
Surface acoustic wave (SAW) filters of assessed quality - Part 2: Guidance on use
(IEC 60862-2:2002)

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**Surface acoustic wave (SAW) filters of assessed quality
Part 2: Guidance on use
(IEC 60862-2:2002)**

Filtres à ondes acoustiques de surface
(OAS) sous assurance de la qualité
Partie 2: Guide d'utilisation
(CEI 60862-2:2002)

Oberflächenwellenfilter (OFW-Filter)
mit bewerteter Qualität
Teil 2: Leitfaden für die Anwendung
(IEC 60862-2:2002)

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This European Standard was approved by CENELEC on 2002-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 49/542/FDIS, future edition 2 of IEC 60862-2, prepared by IEC TC 49, Piezoelectric and dielectric devices for frequency control and selection, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60862-2 on 2002-09-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2003-06-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2005-09-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annex ZA is normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60862-2:2002 was approved by CENELEC as a European Standard without any modification.

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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60368-2-1	1988	Piezoelectric filters Part 2: Guide to the use of piezoelectric filters Section 1: Quartz crystal filters	-	-
IEC 60862	Series	Surface acoustic wave (SAW) filters of assessed quality	-	-

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Second edition
2002-05

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sous assurance de la qualité –**

**Partie 2:
Guide d'utilisation**

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**Part 2:
Guidance on use**

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International Electrotechnical Commission
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For price, see current catalogue*

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SURFACE ACOUSTIC WAVE (SAW) FILTERS
OF ASSESSED QUALITY –**
Part 2: Guidance on use

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60862-2 has been prepared by IEC technical committee 49: Piezoelectric and dielectric devices for frequency control and selection.

This second edition cancels and replaces the first edition published in 1991 and constitutes a technical revision.

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

FDIS	Report on voting
49/542/FDIS	49/550/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.

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

IEC 60862 consists of the following parts, under the general title *Surface acoustic wave (SAW) filters of assessed quality*

- Part 1: General information, standard values and test conditions ¹⁾
- Part 2: Guidance on use
- Part 3: Standard outlines ²⁾
- Part 4: Sectional specification – Capability approval (under consideration)
- Part 4-1: Blank detail specification – Capability approval (under consideration)

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 publication will remain unchanged until 2007. At this date, the publication will be

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

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¹⁾ A second edition (generic specification) is under consideration.

²⁾ A second edition is under consideration.

INTRODUCTION

This part of IEC 60862 gives practical guidance on the use of SAW filters which are used in telecommunications, measuring equipment, radar systems and consumer products. IEC 60862-1 should be referred to for general information, standard values and test conditions.

The features of these SAW filters are their small size, light weight, adjustment-free, high stability and high reliability. SAW filters add new features and applications to the field of crystal filters and ceramic filters. At the beginning, SAW filters meant transversal filters which have two interdigital transducers (IDT). Although SAW transversal filters have a relatively higher minimum insertion attenuation, they have excellent amplitude and phase characteristics. Extensive studies have been made to reduce minimum insertion attenuation, such as resonator filter configurations, unidirectional interdigital transducers (UDT), interdigitated interdigital transducers (IIDT). Nowadays, various kinds of SAW filters with low insertion attenuation are widely used in various applications and SAW filters are available in the gigahertz range.

This standard has been compiled in response to a generally expressed desire on the part of both users and manufacturers for guidance on the use of SAW filters, so that the filters may be used to their best advantage. To this end, general and fundamental characteristics have been explained here.

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SURFACE ACOUSTIC WAVE (SAW) FILTERS OF ASSESSED QUALITY –

Part 2: Guidance on use

1 Scope

SAW filters are now widely used in a variety of applications such as TV, satellite communications, optical fibre communications, mobile communications and so on. While these SAW filters have various specifications, many of them can be classified within a few fundamental categories.

This part of IEC 60862 includes various kinds of filter configuration, of which the operating frequency range is from approximately 10 MHz to 3 GHz and the relative bandwidth is about 0,02 % to 100 % of the centre frequency.

It is not the aim of this standard to explain theory, nor to attempt to cover all the eventualities which may arise in practical circumstances. This standard draws attention to some of the more fundamental questions, which should be considered by the user before he places an order for a SAW filter for a new application. Such a procedure will be the user's insurance against unsatisfactory performance.

Standard specifications, given in IEC 60862, and national specifications or detail specifications issued by manufacturers, define the available combinations of nominal frequency, pass bandwidth, ripple, shape factor, terminating impedance, etc. These specifications are compiled to include a wide range of SAW filters with standardized performances. It cannot be over-emphasized that the user should, wherever possible, select his SAW filters from these specifications, when available, even if it may lead to making small modifications to his circuit to enable standard filters to be used. This applies particularly to the selection of the nominal frequency.

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 60368-2-1:1988, *Piezoelectric filters – Part 2: Guide to the use of piezoelectric filters – Section One: Quartz crystal filters*

IEC 60862 (all parts), *Surface acoustic wave (SAW) filters of assessed quality*

3 Terms and definitions

For the purpose of this part of IEC 60862, the following terms and definitions apply.

3.1 General terms

3.1.1

surface acoustic wave (SAW)

acoustic wave, propagating along a surface of an elastic substrate, whose amplitude decays exponentially with substrate depth

3.1.2**surface acoustic wave filter (SAW filter)**

filter characterized by a surface acoustic wave which is usually generated by an interdigital transducer and propagates along a substrate surface to a receiving transducer

3.1.3**power flow vector**

vector, analogous to a Poynting vector, characterizing energy propagation caused by a surface acoustic wave

3.1.4**propagation vector**

vector characterizing the phase progression of a wave

3.1.5**power flow angle**

angle between the direction of the power flow vector and the direction of the propagation vector

3.1.6**SAW beam steering**

SAW propagation phenomenon in anisotropic materials described by an angle of power flow which is not zero

3.1.7**SAW diffraction**

phenomenon (analogous to diffraction of light from a source of finite aperture) which causes SAW beam spreading and wavefront distortion

3.1.8**SAW coupling coefficient (k_s^2)**

SAW electromechanical coupling coefficient is defined as follows:

$$k_s^2 = 2 \left| \frac{\Delta v_s}{v_s} \right|$$

where

$\Delta v_s/v_s$ is the relative velocity change produced by short-circuiting the surface potential from the open-circuit condition

3.1.9**interdigital transducer (IDT)**

SAW transducer made of two comb-like conductive structures deposited on a piezoelectric substrate transforming electrical energy into acoustic energy or vice versa

3.1.10**unidirectional interdigital transducer (UDT)**

transducer capable of radiating and receiving surface acoustic waves in or from a single direction

3.1.11**multiphase transducer**

interdigital transducer having more than two inputs which are driven in different phases. Usually used as a unidirectional transducer

3.1.12**finger**

element of the IDT comb electrode

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3.1.13**dummy finger**

passive finger which may be included in order to suppress wavefront distortion

3.1.14**split finger**

finger formed of more than one element, so as to produce antireflection properties

3.1.15**bus bar**

common electrode which connects individual fingers together and also connects the filter to an external circuit

3.1.16**weighted-response transducer**

transducer intended to produce a specified impulse response by design of the structure (see, for example, 3.1.17 to 3.1.22)

3.1.17**finger overlap or source strength**

length of a finger pair between which only electromechanical interaction is generated

3.1.18**apodization**

weighting produced by the change of finger overlap over the length of the IDT

3.1.19**withdrawal weighting**

weighting by removal of fingers or sources

3.1.20**capacitive weighting**

weighting by change of capacitance between electrodes

3.1.21**series weighting**

weighting by separation of a finger into individual elements having capacitive coupling between them. The elements may be separated from the bus bar

3.1.22**phase weighting**

weighting by change in period of finger arrangement inside the IDT

3.1.23**aperture**

normalized beamwidth of the SAW generated at centre frequency and normalized to the corresponding wavelength

3.1.24**multistrip coupler (MSC)**

array of additional metal strips deposited on a piezoelectric substrate, in a direction transverse to the propagation direction, which transfers acoustic power from one acoustic track to an adjacent track