



IEC 62047-33

Edition 1.0 2019-04

INTERNATIONAL STANDARD

**Semiconductor devices – Micro-electromechanical devices –
Part 33: MEMS piezoresistive pressure-sensitive device**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.080.99; 31.140

ISBN 978-2-8322-6718-9

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	7
4 Essential ratings and characteristics.....	8
4.1 Ratings (Limiting values).....	8
4.2 Recommended operating conditions	8
4.3 Characteristics.....	8
5 Test methods.....	9
5.1 Input resistance	9
5.2 Output resistance.....	9
5.3 Leakage current.....	9
5.3.1 P-N junction isolation type sensitive device	9
5.3.2 Insulating medium type sensitive device	10
5.4 Breakdown voltage	10
5.5 Isolation voltage.....	10
5.6 Static performances	10
5.6.1 Test method	10
5.6.2 Output under normal pressure	12
5.6.3 Zero output.....	12
5.6.4 Output symmetry	13
5.6.5 Full-span output.....	13
5.6.6 Nonlinearity	13
5.6.7 Pressure hysteresis	13
5.6.8 Repeatability	14
5.6.9 Accuracy	15
5.6.10 Sensitivity.....	15
5.6.11 Zero drift.....	15
5.7 Stability.....	16
5.7.1 Test method	16
5.7.2 Zero long-term stability.....	16
5.7.3 Sensitivity long-term stability	16
5.8 Temperature influence	16
5.8.1 Test method	16
5.8.2 Thermal zero drift	17
5.8.3 Thermal sensitivity drift.....	17
5.8.4 Thermal zero output hysteresis.....	17
5.8.5 Thermal sensitivity hysteresis.....	17
5.8.6 Temperature hysteresis	18
5.9 Static pressure influence.....	18
5.9.1 Two way static pressure	18
5.9.2 Unidirectional static pressure.....	19
5.10 Overload	19
5.11 Dynamic performance	19
5.11.1 Test method	19
5.11.2 Frequency response	20
5.11.3 Ringing frequency.....	20

- 5.11.4 Damping ratio 20
- 5.11.5 Rise time 21
- 5.11.6 Resonant frequency..... 21
- 5.11.7 Overshoot..... 21
- 5.12 Environment test..... 21
 - 5.12.1 Storage at high temperature 21
 - 5.12.2 Storage at low temperature..... 21
 - 5.12.3 Temperature cycling 22
 - 5.12.4 Vibration 22
 - 5.12.5 Mechanical shock 22
 - 5.12.6 Acceleration 22
 - 5.12.7 Moisture resistance 22
 - 5.12.8 Mucedine..... 22
 - 5.12.9 Salt atmosphere 22
 - 5.12.10 Electromagnetic compatibility 23
 - 5.12.11 Low pressure 23
 - 5.12.12 High temperature electric life 23
 - 5.12.13 Fatigue life 23
- Bibliography..... 24

- Figure 1 – Structure schematic diagram of the device 7
- Figure 2 – Test connection graph for P-N junction isolation type sensitive device 10
- Figure 3 – Test connection graph for insulating medium type sensitive device 10
- Figure 4 – Test system 11
- Figure 5 – The output wave 20

- Table 1 – Characteristics of the device 8

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SEMICONDUCTOR DEVICES –
MICRO-ELECTROMECHANICAL DEVICES –**
Part 33: MEMS piezoresistive pressure-sensitive device

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62047-33 has been prepared by subcommittee 47F: Micro-electromechanical systems, of IEC technical committee 47: Semiconductor devices.

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

FDIS	Report on voting
47F/327FDIS	47F/332/RVD

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 62047 series, published under the general title *Semiconductor devices – Micro-electromechanical devices*, 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.

A bilingual version of this publication may be issued at a later date.

SEMICONDUCTOR DEVICES – MICRO-ELECTROMECHANICAL DEVICES –

Part 33: MEMS piezoresistive pressure-sensitive device

1 Scope

This part of IEC 62047 defines terms, definitions, essential ratings and characteristics, as well as test methods applicable to MEMS piezoresistive pressure-sensitive device. This document applies to piezoresistive pressure-sensitive devices for automotive, medical treatment, electronic products.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-10, *Environmental testing – Part 2-10: Tests – Test J and guidance: Mould growth*

IEC 60747-14-3, *Semiconductor devices – Part 14-3: Semiconductor sensors – Pressure sensors*

IEC 60749-2, *Semiconductor devices-Mechanical and climatic test methods – Part 2: Low air pressure*

IEC 60749-6, *Semiconductor devices-Mechanical and climatic test methods – Part 6: Storage at high temperature*

IEC 60749-10, *Semiconductor devices – Mechanical and climatic tests methods – Part 10: Mechanical shock*

IEC 60749-12, *Semiconductor devices – Mechanical and climatic tests methods – Part 12: Vibration, variable frequency*

IEC 60749-13, *Semiconductor devices – Mechanical and climatic test methods – Part 13: Salt atmosphere*

IEC 60749-24, *Semiconductor devices – Mechanical and climatic test methods – Part 24: Accelerated moisture resistance-Unbiased HAST*

IEC 60749-25, *Semiconductor devices – Mechanical and climatic test methods – Part 25: Temperature cycling*

IEC 60749-36, *Semiconductor devices – Mechanical and climatic tests methods – Part 36: Acceleration, steady state*

IEC TR 61000-4-1, *Electromagnetic compatibility (EMC) – Part 4-1: Testing and measurement techniques – Overview of the IEC 61000-4 series*