Presentation Objectives

• To introduce the Packaging Technical Group (PTG)
  – Scope
  – Protocol
  – Milestones

• To review the packaging projects
• To invite participation in the Packaging Technical Group
iNEMI Asian Organization

Asian Collaboration
All Member Firms in Asia

iNEMI Asian Steering Committee
OEM Directors
ODM/EMS Directors
Supplier Directors

iNEMI Staff
Dr. Haley Fu
Secretary to Steering Committee
Communications
Membership Development
Technical Facilitation

Technical Groups

Board Assembly
Chair: Tonny Tong,
Flextronics
Xiaodong Jiang
Alcatel-Lucent

Packaging
Chair: Mun Leong Loke
Intel
Members:
Cisco Systems
Intel
Texas Instruments

Materials & Substrates
Chair: Simon Lee
Dow Chemical

Test
Chair: Victor Chen
Huawei
Packaging Technical Group

Scope

• Comprehend and recommend packaging reliability test methods and reliability models
• Comprehend and recommend packaging quality metrology
• Recommend development, investigation or revision of standards
• Evaluate standards for new packaging technology
• Identify and comprehend technology gaps and area of focus
• Build on industry knowledge and capability
• Stimulate supply (materials and equipment) capability
## Packaging Technical Group Scope

**IS / IS NOT**

<table>
<thead>
<tr>
<th>IS:</th>
<th>IS NOT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical evaluation and recommendation of packaging reliability test methods and reliability models</td>
<td>Standardization of reliability and quality requirements, test methods, reliability models and metrology</td>
</tr>
<tr>
<td>Technical evaluation and recommendation of packaging quality metrology</td>
<td>Development of complete standards for a packaging technology</td>
</tr>
<tr>
<td>Technical evaluation of standards</td>
<td>Development of packaging technology</td>
</tr>
<tr>
<td>Recommendation of standards development, investigation or revision of JEDEC/IPA/IEC specifications</td>
<td>Building on learning from prior investigations</td>
</tr>
<tr>
<td>Identifying and comprehending technology gaps and areas of focus to streamline the industry efforts</td>
<td>Stimulating supplier (materials and equipment) capability</td>
</tr>
<tr>
<td>Building on learning from prior investigations</td>
<td>Repeat of prior work</td>
</tr>
<tr>
<td>Stimulating supplier (materials and equipment) capability</td>
<td>Defining supplier technology</td>
</tr>
</tbody>
</table>
iNEMI Packaging Technical Group Protocol

Step 1: Conduct surveys to gather industry input
Step 2: Identify areas of focus & define problem statements
Step 3: Promote the industry involvement & form project teams

Project Teams
Step 4: Define project goals/schedule & execute plans
Step 5: Report out & proliferate/recommend
Packaging Technology Group

Key Responsibilities

The Packaging Technology Group’s responsibility is to provide direction, identify opportunities, and deliver the results and benefits on time.

- Identifies and manages stakeholder’s interests
- Defines key objectives/requirements
- Leads the program planning activity
- Oversees project formation process
- Identifies and manages issues
- Manages program level risk assessment
- Communicates issues and risks
- Identify outstanding performance
- Provide progress reports as needed
The Project Leader’s responsibility is to deliver the results on time.

**Key Responsibilities**

- Develops initial project definition
- Leads planning activity
- Develops Statement of Work for approval
- Secures resource commitments
- Defines project responsibilities
- Sustains project process & procedures
- Monitors & tracks project progress
- Provide regular progress reports
- Identifies and manages issues
- Manages risk assessment
- Deliver the results
### Proposed iNEMI Packaging Technical Group Milestones

<table>
<thead>
<tr>
<th>#</th>
<th>Milestones</th>
<th>Due Date</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Develop the Packaging Technical Group (PTG) preliminary scope and plans</td>
<td>Q3’09</td>
</tr>
<tr>
<td>2</td>
<td>Phase I: Conduct survey of area of focus and interested topics on packaging based on the preliminary scope and the 2009 iNEMI Roadmap</td>
<td>Q3’09</td>
</tr>
<tr>
<td>3</td>
<td>Consolidate the preliminary list of area of focus and interested topics on packaging</td>
<td>Q3’09</td>
</tr>
<tr>
<td>4</td>
<td>Review scope and plans with the Technical Committee; revise scope based on Technical Committee review and direction</td>
<td>Q4’09</td>
</tr>
<tr>
<td>5</td>
<td>Phase II: Participate in the Packaging Substrate Workshop (Nov) to introduce PTG and gather inputs and feedback on its preliminary scope, topics of interest etc.</td>
<td>Q4’09</td>
</tr>
<tr>
<td>6</td>
<td>Promote more packaging, EMS and the supply chain companies to participate PTG</td>
<td>Ongoing</td>
</tr>
<tr>
<td>7</td>
<td>Review and prioritize Areas of Focus and interested topics on packaging; finalize the scope of PTG</td>
<td>Q4’09</td>
</tr>
<tr>
<td>8</td>
<td>Review revised PTG scope, Areas of Focus and interested topics with the Technical Committee</td>
<td>Q4’09</td>
</tr>
<tr>
<td>9</td>
<td>Perform gap analysis from the identified topics</td>
<td>Q1’10</td>
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<tr>
<td>10</td>
<td>Identify potential projects (goals and tasks)</td>
<td>Q1’10</td>
</tr>
<tr>
<td>11</td>
<td>Form project formation teams, identify leaders</td>
<td>Q1’10</td>
</tr>
<tr>
<td>12</td>
<td>Work with Project Teams to identify issues and provide guidance</td>
<td>Ongoing</td>
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## Packaging Technical Group
### Area of Focus

<table>
<thead>
<tr>
<th>Area of Packaging</th>
<th>Topics of Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package Quality and Reliability Requirements</td>
<td>Reliability test methods and lifetime models, defect classification, failure analysis metrology</td>
</tr>
<tr>
<td>General Package Specification and Standards</td>
<td>Dimension and mechanical requirements of PoP (3D) packages, e.g., Co-planarity/high temp warpage, solder joint voids, etc.</td>
</tr>
<tr>
<td>Manufacturing Processes &amp; Technologies</td>
<td>Miniaturization, 3D/SiP packaging, Through Silicon Via (TSV), wafer level packaging, simplification</td>
</tr>
<tr>
<td>Materials Technologies</td>
<td>RoHS, WEEE, ELV directives; thermal management, low dielectric constant for high-speed digital system, low cost, low temperature solder materials</td>
</tr>
<tr>
<td>Substrate Technologies</td>
<td>Low cost, high density, decreased FLI and SLI pitch, reliability.</td>
</tr>
<tr>
<td>Equipment Technologies</td>
<td>Improved accuracy for stacked die, PoP, SiP, etc.</td>
</tr>
<tr>
<td>Design Technologies: Electrical, Thermal, Mechanical and Fluid Flow Simulation &amp; Validation</td>
<td>Time-to-market. Simulation tools for RF modules, nano devices and materials, thermal management</td>
</tr>
<tr>
<td>Metrology</td>
<td>3D packaging measurement &amp; inspection</td>
</tr>
<tr>
<td>Automation</td>
<td>Unit level traceability, data exchange</td>
</tr>
<tr>
<td>Test</td>
<td>Cost, particularly for new non-digital technologies. In-circuit test technologies. Open architecture for test integration.</td>
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</table>
iNEMI Packaging Technical Group
Potential Projects

• Package Quality and Reliability Requirements
  1. Cu wire bonding: Reliability performance relative to Au wire bonding
  2. Reliability for advanced node products with ELK (Extreme low k) and lead-free interconnections
  3. Pb-free bumps: UBM (under bump metallurgy) and alloying effects on the thermal and electromigration performance
  4. Underfill requirements for advanced silicon node packages
  5. Convergence of surface finish and alloys materials
  6. Thermal management for high power density (HD package, 3D packaging, high operating temperature)

• Package Specification and Standards Recommendation
  1. Warpage and coplanarity requirements for advanced silicon node and thin silicon packages
  2. High density Package (PoP, SiP, e.g., RF SiP) – requirements, quality acceptance criteria and metrology
  3. Mobile Internet Device (MID) segment reliability requirements
  4. Ultra thin die stacking (e.g., TSV – Through Silicon Via) – requirements, metrology and acceptance criteria
  5. Grounded lid attachment methodology and testing/performance requirements
  6. Wafer level fan-out packages
  7. Package reliability for medical electronics
Cu Wire Bonding Draft Proposal

• Gold wire is the most common and well understood first level interconnection material; however the use of Cu wire is increasing.

• Cu wire has some distinct advantages and disadvantages
  + Greater mechanical stability than gold wire.
  + Lower cost
  + High thermal conductivity
    – Oxidized at lower temperatures
    – Not as well-understood as gold ball bonding technology
    – Higher hardness causes more difficult bonding parameter optimization
    – Limited reliability data on new PWB materials

• Other interactions in play
  • Material properties of the molding compound
  • IC material change (Low K, Extreme Low K & Ultra Low K)
  • Temperature, humidity & bias conditions on reliability

• Please refer to http://www.inemi.org/cms/calendar/Wire_Bonding.html for additional material on the Cu wire bonding project proposal
Survey Form

We value your feedback and ideas

iNEMI Packaging Substrate Workshop
Questionnaire for iNEMI Packaging Technical Group

iNEMI Packaging Technical Group (PTG) is a newly formed iNEMI technical group. As the first step, this group will focus mainly on the package Quality and Reliability, as well as the general package Specifications and Standards. There will be subsequent steps once the team gets traction and ready to move on with wider scope. This questionnaire intends to collect feedback to identify key areas of interest in the industry and to identify/prioritize the potential consortium projects. Please take a few minutes implementing the following questions and return it to Dr. Haley Fu (haley.fu@inemi.org; Fax: 1-703-880-8567).

Please cycle your answer. You may choose multiple answers when applicable.

YOUR BACKGROUND
• Is your company: • OEM  • Wafer Fabrication  • Assembly/Manufacturing  • Substrate supplier  • Materials supplier
• Equipment supplier  • Other: ____________________
• Which product segments your company dealing business with?
  • Consumer/Portable  • Automotive  • Office/Large System  • Medical  • Netcom  • Other: ____________________
• On the following scale, you would rate your knowledge and experience on the packaging technology:
  (Inexperienced) 1 2 3 4 5 (Very Experienced)

IMPORTANCE RATING ON THE ISSUES THAT CONSORTIUM SHOULD ADDRESS (CYCLE YOUR RATE)

<table>
<thead>
<tr>
<th>Cu wire bonding: reliability performance relative to Au wire bonding</th>
<th>LOW</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comments:</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>
You are cordially invited

• Packaging Technical Group welcomes new membership.
  – Contact person:
    • Dr. Haley Fu, iNEMI Manager of Operations, Asia; Secretary to iNEMI Asia Steering Committee. (Email: haley_fu@iNEMI.org)
    • Mun Leong Loke, iNEMI Packaging Technical Group Chair; Sr. Staff Engineer, Intel Corporation. (Email: mun.leong.loke@intel.com)
  – To gauge response on the potential projects
  – To identify more projects
www.inemi.org

Email contacts:
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haley.fu@inemi.org

ML Loke (PTG chair)
mun.leong.loke@intel.com