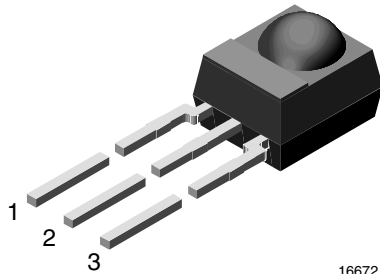




## IR Receiver Modules for Remote Control Systems



16672

### MECHANICAL DATA

#### Pinning for TSOP41.., TSOP43..:

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

#### Pinning for TSOP21.., TSOP23..:

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
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### DESCRIPTION

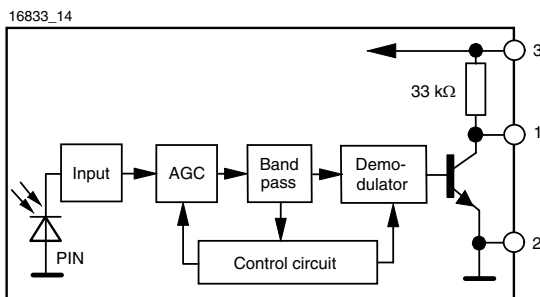
These products are miniaturized receivers for infrared remote control systems. A PIN diode and a preamplifier are assembled on a lead frame, the epoxy package acts as an IR filter.

The demodulated output signal can directly be decoded by a microprocessor. The main benefit of the TSOP41.., TSOP21.. is the compatibility to all IR remote control data formats. The TSOP43.., TSOP23.. are optimized to better suppress spurious pulses from fluorescent lamps, LCD TVs or plasma displays.

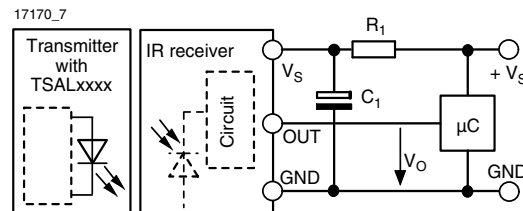
This component has not been qualified according to automotive specifications.

| PARTS TABLE       |                                       |                              |   |                              |
|-------------------|---------------------------------------|------------------------------|---|------------------------------|
| CARRIER FREQUENCY | SHORT BURST AND HIGH DATA RATE (AGC1) |                              | NOISY ENVIROMENTS AND SHORT BURSTS (AGC3) |                              |
|                   | PINNING                               |                              |   |                              |
|                   | 1 = OUT, 2 = GND, 3 = $V_S$           | 1 = OUT, 2 = $V_S$ , 3 = GND | 1 = OUT, 2 = GND, 3 = $V_S$               | 1 = OUT, 2 = $V_S$ , 3 = GND |
| 30 kHz            | TSOP4130                              | TSOP2130                     | TSOP4330                                  | TSOP2330                     |
| 33 kHz            | TSOP4133                              | TSOP2133                     | TSOP4333                                  | TSOP2333                     |
| 36 kHz            | TSOP4136                              | TSOP2136                     | TSOP4336                                  | TSOP2336                     |
| 38 kHz            | TSOP4138                              | TSOP2138                     | TSOP4338                                  | TSOP2338                     |
| 40 kHz            | TSOP4140                              | TSOP2140                     | TSOP4340                                  | TSOP2340                     |
| 56 kHz            | TSOP4156                              | TSOP2156                     | TSOP4356                                  | TSOP2356                     |

### 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    |                                       |             |                          |      |
|-----------------------------|---------------------------------------|-------------|--------------------------|------|
| PARAMETER                   | TEST CONDITION                        | SYMBOL      | VALUE                    | UNIT |
| Supply voltage              |                                       | $V_S$       | - 0.3 to + 6             | V    |
| Supply current              |                                       | $I_S$       | 5                        | mA   |
| Output voltage              |                                       | $V_O$       | - 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              |                                       | $I_O$       | 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**

- 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 ( $T_{amb} = 25\text{ °C}$ , unless otherwise specified) |  |                   |      |          |      |                 |
|---|--|-------------------|------|----------|------|-----------------|
| PARAMETER   | TEST CONDITION   | SYMBOL            | MIN. | TYP.     | MAX. | UNIT            |
| Supply current  | $E_v = 0, V_S = 5\text{ V}$  | $I_{SD}$          | 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  | $I_{OSL} = 0.5\text{ mA}$ , $E_e = 0.7\text{ mW/m}^2$ , 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             |

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

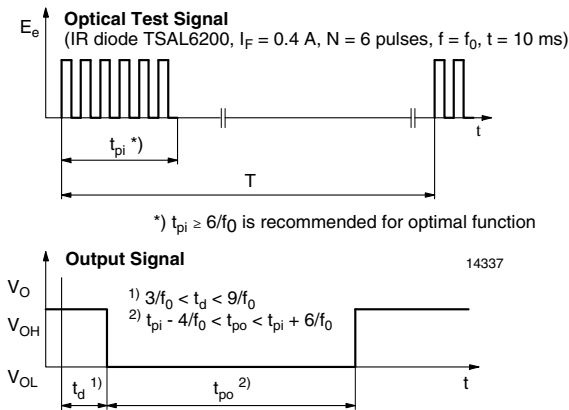


Fig. 1 - Output Active Low

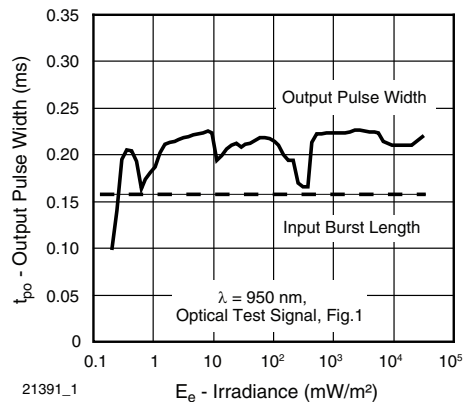


Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

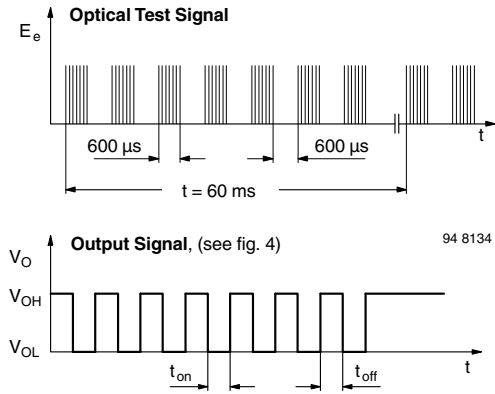


Fig. 3 - Output Function

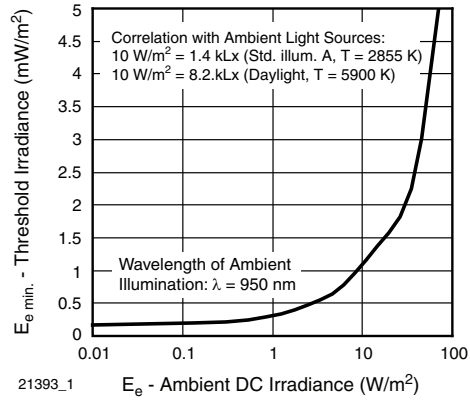


Fig. 6 - Sensitivity in Bright Ambient

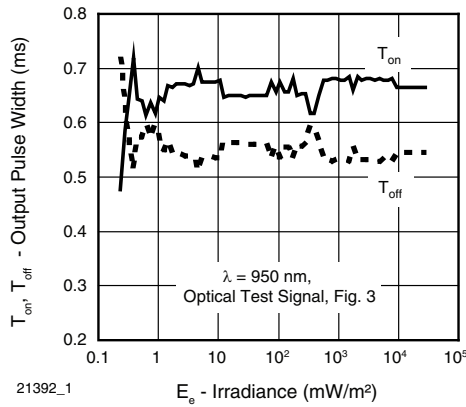


Fig. 4 - Output Pulse Diagram

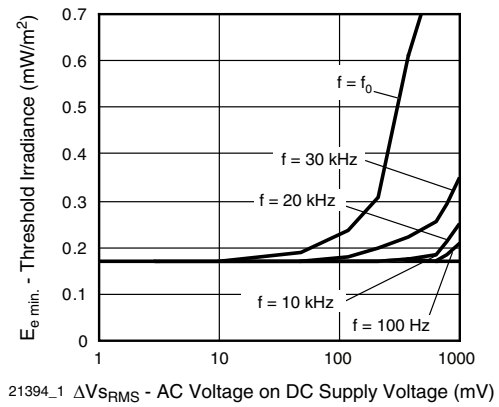


Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

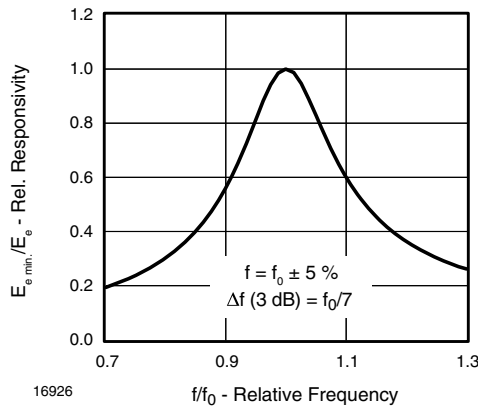


Fig. 5 - Frequency Dependence of Responsivity

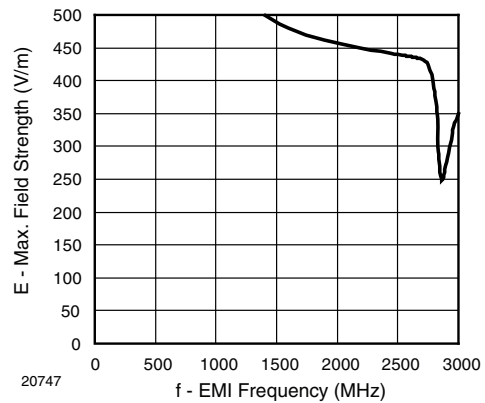


Fig. 8 - Sensitivity vs. Electric Field Disturbances

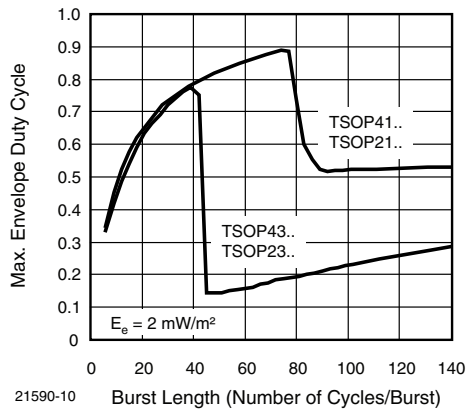


Fig. 9 - Max. Envelope Duty Cycle vs. Burst Length

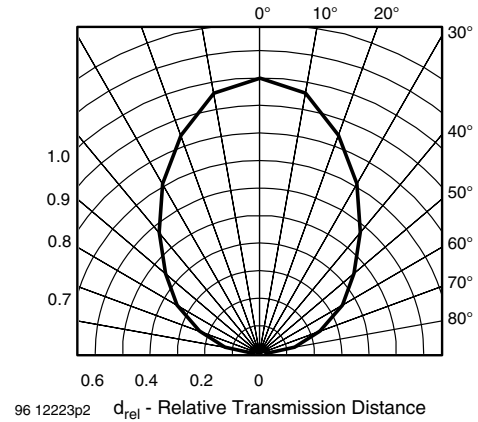


Fig. 12 - Horizontal Directivity

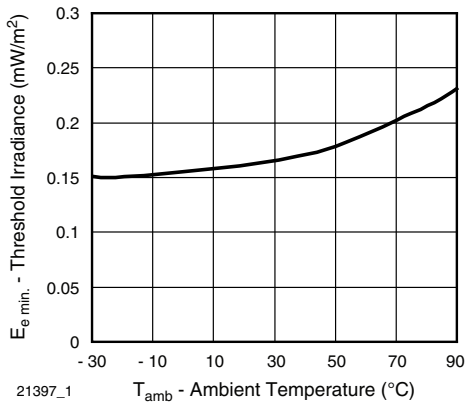


Fig. 10 - Sensitivity vs. Ambient Temperature

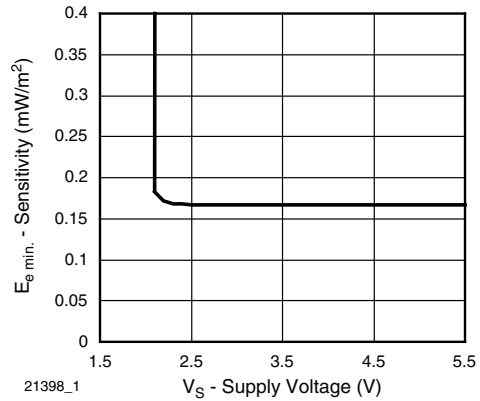


Fig. 13 - Sensitivity vs. Supply Voltage

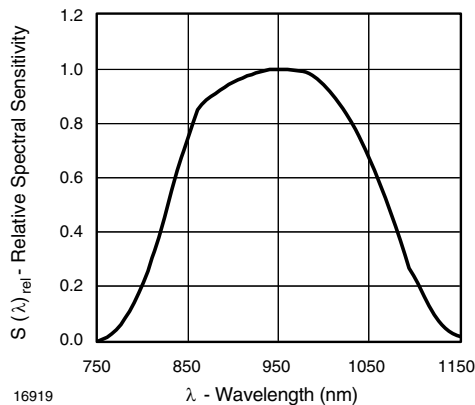


Fig. 11 - Relative Spectral Sensitivity vs. Wavelength



**SUITABLE DATA FORMAT**

These products are 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 IR receiver 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 (see figure 14 or figure 15)

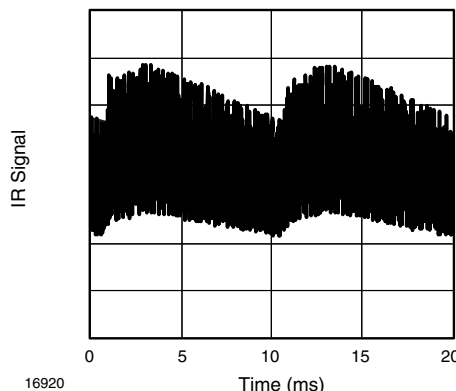


Fig. 14 - IR Signal from Fluorescent Lamp with Low Modulation

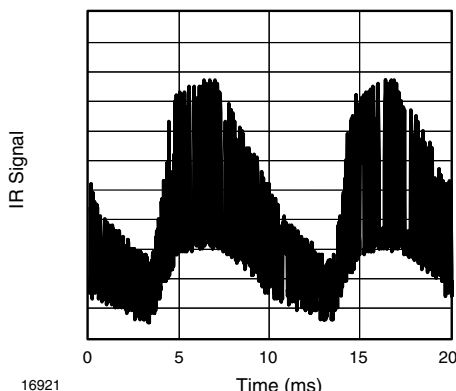


Fig. 15 - IR Signal from Fluorescent Lamp with High Modulation

|  | TSOP41.., TSOP21..   | TSOP43.., TSOP23..   |
|--|--|--|
| Minimum burst length   | 6 cycles/burst   | 6 cycles/burst   |
| After each burst of length a minimum gap time is required of               | 6 to 70 cycles<br>≥ 10 cycles  | 6 to 35 cycles<br>≥ 10 cycles  |
| For bursts greater than a minimum gap time in the data stream is needed of | 70 cycles<br>> 1.1 x burst length  | 35 cycles<br>> 6 x burst length  |
| Maximum number of continuous short bursts/second                           | 2000   | 2000   |
| Recommended for NEC code   | yes  | yes  |
| Recommended for RC5/RC6 code   | yes  | yes  |
| Recommended for Sony code  | yes  | no   |
| Recommended for RECS-80 code   | yes  | yes  |
| Recommended for RCMM code  | yes  | yes  |
| Recommended for r-step code  | yes  | yes  |
| Recommended for XMP code   | yes  | yes  |
| Suppression of interference from fluorescent lamps                         | Common disturbance signals are suppressed (example: signal pattern of fig. 14) | Even critical disturbance signals are suppressed (examples: signal pattern of fig. 14 and fig. 15) |

**Note**

- For data formats with long bursts (more than 10 carrier cycles) please see the datasheet for TSOP22.., TSOP48.., TSOP24.., TSOP44..





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