IR Receiver Modules for Remote Control Systems

Description
The TSOP853.. series are two lens miniaturized receiver modules for infrared remote control systems. One PIN diode per lens and a preamplifier are assembled on a PCB, the epoxy lens cap is designed as an IR filter.
The demodulated output signal can be directly decoded by a microprocessor. The TSOP853.. is optimized to better suppress spurious pulses from energy saving fluorescent lamps but will also suppress some data signals. This component has not been qualified according to automotive specifications.

Features
- Very low supply current
- Photo detectors and preamplifier in one package
- Internal filter for PCM frequency
- Supply voltage: 2.5 V to 5.5 V
- Improved immunity against ambient light
- Capable of side or top view
- Two lenses for high sensitivity and wide receiving angle
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC
- Insensitive to supply voltage ripple and noise

Parts Table

<table>
<thead>
<tr>
<th>Part</th>
<th>Carrier frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSOP85330</td>
<td>30 kHz</td>
</tr>
<tr>
<td>TSOP85333</td>
<td>33 kHz</td>
</tr>
<tr>
<td>TSOP85336</td>
<td>36 kHz</td>
</tr>
<tr>
<td>TSOP85338</td>
<td>38 kHz</td>
</tr>
<tr>
<td>TSOP85340</td>
<td>40 kHz</td>
</tr>
<tr>
<td>TSOP85356</td>
<td>56 kHz</td>
</tr>
</tbody>
</table>

Application Circuit

R₁ and C₁ are recommended for protection against EOS. Components should be in the range of 33 Ω < R₁ < 1 kΩ, C₁ > 0.1 µF.
Absolute Maximum Ratings

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.

<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></td>
<td>$V_S$</td>
<td>-0.3 to +6.0</td>
<td>V</td>
</tr>
<tr>
<td>Supply current</td>
<td></td>
<td>$I_S$</td>
<td>3</td>
<td>mA</td>
</tr>
<tr>
<td>Output voltage</td>
<td></td>
<td>$V_O$</td>
<td>-0.3 to $(V_S + 0.3)$</td>
<td>V</td>
</tr>
<tr>
<td>Output current</td>
<td></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>$T_{stg}$</td>
<td>-25 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td></td>
<td>$T_{amb}$</td>
<td>-25 to +85</td>
<td>°C</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></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 voltage</td>
<td></td>
<td>$V_S$</td>
<td>2.5</td>
<td>5.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Supply current</td>
<td>$V_S = 3.3$ V, $E_v = 0$</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>$E_v = 40$ kV, sunlight</td>
<td>$I_{SH}$</td>
<td>0.45</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Transmission distance</td>
<td>$E_v = 0$ IR diode TSAL6200, $I_F = 250$ mA</td>
<td>d</td>
<td>45</td>
<td></td>
<td>m</td>
<td></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>100</td>
<td></td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>Minimum irradiance</td>
<td>Pulse width tolerance: $t_{di} - 5/fo &lt; t_{po} &lt; t_{di} + 6/fo$, test signal see fig. 1</td>
<td>$E_e_{min}$</td>
<td>0.1</td>
<td>0.25</td>
<td>mW/m²</td>
<td></td>
</tr>
<tr>
<td>Maximum irradiance</td>
<td>$t_{di} - 5/fo &lt; t_{po} &lt; t_{di} + 6/fo$, test signal see fig. 1</td>
<td>$E_e_{max}$</td>
<td>30</td>
<td></td>
<td>W/m²</td>
<td></td>
</tr>
<tr>
<td>Directivity</td>
<td>Angle of half transmission distance</td>
<td>$\phi_{1/2}$</td>
<td>±50</td>
<td></td>
<td>deg</td>
<td></td>
</tr>
</tbody>
</table>
Typical Characteristics

 Tamb = 25 °C, unless otherwise specified

Figure 1. Output Active Low

Figure 2. Pulse Length and Sensitivity in Dark Ambient

Figure 3. Output Function

Figure 4. Output Pulse Diagram

Figure 5. Frequency Dependence of Responsivity

Figure 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: λ = 950 nm

Eemin - Threshold Irradiance (mW/m²)

E - Irradiance (mW/m²)

Emin / E - Rel. Responsivity

f/f0 - Relative Frequency

* ) tpi ≥ 6/f0 is recommended for optimal function

1) 3/f0 < tpi < 5/f0
2) tpi - 4/f0 < tpo < tpi + 6/f0

Output Si
gnal, (see fig. 4)

Optical Test Signal

Optical Test Signal (IR diode TSAL6200, f = 0.4 A, N = 6 pulses, f = f0, T = 10 ms)

Optical Test Signal, fig. 1

λ = 950 nm, optical test signal, fig. 1

0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4

0.1 1 10 100 1000 10000

E - Irradiance (mW/m²)

Optical Test Signal, Fig. 3

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.2

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

0.01 0.1 1 10 100 1000 10000

E - Ambient DC Irradiance (W/m²)

E - Irradiance (mW/m²)

f/f0 - Relative Frequency

ΔΔ(3 dB) = f0/10

Emin - 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)

Wavelength of Ambient Illumination: λ = 950 nm

Eemin - Threshold Irradiance (mW/m²)
Figure 7. Sensitivity vs. Supply Voltage Disturbances

Figure 8. Sensitivity vs. Electric Field Disturbances

Figure 9. Max. Envelope Duty Cycle vs. Burst Length

Figure 10. Sensitivity vs. Ambient Temperature

Figure 11. Relative Spectral Sensitivity vs. Wavelength

Figure 12. Directivity
Suitable Data Format

The TSOP853.. series is designed to suppress spurious output pulses due to noise or disturbance signals. Data and disturbance signals can be distinguished by the devices according to carrier frequency, burst length and envelope duty cycle. The data signal should be close to the band-pass center frequency (e.g. 38 kHz) and fulfill the conditions in the table below.

When a data signal is applied to the TSOP853.. in the presence of a disturbance signal, the sensitivity of the receiver is reduced to insure that no spurious pulses are present at the output. Some examples of disturbance signals which are suppressed are:

- DC light (e.g. from tungsten bulb or sunlight)
- Continuous signals at any frequency
- Modulated noise from fluorescent lamps with electronic ballasts

<table>
<thead>
<tr>
<th>Minimum burst length</th>
<th>6 cycles/burst</th>
</tr>
</thead>
<tbody>
<tr>
<td>After each burst of length</td>
<td>6 to 35 cycles</td>
</tr>
<tr>
<td>A minimum gap time is required of</td>
<td>10 cycles</td>
</tr>
<tr>
<td>For bursts greater than</td>
<td>35 cycles</td>
</tr>
<tr>
<td>A minimum gap time in the data stream is needed of</td>
<td>&gt; 6 x burst length</td>
</tr>
<tr>
<td>Maximum number of continuous short bursts/second</td>
<td>2000</td>
</tr>
<tr>
<td>Compatible to NEC code</td>
<td>yes</td>
</tr>
<tr>
<td>Compatible to RC5/RC6 code</td>
<td>yes</td>
</tr>
<tr>
<td>Compatible to Sony code</td>
<td>no</td>
</tr>
<tr>
<td>Compatible to RCMM code</td>
<td>yes</td>
</tr>
<tr>
<td>Compatible to r-step code</td>
<td>yes</td>
</tr>
<tr>
<td>Compatible to XMP code</td>
<td>yes</td>
</tr>
<tr>
<td>Suppression of interference from fluorescent lamps</td>
<td>Even critical disturbance signals are suppressed</td>
</tr>
</tbody>
</table>

(Examples: Signal pattern of fig. 14 and fig. 15)

For data formats with long bursts (more than 10 carrier cycles) please see the data sheet for TSOP852../TSOP854..
Package Dimensions in millimeters

- (R1.35)
- (0.6) (5x)
- (0.5)
- (4.9)
- (2.2)
- 3.3
- 2.76
- min. 1.5

1: GND
2: Vs
3: Out
4: GND
5: GND

1.7nom 1.7nom 1.7nom 1.7nom

0 - 0.1
min. 1.5

Pick +Place area

Technical drawings according to DIN specifications

Not indicated tolerances ±0.25

* optional GND pad connection not necessary

Possible package deviations caused by tolerances in the manufacturing process either on pick & place side or solder pad side

Proposed pad layout from component side (dim. for reference only) (sideview assembly)

4x1.7=6.8
0.7 (5x)

[Topview assembly]

0.8 (5x)
4x1.7=6.8

Drawing-No: 6550-5292.01-4
Issue: 2, 25.09.07

20426
TSOP853..

Vishay Semiconductors

Taping Version TSOP..TR Dimensions in millimeters

Drawing-No: 9.700-5316.01-4
Issue: 1; 12.02.07
20028
Taping Version TSOP..TT Dimensions in millimeters

Direction of feed

Drawing-No.: 9.700-5317.01-4
Issue : 12.02.08
20629
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