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Semiconductor devices – iTeh Standards
Part 5-6: Optoelectronic devices – Light emitting diodes
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SEMICONDUCTOR DEVICES –

Part 5-6: Optoelectronic devices – Light emitting diodes

FOREWORD

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IEC 60747-5-6 has been prepared by subcommittee 47E: Discrete semiconductor devices, of IEC technical committee 47: Semiconductor devices. It is an International Standard.

This second edition cancels and replaces the first edition published in 2016. This edition constitutes a technical revision.

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

- a) ultraviolet-emitting diodes (UV LED) and their related technical contents were added;
- b) power efficiency (η_{PE}) as part of electrical and optical characteristics were added;
- c) new measuring methods related to thermal resistance were added;
- d) hydrogen sulphide corrosion test was added to quality evaluation;
- e) some standards were added to the bibliography.

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

FDIS	Report on voting
47E/745/FDIS	47E/752/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.

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SEMICONDUCTOR DEVICES –

Part 5-6: Optoelectronic devices – Light emitting diodes

1 Scope

This part of IEC 60747 specifies the terminology, the essential ratings and characteristics, the measuring methods and the quality evaluations of light emitting diodes (LEDs) for general industrial applications such as signals, controllers, sensors, etc.

LEDs for lighting applications are out of the scope of this part of IEC 60747.

LEDs are classified as follows:

- a) LED package;
- b) LED flat illuminator;
- c) LED numeric display and alpha-numeric display;
- d) LED dot-matrix display;
- e) ~~IR LED~~ (infrared-emitting diode (IR LED));
- f) ultraviolet-emitting diode (UV LED).

LEDs with a heat spreader or having a terminal geometry that performs the function of a heat spreader are within the scope of this part of IEC 60747.

An integration of LEDs and controlgears, integrated LED modules, semi-integrated LED modules, integrated LED lamps or semi-integrated LED lamps, are out of the scope of this part of IEC 60747.

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 60051 (all parts), *Direct acting indicating analogue electrical measuring instruments and their accessories*

IEC 60068-2-17, *Basic environmental testing procedures – Part 2-17: Tests – Test Q: Sealing*

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60747-5-13, *Semiconductor devices – Part 5-13: Optoelectronic devices – Hydrogen sulphide corrosion test for LED packages*

IEC 60749-6, *Semiconductor devices – Mechanical and climatic test methods – Part 6: Storage at high temperature*

IEC 60749-10, *Semiconductor devices – Mechanical and climatic test methods – Part 10: Mechanical shock*

IEC 60749-12, *Semiconductor devices – Mechanical and climatic test methods – Part 12: Vibration, variable frequency*

IEC 60749-14, *Semiconductor devices – Mechanical and climatic test methods – Part 14: Robustness of terminations (lead integrity)*

IEC 60749-15, *Semiconductor devices – Mechanical and climatic test methods – Part 15: Resistance to soldering temperature for through-hole mounted devices*

IEC 60749-20, *Semiconductor devices – Mechanical and climatic test methods – Part 20: Resistance of plastic encapsulated SMDs to the combined effect of moisture and soldering heat*

IEC 60749-21, *Semiconductor devices – Mechanical and climatic test methods – Part 21: Solderability*

IEC 60749-24, *Semiconductor devices – Mechanical and climatic test methods – Part 24: Accelerated moisture resistance – Unbiased HAST*

IEC 60749-25, *Semiconductor devices – Mechanical and climatic test methods – Part 25: Temperature cycling*

IEC 60749-36, *Semiconductor devices – Mechanical and climatic test methods – Part 36: Acceleration, steady state*

ISO 2859-1, *Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

3 Terms, definitions and abbreviations

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 General terms and definitions

3.1.1 integrating sphere

~~hollow sphere whose internal surface is a diffuse reflector, as non-selective as possible~~, the interior of which is formed from, or coated with, a diffusely-reflecting material that is as spectrally neutral and as spatially uniform as possible

Note 1 to entry: Owing to the internal reflections within the sphere, the illuminance on any part of the inside surface of the sphere for which the direct flux is hidden is theoretically proportional to the luminous flux entering the sphere or produced inside the sphere. The illuminance of the internal sphere wall can be measured via a small window.

Note 2 to entry: The window of an integrating sphere is often used in radiometric measurement systems to provide a source with good spatial uniformity and with an angular distribution of radiance or luminance that is close to Lambert's cosine law.

[SOURCE: ~~IEC 60050-845:1987, 845-05-24, modified~~ The term "Ulbricht sphere" and the note ~~have been removed.~~ IEC 60050-845:2020, 845-25-028]

3.1.2**diffuse reflector**

reflector composed of a surface with diffuse reflection

3.1.3**diffuse reflection**

~~diffusion~~ scattering by reflection in which, on the macroscopic scale, there is no regular reflection

[SOURCE: ~~IEC 60050-845:1987, 845-04-47~~ IEC 60050-845:2020, 845-24-054]

3.1.4**diffuse transmission**

~~diffusion~~ scattering by transmission in which, on the macroscopic scale, there is no regular transmission

[SOURCE: ~~IEC 60050-845:1987, 845-04-48~~ IEC 60050-845:2020, 845-24-055]

3.1.5**diffuse reflectance**

R_d ρ_d

~~ratio~~ quotient of the diffusely reflected part of the (whole) reflected flux, ~~to~~ and the incident flux

Note 1 to entry: ~~$R = R_r + R_d$~~ Reflectance, ρ , is the sum of regular reflectance, ρ_r , and diffuse reflectance, ρ_d : $\rho = \rho_r + \rho_d$

Note 2 to entry: ~~The results of the measurements of R_r and R_d depend on the instruments and the measuring techniques used.~~ The diffuse reflectance has unit one.

[SOURCE: ~~IEC 60050-845:1987, 845-04-62~~ IEC 60050-845:2020, 845-24-068]

3.1.6**diffuse transmittance**

T_d τ_d

~~ratio~~ quotient of the diffusely transmitted part of the (whole) transmitted flux, ~~to~~ and the incident flux

Note 1 to entry: ~~$T = T_r + T_d$~~ Transmittance, τ , is the sum of regular transmittance, τ_r , and diffuse transmittance, τ_d : $\tau = \tau_r + \tau_d$.

Note 2 to entry: ~~The results of the measurements of T_r and T_d depend on the instruments and the measuring techniques used.~~ The diffuse transmittance has unit one.

[SOURCE: ~~IEC 60050-845:1987, 845-04-63~~ IEC 60050-845:2020, 845-24-069]

3.1.7**lambertian surface**

ideal surface for which the radiation coming from that surface is distributed angularly according to Lambert's cosine law

Note 1 to entry: For a lambertian surface, $M = \pi L$, where M is the radiant exitance or luminous exitance, and L the radiance or luminance.

[SOURCE: ~~IEC 60050-845:1987, 845-04-57~~ IEC 60050-845:2020, 845-24-063]