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

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 contains an IR filter. The demodulated output signal can be directly connected to a microprocessor for decoding.

The TSOP323.., TSOP343..series devices are optimized to suppress almost all spurious pulses from energy saving lamps like CFLs. AGC3 may also suppress some data signals if continuously transmitted.

The TSOP321.., TSOP341.. series are provided primarily for compatibility with old AGC1 designs. New designs should prefer the TSOP323.., TSOP343.. series containing the newer AGC3. The TSOP325.., TSOP345.. series contain a very robust AGC5. This series should only be used for critically noisy environments.

These components have not been qualified according to automotive specifications.

PARTS TABLE

<table>
<thead>
<tr>
<th>AGC Carrier frequency</th>
<th>LEGACY, FOR SHORT BURST REMOTE CONTROLS (AGC1)</th>
<th>NOISY ENVIRONMENTS AND SHORT BURSTS (AGC3)</th>
<th>VERY NOISY ENVIRONMENTS AND SHORT BURSTS (AGC5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 kHz</td>
<td>TSOP34130  TSOP32130  TSOP34330  TSOP32330</td>
<td>TSOP34530  TSOP32530</td>
<td></td>
</tr>
<tr>
<td>33 kHz</td>
<td>TSOP34133  TSOP32133  TSOP34333  TSOP32333</td>
<td>TSOP34533  TSOP32533</td>
<td></td>
</tr>
<tr>
<td>36 kHz</td>
<td>TSOP34136  TSOP32136  TSOP34336 (1)(6)</td>
<td>TSOP32336 (1)(6)</td>
<td>TSOP34536  TSOP32536</td>
</tr>
<tr>
<td>38 kHz</td>
<td>TSOP34138  TSOP32138  TSOP34338 (2)(3)(4)(5)</td>
<td>TSOP32338 (2)(3)(4)(5)</td>
<td>TSOP34538  TSOP32538</td>
</tr>
<tr>
<td>40 kHz</td>
<td>TSOP34140  TSOP32140  TSOP34340</td>
<td>TSOP32340</td>
<td>TSOP34540  TSOP32540</td>
</tr>
<tr>
<td>56 kHz</td>
<td>TSOP34156  TSOP32156  TSOP34356</td>
<td>TSOP32356</td>
<td>TSOP34556  TSOP32556</td>
</tr>
</tbody>
</table>

Package

Mold

Pinning

1 = OUT, 2 = GND, 3 = VS

Dimensions (mm)

6.0 W x 6.95 H x 5.6 D

Mounting

Leaded

Application

Remote control

Best choice for

(1) MCIR  (2) Mitsubishi  (3) RECS-80 Code  (4) r-map  (5) XMP-1, XMP-2  (6) RCMM
**BLOCK DIAGRAM**

![Block Diagram](image)

**APPLICATION CIRCUIT**

![Application Circuit](image)

**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 to +6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Supply current</td>
<td>I_S</td>
<td>3</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Output voltage</td>
<td>V_O</td>
<td>-0.3 to (V_S + 0.3)</td>
<td>V</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>Power consumption</td>
<td>T_amb ≤ 85 °C</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>

**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 = 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>-</td>
<td>0.45</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>V_S</td>
<td>2.5</td>
<td>-</td>
<td>5.5</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Transmission distance</td>
<td>E_V = 0, test signal see Fig. 1, IR diode TSAL6200, I_F = 50 mA</td>
<td>d</td>
<td>-</td>
<td>30</td>
<td>-</td>
<td>m</td>
</tr>
<tr>
<td>Output voltage low</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>E_e min.</td>
<td>-</td>
<td>-</td>
<td>0.08</td>
<td>0.15</td>
<td>mW/m²</td>
</tr>
<tr>
<td>Maximum irradiance</td>
<td>E_e max.</td>
<td>30</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>W/m²</td>
</tr>
<tr>
<td>Directivity</td>
<td>Φ₁/₂</td>
<td>-</td>
<td>± 45</td>
<td>-</td>
<td>-</td>
<td>°</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.
TYPICAL CHARACTERISTICS (T_{amb} = 25 \, ^\circ\text{C}, \text{unless otherwise specified})

- **Optical Test Signal**
  - (IR diode TSAL6200, I_p = 0.4 A, N = 6 pulses, t = t_p, t = 10 ms)
  - t_p > 6/f_0 is recommended for optimal function

- **Output Signal**
  - V_O
  - V_{OH}
  - V_{OL}

- **Fig. 1 - Output Active Low**

- **Fig. 2 - Pulse Length and Sensitivity in Dark Ambient**

- **Fig. 3 - Output Function**

- **Fig. 4 - Output Pulse Diagram**

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

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

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Correlation with ambient light sources:
- 10 W/m² = 1.4 klx (std. illum. A, T = 2655 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 - Maximum 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 - 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. 13 or Fig. 14).

<table>
<thead>
<tr>
<th>Minimum burst length</th>
<th>TSOP341.., TSOP321..</th>
<th>TSOP343.., TSOP323..</th>
<th>TSOP345.., TSOP325..</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6 cycles/burst</td>
<td>6 cycles/burst</td>
<td>6 cycles/burst</td>
</tr>
<tr>
<td>After each burst of length</td>
<td>6 to 70 cycles</td>
<td>6 to 35 cycles</td>
<td>6 to 24 cycles</td>
</tr>
<tr>
<td>A gap time is required of</td>
<td>≥ 10 cycles</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>
<td>24 cycles</td>
</tr>
<tr>
<td>a minimum gap time in the</td>
<td>&gt; 1.2 x burst length</td>
<td>&gt; 6 x burst length</td>
<td>&gt; 25 ms</td>
</tr>
<tr>
<td>data stream is needed of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum number of continuous</td>
<td>2000</td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td>short bursts/second</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCIR code</td>
<td>Yes</td>
<td>Preferred</td>
<td>Yes</td>
</tr>
<tr>
<td>RCMM code</td>
<td>Yes</td>
<td>Preferred</td>
<td>Yes</td>
</tr>
<tr>
<td>XMP-1, XMP-2 code</td>
<td>Yes</td>
<td>Preferred</td>
<td>Yes</td>
</tr>
<tr>
<td>Suppression of interference</td>
<td>Mild disturbance patterns are suppressed (example: signal pattern of Fig. 13)</td>
<td>Complex disturbance patterns are suppressed (example: signal pattern of Fig. 14)</td>
<td>Critical disturbance patterns are suppressed, e.g. highly dimmed LCDs</td>
</tr>
</tbody>
</table>

Notes

- For data formats with long bursts (more than 10 carrier cycles) please see the datasheet for TSOP348.., TSOP344.., TSOP322.., TSOP324..
PACKAGE DIMENSIONS in millimeters

Drawing-No.: 6.550-5169.01-4
Issue: 9 03.11.10
13655

30.5 ± 0.5
8.25
6.95
(5.55)
5.3
6
0.85 max.
0.89
0.7 max.
2.54 nom.
2.54 nom.

5.6
4.1
1.3
0.5 max.

R 2.5
marking area

Not indicated tolerances ± 0.2

technical drawings according to DIN specifications

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