InAsSb photovoltaic detector

P11120-201

High-speed response and high sensitivity in the 5 μm spectral band
Thermoelectrically cooled infrared detector with no liquid nitrogen required

The P11120-201 is an infrared detector that provides high sensitivity in the 5 μm spectral band due to our unique crystal growth technology. The InAsSb photovoltaic detector has a PN junction that ensures high-speed response and high reliability. Typical applications include gas analysis such as CO₂, SOx, CO and NOx. Unlike the P11120-901 metal dewar type detector, the P11120-201 is easy to use as it uses a compact package (TO-8) not requiring liquid nitrogen.

Features
- High-speed response
- High sensitivity
- High reliability
- Compact, thermoelectrically cooled TO-8 package
- Environment-friendly due to use of InAsSb
- Suitable for detecting infrared rays emitted from QCL

Applications
- Gas analysis
- Radiation thermometers
- Thermal imaging
- Remote sensing
- FTIR
- Spectrophotometry

Options (sold separately)
- Heatsink for two-stage TE-cooled type A3179-01
- Temperature controller C1103-04
- Infrared detector module with preamp C4159-07

Structure

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Window material</td>
<td>Sapphire</td>
<td>-</td>
</tr>
<tr>
<td>Package</td>
<td>TO-8</td>
<td>-</td>
</tr>
<tr>
<td>Cooling</td>
<td>Two-stage TE-cooled</td>
<td>-</td>
</tr>
<tr>
<td>Photosensitive area</td>
<td>1.0 mm</td>
<td>mm</td>
</tr>
</tbody>
</table>

Absolute maximum ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermistor power dissipation</td>
<td>-</td>
<td>0.2</td>
<td>mW</td>
</tr>
<tr>
<td>Reverse voltage</td>
<td>Vr</td>
<td>0.1</td>
<td>V</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Topr</td>
<td>-40 to +60</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Tstg</td>
<td>-55 to +60</td>
<td>°C</td>
</tr>
</tbody>
</table>

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 (Td=-30 °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>Peak sensitivity wavelength</td>
<td>( \lambda_p )</td>
<td>Condition</td>
<td>4.0</td>
<td>4.9</td>
<td>-</td>
<td>( \mu m )</td>
</tr>
<tr>
<td>Cutoff wavelength</td>
<td>( \lambda_c )</td>
<td>( \lambda = \lambda_p )</td>
<td>5.6</td>
<td>5.9</td>
<td>-</td>
<td>( \mu m )</td>
</tr>
<tr>
<td>Photo sensitivity</td>
<td>S ( \lambda = \lambda_p )</td>
<td>( V_R=10 \text{ mV} )</td>
<td>0.8</td>
<td>1.6</td>
<td>-</td>
<td>A/W</td>
</tr>
<tr>
<td>Shunt resistance</td>
<td>Rsh</td>
<td>( V_R=10 \text{ mV} )</td>
<td>10</td>
<td>13</td>
<td>-</td>
<td>( \Omega )</td>
</tr>
<tr>
<td>Detectivity</td>
<td>D* ( \lambda_p, 600, 1 )</td>
<td>( 3.5 \times 10^9 )</td>
<td>( 5.0 \times 10^9 )</td>
<td>-</td>
<td>cm(^{-1})Hz(^{1/2})/W</td>
<td></td>
</tr>
<tr>
<td>Noise equivalent power</td>
<td>NEP ( \lambda = \lambda_p )</td>
<td>-</td>
<td>1.8 \times 10^{-11}</td>
<td>2.5 \times 10^{-11}</td>
<td>W/Hz(^{1/2})</td>
<td></td>
</tr>
<tr>
<td>Rise time</td>
<td>tr ( V_R=0 \text{ V}, R_L=50 \text{ } \Omega )</td>
<td>0 to 63%</td>
<td>-</td>
<td>0.4</td>
<td>-</td>
<td>( \mu s )</td>
</tr>
</tbody>
</table>

### Spectral response (D*)

![Spectral response (D*)](image1)

### Spectral response

![Spectral response](image2)
Dark current vs. reverse voltage

Shunt resistance vs. element temperature

Linearity

(Typ. λ=1.55 μm)

(Typ.)
Specifications of two-stage TE-cooler (Ta=25 °C)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowable current</td>
<td>Ic</td>
<td>-</td>
<td>-</td>
<td>1.0</td>
<td>A</td>
</tr>
<tr>
<td>Allowable voltage</td>
<td>Vc</td>
<td>-</td>
<td>-</td>
<td>0.95</td>
<td>V</td>
</tr>
<tr>
<td>Thermistor resistance</td>
<td>Rth</td>
<td>8.1</td>
<td>9.0</td>
<td>9.9</td>
<td>kΩ</td>
</tr>
<tr>
<td>Thermistor power dissipation</td>
<td>Pth</td>
<td>-</td>
<td>-</td>
<td>0.2</td>
<td>mW</td>
</tr>
</tbody>
</table>

Current vs. voltage of TE-cooled type

![Graph of Current vs. Voltage](image1)

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

Cooling characteristics of TE-cooled type

![Graph of Cooling Characteristics](image2)

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

Thermistor temperature characteristic

![Graph of Thermistor Temperature Characteristic](image3)

(Typ.)

<table>
<thead>
<tr>
<th>Element temperature (°C)</th>
<th>Resistance (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40</td>
<td>$10^5$</td>
</tr>
<tr>
<td>-20</td>
<td>$10^6$</td>
</tr>
<tr>
<td>0</td>
<td>$10^7$</td>
</tr>
<tr>
<td>20</td>
<td>$10^8$</td>
</tr>
</tbody>
</table>
**Measurement circuit example**

![Measurement circuit example diagram](image)

- **Black body 800 K**
- **Chopper 600 Hz**
- **Detector**
- **Band-pass filter**
- **r.m.s. meter**

**Dimensional outline (unit: mm)**

![Dimensional outline diagram](image)

- **Window** ϕ10 ± 0.2
- **Photosensitive surface** ϕ0.45
- **Lead** 5.1 ± 0.2
- **10.2 ± 0.2**
- **5.1 ± 0.2**
- **5.1 ± 0.2**
- **6.9 ± 0.2**
- **10 ± 0.2**
- **10.2 ± 0.2**
- **5.1 ± 0.2**
- **6.3 ± 0.2**

- **Detector (anode)**
- **Detector (cathode)**
- **TE-cooler (-)**
- **TE-cooler (+)**
- **Thermistor**
Related information

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

- Precautions
  - Disclaimer
  - Metal, ceramic, plastic products

- Technical information
  - Infrared detectors