

Design for Manufacturability / Assembly

1 Day Course

ABSTRACT

It is well known in the electronics industry that the quality and reliability of any product is highly dependent upon the capability of the manufacturing supplier, regardless of whether it is a contractor or a captured shop. Manufacturing issues are one of the top reasons that companies fail to meet warranty expectations, which can result in severe financial pain and eventual loss of market share. What a surprising number of engineers and managers fail to realize is that focusing on processes only reveals half the issue. Design plays a critical role in the success or failure of manufacturing and assembly.

This course will provide a comprehensive overview of the areas where design plays an important role in the manufacturing process. Within each topic, case studies will be provided as appropriate.

OUTLINE

- Introduction
 - An overview of the SMT process
 - An overview of the wave solder process
- Industry standard design rules
 - Universal requirements from through hole components
 - IPC 2221
 - IPC 4101
 - IPC 7351, Land Pattern Design
- Overview of DfM
 - SMT vs. wave vs. hand assembly
 - Transferable product (avoiding hidden knowledge)
- Design for manufacturability (printed board)
 - Vias (micro and through hole)
 - Trace width and spacing
 - Solder mask
- Design for Manufacturability (Solder)
 - Pad design
 - Hole design / annular ring
 - Component location and orientation
- Design for Manufacturability (Component)
 - Ceramic capacitors
 - Electrolytic capacitors
 - Tantalum capacitors
 - MELF packaging
 - Moisture sensitivity level
 - Pb-free issues
 - BGAs and Flexing
- Design for Sourcing
 - Identifying critical to quality parameters (CTQs)
 - Specifying tolerances
 - Comparing tolerances to supplier capabilities
- Measuring DfM and capturing its value
 - Reviewing defects per million opportunities (DFMO)
 - Review product yield (initial and long-term)
 - Identifying defects through screening
 - Reviewing field failures

- Failure analysis techniques for surface mount and through hole products
 - Introduction and Objectives
 - The need for Root Cause Analysis
 - Problem Solving, Failure Analysis & Root Cause Analysis Of Field Failures
 - Root Cause Approaches, Management & Reporting Methods
 - The” 5 Whys” Technique
 - The Eight Disciplines (8D) Technique
 - Shainin Red “X” Statistical Problem Solving
 - Six Sigma
 - Physics of Failure/ Reliability Physics
 - Generic Failure Categories
 - Design Quality & Errors
 - Manufacturing Quality & Errors
 - Environmental & Usage Role in Over Stress & Accelerated Wear Out Failures
 - Environment & Self Heat Temperature Issues
 - Vibration, Shock & Drop
 - Humidity
 - Contaminates
 - Finding Failure Modes – Where the Problems Are & How They Manifest Themselves.
 - Collecting and Analyzing Data for Problem Solving
 - Trending analysis results (plotting a timeline)
 - Pareto Analysis
 - Other Data Sources
 - Test Reports
 - Warranty Data
 - Maintenance Logs/Reports
 - Customer Surveys
 - Investigation Interviews
 - Fault/Failure Investigation - Identifying the Problems – Part I: Developing a Hypothesis
 - Customer & Service Technician Feedback & Interviews
 - Reference Product & Technology History/Lessons Learned
 - Identifying Contributing Events
 - Ishikawa (fishbone) Diagrams
 - Fault Tree Analysis
 - Dealing with Multiple Problems – Event/Issue Charting
 - Identifying the Problem – Part II: Return Parts Analysis
 - Managing a Return Part Program
 - Initial Issue Confirmation Functional Checks
 - Electrical Fault Isolation
 - Typical Failure Modes, Mechanism & Signatures
 - Printed Circuit Board Substrate Issues
 - Manufacturing Defects
 - Plated Through-Hole Via Issues
 - Conductive Anodic Filaments
 - Electrochemical Migration (Dendritic Growth)
 - PCB Assembly & Soldering Issues
 - Component Placement
 - Solder Quality Issues
 - Insufficient Solder
 - Voids
 - Poor Bonding
 - Excessive Intermetallic Formation
- Conclusion