

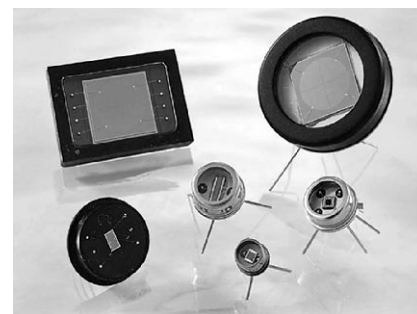
Segmented Photodiodes (SPOT Series)

Features

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

Applications

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



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/cm² and typical uniformity of response for a 1 mm diameter spot is $\pm 2\%$.

Model Number	Active Area Per Element		Element Gap (nm)	Responsivity (A/W)		Capacitance (pF)	Dark Current (nA)		NEP (W/ $\sqrt{\text{Hz}}$)	Reverse Voltage (V)	Rise Time (ns)		Temp. Range (°C)		Package Style
	Area (mm ²)	Dimensions (mm)		970nm			-10V	-10V			-10V 970 nm	-10V 780nm 50 Ω	Operating	Storage	
				min.	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	300@-15V		-40 ~ +100	-55 ~ +125	TO-5
SPOT-2D	3.3	1.3 x 2.5	0.127			11	0.15	2.0	5			TO-5				
SPOT-2DMI	0.7	0.6 x 1.2	0.013			3	0.05	1.0	7			TO-18				
SPOT-3D	2.8	0.6 x 4.6	0.025			7	0.13	2.0	4			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	3	-40 ~ +100	-55 ~ +125	TO-5
SPOT-4DMI	0.25	0.5 sq	0.013			1	0.01	0.5	2.8 e-15					
SPOT-9D	19.6	10 $\phi^{(1)}$	0.102			60	0.50	10.0	1.9 e-14					
SPOT-9DMI	19.6		0.010											

Model Number	Active Area Per Element		Element Gap (nm)	Responsivity 257 nm		Capacitance 0V	Shunt Resistance (M Ω)		NEP (W/ $\sqrt{\text{Hz}}$)	Reverse Voltage (V)	Rise Time 0V, 257nm		Temp Range (°C)		Package Style		
	Area (mm ²)	Dimensions (mm)		A/W			pF	min.			max.	typ.	max.	μs		Operating	Storage
				min.	typ.												

UV-Enhanced Four Elements, Metal Package

SPOT-40UV	1.61	1.3 sq	0.127	0.08	0.10	40	100	500	1.3e-13	5	10	-10 ~ +60	-20 ~ +70	TO-5
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⁽¹⁾ Overall Diameter (All four Quads)
Chip centering within $\pm 0.010''$.

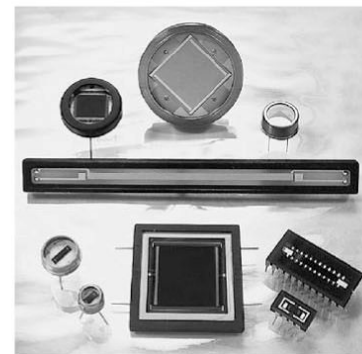
Duo-Lateral, Super Linear PSD's

Features

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

Applications

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

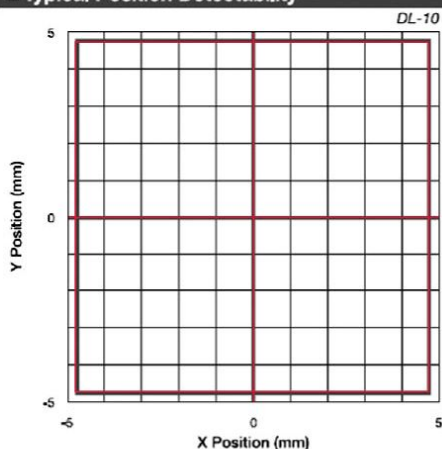


The Super Linear Position Sensors feature state of the art duo-lateral technology to provide a continuous analog output proportional to the displacement of the centroid of a light spot from the center, on the active area. As continuous position sensors, these detectors are unparalleled; offering position 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.

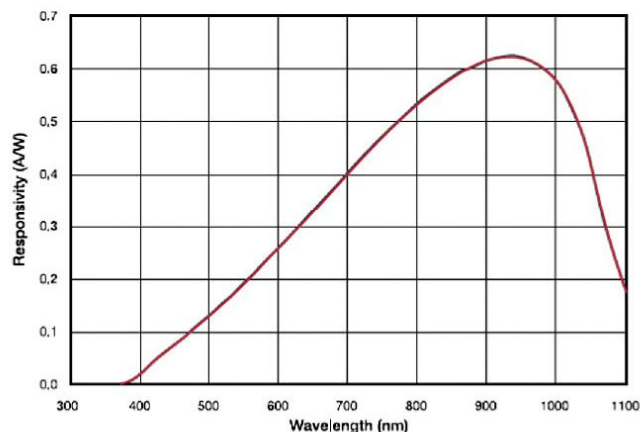
A reverse bias should be applied to these detectors to achieve optimum current linearity at high light levels. Contact us.

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.

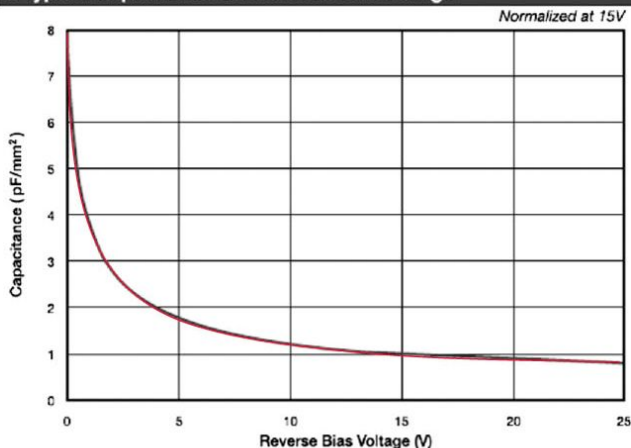
■ Typical Position Detectability



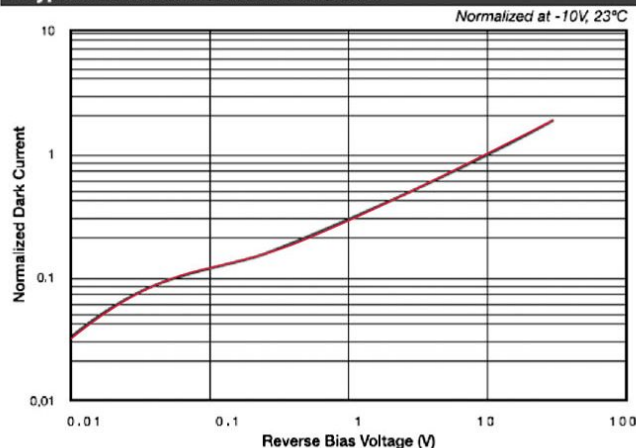
■ Typical Spectral Response



■ Typical Capacitance vs. Reverse Bias Voltage



■ Typical Dark Current vs. Reverse Bias



Model Number	Position Sensing Area		Responsivity (A/W)		Position Detection Error (μm)	Dark Current (nA)		Capacitance (pF)		Rise Time (μs)	Position Detection Drift ⁽¹⁾ ($\mu\text{m}/^\circ\text{C}$)	Inter-electrode Resistance ($k\Omega$)		Temp. Range ($^\circ\text{C}$)		Package Style
	Area (mm^2)	Dimensions (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.					

One-Dimensional Series, Metal Package ($V_{\text{BIAS}} = -15\text{V}$)

Model Number	Area (mm^2)	Dimensions (mm)	Responsivity (min.)	Responsivity (typ.)	Position Detection Error (typ.)	Dark Current (typ.)	Dark Current (max.)	Capacitance (typ.)	Capacitance (max.)	Rise Time (typ.)	Position Detection Drift (typ.)	Inter-electrode Resistance (min.)	Inter-electrode Resistance (max.)	Temp. Range (Operating)	Temp. Range (Storage)	Package Style
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	TO-5
SL5-1	5	5 x 1			5	10	100	5	9	0.10	0.10	20	100	20	100	-10 ~ +60

One-Dimensional Series, Ceramic Package ($V_{\text{BIAS}} = -15\text{V}$)

Model Number	Area (mm^2)	Dimensions (mm)	Responsivity (min.)	Responsivity (typ.)	Position Detection Error (typ.)	Dark Current (typ.)	Dark Current (max.)	Capacitance (typ.)	Capacitance (max.)	Rise Time (typ.)	Position Detection Drift (typ.)	Inter-electrode Resistance (min.)	Inter-electrode Resistance (max.)	Temp. Range (Operating)	Temp. Range (Storage)	Package Style
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	PIN DIP
SL5-2	5	5 x 1			5	10	100	5	9	0.10	0.10	20	100			
SL10-1	20	10 x 2			10	200	500	20	30	0.40	0.10	40	250			
SL15	15	15 x 1			15	150	300	15	25	0.60	0.1	60	300			
SL30	120	30 x 4			30	150	1000	125	150	1.0	0.6	40	80			
SL76-1	190	76 x 2.5			76	100	1000	190	250	14.0	1.4	120	600			

Two-Dimensional Series, Metal Package⁽²⁾ ($V_{\text{BIAS}} = -5\text{V}$)

Model Number	Area (mm^2)	Dimensions (mm)	Responsivity (min.)	Responsivity (typ.)	Position Detection Error (typ.)	Dark Current (typ.)	Dark Current (max.)	Capacitance (typ.)	Capacitance (max.)	Rise Time (typ.)	Position Detection Drift (typ.)	Inter-electrode Resistance (min.)	Inter-electrode Resistance (max.)	Temp. Range (Operating)	Temp. Range (Storage)	Package Style								
DL-2	4	2 sq	0.3	0.4	30	30	600	10	30	0.025	0.20	5	25	-10 ~ +60	-20 ~ +80	TO-8								
DLS-2						10	175	8	14		0.40													
DLS-25						50	1000	35	60		0.25													
DL-4	16	4 sq				0.3	0.4	50	25	300	30						40	0.08	0.30	5	25	-10 ~ +60	-20 ~ +80	TO-8
DLS-4									100	500	5000						175		375					
DL-10	100	10 sq							100	500	5000						175	375	0.20					
DL-20	400	20 sq	200	2000	12000				600	1500	1.00	1.0	1.00	1.0	5	25	-10 ~ +60	-20 ~ +80	Special					

Two-Dimensional Series, Ceramic Package^(2,3) ($V_{\text{BIAS}} = -5\text{V}$)

Model Number	Area (mm^2)	Dimensions (mm)	Responsivity (min.)	Responsivity (typ.)	Position Detection Error (typ.)	Dark Current (typ.)	Dark Current (max.)	Capacitance (typ.)	Capacitance (max.)	Rise Time (typ.)	Position Detection Drift (typ.)	Inter-electrode Resistance (min.)	Inter-electrode Resistance (max.)	Temp. Range (Operating)	Temp. Range (Storage)	Package Style
DLS-10	100	10 sq	0.3	0.4	100	50	400	160	200	0.20	0.70	5	25	-10 ~ +60	-20 ~ +80	Ceramic
DLS-20	400	20 sq				200	100	1000	580	725	1.00					

Two-Dimensional Series, Low-Cost Ceramic Package ($V_{\text{BIAS}} = -5\text{V}$)

Model Number	Area (mm^2)	Dimensions (mm)	Responsivity (min.)	Responsivity (typ.)	Position Detection Error (typ.)	Dark Current (typ.)	Dark Current (max.)	Capacitance (typ.)	Capacitance (max.)	Rise Time (typ.)	Position Detection Drift (typ.)	Inter-electrode Resistance (min.)	Inter-electrode Resistance (max.)	Temp. Range (Operating)	Temp. Range (Storage)	Package Style
DL-10C	100	10 sq	0.3	0.4	100	500	5000	175	375	0.20	0.60	5	25	-10 ~ +60	-20 ~ +80	Ceramic
DL-20C	400	20 sq				200	2000	12000	600	1500	1.00					1.0

⁽¹⁾ 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.⁽²⁾ The DLS Series are packaged with A/R coated windows and have a lower dark current than the DL series.⁽³⁾ Also available in the same package as DL-10. Specify DL-10-1.

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

NOTES:

1. DL(S) series are available with removable windows.

2. Chip centering within $\pm 0.010''$.

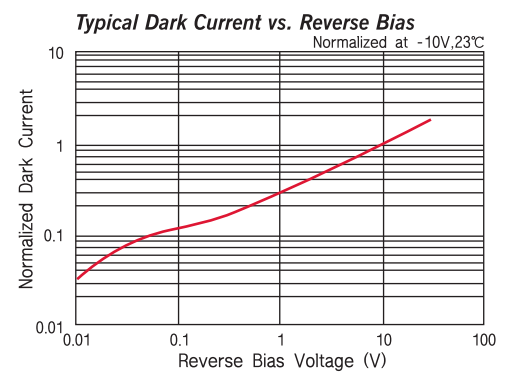
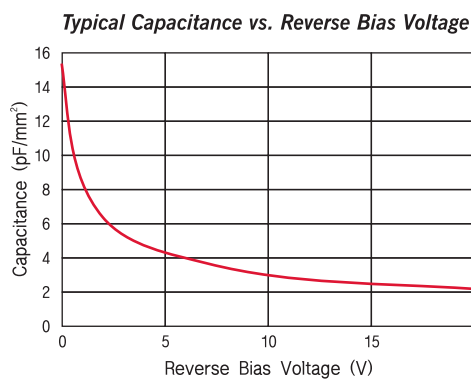
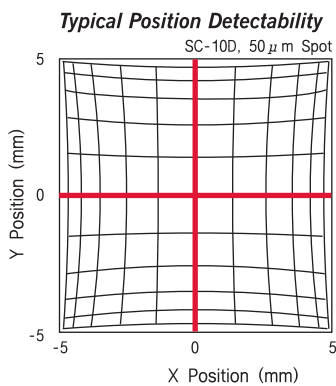
Tetra-Lateral PSD's

Features

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

Applications

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



Model Number	Position Sensing Area		Responsivity (A/W)		Absolute Position Detection Error (mm)	Dark Current (μ A)		Capacitance (pF)	Rise Time ⁽¹⁾ (μ s)	Inter-electrode Resistance (k Ω)		Temp.* Range (°C)		Package Style
	Area (mm ²)	Dimensions (mm)	670 nm		Over 80% of Length 64% of Area	-15 V		-15 V	-15V	670 nm	50 Ω	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 ~ +60	-20 ~ +70	Plastic
LSC-30D	122	30 x 4.1			0.240	0.025	0.250	300	3.00	4	100			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 ~ +70	-20 ~ +80	TO-5
SC-10D	103	10.16 sq			1.30	0.025	0.250	300	1.00					Special
SC-25D	350	18.80 sq			2.5	0.10	1.0	1625	5.00					Special
SC-50D	957	30.94 sq			5.0	0.25	2.5	3900	13.00					Special

Two-Dimensional Series, Plastic Package⁽²⁾

FIL-C4DG	6.45	2.54 sq	0.35	0.42	0.080	0.005	0.050	20	0.66	3	30	-10 ~ +60	-20 ~ +70	Plastic
FIL-C10DG	103	10.16 sq			1.30	0.025	0.250	300	1.00					Plastic

⁽¹⁾Rise time specifications are with a 1 mm spot size at the center of the device.

⁽²⁾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.

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

Chip centering within $\pm 0.010''$

Sum and Difference Amplifier Modules

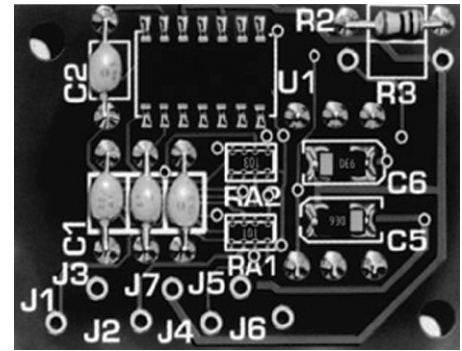
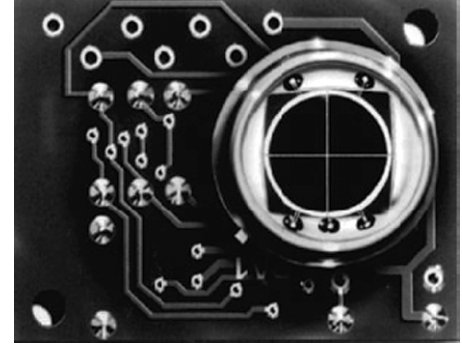
Features

- A 10 μ m gap is available for the QD50-SD Module.
- Other QD7-XX or QD50-XX are available upon request.

Applications

- Position Measuring
- Beam Centering
- Targeting
- Guidance Systems

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.



Model Number	Active Area per Element		Element Gap (nm)	Responsivity (A/W)		Capacitance (pF)	Dark Current (nA)		NEP (W/ $\sqrt{\text{Hz}}$)	Reverse Voltage (V)	Rise Time (ns)	Temp. Range (°C)		Package Style
	Area (mm ²)	Dimensions (mm)		900 nm		0V	900 nm		0V		-30V	Operating	Storage	
				min.	typ.	typ.	typ.	max.	typ.					
QD7-0	7	3.0 \varnothing	0.2	0.47	0.54	20	4.0	15.0	9.0 e-14	30	10	-40 ~ +100	+55 ~ +125	TO-5
QD50-0	50	8.0 \varnothing		125	15.0	30.0	1.3 e-13							

'O' Series

QD7-0	7	3.0 \varnothing	0.2	0.47	0.54	20	4.0	15.0	9.0 e-14	30	10	-40 ~ +100	+55 ~ +125	TO-5
QD50-0	50	8.0 \varnothing		125	15.0	30.0	1.3 e-13							

INPUT

Power supply voltage Vcc = $\pm 4.5\text{V}$ min; $\pm 15\text{V}$ typical; $\pm 18\text{V}$ max
Photodiode bias voltage = $(.91) \times (V_{\text{PDBIAS}})$
$V_{\text{PDBIAS}} = 0$ TO $+V_{\text{cc}}$; Absolute maximum V_{PDBIAS} is $+V_{\text{cc}}$
NOTE : Negative voltages applied to PDBIAS will render the QD7-0-SD or QD50-0-SD inoperative.

OUTPUT

Where i_x is the current from quadrant x
$V_{\text{T-B}} = -\{(i_1 + i_2) - (i_3 + i_4)\} \times (10^4)$
$V_{\text{L-R}} = -\{(i_1 + i_2) - (i_3 + i_4)\} \times (10^4)$
$V_{\text{SUM}} = -\{(i_1 + i_2) - (i_3 + i_4)\} \times (10^4)$

ENVIRONMENTAL

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

MAXIMUM OUTPUT VOLTAGE

Positive : $(+V_{\text{cc}} - 3\text{V})$
Negative : $(-V_{\text{cc}} + 3\text{V})$