1N6266

Hermetic GaAs Infrared Emitting Diode

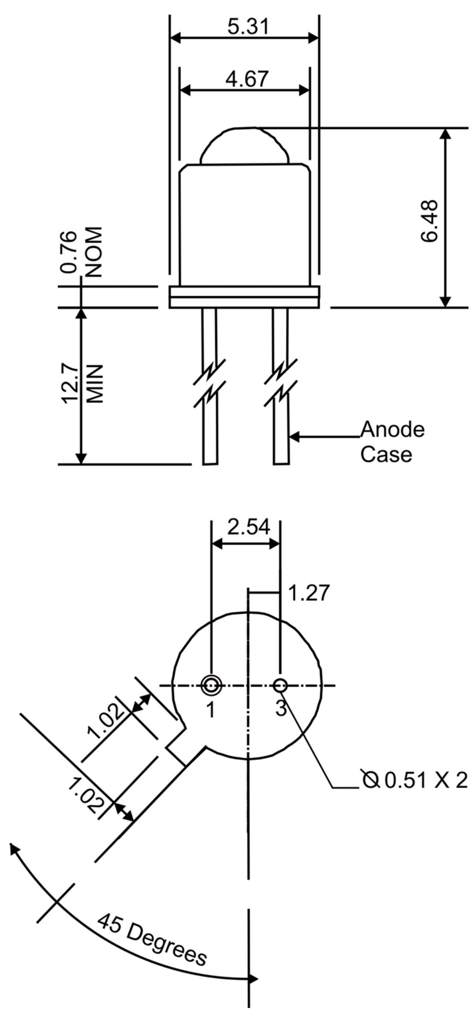
Features

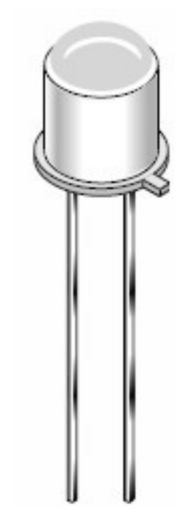
- Good optically to mechanical alignment
- Mechanically and wavelength matched to the TO-18 series phototransistor
- High radiant intensity - typ. 40mW/Sr
- RoHS compliant Pb

Description

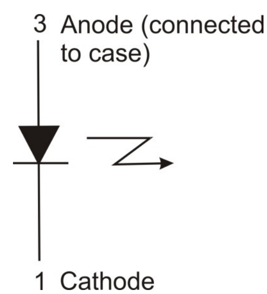
The 1N6266 is a 940nm LED in a narrow angle TO-46 package.

Package Dimensions





Schematic



Notes:

1. Dimensions for all drawings are in mm.
2. Tolerances of + or - 0.25mm on all non-nominal dimensions, unless otherwise specified.

Absolute Maximum Ratings (T_A = 25^O C unless otherwise specified)
Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In Addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Parameter	Symbol	Rating	Units
Operating Temperature	T_{OPG}	-65°C to +125°C	°C
Storage Temperature	T_{STG}	-65°C to +150°C	°C
Solder Temperature (Iron)[3,4,5,6]	T_{SOL-I}	240°C for 5 sec	°C
Solder Temperature (Flow)[3,4,6]	T_{SOL-F}	260°C for 10 sec	°C
Continuous Forward Current	I_F	100	mA
Forward Current (pw, 1µS; 200Hz)	I_F	10	A
Reverse Voltage	V_R	3	V
Power Dissipation T_A = 25°C [1]	P_D	170	mW
Power Dissipation T_A = 25°C [2]	P_D	1.3	W

Electrical/Optical Characteristics (T_A = 25^O C)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Units
Peak Emission Wavelength	I_F = 100mA	λ_P	935		955	nm
Emission Angle at 1/2 Power	I_F = 100mA	Θ		+/- 10		Deg.
Forward Voltage	I_F = 100mA	V_{F1}			1.7	V
Reverse Leakage Current	V_R = 3V	I_R			10	µA
Total Radiant Flux [7]	I_F = 100mA	P_O		10		mW
Radiant Intensity	I_F = 100mA	I_E	25	40		mW/Sr
Rise Time 0-90% of output		t_r		1		µs
Fall Time 100-10% of output		t_f		1		µs

Notes:
1 Derate power dissipation linearly 1.70 mW/°C above 25°C ambient.
2 Derate power dissipation linearly 13.0 mW/°C above 25°C case.
3 RMA flux is recommended.
4 Methanol or Isopropyl alcohols are recommended as cleaning agents.
5 Soldering iron tip 1.6mm minimum from housing.
6 As long as leads are not under stress or spring tension.
7 Total power output, P_O, is the total power radiated by the device into a solid angle of 2π steradians.

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Maximum Ratings Graphs

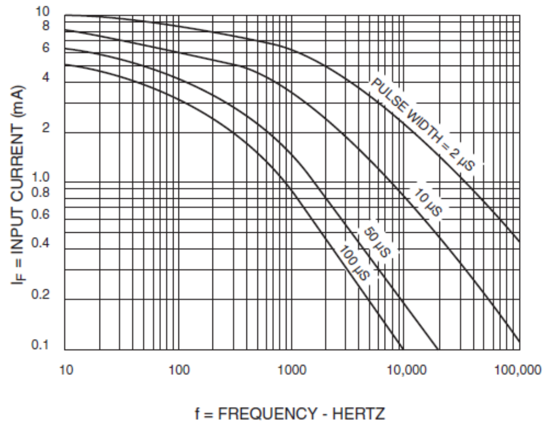


Fig.1 Maximum Pulse Capability

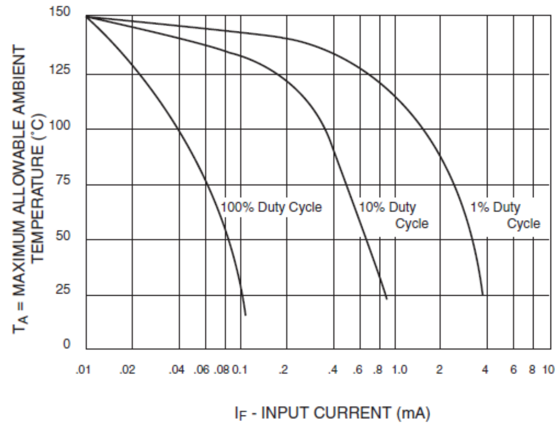


Fig.2 Maximum Temperature vs. Input Current

Typical Performance Characteristics

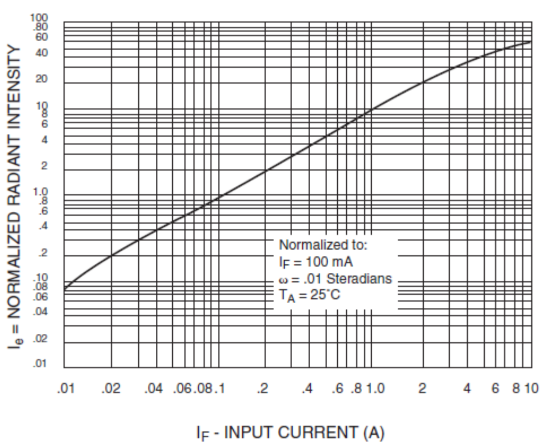


Fig.3 Radiant Intensity vs. Input Current ΔIe/ΔI

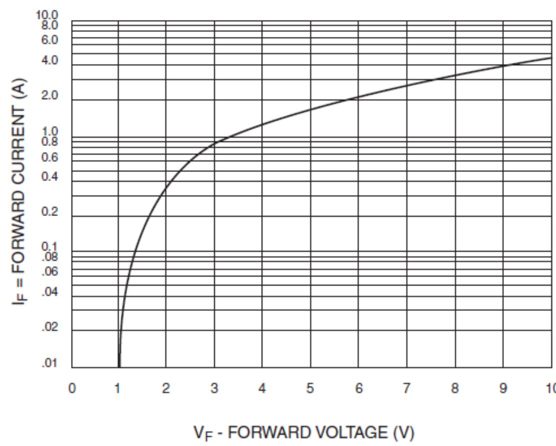


Fig.4 Forward Voltage vs. Forward Current

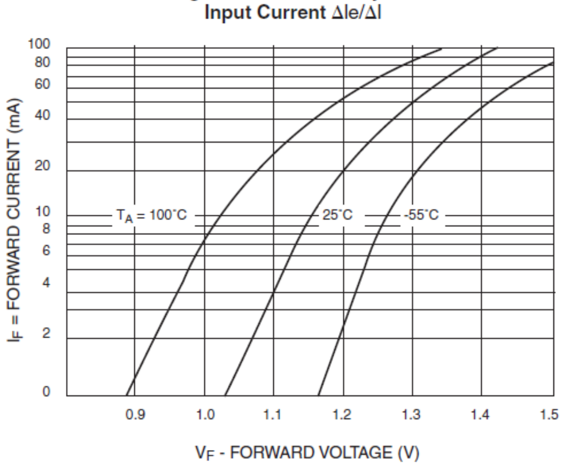


Fig.5 Forward Voltage vs. Forward Current

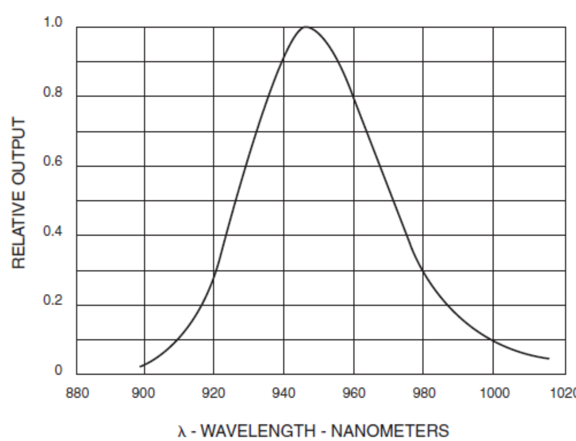


Fig.6 Spectral Output

Typical Performance Characteristics

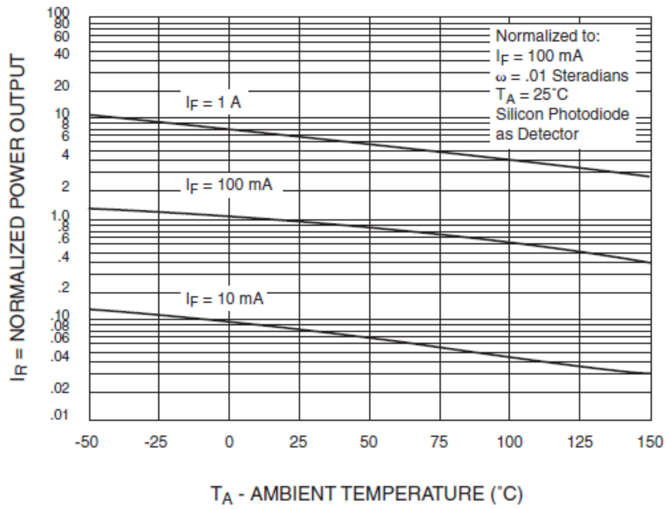


Fig.7 Output vs. Temperature

Infrared Emitting Diode Radiant Intensity

The design of an Infrared Emitting Diode (IRED)-photodetector system normally requires the designer to determine the minimum amount of infrared irradiance received by the photodetector, which then allows definition of the photodetector current. Prior to the introduction of the 1N6266, the best method of estimating the photodetector received infrared was to geometrically proportion the piecewise integration of the typical beam pattern with the specified minimum total power output of the IRED. However, due to inconsistencies of the IRED integral lenses and the beam lobes, this procedure will not provide a valid estimation.

The 1N6266 now provides the designer specifications which precisely define the infrared beam along the device's mechanical axis. The 1N6266 is a premium device selected to give a minimum radiant intensity of 25 mW/steradian into the 0.01 steradians referenced by the the device's mechanical axis and seating plane. Radiant intensity is the IRED beam power output, within a specified solid angle, per unit solid angle.

A quick review of geometry indicates that a steradian is a unit of solid angle, referenced to the center of a sphere, defined by 4 π times the ratio of the area projected by the solid angle to the area of the sphere. The solid angle is equal to the projected area divided by the squared radius.

$$\text{Steradians} = 4\pi A / 4\pi R^2 = A/R^2 = \omega$$

As the projected area has a circular periphery, a geometric integration will solve to show the relationship of the Cartesian angle (∝) of the cone, (from the center of the sphere) to the projected area.

$$\omega = 2\pi\left(1 - \cos\frac{\alpha}{2}\right)$$

Radiant intensity provides an easy, accurate tool to calculate the infrared power received by a photodetector located on the IRED axis. As the devices are selected for beam characteristics, the calculated results are valid for worst case analysis. For many applications a simple approximation for photodetector irradiance is:

$$H \cong Ie/d^2, \text{ in mw/cm}^2$$

where d is the distance from the IRED to the detector in cm.

IRED power output, and therefore Ie, depends on IRED current. This variation ($\Delta I_e/\Delta I$) is documented in Figure 3, and completes the approximation: $H = I_e/d^2\ (\Delta I_e/\Delta I)$. This normally gives a conservative value of irradiance. For more accurate results, the effect of precise angle viewed by the detector must be considered. This is documented in figure 8 ($\Delta I_e/\Delta\omega$) giving:

$$H = I_e/d^2\ (\Delta I_e/\Delta\omega) \text{ in mw/cm}^2$$

For worst case designs, temperature coefficients and tolerances must be considered.

The minimum output current of the detector (I_L) can be determined for a given distance (d) of the detector from the IRED.

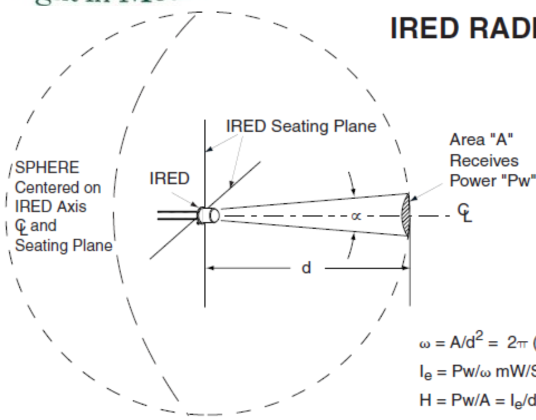
$$I_L = (S)H \cong (S)\ I_e/d^2$$

or

$$I_L = (S)H = (S)\ (I_e/d^2)\ (\Delta I_e/\Delta\omega)\ (\Delta I_e/\Delta I)$$

where S is the sensitivity of the detector in terms of output current per unit irradiance from a GaAs source.

IRED RADIANT INTENSITY SPECIFICATION CONCEPT



$\omega = A/d^2 = 2\pi\,(1 - \cos\frac{\alpha}{2})$ Steradians

$I_e = Pw/\omega$ mW/Steradians

$H = Pw/A = I_e/d^2$ mW/cm^2

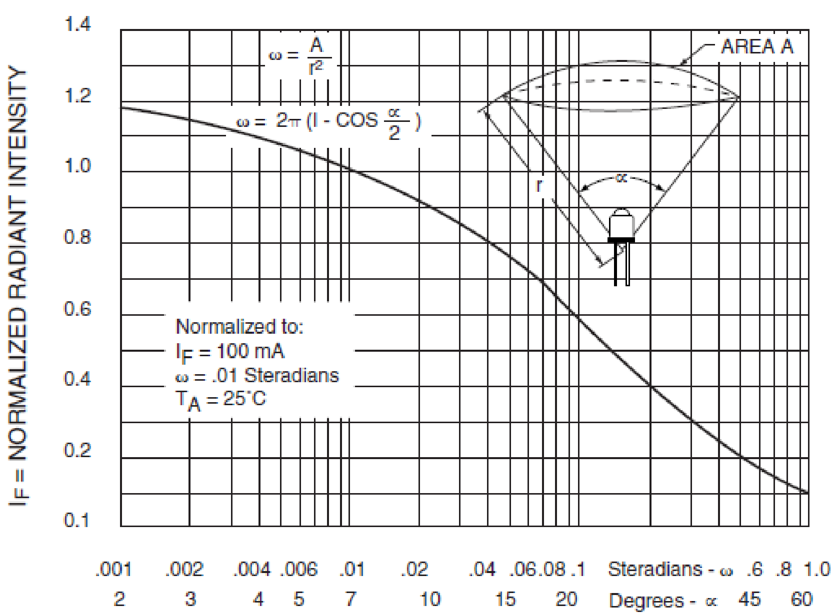


Fig.8 Intensity and Power vs. Angle $\Delta I_e/\Delta\omega$

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MATCHING A PHOTOTRANSISTOR WITH 1N6266

Assume a system requiring a 10 mA I_L at an IRED to detector spacing of 2 cm (seating plane to seating plane), with bias conditions at specification points.

Given: d_1 = 2 cm, I_L = 10 mA min.; I_e = 25 mW/Steradian

Then: $H_1 \cong I_e/d_1^2 = 25/(2)^2 = 6.25$ mW/cm^2

Detector Evaluation:

	I_L MIN	@	H (GaAs)	≅	S(GaAs)
TYPE	mA		mW/cm^2		mA/mw/cm^2
L14G1	1		0.5		2
L14G2	0.5		0.5		1

Calculated I_L @ d_1 is:

L14G1 (S) H_1 = (2) 6.25 = 12.5 mA

L14G2 (S) H_1 = (1) 6.25 = 6.25 mA

Since the system requires an I_L of 10 mA minimum the correct device to use is the L14G1.

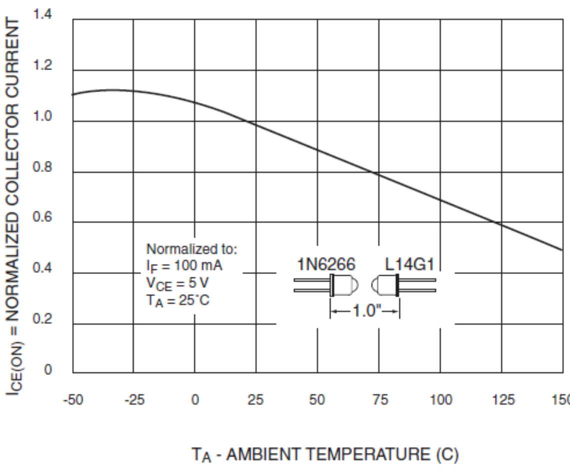

Fig. 9 Output vs. Ambient Temperature IRED/Phototransistor Pair

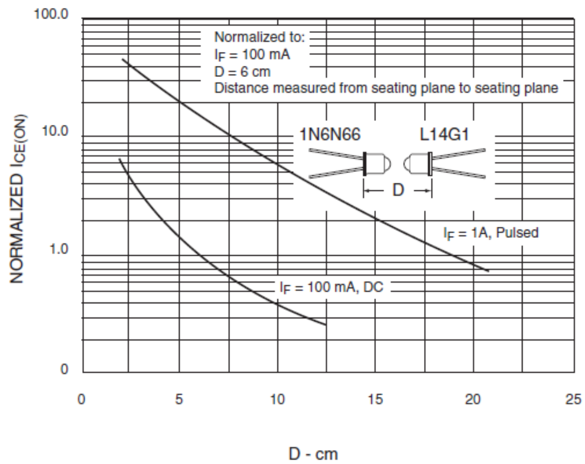

Fig. 10 I_L vs. Distance IRED/Phototransistor Pair

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