SLOVENSKI STANDARD
SIST EN 62007-2:2002

01-september-2002

Semiconductor optoelectronic devices for fibre optic system applications - Part 2: Measuring methods (IEC 62007-2:1997+ A1:1998)

Semiconductor optoelectronic devices for fibre optic system applications -- Part 2: Measuring methods

Optoelektronische Halbleiterbauelemente für faseroptische Systemanwendungen -- Teil 2: Meßverfahren

Dispositifs optoélectroniques à semiconducteurs pour application dans les systèmes à fibres optiques -- Partie 2: Méthodes de mesure

Ta slovenski standard je istoveten z: **EN 62007-2:2000**

ICS:

31.080.01	Polprevodniški elementi (naprave) na splošno	Semiconductor devices in general
31.260	Optoelektronika, laserska oprema	Optoelectronics. Laser equipment
33.180.01	Sistemi z optiļnimi vlakni na sploģno	Fibre optic systems in general

SIST EN 62007-2:2002 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62007-2

July 2000

ICS 31.080.01; 31.260; 33.180.01

English version

Semiconductor optoelectronic devices for fibre optic system applications Part 2: Measuring methods (IEC 62007-2:1997 + A1:1998)

Dispositifs optoélectroniques à semiconducteurs pour application dans les systèmes à fibres optiques
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(CEI 62007-2:1997 + A1:1998)

Optoelektronische Halbleiterbauelemente für faseroptische Systemanwendungen
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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 62007-2:2000 E

Foreword

The texts of the International Standard IEC 62007-2:1997 and its amendment 1, prepared by IEC TC 86, Fibre optics, were submitted to the formal vote and were approved by CENELEC as EN 62007-2 on 2000-04-01 without any modification.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2001-04-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2003-04-01

Annexes designated "informative" are given for information only.
In this standard, annex A is informative.

Endorsement notice

The texts of the International Standard IEC 62007-2: 1997 and its amendment 1 were approved by CENELEC as a European Standard without any modification.

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SEMICONDUCTOR OPTOELECTRONIC DEVICES FOR FIBRE OPTIC SYSTEM APPLICATIONS –

Part 2: Measuring methods

1 Scope

This part of IEC 62007 describes the measuring methods applicable to the semiconductor optoelectronic devices to be used in the field of fibre optic systems and subsystems.

2 Normative references

There are no normative references in this part of IEC 62007.

3 Measuring methods for photoemitters

3.1 Radiant power or forward current of light-emitting diodes (LED), infrared-emitting diodes (IRED) and laser diodes with or without pigtails

a) *Purpose*

To measure the radiant power ϕ_e or the forward current I_F of light-emitting diodes (LED), infrared-emitting diodes (IRED) and laser diodes, with or without pigtails, under specified conditions.

b) *Measuring equipment*

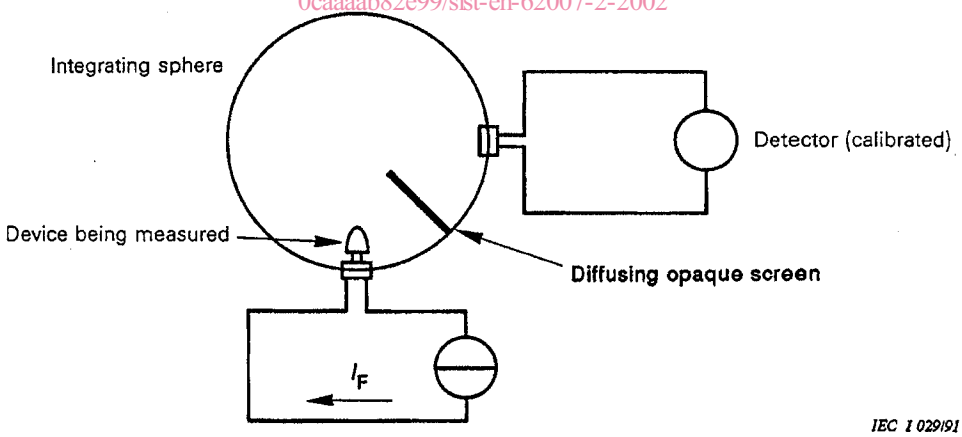


Figure 1

c) *Equipment description and requirements*

The radiation emitted by the device is submitted to multiple reflections from the walls of the integrating sphere; this leads to a uniform irradiance of the surface proportional to the emitted flux. A detector located in the walls of the sphere measures this irradiance. An opaque screen shields the detector from the direct radiation of the device being measured.

d) *Precautions to be observed*

The device being measured, the screen and the apertures shall be small compared to the sphere surface.

The inner surface of the sphere and screen shall have a diffusing coating having a high uniform reflection coefficient (0,8 minimum).

The sphere and detector assembly shall be calibrated.

Change in peak-emission wavelength and flux due to power dissipation shall be taken into account.

When the device being measured is pulsed, the detector shall average the measured radiation.

e) *Measurement procedures*

The emitting device is set at the entrance of the integrating sphere, so that no direct radiation will reach the detector.

For measurement of radiant power, the specified forward current I_F is applied to the device and the radiant power is measured on the photodetector.

For measurement of forward current, a current is applied to the device until the specified radiant power (ϕ_e) is achieved. The value of current is recorded.

f) *Specified conditions*

- Ambient or case temperature.
- Radiant power (when measuring forward current).
- Forward current (when measuring radiant power).

3.2 Switching times of infrared-emitting diode and light-emitting diode with or without pigtails

a) *Purpose*

To measure the turn-on time t_{on} (turn-on delay time $t_{d(on)}$ + rise time t_r) and turn-off time t_{off} (turn-off delay time $t_{d(off)}$ + fall time t_f) of an infrared-emitting diode and light-emitting diode with or without pigtails.

b) *Circuit diagram*

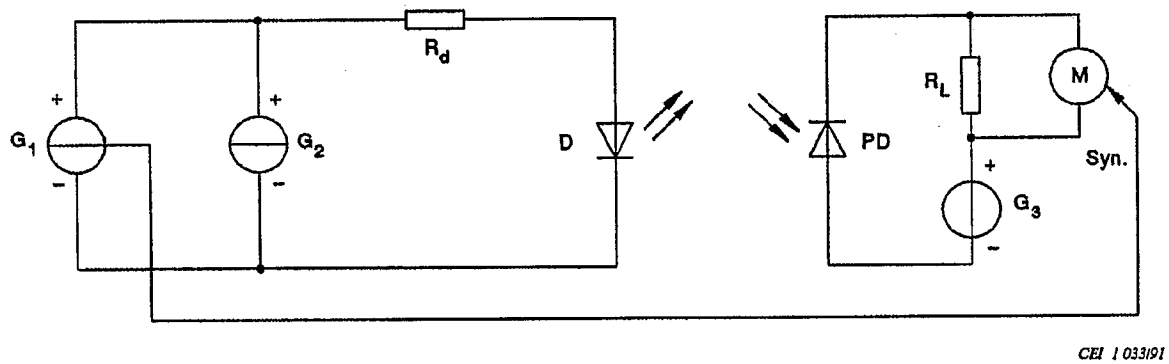


Figure 2

c) *Circuit description*

G_1 = current pulse generator, with high impedance

G_2 = d.c. current bias source

G_3 = d.c. voltage bias source

R_d = resistance for matching the impedance with the generator

D = device being measured

PD = photodiode

R_L = load resistance

M = measuring instrument

Syn. = synchronization signal

d) *Precautions to be observed*

The switching time of the photodiode, the delay time of the test circuit and measuring instrument, the rise and fall times of the input current pulse shall be short enough not to affect the accuracy of the measurement.

The mean output power obtained at the top of the optical pulse (see figure 3) may not necessarily be equivalent to the c.w. radiant power at a current equal to the sum of the d.c. bias and input pulse current.

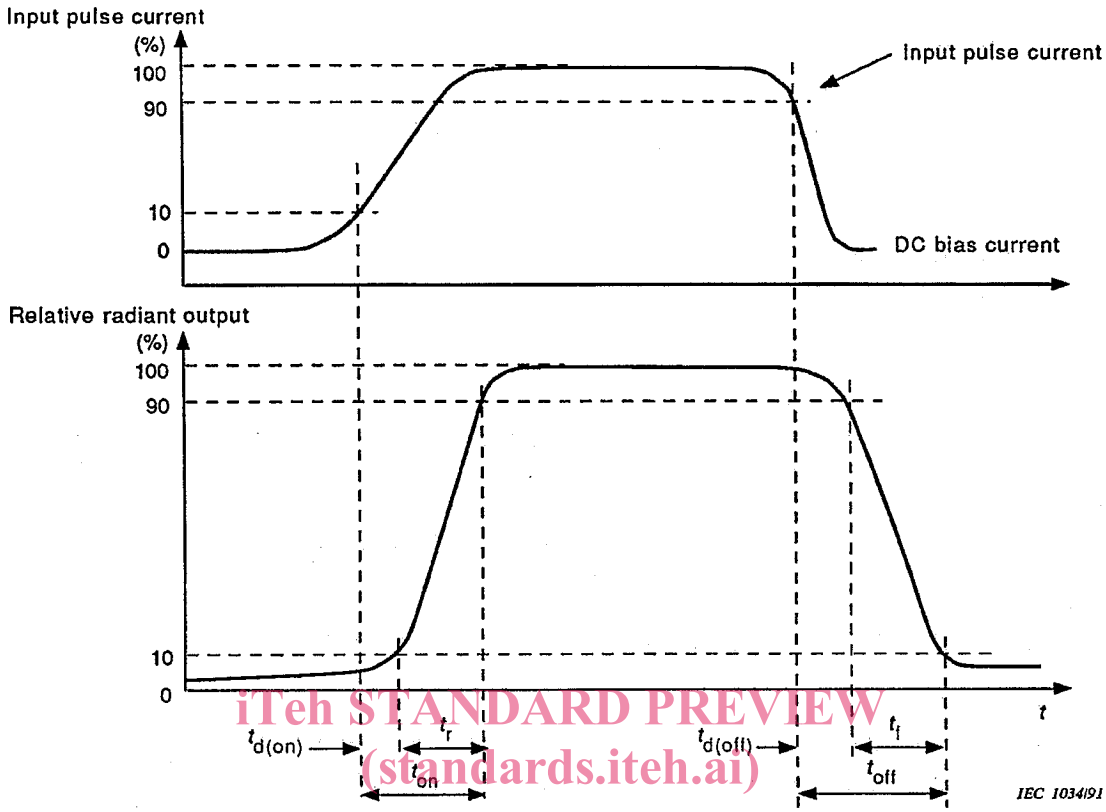
Only the optical port of the device being measured shall be considered.

e) *Measurement procedure*

Apply the specified d.c. and pulse current to the device being measured.

Measure the switching times with the measuring instrument M.

The 100 % radiant output power level is the mean output power obtained at the top of the radiant pulse. The 0 % level is the output power obtained at the d.c. bias current.



$t_{d(on)}$ = turn-on delay time
t_r = rise time
$t_{d(off)}$ = turn-off delay time
t_f = fall time
t_{on} = turn-on time
t_{off} = turn-off time

Figure 3

f) *Specified conditions*

- Ambient or case temperature.
- DC bias current.
- Input pulse current, width and duty cycle.
- Optical port.
- Optical configuration.

3.3 Small signal cut-off frequency (f_c) of light-emitting diodes (LED), infrared-emitting diodes (IRED) and laser diodes with or without pigtails

a) *Purpose*

To measure the small-signal cut-off frequency (f_c) of light-emitting diodes (LED), infrared-emitting diodes (IRED) and laser diodes with or without pigtails, under specified conditions.

b) *Circuit diagram*

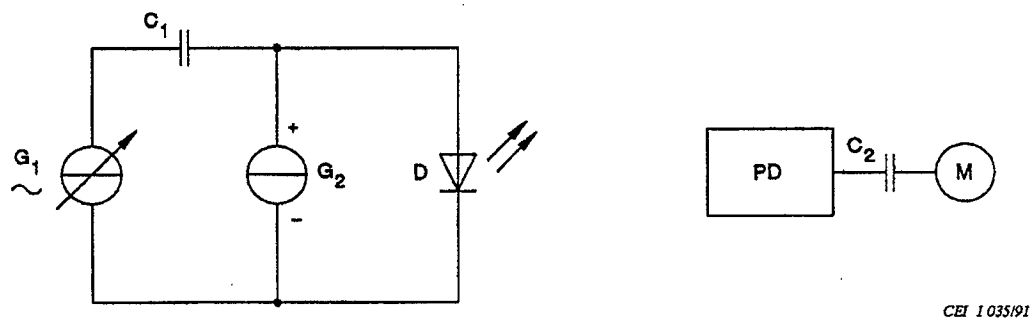


Figure 4

c) *Circuit description and requirements*

D = device being measured

G_1 = adjustable frequency a.c. generator

G_2 = d.c. generator

PD = photodetector

M = measuring instrument for a.c. radiant power

C_1, C_2 = coupling capacitors

d) *Precautions to be observed*

The radiant power reflected back into the laser-diode shall be minimized so as to avoid distortions which could affect the accuracy of the measurements. The photodetector must have a frequency response greater than f_c.

e) *Measurement procedure*

For LED and IRED, the specified direct forward current or the direct forward current required to obtain the specified radiant power is applied to the device being measured.

For laser diodes, the forward current is adjusted to a value equal to the continuous forward current above the threshold or specified radiant power.

The forward current is modulated using generator G_1 at a low frequency (less than $f_c/100$) and the a.c. radiant power is measured on M.

The modulation frequency is increased, keeping the modulation level constant until the output radiant power measured on M has halved.

This frequency is the small-signal cut-off frequency (f_c).

f) *Specified conditions*

For the light-emitting diodes (LED) and infrared-emitting diodes (IRED):

– ambient or case temperature;

– d.c. forward current or radiant power.

For the laser diodes:

– ambient, case or submount temperature;

– difference between (actual) d.c. forward current and threshold current or radiant power.

3.4 Threshold current of laser diodes with or without pigtails

a) *Purpose*

To measure the threshold current of a laser diode, with or without pigtails.

b) *Circuit diagram*

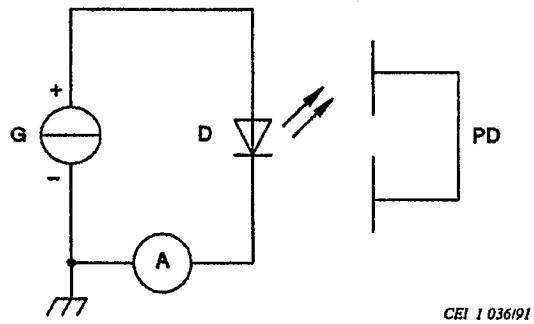


Figure 5

c) *Circuit description and requirements*

D = device being measured

PD = photodetector measuring incident radiant power

A = ammeter

G = generator (pulsed or d.c.)

For pulse measurement, the current generator shall provide current pulses of the required amplitude, duration and repetition rate.

d) *Precautions to be observed*

Radiant power reflected back into the laser diode shall be minimized. The limiting values of the laser diode (I_F and ϕ_e) shall not be overstepped.

e) *Measurement procedure*

A forward current is applied to the diode and the relation between the incident radiant power from the diode and the forward current is recorded.

The forward current at which the second derivative of the recorded curve showing incident radiant power versus the forward current has its first maximum is determined (see figure 6). The forward current at this point is the threshold current I_{TH}.

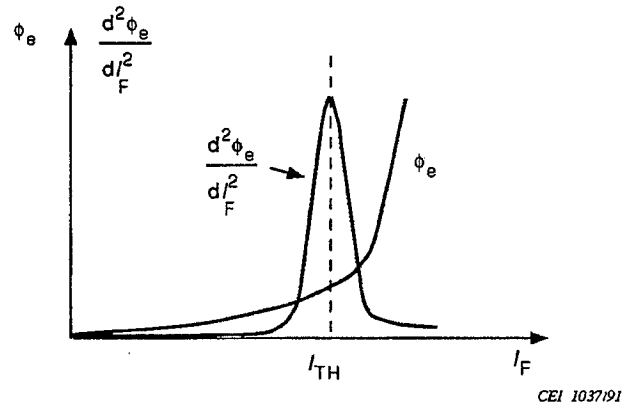


Figure 6

f) *Specified conditions*

- Ambient, case or submount temperature.
- For pulse measurement, repetition frequency and pulse duration of the forward current.

3.5 Relative intensity noise of light-emitting diodes (LED), infrared-emitting diodes (IRED) and laser diodes with or without pigtails

a) *Purpose*

To measure the relative intensity noise (RIN) of LED, IRED and laser diodes, with or without pigtails, under specified conditions.

b) *Circuit diagram*

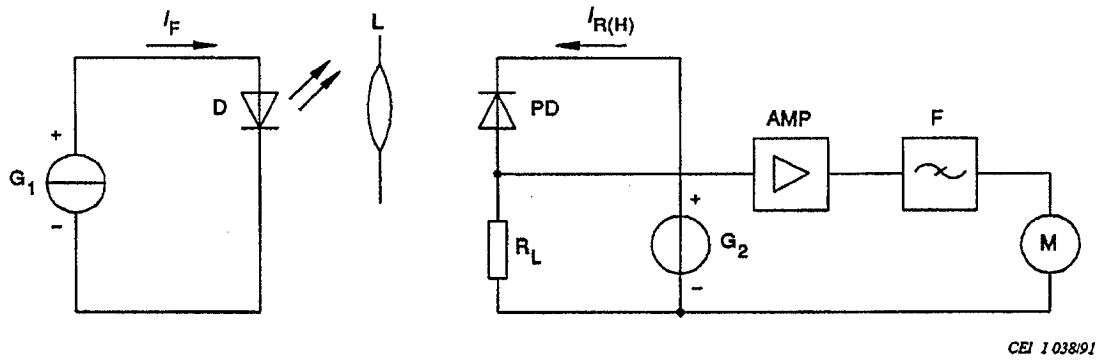


Figure 7

c) *Description of the circuit*

G_1 = d.c. current generator
D = device being measured
L = lens system
I_F = forward current
PD = photodetector
R_L = load resistance
$I_{R(H)}$ = reverse current of the photodetector under optical radiation
G_2 = d.c. voltage bias generator
AMP = a.c. amplifier with gain *G*
F = filter with centre frequency f_o and equivalent noise bandwidth Δf_N
M = measuring instrument (for example level meter, etc.)

d) *Precautions to be observed*

Radiant power reflected back into the laser diode shall be minimized to avoid distortions affecting accuracy of the measurements.

e) *Measurement procedure*

A d.c. current corresponding to the specified radiant power ϕ_e is applied to the device. The noise power N_t is measured by the measuring instrument M and is replaced by reverse current $I_{R(H)}$ of the photodetector, under optical radiation is measured simultaneously.

The photo-emitting device being measured is replaced by a radiation source with broad spectral radiation bandwidth in the same wavelength range.

The irradiant power is adjusted to obtain the same reverse current $I_{R(H)}$ of the photodetector under optical radiation as previously measured. The noise power N_d which corresponds to the photodetector shot-noise plus amplifier noise is measured by the measuring instrument.

RIN is calculated using the formula:

$$RIN = \frac{N_t - N_d}{R_L \times G \times \Delta f_N \times I_{R(H)}}$$

It is expressed in Hz^{-1}.

f) *Specified conditions*

– Ambient, case or submount temperature.
– Radiant power.
– Centre frequency and equivalent noise bandwidth.

3.6 Switching times of a laser diode with or without pigtails

a) *Purpose*

To measure the switching times (turn-on delay time $t_{d(on)}$, rise time t_r, turn-off delay time $t_{d(off)}$ and the fall time t_f) of a laser diode with or without pigtails under specified conditions.

b) *Circuit diagram*

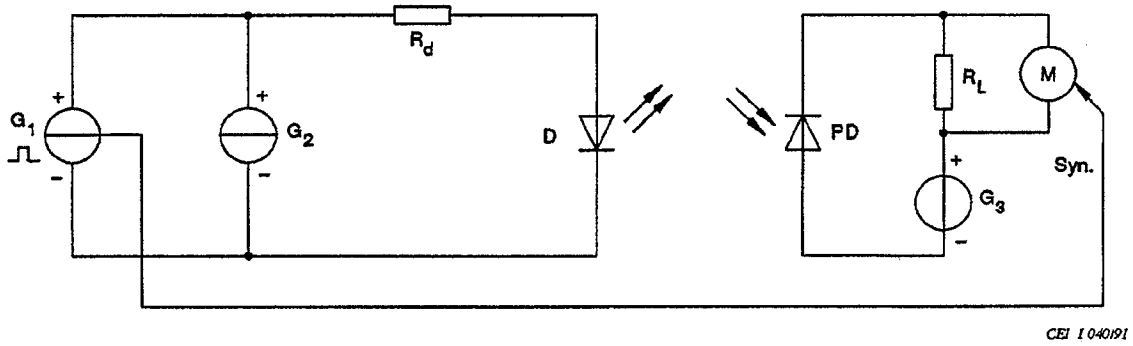


Figure 8

c) *Circuit description*

G_1 = current pulse generator

G_2 = d.c. current bias source

G_3 = d.c. voltage bias source

R_d = resistance for matching the impedance with the generator

D = device being measured

PD = photodiode

R_L = load resistance

M = measuring instrument capable of measuring input and output waveforms simultaneously

Syn. = synchronization signal.

d) *Precautions*

- Radiant power reflected back into the laser diode shall be minimized.
- The pulse width and the duty cycle shall be chosen in order to avoid significant thermal effects.
- A surge current due to switching on/off the circuit, contact with electrostatically charged bodies, etc., shall be avoided.
- The d.c. source G_2 shall have a sufficiently high impedance that does not distort the output of the current pulse generator G_1.
- The switching time of the photodiode PD, and the delay time of the test circuit and measuring instrument should be fast enough not to affect the accuracy of the measurement.

e) *Measurement procedure*

The specified d.c. and pulse current are applied to the device being measured D.

Values of $t_{d(on)}$, t_r, $t_{d(off)}$ and t_f are determined by the measuring instrument.

NOTE – Mean output power at the top of the relative radiant output pulse may not necessarily be equivalent to the c.w. optical power at a current equal to the sum of the d.c. bias and input pulse current.