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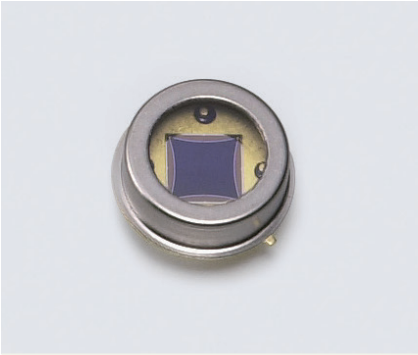
Two-dimensional PSD



S2044

Non-discrete position sensors utilizing photodiode surface resistance

PSD (position sensitive detector) is an optoelectronic position sensor utilizing photodiode surface resistance. There is no element gap due to non-discrete type. Therefore, continuous output signals (X/Y coordinate signals) can be obtained for the movement of the light spot, and the position resolution and response are excellent.

Features

- **Continuous output signal for light spot movement**
- **High position resolution**
- **High-speed response**
- **Simultaneous measurements of position and intensity**
- **Position is measured independent of light spot size**
- **Wide spectral response range**
- **High reliability**

Applications

- **Optical position and angle sensing**
- **Remote optical control systems**
- **Automatic range finder systems**
- **Displacement and vibration monitors**
- **Laser beam alignment**
- **Medical equipment**

Structure

Parameter	Symbol	Specification	Unit
Photosensitive area size	-	4.7 × 4.7	mm
Package	-	Metal	-
Window material	-	Borosilicate glass	-
Resistance length	Rl	5.7	mm

Absolute maximum ratings

Parameter	Symbol	Value	Unit
Reverse voltage	V_R max	20	V
Operating temperature*1	Topr	-10 to +60	°C
Storage temperature*1	Tstg	-20 to +80	°C

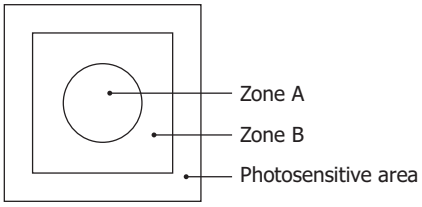
*1: No dew condensation
When there is a temperature difference between a product and the surrounding area in high humidity environment, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.

Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

Electrical and optical characteristics (Ta=25 °C unless otherwise noted)

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit
Spectral response range		λ		-	340 to 1060	-	nm
Peak sensitivity wavelength		λp		-	920	-	nm
Photosensitivity		S	λ=λp	-	0.6	-	A/W
Interelectrode resistance*2		Rie	Vb=0.1 V	5	10	15	kΩ
Position detection error*3	Zone A	E		-	±40	±100	μm
	Zone B			-	±70	±150	
Saturation current		Ist	VR=5 V RL=1 kΩ	-	0.5	-	mA
Dark current		ID	VR=5 V	-	0.5	5	nA
Temperature coefficient of ID		TCID		-	1.15	-	times/°C
Rise time		tr	VR=5 V RL=1 kΩ	-	0.3	-	μs
Terminal capacitance		Ct	VR=5 V f=10 kHz	-	45	-	pF
Position resolution*4		-		-	0.6	-	μm

*2: Measured between two output terminals opposite to each other, and the other terminals are open-circuited on measurement.
*3: Zone A=ϕ1.8 mm, Zone B=4 × 4 mm (See the figure on the right)
*4: Position resolution
This is the minimum detectable light spot displacement. The detection limit is indicated by distance on the photosensitive surface. The numerical value of the resolution of a position sensor using a PSD is proporional to both the length of the PSD and the noise of the measuring system (resolution deteriorates) and inversely proportional to the photocurrent (incident evergy) of the PSD (resolution improves).



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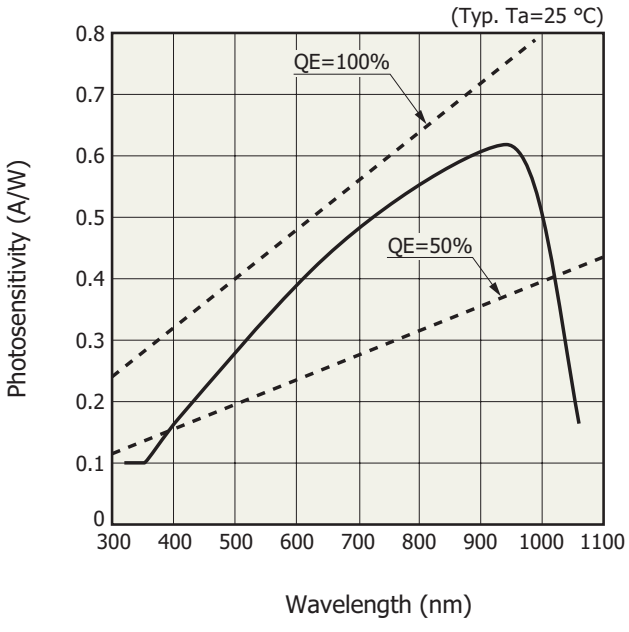
- Light source: LED (900 nm)
- Light spot size: ϕ200 μm
- Frequency range: 1 kHz
- Photocurrent: 1 μA
- Circuit system input noise: 1 μV (1 kHz)
- Interelectrode resistance: Typical value (Refer to specification table.)

Spectral response



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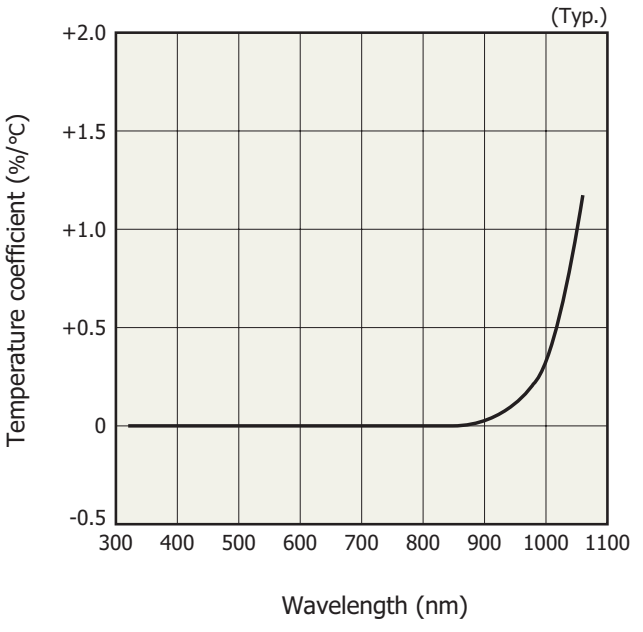
Photosensitivity temperature characteristics



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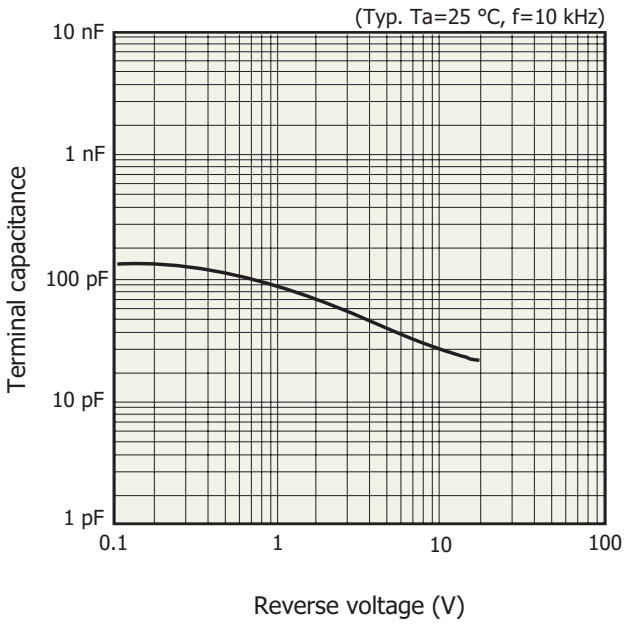
Terminal capacitance vs. reverse voltage



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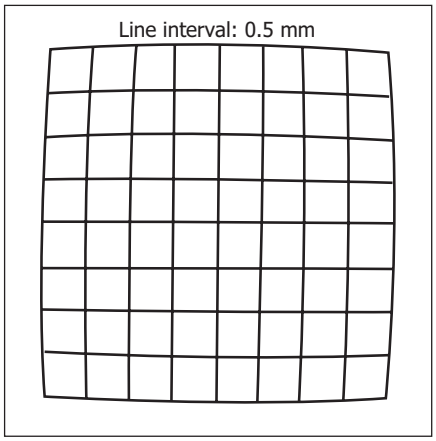
Examples of position detectability (Ta=25 °C, λ=900 nm, light spot size: ϕ200 μm)



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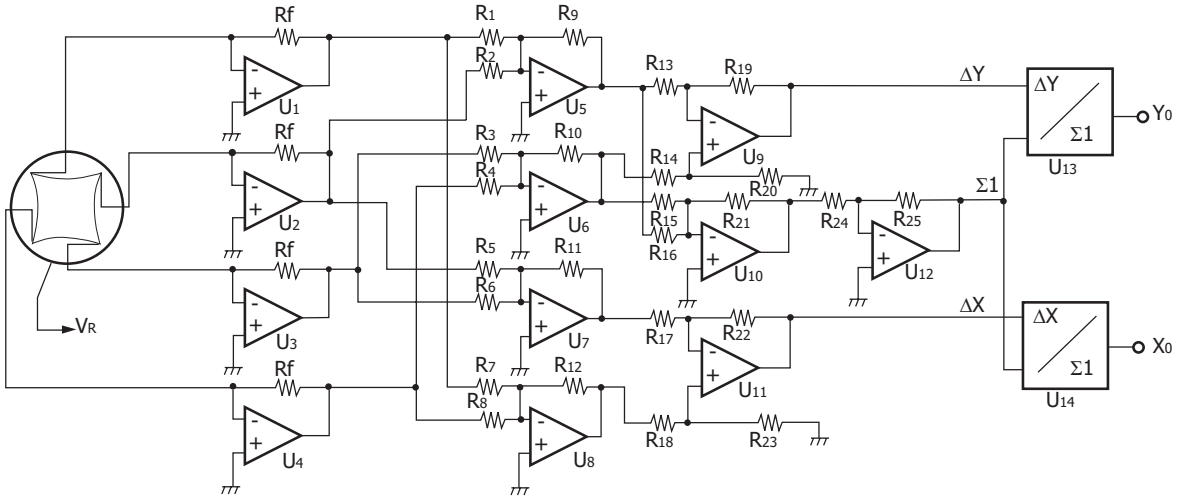
Example of DC-operating circuit



R_1 - R_{25}: same value
Rf: depends on input level
U_1 - U_4: low drift head amplifier, TL071, etc.
U_{13}, U_{14}: analog divider, AD538 (Analog Devices), etc.

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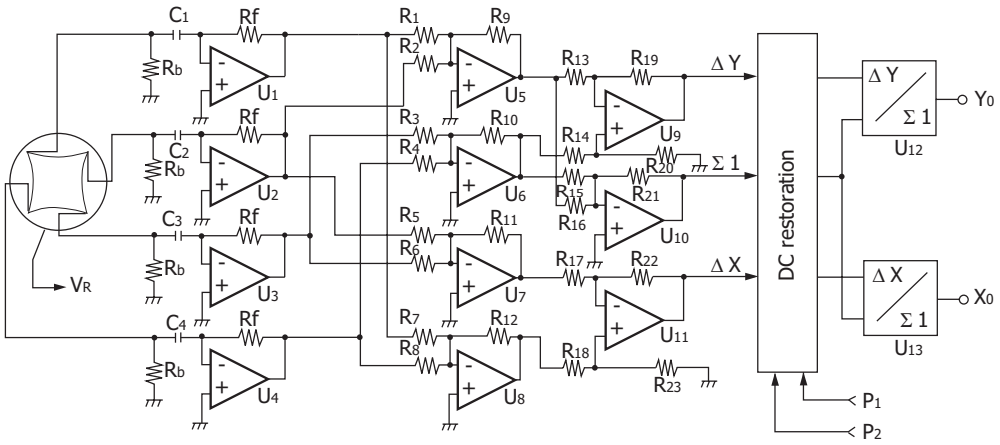
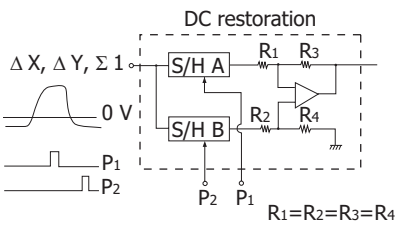
Example of AC-operating circuit



R_1 - R_{24}: same value
Rf: depends on input level
U_1 - U_4: low drift head amplifier, TL071, etc.
U_{12}, U_{13}: analog divider, AD538 (Analog Devices), etc.



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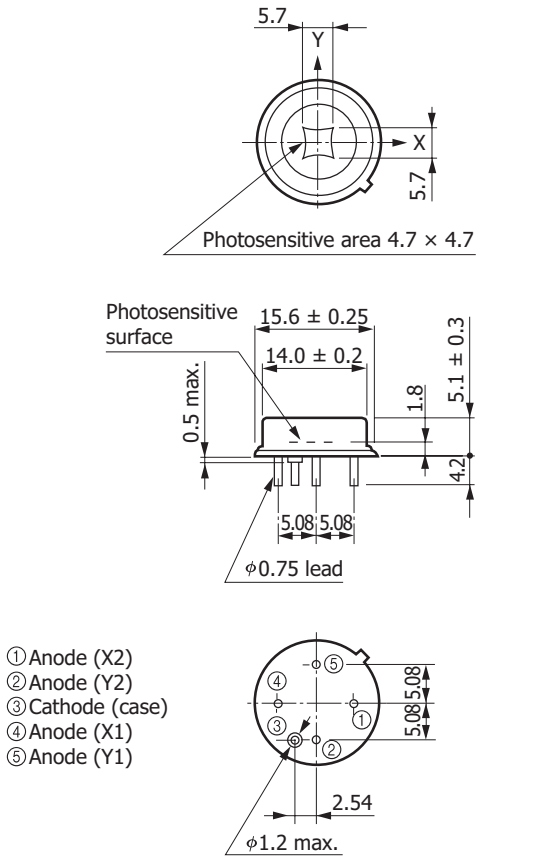
Dimensional outlines (unit: mm)



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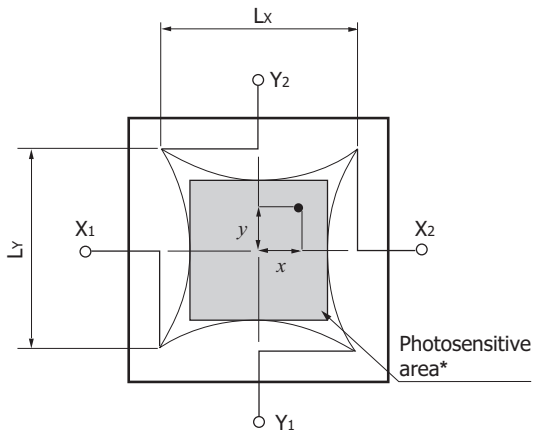
Photosensitive area chart



* Photosensitive area is specified at the inscribed square.

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Position conversion formula

$$\frac{(I_{X2} + I_{Y1}) - (I_{X1} + I_{Y2})}{I_{X1} + I_{X2} + I_{Y1} + I_{Y2}} = \frac{2x}{L_X}$$

$$\frac{(I_{X2} + I_{Y2}) - (I_{X1} + I_{Y1})}{I_{X1} + I_{X2} + I_{Y1} + I_{Y2}} = \frac{2y}{L_Y}$$

L_X=5.7 mm
L_Y=5.7 mm

Related information

www.hamamatsu.com/sp/ssd/doc_en.html

■ Precautions
· Disclaimer
· Metal, ceramic, plastic package products

■ Technical note
· PSD

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