IR Mid Range Proximity Sensors

FEATURES

• Up to 2 m for proximity sensing
• Uses modulated bursts at 38 kHz
• Photo detector and preamplifier 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

APPLICATIONS

• Object approach detection for activation of displays and user consoles, signaling of alarms, etc.
• Simple gesture controls
• Differentiation of car arrival, static, car departure in parking lots
• Reflective sensors for toilet flush
• Navigational sensor for robotics

MECHANICAL DATA

Pinning
1 = OUT, 2 = GND, 3 = VS

DESCRIPTION

The TSSP4P38 is a compact infrared detector module for proximity sensing applications. It receives 38 kHz modulated signals and has a peak sensitivity of 940 nm. The length of the detector’s output pulse varies in proportion to the amount of light reflected from the object being detected.

PARTS TABLE

<table>
<thead>
<tr>
<th>Carrier frequency</th>
<th>38 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package</td>
<td>Mold</td>
</tr>
<tr>
<td>Pinning</td>
<td>1 = OUT, 2 = GND, 3 = VS</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>6.0 W x 6.95 H x 5.6 D</td>
</tr>
<tr>
<td>Mounting</td>
<td>Leaded</td>
</tr>
<tr>
<td>Application</td>
<td>Proximity sensors</td>
</tr>
</tbody>
</table>

BLOCK DIAGRAM

PROXIMITY SENSING

IR emitter
+ 3 V

Envelope signal
38 kHz
+ 3 V

Out to
μC

IR detector
### 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>Vs</td>
<td>-0.3 to +6 V</td>
<td>V</td>
</tr>
<tr>
<td>Supply current (pin 3)</td>
<td></td>
<td>Is</td>
<td>5 mA</td>
<td></td>
</tr>
<tr>
<td>Output voltage (pin 1)</td>
<td></td>
<td>V0</td>
<td>-0.3 to 5.5 V</td>
<td>V</td>
</tr>
<tr>
<td>Voltage at output to supply</td>
<td></td>
<td>Vs - V0</td>
<td>-0.3 to (Vs + 0.3)</td>
<td>V</td>
</tr>
<tr>
<td>Output current (pin 1)</td>
<td></td>
<td>Io</td>
<td>5 mA</td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td></td>
<td>Tj</td>
<td>100 °C</td>
<td></td>
</tr>
<tr>
<td>Storage temperature range</td>
<td></td>
<td>Tstg</td>
<td>-25 to +85 °C</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td></td>
<td>Tamb</td>
<td>-25 to +85 °C</td>
<td>°C</td>
</tr>
<tr>
<td>Power consumption</td>
<td>Tamb ≤ 85 °C</td>
<td>Ptot</td>
<td>10 mW</td>
<td></td>
</tr>
<tr>
<td>Soldering temperature</td>
<td>t ≤ 10 s, 1 mm from case</td>
<td>Tsad</td>
<td>260 °C</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</td>
<td></td>
<td>Isd</td>
<td>0.55</td>
<td>0.7</td>
<td>0.9</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IsH</td>
<td>-</td>
<td>0.8</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Supply voltage</td>
<td></td>
<td>Vs</td>
<td>2.5</td>
<td>5.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Receiving distance</td>
<td></td>
<td>d</td>
<td>-</td>
<td>24</td>
<td>-</td>
<td>m</td>
</tr>
<tr>
<td>Output voltage low</td>
<td></td>
<td>Vol</td>
<td>-</td>
<td>-</td>
<td>100 mV</td>
<td>mV</td>
</tr>
<tr>
<td>Minimum irradiance</td>
<td></td>
<td>Eeₘᵟᵣₙᵋ</td>
<td>-</td>
<td>0.12</td>
<td>0.25</td>
<td>mW/m²</td>
</tr>
<tr>
<td>Maximum irradiance</td>
<td></td>
<td>Eeₘᵠᵢₓ</td>
<td>50</td>
<td>-</td>
<td>-</td>
<td>W/m²</td>
</tr>
<tr>
<td>Directivity</td>
<td></td>
<td>Ψ₁/₂</td>
<td>-</td>
<td>±45</td>
<td>-</td>
<td>deg</td>
</tr>
</tbody>
</table>

**TYPICAL CHARACTERISTICS (Tamb = 25 °C, unless otherwise specified)**

![Optical Test Signal](image)

*tp₂ ≥ 10/fo is recommended for optimal function

![Output Signal](image)

1) 7/fo < tp₂ < 15/fo
2) tp₂ - 5/fo < tp₂ < tp₂ + 6/fo

![Output Pulse Width](image)

![Pulse Length and Sensitivity in Dark Ambient](image)
Fig. 3 - Frequency Dependence of Responsivity

Fig. 4 - Sensitivity in Bright Ambient

Fig. 5 - Sensitivity vs. Supply Voltage Disturbances

Fig. 6 - Max. Output Pulse Width vs. Irradiance

Fig. 7 - Sensitivity vs. Ambient Temperature

Fig. 8 - Relative Spectral Sensitivity vs. Wavelength
The typical application of the TSSP4P38 is a reflective sensor with analog information contained in its output. The sensor evaluates the time required by the AGC to suppress a quasi continuous signal. The time required to suppress a continuous signal is longer when the signal is strong than when the signal is weak. The result is an output pulse length which corresponds to the distance of an object from the sensor. This kind of analog information can be evaluated by a microcontroller. The absolute amount of reflected light depends on the infrared reflectivity of the object and is not evaluated. Only changes in the amount of reflected light, and therefore changes in the pulse width can be evaluated with accuracy.
Example of a signal pattern:

\[
\text{Optical signal} \quad t_{\text{on}} = 120 \text{ ms}, 38 \text{ kHz} \quad t_{\text{repeat}} = 500 \text{ ms}
\]

Example for a sensor hardware:

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

The logarithmic characteristic of the AGC in the TSSP4P38 results in an almost linear relationship between distance and pulse width. Ambient light has also some impact to the pulse width of this kind of sensor, making the pulse shorter.
PACKAGE DIMENSIONS in millimeters

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16003

Marking area

R 2.5

Not indicated tolerances ± 0.2
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