Two-color detector

K12728-010K

Wide spectral response range: 0.32 to 1.7 μm, Compact ceramic package

The K12728-010K is a two-color detector in a compact ceramic package, covering a wide spectral response range. Like the current K1713-09, it incorporates an infrared-transmitting Si photodiode mounted over an InGaAs PIN photodiode, along the same optical axis. It features low noise and low dark current and supports reflow soldering.

Features
- Wide spectral response range
- Compact, low noise, low dark current
- Supports reflow soldering

Applications
- Spectrophotometers
- Radiation thermometers

Structure

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Specification</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Window material</td>
<td>-</td>
<td>-</td>
<td>Borosilicate glass</td>
<td>-</td>
</tr>
<tr>
<td>Package</td>
<td>-</td>
<td>-</td>
<td>Ceramic</td>
<td>-</td>
</tr>
<tr>
<td>Photosensitive area</td>
<td>-</td>
<td>Si</td>
<td>2.4 × 2.4</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>InGaAs</td>
<td>ϕ1.0</td>
<td></td>
</tr>
</tbody>
</table>

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>Reverse voltage</td>
<td>V&lt;sub&gt;R max&lt;/sub&gt;</td>
<td>Si, Ta=25 °C</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>InGaAs, Ta=25 °C</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Topr</td>
<td>No condensation*1</td>
<td>-20 to +70</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Tstg</td>
<td>No condensation*1</td>
<td>-20 to +85</td>
<td>°C</td>
</tr>
</tbody>
</table>

*1: 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.
Two-color detector

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>Si</td>
<td>-</td>
<td>0.32 to 1.1</td>
<td>-</td>
<td>µm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>InGaAs</td>
<td>-</td>
<td>1.1 to 1.7</td>
<td>-</td>
<td>µm</td>
</tr>
<tr>
<td>Peak sensitivity wavelength</td>
<td>λ_p</td>
<td>Si</td>
<td>-</td>
<td>0.96</td>
<td>-</td>
<td>µm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>InGaAs</td>
<td>-</td>
<td>1.55</td>
<td>-</td>
<td>µm</td>
</tr>
<tr>
<td>Photosensitivity</td>
<td>S</td>
<td>Si, λ=λ_p</td>
<td>0.3</td>
<td>0.45</td>
<td>-</td>
<td>A/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>InGaAs, λ=λ_p</td>
<td>0.3</td>
<td>0.55</td>
<td>-</td>
<td>A/W</td>
</tr>
<tr>
<td>Dark current</td>
<td>I_d</td>
<td>Si, V_R=10 mV</td>
<td>-</td>
<td>30</td>
<td>100</td>
<td>pA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>InGaAs, V_R=10 mV</td>
<td>-</td>
<td>80</td>
<td>400</td>
<td>pA</td>
</tr>
<tr>
<td>Cutoff frequency</td>
<td>f_c</td>
<td>Si, -3 dB, V_R=0 V, R_L=50 Ω</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>InGaAs, -3 dB, V_R=0 V, R_L=50 Ω</td>
<td>5</td>
<td>10</td>
<td>-</td>
<td>MHz</td>
</tr>
<tr>
<td>Terminal capacitance</td>
<td>C_t</td>
<td>Si, V_R=0 V, f=10 kHz</td>
<td>-</td>
<td>60</td>
<td>110</td>
<td>pF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>InGaAs, V_R=0 V, f=1 MHz</td>
<td>-</td>
<td>130</td>
<td>200</td>
<td>pF</td>
</tr>
<tr>
<td>Shunt resistance</td>
<td>R_sh</td>
<td>Si, V_R=10 mV</td>
<td>100</td>
<td>300</td>
<td>-</td>
<td>MΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>InGaAs, V_R=10 mV</td>
<td>25</td>
<td>125</td>
<td>-</td>
<td>MΩ</td>
</tr>
<tr>
<td>Detectivity</td>
<td>D*</td>
<td>Si, λ=λ_p</td>
<td>5 × 10^{12}</td>
<td>1.4 × 10^{13}</td>
<td>-</td>
<td>cm·Hz^{1/2}/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>InGaAs, λ=λ_p</td>
<td>5 × 10^{11}</td>
<td>3.5 × 10^{12}</td>
<td>-</td>
<td>cm·Hz^{1/2}/W</td>
</tr>
</tbody>
</table>

Spectral response

(Typ. Ta=25 °C)

Spectral transmittance of window material

(Typ. Ta=25 °C)
**Two-color detector**

### Photosensitivity temperature characteristics

(Typ. $V_R=0$ V)

* Temperature coefficient of sensitivity (%)/°C

![Graph](image1.png)

- InGaAs
- Si

### Dark current vs. reverse voltage

(Typ. $T_a=25$ °C)

* Reverse voltage (V)
* Dark current

![Graph](image2.png)

- InGaAs
- Si

### Terminal capacitance vs. reverse voltage

(Typ. $T_a=25$ °C)

* Reverse voltage (V)
* Terminal capacitance

- InGaAs ($f=1$ MHz)
- Si ($f=10$ kHz)

![Graph](image3.png)

### Shunt resistance vs. element temperature

(Typ. $V_R=10$ mV)

* Element temperature (°C)
* Shunt resistance

- InGaAs
- Si

![Graph](image4.png)
- Dimensional outline (unit: mm)

- Recommended land mark pattern (unit: mm)

- Cathode (Si)
- Anode (Si)
- Cathode (InGaAs)
- Anode (InGaAs)

Center position accuracy of photosensitive area

-0.3 ≤ X ≤ +0.3
-0.3 ≤ Y ≤ +0.3
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 thermal stress applied to the device during reflow soldering varies depending on the circuit board and the reflow oven that is used.

When setting the reflow conditions, verify that the reliability of the device is not compromised by the reflow soldering process.

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

- Precautions
- Disclaimer
- Safety consideration
- Metal, ceramic, plastic package products

Technical information
- Infrared detectors

Information described in this material is current as of January 2018.
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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