

## IR Receiver Modules for Remote Control Systems



### MECHANICAL DATA

#### Pinning:

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

### FEATURES

- Very low supply current
- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Improved shielding against EMI
- Supply voltage: 2.5 V to 5.5 V
- Improved immunity against ambient light
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC
- Insensitive to supply voltage ripple and noise



### DESCRIPTION

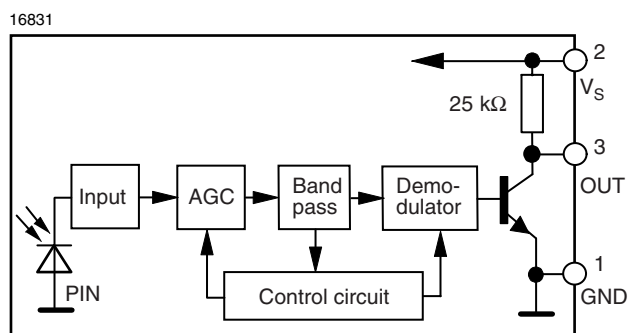
The TSOP311.., TSOP313.. series are miniaturized receivers for infrared remote control systems. A PIN diode and a preamplifier are assembled on a lead frame, the epoxy package acts as an IR filter.

The demodulated output signal can be directly decoded by a microprocessor. The TSOP311.. is compatible with all common IR remote control data formats. The TSOP313.. is optimized to better suppress spurious pulses from energy saving fluorescent lamps but will also suppress some data signals.

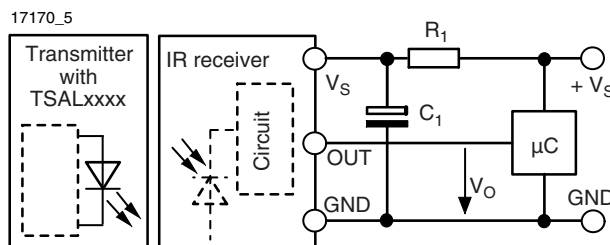
This component has not been qualified according to automotive specifications.

| PARTS TABLE       |   |  |
|-------------------|---|--|
| CARRIER FREQUENCY | SHORT BURSTS AND HIGH DATA RATES (AGC1) | NOISY ENVIRONMENTS AND SHORT BURSTS (AGC3) |
| 30 kHz            | TSOP31130                               | TSOP31330                                  |
| 33 kHz            | TSOP31133                               | TSOP31333                                  |
| 36 kHz            | TSOP31136                               | TSOP31336                                  |
| 38 kHz            | TSOP31138                               | TSOP31338                                  |
| 40 kHz            | TSOP31140                               | TSOP31340                                  |
| 56 kHz            | TSOP31156                               | TSOP31356                                  |

### BLOCK DIAGRAM



### APPLICATION CIRCUIT



$R_1$  and  $C_1$  are recommended for protection against EOS. Components should be in the range of  $33 \Omega < R_1 < 1 \text{ k}\Omega$ ,  $C_1 > 0.1 \mu\text{F}$ .



| 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)       |  | $I_S$     | 3                        | mA   |
| Output voltage (pin 3)       |  | $V_O$     | - 0.3 to ( $V_S + 0.3$ ) | V    |
| Output current (pin 3)       |  | $I_O$     | 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)                     | $E_v = 0$ , $V_S = 3.3 \text{ V}$  | $I_{SD}$           | 0.27 | 0.35     | 0.45 | mA              |
|  | $E_v = 40 \text{ klx}$ , sunlight  | $I_{SH}$           |      | 0.45     |      | mA              |
| Supply voltage                             |  | $V_S$              | 2.5  |          | 5.5  | V               |
| Transmission distance                      | $E_v = 0$ , test signal see fig. 1, IR diode TSAL6200, $I_F = 250 \text{ mA}$              | $d$                |      | 45       |      | m               |
| Output voltage low (pin 3)                 | $I_{OSL} = 0.5 \text{ mA}$ , $E_e = 0.7 \text{ mW/m}^2$ , 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 | $E_e \text{ min.}$ |      | 0.15     | 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

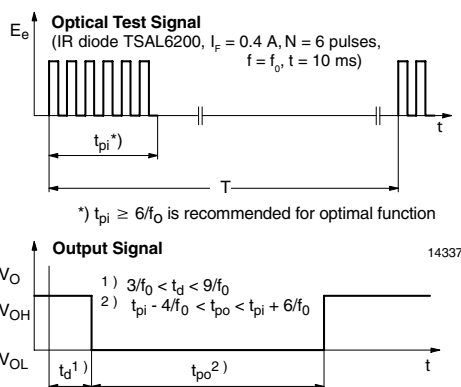


Fig. 1 - Output Active Low



Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

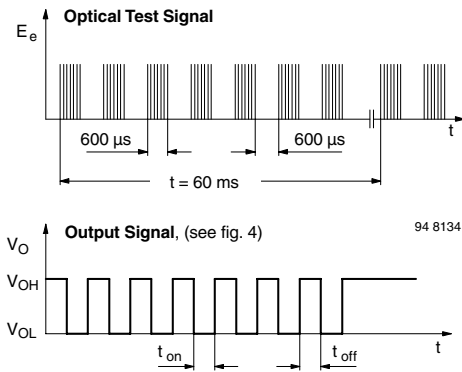
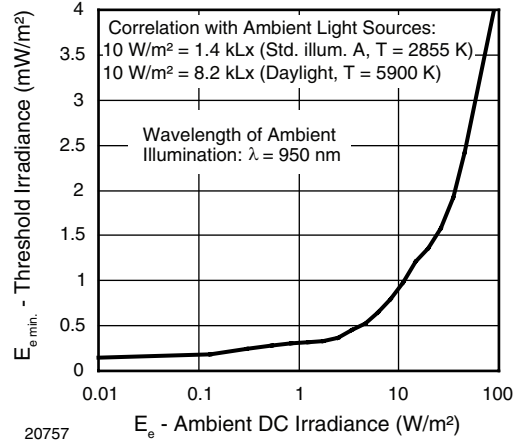
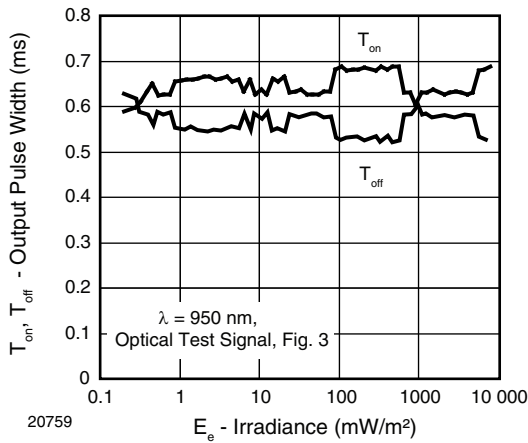


Fig. 3 - Output Function



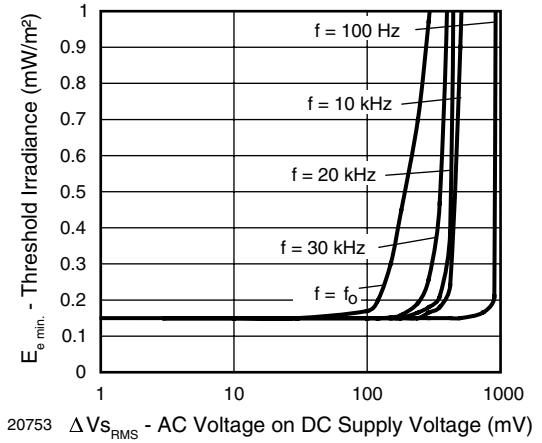
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Fig. 6 - Sensitivity in Bright Ambient



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Fig. 4 - Output Pulse Diagram



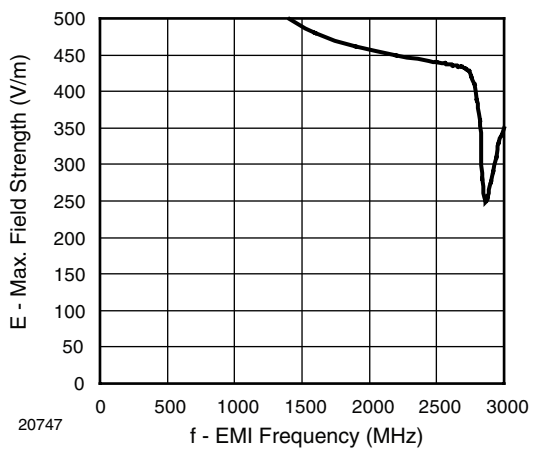
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Fig. 7 - Sensitivity vs. Supply Voltage Disturbances



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Fig. 5 - Frequency Dependence of Responsivity



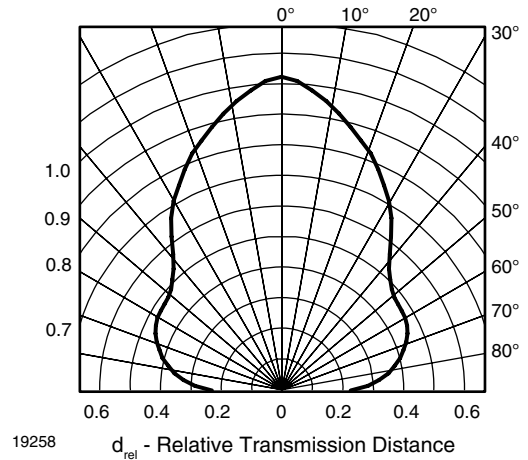
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Fig. 8 - Sensitivity vs. Electric Field Disturbances



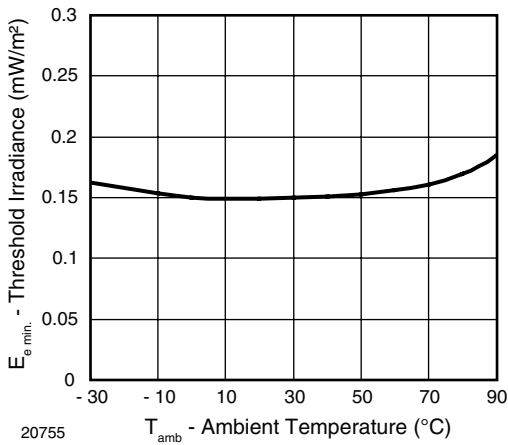
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Fig. 9 - Max. Envelope Duty Cycle vs. Burst Length



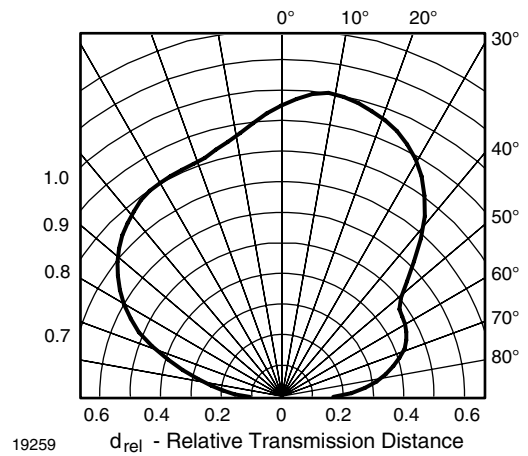
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Fig. 12 - Horizontal Directivity



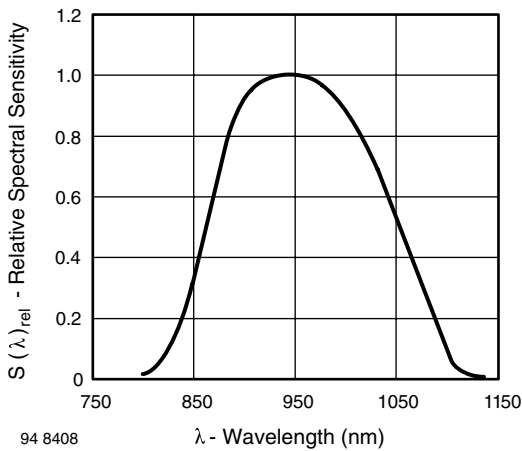
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Fig. 10 - Sensitivity vs. Ambient Temperature



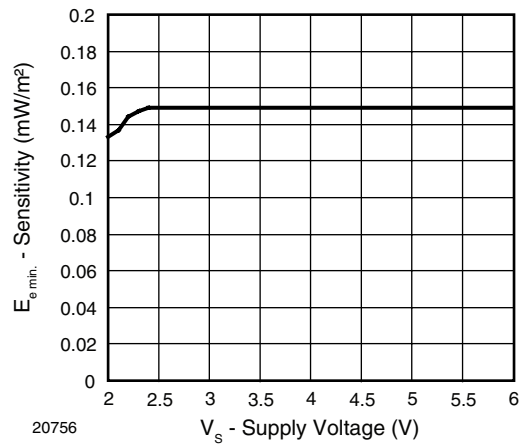
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Fig. 13 - Vertical Directivity



94 8408

Fig. 11 - Relative Spectral Sensitivity vs. Wavelength



20756

Fig. 14 - Sensitivity vs. Supply Voltage

## SUITABLE DATA FORMAT

The TSOP311.., TSOP313.. series 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 TSOP311.., TSOP313.. 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

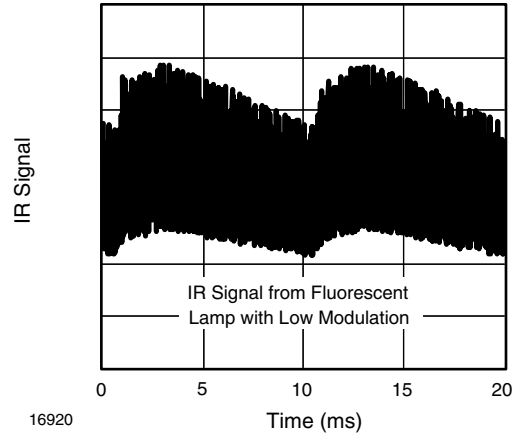


Fig. 15 - IR Signal from Fluorescent Lamp with Low Modulation

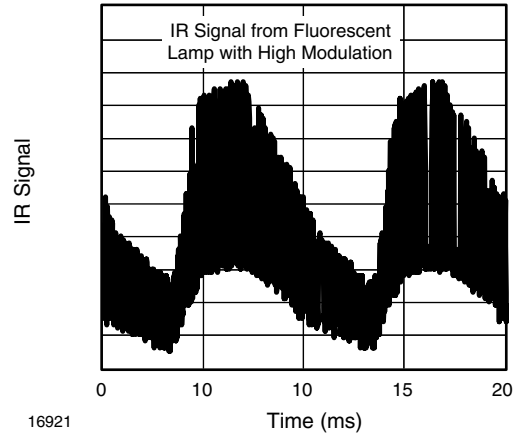


Fig. 16 - IR Signal from Fluorescent Lamp with High Modulation

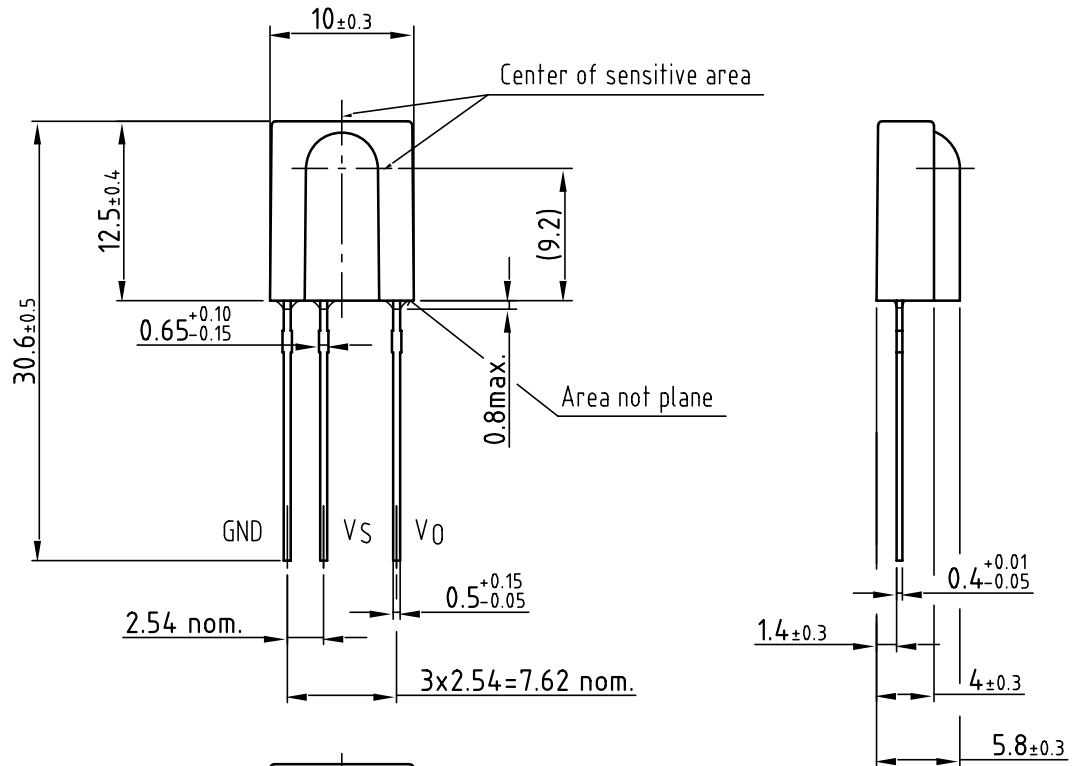
|   | TSOP311..  | TSOP313..  |
|---|--|--|
| Minimum burst length  | 6 cycles/burst   | 6 cycles/burst   |
| After each burst of length<br>A gap time is required of                       | 6 to 70 cycles<br>≥ 10 cycles  | 6 to 35 cycles<br>≥ 10 cycles  |
| For bursts greater than<br>A minimum gap time in the data stream is needed of | 70 cycles<br>> 1.2 x burst length  | 35 cycles<br>> 6 x burst length  |
| Maximum number of continuous short bursts/second                              | 2000   | 2000   |
| Compatible to NEC code  | yes  | yes  |
| Compatible to RC5/RC6 code  | yes  | yes  |
| Compatible to Sony code   | yes  | no   |
| Compatible to RCMM code   | yes  | yes  |
| Compatible to r-step code   | yes  | yes  |
| Compatible to XMP code  | yes  | yes  |
| Suppression of interference from fluorescent lamps                            | Common disturbance signals are suppressed (Example: Signal pattern of fig. 15) | Even critical disturbance signals are suppressed (Examples: Signal pattern of fig. 15 and fig. 16) |

**Note**

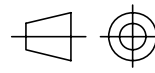
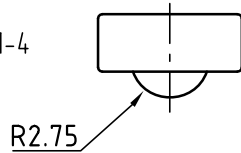
For data formats with short bursts please see the data sheet for TSOP381.., TSOP383..



**PACKAGE DIMENSIONS** in millimeters



Drawing-No.: 6.550-5095.01-4  
Issue: 17; 22.03.04



technical drawings  
according to DIN  
specifications

96 12116

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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.

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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.
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