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IPC/JEDEC J-STD-020D.1

Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State 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 -
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.

Contact:

JEDEC
Solid State Technology Association
2500 Wilson Boulevard
Arlington, VA 22201-3834
www.jedec.org

IPC
3000 Lakeside Drive, Suite 309S
Bannockburn, Illinois
60015-1249
Tel 847 615.7100
Fax 847 615.7105

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Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices

1 PURPOSE

The purpose of this standard is to identify the classification level of nonhermetic solid state 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/preconditioning level should be used for SMD package qualification. Passing the criteria in this test method is not sufficient by itself to provide assurance of long-term reliability.

1.1 Scope This classification procedure applies to all nonhermetic solid state Surface Mount Devices (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 4.2.

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/manufacture 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 C to Revision D 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 leadframe/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 wave-soldered through-hole devices, the soldering operation occurs under the board that shields the devices from the hot solder. Through-hole devices that are soldered using intrusive soldering or "pin in paste" processes may experience the same type of moisture-induced failures as SMT devices.

1.3 Terms and Definitions

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.

acoustic microscope – Equipment that creates an image using ultrasound to view a specimen's surface or subsurface features, including defects and damage. See J-STD-035 for more information.

area array package – A package that has terminations arranged in a grid on the bottom of the package and contained within the package outline.