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
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

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.

MECHANICAL DATA
Pinning:
1 = OUT, 2 = GND, 3 = VS

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>Mold</td>
<td>1 = OUT, 2 = GND, 3 = VS</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>TSSP4038</td>
<td>1 = OUT, 2 = GND, 3 = VS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TSSP4056</td>
<td>1 = OUT, 2 = GND, 3 = VS</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

BLOCK DIAGRAM

PRESENCE SENSING
## 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></td>
<td>$V_S$</td>
<td>-0.3 to +6.0</td>
<td>V</td>
</tr>
<tr>
<td>Supply current (pin 3)</td>
<td></td>
<td>$I_S$</td>
<td>5</td>
<td>mA</td>
</tr>
<tr>
<td>Output voltage (pin 1)</td>
<td></td>
<td>$V_O$</td>
<td>-0.3 to 5.5</td>
<td>V</td>
</tr>
<tr>
<td>Voltage at output to supply</td>
<td>$V_S - V_O$</td>
<td></td>
<td>-0.3 to V$_S + 0.3$</td>
<td>V</td>
</tr>
<tr>
<td>Output current (pin 1)</td>
<td></td>
<td>$I_O$</td>
<td>5</td>
<td>mA</td>
</tr>
<tr>
<td>Junction temperature</td>
<td></td>
<td>$T_J$</td>
<td>100</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td></td>
<td>$T_{stg}$</td>
<td>-25 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td></td>
<td>$T_{amb}$</td>
<td>-25 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Power consumption</td>
<td>$T_{amb} \leq 85$ °C</td>
<td>$P_{tot}$</td>
<td>10</td>
<td>mW</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 (T$_{amb} = 25$ °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>$I_{SD}$</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>$I_{SH}$</td>
<td>-</td>
<td>0.8</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Supply voltage</td>
<td></td>
<td>$V_S$</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, $I_F = 50$ mA</td>
<td>$d$</td>
<td>-</td>
<td>12</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>$V_{OSL}$</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></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>$\varphi_{1/2}$</td>
<td>-</td>
<td>± 45</td>
<td>-</td>
<td>deg</td>
</tr>
</tbody>
</table>
TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

**Fig. 1 - Output Active Low**

- Optical Test Signal (IR diode TSAL6200, \(I_r = 0.4\, \text{A}, 30\) pulses, \(f = f_0, t = 10\, \text{ms}\))
- \(t_{\text{pi}}\) is recommended for optimal function

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

- \(E_e\) - Irradiance (mW/m²)
- \(t_{\text{po}} - \text{Output Pulse Width (ms)}\)

- \(\lambda = 950\, \text{nm},\) optical test signal, Fig. 1

**Fig. 3 - Output Function**

- \(V_O,\) Output Signal, (see Fig. 4)
- \(V_{CH},\) \(V_{CL}\)
- \(t_{\text{on}},\) \(t_{\text{off}}\)

**Fig. 4 - Output Pulse Diagram**

- \(t_{\text{on}},\) \(t_{\text{off}} - \text{Output Pulse Width (ms)}\)
- \(E_e\) - Irradiance (mW/m²)

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

- \(f = f_0 \pm 5\%\)
- \(\Delta f(3\, \text{dB}) = f_0/10\)

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

- \(E_{\text{min.}}\) - Threshold Irradiance (mW/m²)
- \(T_{\text{amb}} - \text{Ambient Temperature (°C)}\)
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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