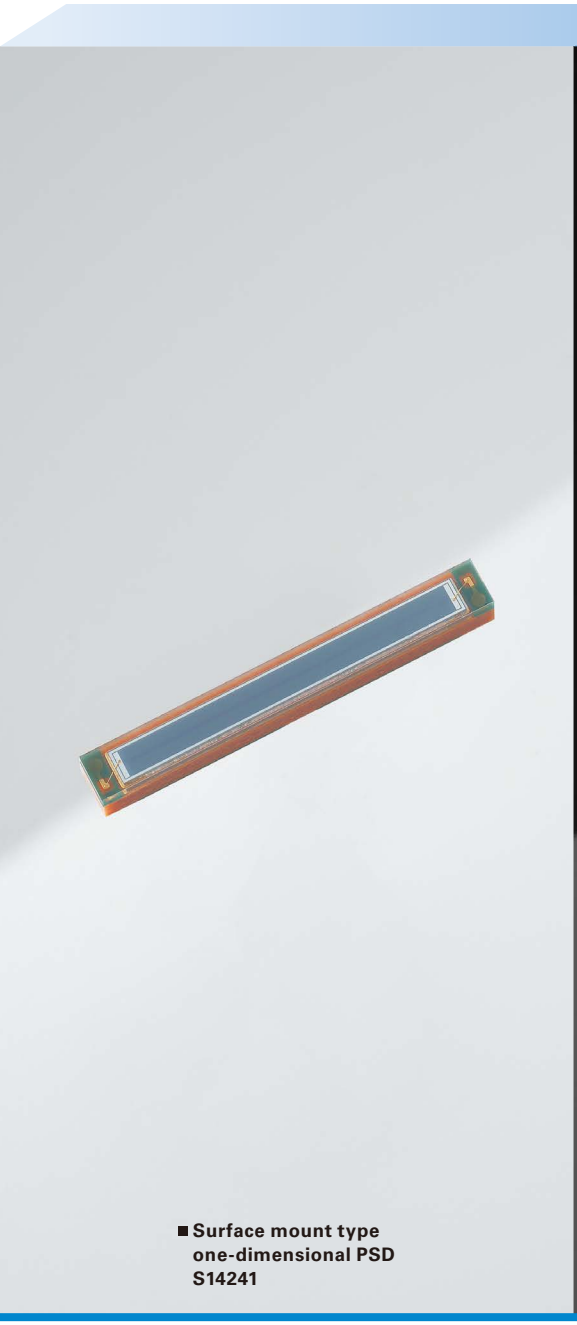
HAMAMATSU
PHOTON IS OUR BUSINESS

Selection guide - February 2025

PSD (position sensitive detector)



■ Surface mount type
one-dimensional PSD
S14241

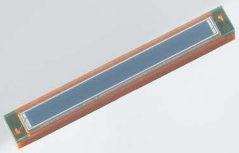
■ Two-dimensional PSD
S2044

■ PSD module
C10443-02

HAMAMATSU PHOTONICS K.K.

PSD (position sensitive detector)

Contents



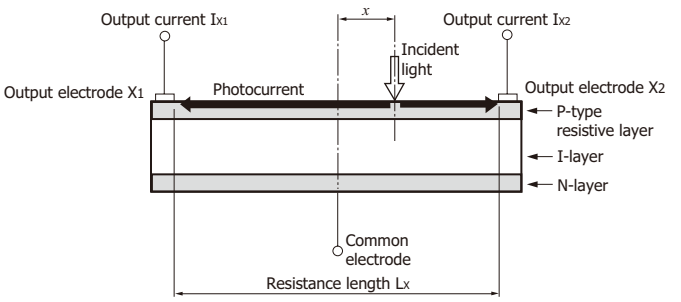
PSD and application examples

Various methods are available for detecting the position of incident light, including methods using an array of many small detectors and a multi-element detector (e.g., image sensor). In contrast to these, the PSD is a monolithic device designed to detect the position of incident light. Since the PSD is a non-segmented photosensor that makes use of the surface resistance of the photodiode, it provides continuous electrical signals and offers excellent position resolution, fast response, and high reliability. Hamamatsu PSDs are fabricated using our unique semiconductor process technology and have the following features:

· Excellent position resolution
· Wide spectral response range
· High-speed response
· Simultaneous detection of light intensity and light intensity center of gravity of spot light
· High reliability

The PSD is used in a wide range of fields such as measurements of position, angles, distortion, vibration, and lens reflection/refraction. Applications also include precision measurement such as laser displacement meters, as well as optical remote control devices, distance sensors, and optical switches.

Schematic of PSD cross section



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· Conversion formula for light spot incident position

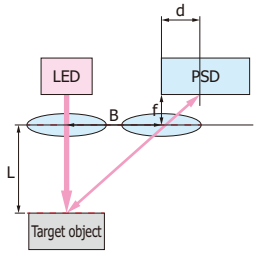
$$\frac{I_{X2} - I_{X1}}{I_{X1} + I_{X2}} = \frac{2x}{L_X}$$

Principle of triangulation

With the optical system shown in the figure on the right, the distance between the light receiving position of the PSD and the object is related to the following equation from the principle of triangulation. This allows obtaining the distance from the PSD output value.

$L = B \times f/d$

L: distance to the object
B: distance between lens optical axes
f : distance between lens and PSD
d: PSD light receiving position



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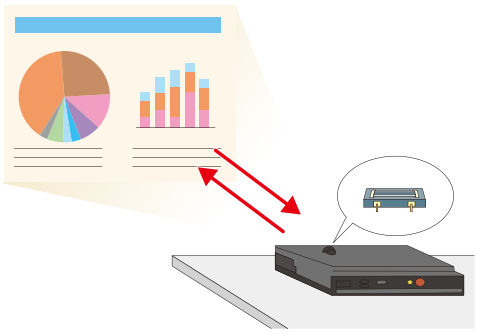
Application examples

[Auto-focus]



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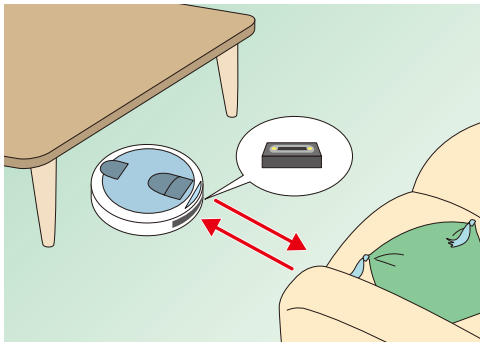
The PSD measures the distance to the screen to autofocus the image.

[Obstacle detection]



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The PSD measures distance to avoid obstacles.

PSD

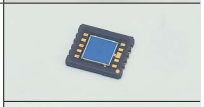
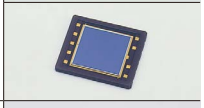
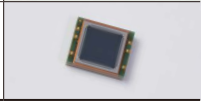
One-dimensional PSD

These PSDs have a belt-like photosensitive area and detect the position along the longer direction.

Type no.	Photosensitive area (mm)	Resistance length (mm)	Interelectrode resistance Vb=0.1 V (kΩ)	Spectral response range (nm)	Package	Photo
S4583-04	1 × 3	3	140	760 to 1100	Plastic	
S4584-04	1 × 3.5	3.5	140	760 to 1100	Plastic	
S4584-06				320 to 1100		
S3274-05			400	760 to 1100		
S7105-04	1 × 4.2	4.2	140	760 to 1100	Plastic	
S7105-06				320 to 1100		
S7105-16				320 to 1100	Glass epoxy	
S7105-05			400	760 to 1100	Plastic	
S15430-01CT	1 × 6	6	50	780 to 1100	Glass epoxy	
S15430-02CT				320 to 1100		
S15430-03CT			300	780 to 1100		
S3931	1 × 6	6	50	320 to 1100	Ceramic	
S3932	1 × 12	12		320 to 1100	Ceramic	
S14241				380 to 1000	Glass epoxy	
S8543	0.7 × 24	24	140	320 to 1100	Ceramic	

Two-dimensional PSD

These PSDs detect two-dimensional positions.

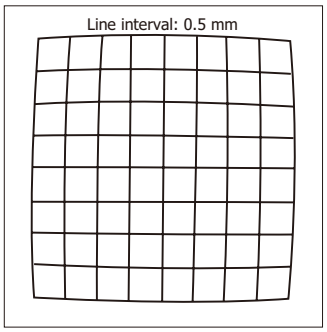
Type no.	Photosensitive area (mm)	Resistance length (mm)	Interelectrode resistance Vb=0.1 V (kΩ)	Spectral response range (nm)	Package	Photo
S2044*1	4.7 × 4.7	5.7	10	320 to 1060	Metal	
S5990-01	4 × 4	4.5	7	320 to 1100	Ceramic chip carrier	
S5991-01	9 × 9	10				
S15534	4 × 4	4.5		380 to 1100	Glass epoxy	

*1: Corresponds to small spot light

Examples of position detectability

[Ta=25 °C, λ=900 nm (S2044), λ=830 nm (S5990-01, S5991-01, S15534), light spot size: ϕ0.2 mm]

[S2044]



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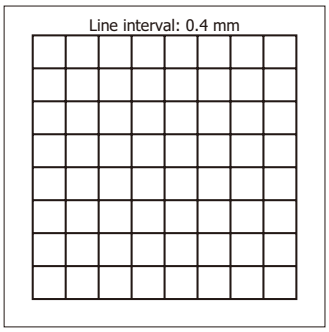
[S5990-01]



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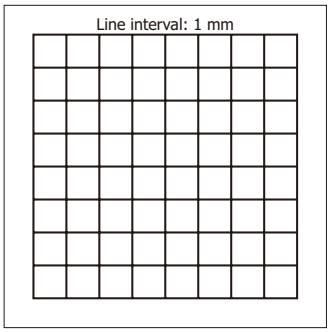
[S5991-01]



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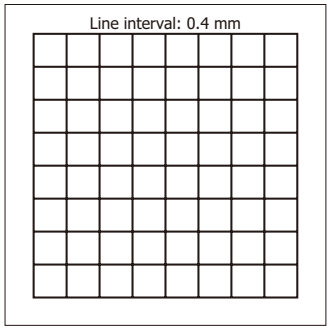
[S15534]



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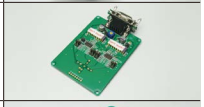
Applied products of PSD

PSD signal processing circuits

DC type

These are signal processing circuits for DC light detection.

Type no.	Compatible PSD	Output	Dimensions (mm)	Photo
C3683-02	One-dimensional PSD	Analog	66 × 56 × 15	
C9068-01		Digital (RS-232C)	110 × 75 × 15	
C4674-01	Two-dimensional PSD	Analog	90 × 65 × 15	
C9069-01		Digital (RS-232C)	110 × 75 × 15	

PSD modules

The high-precision analog output position detectors combine a PSD for precision photometry with a low-noise amplifier.

Type no.	Built-in PSD	Photosensitive area (mm)	Peak sensitivity wavelength (nm)	Photosensitivity*2 (mV/μW)	Output noise voltage Vn Dark state (mVp-p)	Cutoff frequency fc -3 dB (kHz)		Photo
						Lower	Upper	
C10443-01	Two-dimensional PSD	4 × 4	960	-60	1	DC	16	
C10443-02		9 × 9						

*2: λ=λp

HAMAMATSU
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Main Products

Opto-semiconductors

- Si photodiodes
- APD
- MPPC®
- Photo IC
- Image sensors
- PSD
- Infrared detectors
- LED
- Optical communication devices
- Automotive devices
- X-ray flat panel sensors
- MEMS devices
- Mini-spectrometers
- Opto-semiconductor modules

Electron Tubes

- Photomultiplier tubes
- Photomultiplier tube modules
- Microchannel plates
- Image intensifiers
- Xenon lamps / Mercury-xenon lamps
- Deuterium lamps
- Light source applied products
- Microfocus X-ray sources
- X-ray imaging devices

Imaging and Processing Systems

- Scientific cameras
- Spectroscopic and optical measurement systems
- Ultrafast photometry systems
- Life science systems
- Medical systems
- Non-destructive inspection products
- Semiconductor manufacturing support systems
- Material research systems

Laser Products

- Single chip laser diodes
- Laser diode bar modules
- Quantum cascade lasers
- Applied products of semiconductor lasers
- Solid state lasers
- Laser related products

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