Photo Modules for PCM Remote Control Systems

Available types for different carrier frequencies

<table>
<thead>
<tr>
<th>Type</th>
<th>fo</th>
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<th>fo</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSOP1730</td>
<td>30 kHz</td>
<td>TSOP1733</td>
<td>33 kHz</td>
</tr>
<tr>
<td>TSOP1736</td>
<td>36 kHz</td>
<td>TSOP1737</td>
<td>36.7 kHz</td>
</tr>
<tr>
<td>TSOP1738</td>
<td>38 kHz</td>
<td>TSOP1740</td>
<td>40 kHz</td>
</tr>
<tr>
<td>TSOP1756</td>
<td>56 kHz</td>
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</table>

Description
The TSOP17.. – series are miniaturized receivers for infrared remote control systems. PIN diode and preamplifier are assembled on lead frame, the epoxy package is designed as IR filter.
The demodulated output signal can directly be decoded by a microprocessor. TSOP17.. is the standard IR remote control receiver series, supporting all major transmission codes.

Features
- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Improved shielding against electrical field disturbance
- TTL and CMOS compatibility
- Output active low
- Low power consumption
- High immunity against ambient light
- Continuous data transmission possible (up to 2400 bps)
- Suitable burst length ≥10 cycles/burst

Block Diagram
Absolute Maximum Ratings

$T_{\text{amb}} = 25^\circ \text{C}$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>(Pin 2)</td>
<td>$V_S$</td>
<td>$-0.3...6.0$</td>
<td>V</td>
</tr>
<tr>
<td>Supply Current</td>
<td>(Pin 2)</td>
<td>$I_S$</td>
<td>5</td>
<td>mA</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>(Pin 3)</td>
<td>$V_O$</td>
<td>$-0.3...6.0$</td>
<td>V</td>
</tr>
<tr>
<td>Output Current</td>
<td>(Pin 3)</td>
<td>$I_O$</td>
<td>5</td>
<td>mA</td>
</tr>
<tr>
<td>Junction Temperature</td>
<td></td>
<td>$T_J$</td>
<td>100</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td></td>
<td>$T_{\text{stg}}$</td>
<td>$-25...+85$</td>
<td>°C</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td></td>
<td>$T_{\text{amb}}$</td>
<td>$-25...+85$</td>
<td>°C</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>$(T_{\text{amb}} \leq 85 ^\circ \text{C})$</td>
<td>$P_{\text{tot}}$</td>
<td>50</td>
<td>mW</td>
</tr>
<tr>
<td>Soldering Temperature</td>
<td></td>
<td>$T_{\text{sd}}$</td>
<td>260</td>
<td>°C</td>
</tr>
</tbody>
</table>

Basic Characteristics

$T_{\text{amb}} = 25^\circ \text{C}$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</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>$V_S = 5 \text{ V}, E_v = 0$</td>
<td>$I_{SD}$</td>
<td>0.4</td>
<td>0.6</td>
<td>1.5</td>
<td>mA</td>
</tr>
<tr>
<td>Supply Voltage (Pin 2)</td>
<td>$V_S = 5 \text{ V}, E_v = 40 \text{ klx}, \text{sunlight}$</td>
<td>$I_{SH}$</td>
<td>4.5</td>
<td>5.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Transmission Distance</td>
<td>$E_v = 0, \text{test signal see fig.7,}$</td>
<td>$d$</td>
<td>35</td>
<td></td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>Output Voltage Low (Pin 3)</td>
<td>$I_{OSL} = 0.5 \text{ mA}, E_e = 0.7 \text{ mW/m}^2,$</td>
<td>$V_{OSL}$</td>
<td>250</td>
<td></td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>Irradiance (30 – 40 kHz)</td>
<td>$t_{pi} - 5/f_o &lt; t_{po} &lt; t_{pi} + 6/f_o,$</td>
<td>$E_{e \text{ min}}$</td>
<td>0.35</td>
<td>0.5</td>
<td>mW/m$^2$</td>
<td></td>
</tr>
<tr>
<td>Irradiance (56 kHz)</td>
<td>$t_{pi} - 5/f_o &lt; t_{po} &lt; t_{pi} + 6/f_o,$</td>
<td>$E_{e \text{ min}}$</td>
<td>0.4</td>
<td>0.6</td>
<td>mW/m$^2$</td>
<td></td>
</tr>
<tr>
<td>Irradiance</td>
<td>$t_{pl} - 5/f_o &lt; t_{po} &lt; t_{pl} + 6/f_o,$</td>
<td>$E_{e \text{ max}}$</td>
<td>30</td>
<td></td>
<td>W/m$^2$</td>
<td></td>
</tr>
<tr>
<td>Directivity</td>
<td>$\phi_{1/2} = \pm 45,$</td>
<td>$D$</td>
<td></td>
<td></td>
<td>deg</td>
<td></td>
</tr>
</tbody>
</table>

Application Circuit

*) recommended to suppress power supply disturbances

**) The output voltage should not be hold continuously at a voltage below 3.3V by the external circuit.
Suitable Data Format

The circuit of the TSOP17.. is designed in that way that unexpected output pulses due to noise or disturbance signals are avoided. A bandpass filter, an integrator stage and an automatic gain control are used to suppress such disturbances.

The distinguishing mark between data signal and disturbance signal are carrier frequency, burst length and duty cycle.

The data signal should fullfill the following condition:

- Carrier frequency should be close to center frequency of the bandpass (e.g. 38kHz).
- Burst length should be 10 cycles/burst or longer.
- After each burst which is between 10 cycles and 70 cycles a gap time of at least 14 cycles is neccessary.
- For each burst which is longer than 1.8ms a corresponding gap time is necessary at some time in the data stream. This gap time should have at least same length as the burst.
- Up to 1400 short bursts per second can be received continuously.


When a disturbance signal is applied to the TSOP17.. it can still receive the data signal. However the sensitivity is reduced to that level that no unexpected pulses will occure.

Some examples for such disturbance signals which are suppressed by the TSOP17.. are:

- DC light (e.g. from tungsten bulb or sunlight)
- Continuous signal at 38kHz or at any other frequency
- Signals from fluorescent lamps with electronic ballast (an example of the signal modulation is in the figure below).
Typical Characteristics \( (T_{\text{amb}} = 25^\circ \text{C} \text{ unless otherwise specified}) \)

- **Figure 1.** Frequency Dependence of Responsivity
- **Figure 2.** Sensitivity in Dark Ambient
- **Figure 3.** Sensitivity in Bright Ambient
- **Figure 4.** Sensitivity vs. Electric Field Disturbances
- **Figure 5.** Sensitivity vs. Supply Voltage Disturbances
- **Figure 6.** Sensitivity vs. Ambient Temperature
**Optical Test Signal**

(R diode TSAL6200, I_p = 0.4 A, 30 pulses, f = f_0, T = 10 ms)

* t_pi ≥ 10/f_0 is recommended for optimal function

**Output Signal**

1) 7/f_0 < t_p < 15/f_0
2) t_po = t_pi = 6/f_0

**Figure 7. Output Function**

**Optical Test Signal**

T = 60 ms

**Output Signal**

(see Fig.10)

**Figure 8. Output Function**

**Figure 9. Max. Envelope Duty Cycle vs. Burstlength**

**Figure 10. Output Pulse Diagram**

**Figure 11. Supply Current vs. Ambient Temperature**

**Figure 12. Relative Spectral Sensitivity vs. Wavelength**
Figure 13. Vertical Directivity $\varphi_y$

Figure 14. Horizontal Directivity $\varphi_x$

Dimensions in mm
Ozone Depleting Substances Policy Statement

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.

2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.


2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA


Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

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