T505 - February 6, 2024

Item # T505 was discontinued on February 6, 2024 For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

HIGH-SPEED FREE-SPACE DETECTORS

- ▶ **Sensitive to Wavelengths from 400 - 1700 nm**
- ▶ **Bandwidths from 2 GHz to 5 GHz**
- ▶ **Rise Times as Short as 70 ps**

DET08C
AR-Coated Window

DET025A
AR-Coated Window

DET2B
Replaces the battery in our DET series detectors and includes the LDS12B power supply and DET2A power adapter, shown connected.

DET08CL
Uncoated Ball Lens

DET025AL
Uncoated Ball Lens

OVERVIEW

Features

- Four Models Cover Wavelengths from 400 - 1700 nm
- Bandwidths Ranging from 2 to 5 GHz
- Rise Times from 70 ps to 155 ps
- Free-Space Input
- Available with a Flat, AR-Coated Window or Uncoated N-BK7 Ball Lens
- SMA Output Connector
- 8-32 (M4) Tap for Post Mounting

Selection Guide for High-Speed Free-Space Detectors

Wavelength	Element	Input	Bandwidth	Model
400 - 1100 nm	Si	Window	2 GHz	DET025A
		Lens		DET025AL
800 - 1700 nm	InGaAs	Window	5 GHz	DET08C
		Lens		DET08CL

Thorlabs offers a variety of high-speed, high-bandwidth photodetectors designed for free-space input. Together, these detectors are sensitive from the visible to the near infrared (400 - 1700 nm); please see the "Selection Guide" table above for the exact spectral range covered by each detector. All detectors shown here feature GHz signal bandwidths and offer the same ease of use as the rest of our popular DET series. These detectors are designed to perform in test or measurement applications, including research in the fields of data communications, analog microwave, and general high-speed photonics. For comparable detection of fiber-coupled radiation, Thorlabs offers high-speed fiber-coupled detectors. We also have a variety of internally biased free-space photodiodes that operate at slower speeds than the detectors featured here. Our biased photodetectors are compatible with our benchtop photodiode amplifier and PMT transimpedance amplifier.

PDA200C Benchtop Photodiode Amplifier Connected to a DET025A Photodetector Using an SMA-to-BNC Cable

These free-space detectors are reverse biased and contain an internal bias battery, producing a linear response to the incident input light. To maintain the high signal bandwidth, the signal is output through an SMA connector. Thorlabs offers a complete range of electrical adapters and cables, including SMA cables and SMA-to-BNC adapters, for monitoring the output signal with an oscilloscope or other measurement electronics.

Our Si-based free-space detectors are designed for use in the 400 - 1100 nm (DET025A and DET025AL) wavelength range and provide a bandwidth of 2 GHz. For applications extending into the near infrared, consider our InGaAs-based free-space detectors, which provide detection in the 800 - 1700 nm (DET08C and DET08CL) wavelength range and provide a bandwidth of 5 GHz. When looking at high-speed signals, Thorlabs recommends using a 50 Ω load resistor. For lower bandwidth applications, our variable terminator or fixed stub-style terminators quickly adjusts the measured voltage.

Both of the Si-based and InGaAs-based detectors are available with either a flat, AR-coated window or an uncoated ball lens free-space input (see the photos to the right for details). The ball lens captures and focuses incident light onto the relatively

Uncoated Ball Lens Input on the DET08CL

Flat, AR-Coated Window Input on the DET025A

small active area of the detector, making it advantagous for use in applications where the signal input needs to be increased. If the input signal is sufficiently large, a detector with a window over the aperture is recommended since focusing a strong input signal can cause saturation, and possibly damage, to the detector. Additionally, we recommend the detectors with the window over those with the lens when working with a pulsed source, as the chromatic dispersion that occurs as the light passes through the lens can artificially elongate the pulse.

All of these detectors include an A23 12 VDC Bias battery; this was chosen because it provides an extremely low noise source of power. This battery is optionally replaceable by the DET2B Power Adapter Bundle (sold below) when the detector is being used in applications where a small increase in the signal noise due to noise in the line voltage is permissible or the finite lifetime of a battery is not acceptable. Please note that due to slight physical variations of the positive terminal from manufacturer to manufacturer, Thorlabs only recommends using an Energizer® battery in our DET series of photodetectors.

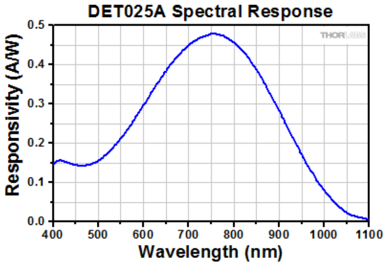
Please note that inhomogeneities at the edges of the active area of the detector can generate unwanted capacitance and resistance effects that distort the time-domain response of the photodiode output. Thorlabs therefore recommends that the incident light on the photodiode is well centered on the active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

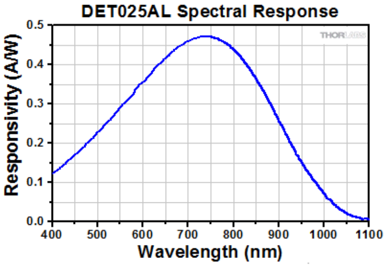
SPECS

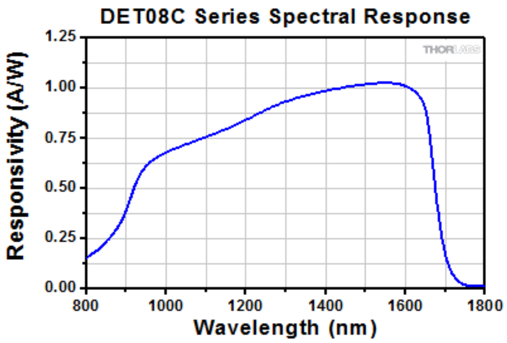
Item #	DET025A	DET025AL	DET08C	DET08CL
Wavelength Range	400 - 1100 nm		800 - 1700 nm	
Material	Si		InGaAs	
Active Area	Ø250 µm		Ø80 µm	
Bandwidth (-3 dB)[a,b,c]	2 GHz		5 GHz	
Input	Flat, AR-Coated Window	Uncoated N-BK7 Ball Lens	Flat, AR-Coated Window	Uncoated N-BK7 Ball Lens
Ball Lens Diameter	N/A	0.059" (1.50 mm)	N/A	0.059" (1.50 mm)
Aperture Size	Ø0.13" (Ø3.2 mm)		Ø0.13" (Ø3.2 mm)	
Signal Output	SMA		SMA	
Minimum Resistor Load	50 Ω		50 Ω	
Maximum Peak Power	18 mW		100 mW	
Output Voltage[d]	2 V (Max)			
Rise Time (t_r)	150 ps @ 653 nm, 20%/80%[a,b,c] (Typ.)		70 ps @ 952 nm, 20%/80%[a,b,c] (Typ.)	
Fall Time (t_f)	150 ps @ 653 nm, 80%/20%[a,b,c] (Typ.)		110 ps @ 952 nm, 80%/20%[a,b,c] (Typ.)	
Bias Voltage	12 V			
Dark Current[a,e]	35 pA		1.5 nA	
NEP (Maximum)	9.29 x 10^{-15} W/√Hz (@ 730 nm)		2 x 10^{-15} W/√Hz (@ 1550 nm)	
Junction Capacitance	1.73 pF (Max)		0.3 pF	
Photodiode Element	-	FDS025	-	

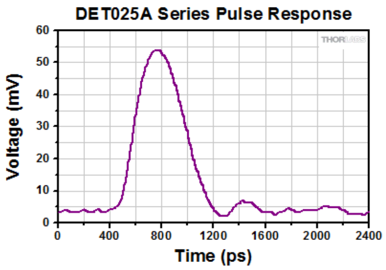
a. Measured with a specified bias voltage of 12 V.
b. For a 50 Ω Load
c. Low battery voltage will result in slower rise times and decreased bandwidth.
d. A higher output voltage will decrease the bandwidth.
e. For a 1 MΩ Load

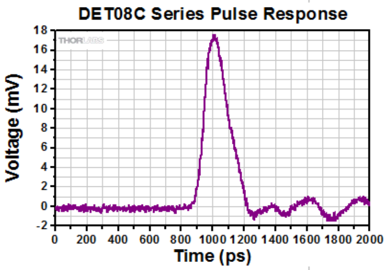
GRAPHS









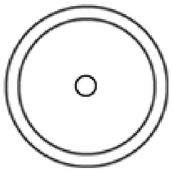


Note: The data for all graphs above were obtained for their respective detectors with the AR-Coated windows included in the measurement set up.

PIN DIAGRAMS

Signal Output

SMA Female



0 - 10 V w/ 50 Ω

BATTERY LIFETIME

Battery Lifetime

When using a battery-operated photodetector it is important to understand the battery’s lifetime and how this affects the operation of the detector. As a current output device, the output current of the photodetector is directly proportional to the light incidented on the detector. Most users will convert this current to a voltage by using a load-terminating resistor. The resistance value is approximately equal to the circuit gain. For very high speed detectors, such as those sold on this page, it is very important to use a 50 Ω terminating resistor to match the impedance of standard coax cables to reduce cable reflections and improve overall signal performance and integrity. Most high bandwidth scopes come equipped with this termination.

The battery usage lifetime directly correlates to the current used by the detector. Most battery manufacturers provide a battery lifetime in terms of mA hr. For example, the battery supplied with the DET08CL detectors is rated for 40 mA hrs. This means that it will reliably operate for 40 hr at a current draw of 1.0 mA. This battery will be used in the following example on how to determine battery lifetime based on usage.

For this example we have a 780 nm light source with an average 1 mW power is applied to an DET08CL. The responsivity of a biased photodetector based on the response curve at this wavelength is 0.5 A/W. The photocurrent can be calculated as:

$$\begin{aligned} I_{current} &= 0.5\ A/W \times 1\ mW \\ &= 0.5\ mA \end{aligned}$$

Given the battery has a rated lifetime of 40 mA hr, the battery will last:

$$\begin{aligned} T &= \frac{40\ mA * hr}{0.5\ mA} \\ &= 80\ hr \end{aligned}$$

or 3.3 days of continuous use. By reducing the average incident power of the light to 10 µW, the same battery would last for about 333 days when used continuously. When using the recommended 50 Ω terminating load, the 0.5 mA photocurrent will be converted into a voltage of:

$$\begin{aligned} V &= I \times R \\ &= 0.5\ mA \times 50\ \Omega \\ &= 25\ mV \end{aligned}$$

If the incident power level is reduced to 10 µW, the output voltage becomes 0.25 mV. For some measurement devices this signal level may be too low and a compromise between battery life and measurement accuracy will need to be made.

When using a battery-powered, biased photodetector, it is desirable to use as low a light intensity as is possible, keeping in mind the minimum voltage levels required. It is also important to remember that a battery will not immediately cease producing a current as it nears the end of its lifetime. Instead, the voltage of the battery will drop, and the electric potential being applied to the photodiode will decrease. This in turn will increase the response time of the detector and lower its bandwidth. As a result, it is important to make sure the battery has sufficient voltage (as given in the *Troubleshooting* chapter of the detector's manual) for the detector to operate within its specified parameters. The voltage can be checked with a multimeter.

Another suggestion to increase the battery lifetime is to remove, or power down the light source illuminating the sensor. Without the light source, the photodetector will continue to draw current proportional to the photodetector's dark current, but this current will be significantly smaller. For example, the DET08CL has a dark current less than 1.5 nA.

For applications where a DET series photodetector is being continuously illuminated with a relatively high-power light source or if having to change the battery is not acceptable, we offer the DET2B power adapter bundle, which includes the power adapter and power supply (sold below). The drawback to this option is the noise in the line voltage will add to the noise in the output signal and could cause more measurement uncertainty.

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 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.

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

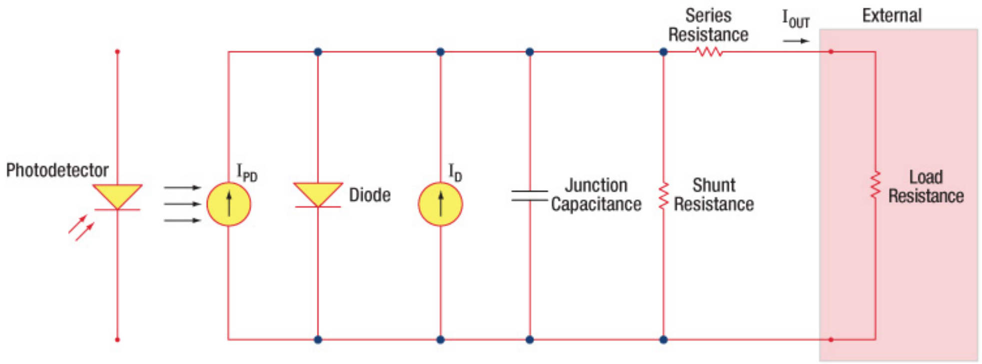


Figure 1: Photodiode Model

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

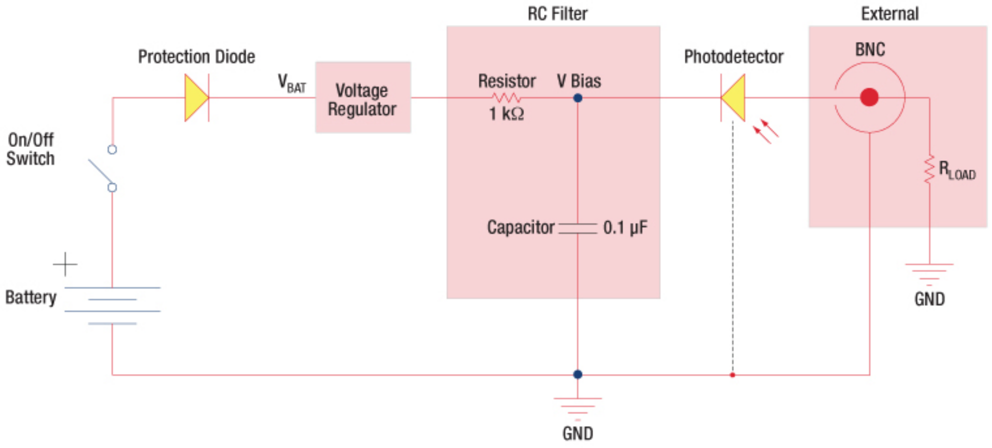


Figure 2: Reverse-Biased Circuit (DET Series Detectors)

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.

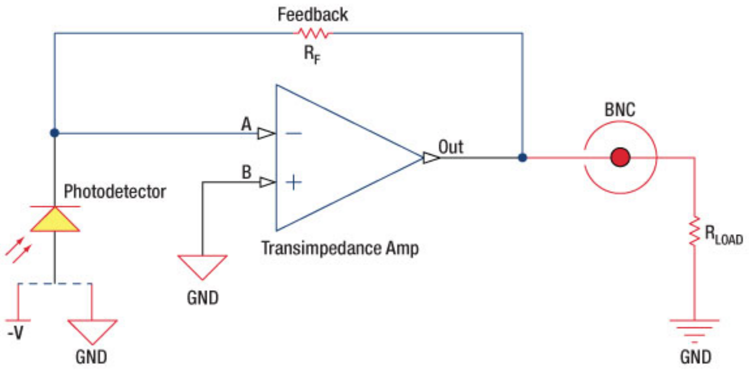


Figure 3: Amplified Detector Circuit

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

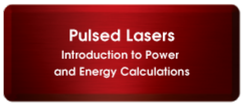
The photoconductor signal will remain constant up to the time constant response limit. Many detectors, including PbS, PbSe, HgCdTe (MCT), and InAsSb, have a typical 1/f noise spectrum (i.e., the noise decreases as chopping frequency increases), which has a profound impact on the time constant at lower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

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

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

PULSE CALCULATIONS

Pulsed Laser Emission: Power and Energy Calculations



Pulsed Lasers
Introduction to 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:

- 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.

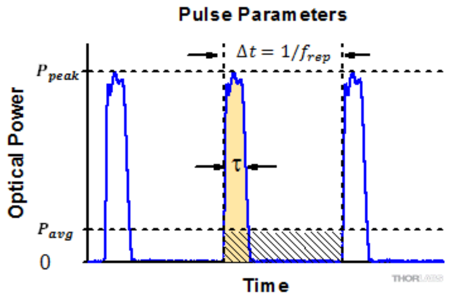


Figure 1: Parameters used to describe pulsed laser emission are indicated in the plot (above) and described in the table (below). **Pulse energy** (**E**) is the shaded area under the pulse curve. Pulse energy is, equivalently, the area of the diagonally hashed region.

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	**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	**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	**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:

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

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.

CROSS REFERENCE

The following table lists Thorlabs' selection of photodiodes, photoconductive, and pyroelectric 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
200 - 1100 nm	Si	FDS010	SM05PD2A SM05PD2B	DET10A2	PDA10A2	-
	Si	-	SM1PD2A	-	-	-
240 - 1170 nm	B-Si	-	-	DET20X2	-	-
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	-	-	-	PDA015A2 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	-	-
0.6 - 16 µm	$LiTaO_3$	-	-	-	PDA13L2[e]	-
750 - 1650 nm	InGaAs	-	-	-	PDA8GS	-
800 - 1700 nm	InGaAs	FGA015	-	-	PDA015C2	-
	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 [f]	-	-	PDAVJ8	-
2.0 - 10.6 µm	HgCdTe (MCT)	VML10T0 VML10T4 [f]	-	-	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. Pyroelectric Detector
f. Photovoltaic Detector with Thermoelectric Cooler

Free-Space Si Detectors: 400 - 1100 nm

The DET025A(/M) and DET025AL(/M) high-speed, free-space detectors are designed for use in the 400 - 1100 nm spectral range. The DET025A(/M) has a flat, AR coated window at the input aperture, while the DET025AL(/M) uses the FDS025 photodiode which has an uncoated ball lens at the input aperture that focuses light onto the detector.

Both detectors have a 2 GHz bandwidth. An 8-32 tapped mounting hole (M4 for the metric version) allows easy mounting to our Ø1/2" posts.

SMA Output on the DET025A Detector

Item #	Wavelength	Detector	Input	Bandwidth	Max Peak Power	Bias Voltage	Rise Time	Fall Time
DET025A(/M)	400 - 1100 nm	Si	Flat AR-Coated Window	2 GHz	18 mW	12 V	150 ps (Typ.)	150 ps (Typ.)
DET025AL(/M)			Uncoated N-BK7 Ball Lens					

Part Number	Description	Price	Availability
DET025A/M	**2 GHz Si Free-Space Photodetector with Window, 400 - 1100 nm, M4 Tap**	**$250.65**	**Today**
DET025AL/M	**2 GHz Si Free-Space Photodetector with Lens, 400 - 1100 nm, M4 Tap**	**$250.65**	**7-10 Days**
DET025A	**2 GHz Si Free-Space Photodetector with Window, 400 - 1100 nm, 8-32 Tap**	**$250.65**	**Today**
DET025AL	**2 GHz Si Free-Space Photodetector with Lens, 400 - 1100 nm, 8-32 Tap**	**$250.65**	**Today**

Free-Space InGaAs Detectors: 800 - 1700 nm

The DET08C(/M) and DET08CL(/M) high-speed, free-space detectors are designed for use in the 800 - 1700 nm spectral range. The DET08C(/M) detector has a flat, AR-coated window at the input aperture, while the DET08CL(/M) detector has an uncoated ball lens at the input aperture that focuses the light onto the detector.

These detectors use an InGaAs detector element and feature a 5 GHz bandwidth. An 8-32 tapped mounting hole (M4 for the metric version) allows easy mounting to our series of Ø1/2" posts.

SMA Output on the DET08C Detector

					Max Peak	Bias	Rise	Fall

Item #	Wavelength	Detector	Input	Bandwidth	Power	Voltage	Time	Time
DET08C(/M)	800 - 1700 nm	InGaAs	Flat, AR-Coated Window	5 GHz	100 mW	12 V	70 ps (Typ.)	110 ps (Typ.)
DET08CL(/M)			Uncoated N-BK7 Ball Lens					

Part Number	Description	Price	Availability
DET08C/M	**5 GHz InGaAs Free-Space Photodetector with Window, 800 - 1700 nm, M4 Tap**	**$325.49**	**7-10 Days**
DET08CL/M	**5 GHz InGaAs Free-Space Photodetector with Lens, 800 - 1700 nm, M4 Tap**	**$325.49**	**Today**
DET08C	**5 GHz InGaAs Free-Space Photodetector with Window, 800 - 1700 nm, 8-32 Tap**	**$325.49**	**Today**
DET08CL	**5 GHz InGaAs Free-Space Photodetector with Lens, 800 - 1700 nm, 8-32 Tap**	**$325.49**	**Today**

Replacement Batteries for Photodetectors

- **A23:** For Currently Shipping DET Photodetectors
- **T505:** For Discontinued DET1-SI and DET2-SI Detectors

The A23 and T505 are replacement alkaline batteries for Thorlabs' currently shipping and discontinued DET photodetectors. For cases where the finite lifetime of a battery is not acceptable, we also offer an AC power adapter; please see below for more information. Information on expected battery lifetime is in the *Battery Lifetime* tab above.

Part Number	Description	Price	Availability
A23	**Replacement 12 V Alkaline Battery for DET Series (Except DET1-SI and DET2-SI)**	**$5.85**	**Today**
T505	**Replacement 22.5 V Alkaline Battery for DET1-SI and DET2-SI**	**$19.95**	**Today**

DET Power Adapter

- **DET2A:** Power Adapter for DET Series Detectors
- **LDS12B**: ±12 VDC Power Supply
- **DET2B:** Bundle of the DET2A and LDS12B

DET2A Power Adapter
The DET2A is a power adapter for our DET series detectors. This power adapter will directly replace the A23 battery and spring-loaded cap to allow the detector to run directly from our LDS12B power supply (sold separately). The DET2A is also compatible with the PDA-C-72 power supply cable for custom connections. Note that when connecting the DET2A and the PDA-C-72 to power DET series detectors, only the brown (+12 V) and black (GND) pins are needed.

LDS12B Power Supply
The LDS12B is a ±12 VDC regulated power supply, which incorporates a current limit, enabling short circuit and overload protection; an on/off switch with an LED indicator; and a switchable AC input voltage (100, 120, or 230 VAC). A region-specific power cord is shipped with the LDS12B power supply based on your location.

DET2B Power Adapter Bundle
The DET2B power adapter bundle includes both the DET2A power adapter and the LDS12B power supply. This power adapter bundle can be used to replace the battery in our DET series detectors. To use the DET2B, simply replace the battery and spring-loaded cap with the included DET2A adapter, insert the 3-pin plug from the LDS12B power supply into the adapter, and screw the adapter into the detector. This procedure is depicted in the animation to the above right.

Part Number	Description	Price	Availability
DET2A	**DET Power Adapter**	**$46.01**	**Today**
LDS12B	**±12 VDC Regulated Linear Power Supply, 6 W, 100/120/230 VAC**	**$93.55**	**Today**
DET2B	**DET Power Adapter & Power Supply Bundle**	**$137.43**	**7-10 Days**


Exell
505 / 221A
22.5 Volts
+