NAVIGATING YOUR PATH TO QUALITY & PRODUCTIVITY IN SMT TECHNOLOGY –
Smart Values In Electronics Assembly Training

WORKSHOP 1
UNDERSTANDING & ENHANCING SMT PROCESSES, BGAs & CSPs
26 & 27 JUNE 2007

WORKSHOP 2
DIRECT CHIP ATTACHMENT PACKAGING – FLIP CHIP & CHIP-ON-BOARD
28 & 29 JUNE 2007

VENUE
SWISSOTEL THE STAMFORD,
SINGAPORE
(Raffles City Convention Centre)
2 STAMFORD ROAD
SINGAPORE

Usage of In-class microscope to enhance learning

Organized by:
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workshop overview

The SMT field is being challenged by highly advanced and demanding assembly techniques. A new wave of packaging has gained critical mass in the last several years and is positioned to eventually overtake many traditional SMT packages. While the migration is strongly on its way, the interim both new and mainstream assembly must co-exist. The objective of this workshop is to provide a comprehensive coverage of advanced assembly techniques. It is designed for the SMT professionals to deal with both today’s needs and emerging leading edge demands. It provides in-depth knowledge on control and management of process yield, merging DCA into mainstream SMT and Tools and Techniques for Analysis and Development with a focus on Array Devices.

BGAs, CSPs and Flip Chips have fast become a major element in the microelectronics industry. A variety of standard BGAs and a vast variety of Array format CSPs and WSCP's have proliferated the market—many with their own unique form factors, in fact so fast has the emergence of these new technologies been that there are more Array Style Packages in the last 5 years than the entire mainstream SMT packages in the last 20 years. Using BGAs require an investment in learning and understanding on how to implement them reliably and assemble them in newer products and transition to Lead Free.

about the workshop

Through this workshop the participants will learn about the latest trends in packages, grasp the complex interaction between variables and how to control and manage them for a successful process. The course focuses on small form factor, miniaturization and advanced packages assembly and control. Participants also learn how to deal with process issues, from mainstream assembly to many of the new devices and attachment methods.

The workshop will also cover BGA assembly with focus on the variables that impact their assembly onto the PCB including an understanding of the collapse mechanism, joint formation requirements and metallurgical interactions taking place considering the vast variety of materials and metallization encountered. The program also aims to provide a grasp of the attachment variables, assembly requirements, assembly variants such as mirror image assembly and the process issues that may be encountered and how to correct them.

Understanding of proper set-up, profiling and rework methodologies, imaging techniques, selection of the rework equipment, rework set-up, developing the rework profile and refining the rework process will also be covered. Emphasis will be placed on the impacts of Lead Free and, for the interim, mixed Sn/Pb and Lead Free process issues.

what you will learn

This workshop will comprise a 2-day intensive training on SMT concepts, processes, Advanced Package Attachment covering all aspects of BGAs, Micro BGAs and Bumped Array CSPs families, their advantages, features, assembly of the device on the PCB and Rework Processes. Regardless of the style and form factor, once the underlying principles are understood, BGA assembly can be approached in a comprehensive manner. This program will dispel many of the realities in dealing with BGA assembly and provide an insight on realistic and practically oriented expectations during the assembly steps. One of the key elements of the program is coverage of Non-Destructive Imaging techniques and their interpretation. A detailed analysis of many process issues, steps, practical and analytical techniques for the hands-on person who is involved in developing the process, specifying equipment and improving yields will be provided.

At the end of this program the participants will acquire an excellent understanding and confidence to address BGAs and Array device yield issues, reduce assembly defects, acquire troubleshooting skills as well as improve their ability to develop processes involving emerging technologies and Lead Free soldering.

module 1 – SMT DIRECTIONS

• Introduction to New Packages
• Product & Process Driving Factors
• From Mainstream to DCA & Everything In-Between
• Yield & Process Capability Needs

module 2 – PROCESS CONSIDERATIONS

• Interactive Variables
• Dealing With Small Form Factor Devices
• Solder Volume For Odd Form Devices
• Solder Volume Calculations for BGAs
• Solder Paste Release
• Pad Design & Layout
• Practical Tips, Guidelines and Control

module 3 – REFLOW ENGINEERING

• High Yield Considerations
• Understanding & Managing Heat Transfer
• Thermal Profiling Considerations
• Reflow Process Window
• Profiling for BGAs
• LF Impact on Moisture Sensitivity of Devices - IPC/Jedec Std.

module 4 – SOLDERING METALLURGY

• Types of Alloys
• Equilibrium Phase Diagrams
• Intermetallic Compounds
• Gold, Silver, Tin & Nickel Films Considerations
• Understanding ‘Black Pad’ Phenomenon

module 5 – ADDRESSING SOLDERING ISSUES

• Solder Balling
• Bridging & Opens
• Non-Wetting
• Solder Migration
• Voids
• Low Shear Strength Failures
• Fillet Lifting
• Tin Whiskers
• Solder Balls on Gold Fingers
• Real Life Examples of Reflow Process Trouble-shooting

module 6 – ANALYTICAL TOOLS & TECHNIQUES

• Equipment Classification, Types & Principle Function
• Microscopy & Imaging – SEM, SAM, RI
• Surface & Metallization – Scanning Probe, AFM, MI
• Materials Behavior – TMA, MI, DSC
• Contamination Analysis – FTIR
• Analytical Equipment – SMT Application Chart

module 7 – BGAs & ARRAY CSPs ASSEMBLY CONSIDERATIONS

• Merging Into Mainstream SMT Processes
• Optional Process Flows
• Key Process Control Points
• Metallurgy Considerations
• Metallurgy Interactions
• Lead Free Impacts
• Mixed Sn/Pb & LF impacts
• (Forward and Backward Compatibility Issues)
• Mirror Image Assembly
• Reliability
• Understanding and addressing BGA / CSP Issues
• - Voids, Bridging, Stretching, Opens, Delamination, Marginal Joints, Warpage related effects
• - Real Life Examples of BGA Process Issue

module 8 – IMAGING TECHNIQUES

• 2-D Vs. 3-D X-Ray
• Tomography & Laminography
• Optical Probes & Endoscopy
• Interpreting Images & Correlation
• AOI and AXI

module 9 – IMPROVING REWORK YIELDS

• Defining Rework Strategy & Approach
• Selection of Equipment & Pre-requisites
• Developing the Rework Recipe
• Developing the Profile
• Optimum Practises For Removal & Reinstall
• Helpful Practical Tips - Do’s & Don’ts

module 10 – CONCLUSION / SUMMARY

• Listing of Applicable Standards
• Solder Volume Calculation Spread Sheet
• Printing Audit Guide

who should attend

This is a high level program and requires a pre-understanding of SMT concepts. The program is meant for the Advanced Level SMT professional who wants to grasp the science of BGA and Array CSP Assembly and must manage the transition to Lead Free. The target audience would comprise Engineering Level personnel from Manufacturing, Assembly, Equipment, Maintenance and Failure Analysis disciplines. The target audience can also include experienced Technicians or Supervisory Levels with adequate grasp of SMT concepts. The program will also benefit related functions such as Vendor Quality or Incoming Quality responsible for materials and vendor development.
Direct Chip Attachment (DCA) Technologies involve merging the interconnection of bare dies directly into the Surface Mount Assembly in co-existence with other packaged components. DCA has gained tremendous importance in the evolving field of SMT with ‘Bare Dies’ being thought of by many as the next ‘Wave of Packaging’. The current product driving forces of ‘smaller’ but also ‘faster’ and ‘cheaper’ place printed circuit board (PCB) real estate at a premium. Manufacturers are therefore forced with the choice of making the components smaller to meet the space restrictions. Unpackaged bare dies, with no signal delays associated with the device package offer the smallest and fastest component footprint available befitting the needs of today’s products. DCA is thus becoming a common design consideration in modern electronic products. One end of the spectrum principle uses of bare dies are in the MCM, COB and Flip Chip applications for instance in the communications and consumer applications, both being very large market segments, and other end of the spectrum, low cost products characterized by handhelds, toys and games, for example. Being a recent and fast evolving technology, however, knowledge in this area has remained generally scarce. It is vital for manufacturers moving into the future to acquire and understand the impact of DCA technologies and how to merge it into mainstream SMT processes.

**About the Workshop**

The objective of this workshop is to educate the participants into the key aspects of DCA. Firstly the workshop will cover and provide an understanding of the selection criterion and considerations for bare dies, their quality and acquisition considerations. The standards governing this area will be reviewed in terms of impacts to both manufacturers and producers.

The second part of the workshop will deal with the two aspects of DCA namely Flip Chip (FC) and Chip-On-Board (COB). Both attachment technologies will be dealt with in terms of positioning, design guidelines and attachment considerations, usage, equipment, process development and analysis with real life examples.

**What you will learn**

This is one unique workshop that has the bandwidth to take you into Direct Chip Attachment from design, process, implementation and failure analysis. The flavor is SMT but every SMT engineer involved in Direct Chip Attachment needs to know what functions are good candidates for DCA from the point of view of application, sizing and reliability. You will learn not only about the design rules, the selection and procurement and also the various attachment processes merging Bare Dies into mainstream SMT.

In addition, this workshop will teach the various options to implement Flip Chip and Chip-On-Board and where they are best positioned to serve their respective needs. You will further learn how to analyze failures, the different failure mechanisms and modes and the proper techniques for analysis. To help you understand the concept you will see many micro-graphs and cross sections.

At the end of this workshop, the participants will gain significantly in the know-how of Direct Chip Attachment and be able to implement DCA, analyze and improve your process yields.

**Workshop Agenda**

**Module 1 – Direct Chip Attachment**
- Overview
- Pro’s & Con’s
- Applications
- Cause Factors
- Foot Print Efficiency
- Flip Chip Vs. Chip On Board

**Module 2 – Bare Dies**
- Selection
- Quality Considerations
- Known Good Die (KGD) & Unknown Bad Die (UBD)
- Procurement Standards
- Road Map

**Module 3 – Flip Chip Design Rules**
- Bump Pitches
- Bump Heights
- Edge Clearance
- Array vs. Peripherals
- Types of Under Bump Metallization (UBMs)
- UBM Parameters
- Bumping Processes
- Bump Shear Strengths

**Module 4 – Flip Chip Attachment**
- Merging with SMT Process
- Process Flow Options
- Understanding Underfills
- Underfilling Trends
- Developing & Qualifying The Process
- Reworking Flip Chip

**Module 5 – Failure Analysis**
- Failure Mechanisms
- Failure Modes
- Micro-sectioning – How To’s
- Analyzing Failures

**Module 6 – Chip On Board**
- Applications
- Design Rules & Pad Design & Layout
- Design Examples

**Module 7 – Attachment**
- Bonding Process
- Ball Bonding Vs. Wedge
- Tools & Equipment
- Bonding Variables
- Merging COB In SMT
- Process Flow Options
- Pro’s & Con’s
- Reworking Chip On Board

**Module 8 – Conclusion**
- Summary
- Useful Websites
- References

**Who Should Attend?**

This is a high level program to address the needs of a range of industries, primarily SMT that are involved with DCA, but certainly include many back-end and packaging areas that deploy DCA as an enabling technology in the manufacturing of BGAs, CSPs and other Micro Array Devices, etc. The latter will also benefit from understanding how the SMT industry perceives bare dies usage in embedding into SMT as well as use of these technologies as enablers in packaging products. The target audience will comprise personnel from Engineering, Process, Manufacturing, Assembly, Failure Analysis and Quality disciplines.
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MUKUL LUTHRA graduated with a Degree in Electrical Engineering in 1974 and has extensive experience in high volume manufacturing, quality & process engineering in the PCBA, Disk Drive and Semiconductor industries. He has numerous features and articles published on SMT, has chaired and presented at international conferences, and has been a well-respected speaker at the Nepcon & GlobalTronics workshops. He authored the ‘Rim Watch’ column and ‘On the Road’ features for Circuits Assembly magazine for several years and remains a writer.

Mukul is the Business Director and founder of Waterfall Technologies. Amongst the previous positions he has held include Marketing Director, ST Microelectronics and Director, Seagate Technology. With over 30 years of High-Tech experience, in Singapore, the US and Canada, he is a leading professional Trainer and Consultant known for his process expertise.

Waterfall Technologies has trained hundreds of professionals over the years in almost every major Multinational and Small and Medium Enterprise involved with PCB Assembly. Developing SMT professionals through training, hands-on problem solving and process improvement is our core competence and primary mission. The training programs and services offered are world class and on the leading edge of technology.

METHODS OF PAYMENT
Payment by crossed cheque to:
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Note: Payments must be received within 5 days upon issue of invoice

CANCELLATION & SUBSTITUTION POLICY
Substitutions are welcome at any time.
All cancellations must be made in writing.
Due to contractual agreement, cancellation charges are as follows:
45 to 10 days notice : 50% of the workshop fee
Less than 10 days : 70% of the workshop fee

Waterfall Technologies reserves the right to cancel the program in case of insufficient participants, in which case, the full fee will be refunded

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