

EIGHTEENTH ANNUAL

BiTS™

Burn-in & Test Strategies Workshop

March 5 - 8, 2017

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

Archive – Session 7

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Session 7

Mike Ramsey
Session Chair

BiTS Workshop 2017 Schedule

Solutions Day

Wednesday March 8 - 8:00 am

Teaming Up

"Applying FEA Simulation for Test Interface Unit"

Jason Koh - Test Tooling Solutions Group

"BI RHINO Handling Solution"

Yaniv Raz- Intel Corporation

"Optical Device Testing at Wafer Level and Package Devices"

Carl Kasinski – Aehr

"Fan-in WLCSP Test Requirements"

Mike Frazier - Mike Frazier

Fan-In WLCSP Test Strategy

Mike Frazier
Xcerra Corporation



BiTS Workshop
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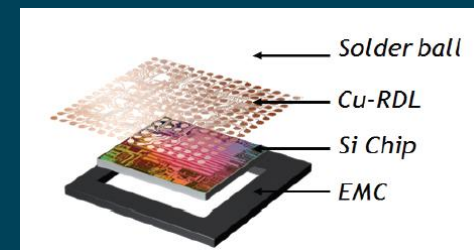
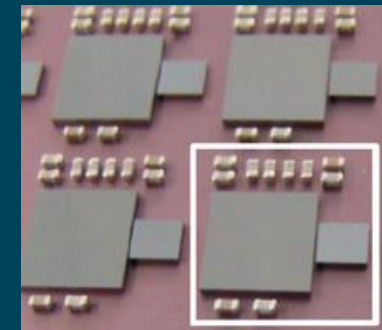


Contents

- WLCSP Market Overview
- Changes in the Industry (Inflection Point)
- Post Saw Test Process Description
- Evaluation Summary
- Conclusion

Fan Out WLCSP

- Definition
 - Fan out implies that the ball grid array is larger than the die
 - Die is encapsulated in molding with RDL layer covering die AND molding
 - Package sizes up to 25mm X 25 mm today
- Advantages
 - Multi-chip and/or passive integration possible
 - Lower cost and smaller package compared to FCBGA
 - Larger area for contact balls
- Disadvantages
 - Higher cost and larger die than FI-WLCSP
 - Yield (associated with placement accuracy)



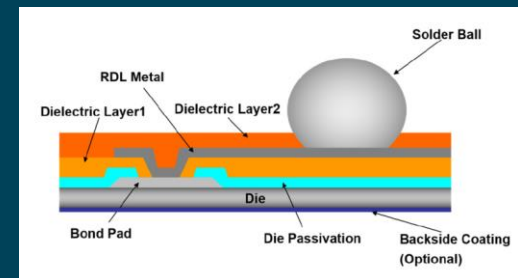
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Fan-In WLCSP

- Definition
 - Fan in implies that the contact balls fit within the die size
 - Bare die or encapsulated up to 7mm X 7mm
- Advantages
 - Smallest possible package size (X,Y and Z dimensions)
 - Lowest possible packaging cost (No Substrate – RDL)
 - High performance (no bond wires, short signal length, low cap.)
- Disadvantages
 - Limited pin count (space for contact balls)
 - Reliability (chipping, cracks, shipping....)
 - Single die, no support for passives

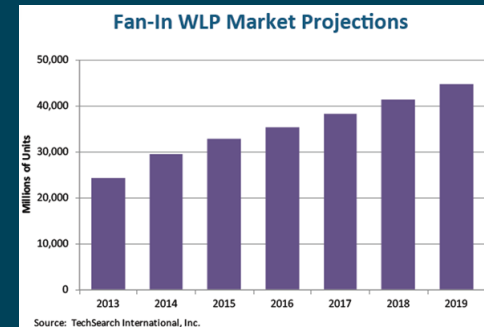
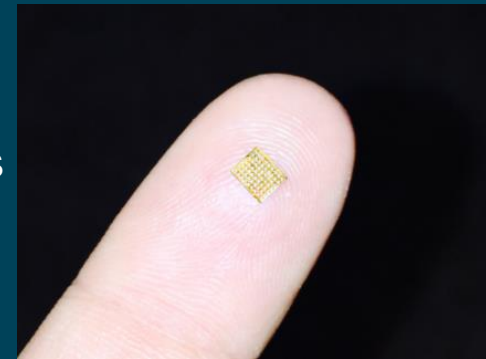


Fan In WLCSP devices make up 30%
of packages in cell phone today



Fan In Market Summary

- Fan in WLCSP market is significantly larger than FO-WLCSP
 - RF Transceivers
 - Baseband
 - Touch controllers
 - PMIC
 - RF Power amps
 - MEM's
- End applications
 - Cell Phones
 - Tablets
 - IOT
 - Automotive
 - Wearables
 - more
- Fine Pitch
 - 0.4 mm ball pitch is typical
 - 0.3mm is leading edge for “direct to board”
 - 0.2mm is leading edge for substrate placement

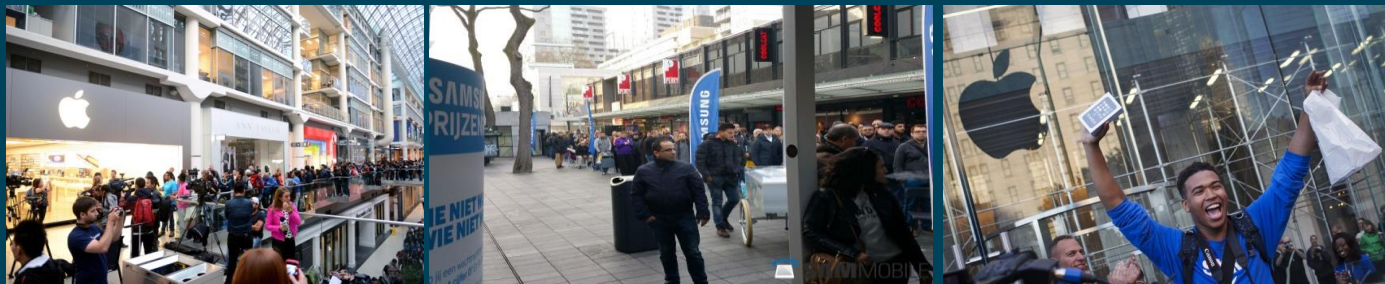


CAGR ~9%

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Quality Demand of the Industry

- Automotive has been traditionally the driver for low defect requirements
- Consumer devices had less stringent quality standards...but this has changed



Drive to near zero defect parts per million (PPM) → defect parts per billion (PPB)

Traditional Process Flow

Wafer Test



Wafer Saw



T&R with vision Inspection



Challenges:

- Test at start of backend processing
- Device picking and Saw process after test



Post Saw Test Advantages

Wafer Saw



Singulated Device Test



Tape & Reel with Vision Inspection

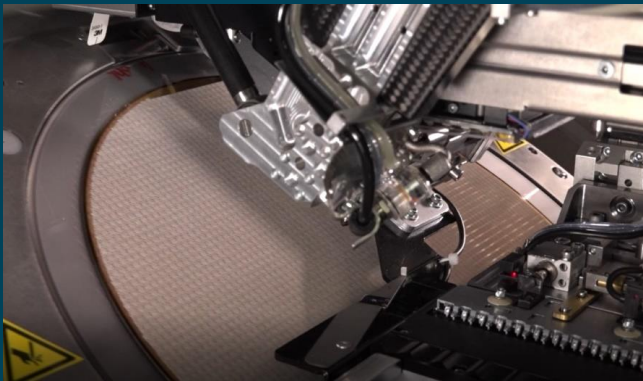


True Final Test of singulated WLCSP devices

- Improved Quality
 - Test Process moved to end of back end processing (PST)
- RMA / device retest
 - Same retest capability as production test

Post Saw Test Process Steps (Device Pick)

- Input from sawn Film frame or Tape and Reel
- Device Placement onto test “substrate”
 - InCarrier, glass wafer, vacuum chuck....

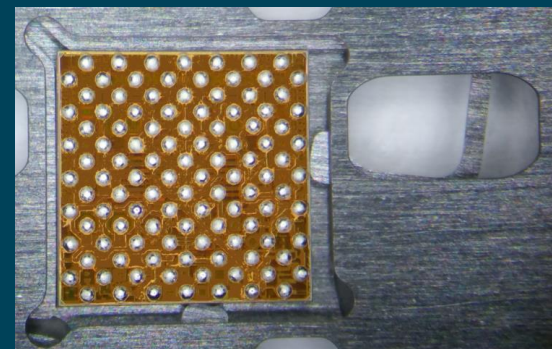


InCarrier Features and benefits

- Easy handling of hundreds of singulated WLCSP devices in a strip format
 - Mechanical alignment for highest accuracy
 - Device retention exceed “drop test”
 - Supports Lots on hold
- Improved throughput with 100% touch efficiency
- Supports Full Tri-temp test environment
- Handling WLCSP for Engineering
 - Device handling for characterization
 - Burn-in / Environmental

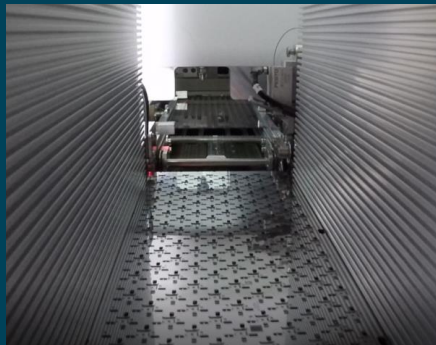


Up to 300 devices / InCarrier



Post Saw Test Process Steps (Device Test)

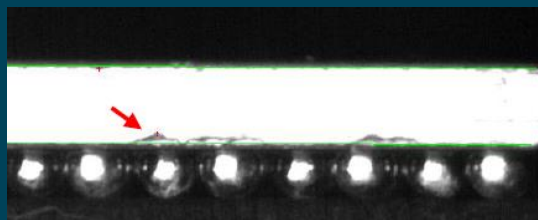
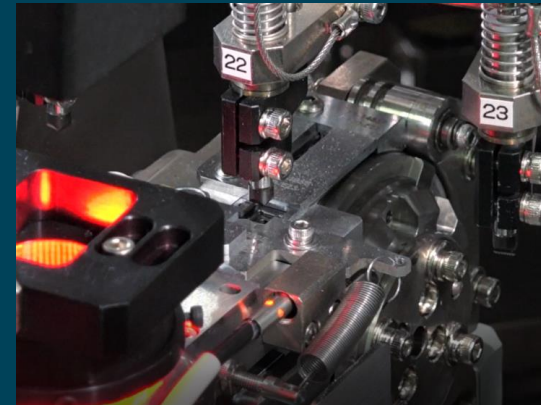
- Present singulated devices to ATE test
 - Strip Handlers, Probers
- Test is the most expensive process step in back end processing
 - Desire is to have highest possible utilization



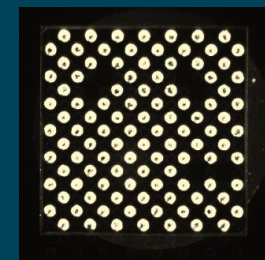
InStrip with MEM's stimulus

Post Saw Test Process Steps (Tape and Reel)

- Remove tested singulated devices for test “substrate” for placement into T+R
 - Device Rotation
 - Laser Mark
 - Mark Inspection
 - Sidewall Inspection
 - Ball side Inspection
 - Tape and reel
 - Pre and post seal inspection



10u crack detection capability



Summary of Results

- System Validation on OSAT floor
 - ESD, safety, operational validation passed
- Correlation achieved to existing probe results
- Large sample run of parts from T+R
 - Reject level detected at 500PPM during first pass
 - Looped sample of units 4 times with 0 rejects detected
- Demonstrated 14% higher test cell throughput



Conclusion

- Quality demand is changing the way people will test WLCSP devices.
- New process flow eliminates test escapes created by singulation process
 - Enables true Final Test of WLCSP devices
- Proven Gentle and reliable handling of singulated WLCSP packages
- Improved test cell efficiency
- Flexibility for wide range of applications

