

7. Solving Package Failure Mechanisms for Improved Reliability

Course Leader: Darvin Edwards – Edwards Enterprises

Course Objective:

This course explores past and present reliability failure mechanisms that plague semiconductor packages. Primary reliability challenges and major failure mechanisms will be investigated in emerging and high-volume package types such as TSVs, FOWLPs, WLCSPs, FC-BGAs plastic leaded, and no lead packages. The class will focus on reliability topics including TSV-chip interactions, micro bump mechanical reliability, electromigration performance, stress induced ILD damage under bumps and wire bonds, Cu vs. Au wire bond reliability challenges, complications associated with package delamination, solder joint reliability, system level issues such as drop and bend reliability, and the impact of aging on reliability performance. For each failure mechanism, the resultant failure modes and failure analysis techniques needed to verify the mechanisms will be summarized. Recommended failure analysis fault isolation techniques will be described.

This solutions-focused course concentrates on process parameters, design techniques and material selections that eliminate failures and improve reliability to ensure participants can design-in reliability and design-out failures. Characterization and implementation of design guidelines that enable reliable products will be described and encouraged. A test structure methodology combined with qualification by similarity will be highlighted as a technique for early detection of chip/package reliability risks.

Course Outline:

1. Introduction to Package Reliability
2. Failure modes vs. Failure Mechanisms
3. Failure Analysis Techniques and Fault Isolation Package Failure Mechanisms: WLCSPs
4. FC-BGA Package Failure Mechanisms
5. Molded and Leaded Package Failure Mechanisms
6. WLCSPs Package Failure Mechanisms
7. Embedded Die & Fan-Out WLP Failure Mechanisms
8. TSV Failure Mechanisms
9. Materials, Modeling, Design Rules and Reliability
10. Common Test Structures for Failure Mechanism Identification
11. Qualification by Similarity (QBS)
12. Summary

Who Should Attend:

This class is for all who work with IC packaging, package reliability, package development, package design, and package processing where a working knowledge of package failure mechanisms is needed. Beginning engineers and those skilled in the art will benefit from the holistic failure mechanism descriptions and the provided proven solutions.

Bio:

Mr. Darvin Edwards has 38 years of experience in the IC packaging industry. He is currently owner of Edwards' Enterprise Consulting LLC which specializes in helping companies solve package reliability problems, assisting in rapid product development, as well as providing worldwide training on topics such as package reliability, materials, TSV and FOWLP technologies, package design and surface mount techniques. Previously, he worked 14 years

as a Fellow at Texas Instruments, managing the Dallas electrical, thermal and thermomechanical modeling team responsible for chip-package interactions and reliability of multiple TI product lines. He has served the IEEE EPS as Member at Large and is the co-chair of the Electronics Components and Technology Conference Applied Reliability committee. Mr. Edwards has authored and co-authored over 65 papers and articles in the field of IC packaging, has written two book chapters, and holds 24 US patents. He is an IEEE Senior Member.