

## IR Receiver Modules for Remote Control Systems



16672

### MECHANICAL DATA

#### Pinning

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

### FEATURES

- Low supply current
- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Improved shielding against EMI
- Supply voltage: 2.7 V to 5.5 V
- Improved immunity against ambient light
- Insensitive to supply voltage ripple and noise
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



### DESCRIPTION

The TSOP21.. series are miniaturized receivers for infrared remote control systems. A PIN diode and a preamplifier are assembled on a lead frame, the epoxy package acts as an IR filter.

The demodulated output signal can directly be decoded by a microprocessor. The main benefit of the TSOP21.. is the compatibility to all IR remote control data formats.

This component has not been qualified according to automotive specifications.

### PARTS TABLE

| CARRIER FREQUENCY | SHORT BURSTS AND HIGH DATA RATES (AGC1) |
|-------------------|---|
| 30 kHz            | TSOP2130                                |
| 33 kHz            | TSOP2133                                |
| 36 kHz            | TSOP2136                                |
| 36.7 kHz          | TSOP2137                                |
| 38 kHz            | TSOP2138                                |
| 40 kHz            | TSOP2140                                |
| 56 kHz            | TSOP2156                                |

### BLOCK DIAGRAM



### APPLICATION CIRCUIT



The external components  $R_1$  and  $C_1$  are optional to improve the robustness against electrical overstress (typical values are  $R_1 = 100 \Omega$ ,  $C_1 = 0.1 \mu F$ ).  
The output voltage  $V_o$  should not be pulled down to a level below 1 V by the external circuit.  
The capacitive load at the output should be less than 2 nF.



| ABSOLUTE MAXIMUM RATINGS (1) |                                       |             |                          |      |
|------------------------------|---------------------------------------|-------------|--------------------------|------|
| PARAMETER                    | TEST CONDITION                        | SYMBOL      | VALUE                    | UNIT |
| Supply voltage (pin 2)       |                                       | $V_S$       | - 0.3 to + 6.0           | V    |
| Supply current (pin 2)       |                                       | $I_S$       | 5                        | mA   |
| Output voltage (pin 1)       |                                       | $V_O$       | - 0.3 to 5.5             | V    |
| Voltage at output to supply  |                                       | $V_S - V_O$ | - 0.3 to ( $V_S + 0.3$ ) | V    |
| Output current (pin 1)       |                                       | $I_O$       | 5                        | mA   |
| Junction temperature         |                                       | $T_j$       | 100                      | °C   |
| Storage temperature range    |                                       | $T_{stg}$   | - 25 to + 85             | °C   |
| Operating temperature range  |                                       | $T_{amb}$   | - 25 to + 85             | °C   |
| Power consumption            | $T_{amb} \leq 85 \text{ °C}$          | $P_{tot}$   | 10                       | mW   |
| Soldering temperature        | $t \leq 10 \text{ s, 1 mm from case}$ | $T_{sd}$    | 260                      | °C   |

**Note**

(1) 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 (1) |  |                      |      |          |      |                 |
|--|--|----------------------|------|----------|------|-----------------|
| PARAMETER                                  | TEST CONDITION   | SYMBOL               | MIN. | TYP.     | MAX. | UNIT            |
| Supply current (pin 2)                     | $E_v = 0, V_S = 5 \text{ V}$   | $I_{SD}$             | 0.65 | 0.85     | 1.05 | mA              |
|  | $E_v = 40 \text{ klx, sunlight}$   | $I_{SH}$             |      | 0.95     |      | mA              |
| Supply voltage                             |  | $V_S$                | 2.7  |          | 5.5  | V               |
| Transmission distance                      | $E_v = 0$ , test signal see fig. 1, IR diode TSAL6200, $I_F = 400 \text{ mA}$              | $d$                  |      | 45       |      | m               |
| Output voltage low (pin 1)                 | $I_{OSL} = 0.5 \text{ mA, } E_e = 0.7 \text{ mW/m}^2$ , test signal see fig. 1             | $V_{OSL}$            |      |          | 100  | mV              |
| Minimum irradiance                         | Pulse width tolerance: $t_{pi} - 5/f_0 < t_{po} < t_{pi} + 6/f_0$ , test signal see fig. 1 | $E_{e \text{ min.}}$ |      | 0.17     | 0.35 | $\text{mW/m}^2$ |
| Maximum irradiance                         | $t_{pi} - 5/f_0 < t_{po} < t_{pi} + 6/f_0$ , test signal see fig. 1                        | $E_{e \text{ max.}}$ | 30   |          |      | $\text{W/m}^2$  |
| Directivity                                | Angle of half transmission distance  | $\phi_{1/2}$         |      | $\pm 45$ |      | deg             |

**Note**

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

**TYPICAL CHARACTERISTICS**

$T_{amb} = 25 \text{ °C}$ , unless otherwise specified

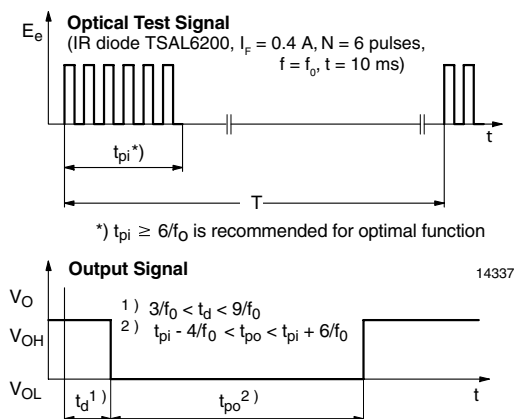


Fig. 1 - Output Active Low



Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

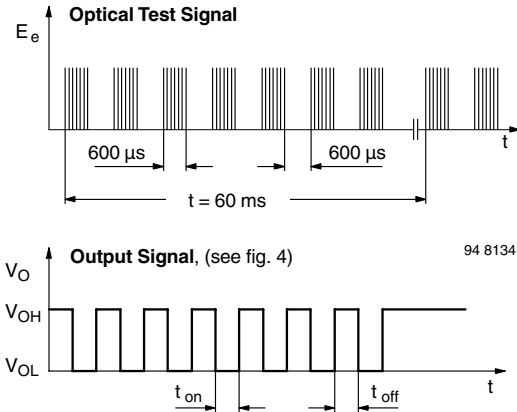


Fig. 3 - Output Function

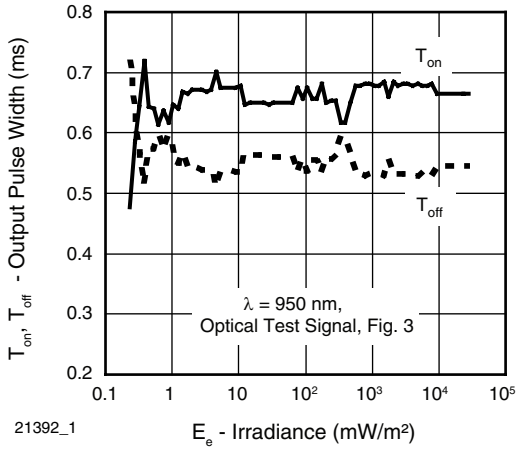


Fig. 4 - Output Pulse Diagram

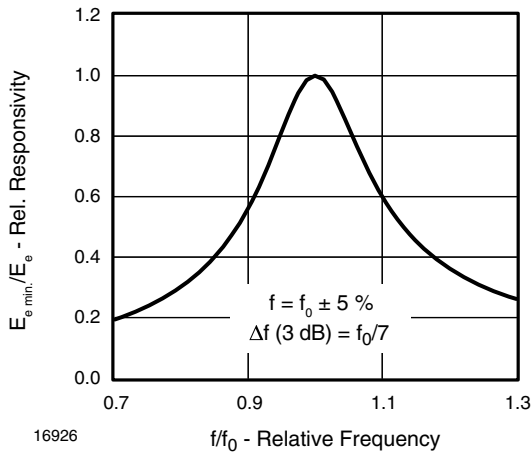


Fig. 5 - Frequency Dependence of Responsivity

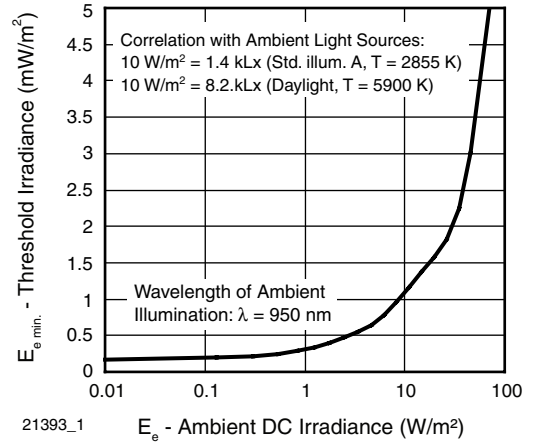


Fig. 6 - Sensitivity in Bright Ambient

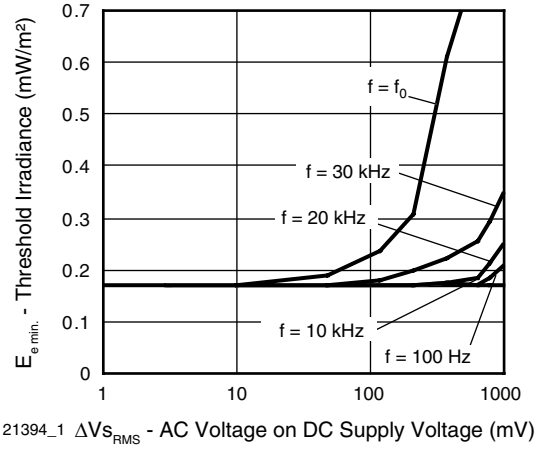


Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

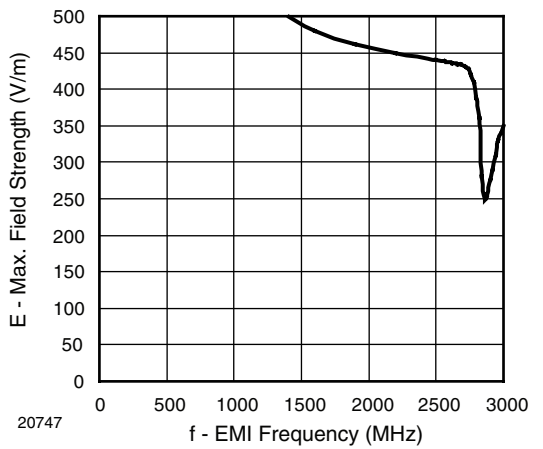


Fig. 8 - Sensitivity vs. Electric Field Disturbances



21396\_1 Burst Length (number of cycles/burst)  
Fig. 9 - Max. Envelope Duty Cycle vs. Burst Length



96 12223p2  $d_{rel}$  - Relative Transmission Distance  
Fig. 12 - Horizontal Directivity



21397\_1  $T_{amb}$  - Ambient Temperature (°C)  
Fig. 10 - Sensitivity vs. Ambient Temperature



21398\_1  $V_s$  - Supply Voltage (V)  
Fig. 13 - Sensitivity vs. Supply Voltage



16919  $\lambda$  - Wavelength (nm)  
Fig. 11 - Relative Spectral Sensitivity vs. Wavelength

### SUITABLE DATA FORMAT

The TSOP21.. 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 TSOP21.. 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 IR signals from common fluorescent lamps (example of noise pattern is shown in figure 14)



Fig. 14 - IR Signal from Fluorescent Lamp with Low Modulation

|   | TSOP21..                                       |
|---|--|
| Minimum burst length  | 6 cycles/burst                                 |
| After each burst of length<br>a minimum gap time is required of               | 6 to 70 cycles<br>≥ 10 cycles                  |
| For bursts greater than<br>a minimum gap time in the data stream is needed of | 70 cycles<br>> 1.1 x burst length              |
| Maximum number of continuous short bursts/second                              | 2000   |
| Compatible to NEC code  | yes  |
| Compatible to RC5/RC6 code  | yes  |
| Compatible to RCMM code   | yes  |
| Compatible to RECS-80 code  | yes  |
| Compatible to r-Step and r-Map data format                                    | yes  |
| Compatible to XMP data format   | yes  |
| Suppression of interference from fluorescent lamps                            | Most common disturbance signals are suppressed |

#### Note

For data formats with long bursts (10 carrier cycles or longer) we recommend the TSOP22.. because of the better noise suppression.

# New TSOP21..

Vishay Semiconductors

IR Receiver Modules for  
Remote Control Systems



## PACKAGE DIMENSIONS in millimeters



Drawing-No.: 6.550-5169.01-4  
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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А