

Long Term Storage of Wafer and Die Semiconductor IC Products

AN98509 provides guidelines on long-term storage of wafer and die semiconductor IC products.

1 Introduction

The occasion might arise in which a customer has a die or wafer product that will be, or has been in storage for an extended amount of time. This document provides some information to help our customers make more informed decisions on how best to store these products and what issues might arise. See Section 7, Frequently Asked Questions on page 3 for more details.

2 General

Receiving, storing, packing, handling, and shipping procedures should prevent mechanical or electrical damage or degradation of the die wafer semiconductor device when subjected to normal handling, shipping, and storage. All packing materials should be either conductive or antistatic, including waffle pack, reels, bags, and fillers (see EIA-583). Appropriate ESD precautions must be taken (see JESD625). Dry bagging or vacuum bagging of product at any point up to and including shipment to the end user should follow industry standard specifications. This includes rebaking and rebagging of parts when necessary. The distributor or user is responsible for verifying conformance to all of the receiving, storing, packing, and shipping requirements prior to use by the end customer.

3 Inventory Control

When several lots of the same part number and package type exist in inventory, product should be used based upon the first-in, first-out (FIFO) inventory method (i.e., delivery or use based upon the oldest date code, or oldest lot number first).

4 Main Concerns

4.1 Moisture Related Mechanics

It is possible that while in storage, especially if not being stored in a controlled atmosphere, moisture might have permeated the vacuum sealed bag that encloses the product and protects it from moisture. Although semiconductor wafers and die are not inherently moisture sensitive, wire bond pads are quite sensitive and moisture might accelerate failure mechanisms that may only present themselves during product packaging such as bonding issues and delamination.

4.2 Die Topside and Backside Contamination

It is possible, due to age, foreign agents, or improper storage conditions, that wafers or die stored for an excessive amount of time might become contaminated. This could result in issues such as Non-Stick-On-Pad (NSOP), topside delamination, poor die attachment, or other such issues. Tests to monitor surface cleanliness, wire bonding, and adhesion (water droplet, for example) should be performed, and plasma cleaning should be implemented in the assembly process if necessary. Cypress also recommends a limited trial-run or assembly evaluation of wire bonding and die attachment to guarantee favorable results before the product is placed into mass-production.

4.3 Improper Storage Conditions

If die and wafers are not stored properly, then issues like those mentioned above could have an even greater probability of occurrence. Die and wafers, when in storage, should be stored at temperature between 18°C and 24°C, relative humidity of less than 30%, and in clean, dry, inert atmosphere (e.g. Nitrogen), and in a vacuum sealed bag. For more details on storage conditions, see Section 7, Frequently Asked Questions on page 3.

4.4 Handling Related Wafer or Die Damage

Handling has the potential to damage the wafer or die. Die stored in Waffle Pack should be handled carefully to avoid possible die edge chipping. Dropping the Waffle Pack can result in die damage. Handling wafer or die with tweezers can cause topside scratches that may cause die failure or degradation through subsequent manufacturing process or application use. It is recommended that tweezers not be used when handling wafer or die. Automated pick and place handling equipment should be set up to ensure no scratching occurs on the wafer or die surface or edges. Proper training, processes and precautions are needed to avoid handling related damage to wafer and die products.

4.5 Risk with KGD Parts

KGD parts are normally shipped in tape and reel, and it is more difficult to ensure long term reliability because of the nature of the transport medium. For very long term storage, it is recommended that products be purchased in wafer form.

4.6 ESDS Considerations

The system for electrostatic discharge sensitive (ESDS) protection should be in compliance with JESD625. When removing devices from reels, the cover tape should be removed at a rate of 10 mm/second or less, and at an angle of between 165° and 180° from the embossed carrier tape to minimize electrostatic generation.

5 Conclusion

In general, the quality and reliability of long term stored Semiconductor IC wafer and die product should be acceptable and comparable to newer product. However, to ensure that no issue will be observed in assembly, Cypress recommends an evaluation of long term stored product before mass production is initiated. It is recommended to purchase these products for long term storage in wafer form.

It is also recommended that storage locations and facilities including distributors, contract manufacturers, programming houses, etc should be qualified and audited regularly to assure that the storage conditions, handling and related precautions are systematic, specified, and observed. This will contribute to a greater probability of successful wafer and die management.

6 References

- Joint IPC/JEDEC Standard J-STD-020, Moisture/Reflow Sensitivity Classification for Nonhermetic Solid-State Surface-Mount Devices
- Joint IPC/JEDEC Standard J-STD-033, Standard for Handling, Packing, Shipping, and Use of Moisture/Reflow-Sensitive Surface-Mount Devices
- JEDEC Standard JESD31, General Requirements for Distributors of Commercial and Military Semiconductor Devices
- JEDEC Standard JESD625, Requirements for Handling Electrostatic-Discharge-Sensitive (ESDS) Devices
- EIA Standard EIA-541, Packaging Material Standards for ESD-Sensitive Items
- EIA Standard EIA-583, Packaging Material Standards for Moisture-Sensitive Items

7 Frequently Asked Questions

Q: I have Cypress product that has been in storage for an extended amount of time. What should I do to ensure that the parts would work in my application?

A: Examination of the vacuum sealed bag must first be done to determine if moisture has penetrated the barrier bag. Additionally, preliminary surface cleanliness and visual inspection should be performed to look for any kind of wafer anomalies.

Q: What kinds of indication will I have if there is a risk for this older material?

A: It is possible for an issue to arise even if there is no visual indication of a problem. However, with the proper testing performed up front, any potential for risk can be minimized.

Q: What are Cypress' storage recommendations?

A: Cypress always recommends that wafers be kept in an environmentally controlled area and in proper containers and vacuum sealed, if possible. Wafers that are not vacuum sealed must be placed in a Nitrogen (N₂) purge cabinet with a flow rate of 2 to 6 SCFH (Standard Cubic Feet per Hour). In an environmentally controlled area, FED STD 209 Class 1000/ISO 14644-1 Class 6 or below, wafers may be stored in open containers while in the queue for testing or while processing is in progress. Wafers may be transported in individual wafer carriers without benefit of a top cover provided the area is Class 1000/ISO Class 6 or below, however, when not in use, it is always recommended for the wafer contained to retain its cover.

Q: What is my shelf life for product, assuming that I store these wafers properly?

A: Cypress' own internal specifications allow for wafers to be stored indefinitely prior to use. However, Cypress can make no guarantees on wafers that are stored outside of its own die banks and/or holding locations. In general, it is recommended that a disposition procedure ensuring good manufacturability be followed in order to use wafers stored for an extended period of time.

Q: What kind of reliability issues should I expect from these parts?

A: The functionality and reliability of the product should be unaffected.

Document History

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*B	4958482	MSWI	10/12/2015	Updated in Cypress template
*C	5868864	AESATMP8	08/31/2017	Updated logo and Copyright.
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