IEC 63041-1

Edition 1.0 2017-12

INTERNATIONAL STANDARD

Piezoelectric sensors – Part 1: Generic specifications

IEC 63041-1:2017-12(en)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

IEC 63041-1

Edition 1.0 2017-12

INTERNATIONAL STANDARD

Piezoelectric sensors –
Part 1: Generic specifications

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.140

ISBN 978-2-8322-5143-0

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PIEZOELECTRIC SENSORS –

Part 1: Generic specifications

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 63041-1 has been prepared by IEC technical committee TC 49: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection.

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

CDV	Report on voting
49/1220/CDV	49/1249/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 63041 series, published under the general title *Piezoelectric sensors*, can be found on the IEC website.

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

PIEZOELECTRIC SENSORS –

Part 1: Generic specifications

1 Scope

This part of IEC 63041 applies to piezoelectric sensors of resonator, delay-line and non-acoustic types, which are used in physical and engineering sciences, chemistry and biochemistry, medical and environmental sciences, etc.

The purpose of this document is to specify the terms and definitions for the piezoelectric sensors, and to make sure from a technological perspective that users understand the state-of-art piezoelectric sensors and how to use them correctly.

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 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050-561:2014, *International Electrotechnical Vocabulary – Part 561: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection*

IEC 60122-2-1, *Quartz crystal units for frequency control and selection – Part 2: Guide to the use of quartz crystal units for frequency control and selection – Section One: Quartz crystal units for microprocessor clock supply*

IEC 60444-9, *Measurement of quartz crystal unit parameters – Part 9: Measurement of spurious resonances of piezoelectric crystal units*

IEC 60617, *Graphical symbols for diagrams*, available at http://std.iec.ch/iec60617

ISO 2859-1:1999, *Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 80000-1:2009, *Quantities and units – Part 1: General*

3 Terms and definitions

3.1 General

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

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

Units, letter symbols and terminology shall, wherever possible, be taken from the following standards: IEC 60027, IEC 60050-561, IEC 60617, and ISO 80000-1.

NOTE Piezoelectric sensors covered herein are those used for the detection and measurement of physical quantities, chemical substances or biological molecules.

3.2 Piezoelectric sensors

3.2.1
piezoelectric sensor element
electronic component which is able to detect physical quantities as a change in its frequency, phase, delay, electrical charge, resistance, Q-value, bandwidth, etc.

Note 1 to entry: For chemical and biochemical sensor applications, the piezoelectric sensor element includes a sensitive or receptive layer (target recognition material).

3.2.2
resonator type sensor element
piezoelectric sensor component using acoustic resonances

3.2.3
delay line type sensor element
piezoelectric sensor component using a surface acoustic wave (SAW) delay-line of transversal type

3.2.4
non-acoustic type sensor element
piezoelectric sensor component using the electrical charge induced by a quasi-static force, torque or the like

Note 1 to entry: Here, the term, "non-acoustic", represents "quasi-static piezoelectric". Accordingly, the (piezoelectric) non-acoustic type sensor element means a sensor element using the quasi-static piezoelectric effect.

3.2.5
piezoelectric sensor cell
sensor element equipped with necessary mechanical accessories and attachments to correctly detect the parameters to be measured

3.2.6
piezoelectric sensor module
sensor element or cell equipped with electronic accessories for interfacing to external data acquisitions

3.2.7
piezoelectric sensor
generic term that includes a sensor element, cell and module

3.2.8
QCM
quartz crystal microbalance
one of the families of chemical and biochemical sensors using crystal resonators

Note 1 to entry: A thickness share mode (TSM) sensor is identical with a QCM.

3.3 Types of chemical sensors

3.3.1
piezoelectric chemical sensor element
piezoelectric sensor component including a sensitive layer (target recognition material), which is necessary for the practical measurement of simple non-biological molecules in quantity, and which works and detects chemical substances mainly in the gas phase

Note 1 to entry: A gas sensor element is one of the chemical sensor elements.

3.3.2
piezoelectric biochemical sensor element
piezoelectric sensor component including a receptive layer (target recognition material), which is necessary for the practical measurement of complex biological molecules in quantity, and which works mainly in aqueous media and detects biomolecules therein

3.4 Types of physical sensors

3.4.1
piezoelectric force sensor element
piezoelectric sensor component whose resonance frequency, delay or electrical charge/voltage is used for force measurement

3.4.2
piezoelectric pressure sensor element
piezoelectric sensor component whose resonance frequency, delay or electrical charge/voltage is used for pressure measurement

3.4.3
piezoelectric torque sensor element
piezoelectric sensor component whose resonance frequency, delay or electrical charge/voltage is used for torque measurement

3.4.4
piezoelectric viscosity sensor element
piezoelectric sensor component whose resonance frequency, delay or insertion loss/gain is used for viscosity measurement

3.4.5
piezoelectric temperature sensor element
piezoelectric sensor component whose resonance frequency or delay is used for temperature measurement

3.4.6
piezoelectric film-thickness sensor element
piezoelectric sensor component whose resonance frequency is used for film-thickness measurement

4 Symbols of sensor elements

4.1 General

Figures 1 to 6 show the conceptual diagrams and defined symbols for sensor elements of bulk acoustic wave (BAW) resonator, SAW resonator and SAW delay-line types. The symbols are essentially the same as those given in IEC 60122-1, IEC 61019-1 and IEC 60862-1.

Figure 7 and Figure 8 show the conceptual diagram and defined symbol for sensor elements of non-acoustic type.

NOTE 1 The diagonal line in Figure 2, Figure 4, Figure 6 and Figure 8 shows an emblem expressing changes in objects to be measured.

NOTE 2 Letter symbols (see 4.6) showing the types of sensors are put in the circle at the upper right corner in Figure 2, Figure 4, Figure 6 and Figure 8.