



NSAI
Standards

Irish Standard
EN 62007-2:2009

Semiconductor optoelectronic
devices for fibre optic system
applications -- Part 2: Measuring
methods (IEC 62007-2:2009
(EQV))

EN 62007-2:2009

Incorporating amendments/corrigenda issued since publication:

<i>This document replaces:</i>	<i>This document is based on:</i> EN 62007-2:2009	<i>Published:</i> 13 March, 2009	
This document was published under the authority of the NSAI and comes into effect on: 9 June, 2009		ICS number: 31.080.01 31.260 33.180.01	
NSAI 1 Swift Square, Northwood, Santry Dublin 9	T +353 1 807 3800 F +353 1 807 3838 E standards@nsai.ie W NSAI.ie	Sales: T +353 1 857 6730 F +353 1 857 6729 W standards.ie	Price Code: M
Údarás um Chaighdeáin Náisiúnta na hÉireann			

English version

**Semiconductor optoelectronic devices
for fibre optic system applications -
Part 2: Measuring methods
(IEC 62007-2:2009)**

Dispositifs optoélectroniques
à semiconducteurs pour application
dans les systèmes à fibres optiques -
Partie 2: Méthodes de mesure
(CEI 62007-2:2009)

Optoelektronische Halbleiterbauelemente
für Anwendungen
in Lichtwellenleitersystemen -
Teil 2: Messverfahren
(IEC 62007-2:2009)

This European Standard was approved by CENELEC on 2009-02-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

Central Secretariat: avenue Marnix 17, B - 1000 Brussels

I.S. EN 62007-2:2009

EN 62007-2:2009

- 2 -

Foreword

The text of document 86C/868/FDIS, future edition 2 of IEC 62007-2, prepared by SC 86C, Fibre optic systems and active devices, of IEC TC 86, Fibre optics, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62007-2 on 2009-02-01.

This European Standard supersedes EN 62007-2:2000.

EN 62007-2:2009 includes the following significant technical changes with respect to EN 62007-2:2000:

- descriptions related to analogue characteristics have been removed;
- some definitions and terms have been revised for harmonisation with other standards originating from SC 86C.

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) 2009-11-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2012-02-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62007-2:2009 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61300	NOTE	Harmonized in EN 61300 series (not modified).
IEC 61315	NOTE	Harmonized as EN 61315:2006 (not modified).
ISO 1101	NOTE	Harmonized as EN ISO 1101:2005 (not modified).

Annex ZA
(normative)**Normative references to international publications
with their corresponding European publications**

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-731	1991	International Electrotechnical Vocabulary (IEV) - Chapter 731: Optical fibre communication	-	-
IEC 60793 (mod)	Series	Optical fibres	EN 60793	Series
IEC 60794	Series	Optical fibre cables	EN 60794	Series
IEC 60874	Series	Connectors for optical fibres and cables	EN 60874	Series

This page is intentionally left BLANK.



INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

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





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2009 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00



INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

W

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references.....	7
3 Terms, definitions and abbreviations.....	7
3.1 Terms and definitions.....	7
3.2 Abbreviations.....	8
4 Measuring methods for photoemitters.....	8
4.1 Outline of the measuring methods.....	8
4.2 Radiant power or forward current of LEDs and LDs with or without optical fibre pigtails.....	8
4.3 Small signal cut-off frequency (f_c) of LEDs and LDs with or without optical fibre pigtails.....	9
4.4 Threshold current of LDs with or without optical fibre pigtails.....	10
4.5 Relative intensity noise of LEDs and LDs with or without optical fibre pigtails.....	12
4.6 S_{11} parameter of LEDs, LDs and LD modules with or without optical fibre pigtails.....	13
4.7 Tracking error for LD modules with optical fibre pigtails, with or without cooler.....	15
4.8 Spectral linewidth of LDs with or without optical fibre pigtails.....	17
4.9 Modulation current at 1 dB efficacy compression (I_F (1 dB)) of LEDs.....	18
4.10 Differential efficiency (η_d) of a LD with or without pigtail and an LD module.....	20
4.11 Differential (forward) resistance r_d of an LD with or without pigtail.....	22
5 Measuring methods for receivers.....	23
5.1 Outline of the measuring methods.....	23
5.2 Noise of a PIN photodiode.....	23
5.3 Excess noise factor of an APD with or without optical fibre pigtails.....	25
5.4 Small-signal cut-off frequency of a photodiode with or without optical fibre pigtails.....	27
5.5 Multiplication factor of an APD with or without optical fibre pigtails.....	28
5.6 Responsivity of a PIN-TIA module.....	30
5.7 Frequency response flatness ($\Delta S/S$) of a PIN-TIA module.....	32
5.8 Output noise power (spectral) density $P_{no,\lambda}$ of a PIN-TIA module.....	33
5.9 Low frequency output noise power (spectral) density ($P_{no,\lambda,LF}$) and corner frequency (f_{cor}) of a PIN-TIA module.....	35
5.10 Minimum detectable power of PIN-TIA module.....	36
Bibliography.....	38
Figure 1 – Equipment setup for measuring radiant power and forward current of LEDs and LDs.....	8
Figure 2 – Circuit diagram for measuring small-signal cut-off frequency LEDs and LDs.....	10
Figure 3 – Circuit diagram for measuring threshold current of a LD.....	11
Figure 4 – Graph to determine threshold current of lasers.....	11
Figure 5 – Circuit diagram for measuring RIN of LEDs and LDs.....	12
Figure 6 – Circuit diagram for measuring the S_{11} parameter LEDs, LDs and LD modules.....	14

Figure 7– Cathode and anode connected to the package of a LD.....	15
Figure 8 – Output radiant power versus time.....	16
Figure 9 – Output radiant power versus case temperature	16
Figure 10 – Circuit diagram for measuring linewidth of LDs.....	17
Figure 11 – Circuit diagram for measuring 1 dB efficacy compression of LDs.....	19
Figure 12 – Plot of $\log V_2$ versus $\log I_1$	20
Figure 13 – Circuit diagram for measuring differential efficiency of a LD	21
Figure 14 – Current waveform for differential efficiency measurement	21
Figure 15 – Circuit diagram for measuring differential resistance	22
Figure 16 – Current waveform for differential resistance	23
Figure 17 – Circuit diagram for measuring noise of a PIN photoreceiver	24
Figure 18 – Circuit diagram for measuring noise with synchronous detection	25
Figure 19 – Circuit diagram for measuring excess noise of an APD.....	26
Figure 20 – Circuit diagram for measuring small-signal cut-off wavelength of a photodiode.....	28
Figure 21 – Circuit diagram for measuring multiplication factor of an APD	29
Figure 22 – Graph showing measurement of I_{R1} and I_{R2}	30
Figure 23 – Circuit diagram for measuring responsivity of a PIN-TIA module	31
Figure 24 – Circuit diagram for measuring frequency response flatness of a PIN-TIA module.....	32
Figure 25 – Circuit diagram for measuring output noise power (spectral) density of a PIN-TIA module under matched output conditions.....	34
Figure 26 – Circuit diagram for measuring output noise power (spectral) density of a non-irradiated PIN-TIA module in the low frequency region.....	35
Figure 27 – Graph of V_m versus frequency.....	36
Figure 28 – Circuit diagram for measuring minimum detectable power of a PIN-TIA module at a specified bit-error rate (<i>BER</i>) or carrier-to-noise ratio (<i>C/N</i>)	37

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SEMICONDUCTOR OPTOELECTRONIC DEVICES
FOR FIBRE OPTIC SYSTEM APPLICATIONS –**

Part 2: Measuring methods

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62007-2 has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 1997, and its amendment 1(1998). It is a technical revision.

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

- a) descriptions related to analogue characteristics have been removed;
- b) some definitions and terms have been revised for harmonisation with other standards originating from SC 86C.

I.S. EN 62007-2:2009

62007-2 © IEC:2009

– 5 –

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

FDIS	Report on voting
86C/868/FDIS	86C/870/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 of the IEC 62007 series can be found, under the general title *Semiconductor optoelectronic devices for fibre optic system applications*, on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

INTRODUCTION

Semiconductor optical signal transmitters and receivers play important roles in optical information networks. This standard covers the measurement procedures for their optical and electrical properties that are intended for digital communication systems. These properties are essential to specify their performance.

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 digital communication systems and subsystems.

All optical fibres and cables that are defined in IEC 60793 series, IEC 60794 series are applicable. All optical connectors that are defined in IEC 60874 series are applicable, if a pigtail is to be terminated with an optical connector.

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 60050-731:1991, *International Electrotechnical Vocabulary – Chapter 731: Optical fibre communication*

IEC 60793 (all parts), *Optical fibres*

IEC 60794 (all parts), *Optical fibre cables*

IEC 60874 (all parts), *Connectors for optical fibres and cables*

3 Terms, definitions and abbreviations

For the purposes of this document, the following terms, definitions and abbreviations apply.

3.1 Terms and definitions

3.1.1

PIN photodiode

photodiode with a large intrinsic region sandwiched between p- and n-doped semiconducting regions used for the detection of optical radiation

[IEV 731-06-29]

3.1.2

avalanche photodiode

photodiode operating with a bias voltage such that the primary photocurrent undergoes amplification by cumulative multiplication of charge carriers

[IEV 731-06-30]

3.1.3

pigtail

short optical fibre or optical fibre cable that is attached to a device being measured

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

-
- [Looking for additional Standards? Visit Intertek Inform Infostore](#)
 - [Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation](#)
-