



FD05D

### Description

Thorlabs' FD05D photodiode is ideal for measuring both pulsed and CW fiber light sources by converting optical power into electrical current. The detector is in a TO-18 package with an anode, cathode, and case connection. The photodiode anode produces a current, which is a function of the incident light power and the wavelength. The responsivity,  $\mathfrak{R}(\lambda)$ , can be read from the plot below 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

$$V_o = P \times \mathfrak{R} \times R_L$$

The bandwidth,  $f_{BW}$ , and the rise time response,  $t_r$ , are determined from the diode capacitance,  $C_j$ , and the load resistance,  $R_L$ , as shown below. The diode capacitance can be lowered by placing a bias voltage from the photodiode cathode to the circuit ground.

$$f_{BW} = \frac{1}{(2\pi)R_L C_j}, \quad t_r = \frac{0.35}{f_{BW}}$$

### Specifications

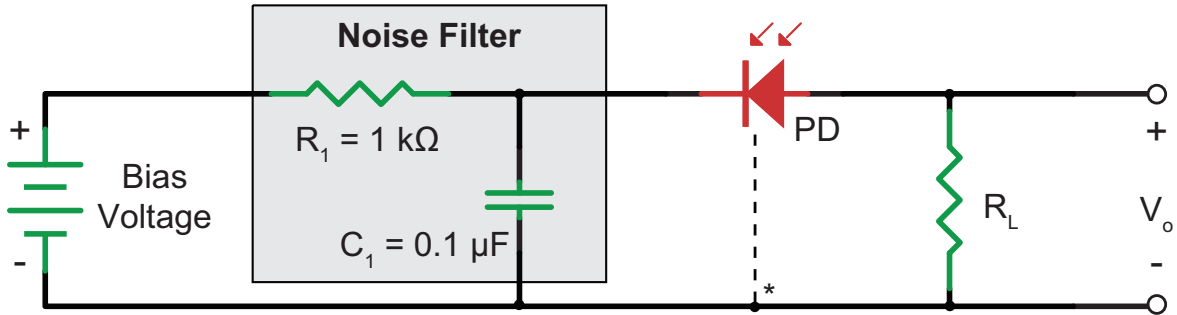
Specifications <sup>a</sup>		
Wavelength Range	$\lambda$	900 - 2600 nm
Peak Wavelength	$\lambda_p$	2300 nm
Responsivity at Peak Wavelength	$\mathfrak{R}(\lambda)$	1.3 A/W (Typ.)
Active Area Diameter		0.5 mm
Rise/Fall Time ( $R_L=50 \Omega$ , 0 V)	$t_r$	17 ns / 17 ns (Typ.)
NEP, Typical (2300 nm)		$5.0 \times 10^{-13}$ W//Hz (Typ.)
Dark Current (0.5 V)	$I_d$	1 $\mu$ A (Typ.)
Capacitance (0 V)	$C_j$	140 pF (Typ.)
Package		TO-18
Sensor Material		InGaAs

Absolute Maximum Ratings	
Max Bias (Reverse) Voltage	1.8 V
Operating Temperature	-40 to 85 °C
Storage Temperature	-55 to 125 °C

a. Unless otherwise noted, all measurements are performed at 25 °C ambient temperature.



## Recommended Circuit



\* Case ground for PD with a third lead.

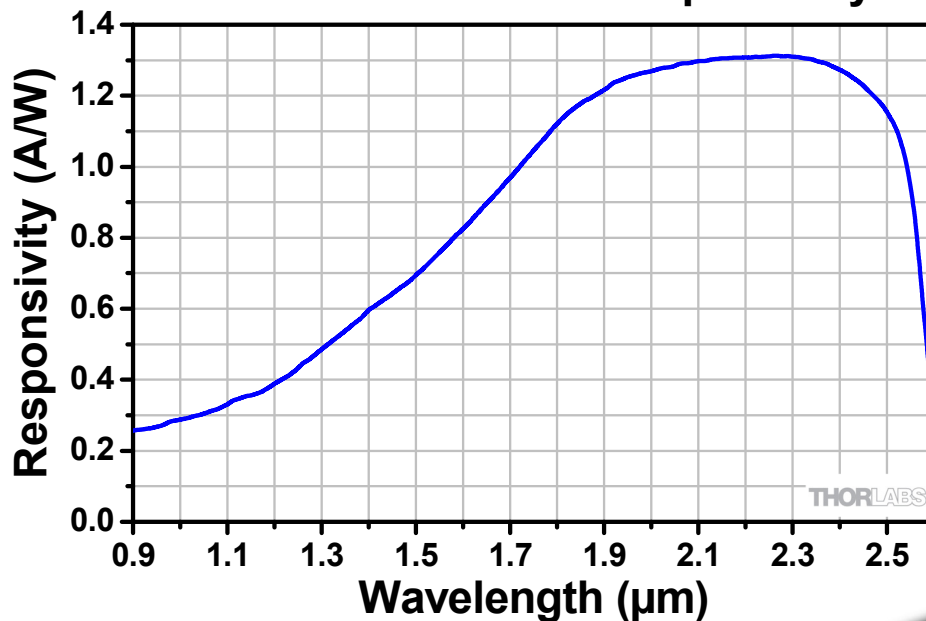
## Responsivity Graph

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:

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

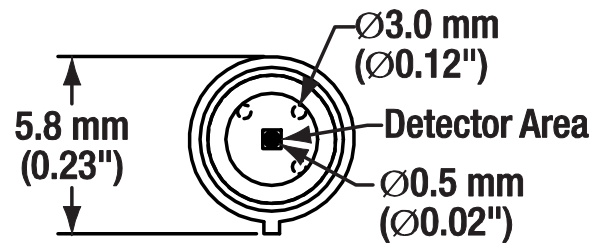
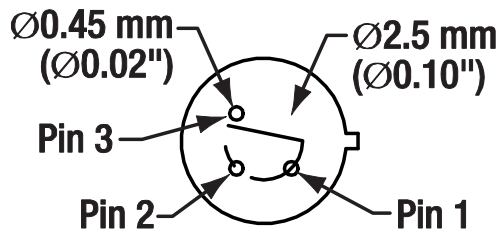
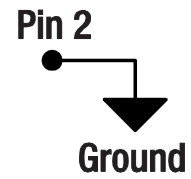
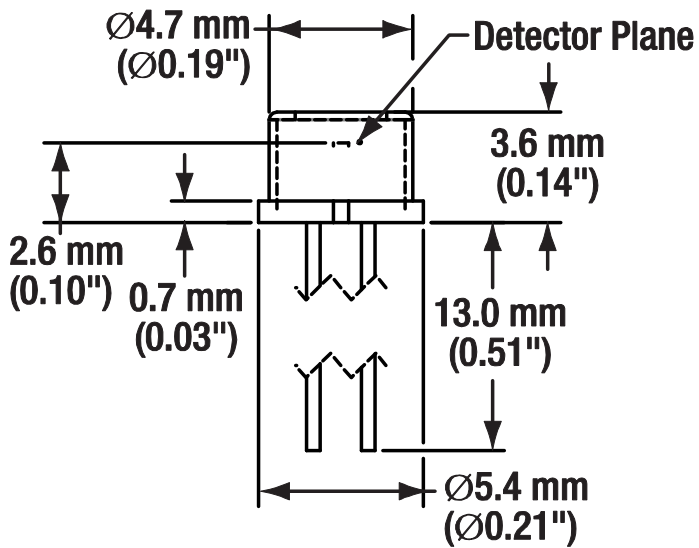
In other words, it is a measure of the effectiveness of the conversion of light power into electrical current. Responsivity varies from lot to lot and with the wavelength of the incident light, applied reverse bias, and temperature. It increases slightly with applied reverse bias due to improved charge collection efficiency in the photodiode. The change in temperature increases or decreases the width of the band gap and varies inversely with the temperature.

### FD05D Photodiode Responsivity



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## Drawing



## ***Precautions and Warranty Information***

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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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- 2. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.*
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