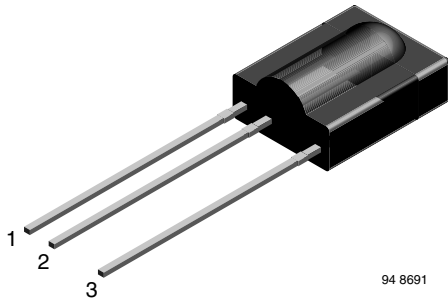


## IR Receiver Modules for Remote Control Systems



94 8691

### LINKS TO ADDITIONAL RESOURCES


[Bends and Cuts](#)

### DESCRIPTION

The TSOP311.., TSOP313.., and TSOP315.. series are miniaturized receivers for infrared remote control systems. A PIN diode and a preamplifier are assembled on a lead frame, the epoxy package contains an IR filter. The demodulated output signal can be directly connected to a microprocessor for decoding.

The TSOP313.. series devices are optimized to suppress almost all spurious pulses from energy saving lamps like CFLs. AGC3 may also suppress some data signals if continuously transmitted.

The TSOP311.. series are provided primarily for compatibility with old AGC1 designs. New designs should prefer the TSOP313.. series containing the newer AGC3. The TSOP315.. series contain a very robust AGC5. This series should only be used for critically noisy environments.

These components have not been qualified according to automotive specifications.

### FEATURES

- Very 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 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)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

### MECHANICAL DATA

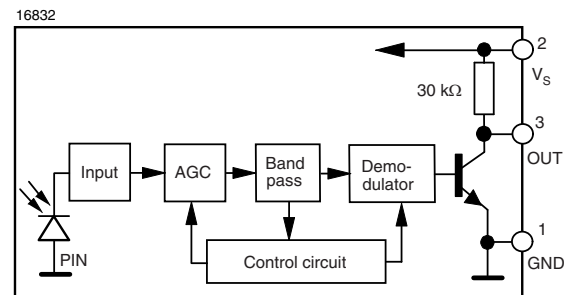
#### Pinning:

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

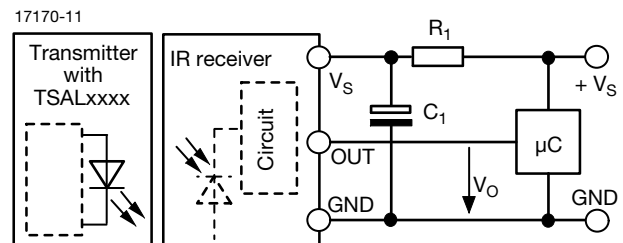
### ORDERING CODE

TSO.1. - 1000 pieces in tubes

### BLOCK DIAGRAM



### APPLICATION CIRCUIT



$R_1$  and  $C_1$  recommended to reduce supply ripple for  $V_S < 2.8$  V



| PARTS TABLE              |        |  |  |   |  |
|--------------------------|--------|--|--|---|--|
| AGC                      |        | LEGACY, FOR SHORT BURST REMOTE CONTROLS (AGC1)   | NOISY ENVIRONMENTS AND SHORT BURSTS (AGC3) | VERY NOISY ENVIRONMENTS AND SHORT BURSTS (AGC5) |  |
| Carrier frequency        | 30 kHz | TSOP31130  | TSOP31330                                  | TSOP31530                                       |  |
|                          | 33 kHz | TSOP31133  | TSOP31333                                  | TSOP31533                                       |  |
|                          | 36 kHz | TSOP31136  | TSOP31336 <sup>(1)(6)</sup>                | TSOP31536                                       |  |
|                          | 38 kHz | TSOP31138  | TSOP31338 <sup>(2)(3)(4)(5)</sup>          | TSOP31538                                       |  |
|                          | 40 kHz | TSOP31140  | TSOP31340                                  | TSOP31540                                       |  |
|                          | 56 kHz | TSOP31156  | TSOP31356                                  | TSOP31556                                       |  |
| Package                  |        | Cast   |  |   |  |
| Pinning                  |        | 1 = GND, 2 = V <sub>S</sub> , 3 = OUT  | 1 = GND, 2 = V <sub>S</sub> , 3 = OUT      | 1 = GND, 2 = V <sub>S</sub> , 3 = OUT           |  |
| Dimensions (mm)          |        | 10.0 W x 12.5 H x 5.8 D  |  |   |  |
| Mounting                 |        | Leaded   |  |   |  |
| Application              |        | Remote control   |  |   |  |
| Best remote control code |        | <sup>(1)</sup> MCIR <sup>(2)</sup> Mitsubishi <sup>(3)</sup> RECS-80 Code <sup>(4)</sup> r-map <sup>(5)</sup> XMP-1, XMP-2 <sup>(6)</sup> RCMM |  |   |  |
| Special options          |        | • Low voltage option: <a href="http://www.vishay.com/doc?82382">www.vishay.com/doc?82382</a>   |  |   |  |

| ABSOLUTE MAXIMUM RATINGS    |                          |                  |                                |      |
|-----------------------------|--------------------------|------------------|--------------------------------|------|
| PARAMETER                   | TEST CONDITION           | SYMBOL           | VALUE                          | UNIT |
| Supply voltage (pin 2)      |                          | V <sub>S</sub>   | -0.3 to +6                     | V    |
| Supply current (pin 2)      |                          | I <sub>S</sub>   | 3                              | mA   |
| Output voltage (pin 3)      |                          | V <sub>O</sub>   | -0.3 to (V <sub>S</sub> + 0.3) | V    |
| Output current (pin 3)      |                          | I <sub>O</sub>   | 5                              | mA   |
| Junction temperature        |                          | T <sub>j</sub>   | 100                            | °C   |
| Storage temperature range   |                          | T <sub>stg</sub> | -25 to +85                     | °C   |
| Operating temperature range |                          | T <sub>amb</sub> | -25 to +85                     | °C   |
| Power consumption           | T <sub>amb</sub> ≤ 85 °C | P <sub>tot</sub> | 10                             | mW   |
| Soldering temperature       | t ≤ 10 s, 1 mm from case | T <sub>sd</sub>  | 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 <sub>amb</sub> = 25 °C, unless otherwise specified) |   |                     |      |      |      |                   |
|---|---|---------------------|------|------|------|-------------------|
| PARAMETER   | TEST CONDITION  | SYMBOL              | MIN. | TYP. | MAX. | UNIT              |
| Supply current (pin 2)  | E <sub>v</sub> = 0, V <sub>S</sub> = 3.3 V  | I <sub>SD</sub>     | 0.27 | 0.35 | 0.45 | mA                |
|   | E <sub>v</sub> = 40 klx, sunlight   | I <sub>SH</sub>     | -    | 0.45 | -    | mA                |
| Supply voltage  |   | V <sub>S</sub>      | 2.5  | -    | 5.5  | V                 |
| Transmission distance   | E <sub>v</sub> = 0, test signal see Fig. 1, IR diode TSAL6200, I <sub>F</sub> = 50 mA   | d                   | -    | 24   | -    | m                 |
| Output voltage low (pin 3)  | I <sub>OSL</sub> = 0.5 mA, E <sub>e</sub> = 0.7 mW/m <sup>2</sup> , test signal see Fig. 1  | V <sub>OSL</sub>    | -    | -    | 100  | mV                |
| Minimum irradiance  | Pulse width tolerance: t <sub>pi</sub> - 5/f <sub>o</sub> < t <sub>po</sub> < t <sub>pi</sub> + 6/f <sub>o</sub> , test signal see Fig. 1 | E <sub>e min.</sub> | -    | 0.12 | 0.25 | mW/m <sup>2</sup> |
| Maximum irradiance  | t <sub>pi</sub> - 5/f <sub>o</sub> < t <sub>po</sub> < t <sub>pi</sub> + 6/f <sub>o</sub> , test signal see Fig. 1                        | E <sub>e max.</sub> | 30   | -    | -    | W/m <sup>2</sup>  |
| Directivity   | Angle of half transmission distance   | φ <sub>1/2</sub>    | -    | ± 45 | -    | °                 |

## TYPICAL CHARACTERISTICS (T<sub>amb</sub> = 25 °C, unless otherwise specified)

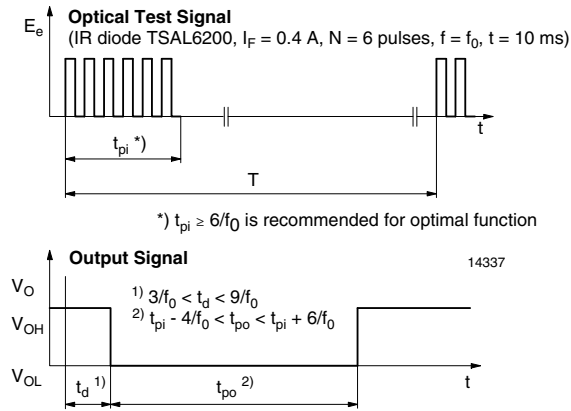


Fig. 1 - Output Active Low

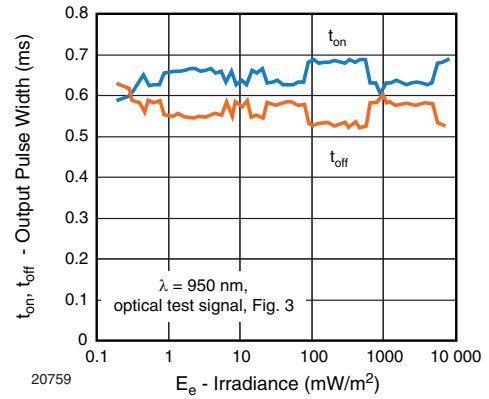


Fig. 4 - Output Pulse Diagram

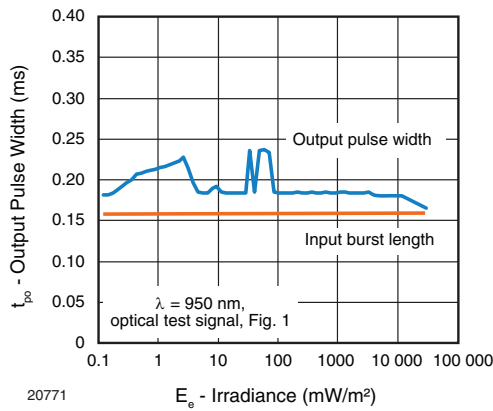


Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

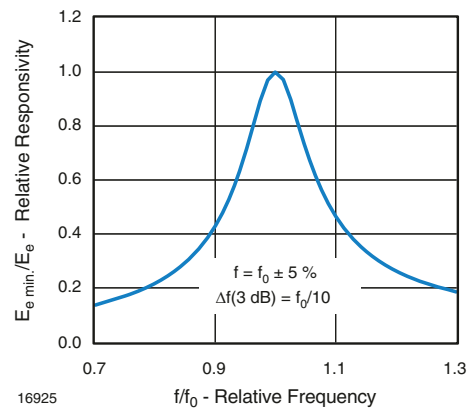


Fig. 5 - Frequency Dependence of Responsivity

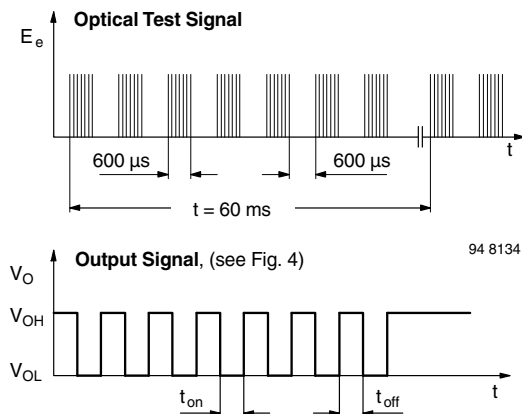


Fig. 3 - Output Function

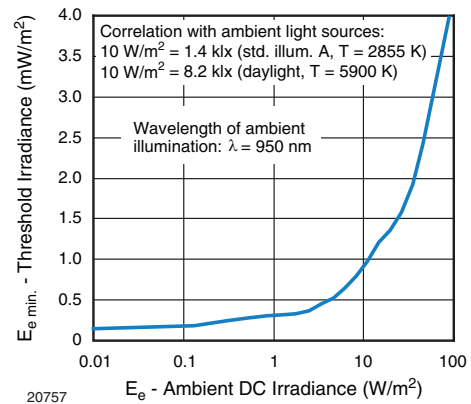


Fig. 6 - Sensitivity in Bright Ambient

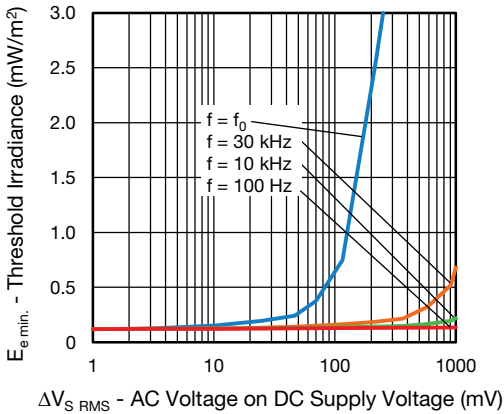


Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

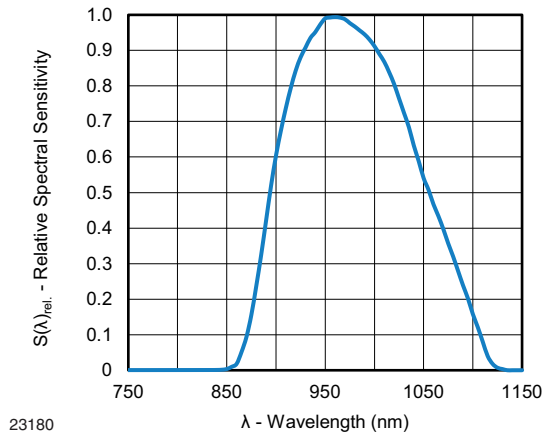


Fig. 10 - Relative Spectral Sensitivity vs. Wavelength

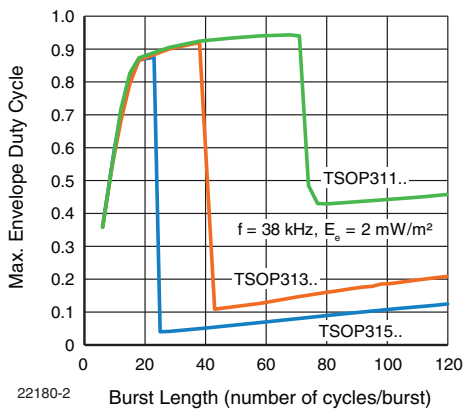


Fig. 8 - Max. Envelope Duty Cycle vs. Burst Length

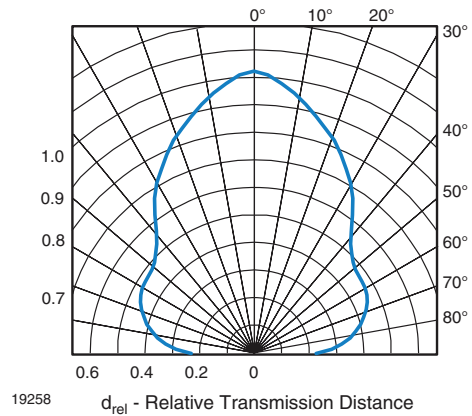


Fig. 11 - Horizontal Directivity

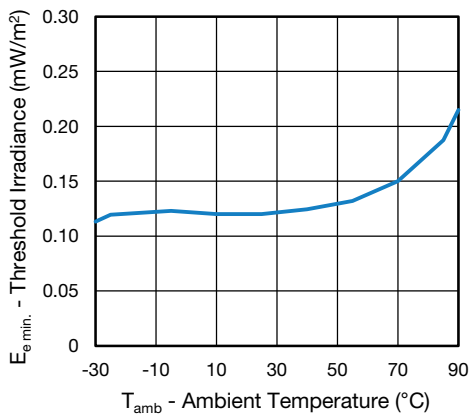


Fig. 9 - Sensitivity vs. Ambient Temperature

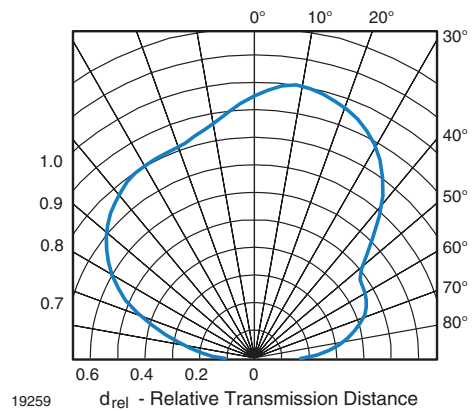


Fig. 12 - Vertical Directivity



Fig. 13 - 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 is applied to the product 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. 14 or Fig. 15).

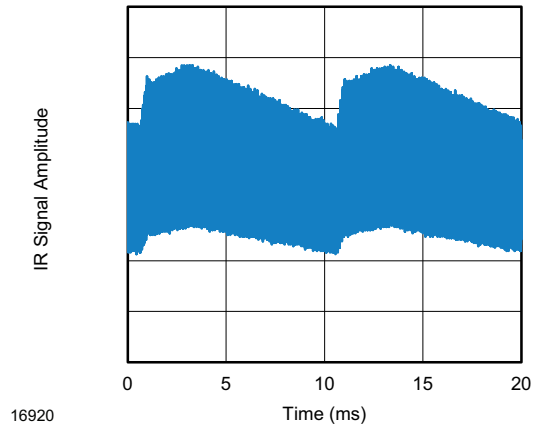


Fig. 14 - IR Disturbance from Fluorescent Lamp with Low Modulation

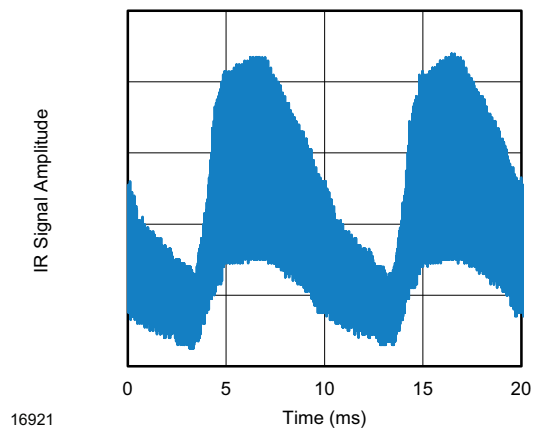


Fig. 15 - IR Disturbance from Fluorescent Lamp with High Modulation

|  | <b>TSOP311..</b>  | <b>TSOP313..</b>   | <b>TSOP315..</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   |
| RCMM code  | Yes   | Preferred  | Yes   |
| XMP-1, XMP-2 code  | Yes   | Preferred  | Yes   |
| Suppression of interference from<br>fluorescent lamps                            | Mild disturbance patterns<br>are suppressed (example:<br>signal pattern of Fig. 14) | Complex disturbance patterns<br>are suppressed (example:<br>signal pattern of Fig. 15) | Critical disturbance<br>patterns 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 TSOP312.., TSOP314..





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