SLOVENSKI STANDARD
SIST EN 62047-7:2011

01-oktober-2011

Polprevodniški elementi - Mikroelektromehanski elementi - 7. del: Filter & duplekser MEMS BAW za radiofrekvenčno krmiljenje in izbiranje

Semiconductor devices - Micro-electromechanical devices - Part 7: MEMS BAW filter & duplexer for radio frequency control and selection

Dispositifs à semiconducteurs - Dispositifs microélectromécaniques - Partie 7: Filtre & duplexeur BAW MEMS pour la commande et le choix des fréquences radioélectriques

Ta slovenski standard je istoveten z: EN 62047-7:2011

ICS:

31.080.01	Polprevodniški elementi (naprave) na splošno	Semiconductor devices in general

SIST EN 62047-7:2011 en

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62047-7

August 2011

ICS 31.080.99

English version

Semiconductor devices -
Micro-electromechanical devices -
Part 7: MEMS BAW filter and duplexer for radio frequency control and selection
(IEC 62047-7:2011)

Dispositifs à semiconducteurs -
Dispositifs microélectromécaniques -
Partie 7: Filtre et duplexeur BAW MEMS pour la commande et le choix des fréquences radioélectriques
(CEI 62047-7:2011)

Halbleiterbauelemente -
Bauelemente der Mikrosystemtechnik -
Teil 7: BAW-MEMS-Filter und -Duplexer zur Hochfrequenz-Regelung und -Auswahl
(IEC 62047-7:2011)

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 62047-7:2011 E

Foreword

The text of document 47F/79/FDIS, future edition 1 of IEC 62047-7, prepared by SC 47F, Micro-electromechanical systems, of IEC TC 47, Semiconductor devices, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62047-7 on 2011-07-21.

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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)	2012-04-21
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2014-07-21

Endorsement notice

The text of the International Standard IEC 62047-7:2011 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60368-1:2000 + A1:2004	NOTE Harmonized as EN 60368-1:2000 + A1:2004 (not modified).
IEC 60368-2-2	NOTE Harmonized as EN 60368-2-2.
IEC 60862-1:2003	NOTE Harmonized as EN 60862-1:2003 (not modified).
IEC 60862-2	NOTE Harmonized as EN 60862-2.

IEC 62047-7

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colour inside

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Dispositifs à semiconducteurs – Dispositifs microélectromécaniques – Partie 7: Filtre et duplexeur BAW MEMS pour la commande et le choix des fréquences radioélectriques

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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International Standard IEC 62047-7 has been prepared by subcommittee 47F: Micro-electromechanical systems, of IEC technical committee 47: Semiconductor devices.

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

FDIS	Report on voting
47F/79/FDIS	47F/87/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.

The committee has decided that the contents of this publication 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.

IMPORTANT – The "colour inside" logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

SEMICONDUCTOR DEVICES – MICRO-ELECTROMECHANICAL DEVICES –

Part 7: MEMS BAW filter and duplexer for radio frequency control and selection

1 Scope

This part of IEC 62047 describes terms, definition, symbols, configurations, and test methods that can be used to evaluate and determine the performance characteristics of BAW resonator, filter, and duplexer devices as radio frequency control and selection devices. This standard specifies the methods of tests and general requirements for BAW resonator, filter, and duplexer devices of assessed quality using either capability or qualification approval procedures.

2 Normative references

Void.

3 Terms and definitions

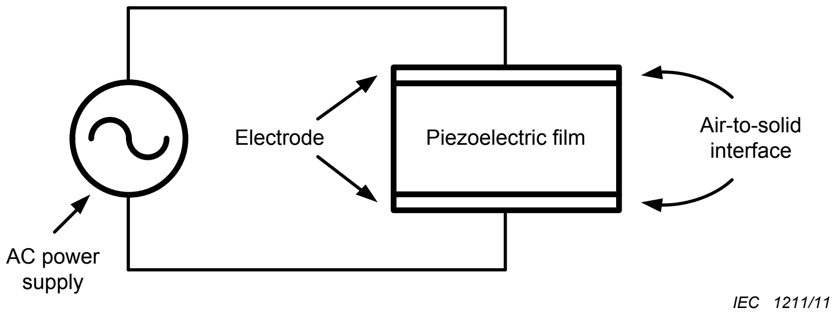
For the purposes of this document, the following terms and definitions apply.

3.1 General terms

3.1.1
bulk acoustic wave
BAW
acoustic wave propagating in a bulk body

3.1.2
BAW resonator
resonator employing bulk acoustic wave

NOTE BAW resonator consists of piezoelectric material between top and bottom electrodes, as shown in Figure 1. The top and bottom electrodes which can be made to vibrate in a vertical direction of the deposited piezoelectric film. The electrodes are either two air-to-solid interfaces or an acoustic Bragg reflector and an air-to-solid interface. The former is often called the film bulk acoustic resonator (FBAR), and the latter is called the solidly-mounted resonator (SMR).



Key

Layers of a piece of BAW resonator		Components to operate a BAW resonator	
Electrode	To provide electrical input to a body of piezoelectric film and electrical connections with a external circuit	AC power supply	Electric power supply to vibrate a BAW resonator
Piezoelectric film	Body layer of a kind of BAW resonator		
Air to solid interface			

Figure 1 – Basic structure of BAW resonator

3.1.3
electrode
electrically conductive plate in proximity to or film in contact with a face of the piezoelectric film by means of which a polarizing or driving field is applied to the element

[IEC/TS 61994-1, 3.21]

3.1.4
piezoelectric film
film which has piezoelectricity

NOTE Piezoelectric films can be distinguished as non-ferroelectric and ferroelectric materials. The non-ferroelectric materials, such as AIN (aluminium nitride) and ZnO (zinc oxide) have low dielectric constant, small dielectric loss, good hardness, and excellent insulating properties. Thus, they are good for microwave resonator and filter applications. The ferroelectric materials, such as PZT (lead-zirconate-titanate) and PLZT (lead-lanthanum-zirconate) have high dielectric constant, large dielectric loss, and fair insulating properties. Thus, they are good for memory and actuator applications.

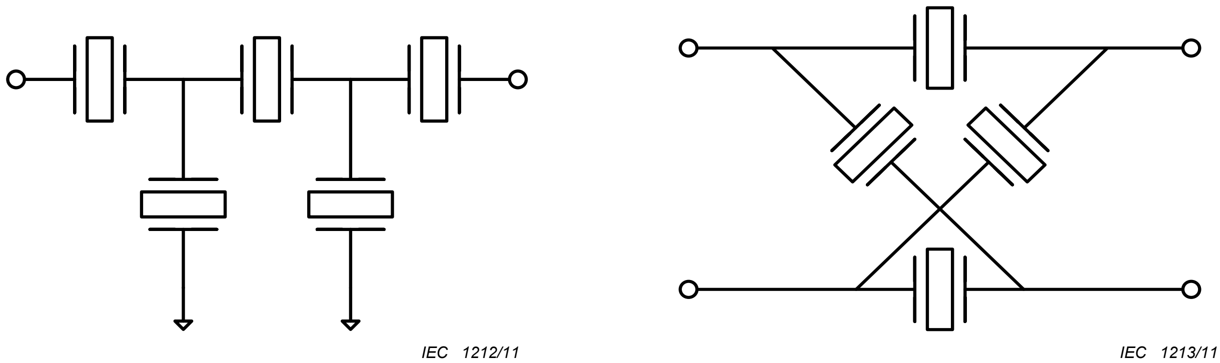
3.1.5
direct piezoelectric effect
effect which a mechanical deformation of piezoelectric material produces a proportional change in the electric polarization of that material

3.1.6
converse (or reverse) piezoelectric effect
effect which mechanical stress proportional to an acting external electric field is induced in the piezoelectric material

NOTE Converse piezoelectric effect is widely being used for acoustic wave resonators and filters, resonant sensors, oscillators, ultrasonic wave generators, and actuators. Direct piezoelectric effect is usually applied for various piezoelectric sensors and voltage generators.

3.2 Related with BAW filter

Figure 2 shows topologies for BAW filter design.



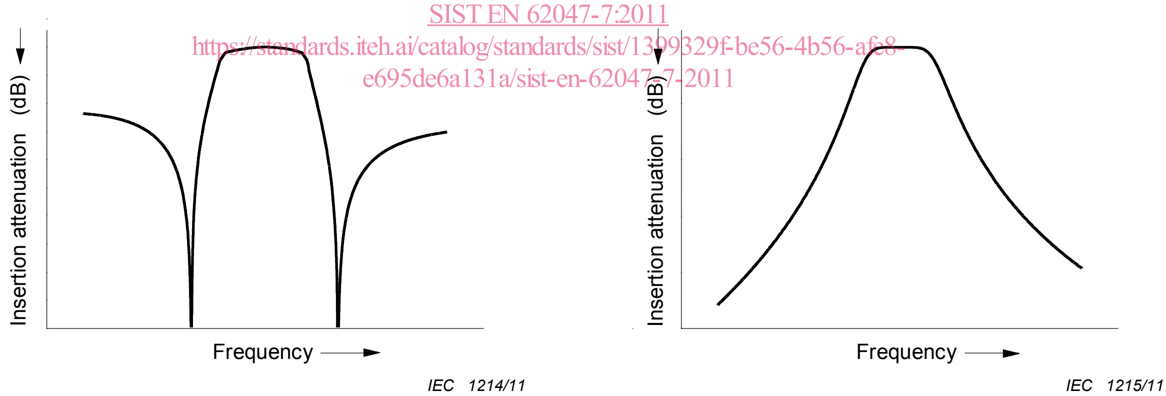
a) Ladder type b) Lattice type

Figure 2 – Topologies for BAW filter design

NOTE BAW resonators are connected in series and parallel for forming electrical filters, as shown in Figure 2. The resonant frequencies of series and parallel resonators should be different to secure the bandwidth of the BAW filter.

3.2.1
ladder filter
filter having a cascade or tandem connection of alternating series and shunt BAW resonators

NOTE BAW resonator connected in series should have slightly higher resonant frequency than that of a parallel BAW resonator. The parallel resonant frequency of the parallel BAW resonator needs to be equal to the series resonant frequency of the series BAW resonator in the filter geometry shown in Figure 2. It gives a steep roll-off, but poor stop-band rejection characteristics as shown in Figure 3a). Thus, helper inductors are usually given to improve the isolation, and in general, the out-of-band rejection far from the passband becomes worse.



a) Ladder type b) Lattice type

Figure 3 – Frequency responses of ladder and lattice type BAW filters

3.2.2
lattice filter
filter having two pairs of resonators electrically coupled in a bridge network, with one pair of resonators in a series arm and the other pair in a shunt arm

[IEC 60862-1: 2003, 2.2.3.8 modified]

NOTE Lattice type filter need more resonators than ladder type one, sine it needs two resonators to synthesize one pole and one transmission zero from the transfer function. The pass-band is obtained when one pair of resonators behaves inductive while the other pair of resonators behaves capacitive. Unlike the ladder type filter, it gives a deep stop-band rejection and good power handling capability, but smooth roll-off characteristics as shown in Figure 3 b).