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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Semiconductor devices – Discrete devices – Part 4: Microwave diodes and transistors

Dispositifs à semiconducteurs – Dispositifs discrets – Partie 4: Diodes et transistors hyperfréquences

IEC 60747-4:2007-08+AMD1:2017-01 CSV(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SEMICONDUCTOR DEVICES –
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Part 4: Microwave diodes and transistors

FOREWORD

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 60747-4 edition 2.1 contains the second edition (2007-08) [documents 47E/330/FDIS and 47E/339/RVD] and its amendment 1 (2017-01) [documents 47E/499/CDV and 47E/517/RVC].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60747-4 has been prepared by subcommittee 47E: Discrete semiconductor devices, of IEC technical committee 47: Semiconductor devices.

This second edition constitutes a technical revision.

The major technical changes with regard to the previous edition are as follows:

a) the clause of bipolar transistors has been added;

b) the clause of field-effect transistors has been amended.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The list of all parts of the IEC 60747 series, under the general title *Semiconductor devices – Discrete devices,* can be found on the IEC website.

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- withdrawn,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

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SEMICONDUCTOR DEVICES – DISCRETE DEVICES –

Part 4: Microwave diodes and transistors

1 Scope

This part of IEC 60747 gives requirements for the following categories of discrete devices:

– variable capacitance diodes and snap-off diodes (for tuning, up-converter or harmonic multiplication, switching, limiting, phased shift, parametric amplification);
– mixer diodes and detector diodes;
– avalanche diodes (for direct harmonic generation, amplification);
– gunn diodes (for direct harmonic generation);
– bipolar transistors (for amplification, oscillation);
– field-effect transistors (for amplification, oscillation).

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 60050-702~~:1992~~, *International Electrotechnical Vocabulary – Chapter 702: Oscillations, signals and related devices* (available at: <http://www.electropedia.org>)

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

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

IEC 60747-8:2000, *Semiconductor devices – Part 8: Field-effect transistors*

~~IEC 60747-16-1:2001, *Semiconductor devices – Part 16-1: Microwave integrated circuits – Amplifiers*~~
~~Amendment 1(2007)~~

3 Variable capacitance, snap-off diodes and fast-switching schottky diodes

3.1 Variable capacitance diodes

3.1.1 General

The provisions of this part deal with diodes (excluding snap-off diodes) in which the variable capacitance effect is used; they cover four applications: tuning, harmonic multiplication, switching (including limiting), parametric amplification.

The devices for these applications are defined as follows:

Diodes for tuning

Diodes which are used to vary the frequency of a tuned circuit. These diodes are usually characterized a frequency of resonance much higher than the frequency of use and have a known capacitance/voltage relationship.

Diodes for harmonic multiplication

These diodes must have a non-linear capacitance/voltage relationship at the frequency of operation and a high ratio of cut-off frequency to operating frequency.

Diodes for switching (including limiting)

These diodes exhibit a fast transition from a high impedance state to a low impedance state and vice versa and can be used to modulate or control the power level in microwave systems.

Diodes for parametric amplification

These diodes are intended to handle small amplitude signals and are most often used in low-noise amplifiers.

3.1.2 Terminology and letter symbols

See 3.1.3.3.

3.1.3 Essential ratings and characteristics

3.1.3.1 General

3.1.3.1.1 Rating conditions

Variable capacitance diodes may be specified either as ambient rated or case rated devices or, where appropriate, as both.

The ratings listed in 3.1.3.2 should be stated at the following temperatures:

– *ambient-rated devices:*

at an ambient temperature of 25 °C and at one higher temperature.

– *case-rated devices:*

at a reference point temperature of 25 °C and at another reference point temperature.

3.1.3.1.2 Application categories

The essential ratings and characteristics to be stated for each category of diode are marked with a + sign in the following table:

– column 1: tuning applications;
– column 2: harmonic multiplication applications;
– column 3: switching (including limiting) applications;
– column 4: parametric amplification applications.

	Categories			
3.1.3.2 Ratings (limiting values)				
The following ratings should be stated:	1	2	3	4
3.1.3.2.1 Temperatures				
Range of operating temperatures	+	+	+	+
Range of storage temperatures	+	+	+	+
3.1.3.2.2 Voltages and currents				
Maximum peak reverse voltage	+	+	+	+
Maximum mean forward current, where appropriate		+	+	+
Maximum peak forward current, where appropriate		+	+	+
3.1.3.2.3 Power dissipation				
Maximum dissipation, under stated conditions, over the operating temperature range	+	+	+	+
3.1.3.3 Electrical characteristics				
Unless otherwise specified, the following characteristics should be given at 25 °C (see Figure 1)				
3.1.3.3.1 Stray capacitance (C_p)				
Typical value under specified conditions	+	+	+	+
3.1.3.3.2 Series inductance (L_s)				
Typical value and, where appropriate, maximum value under specified conditions	+	+	+	+
3.1.3.3.3 Terminal capacitance (C_{tot})				
a) Minimum and maximum values, at a specified bias voltage and at a specified frequency (note 2)	+	+	+	+
b) Typical curve showing the relationship between terminal capacitance and bias voltage	+	+	+	+
3.1.3.3.4 Junction capacitance (C_j)				
Minimum and maximum values at a specified bias voltage (notes 2 and 3). When the order of magnitude of C_p is the same as that of the terminal capacitance C_{tot}, a typical value should be given for C_j instead of minimum and maximum values	+	+	+	+
3.1.3.3.5 Effective quality factor (Q)				
Minimum values at two or more specified frequencies under specified bias conditions (note 4)	+			