



ASSOCIATION CONNECTING  
ELECTRONICS INDUSTRIES®



IPC/JEDEC J-STD-033A

# Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices

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



August 9, 2002

**Supersedes:**

IPC/JEDEC J-STD-033 -

April 1999

JEDEC JEP124

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:**

**EIA/JEDEC**

Engineering Department

2500 Wilson Boulevard

Arlington, VA 22201

Phone (703) 907-7500

Fax (703) 907-7501

**IPC**

2215 Sanders Road

Northbrook, IL 60062-6135

Phone (847) 509-9700

Fax (847) 509-9798

# Table of Contents

<b>1 FOREWORD</b> .....	1	<b>4 DRYING</b> .....	6
1.1 Purpose.....	1	4.1 Post Exposure to Factory Ambient.....	7
1.2 Scope.....	1	4.1.1 Any Duration Exposure.....	7
1.2.1 Packages.....	1	4.1.2 Short Duration Exposure.....	8
1.3 Assembly Processes.....	1	4.2 General Considerations for Baking.....	8
1.3.1 Mass Reflow.....	1	4.2.1 High Temperature Carriers.....	8
1.3.2 Localized Heating.....	1	4.2.2 Low Temperature Carriers.....	8
1.3.3 Socketed Components.....	1	4.2.3 Paper and Plastic Container Items.....	8
1.3.4 Point-to-Point Soldering.....	1	4.2.4 Bakeout Times.....	8
1.4 Reliability.....	2	4.2.5 ESD Protection.....	8
1.5 Terms and Definitions.....	2	4.2.6 Reuse of Carriers.....	8
1.5.1 Active Desiccant.....	2	4.2.7 Solderability Limitations.....	8
1.5.2 Bar Code Label.....	2	<b>5 USE</b> .....	9
1.5.3 Bulk Reflow.....	2	5.1 Incoming Bag Inspection.....	9
1.5.4 Carrier.....	2	5.1.1 Upon Receipt.....	9
1.5.5 Desiccant.....	2	5.1.2 Component Inspection.....	9
1.5.6 Floor Life.....	2	5.2 Floor Life.....	9
1.5.7 Humidity Indicator Card (HIC).....	2	5.3 Safe Storage.....	9
1.5.8 Manufacturer's Exposure Time (MET).....	2	5.3.1 Dry Pack.....	9
1.5.9 Moisture Barrier Bag (MBB).....	2	5.3.2 Dry Atmosphere Cabinet.....	9
1.5.10 Rework.....	2	5.4 Reflow.....	9
1.5.11 Shelf Life.....	2	5.4.1 Opened MBB.....	9
1.5.12 Surface Mount Device (SMD).....	2	5.4.2 Reflow Temperature Extremes.....	10
1.5.13 Solder Reflow.....	2	5.4.3 Additional Thermal Profile Parameters.....	10
1.5.14 Water Vapor Transmission Rate (WVTR).....	2	5.4.4 Multiple Reflow Passes.....	10
<b>2 APPLICABLE DOCUMENTS</b> .....	3	5.4.5 Maximum Reflow Passes.....	10
2.1 American Society for Testing and Materials (ASTM).....	3	5.5 Drying Indicators.....	10
<b>3 DRY PACKING</b> .....	3	5.5.1 Excess Humidity in the Dry Pack.....	10
3.1 Requirements.....	3	5.5.2 Floor Life or Ambient Temperature/ Humidity Exceeded.....	10
3.2 Drying of SMD Packages and Carrier Materials Before Being Sealed in MBBs.....	3	5.5.3 Level 6 SMD Packages.....	10
3.2.1 Drying Requirements - Levels 2a - 5a.....	3	<b>6 BOARD REWORK</b> .....	10
3.2.2 Drying Requirements - Carrier Materials.....	4	6.1 Component Removal, Rework and Remount....	10
3.2.3 Drying Requirements - Other.....	4	6.1.1 Removal for Failure Analysis.....	11
3.2.4 Excess Time Between Bake and Bag.....	4	6.1.2 Removal and Remount.....	11
3.3 Dry Pack.....	4	6.2 Baking of Populated Boards.....	11
3.3.1 Description.....	4	<b>7 DERATING DUE TO FACTORY ENVIRONMENTAL CONDITIONS</b> .....	11
3.3.2 Materials.....	4		
3.3.4 Shelf Life.....	6		

### Figures

Figure 3-1	Typical Dry Pack Configuration for Moisture-Sensitive SMD Packages in Shipping Tubes.....	4
Figure 3-2	Sample Humidity Indicator Card .....	5
Figure 3-3	Moisture-Sensitive Identification Label (Example) .....	6
Figure 3-4	Moisture-Sensitive Caution Label (Example).....	6

### Tables

Table 3-1	Dry Packing Requirements .....	4
Table 4-1	Reference Conditions for Drying Mounted or Unmounted SMD Packages.....	7
Table 4-2	Default Baking Times Used Prior to Dry-Pack that were Exposed to Conditions $\leq$ 60% RH .....	7
Table 5-1	Moisture Classification Level and Floor Life .....	9
Table 7-1	Recommended Equivalent Total Floor Life (days) @ 20°C, 25°C & 30°C For ICs with Novolac, Biphenyl and Multifunctional Epoxies.....	12

---

# Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices

---

## 1 FOREWORD

The advent of surface mount devices (SMDs) introduced a new class of quality and reliability concerns regarding package damage “cracks and delamination” from the solder reflow process. This document describes the standardized levels of floor life exposure for moisture/reflow-sensitive SMD packages along with the handling, packing and shipping requirements necessary to avoid moisture/reflow-related failures. Companion documents, J-STD-020, define the classification procedure and JEP113 define the labeling requirements.

Moisture from atmospheric humidity enters permeable packaging materials by diffusion. Assembly processes used to solder SMD packages to printed circuit boards (PCBs) expose the entire package body to temperatures higher than 200°C. During solder reflow, the combination of rapid moisture expansion, materials mismatch, and material interface degradation can result in package cracking and/or delamination of critical interfaces within the package.

The solder reflow processes of concern are convection, convection/IR, infrared (IR), vapor phase (VPR) and hot air rework tools. The use of assembly processes that immerse the component body in molten solder are not recommended for most SMD packages.

**1.1 Purpose** The purpose of this document is to provide SMD manufacturers and users with standardized methods for handling, packing, shipping, and use of moisture/reflow sensitive SMD packages which have been classified to the levels defined in J-STD-020. These methods are provided to avoid damage from moisture absorption and exposure to solder reflow temperatures that can result in yield and reliability degradation. By using these procedures, safe and damage-free reflow can be achieved, with the dry packing process, providing a minimum shelf life capability in sealed dry-bags of 12 months from the seal date.

## 1.2 Scope

### 1.2.1 Packages

**1.2.1.1 Non-Hermetic** This standard applies to all non-hermetic SMD packages subjected to bulk solder reflow processes during PCB assembly, including plastic encapsulated packages and all other packages made with moisture-permeable polymeric materials (epoxies, silicones, etc.) that are exposed to the ambient air.

**1.2.1.2 Hermetic** Hermetic SMD packages are not moisture sensitive and do not require moisture precautionary handling.

## 1.3 Assembly Processes

**1.3.1 Mass Reflow** This standard applies to bulk solder reflow assembly by convection, convection/IR, infrared (IR), and vapor phase (VPR), processes. It does not apply to bulk solder reflow processes that immerse the component bodies in molten solder (e.g., wave soldering bottom mounted components). Such processes are not allowed for many SMDs and are not covered by the component qualifications standards used as a basis for this document.

**1.3.2 Localized Heating** This standard also applies to moisture sensitive SMD packages that are removed or attached singly by local ambient heating, i.e., “hot air rework.” See Clause 6.

**1.3.3 Socketed Components** This standard does not apply to SMD packages that are socketed and not exposed to solder reflow temperatures. Such SMD packages are not at risk and do not require moisture precautionary handling.

**1.3.4 Point-to-Point Soldering** This standard does not apply to SMD packages in which only the leads are heated to reflow the solder, e.g., hand-soldering, hot bar attach of gull wing leads, and through hole by wave soldering. The heat absorbed by the package body from such operations is typically much lower than for bulk surface mount reflow or hot air rework, and moisture precautionary measures are typically not needed.