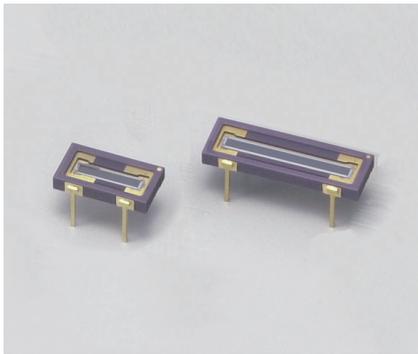


One-dimensional PSD



S3931

S3932

6 to 12 mm resistance length PSD for precision distance measurement

Hamamatsu provides various types of one-dimensional PSD (position sensitive detectors) 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.

Features

- Superior position detection ability
- High reliability
- S3931, S3932: Easy to use 4-pin small ceramic package

Applications

- Displacement sensing
- Distance measurement
- Proximity switching

Structure / Absolute maximum ratings

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

*1: No dew condensation

When there is a temperature difference between a product and the surrounding area in high humidity environments, 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 (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*2 E VR=5 V light spot φ200 μm		Saturation photocurrent*3 VR=5 V RL=1 kΩ (μA)	Dark current ID VR=5 V		Temp. coefficient of ID TCID (times/°C)	Rise time tr VR=5 V RL=1 kΩ (μs)	Terminal capacitance Ct VR=5 V f=10 kHz (pF)	Position resolution*4 (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				
S3932	±60	±240	0.2	20					3.0			80	0.3		

*2: A range of 75% of that from the center of the photosensitive surface to the edge

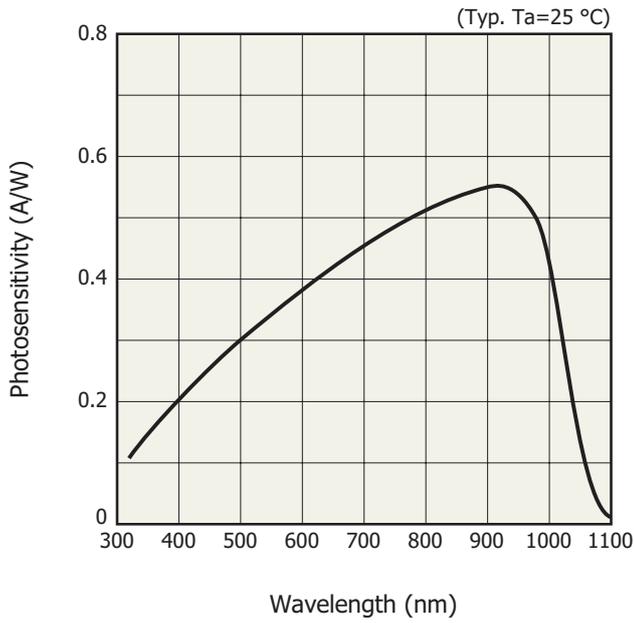
*3: The upper limit of linearity of photocurrent in response to the quantity of light is defined as the point where the linearity deviates by 10%.

*4: Position resolution

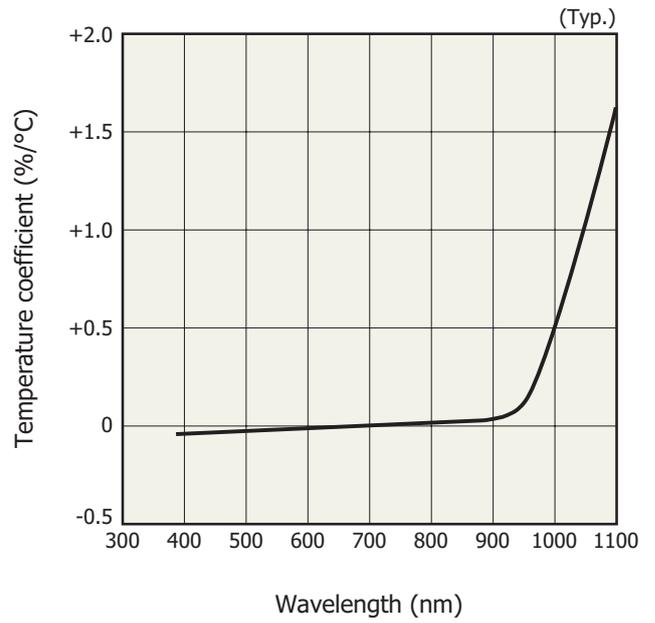
This is the minimum detectable light spot displacement. The detection limit is indicated by the distance on the photosensitive surface. The numerical value of the resolution of a position sensor using a PSD is proportional to both the length of the PSD and the noise of the measuring system (resolution 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)

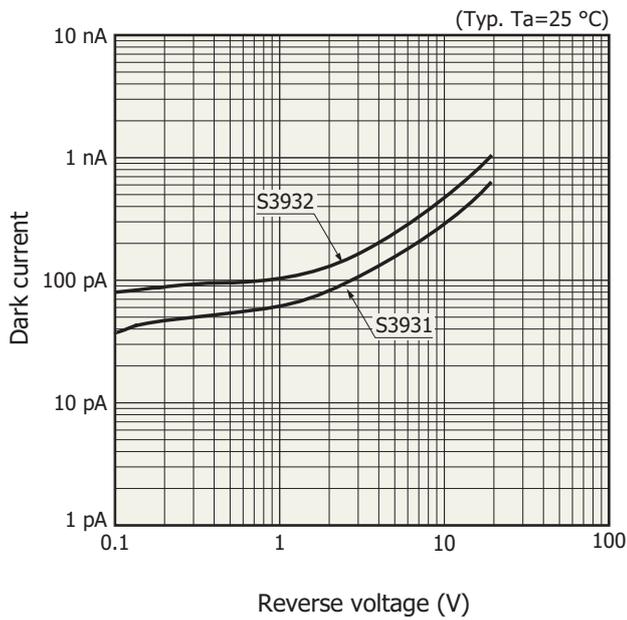
Spectral response



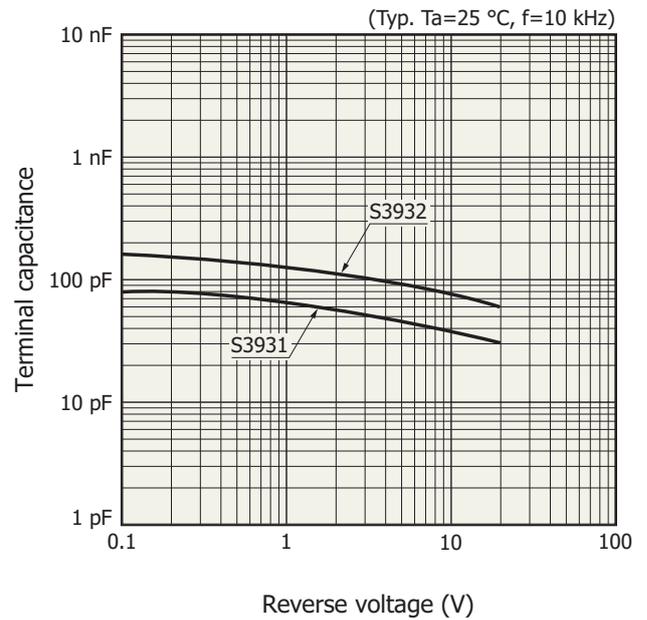
Photosensitivity temperature characteristics



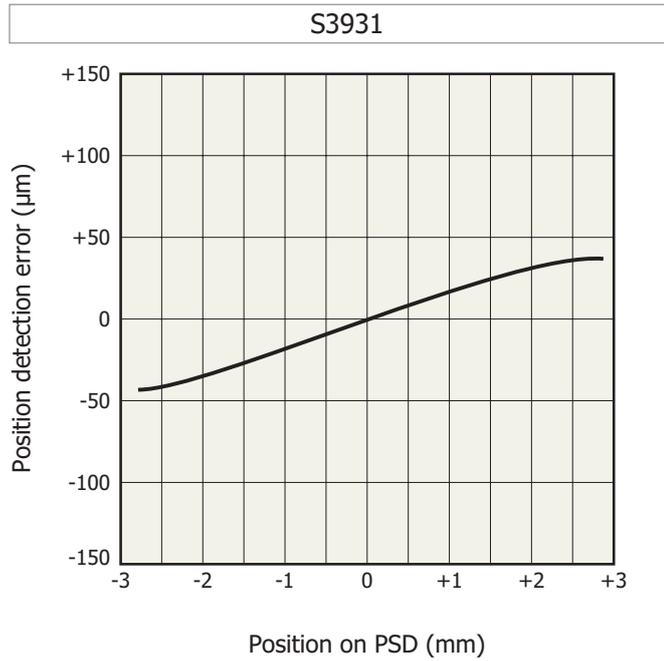
Dark current vs. reverse voltage



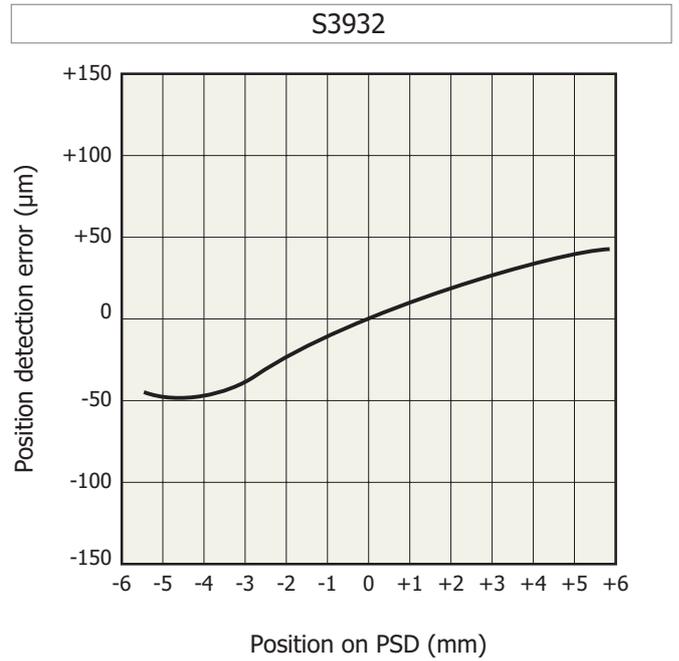
Terminal capacitance vs. reverse voltage



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



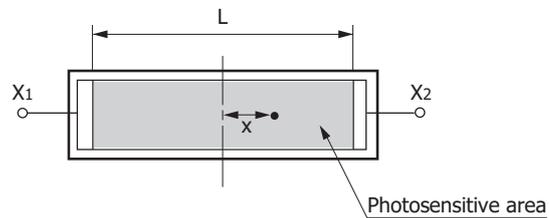
KPSDB0011EC



KPSDB0012EC

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.



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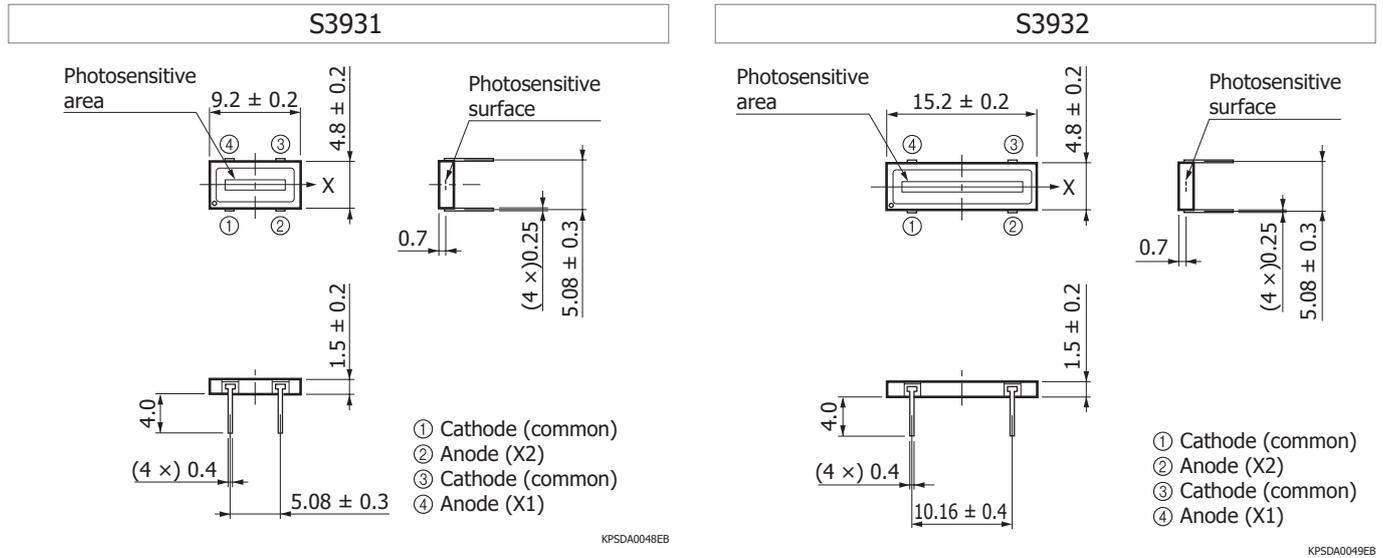
$$\frac{I_2 - I_1}{I_1 + I_2} = \frac{2x}{L}$$

Correction of position detection error

If the light spot position calculated by the above conversion formula is corrected by the least squares method, position detection error can be reduced.

- Example of position detection error correction (S3931)
 - Before correction: ±120 µm max.
 - After correction: ±9 µm max.

Dimensional outlines (unit: mm)



Recommended soldering condition

Solder temperature: 260 °C (5 s or less, once), Keep at least 2 mm away from the root of the lead

Note: When you set soldering conditions, check that problems do not occur in the product by testing out the conditions in advance.

Related information

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

Precautions

- Disclaimer
- Metal, ceramic, plastic package products

Technical information

- PSD

Information described in this material is current as of July 2020.

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