IR Receiver Modules for Remote Control Systems

FEATURES

• Very low supply current
• Photo detector and preamplifier in one package
• Internal filter for PCM frequency
• Improved shielding against EMI
• Supply voltage: 2.5 V to 5.5 V
• Improved immunity against ambient light
•Insensitive to supply voltage ripple and noise
• Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

DESCRIPTION

These products are miniaturized receivers for infrared remote control systems. A PIN diode and a preamplifier are assembled on a lead frame, the epoxy package acts as an IR filter. The demodulated output signal can be directly decoded by a microprocessor. The TSOP382.., TSOP392.. are compatible with all common IR remote control data formats. The TSOP384.., TSOP394.. are optimized to suppress almost all spurious pulses from energy saving fluorescent lamps but will also suppress some data signals. This component has not been qualified according to automotive specifications.

PARTS TABLE

<table>
<thead>
<tr>
<th>CARRIER FREQUENCY</th>
<th>STANDARD APPLICATIONS (AGC2)</th>
<th>VERY NOISY ENVIRONMENTS (AGC4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PINNING 1 = OUT, 2 = GND, 3 = VS 1 = OUT, 2 = VS, 3 = GND 1 = OUT, 2 = GND, 3 = VS 1 = OUT, 2 = VS, 3 = GND</td>
<td></td>
</tr>
<tr>
<td>30 kHz</td>
<td>TSOP38230</td>
<td>TSOP39230</td>
</tr>
<tr>
<td>33 kHz</td>
<td>TSOP38233</td>
<td>TSOP39233</td>
</tr>
<tr>
<td>36 kHz</td>
<td>TSOP38236</td>
<td>TSOP39236</td>
</tr>
<tr>
<td>38 kHz</td>
<td>TSOP38238</td>
<td>TSOP39238</td>
</tr>
<tr>
<td>40 kHz</td>
<td>TSOP38240</td>
<td>TSOP39240</td>
</tr>
<tr>
<td>56 kHz</td>
<td>TSOP38256</td>
<td>TSOP39256</td>
</tr>
</tbody>
</table>

** Please see document “Vishay Material Category Policy”: www.vishay.com/doc?99902
Vishay Semiconductors  IR Receiver Modules for Remote Control Systems

**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</td>
<td>V_S</td>
<td>-0.3</td>
<td>+6</td>
<td>V</td>
</tr>
<tr>
<td>Supply current</td>
<td>I_S</td>
<td>3</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Output voltage</td>
<td>V_O</td>
<td>-0.3</td>
<td>(V_S+0.3)</td>
<td>V</td>
</tr>
<tr>
<td>Output current</td>
<td>I_O</td>
<td>5</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>T_J</td>
<td>100</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>T_stg</td>
<td>-25 to</td>
<td>+85</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>T_amb</td>
<td>-25 to</td>
<td>+85</td>
<td>°C</td>
</tr>
<tr>
<td>Power consumption</td>
<td>P_tot</td>
<td>10</td>
<td></td>
<td>mW</td>
</tr>
<tr>
<td>Soldering temperature</td>
<td>T_sd</td>
<td>260</td>
<td></td>
<td>°C</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</td>
<td>E_v = 0, V_S = 3.3 V</td>
<td>I_SD</td>
<td>0.27</td>
<td>0.35</td>
<td>0.45</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>E_v = 40 klx, sunlight</td>
<td>I_SH</td>
<td>0.45</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>V_S</td>
<td>2.5</td>
<td>5.5</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Transmission distance</td>
<td>d</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td>m</td>
</tr>
<tr>
<td>Output voltage low</td>
<td>I_{OSL} = 0.5 mA, E_e = 0.7 mW/m^2, test signal see fig. 1</td>
<td>V_{OSL}</td>
<td>100</td>
<td></td>
<td></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>0.15</td>
<td>0.35</td>
<td></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>30</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>( \pm 45)</td>
<td>deg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)**

![Optical Test Signal](image1)

**Output Active Low**

- \( t_{pi} \geq 10/t_0 \) is recommended for optimal function

![Output Pulse Width](image2)

**Input Burst Length**

- \( \lambda = 950 \text{ nm}, \) Optical Test Signal, Fig.1

- \( t_{pi} = 0.1 \text{ ms} \) to \( t_{po} = 1 \text{ ms} \)

**E_e - Irradiance (mW/m^2)**

- \( E_{e, min.} \) to \( E_{e, max.} \)

- \( 0.1 \text{ to } 1 \text{ W/m}^2 \)

**Fig. 1 - Output Active Low**

**Fig. 2 - Pulse Length and Sensitivity in Dark Ambient**
TSOP382.., TSOP384.., TSOP392.., TSOP394..
IR Receiver Modules for Remote Control Systems
Vishay Semiconductors

Fig. 3 - Output Function

Optical Test Signal

Output Signal, (see fig. 4)

Fig. 4 - Output Pulse Diagram

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: \( \lambda = 950 \text{ nm} \)

Fig. 6 - Sensitivity in Bright Ambient

Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

Wavelength of Ambient Illumination:
\( \lambda = 950 \text{ nm} \)

Fig. 8 - Sensitivity vs. Electric Field Disturbances

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:
\( \lambda = 950 \text{ nm} \)
Fig. 9 - Max. Envelope Duty Cycle vs. Burst Length

Fig. 10 - Sensitivity vs. Ambient Temperature

Fig. 11 - Relative Spectral Sensitivity vs. Wavelength

Fig. 12 - Horizontal Directivity

Fig. 13 - Vertical Directivity

Fig. 14 - Sensitivity vs. Supply Voltage
SUITABLE DATA FORMAT

These products are designed to suppress spurious output pulses due to noise or disturbance signals. Data and disturbance signals can be distinguished by the devices according to carrier frequency, burst length and envelope duty cycle. The data signal should be close to the band-pass center frequency (e.g. 38 kHz) and fulfill the conditions in the table below.

When a data signal is applied to the IR receiver in the presence of a disturbance signal, the sensitivity of the receiver is reduced to insure that no spurious pulses are present at the output. Some examples of disturbance signals which are suppressed are:
- DC light (e.g. from tungsten bulb or sunlight)
- Continuous signals at any frequency
- Strongly or weakly modulated noise from fluorescent lamps with electronic ballasts (see figure 15 or figure 16)

**Note**
- For data formats with short bursts please see the datasheet for TSOP383.., TSOP385.., TSOP393.., TSOP395..
package dimensions in millimeters

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

Marking area

Not indicated to tolerances ± 0.2
Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay’s knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk and agree to fully indemnify and hold Vishay and its distributors harmless from and against any and all claims, liabilities, expenses and damages arising or resulting in connection with such use or sale, including attorneys fees, even if such claim alleges that Vishay or its distributor was negligent regarding the design or manufacture of the part. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.