

BS IEC 60747-3:2013



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Semiconductor devices

Part 3: Discrete devices: Signal,
switching and regulator diodes

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee EPL/47, Semiconductors.

A list of organizations represented on this committee can be obtained on request to its secretary.

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INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Semiconductor devices –
Part 3: Discrete devices: Signal, switching and regulator diodes**

**Dispositifs à semiconducteurs –
Partie 3: Dispositifs discrets: Diodes de signal, diodes de commutation et diodes
régulatrices**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SEMICONDUCTOR DEVICES –

Part 3: Discrete devices: Signal, switching and regulator diodes

FOREWORD

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International Standard IEC 60747-3 has been prepared by subcommittee 47E: Discrete semiconductor devices, of IEC technical committee 47: Semiconductor devices.

This second edition cancels and replaces the first edition published in 1985, Amendment 1:1991 and Amendment 2:1993. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) All clauses were re-edited to latest IEC publication format and style with all contents from previous publication.
- b) All clauses have been amended by suitable additions and deletions.

This standard is to be read in conjunction with IEC 60747-1:2006 and its Amendment 1 (2010).

The text of this standard is based on the following documents:

FDIS	Report on voting
47E/453/FDIS	47E/455/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 2.

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

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this publication 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.

SEMICONDUCTOR DEVICES –

Part 3: Discrete devices: Signal, switching and regulator diodes

1 Scope

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

- signal diodes (excluding diodes designed to operate at frequencies above several hundred MHz);
- switching diodes (excluding high power rectifier diodes);
- voltage-regulator diodes;
- voltage-reference diodes;
- current-regulator diodes.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050 (all parts), *International Electrotechnical Vocabulary*
(available at <<http://www.electropedia.org>>)

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

3 Terms, definitions and graphical symbols

For the purposes of this document, the terms and definitions given in IEC 60050-521, IEC 60050-702 and IEC 60747-1, and the following, apply.

3.1 Signal and switching diodes

3.1.1

forward recovery voltage

V_{FR}

forward voltage occurring during the forward recovery time after switching from zero or a reverse voltage to a forward current

3.1.2

detector voltage efficiency

η_v

ratio of the d.c. load voltage to the peak sinusoidal input voltage under specified circuit conditions

3.1.3**detector power efficiency** η_p

ratio of the change in d.c. power in the load resistance produced by the a.c. signal, to the available power from a sinusoidal voltage generator when the diode is operated under specified conditions

3.1.4**repetitive pulse energy** E_{PR}

energy of a pulse of short duration that occurs in a repetitive series of pulses

3.1.5**total capacitance** C_{tot}

capacitance at the diode terminals, measured under specified bias conditions

3.2 Voltage reference diodes and voltage regulator diodes**3.2.1****voltage reference diode**

voltage regulator diode where the minimum and maximum voltages are both specified at the same current

[SOURCE: IEC 60050-521:2002, 521-04-16 modified – rewritten]

3.2.2**working direction**

direction of current that results when the N-type semiconductor region is at a positive voltage relative to the P-type region

Note 1 to entry: This is also the reverse direction for voltage regulator diodes.

3.2.3**regulating range**

range of working direction currents within which the voltage is maintained between specified limits

3.2.4**working current** I_Z

current within the regulating range

3.2.5**working voltage** V_Z

voltage within the regulating range

3.2.6**differential working resistance** r_z

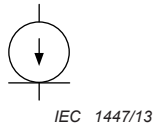
differential resistance at a working current within the regulating range

3.2.7**temperature coefficient of working voltage** α_{VZ}

the quotient of the change in working voltage between two specified values of temperatures, and the difference between these two temperatures

3.3 Current-regulator diodes

3.3.1 Graphical symbol



NOTE The arrow denotes the direction of flow of the regulator (working) current, flowing from the anode to the cathode. This is termed the forward direction for current-regulator diodes, and the terms defining the forward and reverse directions of a PN junction (IEC 60050-521:2002, 521-05-03 and 521-05-04) do not apply.

Figure 1 – Current-regulator diode graphical symbol

3.3.2 regulator voltage

V_s

voltage within the regulating range of a current-regulator diode

Note 1 to entry: “Working voltage” is no longer the preferred term.

3.3.3 limiting voltage

V_L

voltage at point I_L on the current-voltage characteristic

SEE: Figure 2.

3.3.4 knee voltage

V_K

voltage near the lower knee of the current-voltage characteristic

3.3.5 regulator current

I_s

current within the regulating range of a current-regulator diode

Note 1 to entry: “Working current” is no longer the preferred term.

3.3.6 limiting current

I_L

specified current below the regulating range

3.3.7 small-signal regulator conductance

g_s

small-signal conductance within the regulating range of a current-regulator diode

3.3.8 knee conductance

g_k

small-signal regulator conductance at the knee voltage

3.3.9**temperature coefficient of regulator current** α_{IS}

quotient of the change in regulator current between two specified values of temperature and that change of temperature

Note 1 to entry: The change in regulator current is usually expressed as a percentage of regulator current.

Note 2 to entry: "Regulator current" is now used instead of "working current", which is no longer the preferred term.

4 Letter symbols**4.1 General**

The general rules and letter symbols of IEC 60747-1:2006, Clause 4 apply with the following additions.

4.2 Signal and switching diodes**4.2.1 Subscripts**

A, a	anode
K, k	cathode
r	recovery, recovered
S, s	storage, stored

4.2.2 List of letter symbols**4.2.2.1 Voltages**

V_F	Continuous (direct) forward voltage
V_R	Continuous (direct) reverse voltage
V_{RM}	Peak reverse voltage
$V_{(BR)}$	Breakdown voltage
V_{FR}	Forward recovery voltage
V_{FRM}	Peak value of forward recovery voltage

4.2.2.2 Currents

I_F	Continuous (direct) forward current
i_F	Instantaneous forward current
I_{FM}	Peak forward current
I_R	Continuous (direct) reverse current
i_R	Instantaneous reverse current
I_{RM}	Peak reverse current

4.2.2.3 Switching characteristics

t_{fr}	Forward recovery time
t_{rr}	Reverse recovery time
i_{rr}	Reverse recovery current
Q_r	Recovered charge

4.2.2.4 Sundry quantities

r	Differential resistance
-----	-------------------------

η_p	Detector power efficiency
η_v	Detector voltage efficiency
E_{pr}	Repetitive pulse energy

4.3 Voltage reference diodes and voltage regulator diodes

4.3.1 Subscripts

Z, z	working
------	---------

4.3.2 List of letter symbols

4.3.2.1 Voltages

V_Z	Working voltage
V_{nz}	Noise voltage within the working voltage range (V_n is also acceptable if no misunderstanding is possible).

4.3.2.2 Currents

I_Z	Continuous (direct) reverse current within the working voltage range
I_R	Continuous (direct) reverse current at a voltage below the working voltage range

4.3.2.3 Sundry quantities

r_z	Differential (working) resistance
α_{vz}	Temperature coefficient of working voltage (Reserve symbol: S_z)

4.4 Current-regulator diodes

See Figure 2.

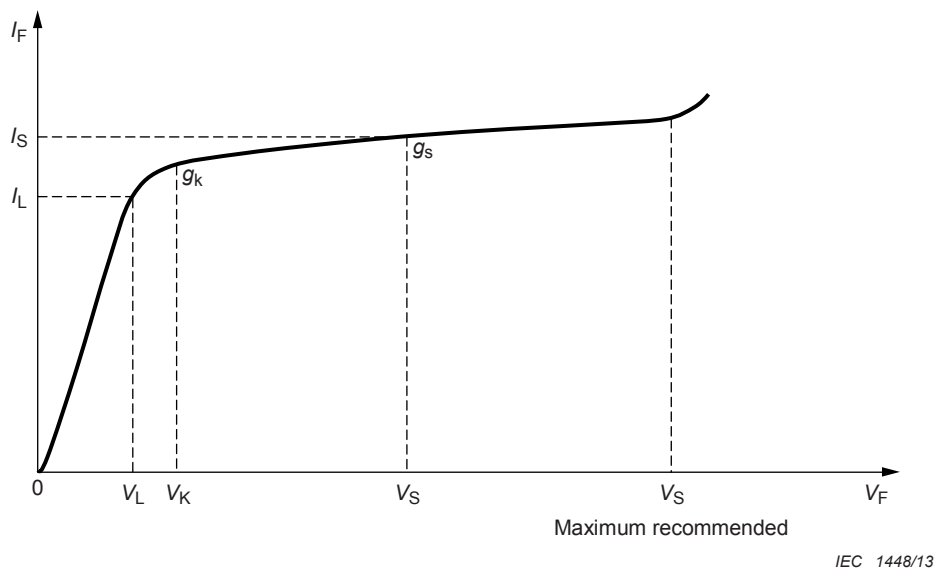


Figure 2 – Current-regulator diode characteristic with symbol identification

4.4.1 Subscripts

S, s	Regulator
L	Limiting
K	Knee