SLOVENSKI STANDARD
SIST EN 60747-16-1:2004

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Polprevodniģke naprave - 16-1. del: Mikrovalovna integrirana vezja - Ojaļevalniki (IEC 60747-16-1:2001)

Semiconductor devices -- Part 16-1: Microwave integrated circuits - Amplifiers

Halbleiterbauelemente -- Teil 16-1: Integrierte Mikrowellen-Verstärker

Dispositifs à semiconducteurs -- Partie 16-1: Circuits intégrés hyperfréquences - Amplificateurs

Ta slovenski standard je istoveten z: EN 60747-16-1:2002

ICS:

31.080.01	Polprevodniški elementi (naprave) na splošno	Semiconductor devices in general
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EUROPEAN STANDARD **EN 60747-16-1**

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ICS 31.080.99

English version

Semiconductor devices
Part 16-1: Microwave integrated circuits - Amplifiers
(IEC 60747-16-1:2001)

Dispositifs à semiconducteurs
Partie 16-1: Circuits intégrés hyperfréquences - Amplificateurs
(CEI 60747-16-1:2001)

Halbleiterbauelemente
Teil 16-1: Integrierte Mikrowellen-Verstärker
(IEC 60747-16-1:2001)

This European Standard was approved by CENELEC on 2002-02-01. 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, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, 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

Ref. No. EN 60747-16-1:2002 E

Foreword

The text of document 47E/200/FDIS, future edition 1 of IEC 60747-16-1, 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 EN 60747-16-1 on 2002-02-01.

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)	2002-11-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2005-02-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annex ZA is normative.

Endorsement notice

The text of the International Standard IEC 60747-16-1:2001 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	1997	Graphical symbols for diagrams Part 12: Binary logic elements	EN 60617-12	1998
IEC 60617-13	1993	Part 13: Analogue elements	EN 60617-13	1993
IEC 60747-1	1983	Semiconductor devices - Discrete devices Part 1: General	-	-
IEC 60747-7	2000	Part 7: Bipolar transistors	-	-
IEC 60748-2	1997	Semiconductor devices - Integrated circuits Part 2: Digital integrated circuits	-	-
IEC 60748-3	1986	Part 3: Analogue integrated circuits	-	-
IEC 60748-4	1997	Part 4: Interface integrated circuits	-	-

INTERNATIONAL STANDARD

IEC 60747-16-1

First edition
2001-11

Semiconductor devices –

Part 16-1:
Microwave integrated circuits – Amplifiers

Dispositifs à semiconducteurs –

Partie 16-1:
Circuits intégrés hyperfréquences –
Amplificateurs

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SEMICONDUCTOR DEVICES –

Part 16-1: Microwave integrated circuits – Amplifiers

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.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
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 60747-16-1 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/200/FDIS	47E/204/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 2004. At this date, the publication will be

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

A bilingual version of this standard may be issued at a later date.

SEMICONDUCTOR DEVICES –

Part 16-1: Microwave integrated circuits – Amplifiers

1 Scope

This part of IEC 60747 provides the terminology, the essential ratings and characteristics, as well as the measuring methods for integrated circuit microwave power amplifiers.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60747. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60747 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60617-12:1997, *Graphical symbols for diagrams – Part 12: Binary logic elements*

IEC 60617-13:1993, *Graphical symbols for diagrams – Part 13: Analogue elements*

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

IEC 60747-7:2000, *Semiconductor devices – Part 7: Bipolar transistors*

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

IEC 60748-3:1986, *Semiconductor devices – Integrated circuits – Part 3: Analogue integrated circuits*

IEC 60748-4:1997, *Semiconductor devices – Integrated circuits – Part 4: Interface integrated circuits*

3 Terminology

3.1
linear (power) gain G_{lin}
power gain in the linear region of the power transfer curve P_o (dBm) = $f(P_i)$

NOTE In this region, ΔP_o (dBm) = ΔP_i (dBm).

3.2
linear (power) gain flatness ΔG_{lin}
power gain flatness when the operating point lies in the linear region of the power transfer curve

3.3
power gain G_p, G
ratio of the output power to the input power

NOTE Usually the power gain is expressed in decibels.

3.4
(power) gain flatness ΔG_p
difference between the maximum and minimum power gain for a specified input power in a specified frequency range

3.5
(maximum available) gain reduction ΔG_{red}
difference in decibels between the maximum and minimum power gains that can be provided by the gain control

3.6 Output power limiting

3.6.1
output power limiting range
range in which, for rising input power, the output power is limiting

NOTE For specification purposes, the limits of this range are specified by specified lower and upper limit values for the input power.

3.6.2
limiting output power $P_{o(ltg)}$
output power in the range where it is limiting

3.6.3
limiting output power flatness $\Delta P_{o(ltg)}$
difference between the maximum and minimum output power in the output power limiting range:

$$\Delta P_{o(ltg)} = P_{o(ltg,max)} - P_{o(ltg,min)}$$

3.7
intermodulation distortion P_n/P_i
ratio of

the output power of the nth order component to

the output power of the fundamental component,

at a specified input power

3.8
power at the intercept point (for intermodulation products) $P_{n(IP)}$
output power at 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)

3.9
magnitude of the input reflection coefficient (input return loss) $|s_{11}|$
see 3.5.2.1 of IEC 60747-7

3.10
magnitude of the output reflection coefficient (output return loss) $|s_{22}|$
see 3.5.2.2 of IEC 60747-7

3.11
magnitude of the reverse transmission coefficient (isolation) $|s_{12}|$
see 3.5.2.4 of IEC 60747-7

3.12
conversion coefficient of amplitude modulation to phase modulation $\alpha_{(AM\text{-}PM)}$
quotient of

the phase deviation of the output signal (in degrees) by

the change in input power (in decibels) producing it

3.13
group delay time $t_{d(grp)}$
ratio of the change, with angular frequency, of the phase shift through the amplifier

NOTE Usually group delay time is very close in value to input-to-output delay time.

3.14
***n*th order harmonic distortion ratio P_{nth}/P_1**
ratio of the power of the nth order harmonic component measured at the output port of the device to the power of the fundamental frequency measured at the output port for a specified output power

3.15
output noise power P_N
maximum noise power measured at the output port of the device within a specified bandwidth in a specified frequency range for a specified output power

3.16
spurious intensity under specified load VSWR P_{sp}/P_o
ratio of the maximum spurious power measured at the output port of the device to the power of the fundamental frequency measured at the output port under specified load VSWR

4 Essential ratings and characteristics

4.1 General

4.1.1 Circuit identification and types

4.1.1.1 Designation and types

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

Microwave amplifiers are divided into four categories:

Type A: Low-noise type.

Type B: Auto-gain control type.

Type C: Limiting type.

Type D: Power type.

4.1.1.2 General function description

A general description of the function performed by the integrated circuit microwave amplifiers and the features for the application should be made.

4.1.1.3 Manufacturing technology

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

4.1.1.4 Package identification

The following statements should be made:

a) IEC and/or national reference number of the outline drawing, or drawing of non-standard package including terminal numbering;

b) principal package material; for example, metal, ceramic, plastic.

4.1.1.5 Main application

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

4.2 Application related description

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

4.2.1 Conformance to system and/or interface information

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

The detailed information about application systems, equipment and circuits such as VSAT systems, DBS receivers, microwave landing systems, etc., should also be given.

4.2.2 Overall block diagram

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

4.2.3 Reference data

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

4.2.4 Electrical compatibility

It should 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 should be given of the type of the input and output circuits, for example, input/output impedances, d.c. block, open-drain, etc. Interchangeability with other devices, if any, should be given.

4.2.5 Associated devices

If applicable, the following should be stated here:

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

– peripheral devices with direct interfacing (list with type number, name, and function).

4.3 Specification of the function

4.3.1 Detailed block diagram – Functional blocks

A detail block diagram or equivalent circuit information of the integrated circuit microwave amplifiers should be given. The block diagram should be composed of the following:

1) functional blocks;
2) mutual interconnections among the functional blocks;
3) individual functional units within the functional blocks;
4) mutual interconnections among the individual functional blocks;
5) function of each external connection;
6) interdependence between the separate functional blocks.

The block diagram should identify the function of each external connection and, where no ambiguity can arise, can also show the terminal symbols and/or numbers. If the encapsulation has metallic parts, any connection to them from external terminals should be indicated. The connections with any associated external electrical elements should be stated, where necessary.

As additional information, the complete electrical circuit diagram can be reproduced, but not necessarily with indications of the values of the circuit components. The graphical symbol for the function shall be given. This may be obtained from a catalogue of standards of graphical symbols or designed according to the rules of IEC 60617-12 or IEC 60617-13.

4.3.2 Identification and function of terminals

All terminals should be identified on the block diagram (supply terminals, input or output terminals, input/output terminals).

The terminal functions 1)-4) should be indicated in a table as follows:

Terminal number	Terminal symbol	1) Terminal designation	2) Function	Function of terminal	
				3) Input/output identification	4) Type of input/output circuit

1) Terminal name

   A terminal name to indicate the function terminal should be given. Supply terminals, ground terminals, blank terminals (with abbreviation NC), non-usable terminals (with abbreviation NU) should be distinguished.

2) Function

   A brief indication of the terminal function should be given.

   – Each function of multi-role terminals, that is terminals that have multiple functions.
   – Each function of the integrated circuit selected by mutual pin connections, programming and/or application of function selection data to the function selection pin, such as mode selection pin.

3) Input/output identification

   Input, output, input/output, and multiplex input/output terminals should be distinguished.

4) Type of input/output circuits

   The type of the input and output circuits, for example, input/output impedances, with or without d.c. block, etc., should be distinguished.