IR Receiver Module for Light Barrier Systems

**FEATURES**
- Low supply current
- Photo detector and preamplifier in one package
- Internal filter for 38 kHz IR signals
- Shielding against EMI
- Supply voltage: 2.7 V to 5.5 V
- Visible light is suppressed by IR filter
- Insensitive to supply voltage ripple and noise
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

**DESCRIPTION**
The TSOP4038 is a compact IR receiver for sensor applications. It has a high gain for IR signals at 38 kHz. The detection level does not change when ambient light or strong IR signals are applied. It can receive continuous 38 kHz signals or 38 kHz bursts.

**MECHANICAL DATA**
Pinning:
1 = OUT, 2 = GND., 3 = V_S

**PARTS TABLE**

<table>
<thead>
<tr>
<th>CARRIER FREQUENCY</th>
<th>SENSOR APPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>38 kHz</td>
<td>TSOP4038</td>
</tr>
</tbody>
</table>

**BLOCK DIAGRAM**

**APPLICATION CIRCUIT**
The external components R_1 and C_1 are optional to improve the robustness against electrical overstress (typical values are R_1 = 100 Ω, C_1 = 0.1 µF). The output voltage V_O should not be pulled down to a level below 1 V by the external circuit. The capacitive load at the output should be less than 2 nF.

**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>V_S</td>
<td>- 0.3 to + 6.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Supply current (pin 3)</td>
<td>I_S</td>
<td>5</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Output voltage (pin 1)</td>
<td>V_O</td>
<td>- 0.3 to 5.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Voltage at output to supply</td>
<td>V_S - V_O</td>
<td>- 0.3 to (V_S + 0.3)</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Output current (pin 1)</td>
<td>I_O</td>
<td>5</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td>T_J</td>
<td>100</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>T_stg</td>
<td>- 25 to + 85</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>T_amb</td>
<td>- 25 to + 85</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td></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  \((T_{\text{amb}} = 25 \, ^{\circ}\text{C}, \text{unless otherwise specified})\)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply current (pin 3)</td>
<td>(E_v = 0, , V_S = 5 , \text{V})</td>
</tr>
<tr>
<td></td>
<td>(E_v = 40 , \text{kx}, \text{sunlight})</td>
</tr>
<tr>
<td>Supply voltage</td>
<td></td>
</tr>
<tr>
<td>Transmission distance</td>
<td>(E_v = 0, \text{test signal see fig. 1, IR diode TSAL6200, } I_F = 400 , \text{mA})</td>
</tr>
<tr>
<td>Output voltage low (pin 1)</td>
<td>(I_{OSL} = 0.5 , \text{mA, } E_e = 2 , \text{mW/m}^2), test signal see fig. 1</td>
</tr>
<tr>
<td>Minimum irradiance</td>
<td>(t_{\text{pi}} - 5/f_0 &lt; t_{\text{po}} &lt; t_{\text{pi}} + 6/f_0), test signal see fig. 1</td>
</tr>
<tr>
<td>Maximum irradiance</td>
<td>(t_{\text{pi}} - 5/f_0 &lt; t_{\text{po}} &lt; t_{\text{pi}} + 6/f_0), test signal see fig. 1</td>
</tr>
<tr>
<td>Directivity</td>
<td>Angle of half transmission distance</td>
</tr>
</tbody>
</table>

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

**Optical Test Signal**  
(IR diode TSAL6200, \(I_F = 0.4 \, \text{A}, 30 \, \text{pulses, } t = t_{\text{po}}, t = 10 \, \text{ms}\))

\[
\begin{align*}
E_e & \quad \text{Optical Test Signal} \\
V_O & \quad \text{Output Signal} \\
V_{OH} & \quad 1) \, \text{if } t_{\text{pi}} < t_{\text{po}} < 15/t_{\text{po}} \\
V_{OL} & \quad 2) \, \text{if } t_{\text{pi}} - 5/t_{\text{po}} < t_{\text{po}} < t_{\text{pi}} + 6/t_{\text{po}} \\
\end{align*}
\]

Fig. 1 - Output Active Low

**Output Signal**  
(see fig. 4)

\[
\begin{align*}
\lambda &= 950 \, \text{nm, } \text{Optical Test Signal, Fig. 3} \\
\end{align*}
\]

Fig. 3 - Output Function

**Optical Test Signal**  
(see fig. 1)

\[
\begin{align*}
600 \, \mu\text{s} & \quad \text{Output Signal} \\
600 \, \mu\text{s} & \quad t = 60 \, \text{ms} \\
\end{align*}
\]

Fig. 4 - Output Pulse Diagram

**Optical Test Signal**  
(see fig. 1)

\[
\begin{align*}
600 \, \mu\text{s} & \quad \text{Output Signal, (see fig. 4)} \\
94 \, 8134 & \quad t_{\text{on}} \quad t_{\text{off}} \\
\end{align*}
\]

Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

\[
\begin{align*}
\lambda &= 950 \, \text{nm, } \text{Optical Test Signal, Fig. 3} \\
\end{align*}
\]

Fig. 4 - Output Pulse Diagram
Fig. 5 - Frequency Dependence of Responsivity

Fig. 6 - Sensitivity vs. Supply Voltage Disturbances

Fig. 7 - Sensitivity vs. Electric Field Disturbances

Fig. 8 - Sensitivity vs. Ambient Temperature

Fig. 9 - Relative Spectral Sensitivity vs. Wavelength

Fig. 10 - Directivity
Fig. 11 - Sensitivity vs. Supply Voltage

PACKAGE DIMENSIONS in millimeters

Drawing-No.: 6.550-5169.11-4
Issue: 13; 17.12.08

R 2.5

Marking area

technical drawings according to DIN specifications

Not indicated tolerances ± 0.2

VSGND

0.85 max.

2.54nom.

0.7 max.

30.5±0.5

2.54nom.

1.3

4.1

5.6

0.5 max.

6.95

3.9

3.9

6.25

(5.55)

0.85 max.

0.89

2.54nom.

OUT

GND

V9

0.85 max.

6.25

0.85 max.

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(5.55)

0.85 max.

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2.54nom.

OUT

GND

V9

0.85 max.

6.25

0.85 max.
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