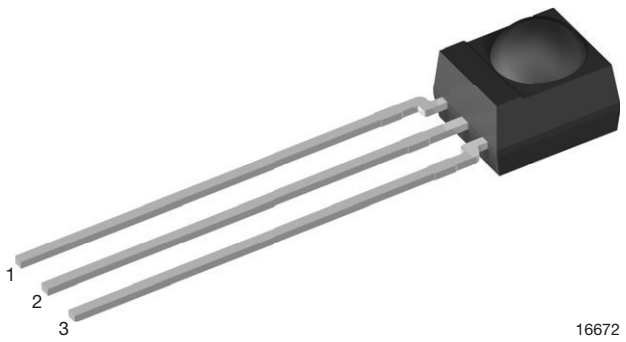
# IR Receiver Modules for Remote Control Systems




## FEATURES

- Improved dark sensitivity
- Improved immunity against optical noise
- Very low supply current
- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Supply voltage: 2.0 V to 3.6 V
- Insensitive to supply voltage ripple and noise
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

HALOGEN FREE

GREEN (5-2008)

## LINKS TO ADDITIONAL RESOURCES

Product Page | 3D Models | Calculators | Marking | Packages | Holders | Bends and Cuts

## DESCRIPTION

The TSOP94... series devices are the latest generation miniaturized IR receiver modules for infrared remote control systems. These series provide improvements in sensitivity to remote control signals in dark ambient as well as in sensitivity in the presence of optical disturbances e.g. from CFLs.

The devices contain a PIN diode and a preamplifier assembled on a lead frame. The epoxy package contains an IR filter. The demodulated output signal can be directly connected to a microprocessor for decoding.

The TSOP946.., series devices are designed to receive long burst codes (10 or more carrier cycles per burst). The third digit designates the AGC level (AGC6) and the last two digits designate the band-pass frequency (see table below). The higher the AGC, the better noise is suppressed, but the lower the code compatibility. AGC6 provides maximized noise suppression. Generally, we advise to select the highest AGC that satisfactorily receives the desired remote code.

These components have not been qualified to automotive specifications.

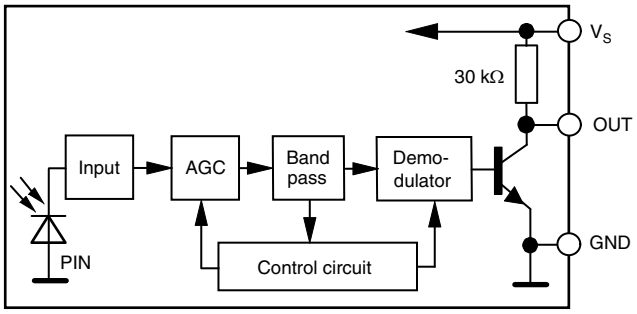
## MECHANICAL DATA

1 = OUT, 2 = GND, 3 = $V_S$

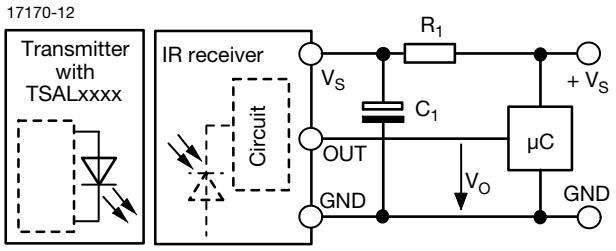
## ORDERING CODE

TSOP946.. - 2160 pieces in tubes

## BLOCK DIAGRAM




## APPLICATION CIRCUIT




$R_1$ and $C_1$ recommended to reduce supply ripple for $V_S$ < 2.2 V



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| PARTS TABLE | | |
|---|---|---|
| **AGC** | | **MAXIMIZED NOISE SUPPRESSION (AGC6)** |
| **Carrier frequency** | 30 kHz | TSOP94630 |
| | 33 kHz | TSOP94633 |
| | 36 kHz | TSOP94636 (5)(6) |
| | 38 kHz | TSOP94638 (3)(4)(11) |
| | 40 kHz | TSOP94640 |
| | 56 kHz | TSOP94656 |
| **Package** | | Mold |
| **Pinning** | | 1 = OUT, 2 = GND, 3 = $V_S$ |
| **Dimensions (mm)** | | 6.0 W x 6.95 H x 5.6 D |
| **Mounting** | | Leaded |
| **Application** | | Remote control |
| **Best choice for** | | (1) Cisco (2) MCIR (3) Mitsubishi (4) NEC (5) Panasonic (6) RC-5 (7) RC-6 (8) RCA (9) r-step (10) Sejin 4PPM (11) Sharp (12) Sony |
| **Special options** | | • Narrow optical filter: www.vishay.com/doc?81590<br>• Wide optical filter: www.vishay.com/doc?82726 |

**Notes**

- 30 kHz and 33 kHz only available on written request
- See datasheet for TSOP942.., TSOP944.. for preferred devices for (1)(2)(7)(8)(9)(10)(12)

| ABSOLUTE MAXIMUM RATINGS | | | | |
|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **VALUE** | **UNIT** |
| Supply voltage | | $V_S$ | -0.3 to +3.6 | V |
| Supply current | | $I_S$ | 3 | mA |
| Output voltage | | $V_O$ | -0.3 to ($V_S$ + 0.3) | V |
| Output current | | $I_O$ | 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 ≤ 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 | $E_v$ = 0, $V_S$ = 3.3 V | $I_{SD}$ | 0.25 | 0.37 | 0.45 | mA |
| | $E_v$ = 40 klx, sunlight | $I_{SH}$ | - | 0.50 | - | mA |
| Supply voltage | | $V_S$ | 2.0 | - | 3.6 | V |
| Transmission distance | $E_v$ = 0, test signal see Fig. 1, IR diode TSAL6200, $I_F$ = 50 mA | d | - | 35 | - | m |
| Output voltage low | $I_{OSL}$ = 0.5 mA, $E_e$ = 0.7 mW/m², test signal see Fig. 1 | $V_{OSL}$ | - | - | 100 | mV |
| Minimum irradiance | Test signal: NEC code | $E_{e\ min.}$ | - | 0.06 | 0.12 | mW/m² |
| Maximum irradiance | $t_{pi}$ - 5/$f_0$ < $t_{po}$ < $t_{pi}$ + 6/$f_0$, test signal see Fig. 1 | $E_{e\ max.}$ | 30 | - | - | W/m² |
| Directivity | Angle of half transmission distance | $\varphi_{1/2}$ | - | ± 45 | - | ° |



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

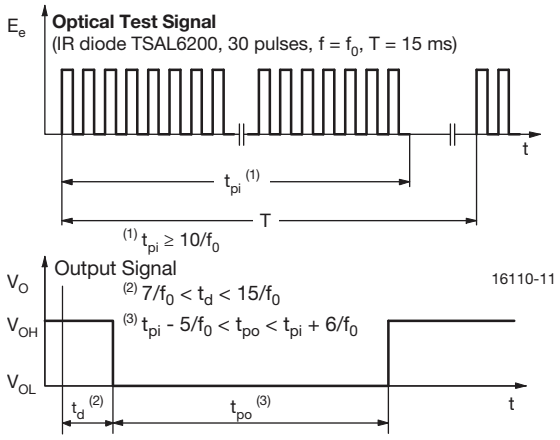



Fig. 1 - Output Delay and Pulse-Width

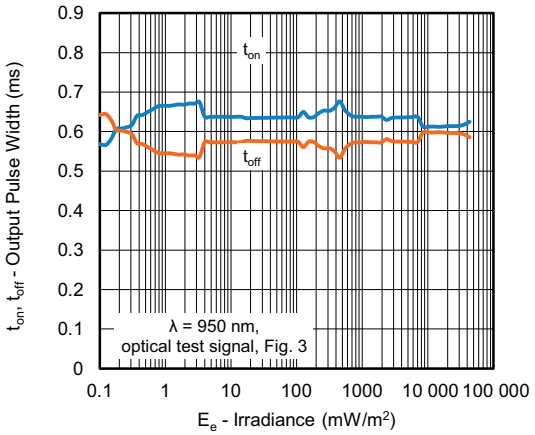



Fig. 4 - Pulse-Width vs. Irradiance in Dark Ambient

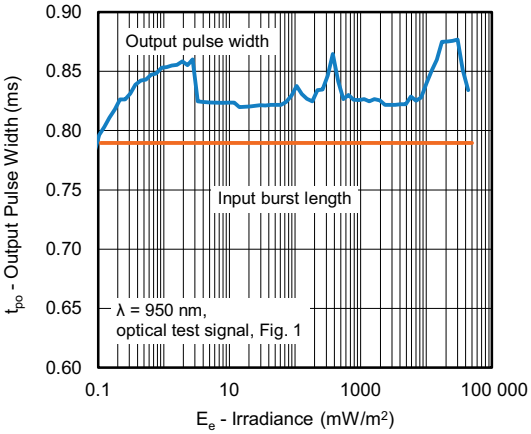



Fig. 2 - Pulse-Width vs. Irradiance in Dark Ambient

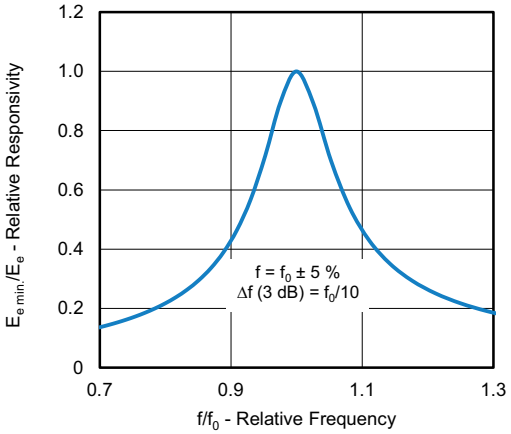



Fig. 5 - Frequency Dependence of Responsivity

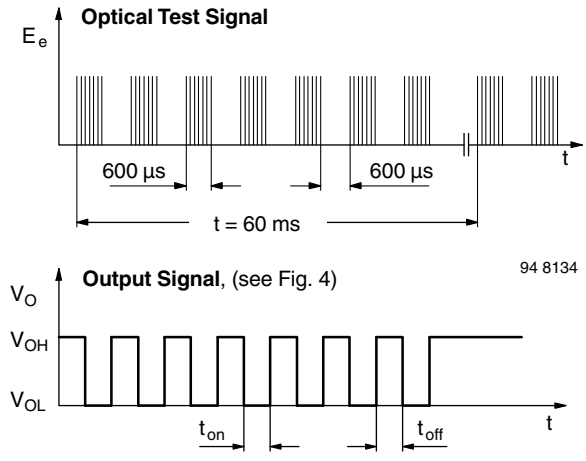



Fig. 3 - Test Signal

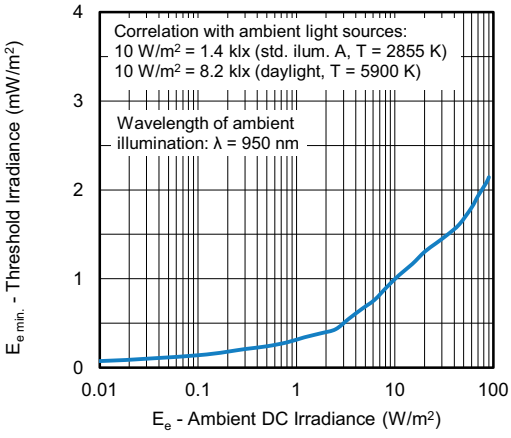



Fig. 6 - Sensitivity in Bright Ambient



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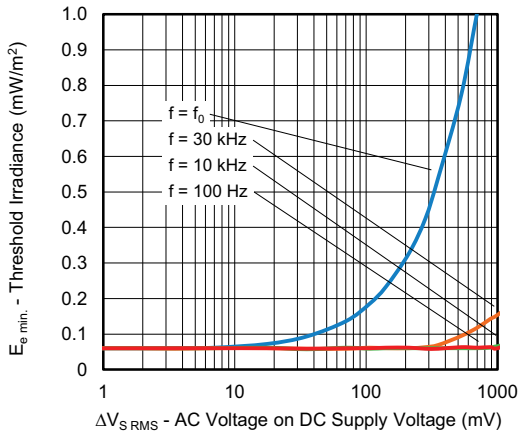



Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

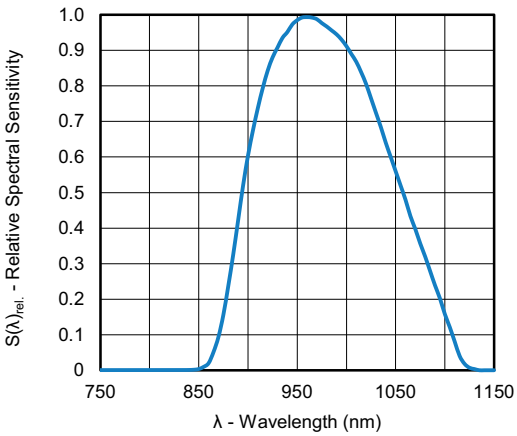



Fig. 10 - Relative Spectral Sensitivity vs. Wavelength

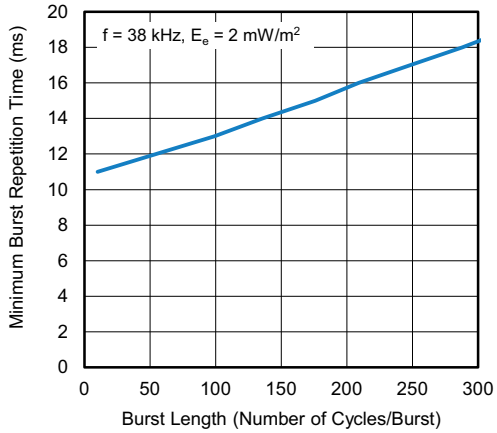



Fig. 8 - Minimum Burst Repetition Time vs. Burst Length

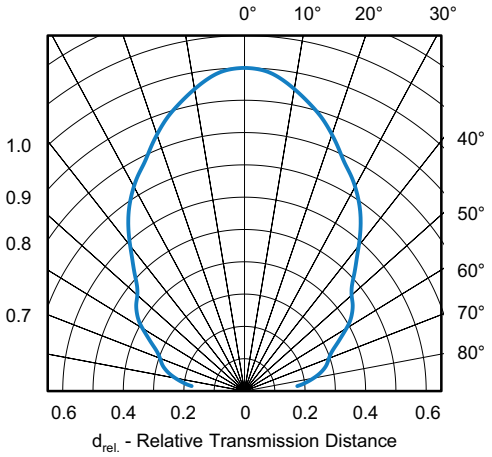



Fig. 11 - Directivity

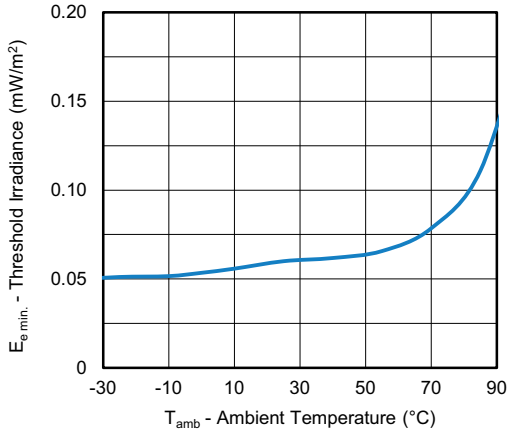



Fig. 9 - Sensitivity vs. Ambient Temperature

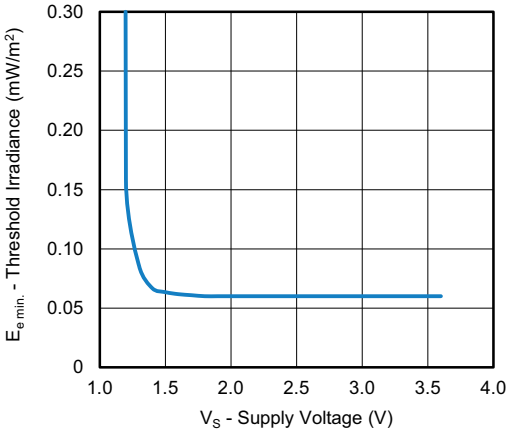



Fig. 12 - Sensitivity vs. Supply Voltage



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## SUITABLE DATA FORMAT

This series is designed to suppress spurious output pulses due to noise or disturbance signals. The devices can distinguish data signals from noise due to differences in frequency, burst length, and envelope duty cycle. The data signal should be close to the device's band-pass center frequency (e.g. 38 kHz) and fulfill the conditions in the table below.

When a data signal is applied to the product in the presence of a disturbance, the sensitivity of the receiver is automatically reduced by the AGC to insure that no spurious pulses are present at the receiver's output. Some examples which are suppressed are:

- DC light (e.g. from tungsten bulbs sunlight)
- Continuous signals at any frequency
- Strongly or weakly modulated patterns from fluorescent lamps with electronic ballasts (see Fig. 13 or Fig. 14)

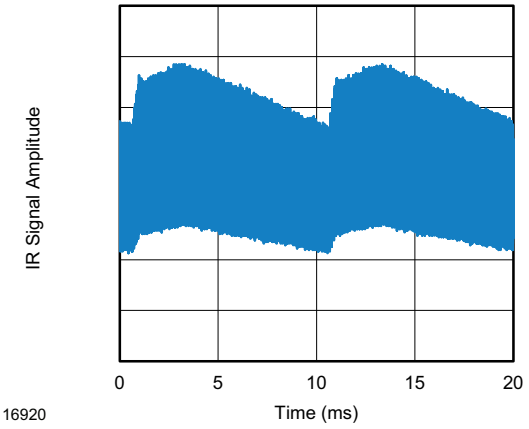



Fig. 13 - IR Emission from Fluorescent Lamp With Low Modulation

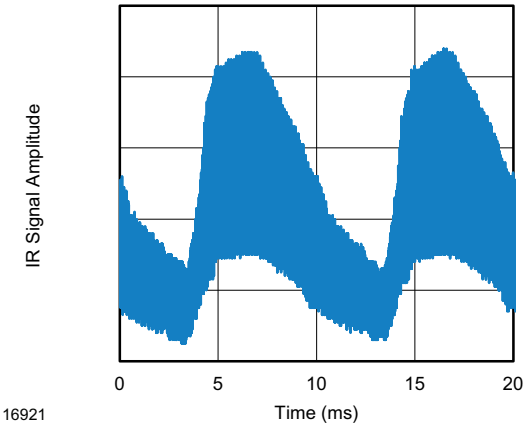



Fig. 14 - IR Emission from Fluorescent Lamp With High Modulation

| | TSOP946.. |
|---|---|
| Minimum burst length | 10 cycles/burst |
| Minimum gap time between bursts | ≥ 13 cycles |
| Minimum idle period between data frames | 12 ms |
| RC-5 code | Preferred |
| RC-6 code | Yes |
| NEC code | Preferred |
| r-step code 56 kHz | Yes |
| Sony code | No |
| RCA 56 kHz code | Yes |
| Mitsubishi code 38 kHz | Preferred |
| Suppression of interference from fluorescent lamps | Fig. 13 and Fig. 14 |

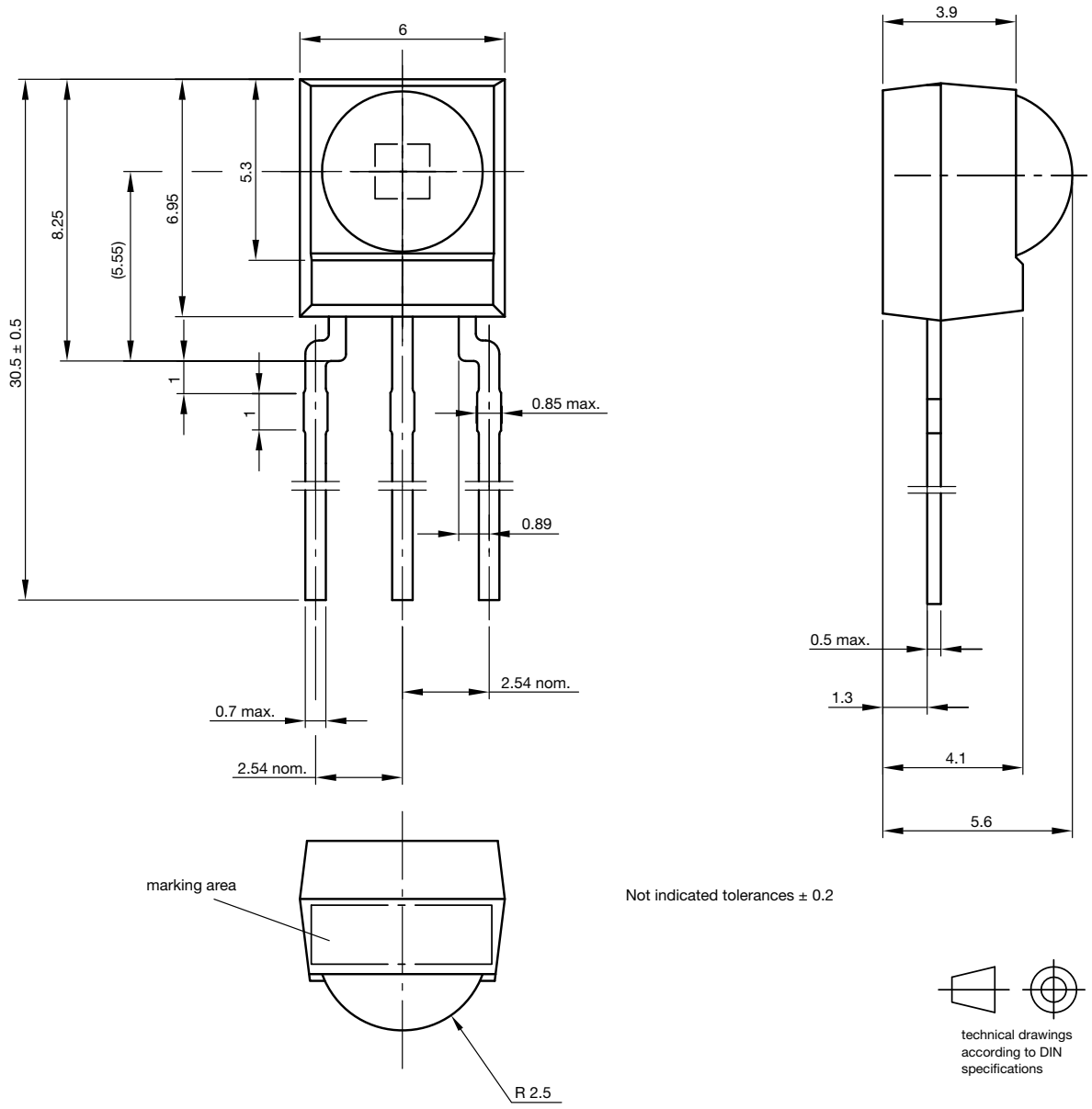
**Note**

- For data formats with short bursts please see the datasheet for TSOP943.., TSOP945..



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**PACKAGE DIMENSIONS** in millimeters




Not indicated tolerances ± 0.2

technical drawings
according to DIN
specifications

Drawing-No.: 6.550-5169.01-4
Issue: 9; 03.11.10
13655



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