Microbonds

X-Wire™ Technology Overview
X-Wire™ Technology

- Enables Cost Effective Solutions to Today’s Packaging Challenges
- Leverages Current Wire Bonding Knowledge, Infrastructure and Supply Chain
- Extends Ability of Wire Bonding to Address Geometry, Density and Yield Requirements
- Flexible, Proven Technology that Uses Tanaka’s Industry Leading Bond Wires
Microbond's X-Wire™ Technology
Insulated Wire Bonding

✓ Removes Limitations to Current Wire Bonding Design Rules

✓ X-Wire™ Technology Allows:
  ▶ Crossing Wires
  ▶ Touching Wires
  ▶ Long Wires
  ▶ Wire Sweep
  ▶ Corner Wires
Bare Wire Vs X-Wire™

Bare Wire

X-Wire™
X-Wires™ - Broadens Wire Bonding Rules

- Actual Test Vehicle Used in Reliability Testing
- Over 500 Crossed Wires per Package

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X-Wires™ - Long Wires Can Cross & Touch

- Long Wires Crossing & Touching
- Long Corner Wires Crossing & Touching
X-Wire™ Simplifies Wire Looping

- X-Wire™ Insulation Coating Features
  - Excellent Adhesion and Flexibility
  - No Cracking or Flaking
X-Wire™ Enables Advanced Packages
X-Wire™ Benefits

- Relax IC & Package Design Rules
- High Performance, Low Inductance Pkg
- High I/O & Array Area Bonding
- Enable System in Package - SiP
- Enable Complex Stacked Die
- Reduction of Die Size
- Lower Substrate Cost
- Fine Pitch Wire Bonding
- Enable Long Wires
- Increased Reliability
- Increased Assembly Yield
- No New Infrastructure
X-Wire™ Benefits

Available X-Wire™ 2.0 Wire Diameters

- 25 µm
- 23 µm
- 20 µm

<table>
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<tr>
<th>Wire Diameter</th>
<th>25 µm</th>
<th>23 µm</th>
<th>20 µm</th>
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<tbody>
<tr>
<td>Pitch Capability</td>
<td>60 µm</td>
<td>50 µm</td>
<td>45 µm</td>
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<tr>
<td>Wire Bonder Platform</td>
<td>ASM Eagle / K&amp;S Maxum</td>
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</table>
X-Wire™ IMC Data
IMC of X-Wire™ at 0 hrs
IMC of X-Wire™ After Aging

<table>
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<tr>
<th>After Baking Test at 175°C</th>
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<tbody>
<tr>
<td>0 hr</td>
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IMC Summary

- Greater than 70% IMC Coverage
- Intermetallic Forms Easily *Through Coating* on Bonded Ball
- Passed 0 hr, 96 hrs & 192 hrs Aging Test at 175°C
X-Wire™ Ball Bond Data
X-Wire™ Free Air Ball

- Stripes Indicate Coating Presence
- Wire is Fully Coated Right Down to Neck
- No Melting of Coating Material
X-Wire™ Bonded Ball

✓ Presence of Coating on the Ball Bond
**X-Wire™ Ball Shear Data**

![Ball Shear Data Graph](image)

**Ball Shear Data**

- **Diameter Size:** 20 µm, 23 µm, 25 µm
- **Ball Shear (g/mil²):**
  - 20 µm
  - 23 µm
  - 25 µm

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X-Wire™ - No Capillary Build Up

Capillary Inspected After

- 0 Bonds
- 1,000,000 Bonds

Negligible Build Up in Capillary Wall Observed

Side View of the 1,000,000 Bonds. Capillary Viewed from Different Angles

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X-Wire™ Ball Bond Summary

- Small Ball Pitch Capability
- High Ball Shear Strength
  - Comparable to Bare Wire
- Long Capillary Life
X-Wire™ Stitch Bond Data
X-Wire™ Stitch Bond

- Bond Through Coating
- Use Standard Wire Bonder
- Use Standard Capillary
- Good Pull Strength
- Laminate Substrate
- Leadframe Substrate
X-Wire™ Stitch Bond
Standard Forward Bonding
X-Wire™ Stitch Bond Remaining After Stitch Pull

Source: ASM Pacific Technology Ltd.
X-Wire™ Pull Strength Data

Pull Strength Data

- Diameter Sizes: 20 µm, 23 µm, 25 µm
- Pull Strength (g):
  - 20 µm
  - 23 µm
  - 25 µm

Legend:
- Min
- Avg
- Max

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X-Wire™ Reverse Stand-Off Stitch Bonding
Stitch Bond Summary

- Bond Through Coating
- Good Pull Strength
- Laminate & Leadframe Capability
- Reverse Stitch Bonding (RSSB) Capability
### X-Wire™ Evaluation by ASM Pacific using Eagle 60 Wirebonder

<table>
<thead>
<tr>
<th></th>
<th>X-Wire™ (20 µm)</th>
<th>X-Wire™ (25 µm)</th>
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<tr>
<td><strong>1st Bond Geometry</strong></td>
<td></td>
<td></td>
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<tr>
<td>Bond Pad Pitch</td>
<td>50</td>
<td>65</td>
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<tr>
<td>Ball Diameter (µm)</td>
<td>39</td>
<td>53</td>
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<tr>
<td>Ball Height (µm)</td>
<td>10</td>
<td>12</td>
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<tr>
<td><strong>1st Bond Strengths</strong></td>
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<tr>
<td>Shear Force (g)</td>
<td>12.0</td>
<td>23.2</td>
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<tr>
<td>Shear Strength (g/ mil²)</td>
<td>6.5</td>
<td>6.9</td>
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<tr>
<td><strong>2nd Bond Strengths</strong></td>
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<tr>
<td>Stitch Pull (g)</td>
<td>4.4</td>
<td>8.5</td>
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X-Wire™ Reliability Data
REL Data Summary

- **MSL Level 3: Pre-Conditioning**
  - Condition: 30°C, 85% RH, 192 hrs

- **Biased HAST**
  - Condition: 130°C, 85% RH, 4 V, 100 hrs

- **High Temperature Storage**
  - Condition: 150°C, 1000 hrs

- **Thermal Cycling**
  - Condition: -55°C to 125°C, 1000 cycles
X-Wire™ 2.0 Head Start Kit
X-Wire™ 2.0 Head Start Kit Content

X-Wire™ 2.0
2 Sample Spools

Documentation
On CD-ROM

Wire Bonder
Spool Ground
Tooling

Set Up
Substrates

Capillaries

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Microbonds
X-Wire™ 2.0 Head Start Kit Features

- Allows Customer to Perform Internal Feasibility & Bondability Testing
- Includes Materials on Current Best Known Methods and Recommendations for Process Setup & Optimization
- ASM and K&S Bonder Platforms Supported
- Includes Choice of Wire Diameters
  - 25 µm, 23 µm, 20 µm Diameter X-Wires™ 2.0

Microbonds
X-Wire™ 2.0 Head Start Kit
Availability & Ordering Information

To Order Please Contact

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