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Semiconductor devices –
Part 16-2: Microwave integrated circuits – Frequency prescalers

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FOREWORD

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International Standard IEC 60747-16-2 has been prepared by subcommittee 47E: Discrete semiconductor devices, of IEC technical committee 47: Semiconductor devices.

This consolidated version of IEC 60747-16-2 consists of the first edition (2001) [documents 47E/160/FDIS and 47E/172/RVD] and its amendment 1 (2007) [documents 47E/338/FDIS and 47E/343/RVD].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 1.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result 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- withdrawn,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.

SEMICONDUCTOR DEVICES –

Part 16-2: Microwave integrated circuits – Frequency prescalers

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 prescalers.

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 60617:2001, *Graphical symbols for diagrams*

IEC 60747-1:2006, *Semiconductor devices – Part 1: General*

IEC 60748-2, *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*

IEC 61340-5-1:2007, *Electrostatics – Part 5-1: Protection of electronic devices from electrostatic phenomena - General requirements*

IEC/TR 61340-5-2:2007, *Electrostatics – Part 5-2: Protection of electronic devices from electrostatic phenomena – User guide*

3 Terms and definitions

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

3.1
power supply voltage V_{xxi}
(terminal voltage)
d.c. voltage required to be applied to an 'i'-th terminal noted by 'xx'

3.2
power supply current I_{xxi}
d.c. current flowing through an 'i'-th terminal noted by 'xx'

3.3
output power P_o
a.c. power measured at the output terminal

3.4
output voltage V_o
amplitude of voltage swing measured at the output terminal

3.5
input power P_i
a.c. power delivered to the input terminal

3.6
input voltage V_i
amplitude of input voltage swing

3.7
high-level modulus control input voltage V_{CH}
control voltage value to transfer the division ratio from low-level modulus to high-level modulus

3.8
low-level modulus control input voltage V_{CL}
control voltage value to transfer the division ratio from high-level modulus to low-level modulus

3.9
high-level modulus control input current I_{CH}
control current value to transfer the division ratio from low-level modulus to high-level modulus

3.10
low-level modulus control input current I_{CL}
control current value to transfer the division ratio from high-level modulus to low-level modulus

3.11
input frequency f_i
input frequency for which the device functions

3.12
division ratio N
ratio of the output frequency and input frequency

3.13
set-up time t_{set}

(under consideration)

4 Essential ratings and characteristics

4.1 General

This clause gives ratings and characteristics required for specifying integrated circuit microwave frequency prescalers used at the microwave or millimetre-wave frequency band.

The integrated circuits contain fixed and two modulus prescalers.

4.1.1 Circuit identification and types

4.1.1.1 Designation and types

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

Microwave frequency prescalers are divided into two categories:

- type A: fixed modulus type;
- type B: two modulus type.

4.1.1.2 General function description

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

4.1.1.3 Manufacturing technology

The manufacturing technology, e.g. 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, MOSFET, Si bipolar transistor, HBT, etc.

4.1.1.4 Package identification

The following should be stated:

a) chip or packaged form;

b) IEC and/or national reference number of the outline drawing or of the drawing of a 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.

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 an interface standard or recommendation.

Detailed information about application systems, equipment and circuits such as VSAT systems, DBS receivers, and microwave landing systems 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 required 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 concerning the type of input and output circuits, for example, input/output impedances, d.c. block, open-drain.

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 concerning the integrated circuit microwave frequency prescalers should be given. The block diagram should be composed of the following:

a) functional blocks;

b) mutual interconnections among the functional blocks;

c) individual functional units within the functional blocks;

d) mutual interconnections among the individual functional blocks;

e) function of each external connection;

f) inter-dependence 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.

For the purpose of providing additional information, the complete electrical circuit diagram can be reproduced, though this will not necessarily involve giving indications of the function. Rules governing such diagrams may be obtained from IEC 60617.

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) to 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 circuits

1) Terminal designation

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

2) Function

A brief indication of terminal function should be given:

– each function of multi-role terminals, i.e. terminals having multiple functions;

– each function of integrated circuits selected by mutual pin connections or function selection data applied to the function selection pin such as mode selection pin.

3) Input/output identification

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

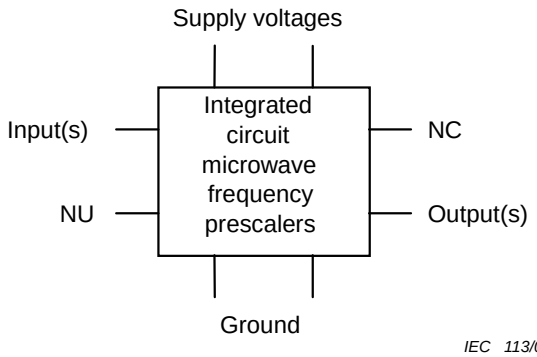
4) Type of input/output circuits

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

5) Type of ground

If the baseplate of the package is used as ground, this should be stated.

Example:



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4.3.3 Functional description

The function performed by the circuit should be specified and include the following information:

– basic function;
– relation to external terminals;
– operation mode (for example, set-up method, preference, etc.);
– interrupt handling.

4.3.4 Family-related characteristics

In this part, all family specific functional descriptions shall be provided (with reference to IEC 60748-2, IEC 60748-3 and IEC 60748-4).

If ratings and characteristics and function characteristics exist for the family, the relevant part of IEC 60748 should be used (for example, for microprocessors, see IEC 60748-2, Chapter III, section 3).

NOTE For each new device family, specific items shall be added to the relevant part of IEC 60748.

4.4 Limiting values (absolute maximum rating system)

The table of these values should contain the following:

– Any interdependence of limiting conditions shall be specified.
– If externally connected and/or attached elements, for example heatsinks, have an influence on the values of the ratings, the ratings shall be prescribed for the integrated circuit with the elements connected and/or attached.

– If limiting values are exceeded for transient overload, the permissible excess and their durations shall be specified.
– Where minimum and maximum values differ during programming of the device, this should be stated.
– All voltages are referenced to a specified reference terminal (V_{SS}, GND, etc.).
– In satisfying the following clauses, if maximum and/or minimum values are quoted, the manufacturer must indicate whether he refers to the absolute magnitude or to the algebraic value of the quantity.
– The ratings given must cover the operation of the multi-function integrated circuit over the specified range of operating temperatures. Where such ratings are temperature-dependent, such dependence should be indicated.

4.4.1 Electrical limiting values

Limiting values should be specified as follows:

Subclause	Parameters	Min.	Max.
4.4.1.1	Power supply voltage(s)	+	+
4.4.1.2	Power supply current(s) (where appropriate)		+
4.4.1.3	Terminal voltage(s) (where appropriate)	+	+
4.4.1.4	Terminal current(s) (where appropriate)		+
4.4.1.5	Input power		+
4.4.1.6	Power dissipation (where appropriate)		+