SLOVENSKI STANDARD
SIST EN 60749-44:2017

01-januar-2017

Polprevodniški elementi - Metode za mehansko in klimatsko preskušanje - 44. del: Metoda za preskušanje učinka enkratnega dogodka z obsevanjem z nevtronskim snopom (IEC 60749-44:2016)

Semiconductor devices - Mechanical and climatic test methods - Part 44: Neutron beam irradiated single event effect (SEE) test method for semiconductor devices (IEC 60749-44:2016)

Ta slovenski standard je istoveten z: **EN 60749-44:2016**

ICS:

31.080.01	Polprevodniški elementi (naprave) na splošno	Semiconductor devices in general

SIST EN 60749-44:2017 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60749-44

October 2016

ICS 31.080.01

English Version

Semiconductor devices - Mechanical and climatic test methods - Part 44: Neutron beam irradiated single event effect (SEE) test method for semiconductor devices (IEC 60749-44:2016)

Dispositifs à semiconducteurs - Méthodes d'essais mécaniques et climatiques - Partie 44: Méthode d'essai des effets d'un événement isolé (SEE) irradié par un faisceau de neutrons pour des dispositifs à semiconducteurs (IEC 60749-44:2016)

Halbleiterbauelemente - Mechanische und klimatische Prüfverfahren - Teil 44: Prüfverfahren zur Einzelereignis-Effekt-Neutronenbestrahlung von Halbleiterbauelementen (IEC 60749-44:2016)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of document 47/2303/FDIS, future edition 1 of IEC 60749-44, prepared by IEC/TC 47 "Semiconductor devices" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60749-44:2016.

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)	2017-05-25
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2019-08-25

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Endorsement notice

The text of the International Standard EC 60749-44:2016 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated :

IEC 60749-38	NOTE	Harmonized as EN 60749-38.

IEC 60749-44

Edition 1.0 2016-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 31.080.01

ISBN 978-2-8322-3541-6

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

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FOREWORD

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International Standard IEC 60749-44 has been prepared by IEC technical committee 47: Semiconductor devices.

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

FDIS	Report on voting
47/2303/FDIS	47/2312/RVD

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

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

A list of all the 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 publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

Part 44: Neutron beam irradiated single event effect (SEE) test method for semiconductor devices

1 Scope

This part of IEC 60749 establishes a procedure for measuring the single event effects (SEEs) on high density integrated circuit semiconductor devices including data retention capability of semiconductor devices with memory when subjected to atmospheric neutron radiation produced by cosmic rays. The single event effects sensitivity is measured while the device is irradiated in a neutron beam of known flux. This test method can be applied to any type of integrated circuit.

NOTE 1 Semiconductor devices under high voltage stress can be subject to single event effects including SEB, single event burnout and SEGR single event gate rupture, for this subject which is not covered in this document, please refer to IEC 62396-4 [2].

NOTE 2 In addition to the high energy neutrons some devices can have a soft error rate due to low energy (<1 eV) thermal neutrons. For this subject which is not covered in this document, please refer to IEC 62396-5 [3].

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.

None.

3 Terms and definitions

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

3.1
critical charge
Qcrit
smallest charge that will cause a SEE if injected or deposited in the sensitive volume

3.2
single-event upset
SEU
in a semiconductor device when the radiation absorbed by the device is sufficient to change a cell's logic state

Note 1 to entry: After a new write cycle, the original state can be recovered.

3.3
multiple bit upset
MBU
energy deposited in the silicon of an electronic component by a single ionising particle causing more than one bit in the same word to be upset

Note 1 to entry: The definition of MBU has been updated due to the introduction of the definition of MCU.

3.4
multiple cell upset
MCU
energy deposited in the silicon of an electronic component by a single ionising particle inducinges several bits in an integrated circuit (IC) to be upset at one time

3.5
soft error
erroneous output signal from a latch or memory cell that can be corrected by performing one or more normal functions of the device containing the latch or memory cell

Note 1 to entry: As commonly used, the term refers to an error caused by radiation or electromagnetic pulses and not to an error associated with a physical defect introduced during the manufacturing process.

Note 2 to entry: Soft errors can be generated from SEU, SEFI, MBU, MCU, and or SET. The term SER has been adopted by the commercial industry while the more specific terms SEU, SEFI, etc. are typically used by the avionics, space and military electronics communities.

Note 3 to entry: The term “soft error” was first introduced (for DRAMs and ICs) by May and Woods of Intel in their April 1978 paper at the IRPS and the term “single event upset” was introduced by Guenzer, Wolicki and Allas of NRL in their 1979 NSREC paper (SEU of DRAMs by neutrons and protons).

3.6
single event effect
SEE
response of a component caused by the impact of a single energetic particle

Note 1 to entry: Examples of energetic particle include galactic cosmic rays, solar energetic particles, energetic neutrons and protons

Note 2 to entry: The range of responses can include both non-destructive (for example upset) and destructive (for example latch-up or gate rupture) phenomena.

3.7
single-event hard error
SHE
single event induced hard error
irreversible change in operation from a single radiation event that is typically associated with permanent damage to one or more of the device elements

Note 1 to entry: Examples include permanently stuck-bit in the device and gate oxide rupture.

3.8
soft error, power cycle
PCSE
soft error that is not corrected by repeated reading or writing but can be corrected by the removal of power

3.9
flux
<particle radiation> time rate of flow of particle energy emitted from or incident on a surface, divided by the area of that surface

Note 1 to entry: The flux is usually expressed in particles per square centimetre second (N/cm^2s) or particles per square centimetre hour (N/cm^2h).

3.10
soft error rate
SER
rate at which soft errors are occurring