Hamamatsu provides various types of one-dimensional PSD (Position Sensitive Detector) designed for precision distance measurement such as displacement meters. S3979 has a 1 × 3 mm active area sealed in a TO-5 package. S3931 and S3932 have an active area of 1 × 6 mm and 1 × 12 mm respectively, and are mounted on a compact ceramic package with a transparent resin window. Variant types (S3931-01, S3932-01) with a visible-cut resin window are also available. S1352 and S3270 offer an active area longer than 30 mm, allowing position detection at a long distance. S3270 has a visible-cut resin window, and S3270-01 with a transparent resin window is also available.

### Features
- Superior position detection ability
- High reliability
- S3931, S3932: Easy to use 4-pin small ceramic package
- Long and narrow active area

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

### General ratings / Absolute maximum ratings

<table>
<thead>
<tr>
<th>Type No.</th>
<th>Package</th>
<th>Window material *1</th>
<th>Active area size (mm)</th>
<th>Reverse voltage VR Max. (V)</th>
<th>Operating temperature Topr (°C)</th>
<th>Storage temperature Tstg (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3979</td>
<td>TO-5</td>
<td>K</td>
<td>1 × 3</td>
<td>20</td>
<td>-10 to +60</td>
<td>-20 to +80</td>
</tr>
<tr>
<td>S3931</td>
<td>R</td>
<td>1 × 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3932</td>
<td>R</td>
<td>1 × 12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1352 *2</td>
<td>Ceramic</td>
<td></td>
<td>2.5 × 34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3270 *2</td>
<td>R (B)</td>
<td>1 × 37</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


### 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 λp (nm)</th>
<th>Photo sensitivity S (A/W)</th>
<th>Inter electrode resistance Rie (kΩ)</th>
<th>Position detection error E (V)</th>
<th>Saturation photocurrent *4</th>
<th>Temp. coefficient of ID</th>
<th>Rise time tr</th>
<th>Terminal capacitance Cl</th>
<th>Position resolution *5</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3979</td>
<td>320 to 1100</td>
<td>920</td>
<td>0.55</td>
<td>100</td>
<td>±15 ±60</td>
<td>100</td>
<td>1.15</td>
<td>2.5</td>
<td>20</td>
<td>0.1</td>
</tr>
<tr>
<td>S3931</td>
<td>320 to 1100</td>
<td>920</td>
<td>0.55</td>
<td>140</td>
<td>±30 ±120</td>
<td>100</td>
<td>1.15</td>
<td>1.5</td>
<td>40</td>
<td>0.2</td>
</tr>
<tr>
<td>S3932</td>
<td>320 to 1100</td>
<td>920</td>
<td>0.55</td>
<td>80</td>
<td>±60 ±240</td>
<td>200</td>
<td>1.15</td>
<td>3.0</td>
<td>80</td>
<td>0.3</td>
</tr>
<tr>
<td>S3931</td>
<td>320 to 1100</td>
<td>920</td>
<td>0.55</td>
<td>125</td>
<td>±500</td>
<td>250</td>
<td>1.15</td>
<td>2.0</td>
<td>150</td>
<td>0.7</td>
</tr>
<tr>
<td>S3270</td>
<td>700 to 1100</td>
<td>960</td>
<td>0.55</td>
<td>150</td>
<td>±400</td>
<td>300</td>
<td>1.15</td>
<td>1.0</td>
<td>100</td>
<td>2.8</td>
</tr>
</tbody>
</table>

*2: Works with microscopic spot light detection.
*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 %.

### 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)
- **Photocurrent:** 1 µA
- **Spot light size:** φ 200 µm
- **Circuit system input noise:** 1 µV (1 kHz)
- **Frequency range:** 1 kHz
- **Inter electrode resistance:** Typical value (refer to the specification table)
One-dimensional PSD S3979, S3931, S3932, S1352, S3270

- **Spectral response**
  - Plot showing photo sensitivity (A/W) vs. wavelength (nm) for S3979, S3931, S3932, S1352, S3270 at typical temperature Ta=25 °C.

- **Photo sensitivity temperature characteristics**
  - Plot showing temperature coefficient (%)/°C vs. wavelength (nm) for S3979, S3931, S3932, S1352, S3270.

- **Dark current vs. reverse voltage**
  - Plot showing dark current vs. reverse voltage (V) for S3979, S3931, S3932, S1352, S3270 at typical temperature Ta=25 °C.

- **Terminal capacitance vs. reverse voltage**
  - Plot showing terminal capacitance vs. reverse voltage (V) for S3979, S3931, S3932, S1352, S3270 at typical temperature Ta=25 °C, f=10 kHz.
- Example of position detectability (Ta=25 °C, λ=900 nm, spot light 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 (±120 µm) of S3931 can be significantly reduced to ±9 µm by using the least square method.
One-dimensional PSD S3979, S3931, S3932, S1352, S3270

S3931

9.2 ± 0.2
ACTIVE AREA

PHOTOSENSITIVE SURFACE

(4 + 0.4)
0.7

5.08 ± 0.3

S3932

15.2 ± 0.2
ACTIVE AREA

PHOTOSENSITIVE SURFACE

(4 + 0.4)
0.7

0.16 ± 0.4

S1352

57.0 ± 0.6
ACTIVE AREA

PHOTOSENSITIVE SURFACE

(4 × 0.25)
19.05

(4 × 0.25)
19.05

S3270

5.5 ± 0.25
ACTIVE AREA

PHOTOSENSITIVE SURFACE

(2 × R1.1)
(2 × R2.2)

1.25

5.0 ± 0.2

0.45 ± 0.05
LEAD

0.75 t GLASS

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