

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Surface acoustic wave (SAW) filters of assessed quality –
Part 1: Generic specification

Filtres à ondes acoustiques de surface (OAS) sous assurance de la qualité –
Partie 1: Spécification générique

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Surface acoustic wave (SAW) filters of assessed quality –
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Filtres à ondes acoustiques de surface (OAS) sous assurance de la qualité –
Partie 1: Spécification générique

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OF ASSESSED QUALITY –****Part 1: Generic specification****FOREWORD**

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International Standard IEC 60862-1 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 2003. This edition constitutes a technical revision.

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

- the terms and definitions from IEC 60862-2:2002 are included;
- the measurement method for the balanced type filter is described;
- the electrostatic discharge (ESD) sensitivity test procedure is considered.

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

FDIS	Report on voting
49/1151/FDIS	49/1164/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 2.

A list of all parts in the IEC 60862 series, published under the general title *Surface acoustic wave (SAW) filters of assessed quality*, can be found on the IEC web site.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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SURFACE ACOUSTIC WAVE (SAW) FILTERS OF ASSESSED QUALITY –

Part 1: Generic specification

1 Scope

This part of IEC 60862 specifies the methods of test and general requirements for SAW filters of assessed quality using either capability approval or qualification approval procedures.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 (all parts), *International Electrotechnical Vocabulary* (available at www.electropedia.org)

IEC 60068-1:2013, *Environmental testing – Part 1: General and guidance*
[IEC 60862-1:2015](https://standards.iteh.ai/catalog/standards/iec/13f639b3-17c5-49e7-84c7-0aa935dc625d/iec-60862-1-2015)

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*
<https://standards.iteh.ai/catalog/standards/iec/13f639b3-17c5-49e7-84c7-0aa935dc625d/iec-60862-1-2015>

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

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

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

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

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

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

IEC 60068-2-20, *Environmental testing – Part 2-20: Tests – Test T: Test methods for solderability and resistance to soldering heat of devices with leads*

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 2-27: Tests – Test Ea and guidance: Shock*

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

IEC 60068-2-31, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

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

IEC 60068-2-52, *Environmental testing – Part 2-52: 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 2-64: Tests – Test Fh: Vibration, broad-band random and guidance*

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

IEC 60122-1, *Quartz crystal units of assessed quality – Part 1: Generic specification*

IEC 60617, *Graphical symbols for diagrams* (available at <http://std.iec.ch/iec60617>)

IEC 60642, *Piezoelectric ceramic resonators and resonator units for frequency control and selection – Chapter I: Standard values and conditions – Chapter II: Measuring and test conditions*

IEC 60695-11-5, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

IEC 60749-28¹, *Semiconductor devices – Mechanical and climatic test methods – Part 28: Electrostatic discharge (ESD) sensitivity testing direct contact charged device model (DC-CDM)*

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

IEC 61340-3-1, *Electrostatics – Part 3-1: Methods for simulation of electrostatic effects – Human body model (HBM) electrostatic discharge test waveforms*

IEC 61340-3-2, *Electrostatics – Part 3-2: Methods for simulation of electrostatic effects – Machine model (MM) electrostatic discharge test waveforms*

IEC 80000 (all parts), *Quantities and units*

ISO 80000 (all parts), *Quantities and units*

¹ To be published.

3 Terms, definitions, units and symbols

3.1 Terms and definitions

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

3.1.1 General terms

3.1.1.1

surface acoustic wave

SAW

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

3.1.1.2

surface acoustic wave filter

SAW filter

filter characterized by one or more surface acoustic wave transmission line or resonant elements, where the surface acoustic wave is usually generated by an interdigital transducer and propagates along a material surface

3.1.1.3

power flow vector

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

3.1.1.4

propagation vector

vector characterizing the phase progression of a wave

3.1.1.5

power flow angle

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

3.1.1.6

SAW beam steering

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

3.1.1.7

SAW diffraction

phenomenon, analogous to diffraction of light from a source of finite aperture, which causes SAW beam spreading and wave-front distortion

3.1.1.8

SAW coupling coefficient

$$k_s^2$$

electromechanical coupling coefficient defined as follows:

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

where

v_s is the SAW propagation velocity on the free surface;

Δv_s is the change of SAW velocity due to short-circuiting the surface potential;

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

3.1.1.9

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

3.1.1.10

unidirectional interdigital transducer

UDT

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

3.1.1.11

multiphase transducer

interdigital transducer having more than two inputs which are driven in different phases

Note 1 to entry: Usually used as a unidirectional transducer.

3.1.1.12

finger

element of the IDT comb electrode

3.1.1.13

solid finger

finger formed of one element with a period of a half wavelength along the propagation direction

3.1.1.14

split finger

finger formed of more than one element, so as to produce antireflection properties in a surface acoustic wave filter

3.1.1.15

dummy finger

passive finger which may be included in order to suppress wave-front distortion

3.1.1.16

bus bar

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

3.1.1.17

weighted-response transducer

transducer intended to produce a specified impulse response by design of the structure

Note 1 to entry: See 3.1.1.18 to 3.1.1.23.

3.1.1.18

finger overlap or source strength

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

3.1.1.19

apodization

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

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3.1.1.20**withdrawal weighting**

weighting by removal of fingers or sources

3.1.1.21**capacitive weighting**

weighting by change of capacitance between electrodes

3.1.1.22**series weighting**

weighting by separation of a finger into individual elements having capacitive coupling between them

Note 1 to entry: The elements may be separated from the bus bar.

3.1.1.23**phase weighting**

weighting by change in period of finger arrangement inside the IDT

3.1.1.24**aperture**

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

3.1.1.25**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

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3.1.1.26**reflector**

SAW reflecting component which normally makes use of the periodic discontinuity provided by a metal strip array or a grooved array

3.1.1.27**spurious reflection**

unwanted signal caused by reflection of SAW or bulk waves from substrate edges or electrodes

3.1.1.28**triple transit echo****TTE**

unwanted signals in a SAW filter which have traversed three times the propagation path between input and output IDTs caused by reflections from output and input transducers

3.1.1.29**bulk wave signal**

unwanted signal caused by bulk wave excitation and detected at the filter output

3.1.1.30**feed through signal****signal of electromagnetic interference**

unwanted signal from the input appearing at the filter output due to stray capacitances and other electromagnetic couplings

3.1.1.31

suppression corrugation

grooves in the non-active side of a substrate for suppressing bulk wave signals

3.1.1.32

acoustic absorber

material with high acoustic loss placed on any part of the substrate for acoustic absorption purposes

3.1.1.33

shielding electrode

electrode intended for the reduction of electromagnetic interference signals

3.1.1.34

interdigitated interdigital transducer

IIDT

SAW transducer made of a combination of three or more interdigital transducers

Note 1 to entry: Same as a multi-IDT in the IEC 60862 series, IIDT(or multi-IDT) resonator filter is used to refer to SAW resonator filters composed of a number of IDTs for input and output in a line alternately with grating reflectors at both ends.

3.1.2 Response characteristics related terms

3.1.2.1

nominal frequency

frequency given by the manufacturer or the specification to identify the filter

3.1.2.2

centre frequency

arithmetic mean of the cut-off frequencies

SEE: Figure 1.

3.1.2.3

reference frequency

frequency defined by the specification to which other frequencies may be referred

SEE: Figure 1.

3.1.2.4

cut-off frequency

frequency of the pass band at which the relative attenuation reaches a specified value

SEE: Figure 1.

3.1.2.5

total power loss

logarithmic ratio of the available power at the given source to the power that the SAW filter delivers to a load impedance under specified operating conditions

3.1.2.6

insertion attenuation

logarithmic ratio of the power delivered directly to the load impedance before insertion of the filter to the power delivered to the load impedance after insertion of the filter

3.1.2.7**nominal insertion attenuation**

insertion attenuation at a specified reference frequency

SEE: Figure 1.

3.1.2.8**relative attenuation**

difference between the attenuation at a given frequency and the attenuation at the reference frequency

SEE: Figure 1.

3.1.2.9**pass band**

band of frequencies in which the relative attenuation is equal to or less than a specified value

3.1.2.10**pass bandwidth**

separation of frequencies between which the relative attenuation is equal to or less than a specified value

3.1.2.11**pass band ripple**

maximum variation in attenuation characteristics within a specified pass band

SEE: Figure 1.

3.1.2.12**TTE ripple**

maximum variation in attenuation characteristics caused by TTE within a specified pass band

SEE: Figure 1.

3.1.2.13**minimum insertion attenuation**

minimum value of insertion attenuation in the pass band

SEE: Figure 1.

3.1.2.14**maximum insertion attenuation**

maximum value of insertion attenuation in the pass band

SEE: Figure 1.

3.1.2.15**stop band**

band of frequencies in which the relative attenuation is equal to or greater than a specified value

3.1.2.16**stop bandwidth**

separation of frequencies between which the relative attenuation is equal to or greater than a specified value

3.1.2.17**stop band rejection**

minimum relative attenuation at a specified stop band