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BSI Standards Publication

Semiconductor devices — mechanical and climatic test methods

Part 42: Temperature humidity storage

National foreword

This British Standard is the UK implementation of EN 60749-42:2014. It is identical to IEC 60749-42:2014.

The UK participation in its preparation was entrusted to Technical Committee EPL/47, Semiconductors.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Foreword

The text of document 47/2200/FDIS, future edition 1 of IEC 60749-42, prepared by IEC/TC 47 "Semiconductor devices." was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60749-42:2014.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-06-16
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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
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	EN 60749-20	-

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SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

Part 42: Temperature and humidity storage

1 Scope

This part of IEC 60749 provides a test method to evaluate the endurance of semiconductor devices used in high temperature and high humidity environments.

This test method is used to evaluate the endurance against corrosion of the metallic interconnection of chips of semiconductor devices contained in plastic moulded and other types of packages. It is also used as a means of accelerating the leakage phenomena due to the moisture penetration through the passivation film and as a pre-conditioning for various kinds of tests.

2 Normative references

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 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*

3 Test equipment

3.1 Capacity of the equipment

The chamber to be used in this test shall be capable of maintaining the test temperature and humidity conditions specified in 4.3 throughout the test duration.

3.2 Materials and construction of the thermostatic/humidistatic chamber

The chamber shall be made of materials that do not deteriorate under high humidity conditions. The design of the chamber shall prevent water condensed on the ceiling of the chamber from dropping on the specimen.

3.3 Water to be used in the test

Water to be used in the tests shall be distilled water or deionised water, with a resistivity of 500 Ωm or more at 23 °C.

4 Procedure

4.1 Preconditioning

When the specimen is a plastic-moulded SMD, the moisture soaking and soldering heat stress treatment specified in IEC 60749-20 shall be carried out before executing this test.

4.2 Initial measurements

The initial measurements shall be carried out in accordance with the applicable procurement document.

4.3 Tests

4.3.1 Inserting and removing specimens

The specimens shall be placed in the chamber at the high temperature and high humidity conditions required by the applicable procurement document. When putting the specimen in and out of the chamber, care shall be taken to ensure that water droplets not to adhere to the specimen and that the specimen does not come into contact with any condensed water.

NOTE When a SMD is to be mounted on a jig for evaluation, the relevant conditions (board materials, size of the land, soldering method, flux cleaning, etc.) are specified in the applicable procurement document.

4.3.2 Test conditions

The temperature and humidity conditions shall be selected from Table 1. Unless otherwise required by the applicable procurement document, condition C shall be used. Where Conditions D, E, and F are specified, the temperature shall be controlled from the start to the end of the test and the humidity shall be controlled between temperature ramp-up and temperature ramp-down, in accordance with the profile of Figure 1, unless otherwise specified in the applicable procurement document. Care should be taken because failure modes consisting of short-circuits (leaks) between external leads through plating metal, that do not occur in the field, may occur under condition C (temperature 85 °C, humidity 85 %), and conditions D, E, and F (the unsaturated pressurized vapour test).

4.3.3 Test duration

The test duration shall be in accordance with Table 1, except when otherwise specified in the applicable procurement document. In this case, acceleration and diffusion models that estimate moisture exposure duration in the use conditions shall be documented and added to the procurement document. Under conditions D, E, and F, the time count shall be started when the vapour pressure and temperature stabilise as shown in Figure 1.

Table 1 – Temperature and humidity storage test conditions

Test condition	Temperature °C	Humidity %	Test duration h	Vapor pressure[a] Pa
A	40 ± 2	90 ± 5	$8\,000\ ^{+168}_{-24}$	$7{,}4 \times 10^3$
B	60 ± 2	90 ± 5	$4\,000\ ^{+168}_{-24}$	$1{,}9 \times 10^4$
C	85 ± 2	85 ± 5	$1\,000\ ^{+168}_{-24}$	$5{,}0 \times 10^4$
D	110 ± 2	85 ± 5	$264\ ^{+8}_{0}$	$1{,}2 \times 10^5$
E	120 ± 2	85 ± 5	$168\ ^{+4}_{0}$	$1{,}7 \times 10^5$
F	130 ± 2	85 ± 5	$96\ ^{+2}_{0}$	$2{,}3 \times 10^5$

[a] Reference value

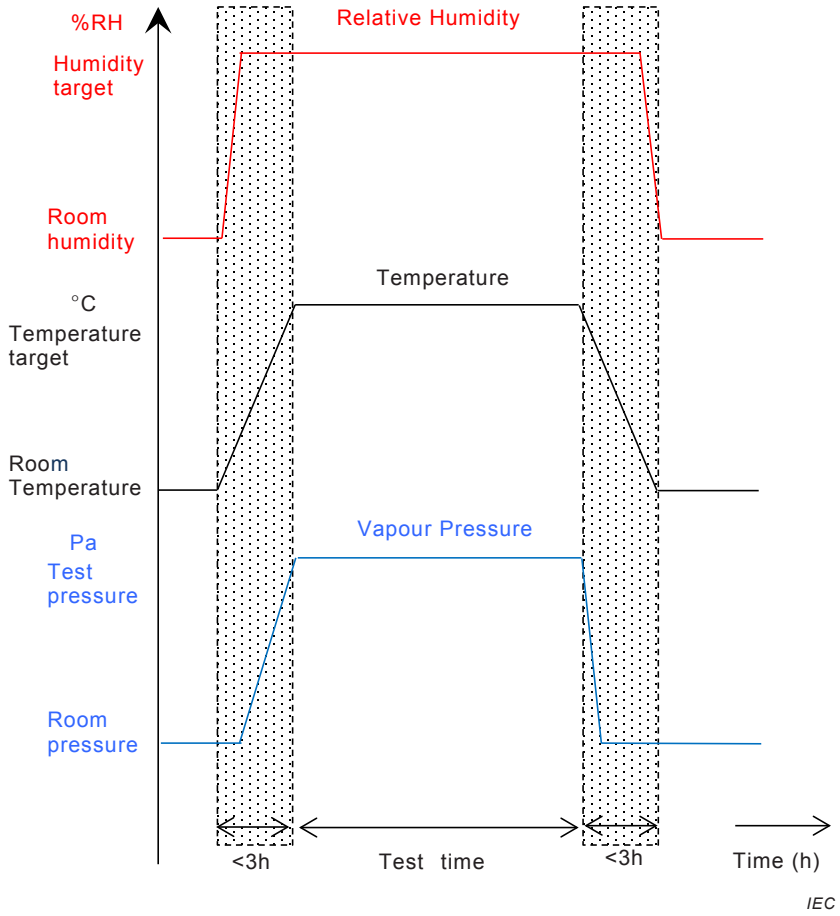

Figure 1 – Unsaturated pressurized vapour test conditions profile

4.3.4 Post treatment

After completion of the test and confirmation that the interior of the chamber has returned approximately to the specified temperature and humidity profile, the specimen shall be removed from the chamber and left at room temperature. The specimens shall be maintained at room ambient, for between 2 h and the completion of the electrical test.

Under conditions D, E, and F, special care shall be taken when handling the specimen after finishing the test, because failure modes different from those ones of the tests may occur due to condensation, sudden changes in the temperature and pressure, and other relevant factors.

4.3.5 End-point measurement

The end-point measurements shall be carried out according to the applicable procurement document.

These measurements shall be carried out within 48 h at room ambient after the completion of the tests, except when otherwise specified in the applicable procurement document.

NOTE Where completion of the end point measurement is expected to exceed 48 h, the moisture loss can be reduced by placing the device in a moisture barrier bag sealed in ambient air without vacuum or desiccant within 6 h after removal from the test chamber.

5 Failure criteria

A device will be considered to have failed if parametric limits are exceeded, or if functionality cannot be demonstrated under nominal and worst-case conditions, as specified in the relevant

specification or data sheet. Electrical failures due to external package damage which are an artefact of the test method shall be excluded from the failure classification.

6 Information to be given in applicable procurement document

a) initial measurements (see 4.2);
b) test condition (other than as specified) (see 4.3.2);
c) test duration (other than as specified) (see 4.3.3);
d) post treatment (other than as specified) (see 4.3.4);
e) end-point measurements (other than as specified) (see 4.3.5);
f) storage conditions (other than as specified) (see 4.3.5).

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