



# IR Receiver Modules for Remote Control Systems



19026

## 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
- 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)



## MECHANICAL DATA

### Pinning for TSOP381..., TSOP383..., TSOP385...:

1 = OUT, 2 = GND, 3 = V<sub>S</sub>

### Pinning for TSOP391..., TSOP393..., TSOP395...:

1 = OUT, 2 = V<sub>S</sub>, 3 = GND

Please see the document "Product Transition Schedule" at [www.vishay.com/ir-receiver-modules/](http://www.vishay.com/ir-receiver-modules/) for up-to-date info, when this product will be released.

## 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 be directly decoded by a microprocessor. The TSOP381..., TSOP391.. are compatible with all common IR remote control data formats. The TSOP383..., TSOP393.. are optimized to better suppress spurious pulses from energy saving fluorescent lamps. The TSOP385..., TSOP395.. have an excellent noise suppression. It is immune to dimmed LCD backlighting and any fluorescent lamps. AGC3 and AGC5 may also suppress some data signals in case of continuous transmission.

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 BURST (AGC3) |                                       | VERY NOISY ENVIROMENTS AND SHORT BURSTS (AGC5) |                                       |
|-------------------|---------------------------------------|---------------------------------------|--|---------------------------------------|--|---------------------------------------|
|                   | PINNING                               |                                       |  |                                       |  |                                       |
|                   | 1 = OUT, 2 = GND, 3 = V <sub>S</sub>  | 1 = OUT, 2 = V <sub>S</sub> , 3 = GND | 1 = OUT, 2 = GND, 3 = V <sub>S</sub>     | 1 = OUT, 2 = V <sub>S</sub> , 3 = GND | 1 = OUT, 2 = GND, 3 = V <sub>S</sub>           | 1 = OUT, 2 = V <sub>S</sub> , 3 = GND |
| 30 kHz            | TSOP38130                             | TSOP39130                             | TSOP38330                                | TSOP39330                             | TSOP38530                                      | TSOP39530                             |
| 33 kHz            | TSOP38133                             | TSOP39133                             | TSOP38333                                | TSOP39333                             | TSOP38533                                      | TSOP39533                             |
| 36 kHz            | TSOP38136                             | TSOP39136                             | TSOP38336                                | TSOP39336                             | TSOP38536                                      | TSOP39536                             |
| 38 kHz            | TSOP38138                             | TSOP39138                             | TSOP38338                                | TSOP39338                             | TSOP38538                                      | TSOP39538                             |
| 40 kHz            | TSOP38140                             | TSOP39140                             | TSOP38340                                | TSOP39340                             | TSOP38540                                      | TSOP39540                             |
| 56 kHz            | TSOP38156                             | TSOP39156                             | TSOP38356                                | TSOP39356                             | TSOP38556                                      | TSOP39556                             |

## BLOCK DIAGRAM



## APPLICATION CIRCUIT



R<sub>1</sub> and C<sub>1</sub> are recommended for protection against EOS. Components should be in the range of 33 Ω < R<sub>1</sub> < 1 kΩ, C<sub>1</sub> > 0.1 µF.



**ABSOLUTE MAXIMUM RATINGS**

| PARAMETER                   | TEST CONDITION                         | SYMBOL    | VALUE                    | UNIT |
|-----------------------------|--|-----------|--------------------------|------|
| Supply voltage              |  | $V_S$     | - 0.3 to + 6             | V    |
| Supply current              |  | $I_S$     | 3                        | mA   |
| Output voltage              |  | $V_O$     | - 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        | $E_v = 0, V_S = 3.3 \text{ V}$   | $I_{SD}$           | 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, $I_F = 200 \text{ mA}$              | $d$                |      | 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: $t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$ , test signal see fig. 1 | $E_e \text{ min.}$ |      | 0.12     | 0.25 | $\text{mW/m}^2$ |
| Maximum irradiance    | $t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$ , 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

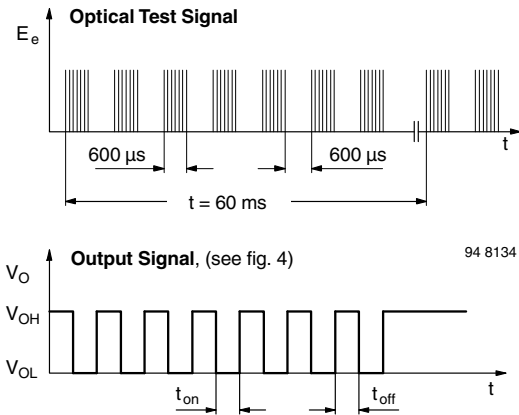


Fig. 3 - Output Function



Fig. 6 - Sensitivity in Bright Ambient



Fig. 4 - Output Pulse Diagram



Fig. 7 - Sensitivity vs. Supply Voltage Disturbances



Fig. 5 - Frequency Dependence of Responsivity

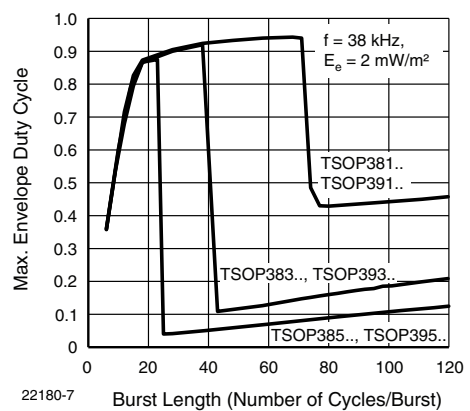


Fig. 8 - Max. Envelope Duty Cycle vs. Burst Length



Fig. 9 - Sensitivity vs. Ambient Temperature



Fig. 12 - Vertical Directivity



Fig. 10 - Relative Spectral Sensitivity vs. Wavelength



Fig. 13 - Sensitivity vs. Supply Voltage



Fig. 11 - Horizontal Directivity



**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 15 or figure 16)



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



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

|  | TSOP381..., TSOP391..  | TSOP383..., TSOP393..  | TSOP385..., TSOP395..  |
|--|--|--|--|
| Minimum burst length   | 6 cycles/burst   | 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  | 6 to 24 cycles<br>≥ 10 cycles  |
| For bursts greater than 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  | 24 cycles<br>> 25 ms   |
| Maximum number of continuous short bursts/second                           | 2000   | 2000   | 2000   |
| Recommended for NEC code   | yes  | yes  | yes  |
| Recommended for RC5/RC6 code   | yes  | yes  | yes  |
| Recommended for Sony code  | yes  | no   | no   |
| Recommended for RCMM code  | yes  | yes  | yes  |
| Recommended for r-step code  | yes  | yes  | yes  |
| Recommended for XMP code   | yes  | 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) | Even critical disturbance signals are suppressed (examples: signal pattern of fig. 15 and fig. 16) |

**Note**

- For data formats with long bursts (more than 10 carrier cycles) please see the datasheet for TSOP382..., TSOP384..., TSOP392..., TSOP394..



PACKAGE DIMENSIONS in millimeters



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