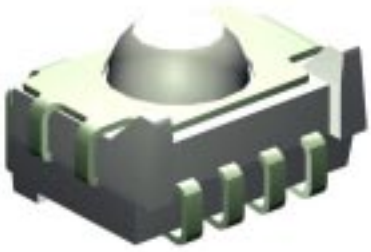
IR Receiver for High Data Rate PCM at 455kHz

Description

The TSOP5700 is a miniaturized SMD IR 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.



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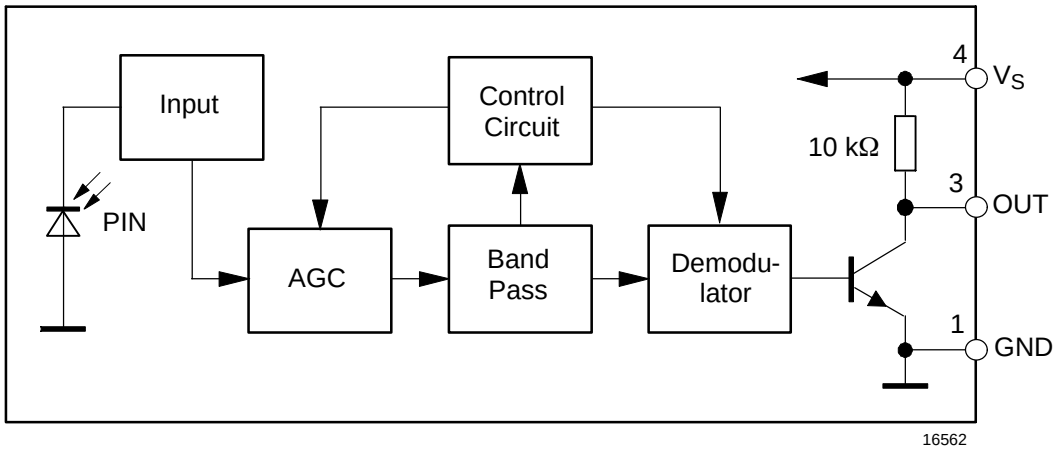
Features

- 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

Special Features

- Data rate 20 kbit/s
- Small size package
- Supply voltage 2.7 – 5.5V
- Short settling time after power on
- High envelope duty cycle can be received
- Enhanced immunity against disturbance from energy saving lamps
- Taping available for topview and sideview assembly

Block Diagramm



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Absolute Maximum Ratings

T_{amb} = 25°C

Parameter	Test Conditions	Symbol	Value	Unit
Supply Voltage	Pin 4	V_S	–0.3...6.0	V
Voltage at output to supply	Pin 3	$V_S - V_O$	–0.3...V_S+0.3	V
Supply Current	Pin 4	I_S	5	mA
Output Voltage	Pin 3	V_O	–0.3...6.0	V
Output Current	Pin 3	I_O	15	mA
Junction Temperature		T_j	100	˚C
Storage Temperature Range		T_{stg}	–40...+85	˚C
Operating Temperature Range		T_{amb}	–25...+85	˚C
Power Consumption	$T_{amb} \leqq$ 85˚C	P_{tot}	50	mW

Basic Characteristics

T_{amb} = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Supply Current (Pin 4)	Dark ambient	I_{SD}		2.0	2.7	mA
	E_v = 40 klx, sunlight	I_{SH}		2.3		mA
Supply Voltage (Pin 4)		V_S	2.7	5	5.5	V
Transmission Distance	λ_p= 870 nm, IR Diode TSHF5400, I_F = 300 mA	d_{max}		15		m
	λ_p= 950 nm, IR Diode TSAL6400, I_F = 300 mA	d_{max}		9		m
Threshold Irradiance	λ_p = 870 nm, optical test signal of Fig.1	$E_{e\ min}$		1.5	2.5	mW/m^2
Maximum Irradiance	Optical test signal of Fig.1	$E_{e\ max}$	30			W/m^2
Output Voltage Low (Pin 3)	1kΩ external pull up resistor	V_{QL}			100	mV
Output Voltage High (Pin 3)	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, 2.5 mW/m$^2 \leq E_e \leq$ 30 W/m^2	Δ_{tpo}	–15	+5	+15	µs
Delay time of output pulse	Optical test signal of Fig.1, E_e > 2.5 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
	1kΩ external pull up resistor	t_r		1.2		µs
Directivity	Angle of half transmission distance	$\varphi_{1/2}$		±50		deg

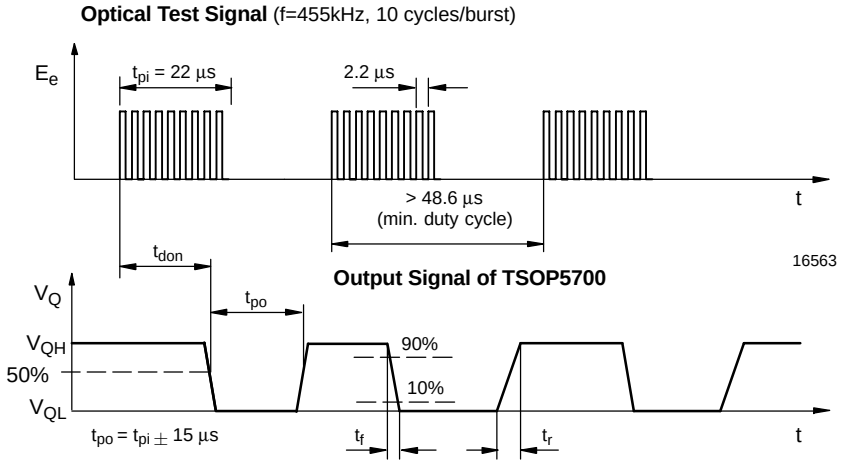
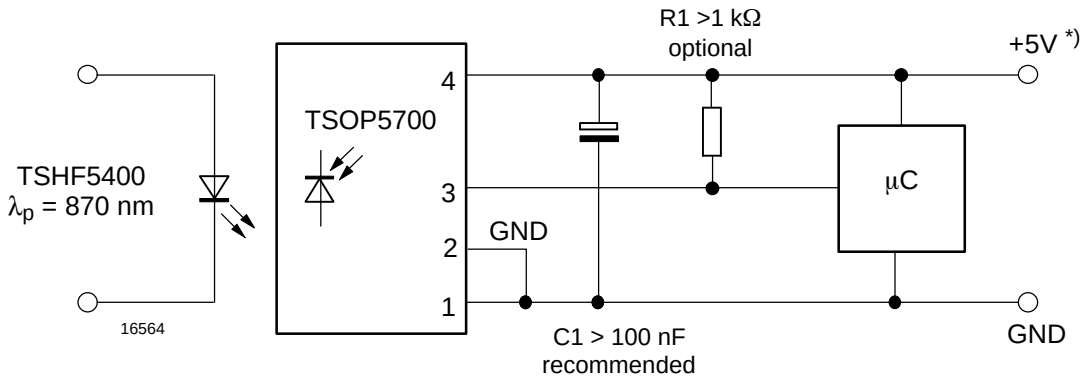


Figure 1. Output Function

Application Circuit



*) tolerated supply voltage range: 2.7 V < V_S < 5.5 V,
with the resistor R1 the slopes of the output pulse are becoming faster.

Recommendation for Suitable Data Formats

The circuit of the TSOP5700 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.

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

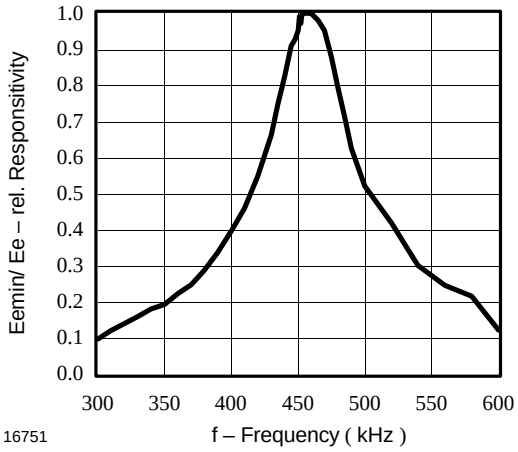


Figure 2. Frequency Dependence of Responsivity

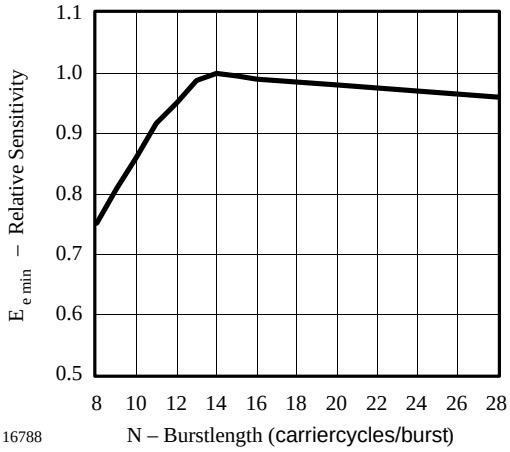


Figure 5. Rel. Sensitivity vs. Burstlength

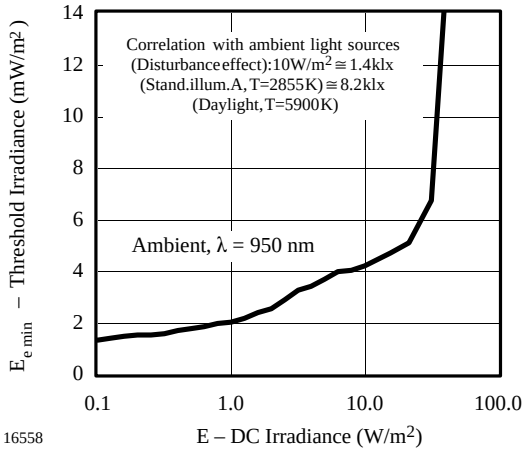


Figure 3. Sensitivity in Bright Ambient

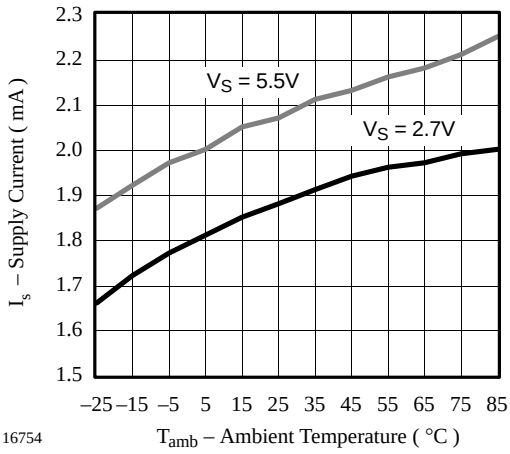


Figure 6. Supply Current vs. Ambient Temperature

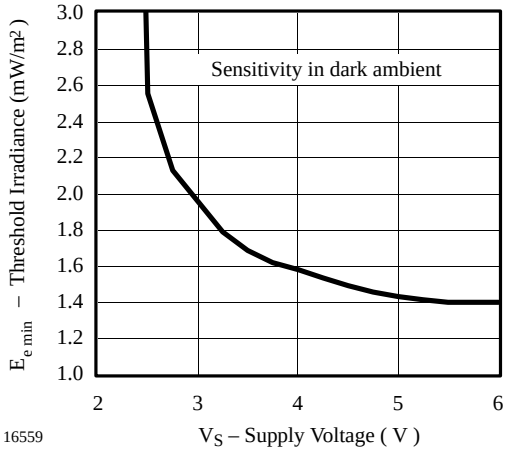


Figure 4. Sensitivity vs. Supply Voltage

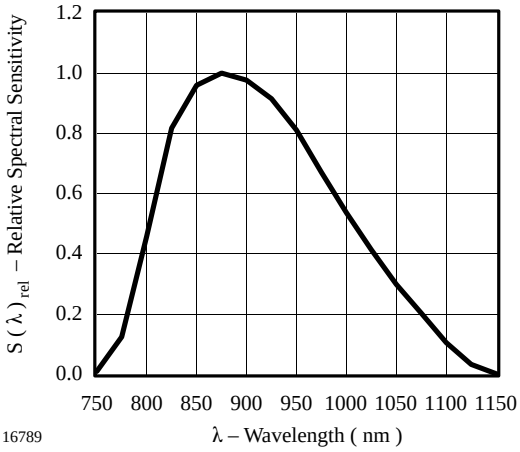


Figure 7. Relative Spectral Sensitivity vs. Wavelength

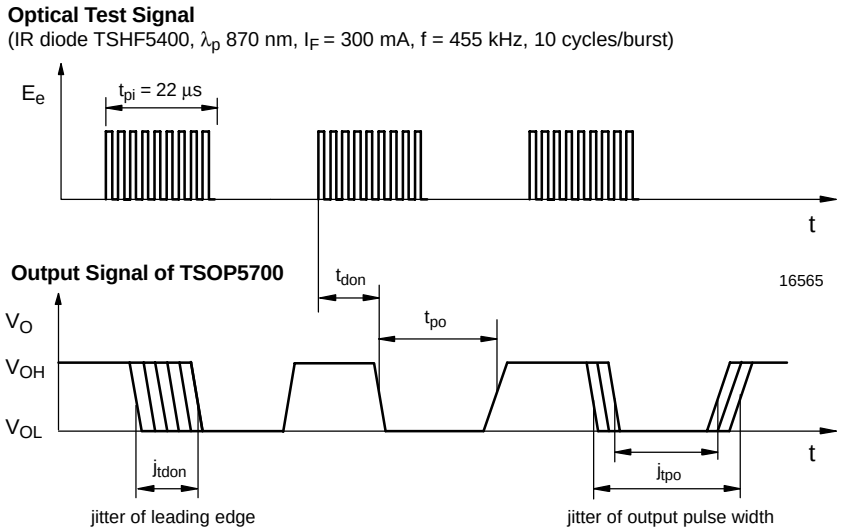


Figure 8. Output Function

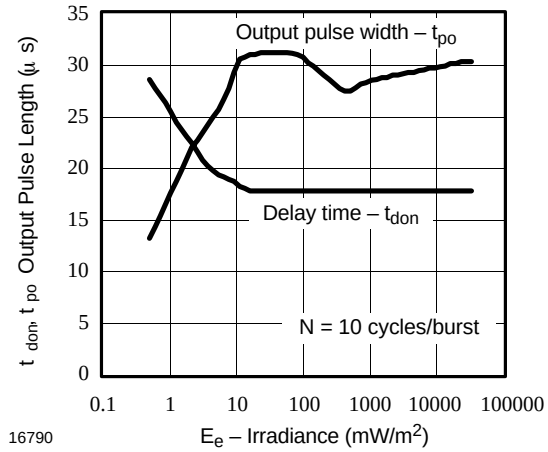


Figure 9. Output Pulse Diagram

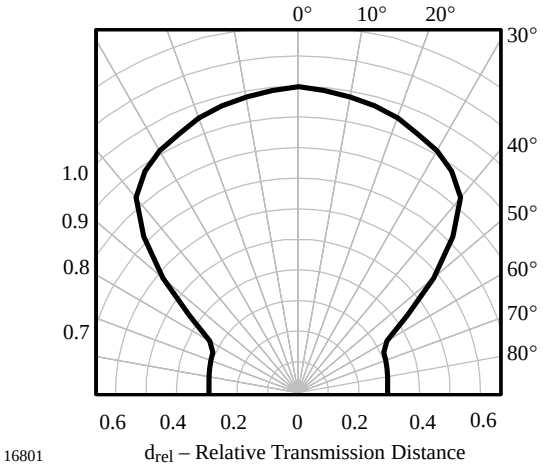


Figure 11. Directivity

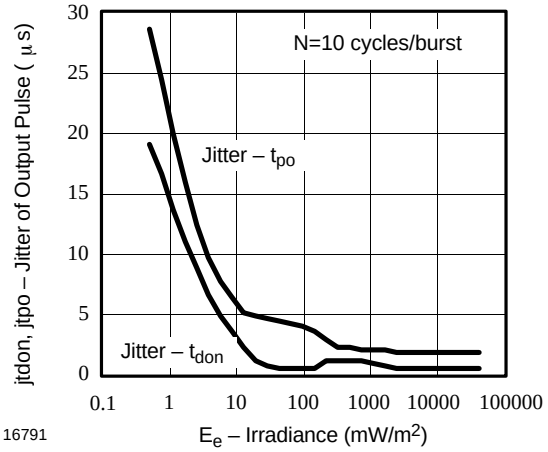


Figure 10. Jitter of Output Pulse vs. Irradiance

Operating Instructions

Reflow Soldering

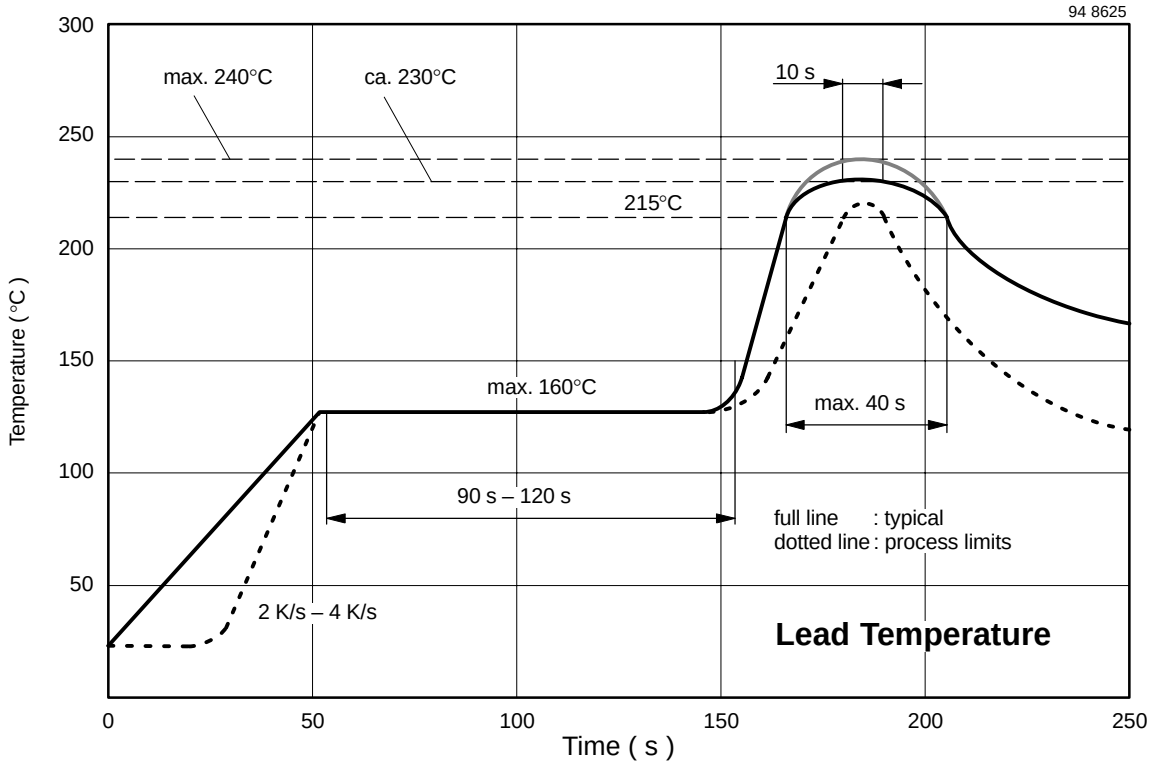
- Reflow soldering must be done within 48 hours stored under max. 30°C, 80% RH after opening envelop
- Recommended soldering paste (composition: SN 63%, Pb 37%) Melting temperature 178°C to 192°C
- Apply solder paste to the specified soldering pads, by using a dispenser or by screen printing.
- Recommended thickness of metal mask is 0.2 mm for screen printing.
- The recommended reflow furnace is a combinationtype with upper and lower heaters.
- Set the furnace temperatures for pre-heating and heating in accordance with the reflow temperature profile as shown below. Excercise extreme care to keep the maximum temperature below 230°C. The following temperature profile means the tempera–ture at the device surface. Since temperature differ–ence occurs between the work and the surface of the circuit board depending on the pes of circuit board or reflow furnace, the operating conditions should be verified prior to start of operation.
- Handling after reflow should be done only after the work surface has been cooled off.

Manual Soldering

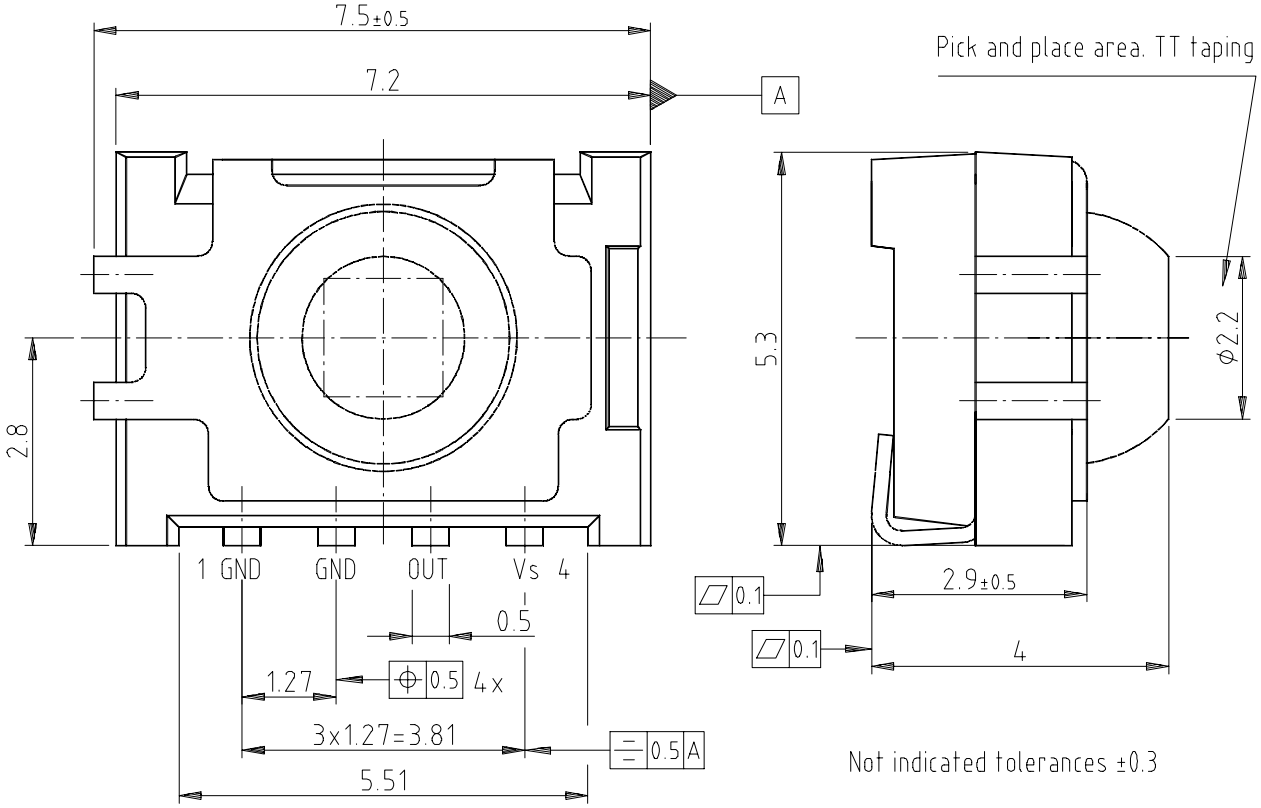
- Use the 6/4 solder or the solder containing silver.
- Use a soldering iron of 25 W or smaller. Adjust the temperature of the soldering iron below 300°C.
- Finish soldering within three seconds.
- Handle products only after the temperature is cooled off.

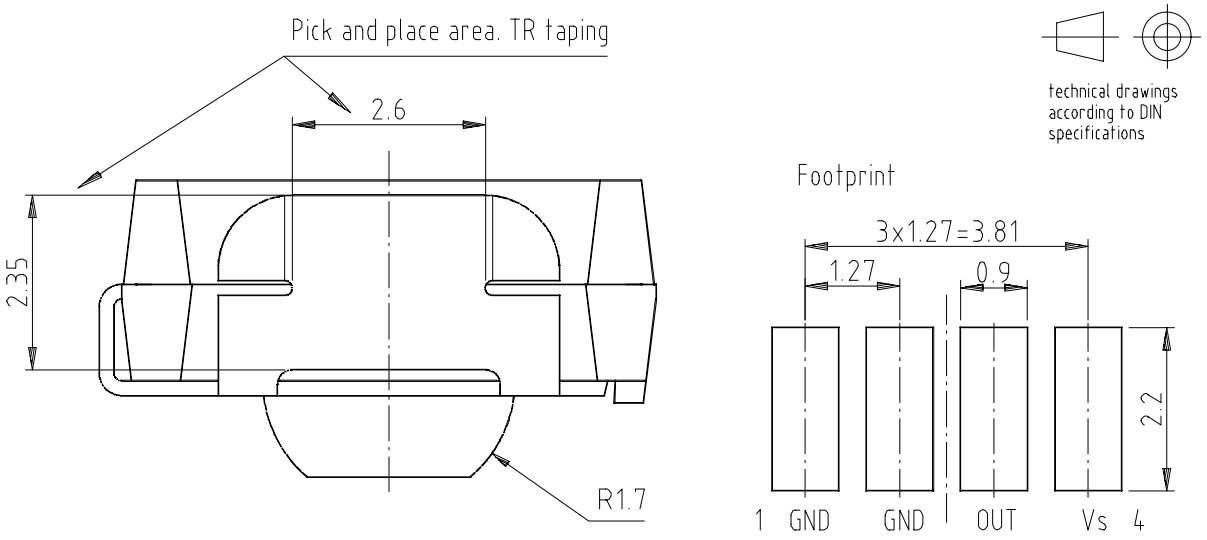
Cleaning

- Perform cleaning after soldering strictly in conformance to the following conditions: Cleaning agent: 2-propanol (isopropyl alcohol). Commercially available grades (industrial use) should be used. Demineralized or distilled water having a resistivity of not less than 500 mΩ corresponding to a conductivity of 2 mS/m.
- Temperature and time: 30 seconds under the temperature below 50°C or 3 minutes below 30°C.
- Ultrasonic cleaning: Below 20 W.



Dimensions in mm





Drawing-No.: 6.544-5341.01-4
Issue: 4; 08.11.01

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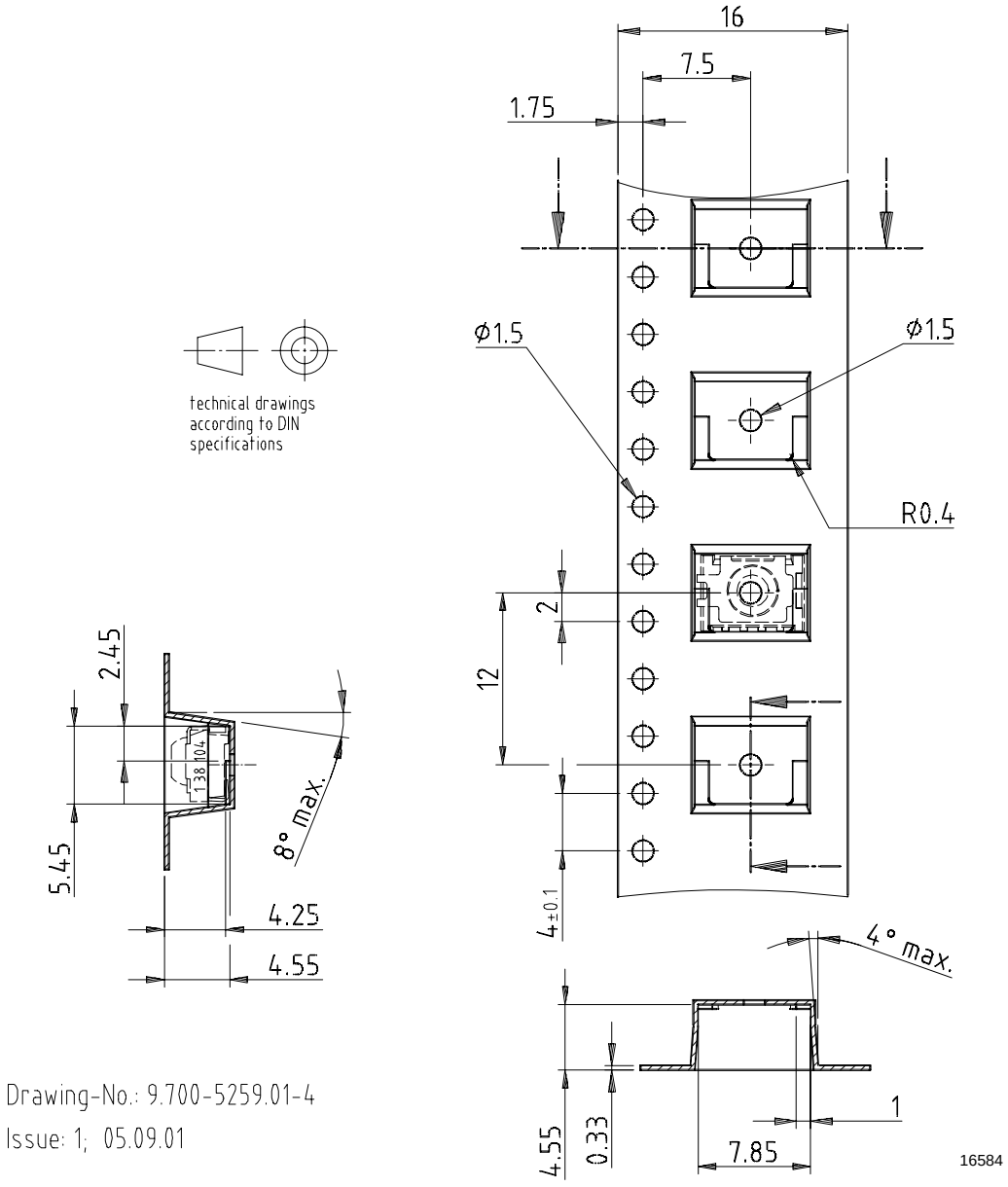
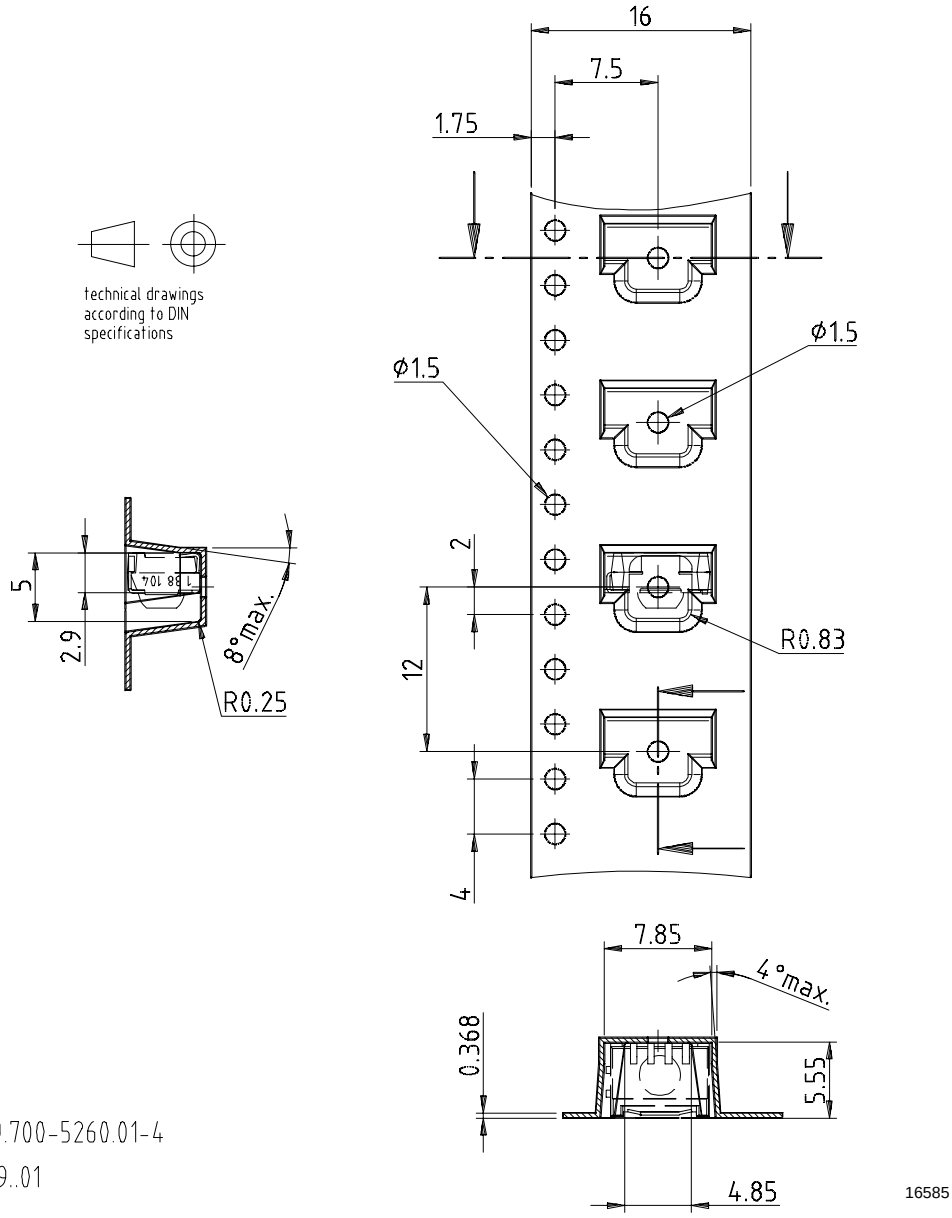
Taping Version TSOP5700TT



Drawing-No.: 9.700-5259.01-4
Issue: 1; 05.09.01

Taping Version TSOP5700TR



Drawing-No.: 9.700-5260.01-4
Issue: 2; 25.09..01

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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