Photodiode PR5030

Two Triangular shaped Silicon Junctions on a single Die

PR5030 is a dual silicon photodiode with two separate cathodes and one common anode. Each photodiode has a triangular shape to form an interface along the diagonal of the die. Therefore, the two segments allow to resolve a position of a slit or an edge above. Both types offer a low dark current combined with a high sensitivity. The dies are molded into a small plastic leadless optical DFN package.

FEATURES
• triangular-shaped photodiodes for higher variability
• low dark current
• anti-reflective coating (ARC)

TYPICAL APPLICATIONS
• LASER beam alignment
• position detection
• ambient light detection

KEY CHARACTERISTICS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Typ</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>package size</td>
<td>2.9 x 1.8 x 0.9</td>
<td>mm</td>
</tr>
<tr>
<td>photodiode size</td>
<td>2 x 0.5</td>
<td>mm²</td>
</tr>
<tr>
<td>peak wavelength</td>
<td>830</td>
<td>nm</td>
</tr>
<tr>
<td>dark current @ 40°C / Vr = 1 V</td>
<td>14</td>
<td>pA</td>
</tr>
<tr>
<td>capacitance @ Vr = 2 V</td>
<td>40</td>
<td>pF</td>
</tr>
</tbody>
</table>

CIRCUIT

SPECTRAL SENSITIVITY

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# Photodiode PR5030

## Electrical and optical Characteristics

### ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{\text{C-A}}$</td>
<td>$V(C1, C2) - V(A)$</td>
<td>-0.3</td>
<td>35</td>
<td>V</td>
</tr>
<tr>
<td>$T_{\text{A}}$</td>
<td>operating ambient temperature</td>
<td>-40</td>
<td>85</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{\text{S}}$</td>
<td>storage temperature</td>
<td>-40</td>
<td>85</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{\text{peak}}$</td>
<td>soldering peak temperature</td>
<td></td>
<td>260</td>
<td>°C</td>
</tr>
<tr>
<td>$P_{\text{tot}}$</td>
<td>total power dissipation</td>
<td>100</td>
<td></td>
<td>mW</td>
</tr>
</tbody>
</table>

### ELECTRICAL CHARACTERISTICS

$Ta = 27^\circ \text{C}$

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{\text{amb}}$</td>
<td>operating temperature range</td>
<td>-40</td>
<td>85</td>
<td>°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{r (C-A)}$</td>
<td>reverse voltage $V(C1, C2) - V(A)$</td>
<td></td>
<td>30</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A_{\text{PD}}$</td>
<td>active area (geometrical) $C1 / C2$</td>
<td>0.5</td>
<td></td>
<td>mm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{\text{d}}/A$</td>
<td>dark current $(C1/C2)$</td>
<td>$T_{\text{amb}} = 40^\circ \text{C}$</td>
<td>14</td>
<td></td>
<td>pA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{r (C-A)} = 1 \text{ V}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{r (C-A)} = 30 \text{ V}$</td>
<td>44</td>
<td></td>
<td>pA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$T_{\text{amb}} = 80^\circ \text{C}$</td>
<td></td>
<td>1.7</td>
<td></td>
<td>nA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{r (C-A)} = 1 \text{ V}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{r (C-A)} = 30 \text{ V}$</td>
<td>2.8</td>
<td></td>
<td>nA</td>
<td></td>
</tr>
<tr>
<td>$\Delta I_{\text{d}}/\Delta T$</td>
<td>temperature coefficient of $I_d$</td>
<td>$V_{r (C-A)} = 1 \text{ V}$</td>
<td>12.5</td>
<td></td>
<td>%/K</td>
<td></td>
</tr>
<tr>
<td></td>
<td>@ $T_{\text{amb}} &gt; 40^\circ \text{C}$</td>
<td>$V_{r (C-A)} = 30 \text{ V}$</td>
<td>11.5</td>
<td></td>
<td>%/K</td>
<td></td>
</tr>
<tr>
<td>$\lambda_{\text{peak}}$</td>
<td>peak sensitivity wavelength</td>
<td></td>
<td>830</td>
<td>nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$S_{\text{peak}}$</td>
<td>peak sensitivity</td>
<td></td>
<td>0.5</td>
<td>A/W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$C_{\text{j0}}$</td>
<td>zero-bias junction capacitance</td>
<td>$f = 1 \text{ MHz}$</td>
<td>79</td>
<td></td>
<td>pF</td>
<td></td>
</tr>
</tbody>
</table>
Photodiode PR5030

**MEASUREMENT SETUP**

Dark currents of the C1- and C2-photodiode are measured as a function of reverse voltage and temperature. The substrate (A) is connected to ground, while a positive voltage is applied to Cx. Symmetric photodiodes C1 and C2 result in similar dark currents. The dark current for a single photodiode is shown.

**OVER TEMPERATURE**

Dark currents for one triangular shaped photodiode of the PR5030 are shown that were measured at reverse voltages of 1 V (blue) and 30 V (orange). In general, the dark current rises by a factor of about 10 every 20 °C.

**AS A FUNCTION OF REVERSE VOLTAGE**

The diagram shows the dependency of dark currents on reverse voltage at different temperatures (given in the diagram). Below 30 V the dark currents barely vary with reverse voltage.
Photodiode PR5030

Electrical and optical Characteristics

SENSITIVITY AFFECTED BY REVERSE VOLTAGE

The spectral sensitivity increases by a few percent when reverse voltages are applied to the photodiodes. The diagram shows the relative deviation of the photocurrent to the zero-bias value. The deviation changes insignificantly when illumination is changed. Please notice that the relative deviation increases if the adjacent photodiode is not biased.

The measurement setup was identical to the one used to determine dark currents above.

CAPACITANCE

The diagram illustrates the dependency of the capacitances on the applied reverse voltage of the PR5030. The capacitance of the photodiodes is proportional to area and decrease with reverse voltage due to the reduction of the space-charge region. Taking the area of each photodiode into account leads to a capacitance density of about 158 pF/mm² at zero reverse voltage.
Photodiode PR5030

Application Notes

CHANNEL SEPARATION

A perpendicular crossover of a light beam between photodiodes C1 and C2 is illustrated. Increments of 10 µm were performed using red light with a diameter of 50 µm. The position of 0 µm is related to the center of the metal line between both photodiodes. The photocurrent was measured with zero applied voltage. Considering a gap between the photodiodes of 20 µm, the observed behavior is consistent with a sharp channel separation.

MOVING APERTURE

By shining light on aperture, the passing light can be detected. Due to the geometry of the photodiodes, the position of the aperture can be detected as given in the diagram.

MOVING OBJECT

The location of an object moving above the triangular shaped photodiodes can be detected. According to the position of the edge, at C1 and C2 the following signals are received.
Photodiode PR5030

Dimensions

**PR5030**

![PR5030 Dimensions Diagram]

**ODFN-4L - 1.8 x 2.9 PACKAGE**

![ODFN-4L Package Diagram]

**SOLDERING INFORMATION**

A lead-free solder profile with a peak temperature of 260°C or less, according to J-STD-020 should be followed. Samples shipped without moisture barrier bag must be dry-baked according to JEDEC guidelines before soldering. Manual soldering must be done with utmost care. Direct infrared heating should be avoided; pure convection heating is recommended.

**TAPE & REEL**

Standard form of delivery is on tape and reel. Reel diameter: 7" (178 mm) Quantity per reel: 3,000 Packaging: moisture barrier bag

**BARE DIES**

PR5030 is available as bare dies on request on tested and sawn wafers or in wafflepack. Please contact us for minimum order quantities and delivery times.
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