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Edition 2.0 2017-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Semiconductor devices – Mechanical and climatic test methods – Part 9: Permanence of marking

Dispositifs à semiconducteurs – Méthodes d'essais mécaniques et climatiques – Partie 9: Permanence du marquage

IEC 60749-9:2017-03(en-fr)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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CONTENTS

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SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

Part 9: Permanence of marking

FOREWORD

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International Standard IEC 60749-9 has been prepared by IEC technical committee 47: Semiconductor devices.

This second edition cancels and replaces the first edition published in 2002. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) revision to Clause 4 Equipment by a complete rewriting of Clause 3 Terms and definitions;
b) additional variant – 'adhesive tape pull test'.

This bilingual version (2019-09) corresponds to the monolingual English version, published in 2017-03.

The text of this standard is based on the following documents:

FDIS	Report on voting
47/2348/FDIS	47/2373/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

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

A list of all parts in the IEC 60749 series, published under the general title *Semiconductor devices – Mechanical and climatic test methods*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

Part 9: Permanence of marking

1 Scope

The purpose of this part of IEC 60749 is to determine whether the marks on solid state semiconductor devices will remain legible when subjected to the application and removal of labels or the use of solvents and cleaning solutions commonly used during the removal of solder flux residue from the printed circuit board manufacturing process.

This test is applicable for all package types. It is suitable for use in qualification and/or process monitor testing. The test is considered non-destructive. Electrical or mechanical rejects can be used for the purpose of this test.

NOTE 1 This procedure does not apply to laser branded packages.

Many available solvents that could be used are either not sufficiently active, too stringent, or even dangerous to humans when in direct contact or when fumes are inhaled.

NOTE 2 The composition of solvents used in this document is considered typical and representative of the desired stringency as far as the usual coatings and markings are concerned.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
solvent A
mixture consisting of the following:

- one part by volume of isopropyl alcohol;
- three parts by volume of volatile petroleum spirits with a flash point greater than 60 °C, or
- three parts by volume of a mixture of 80 % by volume of kerosene and 20 % by volume of ethylbenzene

Note 1 to entry: The solvent should be maintained at a temperature of 20 °C to 30 °C.

3.2
solvent B
semi-aqueous based solvent, (defluxer), e.g. a terpene, aliphatic hydrocarbons, high molecular weight alcohols, etc., or any equivalent national environmental agency-approved HCFC (hydrochlorofluorocarbon), terpene or demonstrated equivalent

3.3
solvent C
mixture consisting of the following:

a) two parts by volume of deionized water;

b) one part by volume of propylene glycol monomethyl ether (laboratory reagent grade);

c) one part by volume of monoethanolamine (laboratory reagent grade)

Note 1 to entry: The solvent should be maintained at a temperature of 63 °C to 70 °C.

3.4
brush
toothbrush with a handle made of a non-reactive material

Note 1 to entry: The brush should have at least three long rows of hard bristles, the free ends of which should lie substantially in the same plane. The toothbrush should be used exclusively with a single solvent and when there is any evidence of softening, bending, wear, or loss of bristles, it should be replaced.

3.5
brush stroke
brush stroke for solvent resistance testing is with normal hand pressure, approximately 0,6 N to 0,8 N

Note 1 to entry: The brush stroke is directed in a forward direction, across the symbolized surface of the device being tested.

3.6
adhesive tape
narrow strip of material, typically used to stick, hold or fasten, with the following properties:

a) physical properties
   - total thickness (mm) 0,06
   - elongation (%) 20
   - tensile (N/100mm) 440
   - adhesion (N/100mm) 25 to 55
   - application temperature (°C) 10 to 55

b) electrical properties (required only to make the test non-destructive)
   - static charge generation (V) (23 ± 2 °C, 50 ± 5 %RH)
   - roll strip <50
   - plate strip <50
   - surface resistivity (Ω) [IEC 61340-2-3] 5 x 109
   - charge decay time, seconds [FED-STD-101C, Method 4046] <0,1

Note 1 to entry: Some adhesive tapes can generate electrostatic charges which cause potential ESD damage to the devices under test. Where this test is to be applied non-destructively, it is recommended that the electrical characteristics of the adhesive tape are verified with the manufacturer.

Note 2 to entry: The SI unit of surface resistivity (Ω) is sometimes referred to as Ω/sq (ohms per square), to distinguish resistivity values from resistance values. However, the use of Ω/sq is deprecated because it can imply a resistance per unit area, which is not correct.

4 Equipment

The equipment used consists of the following:

a) three brushes as defined above;

b) three containers (beakers), a minimum of 400 ml to 500 ml in size, each made from non-reactive materials such as stainless steel, naldene, or glass;

c) an explosive-proof hot plate capable of maintaining solvents B and C at the temperatures defined above.

5 Safety precautions

Solvents listed above exhibit some potential health, environmental and safety hazards. The following safety requirements and precautions are to be followed at all times:

a) always work under a well-vented hood. Avoid inhalation of vapours at all times;

b) safety glasses/eye protection and solvent resistant gloves must be worn at all times while performing this test;

c) solvents are to be kept in covered vessels at all times when not in direct use;

d) avoid contact with skin or eyes, and exposures to open flames or hot surfaces.

6 Procedure

6.1 Solvents test

The solvents test is performed in the order shown below:

a) Label the three vessels, three brushes, and three tweezers, A, B, and C. Divide the test specimens into three equal groups and fill the three vessels with the appropriate solvents A, B, and C, respectively.

b) Each test group, along with a brush, shall be totally immersed for 1 min in each of the solvents.

c) At the end of the exposure time, the specimens shall be removed from each solvent and brushed with normal pressure (approximately 0,6 N to 0,8 N) for ten strokes in a forwards direction on the portion of the specimen where the marking is present.

d) At the conclusion of the brushing, place the devices and the brush back into the vessel of the appropriate solvent.

e) Repeat the procedure above until a total of three immersions and brushings has occurred.

f) Following the third immersion and brushing, rinse the specimens with deionized water, place them on a clean surface, and allow them to dry at room temperature for a minimum of 5 min before inspection.

6.2 Tape pull test

The tape pull test is performed in the order shown below:

a) Obtain marked devices and ensure the ink has been cured. The parts shall be at room temperature and the surfaces should be clean and dry.

b) Place devices mark side up onto the conductive foam mat to provide ESD protection.

c) Remove the tape from the dispenser at a continuous rate as opposed to jerking the tape. The amount of tape shall be sufficient to cover the marked area of the device.

d) Place the tape over the marked portion of one device.

e) Use firm finger pressure to ensure that the entire surface of the marked area is in contact with the tape. Ensure all bubbles are removed from under the tape.

NOTE If the entire surface of the marked area is not covered, then two pieces of tape can be used.

f) Lift the tape off the device in one continuous pull at approximately 2 cm/s and at approximately a 90° angle to the device under test.

g) Observe the mark on the device to see if any portion of the mark came off with the tape.

h) The tape pull test shall be repeated for a total of 3 times.

7 Failure criteria

After subjection to the test, evidence of damage to the device and any specified markings which are missing in whole or in part, faded, smeared, blurred, or shifted (dislodged) to the extent that they cannot be readily identified from a distance of at least 15,0 cm with normal room lighting and without the aid of magnification or with a viewer having a magnification of no greater than 3× shall constitute a failure.

8 Summary

The following details shall be specified in the applicable procurement document:

a) the number of parts to be tested and the acceptance number;

b) any exceptions or changes from standard procedure that are required for a particular device.

Bibliography

IEC 61340-2-3:2016, *Electrostatics – Part 2-3: Methods of test for determining the resistance and resistivity of solid materials used to avoid electrostatic charge accumulation*

FED-STD-101C, *Test procedures for packaging materials; Method 4046, Electrostatic properties of materials*

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