PIN Silicon Photodiode
OP993, OP999

Features:
- Choice of TO-18 (OP993) or T-1¾ package (OP999)
- Small package style ideal for space-limited applications
- Linear response vs. irradiance
- Fast switching time
- Choice of narrow or wide receiving angle

Description:
Each OP993 and OP999 device consists of a PIN silicon photodiode molded in a dark blue injection molded shell package that provides excellent optical and mechanical axis alignment, optical lens surface, control of chip placement and consistency of the outside package dimensions.

OP993 has a TO-18 package style and a wide receiving angle that provides excellent on-axis coupling. OP999 has a T-1¾ package style and a narrow receiving angle that provides excellent on-axis coupling.

Both devices are 100% production tested for close correlation with OPTEK GaAlAs emitters.

Please refer to Application Bulletins 208 and 210 for additional design information and reliability (degradation) data.

Applications:
- Non-contact reflective object sensor
- Assembly line automation
- Machine automation
- Machine safety
- End of travel sensor
- Door sensor

<table>
<thead>
<tr>
<th>Ordering Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Number</td>
</tr>
<tr>
<td>OP993</td>
</tr>
<tr>
<td>OP999</td>
</tr>
</tbody>
</table>

CONTAINS POLYSULFONE
To avoid stress cracking, we suggest using ND Industries’ Vibra-Tite for thread-locking. Vibra-Tite evaporates fast without causing structural failure in OPTEK’S molded plastics.

General Note
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## PIN Silicon Photodiode

**OP993, OP999**

### Electrical Specifications

**Absolute Maximum Ratings** ($T_A = 25^\circ C$ unless otherwise noted)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse Breakdown Voltage</td>
<td></td>
<td></td>
<td>60 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage &amp; Operating Temperature Range</td>
<td></td>
<td></td>
<td>-40°C to +100°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead Soldering Temperature</td>
<td></td>
<td></td>
<td>260°C</td>
<td></td>
<td>[1/16 inch (1.6 mm) from the case for 5 sec. with soldering iron]</td>
</tr>
<tr>
<td>Reverse Breakdown Voltage</td>
<td></td>
<td></td>
<td>60 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Dissipation</td>
<td></td>
<td></td>
<td>100 mW</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Electrical Characteristics** ($T_A = 25^\circ C$ unless otherwise noted)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_L$</td>
<td>Reverse Light Current</td>
<td></td>
<td></td>
<td>12.5</td>
<td>µA</td>
<td>$V_R = 5 V$, $E_E = 1.7 mW/cm^2$ (3)</td>
</tr>
<tr>
<td>OP993</td>
<td></td>
<td>6.5</td>
<td></td>
<td>28.5</td>
<td></td>
<td>$V_R = 5 V$, $E_E = 0.25 mW/cm^2$ (3)</td>
</tr>
<tr>
<td>OP999</td>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_D$</td>
<td>Reverse Dark Current</td>
<td>1</td>
<td></td>
<td>60 nA</td>
<td></td>
<td>$V_R = 30 V$, $E_E = 0$ (4)</td>
</tr>
<tr>
<td>$V_{BR}$</td>
<td>Reverse Breakdown Voltage</td>
<td>60</td>
<td></td>
<td></td>
<td>V</td>
<td>$I_R = 100 \mu A$</td>
</tr>
<tr>
<td>$V_F$</td>
<td>Forward Voltage</td>
<td>1.2</td>
<td></td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$C_T$</td>
<td>Total Capacitance</td>
<td>4</td>
<td></td>
<td></td>
<td>pF</td>
<td>$V_R = 20 V$, $E_E = 0$, $f = 1.0 MHz$</td>
</tr>
<tr>
<td>$t_R$</td>
<td>Rise Time</td>
<td>5</td>
<td></td>
<td></td>
<td>ns</td>
<td>$V_R = 20 V$, $\lambda = 850$ nm, $R_L = 50 \Omega$</td>
</tr>
<tr>
<td>$t_F$</td>
<td>Fall Time</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. RMA flux is recommended. Duration can be extended to 10 seconds maximum when flow soldering. A maximum of 20 grams force may be applied to leads when soldering.
2. Derate linearly 1.67 mW/°C above 25°C.
3. Light source is an unfiltered GaAlAs emitting diode operating at peak emission wavelength of 890 nm and $E_{APT}$ of 1.7 mW/cm² for OP993 and 0.25 mW/cm² for OP999 average within a 0.25” diameter aperture.
4. This dimension is held to within ±0.005” on the flange edge and may vary up to ±0.020” in the area of the leads.
PIN Silicon Photodiode
OP993, OP999

**Coupling Characteristics OP993 and OP293**

- \( V_R = 5 \text{ V} \)
- \( I_F = 20 \text{ mA} \)

**Light Current vs. Irradiance**

- \( V_R = 5 \text{ V} \)
- \( T_A = 25^\circ \text{ C} \)
- \( \lambda = 890 \text{ nm} \)

**Light Current vs. Angular Displacement**

- Test Conditions:
  - \( \lambda = 935 \text{ nm} \)
  - \( V_R = 5 \text{ V} \)
  - Distance Lens to Lens = 1.5 inches

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OP993, OP999

Coupling Characteristics
OP999 and OP299

Light Current vs. Irradiance

Distance Between Lens Tips - inches

Test Conditions:
λ = 935 nm
VR = 5 V

Normalized Current

θ - Angular Displacement - Deg.