# IR Receiver Modules for Remote Control Systems



23196

## LINKS TO ADDITIONAL RESOURCES

Product Page | Marking | Packages | Holders | Bends and Cuts

## DESCRIPTION

This IR receiver series is optimized for short burst remote control systems in different environments. The customer can chose between different IC settings (AGC variants), to find the optimum solution for his application. The higher the AGC, the better noise is suppressed, but the lower the code compatibility.

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. These components have not been qualified to automotive specifications.

## FEATURES

- Individual IC settings to reach maximum performance
- Immunity against noise (lamps, LCD TV, Wi-Fi)
- Low supply current
- Photo detector and preamplifier in one package
- Supply voltage: 2.0 V to 5.5 V
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

HALOGEN FREE

GREEN (5-2008)

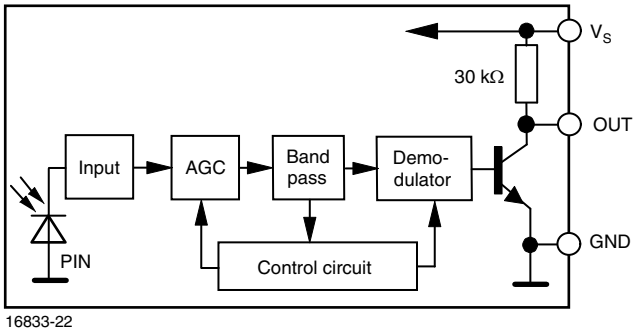
## DESIGN SUPPORT TOOLS

- 3D models
- Window size calculator

## APPLICATIONS

- Infrared remote control systems

## BLOCK DIAGRAM




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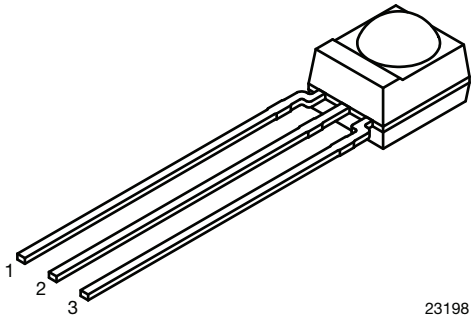
## MECHANICAL DATA

**Pinning for TSOP41.., TSOP43.., TSOP45..:**

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

**Pinning for TSOP21.., TSOP23.., TSOP25..:**

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

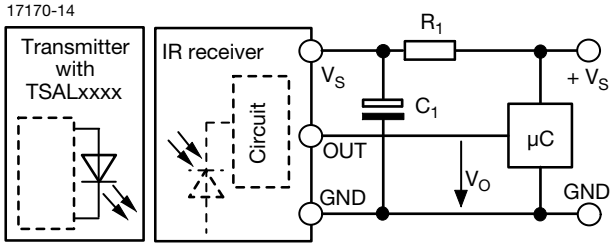



23198

## ORDERING CODE

TSOP2..., TSOP4... - 2160 pieces in tubes

## APPLICATION CIRCUIT




$R_1$ and $C_1$ recommended in case there are strong ripple or spikes on the supply line.

## PARTS TABLE

| AGC | | LEGACY, FOR SHORT BURST REMOTE CONTROLS (AGC1) | | NOISY ENVIRONMENTS AND SHORT BURSTS (AGC3) | | VERY NOISY ENVIRONMENTS AND SHORT BURSTS (AGC5) | |
|---|---|---|---|---|---|---|---|
| Carrier frequency | 30 kHz | TSOP4130 | TSOP2130 | TSOP4330 | TSOP2330 | TSOP4530 | TSOP2530 |
| | 33 kHz | TSOP4133 | TSOP2133 | TSOP4333 | TSOP2333 | TSOP4533 | TSOP2533 |
| | 36 kHz | TSOP4136 | TSOP2136 | TSOP4336 (1)(2) | TSOP2336 (1)(2) | TSOP4536 | TSOP2536 |
| | 38 kHz | TSOP4138 | TSOP2138 | TSOP4338 (3)(5) | TSOP2338 (3)(5) | TSOP4538 | TSOP2538 |
| | 40 kHz | TSOP4140 | TSOP2140 | TSOP4340 | TSOP2340 | TSOP4540 | TSOP2540 |
| | 56 kHz | TSOP4156 | TSOP2156 | TSOP4356 (4) | TSOP2356 (4) | TSOP4556 | TSOP2556 |
| Package | | Mold | | | | | |
| Pinning | | 1 = OUT, 2 = GND, 3 = $V_S$ | 1 = OUT, 2 = $V_S$, 3 = GND | 1 = OUT, 2 = GND, 3 = $V_S$ | 1 = OUT, 2 = $V_S$, 3 = GND | 1 = OUT, 2 = GND, 3 = $V_S$ | 1 = OUT, 2 = $V_S$, 3 = GND |
| Dimensions (mm) | | 6.0 W x 6.95 H x 5.6 D | | | | | |
| Mounting | | Leaded | | | | | |
| Application | | Remote control | | | | | |
| Best choice for | | (1) MCIR (2) RCMM (3) RECS-80 Code (4) r-map (5) XMP | | | | | |
| Special options | | • Narrow optical filter: www.vishay.com/doc?81590<br>• Wide optical filter: www.vishay.com/doc?82726 | | | | | |

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
|---|---|---|---|---|
| Supply voltage | | $V_S$ | -0.3 to +6 | V |
| Supply current | | $I_S$ | 5 | mA |
| Output voltage | | $V_O$ | -0.3 to 5.5 | V |
| Voltage at output to supply | | $V_S$ - $V_O$ | -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



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| **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 | 0.35 | 0.45 | mA |
| | $E_v$ = 40 klx, sunlight | $I_{SH}$ | - | 0.45 | - | mA |
| Supply voltage | | $V_S$ | 2.0 | - | 5.5 | V |
| Transmission distance | $E_v$ = 0, test signal see Fig. 1, IR diode TSAL6200, $I_F$ = 50 mA | d | - | 24 | - | 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: RC5 code | $E_{e\ min.}$ | - | 0.12 | 0.25 | mW/m² |
| | Test signal: XMP code | $E_{e\ min.}$ | - | 0.2 | 0.4 | mW/m² |
| Maximum irradiance | $t_{pi}$ - 3/$f_o$ < $t_{po}$ < $t_{pi}$ + 3.5/$f_o$, test signal see Fig. 1 | $E_{e\ max.}$ | 50 | - | - | W/m² |
| Directivity | Angle of half transmission distance | $\varphi_{1/2}$ | - | ± 45 | - | deg |

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

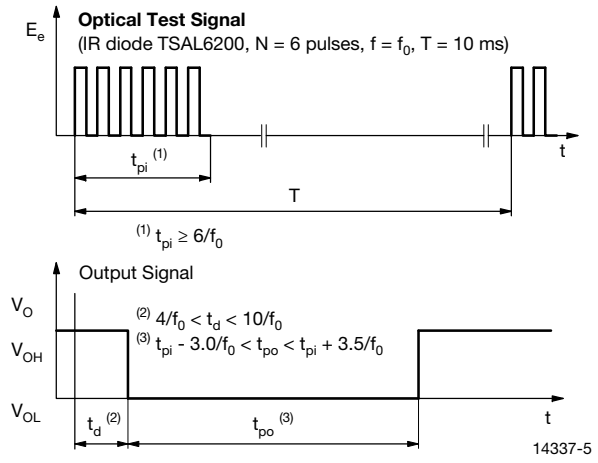



Fig. 1 - Output Active Low

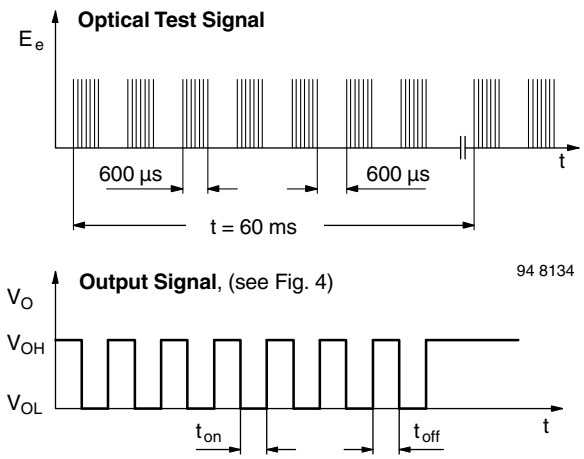



Fig. 3 - Output Function

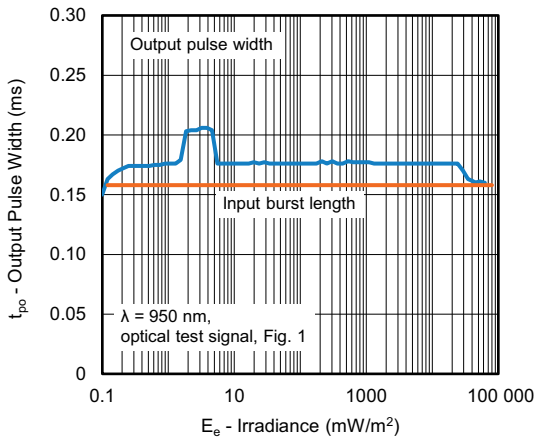



Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

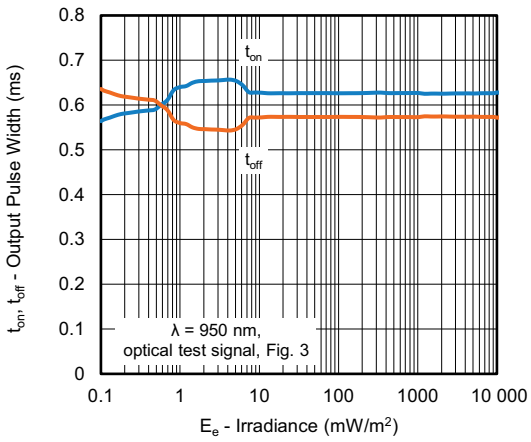



Fig. 4 - Output Pulse Diagram



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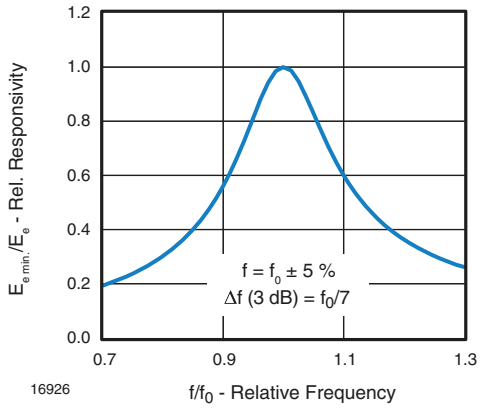



Fig. 5 - Frequency Dependence of Responsivity

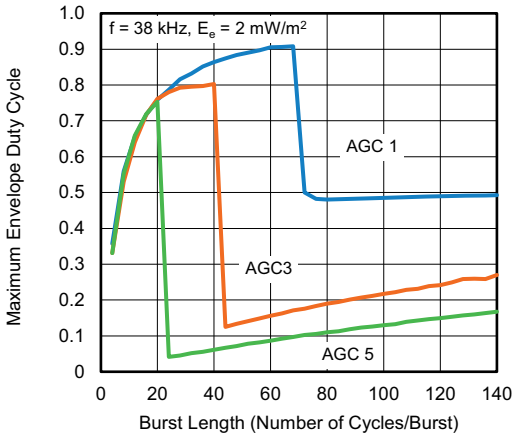



Fig. 8 - Max. Envelope Duty Cycle vs. Burst Length

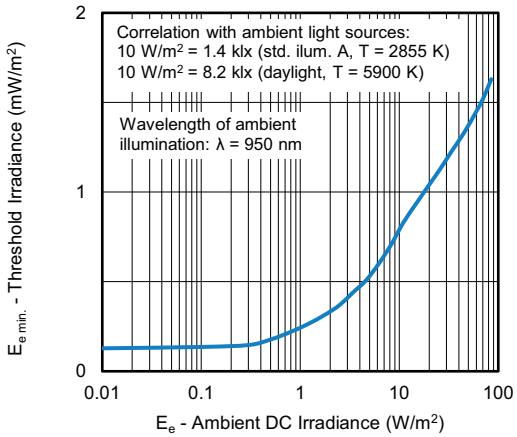



Fig. 6 - Sensitivity in Bright Ambient

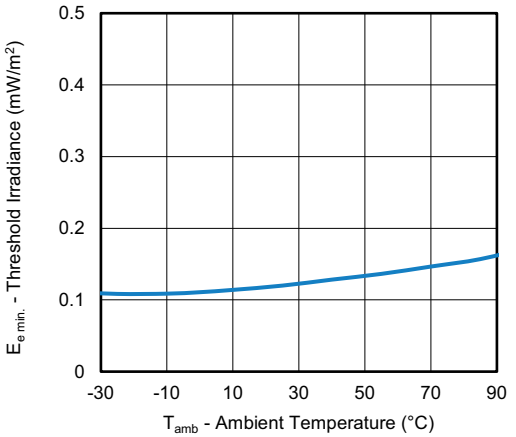



Fig. 9 - Sensitivity vs. Ambient Temperature

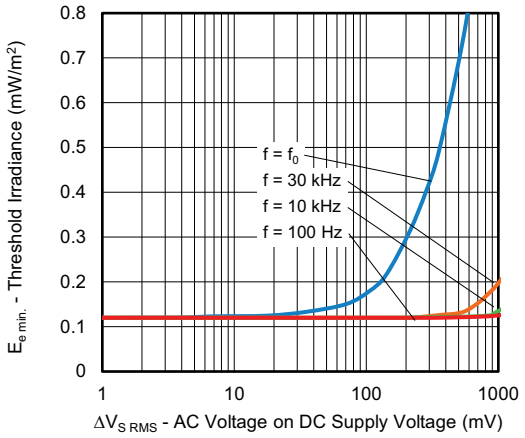



Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

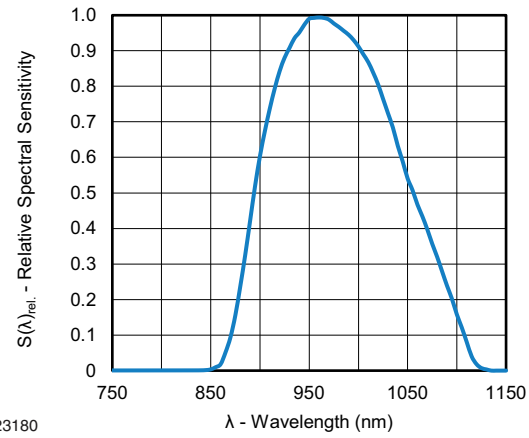



Fig. 10 - Relative Spectral Sensitivity vs. Wavelength



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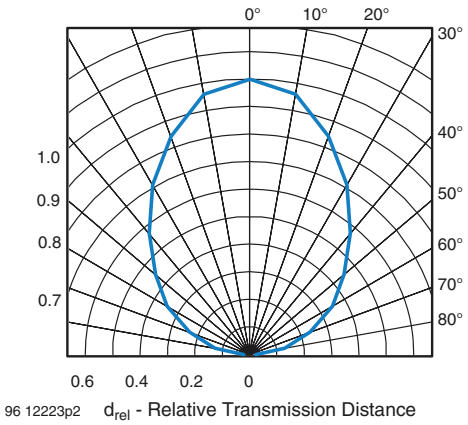



Fig. 11 - Horizontal Directivity

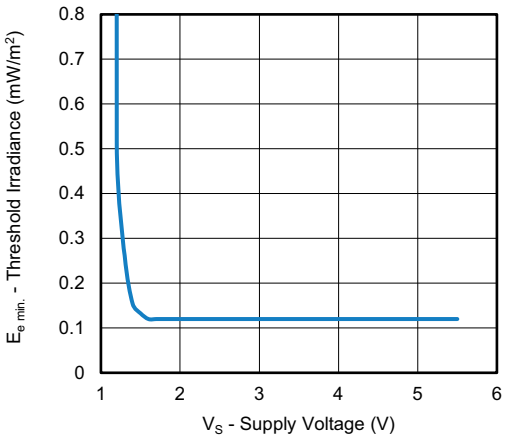



Fig. 12 - Sensitivity vs. Supply Voltage



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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).
- 2.4 GHz and 5 GHz Wi-Fi

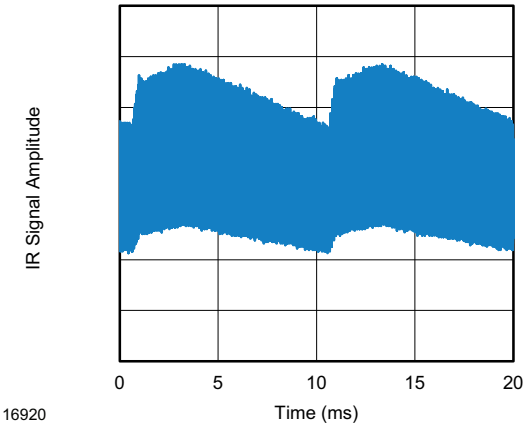



Fig. 13 - IR Disturbance from Fluorescent Lamp With Low Modulation

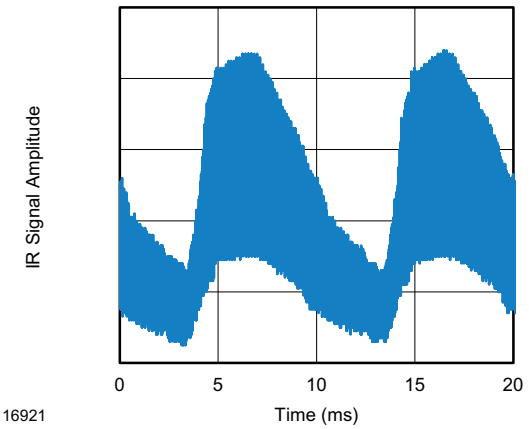



Fig. 14 - IR Disturbance from Fluorescent Lamp With High Modulation

| | TSOP41.., TSOP21.. | TSOP43.., TSOP23.. | TSOP45.., TSOP25.. |
|---|---|---|---|
| Minimum burst length | 6 cycles/burst | 6 cycles/burst | 6 cycles/burst |
| After each burst of length<br>A gap time is required of | 6 to 68 cycles<br>≥ 6 cycles | 6 to 40 cycles<br>≥ 7 cycles | 6 to 20 cycles<br>≥ 7 cycles |
| For bursts greater than<br>a minimum gap time in the data stream is needed of | 68 cycles<br>> 1 x burst length | 40 cycles<br>> 6 x burst length | 20 cycles<br>> 10 x burst length |
| Maximum number of continuous short bursts/second | 2500 | 2500 | 2500 |
| RCMM code | Yes | Preferred | Yes |
| XMP code | Yes | Preferred | Yes |
| r-map code | Yes | Preferred | Yes |
| RECS-80 code | Yes | Preferred | Yes |
| Suppression of interference from fluorescent lamps | Mild disturbance patterns are suppressed (example: signal pattern of Fig. 13) | Complex disturbance patterns are suppressed (example: signal pattern of Fig. 14) | Critical disturbance patterns are suppressed, e.g. highly dimmed LCDs |

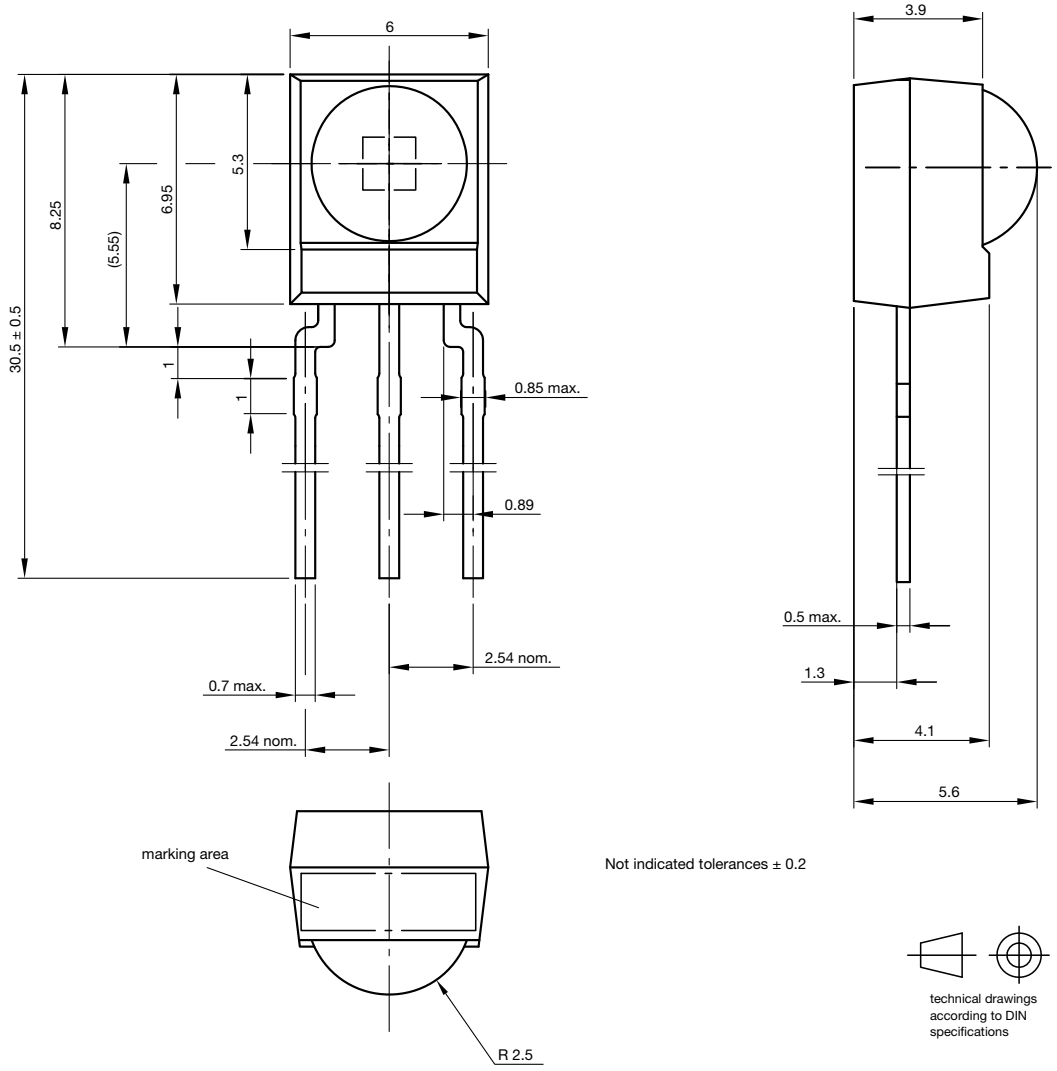
**Note**

- For data formats with long bursts (more than 10 carrier cycles) please see the datasheet for TSOP48.., TSOP44.., TSOP22.., TSOP24..



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**PACKAGE DIMENSIONS** in millimeters




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