# IR Receiver Modules for Remote Control Systems



16672

## 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
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

Pb-free

e3

## MECHANICAL DATA

**Pinning:**

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

## DESCRIPTION

The TSOP321.., TSOP323.. 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 TSOP321.. is compatible with all common IR remote control data formats. The TSOP323.. 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 | TSOP32130 | TSOP32330 |
| 33 kHz | TSOP32133 | TSOP32333 |
| 36 kHz | TSOP32136 | TSOP32336 |
| 38 kHz | TSOP32138 | TSOP32338 |
| 40 kHz | TSOP32140 | TSOP32340 |
| 56 kHz | TSOP32156 | TSOP32356 |

## BLOCK DIAGRAM



16834
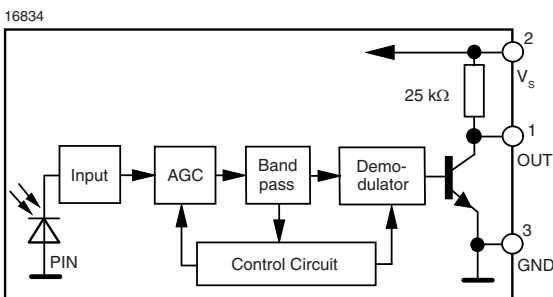
## APPLICATION CIRCUIT



17170_5
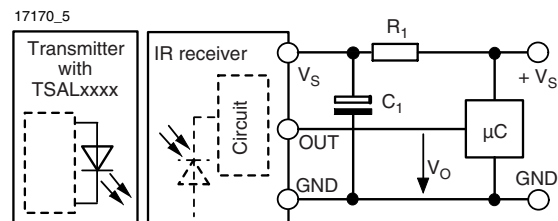
$R_1$ and $C_1$ are recommended for protection against EOS. Components should be in the range of 33 $\Omega$ < $R_1$ < 1 k$\Omega$, $C_1$ > 0.1 µF.

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### IR Receiver Modules for Remote Control Systems

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## 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 1) | | $V_O$ | - 0.3 to ($V_S$ + 0.3) | V |
| Output current (pin 1) | | $I_O$ | 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 | $T_{amb} \leq 85$ °C | $P_{tot}$ | 10 | mW |
| Soldering temperature | $t \leq 10$ 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 condtions 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) | $E_v = 0$, $V_S = 3.3$ V | $I_{SD}$ | 0.27 | 0.35 | 0.45 | mA |
| | $E_v = 40$ 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, $I_F = 250$ mA | d | | 45 | | m |
| Output voltage low (pin 1) | $I_{OSL} = 0.5$ mA, $E_e = 0.7$ 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 | $E_{e\ min.}$ | | 0.1 | 0.25 | mW/m$^2$ |
| Maximum irradiance | $t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$, test signal see fig. 1 | $E_{e\ max.}$ | 30 | | | W/m$^2$ |
| Directivity | Angle of half transmission distance | $\varphi_{1/2}$ | | ± 45 | | deg |

**Note**

[1] $T_{amb} = 25$ °C, unless otherwise specified

## TYPICAL CHARACTERISTICS

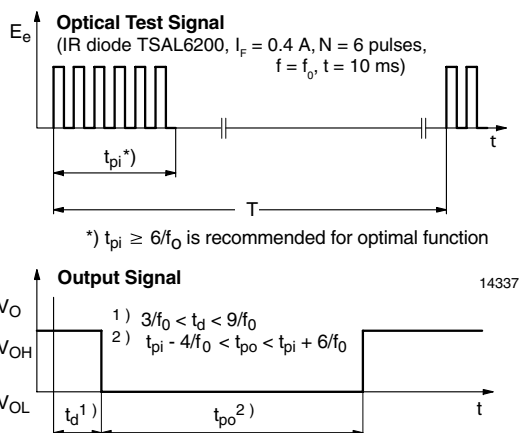$T_{amb} = 25$ °C, unless otherwise specified



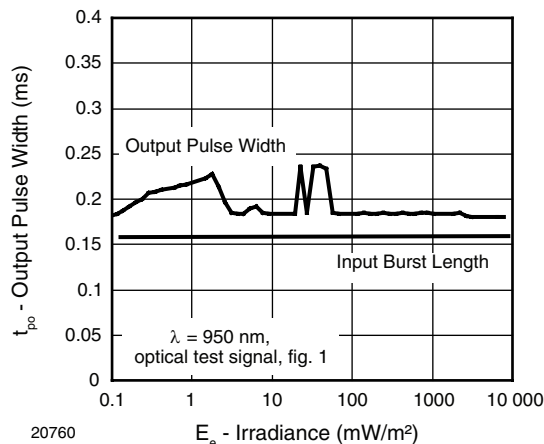Fig. 1 - Output Active Low



Fig. 2 - Pulse Length and Sensitivity in Dark Ambient
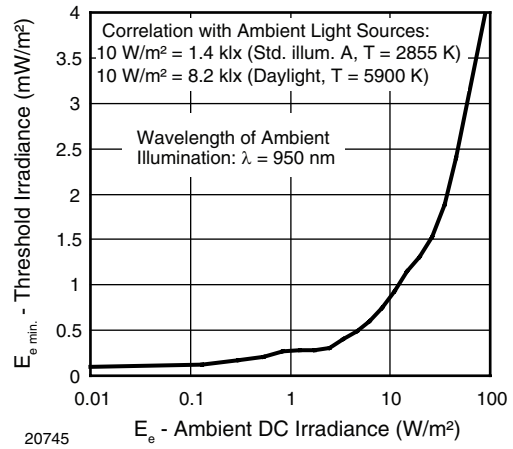
Fig. 3 - Output Function



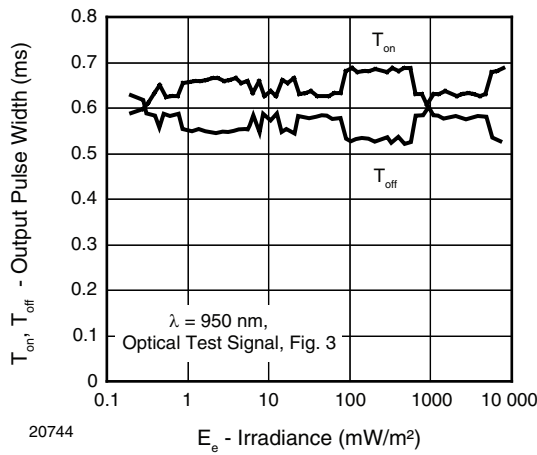Fig. 6 - Sensitivity in Bright Ambient
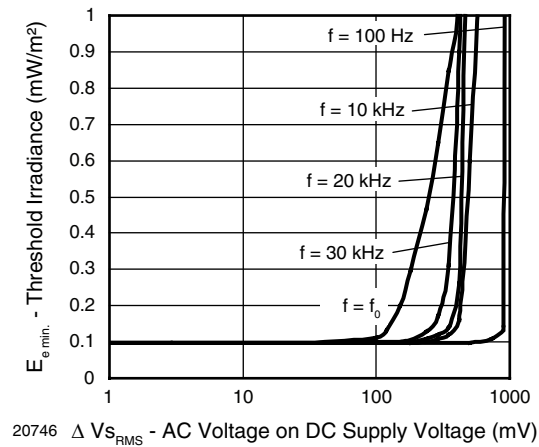


Fig. 4 - Output Pulse Diagram



Fig. 7 - Sensitivity vs. Supply Voltage Disturbances
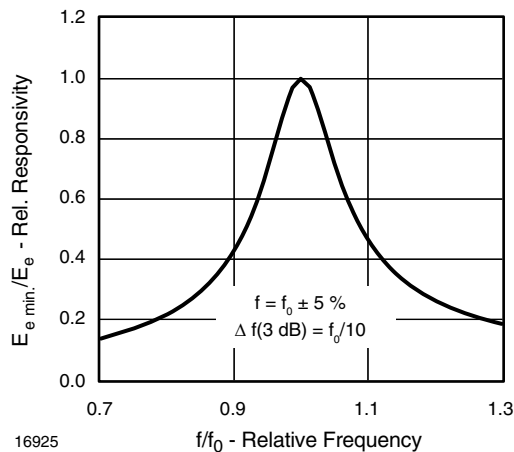


Fig. 5 - Frequency Dependence of Responsivity



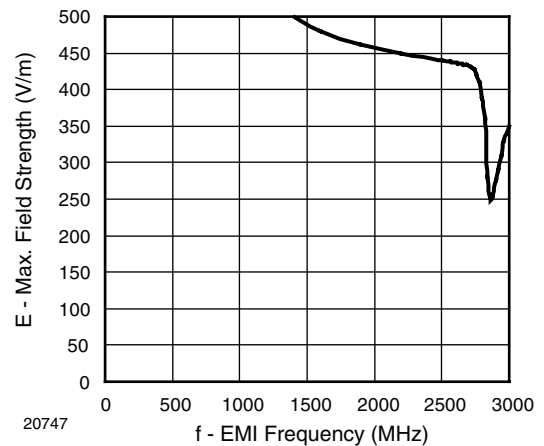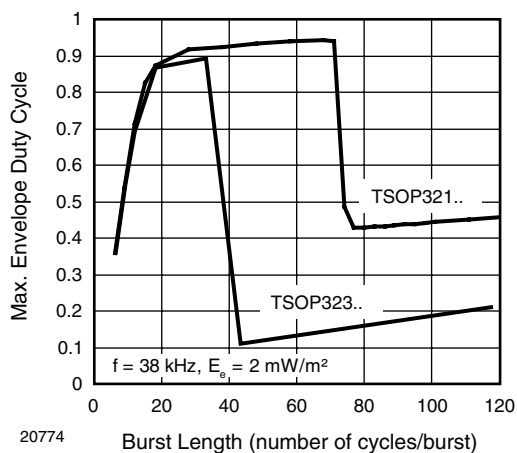Fig. 8 - Sensitivity vs. Electric Field Disturbances

20774

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

Max. Envelope Duty Cycle vs. Burst Length (number of cycles/burst), $f = 38$ kHz, $E_e = 2$ mW/m², TSOP321.., TSOP323..



96 12223p2    $d_{rel}$ - Relative Transmission Distance
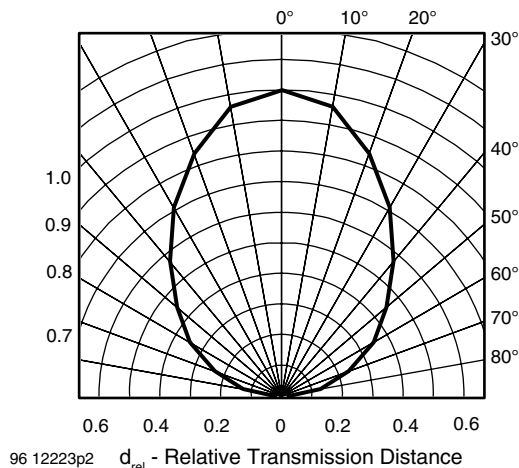
Fig. 12 - Horizontal Directivity



20749
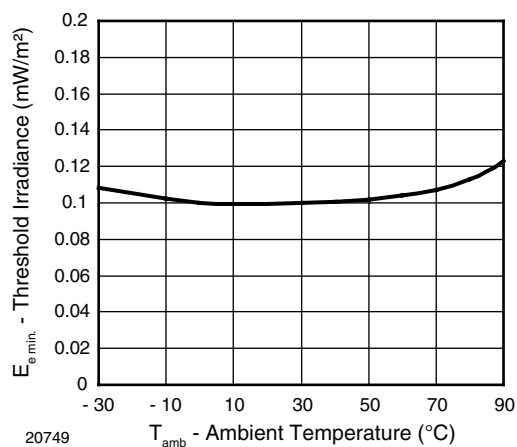
Fig. 10 - Sensitivity vs. Ambient Temperature

$E_{e\ min.}$ - Threshold Irradiance (mW/m²) vs. $T_{amb}$ - Ambient Temperature (°C)



20750

Fig. 13 - Sensitivity vs. Supply Voltage

$E_{e\ min.}$ - Sensitivity (mW/m²) vs. $V_S$ - Supply Voltage (V)



16919
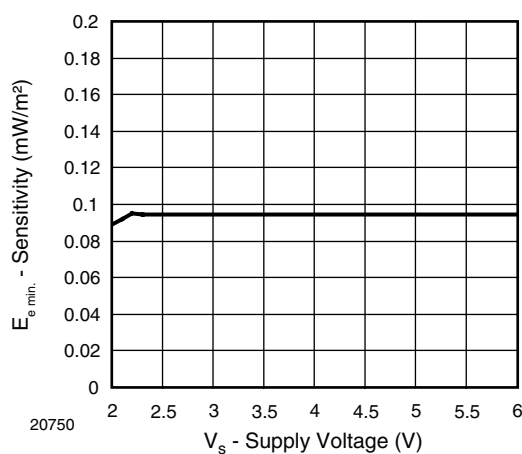
Fig. 11 - Relative Spectral Sensitivity vs. Wavelength

$S\ (\lambda)_{rel}$ - Relative Spectral Sensitivity vs. $\lambda$ - Wavelength (nm)

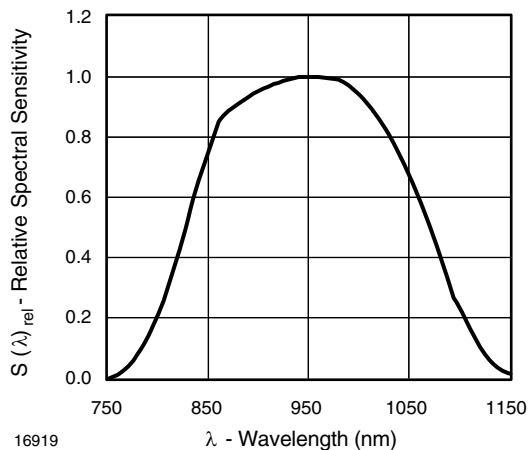## SUITABLE DATA FORMAT

The TSOP321.., TSOP323.. 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 TSOP321.., TSOP323.. 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

|  | TSOP321.. | TSOP323.. |
|---|---|---|
| Minimum burst length | 6 cycles/burst | 6 cycles/burst |
| After each burst of length<br>a minimum gap time is required of | 6 to 70 cycles<br>$\geq$ 10 cycles | 6 to 35 cycles<br>$\geq$ 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 supressed (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 data sheet for TSOP322.., TSOP324.
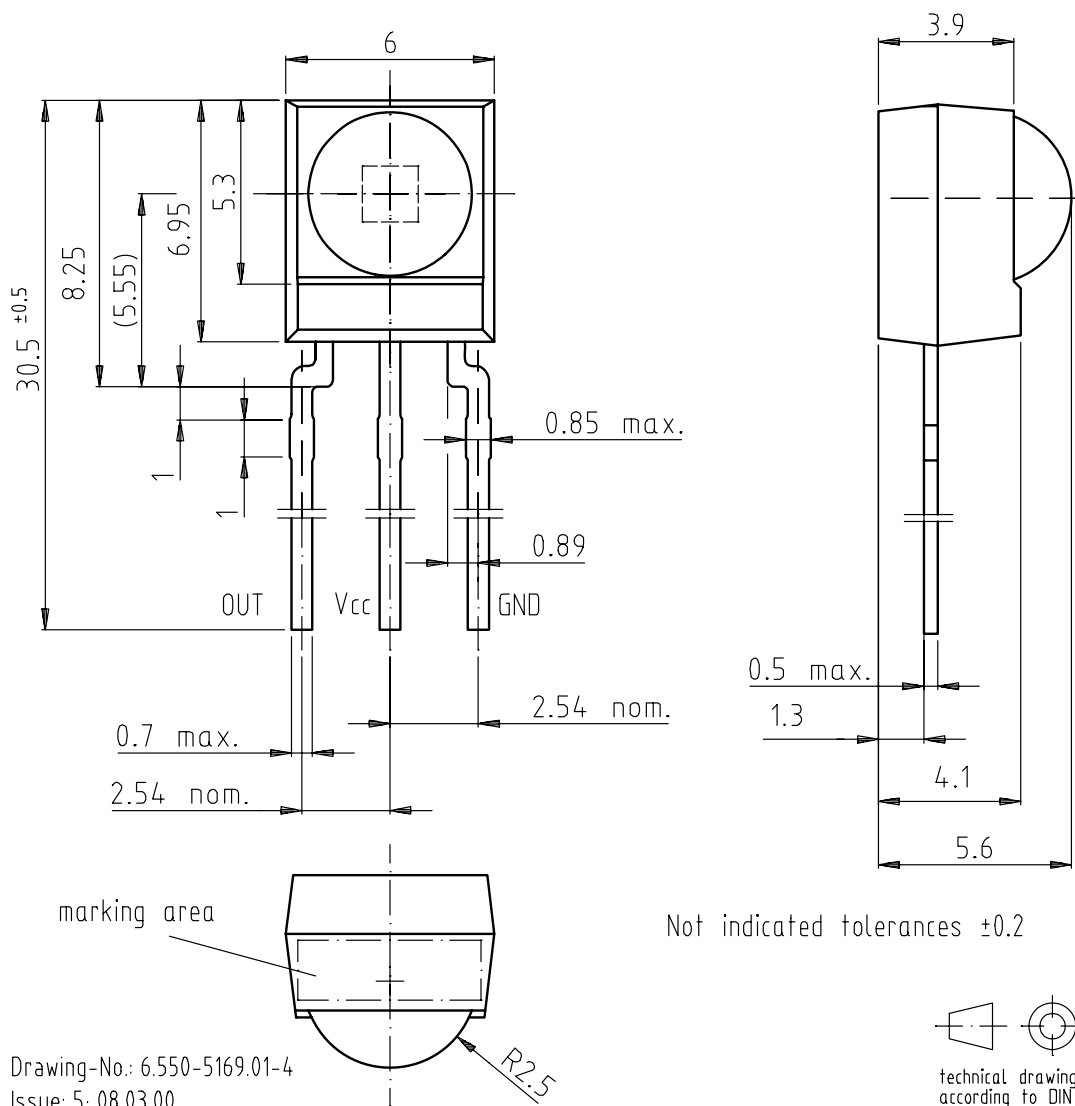
IR Receiver Modules for
Remote Control Systems

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## PACKAGE DIMENSIONS in millimeters



6

5.3

6.95

(5.55)

8.25

30.5 ±0.5

0.85 max.

1

1

0.89

OUT    Vcc    GND

2.54 nom.

0.7 max.

2.54 nom.

marking area

Drawing-No.: 6.550-5169.01-4
Issue: 5; 08.03.00

R2.5

3.9

0.5 max.

1.3

4.1

5.6

Not indicated tolerances ±0.2
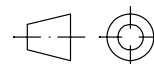
technical drawings
according to DIN
specifications

13655

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## OZONE DEPLETING SUBSTANCES POLICY STATEMENT

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
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.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively.
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.
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

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and may do so without further notice.
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