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Edition 3.1 2017-12
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Quartz crystal units of assessed quality –
Part 1: Generic specification

Résonateurs à quartz sous assurance de la qualité –
Partie 1: Spécification générique

IEC 60122-1:2002-08+AMD1:2017-12 CSV(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Part 1: Generic specification

FOREWORD

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 60122-1 edition 3.1 contains the third edition (2002-08) [documents 49/551/FDIS and 49/558/RVD] and its amendment 1 (2017-12) [documents 49/1254/FDIS and 49/1259/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60122-1 has been prepared by IEC technical committee 49: Piezoelectric and dielectric devices for frequency control and selection.

This third edition of IEC 60122-1 constitutes a technical revision.

International Standard IEC 60122-1 is the first part of a new edition of the IEC standard series for quartz crystal units of assessed quality.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

IEC 60122 consists of the following parts under the general title: Quartz crystal units of assessed quality:

– Part 1: Generic specification (IEC 60122-1);
– Part 2: Guide to the use of quartz crystal units for frequency control and selection (IEC 60122-2 at present);
– Part 3: Standard outlines and lead connections (IEC 60122-3);
– Part 4: Sectional specification – Capability Approval (IEC 61178-2 at present);
– Part 4-1: Blank detail specification – Capability Approval (IEC 61178-2-1 at present);
– Part 5: Sectional specification – Qualification Approval (IEC 61178-3 at present);
– Part 5-1: Blank detail specification – Qualification Approval (IEC 61178-3-1 at present).

The QC number which appears on the front cover of this publication is the specification number in the IEC Quality Assessment System for Electronic Components (IECQ).

The committee has decided that the contents of the base publication and its amendment 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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QUARTZ CRYSTAL UNITS OF ASSESSED QUALITY –

Part 1: Generic specification

1 General

1.1 Scope

This part of IEC 60122 specifies the methods of test and general requirements for quartz crystal units of assessed quality using either capability approval or qualification approval procedures.

1.2 Normative references

The following referenced documents are indispensable for the application 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):1991, *International Electrotechnical Vocabulary (IEV) – Chapter 561: Piezoelectric devices for frequency control and selection*

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-1:1990, *Environmental testing – Part 2: Tests – Tests A: Cold*

IEC 60068-2-2:1974, *Environmental testing – Part 2: Tests – Tests B: Dry heat*

IEC 60068-2-3:1969, *Environmental testing – Part 2: Tests – Test Ca: Damp heat, steady state*

IEC 60068-2-6:1995, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-7:1983, *Environmental testing – Part 2: Tests – Test Ga: Acceleration, steady state*

IEC 60068-2-13:1983, *Environmental testing – Part 2: Tests – Test M: Low air pressure*

IEC 60068-2-14:1984, *Environmental testing – Part 2: Tests – Test N: Change of temperature*

IEC 60068-2-17:1994, *Basic environmental testing procedures– Part 2: Tests – Test Q: Sealing*

IEC 60068-2-20:1979, *Environmental testing – Part 2: Tests – Test T: Soldering*

IEC 60068-2-21:1999, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60068-2-27:1987, *Environmental testing – Part 2: Tests – Test Ea and guidance: Shock*

IEC 60068-2-29:1987, *Environmental testing – Part 2: Tests – Test Eb and guidance: Bump*

IEC 60068-2-30:1980, *Environmental testing – Part 2: Tests – Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)*

IEC 60068-2-32:1975, *Environmental testing – Part 2: Tests – Test Ed: Free fall (Procedure 1)*

IEC 60068-2-45:1980, *Environmental testing – Part 2: Tests – Test XA and guidance: Immersion in cleaning solvents*

IEC 60122-3:2001, *Quartz crystal units of assessed quality – Part 3: Standard outlines and lead connections*

IEC 60444-1:1986, *Measurement of quartz crystal unit parameters by zero phase technique in a π-network – Part 1: Basic method for the measurement of resonance frequency and resonance resistance of quartz crystal units by zero phase techniques in a π-network*

IEC 60444-2:1980, *Measurement of quartz crystal unit parameters by zero phase technique in a π-network – Part 2: Phase offset method for the measurement of motional capacitance of quartz crystal units*

IEC 60444-4:1988, *Measurement of quartz crystal unit parameters by zero phase technique in a π-network – Part 4: Method for the measurement of the load resonance frequency f_L, load resonance resistance R_L and the calculation of other derived values of quartz crystal units, up to 30 MHz*

IEC 60444-5:1995, *Measurement of quartz crystal unit parameters – Part 5: Methods for the determination of equivalent electrical parameters using automatic network analyzer techniques and error corrections*

IEC 60444-6:1995, *Measurement of quartz crystal unit parameters – Part 6: Measurement of drive level dependence (DLD)*

IEC 60617 (all parts), *Graphical symbols for diagrams*

IEC 61178-2:1993, *Quartz crystal units – A specification in the IEC Quality Assessment System for Electronic Components (IECQ) – Part 2: Sectional specification – Capability approval*

IEC 61178-3:1993, *Quartz crystal units – A specification in the IEC Quality Assessment System for Electronic Components (IECQ) – Part 3: Sectional specification – Qualification approval*

IEC 61760-1:2006, *Surface mounting technology – Part 1: Standard method for the specification of surface mounting components (SMDs)*

IEC QC 001001:2000, *IEC Quality Assessment System for Electronic Components (IECQ) – Basic Rules*

IEC QC 001002-2:1998, *ICQ Quality Assessment System for Electronic Components (IECQ) – Rules of Procedure – Part 2: Documentation*

IEC QC 001002-3:1998, *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of Procedure – Part 3: Approval Procedures*

IEC QC 001005:2000, *Register of firms, products and services approved under the IECQ System, including ISO 9000*

ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units*

1.3 Order of precedence

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

– the detail specification;

– the sectional specification;

– the 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.

2 Terminology and general requirements

2.1 General

Units, graphical symbols, letter symbols and terminology shall, wherever possible, be taken from the following standards: IEC 60027, IEC 60050(561), IEC 60617 and ISO 1000.

2.2 Terms, definitions and classification of phenomena

The following paragraphs contain additional terminology applicable to quartz crystal units and describe certain phenomena in this context.

2.2.1
crystal element (crystal blank)
piezoelectric material cut to a given geometrical shape, size and orientation with respect to the crystallographic axes of the crystal

2.2.2
electrode
an electrically conductive plate or film in contact with, or in proximity to, a face of a crystal element by means of which an electric field is applied to the element

2.2.3
crystal resonator
a mounted crystal element that vibrates when an alternating electric field exists between the electrodes

2.2.4
mounting
the means by which the crystal resonator is supported (within its enclosure)

2.2.5
enclosure
the enclosure protecting the crystal resonator(s) and mounting

2.2.6
enclosure type
a crystal enclosure of specific outline dimensions and material with a defined method of sealing

2.2.7
crystal unit
a crystal resonator mounted in an enclosure

2.2.8
socket
a component into which the crystal unit is inserted to hold the crystal unit and to provide electrical connection

2.2.9
mode of vibration
the pattern of motion in a vibrating body of the individual particles resulting from stresses applied to the body, the frequency of oscillation and the boundary conditions existing. The common modes of vibration are:

– flexural;
– extensional;
– face shear;
– thickness shear.

2.2.10
fundamental crystal unit
a crystal resonator designed to operate at the lowest order of a given mode

2.2.11
overtone crystal unit
a crystal resonator designed to operate at a higher order than the lowest of the given mode

2.2.12
overtone order
the numbers allotted to the successive overtones of a given mode of vibration from the ascending series of integral numbers commencing with the fundamental as unity. For shear and extensional modes, this overtone is the integral multiple of the fundamental frequency to which the overtone frequency approximates

2.2.13
crystal unit equivalent circuit
the electric circuit which has the same impedance as the crystal unit in the region of the desired resonance and anti-resonance frequencies. It is represented by an inductance, capacitance and resistance in series, this series arm being shunted by the capacitance between the terminals of the unit. The parameters of the series branch of inductance, capacitance and resistance are given by L_1, C_1 and R_1 respectively: these are termed "motional parameters" of the crystal unit. The shunt (parallel) capacitance is denoted by C_0 (see figure 1).

The parameters are independent of frequency for isolated modes of motion. Generally, the mode in question is sufficiently isolated from other modes to permit this assumption. When this is not true, the equations and measuring methods outlined herein do not apply. For identification of symbols used in this standard, see table 1.

NOTE 1 The equivalent circuit does not represent all the characteristics of a crystal unit.

NOTE 2 The values of R_e, X_e, G_p and B_p vary rapidly around the resonance frequency,

where

R_e is the equivalent circuit series resistance of the resonator;

X_e is the equivalent circuit series reactance of the resonator;

G_p is the equivalent circuit parallel conductance of the resonator;

B_p is the equivalent circuit parallel susceptance of the resonator.