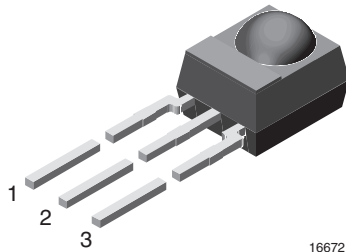


## IR Receiver Modules for Remote Control Systems



16672

### MECHANICAL DATA

#### Pinning

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

### FEATURES

- Low supply current
- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Improved shielding against EMI
- Supply voltage: 2.7 V to 5.5 V
- Improved immunity against ambient light
- Insensitive to supply voltage ripple and noise
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



### DESCRIPTION

The TSOP22.. series are miniaturized receivers for infrared remote control systems. A PIN diode and a preamplifier are assembled on a lead frame, the epoxy package acts as an IR filter.

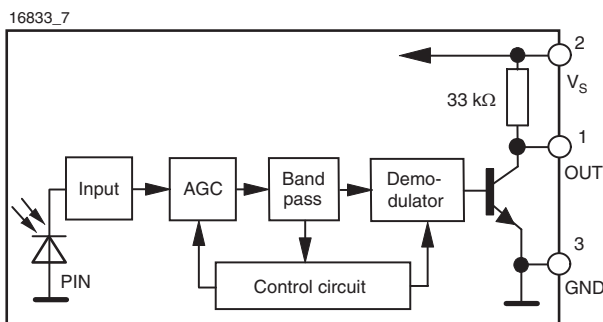
The demodulated output signal can directly be decoded by a microprocessor. The TSOP22.. is the standard IR remote control receiver series, supporting all major data formats.

This component has not been qualified according to automotive specifications.

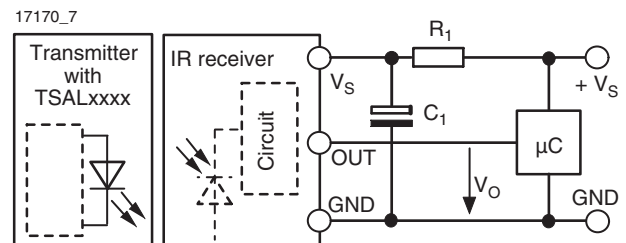
### PARTS TABLE

| CARRIER FREQUENCY | STANDARD APPLICATIONS (AGC2/AGC8) |
|-------------------|-----------------------------------|
| 30 kHz            | TSOP2230                          |
| 33 kHz            | TSOP2233                          |
| 36 kHz            | TSOP2236                          |
| 36.7 kHz          | TSOP2237                          |
| 38 kHz            | TSOP2238                          |
| 40 kHz            | TSOP2240                          |
| 56 kHz            | TSOP2256                          |

### BLOCK DIAGRAM



### APPLICATION CIRCUIT



The external components  $R_1$  and  $C_1$  are optional to improve the robustness against electrical overstress (typical values are  $R_1 = 100 \Omega$ ,  $C_1 = 0.1 \mu F$ ). The output voltage  $V_O$  should not be pulled down to a level below 1 V by the external circuit. The capacitive load at the output should be less than 2 nF.

**ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup>**

| PARAMETER                   | TEST CONDITION                        | SYMBOL      | VALUE                    | UNIT |
|-----------------------------|---------------------------------------|-------------|--------------------------|------|
| Supply voltage (pin 2)      |                                       | $V_S$       | - 0.3 to + 6.0           | V    |
| Supply current (pin 2)      |                                       | $I_S$       | 5                        | mA   |
| Output voltage (pin 1)      |                                       | $V_O$       | - 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 (pin 1)      |                                       | $I_O$       | 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           | $T_{amb} \leq 85\text{ °C}$           | $P_{tot}$   | 10                       | mW   |
| Soldering temperature       | $t \leq 10\text{ s}$ , 1 mm from case | $T_{sd}$    | 260                      | °C   |

**Note**

<sup>(1)</sup> 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 <sup>(1)</sup>**

| PARAMETER                  | TEST CONDITION                                                                                   | SYMBOL              | MIN. | TYP.     | MAX. | UNIT              |
|----------------------------|--------------------------------------------------------------------------------------------------|---------------------|------|----------|------|-------------------|
| Supply current (pin 2)     | $E_v = 0$ , $V_S = 5\text{ V}$                                                                   | $I_{SD}$            | 0.65 | 0.85     | 1.05 | mA                |
|                            | $E_v = 40\text{ klx}$ , sunlight                                                                 | $I_{SH}$            |      | 0.95     |      | mA                |
| Supply voltage             |                                                                                                  | $V_S$               | 2.7  |          | 5.5  | V                 |
| Transmission distance      | $E_v = 0$ , test signal see fig. 1,<br>IR diode TSAL6200,<br>$I_F = 400\text{ mA}$               | $d$                 |      | 45       |      | m                 |
| Output voltage low (pin 1) | $I_{OSL} = 0.5\text{ mA}$ , $E_e = 0.7\text{ mW/m}^2$ ,<br>test signal see fig. 1                | $V_{OSL}$           |      |          | 100  | mV                |
| Minimum irradiance         | Pulse width tolerance:<br>$t_{pi} - 5/f_0 < t_{po} < t_{pi} + 6/f_0$ ,<br>test signal see fig. 1 | $E_{e\text{ min.}}$ |      | 0.17     | 0.35 | mW/m <sup>2</sup> |
| Maximum irradiance         | $t_{pi} - 5/f_0 < t_{po} < t_{pi} + 6/f_0$ ,<br>test signal see fig. 1                           | $E_{e\text{ max.}}$ | 30   |          |      | W/m <sup>2</sup>  |
| Directivity                | Angle of half transmission distance                                                              | $\phi_{1/2}$        |      | $\pm 45$ |      | deg               |

**Note**

<sup>(1)</sup>  $T_{amb} = 25\text{ °C}$ , unless otherwise specified

**TYPICAL CHARACTERISTICS**

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

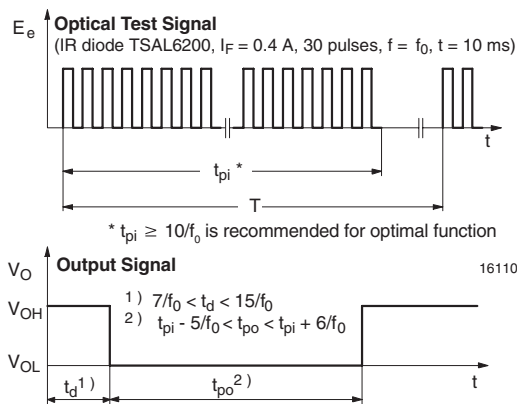


Fig. 1 - Output Active Low

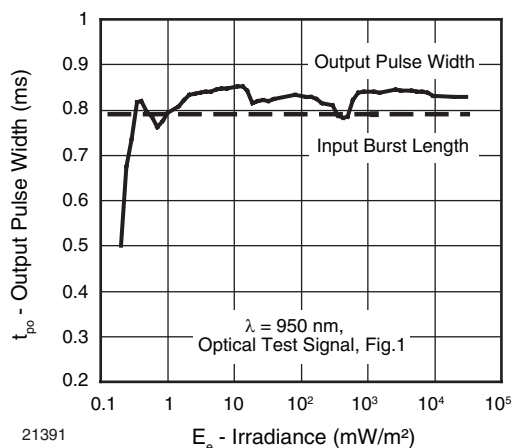


Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

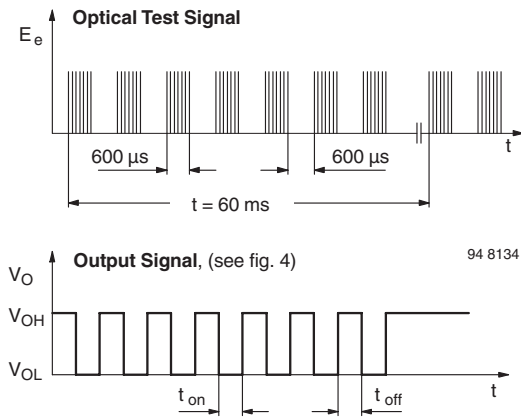


Fig. 3 - Output Function

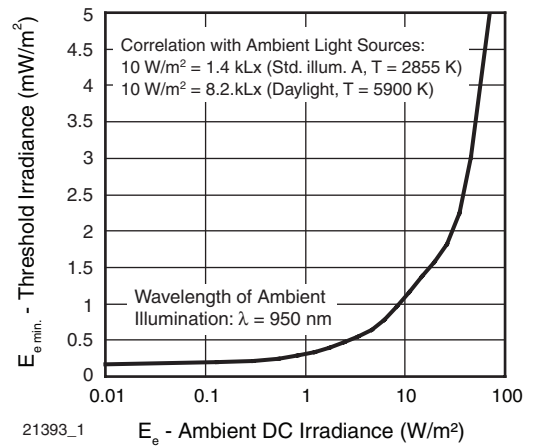


Fig. 6 - Sensitivity in Bright Ambient

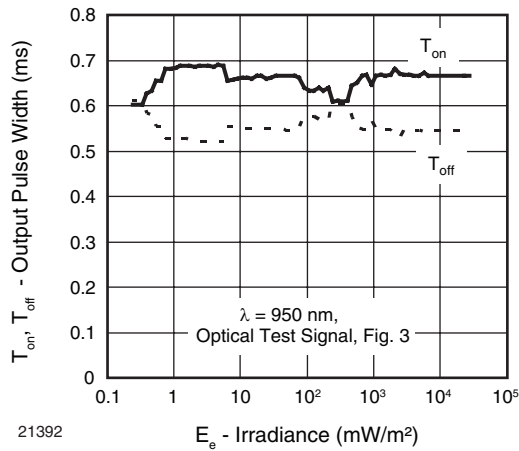


Fig. 4 - Output Pulse Diagram

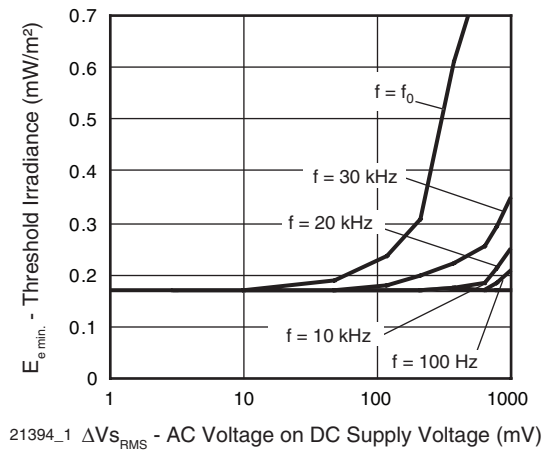


Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

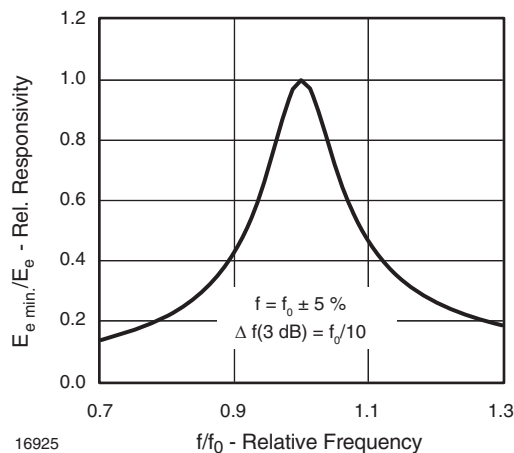


Fig. 5 - Frequency Dependence of Responsivity

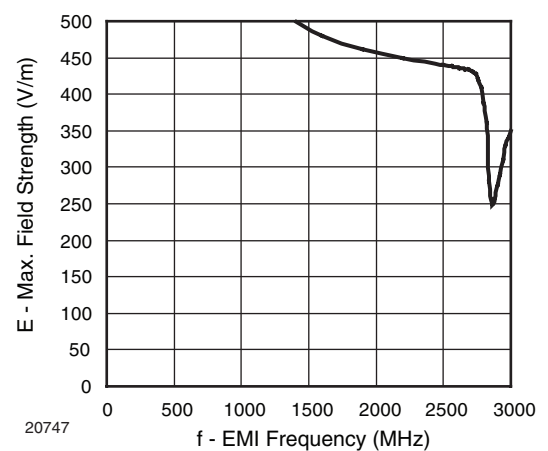


Fig. 8 - Sensitivity vs. Electric Field Disturbances

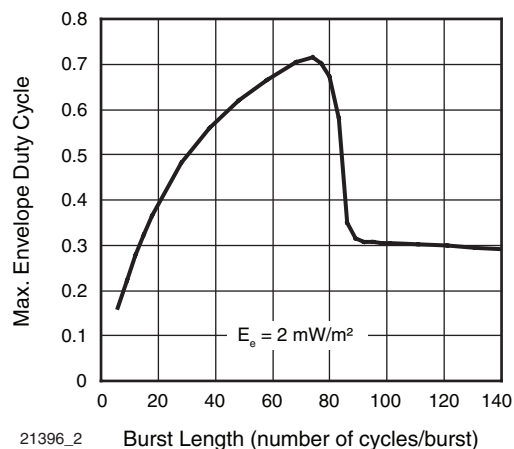


Fig. 9 - Max. Envelope Duty Cycle vs. Burst Length

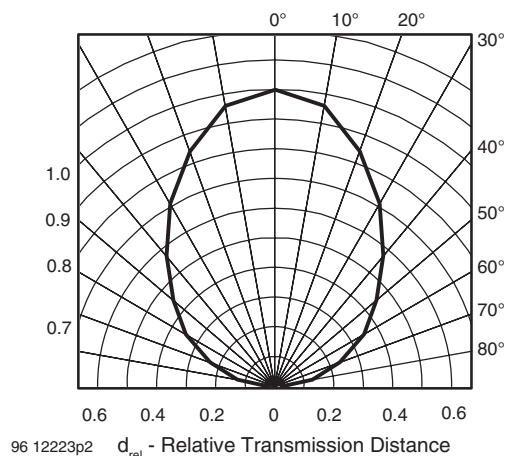


Fig. 12 - Horizontal Directivity

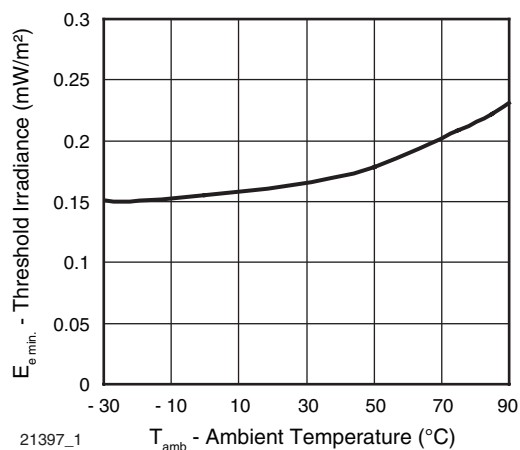


Fig. 10 - Sensitivity vs. Ambient Temperature

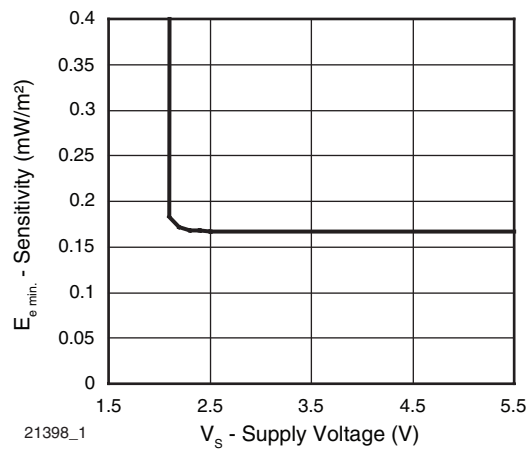


Fig. 13 - Sensitivity vs. Supply Voltage

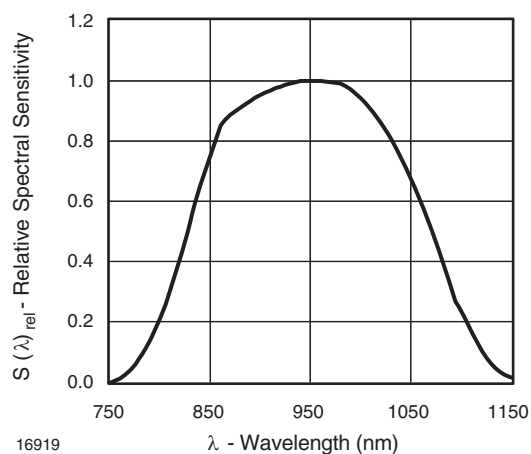


Fig. 11 - Relative Spectral Sensitivity vs. Wavelength

### SUITABLE DATA FORMAT

The TSOP22.. series is designed to suppress spurious output pulses due to noise or disturbance signals. Data and disturbance signals can be distinguished by the devices according to carrier frequency, burst length and envelope duty cycle. The data signal should be close to the band-pass center frequency (e.g. 38 kHz) and fulfill the conditions in the table below.

When a data signal is applied to the TSOP22.. 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 bulb or sunlight)
- Continuous signals at any frequency
- Strongly or weakly modulated noise from fluorescent lamps with electronic ballasts (see figure 14 or figure 15)

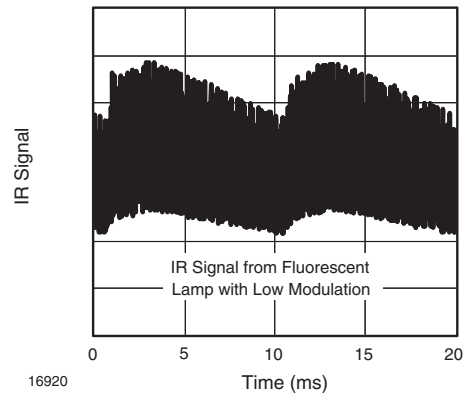


Fig. 14 - IR Signal from Fluorescent Lamp with Low Modulation

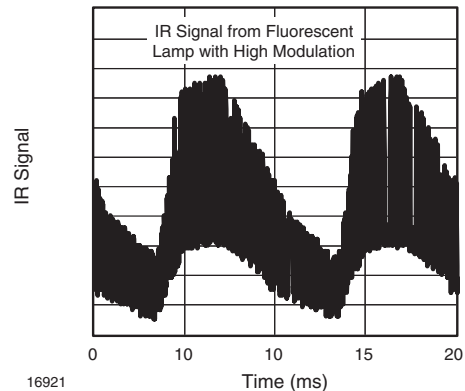


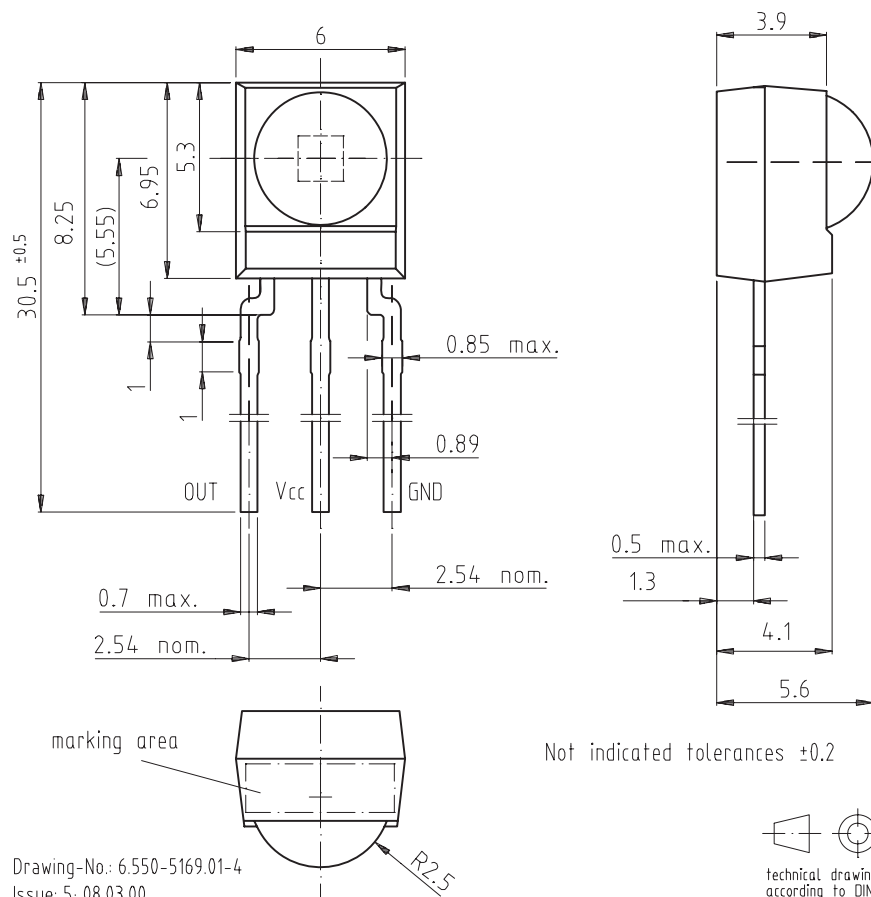
Fig. 15 - IR Signal from Fluorescent Lamp with High Modulation

|                                                                               | TSOP22..                                       |
|-------------------------------------------------------------------------------|------------------------------------------------|
| Minimum burst length                                                          | 10 cycles/burst                                |
| After each burst of length<br>a minimum gap time is required of               | 10 to 70 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                |
| Maximum number of continuous short bursts/second                              | 800                                            |
| Compatible to NEC code                                                        | yes                                            |
| Compatible to RC5/RC6 code                                                    | yes                                            |
| Compatible to Sony code                                                       | yes                                            |
| Compatible to Thomson 56 kHz code                                             | yes                                            |
| Compatible to Mitsubishi code (38 kHz, preburst 8 ms, 16 bit)                 | yes                                            |
| Compatible to Sharp code                                                      | yes                                            |
| Suppression of interference from fluorescent lamps                            | Most common disturbance signals are suppressed |

#### Note

For data formats with short bursts please see the datasheet of TSOP21..

## PACKAGE DIMENSIONS in millimeters



Drawing-No.: 6.550-5169.01-4  
Issue: 5; 08.03.00

**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.

We reserve the right to make changes to improve technical design  
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