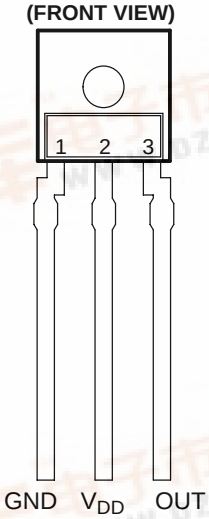
- **Integral Visible Light Cutoff Filter**
- **Converts IR Light Intensity to Output Voltage**
- **Monolithic Silicon IC Containing Photodiode, Operational Amplifier, and Feedback Components**
- **High Sensitivity**
- **Single Voltage Supply Operation (2.7 V to 5.5 V)**
- **Low Noise (200 μVrms Typ to 1 kHz)**
- **Rail-to-Rail Output**
- **High Power-Supply Rejection (35 dB at 1 kHz)**
- **Compact 3-Leaded Plastic Package**

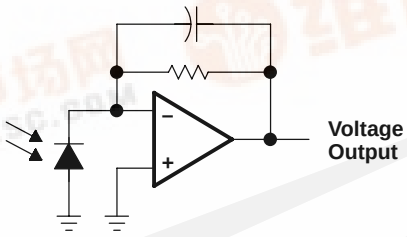
**PACKAGE**
**(FRONT VIEW)**




## Description

The TSL267 is a high-sensitivity low-noise infrared light-to-voltage optical converter that combines a photodiode and a transimpedance amplifier on a single monolithic CMOS integrated circuit. Output voltage is directly proportional to IR light intensity (irradiance) on the photodiode. The TSL267 has a transimpedance gain of 320 MΩ. The device has improved offset voltage stability and low power consumption and is supplied in a 3-lead visible-light-blocking plastic sidelooker package with an integral lens.

## Functional Block Diagram




## Terminal Functions

| TERMINAL NAME | TERMINAL NO. | DESCRIPTION |
|---|---|---|
| GND | 1 | Ground (substrate). All voltages are referenced to GND. |
| OUT | 3 | Output voltage |
| $V_{DD}$ | 2 | Supply voltage |

## Absolute Maximum Ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, $V_{DD}$ (see Note 1) . . . . . 6 V
Output current, $I_O$ . . . . . ±10 mA
Duration of short-circuit current at (or below) 25°C . . . . . 5 s
Operating free-air temperature range, $T_A$ . . . . . –25°C to 85°C
Storage temperature range, $T_{stg}$ . . . . . –25°C to 85°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . . 240°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: All voltages are with respect to GND.

## Recommended Operating Conditions

| | MIN | MAX | UNIT |
|---|---|---|---|
| Supply voltage, $V_{DD}$ | 2.7 | 5.5 | V |
| Operating free-air temperature, $T_A$ | 0 | 70 | °C |

## Electrical Characteristics at $V_{DD}$ = 5 V, $T_A$ = 25°C, $\lambda_p$ = 940 nm, $R_L$ = 10 kΩ (unless otherwise noted) (see Notes 2, 3, and 4)

| PARAMETER | | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $V_D$ | Dark voltage | $E_e$ = 0 | | 0 | | 15 | mV |
| $V_{OM}$ | Maximum output voltage swing | $V_{DD}$ = 4.5 V, | No Load | | 4.49 | | V |
| | | $V_{DD}$ = 4.5 V, | $R_L$ = 10 kΩ | 4 | 4.2 | | |
| $V_O$ | Output voltage | $E_e$ = 4.4 μW/cm$^2$ | | 1.2 | 2 | 2.8 | V |
| $\alpha_{VD}$ | Temperature coefficient of dark voltage ($V_D$) | $T_A$ = 0°C to 70°C | | | –15 | | μV/°C |
| $N_e$ | Irradiance responsivity | See Note 5 | | | 0.45 | | V/(μW/cm$^2$) |
| PSRR | Power supply rejection ratio | $f_{ac}$ = 100 Hz, see Note 6 | | | 55 | | dB |
| | | $f_{ac}$ = 1 kHz, see Note 6 | | | 35 | | dB |
| $I_{DD}$ | Supply current | $E_e$ = 4.4 μW/cm$^2$ | | | 1.9 | 4 | mA |

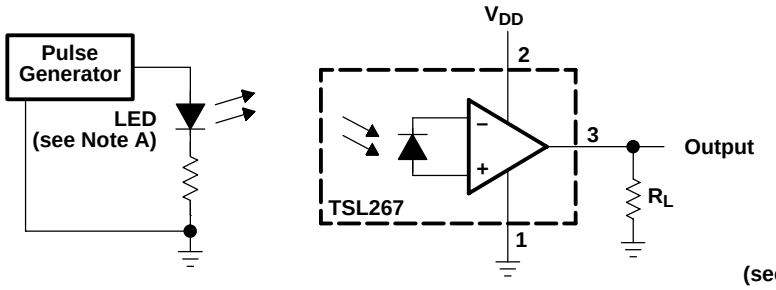
NOTES: 2. Measured with $R_L$ = 10 kΩ between output and ground.
3. Optical measurements are made using small-angle incident radiation from a light-emitting diode (LED) optical source.
4. The input irradiance is supplied by a GaAs light-emitting diode with the following characteristics: peak wavelength $\lambda_p$ = 940 nm.
5. Irradiance responsivity is characterized over the range $V_O$ = 0.1 V to 4.5 V. The best-fit straight line of Output Voltage $V_O$ versus Irradiance $E_e$ over this range will typically have a positive extrapolated $V_O$ value for $E_e$ = 0.
6. Power supply rejection ratio PSRR is defined as 20 log ($\Delta V_{DD}(f)/\Delta V_O(f)$) with $V_{DD}(f = 0)$ = 5 V and $V_O(f = 0)$ = 2 V.

## Switching Characteristics at $V_{DD}$ = 5 V, $T_A$ = 25°C, $\lambda_p$ = 940 nm, $R_L$ = 10 kΩ (unless otherwise noted)

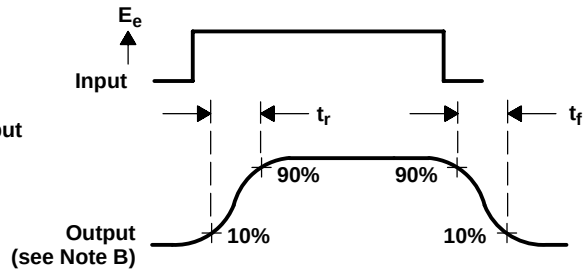
| PARAMETER | | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $t_r$ | Output pulse rise time, 10% to 90% of final value | See Note 7 and Figure 1 | | | 160 | 250 | µs |
| $t_f$ | Output pulse fall time, 10% to 90% of final value | See Note 7 and Figure 1 | | | 150 | 250 | µs |
| $t_s$ | Output settling time to 1% of final value | See Note 7 and Figure 1 | | | 330 | | µs |
| | Integrated noise voltage | f = dc to 1 kHz | $E_e$ = 0 | | 200 | | µVrms |
| $V_n$ | Output noise voltage, rms | f = 10 Hz | $E_e$ = 0 | | 6 | | µV/√Hz rms |
| | | f = 100 Hz | $E_e$ = 0 | | 6 | | |
| | | f = 1 kHz | $E_e$ = 0 | | 7 | | |

NOTE 7: Switching characteristics apply over the range $V_O$ = 0.1 V to 4.5 V.

## PARAMETER MEASUREMENT INFORMATION




TEST CIRCUIT




VOLTAGE WAVEFORM

NOTES: A. The input irradiance is supplied by a pulsed GaAs light-emitting diode with peak wavelength: $\lambda_p$ = 940 nm, $t_r$ < 1 µs, $t_f$ < 1 µs.

B. The output waveform is monitored on an oscilloscope with the following characteristics: $t_r$ < 100 ns, $Z_i$ ≥ 1 MΩ, $C_i$ ≤ 20 pF.

**Figure 1. Switching Times**

## TYPICAL CHARACTERISTICS

**PHOTODIODE SPECTRAL RESPONSIVITY**

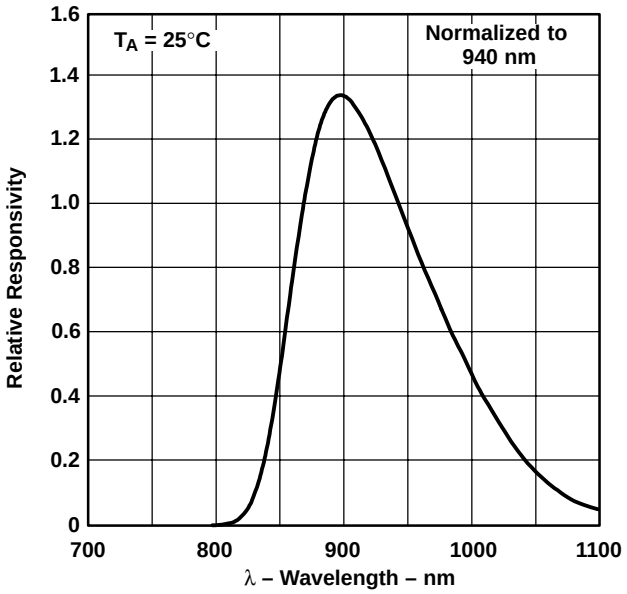



**Figure 2**

**POWER SUPPLY REJECTION RATIO vs FREQUENCY**

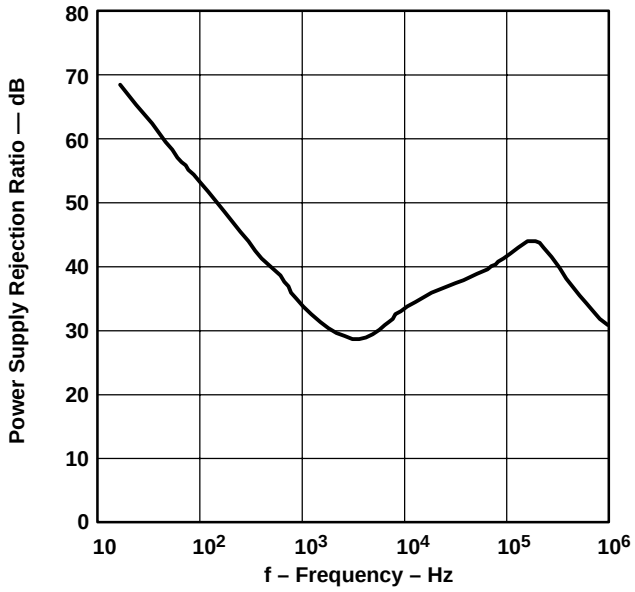



**Figure 3**

**DARK VOLTAGE vs FREE-AIR TEMPERATURE**

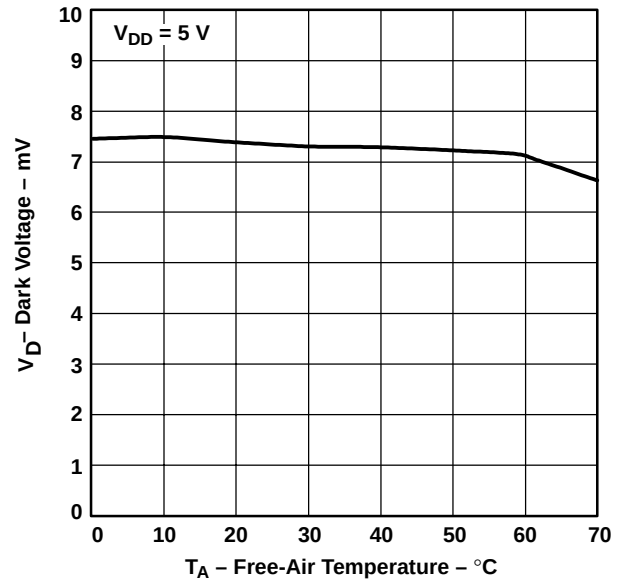



**Figure 4**

**NORMALIZED RESPONSE vs ANGULAR DISPLACEMENT**

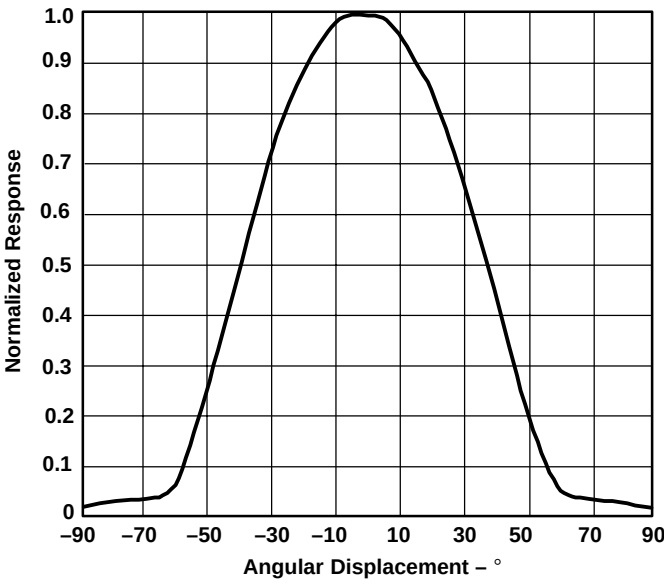



**Figure 5**

## MECHANICAL DATA

The TSL267 is implemented in a visible-light-blocking 3-leaded package with a molded focusing lens.

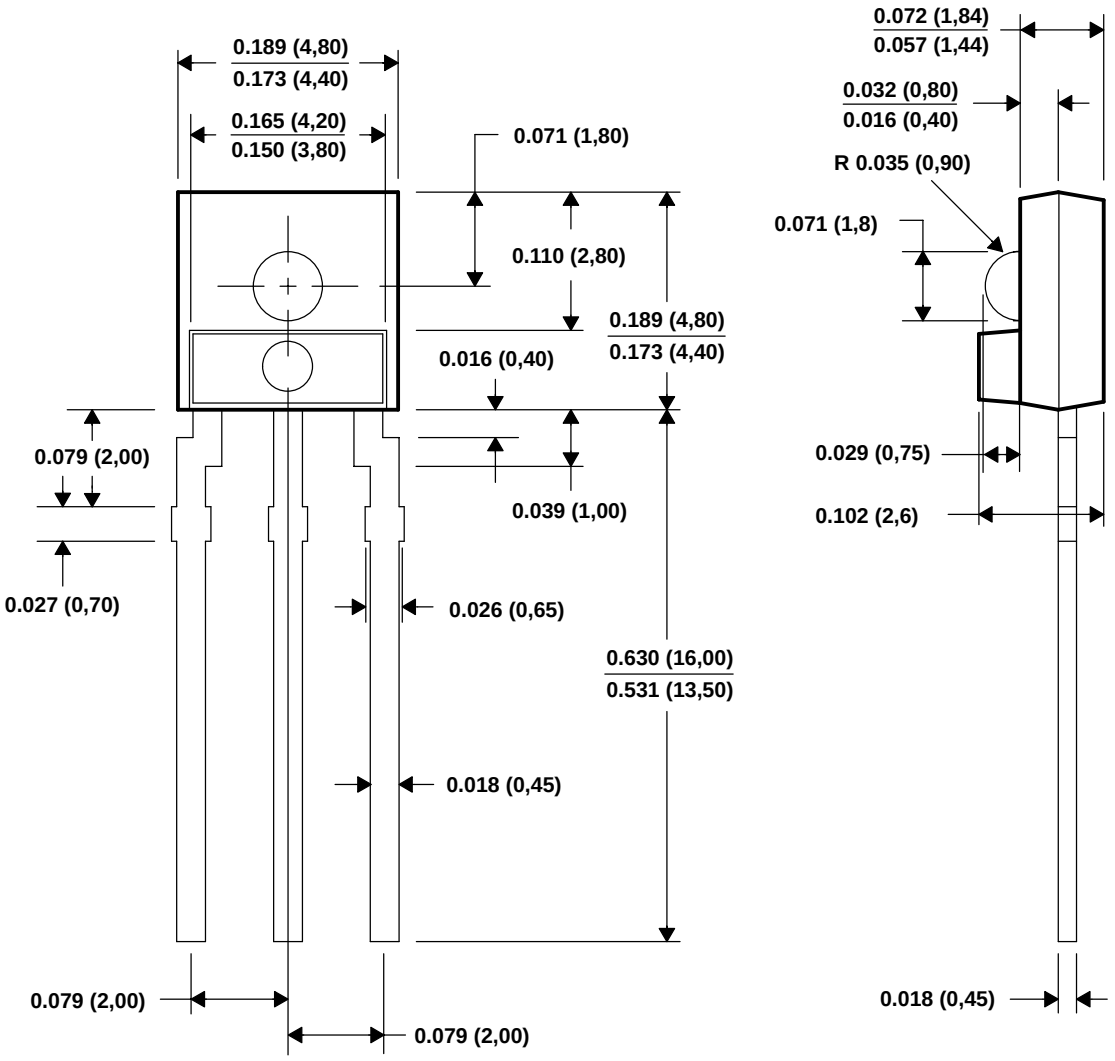



**Figure 6. Package Configuration**

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. All dimensions apply before solder dip.

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