

AN-2023-01: Shelf-Life Control for IC Components

1.1 Introduction

All plastic integrated-circuit (IC) packages such as TSOP and FBGA have a tendency to degrade over time under exposure to the environment so that there is a need for shelf-life and floor-life control to assure their quality and reliability integrity prior to being soldered. This note helps customers to understand these control requirements for IM's IC component products which include DRAM and NAND Flash. The information given can help minimize degradation to the IC components prior to being soldered/assembled and hence ensure the quality and reliability performance of IM products in customers' production and applications.

1.2 Reference

AN-2022-01 Lead-free (Pb-free) soldering reflow guideline

IPC/J-STD-033 Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices

1.3 Definitions

The product shelf-life for semiconductor products after delivery to the customer is based on factors such as the type of materials used in the device, manufacturing conditions, moisture sensitivity level (MSL), the use of moisture barrier bags (MBBs) in product packaging, the amount of desiccant used and the customer's storage conditions. IM carefully controls its internal manufacturing and warehouse processes to deliver products to customers with appropriate shelf-life performance.

Terminology	Definition
Product Shelf-Life	Product shelf-life refers to the length of time from product shipment to customer's soldering/assembly without physical degradation that may subsequently impact manufacturability and quality. The most common degradation is oxidation on IC package lead plating or solder balls.
Moisture Barrier Bag (MBB) Shelf-Life	MBB shelf-life, which is applicable to moisture-sensitive devices (MSL \geq 2) packaged in MBB, refers to the amount of time from the dry-pack sealed date to the bag opened date. Typical MBB shelf-life should not exceed 1 year as aligned with J-STD-033. The most common degradation is related to the amount of moisture absorption inside the plastic package resulting in a possible popcorn effect, severe delamination, or even cracks affecting the product's reliability performance.

1.4 Shelf-life Control Requirements

How customers store and handle IC component products is critical. Customers should fully understand and implement shelf-life control to ensure a product is properly stored upon reception. In summary, IM's IC component shelf-life and MBB shelf-life are shown in the following table:

Package Type	Product Shelf-life Control	MBB Shelf-life Control*
DRAM in TSOP	1 year	1 year
DRAM in FBGA	1 year	1 year

NAND in eMMC	1 year	1 year
NAND in FBGA	1 year	1 year

*At conditions <40°C and <90%RH per J-STD-033

1.5 Common Q&A

Question 1:

What is the difference between Product shelf-life and the MBB shelf-life?

Answer 1:

Product shelf-life is the duration of time from which the product is shipped from Intelligent Memory to its soldering/assembly at the customer's site. Meanwhile, MBB shelf-life is the duration from the MBB sealed date to the date the bag is opened. This is primarily determined by the dry-packing materials and storage conditions and is typically limited to 1 year per J-STD-033 at temperatures below 40°C and humidity levels below 90%RH.

Question 2:

As a customer, is it okay to use a product that has been stored for a longer period than its specified product shelf-life?

Answer 2:

In general, the risk is manageable when extending the product's shelf-life, as long as the product has been properly stored and handled during the storage period before use. The exact product shelf-life for a specific IC component depends on several factors, including the type of materials used in the device, manufacturing conditions, moisture sensitivity levels, the use of moisture barrier bags in product packaging, the amount of desiccant used, and your storage conditions. It is recommended to verify the product's solderability before use if you have any concerns or to bake the product before use when the Humidity Indicator Card (HIC) indicates an elevated moisture level, as per J-STD-033.

Question 3:

If the HIC still indicates low humidity after opening, less than 5% for example, can I use the product without baking it, even if the MBB shelf-life has expired?

Answer 3:

Yes, that is possible. The exact product shelf-life for a specific IC depends on several factors, including the type of materials used in the device, manufacturing conditions, moisture sensitivity levels, the use of moisture barrier bags in product packaging, the amount of desiccant used, and your storage conditions. The MBB shelf-life of 1 year is determined based on conditions of <40°C and <90%RH. Any deviation from these conditions may affect the MBB shelf-life. If the Humidity Indicator Card (HIC) indicates low humidity, the MBB shelf-life can be extended to a maximum of 2 years under controlled environmental conditions.

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REVISION HISTORY

Revision	Description	Date
01	Initial release	04-Sept-2023