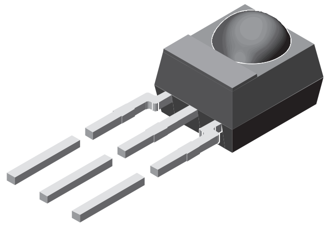
IR Receiver for High Data Rate PCM at 455 kHz

Description

The TSOP7000 is a miniaturized receiver for infrared remote control and IR data transmission. 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. The main benefit is the operation with high data rates and long distances.



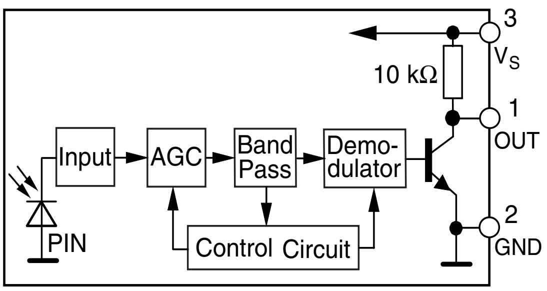
Features

- Photo detector and preamplifier in one package
- Internal Bandfilter for PCM frequency
- Internal shielding against electrical field disturbance
- TTL and CMOS compatibility
- Output active low
- Small size package

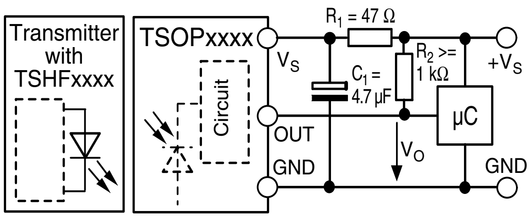
Special Features

- Data rate 20 kbit/s
- Supply voltage 2.7 - 5.5 V
- Short settling time after power on
- High envelope duty cycle can be received
- Enhanced immunity against disturbance from energy saving lamps

Block Diagram



Application Circuit



$R_1 + C_1$ recommended to suppress power supply disturbances.
R_2 optional for improved pulse forming.

Absolute Maximum Ratings

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

Parameter	Test condition	Symbol	Value	Unit
Supply Voltage	Pin 3	V_S	-0.3 to + 6.0	V
Voltage at output to supply	Pin 1	V_S - V_O	-0.3 to V_S + 0.3	V
Supply Current	Pin 3	I_S	5	mA
Output Voltage	Pin 1	V_O	-0.3 to + 6.0	V
Output Current	Pin 1	I_O	15	mA
Junction Temperature		C	100	°C
Storage Temperature Range		T_{stg}	- 25 to + 85	°C
Operating Temperature Range		T_{amb}	- 25 to + 85	°C
Soldering Temperature	t ≤ 10 s, 1 mm from case	T_{sd}	260	°C
Power Consumption		P_{tot}	30	mW

Electrical and Optical Characteristics

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

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Supply Current (Pin 3)	Dark ambient	I_{SD}		2.0	2.7	mA
	E_v = 40 klx, sunlight	I_{SH}		2.3		mA
Supply Voltage (Pin 3)		V_S	2.7	5	5.5	V
Transmission Distance	λ_p= 870 nm, IR Diode TSHF5400, I_F = 300 mA	d_{max}		20		m
	λ_p= 950 nm, IR Diode TSAL6400, I_F = 300 mA	d_{max}		12		m
Threshold Irradiance	λ_p = 870 nm, optical test signal of Fig.1	$E_{e\ min}$		0.8	1.5	mW/m^2
Maximum Irradiance	Optical test signal of Fig.1	$E_{e\ max}$	30			W/m^2
Output Voltage Low (Pin 1)	1 kΩ external pull up resistor	V_{QL}			100	mV
Output Voltage High (Pin 1)	No external pull-up resistor	V_{QH}	V_S - 0.25			V
Bandpassfilter quality		Q		10		
Out-Pulse width tolerance	Optical test signal of Fig.1, 1.5 $mW/m^2 \le E_e \le 30\ W/m^2$	Δ_{tpo}	- 15	+ 5	+ 15	µs
Delay time of output pulse	Optical test signal of Fig.1, E_e > 1.5 mW/m^2	t_{don}	15		36	µs
Receiver start up time	Valid data after power on	t_V		50		µs
Falling time	Leading edge of output pulse	t_f		0.4		µs
Rise time	No external pull up resistor	t_r		12		µs
	1 kΩ external pull up resistor	t_r		1.2		µs
Directivity	Angle of half transmission distance	$\varphi_{1/2}$		± 45		deg

Typical Characteristics (T_{amb} = 25°C unless otherwise specified)

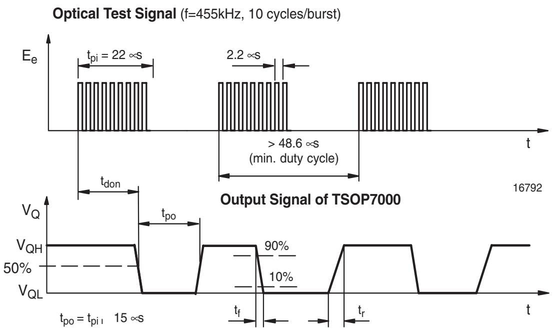


Figure 1. Output Function

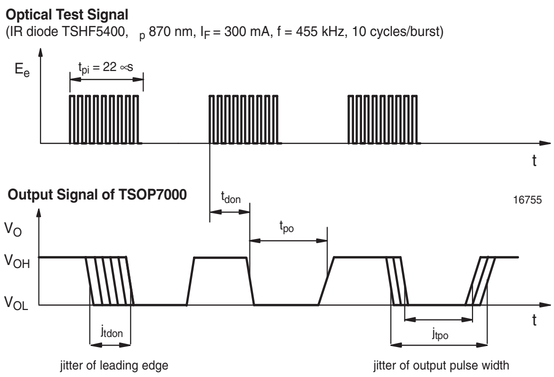


Figure 2. Output Fucntion (mit Jitter)

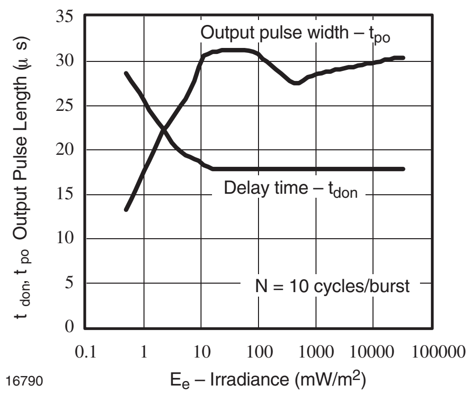


Figure 3. Output Pulse Diagram (t_{don}, t_{po})

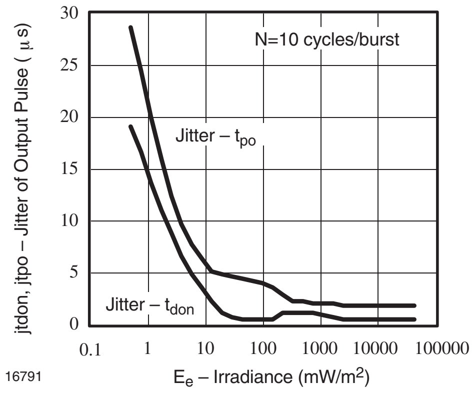


Figure 4. Jitter of Output Pulse

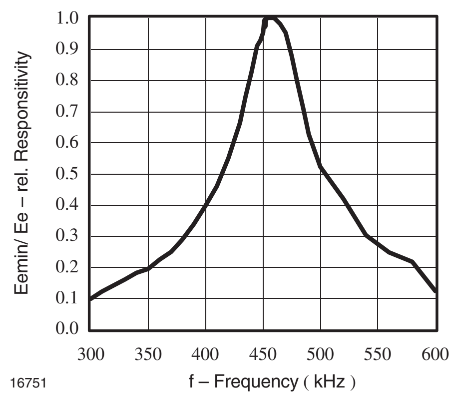


Figure 5. Frequency Dependence of Responsivity

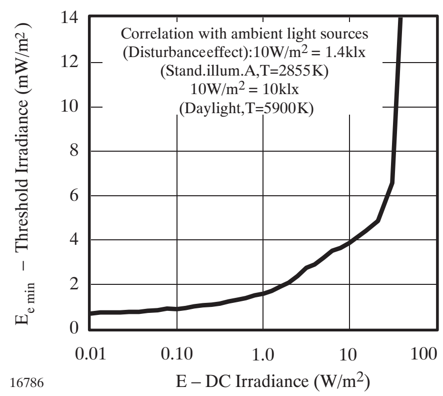


Figure 6. Sensitivity in Bright Ambient

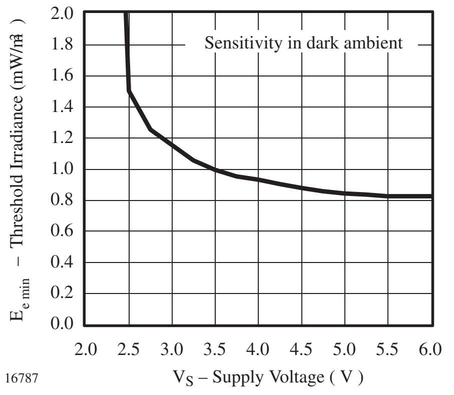


Figure 7. Sensitivity vs. Supply Voltage

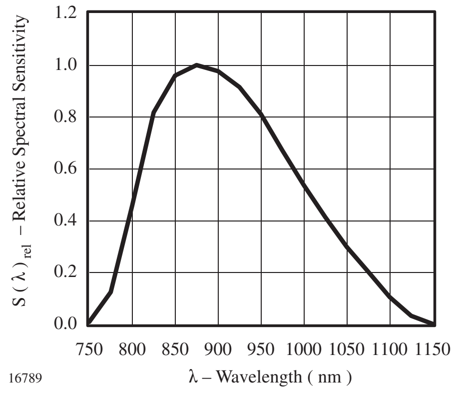


Figure 10. Relative Spectral Sensitivity vs. Wavelength

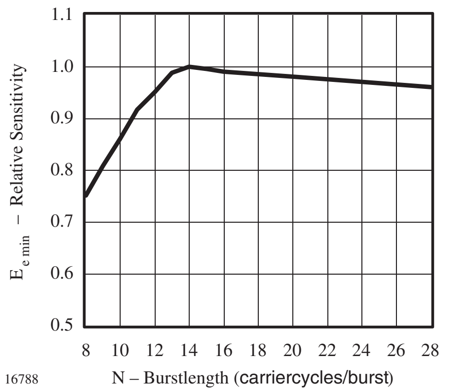


Figure 8. Rel. Sensitivity vs. Burstlength

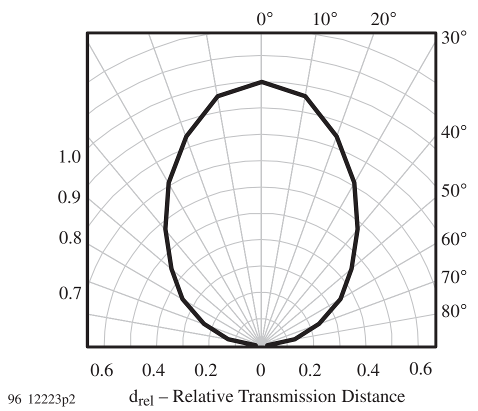


Figure 11. Directivity

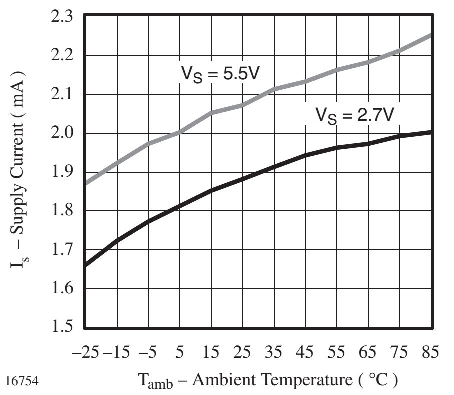


Figure 9. Supply Current vs. Ambient Temperature

Recommendation for Suitable Data Formats

The circuit of the TSOP7000 is designed in that way that disturbance signals are identified and unwated output pulses due to noise or disturbances are avoided. A bandpassfilter, an automatic gain control and an integrator stage is used to suppress such disturbances. The distinguishing marks between data signal and disturbance are carrier frequency, burst length and the envelope duty cycle.

The data signal should fullfill the following conditions:

• The carrier frequency should be close to 455 kHz.

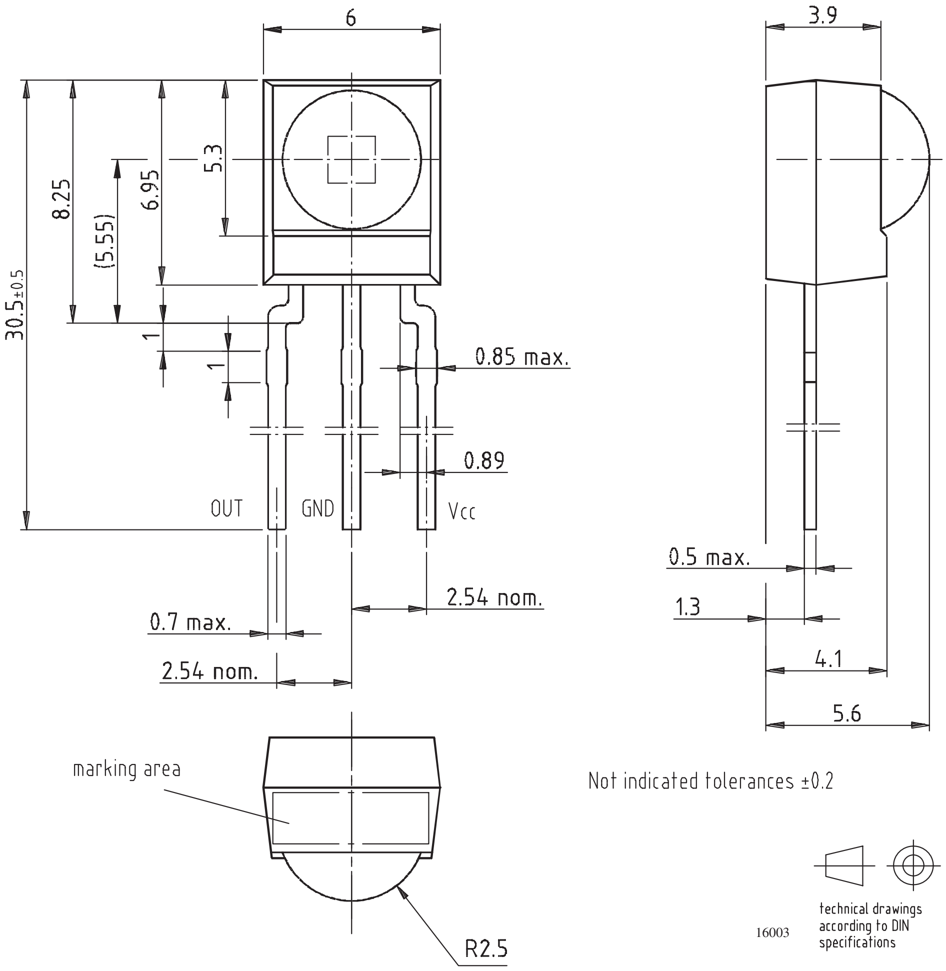
• The burstlength should be at least 22 μs (10 cycles of the carrier signal) and shorter than 500 μs.

• The separation time between two consecutive bursts should be at least 26 μs.

• If the data bursts are longer than 500 μs then the envelope duty cycle is limited to 25 %

• The duty cycle of the carrier signal (455 kHz) may be between 50 % (1.1 μs pulses) and 10 % (0.2 μs pulses). The lower duty cycle may help to save battery power.

Package Dimensions in mm



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 operatingsystems 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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