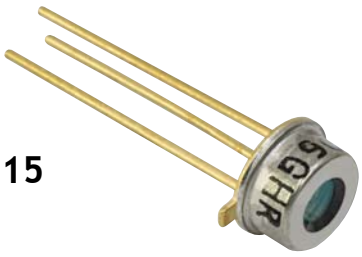
# Si Photodiode



**FDS015**

## Description

Thorlabs' FDS015 photodiode is ideal for measuring both pulsed and CW fiber light sources by converting optical power to electrical current. The FDS015 Si Photodiode is a high-speed, three pin device in a TO-46 package that has a window with a broadband AR coating centered at 850 nm. The photodiode produces a current, which is a function of the incident light power and the wavelength. The responsivity $\Re$ (λ) can be read from the plot on the following page to estimate the amount of photocurrent. This can be converted to a voltage by placing a load resistor ($R_L$) from the photodiode anode to the circuit ground. Where P is the power, the output voltage is expressed by

$$V_o = P \times \Re \times R_L$$

The bandwidth, $f_{BW}$, and the rise time response, $t_R$, are approximately determined from the diode capacitance, $C_J$, and the load resistance, $R_L$, as shown below.

$$f_{BW} = \frac{1}{(2\pi)R_L C_J},\ t_R = \frac{0.35}{f_{BW}}$$

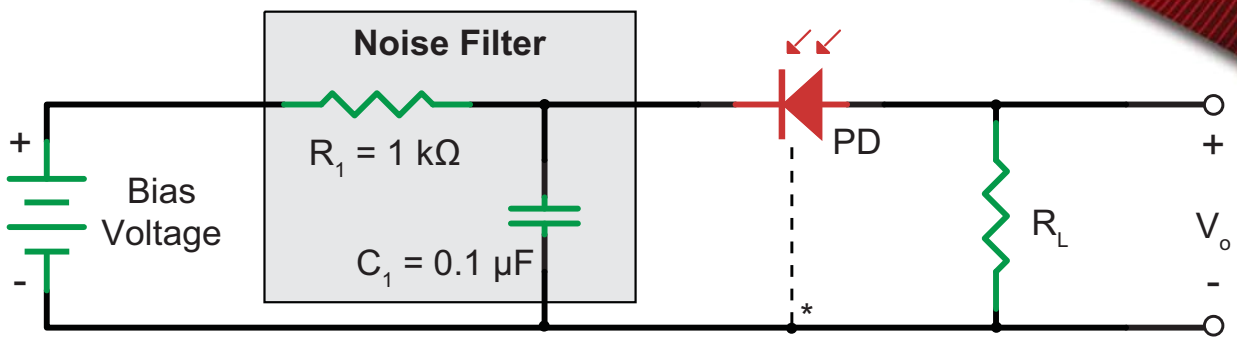
## Specifications

| Specifications[a] | | |
|---|---|---|
| **Wavelength Range** | λ | 400 - 1100 nm |
| **Peak Wavelength** | $\lambda_P$ | 740 nm |
| **Responsivity (850 nm)** | $\Re(\lambda)$ | 0.36 A/W |
| **Rise/Fall Time (850 nm, $R_L$=50 Ω, 5 V)[b]** | $t_r/t_f$ | 35 ps / 200 ps |
| **NEP, Typical (850 nm, 5 V)[c]** | | $8.60 \times 10^{-15}$ W/√Hz |
| **Dark Current (5 V)** | $I_d$ | 0.03 nA (Typ.)<br>0.5 nA (Max) |
| **Bias Voltage (Reverse)** | | 5 V (Typ.)<br>20 V (Max) |
| **Capacitance (5 V)** | $C_j$ | 0.65 pF (Typ.) |
| **Optical Input Power (850 nm)** | | 5 mW (Max) |


| Physical Specifications | |
|---|---|
| **Active Area Diameter** | Ø150 µm |
| **Package** | TO-46 with Flat Window |
| **Sensor Material** | Si |
| **Storage Temperature** | -55 to 125 °C |
| **Operating Temperature** | -40 to 75 °C |

a. Unless otherwise noted, all measurements are performed at 25 °C ambient temperature.
b. Rise and fall times are measured between 20% and 80% of the step height in accordance with the manufacturer's specification sheet.
c. NEP is experimentally limited by thermal noise of the load resistor. For a 50 Ω load, NEP = $5 \times 10^{-11}$ W/√Hz @ 850 nm.

## Recommended Circuit



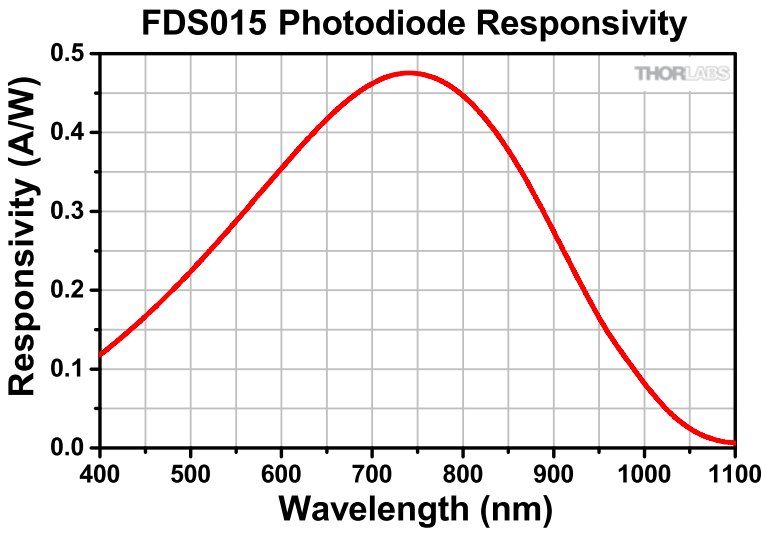

* Case ground for PD with a third lead.

## Responsivity Graph

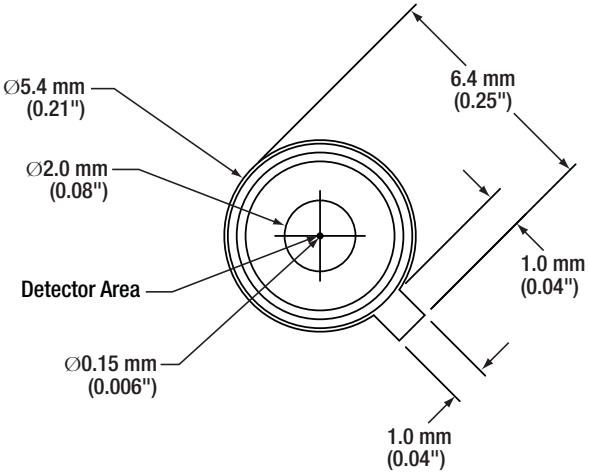
The responsivity of a photodiode is a measure of its sensitivity to light and is defined as the ratio of the photocurrent $I_P$ to the incident light power P at a given wavelength:

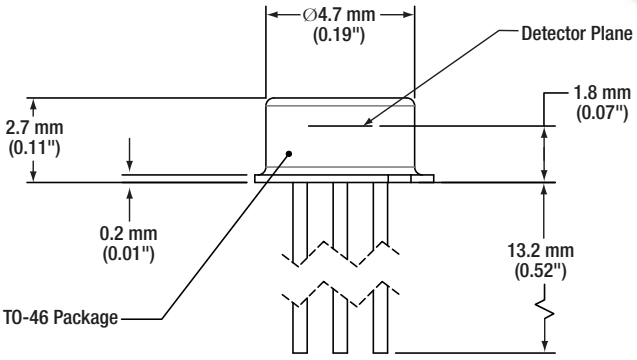
$$R_\lambda = \frac{I_P}{P}$$

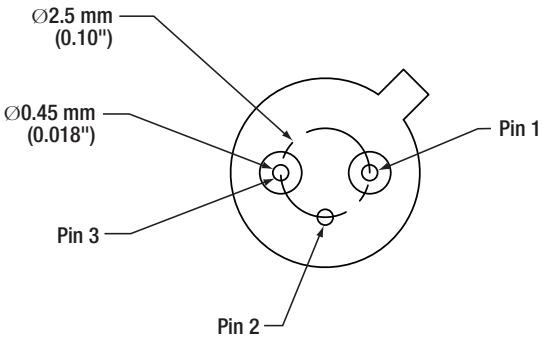
In other words, it is a measure of the effectiveness of the conversion of light power into electrical current. Responsivity is a function of the wavelength of the incident light, applied reverse bias, and temperature conditions.

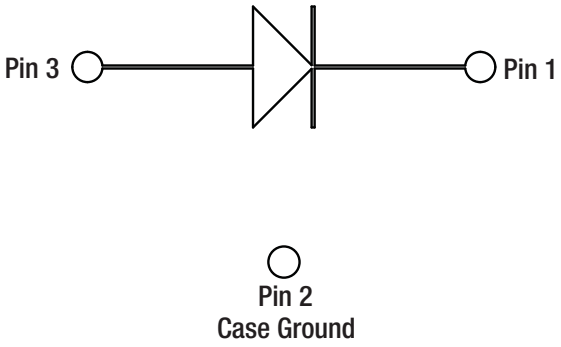


## Drawing




Pin Circle Diameter = 2.5 mm (0.10")

# Precautions and Warranty Information

*These products are ESD (electro static discharge) sensitive and as a result are not covered under warranty. In order to ensure the proper functioning of a photodiode care must be given to maintain the highest standards of compliance to the maximum electrical specifications when handling such devices. The photodiodes are particularly sensitive to any value that exceeds the absolute maximum ratings of the product. Any applied voltage in excess of the maximum specification will cause damage and possible complete failure to the product. The user must use handling procedures that prevent any electro static discharges or other voltage surges when handling or using these devices.*

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