### Features
- Superior position detection ability
- High reliability
- S3931, S3932: Easy to use 4-pin small ceramic package
- Long and narrow photosensitive area
  - S3270: 1 × 37 mm

### Applications
- Displacement sensing
- Distance measurement
- Proximity switching

### Structure / Absolute maximum ratings

<table>
<thead>
<tr>
<th>Type no.</th>
<th>Package</th>
<th>Package window material**1</th>
<th>Photosensitive area size (mm)</th>
<th>Reverse voltage (V)</th>
<th>Operating temperature (°C)</th>
<th>Storage temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3931</td>
<td>Ceramic</td>
<td>R</td>
<td>1 × 6</td>
<td>20</td>
<td>-10 to +60</td>
<td>-20 to +80</td>
</tr>
<tr>
<td>S3932</td>
<td>Ceramic</td>
<td>R</td>
<td>1 × 12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3270**2</td>
<td>R (B)</td>
<td>R (B)</td>
<td>1 × 37</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1: R: clear resin coating, R (B): visible-cut resin coating
*2: Works with microscopic light spot detection

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 (Typ. Ta=25 °C, unless otherwise noted)

<table>
<thead>
<tr>
<th>Type no.</th>
<th>Spectral response range λ (nm)</th>
<th>Peak sensitivity wavelength λp (nm)</th>
<th>Photo sensitivity S (A/W)</th>
<th>Interelectrode resistance Rie (kΩ)</th>
<th>Position detection error E</th>
<th>Saturation photocurrent I0 (μA)</th>
<th>Dark current ID (μA)</th>
<th>Temp. coefficient of Id TCD (μA/°C)</th>
<th>Rise time tr (μs)</th>
<th>Terminal capacitance CQ (pF)</th>
<th>Position resolution E*3 (μm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3931</td>
<td>320 to 1100</td>
<td>920</td>
<td>0.55</td>
<td>Min. (kΩ), Typ. (kΩ), Max. (kΩ)</td>
<td>+30 +120</td>
<td>100</td>
<td>0.15 10</td>
<td>1.15</td>
<td>1.5</td>
<td>40</td>
<td>0.2</td>
</tr>
<tr>
<td>S3932</td>
<td>700 to 1100</td>
<td>960</td>
<td>0.55</td>
<td>10 15 20</td>
<td>+60 +240</td>
<td>300</td>
<td>0.5 20</td>
<td>3.0</td>
<td>3.0</td>
<td>80</td>
<td>0.3</td>
</tr>
</tbody>
</table>

*3: A range of 75% of that from the center of the photosensitive surface to the edge
*4: The upper limit of linearity of photocurrent in response to the quantity of light is defined as the point where the linearity deviates by 10%.
*5: Position resolution

This is the minimum detectable light spot displacement. The detection limit is indicated by the 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)
- Light spot size: 200 μm
- Frequency range: 1 kHz
- Photocurrent: 1 μA
- Circuit system input noise: 1 μV (1 kHz)
- Interelectrode resistance: Typical value (refer to the specification table)
One-dimensional PSD

S3931, S3932, S3270

Spectral response

Photosensitivity (A/W)

Temperature coefficient (%/°C)

Photosensitivity temperature characteristics

Dark current vs. reverse voltage

Terminal capacitance vs. reverse voltage

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Examples of position detectability (Ta=25 °C, λ=900 nm, light spot size: φ0.2 mm)

Conversion formula of spot light position on the PSD

If output signals (photocurrent) $I_1$ and $I_2$ are obtained from electrodes $X_1$ and $X_2$, then the light spot position ($x$) on the PSD can be found by the following formula.

$$ \frac{I_2 - I_1}{I_1 + I_2} = \frac{2x}{L} $$

Correction for position detection error

Position detection characteristics obtained by the above formula can be corrected to reduce position detection errors. For example, the maximum position detection error ($\pm120 \mu m$) of the S3931 can be significantly reduced to $\pm9 \mu m$ by using the least square method.
### Dimensional outlines (unit: mm)

#### S3931
- Photosensitive area: 9.2 ± 0.2, 4.8 ± 0.2
- Photosensitive surface: 0.7
- (4 ×) 0.4, 5.08 ± 0.3

1. Cathode (common)
2. Anode (X2)
3. Cathode (common)
4. Anode (X1)

#### S3932
- Photosensitive area: 15.2 ± 0.2, 4.8 ± 0.2
- Photosensitive surface: 0.7
- (4 ×) 0.4, 5.08 ± 0.3

1. Cathode (common)
2. Anode (X2)
3. Cathode (common)
4. Anode (X1)

#### S3270
- Photosensitive area: 5.5 ± 0.25
- Photosensitive surface: 55 ± 0.5, 42.3 ± 0.4, 1.0
- (2 ×) R1.1, R2.0

1. Anode (X1)
2. Cathode (common)
3. Anode (X2)

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One-dimensional PSD

S3931, S3932, S3270

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

Precautions
- Disclaimer
- Metal, ceramic, plastic package products

Technical information
- PSD

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