IR Sensor Module for Reflective Sensor, Light Barrier, and Fast Proximity Applications

**FEATURES**
- Up to 2 m for presence and proximity sensing
- Uses modulated bursts of infrared light
- PIN diode and sensor IC in one package
- Low supply current
- Shielding against EMI
- Visible light is suppressed by IR filter
- Insensitive to supply voltage ripple and noise
- Supply voltage: 2.5 V to 5.5 V

**DESCRIPTION**
The TSSP40.. series are compact infrared detector modules for presence and fast proximity sensing applications. They provide an active low output in response to infrared bursts at 940 nm. The frequency of the burst should correspond to the carrier frequency shown in the parts table.

This component has not been qualified according to automotive specifications.

**APPLICATIONS**
- Reflective sensors for hand dryers, towel or soap dispensers, water faucets, toilet flush
- Vending machine fall detection
- Security and pet gates
- Person or object vicinity activation
- Fast proximity sensors for toys, robotics, drones, and other consumer and industrial uses

**PARTS TABLE**

<table>
<thead>
<tr>
<th>Carrier frequency</th>
<th>Package</th>
<th>Pinning</th>
<th>Dimensions (mm)</th>
<th>Mounting</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>38 kHz</td>
<td>TSSP4038</td>
<td>1 = OUT, 2 = GND, 3 = V&lt;sub&gt;S&lt;/sub&gt;</td>
<td>6.0 W x 6.95 H x 5.6 D</td>
<td>Leaded</td>
<td>Presence sensors, fast proximity sensors</td>
</tr>
<tr>
<td>56 kHz</td>
<td>TSSP4056</td>
<td>1 = OUT, 2 = GND, 3 = V&lt;sub&gt;S&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**BLOCK DIAGRAM**

**PRESENCE SENSING**

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### ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>SYMBOL</th>
<th>VALUE</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (pin 3)</td>
<td>VS</td>
<td>-0.3 to +6.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Supply current (pin 3)</td>
<td>IS</td>
<td>5</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Output voltage (pin 1)</td>
<td>VO</td>
<td>-0.3 to 5.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Voltage at output to supply</td>
<td>VS - VO</td>
<td>-0.3 to (VS + 0.3)</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Output current (pin 1)</td>
<td>IO</td>
<td>5</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td>TJ</td>
<td>100</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>Tstg</td>
<td>-25 to +85</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>Tamb</td>
<td>-25 to +85</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>Tot</td>
<td>10</td>
<td>mW</td>
<td></td>
</tr>
</tbody>
</table>

**Note**
- Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect the device reliability.

### ELECTRICAL AND OPTICAL CHARACTERISTICS  (Tamb = 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>Supply current (pin 3)</td>
<td>E_v = 0, V_S = 5 V</td>
<td>ISD</td>
<td>0.55</td>
<td>0.7</td>
<td>0.9</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>E_v = 40 klx, sunlight</td>
<td>ISH</td>
<td>-</td>
<td>0.8</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>V_S</td>
<td></td>
<td>2.5</td>
<td>-</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>Transmission distance</td>
<td>E_v = 0, test signal see fig. 1, IR diode TSAL6200, I_c = 200 mA</td>
<td>d</td>
<td>-</td>
<td>25</td>
<td>-</td>
<td>m</td>
</tr>
<tr>
<td>Output voltage low (pin 1)</td>
<td>I_OSL = 0.5 mA, E_e = 2 mW/m^2, test signal see fig. 1</td>
<td>VOSL</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>mV</td>
</tr>
<tr>
<td>Minimum irradiance</td>
<td>Pulse width tolerance: t_pi - 5/f_0 &lt; t_po &lt; t_pi + 6/f_0, test signal see fig. 1</td>
<td>E_e min.</td>
<td>-</td>
<td>0.4</td>
<td>0.7</td>
<td>mW/m^2</td>
</tr>
<tr>
<td>Maximum irradiance</td>
<td>t_pi - 5/f_0 &lt; t_po &lt; t_pi + 6/f_0, test signal see fig. 1</td>
<td>E_e max.</td>
<td>50</td>
<td>-</td>
<td>-</td>
<td>W/m^2</td>
</tr>
<tr>
<td>Directivity</td>
<td>Angle of half transmission distance</td>
<td>( \phi_{1/2} )</td>
<td>-</td>
<td>± 45</td>
<td>-</td>
<td>deg</td>
</tr>
</tbody>
</table>
TYPICAL CHARACTERISTICS (T_{amb} = 25 \degree C, unless otherwise specified)

**Fig. 1 - Output Active Low**

- Optical Test Signal
  - (IR diode TSAL6200, I_{P} = 0.4 A, 30 pulses, f = f_{0}, t = 10 ms)

- t_{p1} \ast

* t_{p1} \geq 10/f_{0} is recommended for optimal function

**Fig. 2 - Pulse Length and Sensitivity in Dark Ambient**

- t_{p1} \leq 15/f_{0}, t_{p2} = 5/f_{0} \leq t_{p2} + 6/f_{0}

**Fig. 3 - Output Function**

**Fig. 4 - Output Pulse Diagram**

**Fig. 5 - Frequency Dependence of Responsivity**

**Fig. 6 - Sensitivity vs. Ambient Temperature**

- τ_{p1} - Output Pulse Width (ms)
- τ_{p2} - Input Burst Length
- E_{e} - Irradiance (mW/m²)
- λ = 950 nm, optical test signal, Fig. 1

- E_{e min} - Threshold Irradiance (mW/m²)
- f = f_{0} \pm 5 \%
- Δf(3 dB) = f_{0}/10

- E_{o min} - Relative Responsivity
- f = f_{0} \pm 5 \%
- Δf(3 dB) = f_{0}/10

- E_{o} - Irradiance (mW/m²)
- E_{o} - Relative Frequency

- E_{o} - Output Pulse Width (ms)

- E_{o} - Output Signal (see Fig. 4)

- T_{amb} - Ambient Temperature (°C)

- V_{o} - Output Signal
- V_{OH}
- V_{OL}

- V_{O}
- V_{OH}
- V_{OL}

- t_{on}, t_{off} - Output Pulse Width (ms)
- τ_{p1}, τ_{p2} - Input Burst Length
- τ_{p1} \leq 15/f_{0}, τ_{p2} = 5/f_{0} \leq τ_{p2} + 6/f_{0}

- E_{e} - Irradiance (mW/m²)
- λ = 950 nm, optical test signal, Fig. 4

- E_{e} - Output Signal, (see Fig. 4)

- E_{e} - Output Pulse Width (ms)

- E_{e} - Optical Test Signal

- 600 \mu s

- t = 60 ms
The typical application of these devices is a reflective or beam break sensor with active low “detect” or “no detect” information contained in its output. The TSSP4056 is also suitable for fast (~ 5 ms) proximity sensor applications for ranges between 10 cm and 2 m. Please see application note “Vishay’s TSSP4056 Sensor for Fast Proximity Sensing” (www.vishay.com/doc?82741).

Example for a sensor hardware:

There should be no common window in front of the emitter and detector in order to avoid crosstalk via guided light through the window.
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