IEC 60679-1

Edition 4.0 2017-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Piezoelectric, dielectric and electrostatic oscillators of assessed quality – Part 1: Generic specification

Oscillateurs piézoélectriques, diélectriques et électrostatiques sous assurance de la qualité – Partie 1: Spécification générique

IEC 60679-1:2017-07(en-fr)

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PIEZOELECTRIC, DIELECTRIC AND ELECTROSTATIC OSCILLATORS OF ASSESSED QUALITY –

Part 1: Generic specification

FOREWORD

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International Standard IEC 60679-1 has been prepared by IEC technical committee TC 49: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection.

This bilingual version (2019-07) corresponds to the monolingual English version, published in 2017-07.

This fourth edition cancels and replaces the third edition published in 2007. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) the title has been changed;
b) additional matters related to oscillator using SAW or MEMS resonator in "Terms, definitions and general information" have been included;
c) measurement methods of IEC 60679-1:2007 have been removed (they will be moved to IEC 62884 series);
d) the content of Annex A has been extended;
e) a new term and definition DIXO (Digital interfaced Crystal Oscillator) has been added;
f) a new term and definition SSXO (Spread Spectrum Crystal Oscillator) has been added;
g) Annex D has been added.

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

FDIS	Report on voting
49/1229/FDIS	49/1233/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.

The French version of this standard has not been voted upon.

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

A list of all parts of the IEC 60679 series, published under the general title *piezoelectric, dielectric and electrostatic oscillators of assessed quality* can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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.

PIEZOELECTRIC, DIELECTRIC AND ELECTROSTATIC OSCILLATORS OF ASSESSED QUALITY –

Part 1: Generic specification

1 Scope

This part of IEC 60679 specifies general requirements for piezoelectric, dielectric and electrostatic oscillators, including Dielectric Resonator Oscillators (DRO) and oscillators using FBAR (hereinafter referred to as "Oscillator"), of assessed quality using either capability approval or qualification approval procedures.

NOTE Dielectric Resonator Oscillators (DRO) and oscillators using FBAR are under consideration.

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, *International electrotecnical vocabulary – Part 561: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection.* Available at www.electropedia.org

IEC 60469, *Transitions, pulses and related waveforms – Terms, definitions and algorithms*

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

IEC 60748-2, *Semiconductor devices – Integrated circuits – Part 2: Digital integrated circuits*

IEC 60749-26, *Semiconductor devices – Mechanical and climatic test methods – Part 26: Electrostatic discharge (ESD) sensitivity testing – Human body model (HBM)*

IEC 60749-27, *Semiconductor devices – Mechanical and climatic test methods – Part 27: Electrostatic discharge (ESD) sensitivity testing – Machine model (MM)*

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

IEC 61340-5-1, *Electrostatics – Part 5-1: Protection of electronic devices from electrostatic phenomena – General requirements*

IEC 62884-1:2017, *Measurement techniques of piezoelectric, dielectric, and electrostatic oscillators – Part 1: Basic methods for the measurement*

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

Where any discrepancies occur for any reason, documents shall rank in the following order of precedence:

- detail specification;
- sectional specification;
- generic specification;
- any other international documents (for example of the IEC) to which reference is made.

The same order of precedence shall apply to equivalent national documents.

3 Terms, definitions and general information

3.1 General

Units, graphical symbols, letter symbols and terminology shall, wherever possible, be taken from the following standards:

- IEC 60027;
- IEC 60050-561;
- IEC 60469;
- IEC 60617;
- ISO 80000-1.

3.2 Terms and definitions

For the purposes 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

3.2.1
simple packaged crystal oscillator
SPXO
crystal controlled oscillator having no means of temperature control or compensation, exhibiting a frequency/temperature characteristic determined substantially by the quartz crystal resonator employed

[SOURCE: IEC 60050-561:2014, 561-03-30]

3.2.2
overtone crystal controlled oscillator
oscillator designed to operate with the controlling piezoelectric resonator functioning in a specified mechanical overtone order of vibration

[SOURCE: IEC 60050-561:2014, 561-03-20, modified – The word "functioning" has been added.]

3.2.3
crystal cut
orientation of the crystal element with respect to the crystallographic axes of the crystal

Note 1 to entry: It can be desirable to specify the cut (and hence the general form of the frequency/temperature performance) of a crystal unit used in an oscillator application. The choice of the crystal cut will imply certain attributes of the oscillator which may not otherwise appear in the detail specification.

[SOURCE: IEC 60050-561:2014, 561-03-04]

3.2.4
voltage controlled crystal oscillator
VCXO
crystal controlled oscillator, the frequency of which can be deviated or modulated according to a specific relation, through application of a control voltage

[SOURCE: IEC 60050-561:2014, 561-03-41]

3.2.5
temperature compensated crystal oscillator
TCXO
crystal controlled oscillator whose frequency deviation due to temperature is reduced by means of a compensation system, incorporated in the device

[SOURCE: IEC 60050-561:2014, 561-03-36]

3.2.6
oven controlled crystal oscillator
OCXO
crystal controlled oscillator in which at least the piezoelectric resonator is temperature controlled

Note 1 to entry: This mode of operation ensures that the oscillator frequency will remain sensibly constant over the operating temperature range of the OCXO, therefore independent of the frequency/temperature characteristic of the crystal unit.

[SOURCE: IEC 60050-561:2014, 561-03-19, modified – The note to entry has been added.]

3.2.7
surface acoustic wave
SAW
acoustic wave, propagating along the surface of an elastic substrate, the amplitude of which decays exponentially with substrate depth

[SOURCE: IEC 60050-561:2014, 561-01-86]

3.2.8
SAWR
surface acoustic wave resonator
SAW resonator
resonator using multiple reflections of surface acoustic waves

[SOURCE: IEC 60050-561:2014, 561-01-87, modified – The term "SAW resonator" has been added.]

3.2.9
one-port SAW resonator
SAW resonator having a pair of terminals

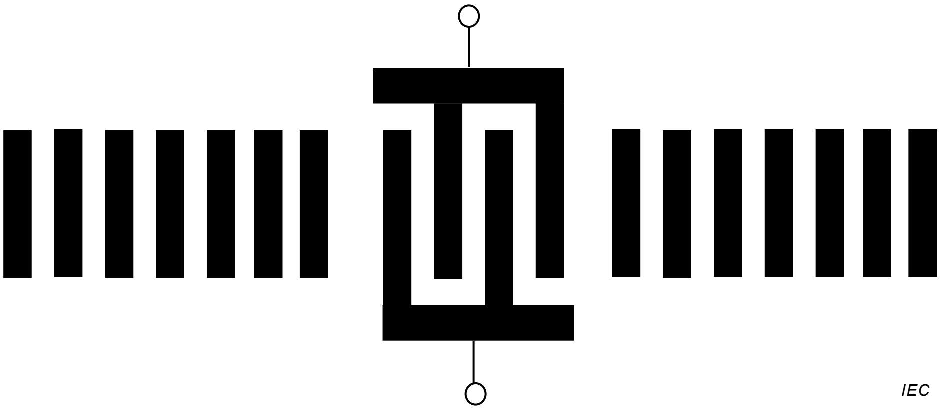
SEE: Figure 1a.

[SOURCE: IEC 60050-561:2014, 561-01-57, modified – The figure reference has been changed.]

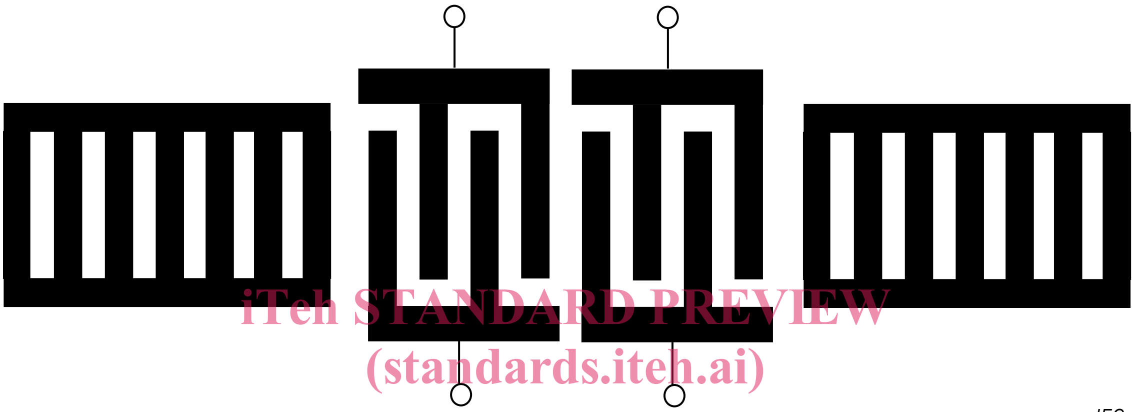
3.2.10
two-port SAW resonator
SAW resonator having input and output ports

SEE: Figure 1b

[SOURCE: IEC 60050-561:2014, 561-01-94, modified – The figure reference has been changed.]



a) One-port resonator with opened array



b) Two-port resonator with shorted arrays

Figure 1 – Basic configurations of SAW resonators

3.2.11
SAW oscillator
oscillator that uses a SAW resonator as the main frequency controlling element

3.2.12
simple packaged SAW oscillator
SPSO
SAW oscillator having no means of temperature control or compensation, exhibiting a frequency/temperature characteristic determined substantially by SAW resonator employed

[SOURCE: IEC 60050-561:2014, 561-03-30, modified – change from crystal oscillator to SAW oscillator and from crystal resonator to SAW resonator.]

3.2.13
voltage controlled SAW oscillator
VCSO
SAW oscillator, the frequency of which can be deviated or modulated according to a specific relation, through application of a control voltage

[SOURCE: IEC 60050-561:2014, 561-03-41, modified – change from crystal resonator to SAW oscillator.]

3.2.14
temperature compensated SAW oscillator
TCSO
SAW oscillator whose frequency deviation due to temperature is reduced by means of a compensation system incorporated in the device

[SOURCE: IEC 60050-561:2014, 561-03-36, modified – change from crystal resonator to SAW oscillator.]

3.2.15
electrostatic micro electro mechanical system oscillator
electrostatic MEMS oscillator
oscillator that uses a MEMS device as the main frequency controlling element

3.2.16
voltage controlled electrostatic MEMS oscillator
electrostatic MEMS oscillator, the frequency of which can be deviated or modulated according to a specified relation, by application of a control voltage

[SOURCE: IEC 60050-561:2014, 561-03-41, modified – change from crystal to MEMS oscillator.]

3.2.17
digital interfaced crystal oscillator
DIXO
crystal oscillator, the frequency and the functions of which can be controlled, by application of an external digital signal

Note 1 to entry: It will be combined as DI-TCXO in TCXO and as DI-OCXO in OCXO.

3.2.18
spread spectrum crystal oscillator
SSXO
crystal oscillator that reduces the peak of frequency spectrum by modulating the oscillation frequency

3.2.19
nominal frequency
frequency given by the manufacturer or the specification to identify the oscillator

[SOURCE: IEC 60050-561:2014, 561-02-31, modified – The word "filter" has been replaced by" oscillator".]

3.2.20
frequency tolerance
maximum permissible deviation of a specified characteristic frequency from the specified value due to a specific cause, or a combination of causes

Note 1 to entry: Frequency tolerances are often assigned separately to specified ambient effects, namely electrical, mechanical and environmental. When this approach is used, it is necessary to define the values of other operating parameters as well as the range of the specified variable, that is to say:

– deviation from the frequency at the specified reference temperature due to operation over the specified temperature range, other conditions remaining constant;
– deviation from the frequency at the specified supply voltage due to supply voltage changes over the specified range, other conditions remaining constant;
– deviation from the initial frequency due to ageing, other conditions remaining constant;
– deviation from the frequency with specified load conditions due to changes in load impedance over the specified range, other conditions remaining constant.

In some cases, an overall frequency tolerance may be specified, due to any/all combinations of operating parameters, during a specified lifetime.

[SOURCE: IEC 60050-561:2014, 561-01-33, modified – Note 1 to entry has been added.]

3.2.21
frequency offset
frequency difference, positive or negative, which should be added to the specified nominal frequency of Oscillator, when adjusting the Oscillator frequency under a particular set of operating conditions in order to minimize its deviation from nominal frequency over the specified range of operating conditions

Note 1 to entry: In order to minimize the frequency deviation from nominal over the entire temperature range, a frequency offset may be specified for adjustment at the reference temperature (see Figure 2).

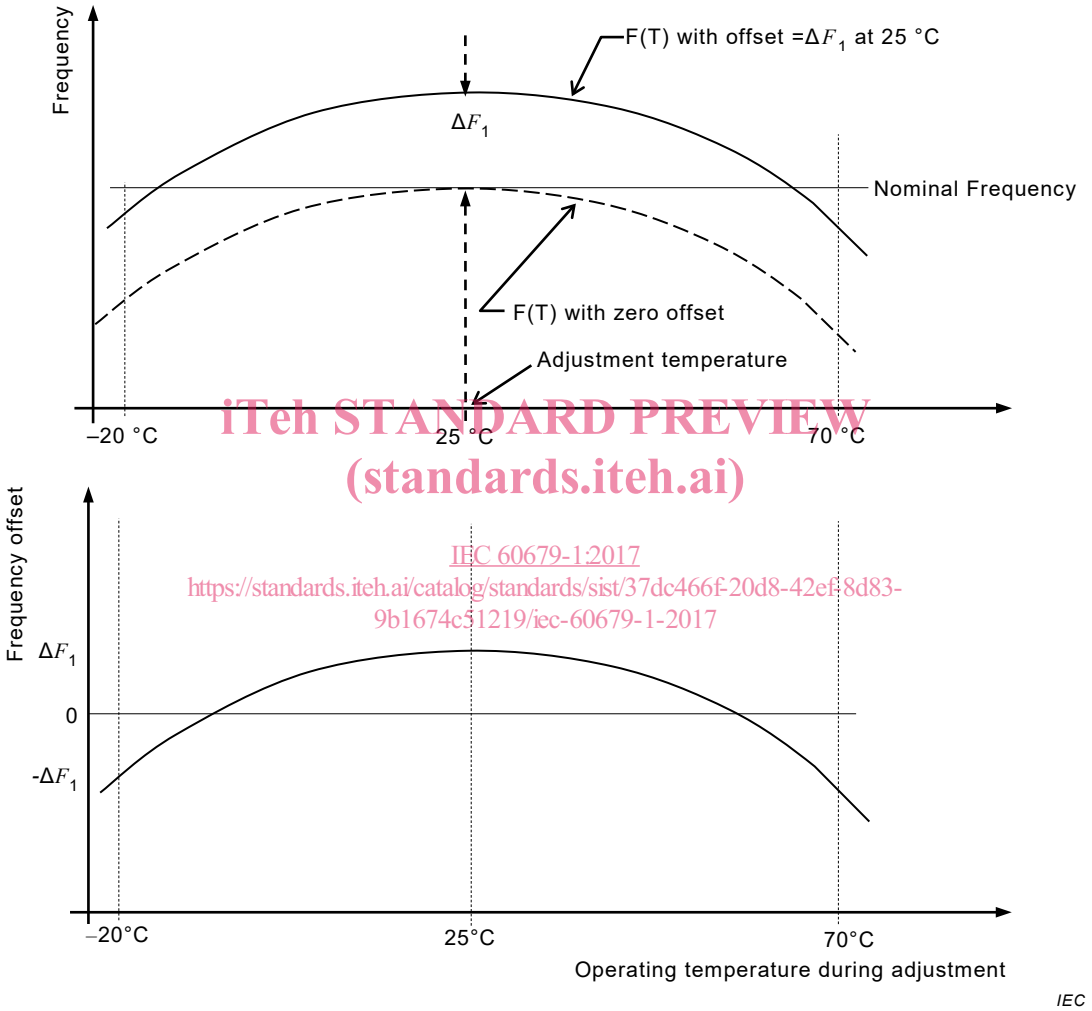


Figure 2 – Example of the use of frequency offset

[SOURCE: IEC 60050-561:2014, 561-03-09]

3.2.22
adjustment frequency
frequency to which an oscillator must be adjusted, under a particular combination of operating conditions, in order to meet the frequency tolerance specification over the specified range of operating conditions

Note 1 to entry: Adjustment frequency corresponds to nominal frequency plus frequency offset.

[SOURCE: IEC 60050-561:2014, 561-03-01]

3.2.23
frequency adjustment range
range over which oscillator frequency may be varied by means of some variable element, for the purpose of

a) setting the frequency to a particular value, or
b) to correct oscillator frequency to a prescribed value after deviation due to ageing, or other changed conditions

Note 1 to entry: For test procedures – see 4.5.11 of IEC 62884-1:2017.

[SOURCE: IEC 60050-561:2014, 561-04-1003-07, modified – Note 1 to entry has been added.]

3.2.24
storage temperature range
minimum and maximum temperatures as measured on the enclosure at which an oscillator may be stored without deterioration or damage to its performance

[SOURCE: IEC 60050-561:2014, 561-02-67, modified – The word "the device" has been replaced by "an oscillator".]

3.2.25
operating temperature range, <of an oscillator>
range of temperatures over which the oscillator will function, maintaining frequency and other output signal characteristics within specified tolerances

[SOURCE: IEC 60050-561:2014, 561-03-18]

3.2.26
operable temperature range

range of temperatures over which the oscillator will continue to provide an output signal, though not necessarily within the specified tolerances of frequency, level, waveform, etc.

[SOURCE: IEC 60050-561:2014, 561-01-58, modified – Some elements and specifications have been changed from resonator to Oscillator.]

3.2.27
reference temperature
temperature at which certain Oscillator performance parameters are measured

Note 1 to entry: The reference temperature is normally 25 °C ± 2 °C.

[SOURCE: IEC 60050-561:2014, 561-03-25]

3.2.28
reference point temperature
temperature measured at a specific reference point relative to an oscillator

[SOURCE: IEC 60050-561:2014, 561-03-24]

3.2.29
thermal transient frequency stability
oscillator frequency time response when ambient temperature is changed from one specified temperature to another with a specific rate

[SOURCE: IEC 60050-561:2014, 561-03-37]

3.2.30
stabilization time
duration, measured from the initial application of power, required for an oscillator to stabilize its operation within specified limits

Note 1 to entry: For test procedures – see 4.5.10 of IEC 62884-1:2017.

[SOURCE: IEC 60050-561:2014, 561-03-33, modified – Note 1 to entry has been added.]

3.2.31
frequency/temperature characteristics
deviation from the frequency at the specified reference temperature due to operation over the specified temperature range, other conditions remaining constant

Note 1 to entry: For test procedures – see 4.5.5 of IEC 62884-1:2017.

3.2.32
frequency/temperature stability
maximum permissible deviation of the oscillator frequency, with no reference implied, due to operation over the specified temperature range at nominal supply and load conditions, other conditions constant

$$f - T_{stability} = \pm \frac{(f_{max} - f_{min})}{(f_{max} + f_{min})}$$

where

f_{max} is the maximum frequency measured during the temperature run,

f_{min} is the minimum frequency measured during the temperature run

Note 1 to entry: For test procedures – see 4.5.5 of IEC 62884-1:2017.

[SOURCE: MIL-PRF-55310E w/Amendment 2:2014]

3.2.33
frequency/voltage coefficient
fractional change in output frequency resulting from an incremental change in supply voltage, other parameters remaining unchanged

Note 1 to entry: In the case of OCXOs, a considerable time may elapse before the full effect of a supply voltage change is observed, as the temperature of the oven may drift gradually to a new value following the voltage perturbation.

Note 2 to entry: For test procedures – see 4.5.7 of IEC 62884-1:2017.

[SOURCE: IEC 60050-561:2014, 561-03-11, modified – Note 2 to entry has been added.]

3.2.34
frequency/load coefficient
fractional change in output frequency resulting from an incremental change in electrical load impedance, other parameters remaining unchanged

Note 1 to entry: For test procedures – see 4.5.6 of IEC 62884-1:2017.

[SOURCE: IEC 60050-561:2014, 561-03-08, modified – Note 1 to entry has been added.]