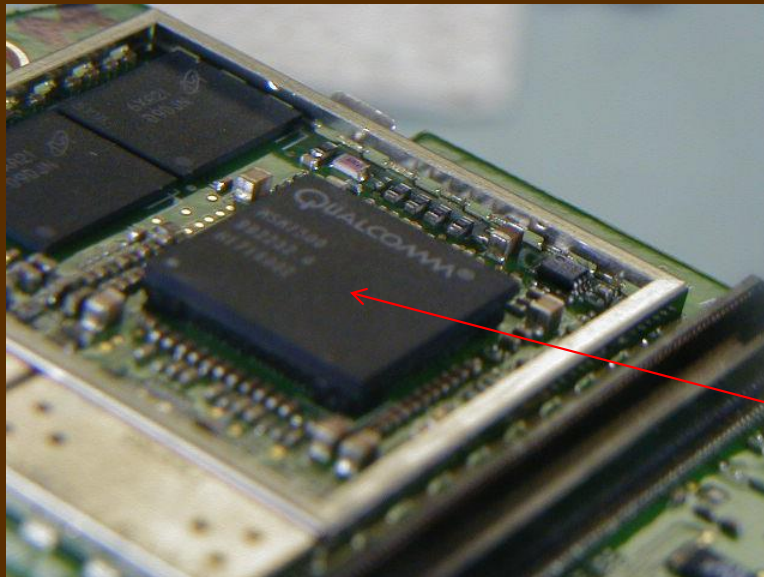
Signal Channel  
Package Substrate  
Socket and Connector  
HDI Printed Circuits



## “Soldered” Socket

Device size socket solders to the target circuit board in place of the BGA device. No fasteners or pcb through holes needed.

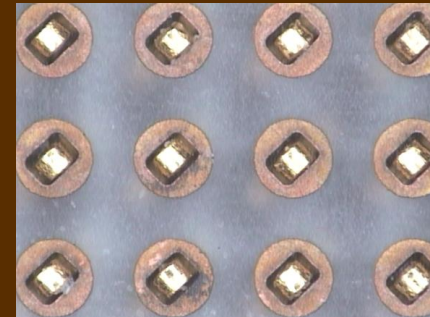
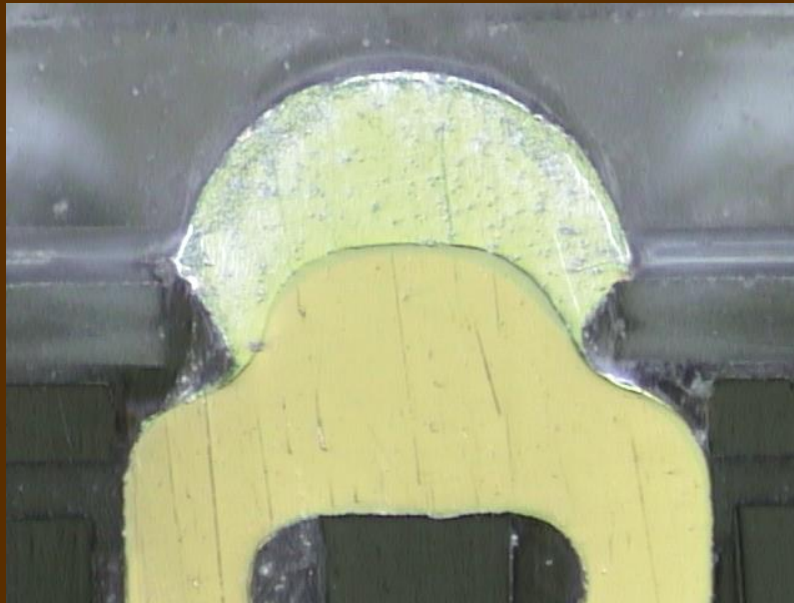
Devices are inserted into the socket and contacts engage with solder ball to retain the device and allows devices to be swapped without rework or reflow



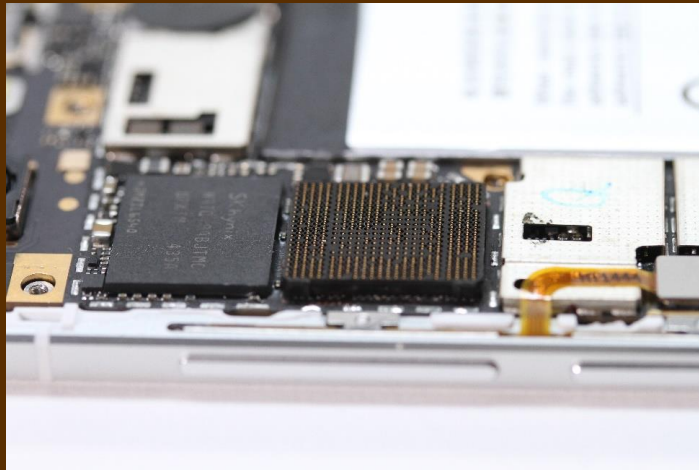


## Metalized Pad to Contact Solder Interface

- Existing contacts used to build with Mechanical Contact Retention – retains contact and seals solder wicking path
- Metalized pad on housing engages with contact tip and solder ball wets out to the metal defined pad diameter while providing strong joint to the contact.



## Example Installation



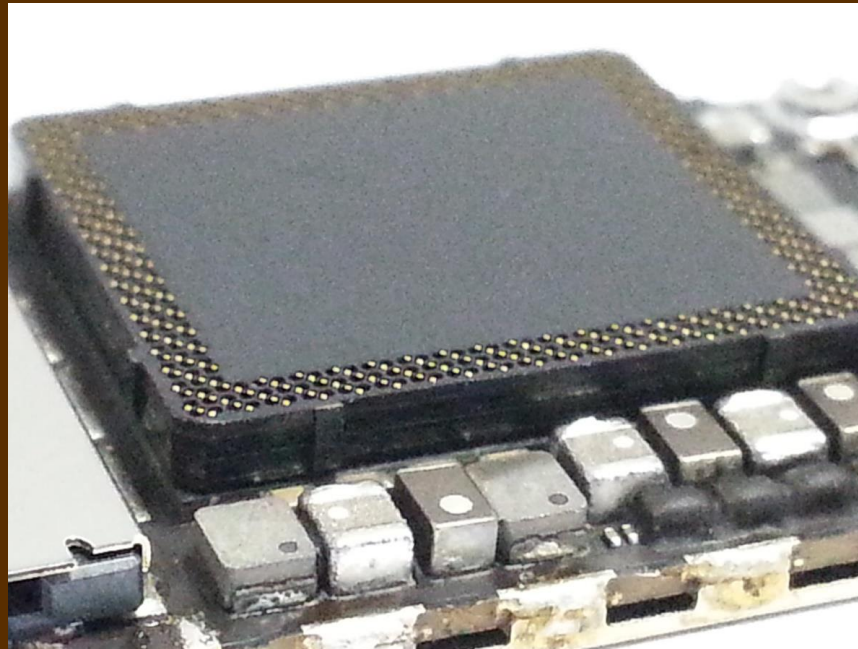
Grypper G40 / G80 shown

## Platform Validation Socket – PoP Application

Socket Solders to the SoC

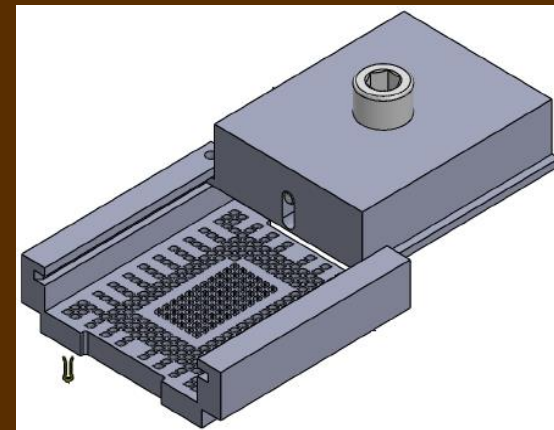
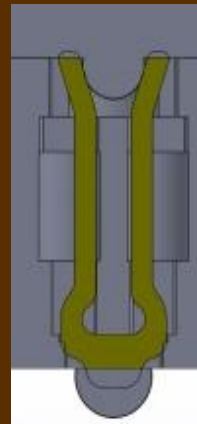
SoC can be soldered to platform PCB

SoC can have separate Socket so both SoC and Memory is socketed for easy device swap



## External Device Retention

- Alternate Socket construction with normally closed spring loaded lid
- Socket is slightly larger than device but solders to exact footprint with component clearances at the pcb level
- Designed for increased life and physical retention of the device

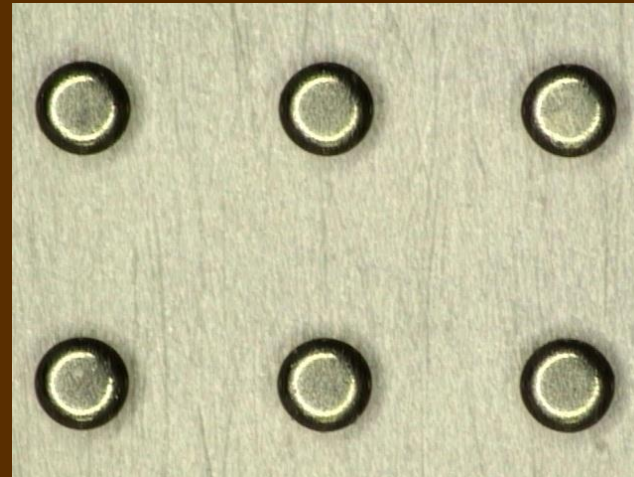
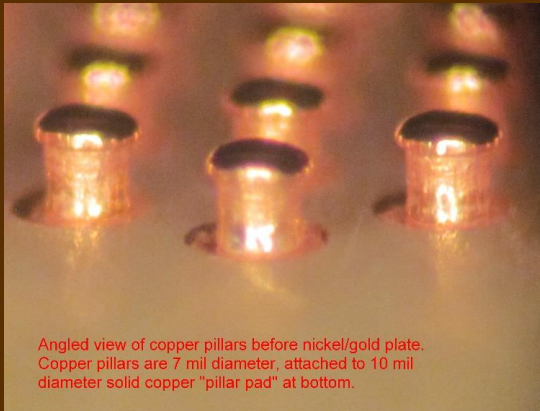




# Core Technology Building Block

## Contact Terminal Deposition

-Contact member terminals deposited directly onto Flexible Circuit or Rigid Substrate creating low profile high speed interface without contact assembly



Solution to small ball or solder bump

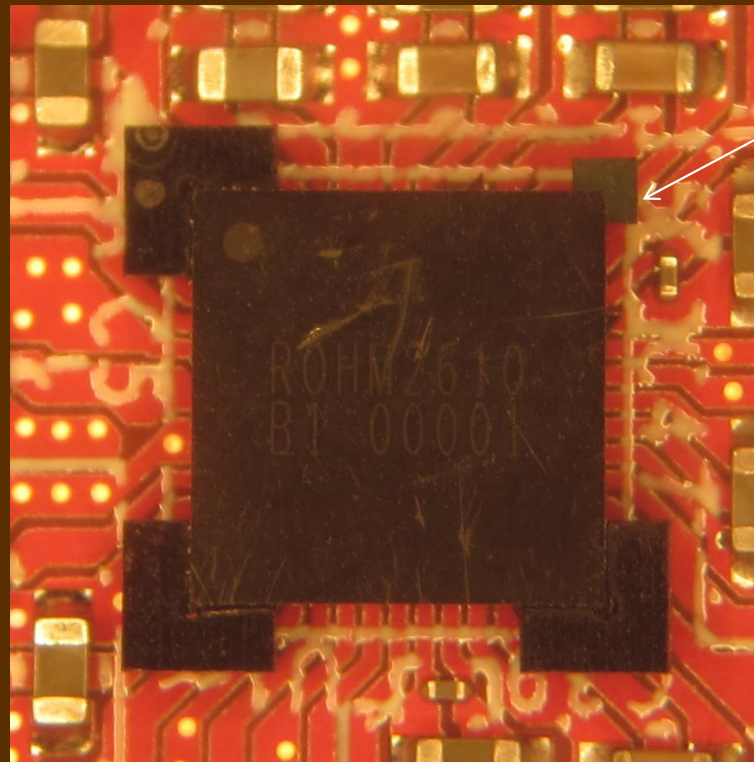
-Copper Pillar Substrate





## Cu Pillar Substrate Combined with Socket

-Socket Soldered to PCB – PMIC Soldered to Substrate – Substrate plugged into socket – Extraction tab added to aid device removal

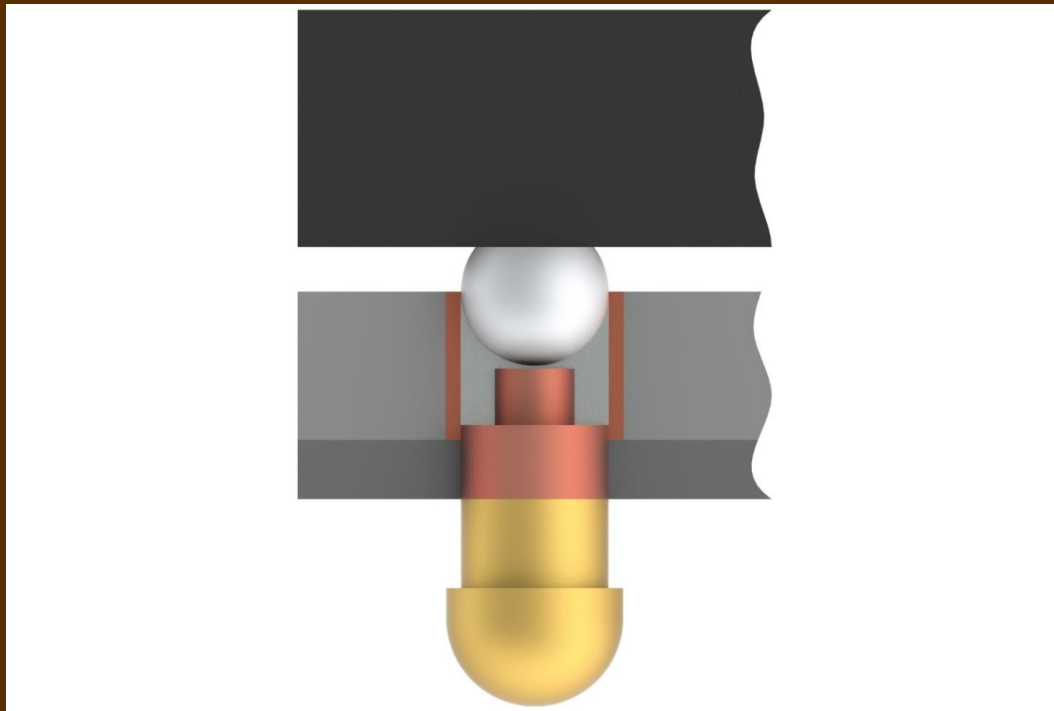


Extraction Tab

G40 example

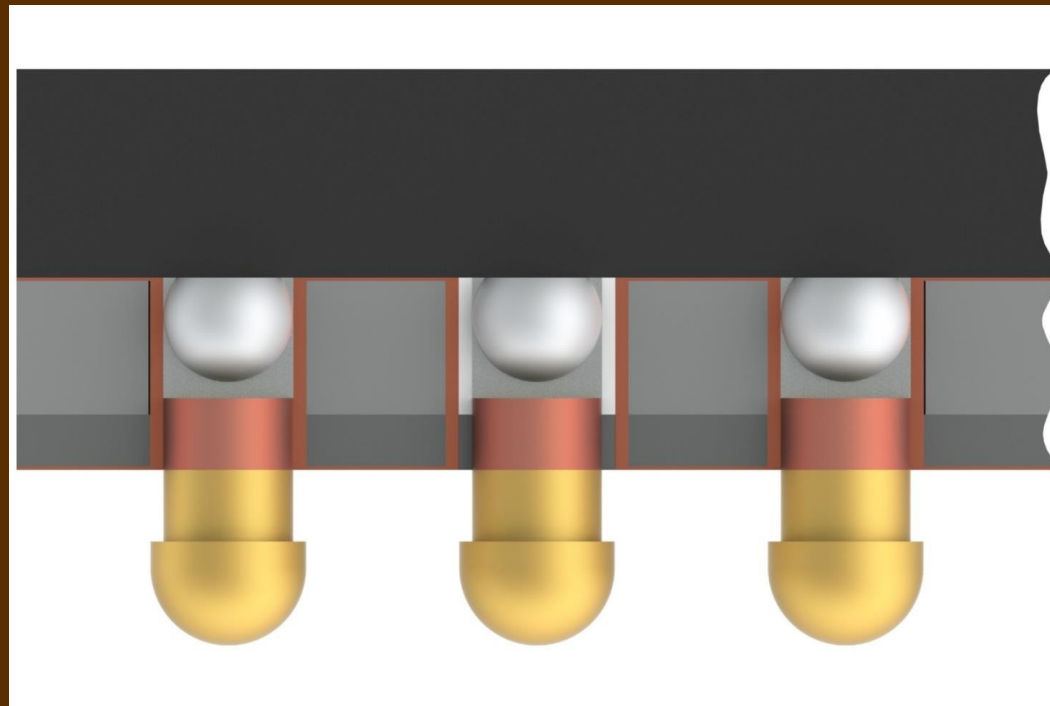
## Dual Core Cu Pillar Substrate

-Dual Core Substrate – BGA Soldered to Plated via and pillar “up”



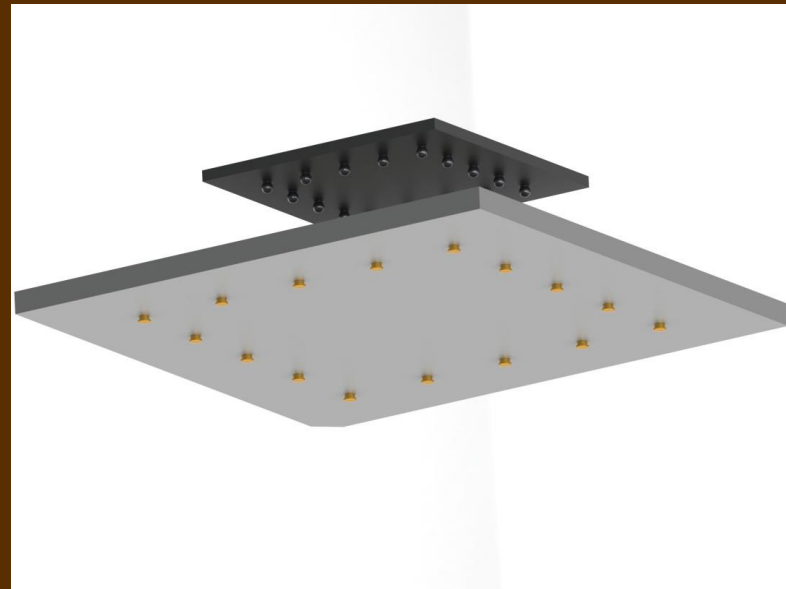
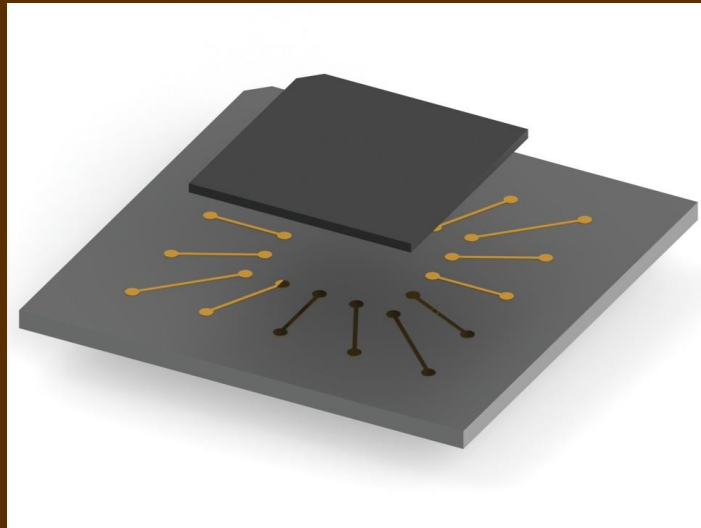
## Shielded Version Possible

-Signal pins shielded – Ground Pins ganged



## Cu Pillar Substrate & Socket Combination

- Circuit Fab capability allows for direct die attach with flip chip routing
- Direct die socketing without package possible



## Performance Enhanced Spring Pin Sockets

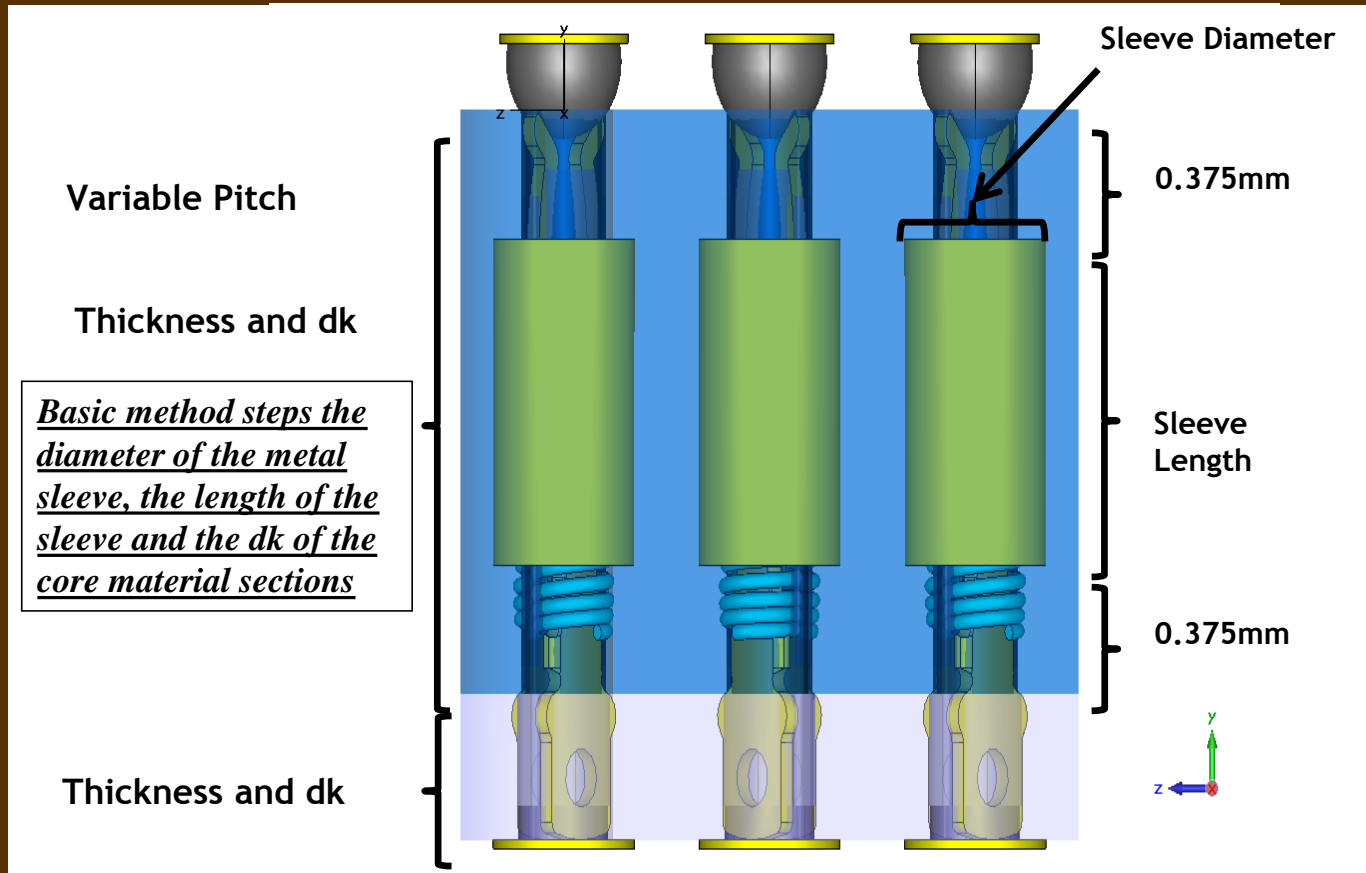
- Leverage commercially available Spring Pins for BGA and LGA applications requiring high insertion count, long pin life, and High Speed signal performance.
- Known spring pin mechanical performance from multiple suppliers and add proprietary housing technology\* to enhance signal performance of any contact or probe.



\* patent pending



## Impedance Tuning Method for Pins



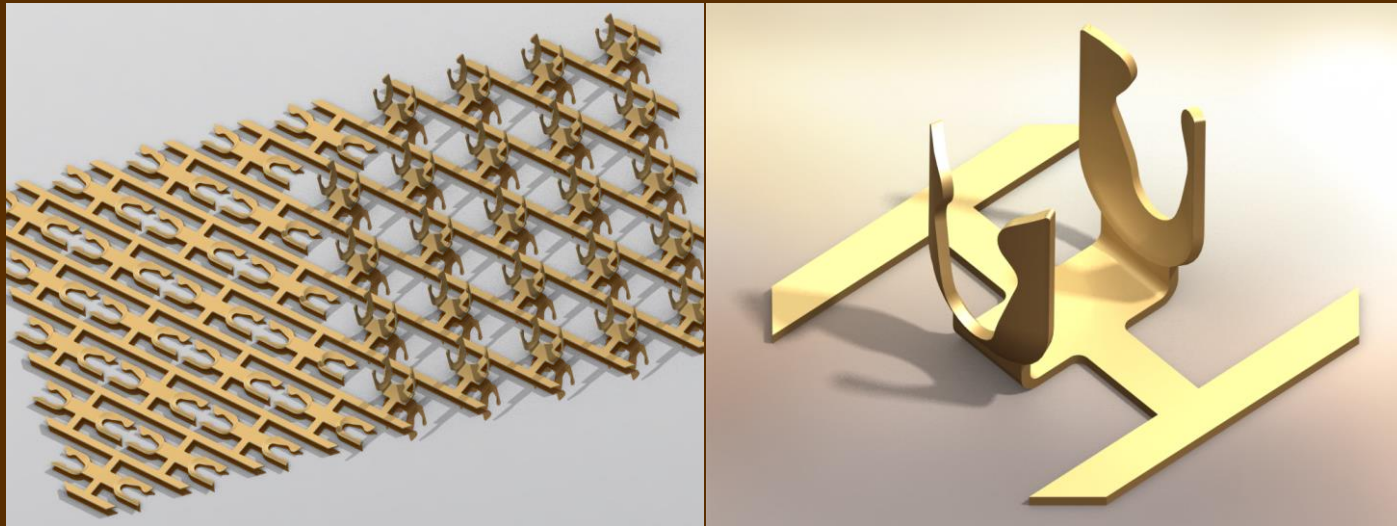


## Multi-Point Ultra Low Profile SMT BGA

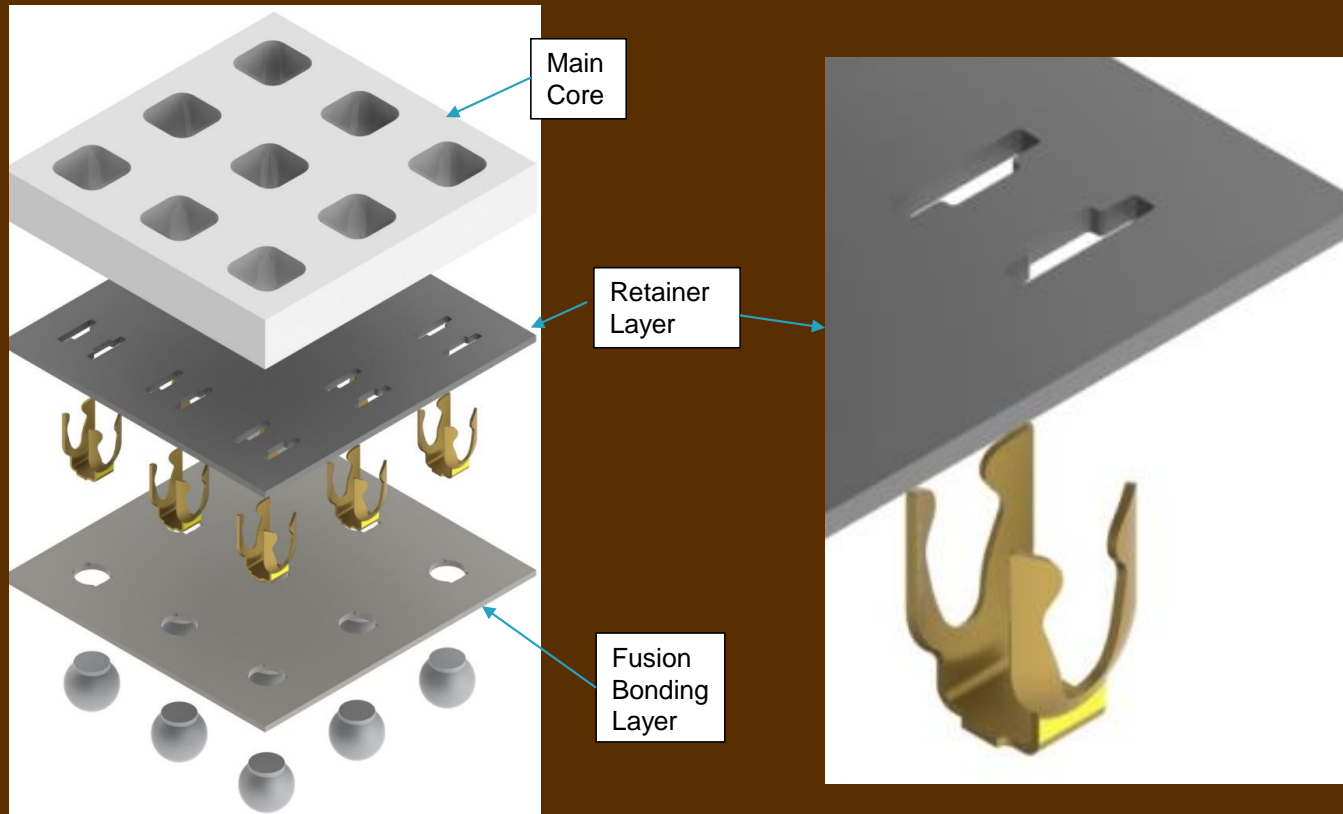
4 prong contact single piece – contact capable of 0.4 mm pitch stamped and formed on pitch– 0.76 x 0.86 shown in assembly

Contacts mate with solder ball in 4 points with oxide cutting action

Very low profile - height and geometry tied to ball size - base to Cu pad has solder ball

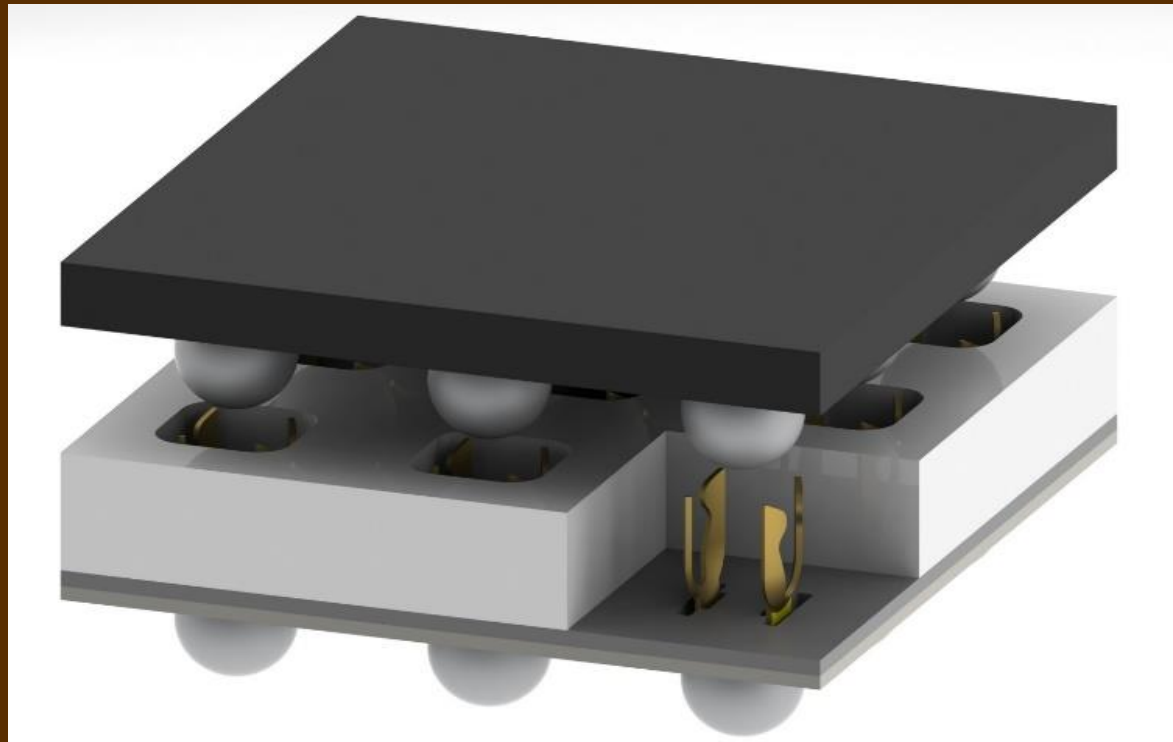


## Multi-Point Ultra Low Profile SMT BGA



## Multi-Point Ultra Low Profile SMT BGA

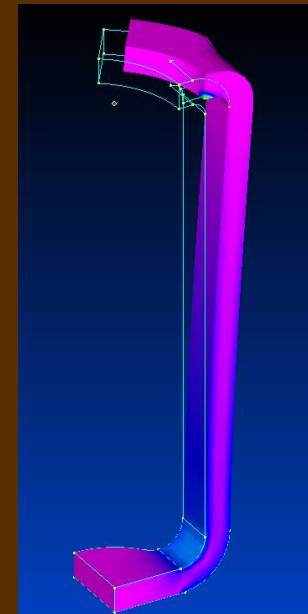
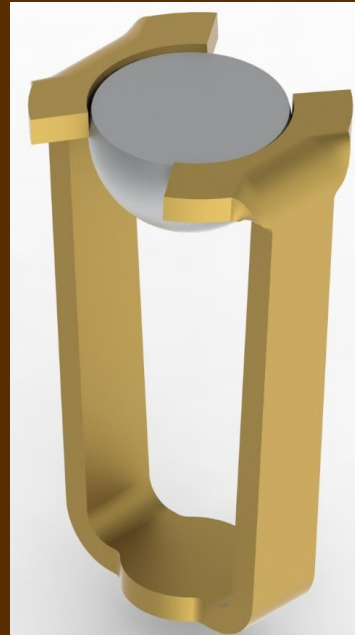
- Contact tips designed to mate with specific ball/bump shape
- Lid or Heat sink may be required for HVM usage





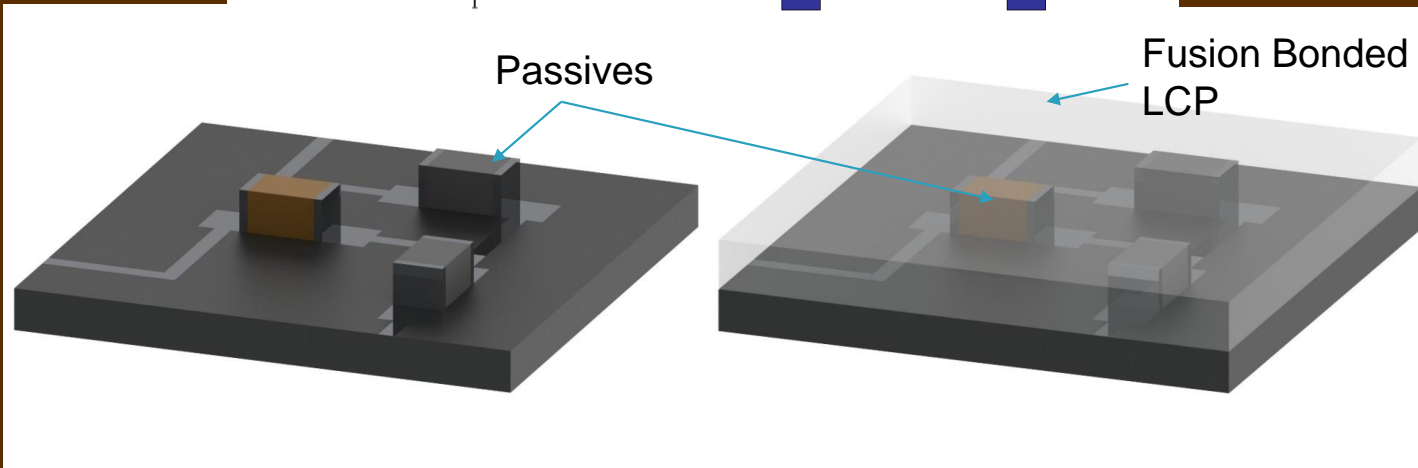
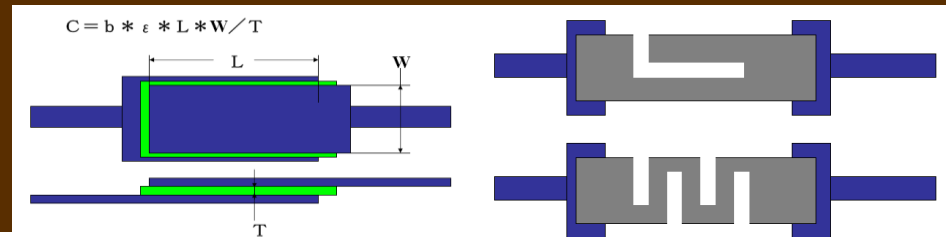
## Dual Purpose Platform Validation – OEM HVM Socket

- Stamped and formed low force dual beams designed for– Zero Footprint
- Direct Insertion similar to Grypper socket with edge contact engagement
- More tolerant of ball size and shape with lower force
- Mated height 1.0 mm – potential 0.75 mm



## Embedded Performance

Technology is allowing the merging of connector or socket technology with performance enhancements embedded within the traditional pcb or socket housing. Printed decoupling, redistribution, signal tuning, optical or RF transmission etc. can be merged with electrical contacts.



## In Summary...

As systems become more and more complex, the historical methods of predicting performance and testing with a custom platform has seen challenges.

Conventional compression mounted sockets require separate pcb designs that often do not look anything like the final end use pcb

Through holes for alignment pins and fasteners drive routing and hardware issues that dictate custom platforms.

The ability to solder a socket directly to the device footprint and insert the device onto a platform that more closely replicates the final end use system has significant advantages.

Key aspects to consider are reflow mounting of the sockets related to new build vs. rework of existing assemblies