DIN EN IEC 60747-16-8

DIN

ICS 31.080.99 Einsprüche bis 2021-08-04

Entwurf

Halbleiterbauelemente – Teil 16-8: Integrierte Mikrowellen-Verstärker – Schaltungsbegrenzer (IEC 47E/735/CD:2020); Text Englisch

Semiconductor devices – Part 16-8: Microwave integrated circuits – Limiters (IEC 47E/735/CD:2020); Text in English

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SEMICONDUCTOR DEVICES –

Part 16-8: Microwave integrated circuits – Limiters

1 Scope

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

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 60617, *Graphical symbols for diagrams* (available at http://std.iec.ch/iec60617>)

IEC 60747-1:2006, *Semiconductor devices – Part 1: General*
IEC 60747-1:2006/AMD 1:2010

IEC 60747-4:2007, *Semiconductor devices – Discrete devices – Part 4: Microwave diodes and transistors*
IEC 60747-4:2007/AMD 1:2017

IEC 60747-16-1:2001, *Semiconductor devices – Part 16-1: Microwave integrated circuits – Amplifiers*
IEC 60747-16-1:2001/AMD 1:2007
IEC 60747-16-1:2001/AMD 2:2017

IEC 60747-16-4:2004, *Semiconductor devices – Part 16-4: Microwave integrated circuits – Switches*
IEC 60747-16-4:2004/AMD 1:2009
IEC 60747-16-4:2004/AMD 2:2017

IEC 60747-16-6:2019, *Semiconductor devices – Part 16-6: Microwave integrated circuits –Frequency multipliers*

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 following terms and definitions apply.

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

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

3.1
insertion loss
L_{ins}
ratio of the input power to the output power, in the linear region of the power transfer curve $P_o(\text{dBm})=f(P_i)$

Note 1 to entry: In this region, $\Delta P_o(\text{dBm})=\Delta P_i(\text{dBm})$.

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Note 2 to entry: Usually the insertion loss is expressed in decibels.

[SOURCE: IEC 60747-16-4:2004/AMD 1:2009, 3.1, modified – "at the switched on port" has been deleted]

3.2
input return loss
$L_{ret(in)}$
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]

3.3
output return loss
$L_{ret(out)}$
ratio of the incident power at the output port to the reflected power at the output port

[SOURCE: IEC 60747-16-6:2019, 3.5]

3.4
input power at 1dB compression
$P_{i(1dB)}$
input power where the insertion loss increases by 1 dB compared with insertion loss in linear region

[SOURCE: IEC 60747-16-4:2004, 3.4]

3.5
output power at 1dB compression
$P_{o(1dB)}$
output power where the insertion loss increases by 1 dB compared with insertion loss in linear region

[SOURCE: IEC 60747-16-4:2004, 3.5]

3.6
intermodulation distortion
P_n/P_1
ratio of the *n*th order component of the output power to the fundamental component of the output power

Note 1 to entry: The abbreviation "IMD_n" is in common use for the *n*th order intermodulation distortion.

[SOURCE: IEC 60747-4:2007/AMD1:2017, 7.2.19]

3.7
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 *n*th order intermodulation components, when the extrapolation is carried out in a diagram showing the output power of the components as a function of the input power

[SOURCE: IEC 60747-16-1:2001, 3.8]

3.8 Output leakage power

3.8.1
leakage power for continuous wave
$P_{leak(cw)}$
output power level at specified continuous wave input power in the nonlinear region

3.8.2
spike leakage power for pulse wave
$P_{leak(spike)}$
maximum output power at specified pulsed input power in the nonlinear region as shown in Figure 1

Note 1 to entry: Spike leakage refers to the very short part of a power pulse that blasts through a limiter.

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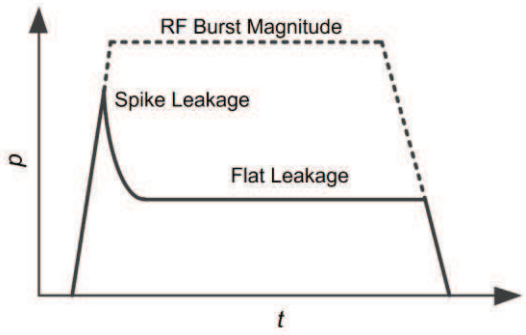

Key

t time

p power

Figure 1 – Limiter input and output power vs. Time for pulse wave

3.8.3
flat leakage power for pulse wave
$P_{leak(flat)}$
flat leakage power after the limiter has fully turned on and the output pulse reaches a constant level (plateau region) at specified pulsed input power in the nonlinear region as shown in Figure 1

Note 1 to entry: Flat leakage power is relatively constant with a slope in plateau region.

3.9
response time
t_{res}
interval between the starting point of leakage and the point where the maximum slope straight-line projection of the trailing edge of the spike intersects the straight-line projection of the flat leakage at specified pulsed input power

3.10
recovery time
t_{rec}
time taken for the insertion loss to return to within 3 dB of its low-level insertion loss following the cessation of the high-power pulse

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.

4.1.2 General function description

A general description of the function performed by the microwave integrated circuit limiters 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, etc. shall be stated. This statement shall include details of the semiconductor technologies such as Schottky-barrier diode, PIN diode, transistor, etc.

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IEC 60747-4:2017 shall be referred to for terminology and letter symbols, essential ratings and characteristics and measuring methods of such microwave devices.

4.1.4 Package identification

The following statements shall be made:

a) chip or packaged form;

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

c) principal package material, for example, metal, ceramic, plastic.

4.1.5 Main application

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

4.2 Application description

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 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 if necessary.

4.2.3 Reference data

The most important properties that 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, e.g. input/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).

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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 limiters shall be given. 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 and/or numbers. 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 may 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, input/output terminals).

The terminal functions shall be indicated in Table 1.

Table 1 - Function of terminals

Terminal number	Terminal symbol	Terminal designation [a]	Function [b]	Function of terminal	
				input/output identification [c]	Type of input/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 and/or application of function selection data to the function selection pin, such as mode selection pin.

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

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

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

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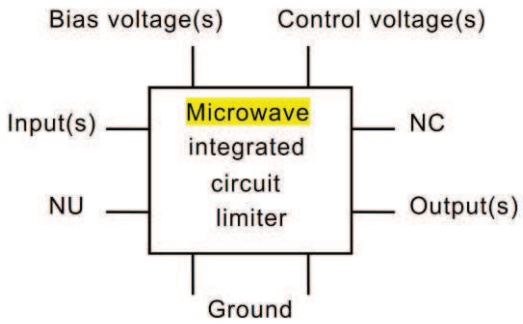
EXAMPLE



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 (e.g., set-up method, preference, etc.);
– interruption handling.

4.4 Limiting values (absolute maximum rating system)

4.4.1 Requirements

The table for these values shall 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 shall be stated;
– All voltages are referenced to a specified reference terminal (V_{SS}, ground, etc.);
– If maximum and/or minimum values are quoted, the manufacturer shall indicate whether he refers to the absolute magnitude or to the algebraic value of the quantity;
– The ratings given shall cover the operation of the multi-function integrated circuit over the specified range of operating temperatures. Where such ratings are temperature-dependent, these dependence shall be indicated.

4.4.2 Electrical limiting values

Limiting values shall be specified as shown in Table 2.

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