IR Receiver Modules for Remote Control Systems

DESCRIPTION
This IR receiver series is optimized for short burst remote control systems in different environments. The customer can choose between different IC settings (AGC variants), to find the optimum solution for his application. The higher the AGC, the better noise is suppressed, but the lower the code compatibility.

The devices contain a PIN diode and a preamplifier 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. These components have not been qualified to automotive specifications.

FEATURES
• Individual IC settings to reach maximum performance
• Immunity against noise (lamps, LCD TV, Wi-Fi)
• Low supply current
• Photo detector and preamplifier in one package
• Supply voltage: 2.0 V to 5.5 V
• Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS
• Infrared remote control systems

DESIGN SUPPORT TOOLS
• 3D models
• Window size calculator

BLOCK DIAGRAM

![Block Diagram of IR Receiver Modules for Remote Control Systems](image-url)
MECHANICAL DATA
1 = OUT, 2 = GND, 3 = $V_S$

ORDERING CODE
TSOP18... - 1500 pieces in bags

APPLICATION CIRCUIT

R₁ and C₁ recommended in case there are strong ripple or spikes on the supply line.

PARTS TABLE

<table>
<thead>
<tr>
<th>AGC</th>
<th>BASIC NOISE SUPPRESSION (AGC1)</th>
<th>ENHANCED NOISE SUPPRESSION (AGC3)</th>
<th>MAXIMIZED NOISE SUPPRESSION (AGC5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier frequency</td>
<td>30 kHz</td>
<td>TSOP18130</td>
<td>TSOP18330</td>
</tr>
<tr>
<td></td>
<td>33 kHz</td>
<td>TSOP18133</td>
<td>TSOP18333</td>
</tr>
<tr>
<td></td>
<td>36 kHz</td>
<td>TSOP18136</td>
<td>TSOP18336 (1)(5)</td>
</tr>
<tr>
<td></td>
<td>38 kHz</td>
<td>TSOP18138</td>
<td>TSOP18338 (2)(4)</td>
</tr>
<tr>
<td></td>
<td>40 kHz</td>
<td>TSOP18140</td>
<td>TSOP18340</td>
</tr>
<tr>
<td></td>
<td>56 kHz</td>
<td>TSOP18156</td>
<td>TSOP18356 (3)</td>
</tr>
</tbody>
</table>

Package
Minicast

Pinning
1 = OUT, 2 = GND, 3 = $V_S$

Dimensions (mm)
5.0 W x 6.95 H x 4.8 D

Mounting
Leaded

Application
Remote control

Best choice for
(1) RCMM (2) RECS-80 Code (3) r-map (4) XMP (5) MCIR

Note
• 30 kHz and 33 kHz only available on written request

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>Output current</td>
<td>$I_O$</td>
<td>5</td>
<td>mA</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>Operating temperature range</td>
<td>$T_{amb}$</td>
<td>-25 to +85</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>$P_{tot}$</td>
<td>10</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>Soldering temperature</td>
<td>$T_{sd}$</td>
<td>260</td>
<td>°C</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.
### Electrical and Optical Characteristics

<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>0.25</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></td>
<td>( V_S )</td>
<td>2.0</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>26</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>Test signal: RC5 code</td>
<td>( E_{e_min} )</td>
<td>-</td>
<td>0.1</td>
<td>0.2</td>
<td>mW/m²</td>
</tr>
<tr>
<td></td>
<td>Test signal: XMP code</td>
<td>( E_{e_min} )</td>
<td>-</td>
<td>0.15</td>
<td>0.3</td>
<td>mW/m²</td>
</tr>
<tr>
<td>Maximum irradiance</td>
<td>( t_{pi} - 3.0/f_0 &lt; t_{po} &lt; t_{pi} + 3.5/f_0 ), test signal see Fig. 1</td>
<td>( E_e )</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>

### Typical Characteristics

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

**Output Delay and Pulse-Width**

- Optical Test Signal
  - IR diode TSAL6200, \( N = 6 \) pulses, \( f = f_o \), \( T = 10 \) ms
  - \( t_{on} \geq 6/f_o \)

**Output Signal**

- \( V_O \)
- \( V_{OH} \)
- \( V_{OL} \)
- \( t_{on} = 3.0/f_0 < t_{po} < t_{on} + 3.5/f_0 \)

**Output Pulse Width**

- \( \lambda = 950 \) nm, optical test signal, Fig. 1

**Optical Test Signal**

- \( 600 \) µs
- \( t = 60 \) ms

**Output Signal, (see Fig. 4)**

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

**Pulse-Width vs. Irradiance in Dark Ambient**

- \( \lambda = 950 \) nm, optical test signal, Fig. 3
**Fig. 5 - Frequency Dependence of Responsivity**

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

**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**

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

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**Maximum Envelope Duty Cycle**

- \( f = f_0 \pm 5\% \)
- \( f = f_0/7 \) (AGC1)
- \( f = f_0/10 \) (AGC3, AGC5)

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**S(\( \lambda \))_{rel.} - Relative Spectral Sensitivity**

- \( \lambda \) - Wavelength (nm)

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**Ee_{min.} - Threshold Irradiance (mW/m²)**

- 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)

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**Ee - Ambient DC Irradiance (W/m²)**

**Tamb - Ambient Temperature (°C)**

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**\( \Delta V_{rms} \) - AC Voltage on DC Supply Voltage (mV)**

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**TSOP181.., TSOP183.., TSOP185..**

Vishay Semiconductors

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**Datasheet Values Refer to PCN-OPT-1288-2023**

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**Rev. 1.8, 08-Aug-2023**

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Fig. 11 - Horizontal and Vertical 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)
- 2.4 GHz and 5 GHz Wi-Fi

<table>
<thead>
<tr>
<th>Minimum burst length</th>
<th>TSOP181..</th>
<th>TSOP183..</th>
<th>TSOP185..</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 68 cycles</td>
<td>6 to 36 cycles</td>
<td>6 to 19 cycles</td>
</tr>
<tr>
<td>A gap time is required of</td>
<td>≥ 7 cycles</td>
<td>≥ 8 cycles</td>
<td>≥ 8 cycles</td>
</tr>
<tr>
<td>For bursts greater than a minimum gap time in the data stream is needed of</td>
<td>68 cycles</td>
<td>36 cycles</td>
<td>19 cycles</td>
</tr>
<tr>
<td>Maximum number of continuous short bursts/second</td>
<td>2100</td>
<td>2100</td>
<td>2100</td>
</tr>
<tr>
<td>RCMM code</td>
<td>Yes</td>
<td>Preferred</td>
<td>Yes</td>
</tr>
<tr>
<td>XMP-1 code</td>
<td>Yes</td>
<td>Preferred</td>
<td>Yes</td>
</tr>
<tr>
<td>r-map code</td>
<td>Yes</td>
<td>Preferred</td>
<td>Yes</td>
</tr>
<tr>
<td>Suppression of interference from fluorescent lamps</td>
<td>Fig. 13</td>
<td>Fig. 13 and Fig. 14</td>
<td>Fig. 13 and Fig. 14</td>
</tr>
</tbody>
</table>

Note

- For data formats with long bursts (more than 10 carrier cycles) please see the datasheet for TSOP182.., TSOP184.., TSOP186..
PACKAGE DIMENSIONS in millimeters

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

Marking area

Not indicated tolerances ± 0.2

Technical drawings according to DIN specifications

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