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Thermal Cycling Test Method for Fatigue Life Characterization of Surface Mount Attachments

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

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

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Thermal Cycling Test Method for Fatigue Life Characterization of Surface Mount Attachments

1.0 SCOPE

This specification establishes a thermal cycling test method to characterize the fatigue lifetimes of surface mount solder attachments of electronic assemblies. The surface mount devices may be solder-attached to rigid, flexible or rigid-flex printed boards. The characterization results can be used to predict field lifetime of solder attachments for the use environments and conditions of electronic assemblies.

1.1 Purpose The purpose of this document is to provide a standardized thermal cycling characterization method and reporting procedure of surface mount solder attachment for use in the study of processes and parameters, and for analytical prediction of solder joint reliability.

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 Section 3.

1.3 Interpretation of "Shall" The imperative form of the verb, is used throughout this specification whenever a requirement is intended to express a provision that is mandatory. Deviation from a ''**shall**'' requirement 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.

1.4 Revision Level Changes The document scope was narrowed for improved alignment with actual industry usage of the standard, focusing on board-level solder attach thermal cycle characterization. Qualification is outside the scope of this document. This resulted in deletion of various comments, sections, and tables not strictly applicable to the refined scope. Wording was revised for improved clarity, accuracy, consistency, and comprehension. While not the focus, other failure modes and mechanisms may be found using this test method.

2.0 APPLICABLE DOCUMENTS

The following documents are applicable and constitute a part of this specification to the extent specified herein. Subsequent issues of, or amendments to, these documents will become a part of this specification.

2.1 IPC[1] and JEDEC[2]

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

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

IPC-A-600 Acceptability of Printed Boards

IPC-2221 Generic Standard on Printed Board Design

IPC-6012 Qualification and Performance Specification for Rigid Printed Boards

IPC/JEDEC J-STD-033 Packaging and Handling of Moisture Sensitive Non-Hermetic Solid State Surface Mount Device

IPC-1602 Standard for Printed Board Handling and Storage

IPC-TM-650 Test Methods Manual

IPC 9241 Guidelines for Microsection Preparation

3.0 TERMS, DEFINITIONS AND CONCEPTS

3.1 General To ensure the reliability of the solder attachment of surface mounted electronic components to a printed board, Design for Reliability (DfR) procedures (see IPC-D-279), and verification by reliability stress-testing are recommended.

During use, surface mount solder attachments can be subjected to a variety of loading conditions which can lead to premature failure. The underlying assumption is that the solder joints have been properly wetted, forming a good metallurgical bond between the solder and the base metal of the component and printed board (PB). This assures that early failures are not infant-mortalities due to defective solder joints.

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