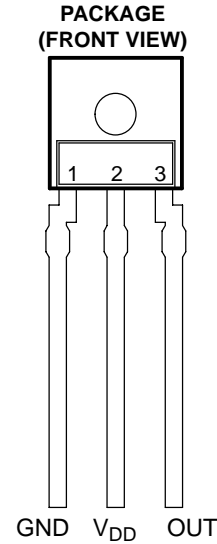


- Converts Light Intensity to Output Voltage
- Integral Color Filter in Blue, Green, or Red
- Monolithic Silicon IC Containing Photodiode, Operational Amplifier, and Feedback Components
- High Sensitivity
- Single Voltage Supply Operation
- Low Noise (200 μ Vrms Typ to 1 kHz)
- Rail-to-Rail Output
-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

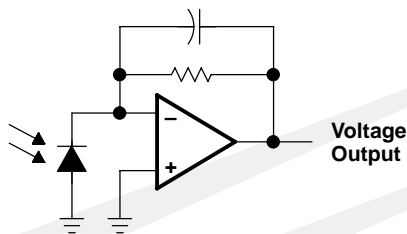


Description

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



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

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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

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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 $20\log(\Delta V_{DD}(f)/\Delta V_O(f))$ with $V_{DD}(f=0) = 5\text{ V}$ and $V_O(f=0) = 2\text{ V}$.



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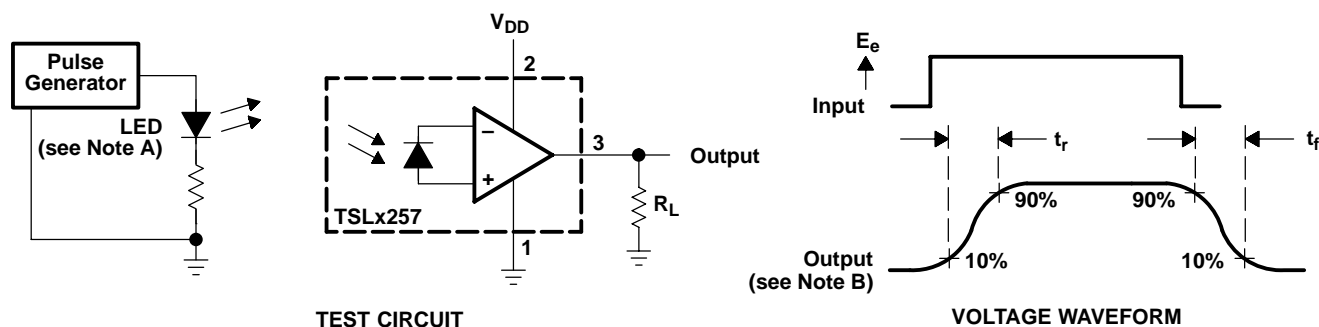
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Switching Characteristics at $V_{DD} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $R_L = 10\text{ k}\Omega$ (unless otherwise noted)

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

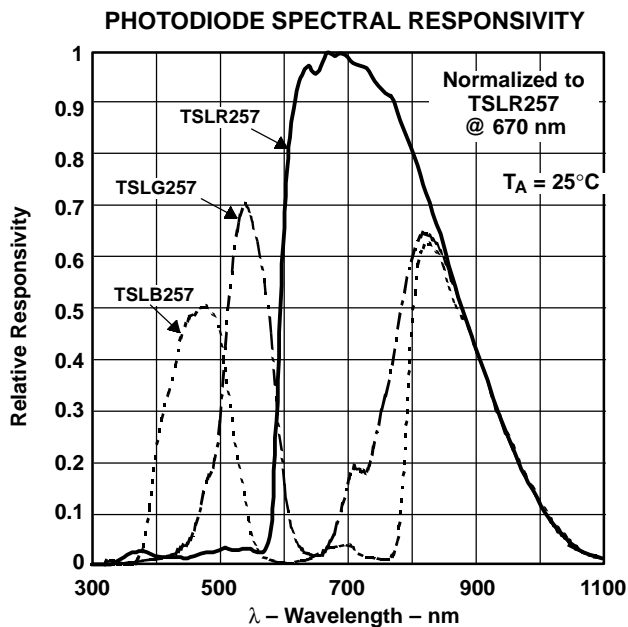


Figure 2

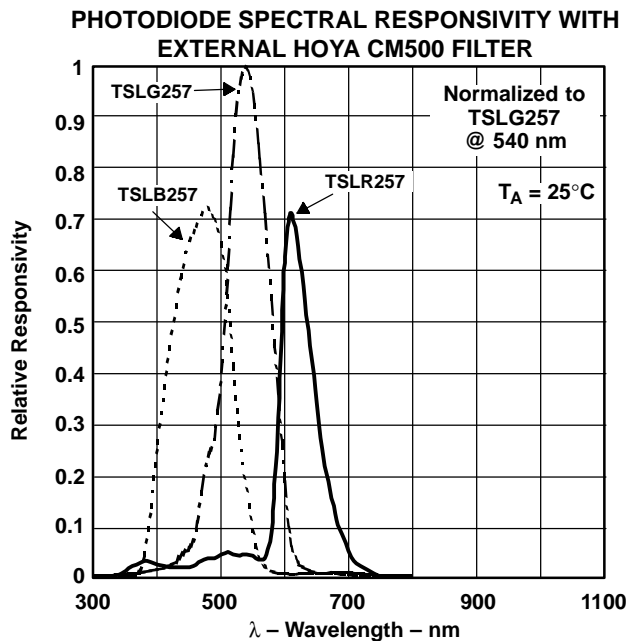


Figure 3

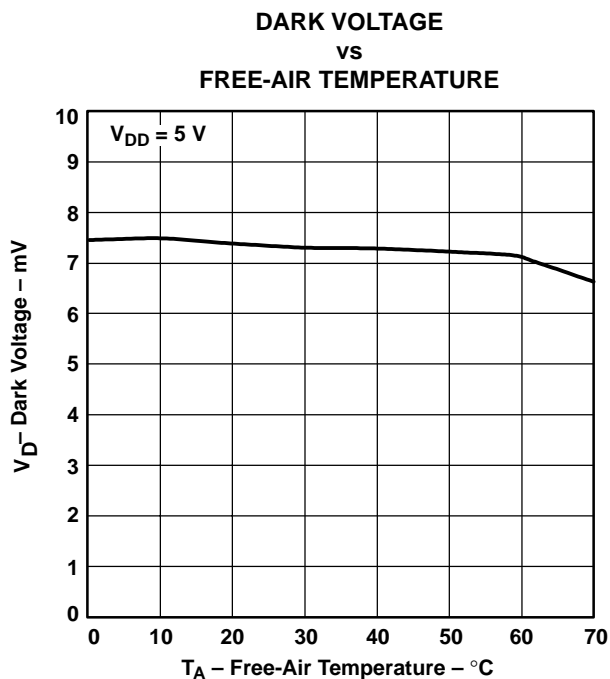


Figure 4

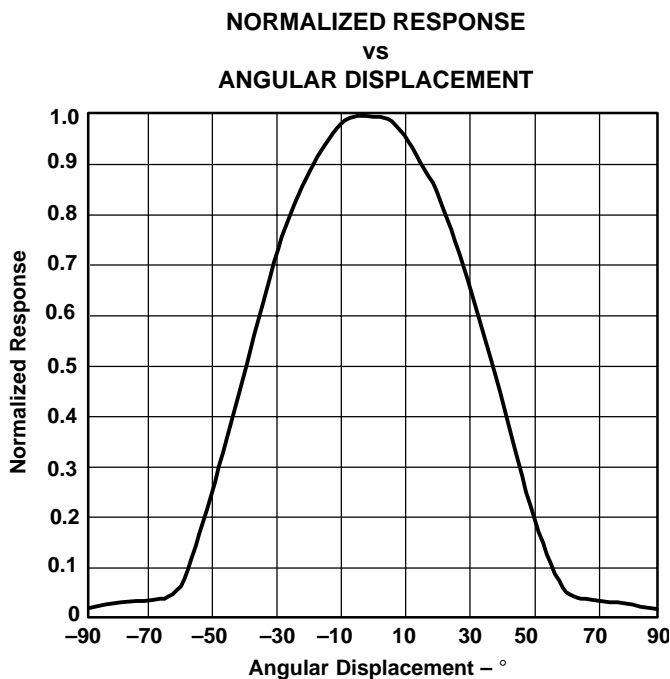


Figure 5

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MECHANICAL DATA

The TSLx257 is implemented in a clear 3-leaded package with a molded focusing lens.

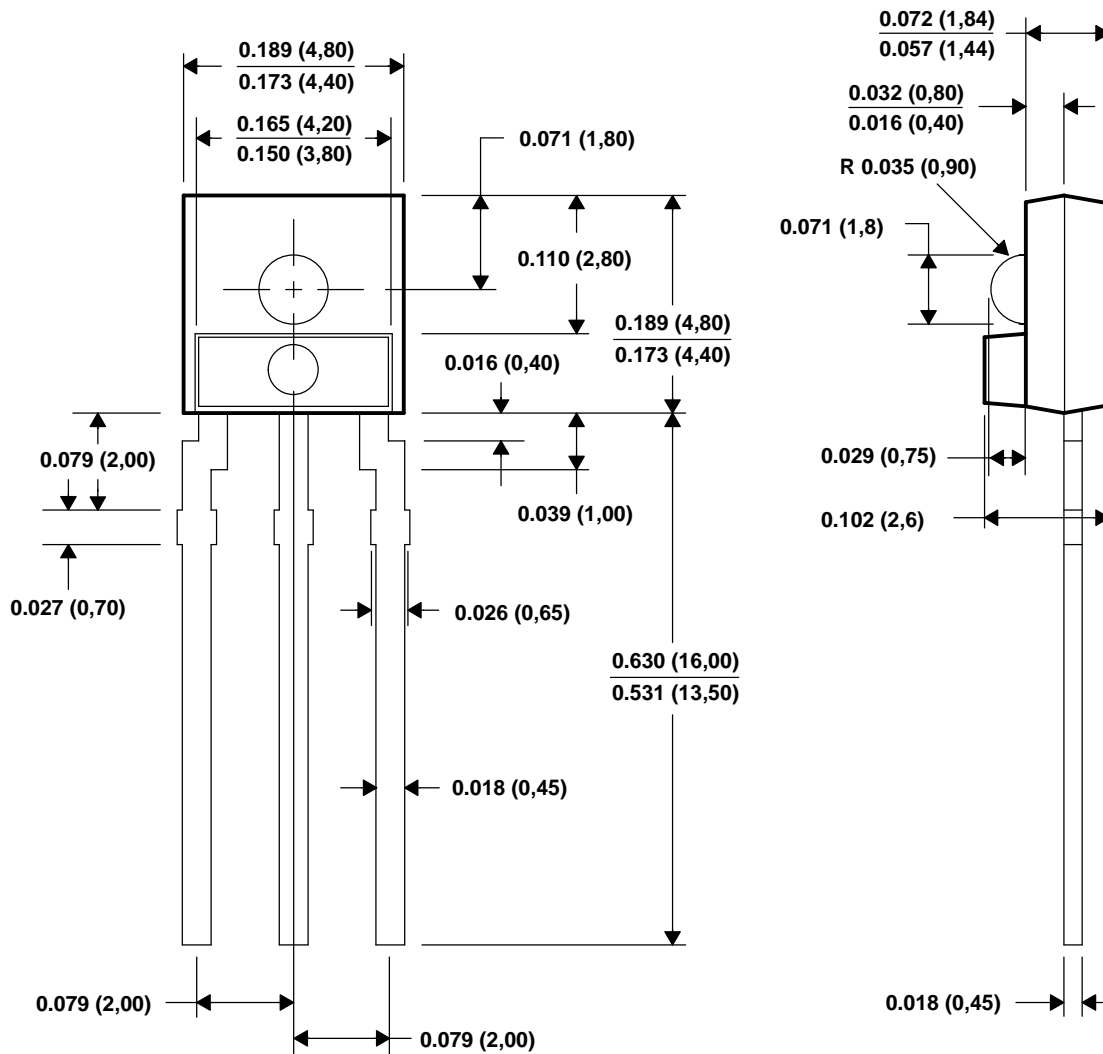


Figure 6. Package Configuration

- 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.
 - D. Package body is a clear nonfilled optically transparent material
 - E. Index of refraction of clear plastic is 1.55.

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