SLOVENSKI STANDARD
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Polprevodniģke naprave - 16-3. del: Mikrovalovna integrirana vezja - Frekvenļ ni pretvorniki (IEC 60747-16-3:2002)

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

Halbleiterbauelemente -- Teil 16-3: Integrierte Schaltungen zur Frequenzumsetzung von Mikrowellen

Dispositifs à semiconducteurs -- Parie 16-3: Circuits intégrés hyperfréquences - Convertisseurs de fréquence

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EUROPEAN STANDARD

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EN 60747-16-3

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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.

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

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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 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 Part 1: General	-	-
IEC 60748-2	1997	Semiconductor devices - Integrated circuits 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.

INTERNATIONAL STANDARD

IEC 60747-16-3

First edition
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Semiconductor devices –

Part 16-3: Microwave integrated circuits – Frequency converters

Dispositifs à semiconducteurs –

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

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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.
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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 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, ΔG_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

3.4
LO/IF isolation, $P_{LO}/P_{LO(IF)}$
ratio of the incident local power to the local leakage power at the IF port with the RF port terminated in a specified impedance

3.5
RF/IF isolation, $P_{RF}/P_{RF(IF)}$
ratio of the incident RF power to the RF feedthrough power at the IF port for a specified local power

NOTE Usually, the RF/IF isolation is applied to the down-converter.

3.6
IF/RF isolation, $P_{IF}/P_{IF(RF)}$
ratio of the incident IF power to the IF feedthrough power at the RF port for a specified local power

NOTE Usually, the IF/RF isolation is applied to the up-converter.

3.7
image rejection, $P_o/P_{o(im)}$
ratio of the output power when the RF signal is applied, to the output power when the image signal is applied

NOTE Usually, the image rejection is applied to the down-converter.

3.8
sideband suppression, $P_o/P_{o(U)}$
ratio of the output power of the desired sideband to the output power of the undesired sideband

NOTE Usually, the sideband suppression is applied to the up-converter.

3.9
LO port return loss, $L_{ret(LO)}$
ratio of the specified incident power at the LO port to the reflected power at the LO port, with the RF port and the IF port terminated in each specified impedance

3.10
RF port return loss, $L_{ret(RF)}$
ratio of the incident power at the RF port to the reflected power at the RF port for a specified local power, with the IF port terminated in a specified impedance

3.11
IF port return loss, $L_{ret(IF)}$
ratio of the incident power at the IF port to the reflected power at the IF port for a specified local power, with the RF port terminated in a specified impedance

3.12
output power, P_o
see IEC 60747-16-2, 3.3[1]

3.13
output power at 1-dB conversion compression, $P_{o(1dB)}$
output power where the conversion gain decreases by 1 dB compared with the linear conversion gain

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1 IEC 60747-16-2:2001, *Semiconductor devices – Part 16-2: Microwave integrated circuits – Frequency prescalers*

3.14
noise figure, F
see IEC 60747-1 Chapter IV, 5.4.4

3.15
intermodulation distortion, P_n/P_1
ratio of the output power of the nth order component to the output power of the fundamental component, at a specified input power

3.16
output power at the intercept point (for intermodulation products), $P_{n(IP)}$
output power at the intersection between the extrapolated output powers of the fundamental component and the nth order intermodulation components, when the extrapolation is carried out in a diagram showing the output power of the components (in decibels) as a function of the input power (in decibels)

4 Abbreviated terms

The abbreviations used in this part of IEC 60747 are as follows:

RF Radio Frequency;

IF Intermediate Frequency;

LO Local Oscillator.

5 Essential ratings and characteristics

5.1 General

This clause gives ratings and characteristics required for specifying integrated circuit microwave frequency converters.

5.1.1 Circuit identification and types

5.1.1.1 Designation and types

The identification of type (device name), the category of circuit and technology applied shall be given.

Microwave frequency converters are divided into two categories:

– type A: down-converter;

– type B: up-converter.

5.1.1.2 General function description

A general description shall be made of the function performed by the integrated circuit microwave frequency converters and the features for the application.

5.1.1.3 Manufacturing technology

The manufacturing technology, for example, semiconductor monolithic integrated circuit, thin film integrated circuit, micro-assembly, shall be stated. This statement shall include details of the semiconductor technologies such as Schottoky-barrier diode, MESFET, Si bipolar transistor, HBT.

5.1.1.4 Package identification

The following shall be stated:

a) chip or packaged form;
b) IEC and/or national reference number of the outline drawing, or of drawing of non-standard package including terminal numbering;
c) principal package material, for example, metal, ceramic, plastic;
d) for chip form: outlines, dimensions, pad sizes, contact material, and recommended contact technologies.

5.1.1.5 Main application

The main application shall be stated if necessary. If the device has restrictive applications, these too shall be stated here.

5.2 Application description

Information on the application of the integrated circuit and its relation to the associated devices shall be given.

5.2.1 Conformance to system and/or interface information

It shall be stated whether the integrated circuit conforms to an application system and/or an interface standard or recommendation.

Detailed information about application systems, equipment and circuits such as VSAT systems, DBS receivers, microwave landing systems shall also be given.

5.2.2 Overall block diagram

A block diagram of the applied systems shall be given if necessary.

5.2.3 Reference data

The most important properties required to permit comparison between derivative types shall be given.

5.2.4 Electrical compatibility

It shall be stated whether the integrated circuit is electrically compatible with other particular integrated circuits or families of integrated circuits, or whether special interfaces are required.

Details shall be given concerning the type of the input and output circuits, for example, input/output impedances, d.c. block, open-drain.

Interchangeability with other devices, if any, shall be given.

5.2.5 Associated devices

If applicable, mention shall be made here of

– devices necessary for correct operation (list with type number, name, and function);
– peripheral devices with direct interfacing (list with type number, name, and function).