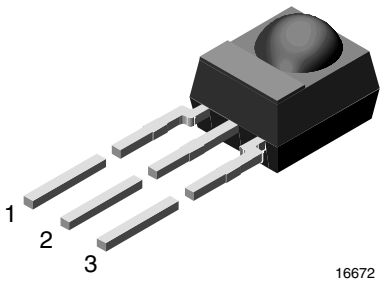
# IR Receiver Modules for Remote Control Systems




## FEATURES

- Low supply current
- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Improved shielding against EMI
- Supply voltage: 2.5 V to 5.5 V
- Improved immunity against ambient light
- 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)

## MECHNICAL DATA

**Pinning for TSOP44.., TSOP48..:**

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

**Pinning for TSOP22.., TSOP24..:**

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

## DESCRIPTION

The TSOP22.., TSOP48.., TSOP24.. and TSOP44.. series are miniaturized IR receiver modules for infrared remote control systems. A PIN diode and a preamplifier are assembled on lead frame, the epoxy package contains an IR filter.

The demodulated output signal can be directly connected to a microprocessor for decoding.

The TSOP24.., TSOP44.. are optimized to suppress almost all spurious pulses from energy saving lamps like CFLs. The AGC4 used in the TSOP24.. and TSOP44.. may suppress some data signals. The TSOP22.., TSOP48.. are legacy products for all common IR remote control data formats. Between these four receiver types, the TSOP24.., TSOP44.. are preferred. Customers should initially try the TSOP24.., TSOP44 in their design.

These components have not been qualified according to automotive specifications.

**PARTS TABLE**

| AGC | | LEGACY, FOR LONG BURST REMOTE CONTROLS (AGC2) | | RECOMMENDED FOR LONG BURST CODES (AGC4) (1) | |
|---|---|---|---|---|---|
| Carrier frequency | 30 kHz | TSOP4830 | TSOP2230 | TSOP4430 | TSOP2430 |
| | 33 kHz | TSOP4833 | TSOP2233 | TSOP4433 | TSOP2433 |
| | 36 kHz | TSOP4836 | TSOP2236 | TSOP4436 (2)(3)(4) | TSOP2436 (2)(3)(4) |
| | 38 kHz | TSOP4838 | TSOP2238 | TSOP4438 (5)(6)(7) | TSOP2438 (5)(6)(7) |
| | 40 kHz | TSOP4840 | TSOP2240 | TSOP4440 | TSOP2440 |
| | 56 kHz | TSOP4856 | TSOP2256 | TSOP4456 (7)(8) | TSOP2456 (7)(8) |
| 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 |
| Dimensions (mm) | | 6.0 W x 6.95 H x 5.6 D | | | |
| Mounting | | Leaded | | | |
| Application | | Remote control | | | |
| Best remote control code | | (2) RC-5 (3) RC-6 (4) Panasonic (5) NEC (6) Sharp (7) r-step (8) Thomson RCA | | | |

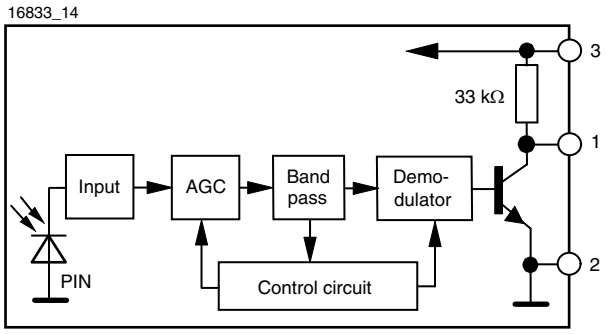
**Note**

(1) We advise try AGC4 first if the burst length is unknown.

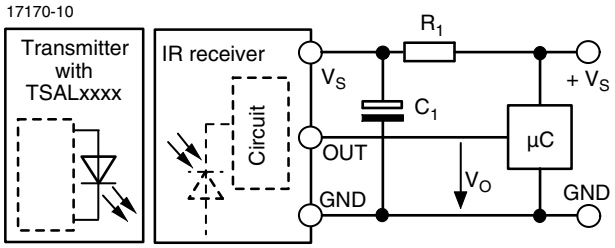


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## BLOCK DIAGRAM




## APPLICATION CIRCUIT




The external components $R_1$ and $C_1$ are optional to improve the robustness against electrical overstress (typical values are $R_1$ = 100 Ω, $C_1$ = 0.1 µF).

| 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 condtions 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, $V_S$ = 5 V | $I_{SD}$ | 0.55 | 0.7 | 0.9 | mA |
| | $E_v$ = 40 klx, sunlight | $I_{SH}$ | | 0.8 | | mA |
| Supply voltage | | $V_S$ | 2.5 | | 5.5 | V |
| Transmission distance | $E_v$ = 0, test signal see fig. 1, IR diode TSAL6200, $I_F$ = 200 mA | d | | 45 | | 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 | Pulse width tolerance: $t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$, test signal see fig. 1 | $E_{e\ min.}$ | | 0.12 | 0.25 | mW/m² |
| Maximum irradiance | $t_{pi} - 5/f_o < t_{po} < t_{pi} + 6/f_o$, test signal see fig. 1 | $E_{e\ max.}$ | 50 | | | W/m² |
| Directivity | Angle of half transmission distance | $\varphi_{1/2}$ | | ± 45 | | deg |



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

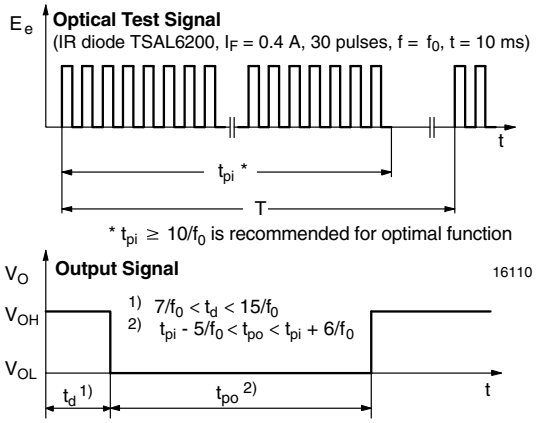



Fig. 1 - Output Active Low

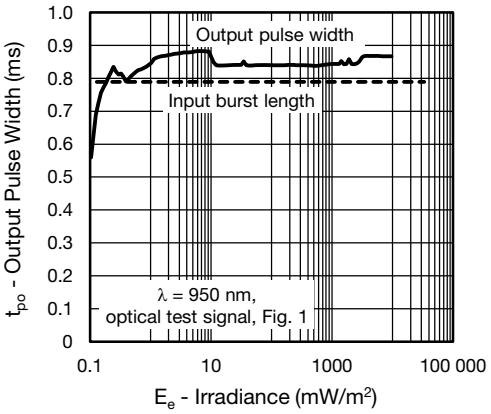



Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

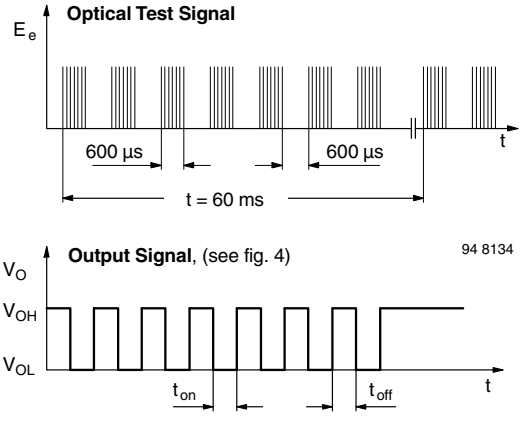



Fig. 3 - Output Function

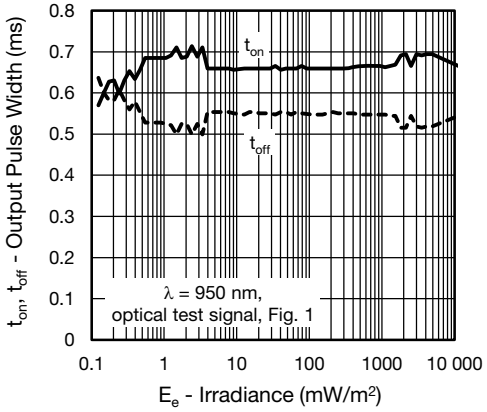



Fig. 4 - Output Pulse Diagram

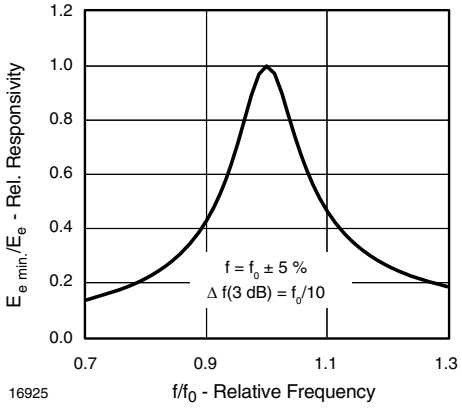



Fig. 5 - Frequency Dependence of Responsivity

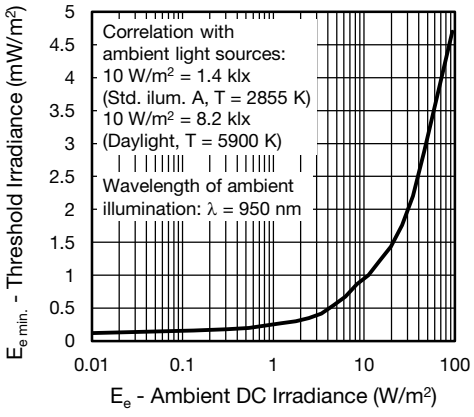



Fig. 6 - Sensitivity in Bright Ambient



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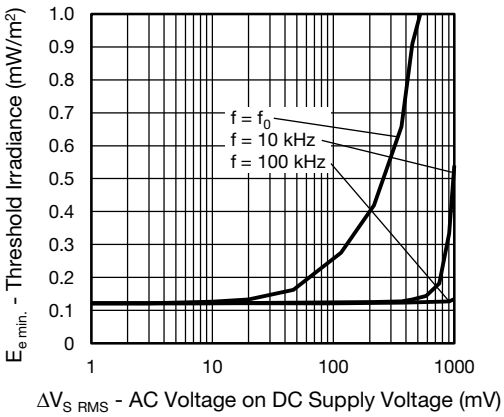



Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

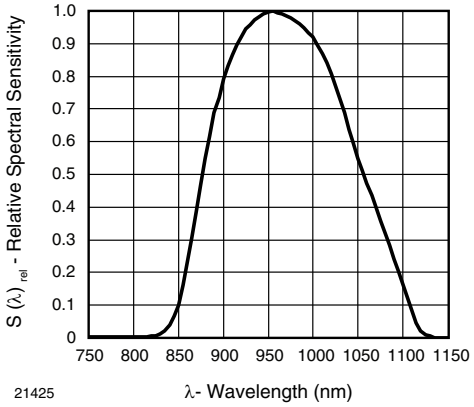



Fig. 10 - Relative Spectral Sensitivity vs. Wavelength

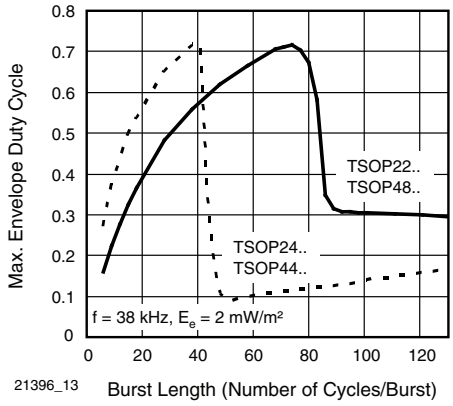



Fig. 8 - Max. Envelope Duty Cycle vs. Burst Length

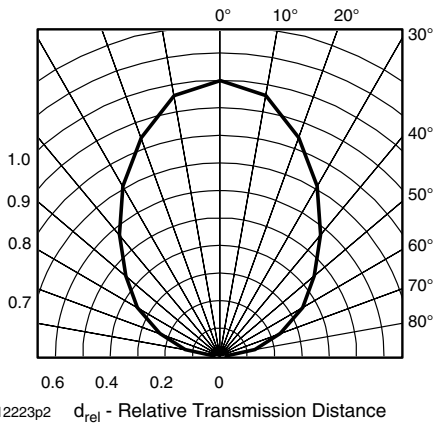



Fig. 11 - Horizontal Directivity

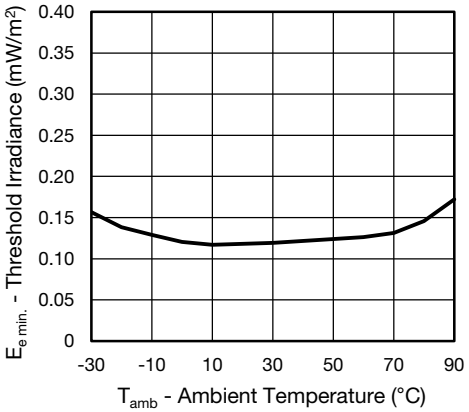



Fig. 9 - Sensitivity vs. Ambient Temperature

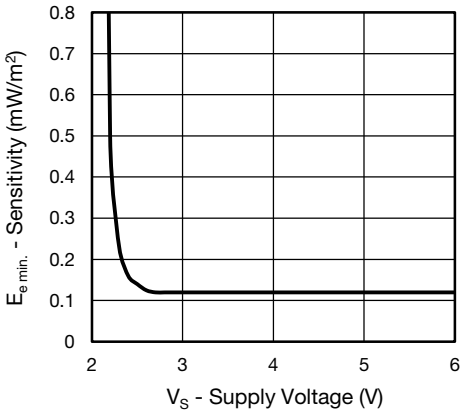



Fig. 12 - Sensitivity vs. Supply Voltage



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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 figure 13 or figure 14).

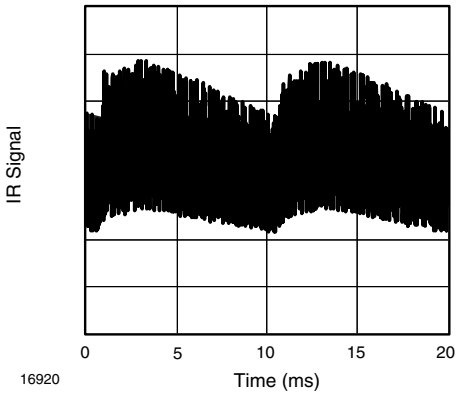



Fig. 13 - IR Disturbance from Fluorescent Lamp with Low Modulation

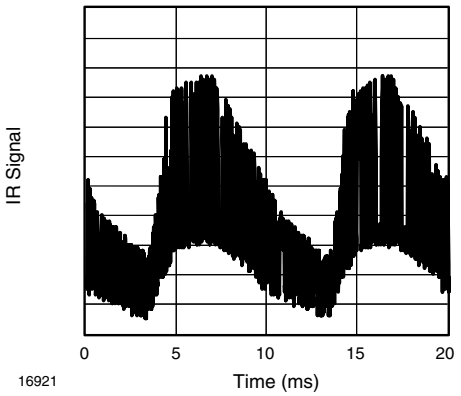



Fig. 14 - IR Disturbance from Fluorescent Lamp with High Modulation

| | TSOP22.., TSOP48.. | TSOP24.., TSOP44.. |
|---|---|---|
| Minimum burst length | 10 cycles/burst | 10 cycles/burst |
| After each burst of length<br>a minimum gap time is required of | 10 to 70 cycles<br>≥ 12 cycles | 10 to 35 cycles<br>≥ 12 cycles |
| For bursts greater than<br>a minimum gap time in the data stream is needed of | 70 cycles<br>> 4 x burst length | 35 cycles<br>> 10 x burst length |
| Maximum number of continuous short bursts/second | 800 | 1300 |
| NEC code | yes | preferred |
| RC5/RC6 code | yes | preferred |
| Thomson 56 kHz code | yes | preferred |
| Sharp code | yes | preferred |
| Suppression of interference from fluorescent lamps | Most common disturbance patterns are suppressed | Even extreme disturbance patterns are suppressed |

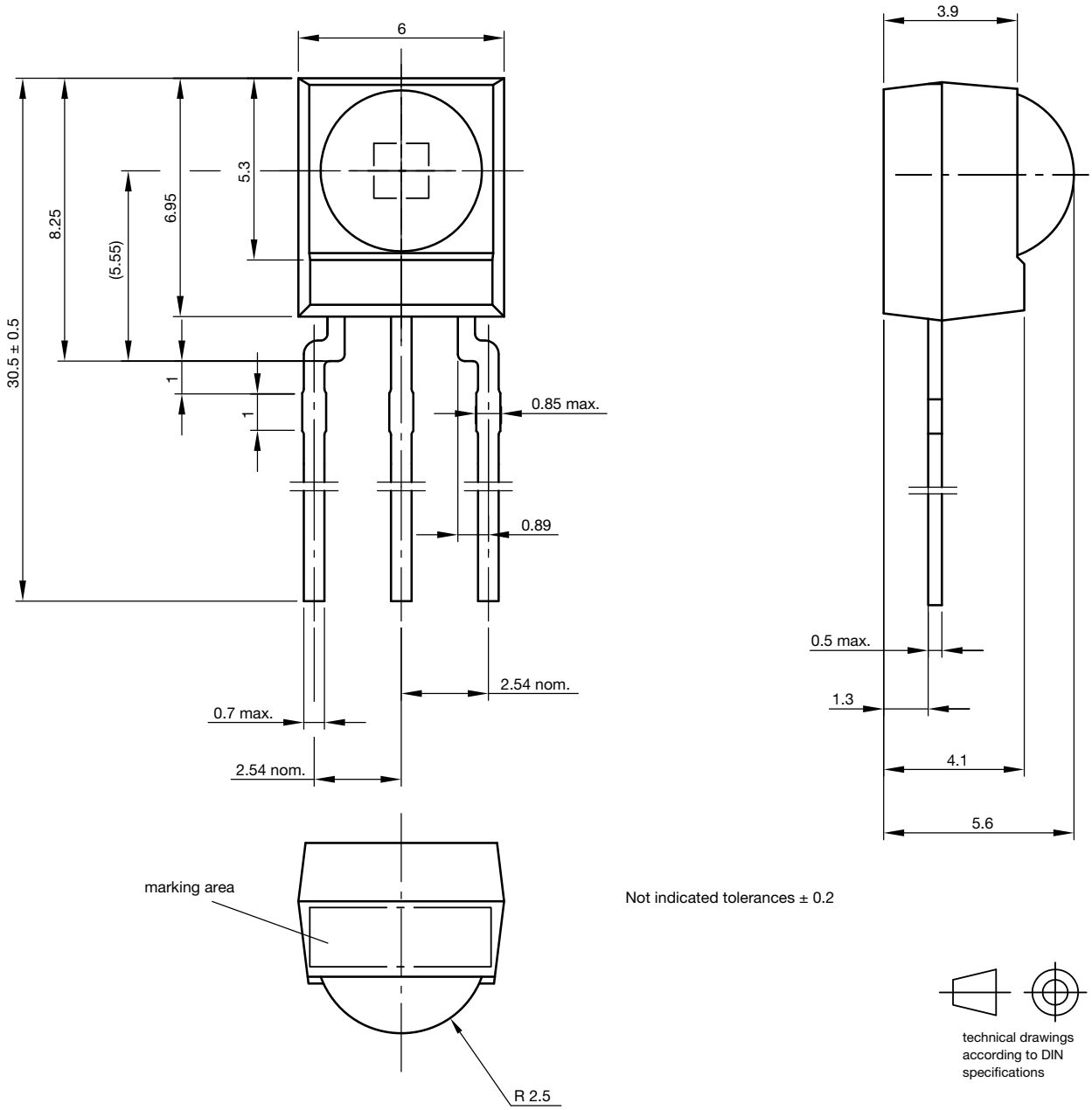
**Notes**

- For data formats with short bursts please see the datasheet of TSOP23.., TSOP43..
- Best choice of AGC for some popular IR-codes:
  - TSOP4436, TSOP2436: RC-5, RC-6, Panasonic
  - TSOP4438, TSOP2438: NEC, Sharp, r-step
  - TSOP4456, TSOP2456: r-step, Thomson RCA
- For SIRCS 15 and 20 bit, Sony 12 bit IR-codes, please see the datasheet for TSOP4S40, TSOP2S40



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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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