Detector Emitter
C
A
A
Marking area
Top view
Emitter
Detector
C
C

Reflective Optical Sensor with PIN Photodiode Output

Description
The TCND5000 is a reflective sensor that includes an infrared emitter and PIN photodiode in a surface mount package which blocks visible light.

Features
- Package type: Surface mount
- Detector type: PIN Photodiode
- Dimensions: L 6 mm x W 4.3 mm x H 3.75 mm
- Peak operating distance: 6 mm
- Peak operating range: 2 mm to 25 mm
- Typical output current under test: I_{ra} > 0.11 \mu A
- Daylight blocking filter
- High linearity
- Emitter wavelength 940 nm
- Lead (Pb)-free soldering released
- Lead (Pb)-free component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC
- Minimum order quantity 2000 pcs, 2000 pcs/reel

Applications
- Proximity sensor
- Object sensor
- Motion sensor
- Touch key

Absolute Maximum Ratings
\( T_{amb} = 25 \degree C \), unless otherwise specified

Input (Emitter)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test condition</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse Voltage</td>
<td></td>
<td>( V_R )</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>Forward current</td>
<td></td>
<td>( I_F )</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>Peak Forward Current</td>
<td>( t_p = 50 \mu s, T = 2 \text{ ms}, \ T_{amb} = 25 \degree C )</td>
<td>( I_{FM} )</td>
<td>500</td>
<td>mA</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td></td>
<td>( P_V )</td>
<td>190</td>
<td>mW</td>
</tr>
<tr>
<td>Junction Temperature</td>
<td></td>
<td>( T_J )</td>
<td>100</td>
<td>\degree C</td>
</tr>
</tbody>
</table>

Output (Detector)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test condition</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse Voltage</td>
<td></td>
<td>( V_R )</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td></td>
<td>( P_V )</td>
<td>75</td>
<td>mW</td>
</tr>
<tr>
<td>Junction Temperature</td>
<td></td>
<td>( T_J )</td>
<td>100</td>
<td>\degree C</td>
</tr>
</tbody>
</table>
Sensor

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test condition</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature Range</td>
<td>Tamb</td>
<td>T_{amb}</td>
<td>- 40 to + 85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>T_{stg}</td>
<td></td>
<td>- 40 to + 100</td>
<td>°C</td>
</tr>
<tr>
<td>Soldering Temperature</td>
<td>acc. fig. 14</td>
<td>T_{sd}</td>
<td>260</td>
<td>°C</td>
</tr>
</tbody>
</table>

Electrical Characteristics

\( T_{amb} = 25 \degree \text{C}, \) unless otherwise specified

### Input (Emitter)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test condition</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Voltage</td>
<td>( I_F = 20 \text{ mA}, T_p = 20 \text{ ms} )</td>
<td>( V_F )</td>
<td>1.2</td>
<td>1.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Temp. Coefficient of ( V_F )</td>
<td>( I_P = 1 \text{ mA} )</td>
<td>( \Delta V_F )</td>
<td>- 1.3</td>
<td></td>
<td></td>
<td>mV/K</td>
</tr>
<tr>
<td>Reverse Current</td>
<td>( V_R = 5 \text{ V} )</td>
<td>( I_R )</td>
<td>10</td>
<td></td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>Junction Capacitance</td>
<td>( V_R = 0 \text{ V}, f = 1 \text{ MHz}, E = 0 )</td>
<td>( C_J )</td>
<td>25</td>
<td></td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>Radiant Intensity</td>
<td>( I_F = 20 \text{ mA}, T_p = 20 \text{ ms} )</td>
<td>( I_o )</td>
<td>7</td>
<td>75</td>
<td></td>
<td>mW/sr</td>
</tr>
<tr>
<td>Angle of Half Intensity</td>
<td>( \varphi )</td>
<td>( \pm 12 )</td>
<td></td>
<td></td>
<td></td>
<td>deg</td>
</tr>
<tr>
<td>Peak Wavelength</td>
<td>( I_F = 100 \text{ mA} )</td>
<td>( \lambda_p )</td>
<td>930</td>
<td>940</td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>Spectral Bandwidth</td>
<td>( I_F = 100 \text{ mA} )</td>
<td>( \Delta \lambda )</td>
<td>50</td>
<td></td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>Temp. Coefficient of ( \lambda_p )</td>
<td>( I_F = 100 \text{ mA} )</td>
<td>( \Delta \lambda_p )</td>
<td>0.2</td>
<td></td>
<td></td>
<td>nm/K</td>
</tr>
<tr>
<td>Rise Time</td>
<td>( I_F = 100 \text{ mA} )</td>
<td>( t_r )</td>
<td>800</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Fall Time</td>
<td>( I_F = 100 \text{ mA} )</td>
<td>( t_f )</td>
<td>800</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Virtual Source Diameter</td>
<td>Method: 63 % encircled energy</td>
<td>( \varnothing )</td>
<td>1.2</td>
<td></td>
<td></td>
<td>mm</td>
</tr>
</tbody>
</table>

See figures 2 to 8 accordingly.
### Output (Detector)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test condition</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Voltage</td>
<td>$I_F = 50 \text{ mA}$</td>
<td>$V_F$</td>
<td>1.0</td>
<td></td>
<td>1.3</td>
<td>V</td>
</tr>
<tr>
<td>Breakdown Voltage</td>
<td>$I_R = 100 \mu\text{A}$</td>
<td>$V_{BR}$</td>
<td>60</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Reverse Dark Current</td>
<td>$V_R = 10 \text{ V}, E = 0$</td>
<td>$I_{ro}$</td>
<td>1</td>
<td>10</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>Diode capacitance</td>
<td>$V_R = 5 \text{ V}, f = 1 \text{ MHz}, E = 0$</td>
<td>$C_D$</td>
<td>1.8</td>
<td></td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>Reverse Light Current</td>
<td>$E_a = 1 \text{ mW/cm}^2, \lambda = 950 \text{ nm}, V_R = 5 \text{ V}$</td>
<td>$I_{ra}$</td>
<td>12</td>
<td></td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>Temp. Coefficient of $I_{ra}$</td>
<td>$V_R = 5 \text{ V}, \lambda = 870 \text{ nm}$</td>
<td>$T_{Kra}$</td>
<td>0.2</td>
<td></td>
<td></td>
<td>%/K</td>
</tr>
<tr>
<td>Angle of Half Intensity</td>
<td>$\varphi$</td>
<td></td>
<td>± 15</td>
<td></td>
<td></td>
<td>deg</td>
</tr>
<tr>
<td>Wavelength of Peak Sensitivity</td>
<td>$\lambda_p$</td>
<td></td>
<td>930</td>
<td></td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>Range of Spectral Bandwidth</td>
<td>$\lambda_{0.5}$</td>
<td></td>
<td>840</td>
<td>1050</td>
<td></td>
<td>nm</td>
</tr>
</tbody>
</table>

see figures 9 to 12 accordingly

### Sensor

$T_{\text{amb}} = 25 ^\circ \text{C}$, unless otherwise specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test condition</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
</table>
| Reverse Light Current              | $V_R = 2.5 \text{ V}, I_F = 20 \text{ mA}$  
D = 30 mm 
reflective mode: see figure 2 | $I_{ra}$ | 110  |      |      |      | nA   |

---

Figure 2. Test Circuit
Typical Characteristics

$T_{\text{amb}} = 25 \, ^\circ\text{C}$, unless otherwise specified

Figure 3. Forward Current vs. Forward Voltage

Figure 4. Radiant Intensity vs. Forward Current

Figure 5. Relative Radiant Power vs. Wavelength

Figure 6. Relative Radiant Intensity vs. Angular Displacement

Figure 7. Reverse Dark Current vs. Ambient Temperature

Figure 8. Relative Reverse Light Current vs. Ambient Temperature
Figure 9. Reverse Light Current vs. Irradiance

Figure 10. Diode Capacitance vs. Reverse Voltage

Figure 11. Relative Spectral Sensitivity vs. Wavelength

Figure 12. Relative Radiant Sensitivity vs. Angular Displacement

Figure 13. Relative Reverse Light Current vs. Distance
Dimensions in mm
Not indicated tolerances ±0.1

Technical drawings according to DIN specifications

Material of Blister tape: PC black
Sealing of cavities with hot sealing cover tape,
C-Pak Type CP - 2010 AS (Thickness: 0.055 - 0.075mm, Base Material: Polyester)

Drawing-No.: 9700-5281.01-4
Issue: 4, 10.02.05
10222

Quantity per reel: 2000 pcs.
Package Dimensions in mm

Not indicated tolerances ±0.1

Emitter (waterclear)

Detector (black)

0.5

0.5

0.4

1.06±0.1

Marking area

Technical drawings according to EN specifications

Solder pad proposal

Drawing-No.: 6544-5357.01-4
Issue: 2, 09.02.05
19968
Precautions For Use

1. Over-current-proof
Customer must apply resistors for protection, otherwise slight voltage shift will cause big current change (Burn out will happen).

2. Storage
2.1 Storage temperature and rel. humidity conditions are: 5 °C to 30 °C, R.H. 60 %
2.2 Floor life must not exceed 72 h, acc. to JEDEC level 4, J-STD-020.

Once the package is opened, the products should be used within 72 h. Otherwise, they should be kept in a damp proof box with desiccant.

Considering tape life, we suggest to use products within one year from production date.

2.3 If opened more than 72 h in an atmosphere 5 °C to 30 °C, R.H. 60 %, devices should be treated at 60 °C ± 5 °C for 15 hrs.

2.4 If humidity indicator in the package shows pink color (normal blue), then devices should be treated with the same conditions as 2.3

Reflow Solder Profiles

Figure 14. Lead (Pb)-Free Reflow Solder Profile

Figure 15. Lead Tin (SnPb) Reflow Solder Profile
Ozone Depleting Substances Policy Statement

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

We reserve the right to make changes to improve technical design and may do so without further notice.

Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify Vishay Semiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany
Notice

Specifications of the products displayed herein are subject to change without notice. Vishay Intertechnology, Inc., or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Vishay’s terms and conditions of sale for such products, Vishay assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of Vishay products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Vishay for any damages resulting from such improper use or sale.