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Guidelines for the Packing, Handling and Repacking of Moisture-Sensitive Components

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Guidelines for the Packing, Handling and Repacking of Moisture-Sensitive Components

FOREWORD

This publication was prepared to establish packing, handling and repacking guidelines for moisture-sensitive components that are susceptible to package cracking as well as other moisture induced failure mechanisms when exposed to the high thermal stresses associated with surface mount processing.

This publication is applicable to semiconductor manufacturers for the shipment of moisture-sensitive components and anyone else who handles these components prior to shipment to the end customer.

The material contained in this publication was formulated under the guidance of the JEDEC JC14.4 Committee on Quality System Standardization.

Guidelines for the Packing, Handling and Repacking of Moisture-Sensitive Components

(From JEDEC Council Ballot JCB-95-38, formulated under the cognizance of JC-14.4
Committee on Quality System Standardization.)

1 Scope

This publication establishes guidelines for the packing, handling and repacking of moisture-sensitive components. The guidelines are applicable to semiconductor manufacturers for the shipment of moisture-sensitive components and anyone else who handles these components prior to shipment to the end customer. This publication also recommends standard dry pack quantities for the shipment of moisture-sensitive components to a distributor.

2 Introduction

Moisture sensitive components are susceptible to package cracking as well as other moisture induced failure mechanisms when exposed to the high thermal stresses associated with surface mount processing. To ensure the package integrity of moisture-sensitive components during surface mount processing, manufacturers package these devices in moisture barrier bags with a desiccant material and humidity indicator card and clearly mark the intermediate box with a tear drop label. If proper handling procedures are followed, the dry pack packaging provides a minimum shelf life of 12 months from the date of seal of the bag.

Appropriate ESD handling procedures must be followed when handling or storing moisture-sensitive components.

3 Applicable documents

ANSI/EIA-583	"Packaging Material Standards for Moisture-Sensitive Items"
ANSI/IPC-SM-786	"Procedure for Characterizing and Handling of Moisture/Reflow Sensitive ICs"
JEP113	"Symbol and Labels for Moisture-Sensitive Devices"
JESD42	"Requirements for Handling Electrostatic-Discharge-Sensitive Devices"

4 Definitions

- 4.1 Moisture barrier bag** - A protective bag that meets MIL-B-81705C, Type I requirements for flexibility, electrostatic discharge protection, mechanical strength, and puncture resistance. The bags should not exhibit contact corrosiveness. The bags must be heat sealable. The Water Vapor Transmission Rate (WVTR) of the bag must be less than 0.02 grams per 100 square inches in 24 hours. The storage life of bagged components will be determined by the properties of the bag material and the amount of desiccant used.
- 4.2 Desiccant** - A dustless, noncorrosive, and moisture absorbent material that meets MIL-D-3464, Type II requirements. Desiccant material is available in fractional or whole units where a unit is the quantity of desiccant required to absorb a minimum of 2.85 grams of water vapor at 20% relative humidity at a temperature of 25°C.
- 4.3 Humidity indicator card** - A card that is placed inside the moisture barrier bag to serve as an aid in determining the exposure level of the contents to moisture. The humidity indicator card must comply with MIL-I-8835A and MIL-P-116, Method II. The number of dots and their resolution must conform to the requirements outlined in ANSI/IPC-SM-786.
- 4.4 ID label** - A label that is affixed to the intermediate product package or container to identify moisture-sensitive devices that require special packing, handling and storage precautions. The ID Label should conform to the guidelines outlined in JEP113 "Symbol and Labels for Moisture-Sensitive Devices."
- 4.5 Caution label** - A label that is affixed to the moisture barrier bag near or on the same side as other labels that may be on the bag that specifies the level, shelf life, seal date, and handling requirements for the devices contained in the bag. The Caution Label should conform to the guidelines outlined in JEP113 "Symbol and Labels for Moisture-Sensitive Devices."

5 Requirements

5.1 Standard dry pack quantities for shipments to distributors

The recommended pack quantity for Plastic Surface Mount Components, PSMCs, is full intermediate containers for tubed and tray devices. It is recognized that drypacked PSMCs may need to be shipped in smaller quantities in order to reduce extra handling. In such cases, the recommended pack quantity for drypacked PSMCs is five tubes per bag or one tray plus cover per bag. This is subject to agreement by all trading partners involved.

5.2 Packing, handling, and repacking guidelines

5.2.1 Packing moisture-sensitive components

Place the components to be shipped in a moisture barrier bag with the correct number of units of desiccant (as specified in Section 5.3 of this guideline) and a humidity indicator card. The humidity indicator card should read 10% relative humidity or less.

Partially or lightly evacuate the bag to reduce packaging bulk and heat seal the bag as close to the end as possible following the heat sealing equipment manufacturer's guidelines. The bag should not be completely evacuated since this will reduce the effectiveness of the desiccant and possibly damage the contents.

Inspect the quality of the bag seal and the condition of the bag to ensure that the seal is complete and that there are no holes or punctures in the bag.

Complete the Caution Label, as specified in JEP113, and place the label on the exterior of the moisture barrier bag near or on the same side as other labels that may be on the bag. Do not place the label over the seal area. Place the bag in an intermediate box or package and place a moisture-sensitive ID Label on the same end of the box as the Product Package Label, as outlined in JEP113.

5.2.2 Receiving moisture-sensitive components

Moisture-sensitive components are shipped in sealed moisture barrier bags packed with desiccant material and a humidity indicator card. Moisture-sensitive components are identified by a tear drop ID Label that is affixed to the intermediate box or package near the Product Package Label. In addition, a Caution Label is affixed to the sealed moisture barrier bag near or on the same side as other labels that may be on the bag.

Upon receipt, inspect the intermediate box to ensure that it is not damaged. If damaged, remove the moisture barrier bag and inspect it for holes, tears or punctures that could expose either the contents or inner layer of the moisture barrier bag. If the bag is damaged, disposition the product per your normal incoming receiving procedures for non-conforming material.

5.2.3 Opening moisture barrier bags

If it is necessary to open the bag, simply cut across the top of the bag as close to the original seal as possible being careful not to damage the contents. By cutting close to the seal, the maximum amount of bag length is preserved for resealing. Once the bag is open, the humidity indicator card should be checked to ensure that it has not expired.

NOTE — If the 20% dot on the humidity indicator card is pink and the 30% dot is not blue, the components have been exposed to a level of moisture beyond that recommended. The product must be rebaked and repacked in a moisture barrier bag with new desiccant and a new humidity indicator card. Contact the manufacturer to determine a mutually agreeable disposition for the product.

5.2.4 Resealing moisture barrier bags

Moisture-sensitive components may be resealed in their original bag with the original desiccant and humidity indicator card provided that they have not been exposed to 30°C/60% relative humidity for more than 6 hours. If the original desiccant and humidity indicator card are reused, then the original date of seal of the bag (as marked by the manufacturer) should be used. The current date should only be used as the date of seal when new desiccant and a new humidity indicator card are used.

Partially or lightly evacuate the bag to reduce packaging bulk and heat seal the bag as close to the end as possible following the heat sealing equipment manufacturer's guidelines. The bag should not be completely evacuated since this will reduce the effectiveness of the desiccant and possibly damage the contents

Inspect the quality of the bag seal and the condition of the bag to ensure that the seal is complete and that there are no holes or punctures in the bag.

NOTE — It is recommended that the resealing be accomplished within 10 minutes of the opening of the original bag to minimize the exposure time of the components, desiccant and humidity indicator card to moisture. The cumulative out of bag time for the components must not exceed 6 hours at 30°C/60% relative humidity. If exceeded, the allowable floor life specified by the manufacturer must be adjusted accordingly and the Level must be either left blank or crossed out.

If the cumulative out of bag time has exceeded six hours, the Level must be either left blank or crossed out and the recommended floor life in Section 2a of the Caution Label must be reduced by one hour for each hour of exposure over six hours.

For example, if the manufacturer specifies Level 5 with a floor life of 24 hours and the components are out of the bag for eight hours in the programming center, then an adjusted floor life of 22 hours should be written in Section 2a of the Caution Label and the Level should be either left blank or crossed out.

5.2.5 Repacking moisture-sensitive components

Place the components to be shipped in a moisture barrier bag with the correct number of units of desiccant (as specified in Section 5.3 of this guideline) and a humidity indicator card. The humidity indicator card should read 10% relative humidity or less.

Partially or lightly evacuate the bag to reduce packaging bulk and heat seal the bag as close to the end as possible following the heat sealing equipment manufacturer's guidelines. The bag should not be completely evacuated since this will reduce the effectiveness of the desiccant and possibly damage the contents.

Inspect the quality of the bag seal and the condition of the bag to ensure that the seal is complete and that there are no holes or punctures in the bag.

NOTE — It is recommended that the components be sealed in the new bag within 10 minutes of the opening of the original bag to minimize the exposure time of the components, desiccant and humidity indicator card to moisture. The cumulative out of bag time for the components must not exceed 6 hours at 30°C/60% relative humidity. If exceeded, the allowable floor life specified by the manufacturer must be adjusted accordingly and the Level must be either left blank or crossed out.

If the cumulative out of bag time has not exceeded six hours, use the manufacturer's specified Level and floor life guideline to fill in both the Level and Section 2a of the Caution Label, as outlined in JEP113. If the cumulative out of bag time has exceeded six hours, the Level must be either left blank or crossed out and the recommended floor life in Section 2a of the Caution Label must be reduced by 1 hour for each hour of exposure over six hours.

For example, if the manufacturer specifies Level 5 with a floor life of 24 hours and the components are out of the bag for eight hours in the programming center, then an adjusted floor life of 22 hours should be written in Section 2a of the Caution Label and the Level should be either left blank or crossed out.

Note the current date in the Bag Seal Date section of the label using MMDDYY", "YYWW", or equivalent format and place the Caution Label on the exterior of the moisture barrier bag near or on the same side as other labels that may be on the bag. Do not place the label over the seal area. Place the bag in an intermediate box or package and place a moisture-sensitive ID Label on the same end of the box as the Product Package Label, as outlined in JEP113.

5.3 Desiccant formula

The amount of desiccant used per moisture barrier bag is based on the bag surface area and water vapor transmission rate in order to maintain an interior relative humidity of less than 20% at 30°C.

The following formula can be used to calculate the correct amount of desiccant to include in the moisture barrier bag.

where,

$$U = 30.4 \times C \times A \times R \times M \times DRF / B$$

U = number of desiccant units where a unit is the quantity of desiccant required to absorb a minimum of 2.85 grams of water vapor at 20% relative humidity at a temperature of 25°C.

30.4 = average number of days per month

C = 0.01 area constant

A = interior surface area of the moisture barrier bag (in ²)

R = water vapor transmission rate of the moisture barrier bag (grams/100square inches/24 hours)

M = maximum storage time (normally 12 months)

DRF = desiccant reduction factor (0.38 at 30°C/60% relative humidity)

B = minimum moisture capacity of the desiccant at 20% relative humidity (normally 2.85 grams)

Typical desiccant quantities for various bag sizes where R = 0.02 grams per 100 square inches in 24 hours, M = 12 months, DRF = 0.38, and B = 2.85 is outlined in table 1. Please note that these values are presented as an example only and must be adjusted for different types of bags and desiccant.

Additional desiccant may be required if dunnage materials are used inside the moisture barrier bag. Additional desiccant should be added at a rate of eight units per pound of cellulose and 0.5 units per pound of synthetic dunnage.

5.4 Desiccant storage

Desiccant can be stored in the original container provided that the container is immediately resealed after each use. Prior to resealing the container, a 10% relative humidity indicator card should be placed inside, if one is not already present. If during a subsequent opening of the container the indicator card shows the moisture of the contents to be higher than 10%, the desiccant should be scrapped or rebaked following the manufacturer's guidelines.

Table 1
(Example only based on assumptions listed below)

Bag Width (Inches)	Bag Length (Inches)	Bag Area (Square Inches)	Desiccant Calculation	# Units Desiccant
2	4	12	0.12	1
4	4	24	0.23	1
4	8	56	0.54	1
6	6	60	0.58	1
6	10	108	1.05	2
8	8	112	1.09	2
8	12	176	1.71	2
10	10	180	1.75	2
10	14	260	2.53	3
10	24	460	4.47	5
12	16	360	3.50	4
14	14	364	3.54	4
14	18	476	4.63	5
16	16	480	4.67	5
16	18	544	5.29	6

Assumptions:

Water Vapor Transmission Rate = 0.02 grams per 100 square inches in 24 hours

Storage Time = 12 months

Desiccant Reduction Factor = 0.38 at 30°C/60% relative humidity

Moisture Capacity of Desiccant = 2.85 grams

Bag Area = 2 x Width x (Length - 1 Inch)

