IPC/JEDEC J-STD-020E

Moisture/Reflow Sensitivity Classification for Nonhermetic Surface Mount Devices

A joint standard developed by the IPC Plastic Chip Carrier Cracking Task Group (B-10a) and the JEDEC JC-14.1 Committee on Reliability Test Methods for Packaged Devices

Supersedes:
IPC/JEDEC J-STD-020D.1 - March 2008
IPC/JEDEC J-STD-020D - August 2007
IPC/JEDEC J-STD-020C - July 2004
IPC/JEDEC J-STD-020B - July 2002
IPC/JEDEC J-STD-020A - April 1999
J-STD-020 - October 1996
JEDEC JESD22-A112
IPC-SM-786A - January 1995
IPC-SM-786 - December 1990

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

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Table of Contents

1 PURPOSE 1
1.1 Scope 1
1.2 Background 1
1.3 Terms and Definitions 1
1.3.1 Accelerated Equivalent Soak 1
1.3.2 *Acoustic Microscope 2
1.3.3 *Area Array Package 2
1.3.4 *Classification Temperature (T_c) 2
1.3.5 Crack 2
1.3.6 *Damage Response 2
1.3.7 Dead-Bug (Orientation) 2
1.3.8 Delamination 2
1.3.9 Downbond Area 2
1.3.10 Floor Life 2
1.3.11 Full Body Hot Air Rework 2
1.3.12 Live-Bug (Orientation) 2
1.3.13 Manufacturer's Exposure Time (MET) 2
1.3.14 Moisture/Reflow Sensitivity Classification 2
1.3.15 Moisture Sensitivity Level (MSL) 2
1.3.16 *Package Thickness 2
1.3.17 *Peak Package Body Temperature (T_p) 2
1.3.18 Reclassification 2
1.3.18 *Soak 2
1.3.19 Wire-Bond Surface 2

2 APPLICABLE DOCUMENTS 3
2.1 JEDEC 3
2.2 IPC 3
2.3 Joint Industry Standards 3

3 APPARATUS 3
3.1 Temperature Humidity Chambers 3
3.2 Solder Reflow Equipment 3
3.2.1 Full Convection (Preferred) 3
3.2.2 Infrared 3
3.3 Ovens 4
3.4 Microscopes 4
3.4.1 Optical Microscope 4
3.4.2 Acoustic Microscope 4
3.5 Cross-Sectioning 4
3.6 Electrical Test 4
3.7 Weighing Apparatus (Optional) 4
3.8 Beaded Thermocouple Temperature Measurement 4

4 CLASSIFICATION/RECLASSIFICATION 4
4.1 Classification Temperatures (T_c) 4
4.2 Compatibility with Pb-Free Assembly Rework 5
4.3 Reclassification 5

5 PROCEDURE 6
5.1 Sample Requirements 6
5.1.1 Reclassification (Qualified Package without Additional Reliability Testing) 6
5.1.2 Classification/Reclassification and Rework 6
5.2 Initial Electrical Test 6
5.3 Initial Inspection 6
5.4 Bake 6
5.5 Moisture Soak 6
5.6 Reflow 7
5.7 Final External Visual 9
5.8 Final Electrical Test 9
5.9 Final Acoustic Microscopy 9

6 CRITERIA 9
6.1 Failure Criteria after Reflow Simulation 9
6.2 Criteria Requiring Further Evaluation 9
6.2.1 Delamination 9
6.2.3 Moisture Induced Body Warpage during Board Assembly of Substrate Based Packages (e.g. BGA, LGA, etc.) 10
6.2.4 Bare Die with Polymer Layers 10
6.2.5 Non-IC Packages 10
6.3 Failure Verification 10

7 MOISTURE/REFLOW SENSITIVITY CLASSIFICATION 10

8 OPTIONAL WEIGHT GAIN/LOSS ANALYSIS 11
8.1 Weight Gain 11
8.2 Absorption Curve 11
8.2.1 Read Points 11
8.2.2 Dry Weight 11
8.2.3 Moisture Soak 11
8.2.4 Readouts 11
8.3 Desorption Curve 12
8.3.1 Read Points 12
8.3.2 Baking 12
8.3.3 Readouts 12

9 ADDITIONS AND EXCEPTIONS 12

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ANNEX A 13

ANNEX B 14

Figures

Figure 5-1 Classification Profile (Not to scale) 8

Tables

Table 4-1 SnPb Eutectic Process – Classification Temperatures (T_c) 4

Table 4-2 Pb-Free Process – Classification Temperatures (T_c) 5

Table 5-1 Moisture Sensitivity Levels.................................. 7

Table 5-2 Classification Profiles 8

Table B-1 Major Changes from Revision D to Revision E 14

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Moisture/Reflow Sensitivity Classification for Nonhermetic Surface Mount Devices

1 PURPOSE

The purpose of this standard is to identify the classification level of nonhermetic surface mount devices (SMDs) that are sensitive to moisture-induced stress so that they can be properly packaged, stored, and handled to avoid damage during assembly solder reflow attachment and/or repair operations.

This standard may be used to determine what classification level should be used for Surface Mount Device (SMD) package qualification. Passing the criteria in this test method is not sufficient by itself to provide assurance of long-term reliability. MSL (moisture sensitivity level) ratings generated by this document are utilized to determine the soak conditions for pre-conditioning as per JESD22-A113.

Note: A related document, J-STD-075 (Classification of Non-IC Electronic Components for Assembly Processes) identifies and includes PSL (process sensitive level) classification requirements for non-ICs (non-integrated circuits) in addition to referencing MSL (moisture sensitivity level) classification requirements from this document. Some ICs may be process sensitive. Please refer to J-STD-075 for potential future PSL classification requirements for ICs.

1.1 Scope This classification procedure applies to all nonhermetic SMDs in packages which, because of absorbed moisture, could be sensitive to damage during solder reflow. The term SMD as used in this document means plastic encapsulated surface mount packages and other packages made with moisture-permeable materials. The categories are intended to be used by SMD producers to inform users (board assembly operations) of the level of moisture sensitivity of their product devices, and by board assembly operations to ensure that proper handling precautions are applied to moisture/reflow sensitive devices. If no major changes have been made to a previously qualified SMD package, this method may be used for reclassification according to 4.3.

This standard cannot address all of the possible component, board assembly and product design combinations. However, the standard does provide a test method and criteria for commonly used technologies. Where uncommon or specialized components or technologies are necessary, the development should include customer/manufacturer involvement and the criteria should include an agreed definition of product acceptance.

SMD packages classified to a given moisture sensitivity level by using procedures or criteria defined within any previous version of J-STD-020, JESD22-A112 (rescinded), or IPC-SM-786 (rescinded) do not need to be reclassified to the current revision unless a change in classification level or a higher peak classification temperature is desired. Annex B provides an overview of major changes from Revision D to Revision E of this document.

Note: If the procedures in this document are used on packaged devices that are not included in this specification's scope, the failure criteria for such packages must be agreed upon by the device supplier and their end user.

1.2 Background The vapor pressure of moisture inside a nonhermetic package increases greatly when the package is exposed to the high temperature of solder reflow. Under certain conditions, this pressure can cause internal delamination of the packaging materials from the die and/or lead-frame/substrate, internal cracks that do not extend to the outside of the package, bond damage, wire necking, bond lifting, die lifting, thin film cracking, or cratering beneath the bonds. In the most severe case, the stress can result in external package cracks. This is commonly referred to as the ''popcorn'' phenomenon because the internal stress causes the package to bulge and then crack with an audible ''pop.'' SMDs are more susceptible to this problem than through-hole parts because they are exposed to higher temperatures during reflow soldering. The reason for this is that the soldering operation must occur on the same side of the board as the SMD device. For through-hole devices, the soldering operation occurs under the board that shields the devices from the hot solder.

1.3 Terms and Definitions Other than the following, the definitions of terms used in this standard are in accordance with IPC-T-50. Terms marked with an asterisk (*) are direct excerpts of IPC-T-50 and are reprinted here for convenience.

1.3.1 Accelerated Equivalent Soak A soak at a higher temperature for a shorter time (compared to the standard soak), to provide roughly the same amount of moisture absorption. See also ''Soak.''

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