IR Receiver Modules for Remote Control Systems

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
- Material categorization:
  for definitions of compliance please see www.vishay.com/doc?99912

DESCRIPTION

The TSOP312.., TSOP314..series 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 TSOP314.. series devices are optimized to suppress almost all spurious pulses from energy saving lamps like CFLs. The AGC4 used in the TSOP314.. may suppress some data signals. The TSOP312.. series are provided primarily for compatibility with old AGC2 designs. New designs should prefer the TSOP314.. series containing the newer AGC4.

These components have not been qualified according to automotive specifications.

<table>
<thead>
<tr>
<th>PARTS TABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGC</td>
</tr>
<tr>
<td>Carrier frequency</td>
</tr>
<tr>
<td>30 kHz</td>
</tr>
<tr>
<td>33 kHz</td>
</tr>
<tr>
<td>36 kHz</td>
</tr>
<tr>
<td>38 kHz</td>
</tr>
<tr>
<td>40 kHz</td>
</tr>
<tr>
<td>56 kHz</td>
</tr>
<tr>
<td>Package</td>
</tr>
<tr>
<td>Pinning</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
</tr>
<tr>
<td>Mounting</td>
</tr>
<tr>
<td>Application</td>
</tr>
<tr>
<td>Best remote control code</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 (pin 2)</td>
<td>E_v = 0, V_S = 3.3 V</td>
<td>I_SD</td>
<td>0.27</td>
<td>mA</td>
</tr>
<tr>
<td>Supply current (pin 2)</td>
<td>E_v = 0, V_S = 3.3 V</td>
<td>I_S</td>
<td>0.35</td>
<td>mA</td>
</tr>
<tr>
<td>Output voltage (pin 3)</td>
<td>E_v = 40 klx, sunlight</td>
<td>I_O</td>
<td>0.45</td>
<td>mA</td>
</tr>
<tr>
<td>Output current (pin 3)</td>
<td></td>
<td>V_O</td>
<td>-0.3</td>
<td>V</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</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>T_amb</td>
<td>-25</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>
<tr>
<td>Soldering temperature</td>
<td>t ≤ 10 s, 1 mm from case</td>
<td>T_sd</td>
<td>260</td>
<td>°C</td>
</tr>
</tbody>
</table>

*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 (pin 2)</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>Supply voltage</td>
<td>E_v = 0, V_S = 3.3 V</td>
<td>I_SH</td>
<td>-</td>
<td>0.45</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Transmission distance</td>
<td>IR diode TSAL6200, I_f = 200 mA</td>
<td>d</td>
<td>-</td>
<td>45</td>
<td>-</td>
<td>m</td>
</tr>
<tr>
<td>Output voltage low (pin 3)</td>
<td>I_OSL = 0.5 mA, E_e = 0.7 mW/m², test signal see fig. 1</td>
<td>V_OSL</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>mV</td>
</tr>
<tr>
<td>Minimum irradiance</td>
<td>Pulse width tolerance:</td>
<td>E_e</td>
<td>-</td>
<td>0.12</td>
<td>0.25</td>
<td>mW/m²</td>
</tr>
<tr>
<td>Maximum irradiance</td>
<td>t_p0 - 5/fo &lt; t_p0 &lt; t_p1 + 6/fo, test signal see fig. 1</td>
<td>E_e</td>
<td>-</td>
<td>30</td>
<td>-</td>
<td>W/m²</td>
</tr>
<tr>
<td>Directivity</td>
<td>Angle of half transmission distance</td>
<td>t_p1/2</td>
<td>-</td>
<td>± 45</td>
<td>45</td>
<td>deg</td>
</tr>
</tbody>
</table>

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

![Optical Test Signal](image1)

**Output Signal**

- **V_O**:
  - 1^st pulse: t_p0 < t_p0 < 15/fo
  - 2^nd pulse: t_p0 < 5/fo < t_p0 < t_p1 + 6/fo

![Output Pulse Width](image2)

**Output Pulse Width**

- 20752
- 20512
- 19252
- 17912
- 16612

**Output Pulse Width (ns)**

- **E_e** - Irradiance (mW/m²)
- **λ** = 950 nm, optical test signal, fig. 1

![Pulse Length and Sensitivity in Dark Ambient](image3)
**Fig. 3 - Output Function**

- Optical Test Signal
- $E_e$ - Irradiance (mW/m²)
- $t_{on}$, $t_{off}$ - Output Pulse Width (ms)
- $V_O$, $V_{OH}$, $V_{OL}$

**Fig. 4 - Output Pulse Diagram**

- $E_e$ - Irradiance (mW/m²)
- $t_{on}$, $t_{off}$ - Output Pulse Width (ms)
- $\lambda = 950$ nm, optical test signal, fig. 3

**Fig. 5 - Frequency Dependence of Responsivity**

- $E_{R_{max}}/E_R$ - Relative Responsivity
- $f = f_0 \pm 5\%$
- $\Delta f(3\,\text{dB}) = f_0/10$

**Fig. 6 - Sensitivity in Bright Ambient**

- 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: $\lambda = 950$ nm
- $E_{e\,\text{min.}}$ - Relative Responsivity
- $E_e$ - Ambient DC Irradiance (W/m²)
- $\Delta V_{S_{RMS}}$ - AC Voltage on DC Supply Voltage (mV)

**Fig. 7 - Sensitivity vs. Supply Voltage Disturbances**

- $f = f_0$
- $f = 30$ kHz
- $f = 10$ kHz
- $f = 100$ Hz

**Fig. 8 - Maximum Envelope Duty Cycle vs. Burst Length**

- Max. Envelope Duty Cycle
- $f = 38$ kHz, $E_e = 2$ mW/m²
- Burst Length (number of cycles/burst)
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).

![Fig. 14 - IR Disturbance from Fluorescent Lamp with Low Modulation](image1)

![Fig. 15 - IR Disturbance from Fluorescent Lamp with High Modulation](image2)

<table>
<thead>
<tr>
<th>Minimum burst length</th>
<th>TSOP312..</th>
<th>TSOP314..</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 cycles/burst</td>
<td>10 cycles/burst</td>
<td></td>
</tr>
<tr>
<td>After each burst of length</td>
<td>10 to 70 cycles</td>
<td>10 to 35 cycles</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>70 cycles</td>
<td>35 cycles</td>
</tr>
<tr>
<td>a minimum gap time in the data stream is needed of</td>
<td>&gt; 4 x burst length</td>
<td>&gt; 10 x burst length</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 TSOP311.., TSOP313..
- For SIRCS 15 and 20 bit, Sony 12 bit IR codes, please see the datasheet for TSOP31S40.
PACKAGE DIMENSIONS in millimeters

Center of sensitive area

Area not plane

R 2.75

technical drawings according to DIN specifications

Drawing-No.: 6.550-5095.01-4
Issue: 20; 15.03.10
94 12116

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IR Receiver Modules for Remote Control Systems

Vishay offers stock Cast IR Receivers in three different packages:

- Loose packed in tubes and mounted on tape for reel or ammopack
- Vishay IR receiver with plastic holders are packed in plastic tubes

FEATURES

- Material categorization:
  For definitions of compliance please see www.vishay.com/doc?99912

AVAILABLE FOR

- TSOP312..
- TSOP311..
- TSOP12...
- TSOP11...
- TSOP13...
- TSOP313..
- TSOP314..
- TSOP315..
- TSMP1138

LOOSE PACKED IN TUBE

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>T</th>
<th>S</th>
<th>d</th>
<th>P</th>
<th>d</th>
<th>d</th>
<th>d</th>
<th>d</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2 or 3 digit product series</td>
<td></td>
<td>2 digit frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

O = for IR receiver applications
M = for repeater/learning applications

Note

- d = “digit”, please consult the list of available devices create a valid part number.

EXAMPLE: TSOP1238

PACKAGING QUANTITY

- 50 pieces per tube
- 20 tubes per carton

PACKAGING DIMENSIONS in millimeters

Wall thickness: 0.6

Drawing-No.: 9.700-5377.0-4
Rev. 1; Date: 26.04.2011

Printing for tubes 1.400-5548.0-3 version 1
Cast IR Receiver Packaging Options

TAPE AND REEL/AMMOPACK

Up to 3 consecutive components may be missing if the gap is followed by at least 6 components. A maximum of 0.5 % of the components per reel quantity may be missing. At least 5 empty positions are present at the start and the end of the tape to enable insertion.

Tensile strength of the tape: > 15 N

Pulling force in the plane of the tape, at right angles to the reel: > 5 N

ORDERING INFORMATION

Note
• d = "digit", please consult the list of available devices create a valid part number.

EXAMPLE: TSOP1238SS1BS12
TSOP1238SS1BS12Z

PACKAGING QUANTITY
• 1000 pieces per reel
• 1000 pieces per ammopack
### OUTER PACKAGING

**CARTON BOX DIMENSIONS** in millimeters

<table>
<thead>
<tr>
<th>KINDS OF CARTON BOX</th>
<th>THICKNESS</th>
<th>WIDTH</th>
<th>LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packaging Plastic Tubes</td>
<td>82</td>
<td>152</td>
<td>564</td>
</tr>
<tr>
<td>(Normal/auxiliary devices)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tape and Reel Box</td>
<td>400</td>
<td>310</td>
<td>410</td>
</tr>
<tr>
<td>(Taping in reels)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammo-Box</td>
<td>50</td>
<td>130</td>
<td>350</td>
</tr>
<tr>
<td>(Zigzag taping)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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