

# Stencil Technology and Design Workshop



Presented by Bill Coleman, Ph.D., Photo Stencil  
In-House Workshop scheduled Friday each month 2011

## Course Description

This workshop provides information on stencil printing performance and how stencil technology and design influences printing performance. Much of the data presented was generated during print performance studies at independent test laboratories. Solder volume and solder volume dispersion are the key data used to predict print performance and overall SMT assembly yields/defect rates.

Stencil designs for a variety of applications will be reviewed in detail.

A complete workbook of all information including reference information will be provided to all attendees.

## Who Should Attend

This is a hands-on workshop for process engineers, quality control engineers, supervisors, managers, and technicians who are involved with solder-paste screen printing, process control, solder paste selection, and optimizing the assembly process.

## Morning Topics

### 9-9:15 Company Overview (15 minutes)

#### 9:15-9:20 Questions

Introductory section provides a brief overview of the company and its history since 1979. Company mission statement, product technology, quality control systems, special design projects, manufacturing operations, and product review will be presented.

### 9:20-10:05 Print Process and Stencil Technology (45 minutes)

#### 10:05-10:15 Questions

Overall review of important printing process parameters. The following topics will be covered:

- Board variables
- Solder paste variables
- Printer and stencil variables
- Stencil designs will be reviewed in detail covering the technologies of Electroformed Stencils, Laser Stencils and Chem-Etch Stencils
- The Print Area Ratio and its influence on solder paste release
- Aperture design guidelines and a stencil performance hierarchy

### Break 10:15-10:30

### 10:30-11:30 Stencil Design and Stencil Applications (60 minutes)

#### 11:30-12:00 Questions

This section will review the following stencil applications:

- No Clean Paste Aperture Design
- SMT/Through-hole
- Flip Chip/SMT
- Step Stencils
- Two Print Stencils for Miniature Devices

- Adhesive Printing
- BGA/ $\mu$ BGA/CSP
- BGA Ball Placement Tooling
- BGA Repair Tools
- Mini Stencil Repair Tools
- LCC / QFN / BGA Repair Tools
- Quick Print by Photo Stencil
- Squeegee Blades
- Lead Free Printing Considerations
- Special Designs
- Wafer Level Ball Drop Placement
- Wafer Bumping Stencil

### **12:00-12:20 Lead-Free Process Impacts (20 minutes)**

#### **12:20-12:30 Questions**

This section covers an overview of process changes and considerations in lead-free manufacturing. The July 2006 deadline to become WEEE and RoHS compliant for suppliers to European markets has quietly come and gone with little notoriety. Many suppliers have lead-free capabilities, however, they are waiting for their customers to place orders. Topics include:

- Environmental concerns
- Legislation
- Replacement alloys
- Stencil design considerations
- Case study comparison of stencil technologies and lead-free printing

### **Lunch 12:30-1:30**

### **Afternoon Topics**

#### **1:30-1:50 Intrusive Reflow for Tin/Lead and Lead-Free Solder (20 minutes)**

##### **1:50-2:00 Questions**

This section reviews in detail the stencil designs for printing solder paste in and around through-hole locations for reflow as an alternative to wave solder of through-hole parts. Examples of three different stencil designs will be shown along with a spreadsheet for determining stencil design to provide sufficient solder volume. Printer set up to optimize the amount of paste hole-fill is reviewed. X-rays of reflowed through leads are also presented.

#### **2:00-2:20 Print Performance Studies Comparing Electroform, Laser, Laser with Electropolish, and Laser with Electropolish and Nickel plating. (20 minutes)**

##### **2:20-2:30 Questions**

This session is an in-depth review of available stencil technologies. Identical stencils were produced using the same Gerber file with a wide range of apertures. Visual appearance and solder paste volume were gathered and stencils were ranked according to their performance. Utilizing this study, stencil selection guidelines are offered based on area ratio, aperture size and foil thickness.

### **Break 2:30-2:45**

#### **2:45-3:15 Lead-Free Solder Paste Volume Print Performance Comparisons for Electroformed and Laser Stencils. (Independent Stencil Study) (20 minutes)**

##### **3:15-3:30 Questions**

This is a summary of a recent study performed at Universal Instruments on a series of 12 stencils (5 Electroform and 7 Laser) comparing the print performance for lead-free and tin/lead solder pastes. Stencils were provided by the five leading stencil manufacturers, including Photo Stencil. An Open Yield Analysis for Array Devices, developed by Universal Instruments, is also used to correlate stencil performance directly to SMT assembly yields. A grading system is used to rank the stencil performance.

#### **3:30-3:45 Solder Paste Printing Problems and Solutions. (15 minutes)**

##### **3:45-4:00 Questions**

This session reviews issues related to printing equipment, tools, methods, materials and SMT assembly failure modes. Solutions are developed to solve some of these problems.

**4:00-5:00 Additional questions**