

Photoconductive Series

Planar Diffused Silicon Photodiodes

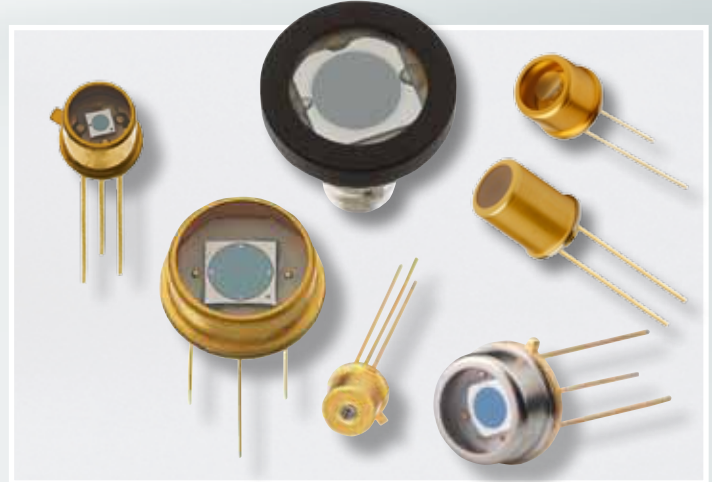
The **Photoconductive Detector Series** are suitable for high speed and high sensitivity applications. The spectral range extends from 350 to 1100 nm, making these photodiodes ideal for visible and near IR applications, including such AC applications as detection of pulsed LASER sources, LEDs, or chopped light.

To achieve high speeds, these detectors should be reverse biased. Typical response times from 10 ns to 250 ns can be achieved with a 10V reverse bias, for example. When a reverse bias is applied, capacitance decreases (as seen in the figure below) corresponding directly to an increase in speed.

As indicated in the specification table, the reverse bias should not exceed 30 volts. Higher bias voltages will result in permanent damage to the detector.

Since a reverse bias generates additional dark current, the noise in the device will also increase with applied bias. For lower noise detectors, the Photovoltaic Series should be considered.

Refer to the Photoconductive Mode (PC) paragraph in the "Photodiode Characteristics" section of this catalog for detailed information on electronics set up.



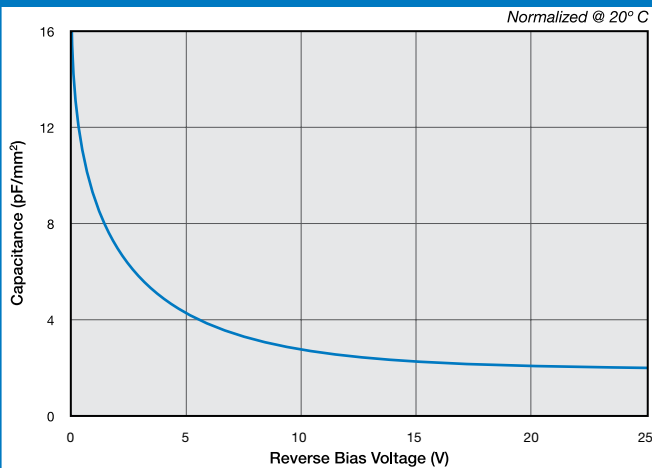
APPLICATIONS

- Pulse Detectors
- Optical Communications
- Bar Code Readers
- Optical Remote Control
- Medical Equipment
- High Speed Photometry

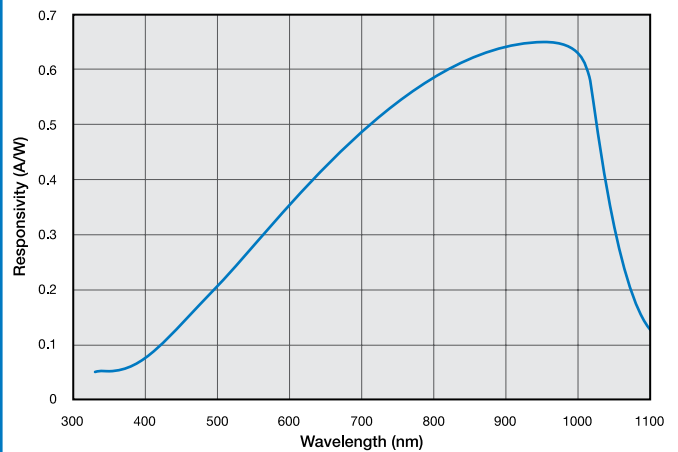
FEATURES

- High Speed Response
- Low Capacitance
- Low Dark Current
- Wide Dynamic Range
- High Responsivity

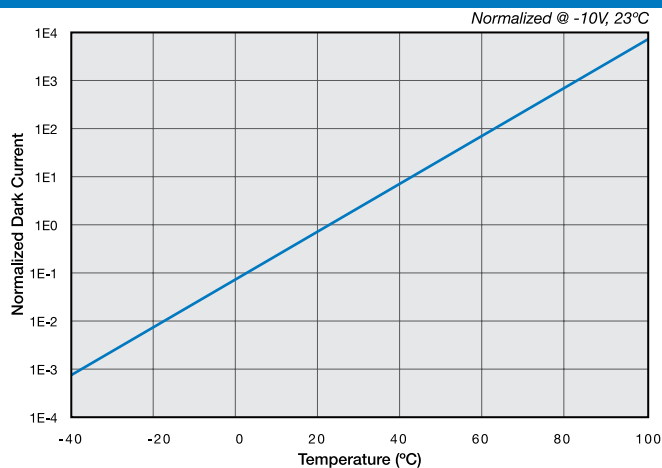
Typical Capacitance vs. Reverse Bias



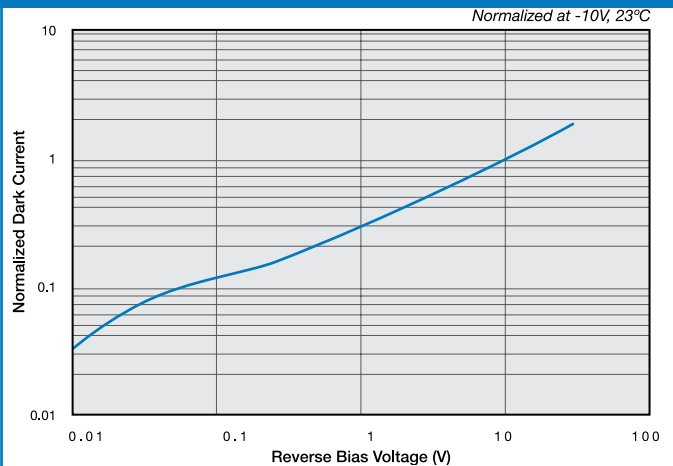
Typical Spectral Response



Typical Dark Current vs. Temperature



Typical Dark Current vs. Reverse Bias



Photoconductive Series

Typical Electro-Optical Specifications at T_A=23°C

Model Number	Active Area		Peak Responsivity Wavelength	Responsivity at λ_p		Capacitance (pF)		Dark Current (nA)		NEP (W/√Hz)	Reverse Voltage (V)	Rise Time (ns)	Temp.* Range (°C)		Package Style ¶
	Area (mm ²)	Dimensions (mm)		λ_p (nm)	(A/W)	0 V	-10 V	-10 V				-10V 632nm 50 Ω	Operating	Storage	
				typ.	min.	typ.	typ.	typ.	max.	typ.	max.	typ.			

'D' Series, Metal Package

PIN-020A	0.20	0.51 φ	970	0.60	0.65	4	1	0.01	0.15	2.8 e-15	30	6	-40 ~ +100	-55 ~ +125	1 / TO-18																																											
PIN-040A	0.81	1.02 φ				8	2	0.05	0.50	6.2 e-15		8			10	12	14	17	24	43	250	-10 ~ +60	-20 ~ +70	10/ Lo-Prof 11 / BNC 12 / BNC																																		
PIN-2DI ‡	1.1	0.81 x 1.37				25	5	0.10	1.0	8.7 e-15		45													12	0.15	2	1.1 e-14	85	15	0.25	3	1.4 e-14	225	40	0.35	6	1.6 e-14	330	60	0.5	10	1.9 e-14	700	130	1	15	2.8 e-14	1500	300	2	25	3.9 e-14	9500	1800	15	1000	1.1 e-13
PIN-3CDI	3.2	1.27 x 2.54				PIN-3CD	PIN-5DI	5.1	2.54 φ	13																																																
PIN-3CD												PIN-5DI			PIN-5D	PIN-13DI	PIN-13D	PIN-6DI	PIN-6D	PIN-44DI	PIN-44D				PIN-10DI	PIN-10D	PIN-25D																															

'O' Series, Metal Package

OSD1-0	1	1.0 sq	900	0.47	0.54	12	3	1	3	4.5 e-14	50	10	-25 ~ +75	-40 ~ +100	7 / TO-18
OSD5-0	5	2.5 φ				50	8	5	10	1.0 e-13		8			5 / TO-5
OSD15-0	15	3.8 sq				150	20	8	15	1.3 e-13		9			5 / TO-5
OSD60-0	58	7.6 sq				600	75	15	50	1.7 e-13		14			69 / TO-8
OSD100-0A	100	11.3 φ				1000	130	30	70	2.5 e-13		19			55 / Special

'D' Series, Plastic Package

PIN-220D«	200	10 x 20	970	0.60	0.65	3200	600	5	100	6.2 e-14	30	75	-10 ~ +60	20 ~ +70	27 / Plastic
-----------	-----	---------	-----	------	------	------	-----	---	-----	----------	----	----	-----------	----------	--------------

‡ The 'I' suffix on the model number is indicative of the photodiode chip being isolated from the package by an additional pin connected to the case.

¶ For mechanical drawings please refer to pages 61 thru 73.

* Non-condensing temperature and storage range, Non-condensing environment.

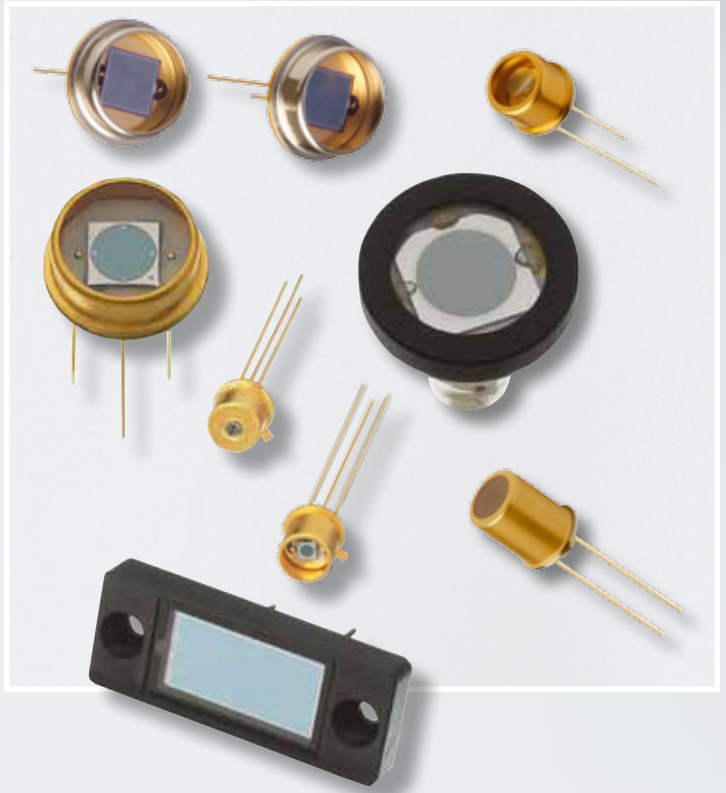
« Minimum order quantities apply

The **Photovoltaic Detector** series is utilized for applications requiring high sensitivity and moderate response speeds, with an additional sensitivity in the visible-blue region for the blue enhanced series. The spectral response ranges from 350 to 1100 nm, making the regular photovoltaic devices ideal for visible and near IR applications. For additional sensitivity in the 350 nm to 550 nm region, the blue enhanced devices are more suitable.

These detectors have high shunt resistance and low noise, and exhibit long term stability. Unbiased operation of these detectors offers stability under wide temperature variations in DC or low speed applications. For high light levels (greater than 10mW/cm²), the Photoconductive Series detectors should be considered for better linearity.

These detectors are not designed to be reverse biased! Very slight improvement in response time may be obtained with a slight bias. Applying a reverse bias of more than a few volts (>3V) will permanently damage the detectors. If faster response times are required, the Photoconductive Series should be considered.

Refer to the **Photovoltaic Mode (PV)** paragraph in the "Photodiode Characteristics" section of this catalog for detailed information on electronics set up.



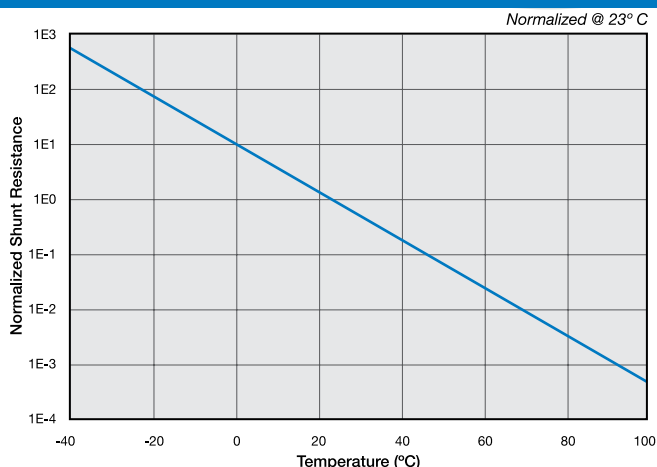
APPLICATIONS

- Colorimeters
- Photometers
- Spectroscopy Equipment
- Fluorescence

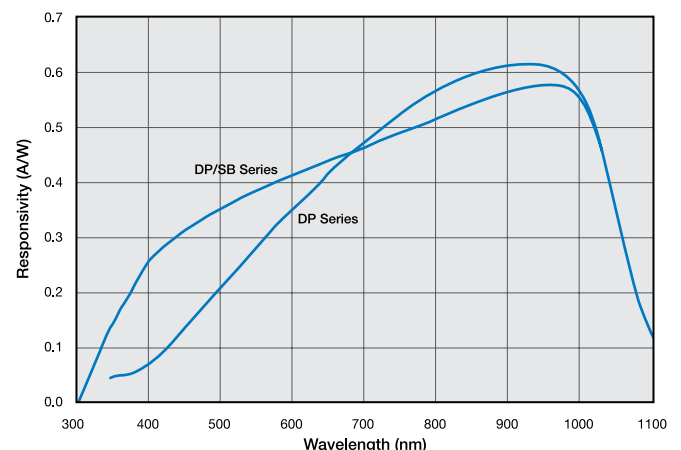
FEATURES

- Ultra Low Noise
- High Shunt Resistance
- Wide Dynamic Range
- Blue Enhanced

Typical Shunt Resistance vs. Temperature



Typical Spectral Response



Photovoltaic Series

Typical Electro-Optical Specifications at $T_A=23^{\circ}\text{C}$

Model Number	Active Area		Peak Responsivity Wavelength	Responsivity at λ_p		Capacitance (pF)	Shunt Resistance (G Ω)		NEP (W/ $\sqrt{\text{Hz}}$)	Rise Time (ns)	Temp.* Range (°C)		Package Style ¶
	Area (mm ²)	Dimensions (mm)		λ_p (nm)	(A/W)	0 V	-10 mV		0V 970 nm	0 V 632 nm 50 Ω	Operating	Storage	
				typ.	min.	typ.	max.	min.	typ.	typ.			

'DP' Series, Metal Package

CD-1705	0.88	0.93 sq	850	970	0.55	0.60	70	1.0	10	2.1 e-15	2000	-40 ~ +100	-55 ~ +125	68 / Plastic
PIN-2DPI ‡	1.1	0.81 x 1.37					150				30			4 / TO-18
PIN-125DPL	1.6	1.27 sq.					160							8 / TO-18
PIN-3CDPI	3.2	1.27 x 2.54					320	0.5	5.0	3.0 e-15	50			4 / TO-18
PIN-3CDP														7 / TO-18
PIN-5DPI	5.1	2.54 ϕ					500	0.4	4.0	3.4 e-15	60			2 / TO-5
PIN-5DP														5 / TO-5
PIN-13DPI	13	3.6 sq					1200	0.35	3.5	3.6 e-15	150			2 / TO-5
PIN-13DP														5 / TO-5
PIN-6DPI	16.4	4.57 ϕ					2000	0.2	2.0	3.9 e-15	220			3 / TO-8
PIN-6DP														6 / TO-8
PIN-44DPI	44	6.6 sq					4300	0.1	1.0	4.8 e-15	475			3 / TO-8
PIN-44DP														6 / TO-8
PIN-10DPI	100	11.28 ϕ					9800	0.05	0.2	6.8 e-15	1000	-10 ~ +60	-20 ~ +70	10/ Lo-Prof
PIN-10DP														11 / BNC
PIN-25DP	613	27.9 ϕ					60000	0.002	0.1	3.0 e-14	6600			12 / BNC

'DP' Series, Plastic Package §

PIN-220DP	200	10 x 20	970	0.55	0.60	20000	0.02	0.2	1.2 e-14	2200	-10 ~ +60	-20 ~ +70	27 / Plastic
-----------	-----	---------	-----	------	------	-------	------	-----	----------	------	-----------	-----------	--------------

Super Blue Enhanced 'DP/SB' Series, (All Specifications @ $\lambda = 410 \text{ nm}$. $V_{\text{BIAS}} = 0\text{V}$, $R_L = 50\Omega$)

Model No.	Active Area/Dimensions		Responsivity (A/W)		Capacitance (pF)	R _{sh} (MΩ)	NEP (W/√Hz)	Operating Current (mA)	Rise Time (μs)			Package Style ¶
	mm²	mm	min.	typ.	typ.	min.	typ.	max.	typ.			
PIN-040DP/SB	0.81	1.02 ϕ	0.15	0.20	60	600	2.0 e-14	0.5	0.02	-10 ~ +60	-20 ~ +70	1 / TO-18
PIN-5DP/SB †	5.1	2.54 ϕ			450	150	5.2 e-14	2.0	0.2			5 / TO-5
PIN-10DP/SB	100	11.28 ϕ			8800	10	2.0 e-13	10.0	2.0			11 / BNC
PIN-10DPI/SB												10 / Metal
PIN-220DP/SB	200	10 x 20			17000	5	2.9 e-13	10.0	4.0			27 / Plastic

'5T' Series, Blue

Model No.	Active Area/Dimensions		Responsivity (A/W) 436nm		Capacitance (pF) 0V	R_{sh} ($M\Omega$)	NEP ($\text{W}/\sqrt{\text{Hz}}$)	Dark Current (nA)	Rise Time (μs)			Package Style ¶
	mm^2	mm	min.	typ.	max	min.	typ.	max.	typ.			
OSD1-5T	1.0	1.0 sq	0.18	0.21	35	250	2.5 e-14	1.0	7	-25 ~ +75	-45 ~ +100	7 / TO-18
OSD3-5T	3.0	2.5 x 1.2			80	100	3.0 e-14	2.0	9			7 / TO-18
OSD5-5T	5.0	2.5 ϕ			130	100	3.3 e-14	2.0	9			5 / TO-5
OSD15-5T	15.0	3.8 sq			390	50	5.6 e-14	10.0	12			5 / TO-5
OSD60-5T	62.0	7.9 sq			1800	3	2.1 e-13	25.0	30			69 / TO-8
OSD100-5TA	100.0	11.3 ϕ			2500	2	2.5 e-13	30.0	45			55 / Special

‡ The "I" suffix on the model number is indicative of the photodiode chip being isolated from the package by an additional pin connected to the case.

For mechanical drawings please refer to pages 61 thru 73.

† Operating Temperature: -40 to +100 $^{\circ}\text{C}$, Storage Temperature: -55 to +125 $^{\circ}\text{C}$.

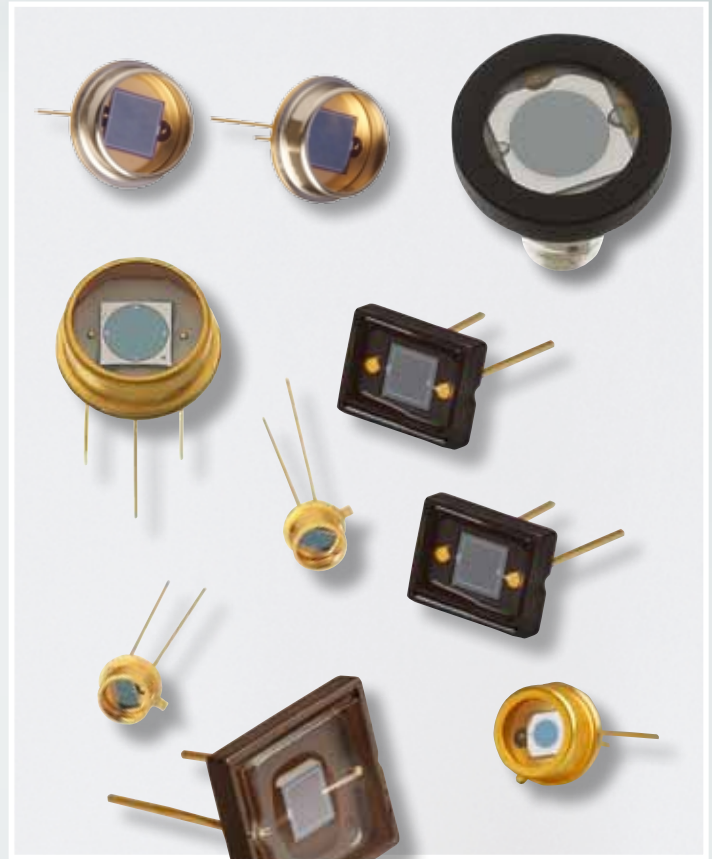
* Non-Condensing temperature and Storage Range, Non-Condensing Environment.

OSI Optoelectronics offers two distinct families of UV enhanced silicon photodiodes. Inversion channel series and planar diffused series. Both families of devices are especially designed for low noise detection in the UV region of electromagnetic spectrum.

Inversion layer structure UV enhanced photodiodes exhibit 100% internal quantum efficiency and are well suited for low intensity light measurements. They have high shunt resistance, low noise and high breakdown voltages. The response uniformity across the surface and quantum efficiency improves with 5 to 10 volts applied reverse bias. In photovoltaic mode (unbiased), the capacitance is higher than diffused devices but decreases rapidly with an applied reverse bias. Photocurrent non-linearity sets in at lower photocurrents for inversion layer devices compared to the diffused ones. Below 700nm, their responsivities vary little with temperature.

Planar diffused structure UV enhanced photodiodes show significant advantages over inversion layer devices, such as lower capacitance and higher response time. These devices exhibit linearity of photocurrent up to higher light input power compared to inversion layer devices. They have relatively lower responsivities and quantum efficiencies compared to inversion layer devices

There are two types of planar diffused UV enhanced photodiodes available: UVDQ and UVEQ. Both series have almost similar electro-optical characteristics, except in the UVEQ series, where the near IR responses of the devices are suppressed. This is especially desirable if blocking the near IR region of the spectrum is necessary. UVDQ devices peak at 970 nm and UVEQ devices at 720 nm (see graph). Both series may be biased for lower capacitance, faster response and wider dynamic range. Or they may be operated in the photovoltaic (unbiased) mode for applications requiring low drift with temperature variations. The UVEQ devices have a higher shunt resistance than their counterparts of UVDQ devices, but have a higher capacitance.



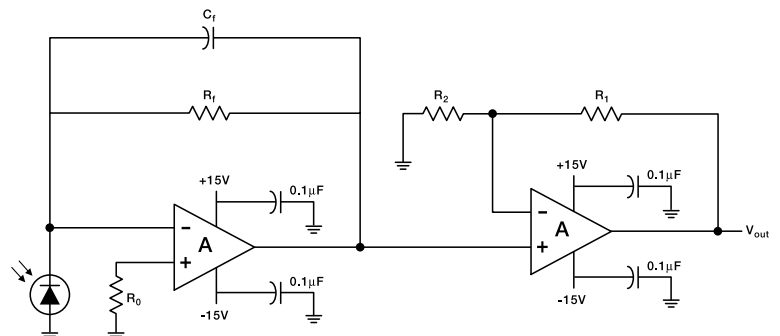
APPLICATIONS

- Pollution Monitoring
- Medical Instrumentation
- UV Exposure Meters
- Spectroscopy
- Water Purification
- Fluorescence

FEATURES

- Inversion series:
 - 100% Internal QE
- Ultra High R_{SH}
- Planar Diffused Series:
 - IR Suppressed
 - High Speed Response
 - High Stability
- Excellent UV response

These detectors are ideal for coupling to an OP-AMP in the current mode configuration as shown.



Inversion Layer UV Enhanced Photodiodes

Typical Electro-Optical Specifications at $T_A=23^{\circ}\text{C}$

Model Number	Active Area		Responsivity (A/W)		Capacitance (pF)	Shunt Resistance (MΩ)		NEP (W/√Hz)	Reverse Voltage (V)	Rise Time (μs)	Operating Current (mA)	Temp.* Range (°C)		Package Style ¶
	Area (mm²)	Dimensions (mm)	254 nm		0 V	-10 mV		0V 254 nm		0 V 254 nm 50 Ω	0 V	Operating	Storage	
			min.	typ.	max.	min.	typ.	typ.	max.	typ.	typ.			

'UV Enhanced' Series, Inversion Layer, Metal Package

UV-001«	0.8	1.0 ϕ	0.09	0.14	60	250	500	6.4 e-14	5	0.2	0.1	-20 ~ +60	-55 ~ +80	5 / TO-5							
UV-005	5.1	2.54 ϕ			300	80	200	1.0 e-13		0.9											
UV-015	15	3.05 x 3.81			800	30	100	1.4 e-13		2.0											
UV-20	20	5.08 ϕ			1000	25	50	2.0 e-13		2.0											
UV-35	35	6.60 x 5.33			1600	20	30	1.7 e-13		3.0		-10 ~ +60	-20 ~ +70	6 / TO-8							
UV-50	50	7.87 ϕ			2500	10	20	2.6 e-13		3.5											
UV-50L ‡																					
UV-100	100	11.28 ϕ			4500	5	10	4.5 e-13		5.9											
UV-100L										10 / Lo-Prof											

'UV Enhanced' Series, Inversion Layer, Plastic Package §

UV-35P	35	6.60 x 5.33	0.09	0.14	1600	15	30	1.7 e-13	5	3.0	0.1	-10 ~ +60	-20 ~ +70	25 / Plastic
FIL-UV50	50	7.87 ϕ			2500	10	20	2.1 e-13		3.5				15 / Plastic

‡ The 'L' suffix on the model number is indicative of the photodiode chip being isolated from the package by an additional pin connected to the case.

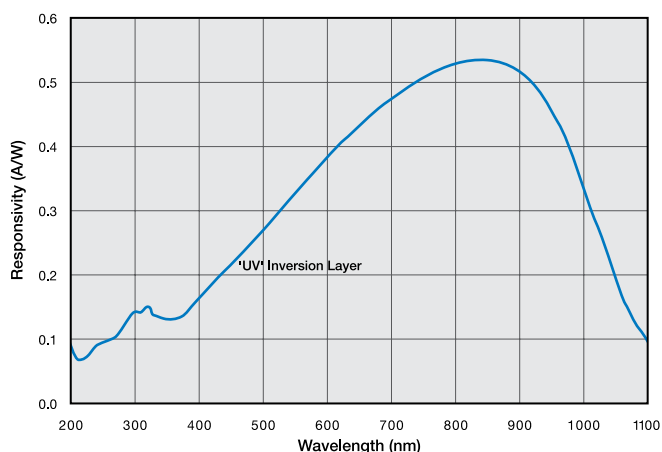
§ The photodiode chips in "FIL" series are isolated in a low profile plastic package. They have a large field of view as well as in line pins.

¶ For mechanical drawings please refer to pages 61 thru 73.

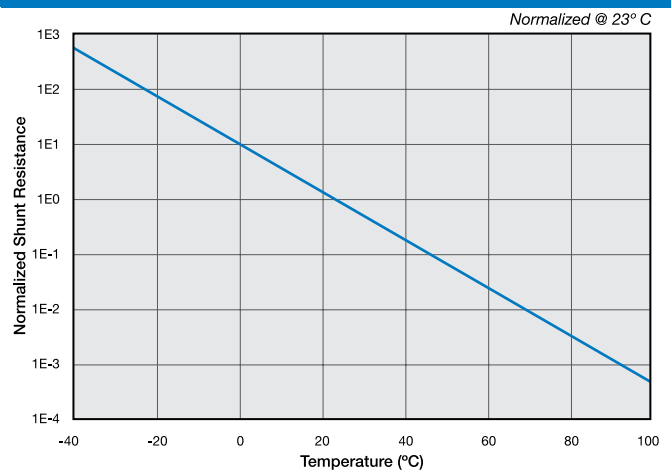
* Non-Condensing temperature and Storage Range, Non-Condensing Environment.

« Minimum order quantities apply

Typical Spectral Response



Typical Shunt Resistance vs. Temperature



Planar Diffused UV Enhanced Photodiodes

Typical Electro-Optical Specifications at $T_A=23^{\circ}\text{C}$

Model Number	Active Area		Peak Wavelength λ_P (nm)	Responsivity (A/W)			Capacitance (pF)		Shunt Resistance (GOhm)		NEP (W/√Hz)		Reverse Voltage (V)	Rise Time (μs)		Temp.* Range (°C)		Package Style ¶
	Area (mm ²)	Dimensions (mm)		200 nm	633 nm	Peak	0 V		-10 mV		0V 200 nm			0 V 1kOhm				
				typ.	typ.	typ.	typ.		min.	typ.	typ.			max.		typ.	Operating	

'UV-DQ' Series Planar Diffused, Metal Package, Quartz Window

UV-005DQ	5.7	2.4 x 2.4	980	0.12	0.33	0.5	65	0.3	1	3.6 E-14	5	0.2	-20 ~ +60	-55 ~ +80	5 / TO-5
UV-013DQ	13	3.6 x 3.6					150	0.2	0.8	4.1 E-14		0.5			
UV-035DQ	34	5.8 x 5.8					380	0.1	0.4	5.8 E-14		1			
UV-100DQ	100	10 X 10					1100	0.04	0.2	8.2 E-14		3			

'UV-DQC' Series Planar Diffused, Ceramic Package, Quartz Window

UV-005DQC	5.7	2.4 x 2.4	980	0.12	0.33	0.5	65	0.3	1	3.6 E-14	5	0.2	-20 ~ +60	-20 ~ +80	25 / Ceramic
UV-035DQC	34	5.8 x 5.8					380	0.1	0.4	5.8 E-14		1			
UV-100DQC	100	10 X 10					1100	0.04	0.2	8.2 E-14		3			

'UV-EQ' Series Planar Diffused, Metal Package, Quartz Window

UV-005EQ	5.7	2.4 x 2.4	720	0.12	0.34	0.36	140	2	20	8.2 E-15	5	0.5	-20 ~ +60	-55 ~ +80	5 / TO-5
UV-013EQ	13	3.6 x 3.6					280	1	10	1.1 E-14		1			
UV-035EQ	34	5.8 x 5.8					800	0.5	5	1.6 E-14		2			
UV-100EQ	100	10 X 10					2500	0.2	2	2.6 E-14		7			

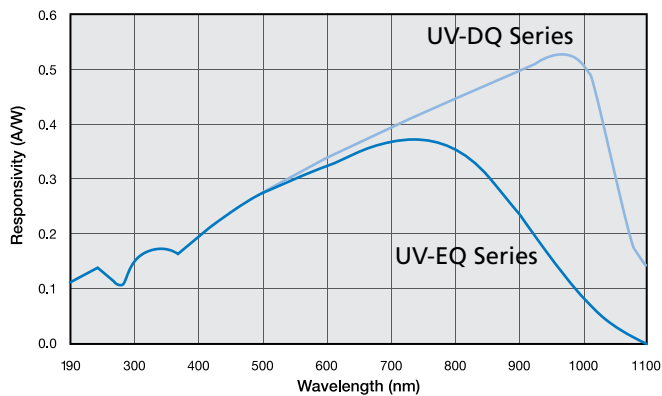
'UV-EQC' Series Planar Diffused, Ceramic Package, Quartz Window

UV-005EQC	5.7	2.4 x 2.4	720	0.12	0.34	0.36	140	2	20	8.2E-15	5	0.5	-20 ~ +60	-20 ~ +80	25 / Ceramic
UV-035EQC	34	5.8 x 5.8					800	0.5	5	1.6 E-14		2			
UV-100EQC	100	10 X 10					2500	0.2	2	2.6E-14		7			

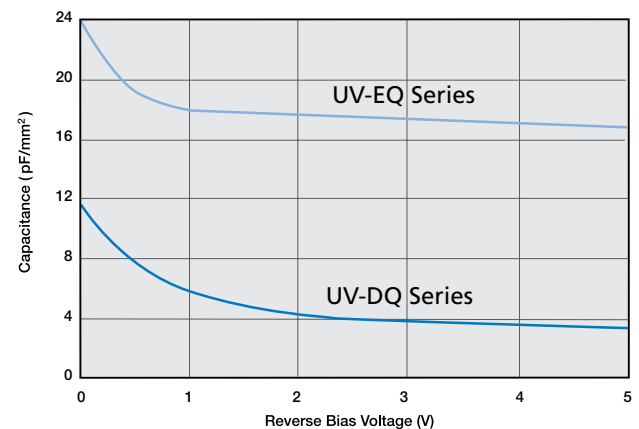
¶ For mechanical specifications please refer to pages 61 thru 73.

* Non-Condensing temperature and Storage Range, Non-Condensing Environment.

Typ. Responsivity with Quartz Window ($T_A = 25^{\circ}\text{C}$)



Typ. Capacitance vs. Reverse Bias ($T_A = 23^{\circ}\text{C}$, $f=1\text{MHz}$)



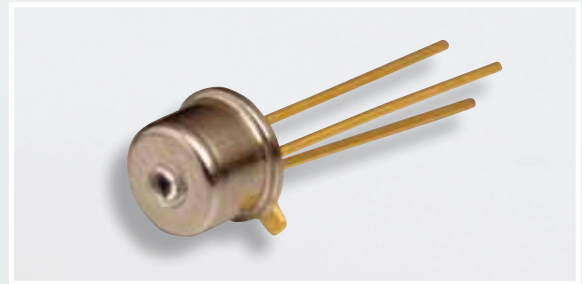
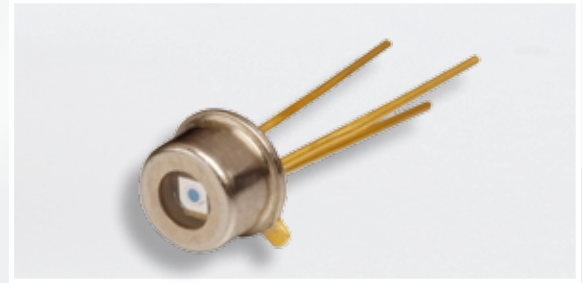
High Speed Silicon Photodiodes

High Speed Silicon Series

OSI Optoelectronics High Speed Silicon series are small area devices optimized for fast response time or High bandwidth applications. **The BPX-65** complements the rest of the high speed group with an industry standard.

The spectral range for these devices goes from 350 nm to 1100 nm. The responsivity and response time are optimized such that the HR series exhibit a peak responsivity of 0.50 A/W at 800 nm and typical response times of a few hundred pico seconds at -5V.

Note that for all high-speed photodetectors, a reverse bias is required to achieve the fastest response times. However, the reverse bias should be limited to maximum reverse voltage specified to avoid damage to the detector. Output signals can be measured directly with an oscilloscope or coupled to high frequency amplifiers as shown in figure 10 of the Photodiode Characteristics section of the catalog. All parts in the High-Speed silicon series are available with a flat window or ball lens (L).



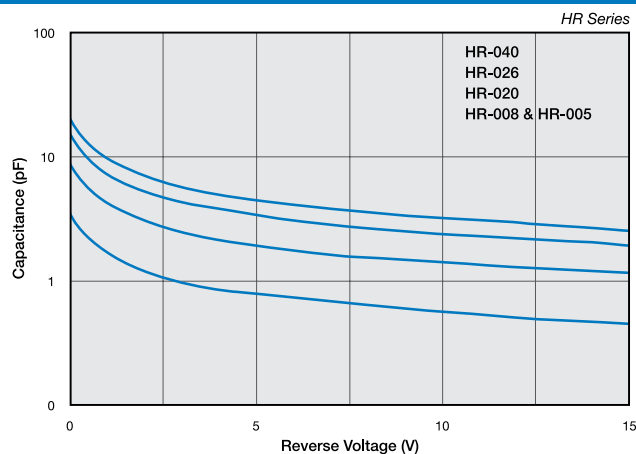
APPLICATIONS

- Video Systems
- Computers and Peripherals
- Industrial Control
- Guidance Systems
- Laser Monitoring

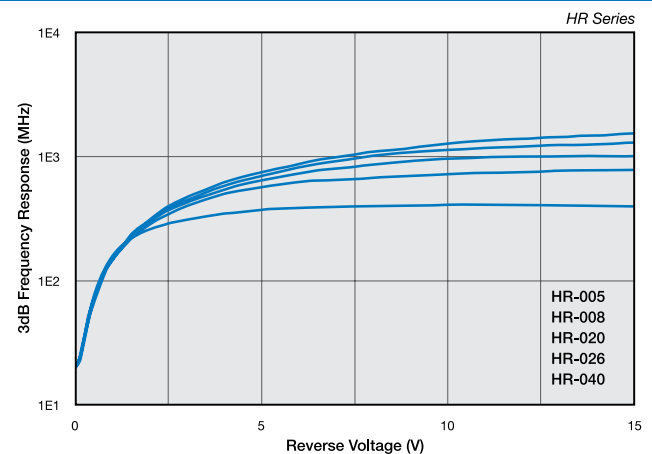
FEATURES

- Low Dark Current
- Low Capacitance
- TO-46 Package
- w/Lensed Cap
- Sub ns Response

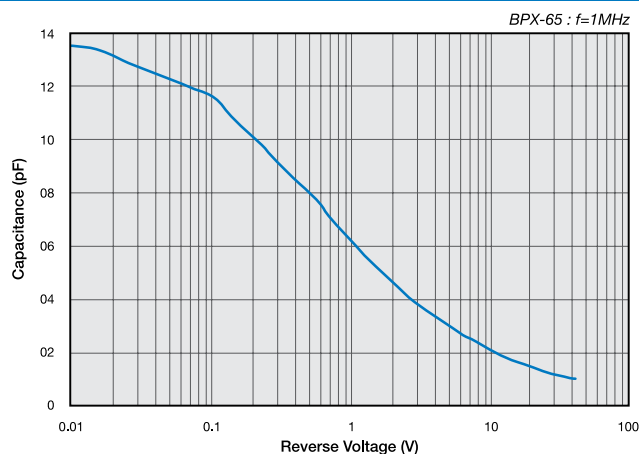
Typical Capacitance vs. Reverse Bias



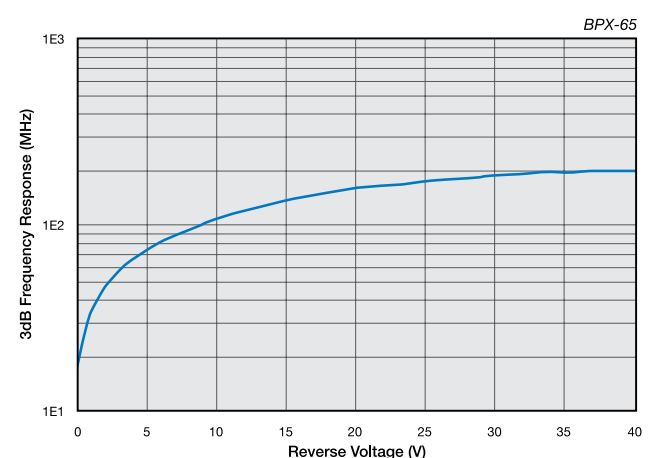
Typical Frequency Response vs. Reverse Bias



Typical Capacitance vs. Reverse Bias



Typical Frequency Response vs. Reverse Bias



High Speed Silicon Series

Typical Electro-Optical Specifications at $T_A=23^{\circ}\text{C}$

Model Number	Active Area		Peak Wavelength (nm)	Responsivity (A/W)		Capacitance (pF) ‡	Dark Current (nA) ‡		NEP (W/√Hz)	Reverse Voltage (V)	Rise Time (ns)	Temp.** Range (°C)		Package Style ¶
	Area (mm²)	Dimensions (mm)		830 nm	830 nm 50 Ω				Operating		Storage			
				min.	typ.	typ.	typ.	max.		typ.		max.	typ.	
High Responsivity Series (V _{BIAS} =-5 V)														
PIN-HR005 PIN-HR005L*	0.01	0.127 ϕ	800	0.45*	0.50*	0.8	0.03	0.8	5.0 e-15	15	0.60	-25 ~ +85	-40 ~ +100	9 / TO-18 16 / TO-18 (L - Ball Lens Cap)
PIN-HR008 PIN-HR008L*	0.03	0.203 sq				0.8	0.03	0.8	5.0 e-15		0.60			
PIN-HR020 PIN-HR020L*	0.20	0.508 ϕ				1.8	0.06	1.0	7.1 e-15		0.80			
PIN-HR026 PIN-HR026L*	0.34	0.660 ϕ				2.6	0.1	1.5	1.0 e-14		0.90			
PIN-HR040 PIN-HR040L*	0.77	0.991 ϕ				4.9	0.3	2.0	1.9 e-14		1.0			
BPX-65 (V _{BIAS} =-20 V)														
BPX-65	1.0	1.0 sq	900	0.45	0.5	3.0	0.5	5.0	2.3 e-14	50	2.0			7 / TO-18

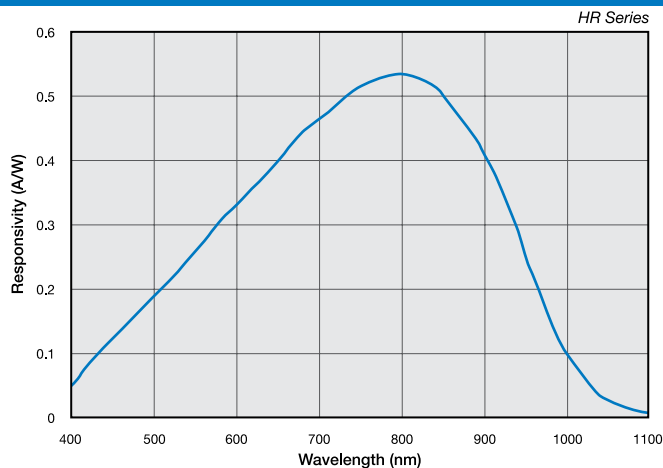
¶ For mechanical drawing, please refer to pages 61 thru 73.

* Responsivities are measured for Flat window devices. L- Refers to devices with a Ball-type lens cap.

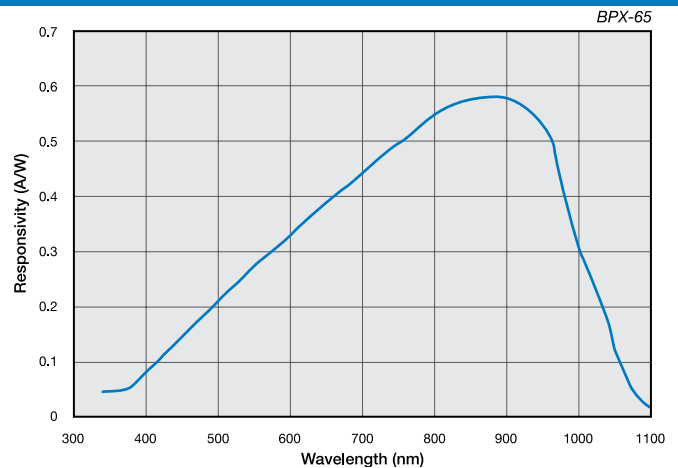
Chip centering is within +/- 0.005" with respect to OD of the Header.

** Non-Condensing temperature and Storage Range, Non-Condensing Environment.

Typical Spectral Response



Typical Spectral Response



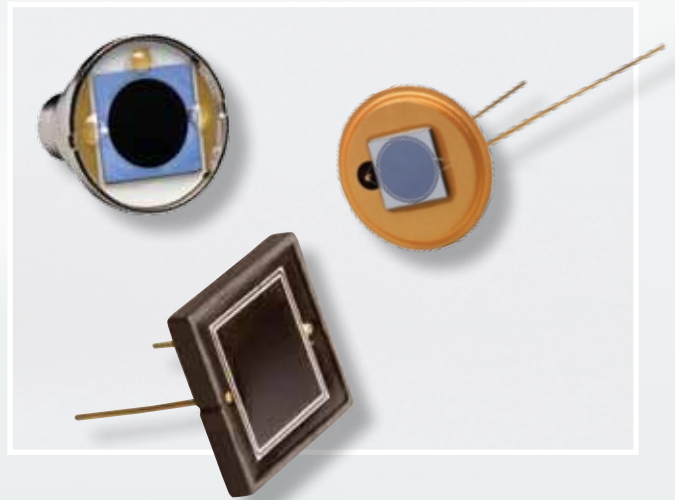
Soft X-Ray, Deep UV Enhanced Series

Inversion Layer Silicon Photodiodes

OSI Optoelectronics' 1990 R&D 100 award winning X-UV detector series are a unique class of silicon photodiodes designed for additional sensitivity in the X-Ray region of the electromagnetic spectrum without use of any scintillator crystals or screens. Over a wide range of sensitivity from 200 nm to 0.07 nm (6 eV to 17,600 eV), one electron-hole pair is created per 3.63eV of incident energy which corresponds to extremely high stable quantum efficiencies predicted by $E(ph) / 3.63\text{eV}$ (See graph below). For measurement of radiation energies above 17.6 keV, refer to the "Fully Depleted High Speed and High Energy Radiation Detectors" section.

A reverse bias can be applied to reduce the capacitance and increase speed of response. In the unbiased mode, these detectors can be used for applications requiring low noise and low drift. These detectors are also excellent choices for detecting light wavelengths between 350 to 1100 nm.

The detectors can be coupled to a charge sensitive preamplifier or low-noise op-amp as shown in the circuit on the opposite page.



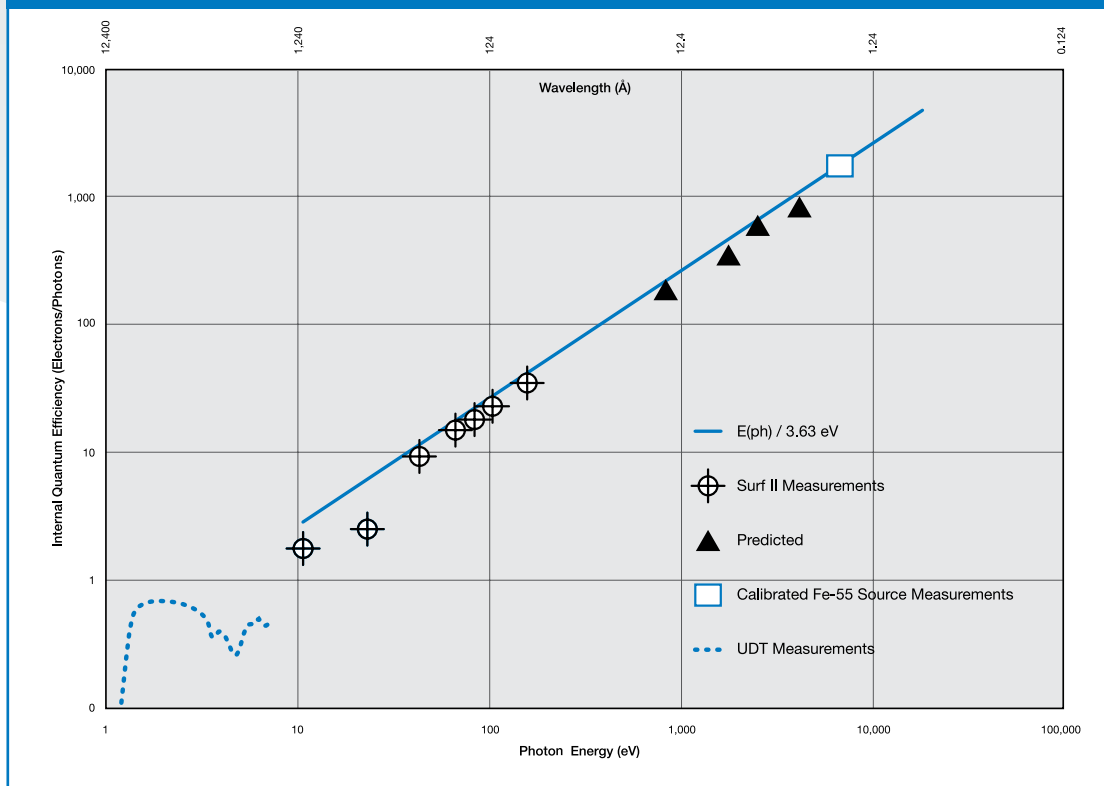
APPLICATIONS

- Electron Detection
- Medical Instrumentation
- Dosimetry
- Radiation Monitoring
- X-ray Spectroscopy
- Charged Particle Detection

FEATURES

- Direct Detection
- No Bias Needed
- High Quantum Efficiency
- Low Noise
- High Vacuum Compatible
- Cryogenically Compatible
- 0.070 nm to 1100 nm Wavelength Range

Typical Quantum Efficiency



Soft X-Ray, Deep UV Enhanced Photodiodes

Typical Electro-Optical Specifications at $T_A=23^{\circ}\text{C}$

Model Number	Active Area		Capacitance (nF)		Shunt Resistance (MΩ)		NEP (W/√ Hz)		Temp. Range* (°C)		Package Style ¶
	Area (mm²)	Dimension (mm)	0 V		-10 mV		0V 200 nm		Operating	Storage	
			typ.	max.	min.	typ.	typ.	max.			

'XUV' Series Metal Package

XUV-005	5	2.57 ϕ	0.3	0.5	200	2000	2.9 e -15	9.1 e -15	-20 ~ +60	-20 ~ +80	22 / TO-5
XUV-020	20	5.00 ϕ	1.2	1.6	50	500	5.8 e -15	1.8 e -14			23 / TO-8
XUV-035	35	6.78 x 5.59	2	3	30	300	7.4 e -15	2.3 e -14			
XUV-100	100	11.33 ϕ	6	8	10	100	7.4 e -15	4.1 e -14			28 / BNC

'XUV' Series Ceramic Package

XUV-50C	50	8.02 ϕ	2	3	20	200	9.1 e -15	2.9 e -14	-20 ~ +60	-20 ~ +80	25 / Ceramic
XUV-100C	100	10.00 sq	6	8	10	100	1.3 e -14	4.1 e -14			25 / Ceramic

¶ For mechanical drawings please refer to pages 61 thru 73.

All XUV devices are supplied with removable windows.

* Non-Condensing temperature and Storage Range, Non-Condensing Environment.

Circuit example

In this circuit example, the pre-amplifier is a FET input op-amp or a commercial charge sensitive preamplifier. They can be followed by one or more amplification stages, if necessary. The counting efficiency is directly proportional to the incident radiation power. The reverse bias voltage must be selected so that the best signal-to-noise ratio is achieved.

For low noise applications, all components should be enclosed in a metal box. Also, the bias supply should be either simple batteries or a very low ripple DC supply.

Amplifier: OPA-637, OPA-27 or similar

R_F : 10 $M\Omega$ to 10 $G\Omega$

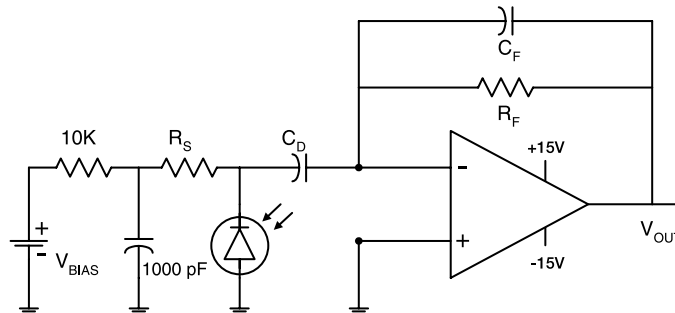
R_S : 1 $M\Omega$; Smaller for High Counting Rates

C_F : 1pF

C_D : 1pF to 10 μF

OUTPUT $V_{OUT} = Q / C_F$

Where Q is the Charge Created By One Photon or One Particle



High Breakdown Voltage, Fully Depleted Series

Large Active Area Photodiodes

The Large Active Area High Speed Detectors can be fully depleted to achieve the lowest possible junction capacitance for fast response times. They may be operated at a higher reverse voltage, up to the maximum allowable value, for achieving even faster response times in nano seconds. The high reverse bias at this point, increases the effective electric field across the junction, hence increasing the charge collection time in the depleted region. Note that this is achieved without the sacrifice for the high responsivity as well as active area.

The Large Active Area Radiation Detectors can also be fully depleted for applications measuring high energy X-rays, γ -rays as well as high energy particles such as electrons, alpha rays and heavy ions. These types of radiation can be measured with two different methods. Indirect and direct.

Indirect High Energy Radiation Measurement:

In this method, the detectors are coupled to a scintillator crystal for converting high energy radiation into a detectable visible wavelength. The devices are mounted on a ceramic and covered with a clear layer of an epoxy resin for an excellent optical coupling to the scintillator. This method is widely used in detection of high energy gamma rays and electrons. This is where the X-UV devices fail to measure energies higher than 17.6 keV. The type and size of the scintillator can be selected based on radiation type and magnitude.

Direct High Energy Radiation Measurement:

Both PIN-RD100 and PIN-RD100A, can also be used without any epoxy resin or glass window for direct measurement of high energy radiation such as alpha rays and heavy ions. The radiation exhibits loss of energy along a linear line deep into the silicon after incident on the active area.

The amount of loss and the penetration depth is determined by the type and magnitude of the radiation. In order to measure completely the amount of radiation, the depletion layer should be deep enough to cover the whole track from the incident point to the stop point. This requires a high bias application to fully deplete the detector. In spite of the large active area as well as high bias voltage applications, the devices exhibit super low dark currents, low capacitances and low series resistances.



APPLICATIONS

Large Active Area

High Speed Detectors

- Laser Guided Missiles
- Laser Warning
- Laser Range Finder
- Laser Alignment
- Control Systems

Large Active Area

Radiation Detectors

- Electron Detection
- Medical Instrumentation
- High Energy Spectroscopy
- Charged Particle Detection
- High Energy Physics
- Nuclear Physics

FEATURES

Large Active Area

High Speed Detectors

- Large Active Area
- Fully Depleteable
- Fast Response
- Ultra Low Dark Current
- Low Capacitance

Large Active Area

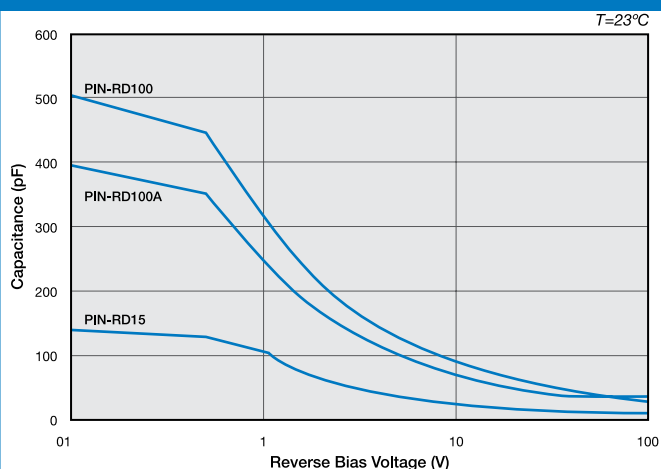
Radiation Detectors

- Large Active Area
- Scintillator Mountable
- Fully Depleteable
- Ultra Low Dark Current
- Low Capacitance
- High Breakdown Voltage

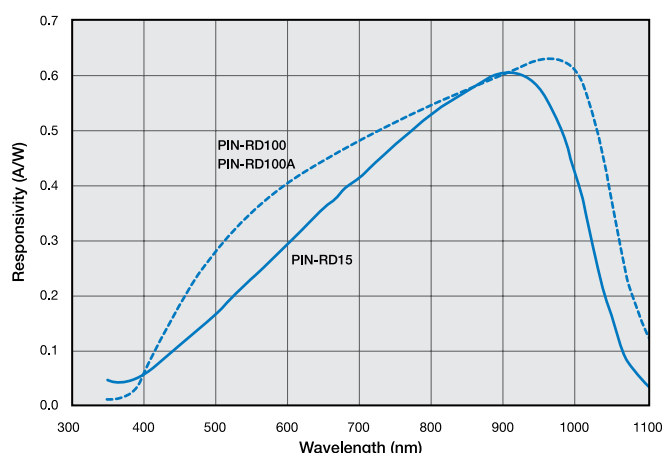
In addition to their use in high energy particle detection, the PIN-RD100 and PIN-RD100A are also excellent choices for detection in the range between 350 to 1100 nm in applications where a large active area and high speed is desired.

These detectors can be coupled to a charge sensitive preamplifier or lownoise op-amp as shown in the opposite page. The configuration for indirect measurement is also shown with a scintillator crystal.

Typical Capacitance vs. Reverse Bias Voltage



Typical Spectral Response



Fully Depleted Photodiodes

Typical Electro-Optical Specifications at $T_A=23^{\circ}\text{C}$

Model Number	Active Area		Peak Responsivity Wavelength (nm)	Responsivity (A/W)	Depletion Voltage	Dark Current (nA)		Capacitance (pF)		Rise Time (ns)	NEP (W/√Hz)	Reverse Voltage (V)	Temp.* Range (°C)		Package Style ¶
	Area (mm²)	Dimensions (mm)		900 nm	V	-100 V		-100 V		900 nm -100 V 50Ω	900nm -100V	10 μA	Operating	Storage	
				typ.	typ.	typ.	max.	typ.	max.	typ.	typ.	max.			

Large Active Area, High Speed

PIN-RD07	7.1	3.00 ϕ	900	0.55	48	0.2	5.0	8.0	9.0	1.5	1.2 e-14	135	-40 ~ +100	-55 ~ +125	26 / TO-8
PIN-RD15	14.9	4.35 ϕ		0.58	55	1.0	30	14	16	3.0	2.5 e-14	140			
PIN-RD100	100	10 Sq	950	0.60	75	2	10	50	60	40	3.2 e-14	120	-20 ~ +60	-20 ~ +80	25 / Ceramic
PIN-RD100A	100	10 Sq			35	2 †	10 †	40 †	45 †	6	3.4 e-14	70			

Model Number	Active Area		Peak Responsivity Wavelength (nm)	Responsivity 900 nm	Capacitance (pF)	Shunt Resistance (GΩ)		NEP (W/√Hz)	Rise Time (ns)	Temp.* Range (°C)		Package Style ¶
	Area (mm²)	Dimensions (mm)		A/W	0 V	-10 V		900 nm	0 V 632nm 50Ω	Operating	Storage	
				typ.	typ.	min.	typ.	typ.	typ.			

OSD35-LR Series

OSD35-LR-A	34.2	5.8 x 5.9	830	0.54	1300	2	3	5.6 e-15	---	-25 ~ +75	-45 ~ +100	25 / Ceramic
OSD35-LR-D	34.2	5.8 x 5.9	830	0.54	1300	0.1	0.3	1.8 e-14	---			

OSD-35-LR's ceramic packages come without window, instead the optically clear epoxy is used.

† Measured at $V_{\text{bias}} = -50\text{V}$

¶ For mechanical drawings please refer to pages 61 thru 73.

* Non-Condensing temperature and Storage Range, Non-Condensing Environment.

DIRECT DETECTION

For direct detection of high-energy particles, the pre-amplifier is a FET input op-amp, followed by one or more amplification stages, if necessary, or a commercial charge sensitive preamplifier. The counting efficiency is directly proportional to the incident radiation power. The reverse bias voltage must be selected as such to achieve the best signal-to-noise ratio. For low noise applications, all components should be enclosed in a metal box. Also, the bias supply should be either simple batteries or a very low ripple DC supply. The detector should also be operated in the photovoltaic mode.

Amplifier: OPA-637, OPA-27 or similar

R_F : 10 MΩ to 10 GΩ

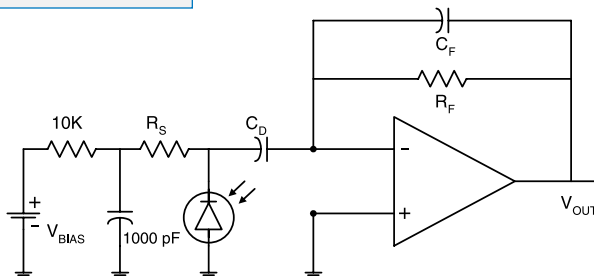
R_S : 1 MΩ; Smaller for High Counting Rates

C_F : 1pF

C_D : 1pF to 10 μF

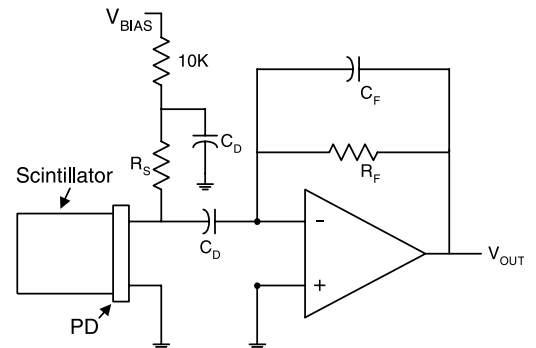
$$\text{OUTPUT } V_{\text{OUT}} = Q / C_F$$

Where Q is the Charge Created By One Photon or One Particle



INDIRECT DETECTION (WITH SCINTILLATOR CRYSTAL)

The circuit is very similar to the direct detection circuit except that the photodiode is coupled to a scintillator. The scintillator converts the high-energy X-rays and/or γ-rays into visible light. Suitable scintillators include CsI(TL), CdWO₄, BGO and NaI(TL). The amplifier should be a FET input op-amp, followed by one or more amplification stages, or a commercial charge sensitive preamplifier. The output voltage depends primarily on the scintillator efficiency and should be calibrated by using radioactive sources.



Multi-Channel X-Ray Detector Series

Scintillator Compatible Photodiode Arrays

This series consists of 16-element arrays: the individual elements are grouped together and mounted on PCB.

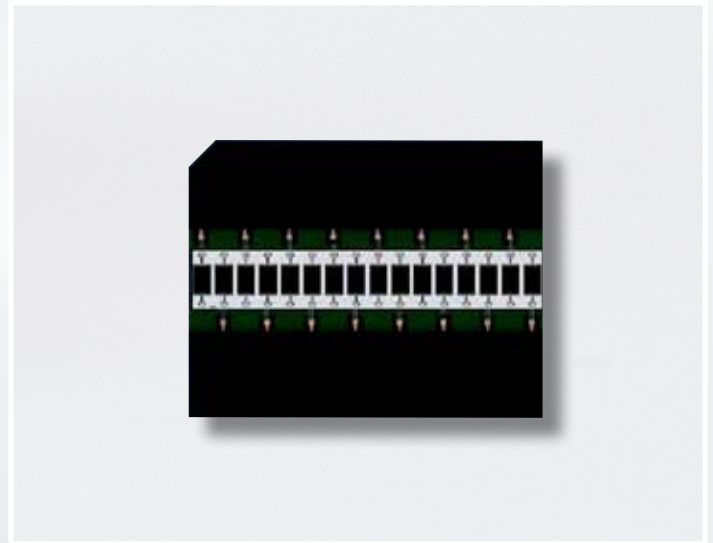
For X-ray or Gamma-ray application, these multi-channel detectors offer scintillator-mounting options: **BGO, CdWO₄ or CsI(Tl)**.

BGO (Bismuth Germanate) acts as an ideal energy absorber: it is widely accepted in high-energy detection applications.

CdWO₄ (Cadmium Tungstate) exhibits sufficiently high light output, helping improve Spectrometry results.

CsI (Cesium Iodide) is another high energy absorber, providing adequate resistance against mechanical shock and thermal stress.

When coupled to scintillator, these Si arrays map any medium or high radiation energy over to visible spectrum via scattering effect. Also, their specially designed PCB allows end-to-end connectivity. Multiple arrays can be deployed in situation that calls for larger scale assembly.



APPLICATIONS

- Position Sensors
- Multi-channel Gamma counting
- X-ray Security Systems

FEATURES

- Scintillator Platform
- 5 Volt Bias
- Channel spacing variety

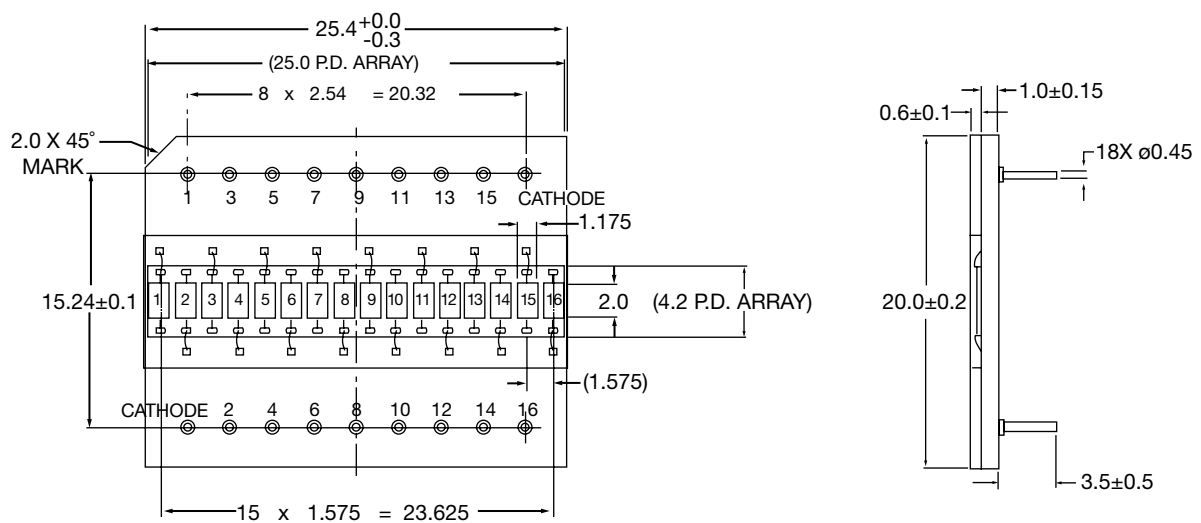
Multi-Channel X-Ray Detector Series

Typical Electro-Optical Specifications at $T_A=23^{\circ}\text{C}$

Model Number	Number of Elements	Active Area Per Element		Pitch (mm)	Responsivity (A/W)		Dark Current (pA)	Terminal Capacitance (pF)	Rise Time (μs)	Reverse Bias (V)	NEP (W/√Hz)	Temp. Range (°C)	
					540 nm	930 nm	-10 mV	0V, 10 KHz	0V, 1KΩ		-10mV 930nm	Operating	Storage
		Area (mm²)	Dimensions (mm)		typ.	typ.	typ.	typ.	typ.	max.	typ.		
Photoconductive Arrays													
A2C-16-1.57	16	2.35	2.00 x 1.18	1.57	0.31	0.59	5	28	0.1	5	5.30 e-15	-10 ~ +60	-20 ~ +70

Mechanical Specifications (All units in mm)

A2C-16-1.57



YAG Series

Nd:YAG Optimized Photodetectors

The **YAG Series** of photo detectors are optimized for high response at 1060 nm, the YAG laser light wavelength, and low capacitance, for high speed operation and low noise. These detectors can be used for sensing low light intensities, such as the light reflected from objects illuminated by a YAG laser beam for ranging applications. The **SPOT Series** of quadrant detectors are well suited for aiming and pointing applications. These are all N on P devices.

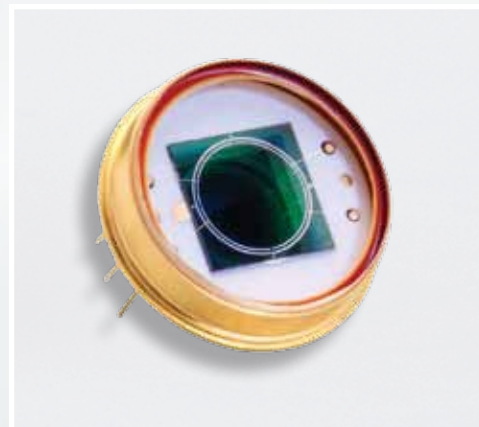
These detectors can be used in the photovoltaic mode, for low speed applications requiring low noise, or in the photoconductive mode, with an applied reverse bias, for high speed applications.

APPLICATIONS

- Nd:YAG Pointing
- Laser Pointing & Positioning
- Position Measurement
- Surface Profiling
- Guidance Systems

FEATURES

- Nd:YAG Sensitivity
- High Breakdown Voltage
- Large Area
- High Speed
- High Accuracy



Model Number	Active Area		Peak Responsivity Wavelength	Responsivity (A/W)	Element Gap	Dark Current (nA)		Capacitance (pF)		Rise Time (ns)	NEP (W/√Hz)	Reverse Voltage (V)	Temp.* Range (°C)		Package Style ¶
	Area (mm²)	Dimensions (mm)	λp nm	1000nm -180V	mm	-180 V	-180 V	1064 nm -180 V 50 Ω	1064 nm -180 V	100 μA	Operating	Storage			
			typ.	typ.	typ.	typ.	max.	typ.	max.	typ.			typ.	max.	

Nd: YAG Optimized Single Element

PIN-5-YAG	5.1	2.54 φ	1000	0.6	-	50	-	5	-	18	1.2 e-14	200	-40 ~ +100	-55 ~ +125	2 / TO-5
PIN-100-YAG	100	11.28 φ				75	1000	25	-	30	2.5 e-14				20 / Metal

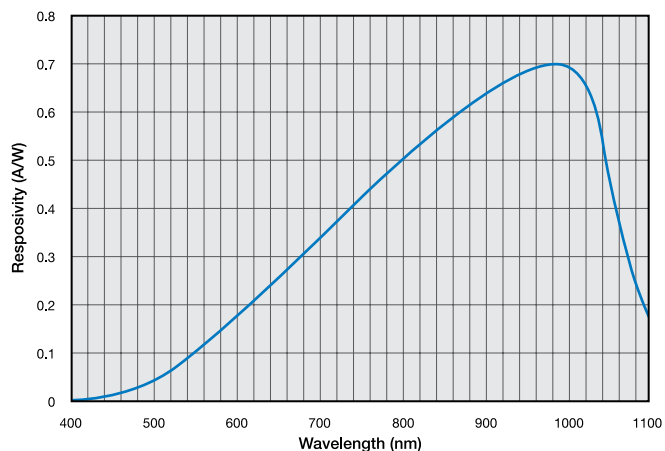
Nd: YAG Optimized Quadrant Photodetectors**

SPOT-9-YAG	19.6	10 φ	1000	0.4	0.1	35	250	5	1	18	3.2 e-14	200	-20 ~ +60	-20 ~ +80	20 / Metal
SPOT-11-YAG FL	26	11.5 φ			0.13	25	100	12	-	15	3.4 e-14				29 / Metal
SPOT-13-YAG-FL	33.7	13.1 φ		0.4	0.13	30	200	15	-	15	-	300	-55 ~ +125C	-55 ~ +125C	29 / Metal
SPOT-15-YAG	38.5	14.0 φ		0.6	0.2	1000	3000	15	30	36	-				20 / Metal

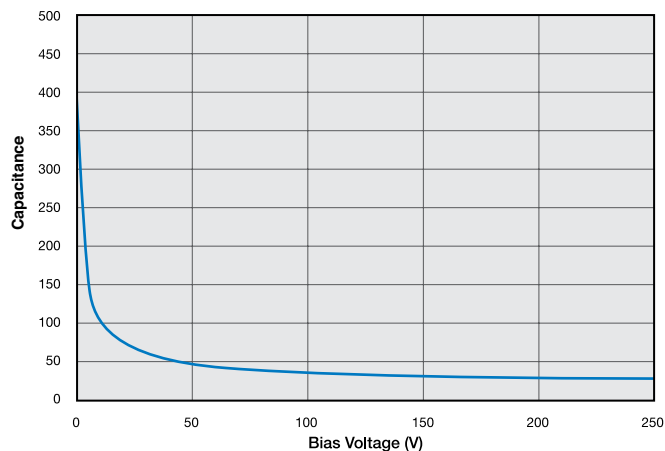
¶ For mechanical drawings please refer to pages 61 thru 73.

** Specifications are per element

Typical Spectral Response

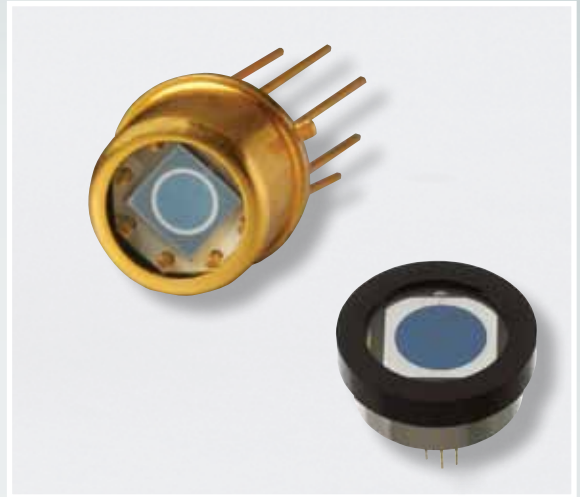


Typical Capacitance vs. Bias Voltage



The Photop™ Series, combines a photodiode with an operational amplifier in the same package. Photops™ general-purpose detectors have a spectral range from either 350 nm to 1100 nm or 200 nm to 1100nm. They have an integrated package ensuring low noise output under a variety of operating conditions. These op-amps are specifically selected by OSI Optoelectronics engineers for compatibility to our photodiodes. Among many of these specific parameters are low noise, low drift and capability of supporting a variety of gains and bandwidths determined by the external feedback components. Operation from DC level to several MHz is possible in an either unbiased configuration for low speed, low drift applications or biased for faster response time.

Any modification of the above devices is possible. The modifications can be simply adding a bandpass optical filter, integration of additional chip (hybrid) components inside the same package, utilizing a different op-amp, photodetector replacement, modified package design and / or mount on PCB or ceramic.



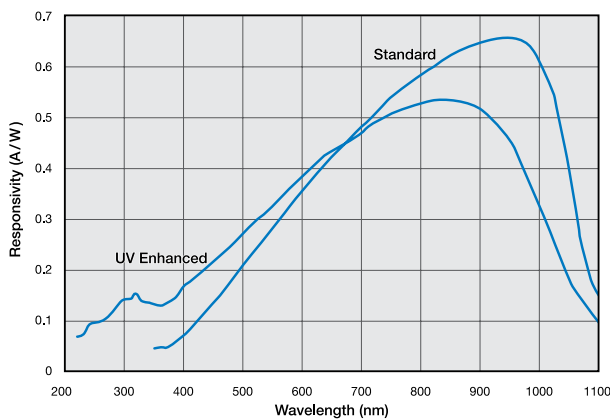
APPLICATIONS

- General Purpose Light Detection
- Laser Power Monitoring
- Medical Analysis
- Laser Communications
- Bar Code Readers
- Industrial Control Sensors
- Pollution Monitoring
- Guidance Systems
- Colorimeter

FEATURES

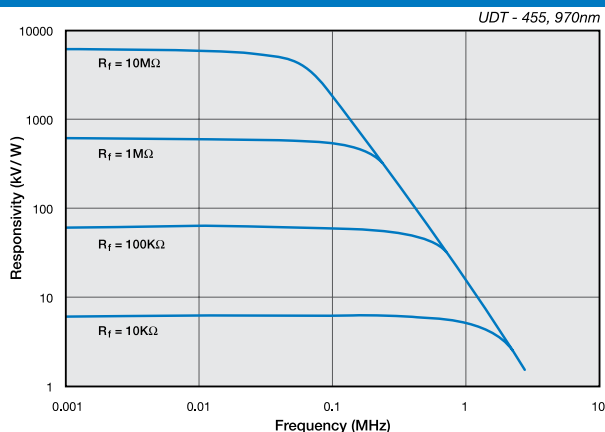
- Detector/Amplifier Combined
- Adjustable Gain/Bandwidth
- Low Noise
- Wide Bandwidth
- DIP Package
- Large Active Area

Typical Spectral Response

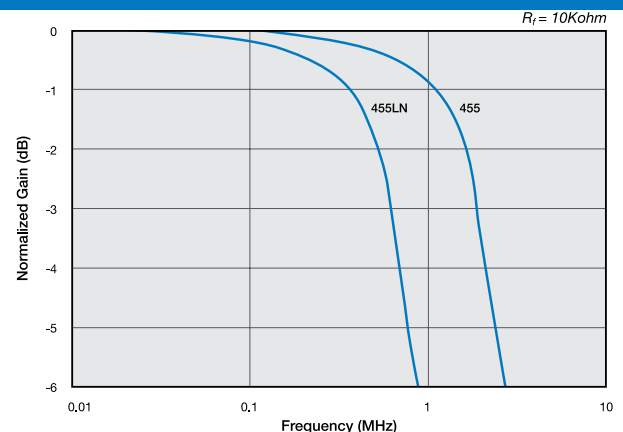


For your specific requirements, contact one of our Applications Engineers.

Typical Responsivity vs. Frequency



Typical Gain vs. Frequency



Photops™ (Photodiode Specifications)

Typical Electro-Optical Specifications at T_A=23°C

Model Number	Active Area		Responsivity (A/W)				Capacitance (pF)		Dark Current (nA)		Shunt Resistance (MΩ)	NEP (W/√Hz)		Reverse Voltage	Temp.* Range (°C)		Package Style	
	Area (mm²)	Dimension (mm)	254 nm		970 nm		0 V	-10 V	-10 V		-10 mV	0 V 254 nm	-10 V 970 nm	V	Operating	Storage		
			min.	typ.	min.	typ.	typ.	typ.	typ.	max.	typ.	typ.	typ.	max.				
350-1100 nm Spectral Range																		
UDT-455	5.1	2.54 φ	---	0.60	0.65	85	15	0.25	3	---	1.4 e -14	30**	0 ~ + 70	-30 ~ + 100	30 / TO-5			
OSI-515*						330	60	0.5	10		1.9 e -14				31 / TO-8			
UDT-020D						16	4.57 φ	1500	300		2				25	3.9 e -14	32 / Special	
UDT-555D	100	11.3 φ																
200-1100 nm Spectral Range																		
UDT-455UV	5.1	2.54 φ	0.10	0.14	---	300	---			100	9.2 e -14	---	5**	30 / TO-5				
OSI-020UV	16	4.57 φ				1000				50	1.3 e -13			31 / TO-8				
UDT-055UV	50	7.98 φ				2500				20	2.1 e -13			32 / Special				
UDT-555UV	100	11.3 φ								4500	10			2.9 e -13	32 / Special			
UDT-555UV/LN**																		

Operational Amplifier Specifications Electro-Optical Specifications at T_A=23 °C

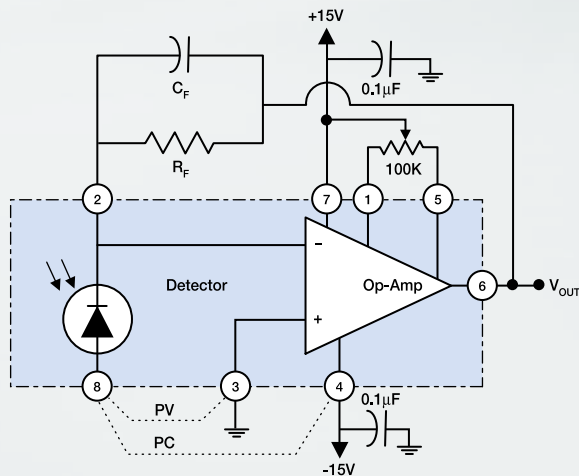
Model Number	Supply Voltage			Quiescent Supply Current (mA)		Input Offset Voltage		Temp. Coefficient Input Offset Voltage		Input Bias Current		Gain Bandwidth Product		Slew Rate		Open Loop Gain, DC		Input Noise Voltage		Input Noise Current
	min.	typ.	max.	± 15 V		mV		μV / °C		pA		MHz		V / μs		V / mV		100 Hz	1 kHz	1 kHz
				typ.	max.	typ.	max.	typ.	max.	typ.	max.	min.	typ.	min.	typ.	min.	typ.	typ.	typ.	typ.
UDT-455	---	±15	±18	2.8	5.0	0.5	3	4	30	±80	±400	3.0	5.4	5	9	50	200	20	15	10
UDT-455UV																				
UDT-020D																				
OSI-020UV	---	±15	±18	1.8	2	0.03	0.12	0.35	1	0.5	20	---	5.1	---	20	1000	2000	5.8	5.1	0.8
OSI-515*	---	±15	±18	6.5	7.2	1	3	10	---	±15	±40	23	26	125	140	3	6.3	---	12	10
UDT-555UV/LN	---	±15	±18	2.5	3.5	0.1	0.5	±2	±5	±0.8	±2	---	2	1	2	501	1778	15	8	0.5
UDT-055UV	---	±15	±22	2.7	4.0	0.4	1	3	10	±40	±200	3.5	5.7	7.5	11	75	220	20	15	10
UDT-555D																				
UDT-555UV																				

¶ For mechanical drawings please refer to pages 61 thru 73.

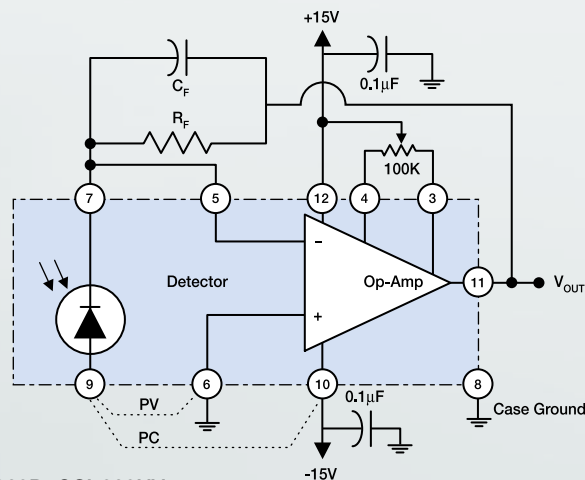
** LN – Series Devices are to be used with a 0V Bias.

* Non-Condensing temperature and Storage Range, Non-Condensing Environment.

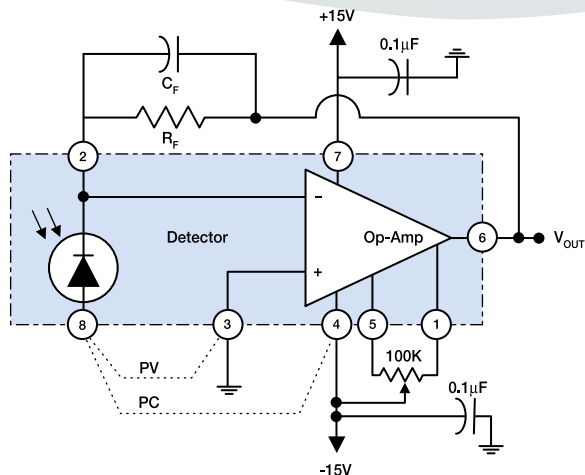
OSI-515 replaces UDT-455HS



UDT-455,
UDT-555D, 555UV, 055UV
OSI-515: pin 1 & 5 are N/C
(No offset adjustment needed).



UDT-020D, OSI-020UV



UDT-555UV/LN

The output voltage is proportional to the light intensity of the light and is given by:

$$V_{OUT} = I_P \times R_F$$

$$= (P \times R_\lambda) \times R_F \quad (1)$$

Frequency Response (Photodiode/Amplifier Combination)

The frequency response of the photodiode / amplifier combination is determined by the characteristics of the photodiode, pre-amplifier as well as the feedback resistor (R_F) and feedback capacitor (C_F). For a known gain, (R_F), the 3dB frequency response of the detector/pre-amp combination is given by:

$$f_{3dB} = \frac{1}{2\pi C_F R_F} \quad (2)$$

However, the desired frequency response is limited by the Gain Bandwidth Product (GBP) of the op-amp. In order to have a stable output, the values of the R_F and C_F must be chosen such that the 3dB frequency response of the detector / pre-amp combination, be less than the maximum frequency of the op-amp, i.e. $f_{3dB} \leq f_{max}$.

$$f_{max} = \sqrt{\frac{GBP}{2\pi R_F (C_F + C_J + C_A)}} \quad (3)$$

where C_A is the amplifier input capacitance.

In conclusion, an example for frequency response calculations, is given below. For a gain of 10^3 , an operating frequency of 100 Hz, and an op-amp with GBP of 5 MHz:

$$C_F = \frac{1}{2\pi f_{3dB} R_F} = 15.9pF \quad (4)$$

Thus, for $C_F = 15.9$ pF, $C_J = 15$ pF and $C_A = 7$ pF, f_{max} is about 14.5 kHz. Hence, the circuit is stable since $f_{3dB} \leq f_{max}$.

For more detailed application specific discussions and further reading, refer to the APPLICATION NOTES INDEX in the catalog.

Note: The shaded boxes represent the Photop™ components and their connections. The components outside the boxes are typical

BPW-34

Plastic Molded - Industry Standard

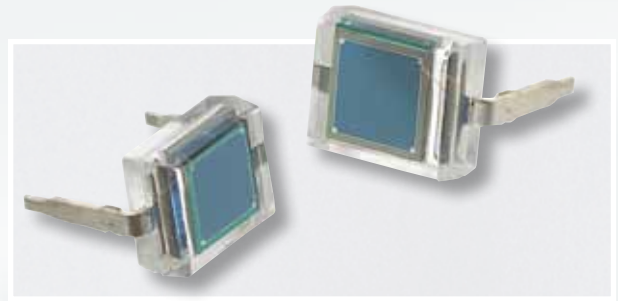
BPW-34 series are a family of high quality and reliability plastic encapsulated photodiodes. The devices in this series, exhibit similar electrical characteristics, but vary in optical response. BPW-34B has an excellent response in the blue region of the spectrum. **They are excellent for mounting on PCB and hand held devices in harsh environments.**

APPLICATIONS

- IR Sensors • Bar Code Scanners
- Color Analysis
- Smoke Detectors

FEATURES

- High Reliability
- High Density Package
- Rugged Resin Mold
- High Speed and Low Dark Current



Model Number	Active Area		Peak Responsivity Wavelength	Responsivity at λ_p		Capacitance (pF)		Dark Current (nA)		NEP (W/ $\sqrt{\text{Hz}}$)	Reverse Voltage (V)	Rise Time (ns)	Temp* Range (°C)		Package Style \dagger
	Area (mm ²)	Dimensions (mm)		λ_p (nm)	(A/W)	0 V 1 MHz	-10 V 1MHz	-10 V		-10 V 970 nm		-10 V 830 nm 50 Ω	Operating	Storage	
			typ.	min.	typ.	typ.	typ.	typ.	typ.	max.	typ.	max.	typ.		

BPW 34 Series

BPW-34 «				0.55	0.60						4.2e -14			-25 ~ +85	-40 ~ +100	19 / Plastic Molded
BPW-34S	7.25	2.69 sq.	970			65	12	2	30			40	20			
BPW-34B «				0.15**	0.20**						1.3e -13**					

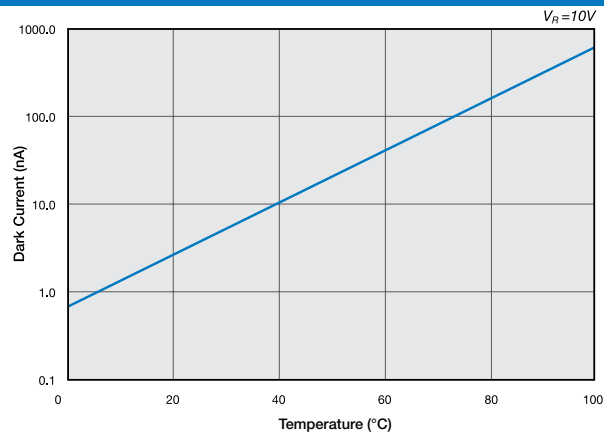
\dagger For mechanical drawings please refer to pages 61 thru 73.

* Non-condensing temperature and storage range, Non-condensing environment.

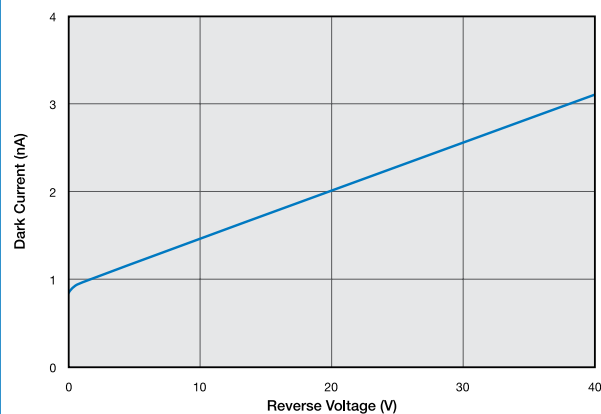
** Responsivity and NEP values for the BPW-34B are given at 410nm.

« Minimum order quantities apply

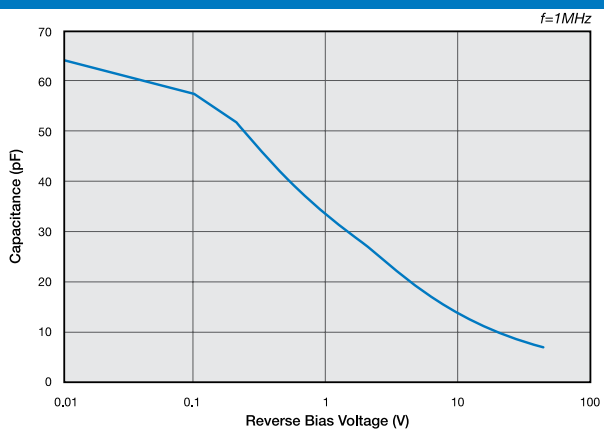
Typical Dark Current vs. Temperature



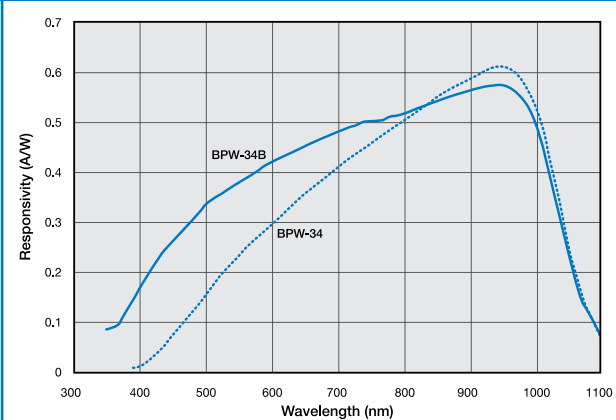
Typical Dark Current vs. Reverse Bias



Typical Capacitance vs. Reverse Bias Voltage



Typical Spectral Response



Plastic Encapsulated Series

Lead Frame Molded Photodiodes

OSI Optoelectronics offers a line of high quality and reliability plastic encapsulated photodiodes. These molded devices are available in a variety of shapes and sizes of photodetectors and packages, including industry standard T1 and T13/4, flat and lensed side lookers as well as a surface mount version (SOT- 23). They are excellent for mounting on PCB and hand held devices in harsh environments.

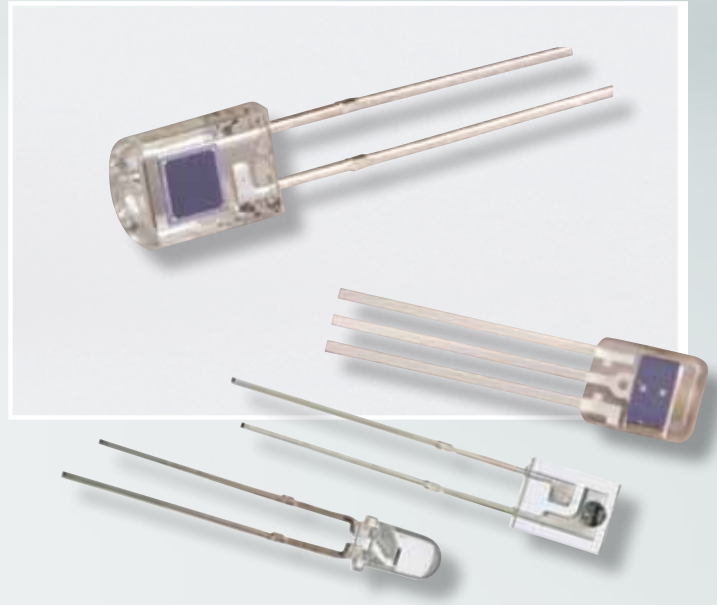
They have an **excellent response** in the **NIR spectrum** and are also available with visible blocking compounds, transmitting only in the 700-1100 nm range. They offer fast switching time, low capacitance as well as low dark current. They can be utilized in both photoconductive and photovoltaic modes of operation.

APPLICATIONS

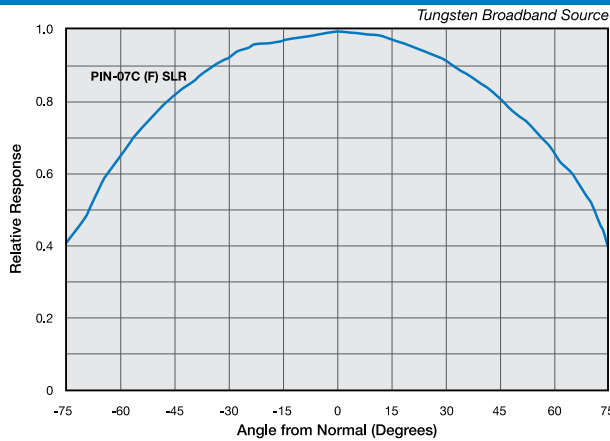
- Bar Code Readers
- Industrial Counters
- Measurement and Control
- IR Remote Control
- Reflective Switches

FEATURES

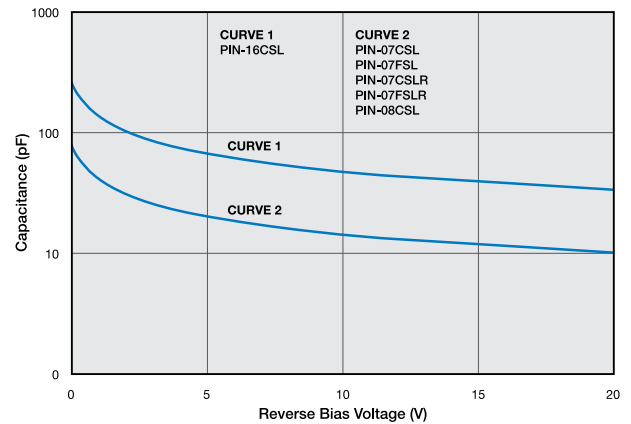
- High Density Package
- Rugged Molded Package
- Low Capacitance
- Low Dark Current
- Lead Frame Standard
- SMT
- Molded Lens Feature
- Side Lookers
- Filter on Chip (700nm Cutoff)



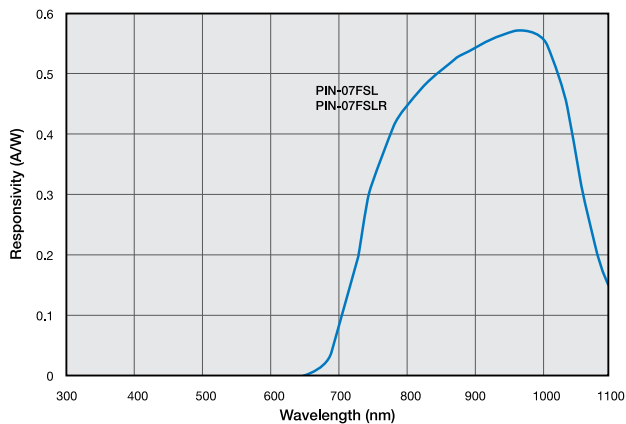
Typical Angular Detection Characteristics



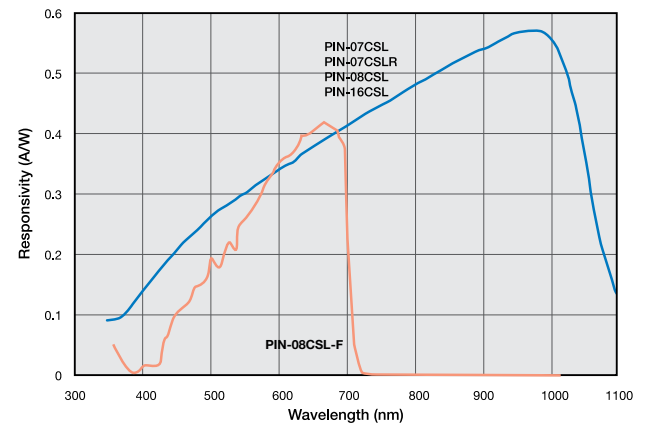
Typical Capacitance vs. Reverse Bias Voltage



Typical Spectral Response



Typical Spectral Response



Plastic Encapsulated Series «

Typical Electro-Optical Specifications at T_A=23°C

Model Number	Active Area		Spectral Range (nm)	Responsivity I _p =970nm	Capacitance (pF) 1 MHz		Dark Current (nA)		Reverse Voltage (V)	Rise Time (ns)	Temp.* Range (°C)		Package Style ¶			
	Area (mm ²)	Dimensions (mm)		(A/W)	0 V	-10 V	-10 V			-10 V peak λ 50 Ω	Operating	Storage				
				typ.	typ.	typ.	typ.	max.	max.	typ.						
PIN-0.81-LLS	0.81	1.02 ϕ	350-1100	0.55	10	2	2	30	20	11	-25 ~ +85	-40 ~ +100	62 / Leadless Ceramic			
PIN-0.81-CSL															60 / Resin Molded	
PIN-4.0-LLS	3.9	2.31x1.68	350-1100		60	10							62 / Leadless Ceramic			
PIN-4.0-CSL													60 / Resin Molded			
PIN-07-CSL	8.1	2.84 Sq	350-1100		85	15	5							57 / Resin Molded		
PIN-07-FSL			700-1100													
PIN-07-CSLR	8.1	2.84 Sq	350-1100													56 / Resin Molded
PIN-07-FSLR			700-1100													
PIN-08-CSL-F	8.4	2.90 Sq	350-720	0.43@660nm	..	25	..	10					75			60 / Resin Molded
PIN-8.0-LLS	8.4	2.90 Sq	350-1100	0.55	100	25	10	30					50			62 / Leadless Ceramic
PIN-8.0-CSL																
PIN-16-CSL	16	4.00 Sq					330			55			5		100	

¶ For mechanical drawings please refer to pages 61 thru 73.

* Non-Condensing temperature and Storage Range, Non-Condensing Environment.

The "CSL-F" series is a homogeneous silicon photodiode and optical filter combination device. The filter coating is directly deposited onto the chip during wafer process.

Detector-Filter Combination Series

Planar Diffused Silicon Photodiodes

The Detector-Filter combination series incorporates a filter with a photodiode to achieve a tailored spectral response. OSI Optoelectronics offers a multitude of standard and custom combinations. Upon request, all detector-filter combinations can be provided with a NIST traceable calibration data specified in terms of Amps/Watt, Amps/lumen, Amps/lux or Amps/footcandle.

Among many possible custom combinations, following are a few detector-filter combinations available as standard parts.

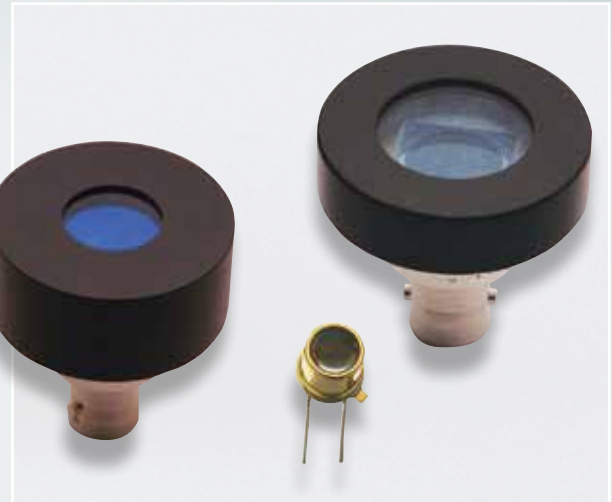
PIN-10DF - is a 1 cm² active area, BNC package detector-filter combination, optimized to achieve a flat responsivity, from 450 to 950 nm. This is the spectral response required for radiometric measurements. This type of detector has several advantages over thermopile, such as sensitivity, which is about a thousand times higher, as well as 10 times more stability.

PIN-10AP - is a 1 cm² active area, BNC package detector- filter combination which duplicates the response of the most commonly available optical aid; the human eye. The eye senses both brightness and color, with response varying as a function of the wavelength. This response curve is commonly known as the CIE curve. The AP filters accurately match the CIE curve to within 4% of area.

PIN-555AP - has the same optical characteristics as the PIN 10-AP, with an additional operational amplifier in the same package. The package and the opamp combination is identical to UDT-555D detector-amplifier combination (Photops™).

PIN-005E-550F - uses a low cost broad bandpass filter with peak transmission at 550nm to mimic the CIE curve for photometric applications. The pass band is similar to the CIE curve, but the actual slope of the spectral response curve is quite different. This device can also be used to block the near IR portion of the spectral range, 700 nm and above.

PIN-005D-254F - is a 6 mm² active area, UV enhanced photodiode-filter combination which utilizes a narrow bandpass filter peaking at 254 nm.



APPLICATIONS

- Analytical Chemistry
- Spectrophotometry
- Densitometers
- Photometry/Radiometry
- Spectroradiometry
- Medical Instrumentation
- Liquid Chromatography

FEATURES

- CIE Match (AP series)
- Flat Band Response (DF)
- 254 Narrow Bandpass
- w/ Amplifier Hybrid
- BNC Packages

CUSTOMIZED CAPABILITIES

Current existing standard photodiodes can be modified by adding various optical filter(s), to match your specific spectral requirements. The filters can either replace the standard glass windows or be used in conjunction with the glass window, depending on the specific requirement and / or nature of the filter. Customer furnished optical filters can also be incorporated in the package. The following are among a few of the optical filter types available. These colored glass filters are grouped into four major categories: Shortpass Filters, Longpass Filters, Bandpass Filters, and Neutral Density Filters. Windows are also available with Custom Thin Film, Anti-reflective, Cut-on and Cut-off Filter Coatings.

ALL PHOTODIODES WITH OR WITHOUT FILTERS CAN BE CALIBRATED IN HOUSE FOR RESPONSIVITY FROM 200 NM TO 1100 NM IN 10 NM STEPS AS WELL AS SINGLE POINT CALIBRATION. ALL OPTICAL CALIBRATIONS ARE NIST TRACEABLE.

Detector-Filter Combination Series

Typical Electro-Optical Specifications at $T_A=23^\circ\text{C}$

Model Number	Active Area		Spectral Match	Responsivity at 550nm		Capacitance (pF)	Shunt Resistance (MΩ)	NEP (W/√Hz)	Rise Time (μs)	Temp. Range (°C)		Package Style ¶
	Area (mm²)	Dimensions (mm)	λp (nm)	(A/W)	mA/Lum	0 V	-10 mV	-10mV 550 nm	0 V 550 nm 50 Ω	Operating	Storage	
			typ.	typ.		typ.	typ.	typ.	typ.			
Detector Filter Combination Series												
PIN-10DF	100	11.28 φ	± 7% ±	0.15	---	1500	20	1.9 e-13	1.0	0 ~ +70	-25 ~ +85	13 / BNC
PIN-10AP-1			4%***	0.27	0.4			1.1 e-13	0.15			33 / Special
PIN-555AP-1§									0.1*			5 / TO-5
PIN-005E-550F	5.7	2.4 sq.	---	0.23	---	200	500	2.5 e-14	0.1*			18 / TO-5
PIN-005D-254F				0.025*	100	300	3.0 e-13*					

‡ Point by point from 450nm to 950nm.

§ PIN-555AP is a Detector / Operational Amplifier hybrid. For Op-Amp specifications, please see p.29.

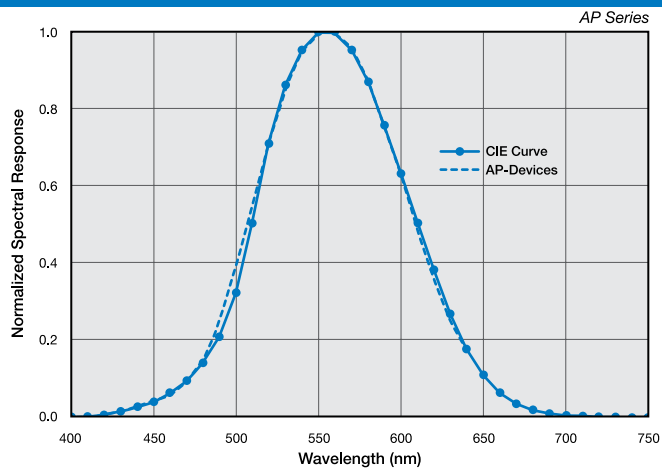
¶ For mechanical drawings please refer to pages 61 thru 73.

* $\lambda=254\text{nm}$

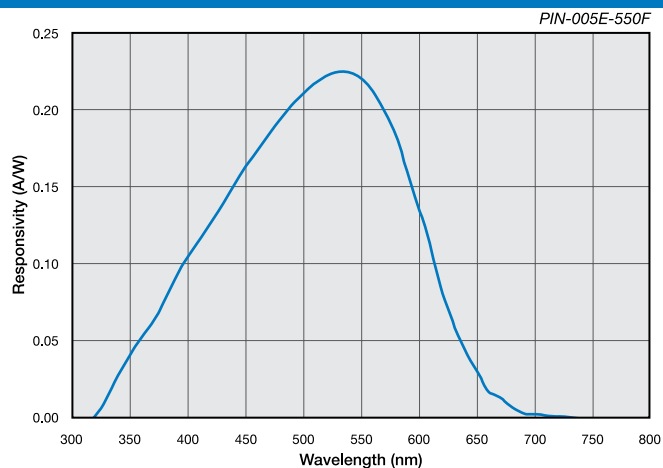
** Non-condensing temperature and storage range, Non-condensing environment.

*** Area within CIE Curve

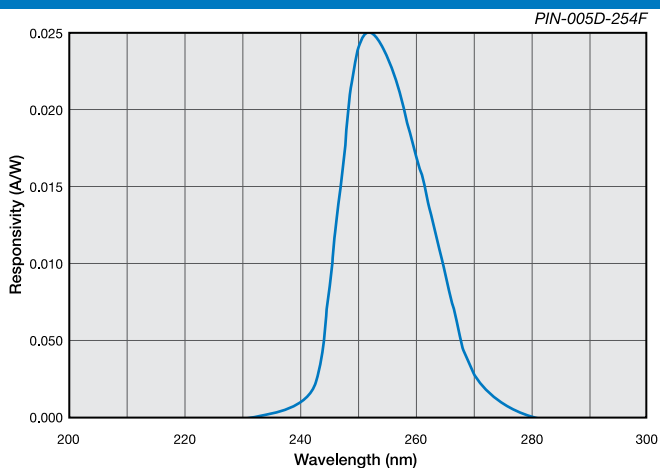
Typical Spectral Response



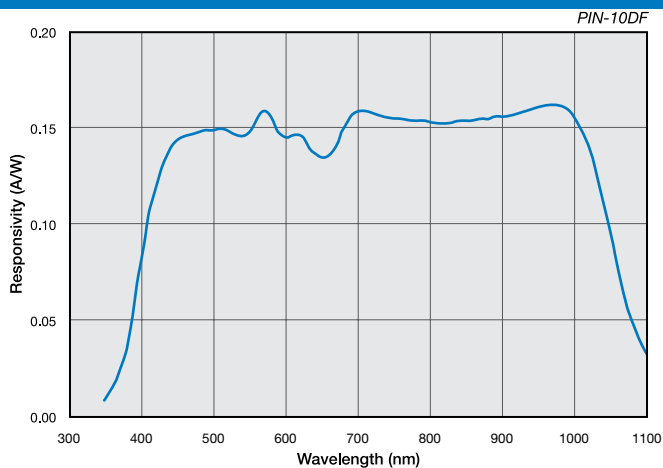
Typical Spectral Response



Typical Spectral Response



Typical Spectral Response



Series E photodiodes are Blue-enhanced detectors with high quality color-correcting filters. The resulting spectral response approximates that of the human eye.

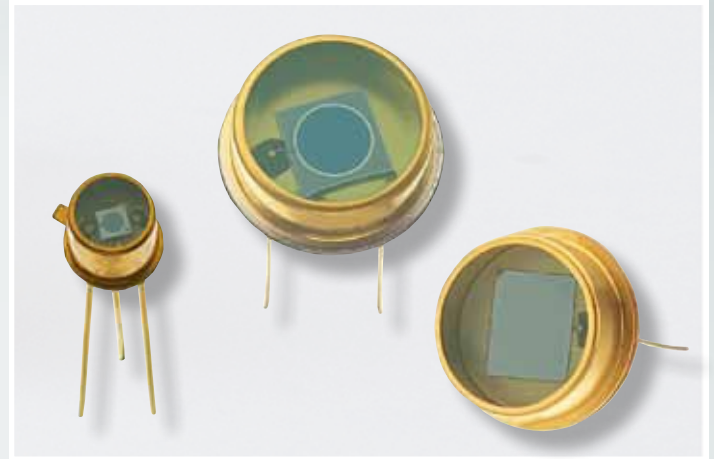
In addition to the Series E photodiodes listed, OSI Optoelectronics can provide other photodiodes in this catalog with a variety of optical filters.

APPLICATIONS

- Photometry/Radiometry
- Medical Instrumentation
- Analytical Chemistry

FEATURES

- Human Eye Response
- TO Can Packages



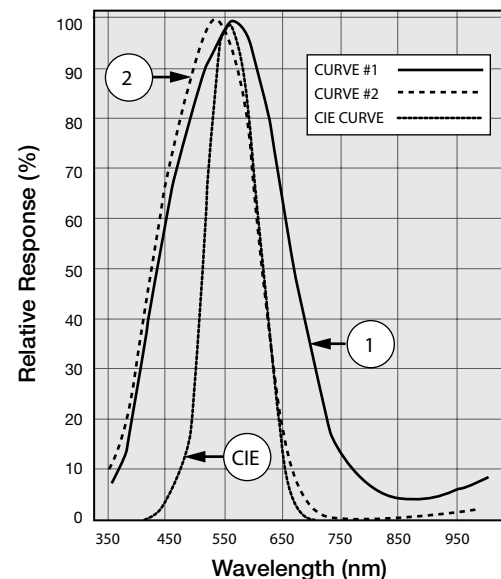
Model Number	Active Area		Responsivity (nA Lux ⁻¹)		Dark Current (nA)		NEP (WHz ^{-1/2})	Capacitance (pF)		Shunt Resistance (MΩ)**		Reverse Voltage (DC)	Spectral Curve	Temp. Range (°C)		Package Style ¶
	Area (mm ²)	Dimensions (mm)					550 nm VR=0							Operating	Storage	
			min.	typ.	max.	typ.	typ.	Vr=0V max.	Vr=12V max.	min.	typ.	max.				
OSD-E Series																
OSD1-E	1	1.0 × 1.0	1	2.2	1	0.2	1.5 × 10 ⁻¹⁴	35	7	250	1000	15	1	-25 ~ +85	-40 ~ +120	7 / TO-18
OSD3-E	3	2.5 × 1.2	3	6.6	2	0.5	1.8 × 10 ⁻¹⁴	80	20	100	700		1			7 / TO-18
OSD5-E	5	2.5 ϕ	5	11	2	0.5	1.9 × 10 ⁻¹⁴	130	35	100	600		1			5 / TO-5
OSD15-E	15	3.8 × 3.8	15	33	10	2	5.2 × 10 ⁻¹⁴	390	80	50	80		1			5 / TO-5
OSD60-E	100	11.3 ϕ	30	56	30	8	1.2 × 10 ⁻¹³	2500	520	2	10		2			69 / TO-8

Characteristics measured at 22° C (±2) and a reverse bias of 12 volts unless otherwise stated.

** Shunt Resistance measured at +/- 10mV.

¶ For mechanical drawings please refer to pages 61 thru 73.

CIE Curve vs. E Type Parts



Unit Conversion Table for Illuminance

The Series E photodiodes have been color corrected to provide a photopic eye response. These devices can be used as low illuminance monitors, i.e. visible light measurement instruments and adjusting brightness of visible display.

Lux lx (lm/m ²)	Phot Ph (lm/cm ²)	Foot-candle fc (lm/ft ²)	Watt per square cm* W/cm ²
1	1.000 x 10 ⁻⁴	9.290 x 10 ⁻²	5.0 x 10 ⁻⁶
1.000 x 10 ⁴	1	9.290 x 10 ²	9.290 x 10 ⁻²
1.076 x 10 ¹	1.076 x 10 ⁻³	1	5.0 x 10 ⁻⁵
2.0 x 10 ⁵	1.0 x 10 ¹	1.9 x 10 ⁴	1

*Total irradiance (measured value) by the CIE standard light source "A".

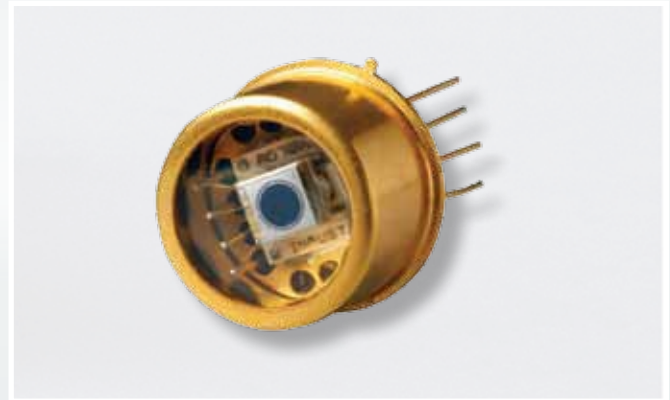
Dual Sandwich Detector Series

Two Color Photodiodes

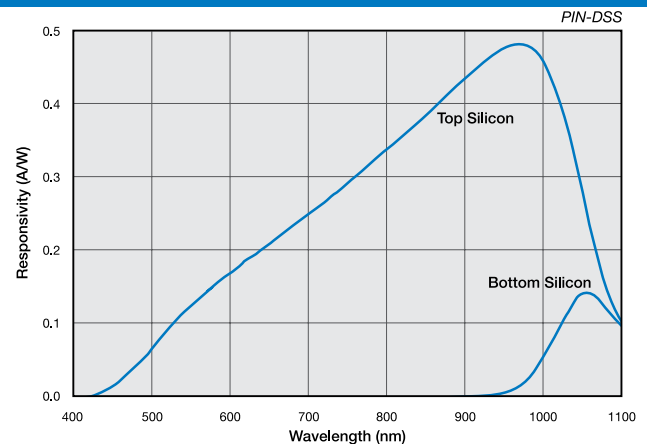
Dual Sandwich Detectors or Two Color Detectors are mostly employed for remote temperature measurements. The temperature is measured by taking the ratio of radiation intensities of two adjacent wavelengths and comparing them with the standard black body radiation curves. The advantages of optical remote measurement have definitely made these devices the perfect match for this type of measurements. They are independent of emissivity and unaffected by contaminants in the field of view or moving targets. In addition, measurements of targets out of the direct line of sight and the ability to function from outside RF/EMI interference or vacuum areas are possible. They also have the advantages of overcoming obstructed target views, blockages from sight tubes, channels or screens, atmospheric smoke, steam, or dust, dirty windows as well as targets smaller than field of view and/or moving within the field of view. These detectors can also be used in applications where wide wavelength range of detection is needed.

OSI Optoelectronics offers three types of dual sandwich detectors. The Silicon-Silicon sandwich, in which one silicon photodiode is placed on top of the other, with the photons of shorter wavelengths absorbed in the top silicon and the photons of longer wavelengths penetrating deeper, absorbed by the bottom photodiode. For applications requiring a wider range of wavelength beyond 1.1 μm , an InGaAs photodiode replaces the bottom photodiode. The Silicon-InGaAs version is also available with a two stage thermo-electric cooler for more accurate measurements by stabilizing the temperature of the InGaAs detector.

All devices are designed for photovoltaic operation (no bias), however, they may be biased if needed, to the maximum reverse voltage specified. They are ideal for coupling to an operational amplifier in the current mode. For further details refer to the "Photodiode Characteristics" section of this catalog.



Typical Spectral Response



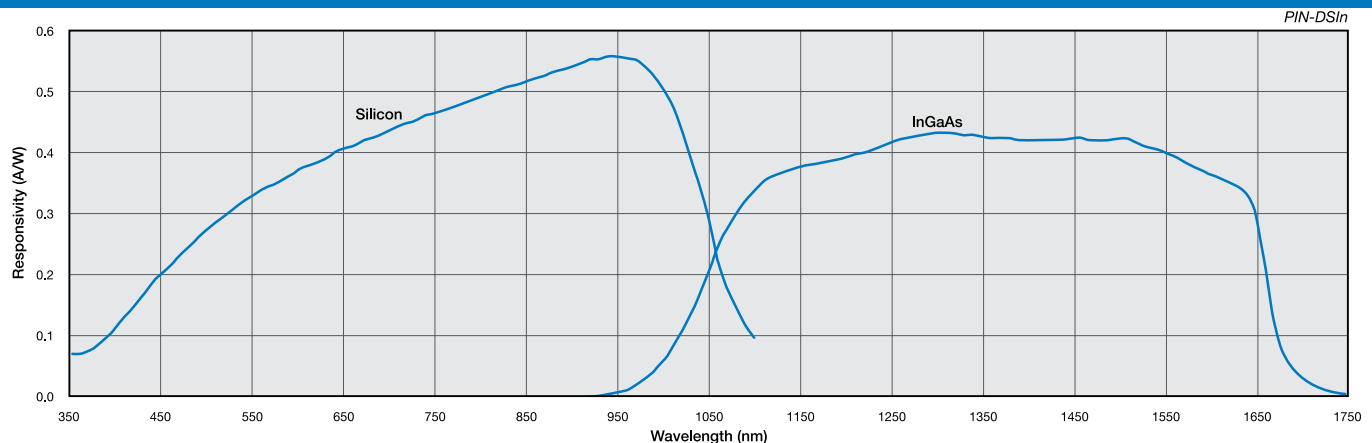
APPLICATIONS

- Flame Temperature sensing
- Spectrophotometer
- Dual-wavelength detection
- IR Thermometers for Heat Treating, induction heating, and other metal parts processing

FEATURES

- Compact
- Hermetically Sealed
- Low Noise
- Wide Wavelength Range
- Remote Measurements
- w/ TEC

Typical Spectral Response



Dual Sandwich Detector Series

Typical Electro-Optical Specifications at $T_A=23^{\circ}\text{C}$

Model Number	Detector Element	Active Area	Spectral Range (nm)	Peak Wavelength	Responsivity	Capacitance	Shunt Resistance		NEP	D* @ peak	Reverse Voltage	Rise Time (μs)	Temp* Range (°C)	Package Style	
		Dimension (mm)		nm	λp	0 V	-10 mV		0V, λp	0V, λp	V	0 V 50 Ω λP	Operating		Storage
					A / W	pF	MΩ		(W/√Hz)	(cm√Hz/W)					
				typ.	typ.	typ.	min.	typ.	typ.	typ.	max.	typ.			

Non-Cooled

PIN-DSS	Si (top)	2.54 ϕ	400-1100	950	0.45	70	50	500	1.3 e -14	1.7 e +13	5	10	-40 ~ +100	-55 ~ +125	17 / TO-5
	Si		950-1100	1060	0.12				4.8 e -14	4.7 e +12		150			
PIN-DSIn	Si (top)	2.54 ϕ	400-1100	950	0.55 §	450	150		1.9 e -14 §	1.2 e +13 §	5	4			
	InGaAs	1.50 ϕ	1000-1800	1300	0.60				2.1 e -13	8.4 e +11		4			

Two Stage Thermoelectrically Cooled ‡

PIN-DSIn-TEC	Si (top)	2.54 ϕ	400-1100	950	0.55 §	450	150		1.9 e -14 §	1.2 e +13 §	5	4	-40 ~ +100	-55 ~ +125	24 / TO-8
	InGaAs	1.50 ϕ	1000-1800	1300	0.60				2.1 e -13	8.4 e +11		4			

§ @ 870 nm

‡ Thermo-Electric Cooler and Thermistor Specifications are specified in the tables below.

¶ For mechanical drawings please refer to pages 61 thru 73.

* Non-Condensing temperature and Storage Range, Non-Condensing Environment.

Thermistor Specifications

PARAMETER	CONDITION	SPECIFICATION
Temperature Range	---	-100 $^{\circ}\text{C}$ to +100 $^{\circ}\text{C}$
Nominal Resistance	---	1.25 K Ω @ 25 $^{\circ}\text{C}$
Accuracy	-100 $^{\circ}\text{C}$ to -25 $^{\circ}\text{C}$	± 6.5 $^{\circ}\text{C}$
	-25 $^{\circ}\text{C}$ to +50 $^{\circ}\text{C}$	± 3.5 $^{\circ}\text{C}$
	@ 25 $^{\circ}\text{C}$	± 1.5 $^{\circ}\text{C}$
	+50 $^{\circ}\text{C}$ to +100 $^{\circ}\text{C}$	± 6.7 $^{\circ}\text{C}$

Two Stage Thermo-electric Specifications

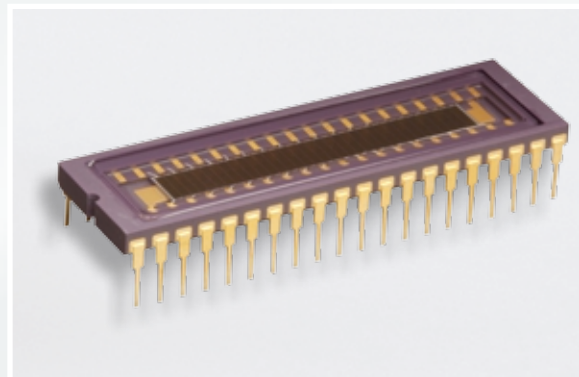
PARAMETER	SYMBOL	CONDITION	SPECIFICATION
Maximum Achievable Temperature Difference	ΔT_{MAX} ($^{\circ}\text{C}$)	I = I_{MAX} QC = 0	Vaccum Dry
			91 83
Maximum Amount Of Heat Absorbed At The Cold Face	Q_{MAX} (W)	I = I_{MAX} , $\Delta T = 0$	0.92
Input current In Greatest ΔT_{MAX}	I_{MAX} (A)	---	1.4
Voltage At ΔT_{MAX}	V_{MAX} (V)	---	2.0

Multi-Element Array Series

Planar Diffused Silicon Photodiodes

Multichannel array photodetectors consist of a number of single element photodiodes laid adjacent to each other forming a one-dimensional sensing area on a common cathode substrate. They can perform simultaneous measurements of a moving beam or beams of many wavelengths. They feature low electrical cross talk and super high uniformity between adjacent elements allowing very high precision measurements. Arrays offer a low cost alternative when a large number of detectors are required. The detectors are optimized for either UV, visible or near IR range.

They can be either operated in photoconductive mode (reverse biased) to decrease the response time, or in photovoltaic mode (unbiased) for low drift applications. A2V-16 can be coupled to any scintillator crystal for measuring high-energy photons in the X-ray and gamma ray region of electromagnetic spectrum. In addition, they have been mechanically designed, so that several of them can be mounted end to end to each other in applications where more than 16 elements are needed.



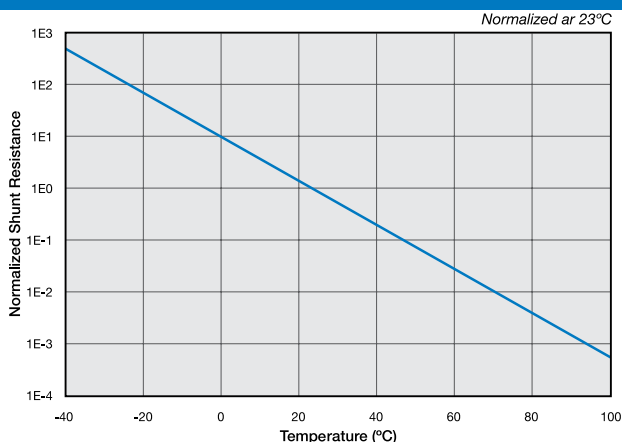
APPLICATIONS

- Level Meters
- Optical Spectroscopy
- Medical Equipment
- High Speed Photometry
- Computed Tomography Scanners
- Position Sensors

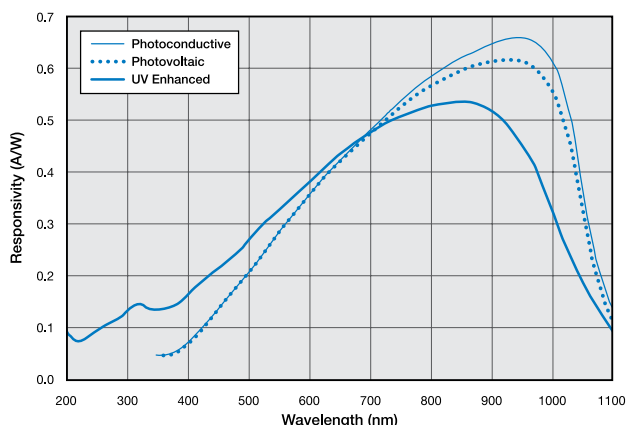
FEATURES

- Common Substrate Array
- Ultra Low Cross Talk
- UV Enhanced (A5V-35UV)
- Low Dark Current
- Low Capacitance
- Solderable

Typical Shunt Resistance vs. Temperature



Typical Spectral Response



Typical Capacitance vs. Reverse Bias Voltage

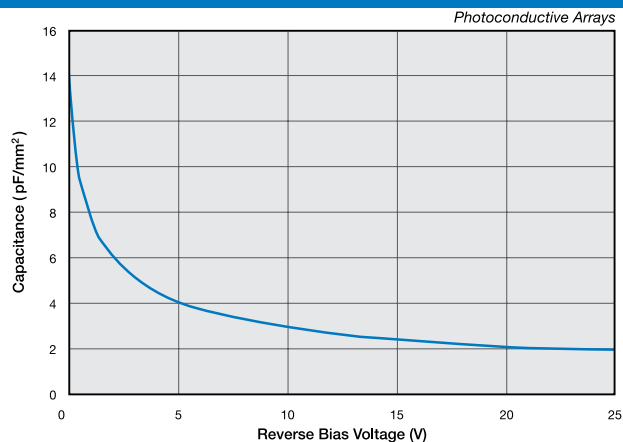


Figure 11 in the "Photodiode Characteristics" section of this catalog provides a detailed circuit example for the arrays.

Multi-Element Array Series

Typical Electro-Optical Specifications at T_A=23°C

Model Number	Number of Elements	Active Area Per Element		Pitch (mm)	Responsivity (A/W)	Shunt Resistance (MΩ)	Dark Current (nA)	Capacitance (pF)		NEP (W / √Hz)		Temp. Range* (°C)		Package Style ¶
		Area (mm ²)	Dimensions (mm)		970nm	-10 mV	-10 V	0 V	-10 V	0 V 970nm	-10 V 970nm	Operating	Storage	
					typ.	typ.	typ.	typ.		min.	typ.			
Photoconductive Arrays														
A5C-35	35	3.9	4.39 x 0.89	0.99	0.65	---	0.05	---	12	---	6.2 e-15	-30 ~ +85	-40 ~ +125	54 / 40 pin DIP
A5C-38	38													
Photovoltaic Arrays														
A2V-16	16	1.92	1.57 x 1.22	1.59	0.60	1000	---	170	---	4.8 e-15	---			53 / PCB
A5V-35	35	3.9	4.39 x 0.89	0.99	0.60	1000	---	340	---	4.8 e-15	---			54 / 40 pin DIP
A5V-38	38													
A2V-76	76	1.8	6.45 x 0.28	0.31	0.50	500	---	160	---	8.2 e-15	---			52 / Ceramic
UV Enhanced Array (All Specifications @ λ =254 nm, V _{BIAS} = -10V)														
A5V-35UV	35	3.9	4.39 x 0.89	0.99	0.06**	500	---	340	---	6.8 e-14	---			54 / 40 pin DIP

The chips are equipped with 2" long bare tinned leads soldered to all anodes and the common cathode.

'V' suffix indicates the device is optimized for 'photovoltaic' operation.

'C' suffix indicates the device is optimized for 'photoconductive' operation.

¶ For mechanical drawings please refer to pages 61 thru 73.

* Non-Condensing temperature and Storage Range, Non-Condensing Environment.

** λ = 254 nm

Solderable Chip Series

Planar Diffused Silicon Photodiodes

The **Solderable photodiode chip series** offer a low cost approach to applications requiring large active area photodetectors with or without flying leads for ease of assembly and / or situations where the detector is considered "disposable". They have low capacitance, moderate dark currents, wide dynamic ranges and high open circuit voltages. These detectors are available with two 3" long leads soldered to the front (anode) and back (cathode). There are two types of photodiode chips available. "Photoconductive" series, (SXXCL) for low capacitance and fast response and "Photovoltaic" series (SXXVL) for low noise applications.

All of the devices are also available in chip form without any leads. For ordering subtract suffix 'L' from the model number, e.g. S-100C.

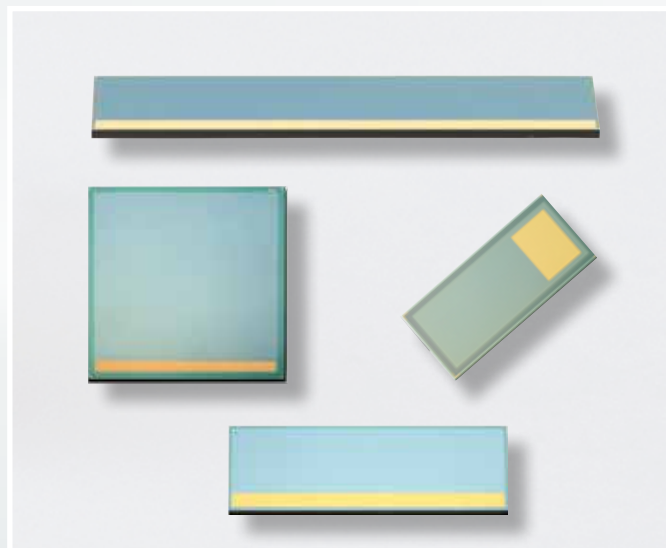
For large signal outputs, the detectors can be connected directly to a current meter or across a resistor for voltage measurements. Alternately, the output can be measured directly with an oscilloscope or with an amplifier. Please refer to the "Photodiode Characteristics" section for further details.

APPLICATIONS

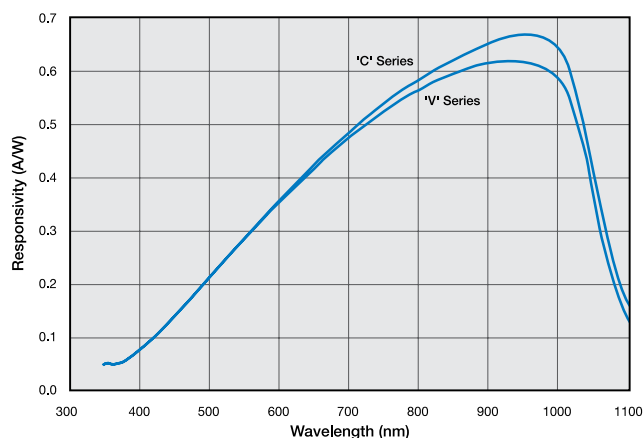
- Solar Cells
- Low Cost Light Monitoring
- Diode Laser Monitoring
- Low Capacitance

FEATURES

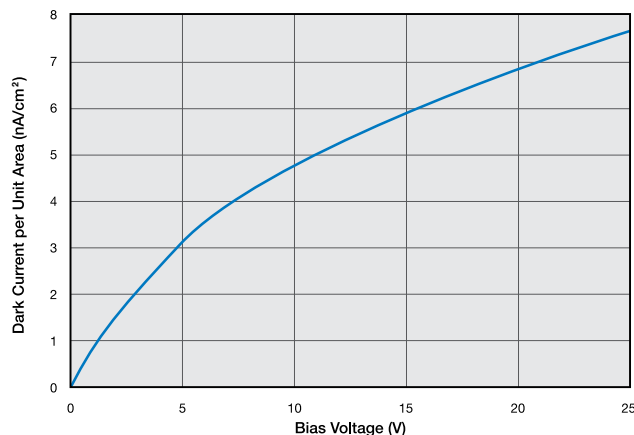
- Large Active Areas
- Various Sizes
- High Shunt Resistance
- With or Without Leads



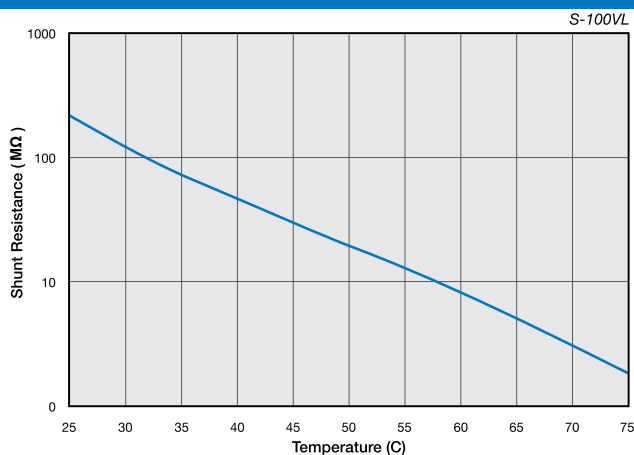
Typical Spectral Response



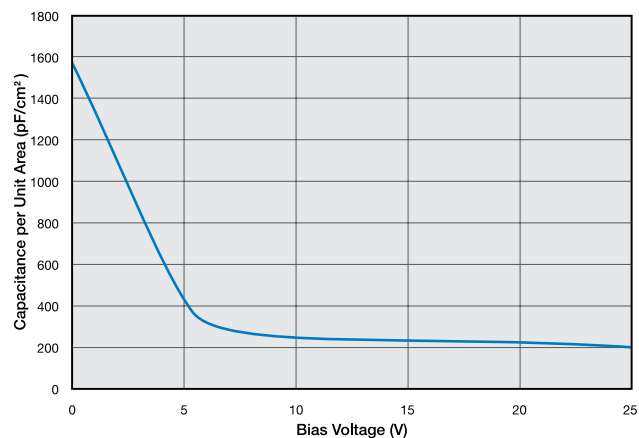
Typical Dark Current per Unit Area vs. Bias Voltage



Typical Shunt Resistance vs. Temperature



Typical Capacitance per Unit Area vs. Bias Voltage



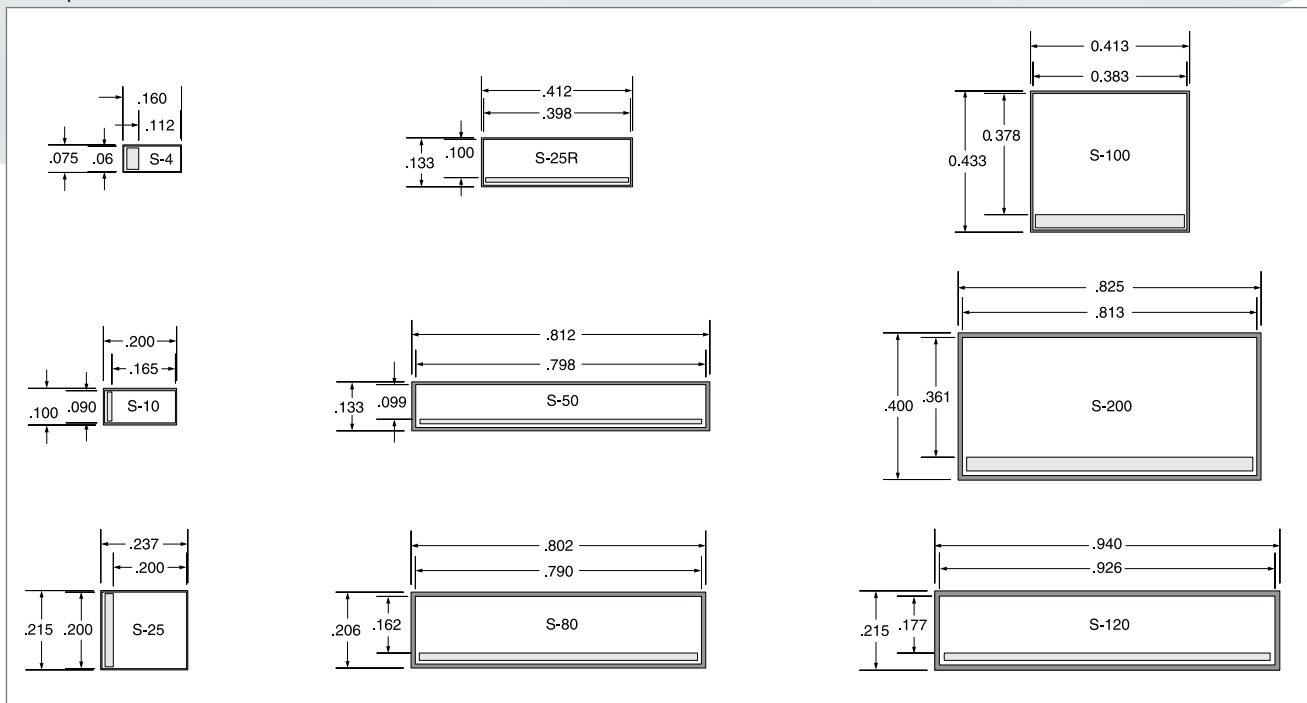
Solderable Chip Series

Typical Electro-Optical Specifications at T_A=23°C

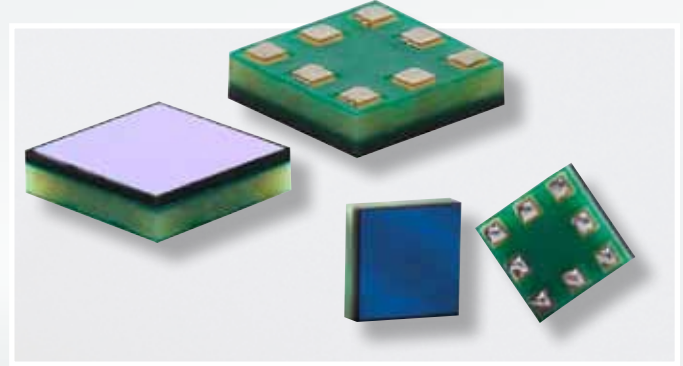
Model Number	Active Area		Chip size mm (inches)	Peak Responsivity Wavelength	Responsivity at λ_p		Shunt Resistance (M Ω)	Dark Current (nA)	Capacitance (pF)				
	Area mm ² (inches ²)	Dimensions mm (inches)		λ_p (nm)	A/W		-10 mV	-5 V	0 V	-5 V			
				typ.	min.	typ.	min.	max.	typ.	typ.			
S-4CL §	4.7 (0.007)	1.7 x 2.8 (0.07 x 0.11)	1.9 x 4.1 (0.08 x 0.16)	970	0.60	0.65	---	20	---	15			
S-4VL							10	---	370	---			
S-10CL	9.6 (0.015)	2.3 x 4.2 (0.09 x 0.17)	2.5 x 5.1 (0.10 x 0.20)				---	40	---	30			
S-10VL							8	---	750	---			
S-25CL	25.8 (0.04)	5.1 x 5.1 (0.20 x 0.20)	5.5 x 6.0 (0.22 x 0.24)				---	100	---	95			
S-25VL							5	---	2100	---			
S-25CRL	25.4 (0.039)	2.5 x 10.1 (0.10 x 0.40)	3.4 x 10.5 (0.13 x 0.41)				---	100	---	95			
S-25VRL							5	---	2100	---			
S-50CL	51.0 (0.079)	2.5 x 20.3 (0.10 x 0.80)	3.4 x 20.6 (0.13 x 0.81)				---	300	---	200			
S-50VL							3	---	4000	---			
S-80CL	82.6 (0.128)	4.1 x 20.1 (0.16 x 0.79)	5.2 x 20.4 (0.21 x 0.80)				---	500	---	300			
S-80VL							2	---	6000	---			
S-100CL	93.4 (0.145)	9.7 x 9.7 (0.38 x 0.38)	10.5 x 11.00 (0.42 x 0.43)				---	600	---	375			
S-100VL							1.0	---	8500	---			
S-120CL	105.7 (0.164)	4.5 x 23.5 (0.18 x 0.93)	5.5 x 23.9 (0.22 x 0.94)				---	800	---	450			
S-120VL							0.5	---	10000	---			
S-200CL	189.0 (0.293)	9.2 x 20.7 (0.36 x 0.81)	10.2 x 21.0 (0.40 x 0.83)				---	1200	---	750			
S-200VL							0.2	---	17000	---			

§ All of the above bare chips are provided with two 3" long 29-30 AWG insulated color coded leads attached to the front for anode (RED) and to the back for Cathode (BLACK). They are also available in chip form only (Leadless). For Ordering subtract Suffix 'L' from the Model Number, i.e. S-100C.

All chip dimensions in inches.



The **BI-SMT** product series are single channel back-illuminated silicon photodiodes specifically designed to minimize 'dead' areas at the edge of the device. Each device is designed on a package with dimensions very similar to the chip itself. This design allows for multiple detectors to be arranged in a tiled format and offers ease of coupling to a scintillator.



APPLICATIONS

- X-Ray Inspection
- Computed Tomography
- General Industrial Use

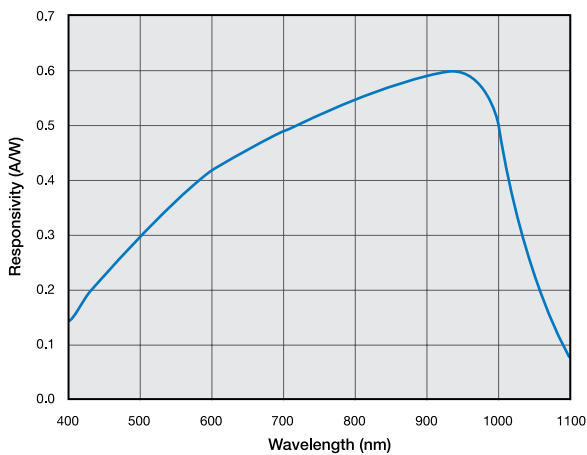
FEATURES

- Chip Size Package
- Ease of coupling to Scintillator
- Patterned Electrodes

Model Number	Active Area		Peak Responsivity Wavelength	Responsivity at 540nm		Responsivity at 920nm		Capacitance (pF)		Dark Current (nA)		Shunt Resistance (MΩ)	Reverse Voltage (V)	Rise Time (μs)	Temp* Range (°C)		Package Style ¶
	Area (mm²)	Dimensions (mm)		λp (nm)	(A/W)	(A/W)	0 V 1 KHz	-10 mV	-10mV	0V, 1 KΩm, 650nm	Operating			Storage			
				typ.	min.	typ.	min.	typ.	typ.	max.					typ.	max.	

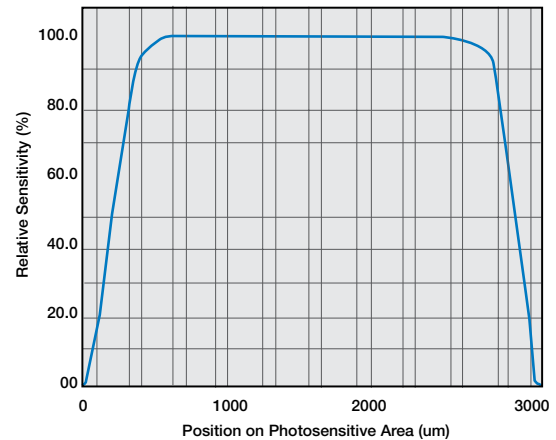
33BI-SMT	5.76	2.4 x 2.4	920	0.30	0.35	0.53	0.59	50	.02	.5	500	10	10	-20 ~ +60	-20 ~ +80	SMT
55BI-SMT	19.36	4.4 x 4.4						200	.04	2	250		20			
1010BI-SMT	88.36	9.4 x 9.4						900	.16	10	1		20			

Typical Spectral Response ($T_A=25^{\circ}\text{C}$)

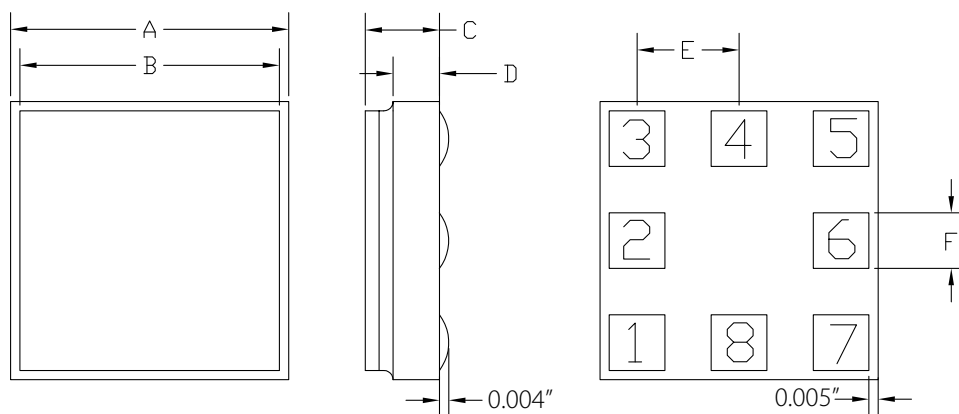


Typ. Sensitivity Uniformity

($T_A=25^{\circ}\text{C}$, $\lambda=650\text{nm}$, $V_r=0\text{V}$, 50 μm Spot)



BI-SMT Mechanical Specifications



Pad Assignments:

Cathode: 1, 3, 5, 7

Anode: 2, 4, 6, 8

Dimensions (inches)						
Model Number	A	B	C	D	E	F
33BI-SMT	0.118	0.11	0.031	0.02	0.043	0.024
55BI-SMT	0.197	0.189	0.051	0.039	0.0825	0.024
1010BI-SMT	0.394	0.386	0.051	0.039	0.163	0.059

Avalanche Photodiodes

Ultra High Gain Silicon Photodetectors

Silicon Avalanche Photodiodes make use of internal multiplication to achieve gain due to impact ionization. The result is the optimized series of high Responsivity devices, exhibiting excellent sensitivity. OSI Optoelectronics offers several sizes of detectors that are available with flat windows or ball lenses for optical fiber applications.

APPLICATIONS

- High Speed Optical Communications
- Laser Range Finder
- Bar Code Readers
- Optical Remote Control
- Medical Equipment
- High Speed Photometry

FEATURES

- High Responsivity
- High Bandwidth / Fast Response
- Low Noise
- Low Bias Voltage
- Hermetically Sealed TO-Packages



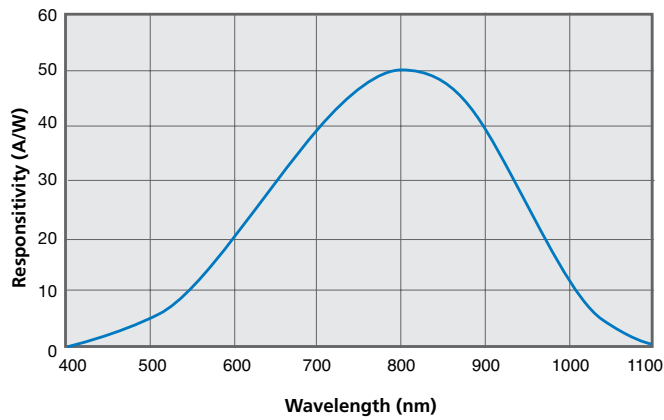
Electro-Optical Characteristics ($T_A = 23^\circ \text{C}$, typical values at gain listed, unless otherwise specified)

Product Model	Active Area		Responsivity @Gain M λ = 800 nm (A/W)	Dark Current Gain M (nA)		Ct Gain M (pF)	Q.E. M = 1 λ = 800 nm (%)	Breakdown Voltage 100μA (V)		Temperature Coefficient of Breakdown Voltage (V/°C)	Bandwidth -3dB Gain M λ = 800 nm (MHz)	Excess Noise Figure Gain M λ = 800 nm	Gain M λ = 800 nm	Storage Temperature (°C)	Operating Temperature (°C)	Package Style * 2
	Diameter*1 (mm)	Area (mm²)		Typ	Max			Typ	Max							
APD02-8-150-T52	0.2	0.03	50	0.05	1	1.5	75	150	250	0.45	1000	0.3	100	-55 ~ +125	-40 ~ +100	65 / TO-52 or 66 / TO-52L
APD05-8-150-T52	0.5	0.19		0.1	1	3	75	150	250	0.45	900	0.3	100			65 / TO-52 or 66 / TO-52L
APD10-8-150-T52	1.0	0.78		0.2	2	6	75	150	250	0.45	600	0.3	100			65 / TO-52 or 66 / TO-52L
APD15-8-150-T05	1.5	1.77		0.5	5	10	75	150	250	0.45	350	0.3	100			67 / TO-5
APD30-8-150-T05	3.0	7.0	30	1	10	40	75	150	250	0.45	65	0.3	60			67 / TO-5
APD50-8-150-T08	5.0	19.6	20	3	30	105	75	150	250	0.45	25	0.3	40			

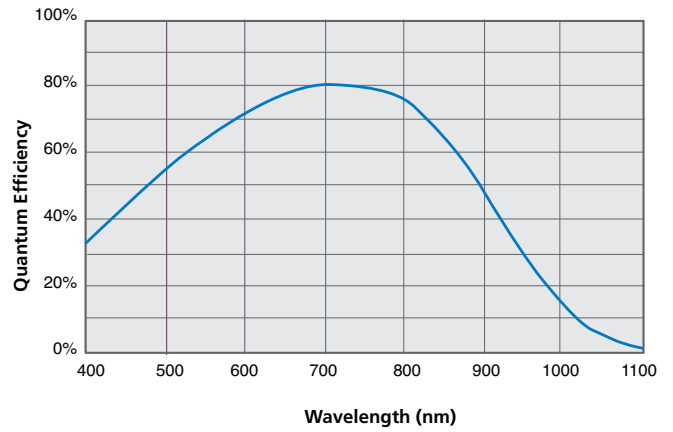
*1: Area in which a typical gain can be obtained.

*2: Please refer to the Silicon APD brochure for more detailed information.
Cap with micro-lens is available for small active area size.

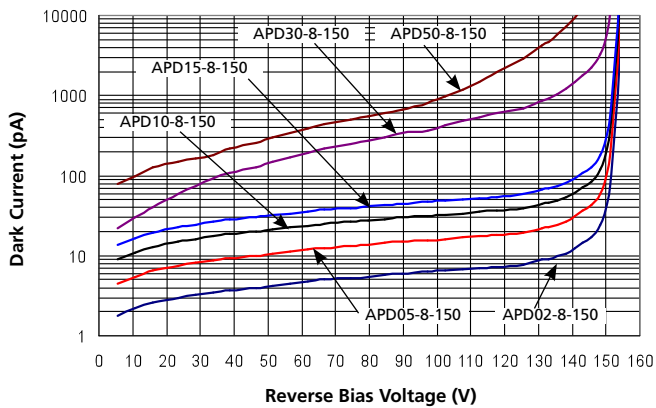
Typ. Spectral Response ($T_A = 23^\circ\text{C}$, $M = 100$)



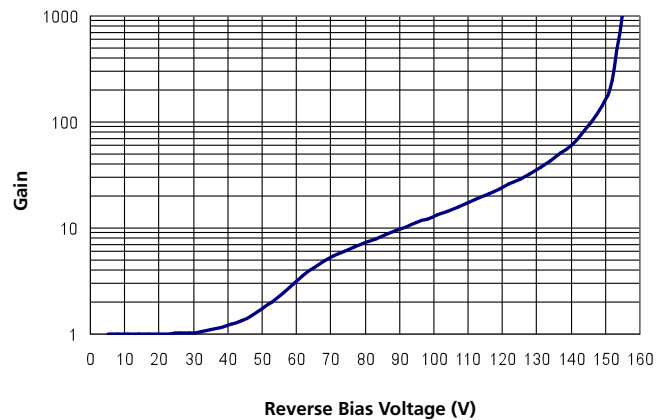
Typ. Quantum Efficiency vs. Wavelength ($T_A = 23^\circ\text{C}$)



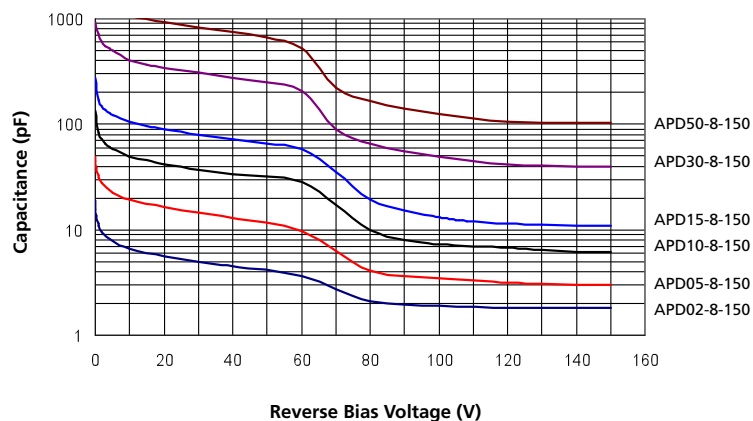
Typ. Dark Current vs. Reverse Bias ($T_A = 23^\circ\text{C}$)



Typ. Gain vs. Reverse Bias ($T_A = 23^\circ\text{C}$, 800 nm)



Typ. Capacitance vs. Reverse Bias ($T_A = 23^\circ\text{C}$, $f = 1\text{MHz}$)



Segmented Photodiodes (SPOT Series)

Position Sensing Detector (PSD)

The **SPOT** Series are common substrate photodetectors segmented into either two (2) or four (4) separate active areas. They are available with either a 0.005" or 0.0004" well defined gap between the adjacent elements resulting in high response uniformity between the elements. The SPOT series are ideal for very accurate nulling or centering applications. Position information can be obtained when the light spot diameter is larger than the spacing between the cells.

Spectral response range is from 350-1100nm. Notch or bandpass filters can be added to achieve specific spectral responses.

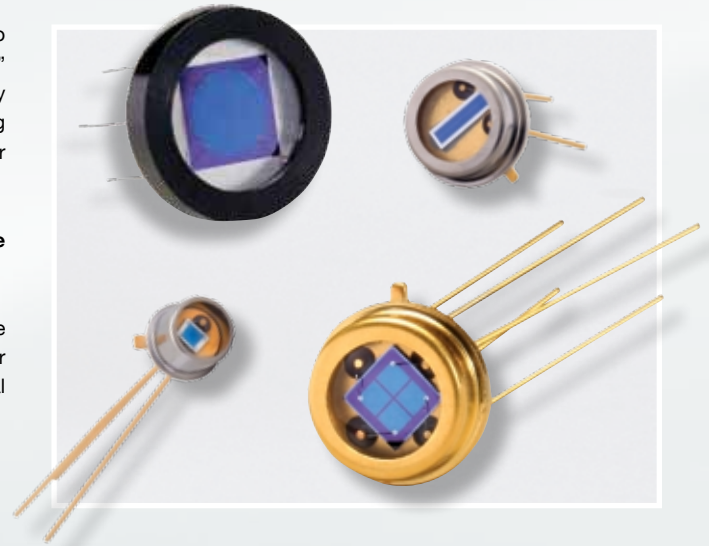
These detectors exhibit excellent stability over time and temperature, fast response times necessary for high speed or pulse operation, and position resolutions of better than 0.1 μm . Maximum recommended power density is 10 mW / cm^2 and typical uniformity of response for a 1 mm diameter spot is $\pm 2\%$.

APPLICATIONS

- Machine Tool Alignment
- Position Measuring
- Beam Centering
- Surface Profiling
- Targeting
- Guidance Systems

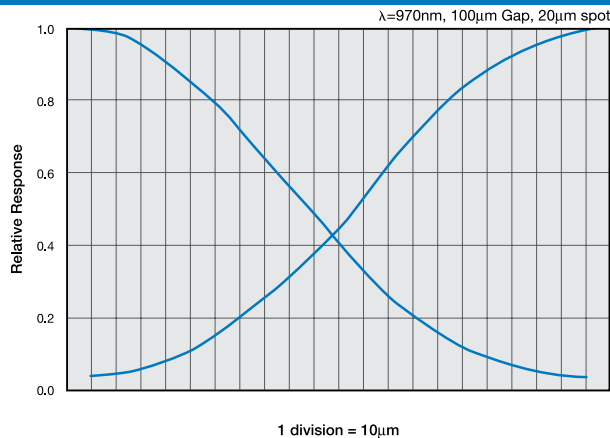
FEATURES

- High Accuracy
- Excellent Resolution
- High-Speed Response
- Ultra Low Dark Current
- Excellent Response Match
- High Stability over Time and Temperature

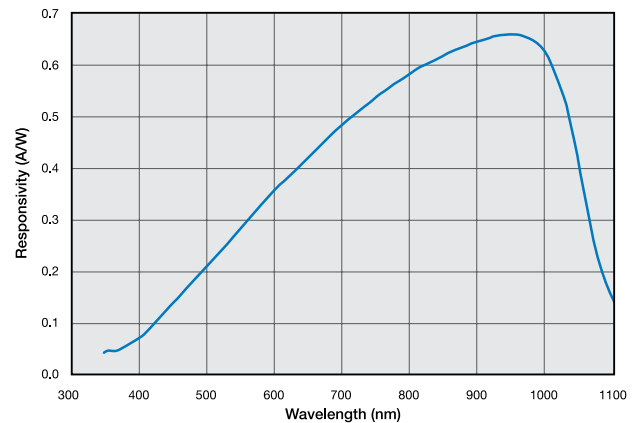


The circuit on the opposite page represents a typical biasing and detection circuit set up for both bi-cells and quad-cells. For position calculations and further details, refer to "Photodiode Characteristics" section of the catalog.

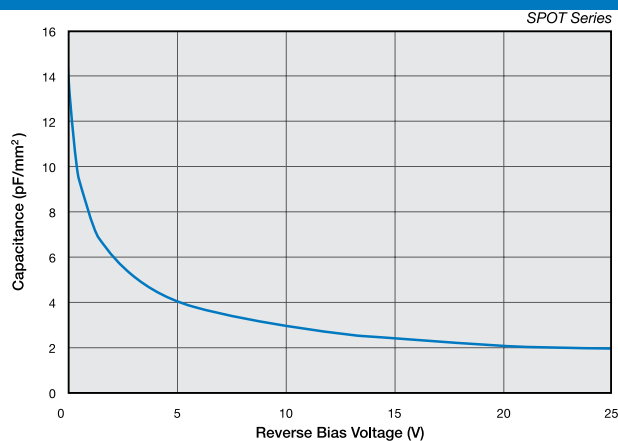
Typical Cross-Over Characteristics



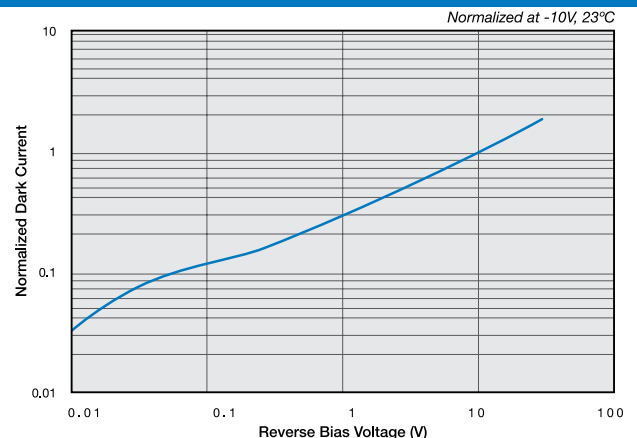
Typical Spectral Response



Typical Capacitance vs. Reverse Bias Voltage



Typical Dark Current vs. Reverse Bias



Segmented Photodiodes (SPOT Series)

Typical Electro-Optical Specifications at $T_A=23^{\circ}\text{C}$

Model Number	Active Area Per Element		Element Gap (mm)	Responsivity (A/W)		Capacitance (pF)	Dark Current (nA)		NEP (W/√Hz)	Reverse Voltage (V)	Rise Time (ns)	Temp Range (°C)		Package Style ¶
	Area (mm²)	Dimensions (mm)		970 nm		-10 V	-10 V		-10 V 970 nm		-10 V 780 nm 50 Ω	Operating	Storage	
				min.	typ.	typ.	typ.	max.	typ.	max.	typ.			

Two-Element Series, Metal Package

CD-25T	2.3	4.6 x 0.5	0.2	0.60	0.65	50@ -15V	20@ -15V	1.1 e-14	30	18	-40 ~ +100	-55 ~ +125	2 / TO-5
SPOT-2D	3.3	1.3 x 2.5	0.127			11	0.15			22			41 / TO-5
SPOT-2DMI	0.7	0.6 x 1.2	0.013			3	0.05			11			40 / TO-18
SPOT-3D	2.8	0.6 x 4.6	0.025			7	0.13			25			41 / TO-5

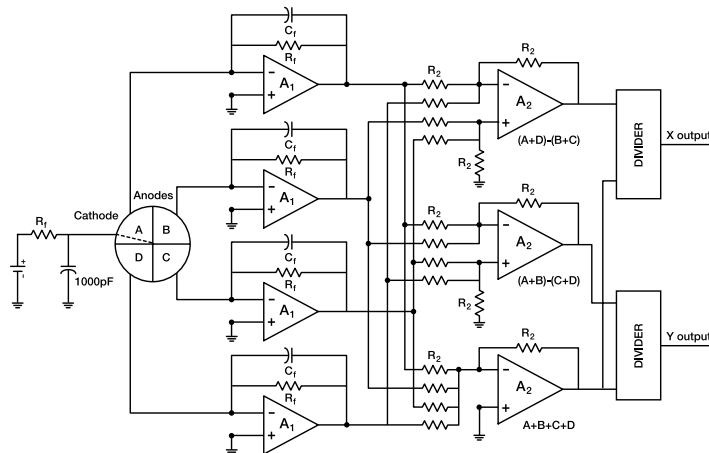
Four Element Series, Metal Package

SPOT-4D	1.61	1.3 sq	0.127	0.60	0.65	5	0.10	1.0	8.7 e-15	30	22	-40 ~ +100	-55 ~ +125	41 / TO-5	
SPOT-4DMI	0.25	0.5 sq	0.013			1	0.01	0.5	2.8 e-15		9				
SPOT-9D	19.6	10 ϕ ±	0.102			60	0.50	10.0	1.9 e-14		33			43 / LoProf	
SPOT-9DMI	19.6		0.010								28				

± Overall Diameter (All four Quads)

¶ For mechanical drawings please refer to pages 61 thru 73.

Chip centering within ±0.010".



Duo-Lateral, Super Linear PSD's

Position Sensing Detectors (PSD)

The **Super Linear Position Sensors** feature state of the art duo-lateral technology to provide a continuous analog output proportional to the displacement of the centroid of a light spot from the center, on the active area. As continuous position sensors, these detectors are unparalleled; offering position accuracies of 99% over 64% of the sensing area. These accuracies are achieved by duo-lateral technology, manufacturing the detectors with two separate resistive layer, one located on the top and the other at the bottom of the chip. One or two dimensional position measurements can be obtained using these sensors. A reverse bias should be applied to these detectors to achieve optimum current linearity at high light levels.

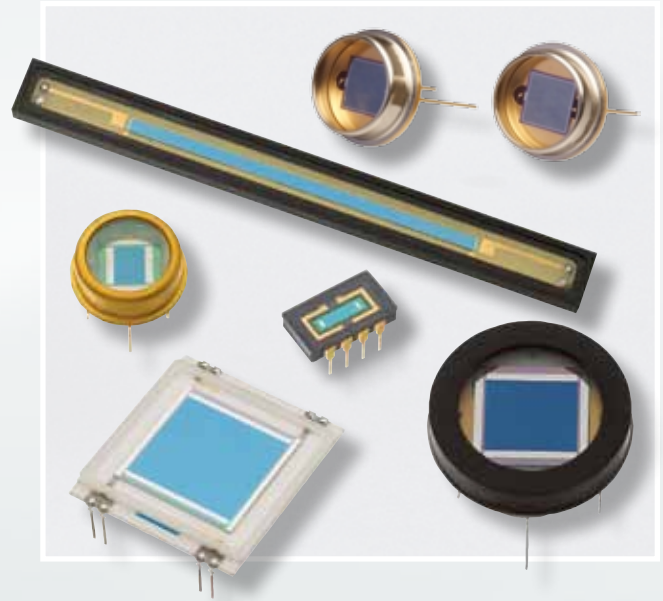
The maximum recommended power density incident on the duo lateral PSDs are $1 \text{ mW} / \text{cm}^2$. For optimum performance, incident beam should be perpendicular to the active area with spot size less than 1mm in diameter.

APPLICATIONS

- Beam Alignment
- Position Sensing
- Angle Measurement
- Surface Profiling
- Height Measurements
- Targeting
- Guidance System
- Motion Analysis

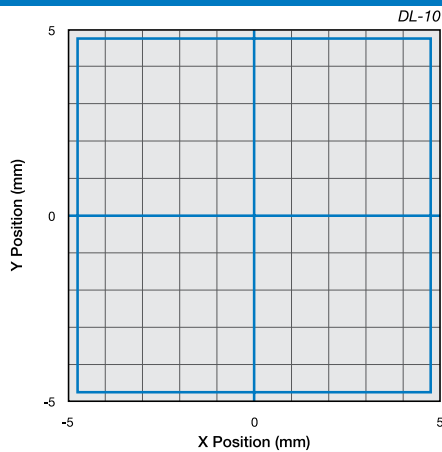
FEATURES

- Super Linear
- Ultra High Accuracy
- Wide Dynamic Range
- High Reliability
- Duo Lateral Structure

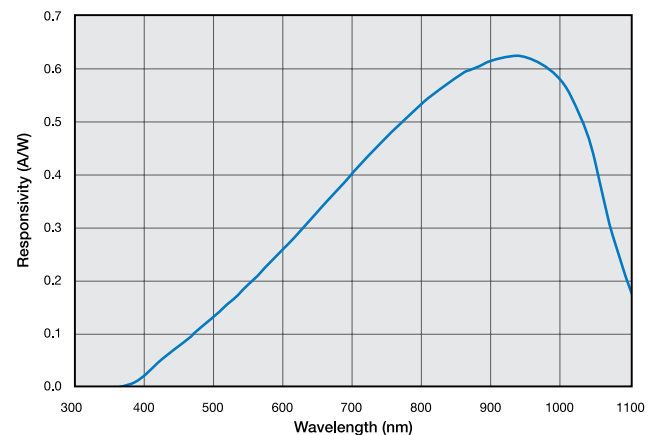


For position calculations and further details on circuit set up, refer to the "Photodiode Characteristics" section of the catalog.

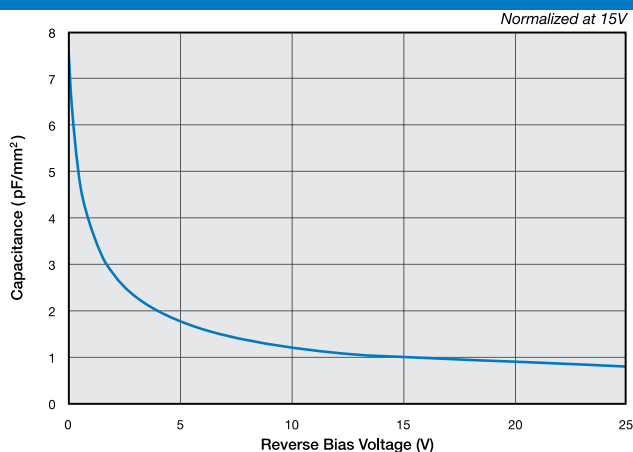
Typical Position Detectability



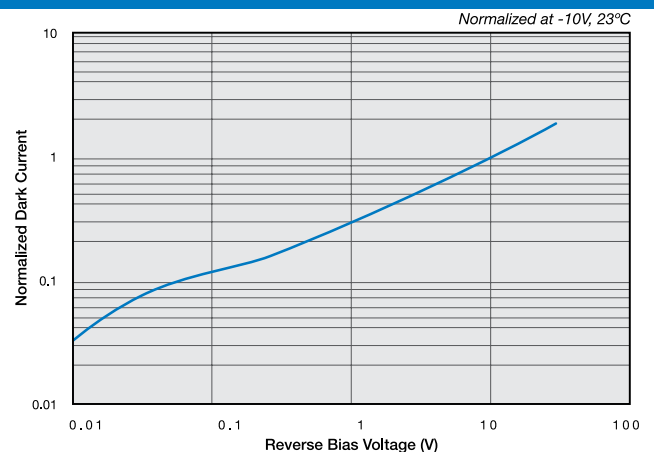
Typical Spectral Response



Typical Capacitance vs. Reverse Bias Voltage



Typical Dark Current vs. Reverse Bias



Duo-Lateral Super Linear PSD's

Typical Electro-Optical Specifications at T_A=23°C

Model Number	Position Sensing Area		Responsivity (A/W)		Position Detection Error (μm)	Dark Current (nA)		Capacitance (pF)		Rise Time (μs)	Position Detection Drift † (μm / °C)	Inter-electrode Resistance (kΩ)		Temp Range (°C)		Package Style ¶
	Area (mm²)	Dimension (mm)	670 nm		Over 80% of Length 64% of Sensing Area	-15 V, SL Series -5 V, DL Series		-15 V, SL Series -5 V, DL Series		670 nm 50 Ω		min.	max.	Operating	Storage	
			min.	typ.	typ.	typ.	max.	typ.	max.	typ.						
One-Dimensional Series, Metal Package (V _{BIAS} =-15V)																
SL3-1	3	3 x 1	0.3	0.4	3	5	50	3	7	0.04	0.06	15	80	-10 ~ +60	-20 ~ +80	41 / TO-5
SL5-1	5	5 x 1			5	10	100	5	9	0.10	0.10	20	100			42 / TO-8
One-Dimensional Series, Ceramic Package (V _{BIAS} =-15V)																
SL3-2	3	3 x 1	0.3	0.4	3	5	50	3	7	0.04	0.06	15	80	-10 ~ +60	-20 ~ +80	48 / 8-pin DIP
SL5-2	5	5 x 1			5	10	100	5	9	0.10	0.10	20	100			
SL15	15	15 x 1			15	150	300	15	25	0.60	0.1	60	300			49 / 24-pin DIP
SL30	120	30 x 4			30	150	1000	125	150	1.0	0.6	40	80			51 / Ceramic
SL76-1	190	76 x 2.5			76	100	1000	190	250	14.0	1.4	120	600			50 / Special
Two-Dimensional Series, Metal Package § (V _{BIAS} =-5V)																
DL-2 «	4	2 sq	0.3	0.4	30	30	600	10	30	0.025	0.20	5	25	-10 ~ +60	-20 ~ +80	37 / TO-8
DLS-2 «						10	175	8	14		0.40					
DLS-2S «																
DL-4	16	4 sq			50	50	1000	35	60	0.08	0.25					37 / TO-8
DLS-4						25	300	30	40		0.30					
DL-10	100	10 sq			100	500	5000	175	375	0.20	0.60					34 / Special
DL-20	400	20 sq			200	2000	12000	600	1500	1.00	1.0					35 / Special
Two-Dimensional Series, Ceramic Package § (V _{BIAS} =-5V)																
DLS-10	100	10 sq	0.3	0.4	100	50	400	160	200	0.20	0.70	5	25	-10 ~ +60	-20 ~ +80	36 / Ceramic
DLS-20	400	20 sq			200	100	1000	580	725	1.00	1.2					
Two-Dimensional Series, Low-Cost Ceramic Package (V _{BIAS} =-5V)																
DL-10C	100	10 sq	0.3	0.4	100	500	5000	175	375	0.20	0.60	5	25	-10 ~ +60	-20 ~ +80	38 / Ceramic
DL-20C	400	20 sq			200	2000	12000	600	1500	1.00	1.0					39 / Ceramic

† The position temperature drift specifications are for the die mounted on a copper plate without a window and the beam at the electrical center of the sensing area.

§ The DLS Series are packaged with A/R coated windows and have a lower dark current than the DL series.

¶ For mechanical drawings please refer to pages 61 thru 73.

* Non-Condensing temperature and Storage Range, Non-Condensing Environment.

NOTES:

- DL(S) series are available with removable windows.
- Chip centering within ± 0.010".

« Minimum order quantities apply

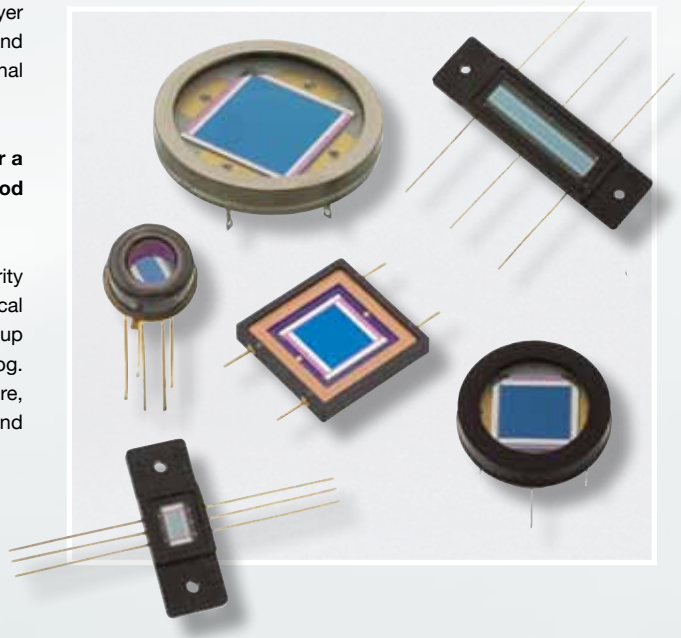
Tetra-Lateral PSD's

Position Sensing Detectors (PSD)

Tetra-lateral position sensing detectors are manufactured with one single resistive layer for both one and two dimensional measurements. They feature a common anode and two cathodes for one dimensional position sensing or four cathodes for two dimensional position sensing.

These detectors are best when used in applications that require measurement over a wide spacial range. They offer high response uniformity, low dark current, and good position linearity over 64% of the sensing area.

A reverse bias should be applied to these detectors to achieve optimum current linearity when large light signals are present. The circuit on the opposite page represents a typical circuit set up for two dimensional tetra-lateral PSDs. For further details as well as the set up for one dimensional PSDs refer to the "Photodiode Characteristics" section of the catalog. Note that the maximum recommended incident power density is $10 \text{ mW} / \text{cm}^2$. Furthermore, typical uniformity of response for a $1 \text{ mm } \phi$ spot size is $\pm 5\%$ for SC-25D and SC-50D and $\pm 2\%$ for all other tetra-lateral devices.



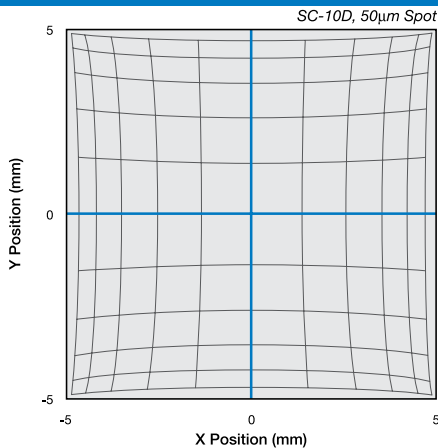
APPLICATIONS

- Tool Alignment and Control
- Leveling Measurements
- Angular Measurements
- 3 Dimensional Vision
- Position Measuring

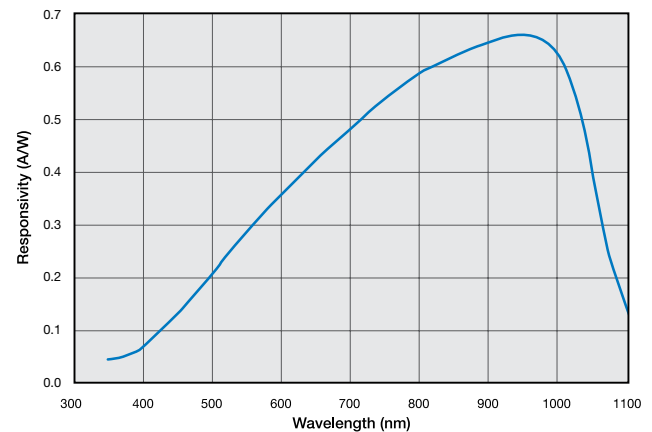
FEATURES

- Single Resistivity Layer
- High Speed Response
- High Dynamic Range
- Very High Resolution
- Spot Size & Shape Independence

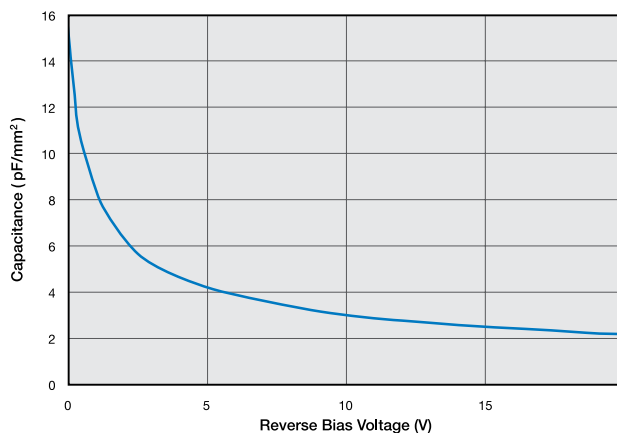
Typical Position Detectability



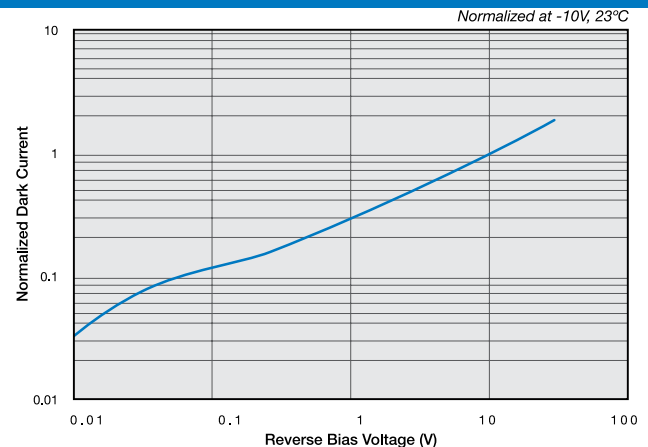
Typical Spectral Response



Typical Capacitance vs. Reverse Bias Voltage



Typical Dark Current vs. Reverse Bias



Tetra-Lateral Position Sensors

Typical Electro-Optical Specifications at $T_A=23^{\circ}\text{C}$

Model Number	Position Sensing Area		Responsivity (A/W)		Absolute Position Detection Error (mm)	Dark Current (μA)		Capacitance (pF)	Rise Time † (μs)	Inter-electrode Resistance (kΩ)		Temp Range (°C)		Package Style ¶
	Area (mm²)	Dimensions (mm)	670 nm		Over 80% of Length 64% of Area	-15 V		-15 V	-15 V 670 nm 50Ω			Operating	Storage	
			min.	typ.	typ.	typ.	max.	typ.	typ.	min.	max.			

One-Dimensional Series, Plastic Package

LSC-5D «	11.5	5.3 x 2.2	0.35	0.42	0.040	0.01	0.10	50	0.25	2	50	~ -10 $\sim +60$	~ -20 $\sim +70$	47 / Plastic
LSC-30D «	122	30 x 4.1			0.240	0.025	0.250	300	3.00	4	100			46 / Plastic

Two-Dimensional Series, Metal Package

SC-4D	6.45	2.54 sq	0.35	0.42	0.080	0.005	0.050	20	0.66	3	30	0 \sim +70 ~ -20 \sim +80	41 / TO-5 44 / Special 45 / Special 21 / Special
SC-10D	103	10.16 sq			1.30	0.025	0.250	300	1.00				
SC-25D	350	18.80 sq			2.5	0.10	1.0	1625	5.00				
SC-50D	957	30.94 2q			5.0	0.25	2.5	3900	5.00				

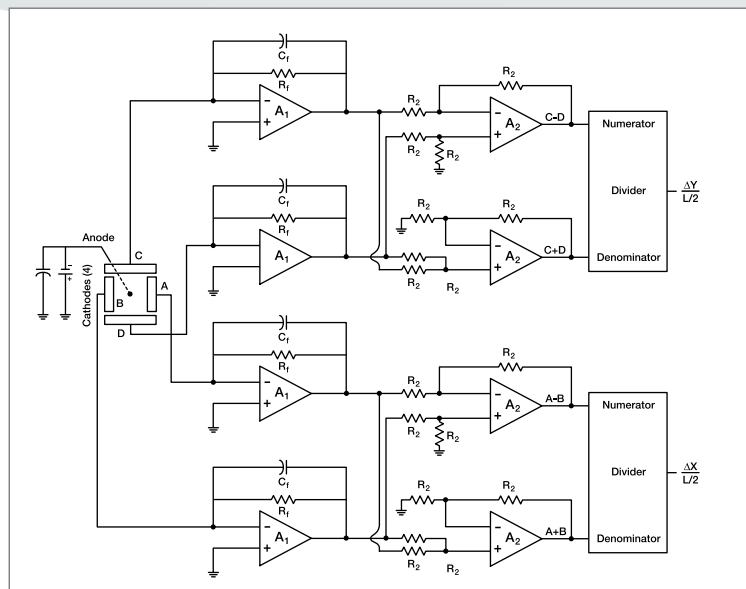
\dagger Rise time specifications are with a 1 mm ϕ spot size at the center of the device.

¶ For mechanical drawings please refer to pages 61 thru 73.

* Non-Condensing temperature and Storage Range, Non-Condensing Environment.

Chip centering within $\pm 0.010^{\circ}$.

« Minimum order quantities apply



For further details, refer to the "Photodiode Characteristics" section of the catalog.

Sum and Difference Amplifier Modules

Position Sensing Modules

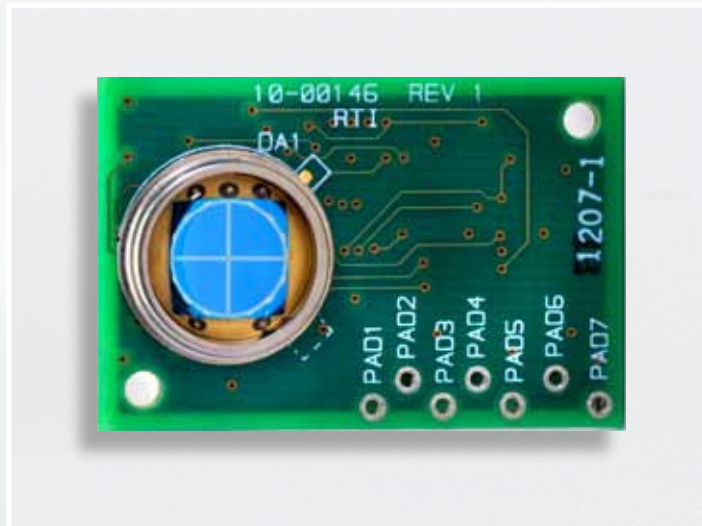
QD7-0-SD or **QD50-0-SD** are quadrant photodiode arrays with associated circuitry to provide two difference signals and a sum signal. The two difference signals are voltage analogs of the relative intensity difference of the light sensed by opposing pairs of the photodiode quadrant elements. In addition the amplified sum of all 4 quadrant elements is provided as the sum signal. This makes the QD7-0-SD or QD50-0-SD ideal for both light beam nulling and position applications. Very precise light beam alignments are possible, and the circuit can also be used for target acquisition and alignment.

APPLICATIONS

- Position Measuring
- Beam Centering
- Targeting
- Guidance Systems

FEATURES

- Other QD7-XX or QD50-XX are available upon request



Values given as per element unless otherwise stated

Model Number	Active Area Total		Element Gap (mm)	Responsivity (A/W)		Capacitance (pF)	Dark Current (nA)		NEP (W/√Hz)	Reverse Voltage (V)	Rise Time (ns)	Temp Range (°C)		Package Style ¶
	Area (mm²)	Dimensions (mm)		900 nm		0 V			-30 V		Operating	Storage		
				min.	typ.	typ.	typ.	max.	typ.	max.			typ.	
'O' Series														
QD7-0	7	3.0 ϕ	0.2	0.47	0.54	20	4.0	15.0	9.0 e-14	30	10	-40 ~ +100	-55 ~ +125	41 / TO-5
QD50-0	50	8.0 ϕ				125	15.0	30.0	1.3 e-13					70 / TO-8

INPUT

Power supply voltage $V_{CC} = \pm 4.5V$ min; $\pm 15V$ typical; $\pm 18V$ max

Photodiode bias voltage = $(.91) \times (V_{PDBIAS})$

$V_{PDBIAS} = 0$ TO $+V_{CC}$; Absolute maximum V_{PDBIAS} is $+V_{CC}$

NOTE: Negative voltages applied to $PDBIAS$ will render the QD7-0-SD or QD50-0-SD inoperative.

ENVIRONMENTAL

Operating temperature	0 to 70° C
Theoretical noise	15 nV/Hz ^{1/2}
Frequency response	(-3dB): 120kHz @ $V_{PDBIAS}=0V$; 880nm 250kHz @ $V_{PDBIAS}=15V$; 880nm
Max slew rate	10V/μs
Output current limit	25 mA

OUTPUT

Where i_x is the current from quadrant x

$$V_{T-B} = -\{(i_1 + i_2) - (i_3 + i_4)\} \times (10^4)$$

$$V_{L-R} = -\{(i_2 + i_3) - (i_1 + i_4)\} \times (10^4)$$

$$V_{SUM} = -\{(i_1 + i_2 + i_3 + i_4)\} \times (10^4)$$

MAXIMUM OUTPUT VOLTAGE

Positive: $(+V_{CC} - 3V)$

Negative: $(-V_{CC} + 3V)$

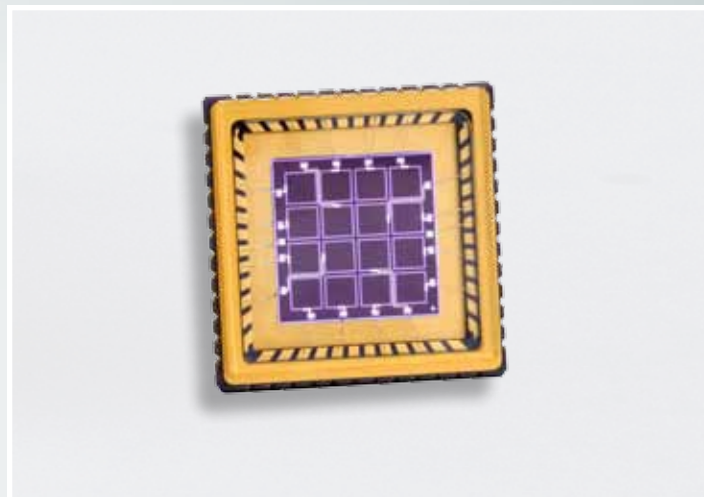
The **PIN-4X4D** is a 4 by 4 array of superblue enhanced Photodetectors. Our proprietary design provides virtually complete isolation between all of the 16 elements. The standard LCC package allows easy integration into your surface mount applications. Numerous applications include Ratio and Scattering measurements, as well as Position Sensing. For custom packages, special electro-optic requirements, or to order these parts in die form, please contact our Applications group.

APPLICATIONS

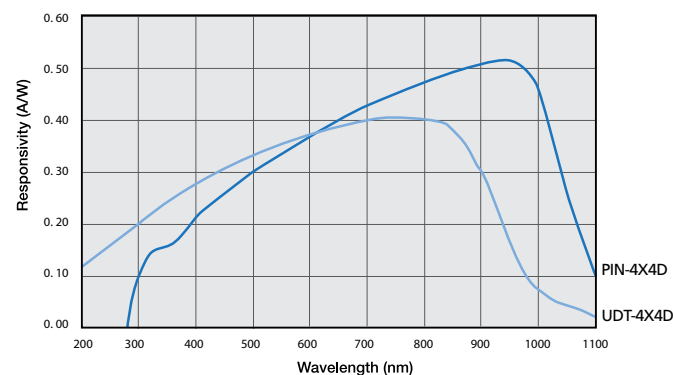
- Scattering Measurements
- Position Sensing

FEATURES

- Speedy Response
- Extremely Low Cross-talk
- Surface Mount Design



Typical Spectral Response



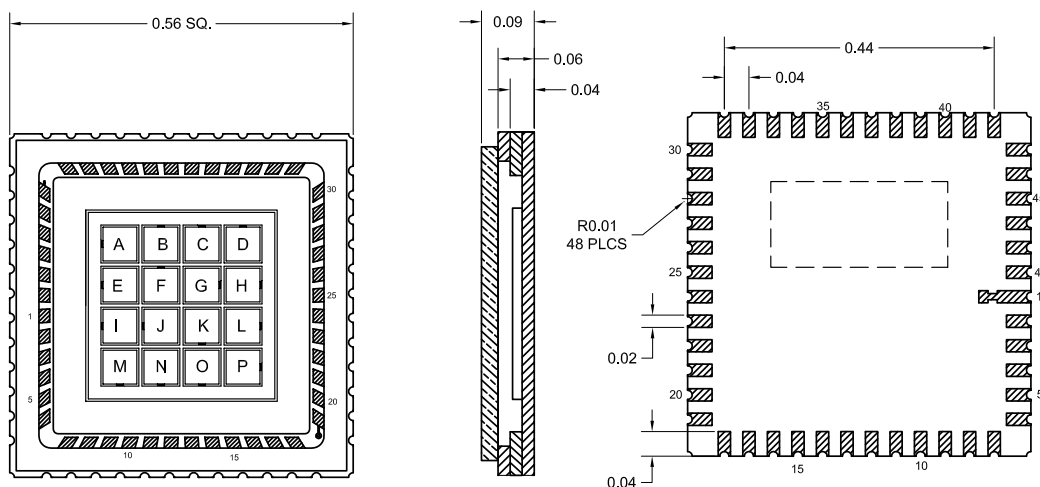
Model Number	Active Area		Peak Responsivity Wavelength	Responsivity (A/W)		Capacitance (pF)	Shunt Resistance (MΩ)		NEP (W/√Hz)	Crosstalk	Temp. Range (°C)		Package Style ¶
	Area (mm²)	Dimensions (mm)		λp nm	632nm	0 V	-10 mV	0 V 632nm	0 V 632nm	Operating	Storage		
								typ.	min.			typ.	
4 x 4 Array Detectors													
PIN-4X4D	1.96	1.4 x 1.4	850	---	0.35	75	50	0.01	5.2e-14	1	-20 ≥ +60	-20 ≥ +80	Ceramic LCC
UDT-4X4D*	1.0	1.0 x 1.0	810	0.35	0.40	35	1.0	0.01	1.0e-14*	0.02%	-20 ≥ +60	-20 ≥ +80	Ceramic LCC

- Non-condensing temperature and storage range, Non-condensing environment.
- All Electro-Optical specifications are given on a per element basis.
- UDT-4X4D: NEP tested at 810nm*

Mechanical Specifications

4x4 Silicon Array Detectors

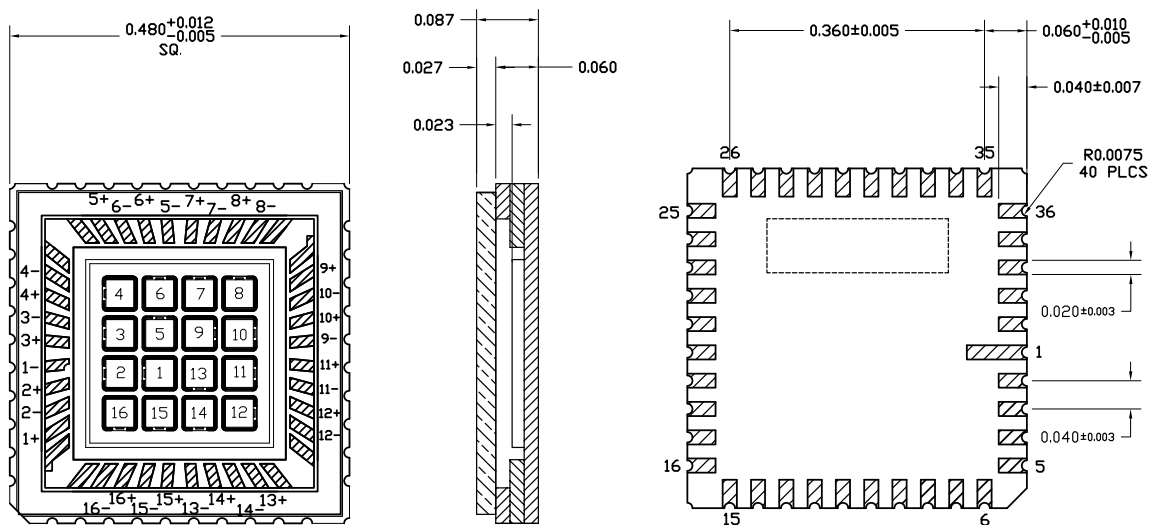
PIN-4X4D



Top views are shown without window

All units in inches.

UDT-4X4D



Top views are shown without window

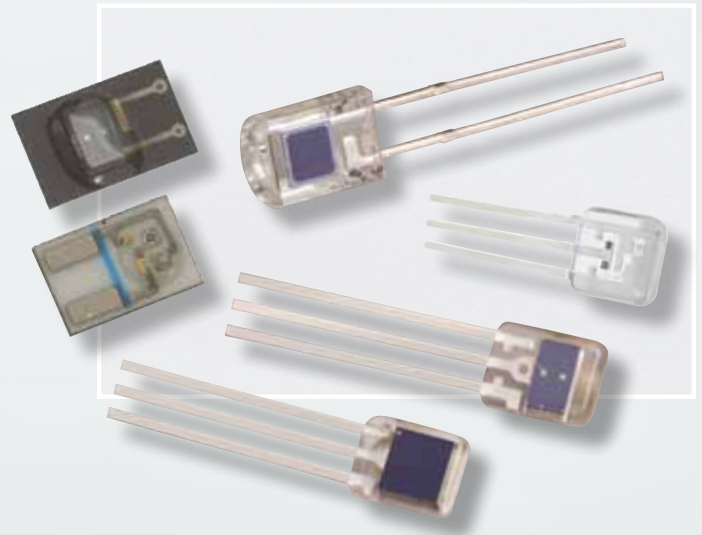
All units in inches.

Dual Emitter / Matching Photodetector Series

Molded Lead Frame and Leadless Ceramic Substrate

The **Dual LED series** consists of a 660nm (red) LED and a companion IR LED such as 880/ 895, 905, or 940nm. They are widely used for radiometric measurements such as medical analytical and monitoring devices. They can also be used in applications requiring a low cost Bi-Wavelength light source. Two types of pin configurations are available: 1.) three leads with one common anode or cathode, or 2.) two leads parallel back-to-back connection. They are available in two types of packaging. Clear lead frame molded side looker, and leadless ceramic substrate.

The matching Photodetector' responses are optimized for maximum responsivity at 66nm as well as near IR wavelengths. They exhibit low capacitance and low dark currents and are available in three different active area sizes in the same two types of packaging as the dual emitters: Clear lead frame molded side looker and leadless ceramic substrate.



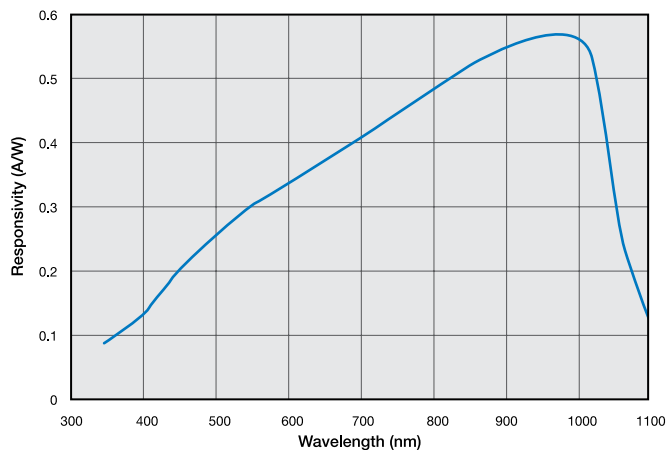
APPLICATIONS

- SpO₂
- Blood analysis
- Medical Instrumentation
- Ratiometric Instruments

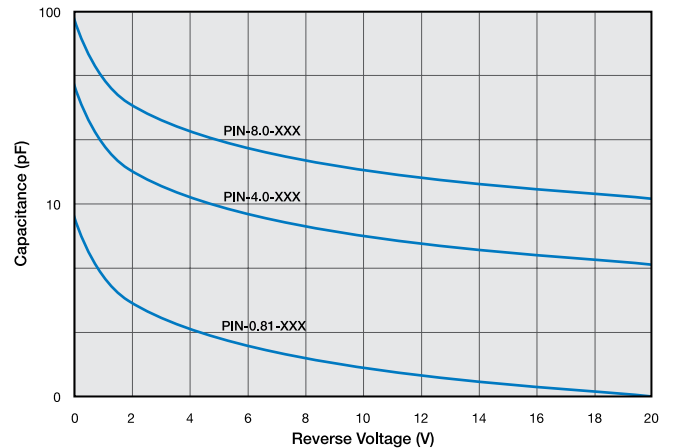
FEATURES

- Leadless ceramic Substrate
- Lead Frame Molded Packages
- Two and Three Lead Designs
- Bi-Wavelengths LEDs
- Matching Detector Response

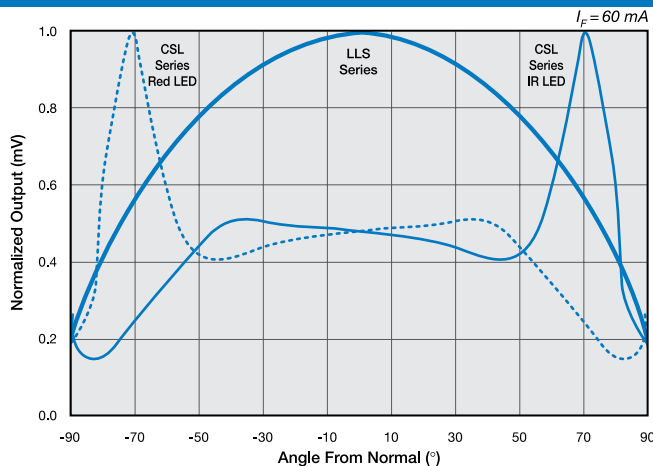
Typical Spectral Response



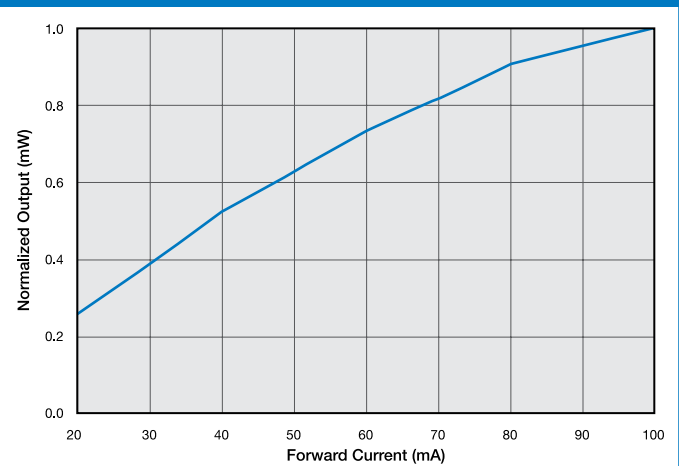
Typical Capacitance vs. Reverse Voltage



Normalized LED Output vs. Angular Distribution



Normalized LED Output vs. Forward Current



Dual Emitter / Matching Photodetector Series

Molded Lead Frame and Leadless Ceramic Substrate

Model Number	Active Area		Spectral Range	Responsivity		Capacitance	Dark Current (nA)	Max. Reverse Voltage	Operating Temp.	Storage Temp.	Package
	Area mm ²	Dimensions mm	nm	A / W		pF	-10 V	V	°C	°C	
				660nm	900nm	-10 V	typ.	10μA			

Photodiode Characteristics «

PIN-0.81-LLS	0.81	1.02 ϕ	350 - 1100	0.33	0.55	2.0	2	20	-25 ~ +85	-40 ~ +100C	62 /Leadless Ceramic			
PIN-0.81-CSL											60 / Molded Lead Frame			
PIN-4.0-LLS	3.9	2.31 x 1.68				10	5				62 /Leadless Ceramic			
PIN-4.0-CSL											60 / Molded Lead Frame			
PIN-8.0-LLS	8.4	2.9 Sq.				25	10				62 /Leadless Ceramic			
PIN-8.0-CSL											60 / Molded Lead Frame			

For mechanical drawings and pin locations, please refer to pages 61 to 77.

« Minimum order quantities apply

Model Number	LED's Used	Package Style ¶	Pin Configuration	Operating Temperature	Storage Temperature
	nm			°C	°C

Dual Emitter Combinations «

DLED-660/880-LLS-2	660	880	64 / Leadless Ceramic	2 Leads / Back to Back*	-25 ~ +85	-40 ~ +80
DLED-660/895-LLS-2		895				
DLED-660/905-LLS-2		905				
DLED-660/905-LLS-3		905		3 Leads / Common Anode		
DLED-660/940-LLS-3		940	63 / Side Looker Plastic			
DLED-660/880-CSL-2		880		2 Leads / Back to Back*		
DLED-660/895-CSL-2		895				
DLED-660/905-CSL-2		905				
DLED-660/905-CSL-3		905		3 Leads / Common Anode		
DLED-660/940-CSL-3		940				

* In Back-to-Back configuration, the LED's are connected in parallel.

« Minimum order quantities apply

LED	Peak Wavelength	Radiant Flux	Spectral Bandwidth	Forward Voltage	Reverse Voltage
	nm	nW	nm	V	V
	i _f =20mA	i _f =20mA	i _f =20mA FWHN	i _f =20mA	i _r =20mA
	typ.	typ.	typ.	max.	max.

LED Characteristics

660nm	660	1.8	25	2.4	5
880nm	880	1.5	80	2.0	
895nm	895	2.0	50	1.7	
905nm	905				
935nm	935	1.5		1.5	
940nm	940				

For mechanical drawings, please refer to pages 61 thru 73.



Phone +49 (0) 8152 983 789-0
 Fax +49 (0) 8152 983 789-1
 E-Mail info@sphereoptics.de
www.sphereoptics.de