Are Spring Probes Valid Below 400 Micron Pitch?

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IEEE SW Test Workshop

Semiconductor Wafer Test Workshop

June 10 - 13, 2012 | San Diego, California

Probably not.

(but wait, there's more)

Market Requirements

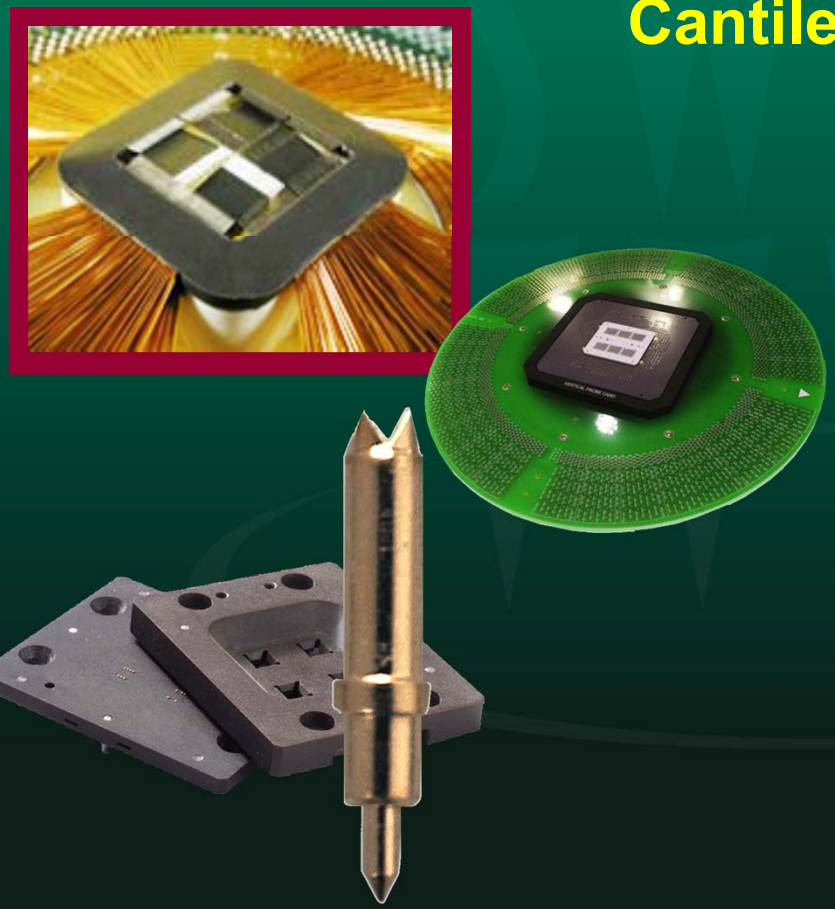
Primarily WLCSP (now) and PoP (pretty soon)

- 0.3 pitch WLCSP bump Ø0.21; 0.2 with Ø0.115 extant
- PoP primarily lands under solder resist or balls

Test Technology Status Quo

- WLCSP on probers, inline cleaning, >200 UPH, expected cycle life >500K
- PoP in pick-and-place applications, offline cleaning, triple-digit UPH, expected cycle life 100-250K

Current Methodology



Cantilever and vertical solutions

- ♦ Limited array depth
- ♦ Limited compliance
- ♦ Difficult to repair
- ♦ High cost of use

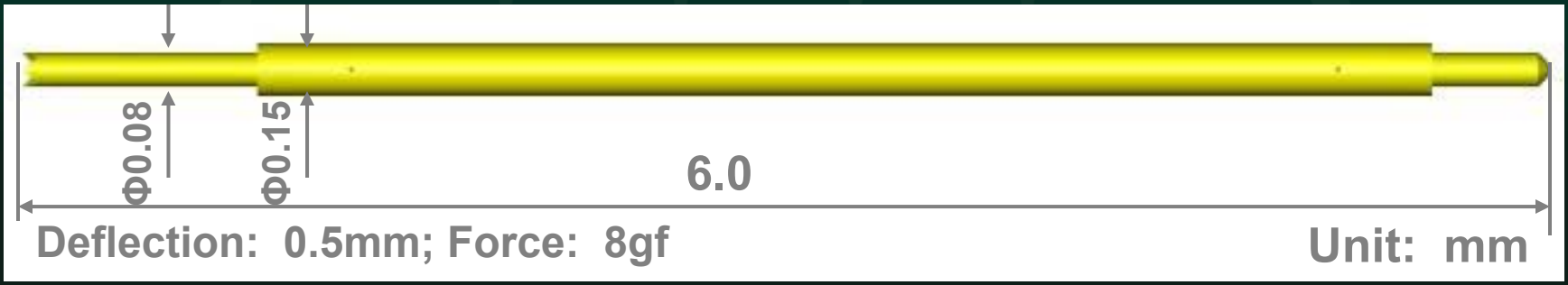
'Floating' spring probes

- ♦ Very reliable
- ♦ Excellent RF performance
- ♦ Easily maintained
- ♦ Limited to 400 µm pitch

Current Methodology

Sub-400 Spring Contact Probes

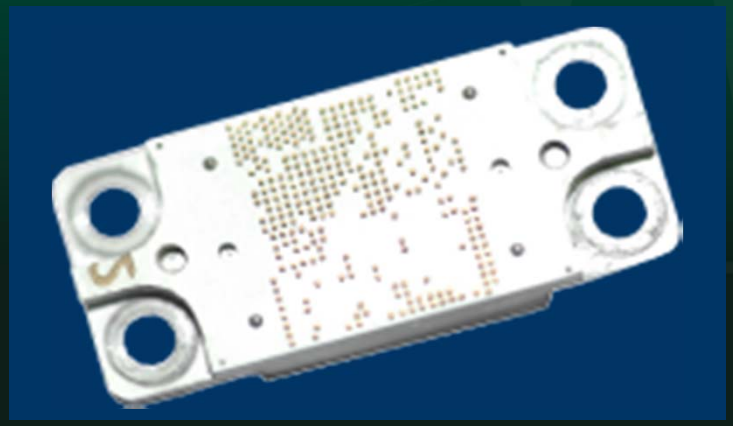
- Similar technology available from several vendors
- Highly compliant at the expense of length
- Field serviceable…
- Difficult to clean
- Fragile



Monet

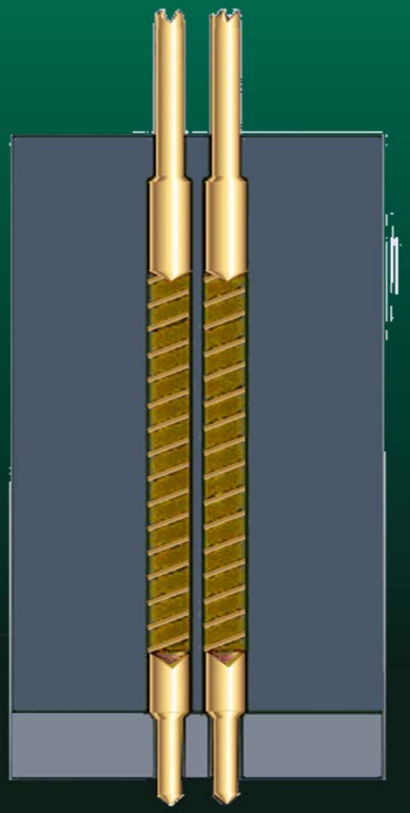
Embedded Barrel:

- ♦ High contact density
- ♦ Short length
- ♦ Good compliance and force
- ♦ HVM robustness
- ♦ Easy maintenance
- ♦ Excellent accuracy



Conductive Cavity

Components

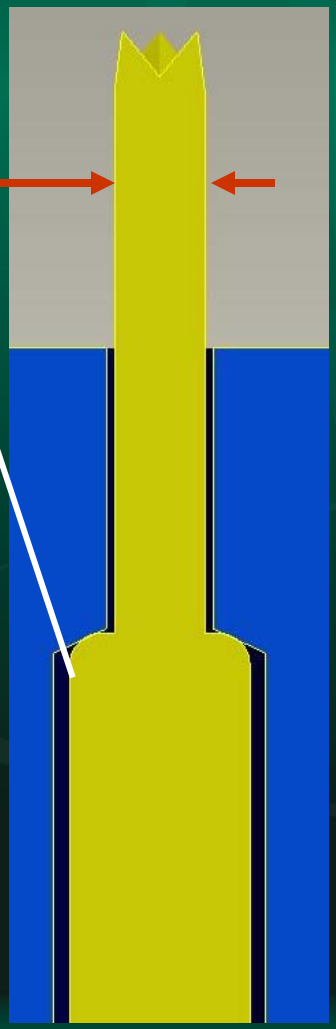


Shift in Diameters

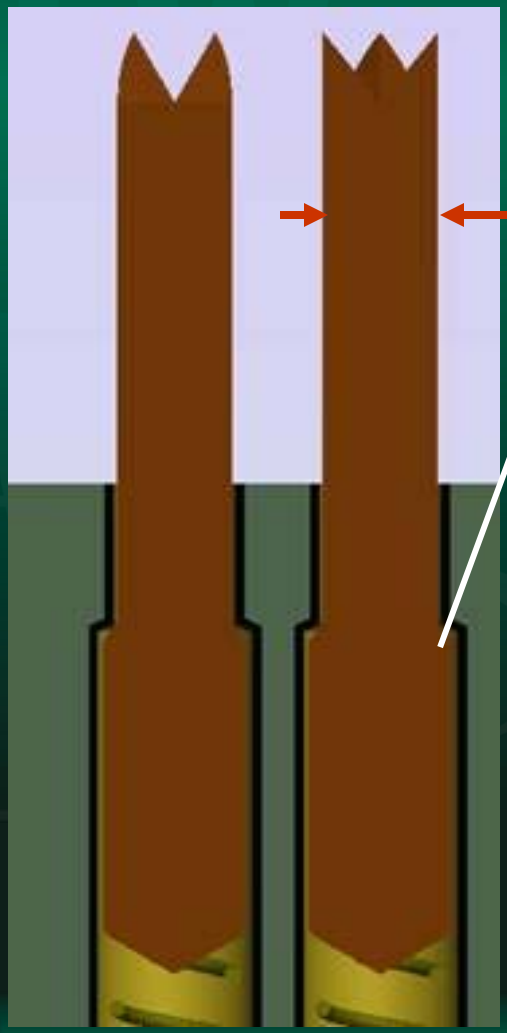
Traditional Probe

80 µm (really tiny)

30 to 50 micron gap between barrel and cavity hole



Embedded Contact



110 µm (comparable to 0.4)

No gap between barrel & socket body

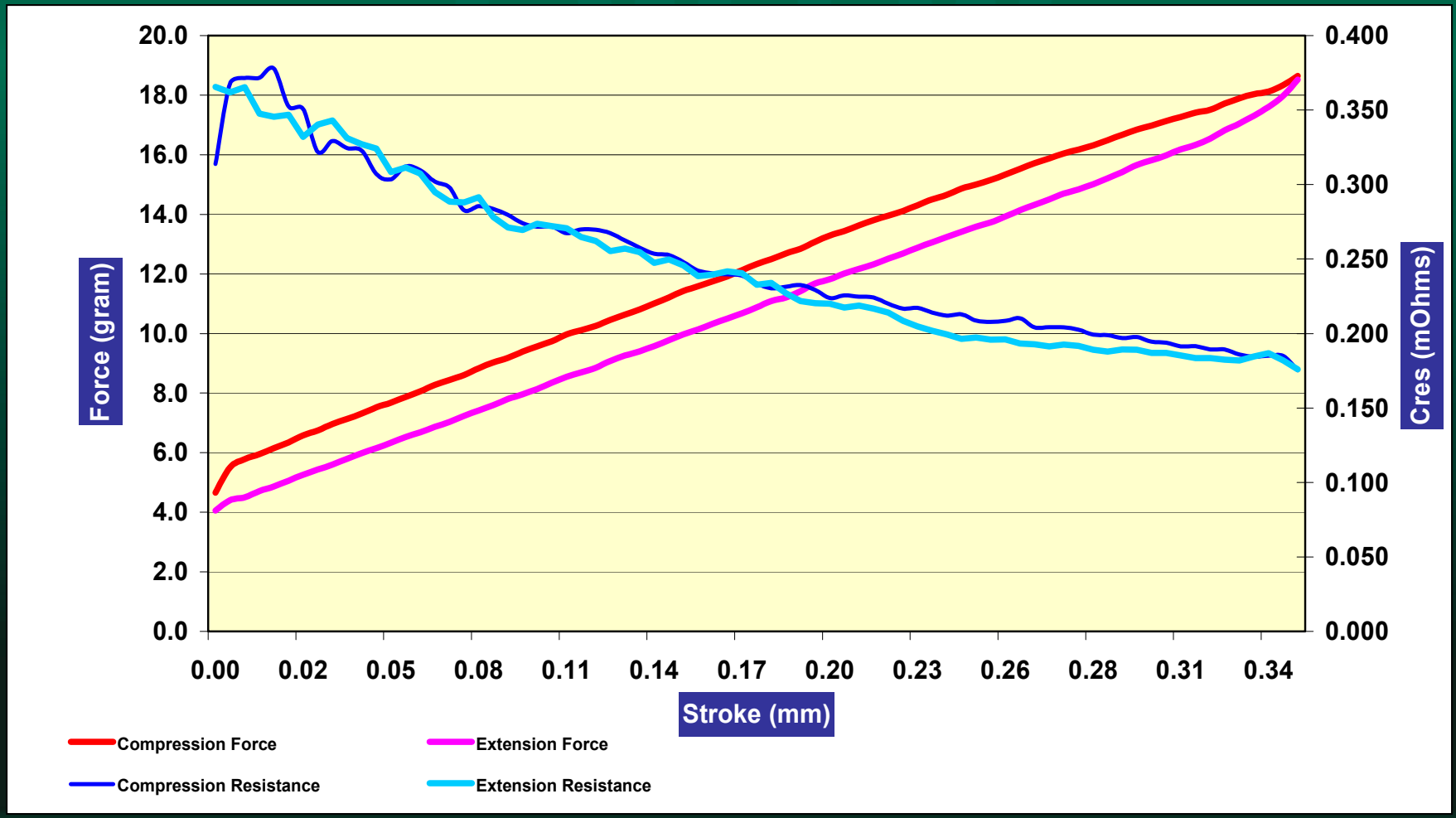
Alignment Improvement

Several Factors

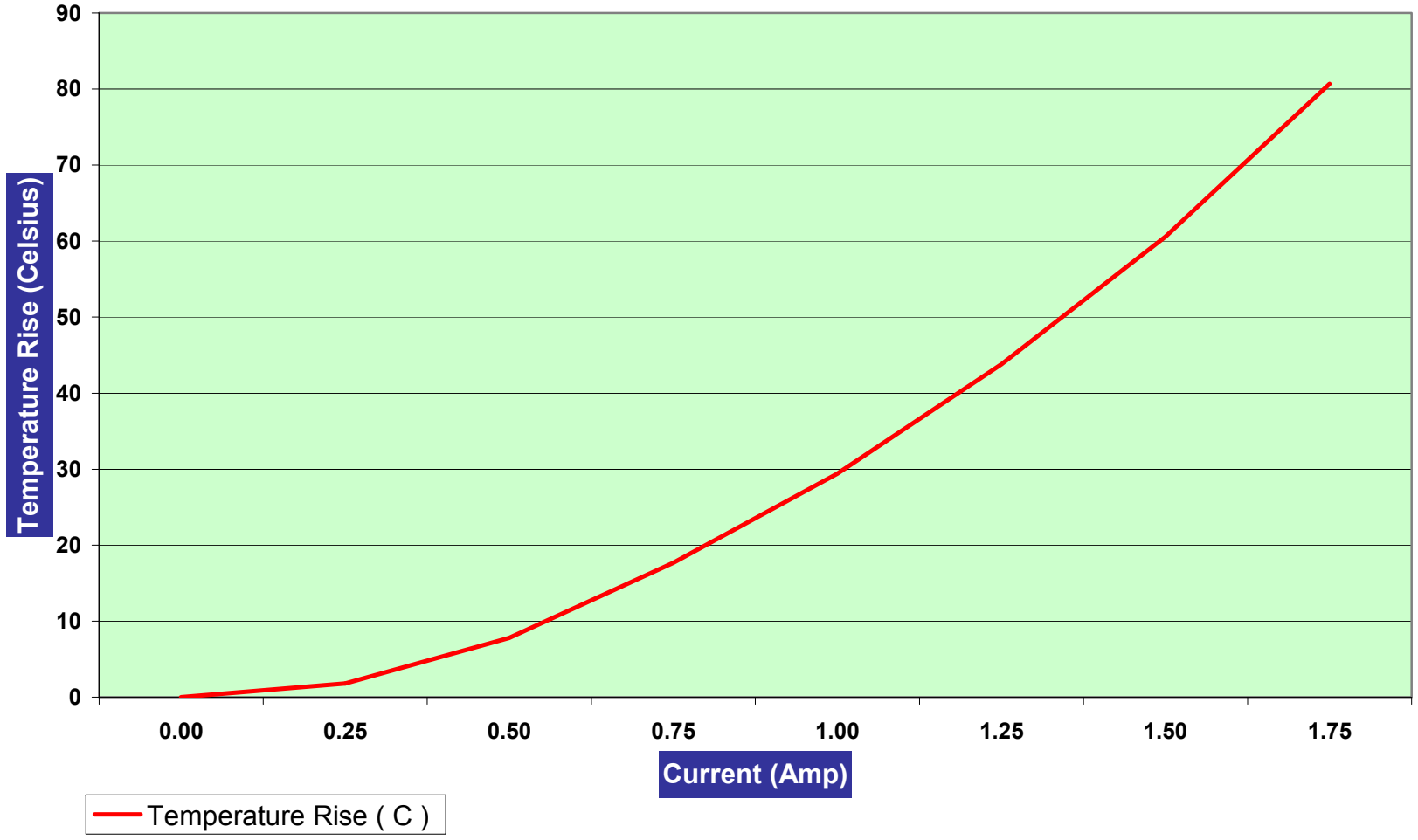
- One less gap
- Improved aspect ratio of hole in plastic
- Larger diameter plunger is more concentric
- Electroforming produces high concentricity of 'barrel'
- Retainer plate true position does not affect top plunger

More Force, Stable Resistance

17 gf versus 8 gf. large 'sweet spot'

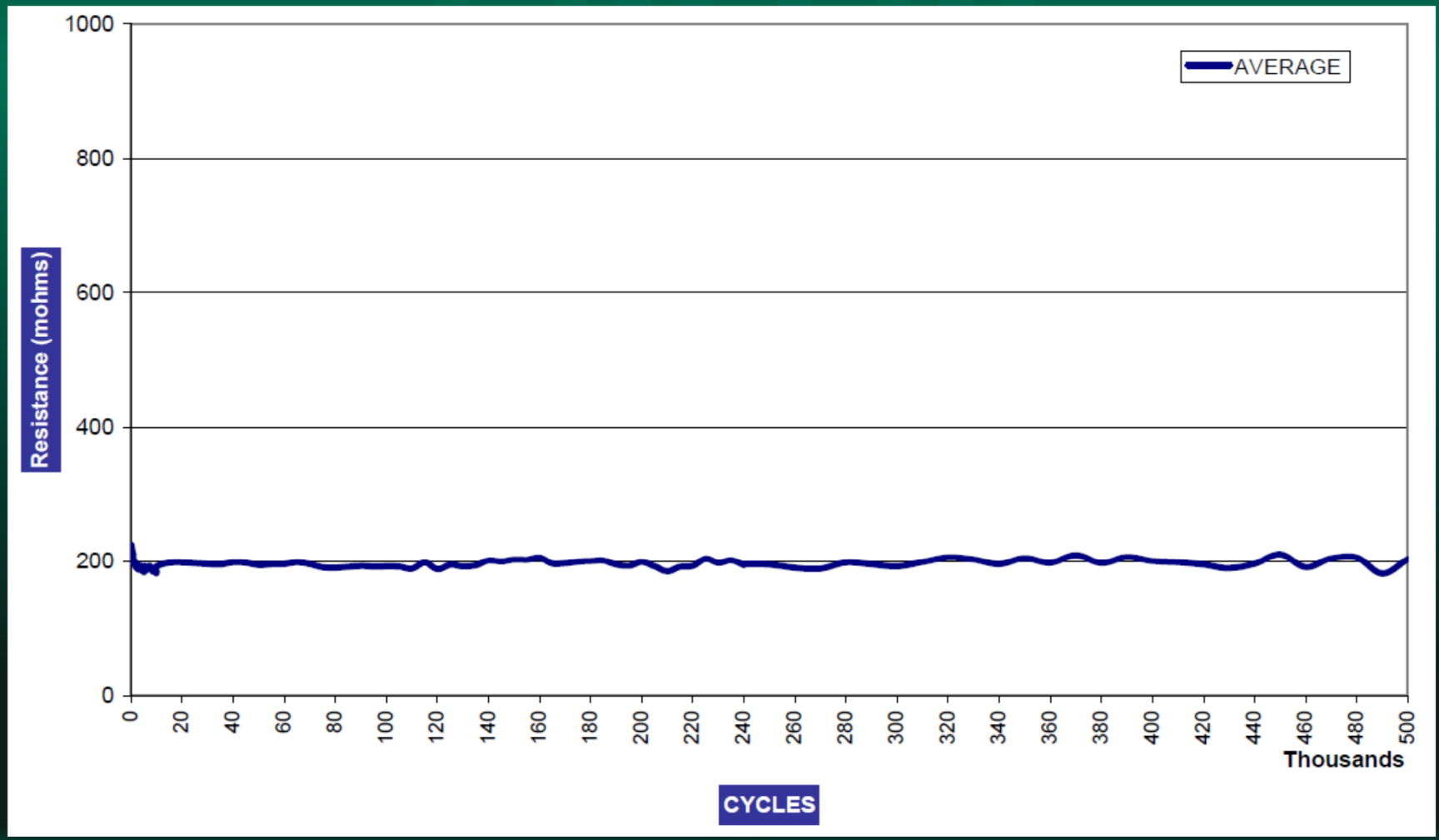


Stable Resistance, High Current Carrying Capacity



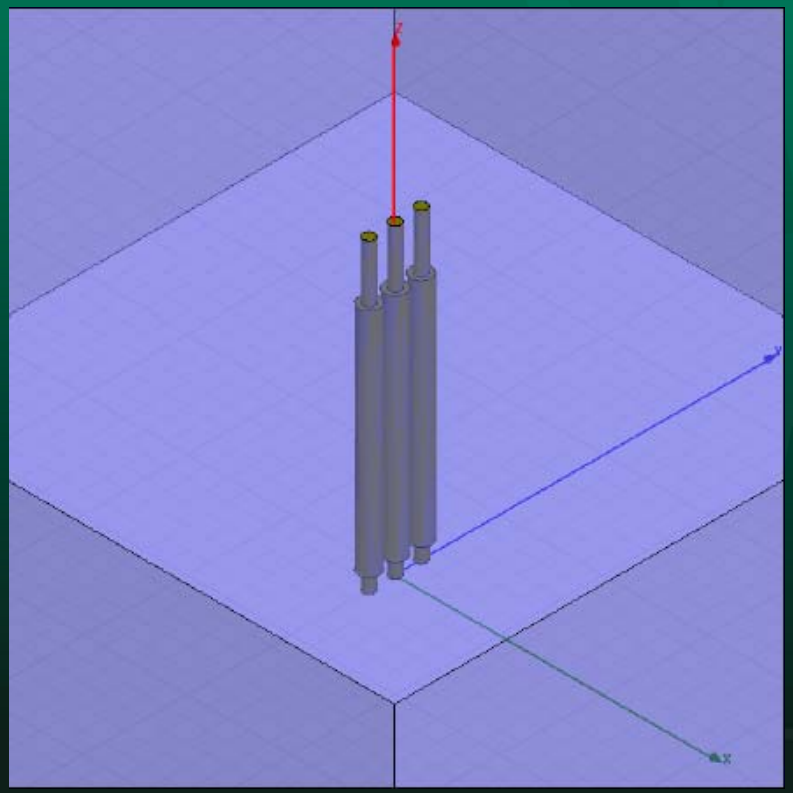
Extended Mechanical Life

Stable performance through 500K touchdowns



Signal Integrity Methodology

Device Side



Board Side

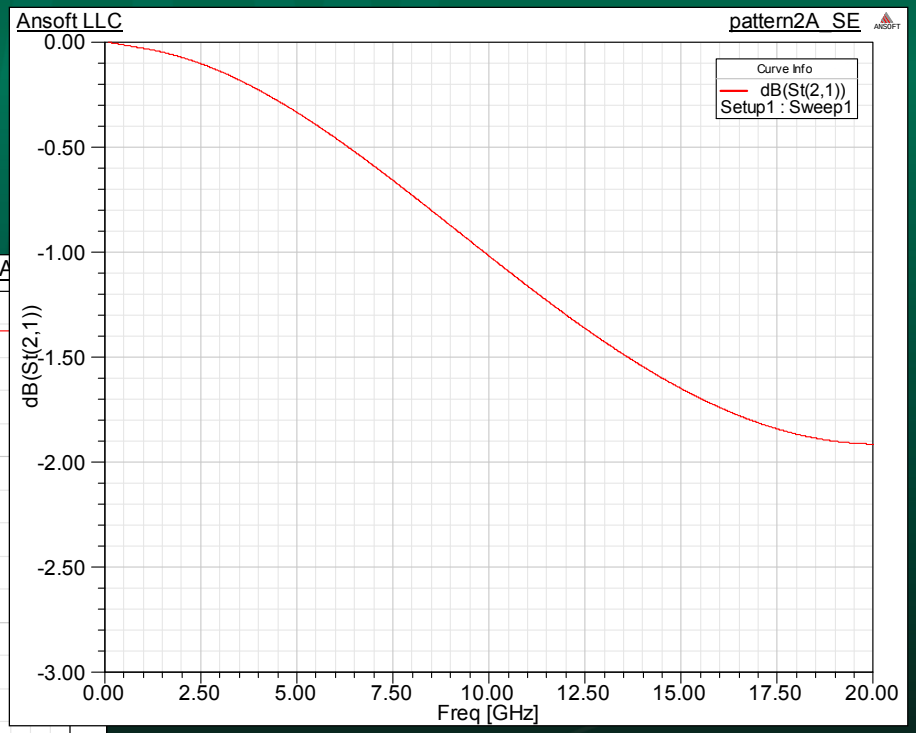
Single Ended

Differential Pair

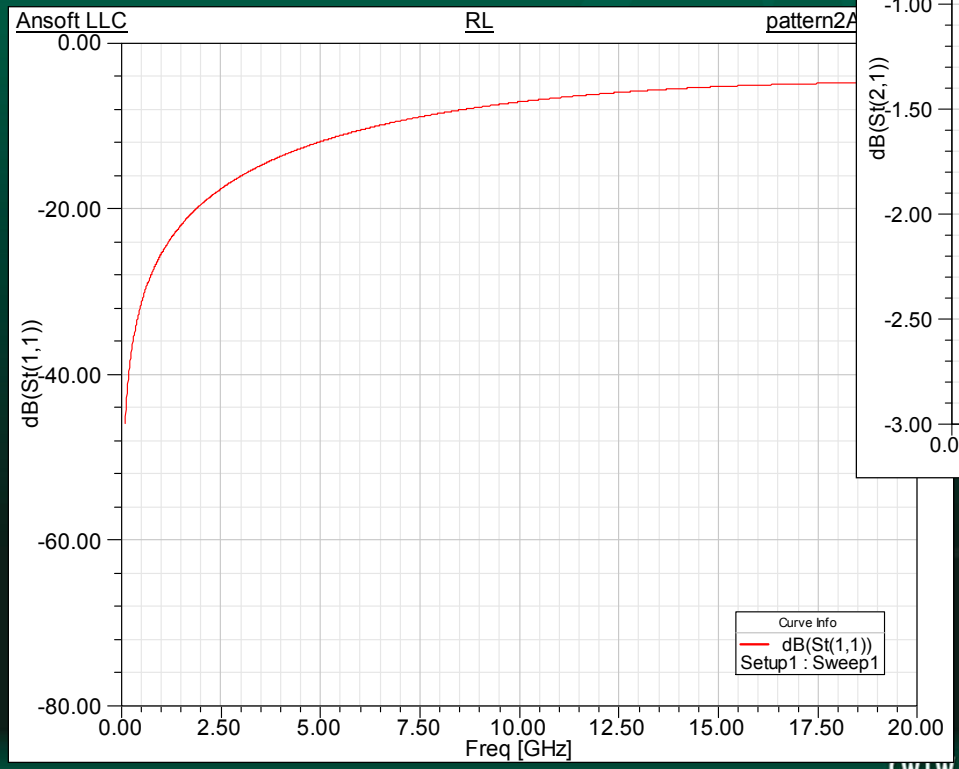
Analog Behavior

10 GHz BW @ 250 µm

Insertion Loss



Return Loss

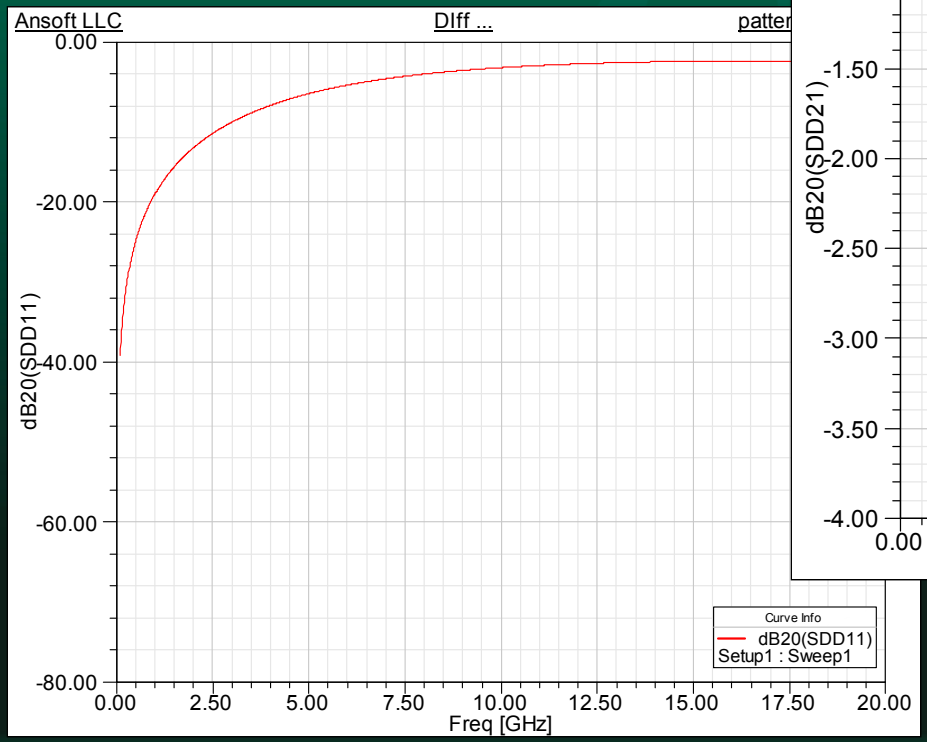


Differential Behavior

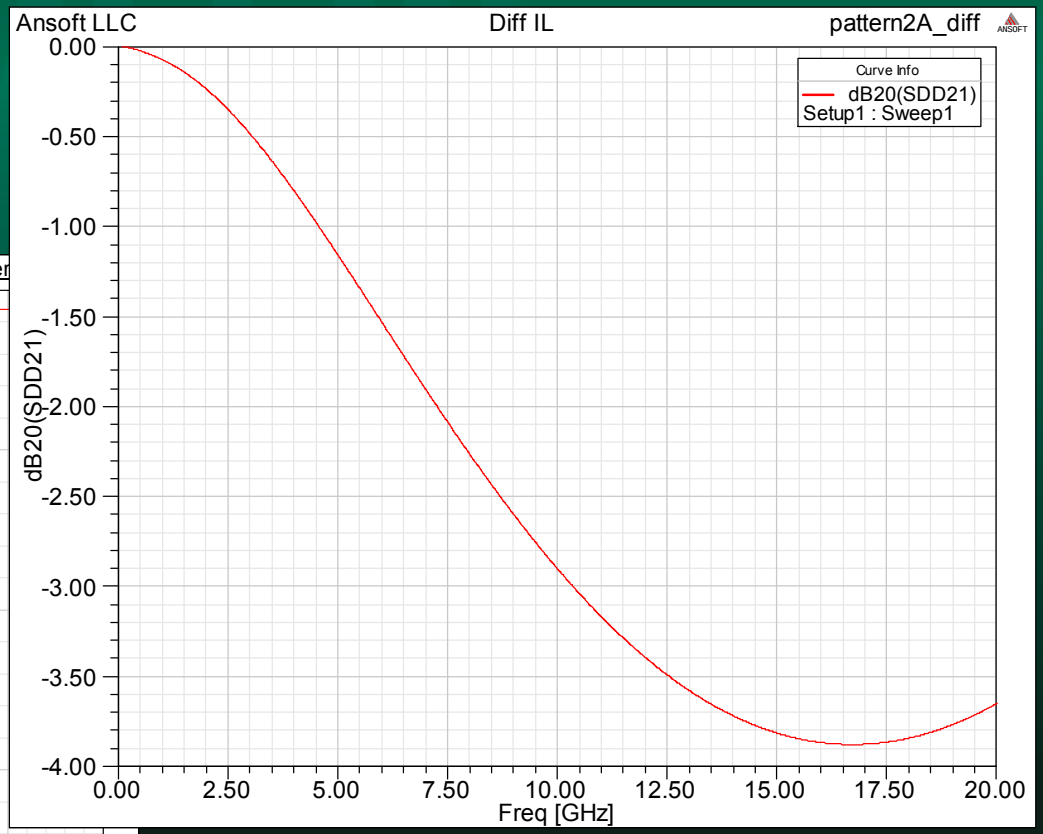
3 Gbps

@ 250 µm

Return Loss



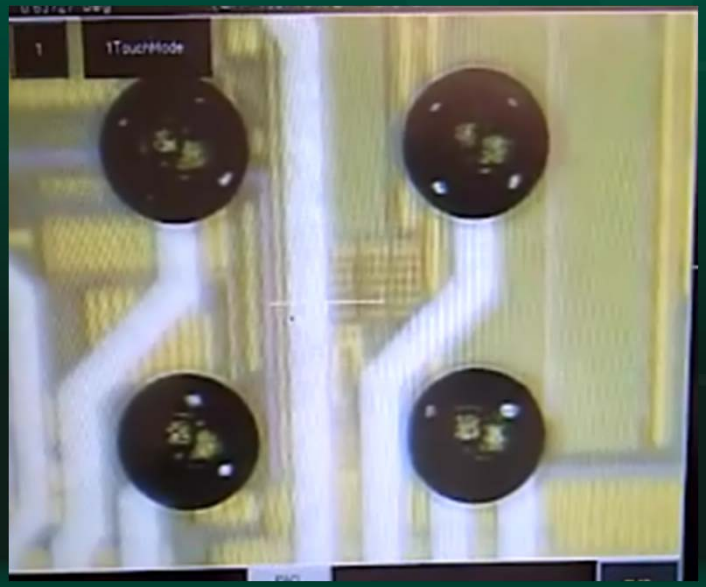
Insertion Loss

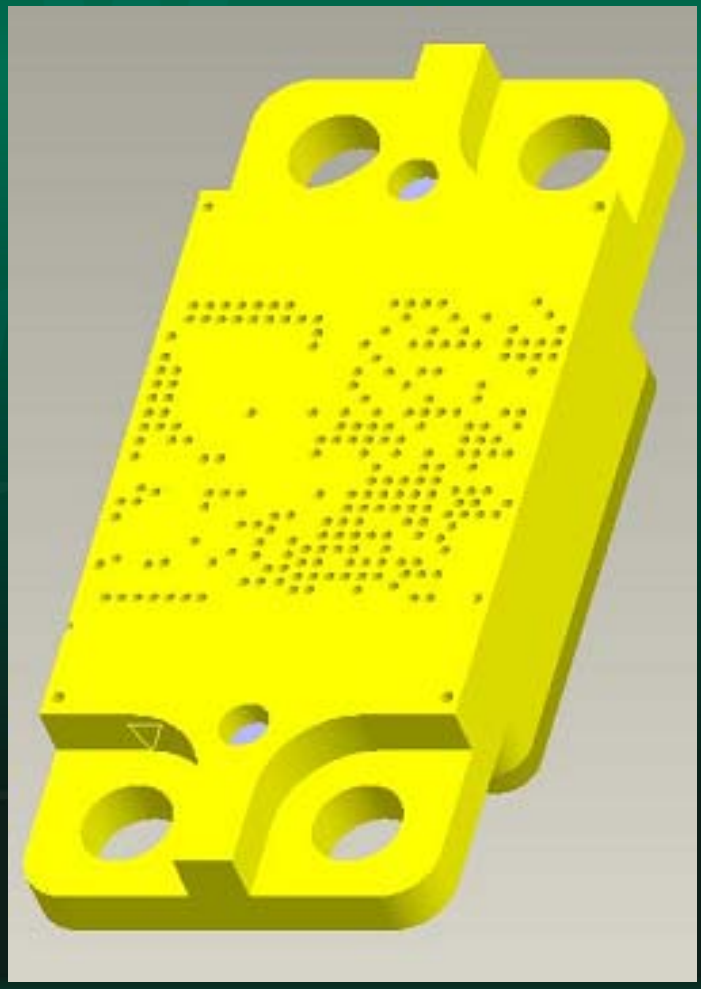


Alpha Program

Validation of manufacturing capability and alignment

- >200 pins per site, 4 sites, 0.25 mm pitch
- Aligned well, passed initial electrical tests





Summary

Spring contact probes are a preferred technology for P0.4mm pitch but are challenged at finer pitches.

By embedding the probe barrel in the contactor body significant gains can be made in robustness, alignment, and signal integrity

This approach has potential for all WLCSP pitches: 250 µm, 200 µm, 180 µm, 150 µm

Acknowledgements

The following persons were instrumental in the creation of this paper:

Praba Prabakaran, Khaled Elmadbouly, Brad Henry, Dave Henry, Kevin DeFord, Peter Fitzsimmons, Tim Marshall – Interconnect Devices, Inc.

Thank You!

Your questions are welcome.