The S14160 series is a small-pixel MPPC that features wide dynamic range. Even with an extremely narrow pixel pitch of 10 or 15 µm, it features high fill factor, reduced crosstalk, and dark count.

**Features**
- Small pixel pitch (10 µm, 15 µm)
- High fill factor
- Wide dynamic range
- Low voltage operation (V<sub>BR</sub>=38 V typ.)
- Low crosstalk and afterpulses
- High gain: 10<sup>5</sup> order

**Applications**
- High energy physics experiments
- Fluorescence measurement
- Flow cytometry
- DNA sequencers
- Environmental analysis

**Structure**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>S14160-1310PS</th>
<th>-1315PS</th>
<th>-3010PS</th>
<th>-3015PS</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective photosensitive area</td>
<td>-</td>
<td>1.3 x 1.3</td>
<td>3 x 3</td>
<td>1.3 x 1.3</td>
<td>3 x 3</td>
<td>mm</td>
</tr>
<tr>
<td>Pixel pitch</td>
<td>-</td>
<td>10</td>
<td>15</td>
<td></td>
<td></td>
<td>µm</td>
</tr>
<tr>
<td>Number of pixels</td>
<td>-</td>
<td>16663</td>
<td>89984</td>
<td>7284</td>
<td>39984</td>
<td></td>
</tr>
<tr>
<td>Geometrical fill factor</td>
<td>-</td>
<td>31</td>
<td>49</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Package</td>
<td>-</td>
<td>Surface mount type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Window</td>
<td>-</td>
<td>Silicone resin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Window refractive index</td>
<td>-</td>
<td>1.57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Absolute maximum ratings (Ta=25 °C)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td>V&lt;sub&gt;R&lt;/sub&gt; max</td>
<td>-</td>
<td>48</td>
<td>V</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Topr</td>
<td>No dew condensation&lt;sup&gt;*1&lt;/sup&gt;</td>
<td>-40 to +60</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Topr</td>
<td>No dew condensation&lt;sup&gt;*1&lt;/sup&gt;</td>
<td>-40 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Soldering temperature</td>
<td>T&lt;sub&gt;sol&lt;/sub&gt;</td>
<td>240°&lt;sub&gt;C&lt;/sub&gt; (3 times)</td>
<td></td>
<td>°C</td>
</tr>
</tbody>
</table>

<sup>*1</sup>: 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.

<sup>*2</sup>: Reflow temperature, JEDEC J-STD-020 MSL 2a, see P.9

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, V_R=V_op, unless otherwise noted)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>S14160-1310PS</th>
<th>-1315PS</th>
<th>-3010PS</th>
<th>-3015PS</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectral response range</td>
<td>( \lambda )</td>
<td>290 to 900</td>
<td>nm</td>
<td>nm</td>
<td>nm</td>
<td>nm</td>
</tr>
<tr>
<td>Peak sensitivity wavelength</td>
<td>( \lambda_p )</td>
<td>460</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Photon detection efficiency at ( \lambda_p )(^*3)</td>
<td>PDE</td>
<td>18</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>%</td>
</tr>
<tr>
<td>Breakdown voltage(^*4)</td>
<td>( V_{BR} )</td>
<td>38±3</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Recommended operating voltage(^*4)</td>
<td>V_op</td>
<td>V_{BR} + 5</td>
<td>V</td>
<td>V_{BR} + 4</td>
<td>V_{BR} + 4</td>
<td>V</td>
</tr>
<tr>
<td>Vop variation within a reel</td>
<td>-</td>
<td>±0.1</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Dark count rate(^*5)</td>
<td>typ.</td>
<td>DCR</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>max.</td>
<td></td>
<td>360</td>
<td>360</td>
<td>360</td>
<td>360</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2100</td>
<td>2100</td>
<td>2100</td>
<td>2100</td>
</tr>
<tr>
<td>Direct crosstalk probability</td>
<td>Pct</td>
<td>&lt; 1</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Terminal capacitance at Vop</td>
<td>Ct</td>
<td>100</td>
<td>530</td>
<td>100</td>
<td>530</td>
<td>530</td>
</tr>
<tr>
<td>Gain</td>
<td>M</td>
<td>1.8 \times 10^5</td>
<td>3.6 \times 10^5</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Temperature coefficient of Vop</td>
<td>( \Delta T_{Vop} )</td>
<td>34</td>
<td>mV/°C</td>
<td>mV/°C</td>
<td>mV/°C</td>
<td>mV/°C</td>
</tr>
</tbody>
</table>

**3**: Photon detection efficiency does not include crosstalk and afterpulses.

**4**: Refer to the data attached for each product.

**5**: Threshold=0.5 p.e.

---

Photon detection efficiency vs. wavelength

(Typ. Ta=25 °C, V_R=V_op)

![Photon detection efficiency vs. wavelength graph](image-url)
Gain, crosstalk probability, photon detection efficiency vs. over voltage

<table>
<thead>
<tr>
<th>S14160-1310PS/-3010PS</th>
<th>S14160-1315PS/-3015PS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Gain, crosstalk probability, photon detection efficiency vs. over voltage" /></td>
<td><img src="image2.png" alt="Gain, crosstalk probability, photon detection efficiency vs. over voltage" /></td>
</tr>
</tbody>
</table>

Linearity

<table>
<thead>
<tr>
<th>S14160-1310PS/-3010PS</th>
<th>S14160-1315PS/-3015PS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Linearity" /></td>
<td><img src="image4.png" alt="Linearity" /></td>
</tr>
</tbody>
</table>
1 photon equivalent pulse output

<table>
<thead>
<tr>
<th>S14160-1310PS</th>
<th>S14160-1315PS</th>
</tr>
</thead>
</table>

(Typ. Ta=25 °C, Vr=Vop)

<table>
<thead>
<tr>
<th>S14160-3010PS</th>
<th>S14160-3015PS</th>
</tr>
</thead>
</table>

(Typ. Ta=25 °C, Vr=Vop)

Hamamatsu
Photon is our business
## Waveform measurement setup

![Waveform measurement setup diagram](image)

- Oscilloscope (1 GHz, 50 Ω)
- +HV
- MPPC
- 50 Ω
- Amp

## Dimensional outlines (unit: mm)

<table>
<thead>
<tr>
<th>S14160-1310PS/-1315PS</th>
</tr>
</thead>
</table>

- Photosensitive area: 1.3 x 1.3
- Silicon resin: 0.3 ± 0.15
- Photosensitive surface: 2.1
- Tolerance unless otherwise noted: ±0.1
- Distance from chip center to package center: *0.1

① NC
② Cathode
③ Anode
④ NC

**Index mark**

- ⑤ NC

**Silicon resin**

- ⑥ 0.8 ± 0.15

**Photosensitive area**

- ⑦ 2.63
MPPC (multi-pixel photon counter)  |  S14160-1310PS/-1315PS/-3010PS/-3015PS

**S14160-3010PS/-3015PS**

![Diagram of S14160-3010PS/-3015PS](image)

- Photosensitive area: $3.0 \times 3.0$
- Silicon resin: $0.25 \pm 0.15$
- Photosensitive surface
- Index mark

**Tolerance unless otherwise noted:** $\pm 0.1$

*Distance from chip center to package center*

---

**Recommended land pattern (unit: mm)**

<table>
<thead>
<tr>
<th>S14160-1310PS/-1315PS</th>
<th>S14160-3010PS/-3015PS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.7</td>
<td>1.1</td>
</tr>
<tr>
<td>0.7</td>
<td>4.3</td>
</tr>
<tr>
<td>2.025</td>
<td>2.2</td>
</tr>
</tbody>
</table>

---

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## Standard packing specifications

S14160-1310PS/-1315PS

Reel (conforms to JEITA ET-7200)

<table>
<thead>
<tr>
<th>Reel diameter</th>
<th>Hub diameter</th>
<th>Tape width</th>
<th>Material</th>
<th>Electrostatic characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>180 mm</td>
<td>60 mm</td>
<td>8 mm</td>
<td>PS</td>
<td>Conductive</td>
</tr>
</tbody>
</table>

Embossed tape (unit: mm, material: PS, conductive)

![Diagram showing dimensions of embossed tape]

Packing quantity

300 pcs/reel

Packing type

Reel and desiccant in moisture-proof packaging (vacuum-sealed)

Lavel

Type No. __________
Lot No. __________
Vop __________
HAMAMATSU
MADE IN JAPAN
S14160-3010PS/-3015PS

Reel (conforms to JEITA ET-7200)

<table>
<thead>
<tr>
<th>Reel diameter</th>
<th>Hub diameter</th>
<th>Tape width</th>
<th>Material</th>
<th>Electrostatic characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>254 mm</td>
<td>80 mm</td>
<td>12 mm</td>
<td>PS</td>
<td>Conductive</td>
</tr>
</tbody>
</table>

Embossed tape (unit: mm, material: PS, conductive)

Packing quantity
300 pcs/reel

Packing type
Reel and desiccant in moisture-proof packaging (vacuum-sealed)

Lavel
Type No. __________
Lot No. __________
Vop __________
HAMAMATSU
MADE IN JAPAN
MPPC (multi-pixel photon counter)  |  S14160-1310PS/-1315PS/-3010PS/-3015PS

**Recommended reflow soldering conditions**

- This surface mount type product supports lead-free soldering. After unpacking, store it in an environment at a temperature of 30 °C or less and a humidity of 60% or less, and perform soldering within 4 weeks.
- This effect that the product receives during reflow soldering varies depending on the circuit board and reflow oven that are used. When you set reflow soldering conditions, check that problems do not occur in the product by testing out the conditions in advance.

**Precautions**

- If necessary, incorporate appropriate protective circuits in power supplies, devices, and measuring instruments to prevent overvoltage and overcurrent.

**Recommended reflow soldering conditions**

- **Preheat**: 70 to 90 s
- **Soldering**: 40 s max.
- **Temperature**:
  - 300 °C
  - 220 °C
  - 190 °C
  - 170 °C

**Time**

- 240 °C max.

**Precautions**

- If necessary, incorporate appropriate protective circuits in power supplies, devices, and measuring instruments to prevent overvoltage and overcurrent.

**Related information**

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

**Precautions**

- **Disclaimer**
- **Surface mount type products**

MPPC is a registered trademark of Hamamatsu Photonics K.K.

Information described in this material is current as of June 2020. Product specifications are subject to change without prior notice due to improvements or other reasons. This document has been carefully prepared and the information contained is believed to be accurate. In rare cases, however, there may be inaccuracies such as text errors. Before using these products, always contact us for the delivery specification sheet to check the latest specifications.

The product warranty is valid for one year after delivery and is limited to product repair or replacement for defects discovered and reported to us within that one year period. However, even if within the warranty period we accept absolutely no liability for any loss caused by natural disasters or improper product use.

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