

TSL267

High-Sensitivity IR Light-to-Voltage Converter

General Description

The TSL267 is a high-sensitivity low-noise infrared light-to-voltage 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 M Ω . 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.

Ordering Information and Content Guide appear at end of datasheet.

Key Benefits & Features

The benefits and features of TSL267, High-Sensitivity IR Light-to-Voltage Converter are listed below:

Figure 1:
Added Value Of Using TSL267

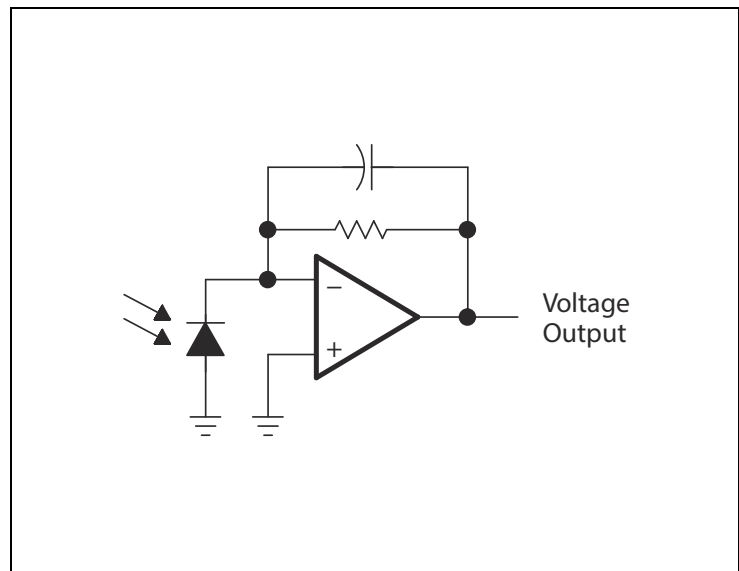
Benefits	Features
<ul style="list-style-type: none"> Enables Extremely Fast Response to Change 	<ul style="list-style-type: none"> Single Photo-Diode and Trans Impedance Architecture
<ul style="list-style-type: none"> Enables Fast Response to Visible Light in Range of 400nm to 700nm Wavelengths 	<ul style="list-style-type: none"> 160μs Output Rise-Time Response
<ul style="list-style-type: none"> Provides for High Sensitivity to Detect a Small Change in Light 	<ul style="list-style-type: none"> High Irradiance Responsivity 0.45V/(μW/cm²) at $\lambda_p = 940$nm
<ul style="list-style-type: none"> Provides Additional Sensitivity Advantages 	<ul style="list-style-type: none"> 2x Gain Lens
<ul style="list-style-type: none"> Provides Full Dynamic Range 	<ul style="list-style-type: none"> Rail-to-Rail Output Swing

- Integral Visible Light Cut-OFF 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 μ Vrms Typ to 1 kHz)
- High Power-Supply Rejection (35 dB at 1 kHz)
- Compact 3-Leaded Plastic Package
- RoHS Compliant (-LF Package Only)

Block Diagram

The functional blocks of this device are shown below:

Figure 2:
TSL267 Block Diagram



Pin Assignments

Figure 3:
Package S Sidelooker (Front View)

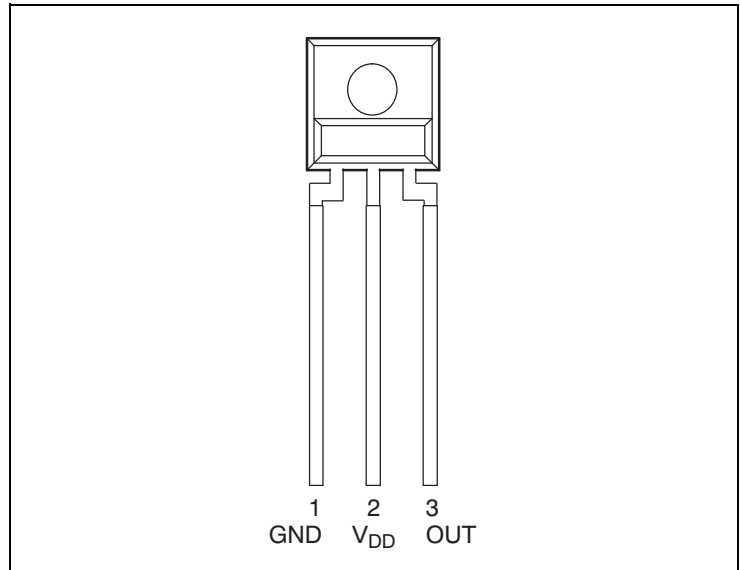


Figure 4:
Package SM Surface Mount Sidelooker (Front View)

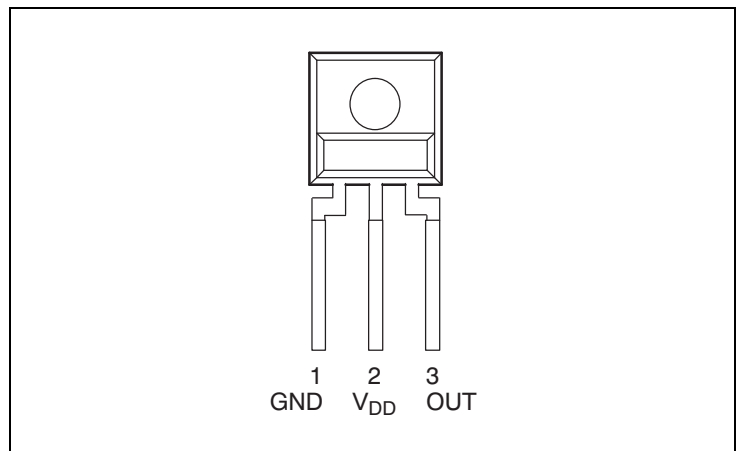


Figure 5:
Terminal Functions

Terminal		Description
Name	No	
GND	1	Ground (substrate). All voltages are referenced to GND.
OUT	3	Output voltage
V _{DD}	2	Supply voltage

Absolute Maximum Ratings

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.

Figure 6:
Absolute Maximum Ratings Over Operating Free-Air Temperature Range (unless otherwise noted)

Symbol	Parameter	Min	Max	Units
V_{DD}	Supply voltage ⁽¹⁾		6	V
I_O	Output current		±10	mA
	Duration of short-circuit current at (or below) 25°C		5	s
T_A	Operating free-air temperature range	-25	85	°C
T_{STRG}	Storage temperature range	-25	85	°C
	Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds (S Package)		260	°C
	Reflow solder, in accordance with J-STD-020C or J-STD-020D (SM Package)		260	°C

Note(s):

1. All voltages are with respect to GND.

Figure 7:
Recommended Operating Conditions

Symbol	Parameter	Min	Nom	Max	Units
V_{DD}	Supply voltage	2.7		5.5	V
T_A	Operating free-air temperature	0		70	°C

Electrical Characteristics

Electrical Characteristics at $V_{DD} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $\lambda_p = 940\text{ nm}$,
 $R_L = 10\text{ k}\Omega$ (unless otherwise noted) see notes ⁽¹⁾, ⁽²⁾, ⁽³⁾.

Figure 8:
Electrical Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_D	Dark voltage	$E_e = 0$	0		15	mV
V_{OM}	Maximum output voltage swing	$V_{DD} = 4.5\text{ V}$, no load		4.49		V
		$V_{DD} = 4.5\text{ V}$, $R_L = 10\text{ k}\Omega$	4	4.2		
V_O	Output voltage	$E_e = 4.4\ \mu\text{W}/\text{cm}^2$	1.2	2	2.8	V
α_{VD}	Temperature coefficient of dark voltage (V_D)	$T_A = 0^\circ\text{C}$ to 70°C		-15		$\mu\text{V}/^\circ\text{C}$
N_e	Irradiance responsivity	See note ⁽⁴⁾		0.45		$\text{V}/(\mu\text{W}/\text{cm}^2)$
PSRR	Power supply rejection ratio	$f_{ac} = 100\text{ Hz}$ ⁽⁵⁾		55		dB
		$f_{ac} = 1\text{ kHz}$ ⁽⁵⁾		35		dB
I_{DD}	Supply current	$E_e = 4.4\ \mu\text{W}/\text{cm}^2$		1.9	4	mA

Note(s):

- Measurements are made with $R_L = 10\text{ k}\Omega$ between output and ground.
- Optical measurements are made using small-angle incident radiation from an LED optical source.
- The input irradiance is supplied by a GaAs light-emitting diode with the following characteristics: peak wavelength $\lambda_p = 940\text{ nm}$.
- Irradiance responsivity is characterized over the range $V_O = 0.1$ 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 $E_e = 0$.
- Power supply rejection ratio PSRR is defined as $20 \log (\Delta V_{DD}(f)/\Delta V_O(f))$ with $V_{DD}(f=0) = 5\text{ V}$ and $V_O(f=0) = 2\text{ V}$.

Figure 9:
Switching Characteristics at $V_{DD} = 5V$, $T_A = 25^\circ C$, $\lambda_p = 940\text{ nm}$, $R_L = 10k\Omega$ (unless otherwise noted)

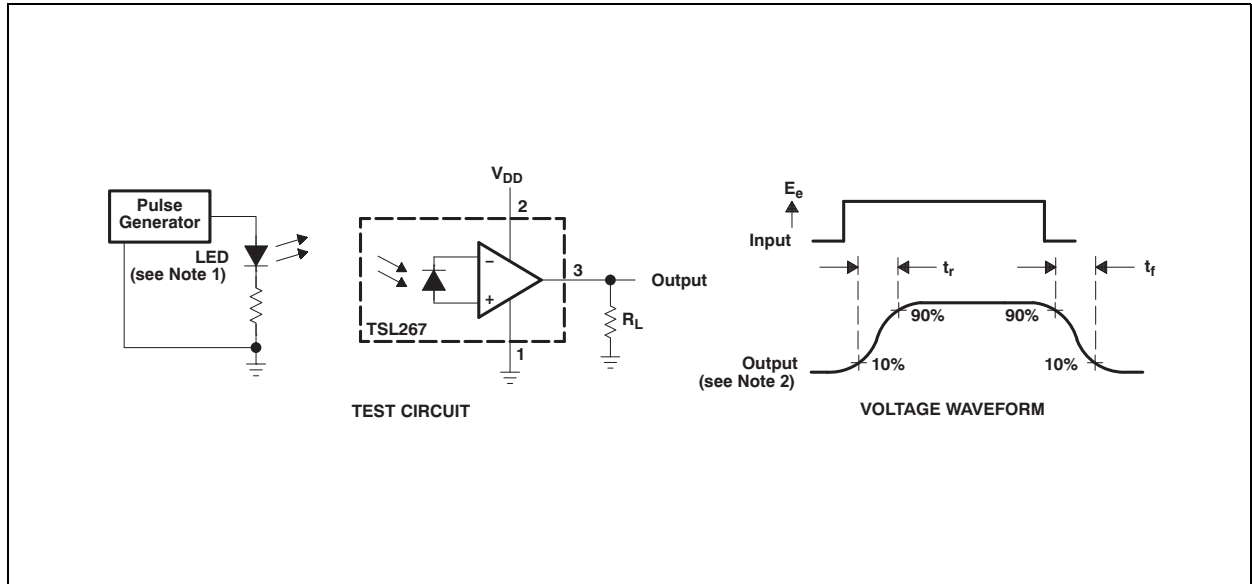
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_r	Output pulse rise time, 10% to 90% of final value	See note (1) and Figure 10		160	250	μs
t_f	Output pulse fall time, 10% to 90% of final value	See note (1) and Figure 10		150	250	μs
t_s	Output settling time, 1% of final value	See note (1) and Figure 10		330		μs
	Integrated noise voltage	$f = \text{dc to } 1\text{ kHz}$, $E_e = 0$		200		μV_{rms}
V_n	Output noise voltage, rms	$f = 10\text{ Hz}$, $E_e = 0$		6		$\mu V/\sqrt{Hz}$ rms
		$f = 100\text{ Hz}$, $E_e = 0$		6		
		$f = 1\text{ kHz}$, $E_e = 0$		7		

Note(s):

- Switching characteristics apply over the range $V_O = 0.1\text{ V}$ to 4.5 V .

Parameter Measurement Information

Figure 10:
Switching Times



Note(s):

1. The input irradiance is supplied by a pulsed GaAs light-emitting diode with the following characteristics: $\lambda_p = 940 \text{ nm}$, $t_r < 1 \mu\text{s}$, $t_f < 1 \mu\text{s}$.
2. The output waveform is monitored on an oscilloscope with the following characteristics: $t_r < 100 \text{ ns}$, $Z_i \geq 1 \text{ M}\Omega$, $C_i \leq 20 \text{ pF}$.

Typical Operating Characteristics

Figure 11:
Photodiode Spectral Responsivity

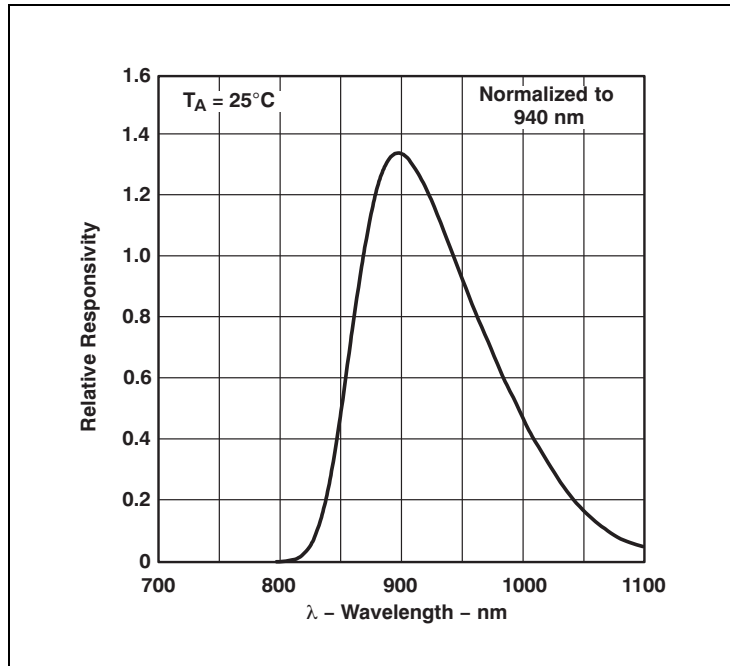


Figure 12:
Power Supply Rejection Ratio vs Frequency

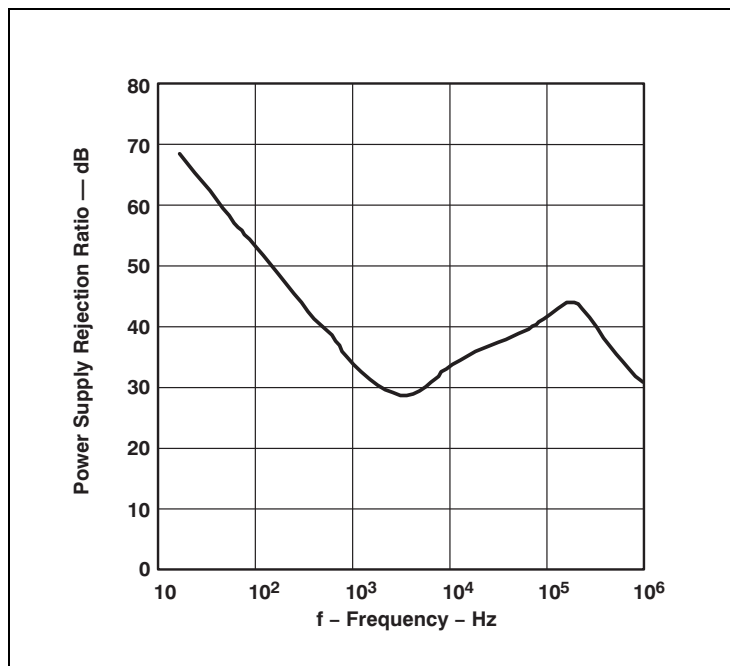


Figure 13:
Dark Voltage vs Free-Air Temperature

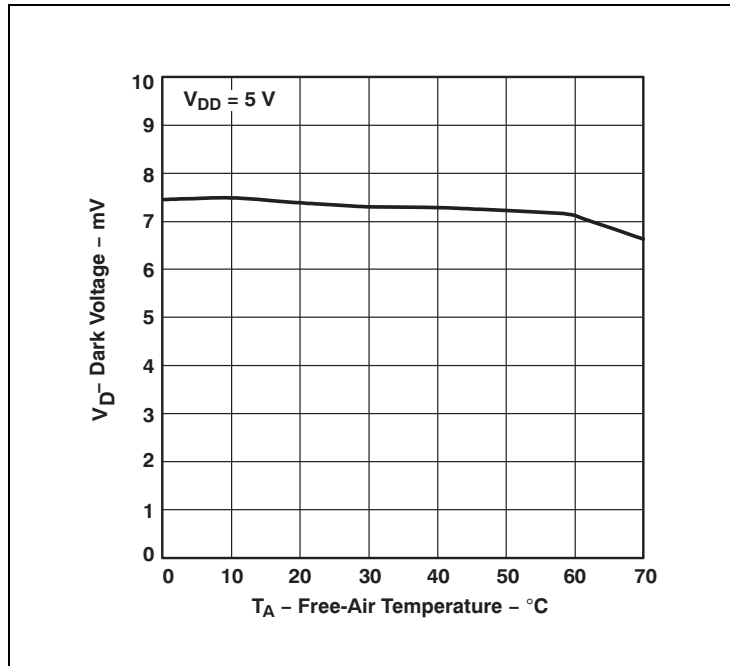
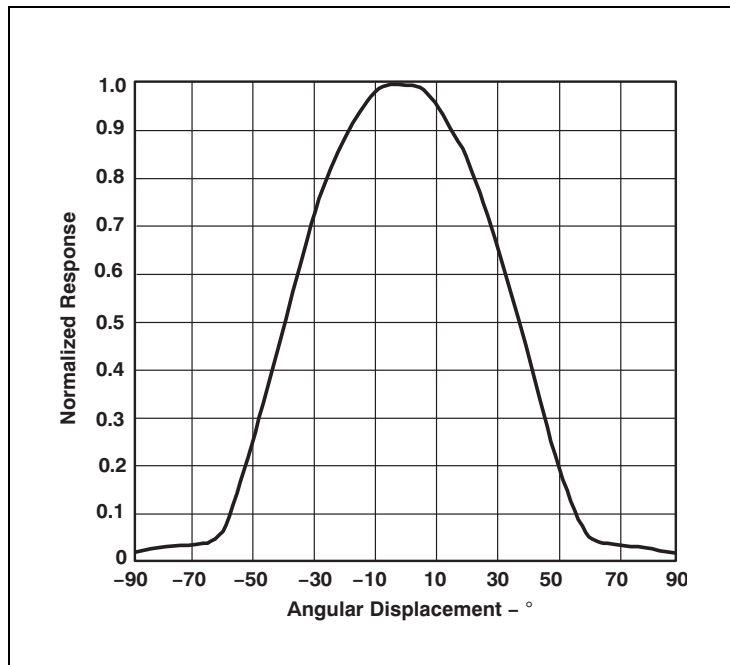


Figure 14:
Normalized Response vs Angular Displacement

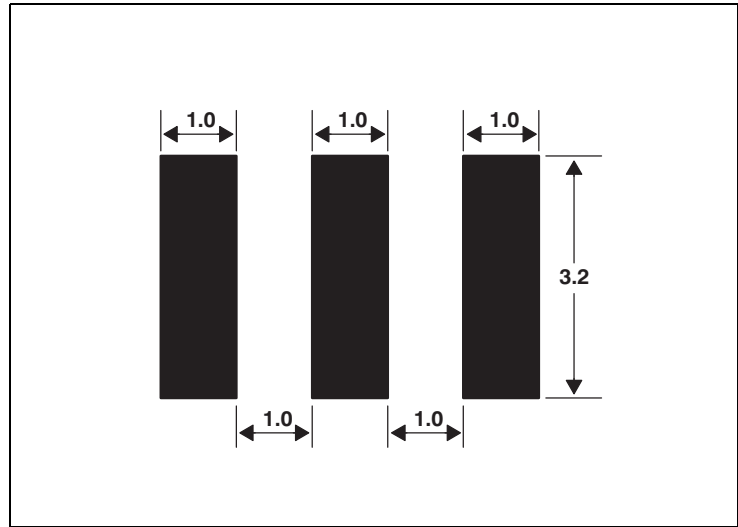


Application Information

PCB Pad Layout

Suggested PCB pad layout guidelines for the SM surface mount package are shown in [Figure 15](#).

Figure 15:
Suggested SM Package PCB Layout



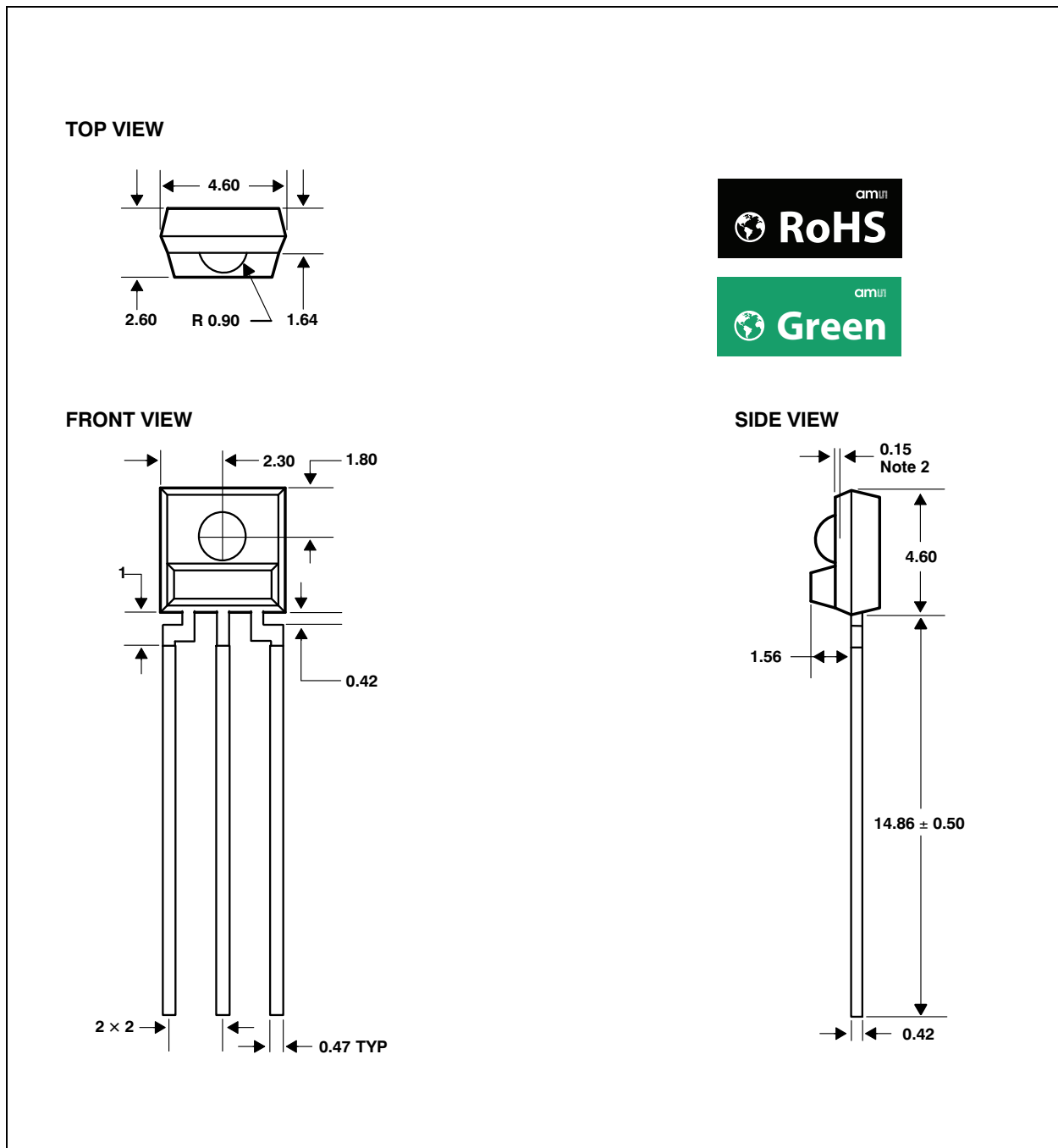
Note(s):

1. All linear dimensions are in millimeters.
2. This drawing is subject to change without notice.

Package Mechanical Data

The device is supplied in a visible light-blocking plastic three-lead through-hole sidelooker package (S).

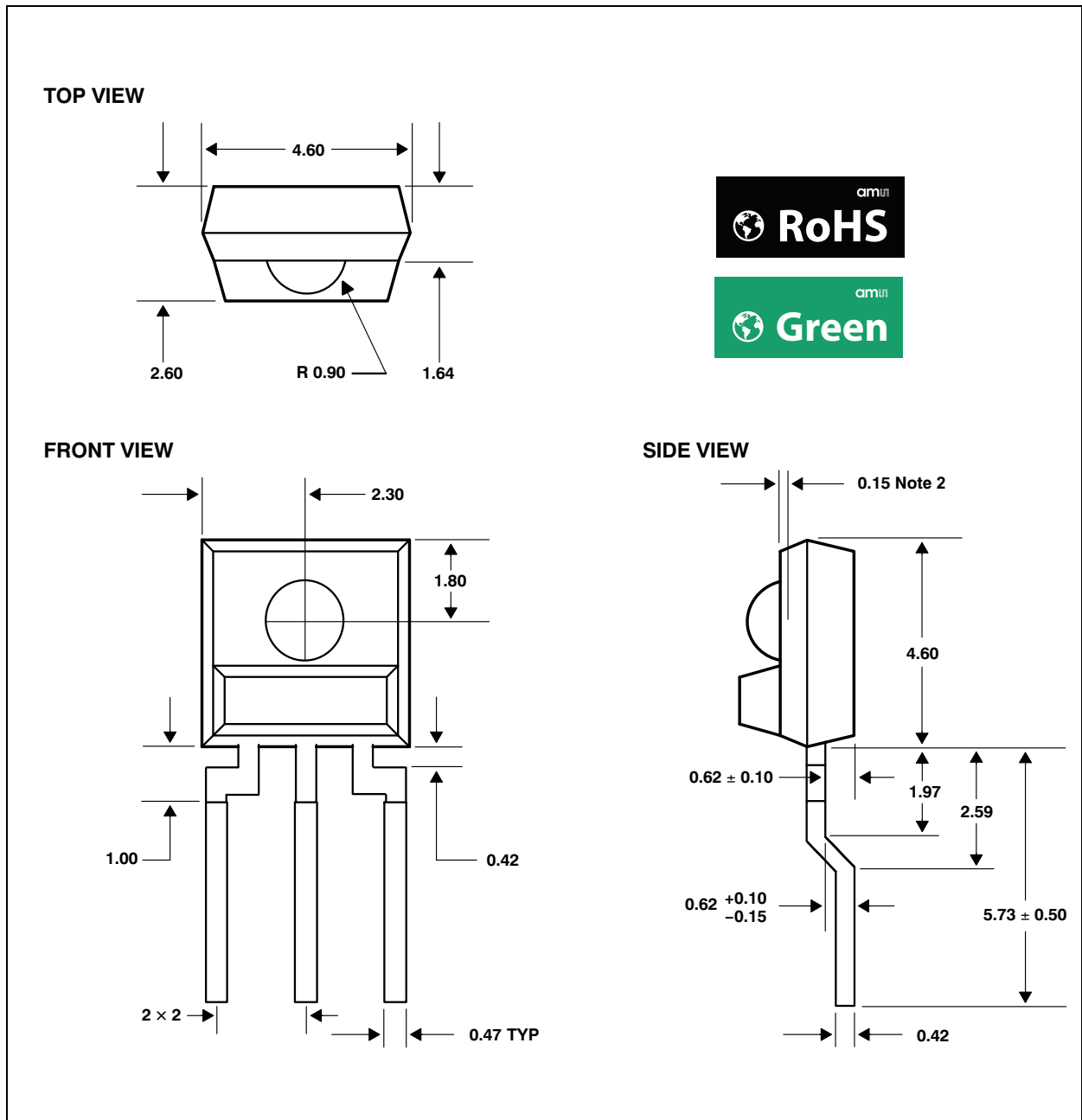
Figure 16:
Package S — Single-In-Line Side-Looker Package Configuration



Note(s):

1. All linear dimensions are in millimeters; tolerance is ± 0.25 mm unless otherwise stated.
2. Dimension is to center of lens arc, which is located below the package face.
3. The integrated photodiode active area is round with a typical diameter of 0.75 mm and is typically located in the center of the lens and 0.97 mm below the top of the lens surface.
4. Lead finish for TSL267-LF: solder dipped, 100% Sn.
5. This drawing is subject to change without notice.

Figure 17:
Package SM — Surface Mount Side-Looker Package Configuration



Note(s):

1. All linear dimensions are in millimeters; tolerance is ± 0.25 mm unless otherwise stated.
2. Dimension is to center of lens arc, which is located below the package face.
3. The integrated photodiode active area is typically located in the center of the lens and 0.97 mm below the top of the lens surface.
4. Index of refraction of clear plastic is 1.55.
5. Lead finish for TSL267SM-LF: solder dipped, 100% Sn.
6. This drawing is subject to change without notice.

Ordering & Contact Information

Figure 18:
Ordering Information

Ordering Code	Device	T _A	Package – Leads	Package Designator
TSL267–LF	TSL267	0°C to 70°C	3-lead Sidelooker – Lead (Pb) Free	S
TSL267SM–LF	TSL267	0°C to 70°C	3-lead Surface – Mount Sidelooker - Lead (Pb) Free	SM

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Document Status

Document Status	Product Status	Definition
Product Preview	Pre-Development	Information in this datasheet is based on product ideas in the planning phase of development. All specifications are design goals without any warranty and are subject to change without notice
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Revision Information

Changes from 033E (2007-Sep) to current revision 1-00 (2016-Jul-11)	Page
Content of TAOS datasheet was converted to the latest ams design	
Added Key Benefits & Features	1
Updated note under Figure 16	11
Updated Figure 18	13

Note(s):

1. Page and figure numbers for the previous version may differ from page and figure numbers in the current revision.
2. Correction of typographical errors is not explicitly mentioned.

Content Guide

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 - 1 Key Benefits & Features
 - 2 Functional Block Diagram

- 3 Pin Assignments**
- 4 Absolute Maximum Ratings**
- 5 Electrical Characteristics**
- 7 Parameter Measurement Information**
- 8 Typical Characteristics**

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 - 10 PCB Pad Layout

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