

INSTRUCTOR INFORMATION

Instructor: Mike Carano

Email: mikecarano@electronics.org

Phone: 612-205-3332

Contact Procedure: Available between 6pm – 9pm Eastern Time USA. Leave message anytime.

PROGRAM DESCRIPTION

In the highly competitive electronics industry, the knowledge and skills of staff directly responsible for the design and manufacturing of High Density (HDI) and Ultra High Density (UHDI) Printed Circuit Boards are essential. HDI and UHDI are enabling technologies critical for miniaturization, Interconnect (IC) substrates and Advanced Packaging. Electronic systems and packages are becoming ever denser. All one has to do is look at the latest smart phones and tablets. However, there are other drivers for this miniaturization trend that may not be as obvious. Fine-pitch packages (QFPs and BGAs) and increasing package pin counts drive the interconnect designs for Military-Aerospace, Medical, Telecom and Industrial Electronics. HDI, when properly designed into the PCB structure, improves signal integrity as well as via reliability.

The materials, processes, and designs of these enabling technologies directly impact the success, or failure, of product performance, reliability, and time to market. The IPC HDI and Ultra HDI course is designed to provide the skills and process knowledge necessary to create high yield, highly reliable HDI interconnects. Key topics discussed include:

- HDI and UHDI-what is it?
- HDI/Ultra - when it makes sense and when it doesn't
- HDI/UHDI roadmaps
- Design of HDI/UHDI
- Materials/Fabrication methods
- Via formation
- Copper Foils-standard vs. low and very low profile
- Surface preparation/Multilayer bonding
- Desmear/metallization (conventional vs direct plate vs emerging processes
- Imaging/fine-line etching
- Via filling (resin/paste and copper fill)

- Copper warp requirements
- Selective solderable finishes
- Quality/acceptability/reliability
- Test methods

Taught by an IPC-certified industry expert with 40+ years of experience in the field, this two-week program (four sessions) utilizes interactive webinars, on-demand recordings, and job-specific exercises to facilitate mastery of the key technologies involved in the fabrication of HDI Printed Circuits (HDI).

LEARNING AND PERFORMANCE OBJECTIVES

This program is designed to provide circuit board designers, process engineers, end-users, and fabricators with a balanced foundation in understanding the function of materials, methods, and processes required to fabricate highly complex HDI and Ultra HDI circuit boards and substrates. Upon completion, participants will be able to:

- Differentiate between HDI and Ultra HDI
- Choose specific materials and copper foils for performance, reliability, and signal integrity
- Understand the trade-off between advanced PCB materials.
- Understand how via formation affects metallization and plating performance
- Build fine line and space (sub 25 micron) circuit designs
- Understand the key parameters that affect impedance
- Gain a better understanding of conventional electroless copper and various direct metallization processes, and their enhancement of manufacturability
- Choose best methods to enhance multilayer bonding and photoresist adhesion for fine line imaging
- Understand the materials and processes for via fill technology (paste, copper, and other methods)
- Understand how to build reliability in blind and buried via circuit designs
- Gain further insight into issues such as microvia interfacial fracture related to stacked via designs
- Use IPC test methods best suited for reliability assurance

COURSE STRUCTURE

- Instructor and participants meet online twice per week from the comfort of their own home.
- Participants can view recorded online sessions to review course content and class discussions.

- Course materials are accessible 24/7 on the new IPC Edge Learning Management System.
- Participants can access the course virtually on any device with an Internet connection and major web browser, including Chrome, Firefox, Safari, Edge, and Internet Explorer.

IPC STANDARDS COVERED (PROVIDED WITH COURSE)

- IPC-2221 Generic Standard on Printed Board Design
- IPC-2222 Sectional Design Standard for Rigid Organic Printed Boards
- IPC-6012 Qualification and Performance Specification for Rigid Printed Boards
- IPC-6013 Qualification and Performance Specification for Flexible/Rigid-Flexible Printed Boards

COURSE SCHEDULE

WEEK 1

Program overview, outlining class schedule, and options for accessing class materials and assignments. Class session will focus on HDI and Ultra HDI overview.

Session 1 topics include:

- Why use HDI/UHDI
- HDI designs
- Sequential lamination
- Electrical Performance and Signal Integrity
- Materials/Glass Styles/Non-reinforced
 - Dielectric films
 - Unclad material
- Test Vehicles
- HDI/Ultra HDI roadmaps

Session 2 topics include:

- Via formation
 - CO2
 - UV-YAG
 - Mechanical
- Surface preparation/lamination
- Copper foil types
- Metallization
 - Conventional
 - Other methods
 - Semi-additive and modified Semi-Additive Processing (mSAP)

WEEK 2

Session 3 topics include:

- Metallization (continued)
 - Direct metallization
 - Carbon
 - Conductive polymer
 - Palladium
- Other methods
- Imaging Technology
 - LDI
 - LED
 - Conventional UV with phototool
- Fine Line Etching
 - Chemical parameters
 - Equipment considerations

Session 4 topics include:

- Via Fill technology
 - Paste fill (polymer)
 - Fill parameters
 - Material properties
 - How to apply plugging paste
 - Issues/concerns
 - Defects
 - Copper plating fill
 - Chemical parameters
 - Plating cell design/equipment
 - Issues/concerns
 - Defects
 - Copper wrap requirements
- Reliability & Acceptability
 - Microvia Interfacial Fractures
 - Thermal and Mechanical Shock Failures
 - Test Methods
 - OM (D-coupons)
 - IST
 - CITC
 - Air-to-Air

FINAL EXAM:

- Complete final exam after the last week of the course.
- Completion of the program with a score of 70% or higher on the final exam is required to earn a certificate of completion.
- Attempts allowed: two. Grading method: Highest grade.