Product Bulletin

#PB1146b

Date Code Restriction and Product Shelf Life
High Performance Programmable Logic Products

Introduction

Date Code Restrictions and the associated shelf life of products are commonly raised issues for advanced semiconductor products. The common concern is for the fitness of use of product that has been held in storage for an extended period. The primary issues are package moisture content and lead finish, as these can lead to difficulties during the circuit board manufacturing process. For Programmable Logic, an additional concern regarding data pattern retention is also a factor. With proper storage conditions, material handling, and monitoring of material, all of these concerns can be alleviated. The following sections examine these concerns, and indicate proper storage and handling methods to ensure you will not experience manufacturing issues with Lattice products.

Moisture Content and Lead Finish

Exposure to moisture in the packaging and storage environment can lead to semiconductor device failure. Moisture content in the package material can cause damage to the device during the board assembly process. Excessive moisture inside the packing materials can cause lead corrosion, impacting both the board assembly process and long-term reliability of the assembled device.

The JEDEC industry standard J-STD-020 defines a set of Moisture Sensitivity Level (MSL) ratings used to identify package sensitivity to moisture. Package materials and physical dimensions determine the MSL rating for each package type. The JEDEC industry standard J-STD-033 for moisture management provides a uniform method to ensure devices are protected during handling, packing, shipment, storage, and use. Specific handling, dry packing, and exposure limits are established for each MSL rating to ensure no manufacturing issues are experienced at the board assembly process. Lattice Semiconductor adheres to these industry standards for packaging of all our devices.

The concept behind moisture control is to dry bake units prior to packaging, and then vacuum seal units in a Moisture Barrier Bag (MBB) along with desiccant and a Humidity Indicator Card (HIC). This combination of techniques ensures proper storage. The amount of desiccant is determined based on the Moisture Vapor Transfer Rate (MVTR) of the MBB, and the desired shelf life of the product. Lattice Semiconductor includes sufficient desiccant to ensure a minimum of 12 months shelf life, and typically includes sufficient desiccant to exceed 18 to 24 months shelf life.

In addition to adhering to the JEDEC standards for packaging, Lattice Semiconductor also audits all dry packed inventories on an annual basis. All inventories are marked with the date of dry pack, and the inventory management system automatically sets a recall date for audit. The MBB is opened, and the HIC inspected for any possible moisture exposure. If there is no indication of moisture exposure, the product is repacked, with fresh desiccant and a new HIC. If moisture exposure is indicated, the product is tested for lead solderability, dry baked, and dry packed. After the material is repacked, the MBB is labeled with the dry bag seal date.

Shelf life is often calculated from the product manufacturer's date code. This date code is defined differently for each manufacturer, and does not provide a common indication of shelf life. Some manufacturers use a device manufacturing date code, while others use a final test or inspection date code. The best indicator of shelf time is the dry bag seal date marked on the outside of the MBB. This shows the shelf life since the last inspection and dry bag seal, and is most indicative of potential moisture exposure.

For products rated as MSL 1, dry packing is not required. These products use small volume packages and materials less sensitive to moisture absorption. For these products, the lack of a Moisture Barrier Bag does elevate the risk of lead contamination due to moisture exposure during storage. Lattice Semiconductor completed a study of the ability of MSL 1 devices to meet solderability requirements after long-term shelf storage. Product with shelf life of 1 to 5 years was selected for study. The material was exposed to Steam Aging for up to 8 hours to simulate additional moisture exposure, and then tested for solderability. The results of this testing demonstrated that even up to 5 years of shelf storage did not degrade the lead integrity of devices.

Managing Material with Older Dry Bag Seal Dates

In the event a customer finds they have inventory with older bag seal dates, there are a few straightforward steps to take to evaluate the viability of the product. These steps allow for evaluation of the product, and remedial treatment to return the product to a usable condition. The steps are defined below.

1. Inspection – inspect the Moisture Barrier Bag for vacuum seal and integrity. It should have no breaks or tears, and be tightly sealed. After opening the MBB, inspect the Humidity Indicator Card (HIC) for signs of moisture exposure. If there is no indication of MBB failure, or moisture exposure, the product is acceptable for use.
2. Repeat Dry Bake – if there is an indication of moisture exposure (damaged MBB, moisture indicated on the HIC), the product should be dry baked to eliminate any risk due to absorption. The JEDEC J-STD-033 standard documents the bake necessary based on the MSL level for the product to ensure the package has been correctly dry baked.
3. Solderability Test – if there is an indication of moisture exposure, and lead tarnish is evident or suspected, devices should be tested for solderability. The JEDEC JESD22-B102 standard defines the proper method to test for lead solderability.

Programmable Logic Data Retention

An additional shelf life concern often raised with Programmable Logic Devices (PLDs) regards data pattern retention during storage. The end user configures PLDs by programming internal storage elements to control device operation. The ability of these internal storage elements to retain the programmed pattern during long-term storage is questioned.

Lattice Semiconductor devices are designed and manufactured to retain the programmed pattern indefinitely across the full range of application and storage conditions as specified in the product data sheet. This level of reliability eliminates any risk of data retention failure due to shelf storage. Reprogramming of devices following shelf storage is not required

Summary

Shelf Life for semiconductor products in advanced packaging is a common concern for end users. As shown above, proper management of products to restrict moisture exposure will lead to successful assembly manufacturing. Lattice Semiconductor complies with the industry standards and guidelines for moisture management, and also audits all inventories to ensure product meets customer expectations. The best indication of shelf life is not the manufacturer's date code, but rather the Dry Bag Seal Date. This represents the most recent inspection for moisture exposure and repackaging with fresh desiccant. Using this date, and adhering to the industry standard practices for moisture management, will result in successful assembly manufacturing.