(Incorporated in the Republic of Singapore)
(Company Registration No. 199901514C)

ANNOUNCEMENT

PRESENTATION MADE AT A CONFERENCE

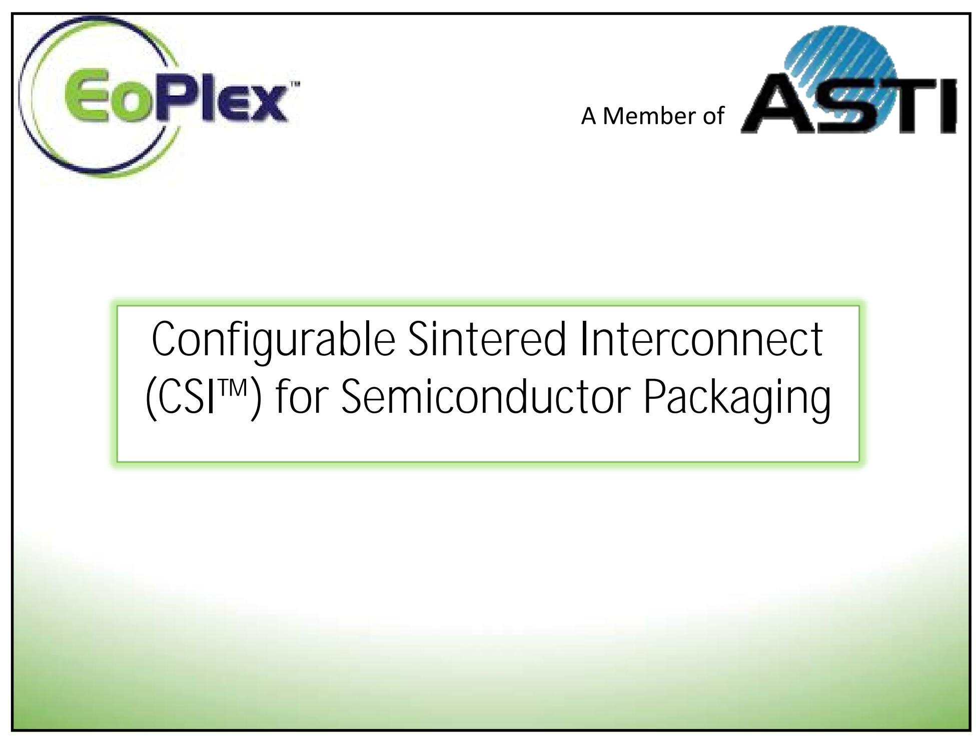
The Board of Directors of ASTI Holdings Limited wishes to announce that a presentation entitled "A New Concept for Lead Frames" (the "**Presentation**") was made during a conference held by the IEEE Components, Packaging, and Manufacturing Society (Santa Clara Valley Chapter) at 2900 Semiconductor Drive, Santa Clara, CA, USA, on 7 April 2015 to conference participants.

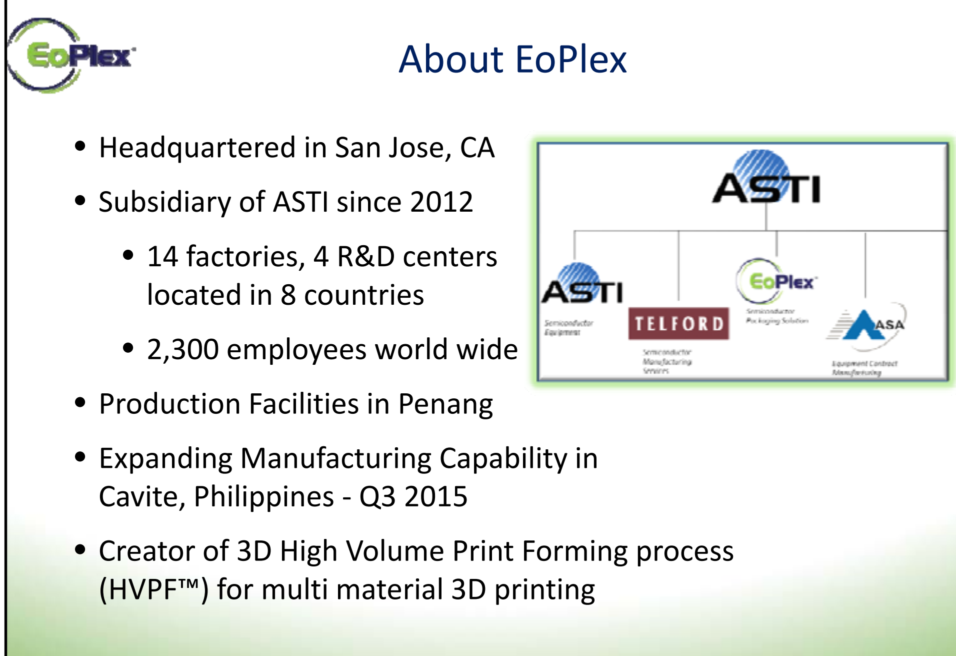
Please find a copy of the Presentation attached hereto as "**Annex A**".

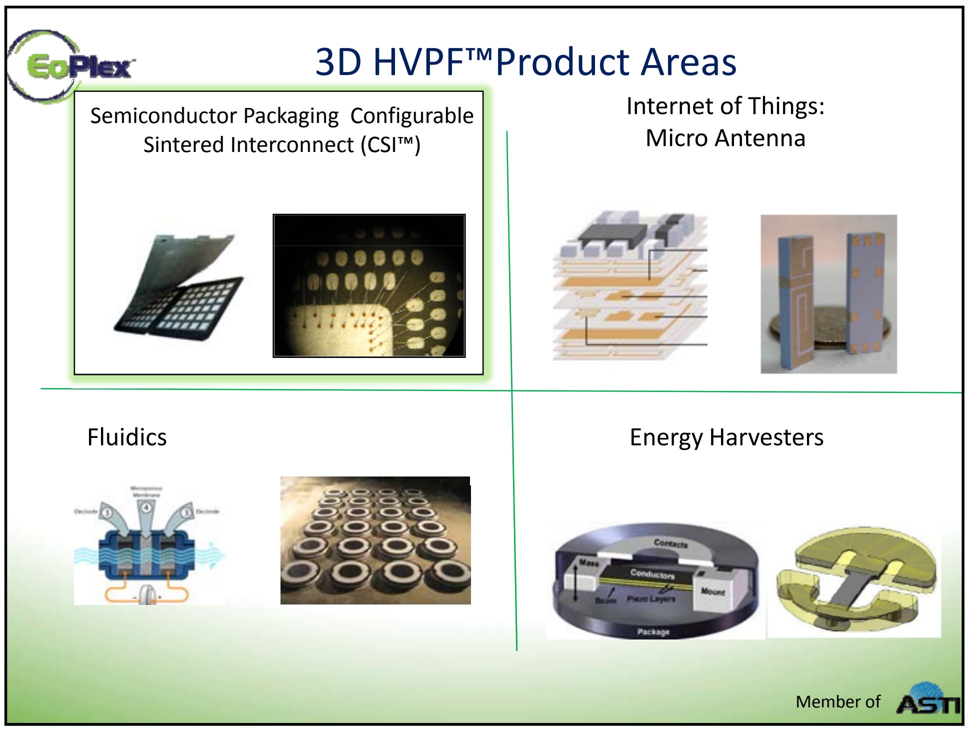
BY ORDER OF THE BOARD

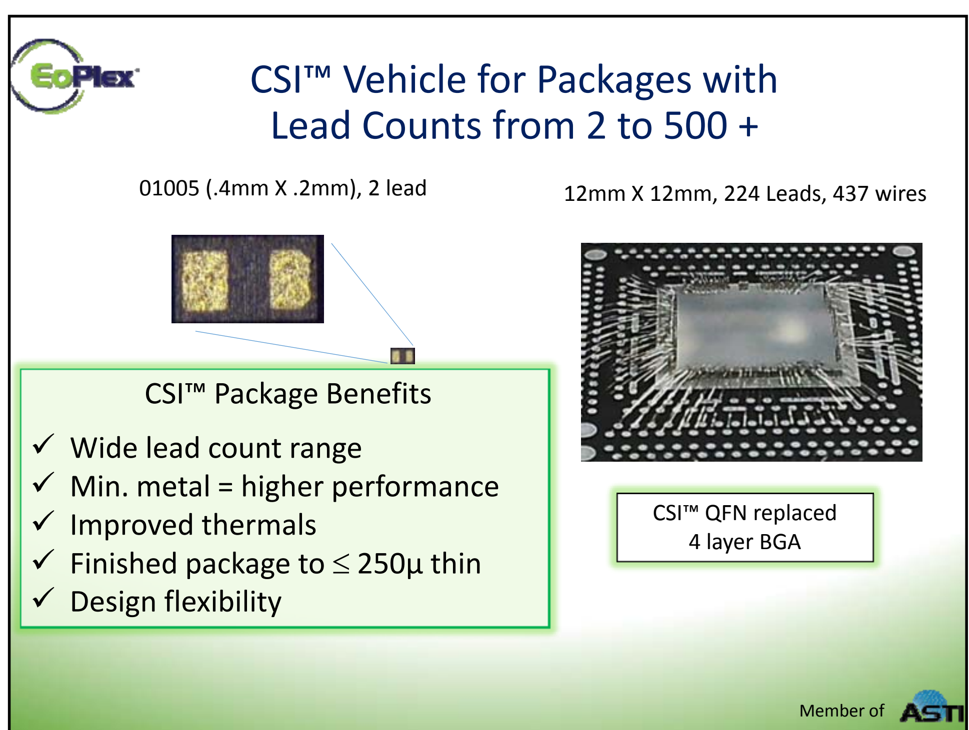
Dato' Michael Loh Soon Gnee
Executive Chairman & Group CEO
1st June 2015

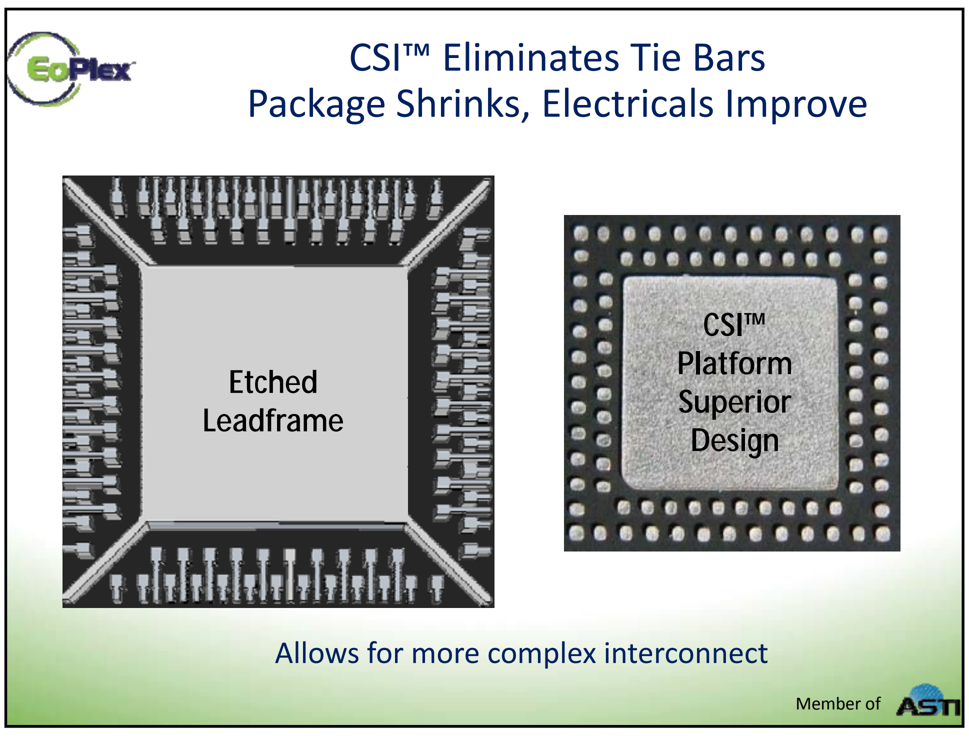
ANNEX A (THE PRESENTATION)

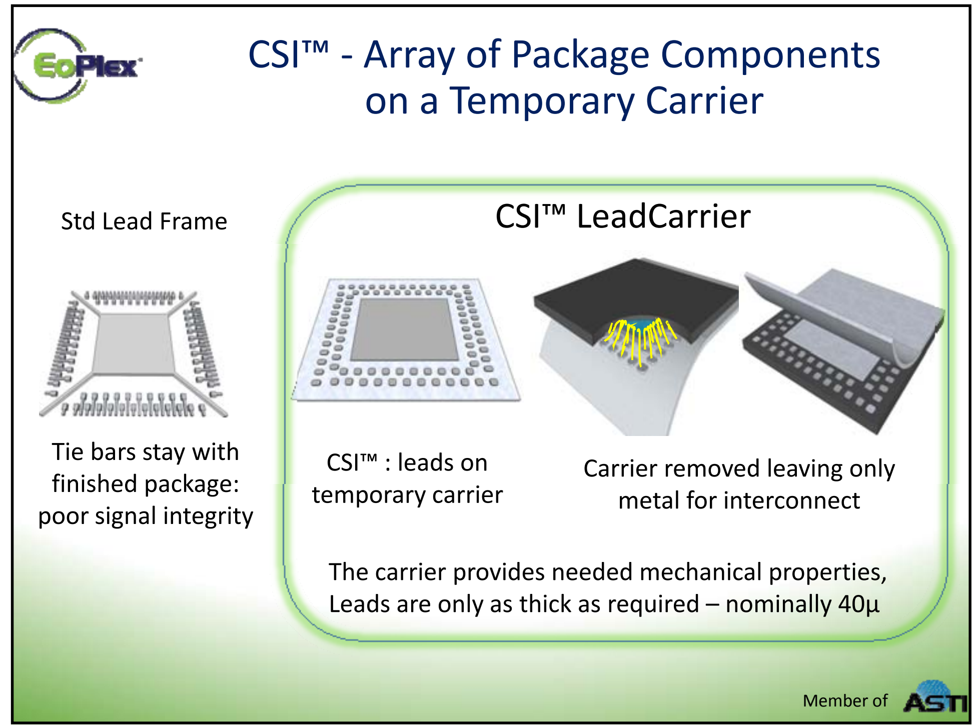


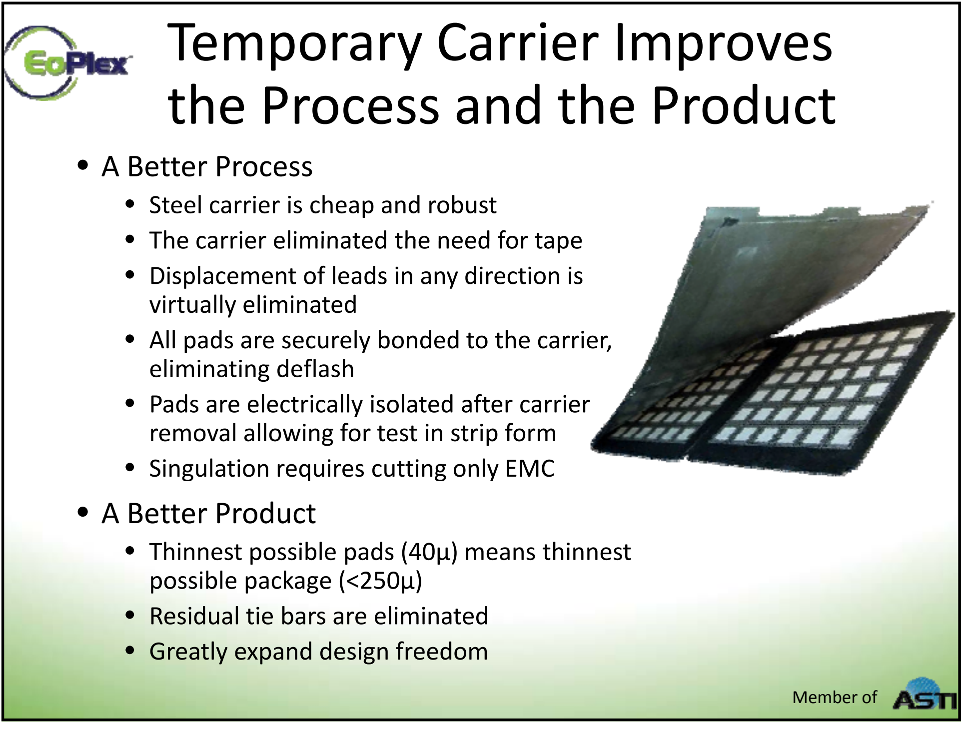


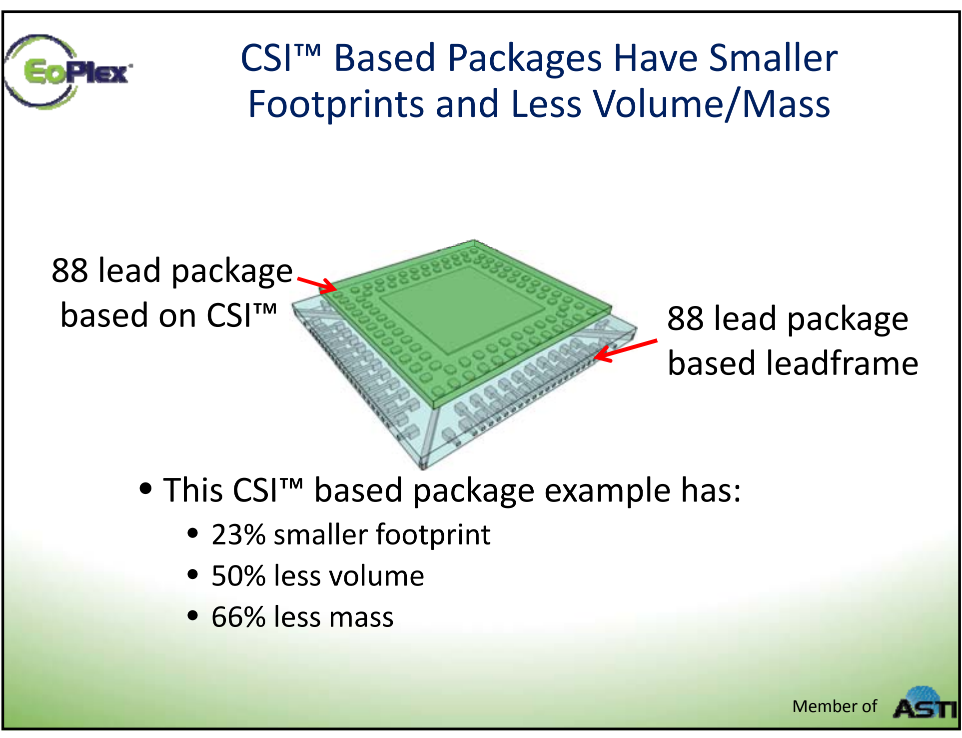

EoPlex
3D HVPF™Product Areas
Semiconductor Packaging Configurable
Sintered Interconnect (CSI™)
Internet of Things:
Micro Antenna
Fluidics
Energy Harvesters
Contacts
Conductors
Mass
Piezo Layers
Mount
Package
Member of ASTI


EoPlex
CSI™ Vehicle for Packages with
Lead Counts from 2 to 500 +
01005 (.4mm X .2mm), 2 lead
12mm X 12mm, 224 Leads, 437 wires
CSI™ Package Benefits
✓ Wide lead count range
✓ Min. metal = higher performance
✓ Improved thermals
✓ Finished package to ≤ 250µ thin
✓ Design flexibility
CSI™ QFN replaced
4 layer BGA
Member of ASTI


EoPlex
CSI™ Eliminates Tie Bars
Package Shrinks, Electricals Improve
Etched
Leadframe
CSI™
Platform
Superior
Design
Allows for more complex interconnect
Member of ASTI


EoPlex
CSI™ - Array of Package Components
on a Temporary Carrier
Std Lead Frame
Tie bars stay with
finished package:
poor signal integrity
CSI™ LeadCarrier
CSI™ : leads on
temporary carrier
Carrier removed leaving only
metal for interconnect
The carrier provides needed mechanical properties,
Leads are only as thick as required – nominally 40µ
Member of ASTI


EoPlex
Temporary Carrier Improves the Process and the Product
• A Better Process
• Steel carrier is cheap and robust
• The carrier eliminated the need for tape
• Displacement of leads in any direction is virtually eliminated
• All pads are securely bonded to the carrier, eliminating deflash
• Pads are electrically isolated after carrier removal allowing for test in strip form
• Singulation requires cutting only EMC
• A Better Product
• Thinnest possible pads (40µ) means thinnest possible package (<250µ)
• Residual tie bars are eliminated
• Greatly expand design freedom
Member of ASTI


EoPlex
CSI™ Based Packages Have Smaller Footprints and Less Volume/Mass
88 lead package based on CSI™
88 lead package based leadframe
• This CSI™ based package example has:
• 23% smaller footprint
• 50% less volume
• 66% less mass
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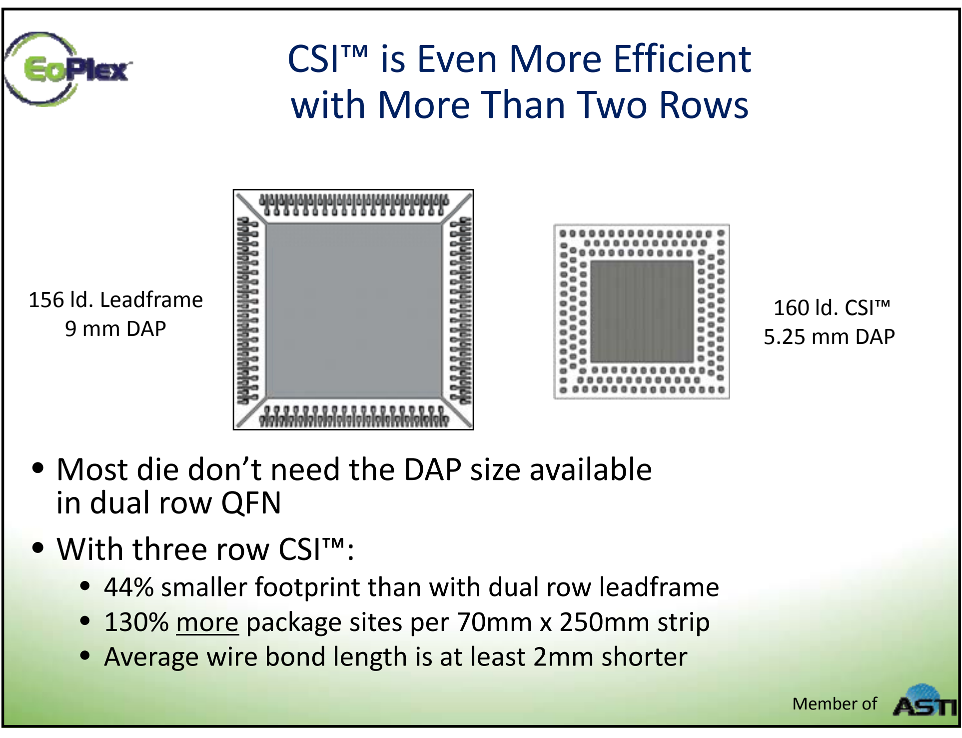
EoPlex
CSI™ is Even More Efficient
with More Than Two Rows
156 ld. Leadframe
9 mm DAP
160 ld. CSI™
5.25 mm DAP
• Most die don't need the DAP size available in dual row QFN
• With three row CSI™:
• 44% smaller footprint than with dual row leadframe
• 130% more package sites per 70mm x 250mm strip
• Average wire bond length is at least 2mm shorter
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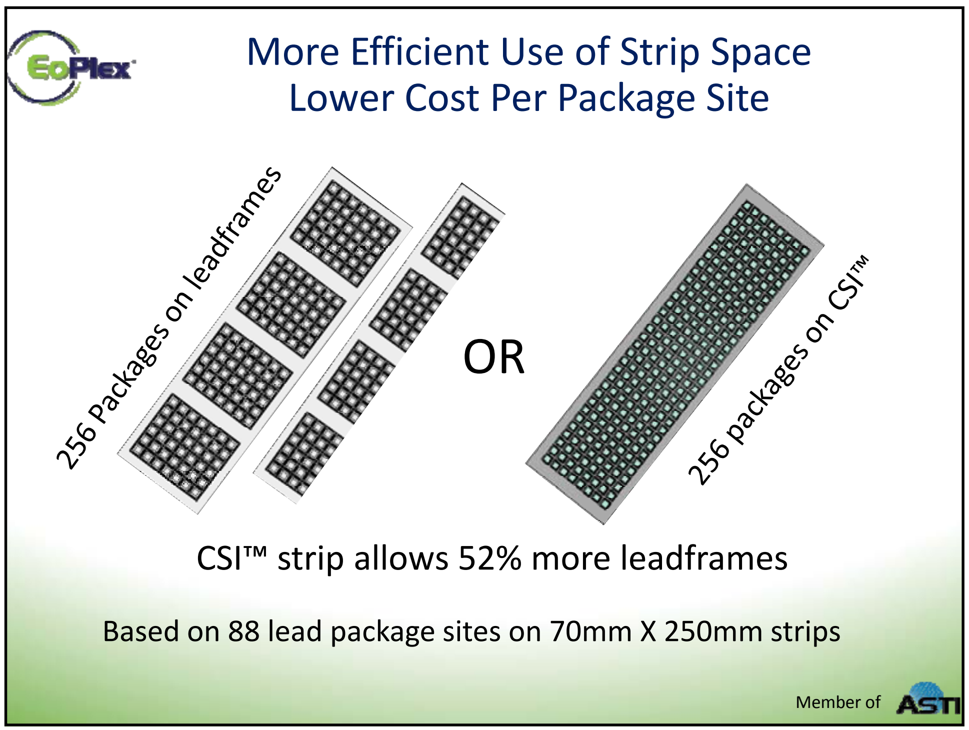
EoPlex
More Efficient Use of Strip Space
Lower Cost Per Package Site
256 Packages on leadframes
OR
256 packages on CSI™
CSI™ strip allows 52% more leadframes
Based on 88 lead package sites on 70mm X 250mm strips
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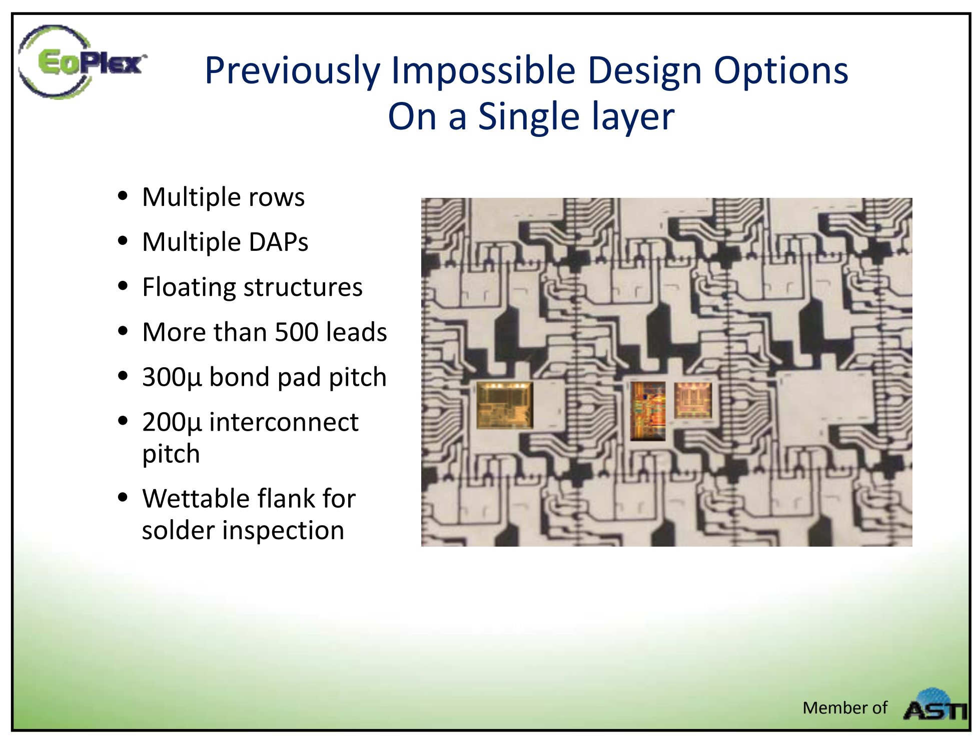
EoPlex
Previously Impossible Design Options
On a Single layer
Multiple rows
Multiple DAPs
Floating structures
More than 500 leads
300µ bond pad pitch
200µ interconnect pitch
Wettable flank for solder inspection
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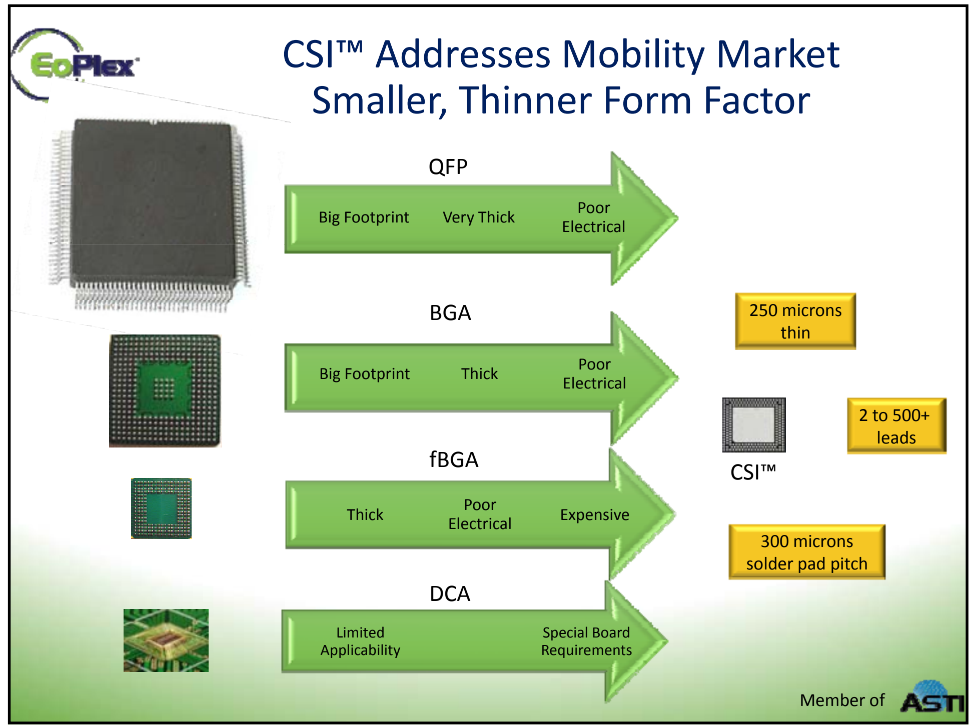
EoPlex
CSI™ Addresses Mobility Market
Smaller, Thinner Form Factor
QFP
Big Footprint
Very Thick
Poor Electrical
BGA
Big Footprint
Thick
Poor Electrical
fBGA
Thick
Poor Electrical
Expensive
DCA
Limited Applicability
Special Board Requirements
250 microns thin
2 to 500+ leads
CSI™
300 microns solder pad pitch
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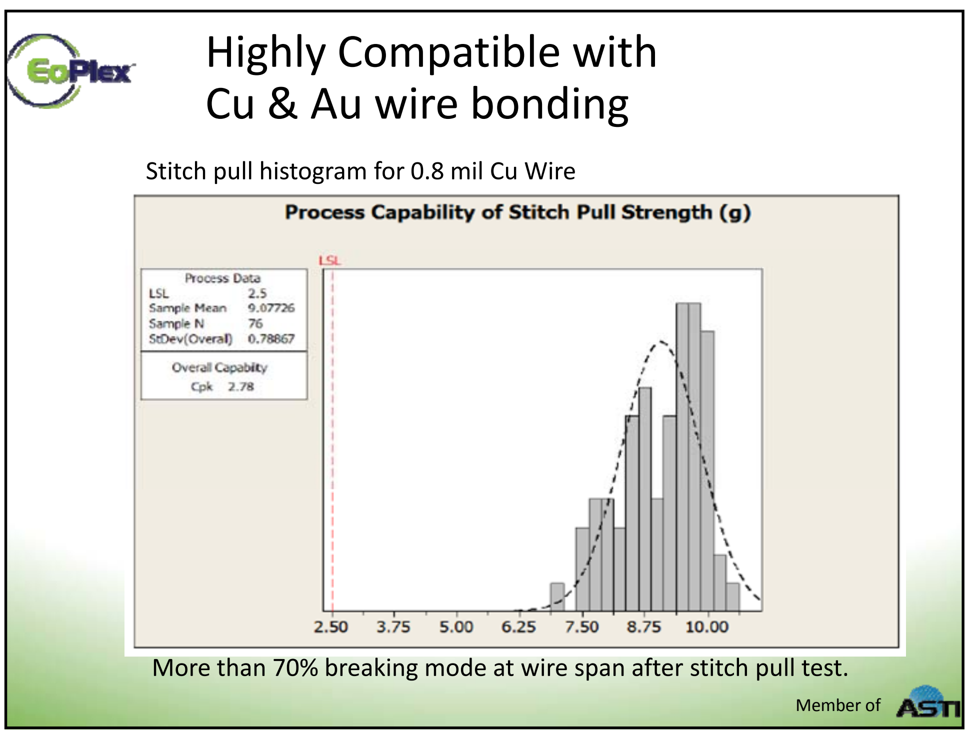
CSI is Fully Compatible with Standard QFN Infrastructure

No Etching or plating required


EoPlex
Highly Compatible with
Cu & Au wire bonding
Stitch pull histogram for 0.8 mil Cu Wire
Process Capability of Stitch Pull Strength (g)
LSL
Process Data
LSL 2.5
Sample Mean 9.07726
Sample N 76
StDev(Overal) 0.78867
Overall Capabilty
Cpk 2.78
2.50
3.75
5.00
6.25
7.50
8.75
10.00
More than 70% breaking mode at wire span after stitch pull test.
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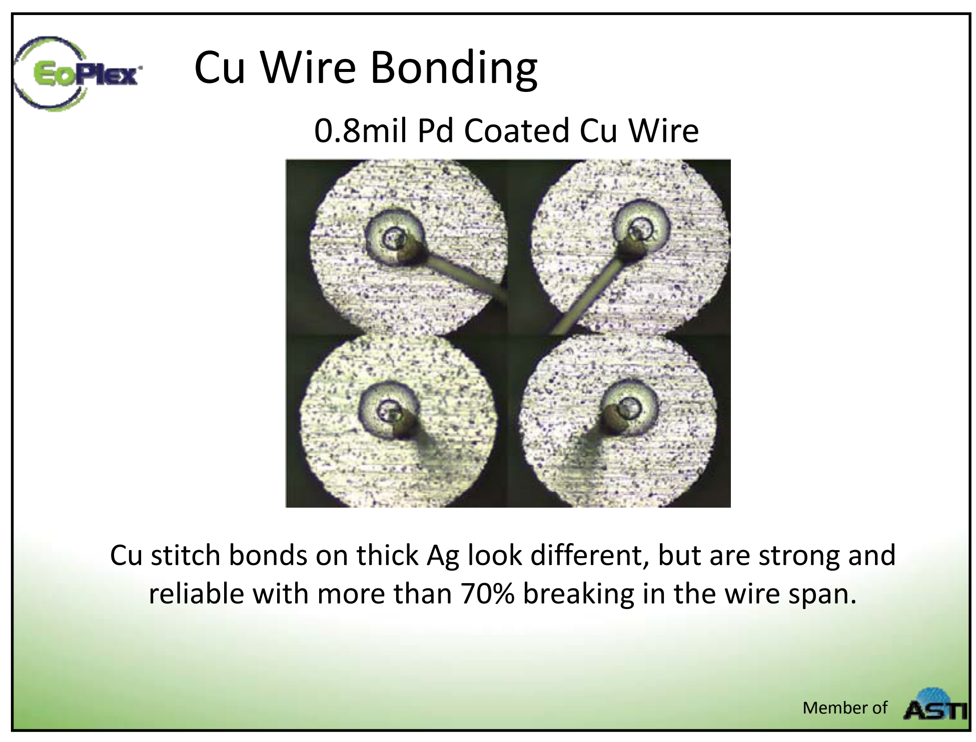
EoPlex
Cu Wire Bonding
0.8mil Pd Coated Cu Wire
Cu stitch bonds on thick Ag look different, but are strong and reliable with more than 70% breaking in the wire span.
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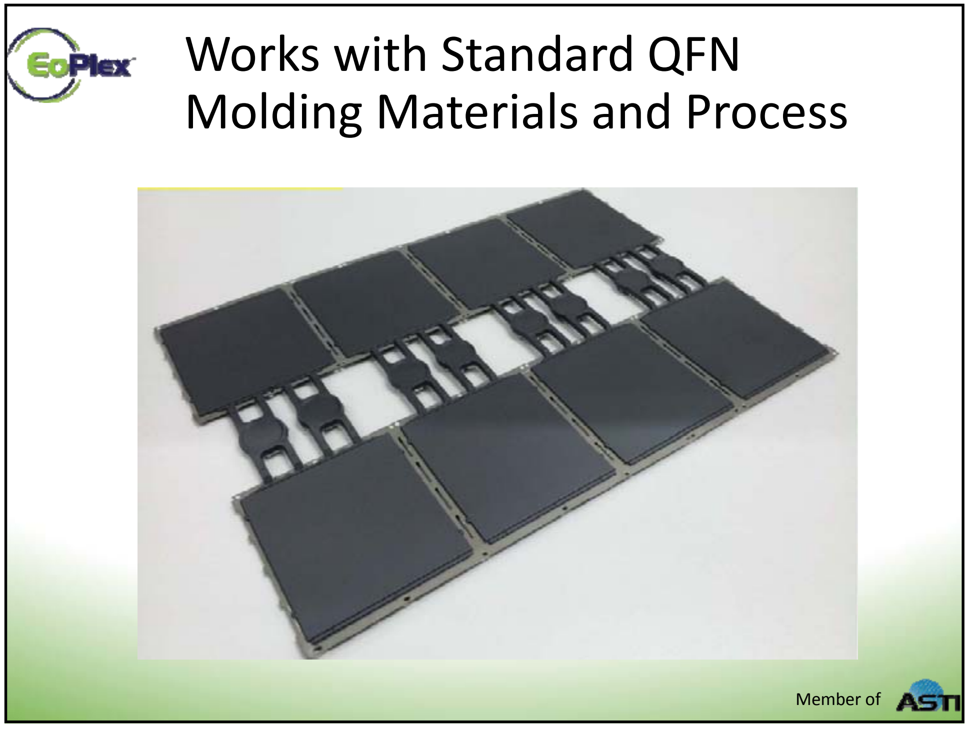
Works with Standard QFN Molding Materials and Process



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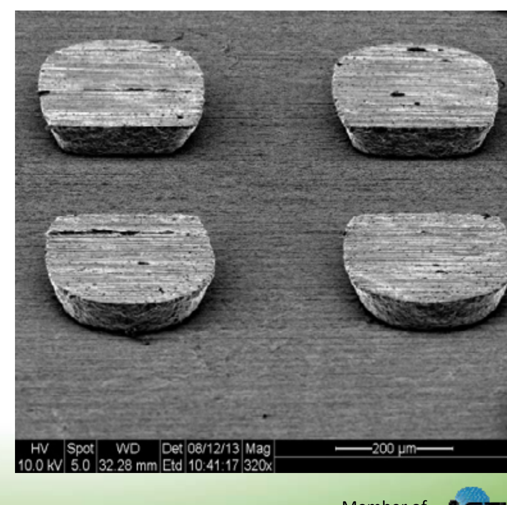
Pad Shape Provides Lock-in Feature and Surface Texture Improves MSL Performance

- Surface roughness of sintered silver improves adhesion
  - Die Pad Avg : 0.87um
  - Bond Pad Avg : 0.45um
- Conical frustum shaped pads
  - Excellent locking of Leads with mold compound



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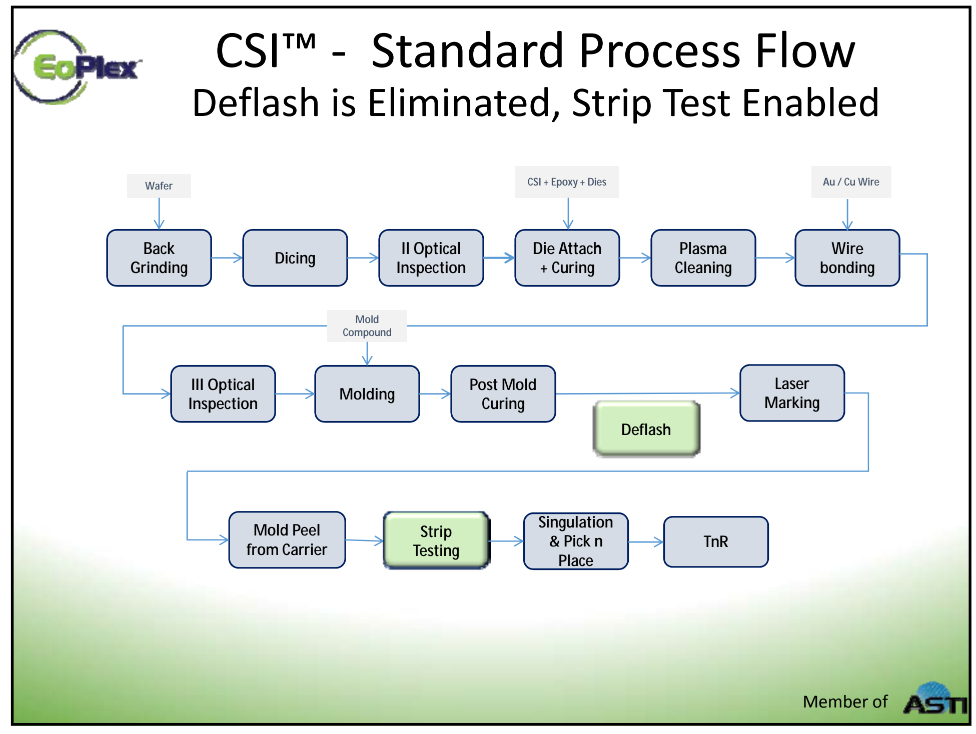
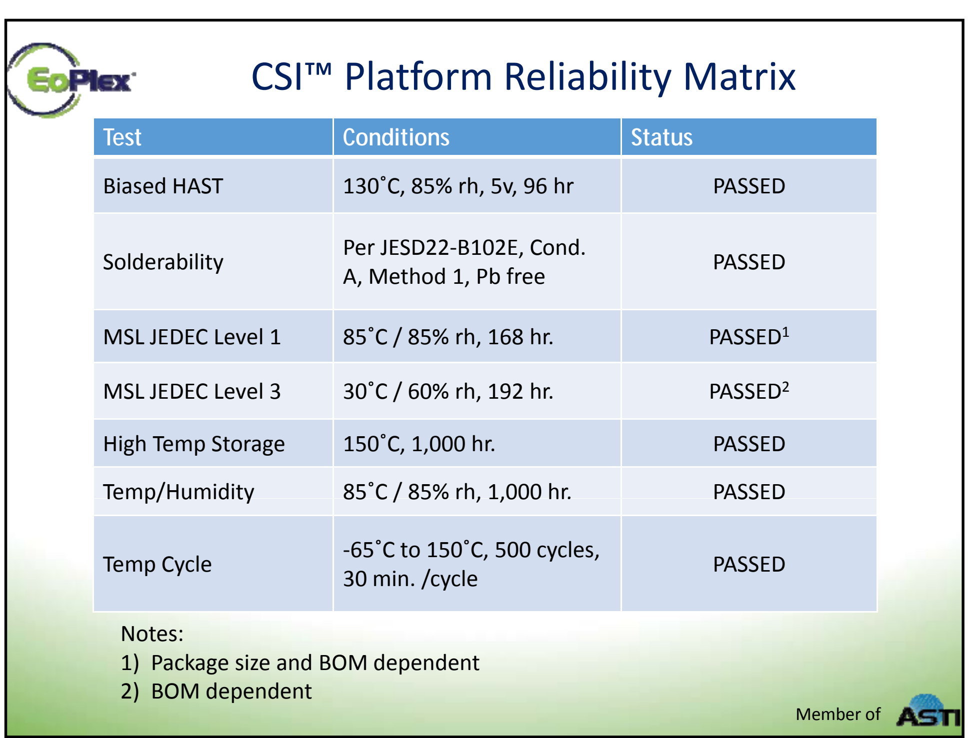
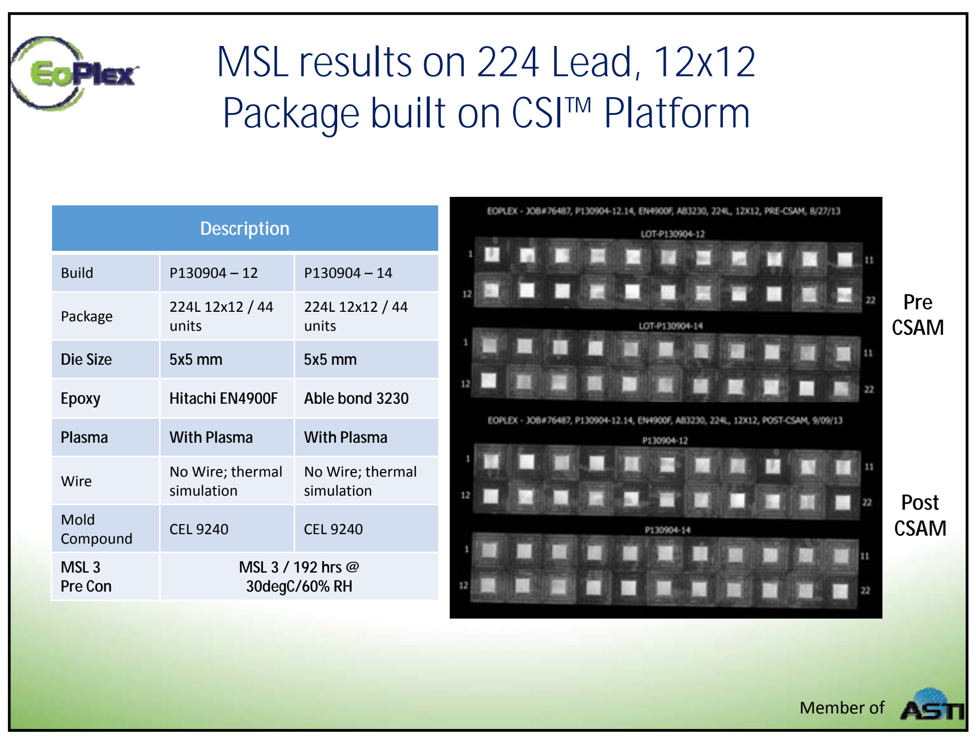




CSI™ Platform Reliability Matrix

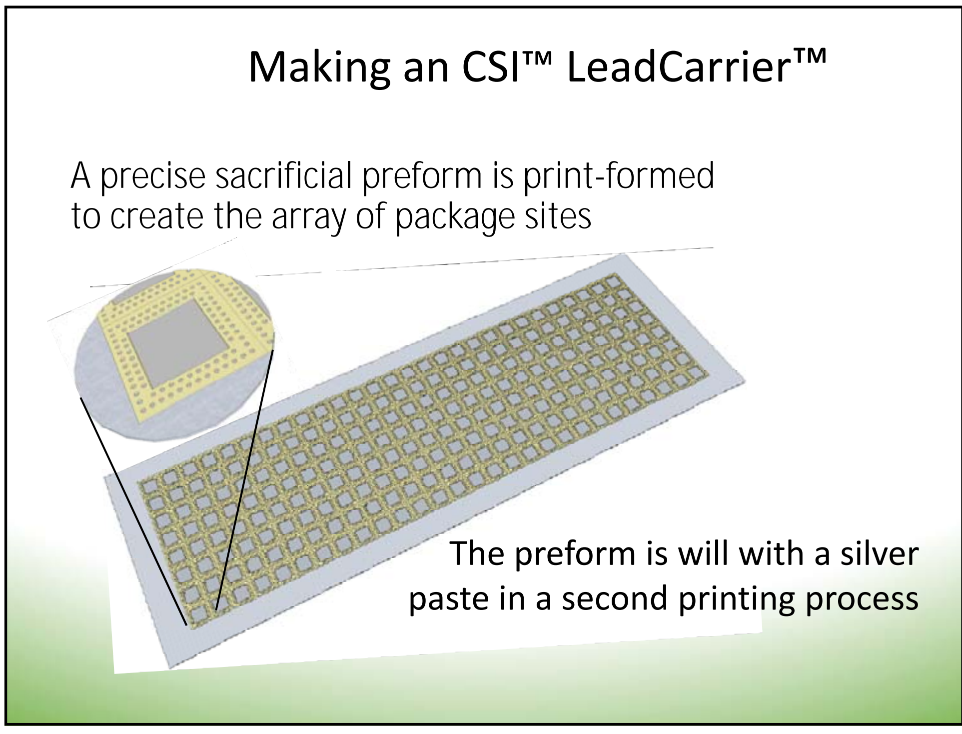
Test	Conditions	Status
Biased HAST	130˚C, 85% rh, 5v, 96 hr	PASSED
Solderability	Per JESD22-B102E, Cond. A, Method 1, Pb free	PASSED
MSL JEDEC Level 1	85˚C / 85% rh, 168 hr.	PASSED[1]
MSL JEDEC Level 3	30˚C / 60% rh, 192 hr.	PASSED[2]
High Temp Storage	150˚C, 1,000 hr.	PASSED
Temp/Humidity	85˚C / 85% rh, 1,000 hr.	PASSED
Temp Cycle	-65˚C to 150˚C, 500 cycles, 30 min. /cycle	PASSED

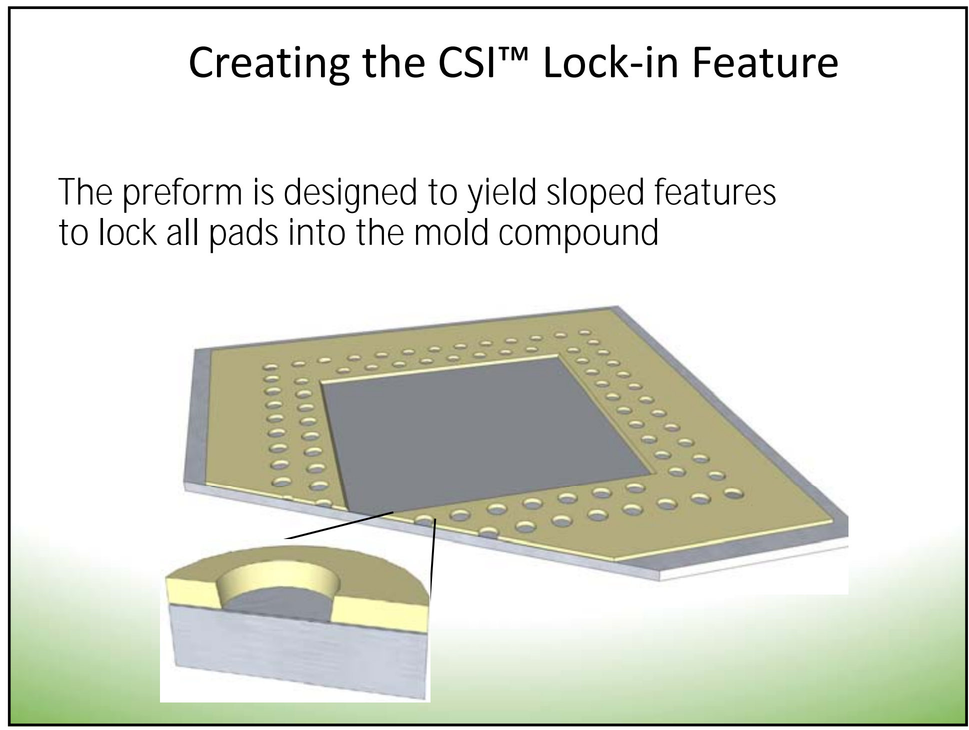
Notes:
1) Package size and BOM dependent
2) BOM dependent



Description		
Build	P130904 – 12	P130904 – 14
Package	224L 12x12 / 44 units	224L 12x12 / 44 units
Die Size	5x5 mm	5x5 mm
Epoxy	Hitachi EN4900F	Able bond 3230
Plasma	With Plasma	With Plasma
Wire	No Wire; thermal simulation	No Wire; thermal simulation
Mold Compound	CEL 9240	CEL 9240
MSL 3 Pre Con	MSL 3 / 192 hrs @ 30degC/60% RH	

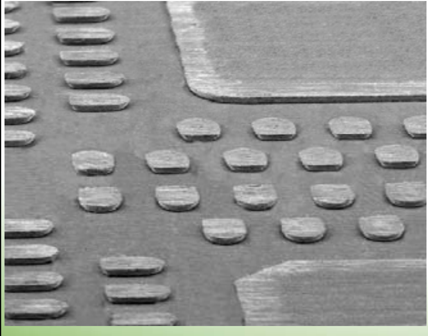
Manufacturing Process For EoPlex CSI™ LeadCarrier


Making an CSI™ LeadCarrier™
A precise sacrificial preform is print-formed
to create the array of package sites
The preform is will with a silver
paste in a second printing process


Creating the CSI™ Lock-in Feature
The preform is designed to yield sloped features
to lock all pads into the mold compound

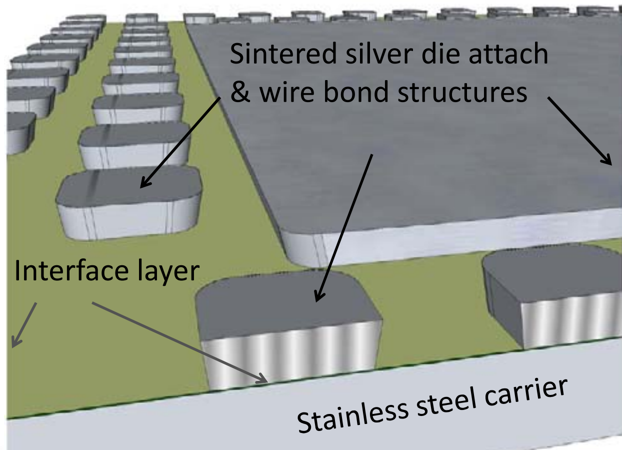
Remove the Preform & Sinter the Silver

Strips are fired to remove the preform and sinter the metal to high density, giving an excellent wire bonding surface



Result is an array of pads with excellent bonding surfaces, controlled adhesion to the carrier and a shape that locks the pads to the mold compound

Interface Chemistry: A Key to CSI™Success



Chemistry of the interface layer provides good adhesion and clean release, with no treatment of solderable surfaces necessary.

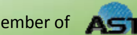
Comparison to Standard Etched Leadframe

Relative to total cost of ownership

- Strip pricing: ≈50% higher
- Strip utilization: As much as 50% greater
- No tape required
- Cut only thin EMC for singulation
- Test in strip is possible

Relative to performance metrics

- Multiple rows, up to around 500 leads
- Design freedom includes multi-chip, redistribution
- Minimum package thickness to 0.2mm vs 0.3mm
- No tie bar stubs = better electrical performance
- Very low thermal resistance
- Solderable lead flank as singulated

Member of 

Summary: EoPlex CSI™ Platform Driving a New Interconnect Paradigm

Final cost per lead up to 50% less

- Improves strip density by up to 50%
- No tape backing - saves cost and disposal
- Faster lower cost singulation - only plastic is cut
- Electrical testability in the strip after peel
- No plating or etching - “green process”
- Fits standard process

Improved performance, enables replacement of more expensive packages like BGAs

- Packages from 2 to 500+ leads
- Minimum metal = better electrical performance
- Excellent thermal performance
- Enables smaller and thinnest (200u) packages

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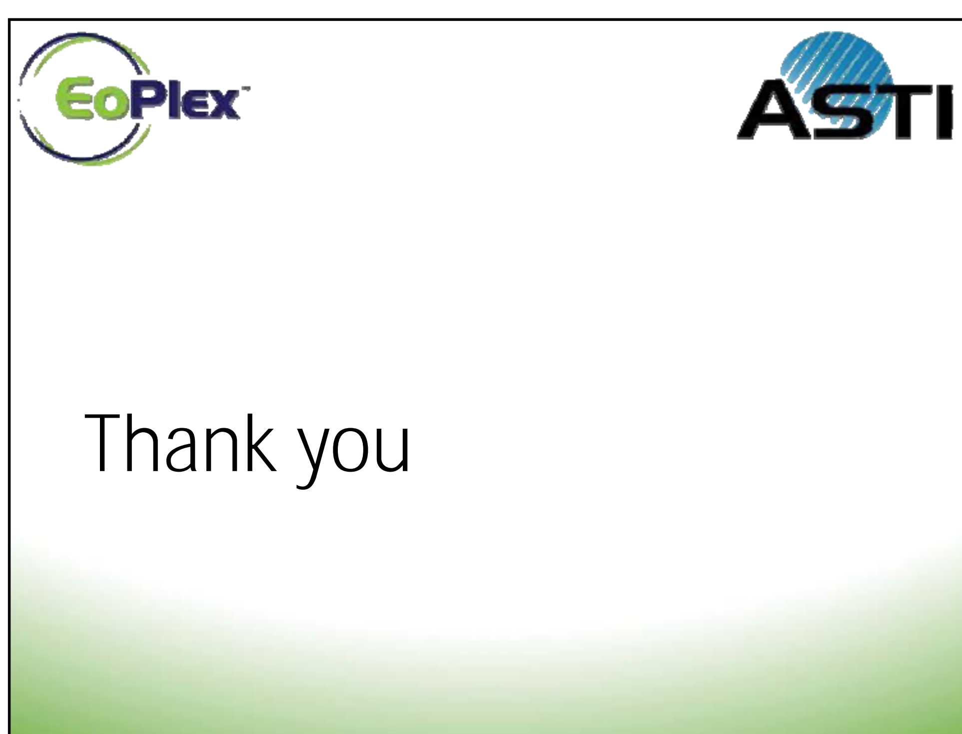
EoPlex
ASTI
Thank you