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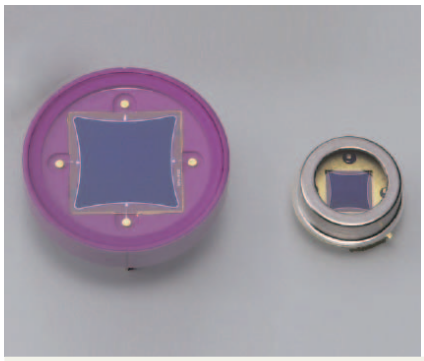
Two-dimensional PSD

S1880, S2044



Non-discrete position sensors utilizing photodiode surface resistance

PSD (position sensitive detector) is an optoelectronic position sensor utilizing photodiode surface resistance. Unlike discrete element detectors such as CCD, PSD provides continuous position data and features high position resolution and high-speed response.

Features

- **High position resolution**
- **Wide spectral response range**
- **High-speed response**
- **Simultaneous measurements of position and intensity**
- **Position is measured independent of light spot size.**
- **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 / Absolute maximum ratings

Parameter	Symbol	S1880	S2044	Unit
Package	-	Ceramic	Metal	-
Photosensitive area size	-	12 × 12	4.7 × 4.7	mm
Reverse voltage	V_R max	20		V
Operating temperature	Topr	-10 to +60		°C
Storage temperature	Tstg	-20 to +80		°C

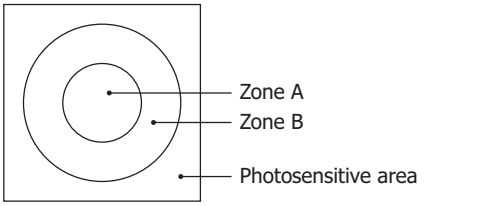
Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

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

Parameter		Symbol	Condition	S1880			S2044			Unit
				Min.	Typ.	Max.	Min.	Typ.	Max.	
Spectral response range		λ		-	320 to 1060	-	-	320 to 1060	-	nm
Peak sensitivity wavelength		λp		-	920	-	-	920	-	nm
Photosensitivity		S	λ=λp	-	0.6	-	-	0.6	-	A/W
Interelectrode resistance*1		Rie	Vb=0.1 V	5	10	15	5	10	15	kΩ
Position detection error*2	Zone A	E		-	±80	±150	-	±40	±100	μm
	Zone B			-	±150	±250	-	±70	±150	
Saturation current		Ist	VR=5 V RL=1 kΩ	-	0.5	-	-	0.5	-	mA
Dark current		ID	VR=5 V	-	1.0	500	-	0.5	5	nA
Temperature coefficient of ID		TCID		-	1.15	-	-	1.15	-	times/°C
Rise time		tr	VR=5 V RL=1 kΩ	-	1.5	-	-	0.3	-	μs
Terminal capacitance		Ct	VR=5 V f=10 kHz	-	300	-	-	45	-	pF
Position resolution*3		-		-	1.5	-	-	0.6	-	μm

*1: Measured between two output terminals opposite to each other, and the other terminals are open-circuited on measurement.
*2: The radius of Zones A and B depend on the product type. They are determined as follows:

Type no.	Zone A (mm)	Zone B (mm)
S1880	2.5	5
S2044	0.9	4 × 4 (quadrate)



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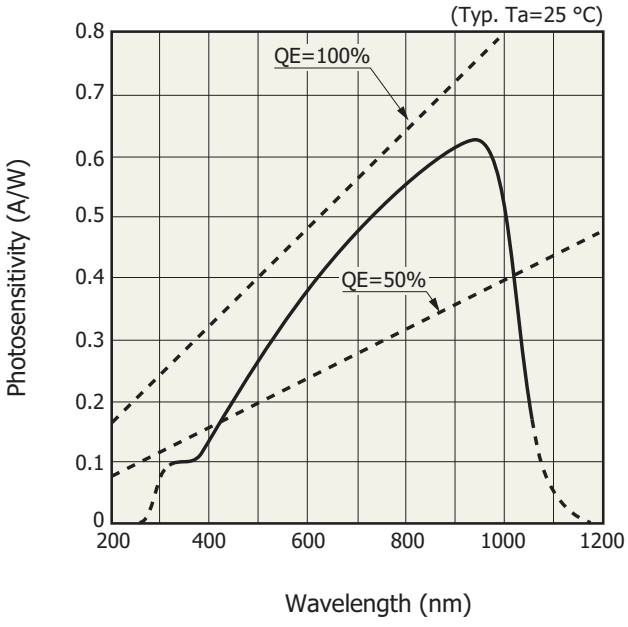
*3: Position resolution
This is the minimum detectable light spot displacement. The detection limit is indicated by distance on the photosensitive surface. The numerical value of the resolution of a position sensor using a PSD is proporional to both the length of the PSD and the noise of the measuring system (resolution deteriorates) and inversely proportional to the photocurrent (incident evergy) of the PSD (resolution improves).
- 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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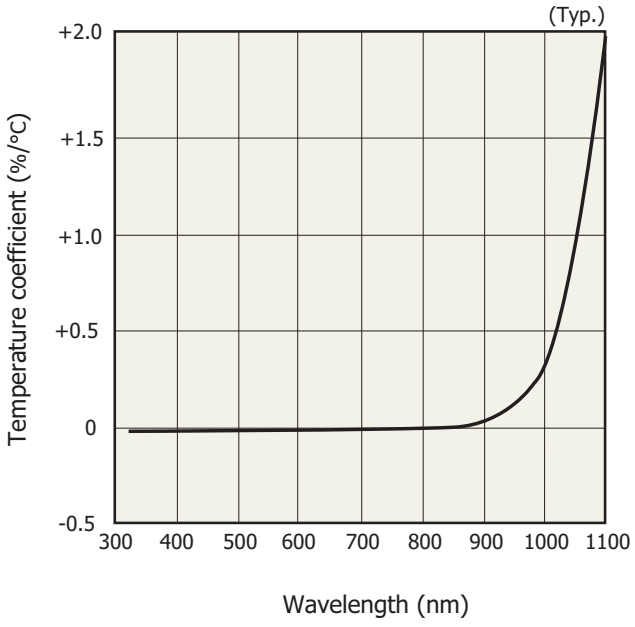
Photosensitivity temperature characteristics



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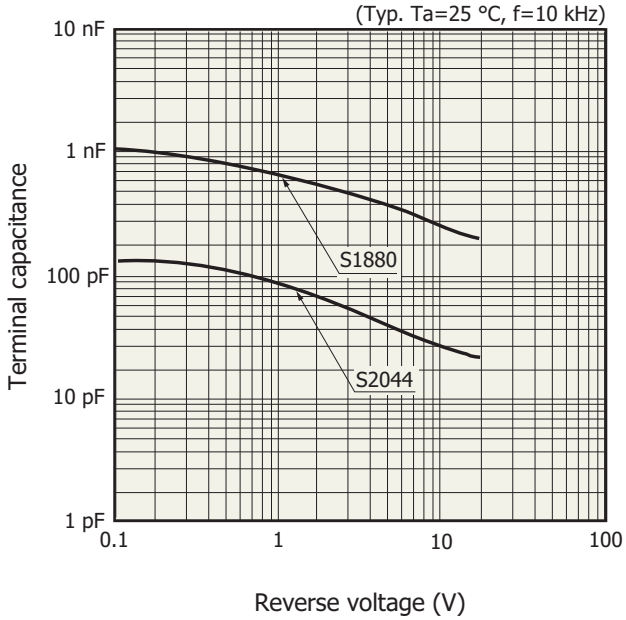
Terminal capacitance vs. reverse voltage



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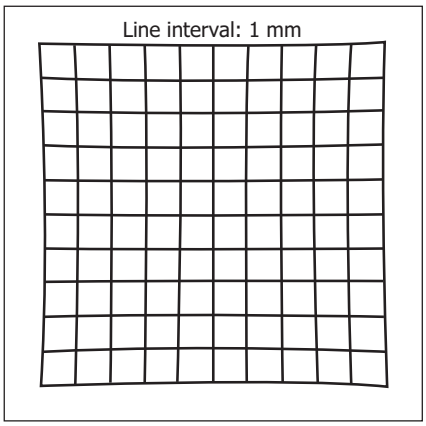
Examples of position detectability (Ta=25 °C, λ=900 nm, light spot size: ϕ200 μm)

S1880	S2044



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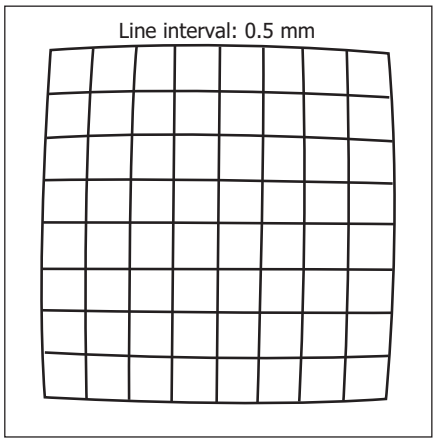

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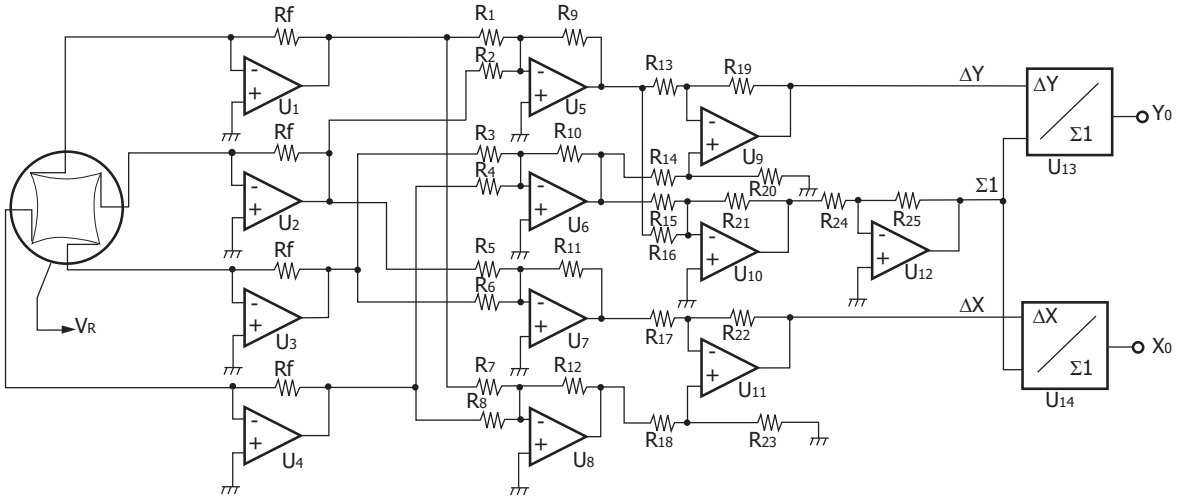
Example of DC-operating circuit



R1 - R25: same value
Rf: depends on input level
U1 - U4: low drift head amplifier, TL071, etc.
U13, U14: analog divider, AD538 (Analog Devices), etc.

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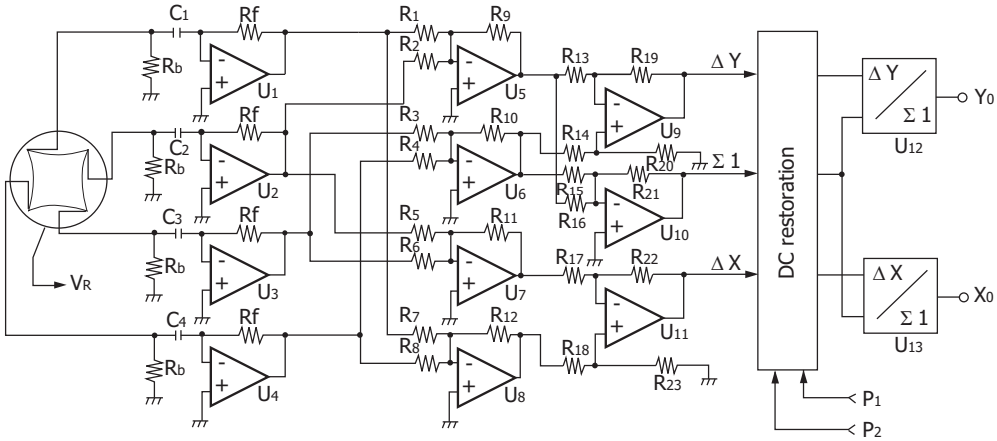
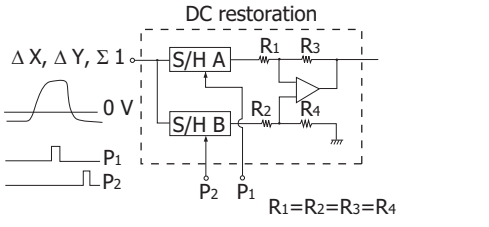
Example of AC-operating circuit



R1 - R24: same value
Rf: depends on input level
U1 - U4: low drift head amplifier, TL071, etc.
U12, U13: analog divider, AD538 (Analog Devices), etc.



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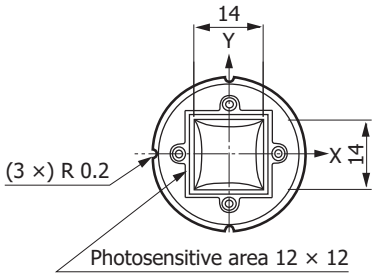
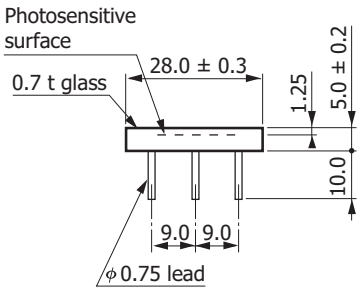
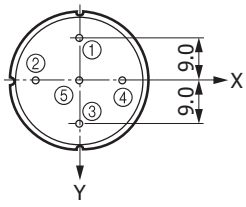
Dimensional outlines (unit: mm)

S1880





① Anode (Y1)
② Anode (X1)
③ Anode (Y2)
④ Anode (X2)
⑤ Cathode (common)



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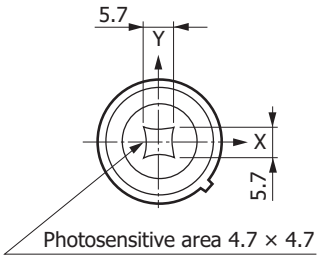
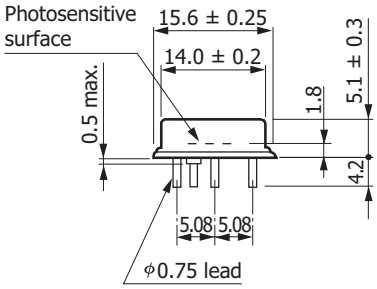
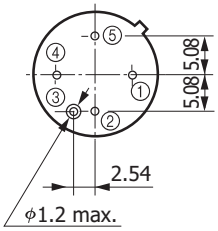
S2044





①Anode (X2)
②Anode (Y2)
③Cathode (case)
④Anode (X1)
⑤Anode (Y1)



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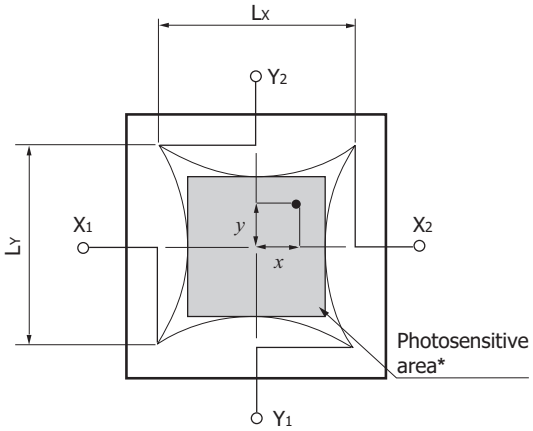
Photosensitive area chart



* Photosensitive area is specified at the inscribed square.

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Position conversion formula

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

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

S1880: L_X=14 mm
L_Y=14 mm
S2044: 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
· Surface mount type products

■ Technical note
· PSD

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