**IR Receiver Modules for Remote Control Systems**

**DESCRIPTION**

These products are miniaturized IR receiver modules for infrared remote control systems. A PIN diode and a preamplifier are assembled on a leadframe, the epoxy package contains an IR filter. The demodulated output signal can be directly connected to a microprocessor for decoding.

The TSOP384.. series devices are optimized to suppress almost all spurious pulses from energy saving lamps like CFLs. The AGC4 used in the TSOP384.. may suppress some data signals. The TSOP382.. series are provided primarily for compatibility with old AGC2 designs. New designs should prefer the TSOP384.. series containing the newer AGC4.

These components have not been qualified according to automotive specifications.

**FEATURES**

- Very low supply current
- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Supply voltage: 2.5 V to 5.5 V
- Improved immunity against ambient light
- Insensitive to supply voltage ripple and noise

**MECHANICAL DATA**

Pinning for TSOP382.., TSOP384..:

1 = OUT, 2 = GND, 3 = V_S

**ORDERING CODE**

TSOP38... - 1500 pieces in bags

**BLOCK DIAGRAM**

**APPLICATION CIRCUIT**

R_1 and C_1 recommended to reduce supply ripple for V_S < 2.8 V
# PARTS TABLE

<table>
<thead>
<tr>
<th>Carrier frequency</th>
<th>AGC LEGACY, FOR LONG BURST REMOTE CONTROLS (AGC2)</th>
<th>RECOMMENDED FOR LONG BURST CODES (AGC4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 kHz</td>
<td>TSOP38230</td>
<td>TSOP38430</td>
</tr>
<tr>
<td>33 kHz</td>
<td>TSOP38233</td>
<td>TSOP38433</td>
</tr>
<tr>
<td>36 kHz</td>
<td>TSOP38236</td>
<td>TSOP38436 (1)(2)(3)</td>
</tr>
<tr>
<td>38 kHz</td>
<td>TSOP38238</td>
<td>TSOP38438 (4)(5)</td>
</tr>
<tr>
<td>40 kHz</td>
<td>TSOP38240</td>
<td>TSOP38440</td>
</tr>
<tr>
<td>56 kHz</td>
<td>TSOP38256</td>
<td>TSOP38456 (6)(7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Package</th>
<th>Minicast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinning</td>
<td>1 = OUT, 2 = GND, 3 = V&lt;sub&gt;S&lt;/sub&gt;</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>Remote control</td>
</tr>
<tr>
<td>Best choice for</td>
<td>(1) RC-5  (2) RC-6  (3) Panasonic  (4) NEC  (5) Sharp  (6) r-step  (7) Thomson RCA</td>
</tr>
<tr>
<td>Special options</td>
<td>Low voltage option: <a href="http://www.vishay.com/doc?82382">www.vishay.com/doc?82382</a></td>
</tr>
</tbody>
</table>

## 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></td>
<td>V&lt;sub&gt;S&lt;/sub&gt;</td>
<td>-0.3 to +6</td>
<td>V</td>
</tr>
<tr>
<td>Supply current</td>
<td></td>
<td>I&lt;sub&gt;S&lt;/sub&gt;</td>
<td>3</td>
<td>mA</td>
</tr>
<tr>
<td>Output voltage</td>
<td></td>
<td>V&lt;sub&gt;O&lt;/sub&gt;</td>
<td>-0.3 to (V&lt;sub&gt;S&lt;/sub&gt; + 0.3)</td>
<td>V</td>
</tr>
<tr>
<td>Output current</td>
<td></td>
<td>I&lt;sub&gt;O&lt;/sub&gt;</td>
<td>5</td>
<td>mA</td>
</tr>
<tr>
<td>Junction temperature</td>
<td></td>
<td>T&lt;sub&gt;j&lt;/sub&gt;</td>
<td>100</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td></td>
<td>T&lt;sub&gt;stg&lt;/sub&gt;</td>
<td>-25 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td></td>
<td>T&lt;sub&gt;amb&lt;/sub&gt;</td>
<td>-25 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Power consumption</td>
<td>T&lt;sub&gt;amb&lt;/sub&gt; ≤ 85 °C</td>
<td>P&lt;sub&gt;tot&lt;/sub&gt;</td>
<td>10</td>
<td>mW</td>
</tr>
<tr>
<td>Soldering temperature</td>
<td>t ≤ 10 s, 1 mm from case</td>
<td>T&lt;sub&gt;sd&lt;/sub&gt;</td>
<td>260</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<sub>amb</sub> = 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&lt;sub&gt;i&lt;/sub&gt; = 0, V&lt;sub&gt;S&lt;/sub&gt; = 3.3 V</td>
<td>I&lt;sub&gt;SD&lt;/sub&gt;</td>
<td>0.27</td>
<td>0.35</td>
<td>0.45</td>
<td>mA</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>E&lt;sub&gt;i&lt;/sub&gt; = 40 klx, sunlight</td>
<td>I&lt;sub&gt;SH&lt;/sub&gt;</td>
<td>-</td>
<td>0.45</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Transmission distance</td>
<td>V&lt;sub&gt;S&lt;/sub&gt; = 3.3 V</td>
<td>d</td>
<td>-</td>
<td>24</td>
<td>-</td>
<td>m</td>
</tr>
<tr>
<td>Output voltage low</td>
<td>E&lt;sub&gt;i&lt;/sub&gt; = 0.5 mA, E&lt;sub&gt;s&lt;/sub&gt; = 0.7 mW/m&lt;sup&gt;2&lt;/sup&gt;, test signal see Fig. 1</td>
<td>V&lt;sub&gt;OSL&lt;/sub&gt;</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>mV</td>
</tr>
<tr>
<td>Minimum irradiance</td>
<td>Pulse width tolerance: t&lt;sub&gt;pi&lt;/sub&gt; - 5/fo &lt; t&lt;sub&gt;po&lt;/sub&gt; &lt; t&lt;sub&gt;pi&lt;/sub&gt; + 6/fo, test signal see Fig. 1</td>
<td>E&lt;sub&gt;s min&lt;/sub&gt;</td>
<td>-</td>
<td>0.12</td>
<td>0.25</td>
<td>mW/m&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Maximum irradiance</td>
<td>Pulse width tolerance: t&lt;sub&gt;pi&lt;/sub&gt; - 5/fo &lt; t&lt;sub&gt;po&lt;/sub&gt; &lt; t&lt;sub&gt;pi&lt;/sub&gt; + 6/fo, test signal see Fig. 1</td>
<td>E&lt;sub&gt;s max&lt;/sub&gt;</td>
<td>30</td>
<td>-</td>
<td>-</td>
<td>W/m&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Directivity</td>
<td>Angle of half transmission distance</td>
<td>Φ&lt;sub&gt;1/2&lt;/sub&gt;</td>
<td>-</td>
<td>±45</td>
<td>-</td>
<td>°</td>
</tr>
</tbody>
</table>

**Note**

- Transmission distance: E<sub>i</sub> = 0, test signal see Fig. 1, IR diode TSAL6200, I<sub>p</sub> = 50 mA
- Output voltage low: E<sub>i</sub> = 0.5 mA, E<sub>s</sub> = 0.7 mW/m<sup>2</sup>, test signal see Fig. 1
- Minimum irradiance: Pulse width tolerance: t<sub>pi</sub> - 5/fo < t<sub>po</sub> < t<sub>pi</sub> + 6/fo, test signal see Fig. 1
- Maximum irradiance: Pulse width tolerance: t<sub>pi</sub> - 5/fo < t<sub>po</sub> < t<sub>pi</sub> + 6/fo, test signal see Fig. 1
- Directivity: Angle of half transmission distance

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

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

- Optical Test Signal
  - (IR diode TSAL6200, I_p = 0.4 A, 30 pulses, f = f_0, t = 10 ms)
  - 1) \( t_p \leq 15/f_0 \)
  - 2) \( t_o - 5/f_0 < t_p < t_o + 6/f_0 \)

- Output Signal
  - \( V_O \)
  - \( V_{OH} \)
  - \( V_{OL} \)

- Input burst length: 600 µs
- Output pulse width: \( 600 \mu s \)

![Fig. 2 - Pulse Length and Sensitivity in Dark Ambient](image2)

- Output pulse width
  - \( t_o - Output Pulse Width (ms) \)
  - \( E_e - Irradiance (mW/m^2) \)
  - \( \lambda = 950 \text{ nm}, \) optical test signal, Fig. 1

![Fig. 4 - Output Pulse Diagram](image4)

- Output Pulse Diagram
  - \( t_{in} \)
  - \( t_{off} \)
  - \( E_e - Irradiance (mW/m^2) \)

![Fig. 5 - Frequency Dependence of Responsivity](image5)

- Frequency Dependence of Responsivity
  - \( f/f_0 - Relative Frequency \)
  - \( \Delta f(3 \text{ dB}) = f_0/10 \)

![Fig. 3 - Output Function](image3)

- Output Function
  - \( V_O \)
  - \( V_{OH} \)
  - \( V_{OL} \)

![Fig. 6 - Sensitivity in Bright Ambient](image6)

- Sensitivity in Bright Ambient
  - \( E_e_{min} - Threshold Irradiance (mW/m^2) \)
  - \( \lambda = 950 \text{ nm} \)

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: \( \lambda = 950 \text{ nm} \)
Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

Fig. 8 - Max. Envelope Duty Cycle vs. Burst Length

Fig. 9 - Sensitivity vs. Ambient Temperature

Fig. 10 - Relative Spectral Sensitivity vs. Wavelength

Fig. 11 - Horizontal Directivity

Fig. 12 - Vertical Directivity
Fig. 13 - Sensitivity vs. Supply Voltage
SUITABLE DATA FORMAT

This series is designed to suppress spurious output pulses due to noise or disturbance signals. The devices can distinguish data signals from noise due to differences in frequency, burst length, and envelope duty cycle. The data signal should be close to the device’s band-pass center frequency (e.g. 38 kHz) and fulfill the conditions in the table below.

When a data signal is applied to the product in the presence of a disturbance, the sensitivity of the receiver is automatically reduced by the AGC to insure that no spurious pulses are present at the receiver’s output.

Some examples which are suppressed are:
• DC light (e.g. from tungsten bulbs sunlight)
• Continuous signals at any frequency
• Strongly or weakly modulated patterns from fluorescent lamps with electronic ballasts (see Fig. 14 or Fig. 15)

<table>
<thead>
<tr>
<th>Minimum burst length</th>
<th>TSOP382..</th>
<th>TSOP384..</th>
</tr>
</thead>
<tbody>
<tr>
<td>After each burst of length</td>
<td>10 cycles/burst</td>
<td>10 cycles/burst</td>
</tr>
<tr>
<td>a minimum gap time is required of</td>
<td>≥ 10 cycles</td>
<td>≥ 10 cycles</td>
</tr>
<tr>
<td>For bursts greater than</td>
<td>&gt; 4 x burst length</td>
<td>&gt; 10 x burst length</td>
</tr>
<tr>
<td>a minimum gap time in the data stream is needed of</td>
<td>70 cycles</td>
<td>35 cycles</td>
</tr>
<tr>
<td>Maximum number of continuous short bursts/second</td>
<td>1800</td>
<td>1500</td>
</tr>
<tr>
<td>NEC code</td>
<td>Yes</td>
<td>Preferred</td>
</tr>
<tr>
<td>RC5/RC6 code</td>
<td>Yes</td>
<td>Preferred</td>
</tr>
<tr>
<td>Thomson 56 kHz code</td>
<td>Yes</td>
<td>Preferred</td>
</tr>
<tr>
<td>Sharp code</td>
<td>Yes</td>
<td>Preferred</td>
</tr>
<tr>
<td>Suppression of interference from fluorescent lamps</td>
<td>Mild disturbance patterns are suppressed (example: signal pattern of Fig. 14)</td>
<td>Complex and critical disturbance patterns are suppressed (example: signal pattern of Fig. 15 or highly dimmed LCDs)</td>
</tr>
</tbody>
</table>

Notes
• For data formats with short bursts please see the datasheet for TSOP383.., TSOP385..
• For Sony 12, 15, and 20 bit IR codes please see the datasheet of TSOP38S40
PACKAGE DIMENSIONS in millimeters

Drawing-No.: 6.550-5263.01-4
Issue: 12; 16.04.10
19009

Marking area

technical drawings according to DIN specifications

R 2

R 2

0.85 max.
2.54 nom.
0.7 max.
2.54 nom.
30.5 ± 0.5
8.25 ± 0.3
6.95 ± 0.3
(5.55)
8.5 ± 0.2
1.1
0.9
1.2 ± 0.2
0.85 max.
4.8
2.8
0.5 max.

Not indicated to tolerances ± 0.2
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