

# Ultrafast Photodetectors

## UPD Series



The UPD series of ultrafast photodetectors are best suited for measurement of optical waveforms from DC to 25 GHz. Various models feature rise times as short as **15 ps** and cover the spectral range from **170 to 2600 nm**.

All photodetectors are enclosed in compact and solid aluminum housings and can be biased with a battery or an external power supply.

The UV-extended versions of the silicon type photodetectors are the only commercial products that cover the spectral range from 170 to 1100 nm.

Another type of unique UV-sensitive InGaAs photodetectors can be used for detecting laser pulses in the range from 350 to 1700 nm, thus having the widest spectral range and the highest speed commercially available.

Perfect impedance matching and state-of-the-art microwave technology assure pulse form measurements without any ringing or artefacts. The customer is free to use a 50  $\Omega$  terminating resistor for highest speed operation, or a high impedance load for obtaining large signals. This guarantees maximum flexibility for diverse applications.

In combination with our BBA series of wideband high-gain amplifiers, the high-speed photodetectors are an advantageous alternative to the expensive and cumbersome avalanche photodiodes.

The UPD series high-speed photodetectors are indispensable tools for laser and photonics research.

### Features

- Ultra High-Speed Operation
- Rise Times: **starting from 15 ps**
- Bandwidths: **up to 25 GHz**
- Spectral Ranges: **170 - 2600 nm**
- Compact Design
- Battery or External Power Supply
- Models for Free-Space Beam, or with FC/PC Receptacle or Pigtailed with SM Fiber

### Applications

- Pulse Form Measurements
- Pulse Duration Measurements
- Precise Synchronization
- Mode Beating Monitoring
- Heterodyne Measurements

### New Models Available: Faster Rise Times & Wider Wavelength Ranges

- **UPD-15-IR2-FC**: Ultrafast InGaAs PIN photodetector, rise time < 15 ps, bandwidth > 25 GHz, spectral range 800 - 1700 nm, fiber-coupled input with FC/APC connector
- **UPD-35-IR2-P**, **UPD-35-IR2-D**: Ultrafast InGaAs PIN photodetectors, rise time < 35 ps, bandwidth > 10 GHz, spectral range 800 - 1700 nm, with polished or diffuse window
- **UPD-35-UVIR-P**, **UPD-35-UVIR-D**: Ultrafast InGaAs PIN photodetectors, rise time < 35 ps, bandwidth > 10 GHz, spectral range 350 - 1700 nm, with polished or diffuse window
- **UPD-50-SP**, **UPD-50-SD**, **UPD-50-UD**, **UPD-50-UP**: Ultrafast Si PIN photodetectors, rise time 50 ps, fall time 50 ps, bandwidth > 7 GHz, spectral range 170 - 1100 nm or 320 - 1100 nm, with polished or diffuse window
- **UPD-100-IR1-P**: Ultrafast Ge photodetector, rise time < 100 ps, pulsewidth (FWHM) 300 ps, spectral range 400 - 2000 nm
- **UPD-3N-IR2-P**: Fast InGaAs photodetector, extended infrared range up to 2.1  $\mu\text{m}$ , rise time 150 ps
- **UPD-5N-IR2-P**: Fast InGaAs photodetector, extended infrared range up to 2.6  $\mu\text{m}$ , rise time 200 ps

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UPD Series • Available Models

Model	Rise Time (ps)	Bandwidth (GHz)	Spectral Range (nm)	Quantum Efficiency @ Peak	Sensitive Area (Dia. $\mu\text{m}$ / $\text{mm}^2$ )	Noise Equiv. Power (W/ $\sqrt{\text{Hz}}$ )	Dark Current (nA)	Material	Optical Input / Window Type <sup>1)</sup>	RF Output Connector Type
UPD-15-IR2-FC	< 15	> 25	800 - 1700	75%	Fiber, 9 $\mu\text{m}$	$1.0 \times 10^{-15}$	0.1	InGaAs	Fiber w. FC/APC <sup>5)</sup>	SMA
UPD-30-VSG-P	< 30	> 10	320 - 900	40%	200x200 / 0.04	$3.0 \times 10^{-15}$	0.1	GaAs	Polished, glass	SMA
UPD-35-IR2-P	< 35	> 10	800 - 1700	80%	55 / 0.0024	$1.0 \times 10^{-15}$	0.3	InGaAs	Polished, glass	SMA
UPD-35-IR2-D	< 35	> 10	800 - 1700	80%	55 / 0.0024	$1.0 \times 10^{-15}$	0.3	InGaAs	Diffuse, quartz	SMA
UPD-35-IR2-FR	< 35	> 10	800 - 1700	80%	55 / 0.0024	$1.0 \times 10^{-15}$	0.3	InGaAs	FC/PC receptacle <sup>5)</sup>	SMA
UPD-35-IR2-FC	< 35	> 10	800 - 1700	80%	Fiber, 9 $\mu\text{m}$	$1.0 \times 10^{-15}$	0.3	InGaAs	Fiber w. FC/APC <sup>5)</sup>	SMA
UPD-35-UVIR-P	< 35	> 10	<b>350 - 1700</b>	80%	55 / 0.0024	$1.0 \times 10^{-15}$	0.3	InGaAs <sup>4)</sup>	Polished, MgF <sub>2</sub>	SMA
UPD-35-UVIR-D	< 35	> 10	<b>350 - 1700</b>	80%	55 / 0.0024	$1.0 \times 10^{-15}$	0.3	InGaAs <sup>4)</sup>	Diffuse, quartz	SMA
UPD-40-VSI-P	< 40	> 8.5	500 - 1690	40%	200x200 / 0.04	$3.0 \times 10^{-10}$	5000	InGaAs	Polished, glass	SMA
UPD-40-IR2-P	< 40	> 8.5	800 - 1700	80%	60 / 0.0028	$1.1 \times 10^{-15}$	0.5	InGaAs	Polished, glass	SMA
UPD-40-IR2-D	< 40	> 8.5	800 - 1700	80%	60 / 0.0028	$1.1 \times 10^{-15}$	0.5	InGaAs	Diffuse, quartz	SMA
UPD-40-IR2-FR	< 40	> 8.5	800 - 1700	80%	60 / 0.0028	$1.1 \times 10^{-15}$	0.5	InGaAs	FC/PC receptacle <sup>5)</sup>	SMA
UPD-40-IR2-FC	< 40	> 8.5	800 - 1700	80%	Fiber, 9 $\mu\text{m}$	$1.1 \times 10^{-15}$	0.5	InGaAs	Fiber w. FC/APC <sup>5)</sup>	SMA
UPD-40-UVIR-P	< 40	> 8.5	<b>350 - 1700</b>	80%	60 / 0.0028	$1.1 \times 10^{-15}$	0.5	InGaAs <sup>4)</sup>	Polished, MgF <sub>2</sub>	SMA
UPD-40-UVIR-D	< 40	> 8.5	<b>350 - 1700</b>	80%	60 / 0.0028	$1.1 \times 10^{-15}$	0.5	InGaAs <sup>4)</sup>	Diffuse, quartz	SMA
UPD-50-SP	< 50	> 7.0	320 - 1100	45%	100 / 0.0079	$1.2 \times 10^{-15}$	0.001	Si	Polished, glass	SMA
UPD-50-SD	< 50	> 7.0	320 - 1100	45%	100 / 0.0079	$1.2 \times 10^{-15}$	0.001	Si	Diffuse, quartz	SMA
UPD-50-UP	< 50	> 7.0	<b>170 - 1100</b>	45%	100 / 0.0079	$1.2 \times 10^{-15}$	0.001	Si <sup>4)</sup>	Polished, MgF <sub>2</sub>	SMA
UPD-50-UD	< 50	> 7.0	<b>170 - 1100</b>	45%	100 / 0.0079	$1.2 \times 10^{-15}$	0.001	Si <sup>4)</sup>	Diffuse, quartz	SMA
UPD-70-IR2-P	< 70	> 5.0	800 - 1700	80%	80 / 0.005	$2.0 \times 10^{-15}$	0.8	InGaAs	Polished, glass	SMA
UPD-70-IR2-D	< 70	> 5.0	800 - 1700	80%	80 / 0.005	$2.0 \times 10^{-15}$	0.8	InGaAs	Diffuse, quartz	SMA
UPD-70-IR2-FR	< 70	> 5.0	800 - 1700	80%	80 / 0.005	$2.0 \times 10^{-15}$	0.8	InGaAs	FC/PC receptacle <sup>5)</sup>	SMA
UPD-70-IR2-FC	< 70	> 5.0	800 - 1700	80%	Fiber, 9 $\mu\text{m}$	$2.0 \times 10^{-15}$	0.8	InGaAs	Fiber w. FC/APC <sup>5)</sup>	SMA
UPD-70-UVIR-P	< 70	> 5.0	<b>350 - 1700</b>	80%	80 / 0.005	$2.0 \times 10^{-15}$	0.8	InGaAs <sup>4)</sup>	Polished, MgF <sub>2</sub>	SMA
UPD-70-UVIR-D	< 70	> 5.0	<b>350 - 1700</b>	80%	80 / 0.005	$2.0 \times 10^{-15}$	0.8	InGaAs <sup>4)</sup>	Diffuse, quartz	SMA
UPD-100-IR1-P <sup>2)</sup>	< 100	> 3.0	<b>400 - 2000</b>	80%	80 / 0.005	$3.0 \times 10^{-13}$	700	Ge	Polished, glass	SMA
UPD-200-SP	< 175	> 2.0	320 - 1100	85%	400 / 0.126	$1.5 \times 10^{-15}$	0.001	Si	Polished, glass	BNC
UPD-200-SD	< 175	> 2.0	320 - 1100	85%	400 / 0.126	$1.5 \times 10^{-15}$	0.001	Si	Diffuse, quartz	BNC
UPD-200-UP	< 175	> 2.0	<b>170 - 1100</b>	85%	400 / 0.126	$1.5 \times 10^{-15}$	0.001	Si <sup>4)</sup>	Polished, MgF <sub>2</sub>	BNC
UPD-200-UD	< 175	> 2.0	<b>170 - 1100</b>	85%	400 / 0.126	$1.5 \times 10^{-15}$	0.001	Si <sup>4)</sup>	Diffuse, quartz	BNC
UPD-300-SP	< 300	> 1.0	320 - 1100	90%	600 / 0.283	$3.0 \times 10^{-15}$	0.01	Si	Polished, glass	BNC
UPD-300-SD	< 300	> 1.0	320 - 1100	90%	600 / 0.283	$3.0 \times 10^{-15}$	0.01	Si	Diffuse, quartz	BNC
UPD-300-UP	< 300	> 1.0	<b>170 - 1100</b>	90%	600 / 0.283	$3.0 \times 10^{-15}$	0.01	Si <sup>4)</sup>	Polished, MgF <sub>2</sub>	BNC
UPD-300-UD	< 300	> 1.0	<b>170 - 1100</b>	90%	600 / 0.283	$3.0 \times 10^{-15}$	0.01	Si <sup>4)</sup>	Diffuse, quartz	BNC
UPD-500-SP	< 500	> 0.6	320 - 1100	90%	800 / 0.5	$3.5 \times 10^{-15}$	0.01	Si	Polished, glass	BNC
UPD-500-SD	< 500	> 0.6	320 - 1100	90%	800 / 0.5	$3.5 \times 10^{-15}$	0.01	Si	Diffuse, quartz	BNC
UPD-500-UP	< 500	> 0.6	<b>170 - 1100</b>	90%	800 / 0.5	$3.5 \times 10^{-15}$	0.01	Si <sup>4)</sup>	Polished, MgF <sub>2</sub>	BNC
UPD-500-UD	< 500	> 0.6	<b>170 - 1100</b>	90%	800 / 0.5	$3.5 \times 10^{-15}$	0.01	Si <sup>4)</sup>	Diffuse, quartz	BNC
UPD-3N-IR2-P	< 150 <sup>6)</sup>	> 0.4 <sup>6)</sup>	<b>800 - 2100</b>	75%	300 / 0.07	$1.5 \times 10^{-13}$	90	InGaAs	Polished, glass	BNC
UPD-5N-IR2-P	< 200 <sup>6)</sup>	> 0.3 <sup>6)</sup>	<b>800 - 2600</b>	70%	300 / 0.07	$7.0 \times 10^{-13}$	2000	InGaAs	Polished, glass	BNC
UPD-2M-IR2-P	< 75000	> 0.004	<b>900 - 1700</b>	80%	2000 / 3.14	$4.0 \times 10^{-14}$	5	InGaAs	Polished, glass	BNC
UPD-2M-IR2-P-1TEC <sup>3)</sup>	< 75000	> 0.004	<b>900 - 1700</b>	75%	2000 / 3.14	$1.0 \times 10^{-14}$	0.3	InGaAs	Polished, glass	BNC

Notes: <sup>1)</sup> The diffuse window reduces the positioning accuracy requirements and increases the damage threshold at the cost of a reduced sensitivity by a factor of approx. three to five. **Recommended for high peak power lasers only.**

<sup>2)</sup> This model has negative output. All other models have positive output by default but may be ordered with negative output if required.

<sup>3)</sup> With TEC cooling module, non-standard housing.

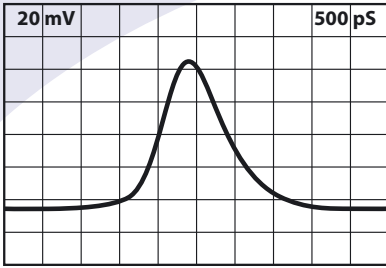
<sup>4)</sup> Modified material with increased blue / UV sensitivity.

<sup>5)</sup> Not compatible with the optional filter holder.

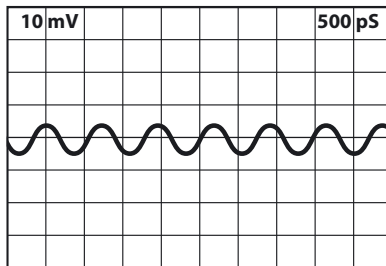
<sup>6)</sup> Greatly improved performance.

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High fidelity pulse form measurement with UPD-200-SP and 1 GHz oscilloscope. The light source is our PULSELAS®-P-1064-100 subnanosecond Q-switched laser.



Longitudinal mode beating of a He-Ne laser (633 nm) recorded with UPD-200-SP photodetector and 1 GHz oscilloscope. The modulation depth of the 1.5 GHz beating signal is limited to 25% by the oscilloscope bandwidth.

## Power Sources for UPD Series (depend on the photodetector model)

### Low-Noise Power Supply

**European Standard**  
Input: 230 V AC  
Output: 12 V DC  
Model: **PS-UPD-12-EU**

### Low-Noise Power Supplies

**Worldwide Usage**  
Input: 100 - 240 V AC

Output: 6 V DC  
Model: **PS-UPD-6-WW**

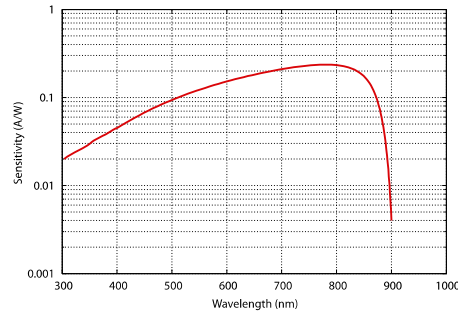
Output: 9 V DC  
Model: **PS-UPD-9-WW**

Output: 12 V DC  
Model: **PS-UPD-12-WW**

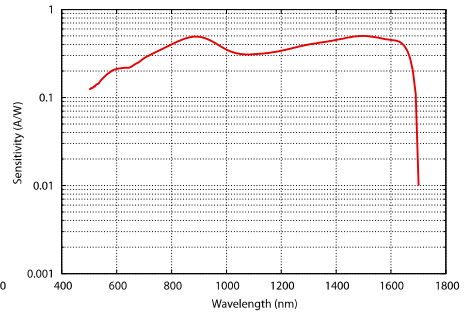
### Bias Battery

6 V  
Model: **BAT-UPD-6V**

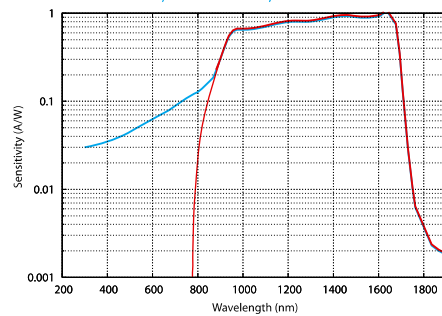
## Spectral Response GaAs Schottky Ultrafast Photodetector UPD-30-VSG-P



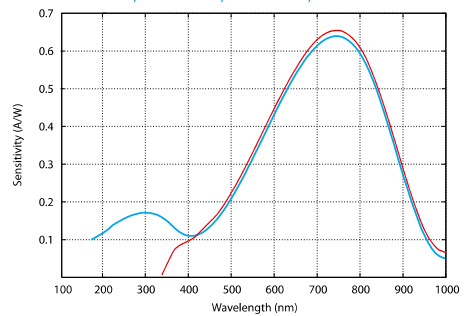
## Spectral Response InGaAs Schottky Ultrafast Photodetector UPD-40-VSI-P



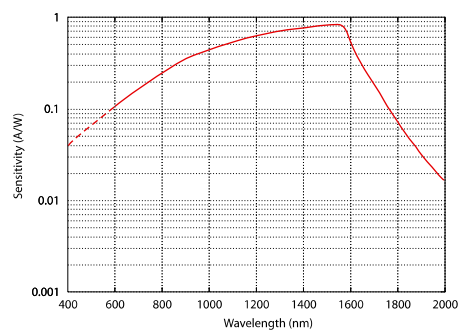
## Spectral Response InGaAs Ultrafast Photodetectors UPD-35-IR2-P, UPD-40-IR2-P, UPD-70-IR2-P UPD-35-UVIR-P, UPD-40-UVIR-P, UPD-70-UVIR-P



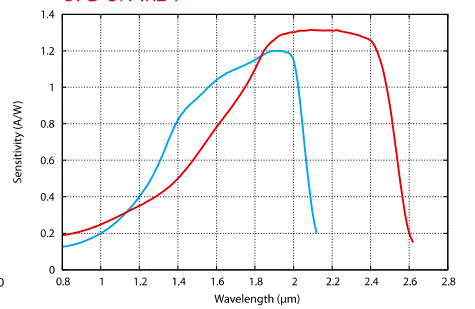
## Spectral Response Si PIN Ultrafast Photodetectors UPD-50-SP, UPD-200-SP, UPD-300-SP, UPD-500-SP UPD-50-UP, UPD-200-UP, UPD-300-UP, UPD-500-UP



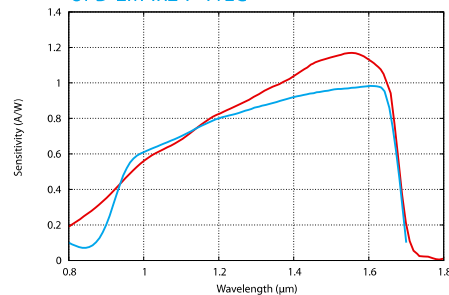
## Spectral Response Ge pn Ultrafast Photodetectors UPD-100-IR1-P



## Spectral Response InGaAs PIN Ultrafast Photodetectors UPD-3N-IR2-P UPD-5N-IR2-P



## Spectral Response InGaAs PIN Ultrafast Photodetectors UPD-2M-IR2-P UPD-2M-IR2-P-1TEC



**Important notice:** The sensitivity curves are for reference only and are not recommended to be used for calibration or amplitude measurement purposes.

## Related Products

- Broadband Amplifiers BBA Series (amplitude gain:  $\times 10$ ,  $\times 100$  or variable  $\times 1 \div 100$ )
- BNC 50  $\Omega$  Terminating Load
- SMA (male) to BNC (female) Adapter
- SMA to SMA Adapter
- Attenuator Filter Adapter

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