

## IR Receiver Modules for Remote Control Systems



23051

### DESIGN SUPPORT TOOLS

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### MECHANICAL DATA

#### Pinning for TSOP53...:

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

### FEATURES

- Improved immunity against HF and RF noise
- Low supply current
- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Supply voltage: 2.5 V to 5.5 V
- Improved immunity against optical noise
- Insensitive to supply voltage ripple and noise
- Compatible with wave or reflow soldering (see "P" version of Minimold option datasheets)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### DESCRIPTION

The TSOP531.., TSOP533.., and TSOP535.. series are miniaturized IR receiver modules for infrared remote control systems. A PIN diode and a preamplifier are assembled on lead frame, the epoxy package contains an IR filter. The demodulated output signal can be directly connected to a microprocessor for decoding.

The TSOP533.. series devices are optimized to suppress almost all spurious pulses from Wi-Fi and CFL sources. They may suppress some data signals if continuously transmitted.

The TSOP531.. series devices are provided primarily for compatibility with old AGC1 designs. New designs should prefer the TSOP533.. series containing the newer AGC3.

The TSOP535.. series are useful to suppress even extreme levels of optical noise, but may also suppress some data signals. Please check compatibility with your codes.

These components have not been qualified according to automotive specifications.

| PARTS TABLE       |        |  |   |  |  |
|-------------------|--------|--|---|--|--|
| AGC               |        | LEGACY, FOR SHORT BURSTS (AGC1)                              | FOR SHORT BURSTS, NOISY ENVIRONMENTS (AGC3) | FOR SHORT BURSTS, VERY NOISY ENVIRONMENTS (AGC5) |  |
| Carrier frequency | 30 kHz | TSOP53130  | TSOP53330                                   | TSOP53530  |  |
|                   | 33 kHz | TSOP53133  | TSOP53333                                   | TSOP53533  |  |
|                   | 36 kHz | TSOP53136  | TSOP53336 <sup>(1)</sup>                    | TSOP53536  |  |
|                   | 38 kHz | TSOP53138  | TSOP53338 <sup>(2)(3)(4)(5)</sup>           | TSOP53538  |  |
|                   | 40 kHz | TSOP53140  | TSOP53340                                   | TSOP53540  |  |
|                   | 56 kHz | TSOP53156  | TSOP53356                                   | TSOP53556  |  |
| Package           |        | Minimold   |   |  |  |
| Pinning           |        | 1 = OUT, 2 = GND, 3 = $V_S$                                  |   |  |  |
| Dimensions (mm)   |        | 5.4 W x 6.35 H x 4.9 D                                       |   |  |  |
| Mounting          |        | Leaded   |   |  |  |
| Application       |        | Remote control   |   |  |  |
| Best choice for   |        | (1) MCIR (2) Mitsubishi (3) RECS-80 Code (4) r-map (5) XMP-1 |   |  |  |

**BLOCK DIAGRAM**

**APPLICATION CIRCUIT**

**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**

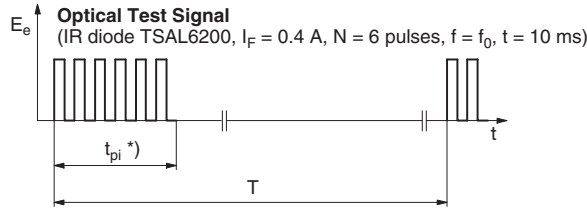
- Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure 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        | $E_v = 0, V_S = 5\text{ V}$  | $I_{SD}$          | 0.55 | 0.7      | 0.9  | mA              |
|                       | $E_v = 40\text{ klx}$ , sunlight   | $I_{SH}$          | -    | 0.8      | -    | mA              |
| Supply voltage        |  | $V_S$             | 2.5  | -        | 5.5  | V               |
| Transmission distance | $E_v = 0$ , test signal see Fig. 1, IR diode TSAL6200, $I_F = 50\text{ mA}$                | $d$               | -    | 24       | -    | 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                        | $E_e\text{ max.}$ | 50   | -        | -    | $\text{W/m}^2$  |
| Directivity           | Angle of half transmission distance  | $\phi_{1/2}$      | -    | $\pm 45$ | -    | deg             |



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



\*)  $t_{pi} \geq 6/f_0$  is recommended for optimal function

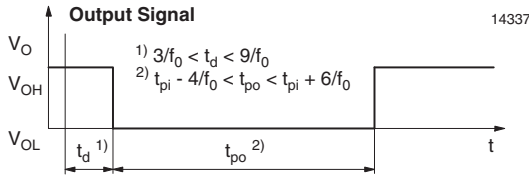


Fig. 1 - Output Active Low

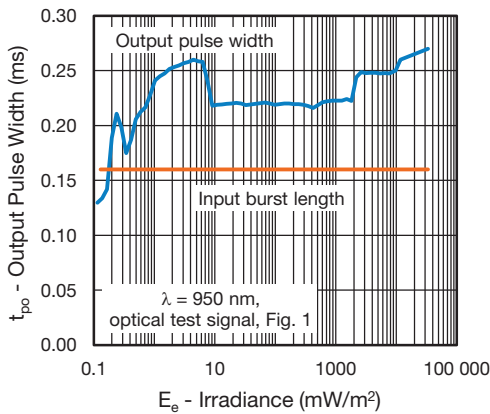


Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

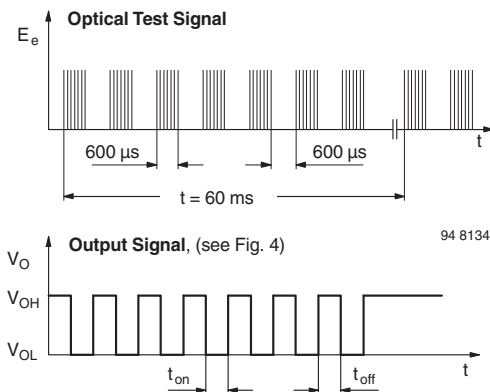


Fig. 3 - Output Function

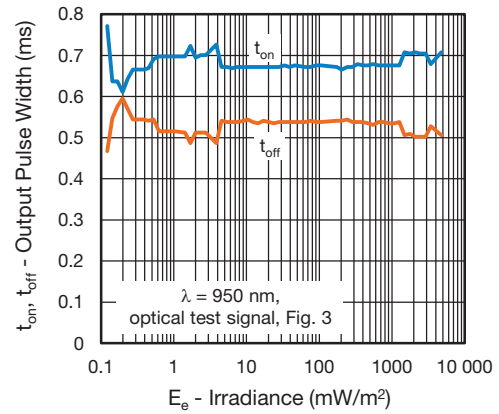


Fig. 4 - Output Pulse Diagram

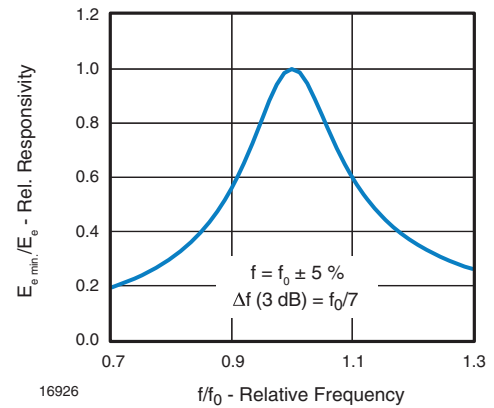


Fig. 5 - Frequency Dependence of Responsivity

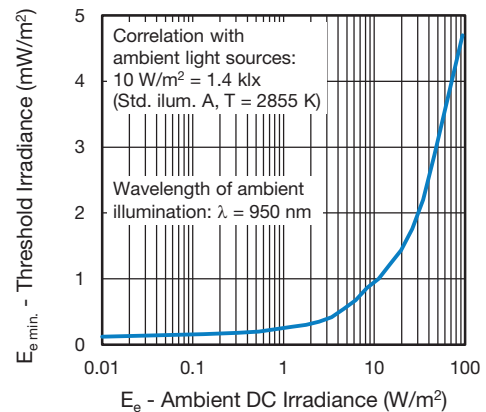


Fig. 6 - Sensitivity in Bright Ambient



Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

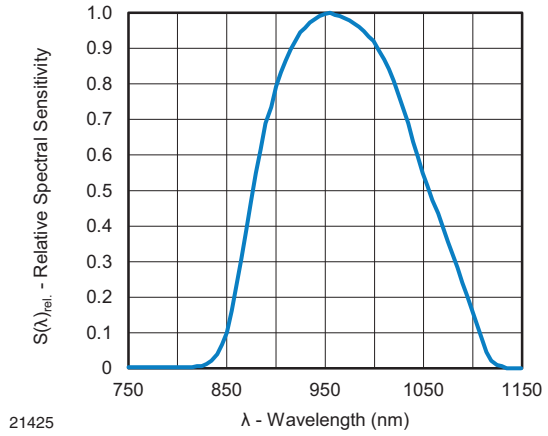


Fig. 10 - Relative Spectral Sensitivity vs. Wavelength

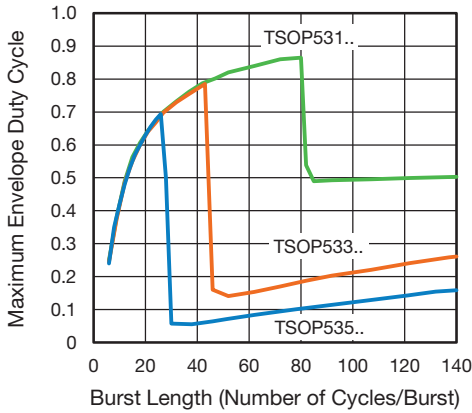


Fig. 8 - Max. Envelope Duty Cycle vs. Burst Length

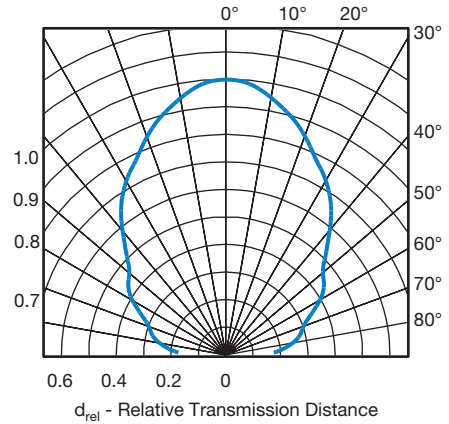


Fig. 11 - Horizontal Directivity

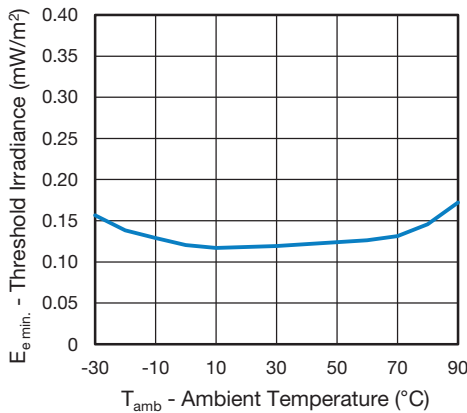


Fig. 9 - Sensitivity vs. Ambient Temperature

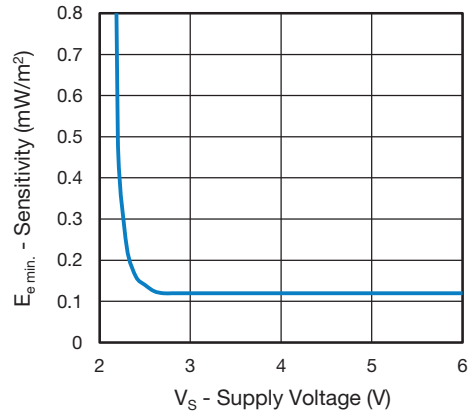


Fig. 12 - Sensitivity vs. Supply Voltage

**SUITABLE DATA FORMAT**

This series is designed to suppress spurious output pulses due to noise or disturbance signals. The devices can distinguish data signals from noise due to differences in frequency, burst length, and envelope duty cycle. The data signal should be close to the device's band-pass center frequency (e.g. 38 kHz) and fulfill the conditions in the table below.

When a data signal presented to the device in the presence of a disturbance, the sensitivity of the receiver is automatically reduced by the AGC to insure that no spurious pulses are present at the receiver's output. Some examples which are suppressed are:

- DC light (e.g. from tungsten bulbs sunlight)
- Continuous signals at any frequency
- Strongly or weakly modulated patterns from fluorescent lamps with electronic ballasts (see Fig. 13 or Fig. 14).
- 2.4 GHz and 5 GHz Wi-Fi



Fig. 13 - IR Disturbance from Fluorescent Lamp With Low Modulation



Fig. 14 - IR Disturbance from Fluorescent Lamp With High Modulation

|  | <b>TSOP531..</b>  | <b>TSOP533..</b>   | <b>TSOP535..</b>  |
|--|---|--|---|
| Minimum burst length   | 6 cycles/burst  | 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  | 6 to 24 cycles<br>≥ 10 cycles   |
| For bursts greater than<br>a minimum gap time in the data<br>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<br>short bursts/second                              | 2000  | 2000   | 2000  |
| MCIR code  | Yes   | Preferred  | Yes   |
| XMP-1 code   | Yes   | Preferred  | Yes   |
| Suppression of interference from<br>fluorescent lamps                            | Mild disturbance patterns<br>are suppressed (example:<br>signal pattern of Fig. 13) | Complex disturbance patterns<br>are suppressed (example: signal<br>pattern of Fig. 14) | Critical disturbance patterns<br>are suppressed,<br>e.g. highly dimmed LCDs |

**Note**

- For data formats with long bursts (more than 10 carrier cycles) please see the datasheet for TSOP532.., TSOP534..



## PACKAGE DIMENSIONS in millimeters



Not indicated tolerances ± 0.2



Technical drawings according to DIN specification.

Drawing no.: 6.550-5335.01-4  
Issue: 1; 16.09.15



## BULK PACKAGING

Standard shipping for minimold is in conductive plastic bags. The packing quantity is determined by weight and a maximum of 0.3 % of the components per carton may be missing.

## ORDERING INFORMATION



### Note

- d = "digit", please consult the list of available series on the previous page to create a valid part number

Examples: **TSOP53338**

**TSOP53356VI1**

**TSOP53338SS1F**

## PACKAGING QUANTITY

- 300 pieces per bag (each bag is individually boxed)
- 6 bags per carton



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