InGaAs PIN photodiodes have large shunt resistance and feature very low noise. Hamamatsu provides various types of InGaAs PIN photodiodes with photosensitive area from $\phi0.3$ mm to $\phi5$ mm.

**Features**

- Low noise, low dark current
- Low terminal capacitance
- Large photosensitive area
- Various photosensitive area sizes available

**Applications**

- Laser monitors
- Optical power meters
- Laser diode life test
- NIR (near infrared) photometry
- Optical communications

**Options**

- Amplifier for InGaAs PIN photodiode C4159-03
- Heatsink for one-stage TE-cooled type A3179
- Heatsink for two-stage TE-cooled type A3179-01
- Temperature controller for TE-cooler type C1103-04

**Structure**

<table>
<thead>
<tr>
<th>Type no.</th>
<th>Dimensional outline/Window material</th>
<th>Package</th>
<th>Cooling</th>
<th>Photosensitive area (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G12180-003A</td>
<td>(1)/A</td>
<td>TO-18</td>
<td>Non-cooled</td>
<td>$\phi0.3$</td>
</tr>
<tr>
<td>G12180-005A</td>
<td>$\phi0.5$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-010A</td>
<td>$\phi1$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-020A</td>
<td>(2)/A</td>
<td>TO-5</td>
<td>One-stage TE-cooled</td>
<td>$\phi2$</td>
</tr>
<tr>
<td>G12180-030A</td>
<td>$\phi3$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-050A</td>
<td>$\phi5$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-110A</td>
<td>(3)/A</td>
<td>TO-8</td>
<td>Two-stage TE-cooled</td>
<td>$\phi1$</td>
</tr>
<tr>
<td>G12180-120A</td>
<td>$\phi2$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-130A</td>
<td>$\phi3$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-150A</td>
<td>$\phi5$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-210A</td>
<td>(4)/A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-220A</td>
<td>$\phi1$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-230A</td>
<td>$\phi2$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-250A</td>
<td>$\phi3$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-250A</td>
<td>$\phi5$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1: A= Borosilicate glass with anti-reflective coating (optimized for 1.55 $\mu$m peak)

The G12180 series may be damaged by electrostatic discharge, etc. Be careful when using the G12180 series.

www.hamamatsu.com
InGaAs PIN photodiodes

G12180 series

Absolute maximum ratings (Ta=25 °C, unless otherwise noted)

<table>
<thead>
<tr>
<th>Type no.</th>
<th>Thermistor power dissipation Pd_th (mW)</th>
<th>TE-cooler allowable current ITE max (A)</th>
<th>TE-cooler allowable voltage VTE max (V)</th>
<th>Reverse voltage VR max (V)</th>
<th>Operating temperature°^2 Topr (°C)</th>
<th>Storage temperature°^2 Tstg (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G12180-003A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td>-40 to +100</td>
<td>-55 to +125</td>
</tr>
<tr>
<td>G12180-005A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>-40 to +100</td>
<td>-55 to +85</td>
</tr>
<tr>
<td>G12180-010A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>-40 to +100</td>
<td>-55 to +85</td>
</tr>
<tr>
<td>G12180-020A</td>
<td>1.5</td>
<td>1</td>
<td>5</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-030A</td>
<td>0.2</td>
<td>1</td>
<td>5</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-050A</td>
<td>0.2</td>
<td>1</td>
<td>5</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-110A</td>
<td>0.2</td>
<td>1</td>
<td>5</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-120A</td>
<td>0.2</td>
<td>1</td>
<td>5</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-130A</td>
<td>0.2</td>
<td>1</td>
<td>5</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-150A</td>
<td>0.2</td>
<td>1</td>
<td>5</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-210A</td>
<td>0.2</td>
<td>1</td>
<td>5</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-220A</td>
<td>0.2</td>
<td>1</td>
<td>5</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-230A</td>
<td>0.2</td>
<td>1</td>
<td>5</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G12180-250A</td>
<td>0.2</td>
<td>1</td>
<td>5</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

°2: No dew condensation
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: Chip temperature and package temperature
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. unless otherwise noted)

<table>
<thead>
<tr>
<th>Type no.</th>
<th>Measurement condition</th>
<th>Thermistor resistance (+25 °C) Rth (kΩ)</th>
<th>Thermistor B constant (-20/+25 °C) B (K)</th>
<th>Spectral response range</th>
<th>Peak sensitivity wavelength λp (µm)</th>
<th>Photosensitivity S</th>
<th>Dark current Id</th>
<th>Temp. coefficient of dark current ∆Tid</th>
<th>Temp. coefficient of dark current ∆Tid</th>
<th>Dark current Id</th>
<th>Temp. coefficient of dark current ∆Tid</th>
</tr>
</thead>
<tbody>
<tr>
<td>G12180-003A</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>0.9 to 1.7</td>
<td>1.55</td>
<td>0.8</td>
<td>0.9</td>
<td>1.1</td>
<td>1.09</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>G12180-005A</td>
<td>-10</td>
<td>9.0</td>
<td>3300</td>
<td>0.9 to 1.67</td>
<td>0.15</td>
<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

°4: VR=5 V
InGaAs PIN photodiodes

### G12180 series

#### Spectral response

![Spectral response graph](Typ.)

- Photosensitivity (A/W) vs. Wavelength (µm)
- Td=25 °C
- Td=-10 °C
- Td=-20 °C

#### Spectral transmittance characteristics of window material

![Spectral transmittance graph](Typ. Ta=25 °C)

- Transmittance (%) vs. Wavelength (µm)

---

<table>
<thead>
<tr>
<th>Type no.</th>
<th>Measurement condition</th>
<th>Cutoff frequency</th>
<th>Terminal capacitance</th>
<th>Shunt resistance</th>
<th>Detectivity</th>
<th>Noise equivalent power</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Element temperature (°C)</td>
<td>f=1 MHz</td>
<td>VR=1 V</td>
<td>R=50 Ω</td>
<td>f=1 MHz</td>
<td>VR=10 mV</td>
</tr>
<tr>
<td>G12180-003A</td>
<td>25</td>
<td>450&lt;sup&gt;*&lt;/sup&gt;</td>
<td>600&lt;sup&gt;*&lt;/sup&gt;</td>
<td>5&lt;sup&gt;*&lt;/sup&gt;</td>
<td>7.5&lt;sup&gt;*&lt;/sup&gt;</td>
<td>200</td>
</tr>
<tr>
<td>G12180-005A</td>
<td>-10</td>
<td>160&lt;sup&gt;*&lt;/sup&gt;</td>
<td>200&lt;sup&gt;*&lt;/sup&gt;</td>
<td>15&lt;sup&gt;*&lt;/sup&gt;</td>
<td>20&lt;sup&gt;*&lt;/sup&gt;</td>
<td>80</td>
</tr>
<tr>
<td>G12180-010A</td>
<td>-20</td>
<td>25&lt;sup&gt;*&lt;/sup&gt;</td>
<td>50&lt;sup&gt;*&lt;/sup&gt;</td>
<td>55&lt;sup&gt;*&lt;/sup&gt;</td>
<td>120&lt;sup&gt;*&lt;/sup&gt;</td>
<td>25</td>
</tr>
<tr>
<td>G12180-020A</td>
<td>4</td>
<td>3</td>
<td>1000</td>
<td>7000</td>
<td>1.3</td>
<td>6.5</td>
</tr>
<tr>
<td>G12180-030A</td>
<td>2.5</td>
<td>7</td>
<td>450</td>
<td>1500</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>G12180-050A</td>
<td>0.5</td>
<td>3</td>
<td>1000</td>
<td>7000</td>
<td>1.3</td>
<td>6.5</td>
</tr>
<tr>
<td>G12180-110A</td>
<td>20</td>
<td>40</td>
<td>75</td>
<td>140</td>
<td>750</td>
<td>3750</td>
</tr>
<tr>
<td>G12180-120A</td>
<td>4</td>
<td>13</td>
<td>250</td>
<td>800</td>
<td>200</td>
<td>900</td>
</tr>
<tr>
<td>G12180-130A</td>
<td>2.5</td>
<td>7</td>
<td>450</td>
<td>1500</td>
<td>120</td>
<td>600</td>
</tr>
<tr>
<td>G12180-150A</td>
<td>0.5</td>
<td>3</td>
<td>1000</td>
<td>7000</td>
<td>40</td>
<td>200</td>
</tr>
<tr>
<td>G12180-210A</td>
<td>20</td>
<td>40</td>
<td>75</td>
<td>140</td>
<td>1750</td>
<td>8750</td>
</tr>
<tr>
<td>G12180-230A</td>
<td>4</td>
<td>13</td>
<td>250</td>
<td>800</td>
<td>500</td>
<td>2000</td>
</tr>
<tr>
<td>G12180-250A</td>
<td>2.5</td>
<td>7</td>
<td>450</td>
<td>1500</td>
<td>280</td>
<td>1400</td>
</tr>
</tbody>
</table>

*<sup>5</sup>: VR=5 V, RL=50 Ω, -3 dB
*<sup>6</sup>: VR=5 V, f=1 MHz
**InGaAs PIN photodiodes**

**G12180 series**

---

### Photosensitivity temperature characteristics

(Typ. V<sub>r</sub>=0 V)

<table>
<thead>
<tr>
<th>Wavelength (µm)</th>
<th>Photosensitivity temperature coefficient (%/°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8</td>
<td>-1.0</td>
</tr>
<tr>
<td>1.0</td>
<td>0</td>
</tr>
<tr>
<td>1.2</td>
<td>0.5</td>
</tr>
<tr>
<td>1.4</td>
<td>1.0</td>
</tr>
<tr>
<td>1.6</td>
<td>1.5</td>
</tr>
<tr>
<td>1.8</td>
<td>2.0</td>
</tr>
</tbody>
</table>

---

### Linearity

(Typ. Ta=25 °C, λ=1.3 µm, R<sub>L</sub>=2 Ω, V<sub>r</sub>=0 V)

<table>
<thead>
<tr>
<th>Incident light level (mW)</th>
<th>Relative sensitivity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>100</td>
<td>99.5</td>
</tr>
<tr>
<td>90</td>
<td>99.0</td>
</tr>
<tr>
<td>80</td>
<td>98.5</td>
</tr>
<tr>
<td>70</td>
<td>98.0</td>
</tr>
<tr>
<td>60</td>
<td>97.5</td>
</tr>
<tr>
<td>50</td>
<td>97.0</td>
</tr>
<tr>
<td>40</td>
<td>96.5</td>
</tr>
<tr>
<td>30</td>
<td>96.0</td>
</tr>
<tr>
<td>20</td>
<td>95.5</td>
</tr>
<tr>
<td>10</td>
<td>95.0</td>
</tr>
<tr>
<td>0</td>
<td>94.5</td>
</tr>
</tbody>
</table>

---

### Dark current vs. reverse voltage

**Non-cooled type**

(Typ. Ta=25 °C)

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

**TE-cooled type**

(Typ.)

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

---

**Hamamatsu**

*Photon is our Business*
### Terminal capacitance vs. reverse voltage

(Typ. Ta=25 °C, f=1 MHz)

<table>
<thead>
<tr>
<th>Reverse voltage (V)</th>
<th>Terminal capacitance (pF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01</td>
<td>10 nF</td>
</tr>
<tr>
<td>0.1</td>
<td>1 nF</td>
</tr>
<tr>
<td>1</td>
<td>100 pF</td>
</tr>
<tr>
<td>10</td>
<td>10 pF</td>
</tr>
<tr>
<td>100</td>
<td>1 pF</td>
</tr>
</tbody>
</table>

### Shunt resistance vs. element temperature

(Typ. Vr=10 mV)

- G12180-003A
- G12180-005A
- G12180-010A/-110A/-210A
- G12180-020A/-120A/-220A
- G12180-030A/-130A/-230A
- G12180-050A/-150A/-250A

### Thermistor temperature characteristics

(Typ.)

<table>
<thead>
<tr>
<th>Element temperature (°C)</th>
<th>Resistance (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40</td>
<td>10^6</td>
</tr>
<tr>
<td>-20</td>
<td>10^5</td>
</tr>
<tr>
<td>0</td>
<td>10^4</td>
</tr>
<tr>
<td>20</td>
<td>10^3</td>
</tr>
</tbody>
</table>

### Cooling characteristics of TE-cooler

(Typ. Ta=25 °C, thermal resistance of heatsink=3 °C/W)

- One-stage TE-cooled type
- Two-stage TE-cooled type
InGaAs PIN photodiodes

**G12180 series**

### Current vs. voltage (TE-cooler)

(Typ. Ta=25 °C, thermal resistance of heatsink=3 °C/W)

![Current vs. voltage characteristics of TE-cooler](image)

#### Dimensional outlines (unit: mm)

1. **G12180-003A/-005A/-010A**
   - Window: ϕ2.2 min., ϕ4.7 ± 0.1, 2.6 ± 0.2, 3.7 ± 0.2
   - Photosensitive surface: ϕ0.45
   - Lead: ϕ2.54 ± 0.2

2. **G12180-020A/-030A**
   - Window: ϕ4.5 min., ϕ8.3 ± 0.1, ϕ9.2 ± 0.2, 4.9 ± 0.2
   - Photosensitive surface: ϕ0.45
   - Lead: ϕ5.1 ± 0.3

---

**HAMAMATSU**

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InGaAs PIN photodiodes

**G12180 series**

(3) **G12180-050A**

- **Dimensional outline**
  - \( \phi 0.45 \) Lead
  - \( \phi 0.45 \) Lead
  - \( \phi 7.0 \text{ min.} \) Window
  - \( \phi 1.0 \) Lead
  - \( \phi 7.5 \pm 0.2 \) Index mark
  - \( \phi 1.0 \) Case

(4) **G12180-110A/-120A/-130A/-150A**

- **Dimensional outline**
  - \( \phi 15.3 \pm 0.2 \) Window
  - \( \phi 0.45 \) Lead
  - \( \phi 10 \pm 0.2 \) Window
  - \( 12 \text{ mm.} \) Photosensitive surface
  - \( 5.1 \pm 0.2 \) Photosensitive surface
  - \( 10.2 \pm 0.2 \) Distance from photosensitive area center to cap center

- **Markings**
  - Detector (anode)
  - Detector (cathode)
  - TE-cooler (-)
  - TE-cooler (+)
  - Thermistor

<table>
<thead>
<tr>
<th>G12180-110A</th>
<th>G12180-120A/-130A/-150A</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.3 ± 0.2</td>
</tr>
<tr>
<td></td>
<td>4.4 ± 0.2</td>
</tr>
</tbody>
</table>

Distance from photosensitive area center to cap center:
-0.3 ≤ X ≤ 0.3
-0.3 ≤ Y ≤ 0.3

Hamamatsu Photonics K.K.
InGaAs PIN photodiodes

G12180 series

(5) G12180-210A/-220A/-230A/-250A

- Window: ϕ10 ± 0.2, ϕ14 ± 0.2, ϕ15.3 ± 0.2
- Photosensitive surface:
  - ϕ0.45
- Lead: 10 ± 0.2

Detector (anode)
Detector (cathode)
TE-cooler (-)
TE-cooler (+)
Thermistor

Distance from photosensitive area center to cap center:
-0.3 ≤ X ≤ +0.3
-0.3 ≤ Y ≤ +0.3

<table>
<thead>
<tr>
<th></th>
<th>G12180-210A</th>
<th>G12180-220A</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6.6 ± 0.2</td>
<td>6.7 ± 0.2</td>
</tr>
</tbody>
</table>

K585ACX/3A
InGaAs PIN photodiodes
G12180 series

Recommendation soldering conditions

Solder temperature: 260 °C (10 s or less, once)
Solder the leads at a point at least 1 mm away from the package body.

Note: When you set soldering conditions, check that problems do not occur in the product by testing out the conditions in advance.

Related information

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

Precautions

- Disclaimer
- Safety consideration
- Compound opto-semiconductors (photosensors, light emitters)

Information described in this material is current as of January 2021.
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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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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Recommended soldering conditions

Solder temperature: 260 °C (10 s or less, once)
Solder the leads at a point at least 1 mm away from the package body.

Note: When you set soldering conditions, check that problems do not occur in the product by testing out the conditions in advance.

Related information

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

- Precautions
- Disclaimer
- Safety consideration
- Compound opto-semiconductors (photosensors, light emitters)

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