PSD (position sensitive detector) is an optoelectronic position sensor utilizing photodiode surface resistance. There is no element gap due to non-discrete type. Therefore, continuous output signals (X/Y coordinate signals) can be obtained for the movement of the light spot, and the position resolution and response are excellent.

### Features
- Continuous output signal for light spot movement
- High position resolution
- High-speed response
- Simultaneous measurements of position and intensity
- Position is measured independent of light spot size
- Wide spectral response range
- 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

### Structure

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>S1880</th>
<th>S2044</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photosensitive area size</td>
<td></td>
<td>12 × 12</td>
<td>4.7 × 4.7</td>
<td>mm</td>
</tr>
<tr>
<td>Package</td>
<td></td>
<td>Ceramic</td>
<td>Metal</td>
<td></td>
</tr>
<tr>
<td>Window material</td>
<td></td>
<td>Borosilicate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance length</td>
<td>Rl</td>
<td>14</td>
<td>5.7</td>
<td>mm</td>
</tr>
</tbody>
</table>

### Absolute maximum ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>S1880</th>
<th>S2044</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td>Vr max</td>
<td>20</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Operating temperature*¹</td>
<td>Topr</td>
<td>-10 to +60</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature*¹</td>
<td>Tstg</td>
<td>-20 to +80</td>
<td></td>
<td>°C</td>
</tr>
</tbody>
</table>

*¹: No dew condensation

When there is a temperature difference between a product and the surrounding area in high humidity environment, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.

Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.
**Electrical and optical characteristics (Ta=25 °C unless otherwise noted)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>S1880</th>
<th>S2044</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectral response range</td>
<td>λ</td>
<td>-</td>
<td>320 to 1060</td>
<td>-</td>
<td>nm</td>
</tr>
<tr>
<td>Peak sensitivity wavelength</td>
<td>λp</td>
<td>-</td>
<td>920</td>
<td>-</td>
<td>nm</td>
</tr>
<tr>
<td>Photosensitivity</td>
<td>S</td>
<td>-</td>
<td>0.6</td>
<td>-</td>
<td>A/W</td>
</tr>
<tr>
<td>Interelectrode resistance</td>
<td>Re</td>
<td>-</td>
<td>5</td>
<td>10</td>
<td>kΩ</td>
</tr>
<tr>
<td>Position detection error</td>
<td>E</td>
<td>-</td>
<td>±80</td>
<td>±150</td>
<td>µm</td>
</tr>
<tr>
<td>Saturation current</td>
<td>Ist</td>
<td>-</td>
<td>0.5</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Dark current</td>
<td>Id</td>
<td>-</td>
<td>1000</td>
<td>500</td>
<td>nA</td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>Tcid</td>
<td>-</td>
<td>1.15</td>
<td>-</td>
<td>times/°C</td>
</tr>
<tr>
<td>Rise time</td>
<td>tr</td>
<td>-</td>
<td>15</td>
<td>-</td>
<td>µs</td>
</tr>
<tr>
<td>Terminal capacitance</td>
<td>Ct</td>
<td>-</td>
<td>300</td>
<td>-</td>
<td>pF</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Type no.</th>
<th>Zone A (mm)</th>
<th>Zone B (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1880</td>
<td>2.5</td>
<td>5</td>
</tr>
<tr>
<td>S2044</td>
<td>0.9</td>
<td>4 x 4 (quadrature)</td>
</tr>
</tbody>
</table>

*4: 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)
- Photocurrent: 1 µA
- Light spot size: ϕ200 µm
- Circuit system input noise: 1 µV (1 kHz)
- Frequency range: 1 kHz
- Interelectrode resistance: Typical value (Refer to specification table.)

**Spectral response**

![Spectral response graph](Typ. Ta=25 °C)

**Photosensitivity temperature characteristics**

![Photosensitivity temperature graph](Typ.)
Terminal capacitance vs. reverse voltage

(Typ. Ta=25 °C, f=10 kHz)

Examples of position detectability (Ta=25 °C, λ=900 nm, light spot size: ϕ200 µm)

<table>
<thead>
<tr>
<th>S1880</th>
<th>S2044</th>
</tr>
</thead>
</table>

Line interval: 1 mm

Line interval: 0.5 mm
Example of DC-operating circuit

R₁ - R₅: same value
Rf: depends on input level
U₁ - U₄: low drift head amplifier, TL071, etc.
U₁₂, U₁₃: analog divider, AD538 (Analog Devices), etc.

Example of AC-operating circuit

R₁ - R₅: same value
Rf: depends on input level
U₁ - U₄: low drift head amplifier, TL071, etc.
U₁₂, U₁₃: analog divider, AD538 (Analog Devices), etc.
Two-dimensional PSD | S1880, S2044

**Dimensional outlines (unit: mm)**

<table>
<thead>
<tr>
<th>S1880</th>
<th>S2044</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Dimensional outline S1880" /></td>
<td><img src="image2" alt="Dimensional outline S2044" /></td>
</tr>
<tr>
<td>Photosensitive area 12 × 12</td>
<td>Photosensitive area 4.7 × 4.7</td>
</tr>
</tbody>
</table>

① Anode (Y2)  
② Anode (X1)  
③ Anode (Y1)  
④ Anode (X2)  
⑤ Cathode (common)

**Photosensitive area chart**

![Photosensitive area chart](image3)

**Position conversion formula**

\[
\frac{(D_2 + I_2) - (D_1 + I_1)}{D_1 + D_2 + I_1 + I_2} = \frac{2x}{L_x}
\]

\[
\frac{(D_2 + I_2) - (D_1 + I_1)}{D_1 + D_2 + I_1 + I_2} = \frac{2y}{L_y}
\]

S1880: Lx=14 mm  
Ly=14 mm  
S2044: Lx=5.7 mm  
Ly=5.7 mm

*Photosensitive area is specified at the inscribed square.*
Two-dimensional PSD

S1880, S2044

Related information
www.hamamatsu.com/sp/ssd/doc_en.html

- Precautions
- Disclaimer
- Metal, ceramic, plastic package products
- Surface mount type products

Technical information
- PSD

Information described in this material is current as of March 2020.
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