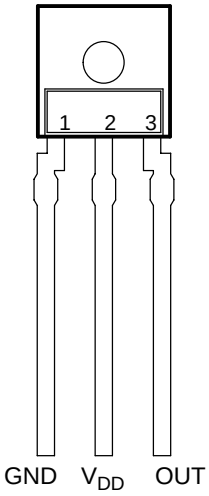
- **Monolithic Silicon IC Containing Photodiode, Operational Amplifier, and Feedback Components**
- **Converts Light Intensity to Output Voltage**
- **High Irradiance Responsivity . . . Typically 60 mV/(μW/cm^2) at λ_p = 880 nm (TSL253)**
- **High Bandwidth**
- **Compact 3-Leaded Clear Plastic Package**
- **Low Dark (Offset) Voltage . . . 10 mV Max At 25°C, V_{DD} = 5 V**
- **Single-Supply Operation**
- **Wide Supply-Voltage Range . . . 2.7 V to 5.5 V**
- **Low Supply Current . . . 600 μA Typical at V_{DD} = 5 V**

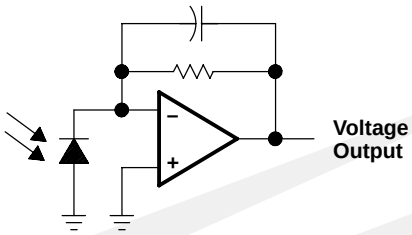
SR PACKAGE
(FRONT VIEW)



Description

The TSL253 and TSL254 are light-to-voltage optical converters, each combining a 1-mm-square photodiode and a transimpedance amplifier (feedback resistor = 16 MΩ, and 1 MΩ respectively) on a single monolithic IC. Output voltage is directly proportional to the light intensity (irradiance) on the photodiode. These devices use silicon-gate CMOS technology that provides improved amplifier offset-voltage stability and low power consumption.

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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800 Jupiter Road, Suite 205 • Plano, TX 75074 • (972) 673-0759

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

Supply voltage, V_{DD} (see Note 1) . . . . . 7 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, λp = 880 nm, R_L = 10 kΩ (unless otherwise noted) (see Notes 2 and 3)

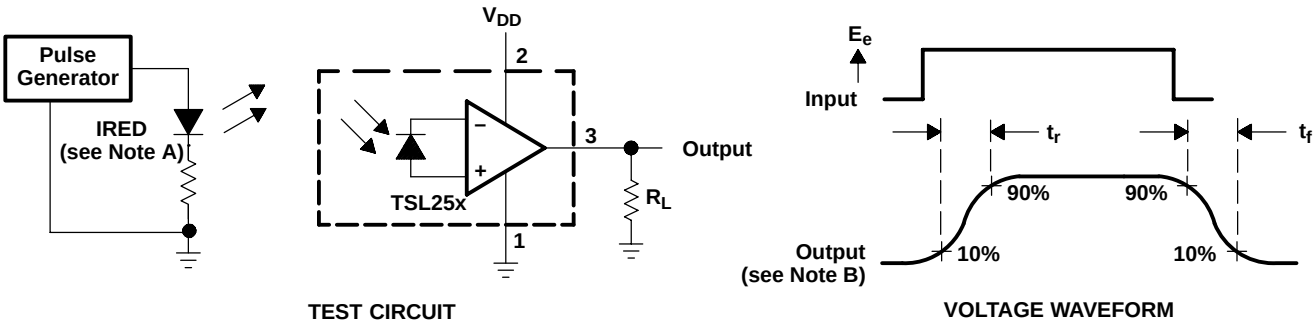
PARAMETER		TEST CONDITIONS	TSL253			TSL254			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_D	Dark voltage	E_e = 0			10			10	mV
V_{OM}	Maximum output voltage swing	E_e = 2 mW/cm²	3	3.5		3	3.5		V
V_O	Output voltage	E_e = 35 µW/cm²	1.6	2	2.4				V
		E_e = 595 µW/cm²				1.6	2	2.4	
α_{vo}	Temperature coefficient of output voltage (V_O)	300 nm < λ < 700 nm		–0.2			–0.2		%/°C
		λ_p = 880 nm		0.05			0.05		
N_e	Irradiance responsivity			60			3.5		mV/(µW/cm²)
	Power supply rejection, dc			60			60		dB
	Power supply rejection, ac	f_{ac} = 1 kHz		18			44		dB
I_{DD}	Supply current			0.6	1.5		0.6	1.5	mA

NOTES: 2. The input irradiance E_e is supplied by a GaAlAs infrared-emitting diode with λ_p = 880 nm.
3. Irradiance responsivity is characterized over the range V_O = 0.05 to 3 V.

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

PARAMETER		TEST CONDITIONS		TSL253			TSL254			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
t_r	Output pulse rise time	V_{DD} = 5 V,	λ_p = 880 nm		7.5			2		µs
t_f	Output pulse fall time	V_{DD} = 5 V,	λ_p = 880 nm		7.5			2		µs
V_n	Output noise voltage	V_{DD} = 5 V	f = 100 Hz		3			1.7		µV/√Hz
			f = 1 kHz		3			1		
			f = 10 kHz		6			1.3		

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT VOLTAGE WAVEFORM

NOTES: A. The input irradiance is supplied by a pulsed GaAlAs infrared-emitting diode with the following characteristics: λ_p = 880 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, $Z_i \geq$ 1 MHz, $C_i \leq$ 20 pF.

Figure 1. Switching Times

TYPICAL CHARACTERISTICS

OUTPUT VOLTAGE
vs
IRRADIANCE

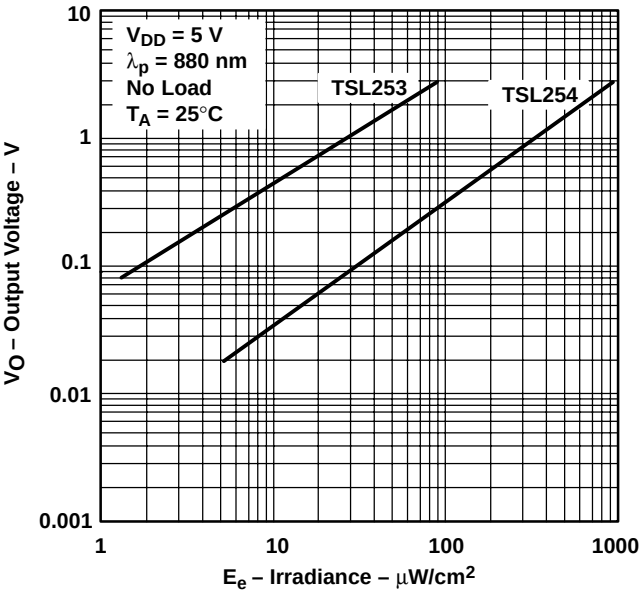


Figure 2

PHOTODIODE SPECTRAL RESPONSIVITY

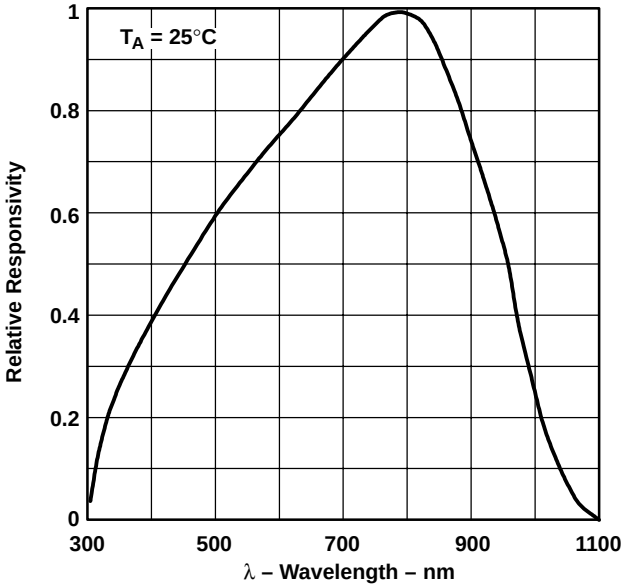


Figure 3

MAXIMUM OUTPUT VOLTAGE
vs
SUPPLY VOLTAGE

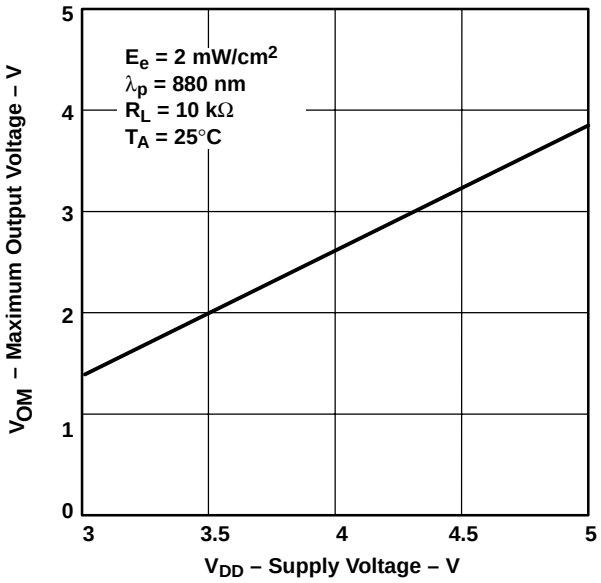


Figure 4

NORMALIZED OUTPUT VOLTAGE
vs
ANGULAR DISPLACEMENT

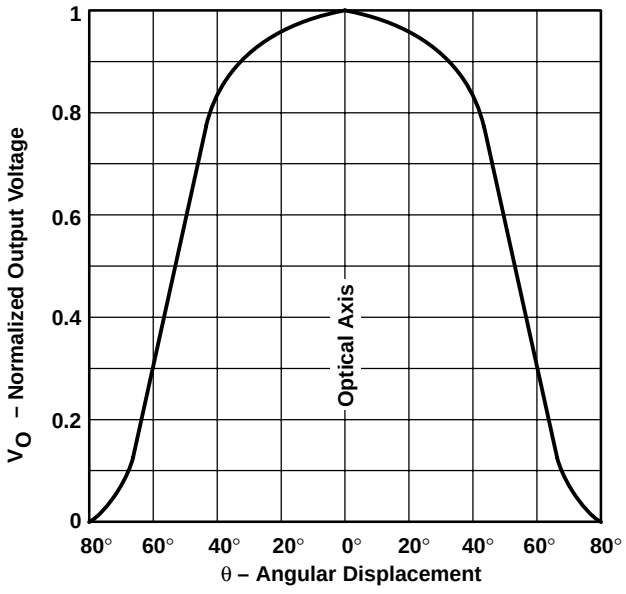


Figure 5

TYPICAL CHARACTERISTICS

POWER SUPPLY REJECTION vs FREQUENCY

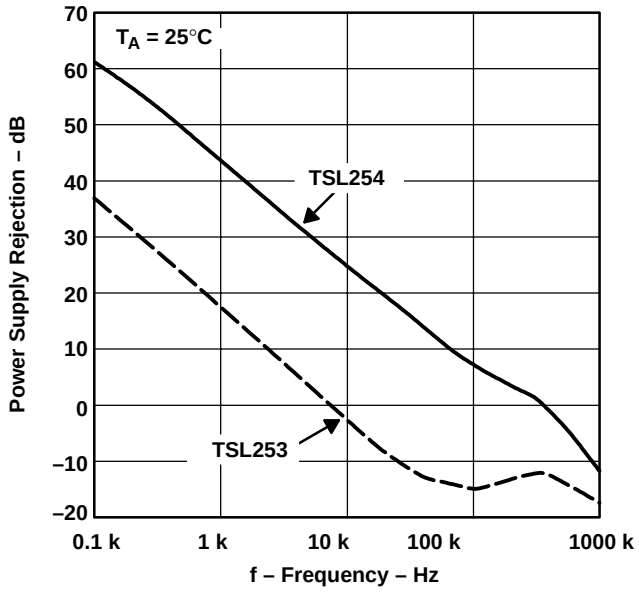


Figure 6

SUPPLY CURRENT vs FREE-AIR TEMPERATURE

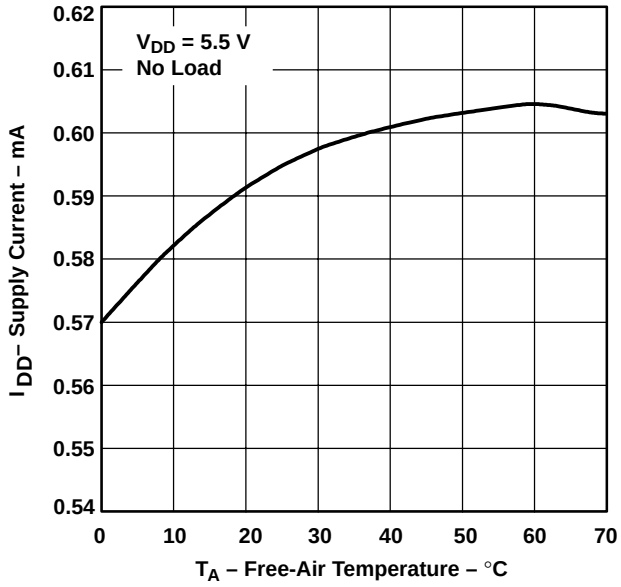


Figure 7

SUPPLY CURRENT vs SUPPLY VOLTAGE

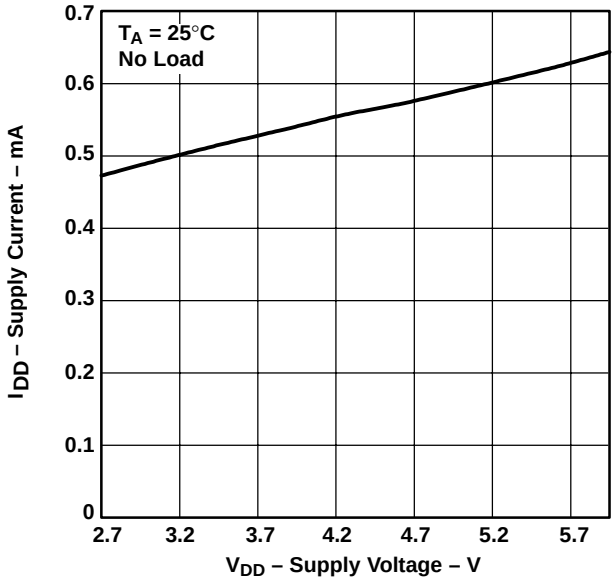


Figure 8

OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE

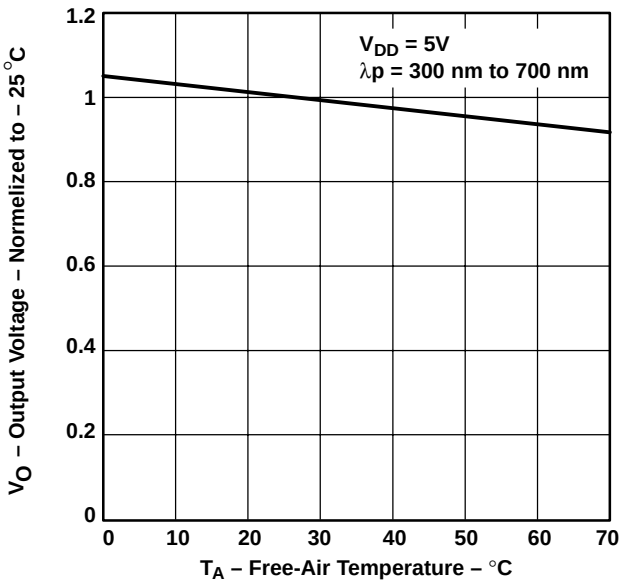


Figure 9

TYPICAL CHARACTERISTICS

OUTPUT VOLTAGE vs SUPPLY VOLTAGE

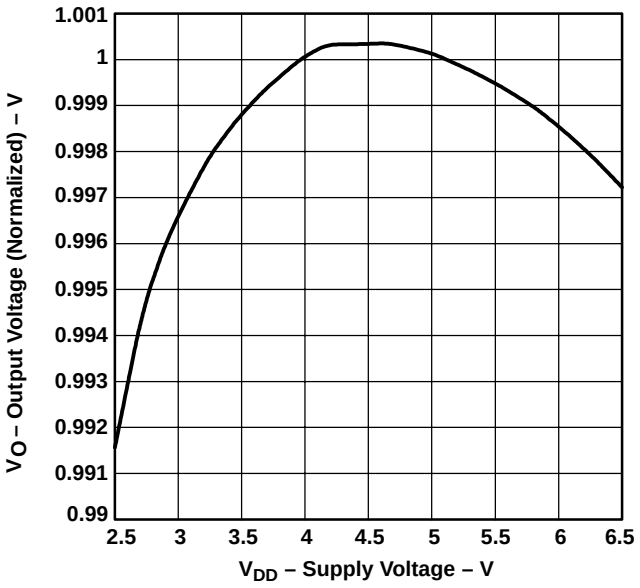


Figure 10

INTEGRATED NOISE VOLTAGE vs MEASUREMENT BANDWIDTH FREQUENCY

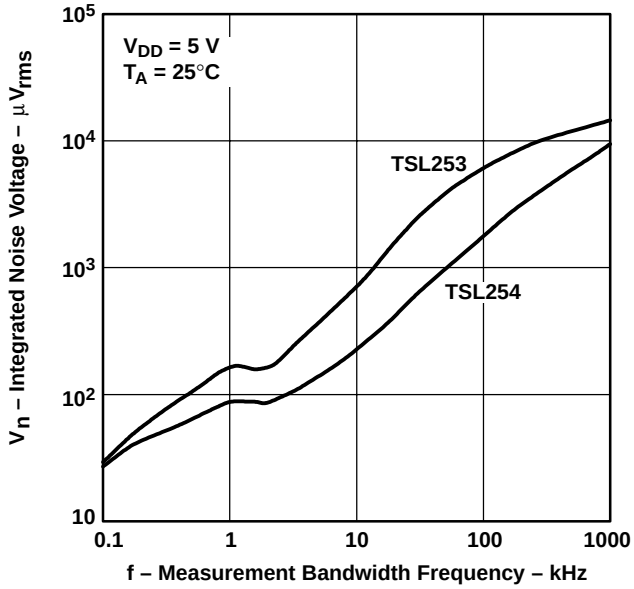
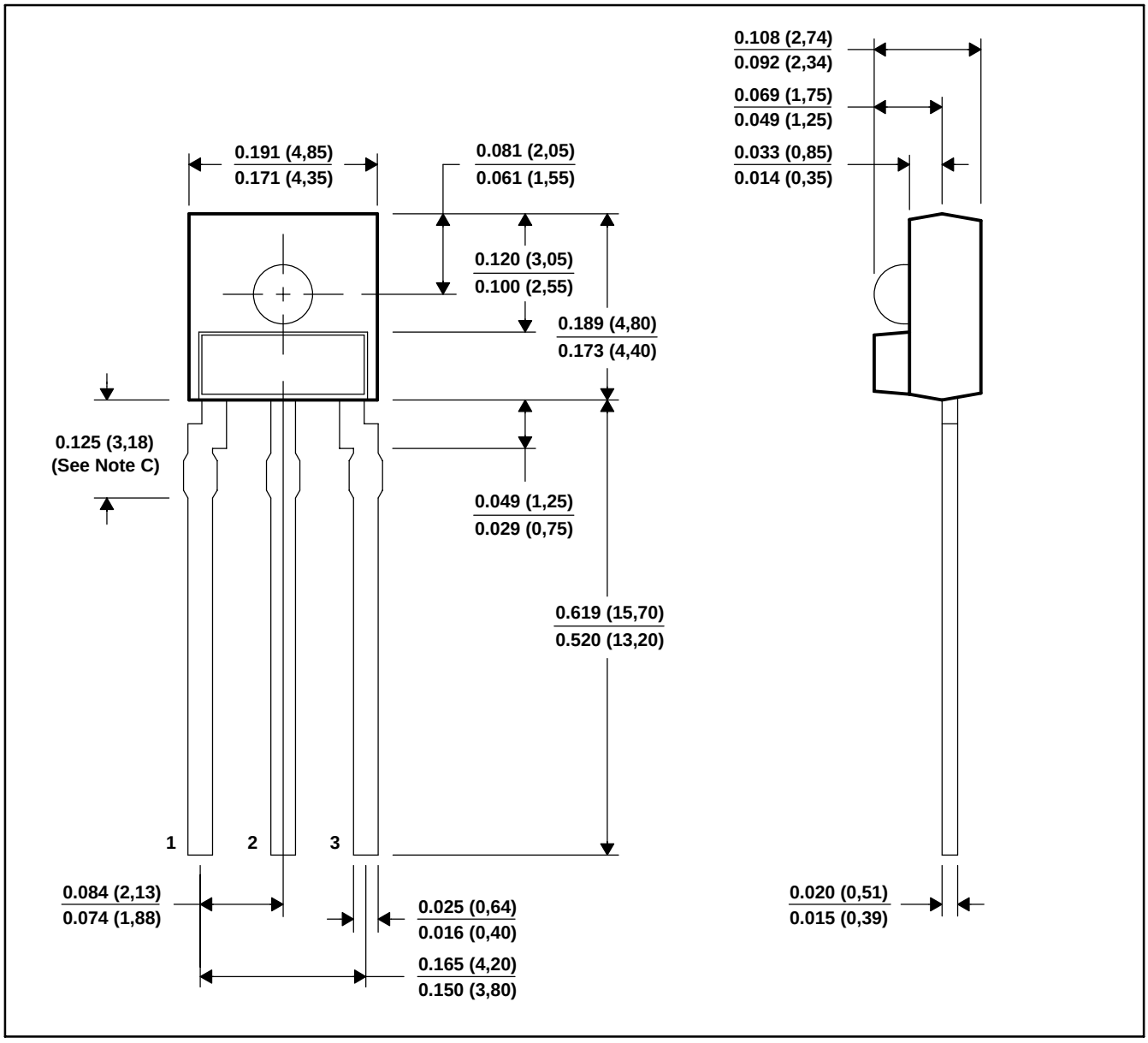


Figure 11

MECHANICAL DATA

PLASTIC SINGLE-IN-LINE PACKAGE (OPTO)



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. All dimensions apply before solder dip.
E. Package body is a clear nonfilled optically transparent material
F. Index of refraction of clear plastic is 1.55.

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