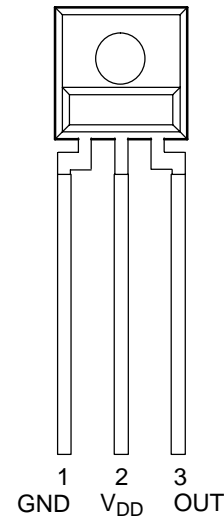


- Converts Light Intensity to Output Voltage
- Integral Color Filter in Blue, Green, or Red
- Monolithic Silicon IC Containing Photodiode, Operational Amplifier, and Feedback Components
- High Sensitivity
- Single Voltage Supply Operation
- Low Noise (200 μ Vrms Typ to 1 kHz)
- Rail-to-Rail Output
- High Power-Supply Rejection (35 dB at 1 kHz)
- Compact 3-Leaded Plastic Package
- RoHS Compliant (LF Package Only)

PACKAGE S
SIDELOOKER
(FRONT VIEW)

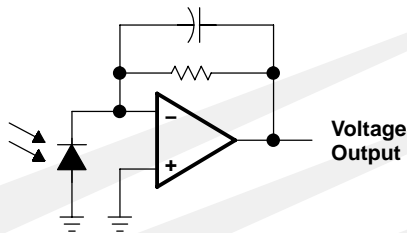


Description

The TSLB257, TSLG257, and TSLR257 are high-sensitivity low-noise light-to-voltage optical converters that incorporate onboard blue, green, and red optical filters, respectively. These devices combine a photodiode and a transimpedance amplifier on a single monolithic CMOS integrated circuit with a color filter over the photodiode. Output voltage is directly proportional to light intensity (irradiance) on the photodiode. Each device has a transimpedance gain of 320 M Ω with improved offset voltage stability and low power consumption, and is supplied in a 3-lead clear plastic sidelooker package with an integral lens.

These devices are ideal for applications such as colorimetry, printing process control, display color correction, and selectively ambient light detection or rejection.

Functional Block Diagram



Available Options

DEVICE	T _A	PACKAGE – LEADS	PACKAGE DESIGNATOR	ORDERING NUMBER
TSLB257	0°C to 70°C	3-lead Sidelooker	S	TSLB257S
TSLB257	0°C to 70°C	3-lead Sidelooker — Lead (Pb) Free	S	TSLB257S-LF
TSLG257	0°C to 70°C	3-lead Sidelooker	S	TSLG257S
TSLG257	0°C to 70°C	3-lead Sidelooker — Lead (Pb) Free	S	TSLG257S-LF
TSLR257	0°C to 70°C	3-lead Sidelooker	S	TSLR257S
TSLR257	0°C to 70°C	3-lead Sidelooker — Lead (Pb) Free	S	TSLR257S-LF

TSLB257, TSLG257, TSLR257 HIGH-SENSITIVITY COLOR LIGHT-TO-VOLTAGE CONVERTERS

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Terminal Functions

TERMINAL NAME	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

TSLB257, TSLG257, TSLR257 HIGH-SENSITIVITY COLOR LIGHT-TO-VOLTAGE CONVERTERS

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Electrical Characteristics at $V_{DD} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $R_L = 10\text{ k}\Omega$ (unless otherwise noted) (see Notes 2 and 3)

PARAMETER	TEST CONDITIONS	TSLB257			TSLG257			TSLR257			UNIT			
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX				
V_D	Dark voltage	$E_e = 0$			0		15	0		15	0		15	mV
V_{OM}	Maximum output voltage swing	$V_{DD} = 4.5\text{ V}$, No Load			4.49			4.49			4.49			V
		$V_{DD} = 4.5\text{ V}$, $R_L = 10\text{ k}\Omega$			4	4.2		4	4.2		4	4.2		
V_O	Output voltage	$E_e = 1.7\text{ }\mu\text{W}/\text{cm}^2$, $\lambda_p = 470\text{ nm}$, Note 4			1.3	2	2.7							V
		$E_e = 1.6\text{ }\mu\text{W}/\text{cm}^2$, $\lambda_p = 524\text{ nm}$, Note 5						1.3	2	2.7				
		$E_e = 1.1\text{ }\mu\text{W}/\text{cm}^2$, $\lambda_p = 635\text{ nm}$, Note 6									1.3	2	2.7	
α_{VD}	Temperature coefficient of dark voltage (V_D)	$T_A = 0^\circ\text{C}$ to 70°C			-15			-15			-15			$\mu\text{V}/^\circ\text{C}$
R_e	Irradiance responsivity	$\lambda_p = 470\text{ nm}$, see Notes 4 and 7			1.18			0.35			0.09			V/ ($\mu\text{W}/\text{cm}^2$)
		$\lambda_p = 524\text{ nm}$, see Notes 5 and 7			0.53			1.25			0.14			
		$\lambda_p = 565\text{ nm}$, see Notes 7 and 8			0.09			1.17			0.36			
		$\lambda_p = 635\text{ nm}$, see Notes 6 and 7			0.05			0.14			1.82			
R_V	Illuminance responsivity	$\lambda_p = 470\text{ nm}$, see Notes 4 and 7			1.57			0.47			0.12			V/lx
		$\lambda_p = 524\text{ nm}$, see Notes 5 and 7			0.10			0.24			0.027			
		$\lambda_p = 565\text{ nm}$, see Notes 7 and 8			0.015			0.20			0.06			
		$\lambda_p = 635\text{ nm}$, see Notes 6 and 7			0.033			0.093			1.21			
PSRR	Power supply rejection ratio	$f_{ac} = 100\text{ Hz}$, see Note 10			55			55			55			dB
		$f_{ac} = 1\text{ kHz}$, see Note 10			35			35			35			
I_{DD}	Supply current	$V_O = 2\text{ V}$ (typical)			1.9	3.5		1.9	3.5		1.9	3.5		mA

- NOTES:
- Measured with $R_L = 10\text{ k}\Omega$ between output and ground.
 - Optical measurements are made using small-angle incident radiation from a light-emitting diode (LED) optical source.
 - The input irradiance is supplied by an InGaN light-emitting diode with the following characteristics: peak wavelength $\lambda_p = 470\text{ nm}$, spectral halfwidth $\Delta\lambda_{1/2} = 35\text{ nm}$, luminous efficacy = $75\text{ lm}/\text{W}$.
 - The input irradiance is supplied by an InGaN light-emitting diode with the following characteristics: peak wavelength $\lambda_p = 524\text{ nm}$, spectral halfwidth $\Delta\lambda_{1/2} = 47\text{ nm}$, luminous efficacy = $520\text{ lm}/\text{W}$.
 - The input irradiance is supplied by an AlInGaP light-emitting diode with the following characteristics: peak wavelength $\lambda_p = 635\text{ nm}$, spectral halfwidth $\Delta\lambda_{1/2} = 17\text{ nm}$, luminous efficacy = $150\text{ lm}/\text{W}$.
 - Responsivity is characterized over the range $V_O = 0.1\text{ V}$ 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 $E_e = 0$.
 - The input irradiance is supplied by a GaP light-emitting diode with the following characteristics: peak wavelength $\lambda_p = 565\text{ nm}$, spectral halfwidth $\Delta\lambda_{1/2} = 28\text{ nm}$, luminous efficacy = $595\text{ lm}/\text{W}$.
 - Illuminance responsivity R_V is calculated from the irradiance responsivity by using the LED luminous efficacy values stated in Notes 4, 5, 6, and 8, and using $1\text{ lx} = 1\text{ lm}/\text{m}^2$.
 - Power supply rejection ratio PSRR is defined as $20\text{ log}(\Delta V_{DD}(f)/\Delta V_O(f))$ with $V_{DD}(f=0) = 5\text{ V}$ and $V_O(f=0) = 2\text{ V}$.

TSLB257, TSLG257, TSLR257 HIGH-SENSITIVITY COLOR LIGHT-TO-VOLTAGE CONVERTERS

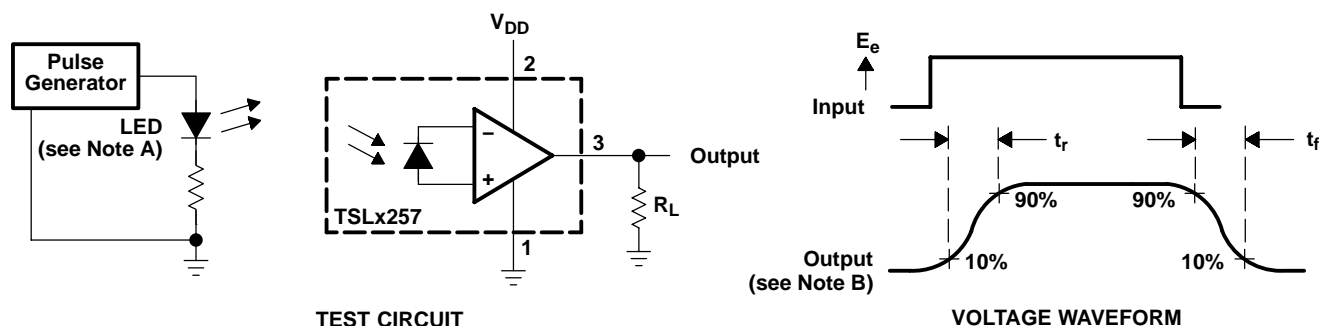
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Switching Characteristics at $V_{DD} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $R_L = 10\text{ k}\Omega$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_r	Output pulse rise time, 10% to 90% of final value	See Note 11 and Figure 1		160	250	μs
t_f	Output pulse fall time, 10% to 90% of final value	See Note 11 and Figure 1		150	250	μs
t_s	Output settling time to 1% of final value	See Note 11 and Figure 1		330		μs
Integrated noise voltage		$f = \text{dc to } 1\text{ kHz}$ $E_e = 0$		200		μVrms
V_n	Output noise voltage, rms	$f = 10\text{ Hz}$ $E_e = 0$		6		$\mu\text{V}/\sqrt{\text{Hz}}$ rms
		$f = 100\text{ Hz}$ $E_e = 0$		6		
		$f = 1\text{ kHz}$ $E_e = 0$		7		

NOTE 11: Switching characteristics apply over the range $V_O = 0.1\text{ V}$ to 4.5 V .

PARAMETER MEASUREMENT INFORMATION



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

Figure 1. Switching Times

TYPICAL CHARACTERISTICS

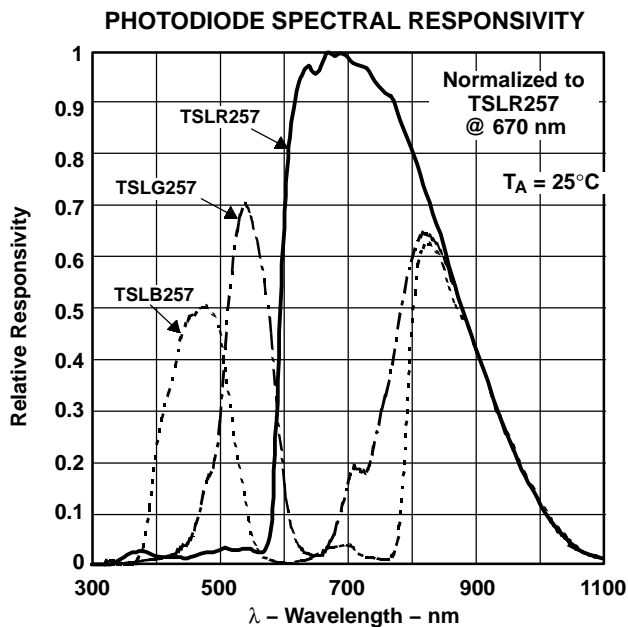


Figure 2

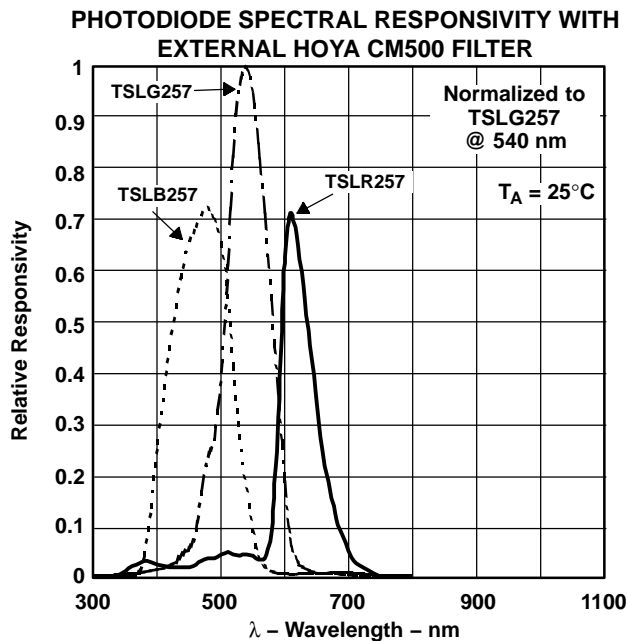


Figure 3

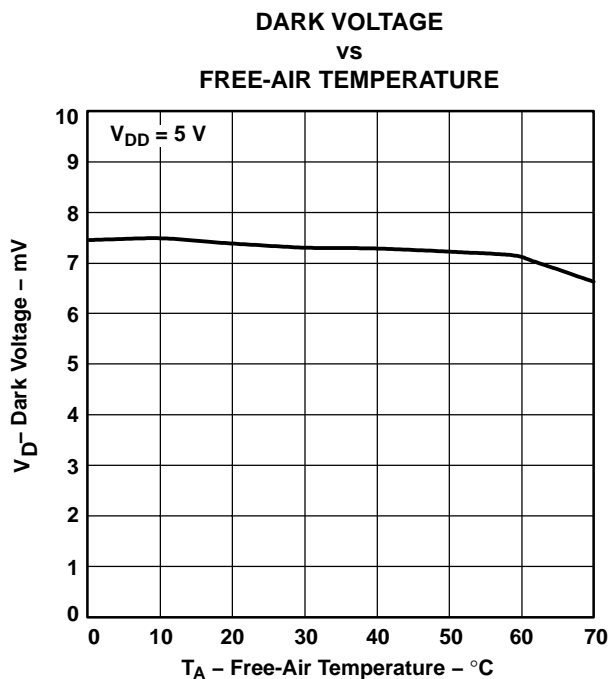


Figure 4

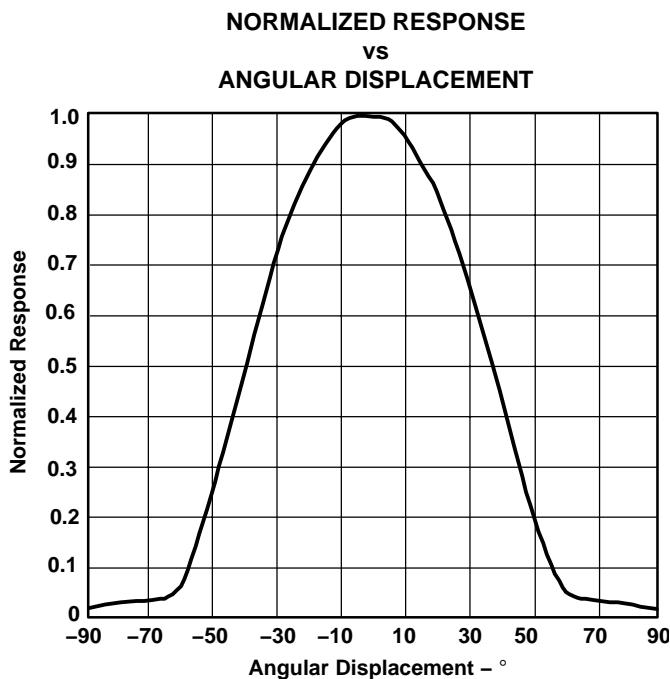


Figure 5

TSLB257, TSLG257, TSLR257
HIGH-SENSITIVITY COLOR
LIGHT-TO-VOLTAGE CONVERTERS

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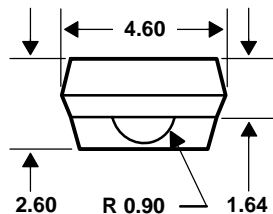
MECHANICAL DATA

The devices are supplied in a clear plastic three-lead package (S).

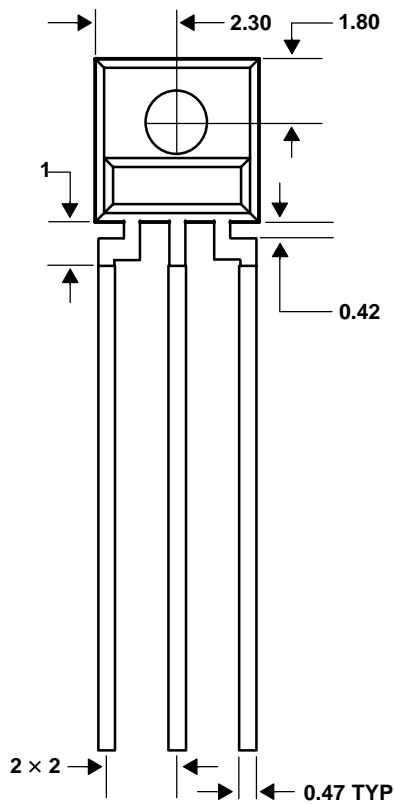
PACKAGE S

PLASTIC SINGLE-IN-LINE SIDE-LOOKER PACKAGE

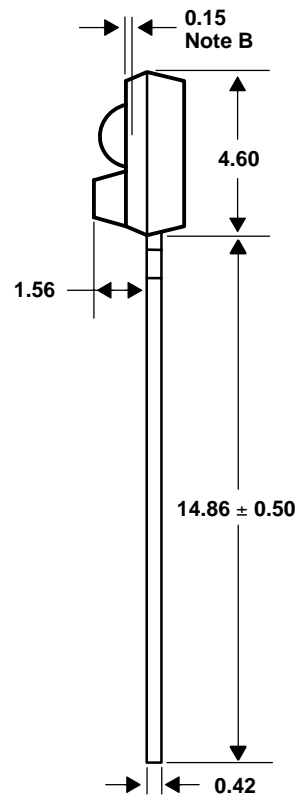
TOP VIEW



FRONT VIEW



SIDE VIEW



Lead Free Available

- NOTES: A. All linear dimensions are in millimeters; tolerance is ± 0.25 mm unless otherwise stated.
 B. Dimension is to center of lens arc, which is located below the package face.
 C. Index of refraction of clear plastic is 1.55.
 D. Lead finish for TSLx257 solder dipped, 63% Sn/37% Pb. Lead finish for TSLx257-LF: solder dipped, 100% Sn.
 E. This drawing is subject to change without notice.

Figure 6. Package S — Single-In-Line Side-Looker Package Configuration

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