JEDEC STANDARD

Accelerated Moisture Resistance - Unbiased Autoclave

JESD22-A102-C

(Revision of JESD22-A102-B)

DECEMBER 2000

JEDEC SOLID STATE TECHNOLOGY ASSOCIATION

Electronic Industries Alliance

NOTICE

JEDEC standards and publications contain material that has been prepared, reviewed, and approved through the JEDEC Board of Directors level and subsequently reviewed and approved by the EIA General Counsel.

JEDEC standards and publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for use by those other than JEDEC members, whether the standard is to be used either domestically or internationally.

JEDEC standards and publications are adopted without regard to whether or not their adoption may involve patents or articles, materials, or processes. By such action JEDEC does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the JEDEC standards or publications.

The information included in JEDEC standards and publications represents a sound approach to product specification and application, principally from the solid state device manufacturer viewpoint. Within the JEDEC organization there are procedures whereby an JEDEC standard or publication may be further processed and ultimately become an ANSI/EIA standard.

No claims to be in conformance with this standard may be made unless all requirements stated in the standard are met.

Inquiries, comments, and suggestions relative to the content of this JEDEC standard or publication should be addressed to JEDEC Solid State Technology Association, 2500 Wilson Boulevard, Arlington, VA 22201-3834, (703)907-7560/7559 or www.jedec.org

Published by
JEDEC Solid State Technology Association 2000
2500 Wilson Boulevard
Arlington, VA 22201-3834

PRICE: Please refer to the current
Catalog of JEDEC Engineering Standards and Publications or call Global Engineering Documents, USA and Canada (1-800-854-7179), International (303-397-7956)

PLEASE!

DON'T VIOLATE
THE
LAW!

JEDEC Solid State Technology Association
2500 Wilson Boulevard
Arlington, Virginia 22201-3834
or call (703) 907-7559

ACCELERATED MOISTURE RESISTANCE - UNBIASED AUTOCLAVE

(From JEDEC Board Ballot JCB-00-55, formulated under the cognizance of the JC-14.1 Subcommittee on Reliability Test Methods for Packaged Devices.)

1 Purpose

The " Unbiased Autoclave Test" is performed to evaluate the moisture resistance integrity of non-hermetic packaged solid state devices using moisture condensing or moisture saturated steam environments. It is a highly accelerated test which employs conditions of pressure, humidity and temperature under condensing conditions to accelerate moisture penetration through the external protective material (encapsulant or seal) or along the interface between the external protective material and the metallic conductors passing through it. This test is used to identify failure mechanisms internal to the package and is destructive.

2 Scope

This test method applies primarily to moisture resistance evaluations and robustness testing. Samples are subjected to a condensing, highly humid atmosphere under pressure to force moisture into the package to uncover weaknesses such as delamination and metallization corrosion. This test is used to evaluate new packages or packages that have undergone changes in materials (e.g. mold compound, die passivation) or design (e.g. die/paddle sizes). However, this test should not be applied on laminate or tape based packages i.e. FR4 material, polyimide tape or equivalent.

Some cautions should be considered when performing this test and evaluating test results. Failure mechanisms, both internal (e.g., due to plastic package swelling from saturation) and external (e.g. dendritic growth of conducting material between leads), may be produced which are not applicable to the intended application use conditions. Most semiconductor components are not rated for field applications conditions exceeding 95% RH, including condensing moisture such as rain or fog. The combination of high humidity, high temperature ($>T_g$) and high pressure may produce unrealistic material failures because absorbed moisture typically decreases the glass transition temperature for most polymeric materials. Extrapolation of autoclave test results to arrive at an application life should be accomplished with care.

3 Apparatus

The test requires a pressure chamber capable of maintaining a specified temperature, and relative humidity.

3.1 Records

A permanent record of the temperature profile for each test cycle is recommended, so the stress conditions can be verified.

3 Apparatus (cont'd)

3.2 Devices under stress

Devices under stress shall be no closer than 3 cm from the internal chamber surface, and must not be subjected to direct radiant heat.

3.3 Ionic contamination

Ionic contamination of the test apparatus and storage chamber shall be controlled to avoid test artifacts.

3.4 Distilled or deionized water

Distilled or deionized water with a minimum resistivity of 1 megaohm-cm at room temperature shall be used.

4 Test conditions

Test conditions consist of a temperature, relative humidity, vapor pressure and duration.

Table 1 — Temperature, relative humidity and pressure[2,3]

Temperature[1] (dry bulb °C)	Relative humidity[1] (%)	Vapor pressure (psia/kPa)
121 ± 2	100%	29.7/205

NOTES

1 Tolerances apply to the entire usable test area.

2 The test conditions are to be applied continuously except during any interim readouts. For interim readouts, devices should be returned to stress within the time specified in 5.2

3 Previous revisions of this document specified the following test conditions:

Condition	Duration
A	24 hours (-0,+2)
B	48 hours (-0, +2)
C	96 hours (-0, +5)
D	168 hours (-0, +5)
E	240 hours (-0, +8)
F	336 hours (-0, +8).

The stress duration is specified by internal qualification requirements, JESD47 or the applicable procurement document. 96 hours duration is typical for this test.

4 Test conditions (cont'd)

CAUTION: For plastic-encapsulated microcircuits, it is known that moisture reduces the effective glass transition temperature of the molding compound. Stress temperatures above the effective glass transition temperature may lead to failure mechanisms unrelated to operational use.

5 Procedure

The test devices shall be mounted in a manner which exposes them to the specified temperature and humidity conditions. Exposure of devices to ambient environments greater than 100 ^{o}C and less than 10% R.H. shall be avoided, particularly during stress ramp-up, ramp-down and the pre-readout drying period. Care should be taken through equipment control or cool down procedures to prevent destructive depressurization of the parts under test. Frequent cleaning of the test chamber is necessary to ensure elimination of contamination.

5.1 Test clock

The test clock starts when the temperature and relative humidity reach the set points specified in clause 4.0 and stops at the beginning of ramp-down.

5.2 Readout

Electrical test shall be performed not sooner than 2 hours and not later than 48 hours after the end of ramp-down with room temperature testing done first in the sequence of testing. Note: For intermediate readouts, devices shall be returned to stress within 96 hours of the end of ramp-down. The rate of moisture loss from devices after removal from the chamber can be reduced by placing the devices in sealed moisture barrier bags, the bags should be non-vacuum sealed without a N2 purge and without dessicant. When devices are placed in sealed bags, the "test window clock" runs at 1/3 of the rate of devices exposed to the laboratory ambient. Thus the test window can be extended to as much as 144 hours, and the time to return to stress to as much as 288 hours by enclosing the devices in sealed moisture barrier bags. Devices that exceed the test window clock or extension shall be removed from test and shall have new samples submitted for testing.

Condensed moisture on the exterior surface of the device package may be removed through contact with an absorbing medium or isopropyl alcohol. Because the purpose of this test is to identify failure mechanisms internal to the package, cleaning of the packaged device or leads is permitted, providing it doesn't induce anomalous failures or obscure valid failures.

5.3 Handling

Hand-coverings which eliminate any source of ancillary contamination or ESD damage shall be used to handle devices and test fixtures. Contamination control is important in the application of this test method and any highly-accelerated moisture stress test.

6 Failure criteria

A device under accelerated moisture resistance shall be defined a failure if its parametric limits are exceeded, or its functionality cannot be demonstrated under nominal and worst-case conditions as specified in the applicable procurement document or data sheet. Electrical failures due to external package damage which are an artifact of the test method shall be excluded from the failure classification.

7 Safety

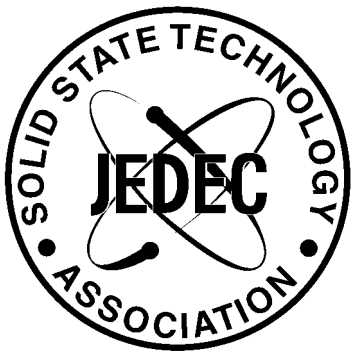
Follow equipment manufacturer's recommendation and local safety regulations.

8 Summary

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

(a) Test duration.

(b) Measurements after test.


SOLID STATE TECHNOLOGY
JEDEC
ASSOCIATION