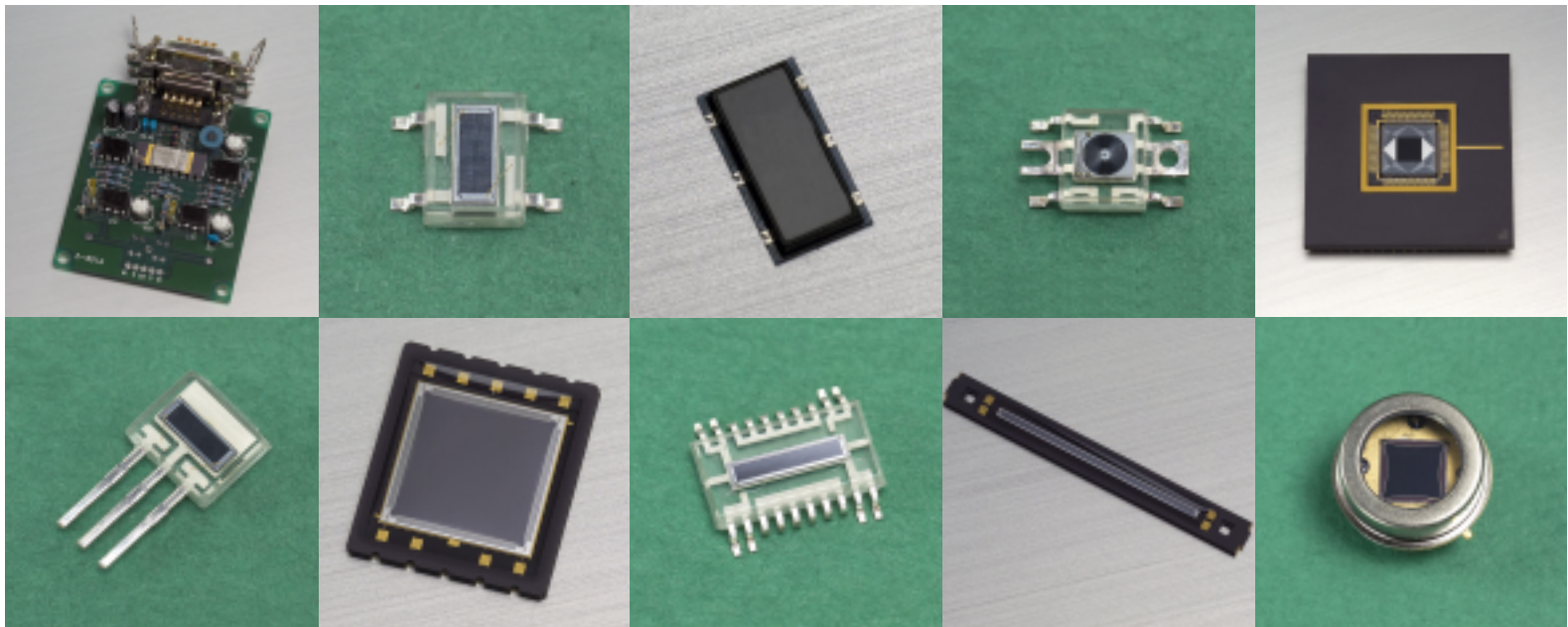


# PSD (Position Sensitive Detectors)



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.

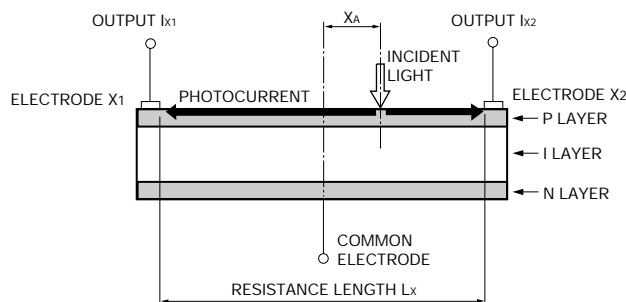
HAMAMATSU PSDs are fabricated using our own cutting-edge semiconductor process technology and have the following features:

- 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](http://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 $\Omega$ )	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	①			
S3273-05				400	760 to 1100	Plastic	①	
S7879 *2				110	440 to 1100	Plastic	①	
S8361 *2, *3					400 to 1100			


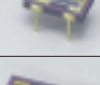
\*1: Plastic package size (unit: mm)

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 $\Omega$ )	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			

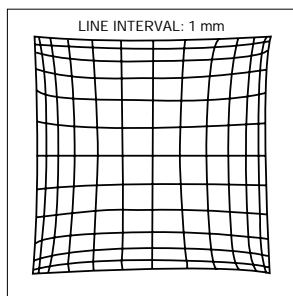
## Two-dimensional PSD

These PSDs detect two-dimensional positions.

Type No.	Active area (mm)	Resistance length (mm)	Interelectrode resistance $V_b=0.1\text{ V}$ (k $\Omega$ )	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				

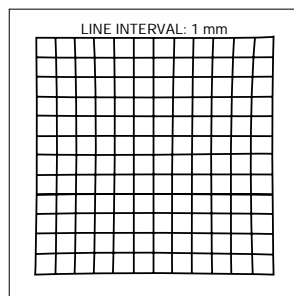
### Examples of position detectability

#### ●S1200



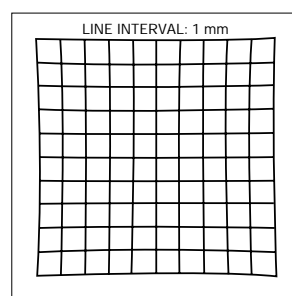
KPSDC0017EA

#### ●S1300



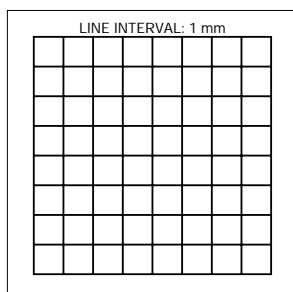
KPSDC0015EA

#### ●S1880



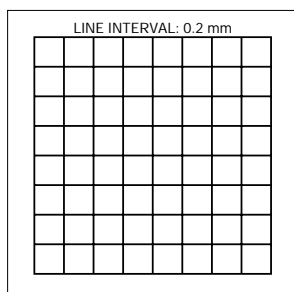
KPSDC0020EA

#### ●S5991-01



KPSDC0065EA

#### ●S7848




KPSDC0084EA

## Special PSD type

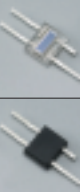
### ■ 128-element PSD array for profile measurement

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

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


### ■ 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)	Interelectrode resistance $V_b=0.1\text{ V}$ (k $\Omega$ )	Spectral response range (nm)	Package *1		Photo
S8301	1 × 3.2	3.0	250	320 to 1100	Plastic	①	
S8301-01				760 to 1100			


### ■ 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)	Interelectrode resistance $V_b=0.1\text{ V}$ (k $\Omega$ )	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	






### ■ Photodiode/PSD sensor

S8302 switches from PSD to dual photodiode mode improving the far and near detection range.



Type No.	Active area (mm)	Interelectrode resistance $V_R=4\text{ V}, V_b=0.1\text{ V}$ (k $\Omega$ )		Spectral response range (nm)	Package *1		Photo
		PSD $V_{SW}=-4\text{ V}$	Dual-photodiode $V_{SW}=0\text{ V}$				
S8302	0.96 × 1.2	140	1000 Min.	760 to 1100	Plastic with mounting terminal	①	

## 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	110 × 75 × 15	
Pin-cushion type 2-D PSD	S1880, S1881, S2044, S5990-01, S5991-01	C4674	Analog	90 × 65 × 15	
		C9069	Digital	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

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

# HAMAMATSU

## HAMAMATSU PHOTONICS K.K., Solid State Division

1126-1, Ichino-cho, Hamamatsu City, 435-8558, Japan

Telephone: (81)53-434-3311, Fax: (81)53-434-5184

www.hamamatsu.com

## Main Products

Si photodiodes  
APD  
Photo IC  
Image sensors  
X-ray flat panel sensors  
PSD  
Infrared detectors  
LED  
Devices for optical communication  
Devices for car applications  
Mini-spectrometers  
High energy particle/X-ray detectors  
Related products

## Hamamatsu also supplies:

Photoelectric tubes  
Imaging tubes  
Light sources  
Imaging and processing  
Systems



Hamamatsu Photonics K. K., Solid State Division has been approved by Lloyd's Register Quality Assurance Limited to the Quality Management System Standard.

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.

© 2005 Hamamatsu Photonics K.K.

## Sales Offices

**ASIA:**  
**HAMAMATSU PHOTONICS K.K.**  
325-6, Sunayama-cho,  
Hamamatsu City, 430-8587, Japan  
Telephone: (81)53-452-2141, Fax: (81)53-456-7889

**U.S.A.:**  
**HAMAMATSU CORPORATION**  
Main Office  
360 Foothill Road, P.O. BOX 6910,  
Bridgewater, N.J. 08807-0910, U.S.A.  
Telephone: (1)908-231-0960, Fax: (1)908-231-1218  
E-mail: usa@hamamatsu.com

**Western U.S.A. Office:**  
Suite 110, 2875 Moorpark Avenue  
San Jose, CA 95128, U.S.A.  
Telephone: (1)408-261-2022, Fax: (1)408-261-2522  
E-mail: usa@hamamatsu.com

**United Kingdom:**  
**Hamamatsu Photonics UK Limited**  
Main Office  
2 Howard Court, 10 Tewin Road, Welwyn Garden City,  
Hertfordshire AL7 1BW, United Kingdom  
Telephone: (44)1707-294888, Fax: (44)1707-325777  
E-mail: info@hamamatsu.co.uk

**South Africa office:**  
PO Box 1112  
Buccleuch 2066  
Johannesburg, South Africa  
Telephone/Fax: (27)11-802-5505

**France, Portugal, Belgium, Switzerland, Spain:**  
**HAMAMATSU PHOTONICS FRANCE S.A.R.L.**  
8, Rue du Saule Trapu, Parc du Moulin de Massy,  
91882 Massy Cedex, France  
Telephone: (33)1 69 53 71 00  
Fax: (33)1 69 53 71 10  
E-mail: infos@hamamatsu.fr

**Swiss Office:**  
Dornacherplatz 7  
4500 Solothurn, Switzerland  
Telephone: (41)32/625 60 60,  
Fax: (41)32/625 60 61  
E-mail: swiss@hamamatsu.ch

**Belgian Office:**  
Scientific Park,  
7, Rue du Bosquet  
B-1348 Louvain-La-Neuve, Belgium  
Telephone: (32)10 45 63 34  
Fax: (32)10 45 63 67  
E-mail: epierson@hamamatsu.com

**Spanish Office:**  
Centro de Empresas de Nuevas Tecnologías  
Parque Tecnológico del Valles  
08290 CERDANYOLA, (Barcelona) Spain  
Telephone: (34)93 582 44 30  
Fax: (34)93 582 44 31  
E-mail: spain@hamamatsu.com

**Germany, Denmark, Netherland, Poland:**  
**HAMAMATSU PHOTONICS DEUTSCHLAND GmbH**  
Arzbergerstr. 10,  
D-82211 Herrsching am Ammersee, Germany  
Telephone: (49)8152-375-0, Fax: (49)8152-2658  
E-mail: info@hamamatsu.de

**Danish Office:**  
Skovbrynet 3  
DK-5610 Assens, Denmark  
Telephone: (45)4346/6333, Fax: (45)4346/6350  
E-mail: lkoldbaek@hamamatsu.de

**Netherlands Office:**  
PO BOX 50.075, 1305 AB ALMERE, The Netherlands  
Telephone: (31)36-5382123, Fax: (31)36-5382124  
E-mail: info@hamamatsu.nl

**Poland Office:**  
02-525 Warsaw,  
8 St. A. Boboli Str., Poland  
Telephone: (48)22-660-8340, Fax: (48)22-660-8352  
E-mail: jbaszak@hamamatsu.de

**North Europe and CIS:**  
**HAMAMATSU PHOTONICS NORDEN AB**  
Smidesvägen 12  
SE-171 41 Solna, Sweden  
Telephone: (46)8-509-031-00, Fax: (46)8-509-031-01  
E-mail: info@hamamatsu.se

**Russian Office:**  
Riverside Towers  
Kosmodamianskaya nab. 52/1, 14th floor  
RU-113054 Moscow, Russia  
Telephone/Fax: (7) 095 411 51 54  
E-mail: info@hamamatsu.ru

**Italy:**  
**HAMAMATSU PHOTONICS ITALIA S.R.L.**  
Strada della Moia, 1/E  
20020 Arese, (Milano), Italy  
Telephone: (39)02-935 81 733  
Fax: (39)02-935 81 741  
E-mail: info@hamamatsu.it

**Rome Office:**  
Viale Cesare Pavese, 435  
00144 Roma, Italy  
Telephone: (39)06-50513454, Fax: (39)06-50513460  
E-mail: inforoma@hamamatsu.it

**Hong Kong:**  
**HAKUTO ENTERPRISES LTD.**  
8th Floor World Trade Centre  
No. 280 Gloucester Road,  
Causeway Bay, Hong Kong  
Telephone: (852)25125729, Fax: (852)28073155

**Taiwan:**  
**HAKUTO Taiwan Ltd.**  
3F-6, No. 188, Section 5, Nanking East Road  
Taipei, Taiwan R.O.C.  
Telephone: (886)2-2753-0188  
Fax: (886)2-2746-5282

**KORYO ELECTRONICS CO., LTD.**  
9F-7, No.79, Hsin Tai Wu Road  
Sec.1, Hsi-Chih, Taipei, Taiwan, R.O.C.  
Telephone: (886)2-2698-1143, Fax: (886)2-2698-1147

**Republic of Korea:**  
**SANGKI TRADING CO., LTD.**  
SUITE 431, WORLD VISION BLDG.  
24-2 YOIDO-DONG  
YOUNGDEUNGPO-KU  
SEOUL, 150-877  
Telephone: (82)2-780-8515  
Fax: (82)2-784-6062

**Singapore:**  
**HAKUTO SINGAPORE PTE LTD.**  
Block 2, Kaki Bukit Avenue 1, #04-01 to #04-04  
Kaki Bukit Industrial Estate, Singapore 417938  
Telephone: (65)67458910, Fax: (65)67418200