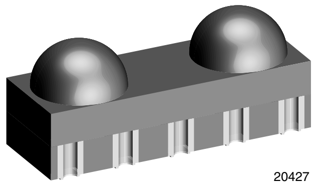
# IR Receiver Modules for Remote Control Systems

## Description

The TSOP85#.. - series are two lens miniaturized receiver modules for infrared remote control systems. One PIN diode per lens and a preamplifier are assembled on a PCB, the epoxy lens cap is designed as an IR filter.

The demodulated output signal can be directly decoded by a microprocessor. The TSOP852.. series is for standard IR remote control applications, supporting all major transmission codes. The TSOP851.. series is optimised for short burst transmission codes and high data rates. The TSOP854.. is optimised for reliable operation even in highly noisy environments.

This component has not been qualified according to automotive specifications.



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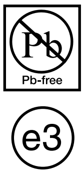
## Features




- Photo detectors and Preamplifier in one package
- Internal filter for PCM frequency
- TTL and CMOS compatibility
- Output active low
- Low power consumption
- Supply voltage: 2.7 V to 5.5 V

## Special Features

- Improved immunity against ambient light
- Suitable burst length ≥ 10 cycles/burst TSOP852.. and TSOP854..
- Suitable burst length ≥ 6 cycles/burst TSOP851..
- SMD assembly with Lead (Pb)-free reflow soldering
- Capable of side or top view
- Two lenses for high sensitivity and wide receiving angle

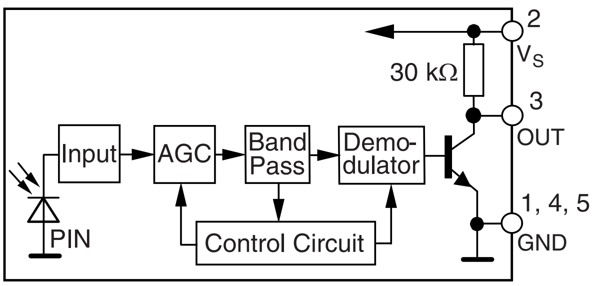
## Product Matrix

| Very noisy environments | Standard applications | Short bursts and high data rates |
|---|---|---|
| TSOP854.. | TSOP852.. | TSOP851.. |

## Frequency Matrix

| Part | Carrier Frequency |
|---|---|
| TSOP85#30 | 30 kHz |
| TSOP85#33 | 33 kHz |
| TSOP85#36 | 36 kHz |
| TSOP85#38 | 38 kHz |
| TSOP85#40 | 40 kHz |
| TSOP85#56 | 56 kHz |

## Block Diagram

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## Application Circuit

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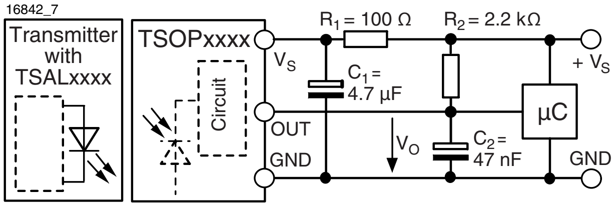



$R_1 + C_1$ are recommended to suppress power supply noise.
$R_2 + C_2$ are optional to optimize the sensitivity.

## Absolute Maximum Ratings

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

| Parameter | Test condition | Symbol | Value TSOP85#.. | Unit |
|---|---|---|---|---|
| Supply Voltage | | $V_S$ | - 0.3 to + 6.0 | V |
| Output Voltage | | $V_O$ | - 0.3 to ($V_S$ + 0.3) | V |
| Output Sink Current | | $I_O$ | 10 | 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 |
| Soldering Temperature | | $T_{sol}$ | 260 | °C |

## Electrical and Optical Characteristics

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

| Parameter | Test condition | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Supply Voltage | | $V_S$ | 2.7 | | 5.5 | V |
| Supply Current | $V_S$ = 3.3 V, $E_v$ = 0 | $I_{SD}$ | 1.0 | 1.3 | 1.6 | mA |
| | $E_v$ = 40 klx, sunlight, $V_S$ = 3.3 V | $I_{SB}$ | | 1.5 | | mA |
| Transmission Distance | $E_v$ = 0<br>IR diode TSAL6200,<br>$I_F$ = 400 mA | d | | 35 | | m |
| Output Voltage Low | $I_{OSL}$ = 0.5 mA, $E_e$ = 0.7 mW/m$^2$ | $V_{OSL}$ | | | 250 | mV |
| Threshold Irradiance (30 - 40 kHz) | $V_S$ = 3 V<br>Pulse width tolerance:<br>$t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$ | $E_{e\ min}$ | | 0.2 | 0.5 | mW/m$^2$ |
| Threshold Irradiance (56 kHz) | $V_S$ = 3 V<br>Pulse width tolerance:<br>$t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$ | $E_{e\ min}$ | | 0.25 | 0.55 | mW/m$^2$ |
| Threshold Irradiance (30 - 40 kHz) | $V_S$ = 5 V<br>Pulse width tolerance:<br>$t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$ | $E_{e\ min}$ | | 0.25 | 0.55 | mW/m$^2$ |
| Threshold Irradiance (56 kHz) | $V_S$ = 5 V<br>Pulse width tolerance:<br>$t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$ | $E_{e\ min}$ | | 0.3 | 0.6 | mW/m$^2$ |
| Maximum Irradiance | $t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$ | $E_{e\ max}$ | 30 | | | W/m$^2$ |
| Directivity | Angle of half transmission distance | $\varphi_{1/2}$ | | ± 50 | | deg |

## Typical Characteristics

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

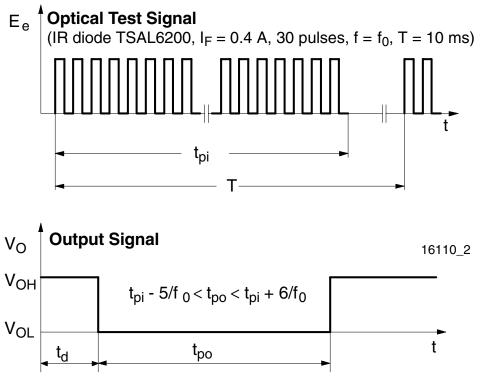



Figure 1. Output Function

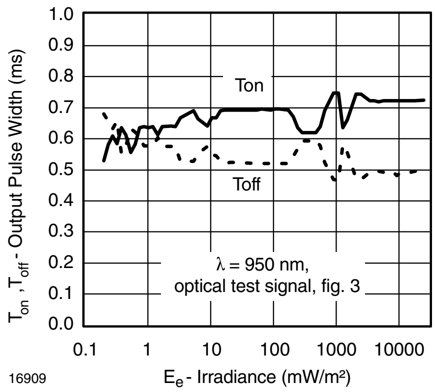



Figure 4. Output Pulse Diagram

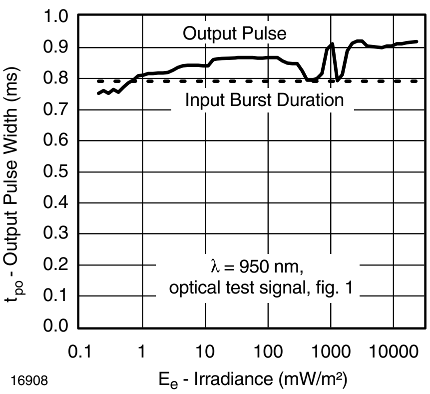



Figure 2. Pulse Length and Sensitivity in Dark Ambient

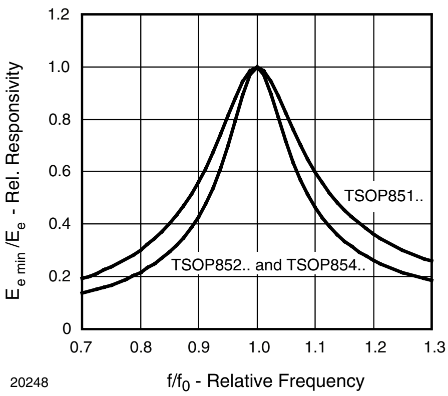



Figure 5. Frequency Dependence of Responsivity

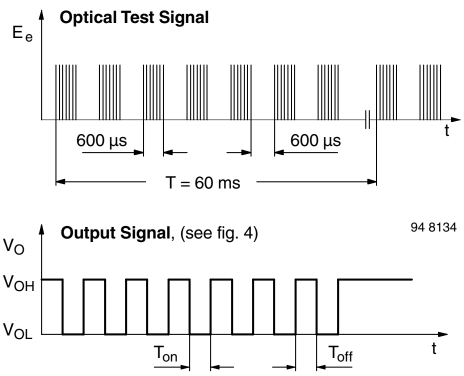



Figure 3. Output Function

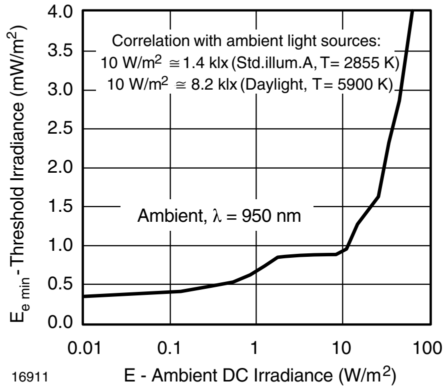



Figure 6. Sensitivity in Bright Ambient

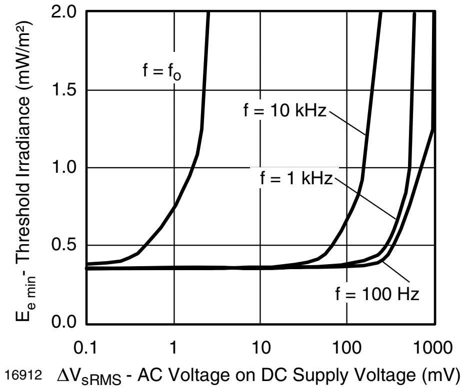



Figure 7. Sensitivity vs. Supply Voltage Disturbances

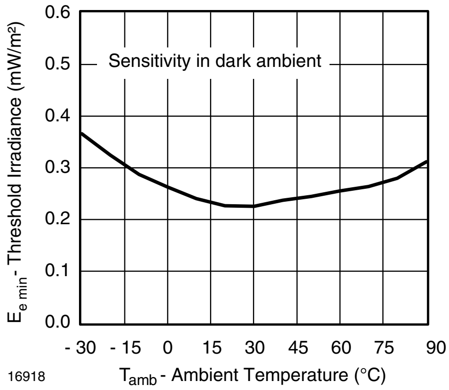



Figure 10. Sensitivity vs. Ambient Temperature

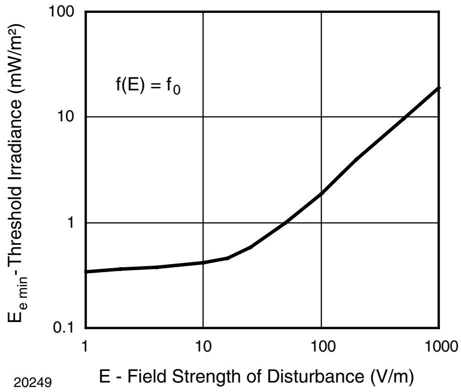



Figure 8. Sensitivity vs. Electric Field Disturbances

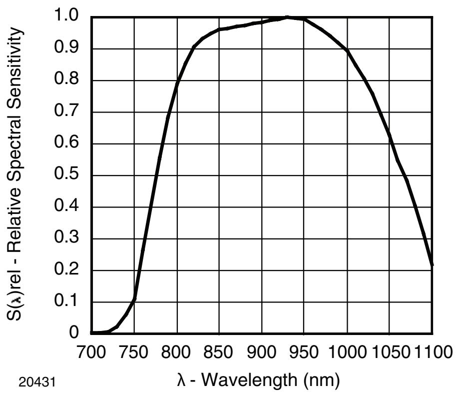



Figure 11. Relative Spectral Sensitivity vs. Wavelength

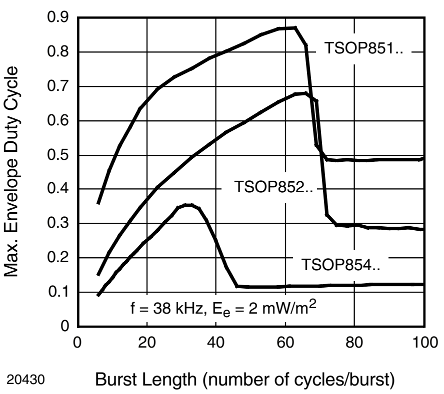



Figure 9. Max. Envelope Duty Cycle vs. Burstlength

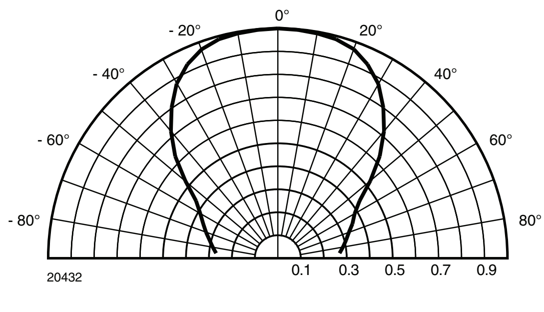



Figure 12. Horizontal Directivity $\varphi_x$

## Suitable Data Format

The TSOP85#.. series is designed in such a way, that spurious output pulses due to noise or disturbance signals are suppressed. The distinguishing characteristics between data and disturbance signals are carrier frequency, burst length and envelope duty cycle. Optimally, the data signal should be close to the band-pass center frequency (e.g. 38 kHz) and fulfill the conditions in the table below.
Examples of suitable data formats are: NEC Code (repetitive pulse), NEC Code (repetitive data), Toshiba Micom Format, Sharp Code, RC5 Code, RC6 Code, R-2000 Code, Sony Code (TSOP852.. and TSOP851.. only). When a data signal is applied to the TSOP85#.. 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 bulbs or sunlight)
- Continuous signals at any frequency
- Strongly or weakly modulated noise from fluores cent lamps with electronic ballasts (see Figure 13 or Figure 14).

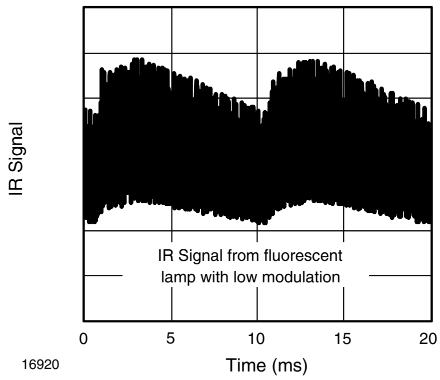


Figure 13. IR Signal from Fluorescent Lamp with low Modulation

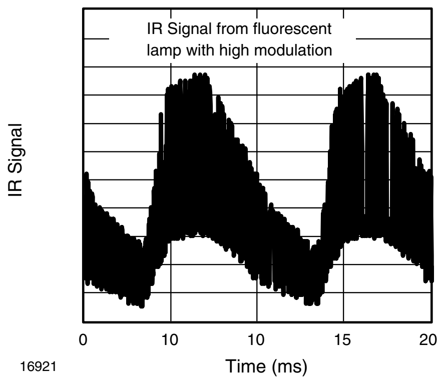
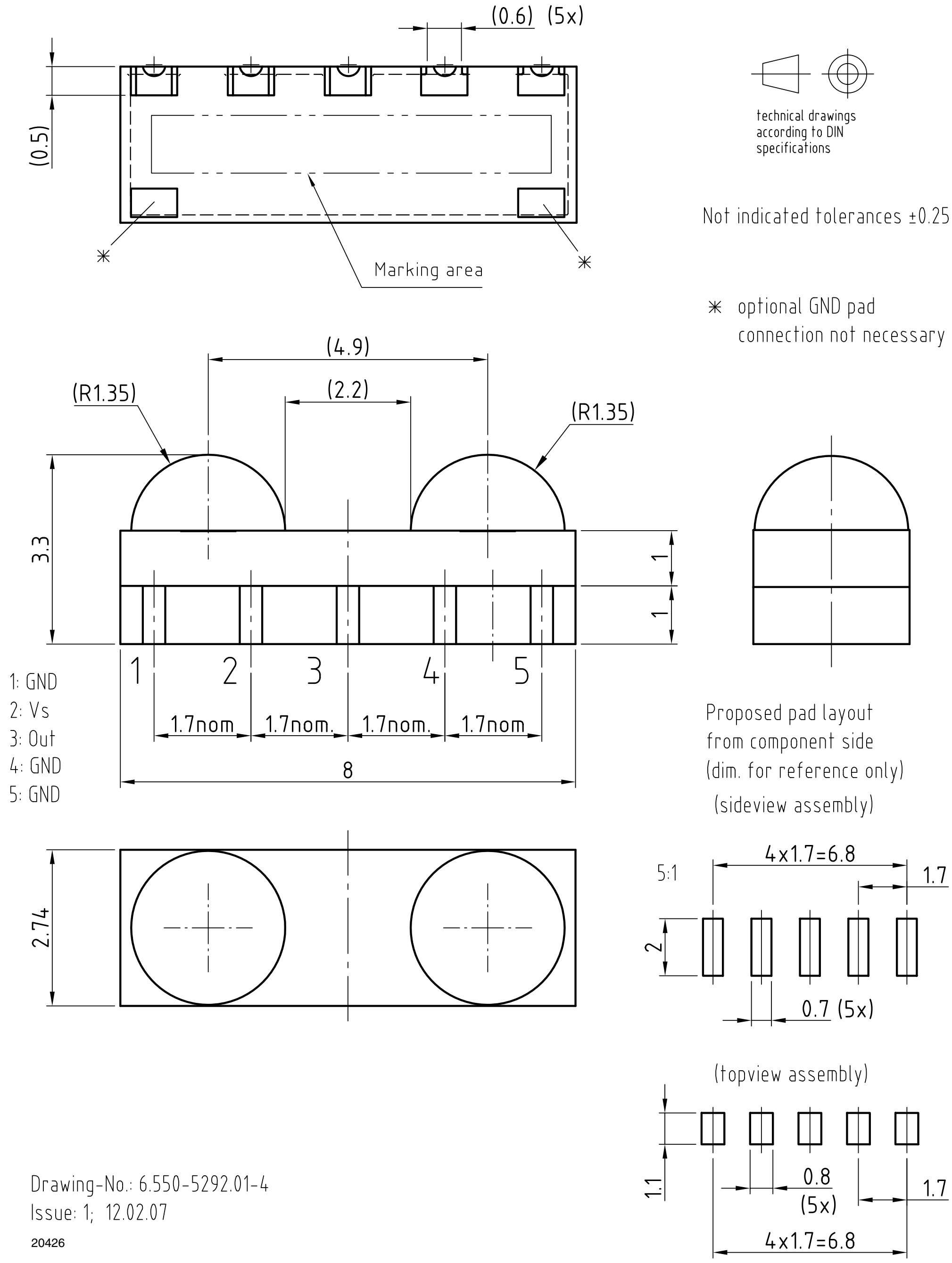


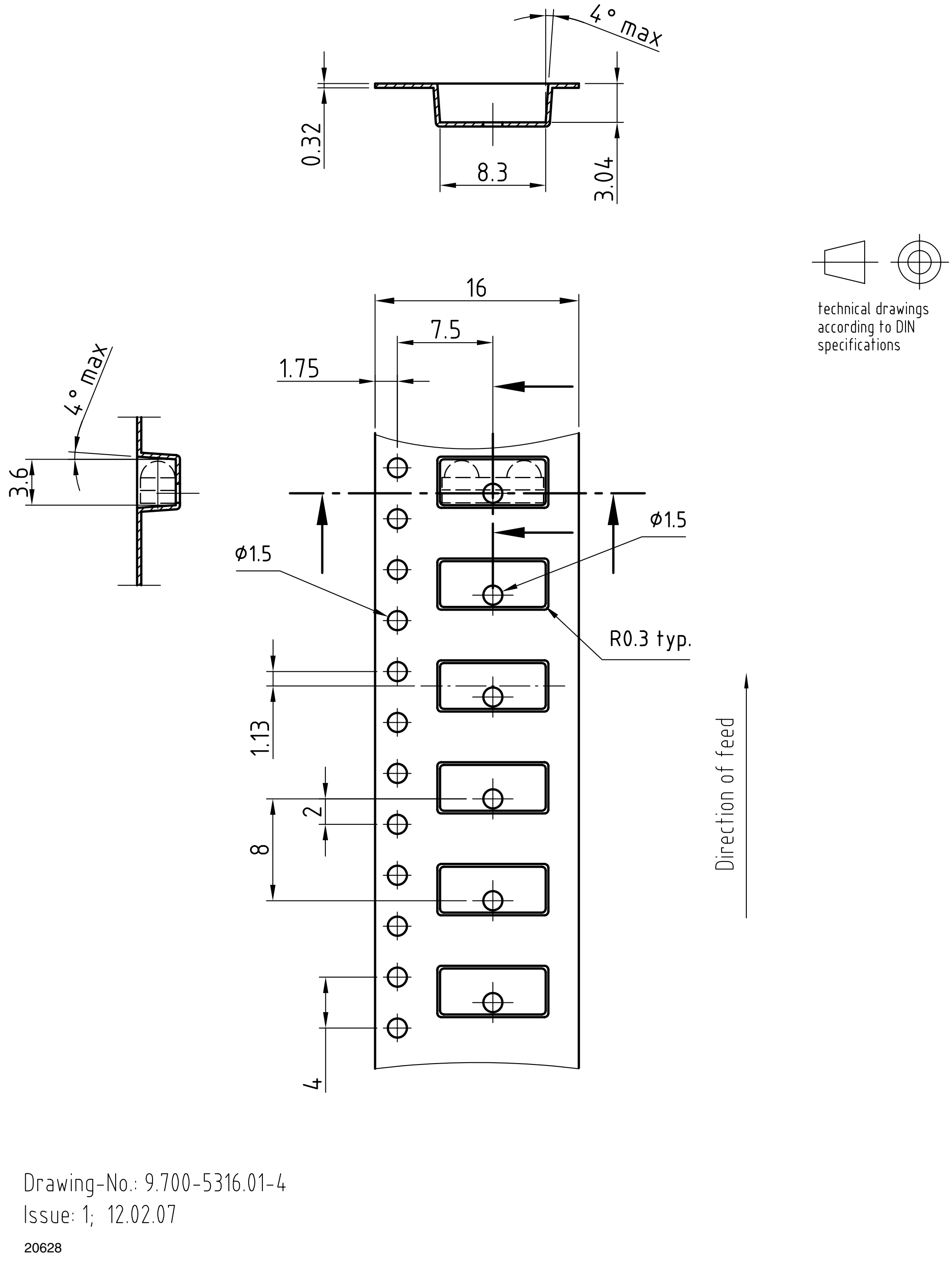
Figure 14. IR Signal from Fluorescent Lamp with high Modulation

| | TSOP854.. | TSOP852.. | TSOP851.. |
|---|---|---|---|
| Minimum burst length: | 10 cycles/burst | 10 cycles/burst | 6 cycles/burst |
| After each burst of length:<br>a gap time is required of: | 10 - 35 cycles<br>14 cycles | 10 - 70 cycles<br>14 cycles | 10 - 70 cycles<br>10 cycles |
| For bursts greater than:<br>a gap time in the data<br>stream is needed of: | 0.9 ms<br><br>> 8 x burst length | 1.8 ms<br><br>> 4 x burst length | 1.8 ms<br><br>> 1.5 x burst length |
| Maximum continuous short bursts/second: | 400 | 800 | 800 |
| Able to suppress noise from fluorescent lamps with modulation type: | weak (fig. 13)<br>strong (fig. 14) | weak (fig. 13)<br>strong (fig. 14) | weak (fig. 13) |

**Package Dimensions** in millimeters



## Taping Version TSOP..TR Dimensions in millimeters

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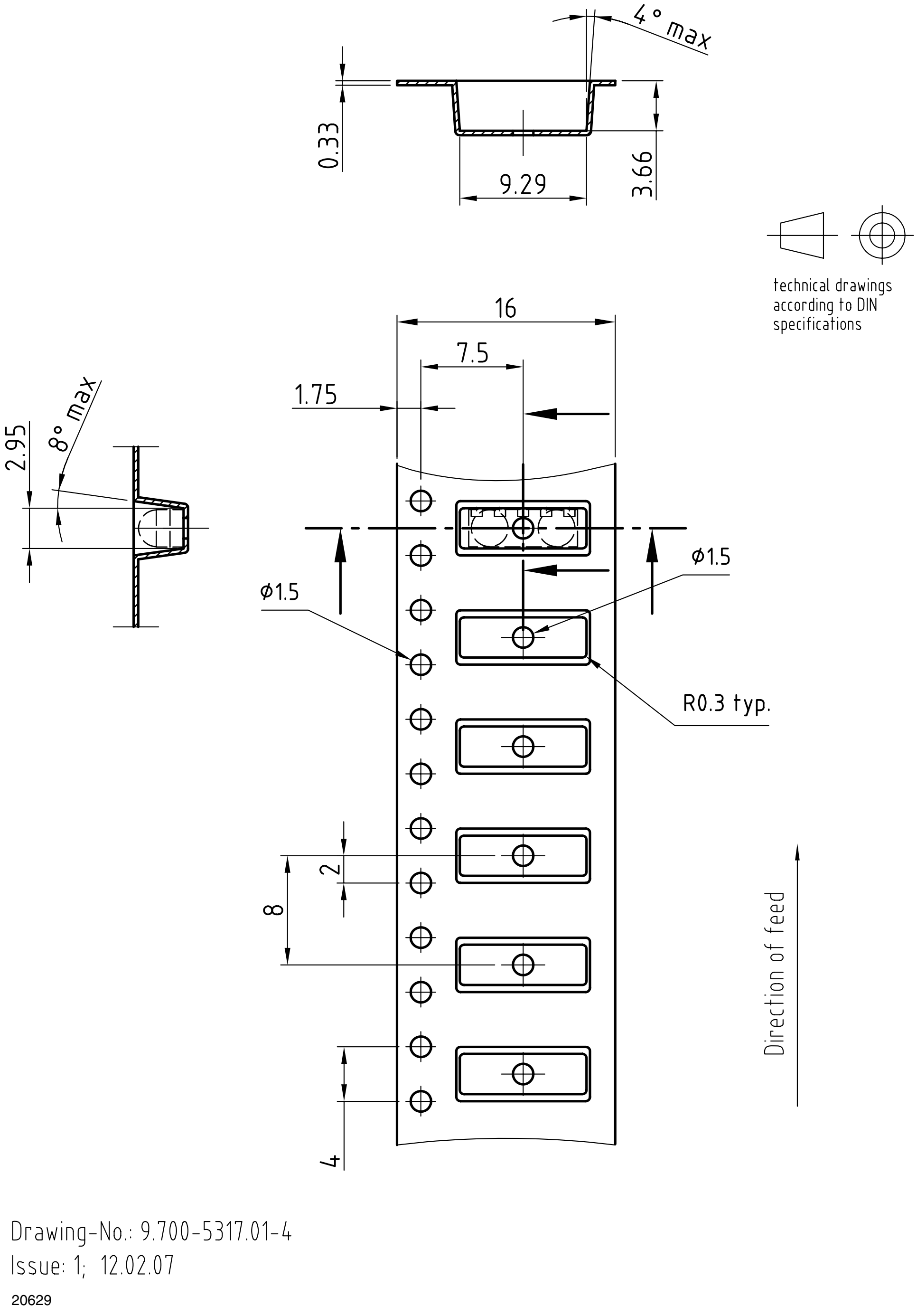
## Taping Version TSOP..TT Dimensions in millimeters



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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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Document Number 81603
Rev. 1.2, 14-Jun-07

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