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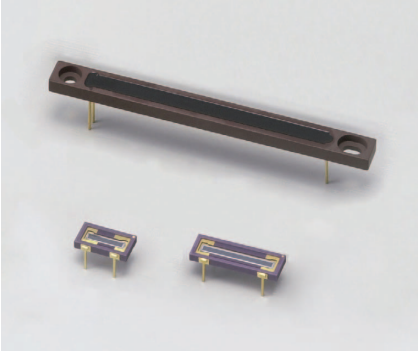
One-dimensional PSD



S3931, S3932, S3270

6 to 37 mm resistance length PSD for precision distance measurement

Hamamatsu provides various types of one-dimensional PSD (position sensitive detector) designed for precision distance measurement such as displacement meters. The S3931 and S3932 have a photosensitive area of 1 × 6 mm and 1 × 12 mm respectively, and are mounted on a compact ceramic package with a transparent resin window. Variant types (S3931-01, S3932-01) with a visible-cut resin window are also available. The S3270 offers a photosensitive area longer than 30 mm, allowing position detection at a long distance. The S3270 has a visible-cut resin window, and the S3270-01 with a transparent resin window is also available.

Features

- **Superior position detection ability**
- **High reliability**
- **S3931, S3932: Easy to use 4-pin small ceramic package**
- **Long and narrow photosensitive area**
  S3270: 1 × 37 mm

Applications

- **Displacement sensing**
- **Distance measurement**
- **Proximity switching**

Structure / Absolute maximum ratings

Type no.	Package	Window material*1	Photosensitive area size (mm)	Absolute maximum ratings		
				Reverse voltage V_R max (V)	Operating temperature Topr (°C)	Storage temperature Tstg (°C)
S3931	Ceramic	R	1 × 6	20	-10 to +60	-20 to +80
S3932		R	1 × 12			
S3270*2		R (B)	1 × 37		-10 to +75	

*1: R: clear resin coating, R (B): visible-cut resin coating
*2: Works with microscopic light spot detection
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.

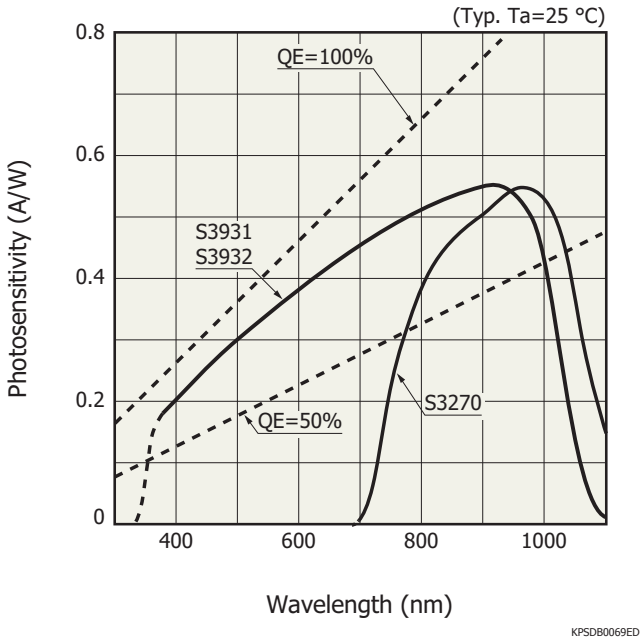
Electrical and optical characteristics (Typ. Ta=25 °C, unless otherwise noted)

Type no.	Spectral response range λ (nm)	Peak sensitivity wavelength λp (nm)	Photo sensitivity S λ=λp (A/W)	Interelectrode resistance Rie Vb=0.1 V			Position detection error*3 E V_R=5 V light spot ϕ200 μm		Saturation photocurrent*4 V_R=5 V R_L=1 kΩ (μA)	Dark current I_D V_R=5 V		Temp. coefficient of I_D T_{CID} (times/°C)	Rise time tr V_R=5 V R_L=1 kΩ (μs)	Terminal capacitance Ct V_R=5 V f=10 kHz (pF)	Position resolution*5 (μm)
				Min. (kΩ)	Typ. (kΩ)	Max. (kΩ)	Typ. (μm)	Max. (μm)		Typ. (nA)	Max. (nA)				
S3931	320 to 1100	920	0.55	30	50	80	±30	±120	100	0.15	10	1.15	1.5	40	0.2
S3932							±60	±240		0.2	20		3.0	80	0.3
S3270	700 to 1100	960		10	15	20	±100	±400	300	0.5	20		1.0	100	2.8

*3: A range of 75% of that from the center of the photosensitive surface to the edge
*4: The upper limit of linearity of photocurrent in response to the quantity of light is defined as the point where the linearity deviates by 10%.
*5: Position resolution
This is the minimum detectable light spot displacement. The detection limit is indicated by the distance on the photosensitive surface. The numerical value of the resolution of a position sensor using a PSD is proportional to both the length of the PSD and the noise of the measuring system (resolution deteriorates) and inversely proportional to the photocurrent (incident energy) 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 the specification table)

Spectral response



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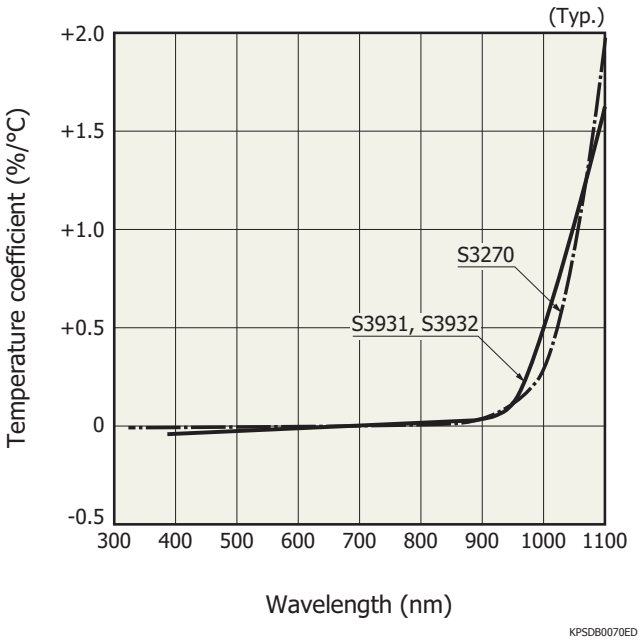
Photosensitivity temperature characteristics



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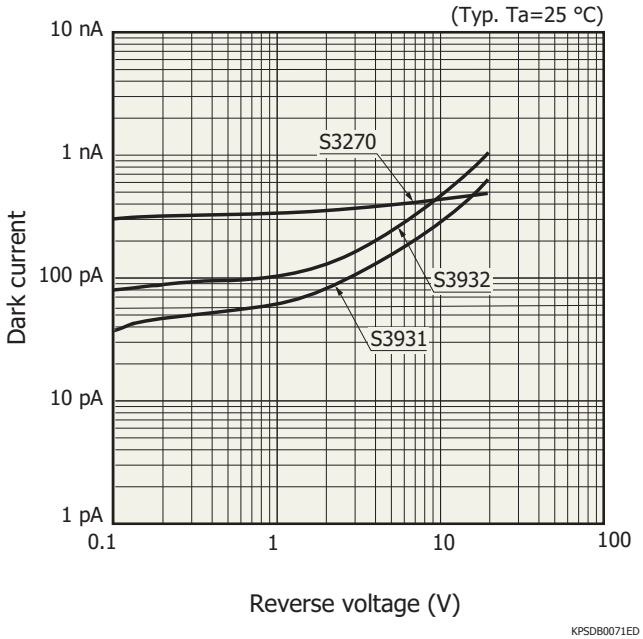
Dark current vs. reverse voltage



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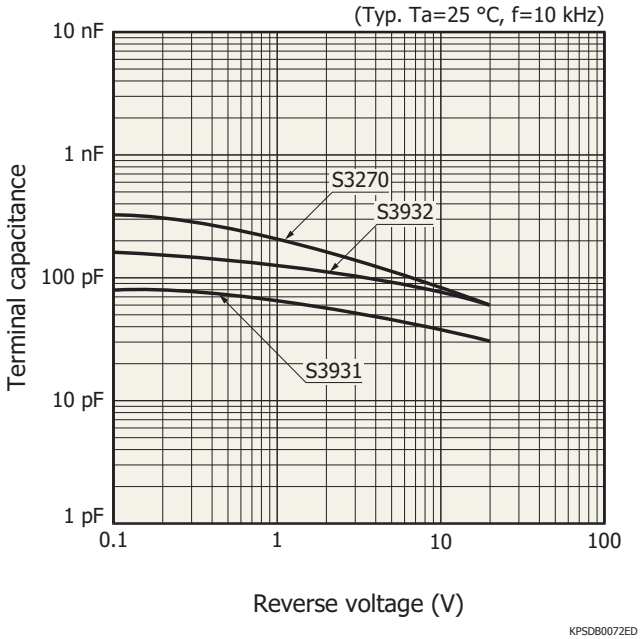
Terminal capacitance vs. reverse voltage



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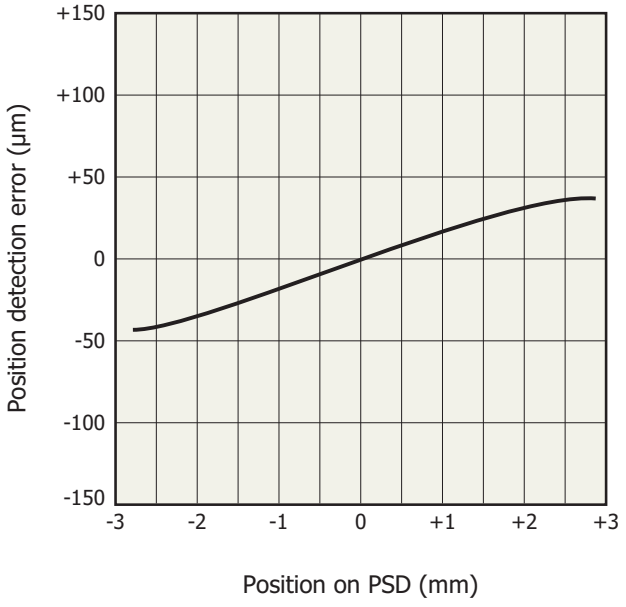
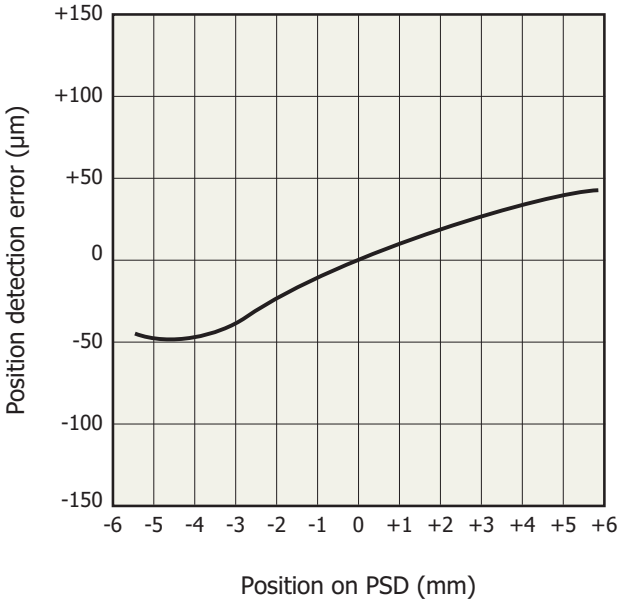
Examples of position detectability (Ta=25 °C, λ=900 nm, light spot size: ϕ0.2 mm)

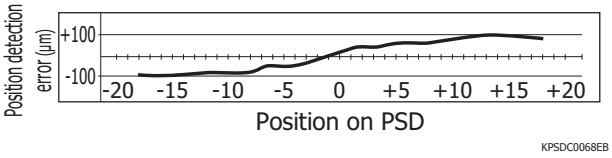
S3931



S3932

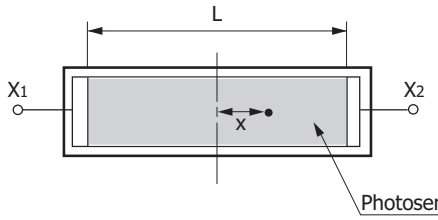


S3270



Conversion formula of spot light position on the PSD

If output signals (photocurrent) I_1 and I_2 are obtained from electrodes X_1 and X_2, then the light spot position (x) on the PSD can be found by the following formula.



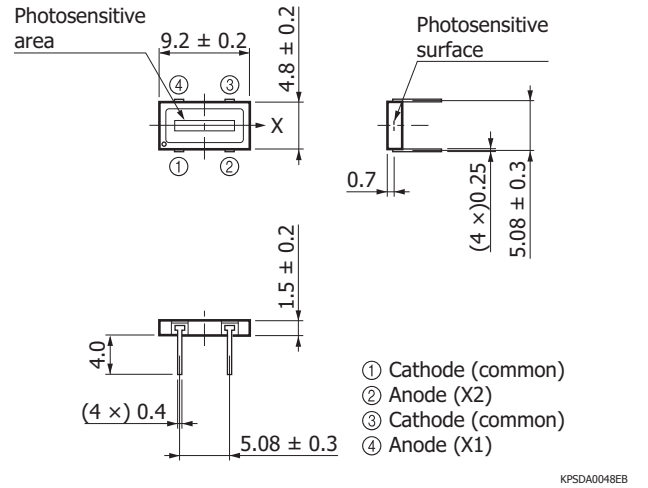
$$\frac{I_2 - I_1}{I_1 + I_2} = \frac{2x}{L}$$

Correction for position detection error

Position detection characteristics obtained by the above formula can be corrected to reduce position detection errors. For example, the maximum position detection error (±120 µm) of the S3931 can be significantly reduced to ±9 µm by using the least square method.

Dimensional outlines (unit: mm)

S3931



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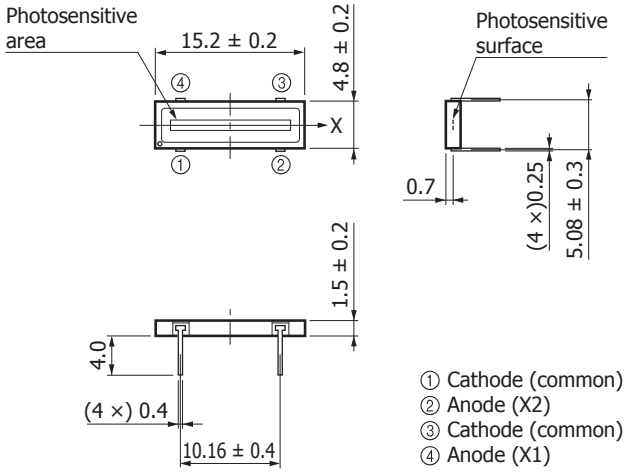
S3932



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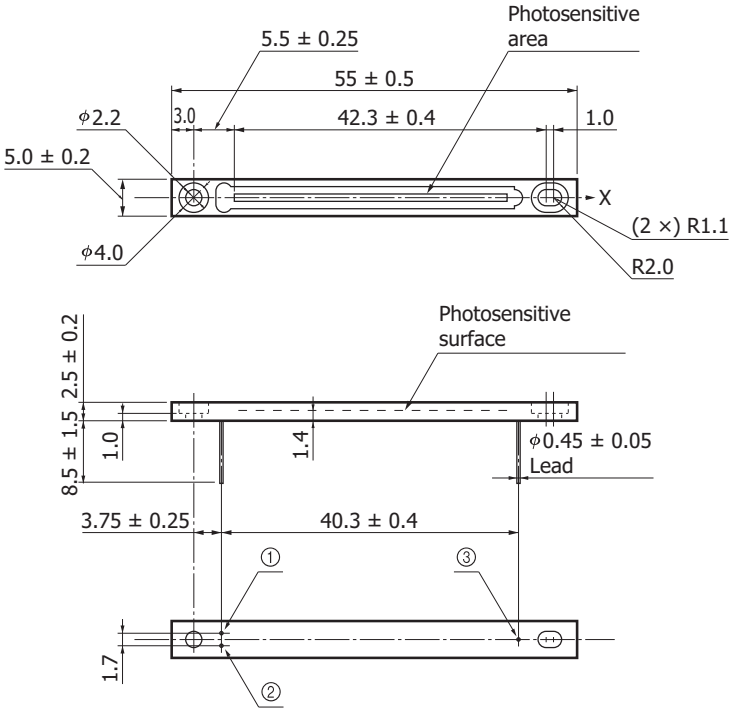
S3270



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Related information

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

■ Precautions

· Disclaimer
· Metal, ceramic, plastic package products

■ Technical information

· PSD

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