

PRE-RELEASE VERSION (FDIS)



**Semiconductor devices –
Part 5-14: Optoelectronic devices – Light emitting diodes – Test method of the
surface temperature based on the thermoreflectance method**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.080.99

Warning! Make sure that you obtained this publication from an authorized distributor.



PROJECT NUMBER:
IEC 60747-5-14 ED1

DATE OF CIRCULATION:
2021-12-24

CLOSING DATE FOR VOTING:
2022-02-04

SUPERSEDES DOCUMENTS:
47E/736/CDV, 47E/763/RVC

IEC SC 47E : DISCRETE SEMICONDUCTOR DEVICES	
SECRETARIAT: Korea, Republic of	SECRETARY: Mr Hojun Ryu
OF INTEREST TO THE FOLLOWING COMMITTEES:	HORIZONTAL STANDARD: <input type="checkbox"/>
FUNCTIONS CONCERNED: <input type="checkbox"/> EMC <input type="checkbox"/> ENVIRONMENT <input type="checkbox"/> QUALITY ASSURANCE <input type="checkbox"/> SAFETY	
<input type="checkbox"/> SUBMITTED FOR CENELEC PARALLEL VOTING	<input checked="" type="checkbox"/> NOT SUBMITTED FOR CENELEC PARALLEL VOTING

This document is a draft distributed for approval. It may not be referred to as an International Standard until published as such.

In addition to their evaluation as being acceptable for industrial, technological, commercial and user purposes, Final Draft International Standards may on occasion have to be considered in the light of their potential to become standards to which reference may be made in national regulations.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Semiconductor devices – Part 5-14: Optoelectronic devices – Light emitting diodes – Test method of the surface temperature based on the thermoreflectance method

PROPOSED STABILITY DATE: 2026

NOTE FROM TC/SC OFFICERS:

This FDIS was prepared based on the result of discussions at the SC 47E/WG 9 meeting held online on October 6, 2021.

CONTENTS

FOREWORD	3
1 Scope	5
2 Normative references	5
3 Terms, definitions and abbreviated terms	5
3.1 Terms and definitions.....	5
3.2 Abbreviated terms.....	7
4 Measuring methods	7
4.1 Basic requirements	7
4.1.1 Measuring conditions.....	7
4.1.2 Measuring instruments and equipment.....	7
4.2 Purpose	7
4.3 Measurement.....	8
4.3.1 Measurement setup	8
4.3.2 Measurement principle.....	9
4.3.3 Measurement sequence.....	12
5 Test report.....	13
Annex A (informative) Measurement of the thermorefectance coefficient of a standard metal film.....	15
Annex B (informative) Test example.....	16
Annex C (informative) Junction temperatures measured by different methods.....	19
Bibliography.....	21
Figure 1 – Schematic diagram of the TR setup.....	8
Figure 2 – Schematic illustration of measuring the thermorefectance coefficient, surface temperature, and junction temperature by the TR effect	10
Figure 3 – Sequence of the measurement of the junction temperature using the TR method	13
Figure A.1 – Experimental result of thermorefectance coefficient of a standard Au film	15
Figure B.1 – Photograph of a sample prepared for the junction temperature measurements	17
Figure B.2 – Junction temperature measured by the TR method of the sample shown in Figure B.1.....	17
Figure C.1 – Junction temperature increase with forward current, measured by the methods of forward voltage, thermocouple, and thermorefectance of the sample shown in Figure B.1	20
Table 1 – Summary of test report.....	14
Table B.1 – Summary of test report in example.....	18

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SEMICONDUCTOR DEVICES –

Part 5-14: Optoelectronic devices – Light emitting diodes – Test method of the surface temperature based on the thermorefectance method

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 itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 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.

IEC 60747-5-14 has been prepared by subcommittee 47E: Discrete semiconductor devices, of IEC technical committee 47: Semiconductor devices. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
47E/XX/FDIS	47E/XX/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

SEMICONDUCTOR DEVICES –

Part 5-14: Optoelectronic devices – Light emitting diodes – Test method of the surface temperature based on the thermorefectance method

1 Scope

This part of IEC 60747-5 specifies the measuring method of the surface temperature of single LED die or package, based on the thermorefectance (TR) method. TR is the effect that the reflectance of light changes with the temperature of a substance. This part measures relative change in the reflectance of light from a metal film deposited nearby on the metallurgical pn junction as the relative change in the LED junction temperature. The surface temperature can be approximated as the junction temperature when the thermal resistance effect between the metal surface and the pn junction is negligibly small.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60747-5-6:2021, *Semiconductor devices – Part 5-6: Optoelectronic devices – Light emitting diodes*