

# **IPC-9701B**

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

Supersedes IPC-9701A  
February 2006

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

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  
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# Table of Contents

<b>1.0 SCOPE</b> .....	1	3.5.1.2 Characteristic Life, $N_{63}$ .....	4
1.1 Purpose .....	1	3.5.1.3 Failure Free Life, $N_0$ .....	4
1.2 Definition of Terms .....	1	3.5.1.4 Median Life, $N_{50}$ .....	4
1.3 Interpretation of “Shall” .....	1	3.6 Reliability Tests .....	4
1.4 Revision Level Changes .....	1	3.6.1 Accelerated Reliability Test .....	4
<b>2.0 APPLICABLE DOCUMENTS</b> .....	1	3.6.2 Thermal Cycling .....	4
2.1 IPC and JEDEC .....	1	3.6.3 Thermal Shock .....	4
<b>3.0 TERMS, DEFINITIONS AND CONCEPTS</b> .....	1	3.6.4 Power Cycling .....	4
3.1 General .....	1	3.7 Understanding Solder Attachment Technology ..	4
3.2 Reliability Concepts .....	2	3.7.1 Solder Attachment Technology .....	4
3.2.1 Reliability Definition .....	2	3.7.2 Solder characteristics .....	4
3.3 Physics-of-Failure .....	2	3.7.3 Microstructure and Crack Propagation .....	4
3.3.1 Creep .....	2	3.7.4 Life prediction models and acceleration factors ..	5
3.3.2 Stress Relaxation .....	2	<b>4.0 TEST METHOD</b> .....	5
3.3.3 Solder Creep-Fatigue Models .....	2	4.1 Test Methods .....	5
3.3.4 Differential Thermal Expansion .....	2	4.2 Test Characterization .....	5
3.4 Test Parameters .....	2	4.3 Test Vehicles .....	5
3.4.1 Working Zone .....	2	4.3.1 Component Description .....	5
3.4.2 Cyclic Temperature Range/Swing .....	2	4.3.1.1 Daisy-Chain Package .....	6
3.4.4 Maximum Sample Temperature, $T_s(\max)$ .....	2	4.3.1.2 Component Documentation Requirements .....	6
3.4.5 Maximum Nominal Temperature, $T(\max)$ .....	2	4.3.2 Printed boards .....	6
3.4.6 Minimum Sample Temperature, $T_s(\min)$ .....	2	4.3.2.1 Test Board Design Requirements .....	7
3.4.7 Minimum Nominal Temperature, $T(\min)$ .....	2	4.3.3 Board Assembly .....	8
3.4.8 Mean Cyclic Temperature, $T_{SJ}$ .....	2	4.4 Accelerated Temperature Test Methods .....	8
3.4.9 Nominal $\Delta T$ .....	2	4.4.1 Aging .....	8
3.4.10 Dwell/Soak Time, $t_D$ .....	2	4.4.2 Temperature Cycling .....	8
3.4.11 Dwell/Soak Temperature .....	3	4.4.2.1 Temperature Chambers .....	8
3.4.12 Cycle Time .....	3	4.4.3 Test Monitoring .....	9
3.4.13 Temperature Ramp .....	3	<b>5.0 CHARACTERIZATION TEST REQUIREMENTS</b> ..	10
3.4.14 Maximum Cyclic Strain Range .....	3	5.1 Thermal Cycling Parameters .....	10
3.4.15 Maximum Cyclic Stress Range .....	3	5.1.1 Temperature Cycle Condition .....	10
3.4.16 Hysteresis Loop .....	3	5.2 Test Duration .....	11
3.4.17 Design Service Life .....	3	5.3 Number of Samples .....	11
3.4.18 Projected Service Life .....	3	5.4 Rework .....	11
3.4.19 Infant Mortality Failures .....	3	<b>6.0 FAILURE ANALYSIS</b> .....	11
3.4.20 Random Steady-State Failures .....	3	6.1 Failure Analysis Goal .....	11
3.4.21 Wearout Failures .....	4	6.2 Failure Analysis Procedures .....	11
3.5 Statistical Failure Distribution Concepts .....	4	6.3 Advantages and disadvantages of destructive failure analysis methods .....	11
3.5.1 Statistical Failure Distribution .....	4	6.4 Construction Analysis Procedure .....	12
3.5.1.1 Weibull Slope or Shape Factor, Beta .....	4		

6.5 Data and Failure Analysis Documentation Requirements . . . . . 12

**7.0 QUALITY ASSURANCE** . . . . . 12

7.1 Sample Inspection . . . . . 12

7.2 Documentation Review . . . . . 12

**8.0 REFERENCES FOR INFORMATION PURPOSES** . . . . . 12

**Tables**

Table 4-1 Temperature Cycling Characterization Test Parameters and Conditions . . . . . 5

Table 4-2 Continuous Test Monitoring Requirements . . . 9

**Figures**

Figure 3-1 Representative Temperature Profile for Thermal Cycle Test Conditions . . . . . 3

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

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## 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<sup>1</sup> and JEDEC<sup>2</sup>

**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.

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1. [www.ipc.org](http://www.ipc.org)  
2. [www.jedec.org](http://www.jedec.org)