Si PIN photodiodes

S5980/S5981/S5870 series

Surface mountable, segmented type Si photodiode

Features

Surface mount type ceramic chip carrier package
Compatible with lead-free solder reflow
High sensitivity
Packing
Tray: S5980, S5981, S5870
Reel: S5980-10, S5981-10, S5870-10

Applications

Laser optical axis alignment
Level meter
Pointing device, etc.

Structure

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>S5980/-10</th>
<th>S5981/-10</th>
<th>S5870/-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photosensitive area</td>
<td>A</td>
<td>5 × 5 / 4 segments</td>
<td>10 × 10 / 4 segments</td>
<td>10 × 10 / 2 segments</td>
</tr>
<tr>
<td>Gap between elements</td>
<td>-</td>
<td>-</td>
<td>30 µm</td>
<td>-</td>
</tr>
<tr>
<td>Package</td>
<td>-</td>
<td>Ceramic</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Window material</td>
<td>-</td>
<td>Resin coating</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Absolute maximum ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>S5980/-10</th>
<th>S5981/-10</th>
<th>S5870/-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td>Vr max</td>
<td>30 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature*1</td>
<td>Topr</td>
<td>-40 to +100 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage temperature*1</td>
<td>Tstg</td>
<td>-40 to +125 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soldering conditions</td>
<td>- peak temperature: 240 °C, 1 time*2</td>
<td>-</td>
<td></td>
<td></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, per element)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>S5980/-10</th>
<th>S5981/-10</th>
<th>S5870/-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectral response range</td>
<td>λ</td>
<td>-</td>
<td>320 to 1100</td>
<td>320 to 1100</td>
<td>320 to 1100</td>
</tr>
<tr>
<td>Peak sensitivity wavelength</td>
<td>λp</td>
<td>-</td>
<td>600</td>
<td>960</td>
<td>960</td>
</tr>
<tr>
<td>Photosensitivity</td>
<td>S</td>
<td>λ=λp</td>
<td>0.72</td>
<td>0.72</td>
<td>0.72</td>
</tr>
<tr>
<td>Dark current</td>
<td>ID</td>
<td>Vr=10 V</td>
<td>0.3</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Dark current temperature coefficient</td>
<td>TCD</td>
<td>Vr=10 V, Re=50 Ω, -3 dB</td>
<td>1.15</td>
<td>1.15</td>
<td>1.15</td>
</tr>
<tr>
<td>Cutoff frequency</td>
<td>fc</td>
<td>Vr=10 V</td>
<td>25</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Terminal capacitance</td>
<td>Ct</td>
<td>Vr=10 V, f=1 MHz</td>
<td>10</td>
<td>35</td>
<td>50</td>
</tr>
<tr>
<td>Noise equivalent power</td>
<td>NEP</td>
<td>Vr=10 V, λ=λp</td>
<td>1.4 x 10^-14</td>
<td>1.9 x 10^-14</td>
<td>3.5 x 10^-14</td>
</tr>
</tbody>
</table>

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Si PIN photodiodes

S5980/S5981/S5870 series

**Spectral response**

(Typ. Ta=25 °C)

Photosensitivity (A/W)

<table>
<thead>
<tr>
<th>Wavelength (nm)</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>600</th>
<th>700</th>
<th>800</th>
<th>900</th>
<th>1000</th>
<th>1100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photosensitivity</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
<td>0.5</td>
<td>0.6</td>
<td>0.7</td>
<td>0.8</td>
<td>0.7</td>
<td>0.6</td>
</tr>
</tbody>
</table>

**Sensitivity temperature characteristics**

(Typ.)

Temperature coefficient (%/°C)

<table>
<thead>
<tr>
<th>Wavelength (nm)</th>
<th>190</th>
<th>400</th>
<th>600</th>
<th>800</th>
<th>1000</th>
<th>300</th>
<th>500</th>
<th>700</th>
<th>900</th>
<th>1100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature coefficient</td>
<td>+1.5</td>
<td>+1.0</td>
<td>+0.5</td>
<td>+0.5</td>
<td>+1.0</td>
<td>+0.5</td>
<td>+1.0</td>
<td>+0.5</td>
<td>+1.0</td>
<td>+0.5</td>
</tr>
</tbody>
</table>

**Dark current vs. reverse voltage**

(Typ. Ta=25 °C)

<table>
<thead>
<tr>
<th>Reverse voltage (V)</th>
<th>0.01</th>
<th>0.1</th>
<th>1</th>
<th>10</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark current (A)</td>
<td>1 pA</td>
<td>10 pA</td>
<td>100 pA</td>
<td>1 nA</td>
<td>10 nA</td>
</tr>
</tbody>
</table>

**Terminal capacitance vs. reverse voltage**

(Typ. Ta=25 °C, f=1 MHz)

<table>
<thead>
<tr>
<th>Reverse voltage (V)</th>
<th>0.1</th>
<th>1</th>
<th>10</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal capacitance (pF)</td>
<td>100</td>
<td>10</td>
<td>1</td>
<td>0.1</td>
</tr>
</tbody>
</table>

KMPDB0122EA

KMPDB0123EA

KMPDB0124EA

KMPDB0125EA
Dimensional outlines (unit: mm)

**S5980/-10**

- Photosensitive area: 8.8 ± 0.2 mm
- Index mark: 1.06 ± 0.2 mm
- Silicone resin: 0.46 ± 0.15 mm
- Anode B: 1.5
- Cathode common: 1.27
- Anode C: 1.5
- Anode D: 2.5
- NC: 0.46
- Photosensitive area: 1.26 ± 0.15 mm
- Burrs shall protrude no more than 0.3 mm on any side of package.

**S5981/-10**

- Photosensitive area: 14.5 ± 0.2 mm
- Index mark: 1.26 ± 0.15 mm
- Silicone resin: 0.46
- Anode B: 1.8
- Cathode common: 1.2
- Anode C: 3.0
- Anode D: 1.8
- NC: 0.03
- Photosensitive area: 2.54
- Details of photosensitive area
- Burrs shall protrude no more than 0.3 mm on any side of package.

**S5870/-10**

- Photosensitive area: 16.5 ± 0.2 mm
- Index mark: 1.26 ± 0.15 mm
- Silicone resin: 0.46
- Anode A: 1.8
- NC: 0.03
- Cathode common: 1.2
- Anode B: 2.54
- Details of photosensitive area
- Burrs shall protrude no more than 0.3 mm on any side of package.
## Recommended land patterns (unit: mm)

<table>
<thead>
<tr>
<th>S5980/-10</th>
<th>S5981/-10, S5870/-10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>x:</strong> 0.6 max.</td>
<td><strong>x:</strong> 1.2 max.</td>
</tr>
<tr>
<td><strong>y:</strong> 1.0 min.</td>
<td><strong>y:</strong> 2.8 min.</td>
</tr>
<tr>
<td><strong>y:</strong> 2.5 min.</td>
<td><strong>y:</strong> 2.5 min.</td>
</tr>
</tbody>
</table>

1. Solder all terminals.
2. Do not make the land area larger than necessary.
3. It is preferable that the land sizes be about equal.
4. Make land width x about the same as the terminal width.
5. Make land height y at least 1 mm longer than the terminal height, protruding outside the package.
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- **Standard packing specifications**

  S5980, S5981, S5870

  - Packing quantity
    100 pcs max./tray
    Note: S5980: For mass production orders, please order in units of 100.
    S5981, S5870: For mass production orders, please order in units of 50.

  - Packing state
    Tray and desiccant in moisture-proof packaging (vacuum-sealed)

  S5980-10

  - 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>Φ254 mm</td>
<td>Φ100 mm</td>
<td>24 mm</td>
<td>PS</td>
<td>Conductive</td>
</tr>
</tbody>
</table>

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

  - Packing quantity
    1000 pcs/reel

  - Packing state
    Reel and desiccant in moisture-proof packaging (vacuum-sealed)
Si PIN photodiodes | S5980/S5981/S5870 series

S5870-10, S5981-10

■ 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>ϕ330 mm</td>
<td>ϕ80 mm</td>
<td>24 mm</td>
<td>PS</td>
<td>Conductive</td>
</tr>
</tbody>
</table>

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

■ Packing quantity
100 pcs/reel

■ Packing state
Reel and desiccant in moisture-proof packaging (vacuum-sealed)
Precautions

- This product's light input window uses soft silicone resin. Stain or scratch in the light input window degrades the sensitivity. Avoid contact with the light input window, as applying external force to the resin surface may cause the wire to deform and break.
- When soldering, use rosin-based flux to prevent terminal corrosion. Solder at 260 °C or less within 5 seconds without moisture absorption. Check carefully the conditions of reflow soldering, since they vary depending on the board and reflow oven in use.
- Silicone resin swells with organic solvents. So do not use anything other than alcohol.
- Avoid opening the bag until immediately before using the product so as to prevent oxidation or contamination of terminals or moisture absorption of resin filling.

In addition, if 3 months have passed in an unopened state or 168 hours have passed after opening, bake in nitrogen atmosphere for 3 to 5 hours at 150 °C, or for 12 to 15 hours at 120 °C before use.

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Recommended reflow soldering conditions

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>170 °C</td>
<td>Preheat 70 to 90 s</td>
</tr>
<tr>
<td>190 °C</td>
<td></td>
</tr>
<tr>
<td>220 °C</td>
<td></td>
</tr>
<tr>
<td>300 °C</td>
<td></td>
</tr>
</tbody>
</table>

240 °C max. Soldering 40 s max.
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Related information
www.hamamatsu.com/sp/ssd/doc_en.html

- Precautions
  - Disclaimer
  - Surface mount type products

- Technical information
  - Si photodiode / Application circuit examples

Information described in this material is current as of April 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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