SIXTEENTH ANNUAL

BiTS

Burn-in & Test Strategies Workshop™

March 15 - 18, 2015

Hilton Phoenix / Mesa Hotel
Mesa, Arizona

Archive – Session 5

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Session 5
Ashok Kabadi
Session Chair

BiTS Workshop 2015 Schedule

Performance Day

Tuesday March 17 10:30 am

Handle With Care

"Semi Automated DIB/PIB Loader"

Alexander Wieler - esmo AG

"Mechanical Flip Burn In (FBI) for Tire Pressure Monitoring System"

Raimondo Sessego, James Stanley, & Joe Milazzo - Freescale Semiconductor

"Final Test Solution of WLCSP devices"

Mike Frazier- Xcerra Corporation

BiTS 2015 Burn-in & Test Strategies Workshop

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Final Test Solution of WLCSP Devices

Mike Frazier
Xcerra Corporation

2015 BiTS Workshop
March 15 - 18, 2015

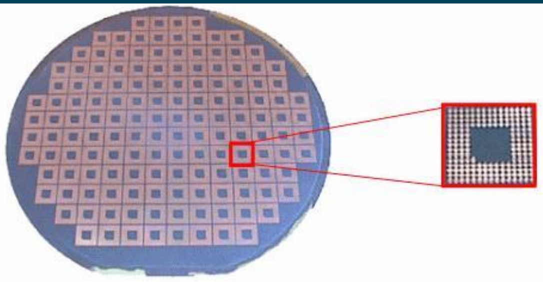
Agenda

- WLCSP Final Test
  - Process flow and equipment required
- InCarrier design and features
  - InCarrier Anatomy
  - Results
- Data Tracking
  - Wafer data @ final test
- Test Cell efficiency

WLCSP Test Solution for Final test

Quality advantage of final test for WLCSP devices

Singulated WLCSP



InCarrier handling

InStrip Final Test

RMA Devices
Re-test
Re-program

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Final Test Solution of WLCSP Devices

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Simplified Process Flow Comparison

Test Wafer On Prober

Dice wafer on Blue Tape

Blue tape to T&R with 5S

Dice wafer on Blue Tape

Pick from WF to InCarrier™ - Test on InStrip™

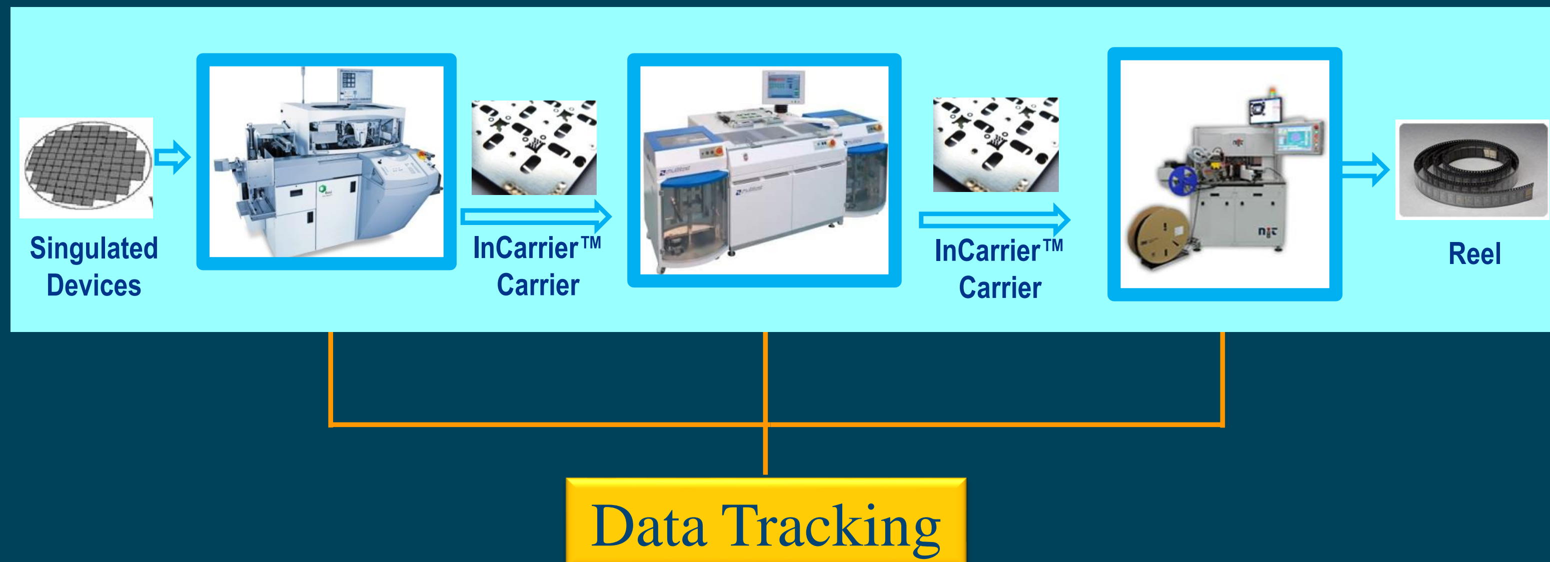
Carrier to T&R with 5S

Device flow for WLCP Final Test

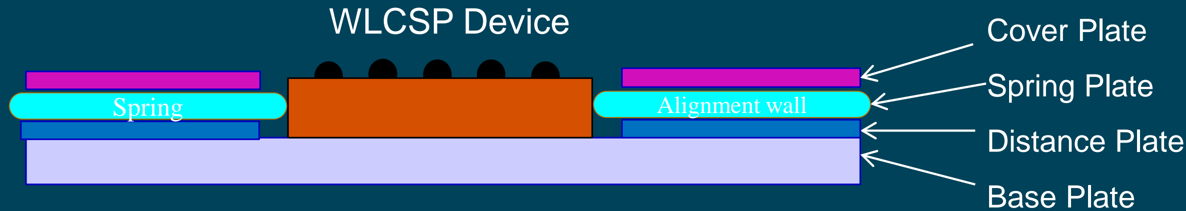
Loading to InCarrier

Final Test

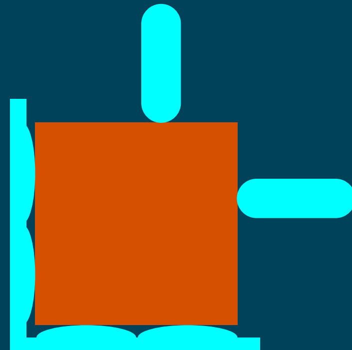
Unload optional vision, **Tape & Reel**



Anatomy of InCarrier

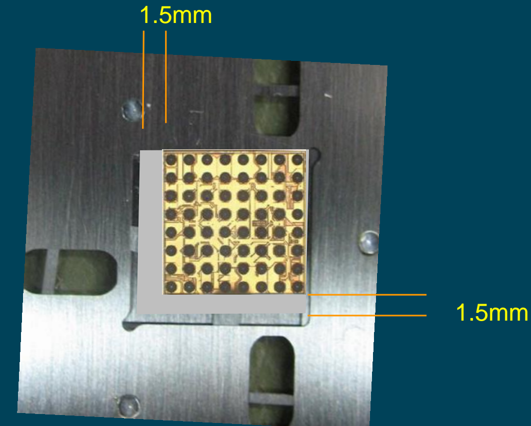


•Spring and alignment wall designed to touch near center of sidewall of device
•Spring force optimized for securing device without damage to sidewalls



•Mechanical alignment of WLCSP devices in InCarrier

•No touching of sensitive corners



•Device pocket /spring mechanism designed to support up to 1.5mm device size variation

Example – 5.5mm X 5.5mm InCarrier can also hold a WLCSP as small as 4mm X 4mm

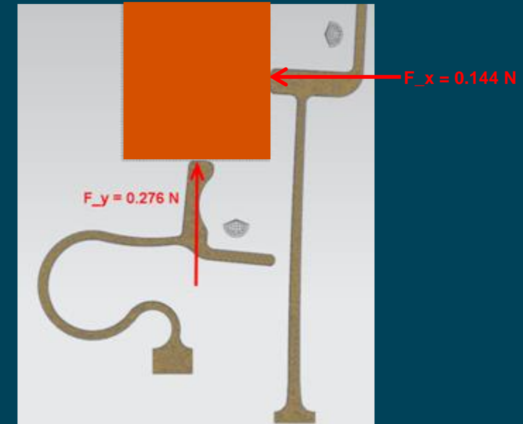
Device/Carrier Handling

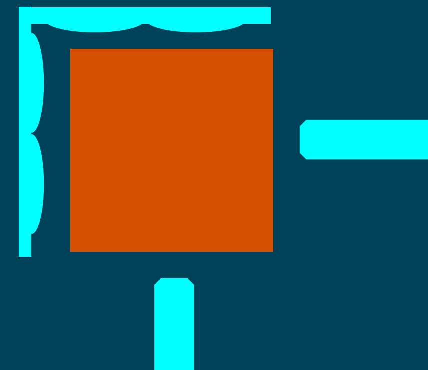
- Standardized InCarrier size for all WLCSP device sizes
  - Same cartridge used for all WLCSP carriers
- InCarrier device handling
  - Device retention exceed “drop test” on hard surface
- Handling WLCSP for Engineering
  - Device handling for characterization
  - Burn-in / Environmental (under investigation)

40 Slot Cartridge

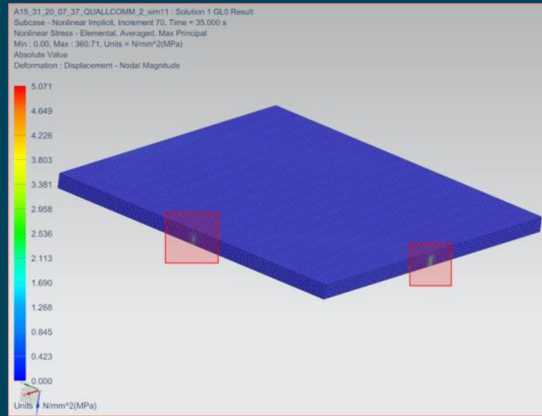
InCarrier® Layout - Stress on Device

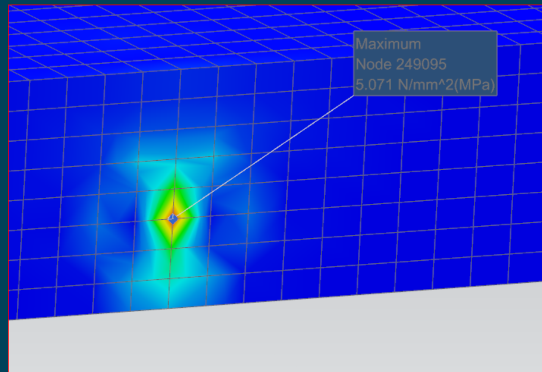
- Carrier springs slide devices to know position in corner for accurate positioning
  - Spring clamping at controlled speed (variable) and all sites in parallel
  - The force is optimized for minimal force againt the device while maintaining position in InCarrier
  - No corners are touched
- Scratches/prints due to springs/carrier sides
  - Zero customer issues reported for damage to devices to date (most in a 6 sigma automotive application)
    - No scratching issues have arisen

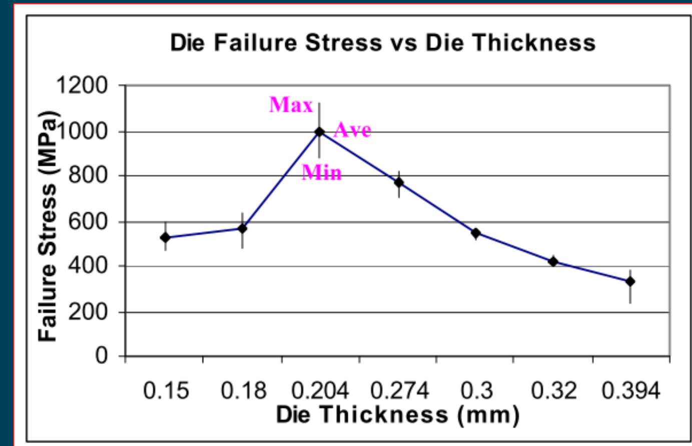




Die Stress Analysis







MECHANICAL CHARACTERIZATION IN FAILURE STRENGTH OF SILICON DICE

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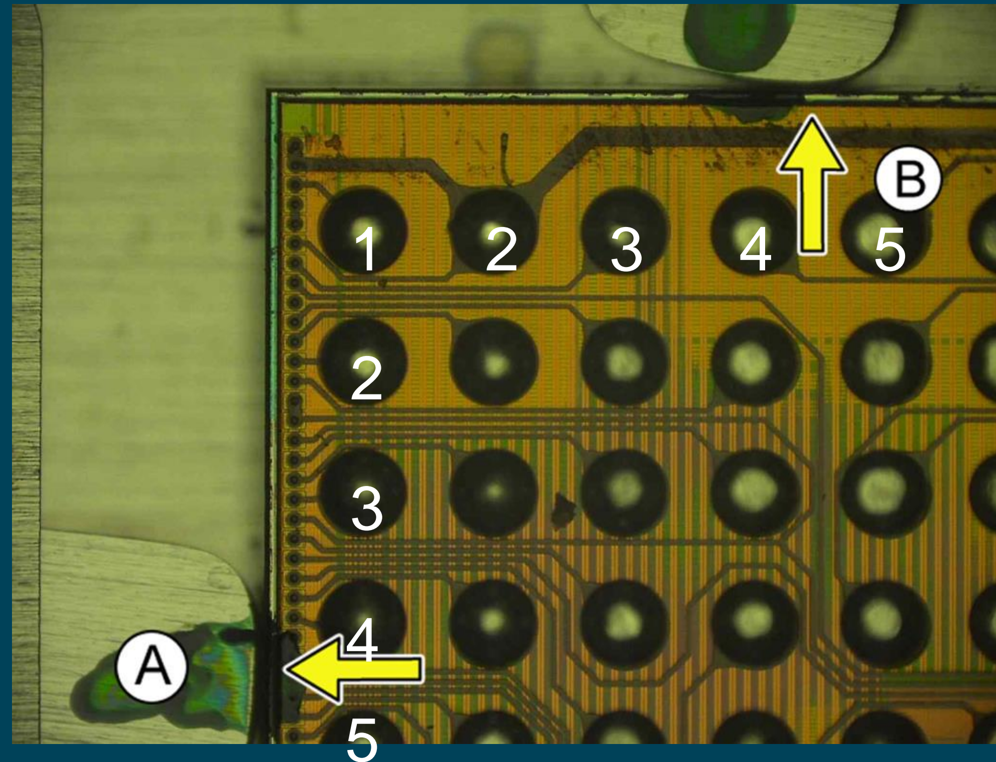
The Stress on the silicon DIE is maximal 5 MPa

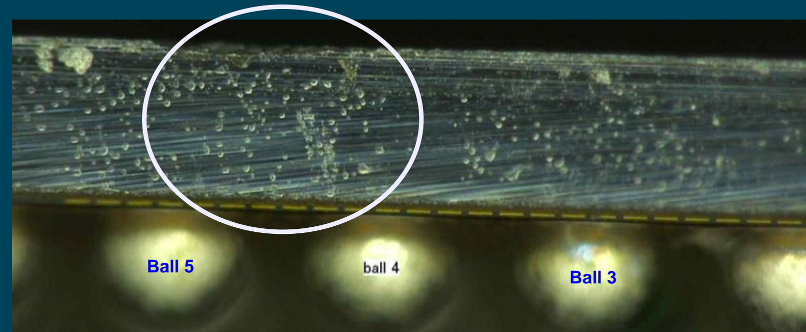
Stress Test with WLCSP Devices

Typical test flow would require 1 insertion/retraction of device into carrier (Rework could add a second or third insertion in extreme examples)

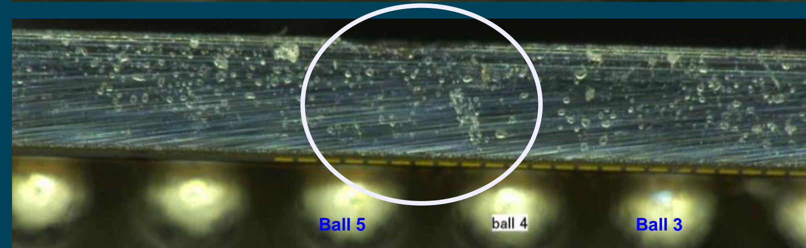


Stress Test Results

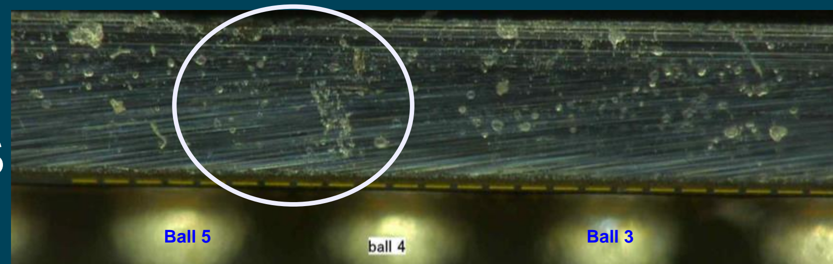
New



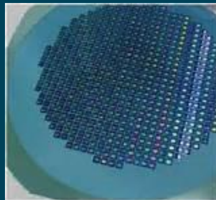
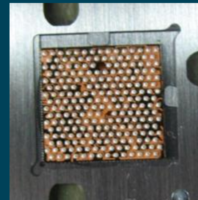
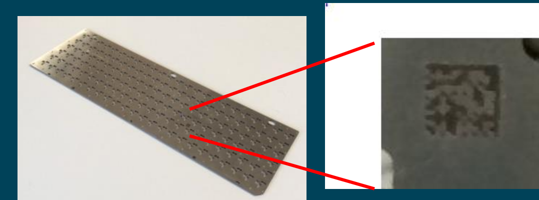
10 cycles



110 cycles



Device Loading into carrier

Pick and place from wafer ring	Die Insertion into carrier	InCarrier ready for test
		

Pick and place from wafer ring

Throughput
- Up to 12,000 UPH

Placement accuracy
- +/- 37um
- 1deg theta

Missed die handling
- Vacuum detection
- Vision camera optional
- Rules creation for action

Semi E84 (device mapping)

Die Insertion into carrier

Device placement
- 1mm or more tolerance for device placement

Carrier device retention
- SW controlled (variable) speed spring operation
- Parallel closing across carrier

Reliable device retention
- Tested retention to exceed drop test

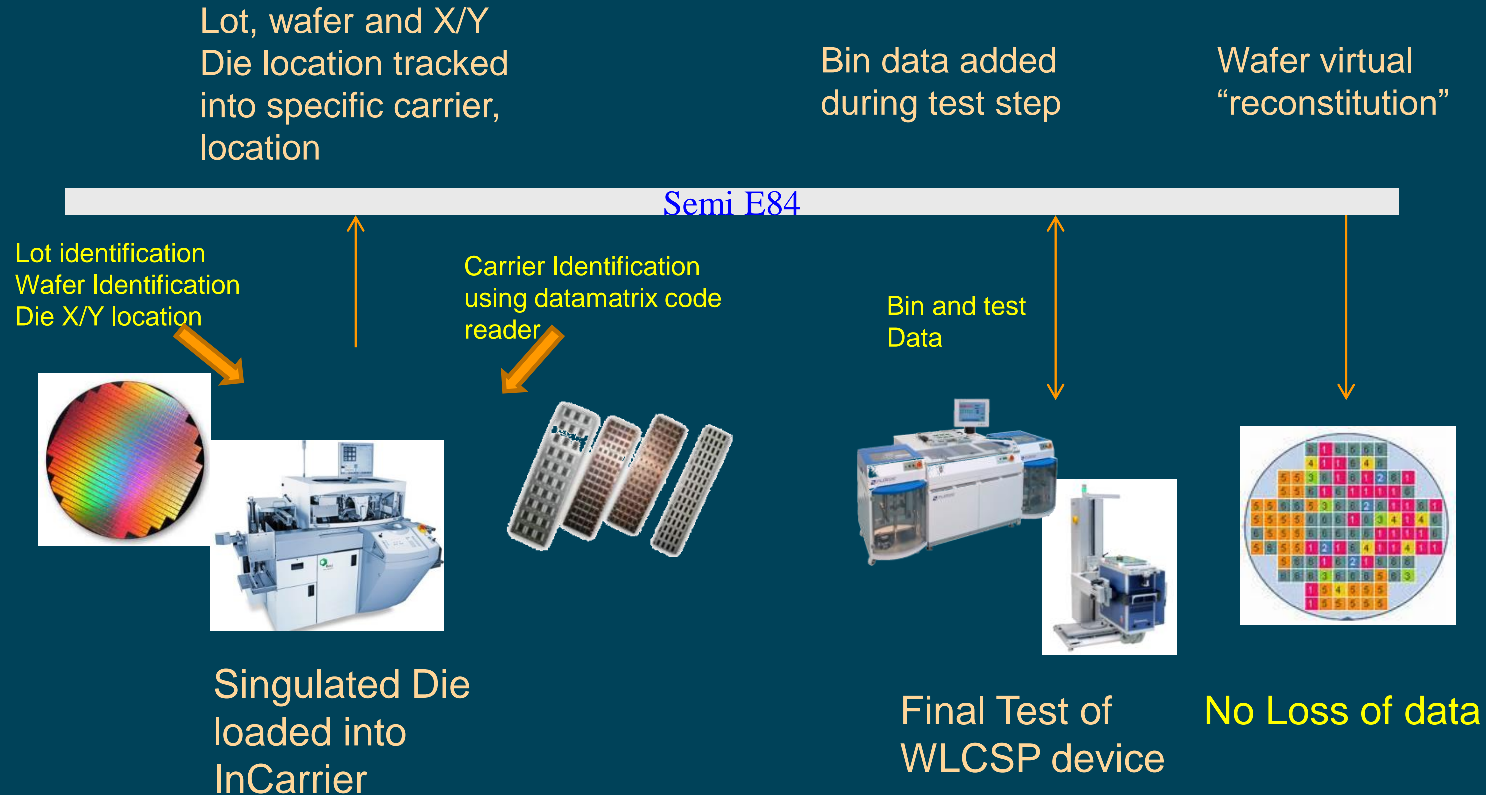
InCarrier ready for test

InCarrier identification
- Datamatrix visual identification

Visual inspection of loaded carrier
- Missing/lifted die detection
- Rules creation for action

HVM production proven solution

Die pick from wafer ring using same technology as current process


Wafer Data Tracking
Lot, wafer and X/Y Die location tracked into specific carrier, location
Bin data added during test step
Wafer virtual "reconstitution"
Semi E84
Lot identification
Wafer Identification
Die X/Y location
Carrier Identification using datamatrix code reader
Bin and test Data
Singulated Die loaded into InCarrier
Final Test of WLCSP device
No Loss of data
* Semi E84 – Specification for substrate mapping
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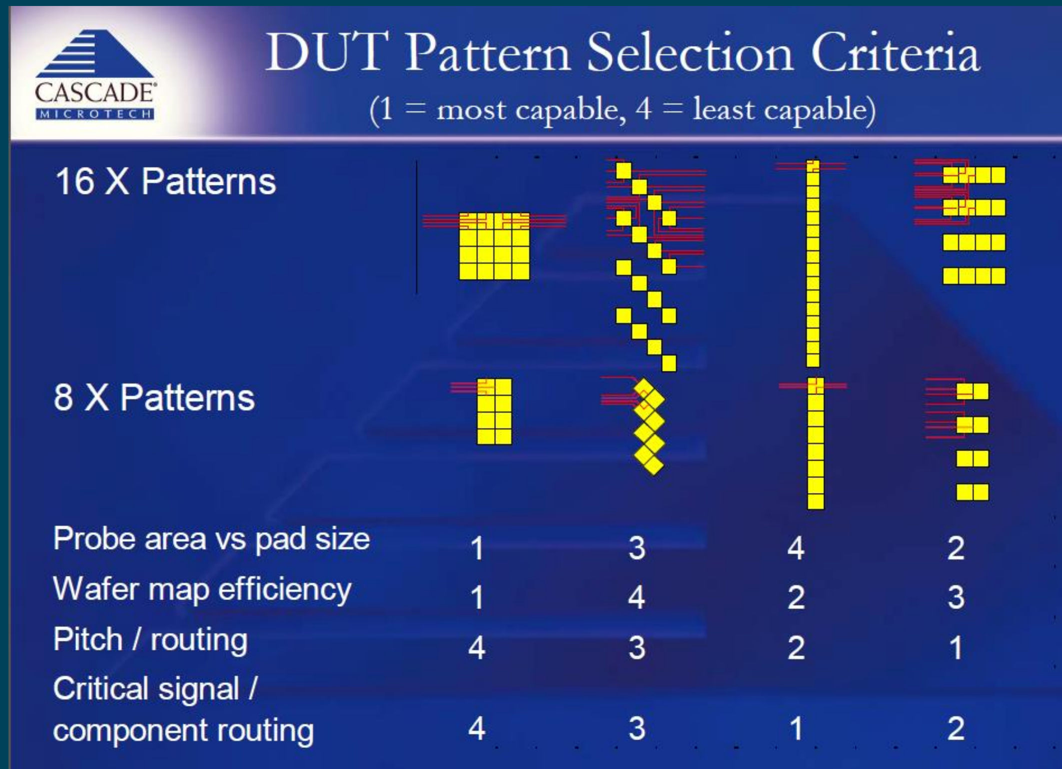
Probe Pattern effects on test

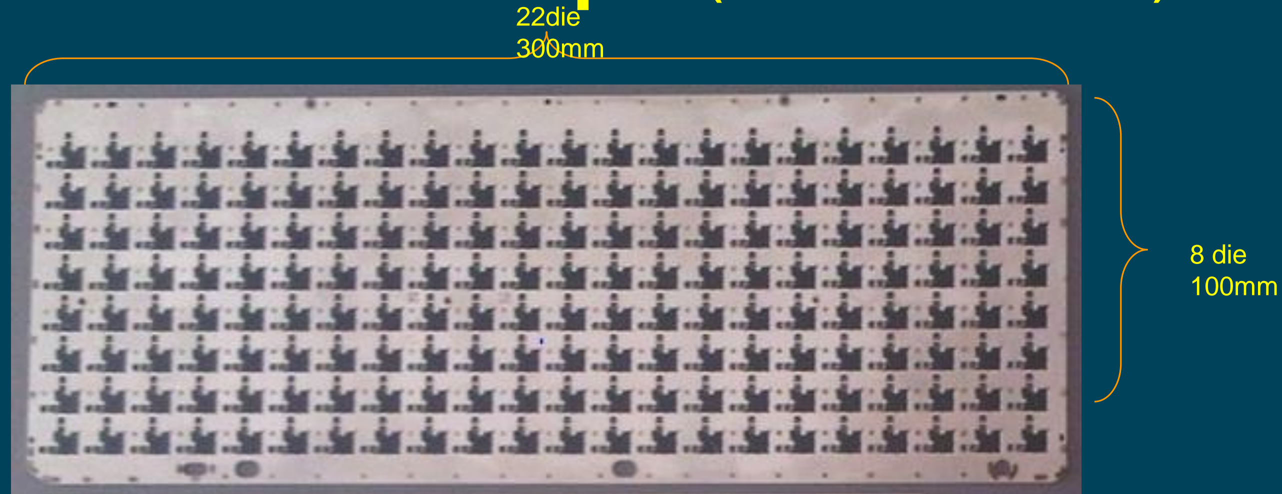


InCarrier offers simplified loadboard layout AND 100% wafer map efficiency

Source: Cascade Microtech

InCarrier example (5mm X 5mm WLCSP)

22die
300mm



8 die
100mm

InCarrier advantages for WLCSP
- •Enables test after wafer sawing
- •100% touch efficiency
- •Spacing between DUT's for easier loadboard/probe design
  - •Improve TTM
- •Re-test of single part possible without touching other parts
- •Re-test of lots if required (re-test after singulation)

Summary

- Eliminates test escapes created by singulation process
  - Enables true Final Test of WLCSP devices
- Gentle and reliable handling of singulated WLCSP packages
  - Uses same pick and place technique as today's process
  - Carrier placement accuracy supports fine pitch device applications
- Wafer data preserved using industry standards for device tracking
- Increased throughput of test cell