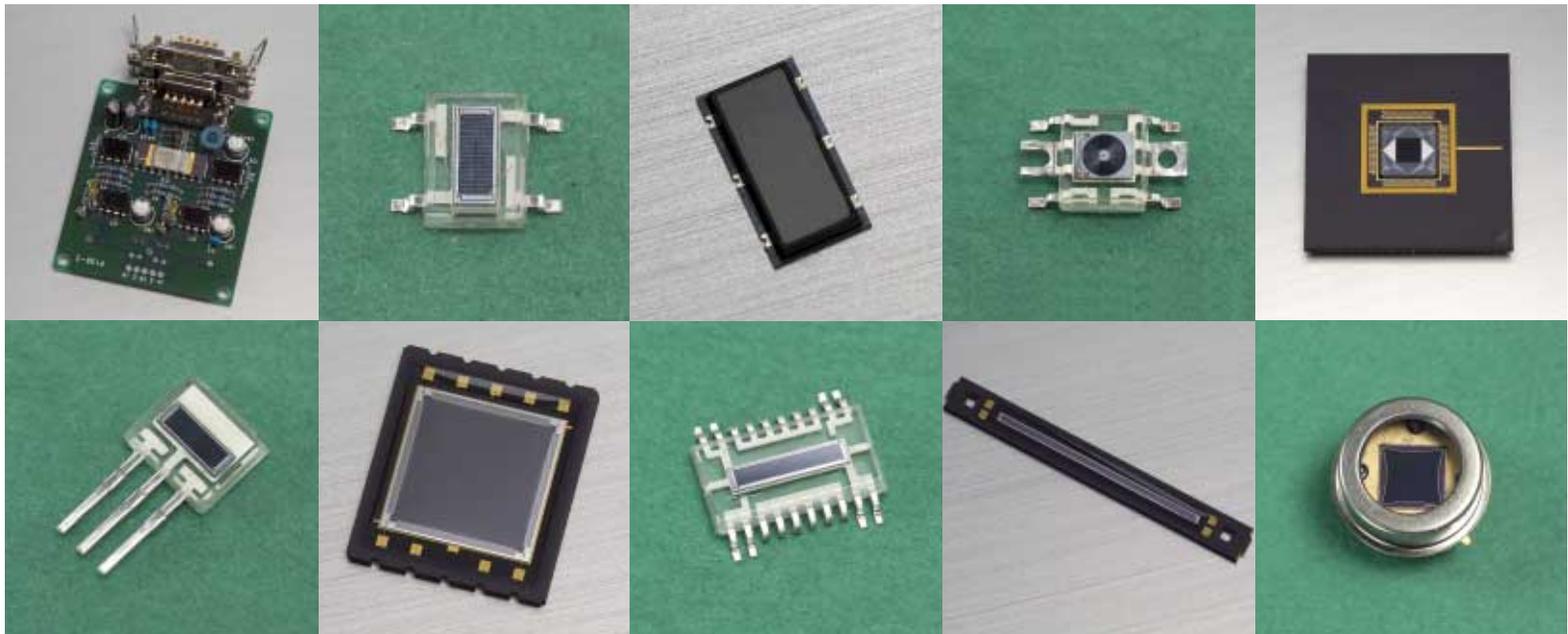


PSD (Position Sensitive Detectors)



Excellent position resolution in a fast, highly reliable sensor

PSDs detect position data of incident spot light. Monolithic, PSDs can track very small positional changes over the active area. In contrast, discrete devices (CCDs) resolve distances limited by their pixel size and can lose microscopic spot information.

PSDs provide higher position resolution with high-speed response and reliability.

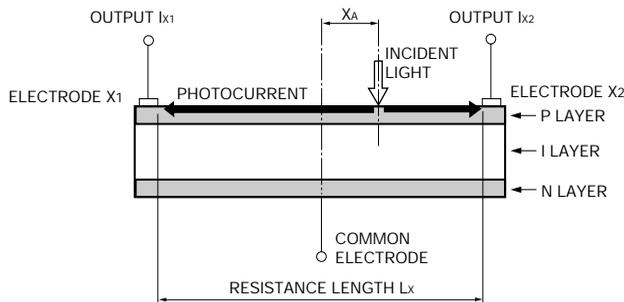
HAMAMATSU PSDs are fabricated using our own cutting-edge semiconductor process technology and have the following features:

- Excellent position resolution
- Wide spectral response range
- High-speed response
- Simultaneously detects light intensity and center-of-gravity position of spot light
- High reliability

PSDs measure position, angles, distortion, vibration, and lens refraction/reflection. Some product examples are laser displacement meters, optical remote control devices, distance sensors, optical switches, and camera shake correctors.

Linear PSDs operate simply, comparing two output currents, which determine the position. See the linear PSD example below. Two-dimensional PSDs compare four output currents. HAMAMATSU sells operating circuit boards for most PSDs.

■ One-dimensional PSD sectional view



KPSDC0091EA

■ Position conversion formula

$$\frac{I_{x2} - I_{x1}}{I_{x1} + I_{x2}} = \frac{2X_a}{L_x}$$

■ HAMAMATSU PSDs

Type		Feature / Line-up
One-dimensional PSD		Visible light cut-off type suitable for detection of infrared light
		High IR sensitivity
		Ideal for detection of microscopic spot light such as from laser diode
		Long, narrow type with active area length of 30 mm or more
Two-dimensional PSD	Tetra-lateral type	High-speed response, low dark current
	Duo-lateral type	Reduced position detection error, excellent position resolution
	Pin-cushion type (improved tetra-lateral type)	PSD utilizing features of tetra-lateral type and duo-lateral type
Special PSD type	128-element PSD array	Linear array consisting of 128 one-dimensional PSDs usable for 3D shape measurement of an object (light section method)
	Nonlinear output PSD	Improved accuracy in triangulation distance measurement on long distance side
	Circular PSD for angle detection	Angle detection of incident light by regarding the center of active area as the origin point
	Photodiode/PSD sensor	Switchable between dual-element photodiode and PSD

For detailed information and data on the products listed in this catalog, see their datasheets that are available from our website www.hamamatsu.com

One-dimensional PSD

These PSDs detect one-dimensional positions.

Type No.	Active area (mm)	Resistance length (mm)	Interelectrode resistance $V_b=0.1\text{ V}$ (k Ω)	Spectral response range (nm)	Package *1		Photo
S6407	1 × 1	1	200	760 to 1100	Plastic with mounting terminal	①	
S6515	1 × 1.2	1.2	140	760 to 1100			
S4580-04	0.8 × 1.5	1.5	140	760 to 1100	Plastic	①	
S4580-06				320 to 1100			
S4581-04	1 × 2	2	140	760 to 1060	Plastic	①	
S4581-06				320 to 1060			
S3271-05			400	760 to 1060			
S4582-04	1 × 2.5	2.5	140	760 to 1100	Plastic	①	
S4582-06				320 to 1100			
S8682			Miniature plastic	②			
S3272-05			400	760 to 1100	Plastic	①	
S4583-04	1 × 3	3	140	760 to 1100	Plastic	①	
S4583-06				320 to 1100			
S8673				Plastic SIP			
S3273-05			400	760 to 1100	Plastic	①	
S7879 *2			110	440 to 1100	Plastic	①	
S8361 *2, *3				400 to 1100			

*1: Plastic package size (unit: mm)

① 4.0 × 4.8 × 1.8[†] ② 3.0 × 4.0 × 1.3[†] ③ 4.5 × 5.5 × 2.0[†]

④ 3.4 × 7.0 × 0.95[†] ⑤ 5.2 × 9.5 × 1.7[†]

*2: Works with microscopic spot light detection

*3: High sensitivity in the red region type

Type No.	Active area (mm)	Resistance length (mm)	Interelectrode resistance $V_b=0.1\text{ V}$ (k Ω)	Spectral response range (nm)	Package *1	Photo	
S4584-04	1 × 3.5	3.5	140	760 to 1100	Plastic	①	
S4584-06				320 to 1100			
S3274-05			400	760 to 1100			
S7105-04	1 × 4.2	4.2	140	760 to 1100	Plastic	③	
S7105-06				320 to 1100			
S7105-05			400	760 to 1100			
S9155	1 × 5.7	5.7	400	760 to 1100	Thin lead-less plastic	④	
S5629	1 × 6	6	50	760 to 1100	Plastic	⑤	
S5629-01				320 to 1100			
S5629-02			300	760 to 1100			
S3979	1 × 3	3	140	320 to 1100	TO-5		
S3931	1 × 6	6	50	320 to 1100	Ceramic		
S3932	1 × 12	12	50	320 to 1100			
S8554	1 × 12	12	50	320 to 1100	Surface-mount type ceramic		
S8543	0.7 × 24	24	140	320 to 1100			
S1352 *2	2.5 × 34	34	20	320 to 1100	Ceramic		
S3270 *2	1 × 37	37	15	700 to 1100			

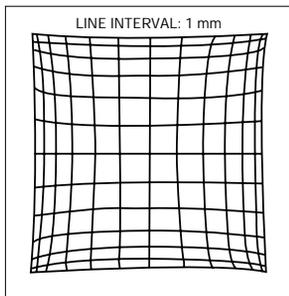
Two-dimensional PSD

These PSDs detect two-dimensional positions.

Type No.	Active area (mm)	Resistance length (mm)	Interelectrode resistance $V_b=0.1\text{ V}$ (k Ω)	Spectral response range (nm)	Structure	Package *1	Photo	
S1200 *2	13 × 13	13 × 13	10	320 to 1060	Tetra-lateral type	Ceramic		
S1300 *2				320 to 1100	Duo-lateral type			
S1880 *2	12 × 12	14 × 14	10	320 to 1060	Pin-cushion type	Ceramic		
S1881 *2	22 × 22	26 ¥ 26	10					
S2044 *2	4.7 × 4.7	5.7 × 5.7	10	320 to 1060	Pin-cushion type	Metal		
S5990-01	4 × 4	4.5 × 4.5	7	320 to 1100	Pin-cushion type	Ceramic chip carrier		
S5991-01	9 × 9	10 × 10	7					
S7848	2 × 2	2 × 2	100	760 to 1100	Tetra-lateral type	Plastic	①	
S7848-01				320 to 1100				

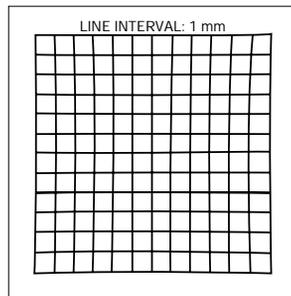
■ Examples of position detectability

●S1200



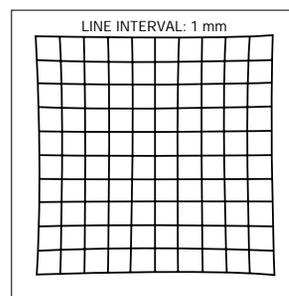
KPSDC0017EA

●S1300



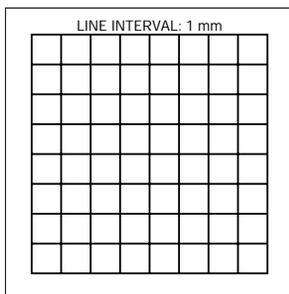
KPSDC0015EA

●S1880



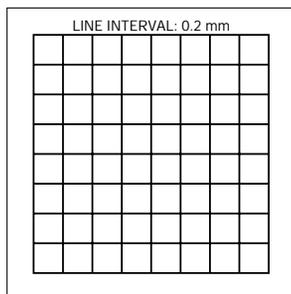
KPSDC0020EA

●S5991-01



KPSDC0065EA

●S7848



KPSDC0084EA

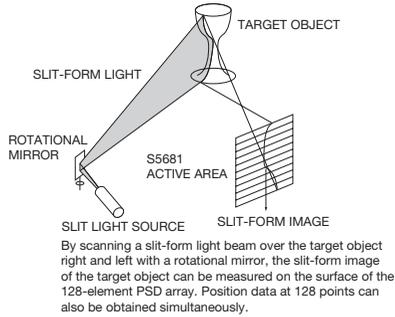
Special PSD type

128-element PSD array for profile measurement

128, vertically stacked, linear PSDs used for high-speed 3D profile measurement

Type No.	Active area (mm)	Resistance length (mm)	Inter-electrode resistance $V_b=0.1\text{ V}$ (k Ω)	Spectral response range (nm)	Package	Photo
S5681	0.025 · 6.375 /128 element	6.375	100	320 to 1100	Ceramic	

Application example

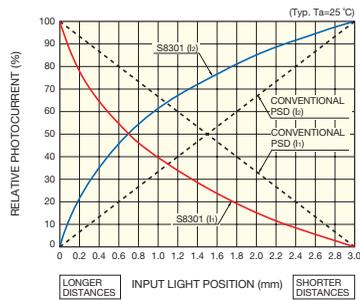


PSD with non-linear corrected output

S8301 series improves long distance accuracy using built-in non-linear correction.

Type No.	Active area (mm)	Resistance length (mm)	Inter-electrode resistance $V_b=0.1\text{ V}$ (k Ω)	Spectral response range (nm)	Package *1	Photo
S8301	1 · 3.2	3.0	250	320 to 1100	Plastic	① 

Photocurrent vs. input light position



Operation expression

$$\text{Input light position } (\mu\text{m}) = 10^n - a$$

$$n = \frac{\log |a| \cdot l_1 + \log |L + a| \cdot l_2}{l_1 + l_2}$$

$$L = 3000$$

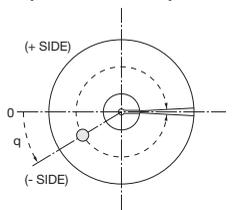
$$a = 300$$

Circular PSD for azimuth angle detection

S8158 reports an azimuth angle (polar angle) relative to the center with a one-dimensional output.

Type No.	Active area (mm)	Inter-electrode resistance $V_b=0.1\text{ V}$ (k Ω)	Spectral response range (nm)	Package *1	Photo
S8158	Inner diameter $\phi 0.54$ Outer diameter $\phi 2.10$	140	320 to 1100	Plastic with mounting terminal	① 

Operation expression



$$\text{ANGLE } (\theta) = \frac{l_2 - l_1}{l_2 + l_1} \sqrt{\frac{360 - 12}{2}}$$

KPSDC0069EA

PSD signal processing circuit

■ DC (low speed) signal detection Designed specifically for DC signal detection

Compatible PSD		PSD signal processing circuit	Output	Dimensional outline (mm)	Photo
Type	Type No.				
1-D PSD	1-D PSD all products	C3683-01	Analog	66 × 56 × 15	
		C9068	Digital (RS-232C)	110 × 75 × 15	
Pin-cushion type 2-D PSD	S1880, S1881, S2044, S5990-01, S5991-01	C4674	Analog	90 × 65 × 15	
		C9069	Digital (RS-232C)	110 × 75 × 15	
Duo-lateral type 2-D PSD	S1300	C4757	Analog	92 × 70 × 15	
Tetra-lateral type 2-D PSD	S1200, S7848, S7848-01	C4758		90 × 65 × 15	

■ AC (pulse) signal detection Designed specifically for AC (pulse) signal detection. Has synchronous circuit. S/H (sample & hold) circuit and LED driver circuit.

Compatible PSD		PSD signal processing circuit	Output	LED repetition frequency (Hz)	Dimensional outline (mm)	Photo
Type	Type No.					
1-D PSD	1-D PSD all products	C5923	Analog	3333	110 × 75 × 15	
Pin-cushion type 2-D PSD	S1880, S1881, S2044, S5990-01, S5991-01	C7563		333		

HAMAMATSU

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PSD
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LED
Optical communication devices
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Light sources
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