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Semiconductor devices -
Part 16-11: Microwave integrated circuits - Power detectors

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IEC 60747-16-11 has been prepared by subcommittee 47E: Discrete semiconductor devices, of IEC technical committee 47: Semiconductor devices. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
47E/887/FDIS	47E/891/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60747 series, published under the general title *Semiconductor devices*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

1 Scope

This part of IEC 60747 specifies the terminology, essential ratings and characteristics, and measuring methods of microwave integrated circuit power detectors.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60747-1:2006, *Semiconductor devices - Part 1: General*
IEC 60747-1:2006/AMD1:2010

IEC 60747-4:2007, *Semiconductor devices - Discrete devices - Part 4: Microwave diodes and* transistors
IEC 60747-4:2007/AMD1:2017

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60747-4 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
output voltage
V_o
voltage measured at the output port

3.2
tangential signal sensitivity
P_TSS
input power when the negative noise peak value of the *output voltage* (3.1) is equal to the positive noise peak value when there is no input signal

3.3
input return loss
$L_\mathrm{ret(in)}$
ratio of the incident power at the input port to the reflected power at the input port

[SOURCE: IEC 60747-16-6:2019, 3.4]

3.4
output current
I_o
current measured at the output port

3.5
voltage sensitivity
β_V
ratio of the *output voltage* (3.1) to the input power

3.6
current sensitivity
β_i
ratio of the *output current* (3.4) to the input power

3.7
frequency response flatness
ΔP_i
difference between the maximum input power and the minimum input power at the same *output voltage* (3.1)

3.8
output slope
k
slope of the *output voltage* (3.1) ideal response curve

3.9
output intercept point
intersection point of the extension line of the *output voltage* (3.1) ideal response curve and the horizontal axis which represents input power or input peak voltage

3.10
dynamic range
input power range in which the actual response curve follows the ideal response curve

3.11
temperature sensitivity
β_T
rate at which calculated input power varies with temperature at the same actual input power

3.12
rise time
$t_{r(out)}$
interval between the lower reference point on the leading edge of the *output voltage* (3.1) and the upper reference point on the leading edge of the *output voltage* (3.1)

Note 1 to entry: Usually the lower reference is 10 % of the amplitude, and the upper reference is 90 % of the amplitude.

3.13
fall time
$t_{f(out)}$
interval between the upper reference point on the trailing edge of the *output voltage* (3.1) and the lower reference point on the trailing edge of the *output voltage* (3.1)

Note 1 to entry: Usually the lower reference is 10 % of the amplitude, and the upper reference is 90 % of the amplitude.

3.14
rising edge propagation delay
t_{rd}
interval between the reference point on the leading edge of the envelope of the radio frequency input voltage and the reference point on the leading edge of the *output voltage* (3.1)

Note 1 to entry: Usually the reference is 50 % of the amplitude.

3.15
falling edge propagation delay
t_{fd}
interval between the reference point on the trailing edge of the envelope of the radio frequency input voltage and the reference point on the trailing edge of the *output voltage* (3.1)

Note 1 to entry: Usually the reference is 50 % of the amplitude.

4 Essential ratings and characteristics

4.1 General requirements

4.1.1 Circuit identification and types

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

Microwave power detectors comprise four categories:

- Type A: Detector diodes;
- Type B: Root mean square detectors;
- Type C: Logarithmic detectors;
- Type D: Envelope detectors and peak detectors.

4.1.2 General function description

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

4.1.3 Manufacturing technology

The manufacturing technology, e.g. semiconductor monolithic integrated circuit, thin film integrated circuit, micro-assembly, shall be stated in the detail specification. This statement shall include details of the semiconductor technologies such as Schottky-barrier diode, metal-semiconductor field effect transistor (MESFET), Si bipolar transistor, etc.

4.1.4 Package identification

The following information shall be given in the detail specification:

a) chip or packaged form;
b) IEC or national reference number or both of the outline drawing, or drawing of non-standard package including terminal numbering;
c) principal package material, for example, metal, ceramic, plastic.

4.2 Application description

4.2.1 Conformance to system or interface information or both

It should be stated in the detail specification whether the integrated circuit conforms to an application system or an interface standard or both, or a recommendation.

Detailed information concerning application systems, equipment and circuits such as very small aperture terminal (VSAT) systems, broadcasting satellite (BS) 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 in the detail specification, if necessary.

4.2.3 Reference data

The most important properties that permit comparison between derivative types should be given in the detail specification.

4.2.4 Electrical compatibility

It should be stated in the detail specification 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, e.g. input and output impedances, DC block, open-drain, etc. Interchangeability with other devices, if any, should also be given.

4.2.5 Associated devices

If applicable, the following should be stated:

- 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 power detectors shall be given in the detail specification. The block diagram shall 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 shall identify the function of each external connection and, where no ambiguity can arise, also show the terminal symbols or numbers or both. If the encapsulation has metallic parts, any connection to them from external terminals shall be indicated. The connections with any associated external electrical elements shall 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. Rules governing such diagrams can be obtained from IEC 60617.

4.3.2 Identification and function of terminals

All terminals shall be identified on the block diagram (supply terminals, input or output terminals, bidirectional terminals), as shown in Figure 1.

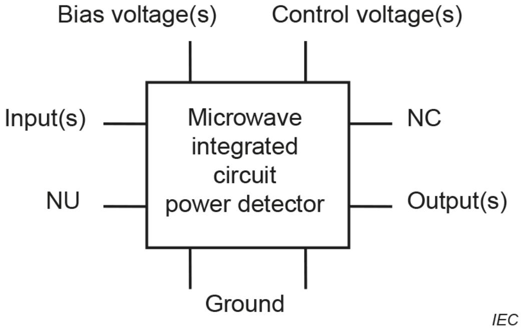

Figure 1 – Example block diagram

The terminal functions shall be indicated in Table 1.

If the baseplate of the package is used as a ground terminal, the type of ground, e.g. analogue ground, digital ground, shall be stated in the column of Function in Table 1.

4.3.3 Function description

The function performed by the circuit shall be specified, including the following information:

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

Table 1 – Function of terminals

Terminal number	Terminal symbol	Terminal designation [a]	Function [b]	Function of terminal	
				Identification [c]	Type of input and output circuits [d]

[a] A terminal designation to indicate the function of the terminal shall be given. Supply terminals, ground terminals, blank terminals (with abbreviation NC), non-usable terminals (with abbreviation NU) shall be distinguished.

[b] A brief indication of the terminal function shall be given:

- each function of multi-role terminals, i.e. terminals having multiple functions;
- each function of integrated circuit selected by mutual pin connections, programming or application or both of function selection data to the function selection pin, such as mode selection pin.

[c] Input, output, bidirectional and multiplex output terminals shall be distinguished.

[d] The type of input and output circuit, e.g. input and output impedances, with or without DC block, etc., shall be distinguished.