SLOVENSKI STANDARD
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Kvarčna kristalna enota določene kakovosti - 2. del: Smernice za uporabo

Quartz crystal units of assessed quality - Part 2: Guidelines for the use

Résonateurs à quartz sous assurance de la qualité - Partie 2: Lignes directrices pour l'utilisation

Ta slovenski standard je istoveten z: **prEN IEC 60122-2:2024**

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COMMITTEE DRAFT FOR VOTE (CDV)

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IEC TC 49 : PIEZOELECTRIC, DIELECTRIC AND ELECTROSTATIC DEVICES AND ASSOCIATED MATERIALS FOR FREQUENCY CONTROL, SELECTION AND DETECTION

SECRETARIAT:	SECRETARY:
Japan	Mr Masanobu Okazaki
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐
	Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.

FUNCTIONS CONCERNED:

☐ EMC ☐ ENVIRONMENT ☒ QUALITY ASSURANCE ☐ SAFETY

☒ SUBMITTED FOR CENELEC PARALLEL VOTING	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING
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TITLE:

Quartz crystal units of assessed quality - Part 2: Guidelines for the use

PROPOSED STABILITY DATE: 2027

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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QUARTZ CRYSTAL UNITS OF ASSESSED QUALLITY

Part 2: Guidelines for the use

FOREWORD

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IEC 60122-2 has been prepared by IEC technical committee 49: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection.

This third edition cancels and replaces the second edition published in 1983. This edition constitutes a technical revision.

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

a) Add SC cut type and related requirements
b) According to the general specification, aging calculation and low level of drive requirements have been added
c) Update the frequency temperature curve according to the common cut requirements
d) Remove infrequently used product types

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

Draft	Report on voting
49XX/FDIS	49/XX/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under 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.

INTRODUCTION

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QUARTZ CRYSTAL UNITS OF ASSESSED QUALLITY

Part 2: Guidelines for the use

1 Scope

This part of IEC 60122 has been compiled in response to a generally expressed desire on the part of both users and manufacturers for a guide to the use of quartz crystal units for filters and oscillators so that the crystal units may be used to their best advantage.

It draws attention to some of the more fundamental questions which should be considered by the user before it places its order for a unit for a new application, and in so doing will, it is hoped, help ensure against unsatisfactory performance, unfavourable cost and non-availability. It is not the function of this standard to explain theory, nor to attempt to cover all the eventualities that may arise in practical circumstances. Lastly, it should not be considered as a substitute for close liaison between manufacturer and user.

Standard specifications, such as those of the IEC of which this guide forms a part, and national specifications or detail specifications issued by manufacturers, will define the available combinations of the resonant characteristics and the temperature characteristic. These specifications are compiled to include a wide range of quartz crystal units with standardized performances. It cannot be over-emphasized that the user should, wherever possible, select the quartz crystal units from these specifications, when available, even if it may lead to making small modifications to the circuit to enable the use of standard resonators. This applies particularly to the selection of the nominal frequency.

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 60122-1:2002, Quartz crystal units of assessed quality - Part 1: Generic specification

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60122-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

4 The quartz crystal unit as an electronic component

4.1 General

The quartz crystal element is a vibrating resonant structure whose orientation and dimensions determine its frequency for a given mode of vibration and which relies on the piezoelectric effect to couple it to an electrical circuit. The intrinsic properties of quartz make it a unique device for highly accurate and stable frequency control and selection because of its high "quality factor" Q. Crystal units are not a primary frequency standard, but when

precisely defined can provide stabilization far in excess of most requirements in the electronic industry.

The crystal element is cut from monocrystalline quartz with precise orientation to the crystallographic axes as shown in Figure 1. This figure shows only generalized examples of the most commonly used crystal cuts.

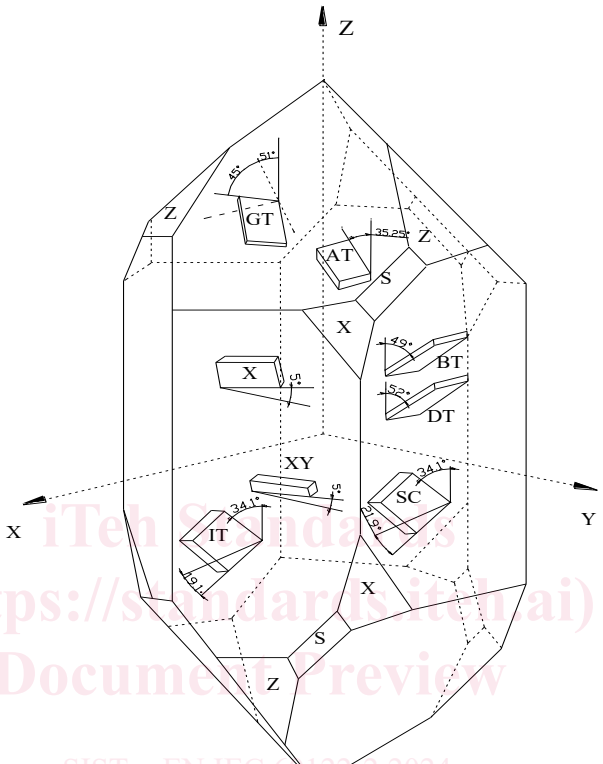


Figure 1 – Designation of the most commonly used crystal cuts

This figure shows a natural quartz crystal. However, most manufacturers now use synthetic material. Techniques have advanced to a point where synthetic quartz is almost indistinguishable from natural material with regard to electrical performance.

There are a number of different cuts and modes of vibration which will produce crystal units of near zero temperature coefficients over a wide frequency range.

4.2 Modes of vibration

The frequency range covered commercially by quartz crystal units may be taken as a few kHz to 500 MHz. Use is made of many cuts and modes of vibration to cover this range and crystals of the common types are summarized in Table I.

AT-cut crystal units can also be produced in the range from 400 kHz to 800 kHz, but they usually require larger enclosures.

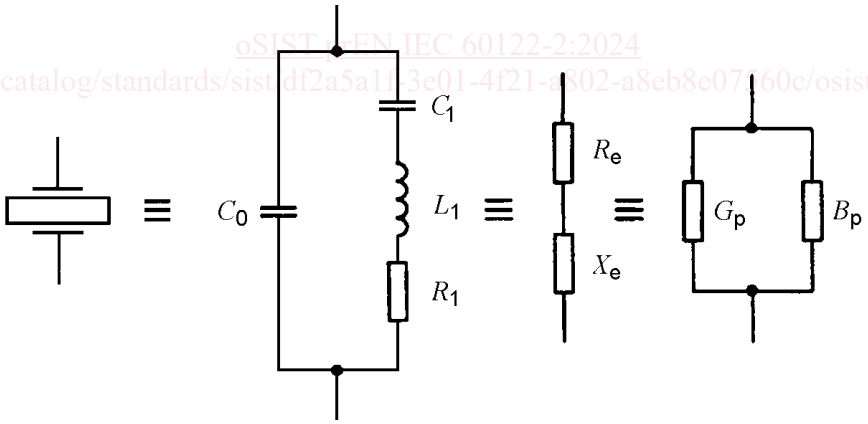
The choice of mode or cut may be affected by the enclosure size or parameters other than the frequency itself.

151 **Table 1 – Modes of vibration as a function of frequency**

Designation of cut	Mode of vibration	Usual frequency range
XY	Flexural	1kHz～80kHz
5° X bar	Extensional	40kHz～200kHz
AT	Thickness shear (fundamental)	800kHz～500MHz
	3rd overtone	5MHz～215MHz
	5th overtone	5MHz～150MHz
	7th overtone	100MHz～200MHz
BT	Thickness shear (fundamental)	3MHz～30MHz
DT	Face shear	100kHz～500kHz
SC	Thickness shear (fundamental)	8.192MHz～30MHz
	3rd overtone	5MHz～100MHz
	5th overtone	5MHz～130MHz
GT	Coupled mode by two extensional modes	100kHz～550kHz
IT	fundamental	8.192MHz～30MHz
	3rd overtone	5MHz～100MHz

152 ### 4.3 The equivalent electrical circuit of a quartz crystal unit

153 The properties of any mode of a lightly damped mechanical vibrator piezoelectrically excited
154 through electrodes can be represented, in the region of the resonance frequency, by an
155 equivalent electrical circuit which consists of a capacitance (C_1), inductance (L_1) and
156 resistance (R_1) in series, shunted by a second capacitance (C_0). A representation of the quartz
157 crystal unit equivalent circuit is shown in Figure 2.



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159 C_0 is Shunt (parallel) capacitance in the equivalent electric circuit(farad)

160 C_1 is Motional capacitance in the equivalent electric circuit(farad)

161 L_1 is Motional inductance in the equivalent electric circuit (henry)

162 R_1 is Motional resistance in the equivalent electric circuit (ohm)

163 R_e is Equivalent series resistance of resonator (ohm)

164 X_e is Equivalent series reactance of resonator (ohm)

165 G_p is Equivalent parallel conductance of resonator(s)

166 B_p is Equivalent parallel susceptance of resonator(s)

167 **Figure 2 – Equivalent circuit of a quartz crystal unit**