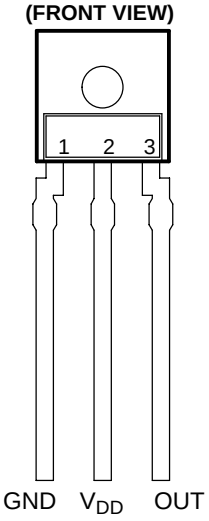
TSL260R, TSL261R, TSL262R
INFRARED LIGHT-TO-VOLTAGE OPTICAL SENSORS

TAOS049 – JANUARY 2003

- **Integral Visible Light Cutoff Filter**
- **Monolithic Silicon IC Containing Photodiode, Operational Amplifier, and Feedback Components**
- **Converts Light Intensity to a Voltage**
- **High Irradiance Responsivity, Typically 111 mV/(μW/cm^2) at λ_p = 940 nm (TSL260R)**
- **Compact 3-Lead Plastic Package**
- **Single Voltage Supply Operation**
- **Low Dark (Offset) Voltage....10mV Max**
- **Low Supply Current.....1.1 mA Typical**
- **Wide Supply-Voltage Range.... 2.7 V to 5.5 V**
- **Replacements for TSL260, TSL261, and TSL262**

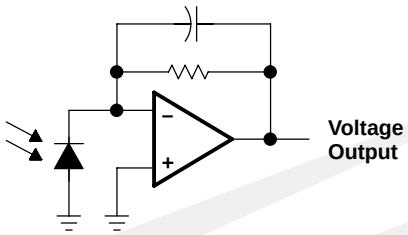
PACKAGE (FRONT VIEW)



Description

The TSL260R, TSL261R, and TSL262R are infrared light-to-voltage optical sensors, each combining a photodiode and a transimpedance amplifier (feedback resistor = 16 MΩ, 8 MΩ, and 2.8 MΩ respectively) on a single monolithic IC. Output voltage is directly proportional to the light intensity (irradiance) on the photodiode. These devices have improved amplifier offset-voltage stability and low power consumption and are supplied in a 3-lead plastic sidelooker package with an integral visible light cutoff filter and 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

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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 (see Note 2) . . . . . 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.

NOTES: 1. All voltages are with respect to GND.
2. Output may be shorted to supply.

Recommended Operating Conditions

	MIN	NOM	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, λp = 940 nm, R_L = 10 kΩ (unless otherwise noted) (see Notes 3, 4, and 5)

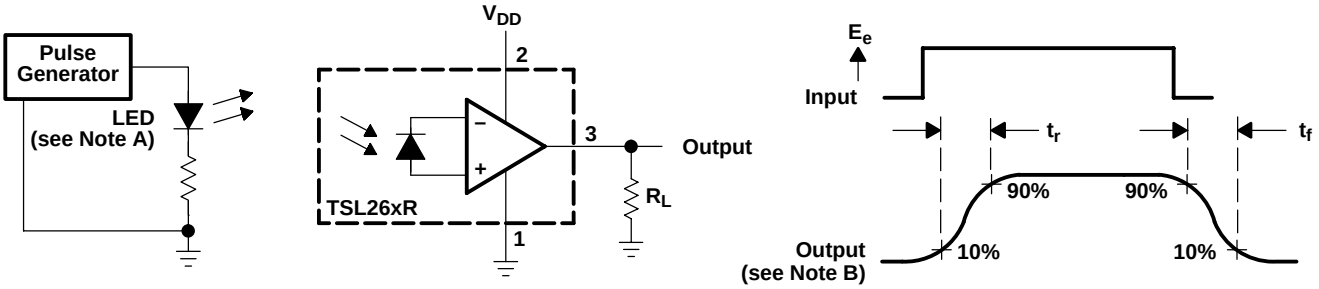
PARAMETER		TEST CONDITIONS	TSL260R			TSL261R			TSL262R			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_D	Dark voltage	E_e = 0	0	4	10	0	4	10	0	4	10	mV
V_{OM}	Maximum output voltage	V_{DD} = 4.5 V	3	3.3		3	3.3		3	3.3		V
V_O	Output voltage	E_e = 18 μW/cm²	1	2	3							V
		E_e = 46 μW/cm²				1	2	3				
		E_e = 220 μW/cm²							1	2	3	
α_{vo}	Temperature coefficient of output voltage (V_O)	E_e = 18 μW/cm², T_A = 0°C to 70°C		8								mV/°C
				0.4								%/°C
		E_e = 46 μW/cm², T_A = 0°C to 70°C					8					mV/°C
							0.4					%/°C
		E_e = 220 μW/cm², T_A = 0°C to 70°C								8		mV/°C
										0.4		%/°C
N_e	Irradiance responsivity	See Note 6		111			43.5			9.1		mV/(μW/cm²)
I_{DD}	Supply current	E_e = 18 μW/cm²		1.1	1.7							mA
		E_e = 46 μW/cm²					1.1	1.7				
		E_e = 220 μW/cm²								1.1	1.7	

NOTES: 3. Measurements are made with R_L = 10 kΩ between output and ground.
4. Optical measurements are made using small-angle incident radiation from an LED optical source.
5. The input irradiance E_e is supplied by a GaAs LED with peak wavelength λ_p = 940 nm
6. Irradiance responsivity is characterized over the range V_O = 0.05 to 2.9 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.

Dynamic Characteristics at T_A = 25°C (see Figure 1)

PARAMETER		TEST CONDITIONS	TSL260R			TSL261R			TSL262R			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_r	Output pulse rise time	V_{DD} = 5 V, λ_p = 940 nm		260			70			7		µs
t_f	Output pulse fall time	V_{DD} = 5 V, λ_p = 940 nm		260			70			7		µs
V_n	Output noise voltage	V_{DD} = 5 V, E_e = 0, f = 1000 Hz		0.8			0.7			0.6		µV/√Hz

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT VOLTAGE WAVEFORM

NOTES: A. The input irradiance is supplied by a pulsed GaAs light-emitting diode with the following characteristics: λ_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

OUTPUT VOLTAGE vs IRRADIANCE

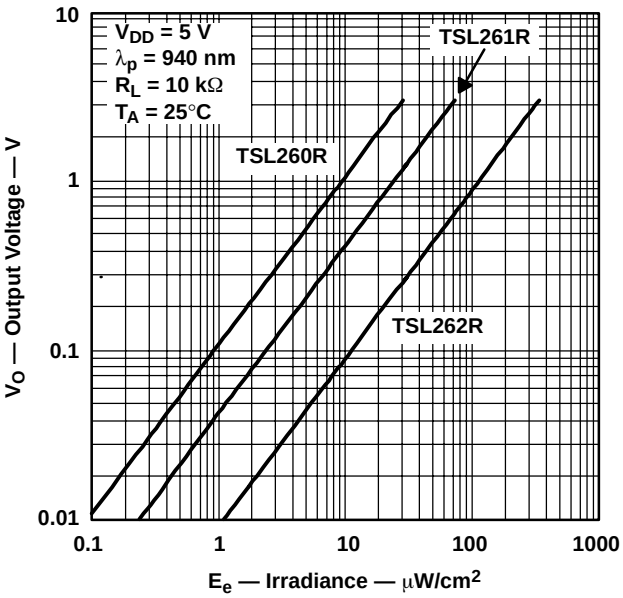


Figure 2

PHOTODIODE SPECTRAL RESPONSIVITY

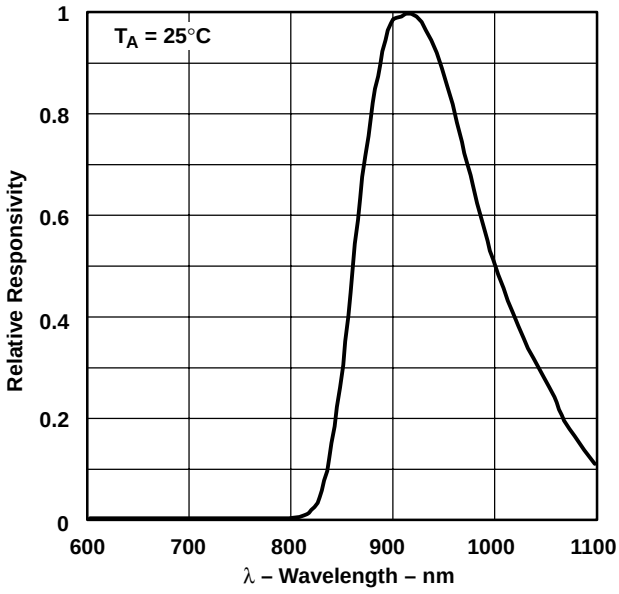


Figure 3

MAXIMUM OUTPUT VOLTAGE vs SUPPLY VOLTAGE

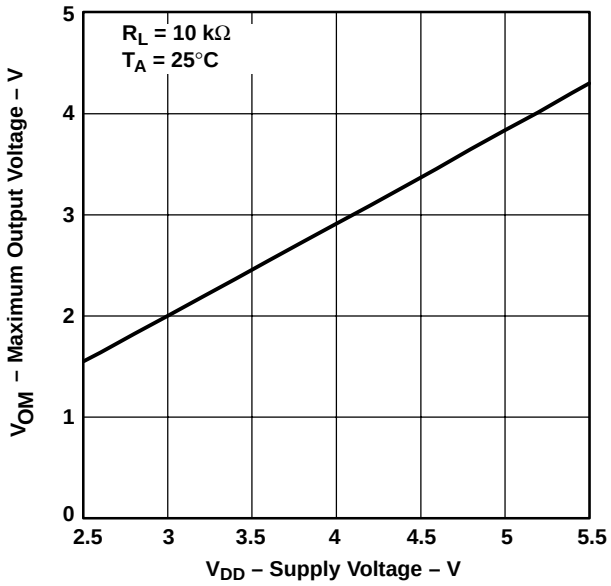


Figure 4

SUPPLY CURRENT vs OUTPUT VOLTAGE

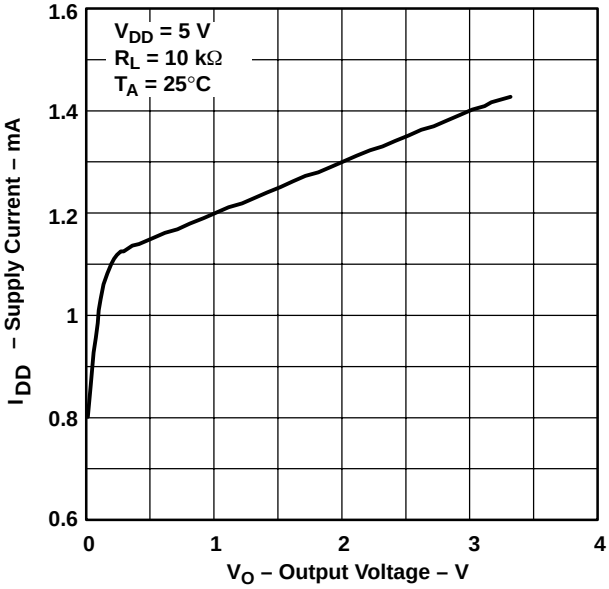


Figure 5

TYPICAL CHARACTERISTICS

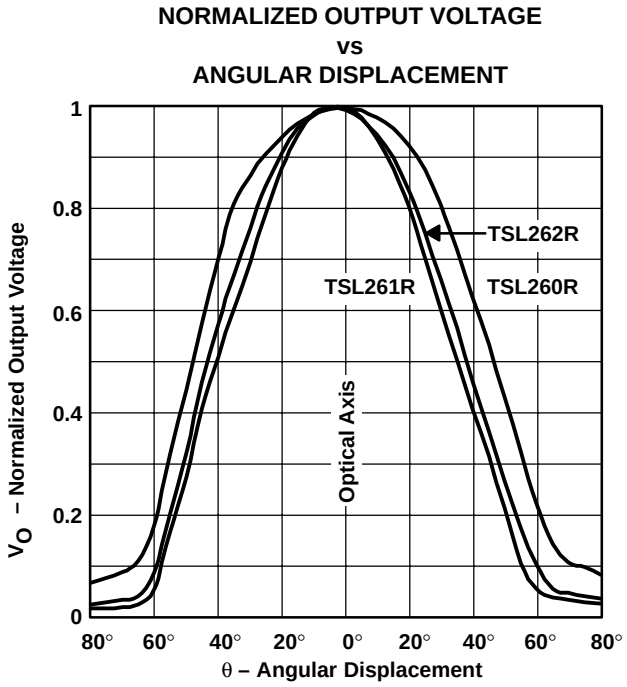


Figure 6

MECHANICAL INFORMATION

The device is supplied in a plastic three-lead package. The integrated photodiode active area is typically 1,0 mm^2 (0.0016 in^2) for TSL260R, 0,5 mm^2 (0.00078 in^2) for the TSL261R, and 0,26 mm^2 (0.0004 in^2) for the TSL262R.

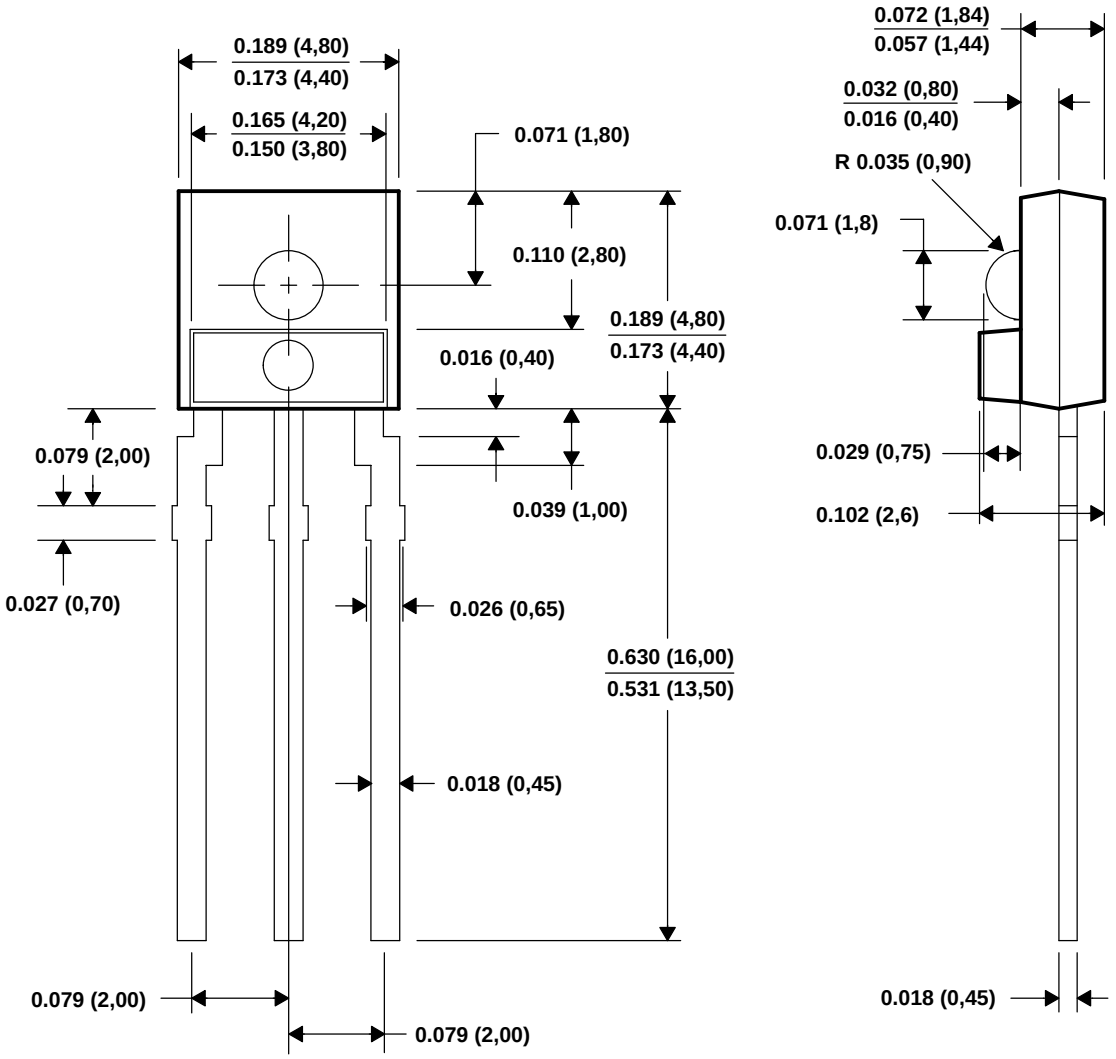


Figure 7. Package Configuration

NOTES: A. All linear dimensions are in inches (millimeters).
B. All dimensions apply before solder dip.
C. Package body is a nonfilled optically transparent material
D. Index of refraction of clear plastic is 1.55.
E. This drawing is subject to change without notice.

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