IR Detector for Mid Range Proximity Sensor

MECHANICAL DATA

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

DESCRIPTION

The TSSP58P38 is a compact infrared detector module for proximity sensing application. 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.

FEATURES

• Up to 2 m for proximity sensing
• Receives 38 kHz modulated signal
• 940 nm peak wavelength
• 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

PARTS TABLE

<table>
<thead>
<tr>
<th>Carrier frequency</th>
<th>38 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package</td>
<td>Minicast</td>
</tr>
<tr>
<td>Pinning</td>
<td>1 = OUT, 2 = GND, 3 = VS</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>5.0 W x 6.95 H x 4.8 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

TSSP58P38
**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>V</td>
<td>-0.3 to +6</td>
<td>V</td>
</tr>
<tr>
<td>Supply current (pin 3)</td>
<td>IS</td>
<td>I</td>
<td>5</td>
<td>mA</td>
</tr>
<tr>
<td>Output voltage (pin 1)</td>
<td>VO</td>
<td>V</td>
<td>-0.3 to 5.5</td>
<td>V</td>
</tr>
<tr>
<td>Voltage at output to supply</td>
<td>VS - VO</td>
<td>V</td>
<td>-0.3 to (VS + 0.3)</td>
<td>V</td>
</tr>
<tr>
<td>Output current (pin 1)</td>
<td>IO</td>
<td>I</td>
<td>5</td>
<td>mA</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>TJ</td>
<td>T</td>
<td>100</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>Tstg</td>
<td>T</td>
<td>-25 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>Tamb</td>
<td>T</td>
<td>-25 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Power consumption</td>
<td>Ptot</td>
<td>P</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** *(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>Ee = 0, VS = 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>Ee = 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>VS</td>
<td>V</td>
<td>2.5</td>
<td>-</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>Receiving distance</td>
<td>d</td>
<td>d</td>
<td>40</td>
<td>-</td>
<td>-</td>
<td>m</td>
</tr>
<tr>
<td>Output voltage low (pin 1)</td>
<td>vsosl</td>
<td>VOSL</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>mV</td>
</tr>
<tr>
<td>Minimum irradiance</td>
<td>Ee min.</td>
<td>Ee_m</td>
<td>0.2</td>
<td>-</td>
<td>0.4</td>
<td>mW/m²</td>
</tr>
<tr>
<td>Maximum irradiance</td>
<td>Ee max.</td>
<td>Ee_m</td>
<td>50</td>
<td>-</td>
<td>-</td>
<td>W/m²</td>
</tr>
<tr>
<td>Directivity</td>
<td>ϕ1/2</td>
<td>ϕ</td>
<td>±45</td>
<td>-</td>
<td>-</td>
<td>deg</td>
</tr>
</tbody>
</table>

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

![Fig. 1 - Output Active Low](image1)

![Fig. 2 - Pulse Length and Sensitivity in Dark Ambient](image2)
**Fig. 3 - Frequency Dependence of Responsivity**

\[
E_{\text{rel}} = \frac{E_{\text{rel}}}{E_{\text{ref}}}
\]

\[
f = f_0 \pm 5\%
\]

\[
\Delta f (3 \text{ dB}) = f_0/10
\]

**Fig. 4 - Sensitivity in Bright Ambient**

\[
E_{\text{thresh}} = \text{Threshold Irradiance (mW/m}^2\text{)}
\]

**Fig. 5 - Sensitivity vs. Supply Voltage Disturbances**

\[
E_{\text{thresh}} = \text{Threshold Irradiance (mW/m}^2\text{)}
\]

**Fig. 6 - Maximum Output Pulse Width vs. Irradiance**

\[
\text{tpo - Output Pulse Width (ms)}
\]

**Fig. 7 - Sensitivity vs. Ambient Temperature**

\[
E_{\text{thresh}} = \text{Threshold Irradiance (mW/m}^2\text{)}
\]

**Fig. 8 - Relative Spectral Sensitivity vs. Wavelength**

\[
S(\lambda_{\text{rel}}) \text{ - Relative Spectral Sensitivity}
\]

Tamb - Ambient Temperature (°C)

Ee - Irradiance (mW/m²)

ΔV_{\text{bias}} - AC Voltage on DC Supply Voltage (mV)

λ - Wavelength (nm)

Correlation with Ambient Light Sources:

- 10 W/m² = 1.4 kLx (Std. illum. A, T = 2855 K)
- 10 W/m² = 8.2 kLx (Daylight, T = 5900 K)

Wavelength of Ambient Illumination: \(\lambda = 950\ \text{nm}\)
The typical application of the TSSP58P38 is a reflective sensor with analog information contained in its output. Such a sensor is evaluating the time required by the AGC to suppress a quasi continuous signal. The time required to suppress such a signal is longer when the signal is strong than when the signal is weak, resulting in a pulse length corresponding 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 much on the environment and is not evaluated. Only sudden changes of the amount of reflected light, and therefore changes in the pulse width, are evaluated using this application.

Example of a signal pattern:

\[ t_{\text{repeat}} = 500 \text{ ms} \]

Optical signal

Response of the TSSP58P38 (strong reflection)

Response of the TSSP58P38 (weak reflection)
Example for a sensor hardware:

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

The logarithmic characteristic of the AGC in the TSSP58P38 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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**Emitter**

TSAL6200

Separation to avoid crosstalk by stray light inside the housing

**IR Receiver**

TSSP58P38

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Marking area

Drawing-No.: 6.550-5263.01-4
Issue: 12; 16.04.10

Not indicated to tolerances ± 0.2

Technical drawings according to DIN specifications

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R 2

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R 2

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R 2

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R 2
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