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THORLABS

SM05PD7A - APR 27, 2022

Item # SM05PD7A was discontinued on APR 27, 2022. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

MOUNTED PHOTODIODES

- **InGaAs, Silicon, Ge, or GaP Photodiodes**
- **Ideal for Measuring Pulsed and CW Sources**
- **Housing with External SM05 or SM1 Threading**

SM05PD2A
FDS010 Photodiode
Mounted in SM05 Externally
Threaded Housing

SM1PD1B
FDS1010 Photodiode
Mounted in SM1
Externally

Hide Overview

OVERVIEW

Mounted and Unmounted Detectors
Unmounted Photodiodes (200 - 2600 nm)
Calibrated Photodiodes (350 - 1800 nm)
Mounted Photodiodes (150 - 1800 nm)
Thermopile Detectors (0.2 - 15 µm)
Photovoltaic Detectors (2.0 - 10.6 µm)
Pigtailed Photodiodes (320 - 1000 nm)

Thorlabs offers photodiodes of GaP, Si, InGaAs, or Ge material mounted in convenient SM05 (0.535"-40) or SM1 (1.035"-40) externally threaded tubes. The electrical output of the photodiode is provided through a standard SMA connector (SM05PD Series) or BNC connector (SM1PD Series) for quick connection to the measuring circuit.

The mounted photodiodes presented here are compatible with the PDA200C Benchtop Photodiode Amplifier and Thorlabs' Modular Photodiode Amplifiers. The photodiodes come in either a Type A (cathode grounded) or Type B (anode grounded) arrangement. The pin codes for specific items may be found below. All models are ideal for measuring pulsed and CW sources. The insulated external thread on the main body makes these photodiodes compatible with all Thorlabs SM05 and SM1 Mounting Adapters.

Click to Enlarge
PDA200C Benchtop Photodiode Amplifier Connected to an SM1-Threaded Mounted Photodiode Using a BNC Cable

Click to Enlarge
The PBM42 Bias Module Used to Apply an External Reverse Bias Voltage to the SM1PD2A Photodiode

Please refer to the tables below for more details on each model and note that these photodiodes are not calibrated. We also offer unmounted calibrated photodiodes.

Please note that inhomogeneities at the edges of the active area of the detector can generate unwanted capacitance and resistance effects that distort the time-domain response of the photodiode output. Thorlabs therefore recommends that the incident light on the photodiode is well centered on the active area. This can be accomplished by placing a focusing lens or pinhole in front of the detector element.

For applying an external bias voltage to these photodiodes, we offer the PBM42 bias module (sold below), which is compatible via adapters with all of the photodiodes on this page and is shown in the image to the right.

For information on the photodiode saturation limit and the noise floor, as well as a collection of Thorlabs-conducted experiments regarding spatial uniformity (or varying responsivity) and dark current as a function of temperature, refer to the *Lab Facts* tab. The *Photodiode Tutorial* provides more general information regarding the operation, terminology, and theory of photodiodes.

Thorlabs offers spectral-flattening filters that are designed to improve the response uniformity of our silicon photodiodes. Click here to learn more.

Hide Photodiode Tutorial

PHOTODIODE TUTORIAL

Photodiode Tutorial

Theory of Operation

A junction photodiode is an intrinsic device that behaves similarly to an ordinary signal diode, but it generates a photocurrent when light is absorbed in the depleted region of the junction semiconductor. A photodiode is a fast, highly linear device that exhibits high quantum efficiency based upon the application and may be used in a variety of different applications.

It is necessary to be able to correctly determine the level of the output current to expect and the responsivity based upon the incident light. Depicted in Figure 1 is a junction photodiode model with basic discrete components to help visualize the main characteristics and gain a better understanding of the operation of Thorlabs' photodiodes.

$$I_{OUT} = I_{DARK} + I_{PD}$$

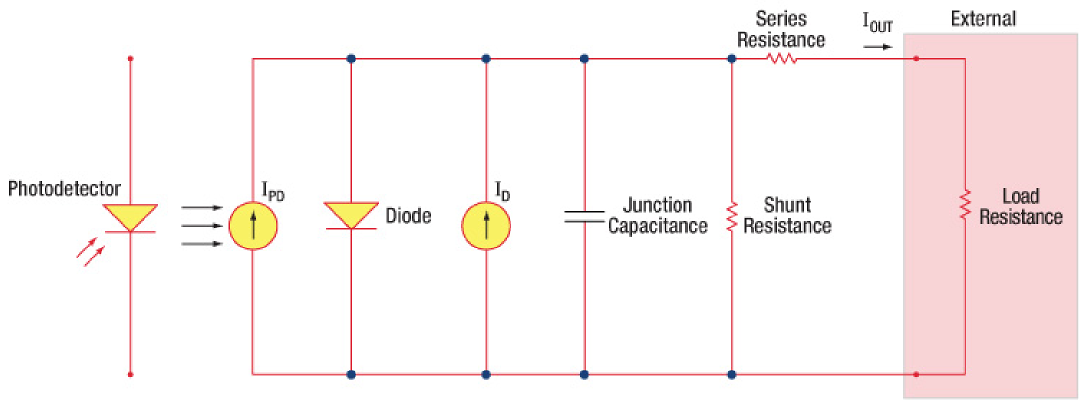


Figure 1: Photodiode Model

Photodiode Terminology

Responsivity

The responsivity of a photodiode can be defined as a ratio of generated photocurrent (I_{PD}) to the incident light power (P) at a given wavelength:

$$R(\lambda) = \frac{I_{PD}}{P}$$

Modes of Operation (Photoconductive vs. Photovoltaic)

A photodiode can be operated in one of two modes: photoconductive (reverse bias) or photovoltaic (zero-bias). Mode selection depends upon the application's speed requirements and the amount of tolerable dark current (leakage current).

Photoconductive

In photoconductive mode, an external reverse bias is applied, which is the basis for our DET series detectors. The current measured through the circuit indicates illumination of the device; the measured output current is linearly proportional to the input optical power. Applying a reverse bias increases the width of the depletion junction producing an increased responsivity with a decrease in junction capacitance and produces a very linear response. Operating under these conditions does tend to produce a larger dark current, but this can be limited based upon the photodiode material. (Note: Our DET detectors are reverse biased and cannot be operated under a forward bias.)

Photovoltaic

In photovoltaic mode the photodiode is zero biased. The flow of current out of the device is restricted and a voltage builds up. This mode of operation exploits the photovoltaic effect, which is the basis for solar cells. The amount of dark current is kept at a minimum when operating in photovoltaic mode.

Dark Current

Dark current is leakage current that flows when a bias voltage is applied to a photodiode. When operating in a photoconductive mode, there tends to be a higher dark current that varies directly with temperature. Dark current approximately doubles for every 10 °C increase in temperature, and shunt resistance tends to double for every 6 °C rise. Of course, applying a higher bias will decrease the junction capacitance but will increase the amount of dark current present.

The dark current present is also affected by the photodiode material and the size of the active area. Silicon devices generally produce low dark current compared to germanium devices which have high dark currents. The table below lists several photodiode materials and their relative dark currents, speeds, sensitivity, and costs.

Material	Dark Current	Speed	Spectral Range	Cost
Silicon (Si)	Low	High Speed	Visible to NIR	Low
Germanium (Ge)	High	Low Speed	NIR	Low
Gallium Phosphide (GaP)	Low	High Speed	UV to Visible	Moderate
Indium Gallium Arsenide (InGaAs)	Low	High Speed	NIR	Moderate
Indium Arsenide Antimonide (InAsSb)	High	Low Speed	NIR to MIR	High
Extended Range Indium Gallium Arsenide (InGaAs)	High	High Speed	NIR	High
Mercury Cadmium Telluride (MCT, HgCdTe)	High	Low Speed	NIR to MIR	High

Junction Capacitance

Junction capacitance (C_j) is an important property of a photodiode as this can have a profound impact on the photodiode's bandwidth and response. It should be noted that larger diode areas encompass a greater junction volume with increased charge capacity. In a reverse bias application, the depletion width of the junction is increased, thus effectively reducing the junction capacitance and increasing the response speed.

Bandwidth and Response

A load resistor will react with the photodetector junction capacitance to limit the bandwidth. For best frequency response, a 50 Ω terminator should be used in conjunction with a 50 Ω coaxial cable. The bandwidth (f_{BW}) and the rise time response (t_r) can be approximated using the junction capacitance (C_j) and the load resistance (R_{LOAD}):

$$f_{BW} = 1 / (2 * \pi * R_{LOAD} * C_j)$$
$$t_r = 0.35 / f_{BW}$$

Noise Equivalent Power

The noise equivalent power (NEP) is the generated RMS signal voltage generated when the signal to noise ratio is equal to one. This is useful, as the NEP determines the ability of the detector to detect low level light. In general, the NEP increases with the active area of the detector and is given by the following equation:

$$NEP = \frac{Incident\ Energy * Area}{\frac{S}{N} * \sqrt{\Delta f}}$$

Here, S/N is the Signal to Noise Ratio, Δf is the Noise Bandwidth, and Incident Energy has units of W/cm^2. For more information on NEP, please see

Thorlabs' Noise Equivalent Power White Paper.

Terminating Resistance

A load resistance is used to convert the generated photocurrent into a voltage (V_{OUT}) for viewing on an oscilloscope:

$$V_{OUT} = I_{OUT} * R_{LOAD}$$

Depending on the type of the photodiode, load resistance can affect the response speed. For maximum bandwidth, we recommend using a 50 Ω coaxial cable with a 50 Ω terminating resistor at the opposite end of the cable. This will minimize ringing by matching the cable with its characteristic impedance. If bandwidth is not important, you may increase the amount of voltage for a given light level by increasing R_{LOAD}. In an unmatched termination, the length of the coaxial cable can have a profound impact on the response, so it is recommended to keep the cable as short as possible.

Shunt Resistance

Shunt resistance represents the resistance of the zero-biased photodiode junction. An ideal photodiode will have an infinite shunt resistance, but actual values may range from the order of ten Ω to thousands of MΩ and is dependent on the photodiode material. For example, and InGaAs detector has a shunt resistance on the order of 10 MΩ while a Ge detector is in the kΩ range. This can significantly impact the noise current on the photodiode. For most applications, however, the high resistance produces little effect and can be ignored.

Series Resistance

Series resistance is the resistance of the semiconductor material, and this low resistance can generally be ignored. The series resistance arises from the contacts and the wire bonds of the photodiode and is used to mainly determine the linearity of the photodiode under zero bias conditions.

Common Operating Circuits

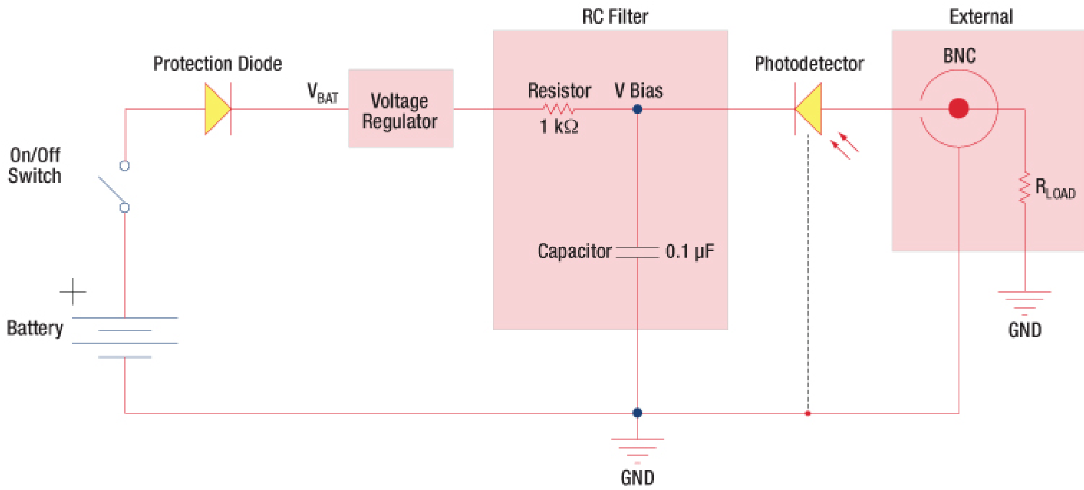


Figure 2: Reverse-Biased Circuit (DET Series Detectors)

The DET series detectors are modeled with the circuit depicted above. The detector is reverse biased to produce a linear response to the applied input light. The amount of photocurrent generated is based upon the incident light and wavelength and can be viewed on an oscilloscope by attaching a load resistance on the output. The function of the RC filter is to filter any high-frequency noise from the input supply that may contribute to a noisy output.

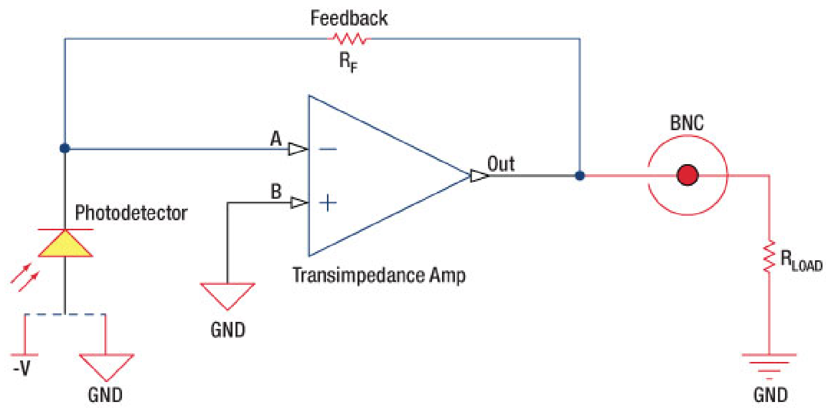


Figure 3: Amplified Detector Circuit

One can also use a photodetector with an amplifier for the purpose of achieving high gain. The user can choose whether to operate in Photovoltaic of Photoconductive modes. There are a few benefits of choosing this active circuit:

- Photovoltaic mode: The circuit is held at zero volts across the photodiode, since point A is held at the same potential as point B by the operational amplifier. This eliminates the possibility of dark current.
- Photoconductive mode: The photodiode is reversed biased, thus improving the bandwidth while lowering the junction capacitance. The gain of the detector is dependent on the feedback element (R_f). The bandwidth of the detector can be calculated using the following:

$$f(-3dB) = \sqrt{\frac{GBP}{4\pi * R_f * C_D}}$$

where GBP is the amplifier gain bandwidth product and C_D is the sum of the junction capacitance and amplifier capacitance.

Effects of Chopping Frequency

The photoconductor signal will remain constant up to the time constant response limit. Many detectors, including PbS, PbSe, HgCdTe (MCT), and InAsSb, have a typical 1/f noise spectrum (i.e., the noise decreases as chopping frequency increases), which has a profound impact on the time constant at lower frequencies.

The detector will exhibit lower responsivity at lower chopping frequencies. Frequency response and detectivity are maximized for

$$f_c = \frac{1}{2\pi\tau_r}$$

Hide Example Circuits

EXAMPLE CIRCUITS

The images below show examples of electrical circuits that can be used in conjunction with our mounted diodes. Our mounted photodiodes with SM05-threaded (0.535"-40) housings utilize an SMA connector type whereas those with SM1-threaded (1.035"-40) housings have a BNC connector type. Figure 1 below depicts a cathode-grounded photodiode with an example circuit. This is a reverse bias configuration with a positive voltage output. Figure 2 depicts an anode-grounded photodiode with an example circuit. Note that in this instance, the polarity of the power source has been reversed. Figure 2 is also a reverse bias configuration but will have a negative voltage output.

The major difference between the configurations shown in Figures 1 and 2 is the range of the output voltage. Figure 1 will output 0 to +V volts, whereas Figure

2 will output -V to 0 volts. For more information on photodiode circuits, values, and theory please see the *Photodiode Tutorial* tab

SM05- and SM1-Threaded Mounted Photodiodes, Cathode Grounded

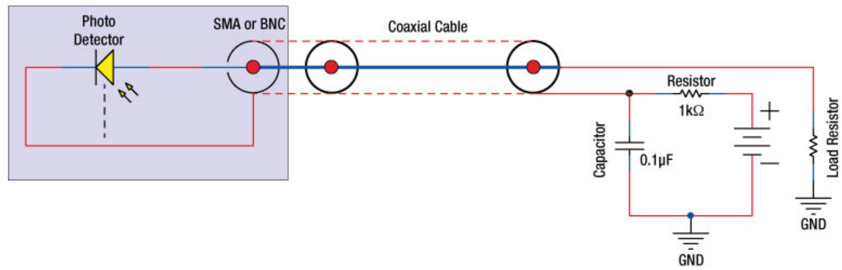


Figure 1

SM05- and SM1-Threaded Mounted Photodiodes, Anode Grounded

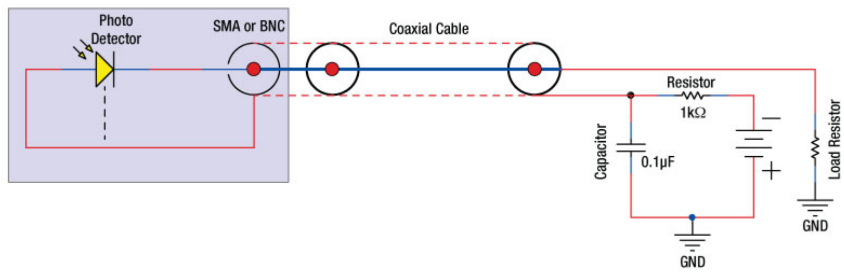


Figure 2

Hide Lab Facts

LAB FACTS

Summary

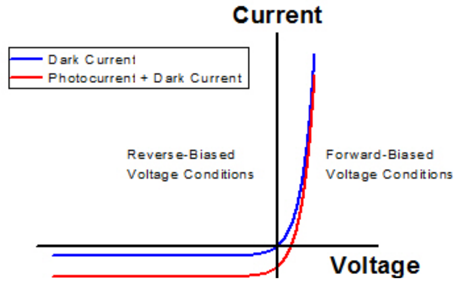
This tab contains a collection of experiments performed at Thorlabs regarding the performance of photodiodes we offer. Each section is its own independent experiment, which can be viewed by clicking in the appropriate box below. *Photodiode Saturation Limit and Noise Floor* explores how different conditions, including temperature, resistivity, reverse-bias voltage, responsivity, and system bandwidth, can affect noise in a photodiode's output. *Photodiode Spatial Uniformity* explores variations in the responsivity as a small-diameter light beam is scanned across the active area of the photodiode. Photodiodes with different material compositions are tested, and eight units of one silicon-based model are tested to investigate unit-to-unit variations. *Dark Current as a Function of Temperature* and *Noise Equivalent Power (NEP) as a Function of Temperature* describe how dark current and NEP, respectively, vary with temperature and how measurements are affected. *Beam Size and Photodiode Saturation* shows how the photodiode saturation point changes with the incident beam size and investigates several models to explain the results. *Bias Voltage* examines the effects of incident power on the effective reverse bias voltage of a photodiode circuit and verifies a reliable model for predicting those changes.

Photodiode Saturation Limit and Noise Floor

We present laboratory measurements of the saturation limit and noise floor of a Thorlabs silicon photodiode. While all photodiodes function similarly, there are a number of parameters that affect the noise floor and saturation limit of a photodiode including the sensor temperature, resistivity, [illegible]

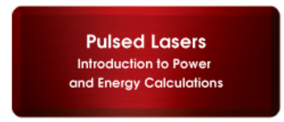
Hide Pulse Calculations

PULSE CALCULATIONS



Pulsed Laser Emission: Power and Energy Calculations

Determining whether emission from a pulsed laser is compatible with a device or application can require referencing parameters that are not supplied by the laser's manufacturer. When this is the case, the necessary parameters can typically be calculated from the available information. Calculating peak pulse power, average power, pulse energy, and related parameters can be necessary to achieve desired outcomes including:



Click above to download the full report.

- Protecting biological samples from harm.
- Measuring the pulsed laser emission without damaging photodetectors and other sensors.
- Exciting fluorescence and non-linear effects in materials.

Pulsed laser radiation parameters are illustrated in Figure 1 and described in the table. For quick reference, a list of equations are provided below. The document available for download provides this information, as well as an introduction to pulsed laser emission, an overview of relationships among the different parameters, and guidance for applying the calculations.

Equations:

Period **and** ***repetition rate*** **are reciprocal:** $\Delta t = \frac{1}{f_{rep}}$ and $f_{rep} = \frac{1}{\Delta t}$

Pulse energy **calculated from** ***average power*****:** $E = \frac{P_{avg}}{f_{rep}} = P_{avg} \cdot \Delta t$

Average power **calculated from** ***pulse energy*****:** $P_{avg} = \frac{E}{\Delta t} = E \cdot f_{rep}$

Peak pulse power **estimated from** ***pulse energy*****:** $P_{peak} \approx \frac{E}{\tau}$

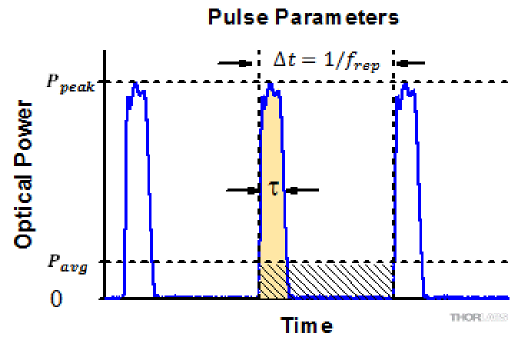
Peak power **and** ***average power*** **calculated from each other:**

$$P_{peak} = \frac{P_{avg}}{f_{rep} \cdot \tau} = \frac{P_{avg} \cdot \Delta t}{\tau}$$ and $$P_{avg} = P_{peak} \cdot f_{rep} \cdot \tau = \frac{P_{peak} \cdot \tau}{\Delta t}$$

Peak power **calculated from** ***average power*** **and** ***duty cycle******:**

$$P_{peak} = \frac{P_{avg}}{\tau/\Delta t} = \frac{P_{avg}}{duty\ cycle}$$

*Duty cycle ($\tau/\Delta t$) is the fraction of time during which there is laser pulse emission.



Click to Enlarge

Figure 1: Parameters used to describe pulsed laser emission are indicated in the plot (above) and described in the table (below). **Pulse energy** (**E**) is the shaded area under the pulse curve. Pulse energy is, equivalently, the area of the diagonally hashed region.

Parameter	Symbol	Units	Description
Pulse Energy	**E**	Joules [J]	A measure of one pulse's total emission, which is the only light emitted by the laser over the entire period. The pulse energy equals the shaded area, which is equivalent to the area covered by diagonal hash marks.
Period	**Δt**	Seconds [s]	The amount of time between the start of one pulse and the start of the next.
Average Power	$\mathbf{P_{avg}}$	Watts [W]	The height on the optical power axis, if the energy emitted by the pulse were uniformly spread over the entire period.
Instantaneous Power	**P**	Watts [W]	The optical power at a single, specific point in time.
Peak Power	$\mathbf{P_{peak}}$	Watts [W]	The maximum instantaneous optical power output by the laser.
Pulse Width	τ	Seconds [s]	A measure of the time between the beginning and end of the pulse, typically based on the full width half maximum (FWHM) of the pulse shape. Also called **pulse duration**.
Repetition Rate	$\mathbf{f_{rep}}$	Hertz [Hz]	The frequency with which pulses are emitted. Equal to the reciprocal of the period.

Example Calculation:

Is it safe to use a detector with a specified maximum peak optical input power of **75 mW** to measure the following pulsed laser emission?

- Average Power: 1 mW
- Repetition Rate: 85 MHz
- Pulse Width: 10 fs

The energy per pulse:

$$E = \frac{P_{avg}}{f_{rep}} = \frac{1\ mW}{85\ MHz} = \frac{1\ x\ 10^{-3} W}{85\ x\ 10^{6} Hz} = 1.18\ x\ 10^{-11} J = 11.8\ pJ$$

seems low, but the peak pulse power is:

More [+]

$$P_{peak} = \frac{P_{avg}}{f_{rep} \cdot \tau} = \frac{1\ mW}{85\ MHz\ \cdot 10\ fs} = 1.18\ x\ 10^3\ W = \mathbf{1.18\ kW}$$

It is ***not safe*** to use the detector to measure this pulsed laser emission, since the peak power of the pulses is >5 orders of magnitude higher than the detector's maximum peak optical input power.

More [+]

Figure 5: Dark Current Data Measured for Four Unmounted Photodiodes

Photodiode Controlled by the Conditions in the Environmental Chamber

Hide C **Experimental Results**

3) Eight Si-Based SM1PD2A Photodetectors: Uniformity of Response to Light Near Peak Responsivity Wavelength Compared

More [+]

The discrete data points, plotted as diamonds, are values of

Dark current measurements were acquired between

CROSS REFERENCE

The following table lists Thorlabs' selection of photodiodes and photoconductive detectors. Item numbers in the same row contain the same detector element.

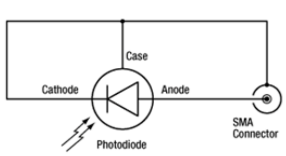
Photodetector Cross Reference						
Wavelength	**Material**	**Unmounted Photodiode**	**Mounted Photodiode**	**Biased Detector**	**Amplified Detector**	**Amplified Detector, OEM Package**
150 - 550 nm	GaP	-	SM05PD7A	DET25K2	PDA25K2	-
200 - 1100 nm	Si	FDS010	SM05PD2A SM05PD2B	DET10A2	PDA10A2	-
	Si	-	SM1PD2A	-	-	-
320 - 1000 nm	Si	-	-	-	PDA8A2	-
320 - 1100 nm	Si	FD11A	SM05PD3A		PDF10A2	-
	Si	- [a]	-	DET100A2 [a]	PDA100A2 [a]	PDAPC2 [a]
340 - 1100 nm	Si	FDS10X10	-	-	-	-
350 - 1100 nm	Si	FDS100 FDS100-CAL [b]	SM05PD1A SM05PD1B	DET36A2	PDA36A2	PDAPC1
	Si	FDS1010 FDS1010-CAL [b]	SM1PD1A SM1PD1B	-	-	-
400 - 1000 nm	Si	-	-	-	PDA015A(/M) FPD310-FS-VIS FPD310-FC-VIS FPD510-FC-VIS FPD510-FS-VIS FPD610-FC-VIS FPD610-FS-VIS	-
400 - 1100 nm	Si	FDS015 [c]	-	-	-	-
	Si	FDS025 [c] FDS02 [d]	-	DET02AFC(/M) DET025AFC(/M) DET025A(/M) DET025AL(/M)	-	-
400 - 1700 nm	Si & InGaAs	DSD2	-	-	-	-
500 - 1700 nm	InGaAs	-	-	DET10N2	-	-
750 - 1650 nm	InGaAs	-	-	-	PDA8GS	-
800 - 1700 nm	InGaAs	FGA015	-	-	PDA015C(/M)	-
	InGaAs	FGA21 FGA21-CAL [b]	SM05PD5A	DET20C2	PDA20C2 PDA20CS2	-
	InGaAs	FGA01 [c] FGA01FC [d]	-	DET01CFC(/M)	-	-
	InGaAs	FDGA05 [c]	-	-	PDA05CF2	-
	InGaAs	-	-	DET08CFC(/M) DET08C(/M) DET08CL(/M)	-	-

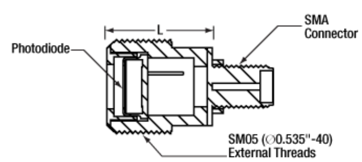
	InGaAs	-	-	-	PDF10C2	-
800 - 1800 nm	Ge	FDG03 FDG03-CAL [b]	SM05PD6A	DET30B2	PDA30B2	-
	Ge	FDG50	-	DET50B2	PDA50B2	-
	Ge	FDG05	-	-	-	-
900 - 1700 nm	InGaAs	FGA10	SM05PD4A	DET10C2	PDA10CS2	-
900 - 2600 nm	InGaAs	FD05D	-	DET05D2	-	-
		FD10D	-	DET10D2	PDA10D2	-
950 - 1650 nm	InGaAs	-	-	-	FPD310-FC-NIR FPD310-FS-NIR FPD510-FC-NIR FPD510-FS-NIR FPD610-FC-NIR FPD610-FS-NIR	-
1.0 - 5.8 µm	InAsSb	-	-	-	PDA10PT(-EC)	-
2.0 - 8.0 µm	HgCdTe (MCT)	VML8T0 VML8T4 [e]	-	-	PDAVJ8	-
2.0 - 10.6 µm	HgCdTe (MCT)	VML10T0 VML10T4 [e]	-	-	PDAVJ10	-
2.7 - 5.0 µm	HgCdTe (MCT)	VL5T0	-	-	PDAVJ5	-
2.7 - 5.3 µm	InAsSb	-	-	-	PDA07P2	-

a. If you are interested in purchasing the bare photodiode incorporated in these detectors without the printed circuit board, please contact Tech Support.
b. Calibrated Unmounted Photodiode
c. Unmounted TO-46 Can Photodiode
d. Unmounted TO-46 Can Photodiode with FC/PC Bulkhead
e. Photovoltaic Detector with Thermoelectric Cooler

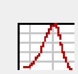
Hide SM05-Threaded Mounted Photodiodes, Cathode Grounded

SM05-Threaded Mounted Photodiodes, Cathode Grounded





Please click on the red document icons ( ) below for the value of L.

Item #	Detector Info[a]	Rise/Fall Time (Typ.)[b]	Active Area (Dimensions)	NEP (W/Hz$^{1/2}$)	Dark Current	Spectral Range (nm)	Material	Junction Capacitance (Typ.)	Reverse Bias Voltage (Max)	Responsivity Plots
SM05PD7A	FGAP71[c]	55 ns / 55 ns @ 5 V	4.8 mm^2 (2.2 x 2.2 mm)	1.3 x 10^{-14}	15 pA (Typ.) @ 5 V 40 pA (Max) @ 5 V	150 - 550	GaP	1000 pF @ 0 V	5 V	
SM05PD2A	FDS010	1 ns / 1 ns @	0.8 mm^2	5.0 x 10$^-$	0.3 nA @ 10 V	200 -	Si	6 pF @ 10 V	25 V	

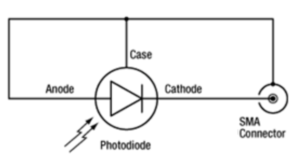
		10 V	(Ø1.0 mm)[d]	14		1100[e]				
SM05PD3A[f]	FD11A	15 ns / 15 ns[f] @ 650 nm, 10 V	1.21 mm^2 (1.1 x 1.1 mm)	4.2×10^{-15}	20 pA (Typ.) @ 10 V 100 pA (Max) @ 10 V	320 - 1100	Si	140 pF @ 0 V	30 V	
SM05PD1A	FDS100	10 ns / 10 ns[g] @ 632 nm, 20 V	13 mm^2 (3.6 x 3.6 mm)	1.2×10^{-14}	1.0 nA (Typ.) @ 20 V 20 nA (Max) @ 20 V	350 - 1100	Si	24 pF @ 20 V	25 V	
SM05PD5A	FGA21	25 ns / 25 ns @ 3 V	3.1 mm^2 (Ø2.0 mm)	6.0×10^{-14}	50 nA @ 1 V	800 - 1700	InGaAs	100 pF @ 3 V	3 V	
SM05PD6A	FDG03	600 ns / 600 ns @ 3 V	7.1 mm^2 (Ø3.0 mm)	2.6×10^{-12}	4.0 µA (Max) @ 1 V	800 - 1800	Ge	6 nF @ 1 V 4.5 nF @ 3 V	3 V	
SM05PD4A	FGA10	10 ns / 10 ns @ 5 V	0.8 mm^2 (Ø1.0 mm)	2.5×10^{-14}	1.1 nA @ 5 V	900 - 1700	InGaAs	80 pF @ 5 V	5 V	

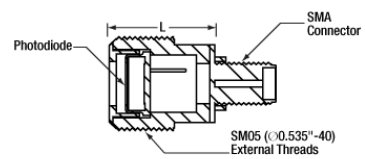
a.bClick the links to view specifications for the integrated photodiodes.
b. R_L = 50 Ω
c. The FGAP71 photodiode is previous generation and no longer offered for individual purchase.
d. The Ø1 mm active area accounts for the two solder leads found on the photodiode face.
e. When long-term UV light is applied, the product specifications may degrade. For example, the product's UV response may decrease and the dark current may increase. The degree to which the specifications may degrade is based upon factors such as the irradiation level, intensity, and usage time.
f. Due to the mounting process, the NEP and dark current specifications of the SM05PD3A will differ from those of the FD11A.
g. The photodiode will be slower at NIR wavelengths.

Part Number	Description	Price	Availability
SM05PD2A	Mounted Silicon Photodiode, 200-1100 nm, Cathode Grounded	$97.34	Today
SM05PD3A	Mounted Silicon Photodiode, 320-1100 nm, Cathode Grounded	$69.60	Today
SM05PD1A	Large Area Mounted Silicon Photodiode, 350-1100 nm, Cathode Grounded	$75.58	Today
SM05PD5A	Mounted InGaAs Photodiode, 800-1700 nm, Cathode Grounded	$304.48	Today
SM05PD6A	Large Area Mounted Germanium Photodiode, 800-1800 nm, Cathode Grounded	$194.65	Today
SM05PD4A	Mounted InGaAs Photodiode, 900-1700 nm, Cathode Grounded	$234.04	Today

Hide SM05-Threaded Mounted Photodiodes, Anode Grounded

SM05-Threaded Mounted Photodiodes, Anode Grounded





Please click on the red document icons ( ) below for the value of L.

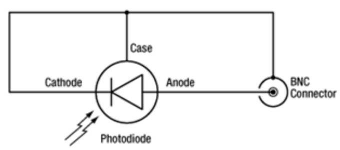
Item #	Detector Info[a]	Rise/Fall Time (Typ.)[b]	Active Area (Dimensions)	NEP ($W/Hz^{1/2}$)[c]	Dark Current	Spectral Range (nm)	Material	Junction Capacitance (Typ.)	Reverse Bias Voltage (Max)	Responsivity Plot
SM05PD2B	FDS010	1 ns / 1 ns @ 830 nm, 10 V	0.8 mm^2 (Ø1.0 mm)	5.0×10^{-14}	0.3 nA (Typ.) @ 10 V	200 - 1100[d]	Si	6 pF @ 10 V	25 V	
SM05PD1B	FDS100	10 ns / 10 ns[e] @ 632 nm, 20 V	13 mm^2 (3.6 x 3.6 mm)	1.2×10^{-14}	1.0 nA (Typ.) @ 20 V 20 nA (Max) @ 20 V	350 - 1100	Si	24 pF @ 20 V		

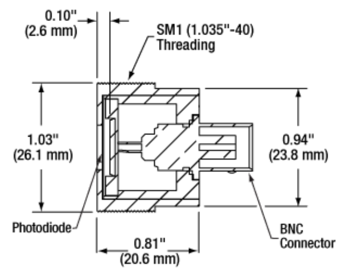
a. Click the links to view specifications for the integrated photodiodes.
b. R_L = 50 Ω
c. Typical Values
d. When long-term UV light is applied, the product specifications may degrade. For example, the product's UV response may decrease and the dark current may increase. The degree to which the specifications may degrade is based upon factors such as the irradiation level, intensity, and usage time.
e. The photodiode will be slower at NIR wavelengths.

Part Number	Description	Price	Availability
SM05PD2B	**Mounted Silicon Photodiode, 200-1100 nm, Anode Grounded**	**$97.34**	**Today**
SM05PD1B	**Large Area Mounted Silicon Photodiode, 350-1100 nm, Anode Grounded**	**$75.03**	**Today**

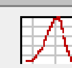
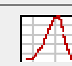
Hide SM1-Threaded Mounted Photodiodes, Cathode Grounded

SM1-Threaded Mounted Photodiodes, Cathode Grounded





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

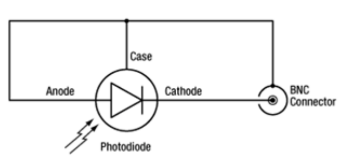
Item #	Detector Info[a]	Rise/Fall Time (Typ.)[b,c]	Active Area (Dimensions)	NEP ($W/Hz^{1/2}$)	Dark Current	Spectral Range (nm)	Material	Junction Capacitance (Typ.)	Reverse Bias Voltage (Max)	Responsivity Plots
SM1PD2A	-	450 ns / 450 ns @ 650 nm, 5 V	10 mm x 10 mm Behind Ø9 mm Clear Aperture	5.74×10^{-14}	1.0 µA (Max) @ 5 V	200 - 1100	Si	1.75 nF @ 0 V	5 V	
SM1PD1A	FDS1010	65 ns @ 632 nm, 5 V		2.07×10^{-13}	600 nA (Max) @ 5 V	350 - 1100	Si	375 pF @ 5 V	25 V	

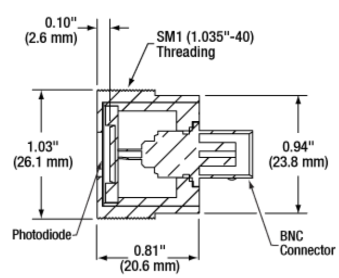
a. Click the link to view specifications for the integrated photodiode.
b. R_L = 50 Ω
c. The photodiode will be slower at NIR wavelengths.

Part Number	Description	Price	Availability
SM1PD2A	**Mounted UV Enhanced Silicon Photodiode, 200-1100 nm, Cathode Grounded**	**$258.43**	**Today**
SM1PD1A	**Mounted Silicon Photodiode, 350-1100 nm, Cathode Grounded**	**$140.87**	**Today**

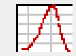
Hide SM1-Threaded Mounted Photodiode, Anode Grounded

SM1-Threaded Mounted Photodiode, Anode Grounded





	Detector	Rise/Fall Time		NEP		Spectral		Junction	Reverse Bias	

Item #	Info[a]	(Typ.)[b,c]	Active Area (Dimensions)	($W/Hz^{1/2}$)	Dark Current	Range (nm)	Material	Capacitance (Typ.)	Voltage (Max)	Responsivity Plots
SM1PD1B	FDS1010	65 ns @ 632 nm, 5 V	10 mm x 10 mm Behind Ø9 mm Clear Aperture	2.07×10^{-13}	600 nA (Max) @ 5 V	350 - 1100	Si	375 pF @ 5 V	25 V	

a. Click the link to view specifications for the integrated photodiode.
b. Typical Values; R_L = 50 Ω
c. The photodiode will be slower at NIR wavelengths.

Part Number	Description	Price	Availability
SM1PD1B	**Large Area Mounted Silicon Photodiode, 350-1100 nm, Anode Grounded**	**$140.87**	**Today**

Hide DC Bias Module for Mounted Photodiodes

DC Bias Module for Mounted Photodiodes

- Module for DC Biasing Our Mounted Photodiodes
- Delrin®* Housing Isolates Connectors and Bias Source
- Post Mountable via Bottom-Located 8-32 and M4 Taps

Specifications	
Bias Voltage	-25 to + 25 V
Cutoff Frequency[a]	350 MHz
Photodiode Input Connector	Female BNC
Output Connector	Female SMA
DC Input Connector	2.5 mm Phono Jack (Cable Included)
Housing Dimensions	2.48" x 1.40" x 0.80" (63.0 mm x 35.6 mm x 20.3 mm)
Operating Temperature	0 to 40 °C
Storage Temperature	0 to 40 °C

- Determined by the Photodiode Used

The PBM42 Bias Module allows a DC bias voltage from a user-supplied, external source to be applied to photodiodes. Designed for use with our mounted photodiodes, the module can accept an input bias voltage from -25 to +25 V from a user-supplied source and has a maximum bandwidth of 350 MHz (dependent on the photodiode).

The input side of the bias module has a BNC connector that can be connected to any of our mounted photodiodes equipped with the same connector by using a BNC cable or T3533 BNC adapter. Alternatively, the input side can be connected to any of our mounted photodiodes with SMA connectors by using an SMA-to-BNC cable or T4001 SMA-to-BNC adapter.

The bias module has an SMA connector on the output side and a 2.5 mm phono jack for the DC voltage input. A 36"-long cable with a 2.5 mm phono plug on one end and bare wires on the other is included with the module. Please note that the photodiode should be operated with a reverse bias. Forward biasing the photodiode can cause damage. For cathode-grounded photodiodes, the tip of the phono plug must be positive. For anode-grounded photodiodes, the tip of the phono plug must be negative. We recommend using a low-noise power supply with the module. For grounding and reverse bias voltage information on all our mounted photodiodes, please see the tables above.

For best frequency performance, the output of the bias module should be terminated with a 50 Ω cable and a 50 Ω impedance device or terminator, such as our T4119. For flexibility in output voltage, the VT2 variable terminator can also be used.

To ensure electrical isolation of the connectors and to protect the photodiode, the compact housing of the PBM42 is constructed from Delrin. Additionally, the housing offers one 8-32-tapped hole and one M4-tapped hole for mounting on our Ø1/2" posts, as shown on the *Overview* tab.

For more information, please see the full presentation on the PBM42 Bias Module.

*Delrin® is a registered trademark of DuPont Polymers, Inc.

Part Number	Description	Price	Availability
PBM42	**Bias Module for Mounted Photodiodes, BNC Input, SMA Output**	**$90.68**	**Today**

Visit the *Mounted Photodiodes* page for pricing and availability information:
https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=1285


SM05PD7A