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Design and Assembly Process Implementation for BGAs

Developed by the IPC Ball Grid Array Task Group (5-21f) of the Assembly & Joining Processes Committee (5-20) of IPC

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Users of this publication are encouraged to participate in the development of future revisions.

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1 SCOPE

This document describes the design and assembly challenges for implementing Ball Grid Array (BGA) and Fine Pitch BGA (FBGA) technology. The effect of BGA and FBGA on current technology and component types is addressed, as is the move to lead-free assembly processes. The focus on the information contained herein is on critical inspection, repair, and reliability issues associated with BGAs. Throughout this document the word ''BGA'' can mean all types and forms of ball/column/bump/pillar grid array packages.

1.1 Purpose The target audiences for this document are managers, design and process engineers, and operators and technicians who deal with the electronic assembly, inspection, and repair processes. The purpose is to provide useful and practical information to those who are using BGAs, those who are considering BGA implementation and companies who are in the process of transition from standard tin/lead reflow processes to those that use lead-free materials.

1.2 Intent This document, although not a complete recipe, identifies many of the characteristics that influence the successful implementation of a robust assembly process. In many applications, the variation between assembly methods and materials is reviewed with the intent to highlight significant differences that relate to the quality and reliability of the final product. The accept/reject criteria for BGA assemblies, used in contractual agreements, is established by J-STD-001 and IPC-A-610.

An additional challenge in implementing BGA assembly processes, along with other types of components, is the need to meet the legislative directives that declare certain materials as hazardous to the environment. The requirements to eliminate these materials from electronic assemblies have caused component manufacturers to rethink the materials used for encapsulation, the plating finishes on the components and the metal alloys used in the assembly attachment process.

2 APPLICABLE DOCUMENTS

2.1 IPC[1]

J-STD-001 Requirements for Soldered Electrical and Electronic Assemblies

J-STD-020 Handling Requirements for Moisture Sensitive Components

J-STD-033 Standard for Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices

J-STD-609 Marking and Labeling of Components, PCBs and PCBAs to Identify Lead (Pb), Pb-Free and Other Attributes

IPC-T-50 Terms and Definitions for Printed Boards and Printed Board Assemblies

IPC-D-279 Design Guidelines for Reliable Surface Mount Technology Printed Board Assemblies

IPC-D-356 Bare Substrate Electrical Test Information in Digital Form

IPC-A-600 Acceptability of Printed Boards

IPC-A-610 Acceptability of Electronic Assemblies

IPC-SM-785 Guidelines for Accelerated Reliability Testing of Surface Mount Attachments

IPC-1601 Printed Board Handling and Storage Guidelines

IPC-2221 Generic Standard on Printed Board Design

IPC-2581 Generic Requirements for Printed Board Assembly Products Manufacturing Description Data and Transfer Methodology

IPC-2611 Generic Requirements for Electronic Product Documentation

IPC-2614 Sectional Requirements for Board Fabrication Documentation

IPC-2616 Sectional Requirements for Assembly Documentation

IPC-4554 Specification for Immersion Tin Plating for Printed Circuit Boards

IPC-4761 Design Guide for Protection of Printed Board Via Structures

IPC-7093 Design and Assembly Process Implementation for Bottom Termination Components

IPC-7094 Design and Assembly Process Implementation for Flip Chip and Die Size Components

IPC-7351 Generic Requirements for Surface Mount Design and Land Pattern Standard

IPC-7525 Stencil Design Guidelines

1. www.ipc.org