SLOVENSKI STANDARD
SIST EN 62047-12:2012

01-januar-2012

Polprevodniški elementi - Mikroelektromehanski elementi - 12. del: Metoda za preskušanje upogibne utrujenosti tankoplastnih materialov z uporabo resonančnih tresljajev struktur mikroelektromehanskih sistemov (MEMS)

Semiconductor devices - Microelectromechanical devices - Part 12: Bending fatigue testing method of thin film materials using resonant vibration of MEMS structures

Halbleiterbauelemente - Bauelemente der Mikrosystemtechnik - Teil 12: Verfahren zur Prüfung der Biege-Ermüdungsfestigkeit von Dünnschichtwerkstoffen unter Verwendung der Resonanzschwingungen bei MEMS-Strukturen

Dispositifs à semiconducteurs - Dispositifs microélectromécaniques - Partie 12: Méthode d'essai de fatigue en flexion des matériaux en couche mince utilisant les vibrations à la résonance des structures à systèmes microélectromécaniques (MEMS)

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(IEC 62047-12:2011)

Dispositifs à semiconducteurs - Dispositifs microélectromécaniques - Partie 12: Méthode d'essai de fatigue en flexion des matériaux en couche mince utilisant les vibrations à la résonance des structures à systèmes microélectromécaniques (MEMS)
(CEI 62047-12:2011)

Halbleiterbauelemente - Bauelemente der Mikrosystemtechnik - Teil 12: Verfahren zur Prüfung der Biege-Ermüdungsfestigkeit von Dünnschichtwerkstoffen unter Verwendung der Resonanzschwingungen bei MEMS-Strukturen
(IEC 62047-12:2011)

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

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Foreword

The text of document 47F/80/FDIS, future edition 1 of IEC 62047-12, prepared by SC 47F, "Micro-electromechanical systems", of IEC TC 47, "Semiconductor device", was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62047-12:2011.

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)	2012-07-18
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2014-10-18

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

IEC 62047-2:2006 NOTE Harmonized as EN 62047-2:2006 (not modified).

Annex ZA
(normative)
Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

Publication	Year	Title	EN/HD	Year
IEC 62047-3	2006	Semiconductor devices - Micro-electromechanical devices - Part 3: Thin film standard test piece for tensile-testing	EN 62047-3	2006
ISO 12107	-	Metallic materials - Fatigue testing - Statistical planning and analysis of data		-

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SEMICONDUCTOR DEVICES – MICRO-ELECTROMECHANICAL DEVICES –

Part 12: Bending fatigue testing method of thin film materials using resonant vibration of MEMS structures

FOREWORD

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International Standard IEC 62047-12 has been prepared by subcommittee 47F: Micro-electromechanical systems, of IEC technical committee 47: Semiconductor devices.

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

FDIS	Report on voting
47F/80/FDIS	47F/90/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 parts of IEC 62047 series, under the general title *Semiconductor devices – Microelectromechanical devices,* 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 web site 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.

SEMICONDUCTOR DEVICES – MICRO-ELECTROMECHANICAL DEVICES –

Part 12: Bending fatigue testing method of thin film materials using resonant vibration of MEMS structures

1 Scope

This part of IEC 62047 specifies a method for bending fatigue testing using resonant vibration of microscale mechanical structures of MEMS (micro-electromechanical systems) and micromachines. This standard applies to vibrating structures ranging in size from 10 μm to 1 000 μm in the plane direction and from 1 μm to 100 μm in thickness, and test materials measuring under 1 mm in length, under 1 mm in width, and between 0,1 μm and 10 μm in thickness.

The main structural materials for MEMS, micromachine, etc. have special features, such as typical dimensions of a few microns, material fabrication by deposition, and test piece fabrication by means of non-mechanical machining, including photolithography. The MEMS structures often have higher fundamental resonant frequency and higher strength than macro structures. To evaluate and assure the lifetime of MEMS structures, a fatigue testing method with ultra high cycles (up to 10^{12}) loadings needs to be established. The object of the test method is to evaluate the mechanical fatigue properties of microscale materials in a short time by applying high load and high cyclic frequency bending stress using resonant vibration.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62047-3:2006, *Semiconductor devices – Micro-electromechanical devices – Part 3: Thin film standard test piece for tensile testing*

ISO 12107, *Metallic materials – Fatigue testing – Statistical planning and analysis of data*

3 Terms and definitions

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

3.1
amplitude
one-half the algebraic difference between the maximum value and minimum value in a loading cycle

3.2
load ratio
algebraic ratio of the maximum value and minimum value of the load of a cycle

3.3
S-N curve
plot of stress or strain (S) against the number of cycles (N) to failure