ASSOCIATION CONNECTING
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Guidelines for Chip-on-Board Technology Implementation

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1.0 INTRODUCTION

The ancient philosopher Heraclitus said, ‘‘There is nothing permanent except change.’’ This aphorism is perhaps nowhere better exemplified than it is in the field of electronics fabrication. Since the middle of this century, the rate of technological change in the electronics industry has accelerated at a dizzying pace. No sooner does one garner a sense of the current technology base than it is outdated.

Technology has evolved from simple point-to-point discrete wiring to very complex multilayer rigid-flex printed wiring boards; from metal eyeleted through holes to through holes metallized in vacuum using sputtering technology; and from circuit lines big enough to be drawn by hand to microscopically small circuit conductors.

Change is with us, change that can make future electronic products cheaper, faster and more reliable. However, in order to profit from that change it must be harnessed. We must be masters of change, not slaves to it. How do we achieve this? We must control change through documentation. This document provides guidance for designers, assemblers, and users in the emergent Chip-On-Board (COB) technology so that they can harness the power and energy of this changing technology more effectively.

COB has found its greatest application in the consumer electronics market in such items as programmed game cards for electronic video games. COB has two major subsets:

- Chip-and-Wire technology where the integrated circuit die is first adhesively bonded to a printed wiring board and is then interconnected by wire bonding with either gold or aluminum wire; and
- Flip Chip technology where the integrated circuit die is plated with solder bumps at the interconnect points and soldered in an inverted fashion to the board, thus effecting both attachment and interconnection in one step. Flip chip bonding has also been done using a conductive organic-based adhesive (rather than solder) onto organic based printed boards.

An allied technology of note is Tape Automated Bonding (TAB). This technology uses reel-to-reel processing and gang bonding assembly equipment. It is typically processed in rolls of 8 mm to 70 mm metal clad polyimide or modified epoxy tapes, not unlike standard photography film.

TAB technology has been used extensively to produce the digital watches we wear and the credit card calculators we carry. Another new technology being developed will incorporate elements of both COB and TAB, though information is insufficient at this writing to accurately portray the technique.

COB technologies will see increased usage in all sectors of electronic production, perhaps even in military and aerospace applications, once their long term reliability is proven. It is the technology of the future.

1.1 Scope This document provides guidelines for the use of Chip-on-Board Technology (hereafter this term may be referenced by the acronym COB). These guidelines include:

- Design guidelines,
- Manufacturing information,
- Assembly guidelines,
- Testing guidelines, and
- Bibliographic references.

1.2 Purpose COB is the logical extension of hybrid circuit technology, but with additional advantages to be discussed later. This document is intended to be an aid to the provider or user of COB technology by providing guidelines for its successful implementation as a continuation of the evolution of electronic assembly from through-hole mount to surface mount and on to the finer pitch of COB.

1.3 Applications Applications for COB circuits include:

- Consumer,
- Industrial/Telecommunications/Computers,
- Military,
- Avionics, and
- Medical/Life Support.

The type of application will dictate the materials and assembly processes to use. Once a suitable materials system has been chosen, size and cost will determine the physical appearance of the completed circuit. Different physical appearances (types) include:

- Only bare devices on one side,
- Only bare devices on both sides,
- Bare devices and surface mount components on one side,
- Bare devices and surface mount components on both sides, and
- Mixed circuits consisting of combinations of bare devices, surface mount components and through hole components.

COB technologies are certain to see increased usage in all sectors of electronic production, possibly even finding their way into military and aerospace applications, once the data is presented that assures long term reliability. It is much like standard Surface Mount Technology, the technology of the future that is here today, awaiting only a cohesive guiding light to show the way; one that will come to bear on all the important issues that block the way of our industry to more fully embrace this important new technology and make it a wide spread reality.

2.0 REFERENCE DOCUMENTS

Although many of the following are not specifically referenced in this document, they are cited as being pertinent to chip-on-board technology implementation.

2.1 Institute for Interconnecting and Packaging Electronic Circuits (IPC)

IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits

IPC-D-249 Design Standard for Flexible Single- and Double- Sided Printed Boards

IPC-FC-250 Specification for Flexible 1 & 2 Sided Printed Boards

IPC-D-319 Design Standard for Rigid Single- and Double-Sided Printed Boards

IPC-D-325 End Product Documentation for Printed Boards

IPC-A-600 Acceptability of Printed Boards

IPC-A-610 Acceptability of Printed Board Assemblies

IPC-CM-770 Printed Board Component Mounting

IPC-SM-780 Guidelines for Component Packaging and Interconnecting with Emphasis on Surface Mounting

IPC-SM-782 Surface Mount Land Patterns (Configurations and Design Rules)

IPC-CC-830 Qualification and Performance of Electrical Insulating Compounds for Printed Board Assemblies

IPC-SM-840 Qualification and Performance of Permanent Polymer Coating (Solder Mask) for Printed Boards

IPC-H-855 Hybrid Microcircuit Design Guide

IPC-D-949 Design Standard for Rigid Multilayer Printed Boards

IPC-ML-950 Performance Specification for Flexible Multilayer Boards

2.2 Electronic Industries Association (EIA)

IS-30 Resistors, Surface Mount

JEDEC Publication 95 Registered and Standard Outlines for Solid State Products

2.3 Department of Defense (DoD)

2.3.1 Standards

MIL-STD-202 Test Methods for Electronic and Electrical Components

MIL-STD-275 Printed Wiring for Electronic Equipment

MIL-STD-454 Standard General Requirements for Electronic Equipment

MIL-STD-810 Environmental Test Methods

MIL-STD-883 Test Methods and Procedures for Microelectronics

2.3.2 Specifications

MIL-P-13949 Revision G, Plastic Sheet, Laminated, Metal Clad for Printed Boards

MIL-C-14550 Copper Plating, Electrodeposited

MIL-P-28809 Printed Wiring Assemblies

MIL-M-38510 Microcircuits, General Specification for

MIL-G-45204 Gold Plating, Electrodeposited

MIL-P-55110 Printed Boards, General Specification for

MIL-P-81728 Plating, Tin Lead, Electrodeposited

2.4 Federal

QQ-S-571 Solder, Tin Alloy, Lead-Tin Alloy and Lead Alloy

2.5 American National Standards Institute (ANSI)

ANSI Y-14.5 Dimensioning and Tolerancing

2.6 American Society For Testing Materials (ASTM)

ASTM-F-72 Specification for Gold Wire for Semiconductor Lead-Bonding

ASTM-F-219 Testing Fine Round and Flat Wire for Electronic Devices and Lamps

ASTM-F-487 Specification for Fine Aluminum 1%-Silicon Wire for Semiconductor Lead Bonding

ASTM-F-584 Practice for Visual Inspection of Semiconductor Lead Bonding