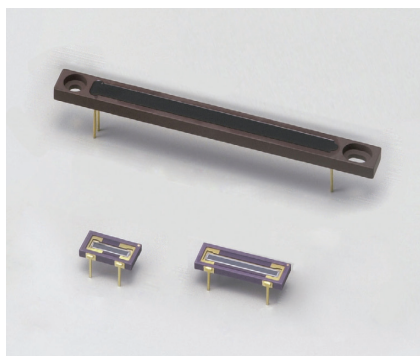


One-dimensional PSD



S3931, S3932, S3270-03

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 S3270-03 offers a photosensitive area longer than 30 mm, allowing position detection at a long distance.

Features

- Superior position detection ability
- High reliability
- S3931, S3932: Easy to use 4-pin small ceramic package
- Long and narrow photosensitive area
S3270-03: 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 Vr max (V)	Operating temperature*2 Topr (°C)	Storage temperature*2 Tstg (°C)
S3931	Ceramic	R	1 × 6	20	-10 to +60	-20 to +80
S3932		R	1 × 12			
S3270-03*3		R (B)	1 × 37		-10 to +75	

*1: R: clear resin coating, R (B): visible-cut resin coating

*2: 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.

*3: 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 λ_p (nm)	Photo sensitivity S $\lambda=\lambda_p$ (A/W)	Interelectrode resistance Rie Vb=0.1 V			Position detection error*4 E VR=5 V light spot ϕ 200 μ m		Saturation photocurrent*5 VR=5 V RL=1 k Ω (μ A)	Dark current ID VR=5 V		Temp. coefficient of ID TCID (times/°C)	Rise time tr VR=5 V RL=1 k Ω (μ s)	Terminal capacitance Ct VR=5 V f=10 kHz (pF)	Position resolution*6 (μ m)
				Min. (k Ω)	Typ. (k Ω)	Max. (k Ω)	Typ. (μ m)	Max. (μ m)		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				
S3270-03	700 to 1100	960	0.54	10	15	20	±100	±400	300	1.0	20	1.0	75	2.8	

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

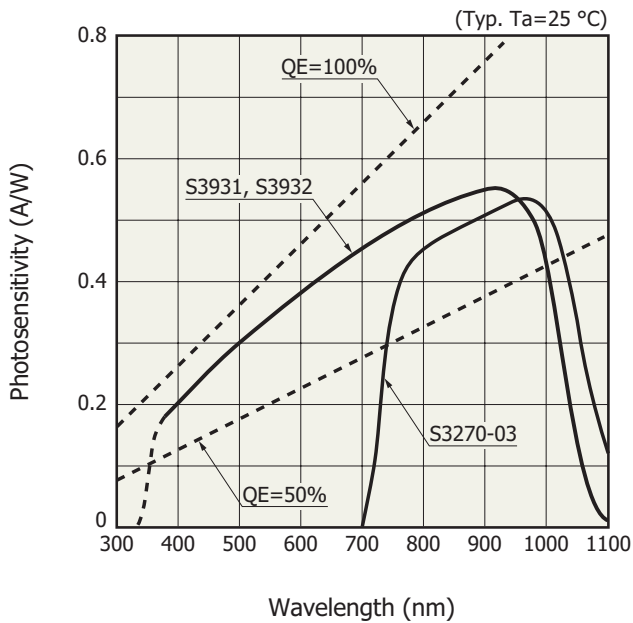
*5: The upper limit of linearity of photocurrent in response to the quantity of light is defined as the point where the linearity deviates by 10%.

*6: 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).

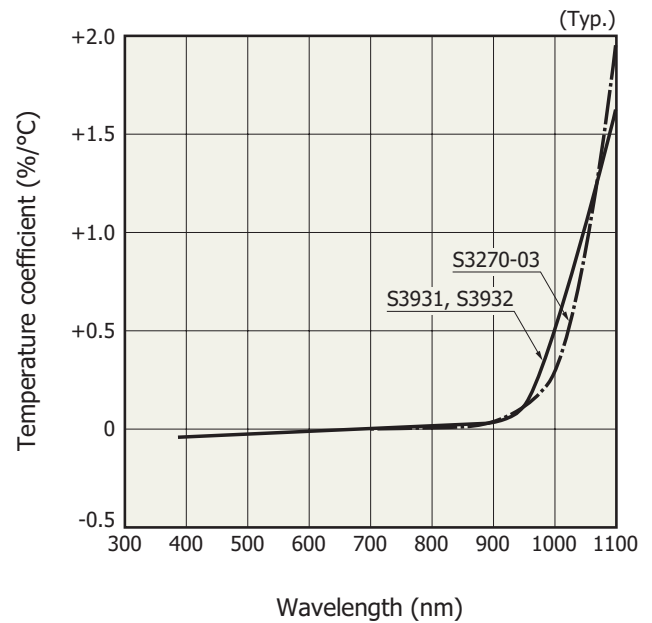
- Light source: LED (900 nm)
- Light spot size: ϕ 200 μ m
- Frequency range: 1 kHz
- Photocurrent: 1 μ A
- Circuit system input noise: 1 μ V (1 kHz)
- Interelectrode resistance: Typical value (refer to the specification table)

Spectral response



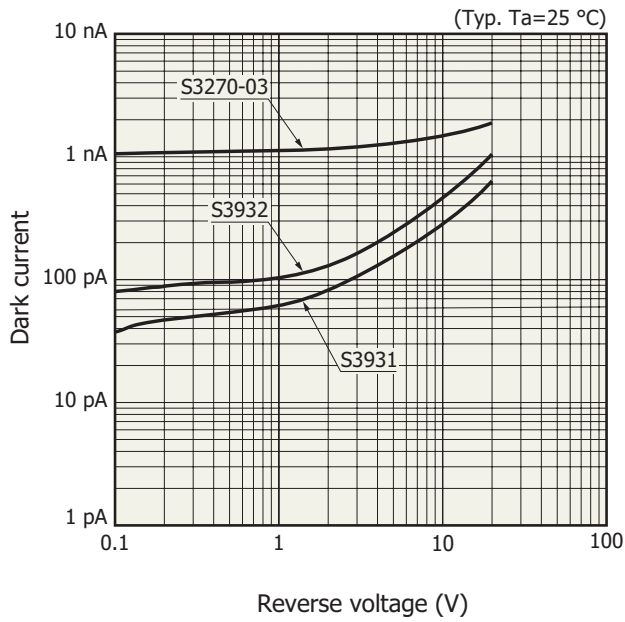
KPSDB0069EE

Photosensitivity temperature characteristics

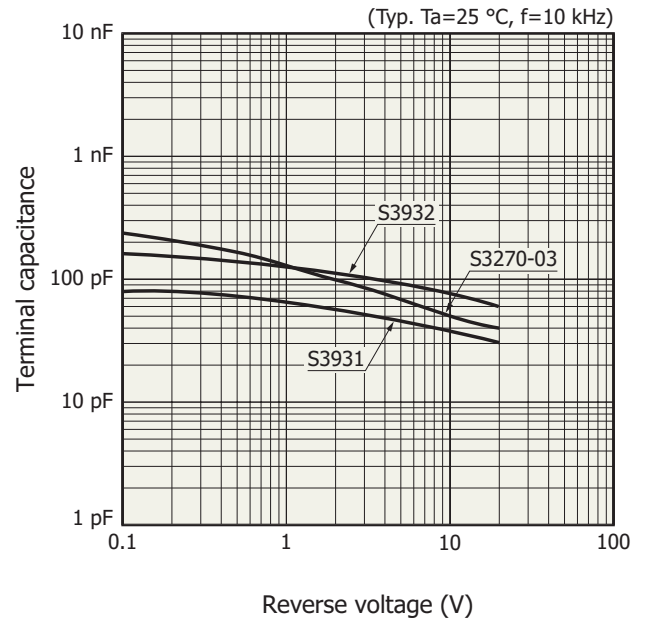


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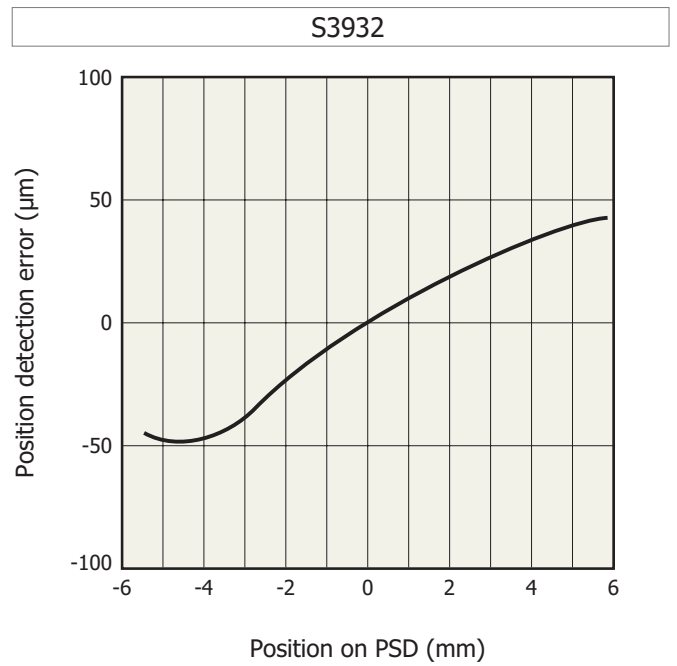
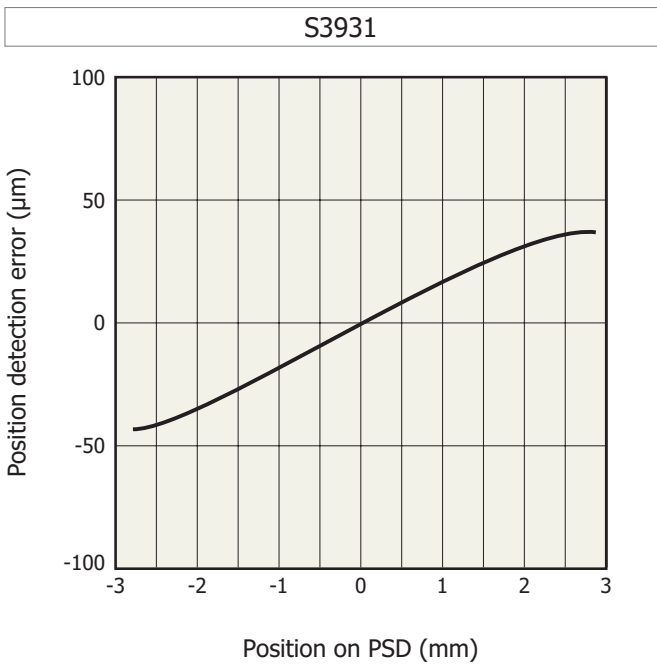
Dark current vs. reverse voltage



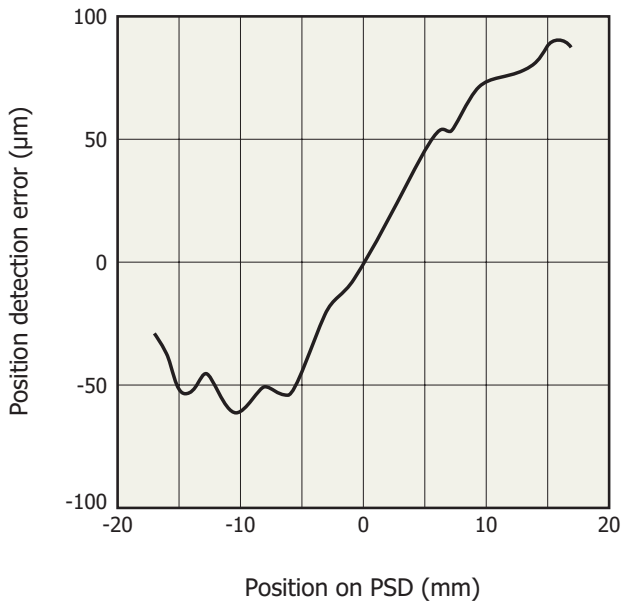
Terminal capacitance vs. reverse voltage



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



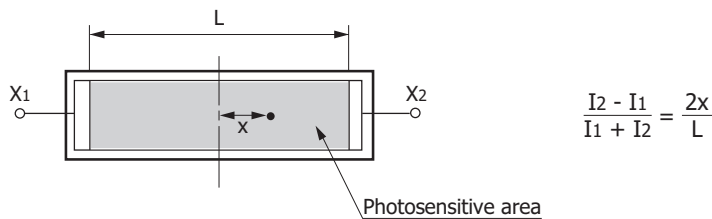
S3270-03



KSPDB0127EA

❑ 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.



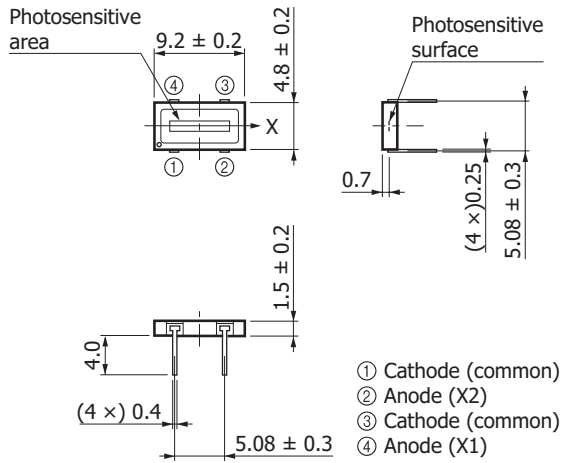
KPSDC0010EB

❑ 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 ($\pm 120 \mu\text{m}$) of the S3931 can be significantly reduced to $\pm 9 \mu\text{m}$ by using the least square method.

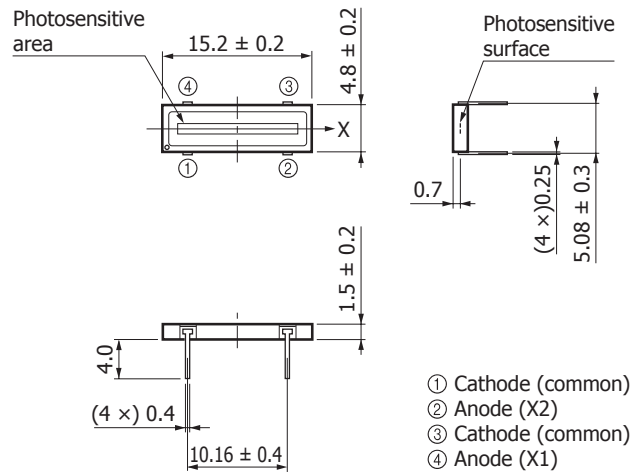
Dimensional outlines (unit: mm)

S3931



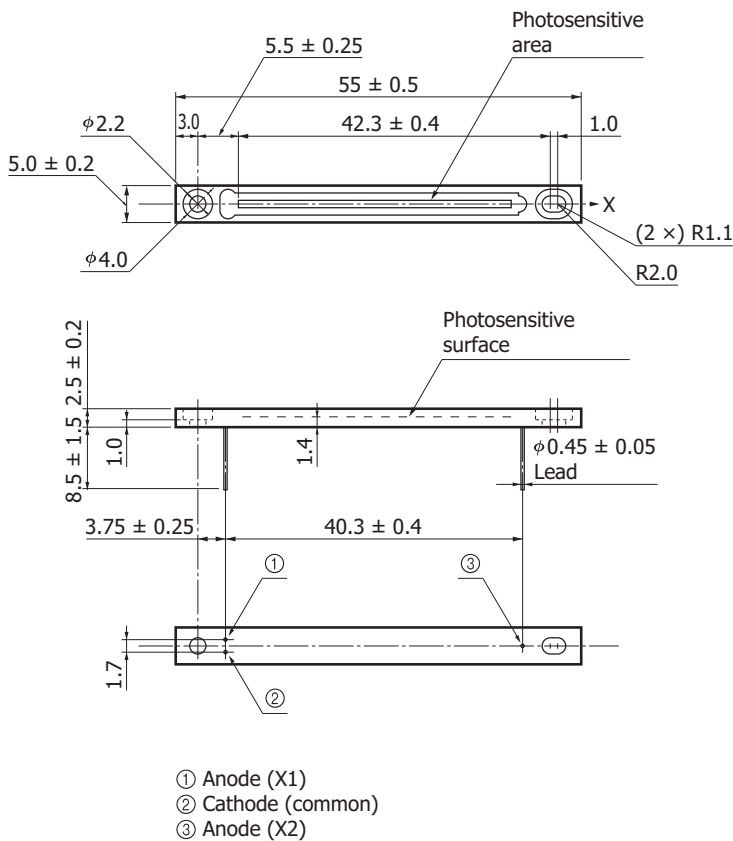
KPSDA0048EB

S3932



KPSDA0049EB

S3270-03



KPSDA0050EC

Recommended soldering conditions

· Solder temperature: 260 °C (5s or less, once)

Solder the leads at a point at least 2 mm away from the package body.

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 / Technical note

Information described in this material is current as of May 2022.

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