

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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**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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PRICE CODE
CODE PRIX



ICS 31.080.10

ISBN 978-2-8322-0897-7

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CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references	6
3 Terms, definitions and graphical symbols	6
3.1 Signal and switching diodes	6
3.2 Voltage reference diodes and voltage regulator diodes.....	7
3.3 Current-regulator diodes.....	8
4 Letter symbols.....	9
4.1 General.....	9
4.2 Signal and switching diodes	9
4.2.1 Subscripts	9
4.2.2 List of letter symbols.....	9
4.3 Voltage reference diodes and voltage regulator diodes.....	10
4.3.1 Subscripts	10
4.3.2 List of letter symbols.....	10
4.4 Current-regulator diodes.....	10
4.4.1 Subscripts	10
4.4.2 List of letter symbols.....	11
5 Essential ratings and characteristics.....	11
5.1 General.....	11
5.2 Signal and switching diodes	11
5.2.1 Ratings (limiting values)	11
5.2.2 Characteristics	11
5.3 Voltage reference diodes and voltage regulator diodes.....	14
5.3.1 Ratings (limiting values)	14
5.3.2 Characteristics	14
5.4 Current-regulator diodes.....	16
5.4.1 Ratings (limiting values)	16
5.4.2 Characteristics	16
6 Measuring methods	17
6.1 General.....	17
6.2 Signal and switching diodes	17
6.2.1 Reverse current I_R	17
6.2.2 Forward voltage V_F	17
6.2.3 Total capacitance C_{tot}	18
6.2.4 Forward recovery time t_{fr} and peak forward recovery voltage V_{FRM}	19
6.2.5 Reverse recovery time (t_{rr}) and recovered charge (Q_r).....	20
6.2.6 Detector voltage efficiency η_V	21
6.2.7 Detector power efficiency η_p	22
6.2.8 Noise V_n , I_n	23
6.3 Voltage reference diodes and voltage regulator diodes.....	24
6.3.1 Working voltage V_Z	24
6.3.2 Differential resistance in the working current range r_Z	25
6.3.3 Temperature coefficient of working voltage α_{VZ}	25
6.3.4 Reverse current I_R	26
6.3.5 Forward voltage V_F	26

6.3.6	Junction capacitance C_{tot}	26
6.3.7	Noise voltage V_n	26
6.4	Current-regulator diodes.....	27
6.4.1	Regulator current I_S	27
6.4.2	Temperature coefficient of regulator current α_{I_S}	27
6.4.3	Regulator current variation ΔI_S	28
6.4.4	Limiting voltage V_L	28
6.4.5	Small-signal regulator conductance g_S	29
6.4.6	Knee conductance g_k	31
7	Acceptance and reliability.....	31
7.1	Acceptance-defining characteristics	31
7.2	Electrical endurance tests	33
Figure 1	– Current-regulator diode graphical symbol.....	8
Figure 2	– Current-regulator diode characteristic with symbol identification.....	10
Figure 3	– Reverse recovery current waveform	12
Figure 4	– Current and voltage waveforms.....	13
Figure 5	– Circuit diagram for the measurement of I_R	17
Figure 6	– Circuit diagram for the measurement of V_F	18
Figure 7	– Circuit diagram for the measurement for C_{tot}	18
Figure 8	– Circuit diagram for the measurement of t_{fr} and V_{FRM}	19
Figure 9	– Circuit diagram for the measurement of t_{rr}	20
Figure 10	– Circuit diagram for the measurement of η_V	21
Figure 11	– Circuit diagram for the measurement of η_p	22
Figure 12	– Circuit diagram for the measurement of noise current.....	23
Figure 13	– Circuit diagram for the measurement of V_Z	24
Figure 14	– Circuit diagram for the measurement of V_n	26
Figure 15	– Circuit diagram for the measurement of I_S	27
Figure 16	– Circuit diagram for the measurement of g_S (two-voltmeter method)	29
Figure 17	– Circuit diagram for the measurement of g_S (two-terminal bridge method)	30
Table 1	– Preferred reference diode working voltages – Voltages in the E24 series	14
Table 2	– Preferred reference diode working voltages – Voltages in the E12 series	15
Table 3	– Acceptance-defining characteristics for acceptance after endurance tests.....	32
Table 4	– Test circuits and conditions for the endurance tests	33

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SEMICONDUCTOR DEVICES –

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

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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

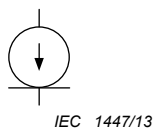
differential resistance at a working current within the regulating range

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.

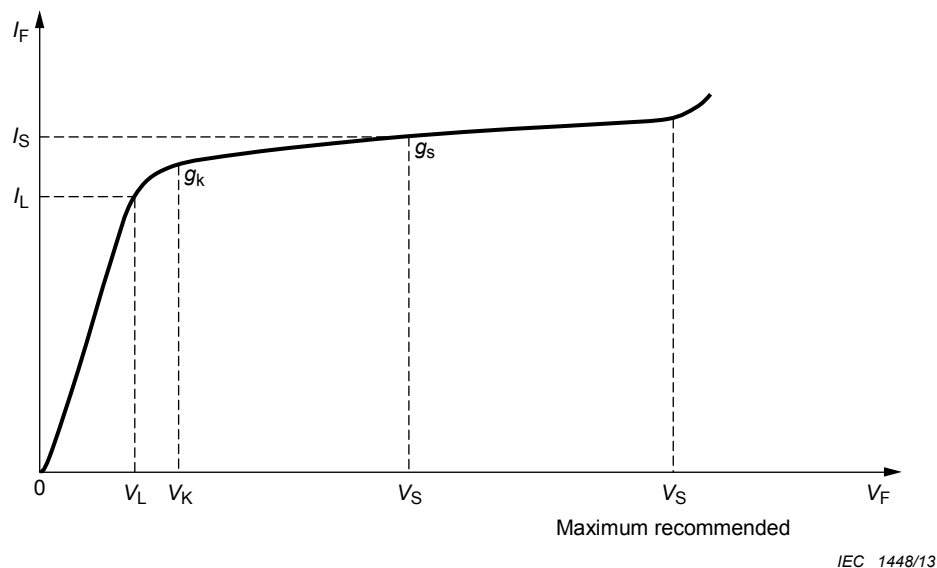


Figure 2 – Current-regulator diode characteristic with symbol identification

4.4.1 Subscripts

S, s	Regulator
L	Limiting
K	Knee

4.4.2 List of letter symbols

4.4.2.1 Voltages

V_S Regulator voltage

V_L Limiting voltage

V_K Knee voltage

4.4.2.2 Currents

I_S Regulator current

I_L Limiting current

4.4.2.3 Sundry quantities

g_s Small-signal regulator conductance

g_k Knee conductance

ΔI_S Regulator current variation

5 Essential ratings and characteristics

5.1 General

The rules of IEC 60747-1:2006, Clause 5 apply, with the following additions.

Voltage and current ratings apply over the rated range of operating temperatures. Where such ratings are temperature-dependent, this dependence should be indicated.

5.2 Signal and switching diodes

5.2.1 Ratings (limiting values)

5.2.1.1 Minimum and maximum storage temperatures (T_{stg})

5.2.1.2 Minimum and maximum operating ambient or case temperature (T_a or T_c)

5.2.1.3 Maximum continuous (direct) reverse voltage (V_R)

5.2.1.4 Maximum peak reverse voltage (V_{RM})

Under specified pulse conditions (for switching diodes).

5.2.1.5 Maximum continuous (direct) forward current (I_F)

5.2.1.6 Maximum peak forward current (I_{FM})

Under specified conditions.

5.2.1.7 Maximum total power dissipation (P_{tot} or P_C)

Where thermal resistance is not given in the characteristics, maximum total power dissipation as a function of temperature over the range of operating temperatures shall also be given.

5.2.1.8 Any special requirements for ventilation and/or mounting

5.2.2 Characteristics

5.2.2.1 Reverse current (I_R)

Maximum value at the maximum continuous (direct) reverse voltage and at a low value of reverse voltage at 25 °C and one higher temperature.

5.2.2.2 Forward voltage (V_F)

Maximum value at the rated maximum continuous (direct) forward current at 25 °C.

Minimum value at low value of continuous (direct) forward current at 25 °C.

5.2.2.3 Total capacitance (C_{tot})

Maximum value at specified low value of reverse voltage at 25 °C; the frequency shall be below that where secondary effects are significant.

5.2.2.4 Recovered charge (Q_r)

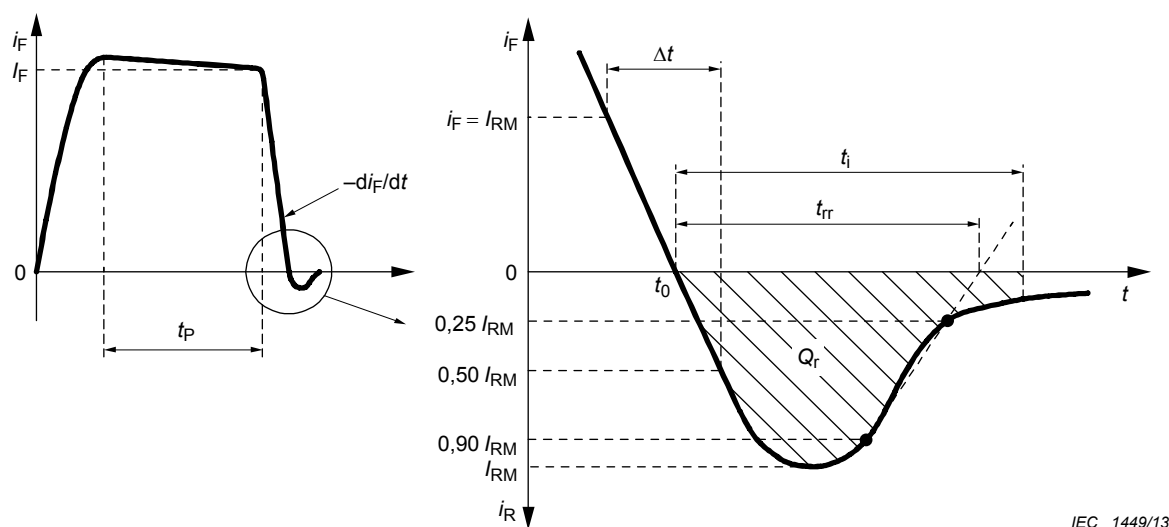
For switching diodes: maximum value when switching from a specified forward current by the application of specified reverse voltage or current and for specified circuit conditions.

NOTE See note in 5.2.2.5.

5.2.2.5 Reverse recovery time (t_{rr})

For switching diodes: maximum value when switching from a specified forward current by the application of specified reverse voltage or current and for specified circuit conditions. See Figure 3.

NOTE Recovered charge and reverse recovery time are measured between the instant when the current passes through zero, when changing from the forward direction to the reverse direction (t_0), and the instant when the reverse current is reduced from its peak value I_{RM} either to a specified low value (preferably 10 % of the peak reverse current) (t_i), or when the extrapolated reverse current reaches zero (t_{rr}). The extrapolation is carried out with respect to two specified points, preferably 90 % and 25 % of the peak reverse current.



IEC 1449/13

Figure 3 – Reverse recovery current waveform

5.2.2.6 Peak forward recovery voltage (V_{FRM})

Maximum value (where appropriate) when switching from a specified reverse voltage to a specified forward current.

5.2.2.7 Forward recovery time (t_{fr})

Maximum value (where appropriate), when switching from a specified reverse voltage (preferably zero) by the application of a specified forward current with a specified rise time between 10 % and 90 %.

NOTE Forward recovery time is measured between the instant when the forward voltage rises through a specified first value (preferably 10 % of the final stable value) and the instant when it falls from its peak value, either to a specified second value close to the final stable value (preferably 110 %) or when the extrapolated forward voltage reaches zero (the extrapolation is carried out with respect to two specified points, preferably 90 % and 50 % of the peak forward voltage). See Figure 4.

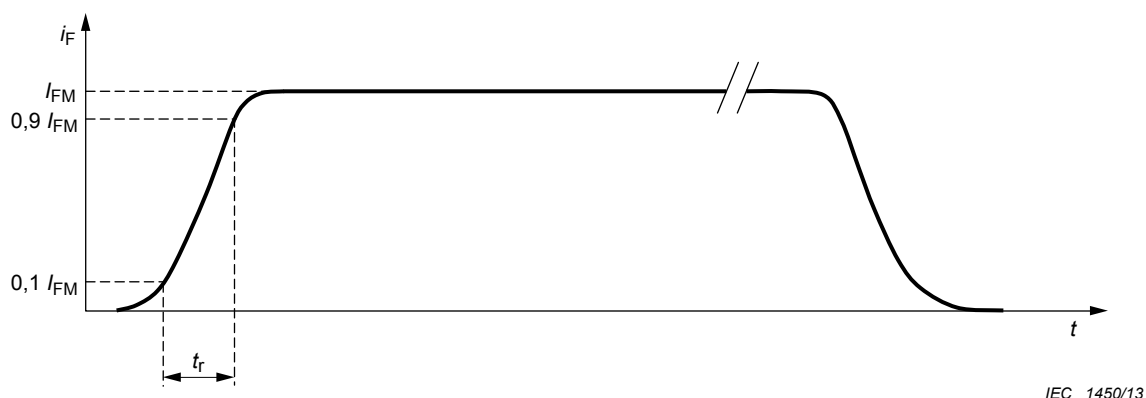


Figure 4 a) Current waveform

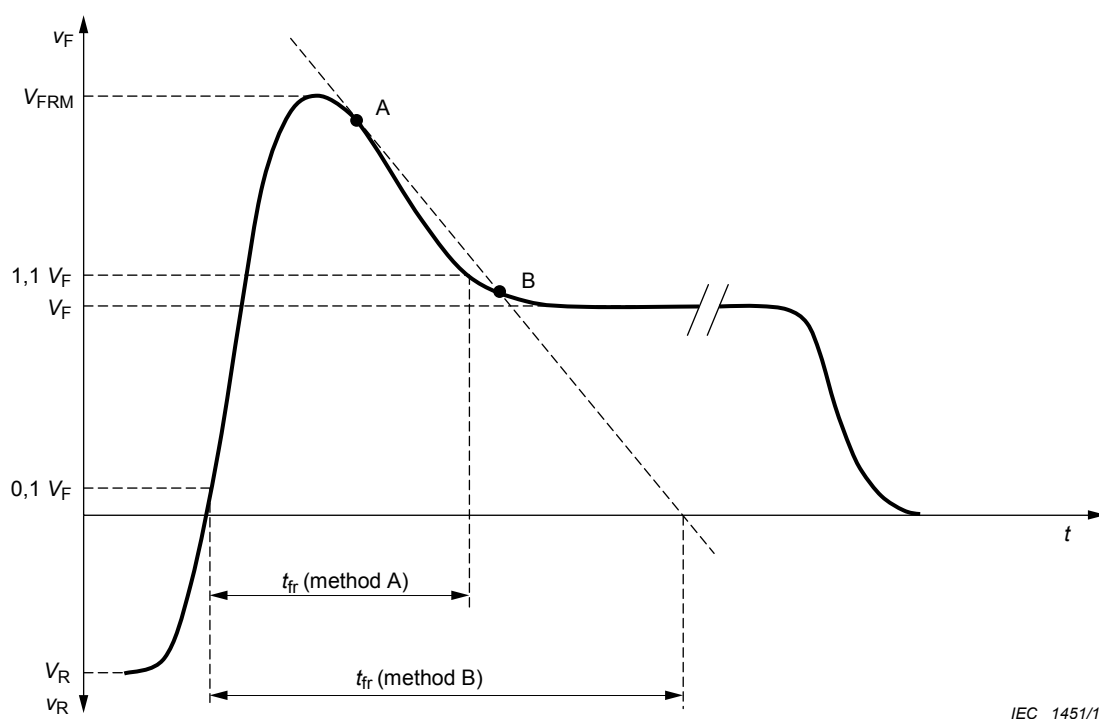


Figure 4 b) Voltage waveform

Figure 4 – Current and voltage waveforms

5.2.2.8 Detector efficiency

For diodes specified for use in detector circuits, the following characteristics shall be stated:

Either: **a) Detector voltage efficiency (η_v)**

Minimum value (for high-level RF detectors) under specified bias conditions at 25 °C. The circuit conditions and the frequency of measurement shall also be specified.

Or: **b) Detector power efficiency (η_p)**

Minimum value (for low-level RF detectors) under specified bias conditions at 25 °C and at one higher temperature. The circuit conditions and the frequency of measurement shall also be specified.

5.2.2.9 Noise (V_n , I_n) (where appropriate)

Maximum value of noise voltage or current, depending respectively on whether the diode is forward or reverse biased.

5.3 Voltage reference diodes and voltage regulator diodes

5.3.1 Ratings (limiting values)

5.3.1.1 Minimum and maximum storage temperatures (T_{stg})

5.3.1.2 Minimum and maximum operating ambient or case, temperature (T_a or T_c)

5.3.1.3 Maximum continuous (direct) reverse current (I_Z)

5.3.1.4 Maximum continuous (direct) forward current (I_F)

(For diodes intended for operation in the forward conductivity region).

5.3.2 Characteristics

5.3.2.1 Working voltage (V_Z)

Nominal, minimum and maximum values, each at a specified current in the scale 1, 2, 5 and preferably with either T_c or T_a and mounting details specified. Alternatively, the conditions may be at a specified T_{vj} and a pulse test method be used, taking into account 6.2.2.

For voltage-reference diodes, the preferred nominal values of working voltages are shown in Table 1 and Table 2. The nominal values in the tables multiplied by 10 are the recommended values for higher voltages. The specified minimum and maximum limits shall not lie outside those shown in the tables.

Table 1 – Preferred reference diode working voltages – Voltages in the E24 series

Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.
2,5	2,7	2,9						
2,8	3,0	3,2	5,8	6,2	6,6	12,4	13,0	14,1
3,1	3,3	3,5	6,4	6,8	7,2	13,8	15,0	15,6
3,4	3,6	3,8	7,0	7,5	7,9	15,3	16,0	17,1
3,7	3,9	4,1	7,7	8,2	8,7	16,8	18,0	19,1
4,0	4,3	4,6	8,5	9,1	9,6	18,8	20,0	21,2
4,4	4,7	5,0	9,4	10,0	10,6	20,8	22,0	23,3
4,8	5,1	5,4	10,4	11,0	11,6	22,8	24,0	25,6
5,2	5,6	6,0	11,4	12,0	12,7	25,1	27,0	28,9

Table 2 – Preferred reference diode working voltages – Voltages in the E12 series

Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.
2,4	2,7	3,0						
2,9	3,3	3,6	6,1	6,8	7,5	13,0	15,0	16,5
3,5	3,9	4,3	7,3	8,2	9,1	16,0	18,0	20,5
4,2	4,7	5,2	9,0	10,0	11,0	20,0	22,0	24,5
5,0	5,6	6,2	10,5	12,0	13,5	24,0	27,0	30,0

5.3.2.2 Differential resistance within the working voltage range (r_z)

Maximum value at the current specified in 5.3.2.1.

Maximum value at a recommended minimum operating current.

5.3.2.3 Temperature coefficient of working voltage (α_{VZ})

Minimum and maximum values (percent per degree Celsius) at the current specified in 5.3.2.1. If this coefficient varies significantly with the temperature, the variation shall be stated, and the temperatures (preferably junction temperatures) at which the measurements are made shall be specified.

5.3.2.4 Junction capacitance

Maximum value (where appropriate) at a specified reverse voltage below the minimum working voltage.

5.3.2.5 Reverse current (I_R)

Maximum value at a specified reverse voltage below the minimum working voltage.

5.3.2.6 Forward voltage (V_F)

Maximum value at the maximum continuous (direct) forward current (where appropriate – for voltage-regulator diodes intended for operation in the forward region).

5.3.2.7 Noise voltage within the working voltage range (V_{nz})

Maximum value (where appropriate) under specified conditions of frequency, bandwidth and operating current. Where the variation of this characteristic with temperature is significant, this shall be specified.

5.4 Current-regulator diodes

5.4.1 Ratings (limiting values)

5.4.1.1 Minimum and maximum storage temperatures (T_{stg})

5.4.1.2 Minimum and maximum operating ambient or case, temperatures (T_a or T_c)

5.4.1.3 Maximum total power dissipation at an ambient or case temperature of 25 °C (P_{tot}) and a derating curve or derating factor

5.4.1.4 Maximum reverse voltage / Maximum reverse current

Either: a) Maximum reverse (negative anode-cathode) voltage (V_R)
or: b) Maximum reverse current (I_R)

(Where appropriate)

5.4.1.5 Maximum forward voltage (V_F)

(Where appropriate)

5.4.2 Characteristics

5.4.2.1 Regulator current (I_{S1})

Minimum and maximum values at a specified operating voltage (V_{S1}).

5.4.2.2 Regulator current (I_{S2})

Maximum value at the maximum recommended operating voltage (V_{S2}).

5.4.2.3 Temperature coefficient of regulator current (α_{IS})

Highest (most positive or maximum) and lowest (most negative or minimum) values at the operating voltage specified in 5.4.2.1 and specified range of T_a or T_c .

5.4.2.4 Regulator current variation / Small-signal regulator conductance

Either: a) Regulator current variation (ΔI_S)

Maximum value for a specified change of V_S between two specified values of V_S on either side of V_{S1}

Or: b) Small-signal regulator conductance (g_s)

Maximum value at V_{S1} and $f = 1$ kHz

5.4.2.5 Limiting voltage (V_L)

Maximum value at specified current (I_L), preferably $0,8 I_{S1}$ min

5.4.2.6 Where appropriate, knee conductance (g_k)

Maximum value at specified voltage (V_K) and $f = 1$ kHz

6 Measuring methods

6.1 General

The rules of IEC 60747-1:2006, Clause 6 apply.

In particular, IEC 60747-1:2006, 6.2 applies if pulse measurements are used in place of any of the d.c. methods specified below. In these cases:

- the variable generator is replaced by a pulse generator;
- the voltmeter is replaced by a peak-reading instrument;
- the ammeter is replaced by a peak-reading;
- pulse width and duty cycle (t_p , δ) shall be specified. Preferably: $t_p = 300 \mu s$, $\delta \leq 2 \%$.

6.2 Signal and switching diodes

6.2.1 Reverse current I_R

a) Purpose

To measure the reverse current of a diode under specified reverse voltage.

b) Circuit diagram (Figure 5)

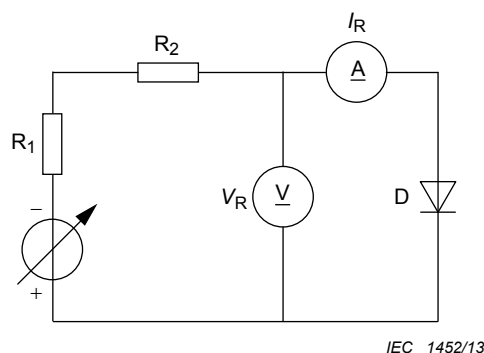


Figure 5 – Circuit diagram for the measurement of I_R

c) Circuit description and requirements

D diode being measured

R_1 calibrated resistor (pulse measurement only)

R_2 protective resistor

d) Measurement procedure

The temperature is set to the specified value.

The variable voltage generator is adjusted to obtain the specified value of reverse voltage V_R across the diode.

The reverse current I_R is read from the ammeter A.

e) Specified conditions

- ambient or case temperature (T_a , T_c);
- reverse voltage (V_R).

6.2.2 Forward voltage V_F

a) Purpose

To measure the forward voltage across a signal or switching diode under specified conditions.

b) Circuit diagram (Figure 6)

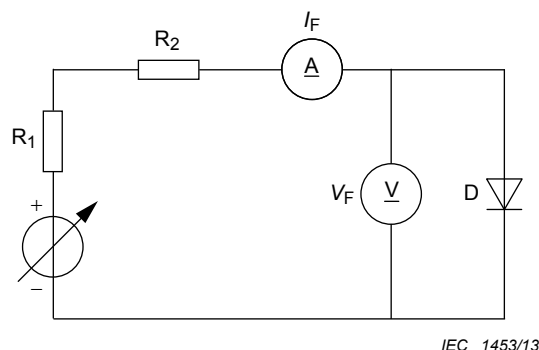


Figure 6 – Circuit diagram for the measurement of V_F

c) Circuit description and requirements

D diode being measured

R_1 calibrated resistor (pulse measurement only)

R_2 a high-value resistor

d) Measurement procedure

The temperature is set to the specified value.

The variable voltage generator is adjusted to obtain the specified value of forward current I_F as measured on ammeter A.

The forward voltage V_F is read from the voltmeter V.

e) Specified conditions

- ambient or case temperature (T_a , T_c);
- forward current (I_F).

6.2.3 Total capacitance C_{tot}

a) Purpose

To measure the total capacitance of a diode under specified conditions.

b) Circuit diagram (Figure 7)

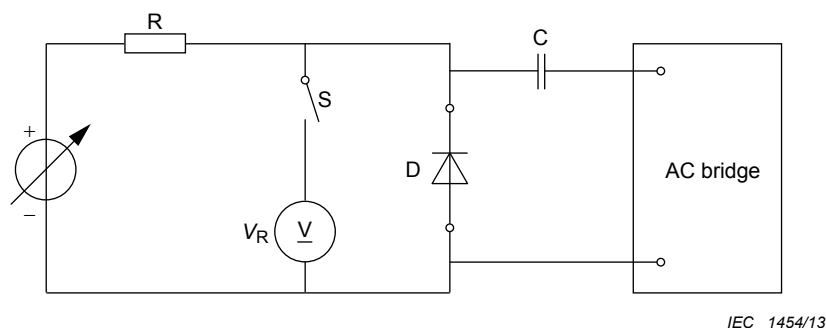


Figure 7 – Circuit diagram for the measurement for C_{tot}

c) Circuit description and requirements

D diode being measured

R low conductance resistor compared with the admittance of the diode being measured.

C capacitor C able to withstand the reverse bias voltage of the diode and to present a short-circuit at the frequency of measurement.

d) *Precautions to be observed*

If the measured capacitance is very small, the mounting conditions will affect the accuracy of the results and they should be specified.

e) *Measurement procedure*

The temperature is set to the specified value.

The voltage across the diode is adjusted to the specified value V_R . Then the voltmeter V is taken out of the circuit and the capacitance of the diode being measured is determined, using the a.c. bridge, by subtracting the value without the diode in its mounting from the value with the diode in its mounting.

f) *Specified conditions*

- ambient or case temperature (T_a , T_c);
- reverse voltage (V_R);
- measurement frequency, if different from 1 MHz;
- mounting conditions of the diode, if necessary.

6.2.4 Forward recovery time t_{fr} and peak forward recovery voltage V_{FRM}

a) *Purpose*

To measure the forward recovery time and the peak forward recovery voltage of the diode.

b) *Circuit diagram (Figure 8)*

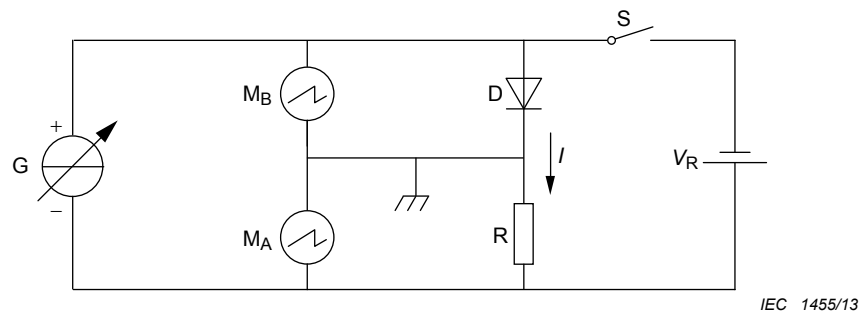


Figure 8 – Circuit diagram for the measurement of t_{fr} and V_{FRM}

c) *Circuit description and requirements*

D diode being measured

G current-pulse generator having a compliance voltage (open-circuit output voltage) of 50 V minimum or three times V_{FRM} , whichever is greater

R non-inductive calibrated resistor

S electronic switch, which is closed except for a period starting just before the current pulse and throughout its duration

M_A and M_B oscilloscopes or other monitoring instruments

The pulse duration shall be long enough for the forward voltage to have reached the stable value V_F .

The pulse duration and the duty cycle of the current-pulse generator should be such that negligible internal heating of the diode occurs.

d) *Measurement procedure*

The temperature is set to the specified value.

While monitoring the current waveform on M_A , the current-pulse source is adjusted to the specified conditions of rise time t_r and forward current I_{FM} .

The reverse voltage V_R is adjusted to the specified value, and switch S is appropriately set.

The peak forward recovery voltage V_{FRM} and the forward recovery time t_{fr} are measured on the waveform of voltage across the diode on M_B in accordance with the applied specification method.

e) *Specified conditions*

- ambient or case temperature (T_a , T_c);
- peak forward current (I_{FM});
- rise time of current pulse (t_r) (between 10 % and 90 % of I_{FM} , unless otherwise stated);
- voltages defining the beginning and the end of the forward recovery time, if different from 10 % and 110 %, respectively, of V_F ;
- reverse voltage (V_R).

6.2.5 Reverse recovery time (t_{rr}) and recovered charge (Q_r)

a) *Purpose*

To measure the reverse recovery time of a diode under specified switching conditions and to calculate the charge recovered from a diode when it is rapidly switched from a forward biased condition to a reverse biased condition.

b) *Circuit diagram (Figure 9)*

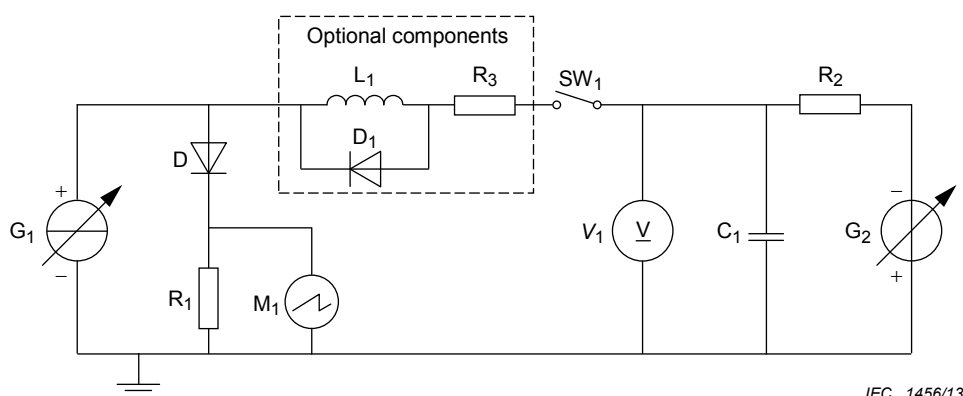


Figure 9 – Circuit diagram for the measurement of t_{rr}

c) *Circuit description and requirements*

- D diode being measured
- G_1 current generator supplying the forward current (I_F)
- R_1 non-inductive current shunt
- M_1 measuring instrument (eg. oscilloscope)
- SW_1 switch to turn off the diode
- C_1 capacitor to provide the reverse current pulse, large enough to maintain the reverse voltage applied to the diode for at least three times $t_{rr \max}$ while passing a current equal to $I_F + I_{rr \max}$. For example:

$$C_1 \min = \frac{20(I_F + I_{rr \max})t_{rr \max}}{V_{rr \max}}$$

- R_2 protective resistor for G_2

- G_2 voltage generator to provide the specified reverse voltage as measured on V_1

If a peak reverse current ($I_{rr,max}$) is specified:

Set G_2 to $V_R \max$ and R_3 to $V_R \max / (I_F + I_{rr,max})$.

If the rate of change of current (di/dt) is specified:

Set L_1 to $V_R \max / (di/dt)$ and provide D_1 to clamp the voltage generated by L_1 when the diode being tested turns off.

d) *Measurement procedure*

The temperature is set to the specified value.

With SW_1 open, set G_2 to provide the reverse voltage to be applied to the diode as measured on V_1 . Adjust G_1 to apply the forward current (I_F) as measured on M_1 . After this current has been applied for at least the time necessary to ensure that the diode is fully charged, close switch SW_1 . The resultant current pulse is recorded on the measuring instrument M_1 .

Reverse recovery time is measured between the two points specified in 5.2.2.5 and recovered charge is calculated between the same two points using one of the following equations:

$$Q_r = \int_{t_0}^{t_0+t_I} I_R \cdot dt \dots\dots or \dots\dots Q_r = \int_{t_0}^{t_0+t_{rr}} I_R dt$$

e) *Specified conditions*

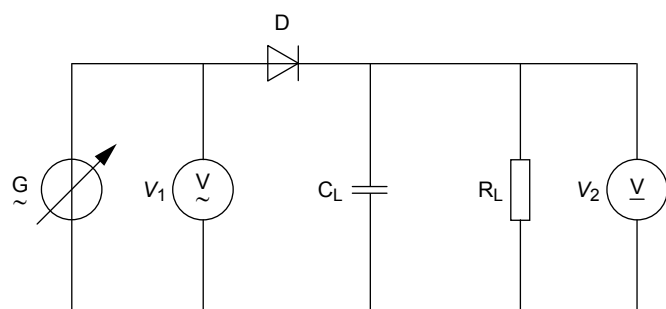
- ambient or case temperature (T_a , T_c);
- forward current (I_F);
- Reverse voltage (V_R) or reverse recovery current ($I_{rr,max}$);
- Rate of change of current (di/dt) (if required);
- End time t_i or t_{rr} .

6.2.6 Detector voltage efficiency η_v

a) *Purpose*

To measure the detector voltage efficiency of a signal diode under specified conditions.

b) *Circuit diagram (Figure 10)*



IEC 1457/13

Figure 10 – Circuit diagram for the measurement of η_v

c) *Circuit description and requirements*

- D diode being measured
- G low-impedance generator
- V r.m.s. reading voltmeter

The value of R_L should match the output impedance of the generator G . The time constant $C_L R_L$ should be large compared to the reciprocal of the measurement frequency.

d) *Measurement procedure*