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Design and Assembly Process Implementation of 3D Components

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of the Packaged Electronic Components Committee (B-10) of IPC

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Users of this publication are encouraged to
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Design and Assembly Process Implementation of 3D Components

1 SCOPE

This document describes the design and assembly challenges and ways to address those challenges for implementing 3D component technology. Recognizing the effects of combining multiple uncased semiconductor die elements in a single-package format can impact individual component characteristics and can dictate suitable assembly methodology. The information contained in this standard focuses on achieving optimum functionality, process assessment, end-product reliability and repair issues associated with 3D semiconductor package assembly and processing.

1.1 Purpose Performance-driven electronic systems continue to challenge companies in search of more innovative semiconductor package methodologies. The key market driver for semiconductor package technology is to provide greater functionality and improved performance without increasing package size. The package interposer is the key enabler. Although glass-reinforced epoxy-based materials and high-density Cu interconnect capability will continue to have a primary role for array-configured packaging, there is a trend toward alternative dielectric platforms as well as toward combining multiple functions within the same die element. To address this movement, an increasing number of semiconductor die developed for advanced applications now require higher I/O with contact pitch variations that are significantly smaller than the mainstream semiconductor products previously in the market. For these applications, companies are developing interposer technologies that can provide interconnect densities far superior to organic-based counterparts.

1.1.1 Target Audience The target audiences for this standard are managers, design/process engineers and operators who deal with:

- Implementing 3D semiconductor packaging
- Interposer, substrate and printed board design
- Board-level assembly, inspection and repair processes

1.1.2 Intent This standard intends to provide useful and practical information to those who are designing, developing or using 3D-packaged semiconductor components or those who are considering 3D package implementation. The 3D semiconductor package may include multiple die elements—some homogeneous and some heterogeneous. The package may also include several discrete passive SMT devices, some of which are surface mounted and some of which are integrated (embedded) within the components' substrate structure.

1.2 Classification IPC standards recognize that electrical and electronic assemblies are subject to classifications by intended end-item use. Three general end-product classes have been established to reflect differences in manufacturability, complexity, functional performance requirements, and verification (inspection/test) frequency. It should be recognized that there may be overlaps of equipment between classes.

CLASS 1 General Electronic Products

Includes products suitable for applications where the major requirement is function of the completed assembly.

CLASS 2 Dedicated Service Electronic Products

Includes products where continued performance and extended life is required, and for which uninterrupted service is desired but not critical. Typically, the end-use environment would not cause failures.

CLASS 3 High Performance/Harsh Environment Electronic Products

Includes products where continued high performance or performance-on-demand is critical, equipment downtime cannot be tolerated, end-use environment may be uncommonly harsh, and the equipment must function when required, such as life support or other critical systems.

1.3 Measurement Units All dimensions and tolerances in this specification are expressed in hard SI (metric) units and bracketed soft imperial [inch] units. Users of this specification are expected to use metric dimensions. All dimensions ≥ 1 mm [0.0394 in] will be expressed in millimeters and inches. All dimensions < 1 mm [0.0394 in] will be expressed in micrometers and microinches.

1.4 Use of "Lead" For readability and translation, this document uses the noun lead only to describe leads of a component. The metallic element lead is always written as Pb.

1.5 Abbreviations and Acronyms Periodic table elements are abbreviated in the standard. See Appendix A for full spellings of abbreviations (including elements) and acronyms used in this standard.