

SIXTEENTH ANNUAL

**BiTS**™

**Burn-in & Test Strategies Workshop**

March 15 - 18, 2015

Hilton Phoenix / Mesa Hotel  
Mesa, Arizona



**Archive – Session 3**

## Session 3

Valts Treibergs  
*Session Chair*

BiTS Workshop 2015 Schedule

## Frontiers Day

Monday March 16 4:30 pm

### Wafer Level Pots of Gold

#### "Coplanarity Analysis of WLCSP Spring Probe Head"

Jiachun (Frank) Zhou , Daniel DeVecchio , & Cody Jacob - Smiths Connectors

#### "Pushing the envelope in DFM (Design for Manufacturing) for 0.2 mm Pitch WLCSP Socket"

Paul Gunn, Muhammad Syafiq, & Takuto Yoshida - Test Tooling Solutions Group

#### "Space Transformer PCB For Testing 200 $\mu$ m WLCSP"

Khaled Elmadbouly - Smiths Connectors

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# Pushing the Envelope in DFM (Design for Manufacturing) for 0.2mm Pitch WLCSP Socket

**Paul Gunn, Muhammad Syafiq, Takuto Yoshida**  
**Test Tooling Solutions Group**



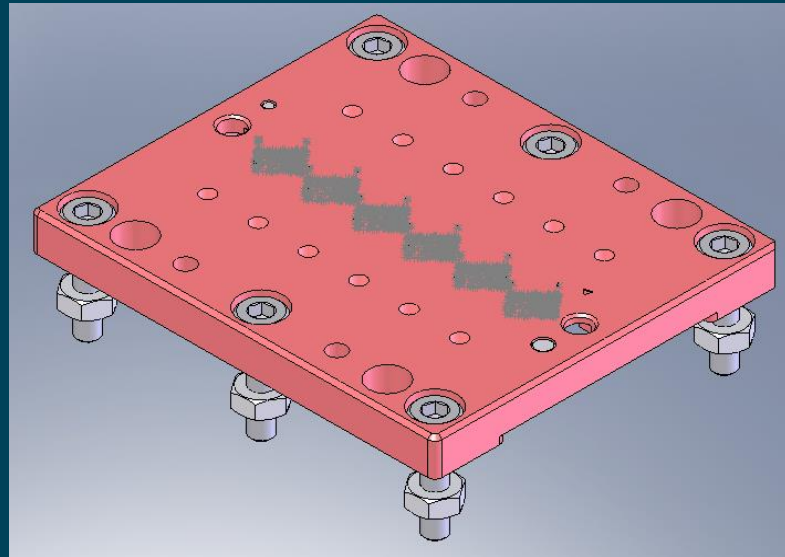
**2015 BiTS Workshop**  
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## Contents

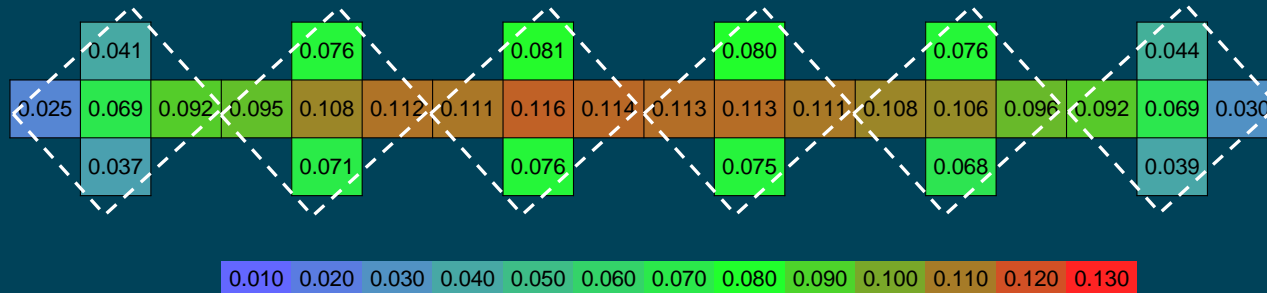
- Socket 1 Design
- Improved Socket 2 Design
- First FEA Simulation for Socket 2
- FEA Simulation Improvement
- Compare FEA Simulation and Actual Measurement
- Improved Socket 3 Design
- Conclusion

## Socket 1 Design



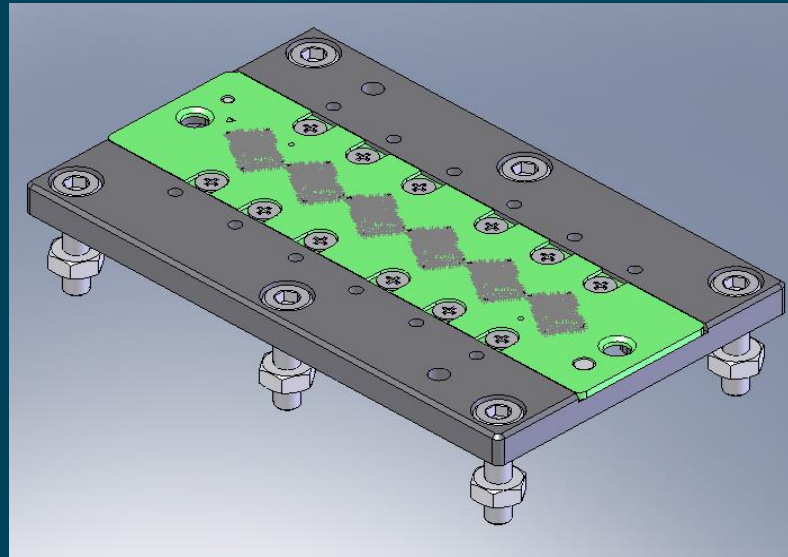
- Total 1656 pins for 6 devices
- 1 Top Plate (TP) Design
- Socket side 6x M3 screws to keep TP coplanar at pin areas
- Without FEA

# Socket 1 Coplanarity Measurement



- Target 0.050mm for coplanarity
- Max. 0.116mm coplanarity from measurement
- Warpage trend shows at center area
- TP hardness is not enough
- Tight screws is far from pin areas
- FEA is required for next design

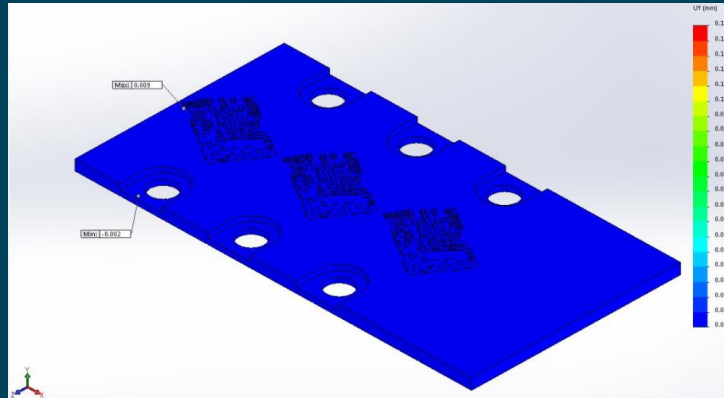
## Improved Socket 2 Design



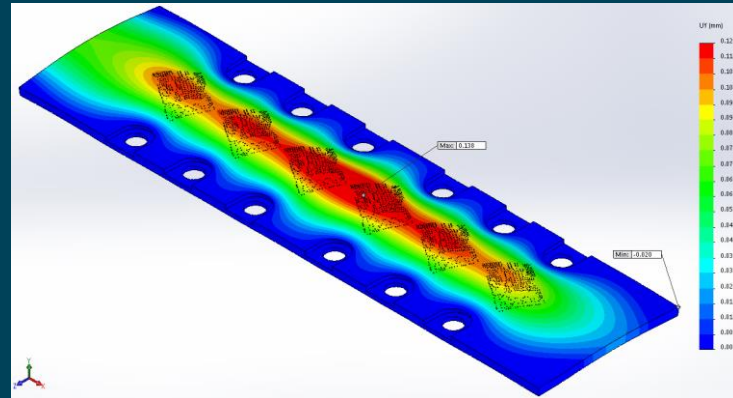
- Total 2370 pins for 6 devices
- Improvements
  - Stainless Steel Holder & Ceramic Peek TP
  - 12x TP screws closer to pin area
  - Design with FEA simulation



# First FEA Simulation for Socket 2



Nominal Case

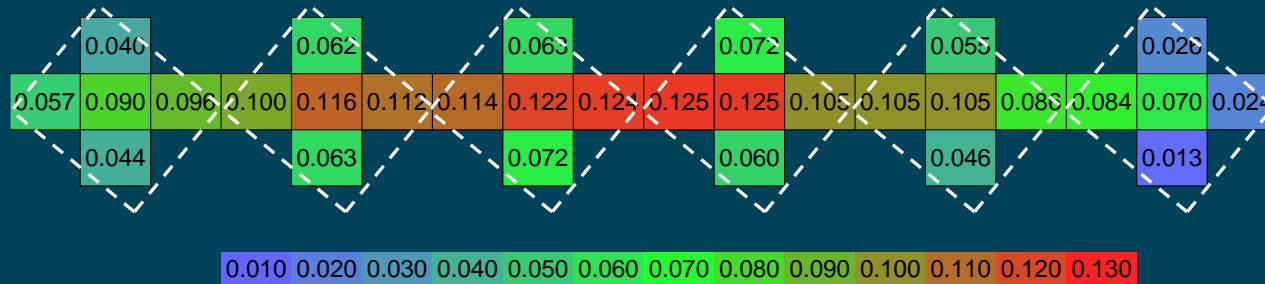


Worst Case

Items	Nominal Case	Worst Case
Coplanarity of TP [mm]	0.011	0.158

- Coplanarity values are different in nominal and worst case
- We estimated actual coplanarity close to nominal case

## Socket 2 Coplanarity Measurement

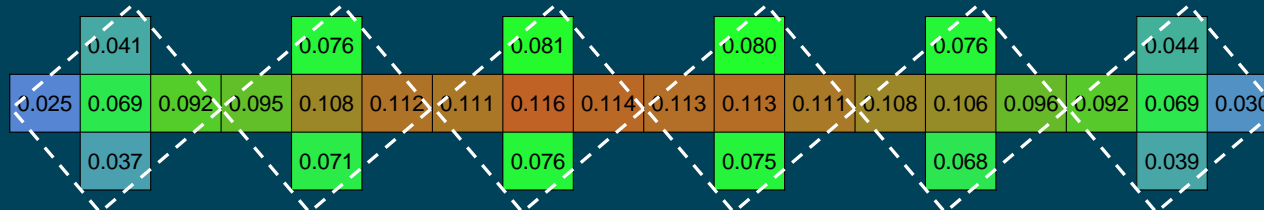
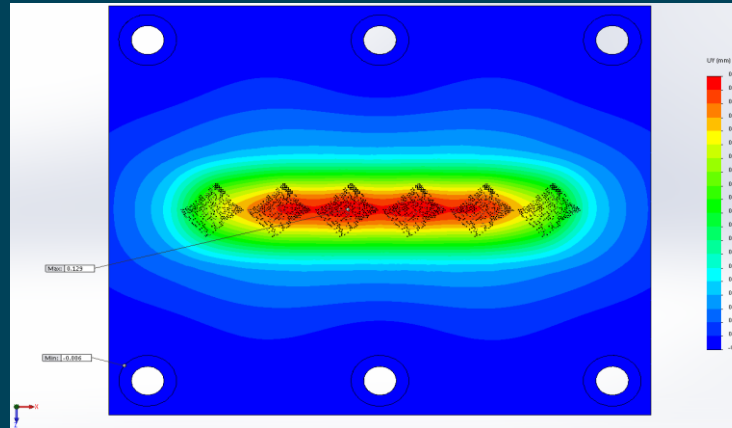


- Target 0.050mm for coplanarity
- Max. 0.125mm coplanarity from measurement
- Coplanarity measurement close to worst case
- Need to improve the FEA

## FEA Simulation Improvement

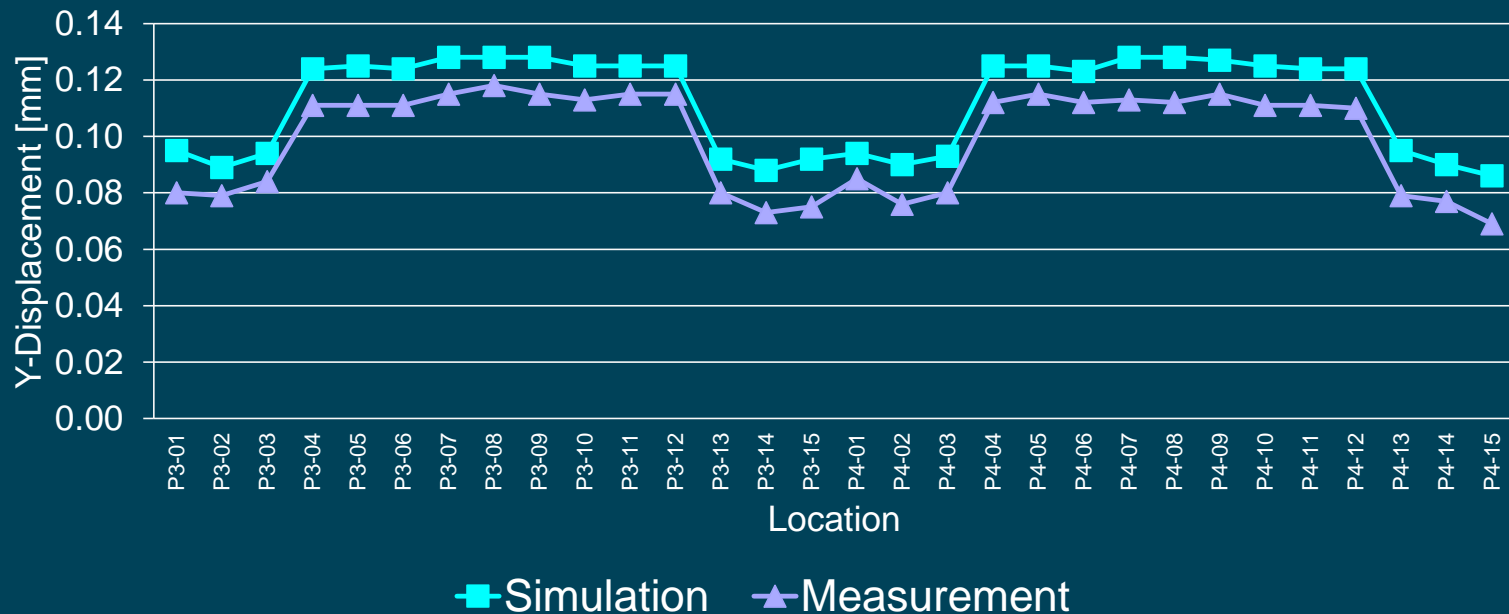
- Implement elastic membrane technique
  - To predict deformation
  - To predict stress values
- Elastic membrane technique provides
  - More stiffness reliability
  - More robust design
- Refer to Prabakaran and Pal, Finite Element Analysis using Elastic Membrane Technique for Test Socket Design Optimization (BiTS, 2008)

## Improved Socket 1 Simulation



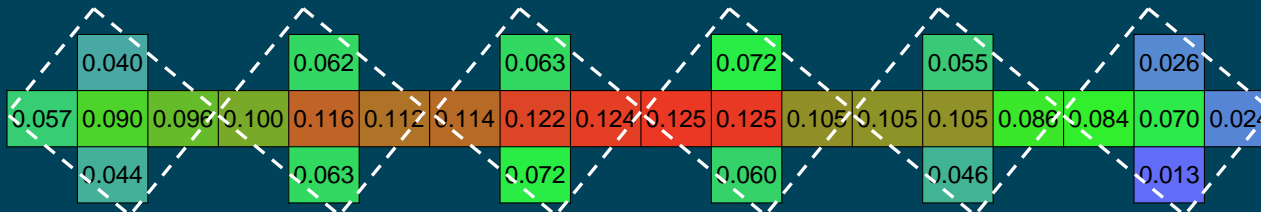
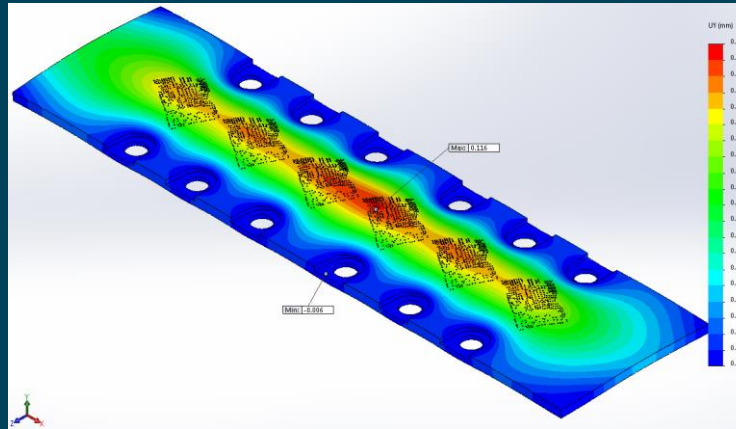
- Max. 0.129mm coplanarity from improved simulation
- Max. 0.116mm coplanarity from measurement

## Compare Socket 1 Simulation and Actual Measurement



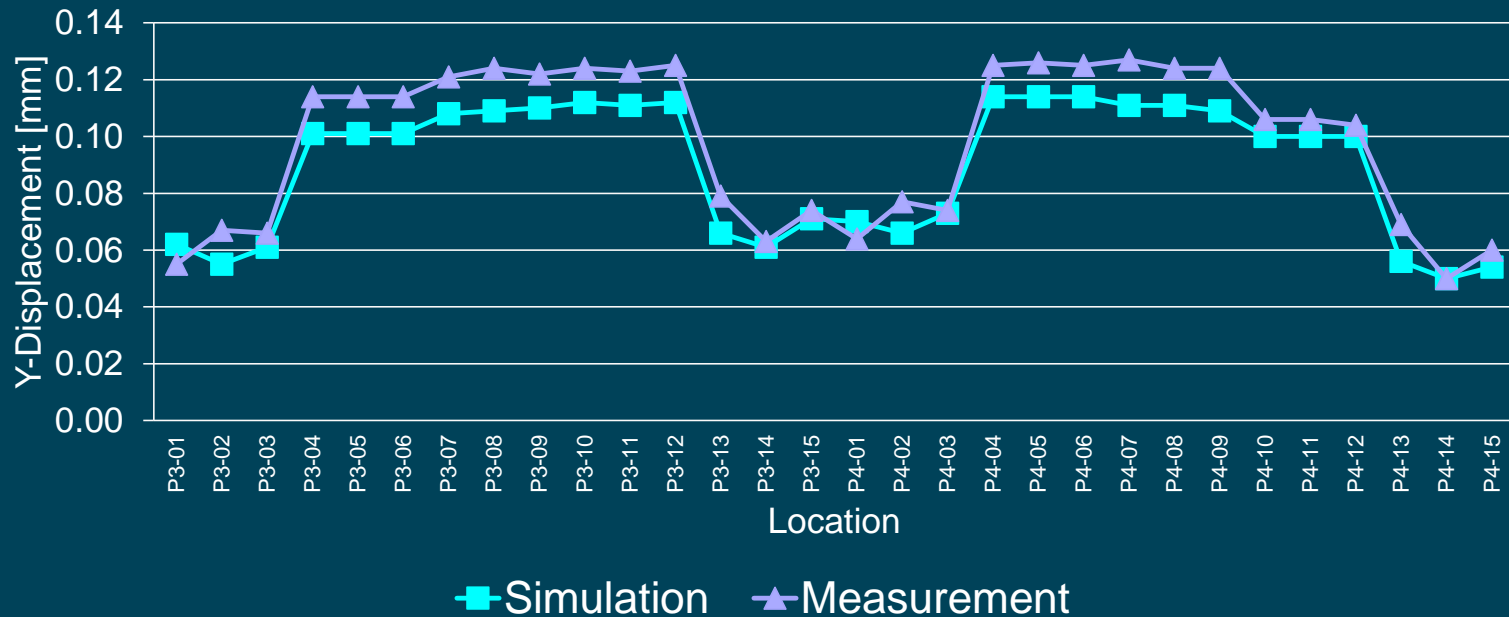
- Coplanarity error rate is 20% or less

## Improved Socket 2 Simulation



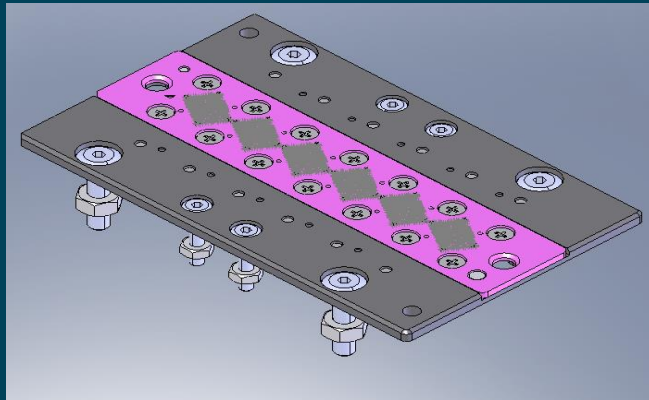
- Max. 0.116mm coplanarity from improved simulation
- Max. 0.125mm coplanarity from measurement

## Compare Socket 2 Simulation and Actual Measurement

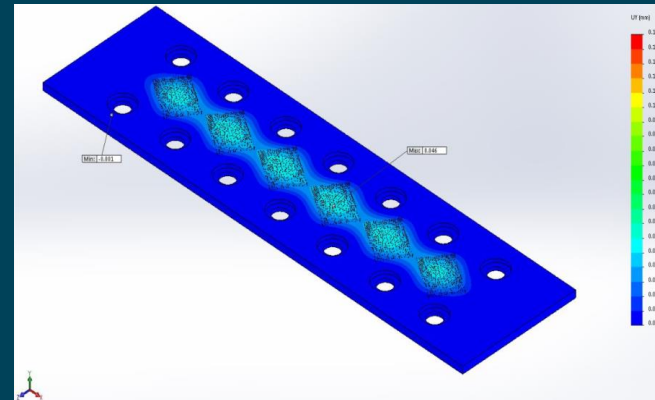


- Coplanarity error rate is 19% or less

## Improved Socket 3 Design



Socket Design



Improved Simulation

- Total 2430 pins for 6 devices
- Target 0.050mm for coplanarity
- Max. 0.046mm coplanarity from improved simulation



## Conclusion

- FEA simulation using Elastic Membrane technique proves good DFM relationship between design to actual socket
- FEA provides more robust design and stiffness to enhance product reliability

## Reference

- Prabakaran and Pal, 2008, Finite Element Analysis using Elastic Membrane Technique for Test Socket Design Optimization, Burn-In and Test Socket Workshop, Hot Topics Session