IEC 60747-5-6

Edition 1.0 2016-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Semiconductor devices –
Part 5-6: Optoelectronic devices – Light emitting diodes

Dispositifs à semiconducteurs –
Partie 5-6: Dispositifs optoélectroniques – Diodes électroluminescentes

IEC 60747-5-6:2016-02(en-fr)

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SEMICONDUCTOR DEVICES –

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FOREWORD

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

This first edition of IEC 60747-5-6, together with IEC 60747-5-4, IEC 60747-5-5 and IEC 60747-5-7, cancels and replaces IEC 60747-5-1, IEC 60747-5-2 and IEC 60747-5-3, published in 1997, and their amendments. This edition constitutes a technical revision.

This edition includes significant technical changes to the clauses for light emitting diodes in IEC 60747-5-1:1997, IEC 60747-5-2:1997 and IEC 60747-5-3:1997, including their amendments.

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

FDIS	Rapport de vote
47E/529/FDIS	47E/535/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.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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- withdrawn,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 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.

The types of LED are divided into the following five classes:

a) LED package;

b) LED flat illuminator;

c) LED numeric display and alpha-numeric display;

d) LED dot-matrix display;

e) I LED (infrared-emitting diode).

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

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

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, *Sampling procedures for inspection by attributes*

3 Terms and definitions

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

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

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

3.1.2
diffuse reflector
reflector composed of a surface with diffuse reflection

3.1.3
diffuse reflection
diffusion by reflection in which, on the macroscopic scale, there is no regular reflection

[SOURCE: IEC 60050-845:1987, 845-04-47]

3.1.4
diffuse transmission
diffusion by transmission in which, on the macroscopic scale, there is no regular transmission

[SOURCE: IEC 60050-845:1987, 845-04-48]

3.1.5
diffuse reflectance
R_d
ratio of the diffusely reflected part of the (whole) reflected flux, to the incident flux

Note 1 to entry: $R = R_r + R_d$

Note 2 to entry: The results of the measurements of R_r and R_d depend on the instruments and the measuring techniques used.

[SOURCE: IEC 60050-845:1987, 845-04-62]

3.1.6
diffuse transmittance
T_d
ratio of the diffusely transmitted part of the (whole) transmitted flux, to the incident flux

Note 1 to entry: $T = T_r + T_d$

Note 2 to entry: The results of the measurements of T_r and T_d depend on the instruments and the measuring techniques used.

[SOURCE: IEC 60050-845:1987, 845-04-63]

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 or luminous exitance, and L the radiance or luminance.

[SOURCE: IEC 60050-845:1987, 845-04-57]

3.1.8
spectral reflectance
$R(\lambda)$
ratio between the spectral radiant flux of wavelength λ that is reflected by an object and the spectral radiant flux of wavelength λ that is absorbed by the object

Note 1 to entry: Spectral reflectance is also known as the “spectral reflection factor.”

3.1.9
spectral transmittance
$T(\lambda)$
ratio between the spectral radiant flux of wavelength λ that is transmitted by an object and the spectral radiant flux of wavelength λ that is absorbed by the object

Note 1 to entry: Spectral transmittance is also known as the “spectral transmittance factor”.

3.1.10
spectral distribution
proportion of the quantum of radiation per unit wavelength included in the micro wavelength interval centre on wavelength λ, which is expressed as a function of wavelength λ

Note 1 to entry: Spectral distribution is also known as the “spectrum distribution”.

3.1.11
spectral sensitivity
$S(\lambda)$
light sensitivity as a function of wavelength

Note 1 to entry: The response output of the optical receiver for the radiant power (or luminous flux) input of wavelength λ is expressed as a function of wavelength λ.

3.1.12
distribution temperature
temperature of the Planckian radiator whose relative spectral distribution $S(\lambda)$ is the same or nearly the same as that of the radiation considered in the spectral range of interest

Note 1 to entry: The unit used is: K.

[SOURCE: IEC 60050-845:1987, 845-04-14]

3.2 Terms and definitions relating to the measurement of the quantity of radiation

3.2.1
radiant energy
Q_e
time integral of the radiant flux Φ_e over a given duration Δt

$$Q_e = \int_{\Delta t} \Phi_e \mathrm{d}t$$

Note 1 to entry: The unit used is: J (1 J = 1 W · s).

[SOURCE: IEC 60050-845:1987, 845-01-27]

3.2.2
radiant flux
Φ_e
power emitted, transmitted or received in the form of radiation

$$\Phi_e = \frac{\mathrm{d}Q_e}{\mathrm{d}t}$$

Note 1 to entry: The unit used is: W.

[SOURCE: IEC 60050-845:1987, 845-01-24, modified – The formula has been added.]

3.2.3
radiant intensity
I_e
quotient of the radiant flux $\mathrm{d}\Phi_e$ leaving the source and propagated in the element of solid angle $\mathrm{d}\Omega$ containing the given direction, by the element of solid angle

$$I_e = \frac{\mathrm{d}\Phi_e}{\mathrm{d}\Omega} \quad (\mathrm{d}\Omega\text{: solid angle})$$

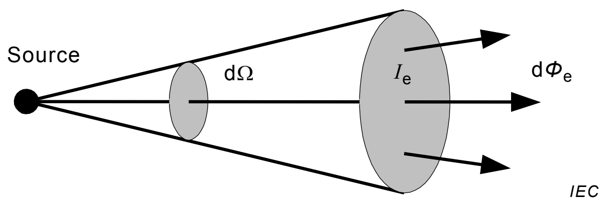

Figure 1 – Radiant intensity

Note 1 to entry: For a radiation source that is not regarded as a point radiation source, the limit value determined by the value (which is calculated by dividing the radiant power that is absorbed by a small area by the solid angle formed by the small area toward an arbitrary point on the radiation source) when the distance between the radiation source and the small area becomes longer, is used to calculate the radiant intensity.

Note 2 to entry: The unit used is: W/sr.

[SOURCE: IEC 60050-845:1987, 845-01-30, modified – The symbol I has been removed and Figure 1 has been added.]

3.2.4
radiance
L_e

quantity defined by the formula $L_e = \frac{d\Phi_e}{dA \cdot \cos\theta \cdot d\Omega}$,

where

$d\Phi_e$ is the radiant flux transmitted by an elementary beam passing through the given point and propagating in the solid angle $d\Omega$ containing the given direction;

dA is the area of a section of that beam containing the given point;

θ is the angle between the normal to that section and the direction of the beam

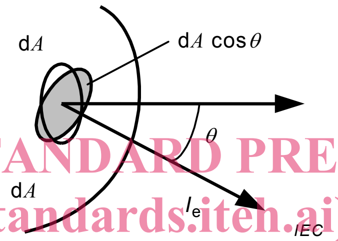

Figure 2 – Radiance

Note 1 to entry: The unit used is: W/(sr·m²).

[SOURCE: IEC 60050-845:1987, 845-01-34, modified – omitting the part about Notes]

3.2.5
radiant exitance
M_e

quotient of the radiant flux $d\Phi_e$ leaving an element of the surface containing the point, by the area dA of that element

$$M_e = \frac{d\Phi_e}{dA} = \int_{2\pi sr} L_e \cdot \cos\theta \cdot d\Omega \quad (dA\text{: small area})$$

Note 1 to entry: An equivalent definition could be given as follows: Integral, taken over the hemisphere visible from the given point, of the expression $L_e \cdot \cos\theta \, d\Omega$, where L_e is the radiance at the given point in the various directions of the emitted elementary beams of solid angle $d\Omega$, and θ is the angle between any of these beams and the normal to the surface at the given point.

Note 2 to entry: The unit used is: W/m².

[SOURCE: IEC 60050-845:1987, 845-01-47]