JEDEC STANDARD

Mechanical Shock

JESD22-B104C

(Revision of JESD22-B104-B)

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JEDEC SOLID STATE TECHNOLOGY ASSOCIATION

JEDEC Solid State Technology Association

EIA Electronic Industries Alliance

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TEST METHOD B104C
MECHANICAL SHOCK

(From JEDEC Board Ballot JCB-04-70, formulated under the cognizance of the JC-14.1 Subcommittee on Reliability Test methods for Packaged Devices.)

1 Scope

The Mechanical Shock Test Method is intended to evaluate component(s) for use in electrical equipment. It is intended to determine the compatibility of the component(s) to withstand moderately severe shocks as a result of suddenly applied forces or abrupt change in motion produced by handling, transportation or field operation. Mechanical Shock of this type may disturb operating characteristics, particularly if the shock pulses are repetitive. This is a destructive test intended component qualification. It is normally applicable to cavity-type packages.

2 Apparatus

The shock-testing apparatus shall be capable of providing shock pulses up to a peak acceleration of 2900 multiples of gravity (G) with a pulse duration between 0.3 and 2.0 milliseconds (ms) to the body of the device and a velocity change of 48 to 214 inches per second (in/s), metric equivalent 122 to 543 cm/sec. The acceleration pulse shall be a half-sine waveform with an allowable deviation from specified acceleration level not greater than +/- 20% of the specified peak acceleration. This is determined by a transducer having a natural frequency[3] 5X the frequency of the shock pulse being established and measured through a low pass filter having a band width preferably at least 5X the frequency of the shock pulse being established. It is very important that the transducer resonance does not approach the measured value. Filtering should not be used in lieu of good measurement setup and procedure practices. The pulse duration shall be measured between the points at 10% of the peak acceleration during rise time and 10% of the peak acceleration during decay time. Absolute tolerances of the pulse duration shall be +/- 30% of the specified duration. It is recommended that the test velocity change shall be +/- 10% of the levels specified in Table 1.

3 Terms and definitions

3.1 Equivalent drop height

The free-fall drop height (in vacuum, under standard gravity, from rest) needed to attain a velocity equal to the velocity change specified in the tests. It is the theoretical height, which will impart the specified velocity change if impact with zero rebound occurs. This height is provided for reference only in the various service conditions.

3.2 Peak acceleration

The maximum of the acceleration interval of the dynamic motion of the test apparatus.

3 Terms and definitions (cont'd)

3.3 Pulse duration

The length of time between the beginning and the end of the acceleration interval. The beginning is defined as when the acceleration first reaches 10% of the specified peak level. The end is defined as when the acceleration first returns to 10% of the specified peak level after having reached the specified peak acceleration. level. The basic frequency of the pulse is 1/ (2X duration).

3.4 Service condition

The designation of the severity of test.

3.5 Velocity change

The integral of the acceleration interval of the dynamic motion of the test apparatus, over the duration of the entire impact event, including at least the pulse duration interval.

3.6 Vertical direction

The direction that is parallel with gravity and pointing away from earth.

3.7 Component

A packaged semiconductor device.

3.8 Cavity package

A component that has the device located within a cavity of the package body.

3.9 Deviation from specified acceleration level

Maximum difference of the measured acceleration from the target acceleration.

4 Procedure

The shock-testing apparatus shall be mounted on a sturdy laboratory table or equivalent base and leveled before use. Means shall be provided to prevent the shock from being repeated due to "bounce" in the apparatus. Unless otherwise specified, the device shall be subjected to five shock pulses of the peak (g) level specified in the selected test condition and for the pulse duration specified in each of the orientations X1, X2, Y1, Y2, Z1 and Z2, for a total of 30 shocks. One required orientation (Y1) should be defined as that one in which the internal element(s) is most likely to be removed from its mount.

Components subjected to the test will be randomly selected and typical of production. The component shall be rigidly mounted or restrained by its case with suitable protection for the leads. If component rework, burn in or other stressful process is possible, such a process or processes should be applied to the some component(s) prior to shock test. Use of such processes in the test hardware preparation will be documented in the test results.

4 Procedure (cont'd)

4.1 Component level test

Component level test consists subjecting the component(s) to at least one of the following service conditions. Service condition will be documented. Shock will be applied to the component outer surface casing in a manner to simulate expected impacts during processing, packaging, and packaged shipment. The components will be mounted in such a manner so that they experience the full-specified shock level at the component. At least five shocks in each of two directions of three orthogonal axes will be applied (minimum total of 30 shocks) at the severity of the designated service condition. See Table 1.

Table 1 — Component test levels

Service condition	Equivalent drop height (inches) / (cm)	Velocity change (in/s)/ (cm/s)	Acceleration peak (G)	Pulse duration (ms)
H	59 / 150	214 / 543	2900	0.3
G	51 / 130	199 / 505	2000	0.4
B	44 / 112	184 / 467	1500	0.5
F	30 / 76.2	152 / 386	900	0.7
A	20 / 50.8	124 / 316	500	1.0
E	13 / 33.0	100 / 254	340	1.2
D	7 / 17.8	73.6 / 187	200	1.5
C	3 / 7.62	48.1 / 122	100	2.0

4.2 Measurements

Hermeticity tests, if applicable, visual examination and electrical measurements (consisting of parametric and functional tests) shall be performed.

5 Failure criteria

A component shall be defined as a failure if hermeticity requirements cannot be demonstrated, if parametric limits are exceeded or if functionality cannot be demonstrated under the conditions specified in the applicable procurement document. Mechanical damage, such as cracking, chipping or breaking of the package will also be considered a failure provided such damage was not caused by fixturing or handling and the damage is critical to component performance in the specific application.

6 Summary

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

a) Test service condition, for each test performed.
b) Electrical measurements.
c) Sample size and accept number.
d) Disposition of failures.
e) Hermetic leak rate (if applicable).
f) Description of mounted state test vehicle and fixture (if applicable).
g) Description of component pre-test stress history (if applicable).

Annex A (informative) Differences between JESD22-B104C and JESD22-B104-B

The following list briefly describes most of the changes made to entries that appear in this publication, JESD22-B104C, compared to its predecessor, JESD22-B104-B (March 2001). If the change to a concept involves any words added or deleted, it is included. Punctuation changes may not be included.

Page	Description of change
1	Modified Clause 2, Apparatus.
2	Modified 3.3, definition for pulse duration.
2	Added definition 3.9.

Standard Improvement Form **JEDEC JESD22-B104C**

The purpose of this form is to provide the Technical Committees of JEDEC with input from the industry regarding usage of the subject standard. Individuals or companies are invited to submit comments to JEDEC. All comments will be collected and dispersed to the appropriate committee(s).

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1. I recommend changes to the following:

☐ Requirement, clause number _____

☐ Test method number _____ Clause number _____

The referenced clause number has proven to be:

☐ Unclear ☐ Too Rigid ☐ In Error

☐ Other _____

2. Recommendations for correction:

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