The S15639-1325PS is a surface mount type MPPC designed for automotive LiDAR applications that achieves high sensitivity and low afterpulses.

**Features**
- High photon detection efficiency: 9% ($\lambda=905$ nm)
- Low afterpulse probability: 1% max.
- High gain: $1.3 \times 10^6$
- Low crosstalk

**Applications**
- Distance measurement
- LiDAR

**Structure**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective photosensitive area</td>
<td>$1.3 \times 1.1$</td>
<td>mm</td>
</tr>
<tr>
<td>Pixel pitch</td>
<td>25</td>
<td>$\mu$m</td>
</tr>
<tr>
<td>Number of pixels</td>
<td>2120</td>
<td>-</td>
</tr>
<tr>
<td>Package</td>
<td>Surface mount type</td>
<td>-</td>
</tr>
<tr>
<td>Window material</td>
<td>Silicone resin</td>
<td>-</td>
</tr>
<tr>
<td>Refractive index of window material</td>
<td>1.57</td>
<td>-</td>
</tr>
<tr>
<td>Thermal resistance*1</td>
<td>409</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

*1: Between junction temperature and ambient temperature (typical example)

**Absolute maximum ratings**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>Topr</td>
<td>No dew condensation*2</td>
<td>-40 to +105</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Tstg</td>
<td>No dew condensation*2</td>
<td>-40 to +125</td>
<td>°C</td>
</tr>
<tr>
<td>Soldering temperature</td>
<td>Tsol</td>
<td></td>
<td>260 (3 times)*3</td>
<td>°C</td>
</tr>
<tr>
<td>Output current (DC)</td>
<td>Imax</td>
<td>Average value</td>
<td>1</td>
<td>mA</td>
</tr>
</tbody>
</table>

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

*3: Reflow soldering, JEDEC J-STD-020 MSL 2a, see P.7

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)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectral response range</td>
<td>λ</td>
<td></td>
<td>-</td>
<td>400 to 1000</td>
<td>-</td>
<td>nm</td>
</tr>
<tr>
<td>Peak sensitivity wavelength</td>
<td>λp</td>
<td></td>
<td>-</td>
<td>660</td>
<td>-</td>
<td>nm</td>
</tr>
<tr>
<td>Photon detection efficiency**4</td>
<td>PDE</td>
<td>λ=λp, VR=VBR + 10 V</td>
<td>-</td>
<td>30</td>
<td>-</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>λ=905 nm, VR=VBR + 10 V</td>
<td>-</td>
<td>7.5</td>
<td>-</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>λ=905 nm, VR=VBR + 14 V**5</td>
<td>-</td>
<td>9</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Breakdown voltage</td>
<td>VBR</td>
<td></td>
<td>37</td>
<td>42</td>
<td>47</td>
<td>V</td>
</tr>
<tr>
<td>Recommended operating voltage**6</td>
<td>Vop</td>
<td></td>
<td>-</td>
<td>VBR + 10 V</td>
<td>VBR + 14 V</td>
<td>V</td>
</tr>
<tr>
<td>Vop variation in a reel**7</td>
<td></td>
<td></td>
<td>-</td>
<td>±0.25</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Dark current</td>
<td>Io</td>
<td></td>
<td>-</td>
<td>0.2</td>
<td>0.45</td>
<td>μA</td>
</tr>
<tr>
<td>Dark count rate**8</td>
<td>DCR</td>
<td>VR=VBR + 10 V</td>
<td>-</td>
<td>0.7</td>
<td>2.0</td>
<td>Mcps</td>
</tr>
<tr>
<td>Crosstalk probability</td>
<td></td>
<td>VR=VBR + 10 V</td>
<td>-</td>
<td>4</td>
<td>-</td>
<td>%</td>
</tr>
<tr>
<td>Afterpulse probability</td>
<td></td>
<td>VR=VBR + 10 V</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>%</td>
</tr>
<tr>
<td>Recovery time</td>
<td>trecvr</td>
<td>VR=VBR + 10 V</td>
<td>-</td>
<td>46</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Terminal capacitance</td>
<td>Ct</td>
<td>VR=VBR + 10 V, f=100 kHz</td>
<td>-</td>
<td>42</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>Gain</td>
<td>M</td>
<td>VR=VBR + 10 V</td>
<td>-</td>
<td>1.3 × 10⁶</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>Temperature coefficient of Vop</td>
<td>ΔTVop</td>
<td></td>
<td>-</td>
<td>81</td>
<td>-</td>
<td>mV/°C</td>
</tr>
</tbody>
</table>

**4: Photon detection efficiency does not include crosstalk and afterpulses.
**5: When using VR more than VBR + 10 V, provide a protective resistance over 5 kΩ or an appropriate current limiting circuit.
**6: Refer to the data attached to each product.
**7: The center value of the recommended operating voltage (Vop) of products in the reel is indicated on the label attached to the reel.
**8: Threshold=0.5 p.e.
**MPPC (Multi-Pixel Photon Counter)**

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**Dark current vs. overvoltage (typical example)**

![Graph showing dark current vs. overvoltage](image1)

- **Overvoltage (V)**
- **Dark current**

- 10 mA
- 1 mA
- 100 µA
- 100 nA
- 10 nA
- 1 nA
- 100 pA
- 100 pA

**Overvoltage (V)**

- -5
- 0
- 5
- 10
- 15
- 20
- 25
- 30
- 35
- 40
- 45

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**Dark current vs. reverse voltage (typical example)**

![Graph showing dark current vs. reverse voltage](image2)

- **Reverse voltage (V)**
- **Dark current**

- 10 mA
- 1 mA
- 100 µA
- 100 nA
- 10 nA
- 1 nA
- 100 pA
- 100 pA

**Reverse voltage (V)**

- 35
- 45
- 55
- 65
- 75
- 80

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**Gain, crosstalk probability, photon detection efficiency vs. overvoltage (typical example)**

![Graph showing gain, crosstalk probability, photon detection efficiency](image3)

- **Overvoltage (V)**
- **Gain**

- $3.0 \times 10^6$
- $2.5 \times 10^6$
- $2.0 \times 10^6$
- $1.5 \times 10^6$
- $1.0 \times 10^6$
- $0.5 \times 10^6$

- **Crosstalk probability**

- **Photon detection efficiency**

- $\lambda = 905 \text{ nm}$

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**Gain, crosstalk probability, photon detection efficiency vs. reverse voltage (typical example)**

![Graph showing gain, crosstalk probability, photon detection efficiency](image4)

- **Reverse voltage (V)**
- **Gain**

- $3.0 \times 10^6$
- $2.5 \times 10^6$
- $2.0 \times 10^6$
- $1.5 \times 10^6$
- $1.0 \times 10^6$
- $0.5 \times 10^6$

- **Crosstalk probability**

- **Photon detection efficiency**

- $\lambda = 905 \text{ nm}$
**Pulse waveform**

(Ta=25 °C, Vsel=Vop)

**Linearity (typical example)**

(Ta=25 °C, λ=910 nm)

*This graph does not include the reduction of linearity due to heat.*

**Afterpulse probability vs. overvoltage (typical example)**

(Ta=25 °C)
### Dimensional outline (unit: mm)

- Photosensitive area: 0.12* mm
- Photosensitive surface: 0.2 mm

### Recommended land pattern (unit: mm)

- Anode ① — Cathode ②
- ① ③ NC

Tolerance unless otherwise noted: ±0.1

* Distance from package center to photosensitive area center
Standard packing specifications

Reel (conforms to JEITA ET-7200)

<table>
<thead>
<tr>
<th>Outer 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)

Packing quantity
1000 pcs/reel

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

Precaution
Overcurrent may flow depending on ambient temperature, incident light level, heat dissipation status, and applied bias. If an overcurrent flows, the element temperature may rise, causing damage to the product.
**Recommended reflow soldering conditions**

- After unpacking, store the device in an environment at a temperature range of 5 to 30 °C and a humidity of 60% or less, and perform reflow soldering within 4 weeks.
- The 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.

**Baking**

If more than 3 months have passed in the unopened state, or storage conditions are exceeded after opening the package, baking is required to remove moisture before reflow soldering. For the baking, refer to the precautions "Surface mount type products."

- **Recommended baking conditions**
  
  **Temperature:** 120 °C, 3 hours, up to twice

  **Note:** Before setting the baking conditions, perform experiments to confirm that no problems occur with the product.

**Related information**

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

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

**Technical information**

- **MPPC / Technical note**

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