Statement of Work (SOW)
iNEMI Substrates/Packaging TIG
New Packaging Technology Qualification Methodology Project

Version 1.0
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Basic Project Information

Background/Context

- New package technologies are qualified using procedures and test conditions based on past experience with the most similar technology previously qualified.
  - While previous experience is important to consider, it cannot be the only criterion.
  - Relying too much on experience may result in overlooking new failure modes and/or new wear out mechanisms.
  - Current test standards may not capture the reliability risk in the new package, or may over-stress the technology in the new package.
- Lack of understanding of the assembly processes, application environments, and use conditions of all potential end-users (vs targeted end-users) poses challenges when developing the appropriate reliability test plan for new package/materials. For example:
  - Test plan only focuses on standard test methodology or complies with the requirements of a few key customers.
  - For new technologies field knowledge (failures, issues, etc.) cannot be fed back into the test plan.
  - For new materials/package development, test plan completeness is always questionable.
  - Proceeding quickly to device qualification in the new package may delay determination of root cause for technology issues for the new package.
  - Little effort by industry to come out with a new test standard for new packaging technologies.

Purpose of Project

The purpose of this project is to develop a methodology for qualifying new packaging technology to address the gaps resulting from:
- Lack of understanding of assembly processes.
- Lack of understanding of the interactions of the materials and components within the new package.
- Lack of understanding of the application environment.
- Lack of understanding of the use conditions of all potential end-users.
- Lack of understanding how variations of the packaging and manufacturing process could affect product quality and reliability.
Scope of Work

- Develop a methodology highlighting best practices, (e.g., FMEAs, technology qualification prior to product qualification, test to fail,) for qualifying new packaging technology.

- Validate the methodology by case study of issues and failure modes from a few recent packaging technologies developed in past ten years (e.g., copper wire bonding, wire-bonded stack die, solder joint reliability, package-on-package, packages with internal SAC solder – non-high melting temp).

- Apply the methodology to selected new technologies for effectiveness and completeness (e.g. silver wire-bonding, etc.).

- Target market segment will be determined by the results of the survey planned for work plan #2 (focused areas would be IoT (sensors, wearables), automotive electronics and so on).

IS / IS NOT Analysis

<table>
<thead>
<tr>
<th>This Project IS:</th>
<th>This Project IS NOT:</th>
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<tbody>
<tr>
<td>Collect current industry specifications and methodology on packaging qualification and reliability testing requirements</td>
<td>Develop new inspection and measurement equipment machines/systems.</td>
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<tr>
<td>Develop a methodology to address the gaps in current standards and standard practices for package qualification</td>
<td>Conduct qualification efforts on specific metrologies at a specific company</td>
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<tr>
<td>Validate the methodology via known issues</td>
<td>Develop a specific standard(s)</td>
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<td>Apply the methodology on selected new technologies</td>
<td>Repeat prior or existing work</td>
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<tr>
<td>Recommend the methodology developed in this project to the industry</td>
<td>Biased towards specific suppliers, geographies, or market segments</td>
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<tr>
<td>Focus on package technology qualification metrology</td>
<td>Work on device test plan</td>
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Business Impact

- Provide benchmark result and gap analysis on current industry specifications on packaging qualification and reliability test requirements.
- Provide a documented methodology for new packaging qualification as best practice recommendations to the industry and the standards organizations

Participating Organization

- iNEMI member companies
- Industry as a whole

Outcome of Project

- A documented methodology for new packaging qualification best practice.
- Make recommendations to industry and the appropriate standards organizations.
- Provide a summary report to all iNEMI members.

NOTE: All changes to SOW must be approved by the Technical Committee for version control
Previous Related Work
Existing industry standards will be reviewed and summarized as part of this project.
There is no iNEMI project related to this project objective.

Prospective Participants
- OEMs, ODMs, EMS (device users)
- Device suppliers
- Assembly suppliers
- Material suppliers (die interconnect, substrate/leadframe, encapsulant, etc.)

Project Plan

Schedule with Milestones

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<th>Phase 1</th>
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The project will consist of the following tasks:

Task 1 – Collect current industry standards among project members (1 month)
Task 2 – Conduct industry survey (2 months)
  - Conduct an online survey to ensure no similar methodology already exists
  - Determine the focused market segment
  - Interim report on the industry benchmark and gap analysis results
Task 3 – Develop a methodology based on the gap analysis from the interim report. (2 months)
  - Focus on best practices to address each gap
Task 4 – Validate the methodology (2 months)
  - Define a few recent packaging technologies as candidates
  - Validate the methodology based on failure modes that were not caught during qualification,
    i.e., should the methodology be applied, would those failure modes be caught during qualification
Optional Task 5 – Apply the methodology to selected new technology (3 months)
  - Define the candidates
  - Develop a reliability test plan based on the proposed methodology
    - Perform the actual reliability test and compare the results with that from conventional reliability test plan
Task 6 – Final report and recommendation to the industry (1 month)
**Project Monitoring Plans**

Ensure open lines of communication among participants
- Weekly or bi-weekly conference calls
- Meeting minutes provided through e-mail
- Follow-up with individuals on an as-needed basis
- Workshops and face-to-face meetings as appropriate
- Technical reviews (2) will be provided to update the Technical Committee.
- Progress reports will be provided upon request for presentation at regularly scheduled iNEMI meetings (e.g., at member council meetings).
- Track and document approximate man-months per quarter per team member (this will require the active members of the team to provide estimates).
- Track and document approximate number of people on the project per quarter (this can be tracked through iNEMI's Quick database).
- Project phase/summary report will be provided to iNEMI members and the report will be published on the iNEMI website.

**General and Administrative**

Guidelines for this project and all other iNEMI Projects are documented at http://thor.inemi.org/webdownload/join/gen_guidelines.pdf.