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</th>
<th>30 kHz</th>
<th>33 kHz</th>
<th>36 kHz</th>
<th>38 kHz</th>
<th>40 kHz</th>
<th>56 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier frequency</td>
<td>TSOP34130</td>
<td>TSOP34133</td>
<td>TSOP34136</td>
<td>TSOP34138</td>
<td>TSOP34140</td>
<td>TSOP34156</td>
</tr>
<tr>
<td></td>
<td>TSOP32130</td>
<td>TSOP32133</td>
<td>TSOP32136</td>
<td>TSOP32138</td>
<td>TSOP32140</td>
<td>TSOP32156</td>
</tr>
<tr>
<td></td>
<td>TSOP34330</td>
<td>TSOP34333</td>
<td>TSOP34336 [1][8]</td>
<td>TSOP34338 [2][3][4][5]</td>
<td>TSOP34340</td>
<td>TSOP34356</td>
</tr>
<tr>
<td></td>
<td>TSOP32330</td>
<td>TSOP32333</td>
<td>TSOP32336 [1][8]</td>
<td>TSOP32338 [2][3][4][5]</td>
<td>TSOP32340</td>
<td>TSOP32356</td>
</tr>
<tr>
<td></td>
<td>TSOP34530</td>
<td>TSOP34533</td>
<td>TSOP34536</td>
<td>TSOP34538</td>
<td>TSOP34540</td>
<td>TSOP34556</td>
</tr>
<tr>
<td></td>
<td>TSOP32530</td>
<td>TSOP32533</td>
<td>TSOP32536</td>
<td>TSOP32538</td>
<td>TSOP32540</td>
<td>TSOP32556</td>
</tr>
</tbody>
</table>

**Package**
- Mold

<table>
<thead>
<tr>
<th>Pinning</th>
<th>1 = OUT, 2 = GND, 3 = VS</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0 W x 6.95 H x 5.6 D</td>
<td></td>
</tr>
</tbody>
</table>

**Application**
- Remote control

**Best choice for**
- [1] MCIR
- [4] r-map
- [6] RCMM

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**Document Information**
Rev. 1.7, 24-Sep-2018
Document Number: 82490
**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>VS</td>
<td></td>
<td>-0.3 to +6</td>
<td>V</td>
</tr>
<tr>
<td>Supply current</td>
<td>IS</td>
<td></td>
<td>3</td>
<td>mA</td>
</tr>
<tr>
<td>Output voltage</td>
<td>VO</td>
<td></td>
<td>-0.3 to (VS + 0.3)</td>
<td>V</td>
</tr>
<tr>
<td>Output current</td>
<td>IO</td>
<td></td>
<td>5</td>
<td>mA</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>TJ</td>
<td></td>
<td>100</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Tstg</td>
<td></td>
<td>-25 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Tamb</td>
<td></td>
<td>-25 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Power consumption</td>
<td>Tamb ≤ 85 °C</td>
<td>Ptot</td>
<td>10</td>
<td>mW</td>
</tr>
<tr>
<td>Soldering temperature</td>
<td></td>
<td>Tsd</td>
<td>260</td>
<td>°C</td>
</tr>
</tbody>
</table>

**ELECTRICAL AND OPTICAL CHARACTERISTICS** *(Tamb = 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, VS = 3.3 V</td>
<td>ISD</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>ISh</td>
<td>-</td>
<td>0.45</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>VS</td>
<td></td>
<td>2.5</td>
<td>-</td>
<td>5.5</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>IosL = 0.5 mA, E_o = 0.7 mW/m², test signal see Fig. 1</td>
<td>VosL</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>mV</td>
</tr>
<tr>
<td>Minimum irradiance</td>
<td>Pulse width tolerance: t_{pi} - 5/fo &lt; t_{po} &lt; t_{pi} + 6/fo, test signal see Fig. 1</td>
<td>E_o,min.</td>
<td>-</td>
<td>0.08</td>
<td>0.15</td>
<td>mW/m²</td>
</tr>
<tr>
<td>Maximum irradiance</td>
<td>t_{pi} - 5/fo &lt; t_{po} &lt; t_{pi} + 6/fo, test signal see Fig. 1</td>
<td>E_o,max.</td>
<td>30</td>
<td>-</td>
<td>-</td>
<td>W/m²</td>
</tr>
<tr>
<td>Directivity</td>
<td>Angle of half transmission distance</td>
<td>(\phi_{1/2})</td>
<td>-</td>
<td>± 45</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_{\text{amb}} = 25 \degree \text{C}, \text{unless otherwise specified})

Fig. 1 - Output Active Low

Optical Test Signal
(IR diode TSAL6200, I_{F} = 0.4 A, N = 6 pulses, t = t_{O}, t = 10 ms)

\(^{\ast}) t_{O} > 6/f_{0} \text{ is recommended for optimal function}

Output Signal

\(E_{e}\)
\(V_{O}\)
\(V_{OH}\)
\(V_{OL}\)

\(^{1)} 3/f_{0} < t_{O} < 8/f_{0}\)
\(^{2)} I_{F} < 4/f_{0} < I_{F} < 6/f_{0}

\(t_{0}\)
\(t_{p} = t_{0}\)

Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

Output pulse width

Input burst length

\(\lambda = 950 \text{ nm}, \text{optical test signal, Fig. 1}\)

\(E_{e} - \text{Irradiance (mW/m}^{2}\\)

\(0.1\)
\(1\)
\(10\)
\(100\)
\(1000\)
\(10,000\)

\(0.05\)
\(0.10\)
\(0.15\)
\(0.20\)
\(0.25\)
\(0.30\)
\(0.35\)
\(0.40\)

\(t = 60 \text{ ms}\)

Fig. 3 - Output Function

Optical Test Signal

Output Signal

(see Fig. 4)

\(600 \mu\text{s}\)

\(t_{on}\)
\(t_{off}\)

Fig. 4 - Output Pulse Diagram

Output Pulse Width (ms)

\(\lambda = 950 \text{ nm}, \text{optical test signal, Fig. 3}\)

\(E_{e} - \text{Irradiance (mW/m}^{2}\\)

\(0.1\)
\(1\)
\(10\)
\(100\)
\(1000\)
\(10,000\)

\(0.05\)
\(0.10\)
\(0.15\)
\(0.20\)
\(0.25\)
\(0.30\)
\(0.35\)
\(0.40\)

\(f = f_{0} \pm 5 \%
\(\Delta(3\text{ dB}) = f_{0}/10\)

Fig. 5 - Frequency Dependence of Responsivity

Correlation with ambient light sources:

- 10 W/m\(^2\) = 1.4 klx (std. illum. A, T = 2855 K)
- 10 W/m\(^2\) = 8.2 klx (daylight, T = 5900 K)

Wavelength of ambient illumination: \(\lambda = 950 \text{ nm}\)

\(E_{e \text{min.}} - \text{Threshold Irradiance (mW/m}\^{2}\\)

\(0.1\)
\(1\)
\(10\)
\(100\)

\(0.01\)
\(0.1\)
\(1\)
\(10\)
\(100\)

\(0.5\)
\(1.0\)
\(1.5\)
\(2.0\)
\(2.5\)
\(3.0\)
\(3.5\)
\(4.0\)

\(E_{e} - \text{Irradiance (mW/m}^{2}\\)

\(0.01\)
\(0.1\)
\(1\)
\(10\)
\(100\)

\(0.05\)
\(0.10\)
\(0.15\)
\(0.20\)
\(0.25\)
\(0.30\)
\(0.35\)
\(0.40\)

Fig. 6 - Sensitivity in Bright Ambient

Correlation with ambient light sources:

- 10 W/m\(^2\) = 1.4 klx (std. illum. A, T = 2855 K)
- 10 W/m\(^2\) = 8.2 klx (daylight, T = 5900 K)

Wavelength of ambient illumination: \(\lambda = 950 \text{ nm}\)
**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>6 cycles/burst</td>
<td>6 cycles/burst</td>
<td>6 cycles/burst</td>
<td></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 a minimum gap time in the data stream is needed of</td>
<td>70 cycles</td>
<td>35 cycles</td>
<td>24 cycles</td>
</tr>
<tr>
<td>&gt; 1.2 x burst length</td>
<td>&gt; 6 x burst length</td>
<td>&gt; 25 ms</td>
<td></td>
</tr>
<tr>
<td>Maximum number of continuous short bursts/second</td>
<td>2000</td>
<td>2000</td>
<td>2000</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 from fluorescent lamps</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

Not indicated tolerances ± 0.2

technical drawings according to DIN specifications

marking area

R 2.5
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