

INTERNATIONAL STANDARD

IEC
60679-1

Third edition
2007-04

Quartz crystal controlled oscillators of assessed quality –

Part 1: Generic specification



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE **XC**

For price, see current catalogue

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms, definitions and general information	9
3.1 General	9
3.2 Definitions	9
3.3 Preferred values for ratings and characteristics	19
3.4 Marking	21
4 Quality assessment procedures	21
4.1 Primary stage of manufacture.....	21
4.2 Structurally similar components	21
4.3 Subcontracting	22
4.4 Incorporated components	22
4.5 Manufacturer's approval	22
4.6 Approval procedures	22
4.7 Procedures for capability approval	23
4.8 Procedures for qualification approval.....	23
4.9 Test procedures	24
4.10 Screening requirements	24
4.11 Rework and repair work.....	24
4.12 Certified test records	24
4.13 Validity of release.....	24
4.14 Release for delivery	24
4.15 Unchecked parameters.....	25
5 Test and measurement procedures.....	25
5.1 General	25
5.2 Test and measurement conditions	25
5.3 Visual inspection	26
5.4 Dimensions and gauging procedures	27
5.5 Electrical test procedures	27
5.6 Mechanical and environmental test procedures	70
5.7 Endurance test procedure	76
Annex A (normative) Load circuit for logic drive	78
Annex B (normative) Latch-up test.....	81
Annex C (normative) Electrostatic discharge sensitivity classification	82
Bibliography.....	83
Figure 1 – Example of the use of frequency offset	11
Figure 2 – Typical frequency fluctuation characteristics	14
Figure 3 – Characteristics of an output waveform.....	16
Figure 4 – Clock signal with phase jitter	17
Figure 5 – Phase jitter measures	17

Figure 6 – Gaussian distribution of jitter.....	18
Figure 7 – Jitter amplitude and period of jitter frequency.....	18
Figure 8 – Jitter tolerance according to ITU-T G.825, ANSI T1.105.03, Telcordia GR-253 and ETSI EN 300462	19
Figure 9 – Test circuits for insulation resistance measurements.....	27
Figure 10 – Test circuit for voltage proof test.....	28
Figure 11 – Test circuit for oscillator input power measurement.....	28
Figure 12 – Test circuit for oven and oscillator input power measurement.....	29
Figure 13 – Test circuit for measurement of output frequency, method1.....	30
Figure 14 – Test circuit for measurement of output frequency, method 2.....	30
Figure 15 – Test circuit for measurement of frequency/temperature characteristics.....	31
Figure 16 – Thermal transient behaviour of typical oscillator.....	33
Figure 17 – Generalized oscillator circuit	34
Figure 18 – Test circuit for start-up behaviour and start-up time measurement	35
Figure 19 – Typical start-up behaviour with slow supply voltage ramp.....	35
Figure 20 – Definition of start-up time	37
Figure 21 – Supply voltage waveform for periodical t_{SU} measurement	37
Figure 22 – Typical oscillator stabilization characteristic	38
Figure 23 – Example of retrace characteristic	39
Figure 24 – Test circuit for the measurement of output voltage	39
Figure 25 – Test circuit for the measurement of pulse outputs	40
Figure 26 – Test circuit for harmonic distortion measurement	40
Figure 27a – Symmetrical	40
Figure 27b – Large odd harmonic content	40
Figure 27c – Large even harmonic content	41
Figure 27 – Quasi-sinusoidal output waveforms	41
Figure 28a – Ideal spectrum	41
Figure 28b – Spectrum showing severe harmonic distortion	41
Figure 28 – Frequency spectrum for harmonic distortion.....	41
Figure 29 – Test circuit for the determination of isolation between output ports.....	44
Figure 30 – Test circuit for measuring suppression of gated oscillators.....	44
Figure 31 – Test circuit for tri-state disable mode output current.....	45
Figure 32 – Test circuit for output gating time – tri-state	46
Figure 33 – Test circuit for modulation index measurement.....	46
Figure 34 – Modulation waveform for index calculation	47
Figure 35 – Logarithmic signal amplitude scale.....	47
Figure 36 – Test circuit to determine amplitude modulation sensitivity	49
Figure 37 – Frequency spectrum of amplitude modulation distortion	49
Figure 38 – Test circuit to determine pulse amplitude modulation	50
Figure 39 – Pulse modulation characteristic.....	50
Figure 40 – Test circuit for the determination of modulation input impedance.....	51
Figure 41 – Test circuit for the measurement of f.m. deviation	52
Figure 42 – Test circuit for the measurement of f.m. sensitivity.....	54

Figure 43a – Static test.....	54
Figure 43b – Dynamic test	55
Figure 43 – Test circuit for the measurement of frequency modulation distortion.....	55
Figure 44 – Test circuit for the measurement of single-sideband phase noise	56
Figure 45 – Typical noise pedestal spectrum	57
Figure 46 – Test circuit for the measurement of incidental frequency modulation	59
Figure 47 – Test circuit for method 1.....	60
Figure 48 – Test circuit for method 2.....	61
Figure 49 – Circuit modifications for methods 1 and 2.....	62
Figure 50 – Time-domain short-term frequency stability of a typical 5 MHz precision oscillator	63
Figure 51a – Typical arrangement for radiated interference tests, 30 MHz and above.....	64
Figure 51b – Typical arrangement for radiated interference tests, below 30 MHz	64
Figure 51 – Radiated interference tests	64
Figure 52 – Characteristics of line impedance of stabilizing network	65
Figure 53 – Circuit diagram of line impedance of stabilizing network.....	66
Figure 54 – Phase jitter measurement with sampling oscilloscope	67
Figure 55 – Block diagram of a jitter and wander analyzer according to ITU-T O.172	69
Figure A.1 – Circuit for TTL.....	78
Figure A.2 – Circuit for schottky logic.....	78
Table 1 – Measuring sets bandwidth	66
Table 2 – Fourier frequency range for phase noise test.....	68
Table 3 – Standard bit rates for various applications	70
Table 4 – Tensile force	70
Table 5 – Thrust force.....	71
Table 6 – Bending force	71
Table 7 – Torque force.....	72
Table A.1 – Value to be using when calculating R_1 and R_2	79

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**QUARTZ CRYSTAL CONTROLLED OSCILLATORS
OF ASSESSED QUALITY –**
Part 1: Generic specification

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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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 60679-1 has been prepared by IEC technical committee 49: Piezoelectric and dielectric devices for frequency control and selection.

This third edition cancels and replaces the second edition published in 1997 and its Amendments 1 (2002) and 2 (2003) and constitutes a technical revision. It represents a step in a revision of all parts of the IEC 60679 series to include the test requirements of the IECQ system. This edition is based on the relevant standards of that system.

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

FDIS	Report on voting
49/769/FDIS	49/776/RVD

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

A list of all parts of the IEC 60679 series, published under the general title *Quartz crystal controlled oscillators of assessed quality*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

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

QUARTZ CRYSTAL CONTROLLED OSCILLATORS OF ASSESSED QUALITY –

Part 1: Generic specification

1 Scope

This part of IEC 60679 specifies the methods of test and general requirements for quartz crystal controlled oscillators of assessed quality using either capability approval or qualification approval procedures.

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, *International Electrotechnical Vocabulary (IEV) – Part 561: Piezoelectric devices for frequency control and selection*

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*
Amendment 1 (1992)

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

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

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

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

IEC 60068-2-10, *Environmental testing – Part 2-10: Tests – Test J and guidance: Mould growth*

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

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

IEC 60068-2-17, *Environmental testing – Part 2: Tests – Test Q: Sealing*

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

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

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

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

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

IEC 60068-2-32, *Environmental testing – Part 2: Tests – Test Ed: Free fall*

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

IEC 60068-2-52, *Environmental testing – Part 2: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60068-2-58, *Environmental testing – Part 2-58: Tests – Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*

IEC 60068-2-64, *Environmental testing – Part 2: Test methods – Test Fh: Vibration, broad-band random (digital control) and guidance*

IEC 60068-2-78:2001, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60469-1:1987, *Pulse techniques and apparatus – Part 1: Pulse terms and definitions*

IEC 60617-DB: 2001¹, *Graphical symbols for diagrams*

IEC 60679-5, *Quartz crystal controlled oscillators of assessed quality – Part 5: Sectional specification – Qualification approval*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test*

IECQ 01, *IEC Quality Assessment System for Electronic Components (IECQ) – Basic Rules*

IEC QC 001002-2:1998, *IEC 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*

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

ITU-T G.810, *Definitions and terminology for synchronization networks*

ITU-T G.811: *Timing characteristics of primary reference clocks*

ITU-T G.812, *Timing requirements of slave clocks suitable for use as node clocks in synchronization networks*

ITU-T G.813, *Timing characteristics of SDH equipment slave clocks (SEC)*

ITU-T G.825, *The control of jitter and wander within digital networks which are based on the synchronous digital hierarchy (SDH)*

¹ "DB" refers to the IEC on-line database.

ANSI T1.101, *Synchronization Interface Standard*

ANSI T1.105.03, *Synchronous Optical Network (SONET) – Jitter and Wander at Network Equipment Interfaces*

ETSI EN 300 462 (all parts), *Transmission and Multiplexing (TM); Generic requirements for synchronization networks*

Telcordia GR-253, *Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria*

- **Order of precedence**

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.