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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Surface mounting technology –
Part 4: Classification, packaging, labelling and handling of moisture sensitive devices

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Technique du montage en surface (SMT) –
Partie 4: Classification, emballage, étiquetage et manipulation des dispositifs sensibles à l'humidité

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SURFACE MOUNTING TECHNOLOGY –

Part 4: Classification, packaging, labelling and handling of moisture sensitive devices

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IEC 61760-4 edition 1.1 contains the first edition (2015-05) [documents 91/1244FDIS and 91/1259/RVD] and its amendment 1 (2018-03) [documents 91/1419/CDV and 91/1486/RVC].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 61760-4 has been prepared by IEC technical committee 91: Electronics assembly technology.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61760, published under the general title *Surface mounting technology*, can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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INTRODUCTION

Due to the higher temperature profiles of reflow soldering processes using tin-silver-copper alloys or other lead-free solder alloys with higher melting temperatures than Sn-Pb eutectic solder, the sensitivity of components against soldering heat, when being exposed to moisture before soldering, becomes an increasingly important factor.

The currently existing standards describing the moisture sensitivity classification of devices are applicable for plastic encapsulated semiconductors and similar solid state packages (e.g. IEC 60749-20), but not for other types of components.

This part of IEC 61760 also extends the classification and packaging methods as described in J-STD-020 and J-STD-033. It is intended to be used for such type of components, where J-STD-020 and J-STD-033 are not required or not appropriate.

It is important to note that moisture sensitivity levels existing in both J-STD 020 and IEC 61760-4 are equivalent.

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SURFACE MOUNTING TECHNOLOGY –

Part 4: Classification, packaging, labelling and handling of moisture sensitive devices

1 Scope

This part of IEC 61760 specifies the classification of moisture sensitive devices into moisture sensitivity levels related to soldering heat, and provisions for packaging, labelling and handling.

This part of IEC 61760 extends the classification and packaging methods to such components, where currently existing standards are not required or not appropriate. For such cases this standard introduces additional moisture sensitivity levels and an alternative method for packaging.

This standard applies to devices intended for reflow soldering, like surface mount devices, including specific through-hole devices (where the device supplier has specifically documented support for reflow soldering), but not to

- semiconductor devices,
- devices for flow (wave) soldering.

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NOTE Background of this standard and its relation to currently existing standards, e.g. IEC 60749-20 or J-STD-020 and J-STD-033, are described in the INTRODUCTION.

2 Normative references

IEC 61760-4:2015

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 60749-20, *Semiconductor devices – Mechanical and climatic test methods – Part 20: Resistance of plastic encapsulated SMDs to the combined effect of moisture and soldering heat*

IEC 61340-5-1, *Electrostatics – Part 5-1: Protection of electronic devices from electrostatic phenomena – General requirements*

IEC 61760-2, *Surface mounting technology – Part 2: Transportation and storage conditions of surface mounting devices (SMD) – Application guide*

~~IPC/JEDEC J-STD-020D.1, March 2008, *Moisture/Reflow Sensitivity Classification for Non-hermetic Solid State Surface Mount Devices*~~

IPC/JEDEC J-STD-020E, January 2015, *Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
moisture sensitive device
MSD
device, where during soldering the evaporation of absorbed moisture is likely to deteriorate its electrical or mechanical performance compared to what is given in the relevant specification

Note 1 to entry: This note applies to the French language only.

3.2
moisture sensitivity level
MSL
rating indicating a device's susceptibility to damage due to absorbed moisture when subjected to reflow soldering

Note 1 to entry: This note applies to the French language only.

3.3
moisture barrier bag
MBB
bag designed to restrict the transmission of water vapour and used to pack moisture sensitive devices

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Note 1 to entry: This note applies to the French language only.

3.4
manufacturer's exposure time
MET
maximum time after baking that the component manufacturer requires to process components prior to sealing of the bag

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Note 1 to entry: The manufacturer's exposure time also includes the maximum time allowed at the distributor in order to keep the bag open to split up its content into smaller shipments.

Note 2 to entry: This note applies to the French language only.

3.5
floor life
allowable time for a device or semi-finished assembly to be exposed to normal room environment humidity and temperature after removal from a moisture barrier bag or storage chamber and before a solder reflow process

3.6
shelf life
recommendation of time that products can be stored in the original packaging, during which the defined quality of the goods remains acceptable under specified conditions of transportation, storage and handling

3.7
active desiccant
absorbent material used to maintain a low relative humidity

3.8
unit of desiccant
amount of active desiccant that will absorb a minimum of 2,85 g of water vapour at 25 °C and a relative humidity of 20 % within 24 h

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3.9
moisture indicating desiccant
desiccant whose colour (hue) changes perceptibly, when a certain relative humidity is exceeded

Note 1 to entry: Typically a colour change due to a moisture indicating desiccant is from blue to pink, when the change from dry state to wet state is detected.

3.10
humidity indicator card
HIC
card on which a moisture sensitive chemical is printed such that it changes colour from dry to wet when the indicated relative humidity is exceeded

Note 1 to entry: This note applies to the French language only.

3.11
water vapour transmission rate
WVTR
measure of the permeability of a plastic film material to moisture, used to specify a moisture barrier bag for dry packing

Note 1 to entry: This note applies to the French language only.

4 General information

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4.1 Moisture sensitive devices

Certain materials, plastic polymers and fillers are hygroscopic and can absorb moisture dependent on time and the storage environment. Absorbed moisture will vaporize during rapid heating in the solder reflow process, generating

- pressure in the material,
- deformation,
- swelling,
- delamination,
- cracking,
- degradation of inner connection.

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The penetration of moisture into the absorbing material is generally caused through exposure to the ambient air. Moisture absorption or moisture penetrating into cavities can lead to moisture concentrations in the device which are high enough to cause cracking and/or delamination to the device during the soldering process (e.g. “popcorn phenomenon”), which may adversely affect reliability.

NOTE “Popcorn phenomenon”: internal stress causes the package to bulge and then crack with an audible “pop”.

Moisture can also influence the bonding strength of adhesives, sealings, encapsulants, plastics with galvanic coating, etc.

Moisture exposure also can induce the transport of ionic contaminations into the device, thereby increasing the potential for circuit failure due to corrosion.

Hence it is necessary to dry moisture-sensitive devices, to seal them in a moisture barrier bag and only to remove them immediately prior to soldering onto the PCB. The permissible time from the opening of the moisture barrier bag until the final soldering process that a device can remain unprotected in an environment with a level of humidity approximating to real-world

conditions (e.g. 30 °C/60 % RH) is a measure of the sensitivity of the device to ambient humidity. This amount of time is called floor life.

4.2 Moisture sensitivity level (MSL)

The moisture sensitivity level (MSL) is determined at the classification temperature, which is set above practical soldering temperatures. The actual soldering temperature measured at the top surface of the component therefore shall be less than the classification temperature.

Packaging, storage, floor life and pre-treatment of moisture sensitive devices before being subjected to reflow soldering processes are identified by the MSL (see Clause 5 and Table 1).

The method for classification of devices into MSL is described in Clause 6.

4.3 Relation to other environmental test methods (humidity tests)

In humidity tests, e.g. as in IEC 60068-2-78, devices are tested as they are (unmounted) or in mounted condition, e.g. soldered to a test board. These tests detect the influence of adsorbed or absorbed moisture to the performance of the device, e.g. electrical characteristics, corrosion effects, but cannot detect the influence of absorbed moisture to the sensitivity against heat stresses of the soldering processes.

The target of the test method described in this standard is to test the resistance of devices against the soldering heat in combination with the humidity load as preconditioning process.

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Other effects of humidity, like detoriation of electrical characteristics or isolation properties, are not covered by this standard and need to be tested separately.

5 Assessment of moisture sensitivity

5.1 Identification of non moisture sensitive devices

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Non moisture sensitive devices shall be identified by analysis of design and materials of devices depending on whether they can absorb humidity, or humidity can penetrate into cavities. If the materials apparently do not absorb humidity, the devices may be declared by the manufacturer as non moisture sensitive.

Such non moisture sensitive devices shall be designated as level "N". There are no requirements for non moisture sensitive devices.

5.2 Classification

The procedure to classify moisture sensitive devices into MSL is described in Clause 6. The devices are classified at the appropriate classification temperature selected from Table 3 and Table 4.

The recommended procedure is to start testing at the lowest moisture sensitivity level, which the evaluation package is reasonably expected to pass (based on knowledge of other similar evaluation packages).

If supplier and user agree, components can be classified at temperatures other than those in Table 4.

If the conditions in Table 1 and/or Table 2 are not suitable for a specific product, other conditions can be applied according to the agreement between users and suppliers.