NSAI Standards

Irish Standard
I.S. EN 60747-16-3:2002&A1:2009&A2:2017

# Semiconductor devices - Part 16-3: Microwave integrated circuits - Frequency converters

**I.S. EN 60747-16-3:2002&A1:2009&A2:2017**

*Incorporating amendments/corrigenda/National Annexes issued since publication:*

EN 60747-16-3:2002/A1:2009
EN 60747-16-3:2002/A2:2017

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| *This document is based on:* | *Published:* |
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|---|---|---|
| NSAI | T +353 1 807 3800 | Sales: |
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## National Foreword

I.S. EN 60747-16-3:2002&A1:2009&A2:2017 is the adopted Irish version of the European Document EN 60747-16-3:2002, Semiconductor devices - Part 16-3: Microwave integrated circuits - Frequency converters

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*In line with international standards practice the decimal point is shown as a comma (,) throughout this document.*

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 60747-16-3:2002/A2

December 2017

ICS 31.080.99

English Version

# Semiconductor devices - Part 16-3: Microwave integrated circuits - Frequency converters (IEC 60747-16-3:2002/A2:2017)

Dispositifs à semiconducteurs - Partie 16-3: Circuits intégrés hyperfréquences - Convertisseurs de fréquence (IEC 60747-16-3:2002/A2:2017)

Halbleiterbauelemente - Teil 16-3: Integrierte Schaltungen zur Frequenzumsetzung von Mikrowellen (IEC 60747-16-3:2002/A2:2017)

This amendment A2 modifies the European Standard EN 60747-16-3:2002; it was approved by CENELEC on 2017-09-20. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment 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 CEN-CENELEC Management Centre or to any CENELEC member.

This amendment 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 CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**



Ref. No. EN 60747-16-3:2002/A2:2017 E

## European foreword

The text of document 47E/545/CDV, future IEC 60747-16-3:2002/A2, prepared by SC 47E "Discrete semiconductor devices" of IEC/TC 47 "Semiconductor devices" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60747-16-3:2002/A2:2017.

The following dates are fixed:

| | | |
|---|---|---|
| • latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2018-06-20 |
| • latest date by which the national standards conflicting with the document have to be withdrawn | (dow) | 2020-09-20 |

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

## Endorsement notice

The text of the International Standard IEC 60747-16-3:2002/A2:2017 was approved by CENELEC as a European Standard without any modification.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 60747-16-3/A1

April 2009

ICS 31.080.99

English version

# Semiconductor devices - Part 16-3: Microwave integrated circuits - Frequency converters

(IEC 60747-16-3:2002/A1:2009)

Dispositifs à semiconducteurs - Partie 16-3: Circuits intégrés hyperfréquences - Convertisseurs de fréquence (CEI 60747-16-3:2002/A1:2009)

Halbleiterbauelemente - Teil 16-3: Integrierte Schaltungen zur Frequenzumsetzung von Mikrowellen (IEC 60747-16-3:2002/A1:2009)

This amendment A1 modifies the European Standard EN 60747-16-3:2002; it was approved by CENELEC on 2009-04-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

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CENELEC

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

**Central Secretariat: avenue Marnix 17, B - 1000 Brussels**



Ref. No. EN 60747-16-3:2002/A1:2009 E

## Foreword

The text of document 47E/357/CDV, future amendment 1 to IEC 60747-16-3:2002, prepared by SC 47E, Discrete semiconductor devices, of IEC TC 47, Semiconductor devices, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60747-16-3:2002 on 2009-04-01.

The following dates were fixed:

| | | |
|---|---|---|
| – latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2010-01-01 |
| – latest date by which the national standards conflicting with the amendment have to be withdrawn | (dow) | 2012-04-01 |

Annex ZA has been added by CENELEC.

## Endorsement notice

The text of amendment 1:2009 to the International Standard IEC 60747-16-3:2002 was approved by CENELEC as an amendment to the European Standard without any modification.

EUROPEAN STANDARD **EN 60747-16-3**

NORME EUROPÉENNE

EUROPÄISCHE NORM July 2002

ICS 31.080.99

English version

# Semiconductor devices
# Part 16-3: Microwave integrated circuits - Frequency converters
(IEC 60747-16-3:2002)

Dispositifs à semiconducteurs
Parie 16-3: Circuits intégrés hyperfréquences - Convertisseurs de fréquence
(CEI 60747-16-3:2002)

Halbleiterbauelemente
Teil 16-3: Integrierte Schaltungen zur Frequenzumsetzung von Mikrowellen
(IEC 60747-16-3:2002)

This European Standard was approved by CENELEC on 2002-07-01. 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.

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

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



Ref. No. EN 60747-16-3:2002 E

## Foreword

The text of document 47E/212/FDIS, future edition 1 of IEC 60747-16-3, prepared by SC 47E, Discrete semiconductor devices, of IEC TC 47, Semiconductor device, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60747-16-3 on 2002-07-01.

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) | 2003-04-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2005-07-01 |

Les annexes appelées "normatives" font partie du corps de la norme.
Dans la présente norme, l'annexe ZA est normative.
L'annexe ZA a été ajoutée par le CENELEC.

## Endorsement notice

The text of the International Standard IEC 60747-16-3:2002 was approved by CENELEC as a European Standard without any modification.

# 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.

| Publication | Year | Title | EN/HD | Year |
|---|---|---|---|---|
| IEC 60617-12 | - [1] | Graphical symbols for diagrams<br>Part 12: Binary logic elements | EN 60617-12 | 1998 [2] |
| IEC 60617-13 | - [1] | Part 13: Analogue elements | EN 60617-13 | 1993 [2] |
| IEC 60747-1 | 1983 | Semiconductor devices - Discrete devices and integrated circuits<br>Part 1: General | - | - |
| IEC 60748-2 | 1997 | Semiconductor devices - Integrated circuits<br>Part 2: Digital integrated circuits | - | - |
| IEC 60748-3 | - [1] | Part 3: Analogue integrated circuits | - | - |
| IEC 60748-4 | - [1] | Part 4: Interface integrated circuits | - | - |

[1] Undated reference.

[2] Valid edition at date of issue.

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# INTERNATIONAL STANDARD

# IEC 60747-16-3

First edition
2002-05

## Semiconductor devices –

## Part 16-3:
## Microwave integrated circuits – Frequency converters

*Dispositifs à semiconducteurs –*

*Partie 16-3:*
*Circuits intégrés hyperfréquences –*
*Convertisseurs de fréquence*

Reference number
IEC 60747-16-3:2002(E)

## Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

## Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

## Further information on IEC publications

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- **Catalogue of IEC publications**

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# INTERNATIONAL STANDARD

# IEC 60747-16-3

First edition
2002-05

## Semiconductor devices –

## Part 16-3: Microwave integrated circuits – Frequency converters

*Dispositifs à semiconducteurs –*

*Partie 16-3: Circuits intégrés hyperfréquences – Convertisseurs de fréquence*



International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

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*For price, see current catalogue*

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

# SEMICONDUCTOR DEVICES –

## Part 16-3: Microwave integrated circuits – Frequency converters

## 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.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
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International Standard IEC 60747-16-3 has been prepared by subcommittee 47E: Discrete semiconductor devices, of IEC technical committee 47: Semiconductor devices.

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

| FDIS | Report on voting |
|---|---|
| 47E/212/FDIS | 47E/219/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.

The committee has decided that the contents of this publication will remain unchanged until 2008. At this date, the publication will be

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

# SEMICONDUCTOR DEVICES –

# Part 16-3: Microwave integrated circuits – Frequency converters

## 1 Scope

This part of IEC 60747 provides new measuring methods, terminology and letter symbols, as well as essential ratings and characteristics for integrated circuit microwave frequency converters.

## 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 60617-12, *Graphical symbols for diagrams – Part 12: Binary logic elements*

IEC 60617-13, *Graphical symbols for diagrams – Part 13: Analogue elements*

IEC 60747-1:1983, *Semiconductor devices – Discrete devices and integrated circuits – Part 1: General*

IEC 60748-2:1997, *Semiconductor devices – Integrated circuits – Part 2: Digital integrated circuits*

IEC 60748-3, *Semiconductor devices – Integrated circuits – Part 3: Analogue integrated circuits*

IEC 60748-4, *Semiconductor devices – Integrated circuits – Part 4: Interface integrated circuits*

## 3 Terms and definitions

For the purpose of this part of IEC 60747, the following terms and definitions apply:

**3.1**
**conversion gain, $G_c$**
ratio of the desired converted output power to the input power

NOTE Usually, the conversion gain is expressed in decibels.

**3.2**
**conversion gain flatness, $\Delta G_c$**
difference between the maximum and the minimum conversion gain for a specified input power in a specified frequency range

**3.3**
**LO/RF isolation, $P_{LO}/P_{LO(RF)}$**
ratio of the incident local power to the local leakage power at the RF port with the IF port terminated in a specified impedance