56 Sparta Avenue • Newton, New Jersey 07860
(973) 300-3000 Sales • (973) 300-3600 Fax
www.thorlabs.com

THORLABS

APD110C - DEC 18, 2019

Item # APD110C was discontinued on DEC 18, 2019. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

INGAAS AVALANCHE PHOTODETECTORS

- High-Speed Response up to 1 GHz
- Conversion Gains up to 9.0×10^6 V/W
- Wavelength Ranges Covering 850 to 1700 nm
- Temperature-Compensated and Variable Gain Versions Available

APD310
High-Speed APD

APD110C
Standard APD

APD130C
Temperature-Compensated APD

APD430C
Variable-Gain, Temperature-Compensated APD

Hide Overview

OVERVIEW

Features

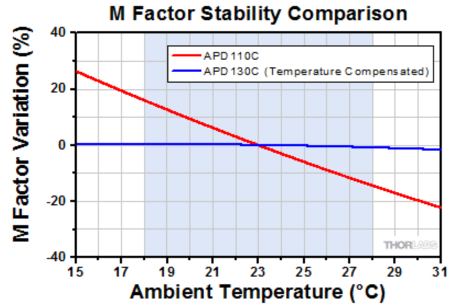
- Noise Equivalent Powers (NEP) as Low as 0.12 pW/√Hz
- Max Bandwidth up to 1 GHz at 3 dB
- Temperature-Compensated Versions Provide M Factor Stability of ≤±3% Over 18 to 28 °C
- Variable Gain Detectors Available: M Factor from 4 to 20 or 2 to 10
- Internal SM05 and External SM1 Threading for Lens Tubes
- Power Supply Included

InGaAs APD Selection Guide			
Item #	**Wavelength Range**	**Bandwidth (3 dB)**	**Type (Quick Links)**
APD110C	900 - 1700 nm	DC - 50 MHz	Standard
APD130C(/M)			Temperature Compensated
APD410C(/M)		DC - 10 MHz	Variable Gain, Temperature Compensated
APD430C(/M)		DC - 400 MHz	
APD450C	1260 - 1620 nm	0.3 - 1600 MHz	
APD310	850 - 1650 nm	5 - 1000 MHz	Variable Gain

Thorlabs' InGaAs Avalanche photodetectors (APDs) are designed to offer increased sensitivity and lower noise compared to standard PIN detectors, making them ideal for applications with low optical power levels. In addition to our standard APDs, versions featuring variable gain (i.e., M factor) and/or temperature compensation are offered.

In general, avalanche photodiodes use an internal gain mechanism to increase sensitivity. A high reverse bias voltage is applied to the diodes to create a strong electric field. When an incident photon generates an electron-hole pair, the electric field accelerates the electrons, leading to the production of secondary electrons by impact ionization. The resulting electron avalanche can produce a gain factor of several hundred times, described by a multiplication factor, M, that is a function of both the reverse bias voltage and temperature. In general, the M factor increases with lower temperatures and decreases with higher temperatures. Similarly, the M factor will increase when the reverse bias voltage is raised and decrease when the reverse bias voltage is lowered.

Our APD130C(/M) temperature-compensated APD features an integrated thermistor that adjusts the bias voltage to compensate for the effect of temperature changes on the M factor. A comparison with our non-temperature-compensated APDs is provided in the graph to the right.



Click to Enlarge
The above plot shows sample data comparing the M factor stability of our temperature-compensated avalanche photodetectors to our standard packages. The blue shaded region indicates the temperature range over which the M factor stability is guaranteed to within ±3%.

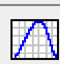
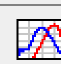
In addition to being temperature compensated, the APD410C(/M), APD430C(/M), and APD450C variable-gain APDs allow the reverse bias voltage across the diode to be adjusted via a rotary knob on the side of the housing, which varies the M factor continuously from 4 to 20.

For extremely light-sensitive applications, Thorlabs offers Menlo Systems' APD310 variable-gain, high-sensitivity avalanche photodectector, which offers high-speed response up to 1 GHz.

A complete list of all of our APDs, including those that have a silicon photodiode for use at UV and visible wavelengths, can be found on the *Selection Guide* tab. Please note that these packaged APDs are not suitable for use as single photon counters. Thorlabs has single photon counters available here.

Hide APDxxxC Specs

APDXXXC SPECS

Item #	APD110C	APD130C(/M)	APD410C(/M)	APD430C(/M)	APD450C
Detector Type	InGaAs APD				
Wavelength Range	900 - 1700 nm				1260 - 1620 nm
Output Bandwidth (3 dB)	DC - 50 MHz		DC - 10 MHz	DC - 400 MHz	0.3 - 1600 MHz
Active Area Diameter	0.2 mm				75 µm with Ø1.5 mm Ball Lens
Typical Max Responsivity	9 A/W @ 1500 nm (M = 10)[a]		18 A/W @ 1550 nm (M = 20)		9 A/W @ 1550 nm (M = 10)
Responsivity Graph (Click to View)					
M Factor[b]	10		4 - 20 (Continuously Adjustable)		2 - 10 (Continuously Adjustable)
M Factor Temperature Stability[c]	Not Specified	±2% (Typical); ±3% (Max)			
Transimpedance Gain	50 kV/A (50 Ω Termination)[d] 100 kV/A (High-Z Termination)		250 kV/A (50 Ω Termination)[d] 500 kV/A (High-Z Termination)	5 kV/A (50 Ω Termination)[d] 10 kV/A (High-Z Termination)	5 kV/A (50 Ω Termination)
Max Conversion Gain[e,f]	0.9×10^6 V/W		9.0×10^6 V/W	1.8×10^5 V/W	45×10^3 V/W
CW Saturation Power	4.2 µW		0.45 µW @ 1550 nm (M = 20) 2.25 µW @ 1550 nm (M = 4)	22 µW @ 1550 nm (M = 20) 110 µW @ 1550 nm (M = 4)	0.1 mW @ 1550 nm (M=10) 0.5 mW @ 1550 nm (M=2)
Max Input Power[g]	1 mW				
Minimum NEP[h]	0.46 pW/√Hz (DC - 50 MHz)		0.12 pW/√Hz (DC - 10 MHz)	0.45 pW/√Hz (DC - 100 MHz)	1.1 pW/√Hz (0.3 - 1600 MHz)
Integrated Noise[i]	3.3 nW (RMS, DC - 50 MHz)		0.38 nW (RMS, DC - 10 MHz)	17 nW (RMS, DC - 400 MHz)	35 pW (0.3 - 1600 MHz)

Electrical Output	50 Ω BNC			50 Ω SMA
Max Output Voltage Swing	1.8 V (50 Ω Termination) 3.6 V (High-Z Termination)	2.0 V (50 Ω Termination) 4.1 V (High-Z Termination)		2.0 V (50 Ω Termination)
DC Offset Electrical Output	< ±15 mV	< ±25 mV	< ±3 mV	N/A
Included Power Supply[j]	±12 V @ 250 mA (100/120/230 VAC, 50 - 60 Hz, Switchable)			
General				
Operating Temperature Range	0 to 40 °C (Non-Condensing)			
Storage Temperature Range	-40 to 70 °C			
Dimensions (H x W x D)	2.97" x 2.00" x 1.08" (75.5 mm x 50.8 mm x 27.4 mm)	2.97" x 2.20" x 1.09" (75.5 mm x 55.8 mm x 27.6 mm)		2.83" x 2.22" x 1.08" (72.0 mm x 56.3 mm x 27.4 mm)

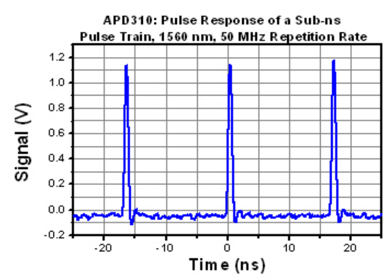
- These detectors are factory set to M = 10, but other M factors are available on request. Please contact techsupport@thorlabs.com for more information.
- The responsivity scales with the M factor, which is dependent on the reverse bias voltage across the photodiode. For a given photodiode, a higher M factor corresponds to a higher reverse bias voltage, which increases the photodiode responsivity. By definition, M = 1 corresponds to a reverse bias voltage of 0 V.
- Within the 23 ± 5 °C temperature range.
- 50 Ω termination is recommended for the best performance.
- At the Peak Responsivity Wavelength.
- The Conversion Gain is product of the Transimpedance Gain and the Responsivity for a given M factor and wavelength.
- This value is the damage threshold for the photodiode.
- For more information on how NEP is calculated, please see Thorlabs' Noise Equivalent Power White Paper.
- At Maximum Gain Settings
- A replacement power supply is available below.

All technical data are valid at 23 ± 2 °C (APD110C) or 23 ± 5 °C (APD130C, APD410C, APD430C, and APD450C) and 45% ± 15% relative humidity (non-condensing).

Hide APD310 Specs

APD310 SPECS

Item #	**APD310**
Detector Type	InGaAs APD
Wavelength Range	850 - 1650 nm
Bandwidth	5 MHz - 1000 MHz (3 dB) 1 MHz - 1800 MHz (Max)
Active Area Diameter	0.03 mm
Optical Input	Free Space[a]
Conversion Gain (Max)[b]	2.5 x 10^4 V/W @ 1 GHz, 1500 nm
Max Input Power	10 mW
NEP (Calculated)[c]	2 pW/√Hz
Rise Time	500 ps
Dark State Noise Level[d]	-80 dBm
Operating Temperature	10 - 40°C
Electrical Output	BNC, 50 Ω
Output Coupling	AC
Current Consumption	200 mA
Supply Voltage	12 - 15 V[e]
Dimensions	2.4" x 2.2" x 1.87" (60 mm x 56 mm x 47.5 mm)

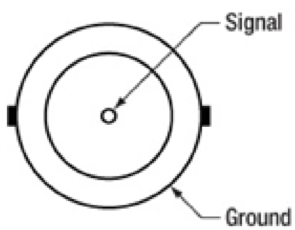


- With adapter for Thorlabs' SM05 Mount
- Gain Adjustable via Push Buttons
- The noise-equivalent power is a measure of the detector's minimum detectable power per square root of bandwidth. Since this value only depends on the detector itself, it can be used to compare two detectors that do not have the same integration time. The smaller the NEP value, the better the detector.
- This is a measure of the noise when no light is incident on the detector's photosensitive area. Span: 5 MHz, Resolution Bandwidth: 3 kHz
- Power supply included with adapters for EU/USA.

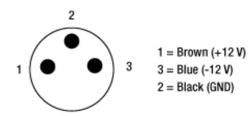
Hide Pin Diagrams

PIN DIAGRAMS

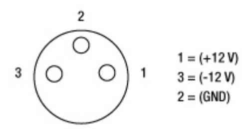
BNC Female Output (Photodetector)



APD Male (Power Cables)



APD Female (Photodetector)



Hide Fiber Coupling

FIBER COUPLING

Fiber Coupling

In fiber coupling applications, we recommend taking into account the divergence of light from the fiber tip to ensure that all of the signal is focused onto the detector active area. When using a standard fiber connector adapter with a detector with an active area smaller than Ø1 mm, high coupling losses and degradation of the frequency response may occur.

Click to Enlarge
Output from a fiber is coupled into the photodetector using an aspheric lens to focus the signal onto the detector active area.

Components for Fiber Coupling	
Item #	**Description**
-	Avalanche Photodetector
LM1XY(/M)	Translating Lens Mount for Ø1" Optics
SM1L10	SM1 (1.035"-40) Lens Tube, 1" Long
-	Fiber Collimator (Dependent on Fiber)
AD11F or AD12F	SM1-Threaded Adapters for Ø11 or Ø12 mm Fiber Collimators (Dependent on Collimator)
-	Mounted Molded Aspheric Lens (Dependent on Collimator)
S1TM06, S1TM08, S1TM09, S1TM10, or S1TM12	SM1-Threaded Adapter for Molded Aspheric Lens Cell (Dependent on Lens)

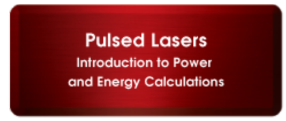
To achieve high coupling efficiency, a fiber collimation package, focusing lens, and X-Y translator should be used, as shown in the photo to the right. The avalanche photodetector is shown with a fiber collimator, lens tube collimator adapter, lens tube, and X-Y translation mount. An adapter inside the lens tube holds an aspheric lens (not visible) to focus the collimated light onto the active area of the detector. The X-Y translation mount corrects for any centering issues.

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

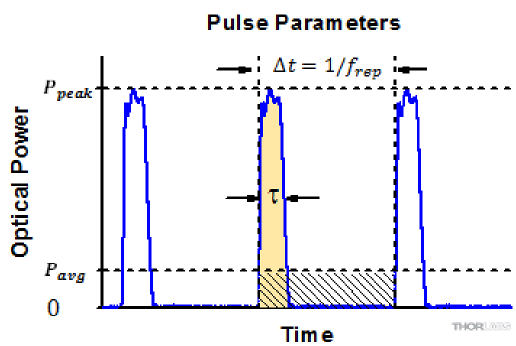
Peak power **and** ***average power*** **calculated from each other:**

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

Hide Selection Guide

SELECTION GUIDE

Avalanche Photodetector Selection Guide

Item #	Detector Type	Wavelength Range	3 dB Bandwidth	Active Area Diameter	M Factor	Typical Max Responsivity	Max Conversion Gain[a]	Temperature Compensated	Variable Gain
APD440A2			DC - 0.1 MHz	1 mm	5 - 50	25 A/W @ 600 nm (M = 50)	1.25 x 10^9 V/W	✓	✓

APD410A2	UV Enhanced Silicon APD	200 - 1000 nm	DC - 10 MHz	0.5 mm	5 - 50	25 A/W @ 600 nm (M = 50)	12.5 x 10^6 V/W	✓	✓
APD130A2			DC - 50 MHz	1 mm	50	25 A/W @ 600 nm (M = 50)	2.5 x 10^6 V/W	✓	-
APD430A2			DC - 400 MHz	0.2 mm	10 - 100	50 A/W @ 600 nm (M = 100)	5.0 x 10^5 V/W	✓	✓
APD440A	Silicon APD	400 - 1000 nm	DC - 0.1 MHz	1 mm	10 - 100	53 A/W @ 800 nm (M = 100)	2.65 x 10^9 V/W	✓	✓
APD410A			DC - 10 MHz	1.0 mm	10 - 100	53 A/W @ 800 nm (M=100)	26.5 x 10^6 V/W	✓	✓
APD120A			DC - 50 MHz	1 mm	50	25 A/W @ 800 nm (M = 50)	2.5 x 10^6 V/W	-	-
APD130A			DC - 50 MHz	1 mm	50	25 A/W @ 800 nm (M = 50)	2.5 x 10^6 V/W	✓	-
APD430A			DC - 400 MHz	0.5 mm	10 - 100	53 A/W @ 800 nm (M = 100)	5.3 x 10^5 V/W	✓	✓
APD210			5 - 1000 MHz[b]	0.5 mm	N/A	N/A	2.5 x 10^5 V/W[c]	-	✓
APD110C	InGaAs APD	900 - 1700 nm	DC - 50 MHz	0.2 mm	10	9 A/W @ 1500 nm (M = 10)	0.9 x 10^6 V/W	-	-
APD130C			DC - 50 MHz	0.2 mm	10	9 A/W @ 1500 nm (M = 10)	0.9 x 10^6 V/W	✓	-
APD410C			DC - 10 MHz	0.2 mm	4 - 20	18 A/W @ 1550 nm (M = 20)	9.0 x 10^6 V/W	✓	✓
APD430C			DC - 400 MHz	0.2 mm	4 - 20	18 A/W @ 1550 nm (M = 20)	1.8 x 10^5 V/W	✓	✓
APD450C		1260 - 1620 nm	0.3 - 1600 MHz	1.5 mm[d]	2 - 10	9 A/W @ 1550 nm (M = 10)	45 × 10^3 V/W	✓	✓
APD310		850 - 1650 nm	5 - 1000 MHz[e]	0.03 mm	N/A	N/A	2.5 x 10^4 V/W[f]	-	✓

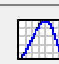
- At Peak Responsivity Wavelength Unless Otherwise Stated
- The max frequency range is 1 MHz - 1600 MHz.
- At 1 GHz and 800 nm
- 75 µm Detector with Ø1.5 mm Ball Lens
- The max frequency range is 1 MHz - 1800 MHz.
- At 1 GHz and 1500 nm

Hide InGaAs Avalanche Photodetectors


APD110C

InGaAs Avalanche Photodetectors

- Internal SM05 and External SM1 Threads Accept Fiber Adapters, Lens Tubes, and Other Components
- Power Supply Included

Key Specifications[a]	
Item #	APD110C
Detector Type	InGaAs APD
Wavelength Range	900 - 1700 nm
Output Bandwidth (3 dB)	DC - 50 MHz
Active Area Diameter	0.2 mm
Typical Max Responsivity	9 A/W @ 1500 nm
Responsivity Graph (Click to View)	
Transimpedance Gain	50 kV/A (50 Ω Termination) 100 kV/A (High-Z Termination)
Max Conversion Gain[b]	0.9 × 10^6 V/W
M Factor	10

Thorlabs' APD110C Avalanche Photodetector is offered as a cost-effective solution for customers with applications that do not require temperature compensation or variable gain.

The orientation of the mechanical and electrical connections, combined with the compact design, ensures that these detectors can fit into tight spaces. Three 8-32 mounting holes, one on each edge of the housing, further ensure easy integration into complicated mechanical setups. The housing also provides compatibility with both our SM05 and SM1 Lens Tubes. An internally SM1-threaded cap is included.

Fiber Coupling Note:
For fiber-coupled applications, we do not recommend using fiber connector adapters such as Thorlabs' S120-FC due to the small size of the detector. High coupling

losses and degradation of the frequency response may occur. To achieve high coupling efficiency, a fiber collimation package, focusing lens, and X-Y translator should be used. See the *Fiber Coupling* tab for details.

M Factor Temperature Stability	Not Specified
Saturation Power (CW)	4.2 µW
Minimum NEP (DC - 50 MHz)[b]	0.46 pW/√Hz
Dimensions (W x H x D)	2.97" x 2.00" x 1.08"

- For a complete list of specifications and responsivity graphs, please see the *APDxxxC Specs* tabs. Data are valid at 23 ± 2 °C and 45% ± 15% relative humidity (non-condensing).
- For more information on how NEP is calculated, please see Thorlabs' Noise Equivalent Power White Paper.

Part Number	Description	Price	Availability
APD110C	InGaAs Avalanche Photodetector, 900 - 1700 nm, 8-32 Taps	$2,379.58	Lead Time

Hide Temperature-Compensated InGaAs Avalanche Photodetectors

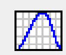
Temperature-Compensated InGaAs Avalanche Photodetectors

- Temperature Compensated to Provide M Factor Stability of ≤±3% Over 18 to 28 °C
- Internal SM05 and External SM1 Threads Accept Fiber Adapters, Lens Tubes, and Other Components
- Power Supply Included

Thorlabs' APD130C(/M) Avalanche Photodetector features an integrated thermistor that maintains an M factor stability of ±3% or better over 23 ± 5 °C by adjusting the bias voltage across the avalanche photodiode, supplying improved output stability in environments with temperature variations.

The orientation of the mechanical and electrical connections, combined with the compact design, ensures that these detectors can fit into tight spaces. Three 8-32 (M4) mounting holes, one on each edge of the housing, further ensure easy integration into complicated mechanical setups. The housing also provides compatibility with both our SM05 and SM1 Lens Tubes. An internally SM1-threaded cap is included.

Fiber Coupling Note:
For fiber-coupled applications, we do not recommend using fiber connector adapters such as Thorlabs' S120-FC due to the small size of the detector. High coupling losses and degradation of the frequency response may occur. To achieve high coupling efficiency, a fiber collimation package, focusing lens, and X-Y translator should be used. See the *Fiber Coupling* tab for details.

Key Specifications[a]	
Item #	**APD130C(/M)**
Detector Type	InGaAs APD
Wavelength Range	900 - 1700 nm
Output Bandwidth (3 dB)	DC - 50 MHz
Active Area Diameter	0.2 mm
Typical Max Responsivity	9 A/W @ 1500 nm (M = 10)
Responsivity Graph (Click to View)	
Transimpedance Gain	50 kV/A (50 Ω Termination) 100 kV/A (High-Z Termination)
Max Conversion Gain[b]	0.9×10^6 V/W
M Factor	10
M Factor Temperature Stability[c]	±2% (Typical); ±3% (Max)
Saturation Power (CW)	4.2 µW
Minimum NEP (DC - 50 MHz)[d]	0.46 pW/√Hz
Dimensions (W x H x D)	2.97" x 2.00" x 1.08"

- For a complete list of specifications and responsivity graphs, please see the *APDxxxC Specs* tab. Data are valid at 23 ± 5 °C and 45% ± 15% relative humidity (non-condensing).
- At the Peak Responsivity Wavelength
- Within the 23 ± 5 °C temperature range.
- For more information on how NEP is calculated, please see Thorlabs' Noise Equivalent Power White Paper.

Part Number	Description	Price	Availability
APD130C/M	InGaAs Avalanche Photodetector, Temperature Compensated, 900 - 1700 nm, M4 Taps	$2,434.77	Today
APD130C	InGaAs Avalanche Photodetector, Temperature Compensated, 900 - 1700 nm, 8-32 Taps	$2,434.77	Today

Hide Variable-Gain, Temperature-Compensated Avalanche Photodetectors

Variable-Gain, Temperature-Compensated Avalanche Photodetectors

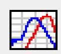
- Continuously Variable Gain
- Temperature Compensated to Provide M Factor Stability of ±3% Over 18 to 28 °C
- Internal SM05 and External SM1 Threads Accept Fiber Adapters, Lens Tubes, and Other Components
- Power Supply Included


Click to Enlarge
The M Factor is controlled by a knob on the side of the APD.

Thorlabs' APD410C(/M), APD430C(/M), and APD450C Avalanche Photodetectors have a variable gain that can be controlled by a knob on the right side of the housing. The gain knob adjusts the reverse bias voltage across the photodiode, allowing the M factor to vary. Like the APD130C detectors above, these devices feature an integrated thermistor that maintains an M factor stability of ±3% or better over 23 ± 5 °C by adjusting the bias voltage across the avalanche photodiode. These detectors offer different bandwidth ranges and sensitivity.

The orientation of the mechanical and electrical connections, combined with the compact design, ensures that these detectors can fit into tight spaces. Three 8-32 (M4) mounting holes, one on each edge of the APD410C(/M) and APD430C(/M) housing, further ensure easy integration into complicated mechanical setups. The APD450C detector offers universal 8-32/M4 mounting holes. The housing also provides compatibility with both our SM05 and SM1 Lens Tubes. An internally SM1-threaded cap is included.

Fiber Coupling Note:
For fiber-coupled applications, we do not recommend using fiber connector adapters such as Thorlabs' S120-FC with the APD410C or APD430C detectors due to the small size of the sensors. High coupling losses and degradation of the frequency response may occur. To achieve high coupling efficiency, a fiber collimation package, focusing lens, and X-Y translator should be used. See the *Fiber Coupling* tab for details.

Key Specifications[a]			
Item #	**APD410C(/M)**	**APD430C(/M)**	**APD450C**
Detector Type	InGaAs APD		
Wavelength Range	900 - 1700 nm		1260 - 1620 nm
Output Bandwidth (3 dB)[b]	DC - 10 MHz	DC - 400 MHz	0.3 - 1600 MHz
Active Area Diameter	0.2 mm		75 µm, with Ø1.5 mm Ball Lens
Typical Max Responsivity	18 A/W @ 1550 nm (M = 20)		9 A/W @ 1550 nm (M = 10)
Responsivity Graph (Click to View)			
Transimpedance Gain	250 kV/A (50 Ω Termination) 500 kV/A (High-Z Termination)	5 kV/A (50 Ω Termination) 10 kV/A (High-Z Termination)	5 kV/A (50 Ω Termination)
Max Conversion Gain[c]	9.0×10^6 V/W	1.8×10^5 V/W	4.5×10^4 V/W (50 Ω Termination)
M Factor Adjustment Range	4 - 20 (Continuous)		2 - 10 (Continuous)
M Factor Temperature Stability[d]	±2% (Typical); ±3% (Max)		
Saturation Power (CW)	0.45 µW @ 1550 nm (M = 20) 2.25 µW @ 1550 nm (M = 4)	22 µW @ 1550 nm (M = 20) 110 µW @ 1550 nm (M = 4)	0.1 mW @ 1550 nm (M = 10) 0.5 mW @ 1550 nm (M = 2)
Minimum NEP[e]	0.12 pW/√Hz (DC - 10 MHz)	0.45 pW/√Hz (DC - 100 MHz)	1.1 pW/√Hz (0.3 - 1600 MHz)
Dimensions (W x H x D)	2.97" x 2.20" x 1.09"		2.83" x 2.22" x 1.08"

- For a complete list of specifications and responsivity graphs, please see the *APDxxxC Specs* tab. Data are valid at 23 ± 5 °C and 45% ± 15% relative humidity (non-condensing).
- At Maximum Gain Setting
- At the Peak Responsivity Wavelength
- Within the 23 ± 5 °C temperature range.
- For more information on how NEP is calculated, please see Thorlabs' Noise Equivalent Power White Paper.

Part Number	Description	Price	Availability
APD410C/M	**InGaAs Variable-Gain Avalanche Photodetector, Temperature Compensated, 900 - 1700 nm, DC - 10 MHz, M4 Taps**	**$2,489.95**	**Today**
APD430C/M	**InGaAs Variable-Gain Avalanche Photodetector, Temperature Compensated, 900 - 1700 nm, DC - 400 MHz, M4 Taps**	**$2,489.95**	**Today**

APD450C	Customer Inspired! InGaAs Variable-Gain Avalanche Photodetector, Temperature Compensated, 1260 - 1620 nm, 0.3 - 1600 MHz, Universal 8-32 / M4 Taps	$1,709.80	Today
APD410C	InGaAs Variable-Gain Avalanche Photodetector, Temperature Compensated, 900 - 1700 nm, DC - 10 MHz, 8-32 Taps	$2,489.95	Today
APD430C	InGaAs Variable-Gain Avalanche Photodetector, Temperature Compensated, 900 - 1700 nm, DC - 400 MHz, 8-32 Taps	$2,489.95	Today

Hide Variable-Gain Avalanche Photodetector

Variable-Gain Avalanche Photodetector

- High-Speed Avalanche Photodetector (up to 1 GHz at 3 dB)
- 100 Step Adjustable Gain
- Internal SM05 (0.535"-40) Threads for Lens Tube Integration
- Power Supply Included

Key Specifications[a]	
Item #	APD310
Detector Type	InGaAs APD
Wavelength Range	850 - 1650 nm
Output Bandwidth	5 MHz - 1000 MHz (3 dB) 1 MHz - 1800 MHz (Max)
Active Area Diameter	0.03 mm
Transimpedance Gain	Variable
Max Conversion Gain	2.5×10^4 V/W
M Factor Temperature Stability	Not Specified
Minimum NEP[b]	2 pW/√Hz

- For a complete list of specifications and responsivity graphs, please see the *APD310 Specs* tab.
- For more information on how NEP is calculated, please see Thorlabs' Noise Equivalent Power White Paper.

Menlo Systems' APD310 InGaAs Avalanche Photodetector provides an extremely light-sensitive alternative to traditional PIN photodiodes and is sensitive and fast enough for the characterization of pulsed lasers on the order of nanoseconds. The InGaAs avalanche photodiode of the APD310 provides exceptional performance for low-light applications in the 850 - 1650 nm range. This APD maintains high-gain stability over the operating temperature range by utilizing a temperature-compensation circuit, which adjusts the ~150 VDC bias to ensure operation near the breakdown voltage.

A 40 dB gain amplifier is integrated into the housing and is AC-coupled to band the output BNC. The output is matched to 50 Ω impedance. The detector has an electronic bandwidth of 5 MHz to 1 GHz (at 3 dB) and offers user-accessible push buttons providing 100 step gain adjustment. The APD310 has SM05 (0.535"-40) threads for easy integration into Thorlabs' family of lens tubes and cage assemblies. For direct fiber mounting, compatible fiber adapters are available. The bottom of the detector has a metric (M4) mounting hole and an M4 to 8-32 adapter for post mounting. The compact packaging allows the APD to be substituted directly into an existing setup while maintaining a small footprint on the benchtop. A location-specific power adapter is included with the detector; contact Technical Support for more information.

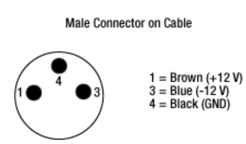
These photodetectors are not suitable for pulses longer than 30 ns or continuous light levels. Please see the FPD510 series for alternatives.

Part Number	Description	Price	Availability
APD310	High-Speed InGaAs Avalanche Detector, 850 - 1650 nm	$2,640.00	Today

Hide ±12 VDC Regulated Linear Power Supply

±12 VDC Regulated Linear Power Supply

- Replacement Power Supply for Avalanche Photodetectors Sold Above (Except Item # APD310)
- ±12 VDC Power Output
- Current Limit Enabling Short Circuit and Overload Protection
- On/Off Switch with LED Indicator
- Switchable AC Input Voltage (100, 120, or 230 VAC)
- 2 m (6.6 ft) Cable with LUMBERG RSMV3 Male Connector
- UL and CE Compliant



The LDS12B ±12 VDC Regulated Linear Power Supply is intended as a replacement for the supply included with our APD series of avalanche photodetectors sold on this page, except for the APD310 photodetector. The cord has three pins: one for ground, one for +12 V, and one for -12 V (see diagram above). This power supply ships with a location-specific power cord. This power supply can also be used with the PDA series of amplified photodetectors, PDB series of balanced photodetectors, PMM series of photomultiplier modules, and the FSAC autocorrelator for femtosecond lasers.

Part Number	Description	Price	Availability

LDS12B	±12 VDC Regulated Linear Power Supply, 6 W, 100/120/230 VAC	$85.22	Today