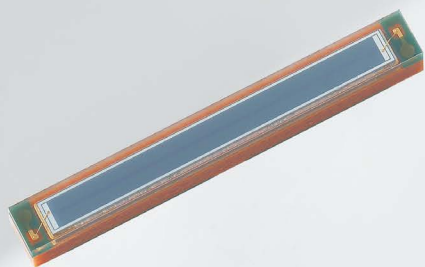
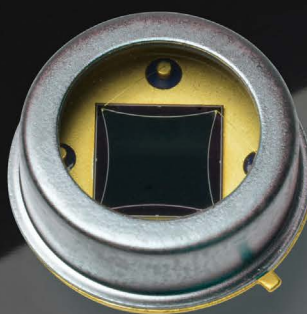


PSD (position sensitive detector)



■ Surface mount type
one-dimensional PSD
S14241



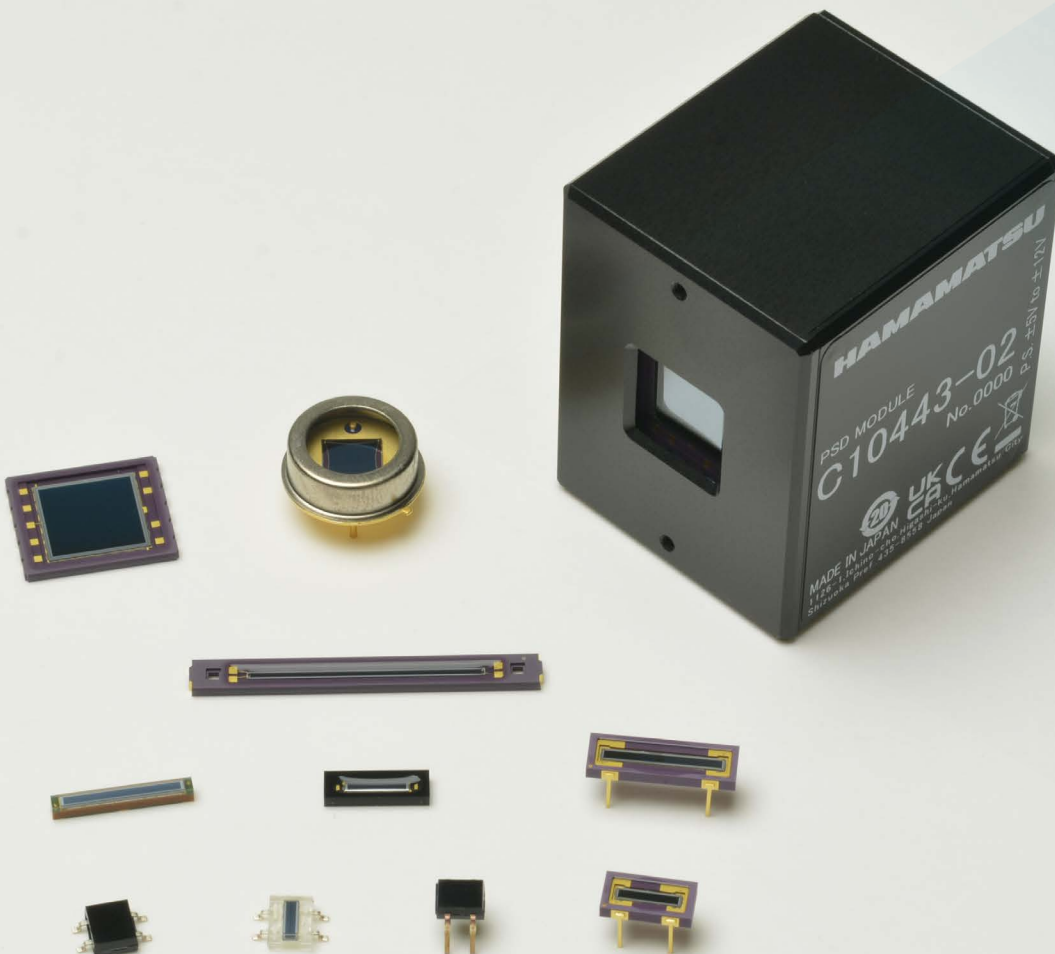
■ Two-dimensional PSD
S2044



■ PSD module
C10443-02

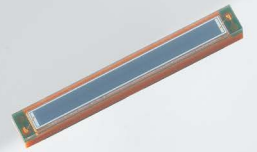
P S D

PSD (position sensitive detector)



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- PSD and application examples 3
- PSD 4
 - One-dimensional PSD 4
 - Two-dimensional PSD 5
- Applied products of PSD 6
 - PSD signal processing circuits 6
 - PSD modules 6
 - Signal processing unit for PSD module 6



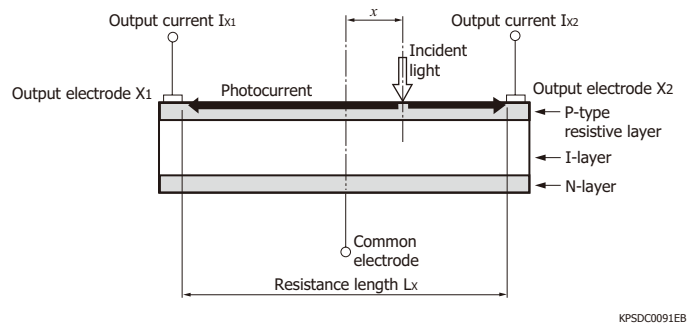
PSD and application examples

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
- Simultaneously detection light level and center-of-gravity position of light spot
- 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



KPSDC0091EB

- Conversion formula for light spot incident position

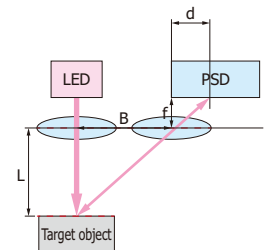
$$\frac{Ix_2 - Ix_1}{Ix_1 + Ix_2} = \frac{2x}{Lx}$$

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.

$$L = B \times f/d$$

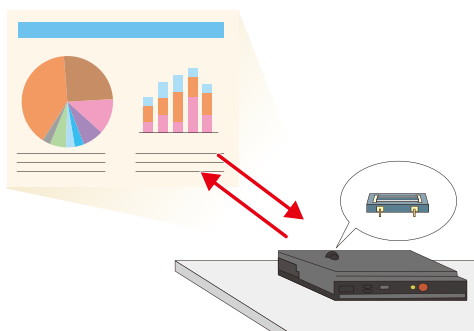
- L : distance to the object
- B : distance between lens optical axes
- f : distance between lens and PSD
- d : PSD light receiving position



KPSDC0100EA

Application examples

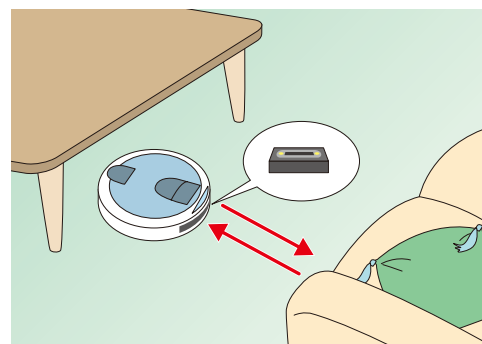
[Auto-focus]



KPSDC0101EA

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

[Obstacle detection]



KPSDC0102EA

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 $V_b=0.1\text{ V}$ (k Ω)	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.

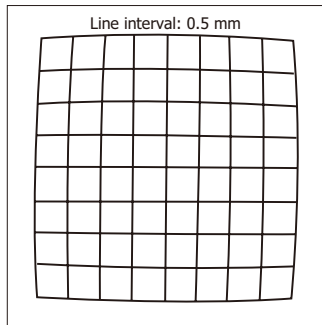
Type no.	Photosensitive area (mm)	Resistance length (mm)	Interelectrode resistance $V_b=0.1\text{ V}$ (k Ω)	Spectral response range (nm)	Package	Photo
S2044 *1	4.7 × 4.7	5.7	10	320 to 1060	Metal	
S5990-01	4 × 4	4.5	7	320 to 1100	Ceramic chip carrier	
S5991-01	9 × 9	10				

*1: Corresponds to small spot light

Examples of position detectability

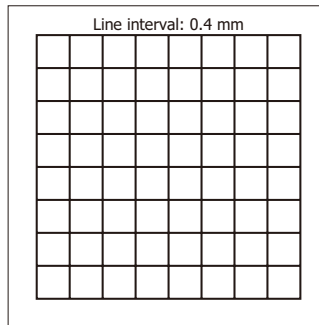
[$T_a=25\text{ }^\circ\text{C}$, $\lambda=900\text{ nm}$ (S2044), $\lambda=830\text{ nm}$ (S5990-01, S5991-01), light spot size: $\phi 0.2\text{ mm}$]

[S2044]



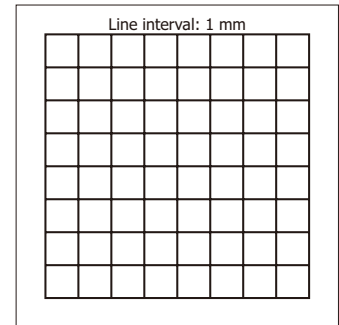
KPSDC0019EA

[S5990-01]



KPSDC0064EB

[S5991-01]







KPSDC0065EA

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		Digital (RS-232C)	110 × 75 × 15	
C4674-01	Two-dimensional PSD	Analog	90 × 65 × 15	
C9069		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: $\lambda = \lambda_p$

Signal processing unit for PSD module

The product converts the output of the PSD module into position signals and outputs in analog and digital form.

Type no.	Compatible PSD module	Analog output (V)	Digital output	Minimum measurement time interval (ms)	Dimensions (mm)	Photo
C10460	C10443-01/-02	-10 to +10	Conforms to RS-232C (16-bit)	2	150 × 30 × 100	

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
Laser 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

Information in this catalog is believed to be reliable. However, no responsibility is assumed for possible inaccuracies or omission. Specifications are subject to change without notice. No patent rights are granted to any of the circuits described herein.
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