Wire Bonding Solutions for Complex Memory Packages

John Foley
Kulicke & Soffa Industries
## Growth in the Memory Market Segment

### DRAM Unit Shipment Forecast (M units)

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<td>8,779</td>
<td>9,078</td>
<td>9,765</td>
<td>10,270</td>
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### NAND Unit Shipment Forecast (M units)

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<td>Total</td>
<td>7,333</td>
<td>7,987</td>
<td>8,779</td>
<td>9,078</td>
<td>9,765</td>
<td>10,270</td>
</tr>
</tbody>
</table>

### Key Points
- Total Memory Market projected to grow about 12% annually
- NAND & DRAM each grow about 7% and continue to dominate majority of memory package volume
- Wire Bonding remains interconnect method of choice for majority of high volume memory packages

Source: Gartner
Challenges in Memory Packages

- Reduced Package Heights with Ultra-Low Loops
- Complex Die Structures Up to 32 Die
- Silver Alloy Wire
- Thin Die Overhang

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IConn MEM PLUS – Key Benefits

• The **IConn MEM PLUS** bonder is optimized for bonding memory devices and is based on the industry leading IConn PLUS platform:
  – Enhanced Process Capability for Complex Memory Packages
  – Advanced Solutions to Enable Bonding with Silver Alloy Wire
  – Increased Productivity
  – Automation & Ease of Use for Stacked Die
Productivity Improvement with Multi-Stitch Bonding

- Simplified method of continuous bonding for stacked die memory devices
- Productivity improvement of up to 20% compared to traditional bonding methods
- Advanced error detection
Advanced Stacked Die Packaging

• New processes developed to enable robust bonding performance on **ultra-thin die** and **long overhang** die structures
  – 20um die thickness
  – Overhang distances over 2mm
  – 25um Ultra-Low loop height capability
Advanced Overhang Die Optimization

- *ProOverhang* is an optimization feature for overhang die packages
  - Characterizes dynamic response on-bonder
  - Automatically recommends parameters within the allowable limit of die deflection and prevent pad crack
  - Maximizes bonding performance and UPH with new servo control capabilities

*Patent Pending*
Improved MTBA – with Automation

• New Optics System design enables programmable focus for taller die stack
  – Auto-Focus capability
  – Automatic illumination adjustment during run-time
Most Advanced Process Capabilities - Introducing ProAg & ProAu
Modeled after the successful ProCu processes

- **Optimal 1st Bond Process**
  - Widest process window for improved portability
  - Finest wire diameters – 13um

- **Increased Net Throughput**
  - Improvement up to 20% and improved MTBA

- **Ease of Use**
  - Response-based parameters reduce optimization time

**Over 100 parameters makes optimization more complex**

**Parameters are based on desired responses**
Package Cost Reduction with Silver Alloy Wire

• Cover Gas Delivery System is optimized for the finest diameter Silver Alloy wire
  – Prevents oxidation
  – Consistent and concentric Free Air Ball formation
  – Fully programmable pneumatics

• New **ProAg** Processes maximize throughput and process robustness
  – 10 to 20% improvement over traditional process
Improved MTBA – Automated Error Recovery

- New capabilities developed to automatically recover from assists during mass production
- Significant improvement in MTBA and reduced need for operator intervention

![Graph showing increase in MTBA from SHTL Recovery]

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Optimized for Memory - IConn MEM PLUS

**IConn MEM PLUS** is

- Equipped to handle memory package challenges of today with the most advanced process solutions and lowest CoO

- Advanced technology supports future package roadmaps for thinner die, taller die stacks, and longer overhang distances

- Bonder is released and under evaluation at all major memory suppliers and their sub-cons

Released January 2016
Thank You!