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Selection and Application of Board Level Underfill Materials

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IPC J-STD-030A

Selection and Application of Board Level Underfill Materials

Developed by the Underfill Materials Design, Selection and Process Task Group (5-24f) of the Assembly and Joining 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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Selection and Application of Board Level Underfill Materials

1 SCOPE

This document provides users of underfill material with guidance in selecting and evaluating underfill material for assembly solder joints second level interconnects. Underfill material is used to increase reliability of electronic devices by two methods: alleviate coefficient of thermal expansion (CTE) mismatch (between the electronic package and the assembly substrate) and/or increase mechanical strength. Underfill materials are also used for environmental protection, mechanical shock or vibration, and anti-tampering uses. Materials used in underfill applications should not adversely affect device reliability nor degrade electrical performance (e.g., ionic impurities). When correctly selected and applied, underfill material should increase the life of the assembly solder joints.

Types of underfill materials currently available in the market include:

- Capillary Flow Underfill
  - Primary UFs (Package level not within the scope of this document)
  - Secondary (Board level)
- No-Flow/Fluxing Underfill
  - Thermal Compression Bonding (TCB) Epoxies (not within the scope of this document)
  - Non-Conductive Paste (NCP)
  - Non-Conductive Film (NCF)
- Removable/Re-Workable Underfill
- Corner Bonding/Glue Bonding
- Molded Underfill (not within scope of document)
- Wafer Applied Underfill (not within scope of document)
- Vacuum Underfill (not within scope of document)

1.1 Introduction This document covers polymer based underfill materials intended for use in printed circuit assemblies (PCA). (See Figure 1-1.)

1.2 Purpose The purpose of this document is to help in identifying underfill materials whose properties are compatible with component assembly joints to reduce thermo mechanical stress so that performance of the assembly is enhanced. The additional role of underfill is protecting the device from environmental factors and increasing strength. Evaluation methods are provided in the document that are intended to be used for assessing underfill material performance in specific applications as well as troubleshooting failures. This document represents the compiled knowledge and experience of the IPC Underfill Adhesives for Flip Chip Applications Task Group.

1.3 Definition of Requirements The word "**shall**" is used in the text of this document wherever there is a requirement for materials, preparation, process control, or acceptance of a soldered connection or a test method. The word "should" reflects "best processing techniques" and is used to reflect general industry practices and a suggestion for guidance only.

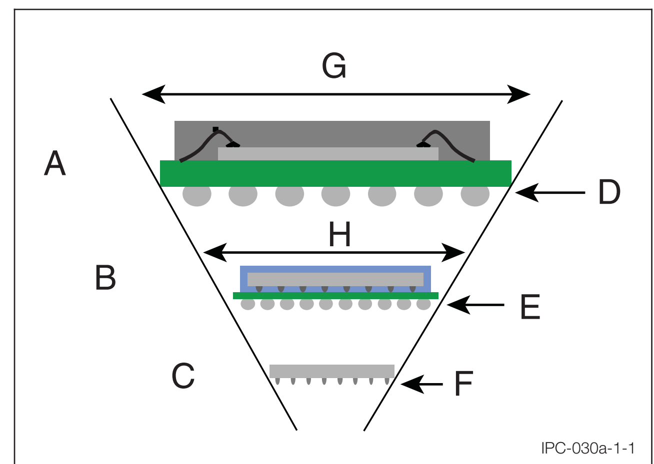

Figure 1-1 Comparison of Various Sized Array Packages
A. Ball Grid Array (BGA)
B. Chip Scale Package (CSP)
C. Flip Chip (FP)
D. 760 micron balls
E. 300 micron balls
F. 75 micron balls
G. 35 mm [1.38 in]
H. 1.2x chip size