IEC 60749-12

Edition 2.0 2017-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Semiconductor devices – Mechanical and climatic test methods – Part 12: Vibration, variable frequency

Dispositifs à semiconducteurs – Méthodes d'essais mécaniques et climatiques – Partie 12: Vibrations, fréquences variables

IEC 60749-12:2017-12(en-fr)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 31.080.01

ISBN 978-2-8322-5156-0

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

Part 12: Vibration, variable frequency

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60749-12 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) alignment with MIL-STD-883J Method 2007, Vibration, variable frequency.

The text of this International Standard is based on the following documents:

CDV	Report on voting
47/2386/CDV	47/2434/RVC

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.

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 12: Vibration, variable frequency

1 Scope

This part of IEC 60749 describes a test to determine the effect of variable frequency vibration, within the specified frequency range, on internal structural elements. This is a destructive test. It is normally applicable to cavity-type packages.

NOTE This test method describes a swept sine test. A random vibration test is described in JEDEC document JESD 22-B103.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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

4 Test apparatus

The apparatus for this test shall include equipment capable of providing the required variable frequency vibration at the specified level and the necessary optical and electrical equipment for post-test measurements.

5 Test method

The device shall be rigidly fastened on the vibration platform and the leads or cables adequately secured to avoid excessive lead resonance. The device shall be vibrated with simple harmonic motion having either a peak to peak amplitude of 1,5 mm (±10 %) or a peak acceleration of the specified test condition A, B, or C in Table 1, below.

Unless required by the relevant specification, the test conditions detailed in Table 1 below shall be applied. Test conditions shall be amplitude controlled below the crossover frequency and acceleration level controlled above. The vibration frequency shall be varied approximately logarithmically between 20 Hz and 2 000 Hz. The entire frequency range of 20 Hz to 2 000 Hz and return to 20 Hz shall be traversed in not less than 4 min. This cycle shall be performed 4 times in each of the orientations X, Y, and Z (total of 12 times), so that the motion shall be applied for a total period of not less than 48 min.

NOTE Alternative test conditions are listed in IEC 60068-2-6 and JEDEC document JESD 22-B103.

Table 1 – Test conditions

Test condition	Peak acceleration (m/s^2) $(+20\%\ 0)$
A	200
B	500
C	700

6 Examination and test measurements

After completion of the test, an external visual examination of the marking shall be performed without magnification or with a viewer having a magnification no greater than 3X and a visual examination of the case, leads, or seals shall be performed at a magnification between 10X and 20X. This examination and any additional specified measurements and examination shall be made after completion of the final cycle or upon completion of a group, sequence, or subgroup of tests which include this test.

When specified, devices with an internal cavity containing parts or elements subject to possible movement or breakage during vibration shall be further examined by radiographic examination or by delidding or opening and internal visual examination at 30X magnification to reveal damage or dislocation. Where this test is performed as part of a group or subgroup of tests, the post-test measurements or inspections need not be performed specifically at the conclusion of this test, but may be performed once at the conclusion of the group or subgroup.

Hermeticity tests for hermetic devices, visual examination, and electrical measurements that consist of parametric and functional testing shall be specified in the applicable procurement document.

7 Failure criteria

A device shall be considered a failure if hermetic limits are exceeded for hermetic devices, if parametric limits are exceeded or if functionality cannot be demonstrated under nominal and worst-case conditions specified in the applicable procurement document.

Mechanical damage such as cracking, chipping, or breaking of the package (10× to 20× magnification) shall also be considered as failures, provided such damage was not incurred by fixing or handling.

8 Summary

The following details shall be specified in the relevant specification:

a) electrical measurements, including any special acceptance criteria (see Clause 6);

b) sample size;

c) test conditions, if different from Clause 6;

d) hermeticity limits for hermetic devices (see Clause 6).

Bibliography

[1] MIL-STD-883J Method 2007, *Vibration, variable frequency*

[2] IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

[3] JESD22-B103, *Vibration, variable frequency*