# IPC-9708
## 2010

# Test Methods for Characterization of Printed Board Assembly Pad Cratering

December 2010

*A standard developed by IPC*

*Association Connecting Electronics Industries*

## The Principles of Standardization

In May 1995 the IPC's Technical Activities Executive Committee (TAEC) adopted Principles of Standardization as a guiding principle of IPC's standardization efforts.

**Standards Should:**

- Show relationship to Design for Manufacturability (DFM) and Design for the Environment (DFE)
- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

**Standards Should Not:**

- Inhibit innovation
- Increase time-to-market
- Keep people out
- Increase cycle time
- Tell you how to make something
- Contain anything that cannot be defended with data

## Notice

IPC Standards and Publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards and Publications shall not in any respect preclude any member or nonmember of IPC from manufacturing or selling products not conforming to such Standards and Publication, nor shall the existence of such Standards and Publications preclude their voluntary use by those other than IPC members, whether the standard is to be used either domestically or internationally.

Recommended Standards and Publications are adopted by IPC without regard to whether their adoption may involve patents on articles, materials, or processes. By such action, IPC does not assume any liability to any patent owner, nor do they assume any obligation whatever to parties adopting the Recommended Standard or Publication. Users are also wholly responsible for protecting themselves against all claims of liabilities for patent infringement.

## IPC Position Statement on Specification Revision Change

It is the position of IPC's Technical Activities Executive Committee that the use and implementation of IPC publications is voluntary and is part of a relationship entered into by customer and supplier. When an IPC publication is updated and a new revision is published, it is the opinion of the TAEC that the use of the new revision as part of an existing relationship is not automatic unless required by the contract. The TAEC recommends the use of the latest revision. Adopted October 6, 1998

## Why is there a charge for this document?

Your purchase of this document contributes to the ongoing development of new and updated industry standards and publications. Standards allow manufacturers, customers, and suppliers to understand one another better. Standards allow manufacturers greater efficiencies when they can set up their processes to meet industry standards, allowing them to offer their customers lower costs.

IPC spends hundreds of thousands of dollars annually to support IPC's volunteers in the standards and publications development process. There are many rounds of drafts sent out for review and the committees spend hundreds of hours in review and development. IPC's staff attends and participates in committee activities, typesets and circulates document drafts, and follows all necessary procedures to qualify for ANSI approval.

IPC's membership dues have been kept low to allow as many companies as possible to participate. Therefore, the standards and publications revenue is necessary to complement dues revenue. The price schedule offers a 50% discount to IPC members. If your company buys IPC standards and publications, why not take advantage of this and the many other benefits of IPC membership as well? For more information on membership in IPC, please visit www.ipc.org or call 847/597-2872.

Thank you for your continued support.

IPC-9708

# Test Methods for Characterization of Printed Board Assembly Pad Cratering

Developed by the SMT Attachment Reliability Test Methods Task Group (6-10d) of the Product Reliability Committee (6-10) of IPC

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

Contact:

IPC
3000 Lakeside Drive, Suite 309S
Bannockburn, Illinois
60015-1249
Tel 847615.7100
Fax 847615.7105

This Page Intentionally Left Blank

# Acknowledgment

Any document involving a complex technology draws material from a vast number of sources. While the principal members of the SMT Attachment Reliability Test Methods Task Group (6-10d) of the Product Reliability Committee (6-10) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

**Product Reliability Committee**

Chair
Reza Ghaffarian, Ph.D.
Jet Propulsion Laboratory

Vice-Chair
Werner Engelmaier
Engelmaier Associates, L.C.

**SMT Attachment Reliability Test Methods Task Group**

Chair
Reza Ghaffarian, Ph.D.
Jet Propulsion Laboratory

Vice-Chair
Werner Engelmaier
Engelmaier Associates, L.C.

**Technical Liaisons of the IPC Board of Directors**

Peter Bigelow
IMI Inc.

Sammy Yi
Flextronics International

**SMT Attachment Reliability Test Methods Task Group**

Mudasir Ahmad, Cisco Systems Inc.

Patricia J. Amick, Boeing - Integrated Defense Systems

Michael Azarian, University of Maryland

Roger L. Bell, Space Systems/Loral

Elizabeth Benedetto, Hewlett-Packard Company

Trevor Bowers, Adtran Inc.

Jennifer Burlingame, Cisco Systems Inc.

Nicole Butel, Avago Technologies

Fritz Byle, Astronautics Corp. of America

Beverley Christian, Research In Motion Limited

Glenn Dody, Dody Consulting

Harold Ellison, Quantum Corporation

Dennis Fritz, MacDermid, Inc.

Mahendra Gandhi, Northrop Grumman Aerospace Systems

Phil Geng, Intel Corporation

David D. Hillman, Rockwell Collins

Christopher Hunt, National Physical Laboratory

Terry Kocour, Plexus Corp.

Frank Liang, Intel Corporation

Jaime Llinas, Hewlett-Packard Company

Anne Lomonte, Draeger Medical Systems, Inc.

Wesley Malewicz, Draeger Medical Systems, Inc.

Alan McAllister, Intel Corporation

David Nelson, Raytheon Company

Keith Newman, Oracle America, Inc.

Deepak Pai, General Dynamics Info. Sys., Inc

Satish Parupalli, Intel Corporation

John Radman, Trace Laboratories - Denver

Paul Reid, PWB Interconnect Solutions Inc.

Rosa Reinosa, Hewlett-Packard Company

Martin Scionti, Raytheon Missile Systems

Russell S. Shepherd, Microtek Laboratories

Julie Silk, Agilent Technologies

Mark Trahan, Texas Instruments Inc.

Vasu Vasudevan, Intel Corporation

Bill Vuono, Raytheon Company

Anthony Wong, National Semiconductor Corp.

Xiang Zhao, Huawei Technologies Co., Ltd.

***A special note of appreciation goes to Mudasir Ahmad, Cisco Systems Inc. and Satish Parupalli, Intel Corporation, for coordinating the development of IPC-9708.***

# Table of Contents



**FIGURES**



**TABLES**

# Test Methods for Characterization of Printed Board Assembly Pad Cratering

## 1 SCOPE

This document provides test methods to evaluate the susceptibility of printed board assembly (PBA) materials and designs to cohesive dielectric failure underneath surface mount technology (SMT) attach pads. The test methods can be used to rank order and compare different printed board materials and design parameters, but do not define acceptance criteria.

**1.1 Performance Classification** This test method guideline recognizes that surface mount assemblies (SMAs) will be subject to variations in performance requirements based on end use. While performance classes are defined in IPC-6011, these performance classifications are not specific as to the required reliability. As of the publication of this standard, the acceptance criteria needs to be established as agreed between user and supplier (AABUS).

**1.2 Definition of Terms** The definition of all terms used herein **shall** be as specified in IPC-T-50, except as otherwise specified in 1.2.1 through 1.2.4.

**1.2.1 BGA** Ball Grid Array package.

**1.2.2 Component** Packaged semiconductor device.

**1.2.3 Solder Joint/Ball** The solder interconnection between a component and PBA.

**1.2.4 Pad Cratering** The formation of a cohesive (or adhesive) dielectric crack or fracture underneath the pad of a surface mount component, most commonly BGA packages.

**1.3 Interpretation** **"Shall"** is used throughout this specification whenever a requirement is intended to express a provision that is mandatory; deviation may be considered if sufficient data is supplied to justify the exception.

The words "should" and "may" are used whenever it is necessary to express non-mandatory provisions. "Will" is used to express a declaration of purpose. To assist the reader, the word "**shall**" is presented in bold characters.

## 2 APPLICABLE DOCUMENTS

The following documents are applicable and constitute a part of this specification to the extent specified herein. Sub-sequent issues of, or amendments to, these documents will become a part of this specification. Documents are grouped under categories such as IPC, Joint Industry Standard, and others depending on the source.

### 2.1 IPC[1]

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

**IPC-6011** Qualification and Performance Specification for Printed Boards

### 2.2 Joint Electron Device Engineering Council[2]

**JESD22-B117A** BGA Ball Shear

**JESD22-B115** Solder Ball Pull

1. www.ipc.org
2. www.jedec.org