

Dry pack information

Application Note



Valid for:

Products from OSRAM Opto Semiconductors

Abstract

SMT components, such as LEDs, are because of their design moisture-sensitive components that might absorb moisture if incorrectly handled and stored. This might lead to damages during the assembling process. To prevent this, OSRAM Opto Semiconductors supplies its products in dry packs. This document gives an overview about the requirements for packing, labeling, handling and storage of moisture sensitive components in dry pack of OSRAM Opto Semiconductors.

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A. Normative references

SMT components, especially those with plastic packages, are at risk of moisture migration into the component while stored. During the soldering process with sudden heatings it can result to an increase in pressure inside the component. In order to prevent this potential damage, there are various methods and procedures which are described in the following standards for handling, packaging, transport and operation of moisture-sensitive components:

- JEDEC-STD-020C
Moisture/Reflow Sensitivity Classification for Plastic Integrated Circuit Surface Mount Devices

- JEDEC-STD-033B
Standard for Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices
- EIA – 583
Packaging Material Standards for Moisture Sensitive Items
- EIA/JEP 113-B
Symbol and Labels for Moisture-Sensitive Devices
- EIA/JEP 124
Guidelines for the Packing, Handling and Repacking of Moisture-Sensitive Components
- MIL-B-81705 C
Barrier Materials
- MIL-D-3464
Desiccants

B. Testing products for moisture sensitivity

Controlling moisture

OSRAM Opto Semiconductors in its design of packing materials and packing methods takes into consideration the susceptibility of some OSRAM Opto Semiconductors packages to moisture induced damage. The risk of this damage being greatest when naturally permeable plastic encapsulation materials are used as the moisture in the package increases or decreases with the Relative Humidity (RH) of the surrounding environment.

Such damage may include delamination between the die and the plastic encapsulation material, which may result in open connections due to broken wire-bonds.

Package cracking may also occur when the components are exposed to the high temperatures and steep temperatures gradients used in reflow board assembly techniques. Moisture in the package having reached a critical level will fracture the package in order to escape. This phenomenon being known as the “popcorn effect”.

Therefore, the control of moisture levels in the package body is critical to reducing the risk of moisture-induced failures.

Testing products for moisture sensitivity

A procedure to define the sensitivity of a component against moisture is set out in JEDEC-STD-020C.

In this standard, moisture sensitive components are classified in eight different groups, each differing in their permissible storage time in a defined climate (characterized by temperature and relative humidity at normal pressure).

C. Dry packing process and materials

The first step in the dry packing process is to remove any moisture built up in the package. This is done by baking the finished product for 2.5 to 48 hours between 85 °C and 125 °C depending on package type. During baking, the product is contained in high temperature resistant device trays, aluminum trays or tubes.

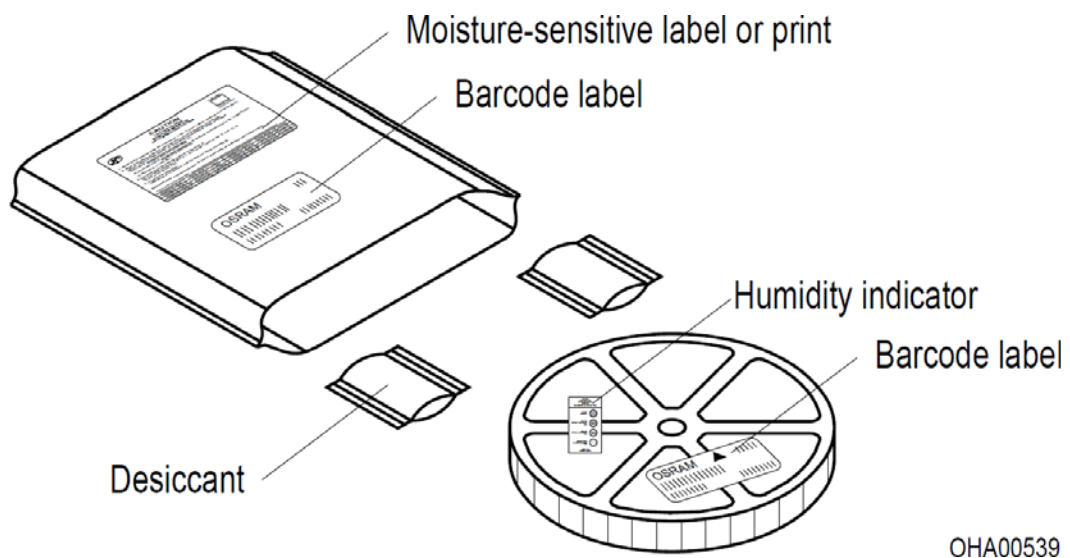
Within 24 hours after baking, the product is sealed with a prescribed number of desiccant pouches and an indicator card in a dry bag under a partial vacuum.

Details of OSRAM Opto Semiconductors dry pack materials are provided in the sections that follow.

Dry pack bag

The dry pack bag (moisture barrier bag) is of a three layer laminated design and is MIL-STD 81705C, type 1, class 1 compliant. ESD (Electro Static Discharge) protection is provided by the middle layer of aluminum metalized polyester. Figure 1 shows exemplary how products are packed in a dry bag. Every bag contains a moisture sensitive label, a desiccant and a humidity indicator.

Figure 1: Moisture-sensitive product is packed in a dry bag containing desiccant and a humidity card



Desiccant

The desiccant material used exceeds the rigid standard of the military specification D-3464 D, type II, contains Silica Gel and Active Clay which are neither acutely nor chronically harmful, do not classify as dangerous nor special waste and can be disposed of in accordance with local and national laws.

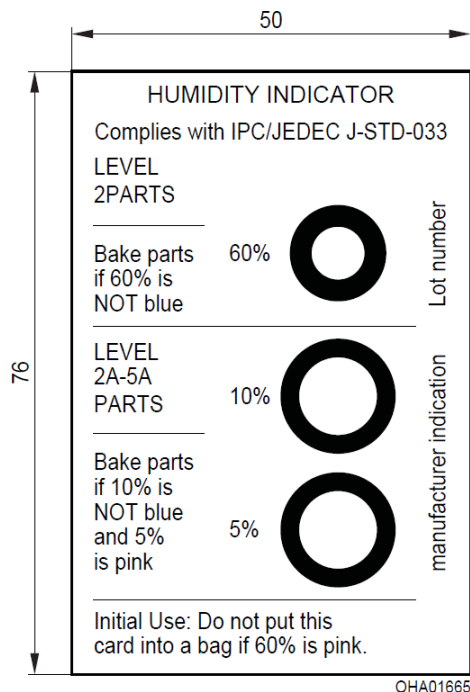
Testing confirms that the desiccant pouches in the bag greatly reduce the presence of moisture by maintaining the environment in the bag at no greater than 10 percent RH, thus protecting the devices during shipment and storage for 24 months. If a 24-month shelf life is exceeded, the devices will need to be dry

baked again if the RH in the bag has exceeded 10 percent RH. This RH change can be seen on the humidity indicator card.

Humidity indicator card

Included in each dry pack bag is a card with humidity-sensitive elements, like shown in Figure 2. It turn from blue to pink whenever the specific RH level is exceeded. If the 10 % dot has changed from blue to pink the product should be re-baked with moisture sensitivity level (MSL) 2A-5A before board assembly whenever a reflow method is used. Baking parts is not necessary if the 10% remain blue, even if 5% turned pink. Level 2 products only have to be re-baked if the 60 % dot has changed the color to pink. To find out, which MSL level is relevant, have a look at the chapter “Dry pack labels”. Detailed information on how to do the rebaking can be found in chapter “Rebaking of devices”.

Figure 2: Humidity indicator card is included in the dry bag



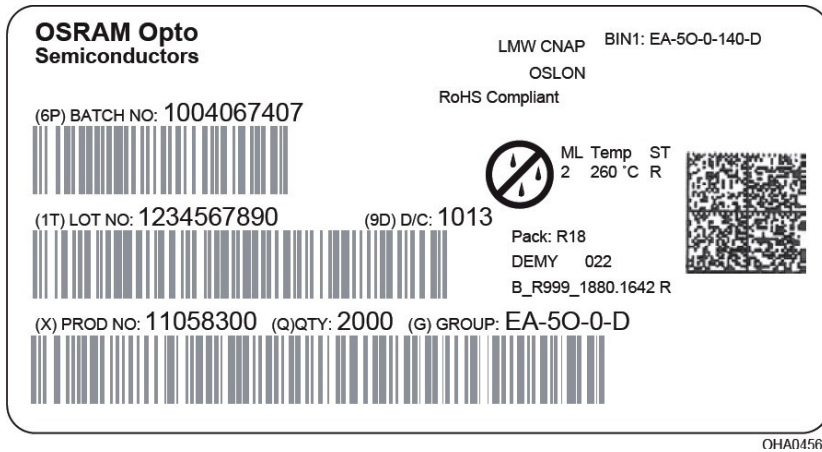
The card may be reused as long all the sensors elements are blue.

Dry pack labels

The following two labels are applied to the outside of the dry pack bag:

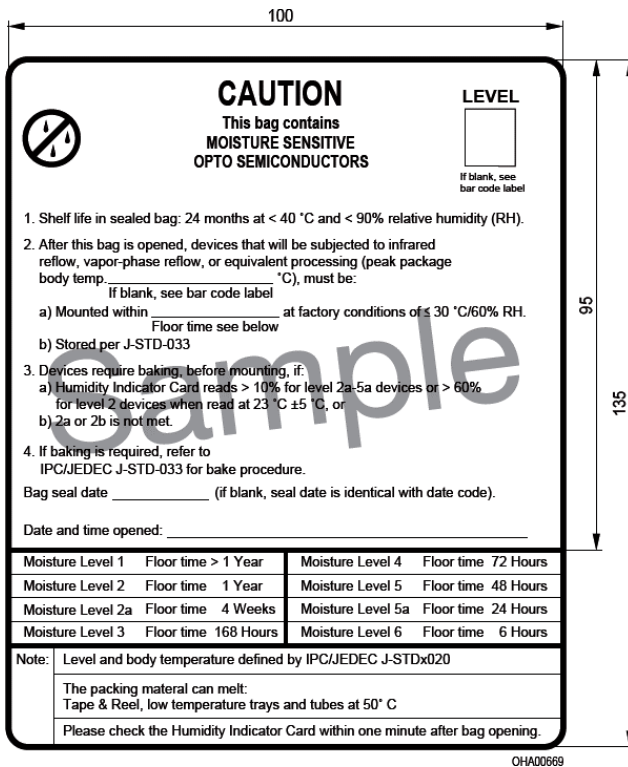
A standard Barcode-Product-Label (BPL), identifies the contents by: producer (OSRAM Opto Semiconductors), country of origin, product designation, lot number, date code, material number and quantity. The BPL also includes a reference to ESD and if necessary extra details of the Moisture Level, development designation, brightness class and laser stamp (see Figure 3).

Figure 3: Barcode-Product-Label is applied to the outside of the dry pack bag



An OSRAM Opto Semiconductor dry pack caution label, which identifies the sealing date of the bag, the moisture level, the dry pack expiration date (which is 24 month later), as well as product handling guidelines (see Figure 4). Here the moisture level for the humidity indicator card can be found.

Figure 4: Moisture sensitive label or print is applied to the outside of the dry pack bag



D. Handling dry packed parts

Incoming inspection

Moisture-sensitive components are shipped in vacuum-sealed moisture barrier bags packed with a desiccant material and a humidity indicator card.

Upon receipt, the bags should be inspected for damage to ensure that the bag integrity has been maintained. Inspection should verify no holes, gouges, tears, or punctures of any kind that may expose the contents of the bag.

Opening moisture barrier bags

To open the bag, simply cut across the top of the bags as close to the original seal as possible being careful not to damage the contents.

Before using dry packed components, it is essential that the humidity indicator be checked immediately after bag opening. Should it indicate a RH of less than 10 % (the color of the 10 % dot has not changed from blue to pink), the components contained are ready for use.

If the humidity indicator in the dry pack shows a RH of more than 10 % (the color of the 10 % dot has changed from blue to pink), the components must be rebaked. Level 2 products only have to be re-baked if the 60 % dot has changed the color to pink. To find out, which MSL level is relevant, have a look at the chapter “Dry pack labels”.

In addition please check the dry pack for damage on opening or storage under too severe climatic condition.

Once the dry pack bag is opened, the desired quantity of units should be removed and the bag resealed within two hours. If the bag is left open longer than 30 minutes the desiccant should be replaced with dry desiccant. The closed desiccant pouches may be dried by baking them at 120 °C – 125 °C for 16 hours if the material of the bag is heat resistant.

Rebaking of devices

If devices have exceeded the specified floor life time for exposure described below or the indicator in a dry pack shows a RH of more than 10 %, they may be baked according IPC/JEDEC J-STD- 033B. When baking products on reel, it is recommended to use 40°C and the baking time for this temperature.

For example MSL 2a and 1.4 mm - 2.0 mm package thickness the baking time would be 22 days.

For a shorter baking time higher temperatures are required according IPC/JEDEC J-STD- 033B.

Note: When baking a product at 50 °C to 125 °C, the product must be put in metal tubes or metal trays, not in the tubes or reels in which the product was shipped.

Resealing a dry pack

After the devices have completed the baking period they should immediately be resealed in the moisture proof bags. If not all the components from a dry pack are used, the original desiccant and humidity detector should be reinserted and the dry pack resealed by using commercially available vacuum – heat – sealing equipment. New desiccant must be added if the humidity indicator has changed

color. Once the devices are removed from the dry pack bag, the total exposure time to the factory environment, prior to mounting the parts onto a circuit board, should not exceed the recommended time specified on the dry pack caution label. (see item 2a in Figure 4). This out-of-bag time varies depending on the moisture-sensitivity rating for the product. If the cumulative out-of-bag time for the components exceeds 6 hours at 30 °C and 60 % RH the allowable floor life specified by the manufacturer must be adjusted accordingly. For example, if the manufacturer specifies Level 3 with a floor life of 168 hours and the components are out of the bag for 24 hours, then an adjusted floor life of 144 h should be written on the label.

Storing unpacked devices

Unpacked devices may be mounted under environmental conditions not exceeding 30 °C and humidity levels of 60 % RH. Devices must be soldered on a printed circuit board (PCB) assemblies within specified floor life hours, described in Table 1.

Table 1: Moisture sensitive level

Moisture Sensitive Level	Floor life
1	no limit
2	1 year
2a	4 weeks
3	168 hours
4	72 hours
5	48 hours
5a	24 hours
6	6 hours

The floor life of in-process materials may be extended by the use of controlled environments. Packages may be stored outside the Moisture Barrier Bag independent of moisture/reflow sensitivity considerations, if the ambient relative humidity is ≤ 10 % RH. The use of desiccator cabinets with dry N₂ or dry air is suggested for such storage. Please refer also to ZVEI "Guidelines for the Long-Term Storage of Components, Subassemblies and Devices".

Storing moisture-proof packs prior to opening

Devices packaged in moisture-proof packaging should be stored in ambient conditions not exceeding temperatures of 40 °C or humidity levels of 90 % RH. Storage life at these conditions should not exceed 24 months.



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ABOUT OSRAM OPTO SEMICONDUCTORS

OSRAM, Munich, Germany is one of the two leading light manufacturers in the world. Its subsidiary, OSRAM Opto Semiconductors GmbH in Regensburg (Germany), offers its customers solutions based on semiconductor technology for lighting, sensor and visualization applications. OSRAM Opto Semiconductors has production sites in Regensburg (Germany), Penang (Malaysia) and Wuxi (China). Its headquarters for North America is in Sunnyvale (USA), and for Asia in Hong Kong. OSRAM Opto Semiconductors also has sales offices throughout the world. For more information go to www.osram-os.com.

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The logo consists of the word "OSRAM" in a large, bold, orange sans-serif font. Below it, the words "Opto Semiconductors" are written in a smaller, black sans-serif font.