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Edition 2.0 2011-07

TECHNICAL SPECIFICATION

Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection – Glossary –
Part 3: Piezoelectric and dielectric oscillators

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PIEZOELECTRIC, DIELECTRIC AND ELECTROSTATIC DEVICES AND ASSOCIATED MATERIALS FOR FREQUENCY CONTROL, SELECTION AND DETECTION – GLOSSARY –

Part 3: Piezoelectric and dielectric oscillators

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 61994-3, which is a technical specification, has been prepared by IEC technical committee 49: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection.

This second edition of IEC 61994-3 cancels and replaces the first edition published in 2004. This edition constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

– definitions updated,
– terminology given in orderly sequence,
– new terminologies are added,
– drawings inserted for easier understanding.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
49/928/DTS	49/949/RVC

Full information on the voting for the approval of this technical specification 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 the IEC 61994 series, under the general title *Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection – Glossary*, can be found on the IEC website.

NOTE 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 next edition.

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

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

PIEZOELECTRIC, DIELECTRIC AND ELECTROSTATIC DEVICES AND ASSOCIATED MATERIALS FOR FREQUENCY CONTROL, SELECTION AND DETECTION – GLOSSARY –

Part 3: Piezoelectric and dielectric oscillators

1 Scope

This part of IEC 61994 specifies the terms and definitions for piezoelectric dielectric oscillators representing the state-of-the-art, which are intended for use in the standards and documents of IEC TC 49.

2 Normative references

Void

3 Terms and definitions

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

3.1
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, i.e. adjustment frequency = nominal frequency + frequency offset

[IEC 60679-1: 2007, 3.2.10]

3.2
Allan variance of fractional frequency fluctuation

unbiased estimate of the preferred definition in the time domain of the short-term stability characteristic of the oscillator output frequency:

$$\sigma_y{}^2(\tau) \cong \frac{1}{M-1}\sum_{k=1}^{M-1}\frac{(Y_{k+1}-Y_k)^2}{2}$$

where

Y_k are the average fractional frequency fluctuations obtained sequentially, with no systematic dead time between measurements;

τ is the sample time over which measurements is averaged;

M is the number of measurements.

NOTE The confidence of the estimate improves as M increases.

[IEC 60679-1: 2007, 3.2.23, modified]

3.3
amplitude modulation distortion

non-linear distortion in which the relative magnitudes of the spectral components of the modulating signal waveform are modified

NOTE This amplitude modulation distortion is also commonly known as frequency distortion, amplitude distortion and amplitude/frequency distortion.

[IEC 60679-1: 2007, 3.2.28, modified]

3.4
crystal cut
orientation of the crystal element with respect to the crystallographic axes of the crystal

NOTE This definition is included as it may 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.

[IEC 60679-1: 2007, 3.2.3]

3.5
decay time
fall time
time interval required for the trailing edge of a waveform to change between two defined levels

NOTE These two defined levels may be the logic levels V_{OH} and V_{OL} being at 90 % and 10 %, respectively, of the maximum amplitude (equaling V_{HI} - V_{LO}) of the waveform, or any other ratio as defined in the detail specification (see Figure 1),

where

V_{OL} is the low level output voltage;
V_{OH} is the high level output voltage;
V_{HI} is the upper flat voltage of the pulse waveform;
V_{LO} is the low flat voltage of the pulse waveform.

[IEC 60679-1: 2007, 3.2.34, modified]

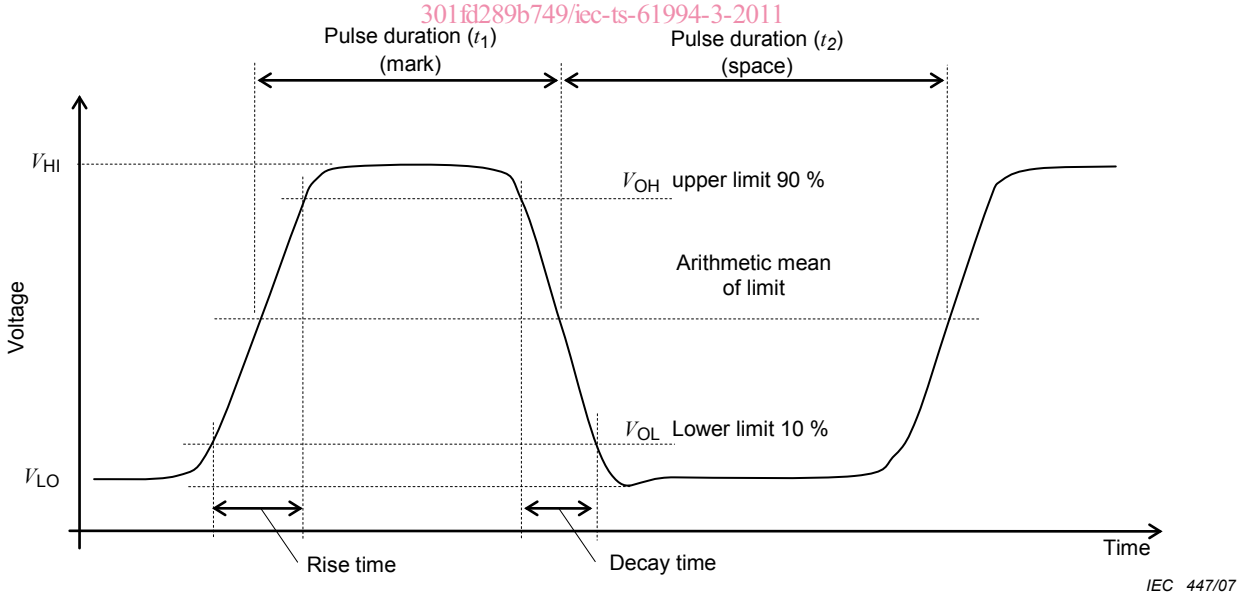

Figure 1 – Characteristics of an output waveform

3.6
electrostatic discharge
ESD
transfer of electric charge between bodies having different electrostatic potentials in proximity or through direct contact

[IEC 60050-161:1990, 161-01-22]

3.7
frequency adjustment range
range over which the 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 the oscillator frequency to a prescribed value after deviation due to ageing, or other changed conditions

[IEC 60679-1: 2007, 3.2.11]

3.8
frequency/load coefficient
fractional change in output frequency resulting from an incremental change in electrical load impedance, other parameters remaining unchanged

[IEC 60679-1: 2007, 3.2.20]

3.9
frequency offset
frequency difference, positive or negative, which should be added to the specified nominal frequency of the oscillator, when adjusting the oscillator frequency under a particular set of operating conditions in order to minimise its deviation from nominal frequency over the specified range of operating conditions

[IEC 60679-1: 2007, 3.2.9]

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

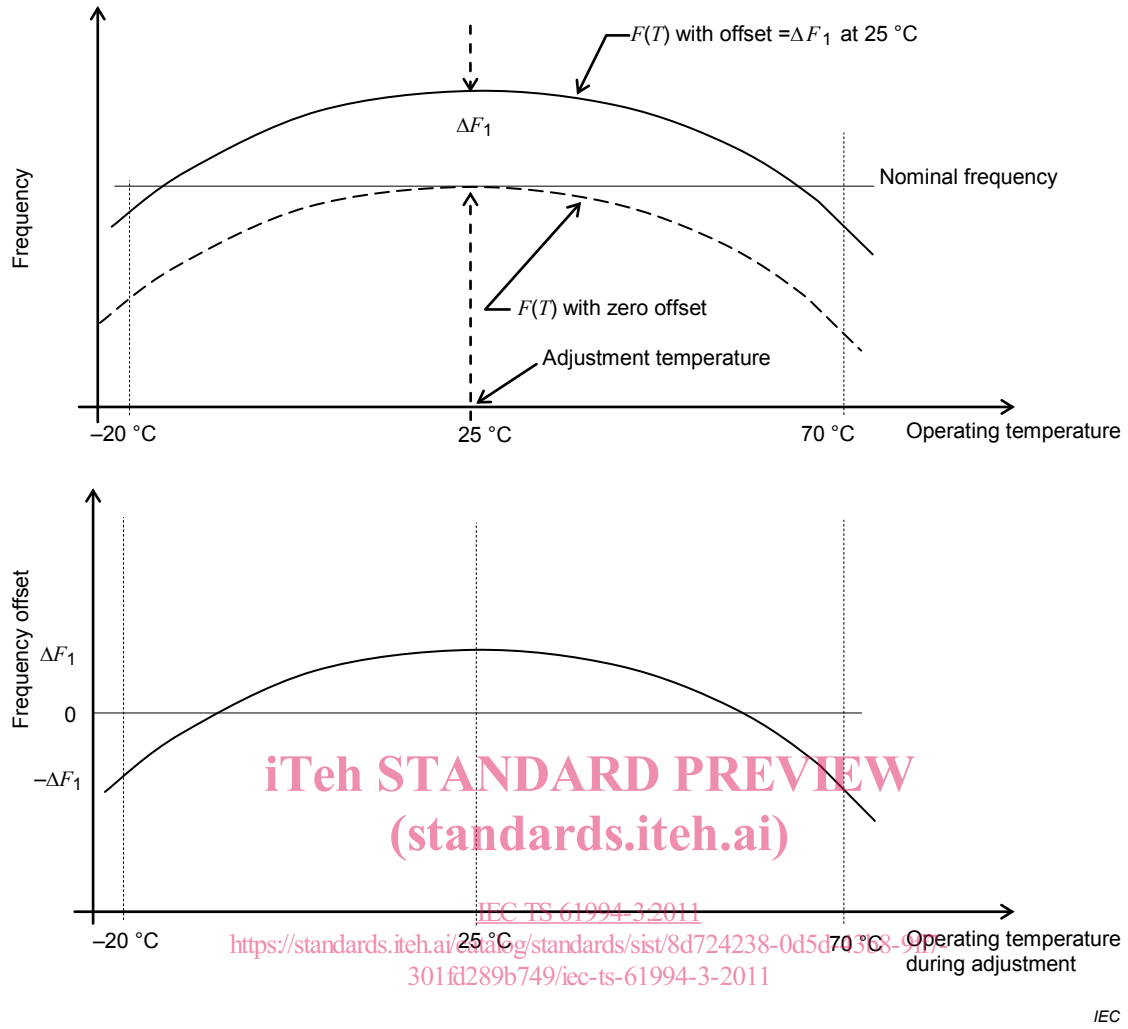

Figure 2 – Example of the use of frequency offset

3.10
frequency tolerance
maximum permissible deviation of the oscillator frequency from a specified nominal value when operating under specified conditions

[IEC 60679-1: 2007, 3.2.8]

NOTE 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.

3.11
frequency/voltage coefficient
fractional change in output frequency resulting from an incremental change in supply voltage, other parameters remaining unchanged

[IEC 60679-1: 2007, 3.2.19]

NOTE 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

3.12
harmonic distortion
non-linear distortion characterised by the generation of undesired spectral components harmonically related to the desired signal frequency

NOTE Each harmonic component is usually expressed as a power (in decibels) relative to the output power of the desired signal.

[IEC 60679-1: 2007, 3.2.30, modified]

3.13
incidental frequency modulation
optional measure of the frequency stability in the frequency domain, best described in terms of the spectrum of the resultant base-band signal obtained by applying the oscillator signal to an ideal discriminator circuit of specified characteristics

NOTE If the detection bandwidth is adequately specified, the incidental frequency modulation may be expressed as a fractional proportion of the output frequency (for example 2×10^{-8} rms in a 10 kHz band).

[IEC 60679-1: 2007, 3.2.27, modified]

3.14
latch-up
persistent state in which a low impedance path results from an input, output or supply overvoltage

3.15
linearity of frequency modulation deviation
measure of the transfer characteristic of a modulation system as compared to its an ideal (straight line) function, usually expressed as an allowable non-linearity in per cent of the specified full range deviation

NOTE 1 Modulation linearity can also be expressed in terms of the permissible distortion of base-band signals produced by the modulation device. (For example, intermodulation and harmonic distortion products not to exceed –40 dB relative to the total modulating signal power).

NOTE 2 Figure 3 is a plot of the output frequency of a typical modulated oscillator specified to have a modulation characteristic of 133,3 Hz/V over a range of ± 3 *V*, with an allowed non-linearity of ± 5 %. Curve *D* is the actual characteristic compared with the ideal (curve *A*) and the limits (curve *B* and *C*).

[IEC 60679-1: 2007, 3.2.29, modified]