Reflective Optical Sensor With Transistor Output

DESCRIPTION
The VCNT2020 is a reflective sensor in a miniature SMD package. It has a compact construction where the emitting light source and the detector are arranged in the same plane. The operating infrared wavelength is 940 nm. The detector consists of a silicon phototransistor. The sensor analog output signal (photo current) is triggered by detection of reflected infrared light from a close by object. The sensor has a built in daylight blocking filter, which greatly suppresses disturbing ambient light and therefore increases signal to noise ratio.

FEATURES
- Package type: SMD
- Detector type: phototransistor
- Dimensions (L x W x H in mm): 2.5 x 2 x 0.8
- Operating range within > 20 % relative collector current: 0.2 mm to 2.5 mm
- Emitter wavelength: 940 nm
- Moisture sensitivity level (MSL): 4
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS
- Position sensor
- Optical switch
- Optical encoder (e.g. disc and tape drives for DVD and / or camera applications)
- Object detection (e.g. paper presence in printer and copy machines)

PRODUCT SUMMARY

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>DISTANCE FOR MAXIMUM CTR_{rel} (mm)</th>
<th>DISTANCE RANGE FOR RELATIVE I_{out} &gt; 20 % (mm)</th>
<th>TYPICAL OUTPUT CURRENT UNDER TEST (mA)</th>
<th>DAYLIGHT BLOCKING FILTER INTEGRATED</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCNT2020</td>
<td>0.5</td>
<td>0.2 to 2.5</td>
<td>1.6</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Notes
(1) CTR: current transfer ratio, I_{out}/I_{in}
(2) Conditions like in table basic characteristics/sensors

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>ORDERING CODE</th>
<th>PACKAGING</th>
<th>VOLUME (1)</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCNT2020</td>
<td>Tape and reel</td>
<td>MOQ: 3000 pcs</td>
<td>Drypack, MSL 4</td>
</tr>
</tbody>
</table>

Note
(1) MOQ: minimum order quantity

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>SYMBOL</th>
<th>VALUE</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT (EMITTER)</td>
<td></td>
<td>V_R</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>Reverse voltage</td>
<td></td>
<td>I_F</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>Forward current</td>
<td></td>
<td>t_p ≤ 100 μs</td>
<td>I_SM</td>
<td>500</td>
</tr>
<tr>
<td>Forward surge current</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OUTPUT (DETECTOR)</td>
<td></td>
<td>V_{BRCEO}</td>
<td>20</td>
<td>V</td>
</tr>
<tr>
<td>Collector emitter breakdown voltage</td>
<td></td>
<td>V_{ECO}</td>
<td>7</td>
<td>V</td>
</tr>
<tr>
<td>Collector current</td>
<td></td>
<td>I_C</td>
<td>20</td>
<td>mA</td>
</tr>
<tr>
<td>SENSOR</td>
<td></td>
<td>T_{amb} ≤ 25 °C</td>
<td>P_{tot}</td>
<td>170</td>
</tr>
<tr>
<td>Total power dissipation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td></td>
<td>T_{amb}</td>
<td>-25 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td></td>
<td>T_{tstg}</td>
<td>-25 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Soldering temperature</td>
<td></td>
<td>T_{sd}</td>
<td>260</td>
<td>°C</td>
</tr>
</tbody>
</table>

For technical questions, contact: sensorstechsupport@vishay.com

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### Absolute Maximum Ratings

![Power Dissipation vs. Ambient Temperature](image1)

![Forward Current vs. Ambient Temperature](image2)

#### Basic Characteristics (T<sub>amb</sub> = 25 °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>
<tbody>
<tr>
<td>INPUT (EMITTER)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward voltage</td>
<td></td>
<td>V&lt;sub&gt;F&lt;/sub&gt;</td>
<td>-</td>
<td>1.25</td>
<td>1.4</td>
<td>V</td>
</tr>
<tr>
<td>Temperature coefficient of V&lt;sub&gt;F&lt;/sub&gt;</td>
<td>I&lt;sub&gt;F&lt;/sub&gt; = 20 mA</td>
<td>TKVF</td>
<td>-</td>
<td>-1.0</td>
<td>-</td>
<td>mV/K</td>
</tr>
<tr>
<td>Peak wavelength</td>
<td></td>
<td>λ&lt;sub&gt;P&lt;/sub&gt;</td>
<td>-</td>
<td>940</td>
<td>-</td>
<td>nm</td>
</tr>
<tr>
<td>Reverse current</td>
<td></td>
<td>V&lt;sub&gt;R&lt;/sub&gt; = 5 V</td>
<td>I&lt;sub&gt;R&lt;/sub&gt;</td>
<td>-</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>OUTPUT (DETECTOR)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector emitter breakdown voltage</td>
<td>I&lt;sub&gt;C&lt;/sub&gt; = 0.1 mA, E = 0</td>
<td>V&lt;sub&gt;BRCEO&lt;/sub&gt;</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Emitter collector voltage</td>
<td></td>
<td>V&lt;sub&gt;ECEO&lt;/sub&gt;</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Collector emitter dark current</td>
<td>V&lt;sub&gt;CE&lt;/sub&gt; = 5 V, E = 0</td>
<td>I&lt;sub&gt;CEO&lt;/sub&gt;</td>
<td>-</td>
<td>1</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>SENSOR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector current</td>
<td>V&lt;sub&gt;CE&lt;/sub&gt; = 5 V, I&lt;sub&gt;F&lt;/sub&gt; = 20 mA, d = 1 mm</td>
<td>I&lt;sub&gt;C&lt;/sub&gt;</td>
<td>0.5</td>
<td>1.6</td>
<td>3.5</td>
<td>mA</td>
</tr>
<tr>
<td>Current transfer ratio</td>
<td>I&lt;sub&gt;C&lt;/sub&gt;/I&lt;sub&gt;E&lt;/sub&gt;, d = 1 mm, V&lt;sub&gt;CE&lt;/sub&gt; = 5 V</td>
<td>CTR</td>
<td>-</td>
<td>8</td>
<td>-</td>
<td>%</td>
</tr>
<tr>
<td>Rise time</td>
<td>I&lt;sub&gt;C&lt;/sub&gt; = 0.8 mA, V&lt;sub&gt;CE&lt;/sub&gt; = 5 V, R&lt;sub&gt;L&lt;/sub&gt; = 100 Ω</td>
<td>t&lt;sub&gt;r&lt;/sub&gt;</td>
<td>-</td>
<td>10</td>
<td>70</td>
<td>μs</td>
</tr>
<tr>
<td>Fall time</td>
<td>I&lt;sub&gt;C&lt;/sub&gt; = 0.8 mA, V&lt;sub&gt;CE&lt;/sub&gt; = 5 V, R&lt;sub&gt;L&lt;/sub&gt; = 100 Ω</td>
<td>t&lt;sub&gt;f&lt;/sub&gt;</td>
<td>-</td>
<td>15</td>
<td>70</td>
<td>μs</td>
</tr>
</tbody>
</table>

![Test Circuit](image3)

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BASIC CHARACTERISTICS (T_{amb} = 25 \, ^\circ C, unless otherwise specified)

Fig. 4 - Forward Current vs. Forward Voltage

Fig. 5 - Forward Voltage vs. Ambient Temperature

Fig. 6 - Collector Dark Current vs. Ambient Temperature

Fig. 7 - Collector Current vs. Forward Current

Fig. 8 - Relative Collector Current vs. Ambient Temperature

Fig. 9 - Relative Collector Current vs. Distance
**FLOOR LIFE**

Time between soldering and removing from MBB must not exceed the time indicated in J-STD-020:
- Moisture sensitivity: level 4
- Floor life: 72 h
- Conditions: $T_{amb} < 30 \, ^\circ C$, RH < 60 

**DRYING**

In case of moisture absorption devices should be baked before soldering. Conditions see J-STD-020 or recommended conditions:
- 192 h at 40 \, ^\circ C (+ 5 \, ^\circ C), RH < 5 
- or
- 96 h at 60 \, ^\circ C (+ 5 \, ^\circ C), RH < 5 

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**REFLOW SOLDER PROFILE**

Fig. 10 - Relative Collector Current vs. Displacement

Fig. 11 - Rise / Fall Time vs. Collector Current

Fig. 12 - Lead (Pb)-free Reflow Solder Profile

According to J-STD-020
PACKAGE DIMENSIONS in millimeters

Drawing-No.: 6.550-5338.01-4
Issue: 1; 16.06.2016

Not indicated tolerances ± 0.1
**TAPE AND REEL DIMENSIONS** in millimeters

3000 pcs/reel

![Diagram of tape and reel dimensions]

Non tolerated dimensions ± 0.1 mm

Drawing refers to following Type: VCNT2020
Drawing No.: 9.800-5132.01-4
Issue: 1; 18.01.2018
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