PDA8GS - March 23, 2023

Item # PDA8GS was discontinued on March 23, 2023. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

InGaAs FIBER-COUPLED AMPLIFIED PHOTODETECTOR

- Wavelength Ranges Between 750 - 1650 nm
- High Signal-to-Noise Ratio
- Ultrafast up to 9.5 GHz
- Fixed or Switchable Gain Versions

FPD310-FC-NIR
Switchable Gain
1500 MHz Max Bandwidth

PDA8GS
Fixed Gain
9.5 GHz Max Bandwidth

FPD610-FC-NIR
Fixed Gain
600 MHz Max Bandwidth

OVERVIEW

Features

- Built-in Amplifier
- OEM Package with FC Bulkhead or Fiber-Coupled Module
- Small Package Allows Easy Mounting
- Minimum Recommended Load Resistor: 50 Ω
- Power Supply Included

Applications

FPD310-FC-NIR

- Detection of Fast Laser Pulses
- Detection of Low Light Signals
- Radio Frequency and Pulse Shape Extraction of Laser Light Sources
- Heterodyne Laser Beat Signal Detection

FPD510-FC-NIR & FPD610-FC-NIR

- Efficient Homodyne and Heterodyne Extraction of Optical Beat Signals
- Detection of Low Light Signals
- Characterization of Pulse Modulated Light Sources
- Detection of Chopped Light Sources

We offer a selection of Indium Gallium Arsenide (InGaAs) Fiber-Coupled Amplified Photodetectors that are sensitive to light in the NIR wavelength range. These fast response detectors are ideal for detection of fast laser pulses, low-light level signals, or chopped light sources. All detectors include a power supply.

Application idea for the PDA8GS 9.5 GHz amplified photodetector.

PDA8GS

The PDA8GS is a versatile, high-speed, amplified photodetector designed to perform in a wide range of test and measurement applications involving fast optical signals. The unit incorporates a high-performance InGaAs PIN photodiode coupled with a transimpedance amplifier that has a gain of 460 V/A into 50 Ω with data rates up to 12.5 Gb/s. The wide bandwidth makes it ideal for evaluating pulsed laser and high-frequency modulation applications. Communication applications include 10 Gb Ethernet, OC192, and analog satellite microwave systems. This model exhibits linear performance across the input range, yielding low analog distortion. A 12 VDC, 750 mA power adapter is included with the PDA8GS. The housing features an FC bulkhead connector, which is compatible with both FC/PC and FC/APC connectors.

FPD310-FC-NIR
Menlo Systems' high-sensitivity, ultrafast PIN FPD310-FC-NIR photodetector is optimized for high gain, high bandwidths, extremely short rise times and high signal-to-noise ratio. The photodetector is an easy-to-use, InGaAs PIN photodiode with an integrated high-gain, low-noise, RF amplifier. The gain can be switched between two fixed settings, which allows optimal performance for many applications. The compact design of this detector allows for easy OEM integration. A low noise power supply with a universal AC input is included. This detector has an SMF28 Pigtail with an FC/APC optical input.

FPD510-FC-NIR & FPD610-FC-NIR
Menlo Systems' high-sensitivity, ultrafast PIN FPD510-FC-NIR and FPD610-FC-NIR photodetectors are optimized for maximum signal-to-noise-ratio for detection of low-level optical beat signals and pulse shapes at frequencies up to 250 MHz and 600 MHz, respectively. These photodetectors are easy-to-use, InGaAs PIN photodiodes with an integrated high-gain, low-noise transimpedance amplifier. The 3 dB bandwidth of these DC-coupled devices is 200 MHz for FPD510-FC-NIR and 500 MHz for FPD610-FC-NIR. The compact design of the detectors allows for easy OEM integration. A low noise power supply with a universal AC input is included with each. The detectors have an SMF28 Pigtail with an FC/APC optical input.

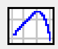
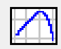
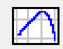
For InGaAs photodetectors with free-space input, click here.

SPECS

Item #	PDA8GS
Material	InGaAs
Bandwidth	DC - 9.5 GHz
Wavelength Range	750 - 1650 nm
Fiber Input	62.5 µm Core Multimode Fiber
Input Connector[a]	FC Bulkhead
Output, 700 mV (Max)[b]	SMA - 50 Ω
Peak Response, SM (Typ.)	0.95 A/W @ 1550 nm
Peak Response, MM (Typ.)	0.525 A/W @ 850 nm
Transimpedance Gain	460 V/A into 50 Ω
Max Optical Power (CW)[b]	1.0 mW
Max Peak Power (Pulsed)[b]	20 mW[c]
Rise Time	<50 ps
Fall Time	<50 ps
Dark Current	-
NEP (Max)	N/A
Junction Capacitance	N/A
Housing Dimensions	3.0" x 2.38" x 1.1" (76.2 mm x 60.45 mm x 27.94 mm)

a. Compatible with both FC/PC and FC/APC connectors.
b. Damage to the photodiode may occur if these maximum ratings are exceeded.
c. Do not hold peak optical power for longer than a 60 ms burst.

Item #	FPD310-FC-NIR	FPD510-FC-NIR	FPD610-FC-NIR
Material	InGaAs		
Optical Input	SMF28 pigtail with FC/APC		
Spectral Range	950 - 1650 nm		
Saturation Limit	<200 µW	<100 µW	<100 µW
Damage Threshold	2 mW	3 mW	3 mW

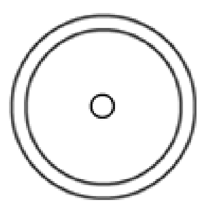
Frequency Range	1 - 1500 MHz	DC - 250 MHz	DC - 600 MHz
3 dB Bandwidth	5 - 1000 MHz	DC - 200 MHz	DC - 500 MHz
Rise Time	0.5 ns	2 ns	1 ns
Gain (fs Pulsed Input)[a]	Setting 1: 2 x 10^4 V_{pp}/W Setting 2: 2 x 10^3 V_{pp}/W	1.5 x 10^5 V_{pp}/W	2 x 10^6 V_{pp}/W
Gain (CW Input)[a]	Setting 1: 2.5 x 10^3 V_{pp}/W Setting 2: 2.5 x 10^2 V_{pp}/W	5 x 10^4 V_{pp}/W	5 x 10^5 V_{pp}W
Dark State Noise Level	-100 dBm/Hz$^{1/2}$ (up to 5 MHz) -130 dBm/Hz$^{1/2}$ (5 to 1500 MHz)	-110 dBm/Hz$^{1/2}$ (up to 5 MHz) -135 dBm/Hz$^{1/2}$ (5 to 250 MHz)	-80 dBm/Hz$^{1/2}$ (up to 5 MHz) -100 dBm/Hz$^{1/2}$ (5 to 600 MHz)
NEP (calculated)	12.0 pW/Hz$^{1/2}$	3.0 pW/Hz$^{1/2}$	5.6 pW/Hz$^{1/2}$
Output Impedance	50 Ω	50 Ω	50 Ω
Output Coupling	AC	DC	DC
Output Signal	~1 V	0 - 1 V	0 - 1 V
Supply Voltage / Max. Current Consumption	+12 VDC / 100 mA	+12 VDC / 50 mA -12 VDC / 20 mA	+5 VDC / <250 mA -12 VDC / <50 mA
Typical Performance Graphs			
Output Connector	SMA female		
Operating Temperature	10 to 40 °C		
Storage Temperature	-20 to +85 °C		
Storage Humidity (RH)	10% to 90%		
Device Dimensions	60 mm x 50 mm x 20 mm (2.4" x 2.0" x 0.79")		

a. These detectors are optimized for femtosecond pulses within the specified frequency range. Gain will be approximately a factor of 10 lower for CW operation.

PIN DIAGRAMS

PDA8GS

Signal Out- SMA Female (Photodetector)

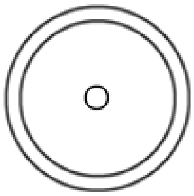


For connection to a suitable monitoring device, e.g. oscilloscope or RF-spectrum-analyzer, with 50 Ω impedance.

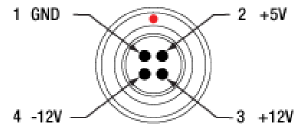
FPD Series Detectors

Signal Out- SMA Female (Photodetector)

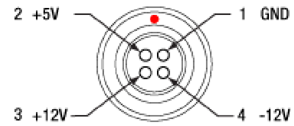
Female (Power Cables)



For connection to a suitable monitoring device, e.g. oscilloscope or RF-spectrum-analyzer, with 50 Ω impedance.



Male Power IN (Photodetector)



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:

- 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*:** $P_{peak} \approx \frac{E}{\tau}$

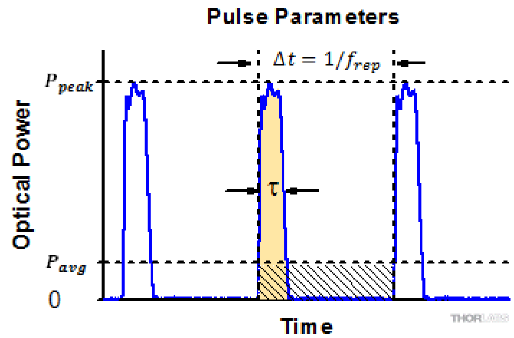
***Peak power* and *average power* calculated from each other:**

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

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

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.

InGaAs Fiber-Coupled Amplified Photodetectors

Part Number	Description	Price	Availability
FPD310-FC-NIR	InGaAs Switchable Gain, High Sensitivity PIN Amplified Detector, 950 - 1650 nm, 1 MHz - 1.5 GHz	$2,145.21	Today
FPD510-FC-NIR	InGaAs Fixed Gain, High Sensitivity PIN Amplified Detector, 950 - 1650 nm, DC - 250 MHz	$2,145.21	Today
FPD610-FC-NIR	InGaAs Fixed Gain, High Sensitivity PIN Amplified Detector, 950 - 1650 nm, DC - 600 MHz	$2,145.21	Today
PDA8GS	InGaAs Fixed Gain Amplified Detector, 750 - 1650 nm, DC - 9.5 GHz	$4,856.50	Lead Time