FOURTEENTH ANNUAL BiTS 2013
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Archive
Session 1

STREAMLINING OPERATIONS

Test operations, generally considered costly, yet necessary, add value to device manufacturing when optimized for efficiency. This session offers a variety of approaches that promise high yields, lean manufacturing, maximized performance at minimal costs, and optimized production times. The first paper discusses a method of incorporating multidimensional Monte Carlo analysis simulation with known design parameters to focus manufacturing improvement efforts and maximize alignment performance while minimizing costs. Presented next is a method for redefining test tooling design rules to gain process margin and prevent substrate chipping caused by test handler misalignment. Zero-cost, software based, virtual tool checkers that bring the whole production area towards a manufacturing LEAN direction is then discussed. Wrapping things up is a paper on a screwless socket and dual pin testing concept said to greatly enhance the robustness and efficiency of IC testing.

Improving Socket Alignment Performance Using Monte Carlo Analysis Techniques and Manufacturing Controls

Daniel DelVecchio, Dustin Allison—Interconnect Devices Incorporated

Tooling Stack-up Process Margin Improvement

Mook Koon Wong, Boon Hor Phee—Intel Malaysia

Zero Cost Virtual Tool Checker

Seong Guan Ooi—Intel Technology Sdn. Bhd.

Enablers for Robust & Fast Online Trouble-shooting for High Parallelism Testing

Benedict Loh—Infineon Technologies
Kohei Hironaka—NHK Spring Co. Ltd.
Michelle Ng—TestPro

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Enablers for Robust & Online Trouble-shooting for High Parallelism Testing

Benedict Loh, Kohei Hironaka, Michelle Ng
Infineon Technologies/NHK Springs/Testpro

2013 BiTS Workshop
March 3 - 6, 2013

Contents

- Production Today
- The Total Concept/Results
- Production KPI Improvement & Cost Savings
- Snap-On Microcontactor - Concept & Structure
- FEM Simulation
- Lab Evaluations
- Maintenance for Snap-On Microcontactor
- Conclusions

Production Today

- **Time is Cost**
- **The Need for:**
  - ¬ High Speed
  - ¬ Robustness
  - ¬ Reliability
  - ¬ High Life-span

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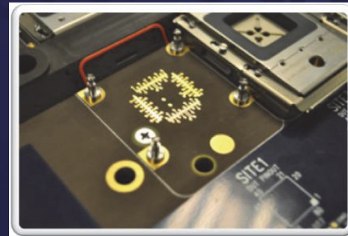
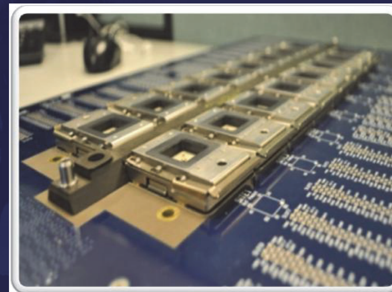
Total Concept - Snap-On Microcontactor





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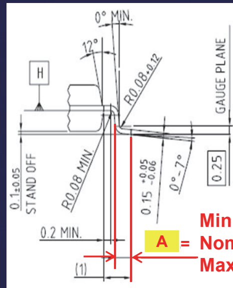
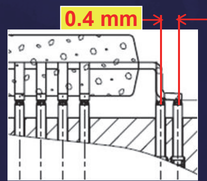
Total Concept - Dual Pin

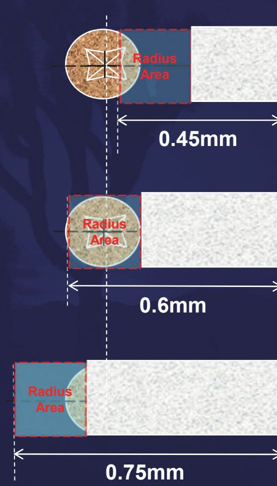
(1) Package Dimension



(2) Socket Pogo Pin Position



(3) Pogo Pin Position vs Lead Foot Length Variation



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Total Concept - Dual Pin

- **Considerations**
  - wide varieties of package tolerances
  - limited landing pad area
- **Traditional versus New Mindset**
  - pin cost vs pin life-span
  - cost per insert

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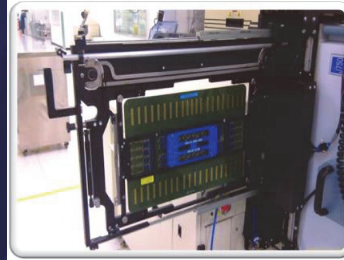
Total Concept - Auto-DIB Changer



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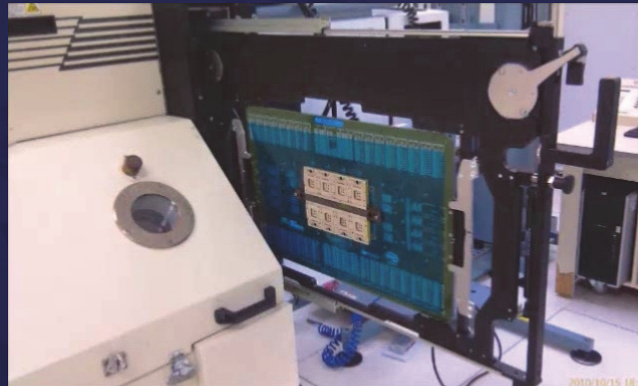
The Total Concept



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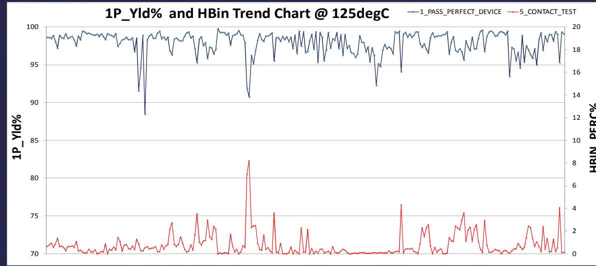
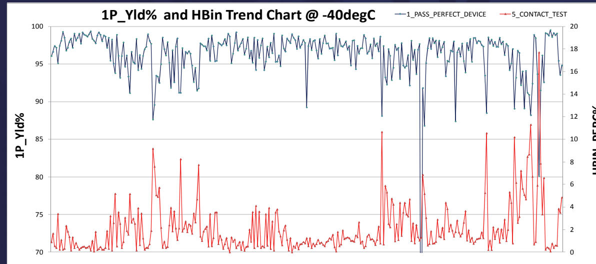
Yield Trends (Single Pin)





Hot 1P_Yld%
- ave. 97.9%

Open/short
- ave. 0.8%

Cold 1P_Yld%
- ave. 96.2%

Open/short
- ave. 2.0%

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Yield Trends (Single vs Dual Pin)

	Elevated Temperature Test			Cold Temperature Test		
	Single Pin	Dual Pin	Gain	Single Pin	Dual Pin	Gain
1P_Yld %	97.9%	99.1%	+1.2%	96.2%	98.7%	+2.5%
Bin 5	0.8%	0.1%	-0.7%	2.0%	0.3%	-1.7%

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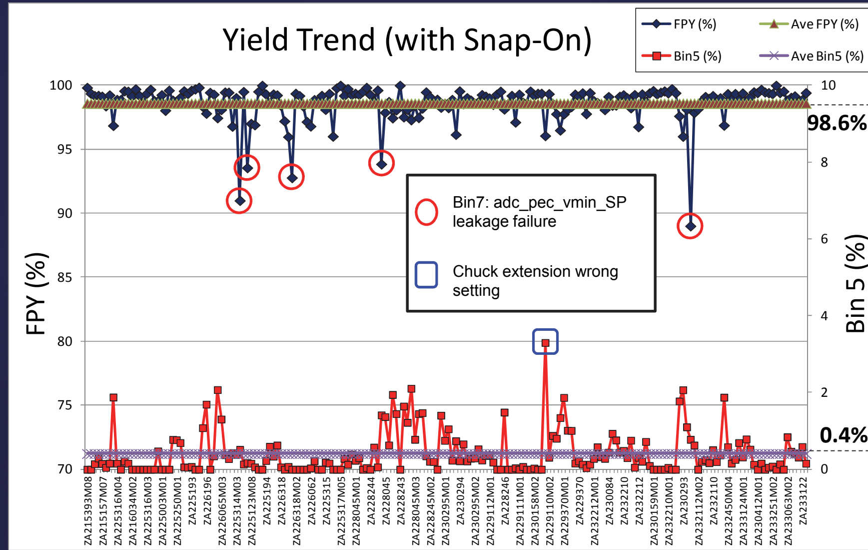

Production KPI Improvement & Cost Savings

- **OEE Gain**
  - Auto-DIB approx. 5 to 8%
  - Snap-On Microcontactor approx. 1.8%
- **TCR Savings**
  - Approx. > USD $1.0 mil

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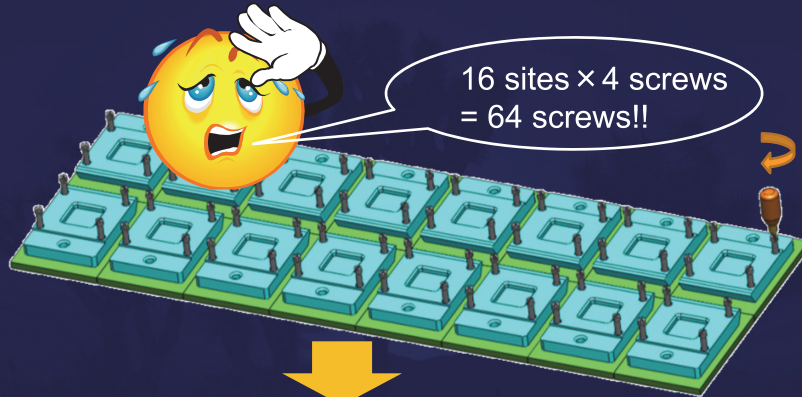
Snap-On Microcontactor Concept & Structure



New concept required!!

Keywords

① Multi-site ② Speedy & Easy ③ Reliable

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Snap-On Microcontactor Concept & Structure

Production & Engineering Requirement

Multi
- Space utilization
- Existing test hardware sharing
- Quick hold & release motion

What is new concept socket?

Speedy & Easy
- Reduce down time
- Tool user friendly
- Avoid use of screws

Mounting Reliability
- Thru force simulation
- Subject to tri-temp test

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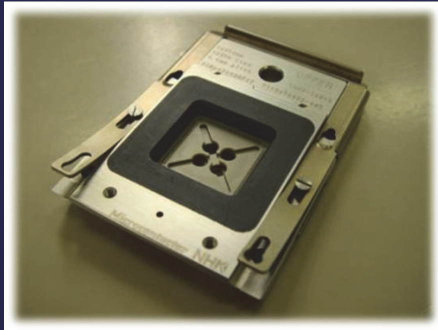
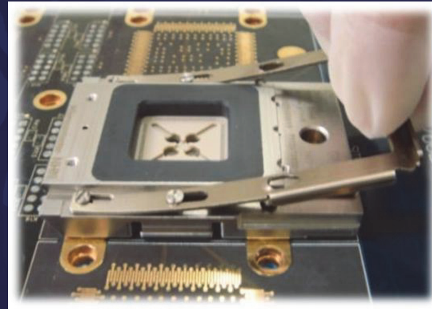
Snap-On Microcontactor Concept & Structure



Uses leaf spring to meet all requirement

It is SNAP-ON Microcontactor ! !



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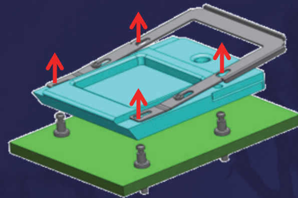
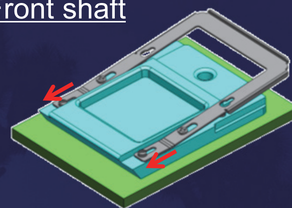
Snap-On Microcontactor Concept & Structure

Set the socket to shafts

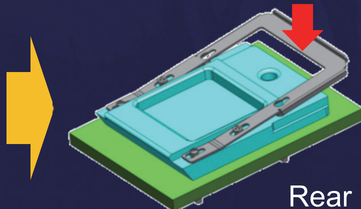


Front shaft

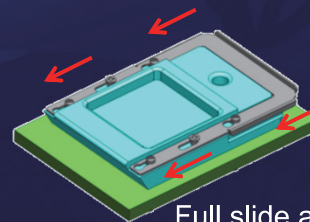


・Shafts are fixed to stiffener in advance
・No change to current screws mounting locations

Press the leaf spring



Rear shaft



Full slide and lock

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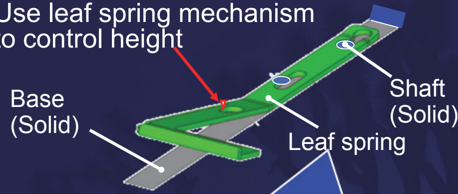
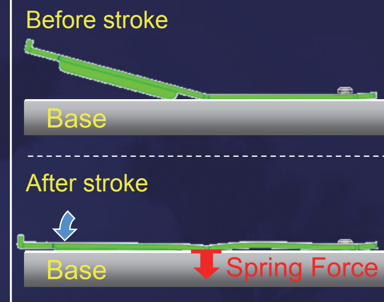
FEM Simulation

Structure

Use leaf spring mechanism to control height



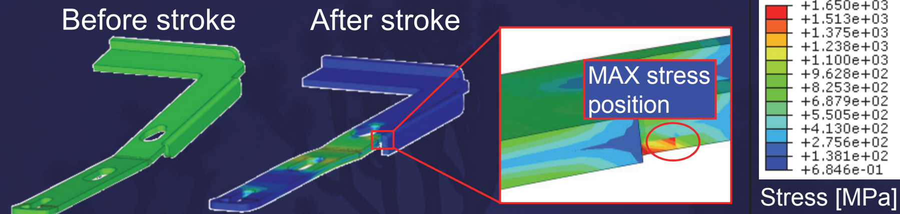
Material : SUS Basis
Young's modulus : 196,000 MPa
Poisson ratio : 0.3

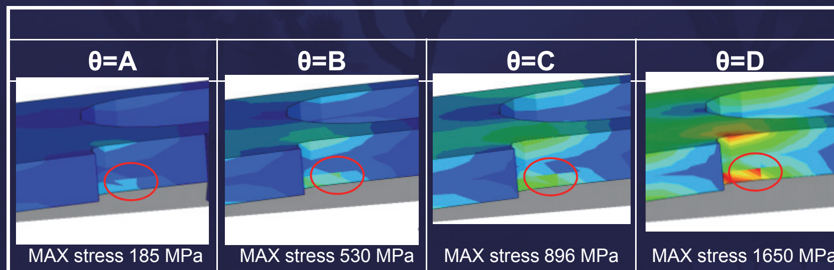


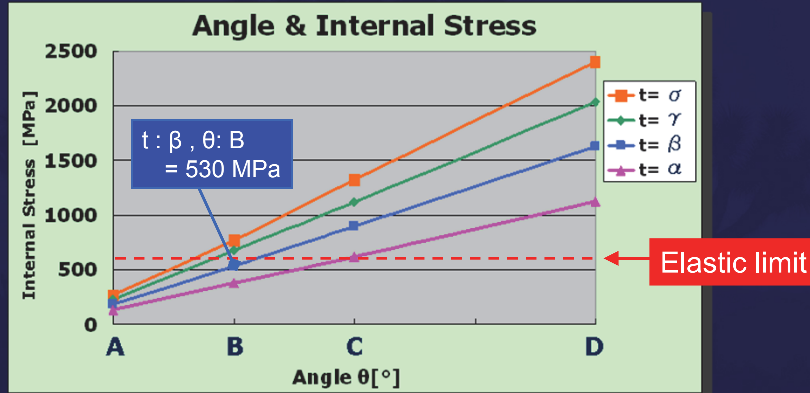
Parameters

FEM Simulation

Simulation result (Internal stress)






FEM Simulation
Simulation Result to Design Considerations (Internal Stress)
Angle & Internal Stress
Internal Stress [MPa]
2500
2000
1500
1000
500
0
t : β , θ: B
= 530 MPa
t= σ
t= γ
t= β
t= α
Elastic limit
A
B
C
D
Angle θ[°]
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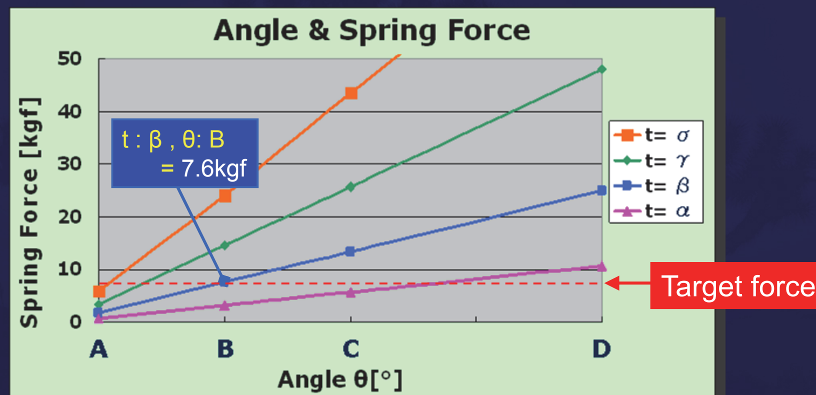
FEM Simulation
Simulation Result (Spring Force)
Target force : 500pins (Max pin count) × 15gf = 7.5 kgf
Angle & Spring Force
Spring Force [kgf]
50
40
30
20
10
0
t : β , θ: B
= 7.6kgf
t= σ
t= γ
t= β
t= α
Target force
A
B
C
D
Angle θ[°]
Total spring force depends on leaf spring design
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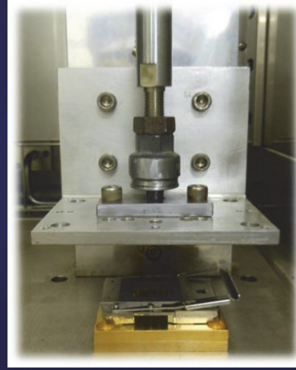
Lab Evaluations

500 times Press Test - High & Low Temperature

① Temperature Equipment



② Condition

High temp : 125℃ 80hrs（Measuring every 8hr）

Low temp : -55℃ 80hrs（Measuring every 8hr）

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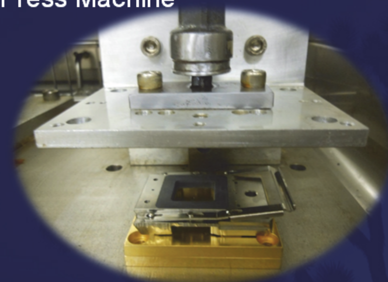
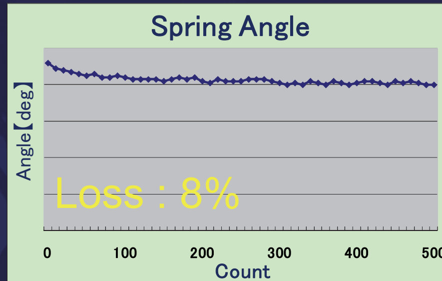
Lab Evaluations

(500 times Press Test - Room Temperature)

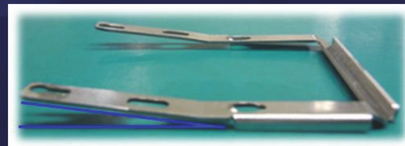
① Press Machine



② Spring Angle (graph)



③ Spring Angle (Form)



No critical difference

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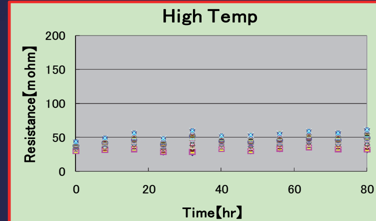
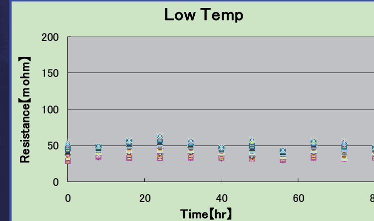
Lab Evaluations

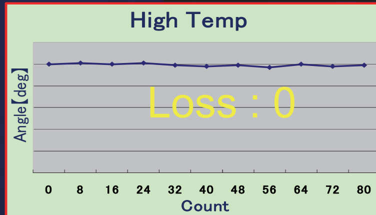
(High & Low Temperature Reliability Test)

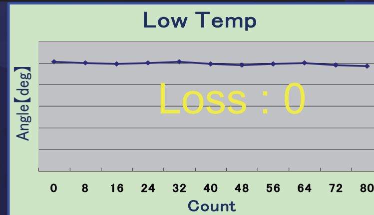
③ Contact Resistance





④ Spring Angle Stable contact = no deformation & force reduction





No angle deformation at hot and cold temp test at 80hrs

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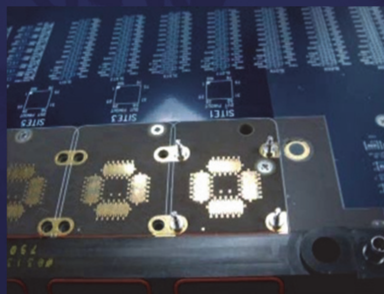
Maintenance for Snap-On Microcontactor

- Use of torque driver for shafts tightening to load board with controlled force
- Use of Checker Jigs for shafts ensuring perpendicularity to load board



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Conclusions

- Significant time reduction in set-up and trouble-shooting achieved with Auto-DIB Changer and Snap-on concepts
- Concepts are easy and simple to implement
- Less tools required and more user-friendly
- Applicable for multi-site testing
- Future works
  - Snap-On manual lid
  - Strip Snap-on Microcontactor
  - Snap-On for BGA packages with more than 1000 pin count

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