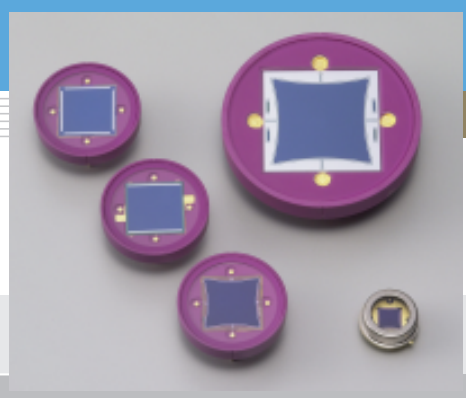


# Two-dimensional PSD

## S1200, S1300, S1880, S1881, S2044

Non-discrete position sensor utilizing photodiode surface resistance



PSD (Position Sensitive Detector) is an optoelectronic position sensor utilizing photodiode surface resistance. Unlike discrete element detectors such as CCD, PSD provides continuous position data and features high position resolution and high-speed response.

PSD can be broadly divided into one-dimensional type and two-dimensional type. Two-dimensional type is further classified by structure into duo-lateral type and tetra-lateral type. The duo-lateral type has superior position detection ability such as smaller position detection error and high position resolution.

Listed in this catalog are typical two-dimensional type PSDs. Other types of PSDs such as one-dimensional type, electron beam detection type and high-energy particle detection type are also available.

### Features

- High position resolution
- Wide spectral response range
- High-speed response
- Simultaneous measurements of position and intensity
- Position is measured independent of light-spot size
- High reliability

### Applications

- Optical position and angle sensing
- Remote optical control systems
- Automatic range finder systems
- Displacement and vibration monitors
- Laser beam alignment
- Medical equipment

### General ratings / Absolute maximum ratings

| General ratings / Absolute maximum ratings |                     |         |                          | Absolute maximum ratings                      |                                                  |                                                 |
|--------------------------------------------|---------------------|---------|--------------------------|-----------------------------------------------|--------------------------------------------------|-------------------------------------------------|
| Type No.                                   | Dimensional outline | Package | Active area size<br>(mm) | Reverse voltage<br>V <sub>R</sub> Max.<br>(V) | Operating temperature<br>T <sub>op</sub><br>(°C) | Storage temperature<br>T <sub>stg</sub><br>(°C) |
| Duo-lateral type two-dimensional PSD       |                     |         |                          |                                               |                                                  |                                                 |
| S1300                                      | ①                   | Ceramic | 13 × 13                  | 20                                            | -10 to +60                                       | -20 to +80                                      |
| Tetra-lateral type two-dimensional PSD     |                     |         |                          |                                               |                                                  |                                                 |
| S1200                                      | ②                   | Ceramic | 13 × 13                  | 20                                            | -10 to +60                                       | -20 to +80                                      |
| Pin-cushion type two-dimensional PSD       |                     |         |                          |                                               |                                                  |                                                 |
| S2044                                      | ③                   | Metal   | 4.7 × 4.7                | 20                                            | -10 to +60                                       | -20 to +80                                      |
| S1880                                      | ④                   | Ceramic | 12 × 12                  |                                               |                                                  |                                                 |
| S1881                                      | ⑤                   |         | 22 × 22                  |                                               |                                                  |                                                 |

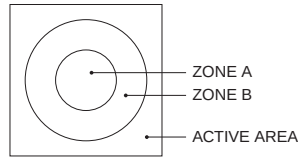
### Electrical and optical characteristics (Typ. Ta=25 °C, unless otherwise noted)

| Type No.                               | Spectral response range<br>λ | Peak sensitivity wavelength<br>λp | Photo sensitivity S<br>λ=λp | Interelectrode resistance *1<br>Rie<br>Vb=0.1 V |      |      | Position detection error *2<br>E |      |        |       | Saturation current Ist<br>VR=5 V<br>RL=1 kΩ | Dark current ID<br>VR=5 V |      | Temp. coefficient of ID<br>TCID | Rise time tr<br>VR=5 V<br>RL=1 kΩ | Terminal capacitance Ct<br>VR=5 V<br>f=10 kHz | Position resolution *3 |
|----------------------------------------|------------------------------|-----------------------------------|-----------------------------|-------------------------------------------------|------|------|----------------------------------|------|--------|-------|---------------------------------------------|---------------------------|------|---------------------------------|-----------------------------------|-----------------------------------------------|------------------------|
|                                        |                              |                                   |                             |                                                 |      |      | ZONE A                           |      | ZONE B |       |                                             |                           |      |                                 |                                   |                                               |                        |
|                                        |                              |                                   |                             |                                                 |      |      | Min.                             | Typ. | Max.   | Typ.  |                                             |                           |      |                                 |                                   |                                               |                        |
|                                        | (nm)                         | (nm)                              | (A/W)                       | (kΩ)                                            | (kΩ) | (kΩ) | (μm)                             | (μm) | (μm)   | (μm)  | (mA)                                        | (nA)                      | (nA) | (times/°C)                      | (μs)                              | (pF)                                          | (μm)                   |
| Duo-lateral type two-dimensional PSD   |                              |                                   |                             |                                                 |      |      |                                  |      |        |       |                                             |                           |      |                                 |                                   |                                               |                        |
| S1300                                  | 320 to 1100                  | 960                               | 0.6                         | 5                                               | 10   | 15   | ±80                              | ±150 | ±150   | ±250  | 0.5                                         | 10                        | 2000 | 1.15                            | 0.8                               | 250                                           | 1.4                    |
| Tetra-lateral type two-dimensional PSD |                              |                                   |                             |                                                 |      |      |                                  |      |        |       |                                             |                           |      |                                 |                                   |                                               |                        |
| S1200                                  | 320 to 1060                  | 920                               | 0.6                         | 5                                               | 10   | 15   | ±150                             | ±300 | ±1200  | ±1500 | 0.5                                         | 3.0                       | 500  | 1.15                            | 1.5                               | 250                                           | 1.4                    |
| Pin-cushion type two-dimensional PSD   |                              |                                   |                             |                                                 |      |      |                                  |      |        |       |                                             |                           |      |                                 |                                   |                                               |                        |
| S2044                                  | 320 to 1060                  | 920                               | 0.6                         | 5                                               | 10   | 15   | ±40                              | ±100 | ±70    | ±150  | 0.5                                         | 0.5                       | 5    | 1.15                            | 0.3                               | 45                                            | 0.6                    |
| S1880                                  |                              |                                   |                             |                                                 |      |      | ±80                              | ±150 | ±150   | ±250  |                                             | 1.0                       | 500  |                                 | 1.5                               | 300                                           | 1.5                    |
| S1881                                  |                              |                                   |                             |                                                 |      |      | ±150                             | ±300 | ±400   | ±600  |                                             | 50                        | 1000 |                                 | 3                                 | 900                                           | 2.8                    |

\*1: Measured between two output terminals opposite to each other, and the other terminals are open-circuited on measurement.

\*2: The radius of Zones A and B depend on the product type. They are determined as follows:

| Type No. | ZONE A (mm) | ZONE B (mm)      |
|----------|-------------|------------------|
| S1300    | 2.5         | 5                |
| S1200    | 2.5         | 5                |
| S2044    | 0.9         | 4 × 4 (quadrate) |
| S1880    | 2.5         | 5                |
| S1881    | 5           | 10               |



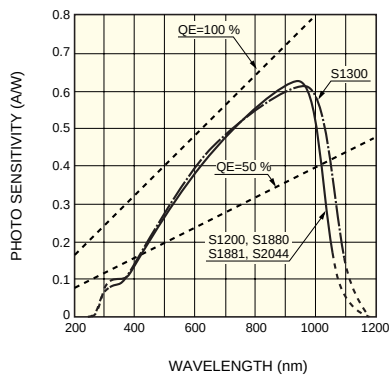
KPSDC0063EA

\*3: Position resolution

This is the minimum detectable light spot displacement. The detection limit is indicated by 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).

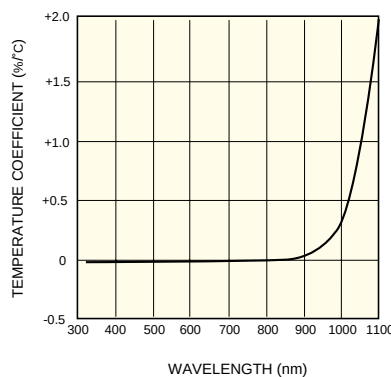
- Light source: LED (900 nm)
- Spot Light size:  $\phi 200 \mu\text{m}$
- Frequency range: 1 kHz
- Photocurrent:  $1 \mu\text{A}$
- Circuit system input noise:  $1 \mu\text{V}$  (1 kHz)
- Interelectrode resistance: Typical value (Refer to specification table.)

## ■ Spectral response



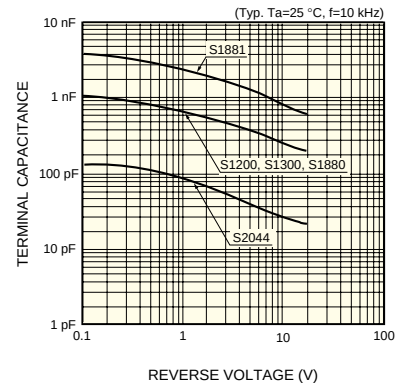
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## ■ Photo sensitivity temperature characteristic



KPSDB0015EB

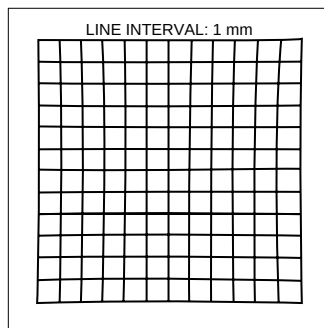
## ■ Terminal capacitance vs. reverse voltage



KPSDB0074EA

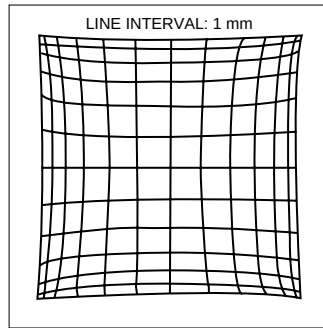
■ Example of position detectability (Ta=25 °C,  $\lambda=900 \text{ nm}$ , spot light size:  $\phi 200 \mu\text{m}$ )

① S1300



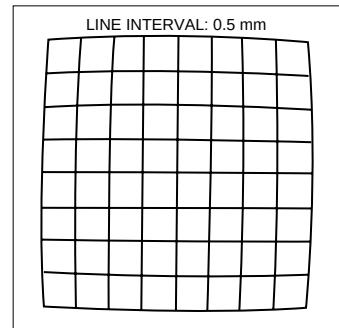
KPSDC0015EA

② S1200



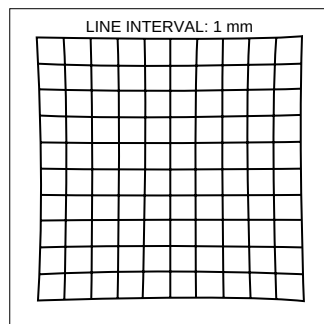
KPSDC0017EA

③ S2044



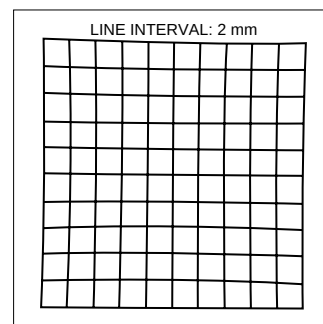
KPSDC0019EA

④ S1880



KPSDC0020EA

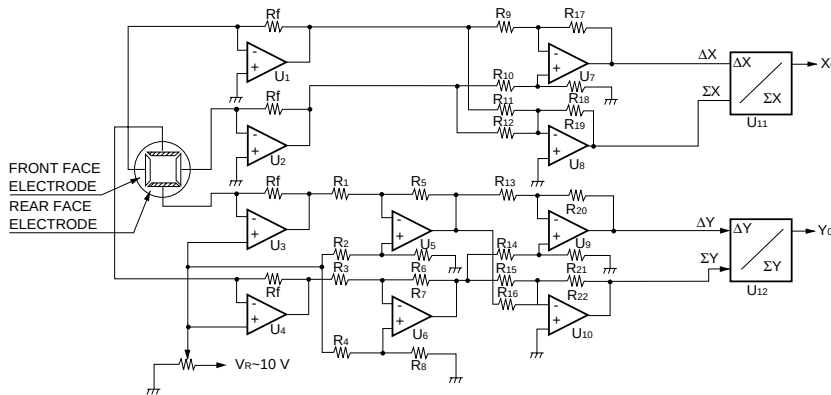
⑤ S1881



KPSDC0021EA

## ■ Example of DC-operating circuit

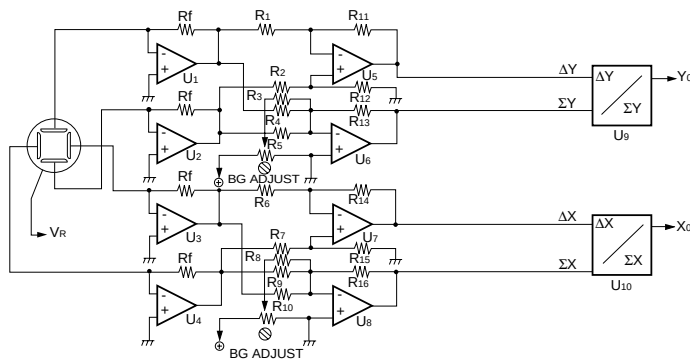
### Duo-lateral type



$R_1 - R_{22}$ : same value  
 $R_f$ : depends on input level  
 $U_1 - U_4$ : low drift head amplifier, TL071, etc.  
 $U_{11}, U_{12}$ : analog divider, AD538 (Analog Devices), etc.

KPSDC0024EB

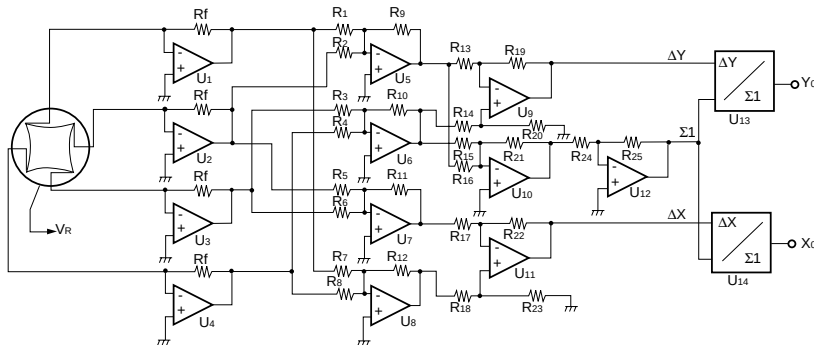
### Tetra-lateral type



$R_1 - R_{16}$ : same value  
 $U_1 - U_4$ : low drift head amplifier, TL071, etc.  
 BG ADJUST: dark current, background canceling V.R.  
 $U_9, U_{10}$ : analog divider, AD538 (Analog Devices), etc.

KPSDC0025EB

### Pin-cushion type

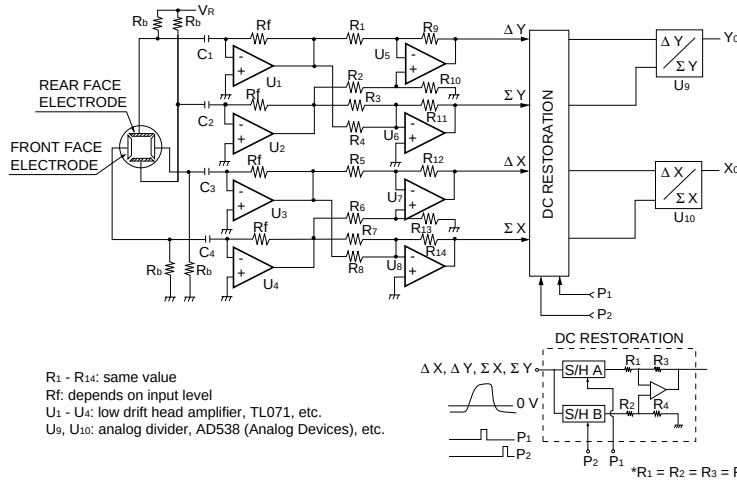


$R_1 - R_{25}$ : same value  
 $R_f$ : depends on input level  
 $U_1 - U_4$ : low drift head amplifier, TL071, etc.  
 $U_{13}, U_{14}$ : analog divider, AD538 (Analog Devices), etc.

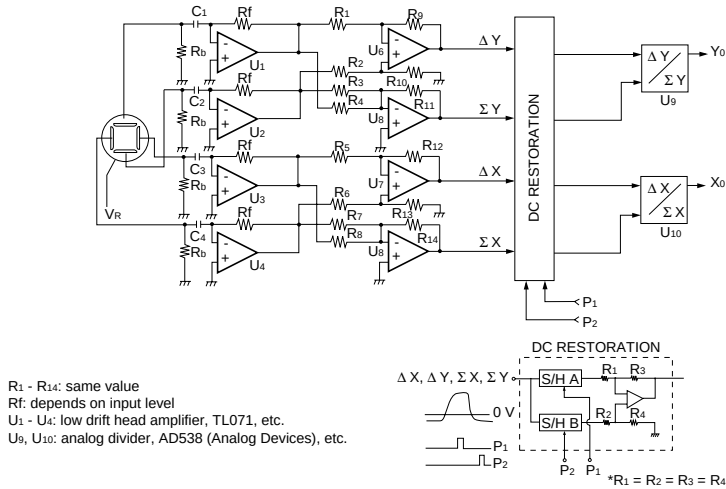
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## Example of AC-operating circuit

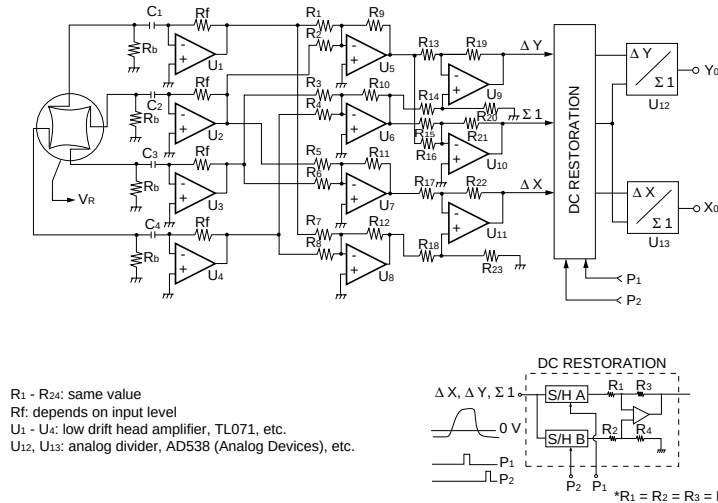
### Duo-lateral type



### Tetra-lateral type

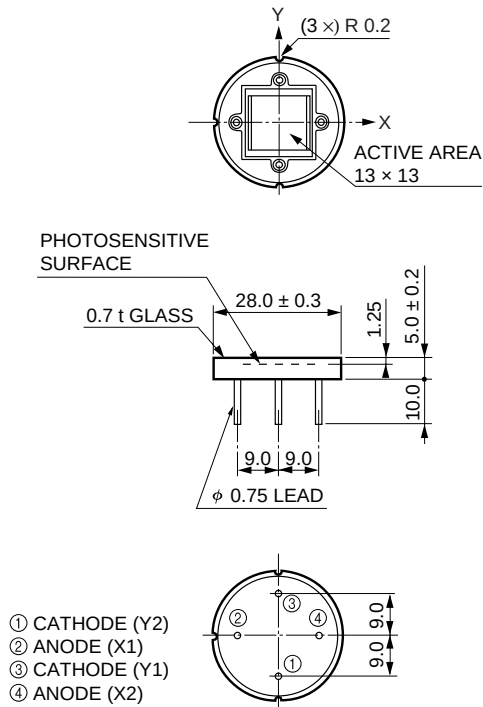


### Pin-cushion type



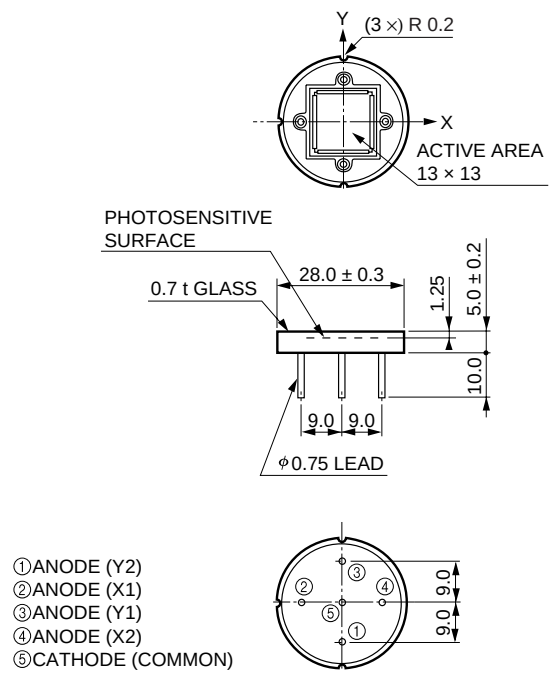
## ■ Dimensional outlines (unit: mm)

### ① S1300



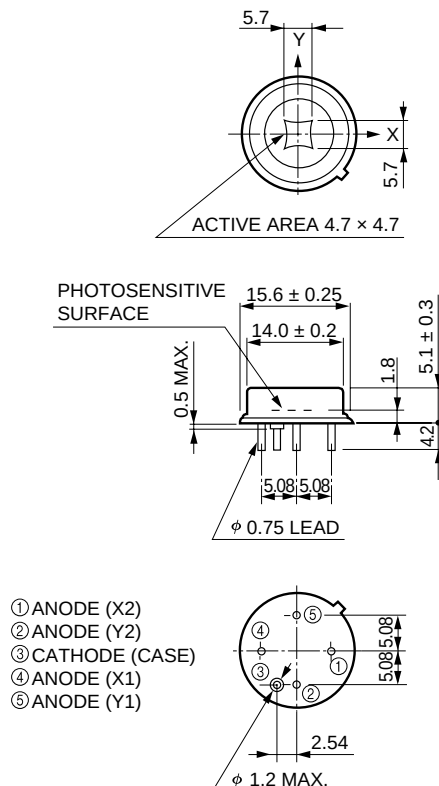
KPSDA0008EC

### ② S1200



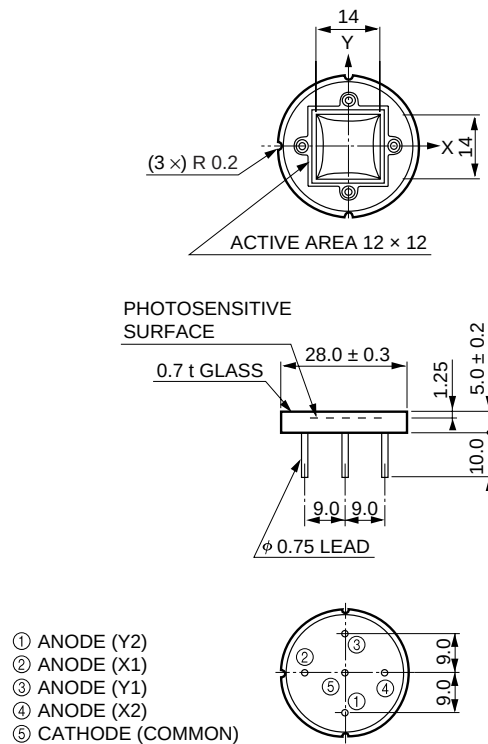
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### ③ S2044



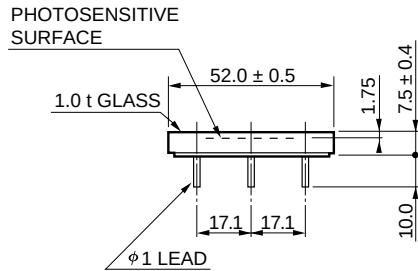
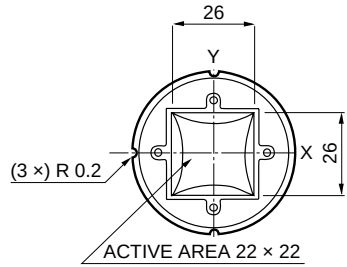
KPSDA0012EC

### ④ S1880

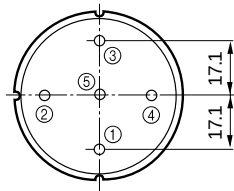


KPSDA0013EB

## ⑤ S1881



- ① ANODE (Y1)
- ② ANODE (X1)
- ③ ANODE (Y2)
- ④ ANODE (X2)
- ⑤ CATHODE (COMMON)



KPSDA0014EA

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HAMAMATSU PHOTONICS K.K., Solid State Division

1126-1 Ichino-cho, Hamamatsu City, 435-8558 Japan, Telephone: (81) 053-434-3311, Fax: (81) 053-434-5184, <http://www.hamamatsu.com>

U.S.A.: Hamamatsu Corporation: 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

Germany: Hamamatsu Photonics Deutschland GmbH: Arzbergerstr. 10, D-82211 Herrsching am Ammersee, Germany, Telephone: (49) 08152-3750, Fax: (49) 08152-2658

France: Hamamatsu Photonics France S.A.R.L.: 8, Rue du Saule Trappu, Parc du Moulin de Massy, 91882 Massy Cedex, France, Telephone: 33-(1) 69 53 71 00, Fax: 33-(1) 69 53 71 10

United Kingdom: Hamamatsu Photonics UK Limited: 2 Howard Court, 10 Tewin Road, Welwyn Garden City, Hertfordshire AL7 1BW, United Kingdom, Telephone: (44) 1707-294888, Fax: (44) 1707-325777

North Europe: Hamamatsu Photonics Norden AB: Smidesvägen 12, SE-171 41 Solna, Sweden, Telephone: (46) 8-509-031-00, Fax: (46) 8-509-031-01

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

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