Section 9

Definition of Symbols and Terms

Angstrom (Å)
A unit of length particularly for measuring electromagnetic wavelengths; one angstrom = 10^{-10} meters = 10^{-4} microns = 3.937 X 10^{-9} inches.

Angular Alignment
A measure of the deviation of the optical axis from the mechanical axis.

Area Source
A source with a diameter greater than 10% of the distance between it and the detector.

Axial Intensity (I_O)
The ratio of the flux emitted by a source and contained within an incremental on axis solid angle subtended by a sensor [units: lumens/ steradian (photometric) or watts/ steradian (radiometric)].

B_L (also "B")
A photometric unit of luminance in (lumens / steradian) / ft^2 or foot-Lamberts.

Blackbody
A 100% efficient radiator and absorber of radiant energy used as a standard for all irradiance measurements.

Blackbody Luminous Efficiency
As a function of temperature, the efficiency of an incandescent blackbody in terms of visible light.

Candela
A photometric unit of luminous intensity (in lumens per steradian) defined as 1/60 the intensity of a one cm^2 blackbody radiator at platinum's solidification temperature (2,046°K).

Candela/cm^2
Luminance unit called "stilb".

$(1/\pi)$ candela/cm^2
Luminance unit called "Lambert".

Channel Impedance
The parallel resistance and capacitance appearing between the active and guard ring junctions.

Color Temperature
The temperature of a blackbody whose radiation has the same visible color as that of a given non-blackbody radiator. TYPICAL UNIT: K (formerly °K).

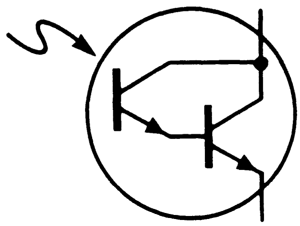
Conversion Efficiency (of a Photoemissive Device)
The ratio of maximum available luminous or radiant flux output to total input power.

Critical Angle
The maximum angle of incidence for which light will be transmitted from one medium to another. Light approaching the interface at angles greater than the critical angle will be reflected back into the first medium.

Dark Current (I_D)
The current which flows in a photodetector when there is no incident radiation on the detector.

Darlington Amplifier
A composite configuration of transistors which provides a high input impedance and a high degree of amplification.

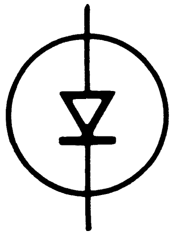
Darlington Connector Phototransistor
A phototransistor the collector and emitter of which are connected to the collector and base, respectively, of a second transistor. The emitter current of the input transistor is amplified by the second transistor and the device has very high sensitivity to light.



DC Transfer Ratio (of an Optically Coupled Isolator)
The ratio of the dc output current to the dc input current.

Delay Time (t_d)
The time interval from the point at which the leading edge of the input pulse has reached 10% of its maximum amplitude to the point at which the leading edge of the output pulse has reached 10% of its maximum amplitude.

Diode
A semiconductor device which passes current in only one direction.



Duty Cycle
A measure of the effect of a pulsed input to a lamp. Expressed as a percentage of on time as compared to total time.

E
Photometric unit of illuminance in lumens / ft^2 (foot-candle).

Emission Beam Angle Between Half-Power Points (θ_{HP})
The angle centered on the optical axis of a light-emitting diode within which the relative radiant power output or photon intensity is not less than half of the maximum output or intensity.

Fall lime (t_f)
The time duration during which the trailing edge of a pulse is decreasing from 90% to 10% of its maximum amplitude.

Flux
Power passing through a surface (energy per unit time); number of photons passing through a surface per unit time. Expressed in lumens or watts.

Flux Density
A measure of the strength of a wave; flux per unit area normal to the direction of the flux; number of photons passing through a surface per unit time per unit area. Expressed in watts/cm* or lumens / ft^2.

Foot-candle
Unit of illumination. Defined as the illuminance on a surface of one square foot on which there is a uniformly distributed flux of one lumen, or lumens / ft^2.

Foot-Lambert
Unit of luminance or brightness. Defined as the uniform luminance of a surface emitting or reflecting light at the rate of one lumen per square foot.

Forward Voltage (V_F)
The voltage across a semiconductor diode associated with the flow of forward current. The p-region is at a positive potential with respect to the n-region.

GaAs, GaAsP, GaP
The most commonly used emitter materials are gallium arsenide (GaAs), gallium arsenide phosphide (GaAsP) and gallium phosphide (GaP).

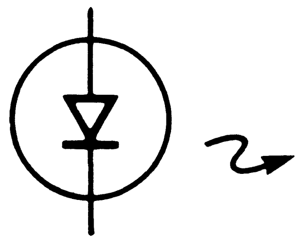
H
Irradiance or radiation flux density in watts/cm* (radiometric unit).

Half Intensity Beam Angle (θ_{HI})
The angle within which the radiant intensity is not less than half the maximum.

Homogeneous Orientation
The parallel orientation of the molecular axes of the nematic molecules in a nematic crystal, relative to the electrode plates.

Illumination (E,)
The luminous flux density incident on a surface; the ratio of flux to area of illuminated surface.
TYPICAL UNITS: lm / ft^2, lx = lm / m^2. 1 lm / ft^2 = 10.764 lx.

Infrared Light-Emitting Diode (Infrared Emitter)
An optoelectronic device containing a semiconductor p-n junction which emits radiant energy in the 0.78 μm to 100 μm wavelength region when forward-biased.



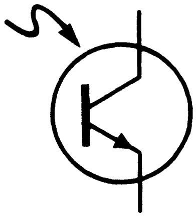
Irradiance (H or E,)
The radiant flux density incident on a surface; the ratio of flux to area of irradiated surface.
TYPICAL UNITS: W / ft^2, W/m*. 1 W / ft^2 = 10.764 W/m*.

Junction Capacity
The capacitance appearing across the junction of a photodiode. It is analogous to a parallel plate capacitor having a voltage controlled dielectric.

Light
For the purpose of these definitions, radiant energy transmitted by wave motion with wavelengths from about 0.3 μm to 30 μm; this includes visible wavelengths (0.38 μm to 0.78 μm) and those wavelengths, such as ultraviolet and infrared, which can be handled by optical techniques used for the visible region. In more restricted usage, radiant energy within the limits of the visual spectrum.

Light Current (IL)
The current that flows through a photosensitive device, such as a phototransistor or a photodiode, when it is exposed to illumination or irradiance.

Phototransistor
Solid state device similar to an ordinary transistor except that light incident on the pn junctions controls the response of this device; offers built-in gain and greater sensitivity than photodiodes.



Point Source
Radiation source whose maximum dimension is less than 1/10 the distance between source and receiver.

Quantum Efficiency (of a Photosensitive Device)
The ratio of the number of carriers generated to the number of photons incident upon the active region.

Radiant Flux (Φ_e)
The time rate of flow of radiant energy.
TYPICAL UNIT: W.

Radiant Pulse Fall Time (t_f)
The time required for a photometric quantity to change from 90% to 10% of its peak value for a step change in electrical input.

Radiant Pulse Time (t_r)
The time required for a photometric quantity to change from 10% to 90% of its peak value for a step change in electrical input.

Radiation and Illumination Sources
The effect of a radiation source on a photodevice is dependent on the device spectral response and the spectral distribution of energy from the source. To discuss such energy, two related sets of terminology are available. The first, radiometric, is a physical system, and the second, photometric, is a physiological system, which defines energy relative to its visual effect.

The defining factor for the photometric system is the spectral response curve of a standard observer, whereas the defining spectral response of the radiometric system can be imagined as unit response for all wavelengths.

Rise Time (t_r)
The time duration during which the leading edge of a pulse is increasing from 10% to 90% of its maximum amplitude.

Series Resistance
The resistance of the undepleted bulk silicon.

Shunt Resistance
The dynamic resistance (d^v / d^i) of the junction at zero volts.

Spectral Output (of a Light-Emitting Diode)
A description of the radiant-energy or light-emission characteristic versus wavelength. This information is usually given by stating the wavelength at peak emission and the bandwidth between half-power points or by means of a curve.

Spectral Distribution of Energy (EX)
A plot showing the variation of spectral emission with wavelength.

Spectral Response (of a Photosensitive Device)
A curve of the electrical-output characteristic versus wavelength of radiant energy incident upon the device.

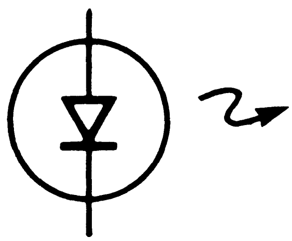
Steradian
Solid angle subtending an area on the surface of a sphere equal to the square of the radius; there are 4π steradians in a sphere.

Storage Time (t_s)
The time interval from a point at which the trailing edge of the input pulse has dropped to 90% of its maximum amplitude to a point at which the trailing edge of the output pulse has dropped to 90% of its maximum amplitude.

Threshold Voltage
Voltage at which a pn junction begins to pass a current; in a solid state lamp, the voltage at which light is first emitted.

Visible Emission, Visible Light
Radiation which is characterized by wavelengths of about 0.38 μm to **0.78 μm.**

Visible-Light-Emitting Diode (VLED)
An optoelectronic device containing a semiconductor junction which emits visible light when forward-biased.



Wavelength at Peak Emission (A,)
The wavelength at which the power output from a light-emitting diode is maximum. TYPICAL UNITS: Å, μm, nm.
1 Å = 10^{-4} μm = 0.1 nm.

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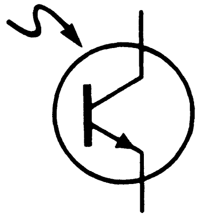
Solid state device similar to an ordinary transistor except that light incident on the pn junctions controls the response of this device; offers built-in gain and greater sensitivity than photodiodes.



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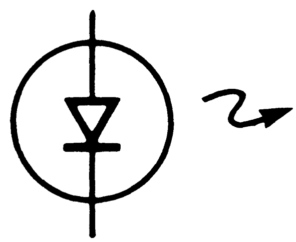

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