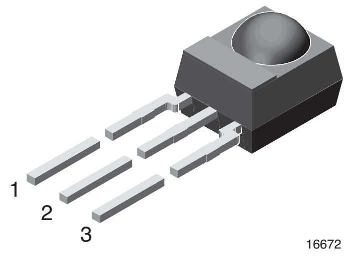
IR Receiver Modules for Remote Control Systems

Description

The TSOP22.. - series are miniaturized receivers for infrared remote control systems. PIN diode and preamplifier are assembled on lead frame, the epoxy package is designed as IR filter.

The demodulated output signal can directly be decoded by a microprocessor. TSOP22.. is the standard IR remote control receiver series, supporting all major transmission codes.



Features

- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Improved shielding against electrical field disturbance
- TTL and CMOS compatibility
- Output active low
- Low power consumption

Special Features

- Improved immunity against ambient light
- Suitable burst length ≥ 10 cycles/burst

Mechanical Data

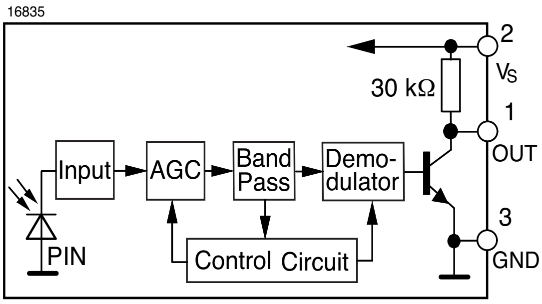
Pinning:

1 = OUT, 2 = V_S, 3 = GND

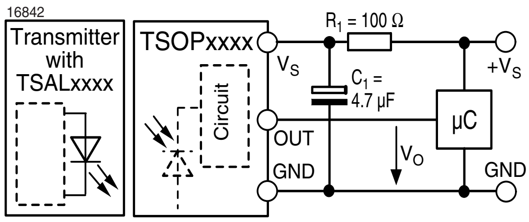
Parts Table

Part	Carrier Frequency
TSOP2230	30 kHz
TSOP2233	33 kHz
TSOP2236	36 kHz
TSOP2237	36.7 kHz
TSOP2238	38 kHz
TSOP2240	40 kHz
TSOP2256	56 kHz

Block Diagram



Application Circuit



R_1 + C_1 recommended to suppress power supply disturbances.

The output voltage should not be hold continuously at a voltage below V_O = 3.3 V by the external circuit.

Absolute Maximum Ratings

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

Parameter	Test condition	Symbol	Value	Unit
Supply Voltage	(Pin 2)	V_S	- 0.3 to + 6.0	V
Supply Current	(Pin 2)	I_S	5	mA
Output Voltage	(Pin 1)	V_O	- 0.3 to + 6.0	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}	50	mW
Soldering Temperature	t ≤ 10 s, 1 mm from case	T_{sd}	260	°C

Electrical and Optical Characteristics

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

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Supply Current (Pin 2)	V_S = 5 V, E_v = 0	I_{SD}	0.8	1.2	1.5	mA
	V_S = 5 V, E_v = 40 klx, sunlight	I_{SH}		1.5		mA
Supply Voltage (Pin 2)		V_S	4.5		5.5	V
Transmission Distance	E_v = 0, test signal see fig.1, IR diode TSAL6200, I_F = 250 mA	d		35		m
Output Voltage Low (Pin 1)	I_{OL} = 0.5 mA, E_e = 0.7 mW/m^2, f = f_o, test signal see fig. 1	V_{OL}			250	mV
Irradiance (30 - 40 kHz)	Pulse width tolerance: $t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$, test signal see fig.1	$E_{e\ min}$		0.2	0.4	mW/m^2
Irradiance (56 kHz)	Pulse width tolerance: $t_{pi} -5/f_o < t_{po} < t_{pi} +6/f_o$, test signal see fig.1	$E_{e\ min}$		0.3	0.5	mW/m^2
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)

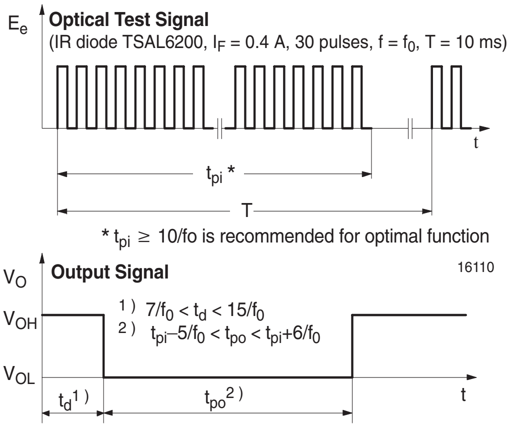


Figure 1. Output Function

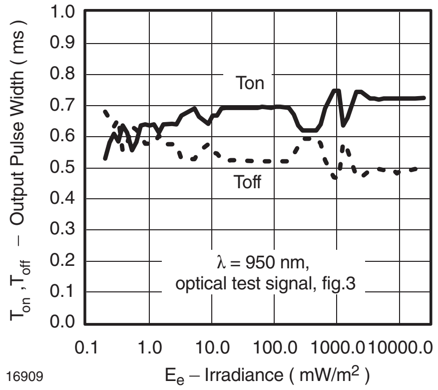


Figure 4. Output Pulse Diagram

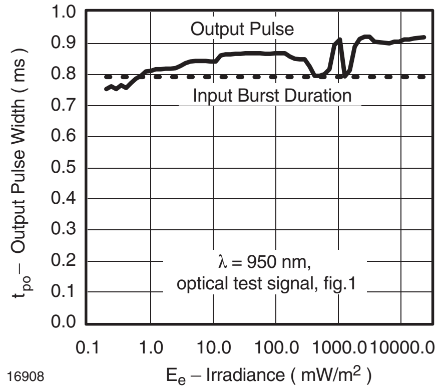


Figure 2. Pulse Length and Sensitivity in Dark Ambient

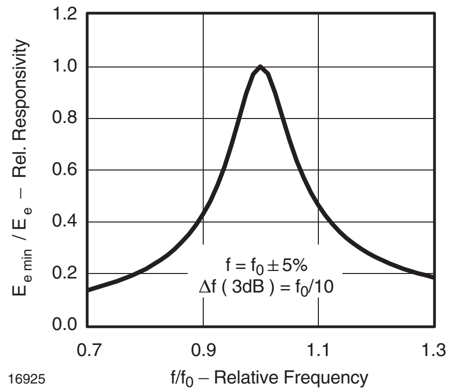


Figure 5. Frequency Dependence of Responsivity

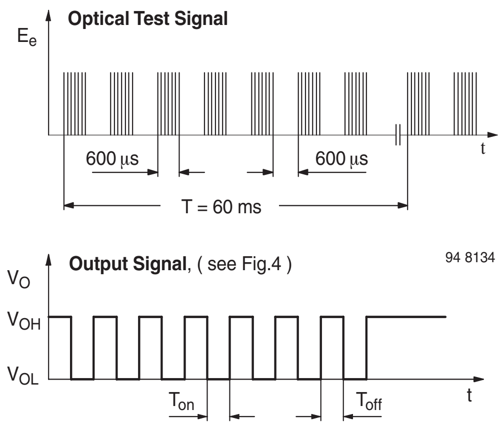


Figure 3. Output Function

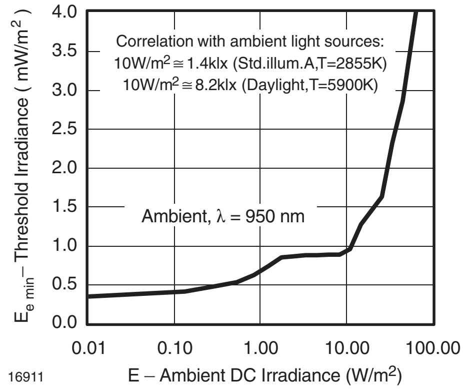


Figure 6. Sensitivity in Bright Ambient

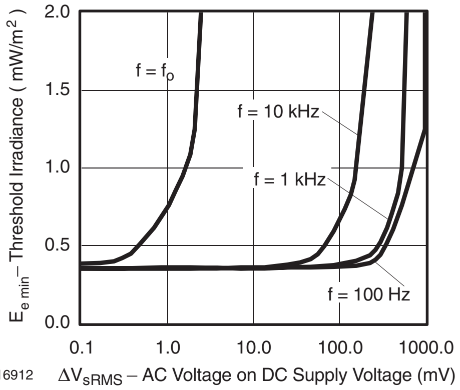


Figure 7. Sensitivity vs. Supply Voltage Disturbances

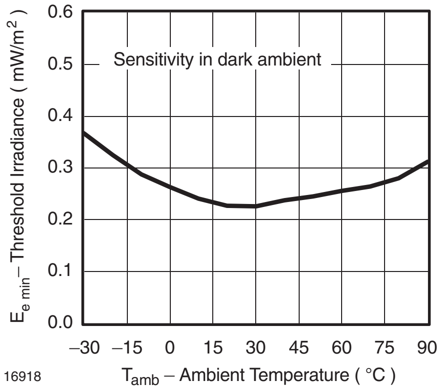


Figure 10. Sensitivity vs. Ambient Temperature

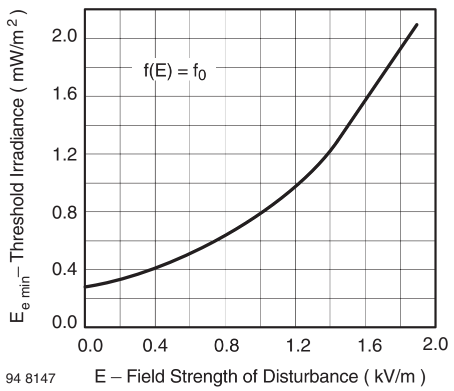


Figure 8. Sensitivity vs. Electric Field Disturbances

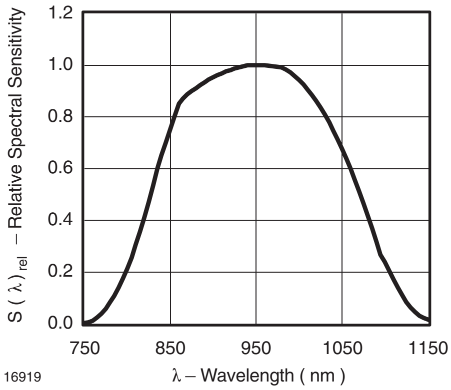


Figure 11. Relative Spectral Sensitivity vs. Wavelength

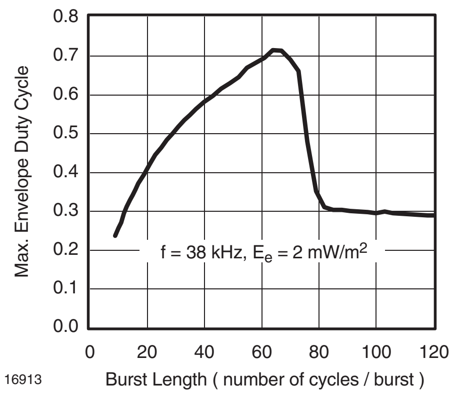


Figure 9. Max. Envelope Duty Cycle vs. Burstlength

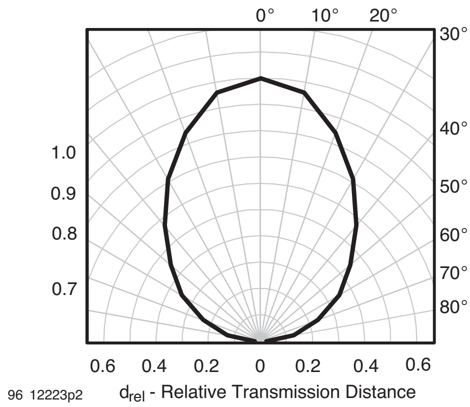


Figure 12. Directivity

Suitable Data Format

The circuit of the TSOP22.. is designed in that way that unexpected output pulses due to noise or disturbance signals are avoided. A bandpass filter, an integrator stage and an automatic gain control are used to suppress such disturbances.

The distinguishing mark between data signal and disturbance signal are carrier frequency, burst length and duty cycle.

The data signal should fulfill the following conditions:

• Carrier frequency should be close to center frequency of the bandpass (e.g. 38 kHz).

• Burst length should be 10 cycles/burst or longer.

• After each burst which is between 10 cycles and 70 cycles a gap time of at least 14 cycles is necessary.

• For each burst which is longer than 1.0 ms a corresponding gap time is necessary at some time in the data stream. This gap time should be at least 4 times longer than the burst.

• Up to 800 short bursts per second can be received continuously.

Some examples for suitable data format are: NEC Code (repetitive pulse), NEC Code (repetitive data), Toshiba Micom Format, Sharp Code, RC5 Code, RC6 Code, R-2000 Code, Sony Code.

When a disturbance signal is applied to the TSOP22.. it can still receive the data signal. However the sensitivity is reduced to that level that no unexpected pulses will occur.

Some examples for such disturbance signals which are suppressed by the TSOP22.. are:

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

• Continuous signal at 38 kHz or at any other frequency

• Signals from fluorescent lamps with electronic ballast with high or low modulation
(see Figure 13 or Figure 14).

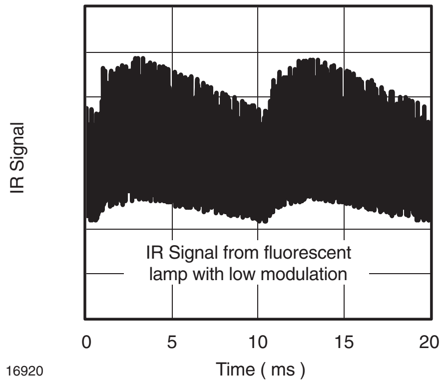


Figure 13. IR Signal from Fluorescent Lamp with low Modulation

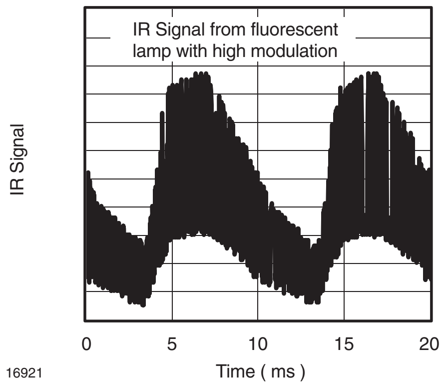


Figure 14. IR Signal from Fluorescent Lamp with high Modulation

Package Dimensions in mm