VISHAY
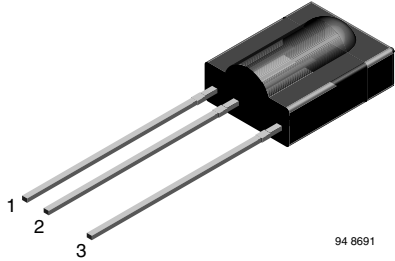
IR Receiver Modules for Remote Control Systems

94 8691

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
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Insensitive to supply voltage ripple and noise

Pb-free

e3

RoHS COMPLIANT

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 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. The TSOP315.. has 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 BURSTS AND HIGH DATA RATES (AGC1)	NOISY ENVIRONMENTS AND SHORT BURSTS (AGC3)	VERY NOISY ENVIRONMENTS AND SHORT BURSTS (AGC5)
30 kHz	TSOP31130	TSOP31330	TSOP31530
33 kHz	TSOP31133	TSOP31333	TSOP31533
36 kHz	TSOP31136	TSOP31336	TSOP31536
38 kHz	TSOP31138	TSOP31338	TSOP31538
40 kHz	TSOP31140	TSOP31340	TSOP31540
56 kHz	TSOP31156	TSOP31356	TSOP31556

BLOCK DIAGRAM

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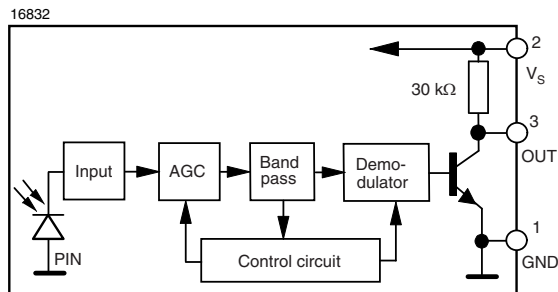
APPLICATION CIRCUIT

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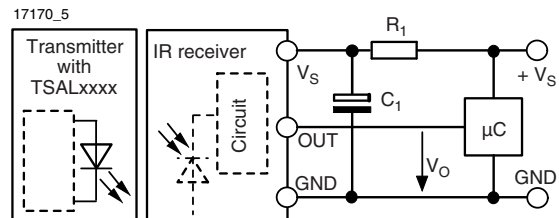
R_1 and C_1 are recommended for protection against EOS. Components should be in the range of 33 Ω < R_1 < 1 kΩ, C_1 > 0.1 µF.

ABSOLUTE MAXIMUM RATINGS

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Supply voltage (pin 2)		V_S	- 0.3 to + 6	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	$T_{amb} \leq 85$ °C	P_{tot}	10	mW
Soldering temperature	$t \leq 10$ 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 °C, unless otherwise specified)

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 3)	$I_{OSL} = 0.5$ 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	$E_{e\ min.}$		0.15	0.35	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

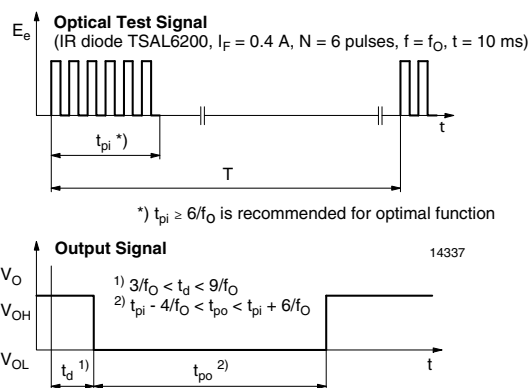## TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)
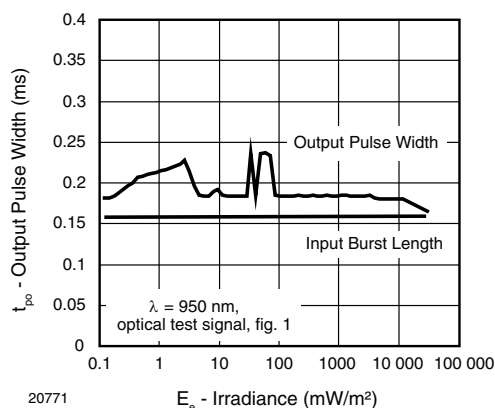

Fig. 1 - Output Active Low
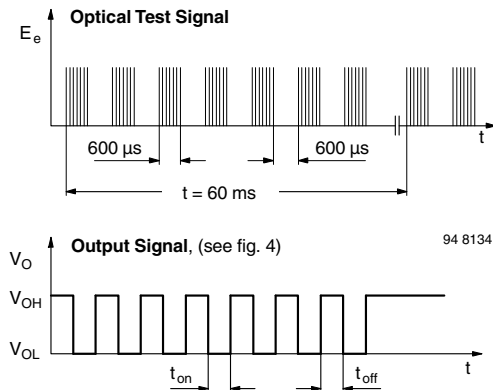

Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

Optical Test Signal

E_e

600 µs   600 µs

t

t = 60 ms

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Output Signal, (see fig. 4)

V_O

V_{OH}

V_{OL}

t_{on} t_{off}

t

Fig. 3 - Output Function

Correlation with Ambient Light Sources:
10 W/m² = 1.4 kLx (Std. illum. A, T = 2855 K)
10 W/m² = 8.2 kLx (Daylight, T = 5900 K)

Wavelength of Ambient
Illumination: λ = 950 nm

$E_{e\ min.}$ - Threshold Irradiance (mW/m²)

E_e - Ambient DC Irradiance (W/m²)

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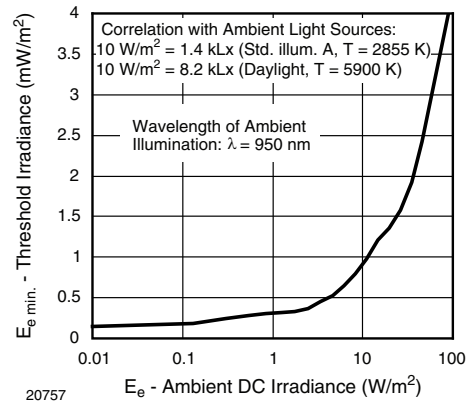
Fig. 6 - Sensitivity in Bright Ambient

T_{on}, T_{off} - Output Pulse Width (ms)

T_{on}

T_{off}

λ = 950 nm,
Optical Test Signal, Fig. 3

E_e - Irradiance (mW/m²)

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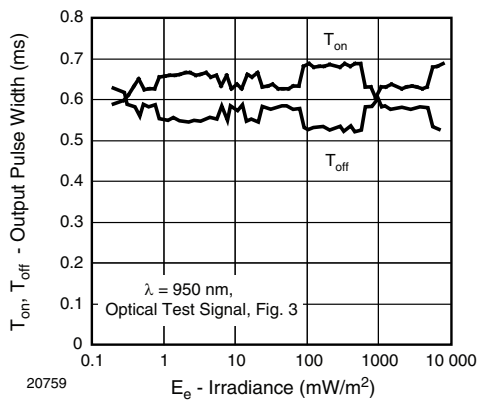
Fig. 4 - Output Pulse Diagram

$E_{e\ min.}$ - Threshold Irradiance (mW/m²)

f = 100 Hz

f = 10 kHz

f = 20 kHz

f = 30 kHz

f = f_o

20753 ΔVs_{RMS} - AC Voltage on DC Supply Voltage (mV)
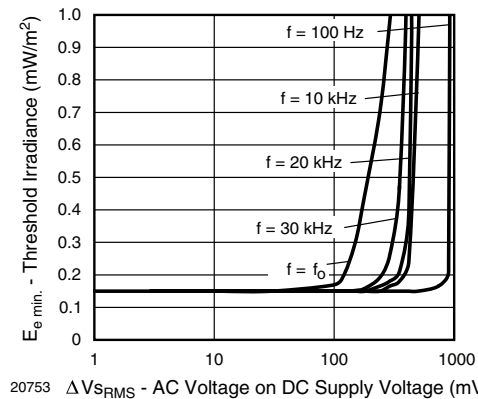
Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

$E_{e\ min.}/E_e$ - Rel. Responsivity

f = f_0 ± 5 %
Δ f(3 dB) = f_0/10

f/f_0 - Relative Frequency

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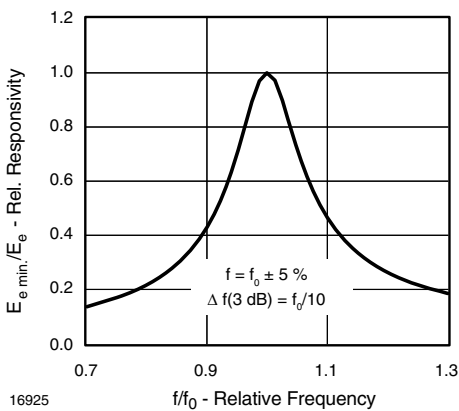
Fig. 5 - Frequency Dependence of Responsivity

E - Max. Field Strength (V/m)

f - EMI Frequency (MHz)

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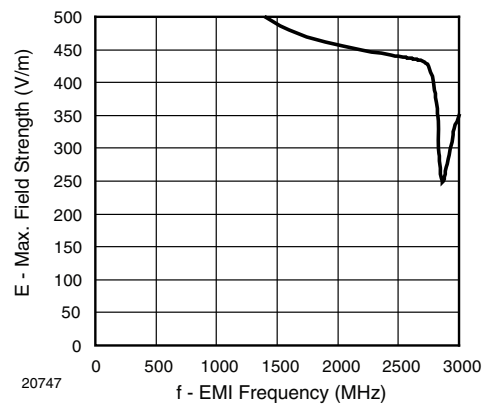
Fig. 8 - Sensitivity vs. Electric Field Disturbances

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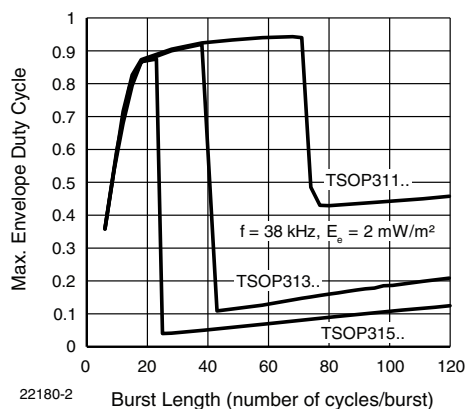
Fig. 9 - Max. Envelope Duty Cycle vs. Burst Length
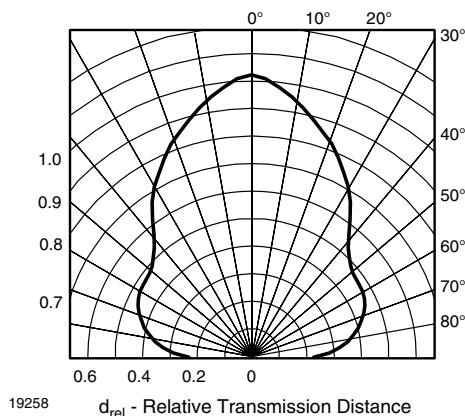

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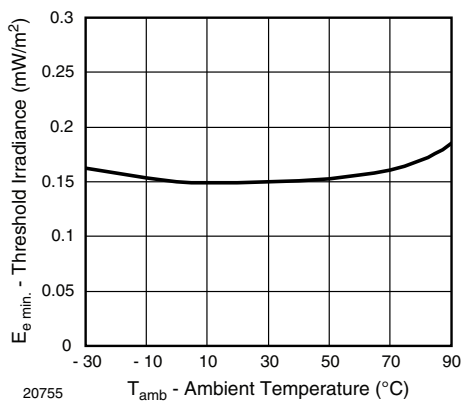Fig. 12 - Horizontal Directivity

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Fig. 10 - Sensitivity vs. Ambient Temperature
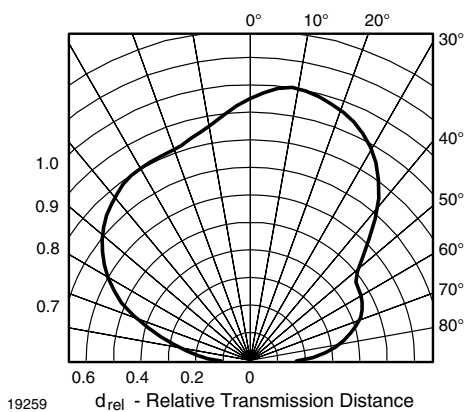
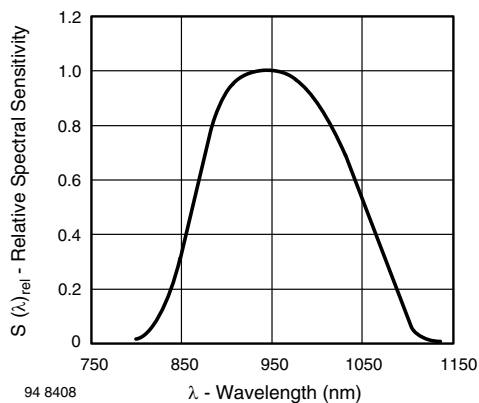

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Fig. 13 - Vertical Directivity

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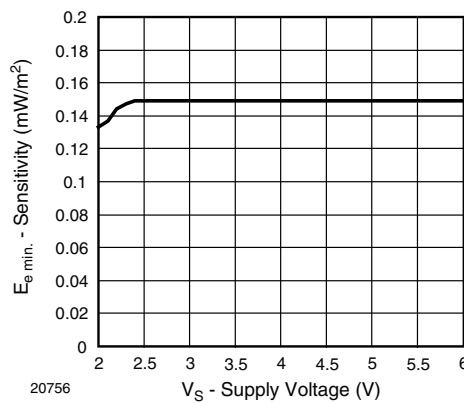Fig. 11 - Relative Spectral Sensitivity vs. Wavelength

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Fig. 14 - Sensitivity vs. Supply Voltage

SUITABLE DATA FORMAT

The TSOP311.., TSOP313.. and TSOP315.. 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.
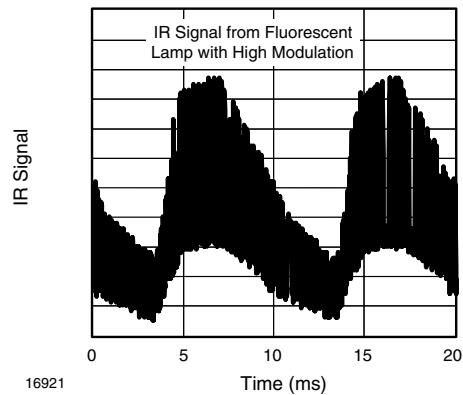
When a data signal is applied to the TSOP311.., TSOP313.. and TSOP315.. in the presence of a disturbance signal, the sensitivity of the receiver is reduced to insure that no spurious pulses are present at the output. Some examples of disturbance signals which are suppressed are:

• DC light (e.g. from tungsten bulb or sunlight)

• Continuous signals at any frequency

• Modulated noise from fluorescent lamps with electronic ballasts
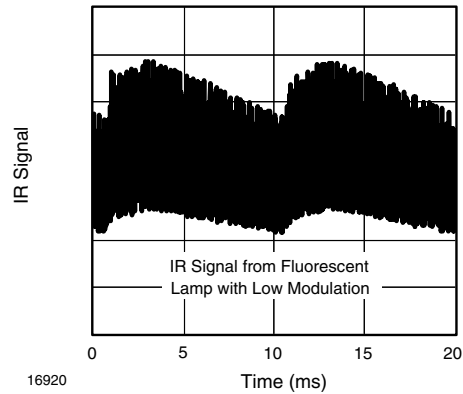
Fig. 15 - IR Signal from Fluorescent Lamp with Low Modulation

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

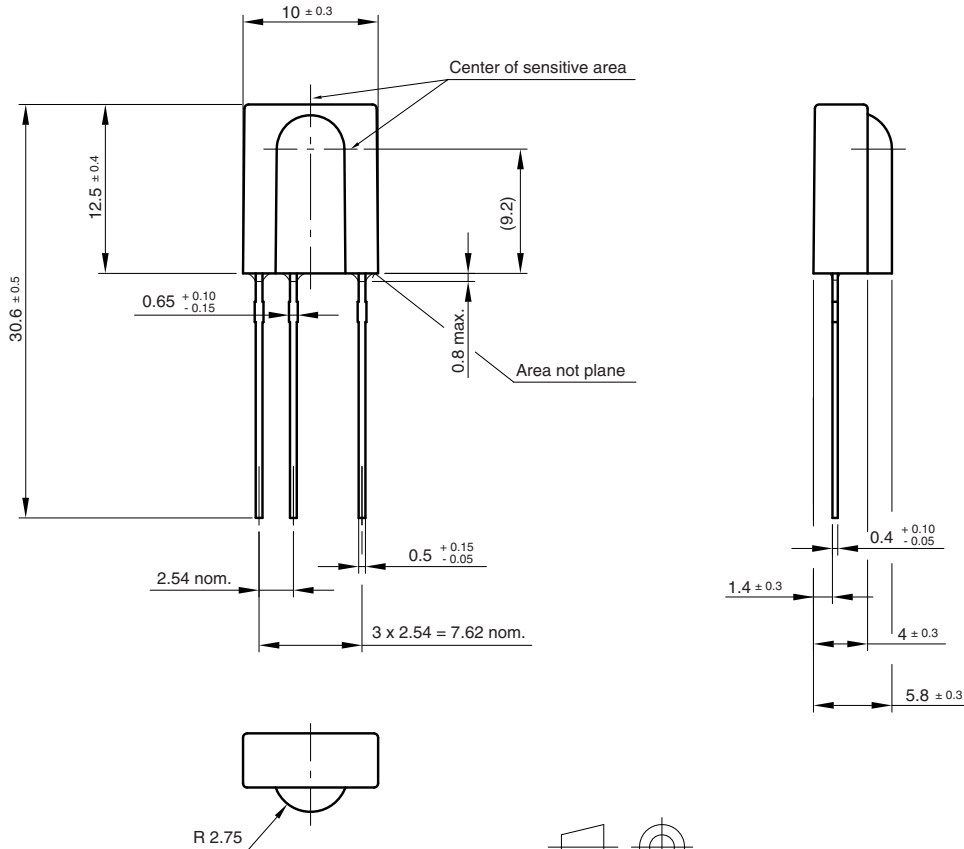|	TSOP311..	TSOP313..	TSOP315..
Minimum burst length	6 cycles/burst	6 cycles/burst	6 cycles/burst
After each burst of length A gap time is required of	6 to 70 cycles ≥ 10 cycles	6 to 35 cycles ≥ 10 cycles	6 to 24 cycles ≥ 10 cycles
For bursts greater than a minimum gap time in the data stream is needed of	70 cycles > 1.2 x burst length	35 cycles > 6 x burst length	24 cycles > 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 supressed (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 short bursts please see the datasheet for TSOP312.., TSOP314..

PACKAGE DIMENSIONS in millimeters

10 ± 0.3

Center of sensitive area

12.5 ± 0.4

(9.2)

30.6 ± 0.5

0.65 +0.10 -0.15

0.8 max.

Area not plane

0.5 +0.15 -0.05

2.54 nom.

3 x 2.54 = 7.62 nom.

0.4 +0.10 -0.05

1.4 ± 0.3

4 ± 0.3

5.8 ± 0.3

R 2.75

technical drawings
according to DIN
specifications

Drawing-No.: 6.550-5095.01-4

Issue: 20; 15.03.10

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