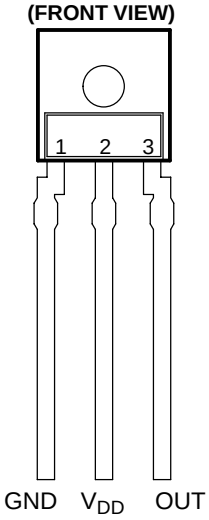
- **Integral Visible Light Cutoff Filter**
- **Monolithic Silicon IC Containing Photodiode, Operational Amplifier, and Feedback Components**
- **Converts Light Intensity to Output Voltage**
- **High Irradiance Responsivity Typically 42 mV/(μW/cm^2) at λ_p = 940 nm (TSL260)**
- **Low Dark (Offset) Voltage . . . 10 mV Max at 25°C, V_{DD} = 5 V**
- **Single-Supply Operation**
- **Wide Supply Voltage Range . . . 3 V to 9 V**
- **Low Supply Current . . . 800 μA Typical at V_{DD} = 5 V**
- **Advanced Linear CMOS Technology**

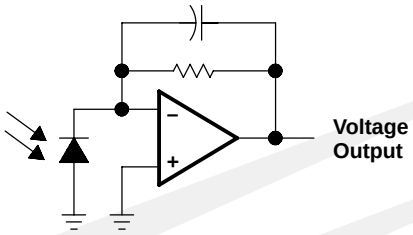
PACKAGE
(FRONT VIEW)



Description

The TSL260, TSL261, and TSL262 are light-to-voltage optical sensors, each combining a photodiode and a transimpedance amplifier (feedback resistor = 16 MΩ, 8 MΩ, and 2 MΩ, respectively) on a single monolithic integrated circuit. The output voltage is directly proportional to the infrared light intensity (irradiance) on the photodiode. The TSL260, TSL261, and TSL262 are manufactured using advanced linear CMOS silicon-gate technology, which provides good 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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Absolute Maximum Ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{DD} (see Note 1) . . . . . 10 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 . . . . . –25°C to 85°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . . 240°C

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

Recommended Operating Conditions

	MIN	NOM	MAX	UNIT
Supply voltage, V_{DD}	3	5	9	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 Note 3)

PARAMETER		TEST CONDITIONS	TSL260			TSL261			TSL262			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_{DARK}	Dark voltage	E_e = 0		3	10		3	10		3	10	mV
V_{OM}	Maximum output	E_e = 2.6 mW/cm^2	3.1	3.5		3.1	3.5		3.1	3.5		V
V_O	Output voltage	E_e = 48 µW/cm^2	1	2	3							V
		E_e = 87 µW/cm^2				1	2	3				
		E_e = 525 µW/cm^2							1	2	3	
	Temperature coefficient of output voltage (V_O)	E_e = 48 µW/cm^2, T_A = 0°C to 70°C		±1								mV/°C
		E_e = 87 µW/cm^2, T_A = 0°C to 70°C					±1					
		E_e = 525 µW/cm^2, T_A = 0°C to 70°C								±1		
N_e	Irradiance responsivity	See Note 4		42			23			3.8		mV/(µW/cm^2)
I_{DD}	Supply current	E_e = 48 µW/cm^2, No load		900	1600							µA
		E_e = 87 µW/cm^2, No load					900	1600				
		E_e = 525 µW/cm^2, No load								900	1600	

NOTES: 3. The input irradiance E_e is supplied by a GaAs infrared-emitting diode with λ_p = 940 nm.
4. Irradiance responsivity is characterized over the range V_O = 0.05 to 3 V.

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

PARAMETER		TEST CONDITIONS	TSL260			TSL261			TSL262			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_r	Output pulse rise time	V_{DD} = 5 V, λ_p = 940 nm		360			90			7		µs
t_f	Output pulse fall time	V_{DD} = 5 V, λ_p = 940 nm		360			90			7		µs
V_n	Output noise voltage	V_{DD} = 5 V, f = 20 Hz		0.6			0.5			0.4		µV/√Hz

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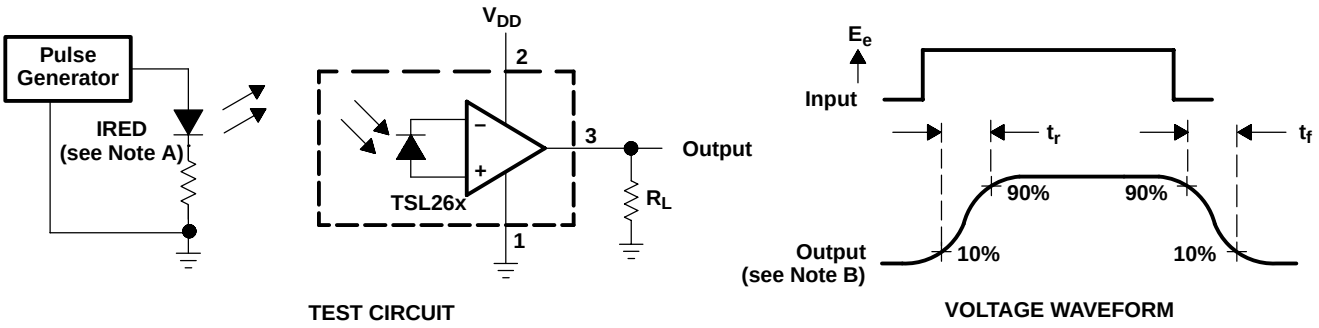
PARAMETER MEASUREMENT INFORMATION



NOTES: A. The input irradiance is supplied by a pulsed GaAs infrared-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, $Z_i \geq$ 1 MHz, $C_i \leq$ 20 pF.

Figure 1. Switching Times

TYPICAL CHARACTERISTICS

OUTPUT VOLTAGE vs IRRADIANCE

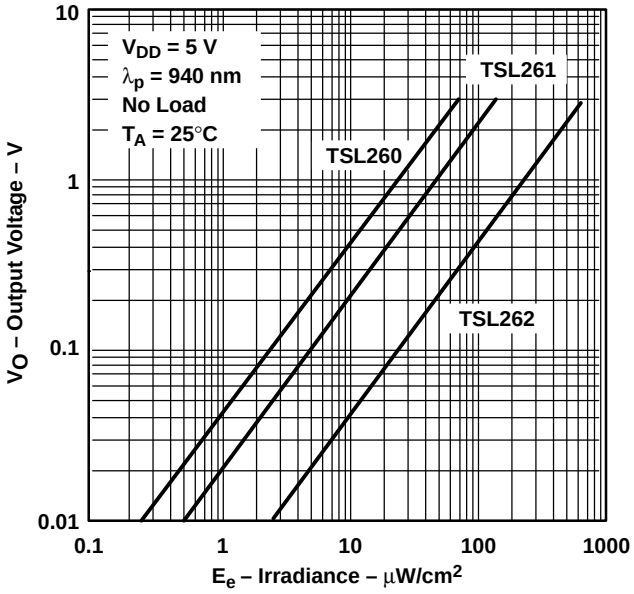


Figure 2

PHOTODIODE SPECTRAL RESPONSE

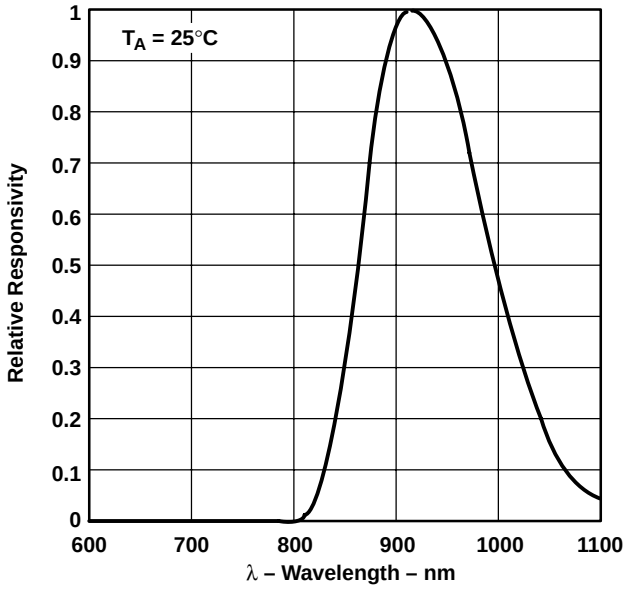


Figure 3

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TYPICAL CHARACTERISTICS

HIGH-LEVEL OUTPUT VOLTAGE vs SUPPLY VOLTAGE

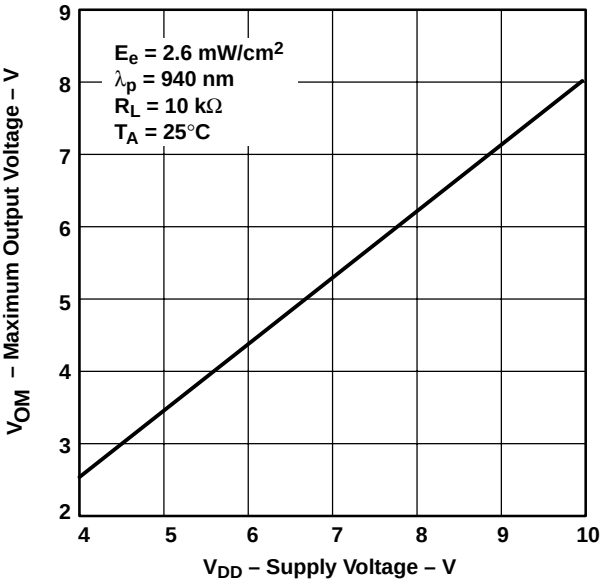

Figure 4

SUPPLY CURRENT vs OUTPUT VOLTAGE

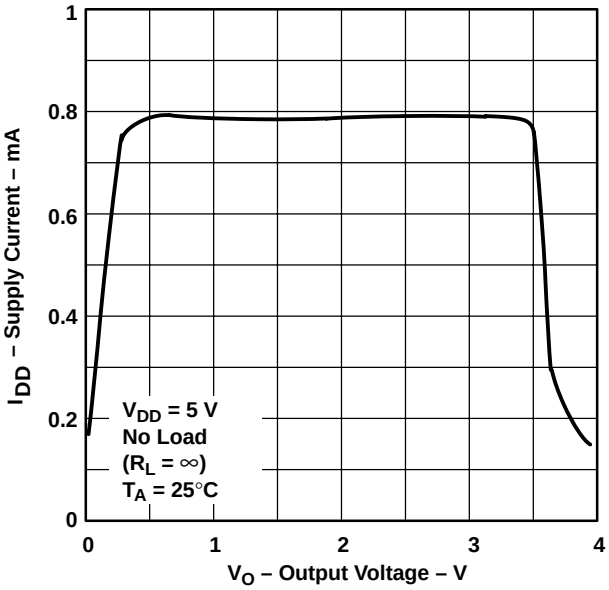

Figure 5

NORMALIZED OUTPUT VOLTAGE vs ANGULAR DISPLACEMENT

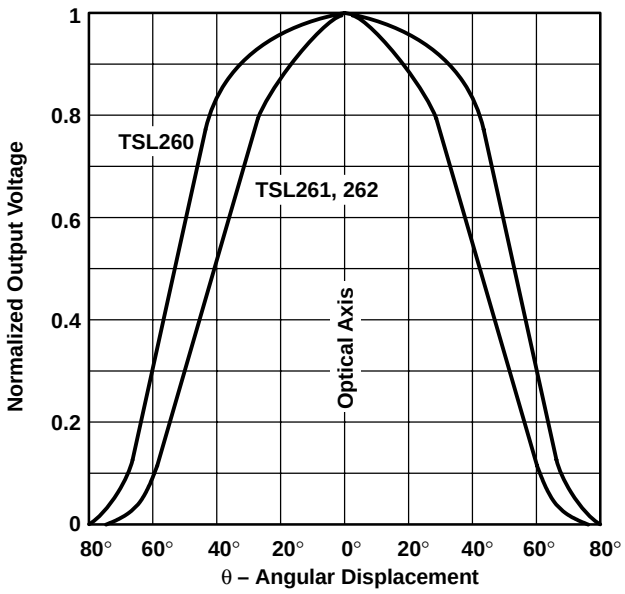

Figure 6

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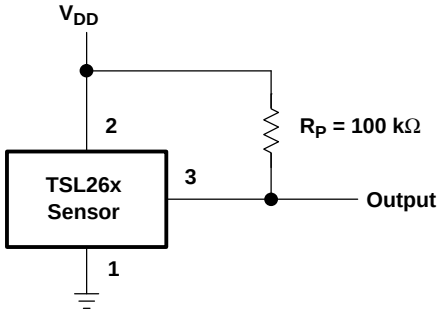
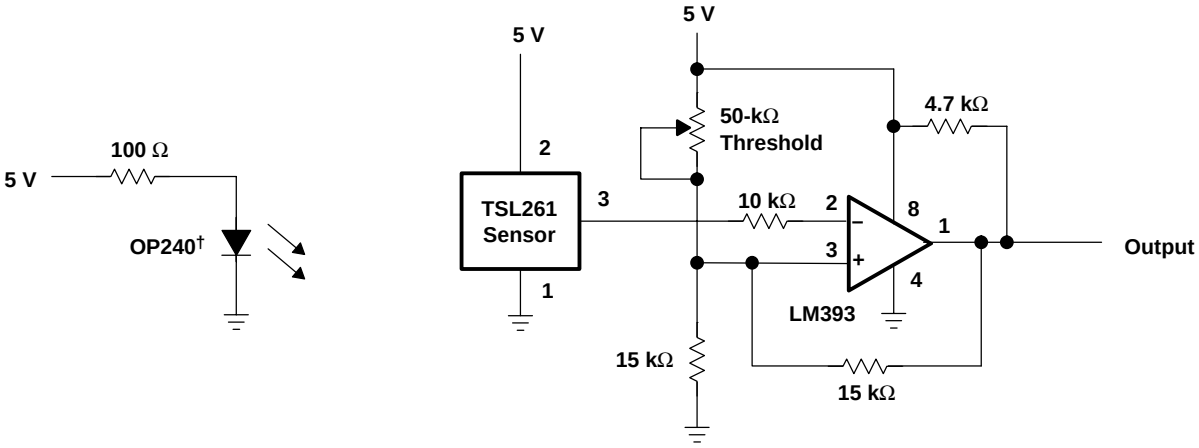
APPLICATION INFORMATION



NOTE A: Pullup resistor extends linear output range to near V_{DD} with minimal (several millivolts typical) effect on V_{DARK}; particularly useful at low V_{DD} (3 V to 5 V).

Figure 7. Pullup for Increased V_{OM}



† OPTEK part number

NOTE A: Output goes high when beam is interrupted; working distance is several inches or less. Intended for use as optical-interrupter switch or reflective-object sensor.

Figure 8. Short-Range Optical Switch With Hysteresis

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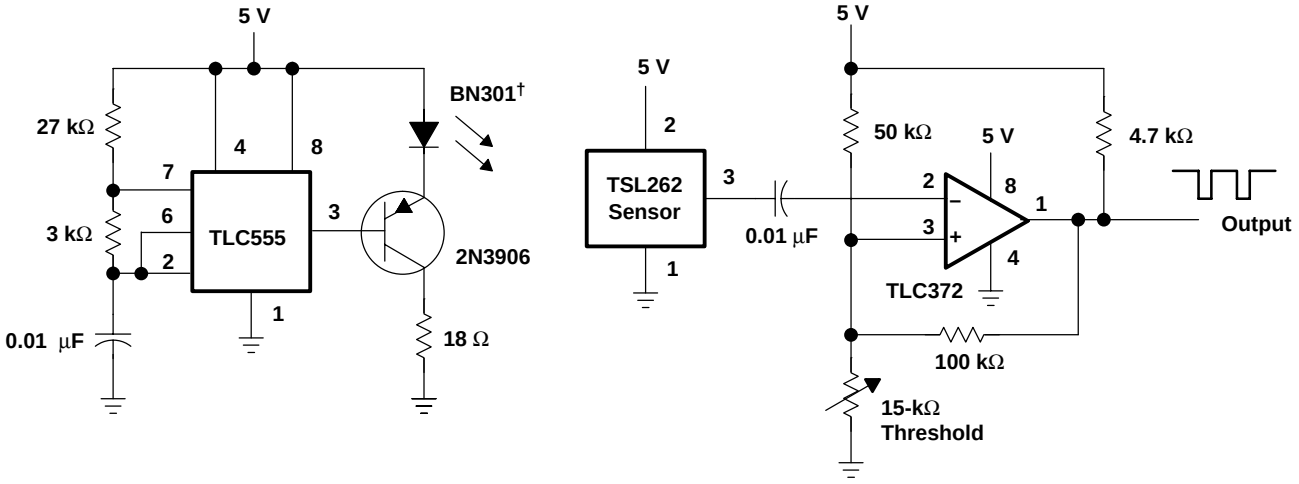
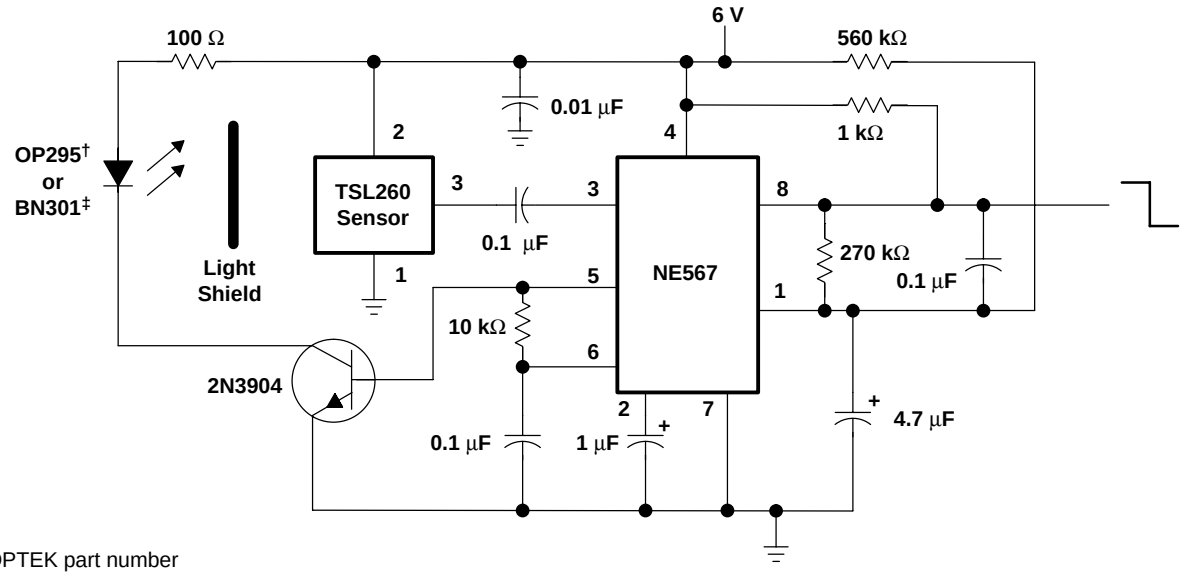
APPLICATION INFORMATION



† Stanley part number

NOTE A: Output pulses low until beam is interrupted. Useful range is 1 ft to 20 ft; can be extended with lenses. This configuration is suited for object detection, safety guards, security systems, and automatic doors.

Figure 9. Pulsed Optical-Beam Interrupter



† OPTEK part number

‡ Stanley part number

NOTE A: Output goes low when light pulses from emitter are reflected back to sensor. Range is 6 in to 18 in depending upon object reflectance. Useful for automatic doors, annunciators, object avoidance in robotics, automatic faucets, and security systems.

Figure 10. Proximity Detector

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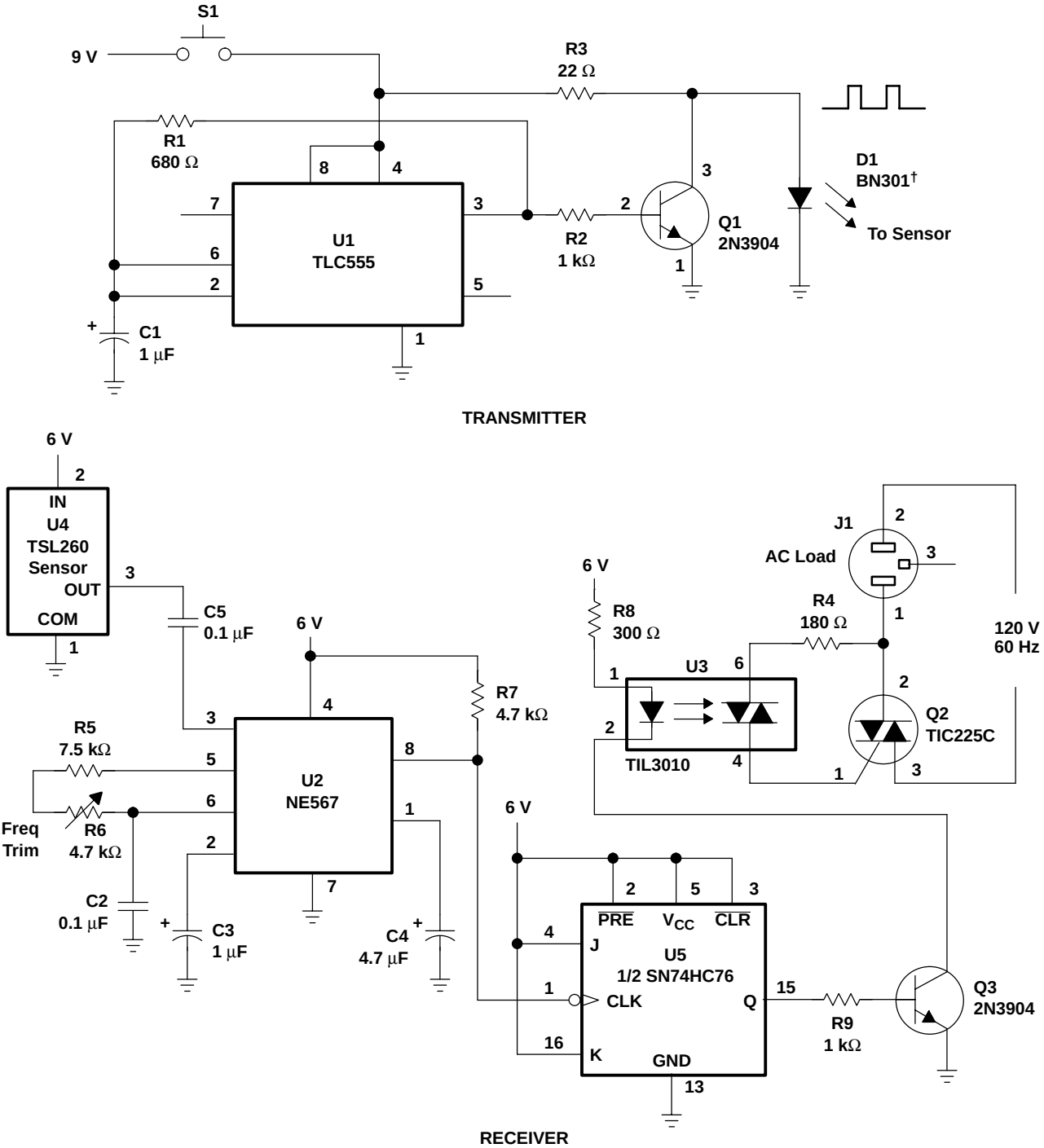
APPLICATION INFORMATION



† OPTEK part number

NOTE A: Single-channel remote control can be used to switch logic or light dc loads by way of U5 or ac loads by way of the optocoupler and triac as shown. Applications include ceiling fans, lamps, electric heaters, etc.

Figure 11. IR Remote Control

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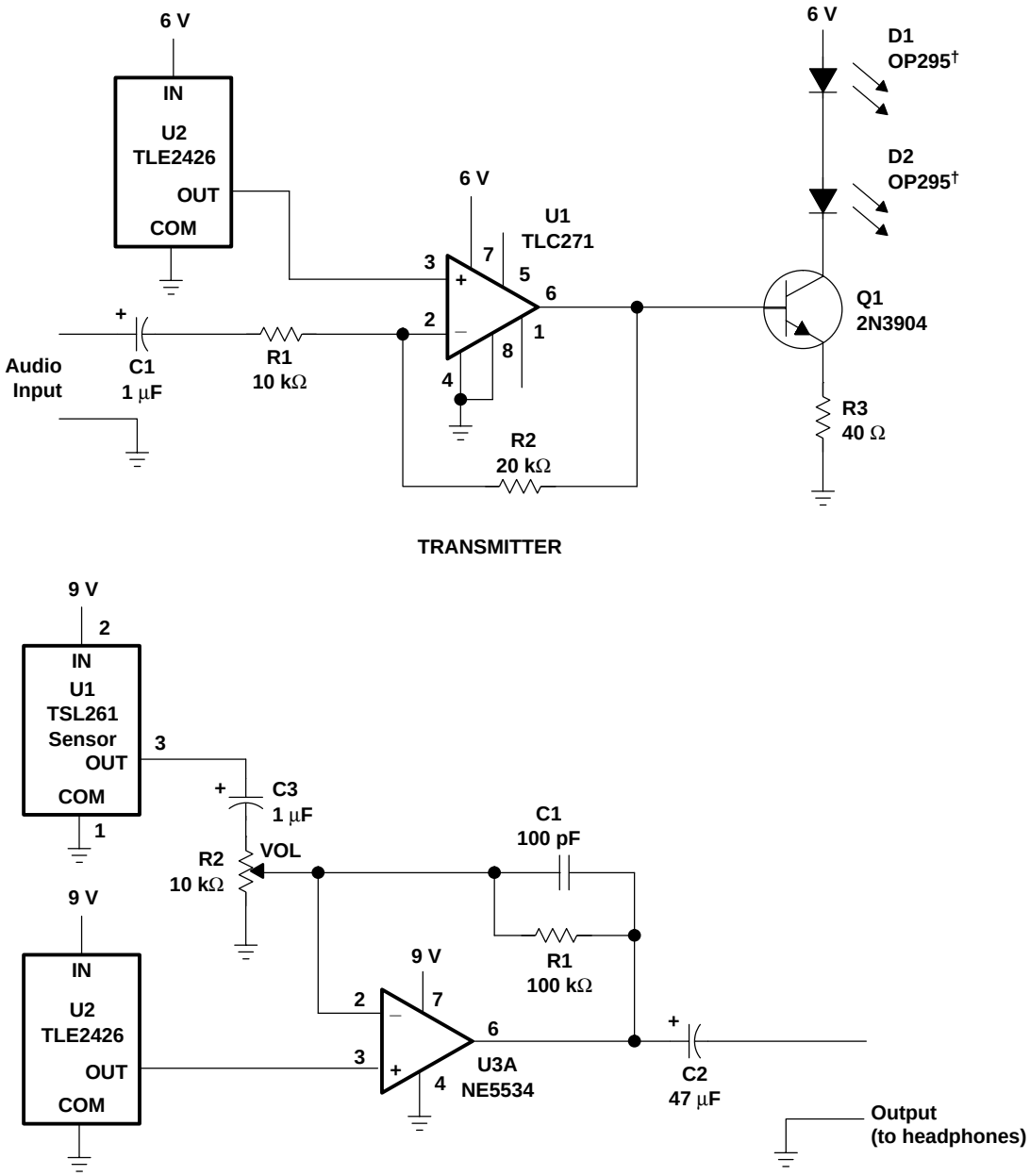
APPLICATION INFORMATION



† OPTEK part number

NOTE A: Simple transmission of audio signal over short distances (<10 ft). Applications include wireless headphones, wireless-telephone headset, and wireless-headset intercom.

Figure 12. IR Voice-Band Audio Link

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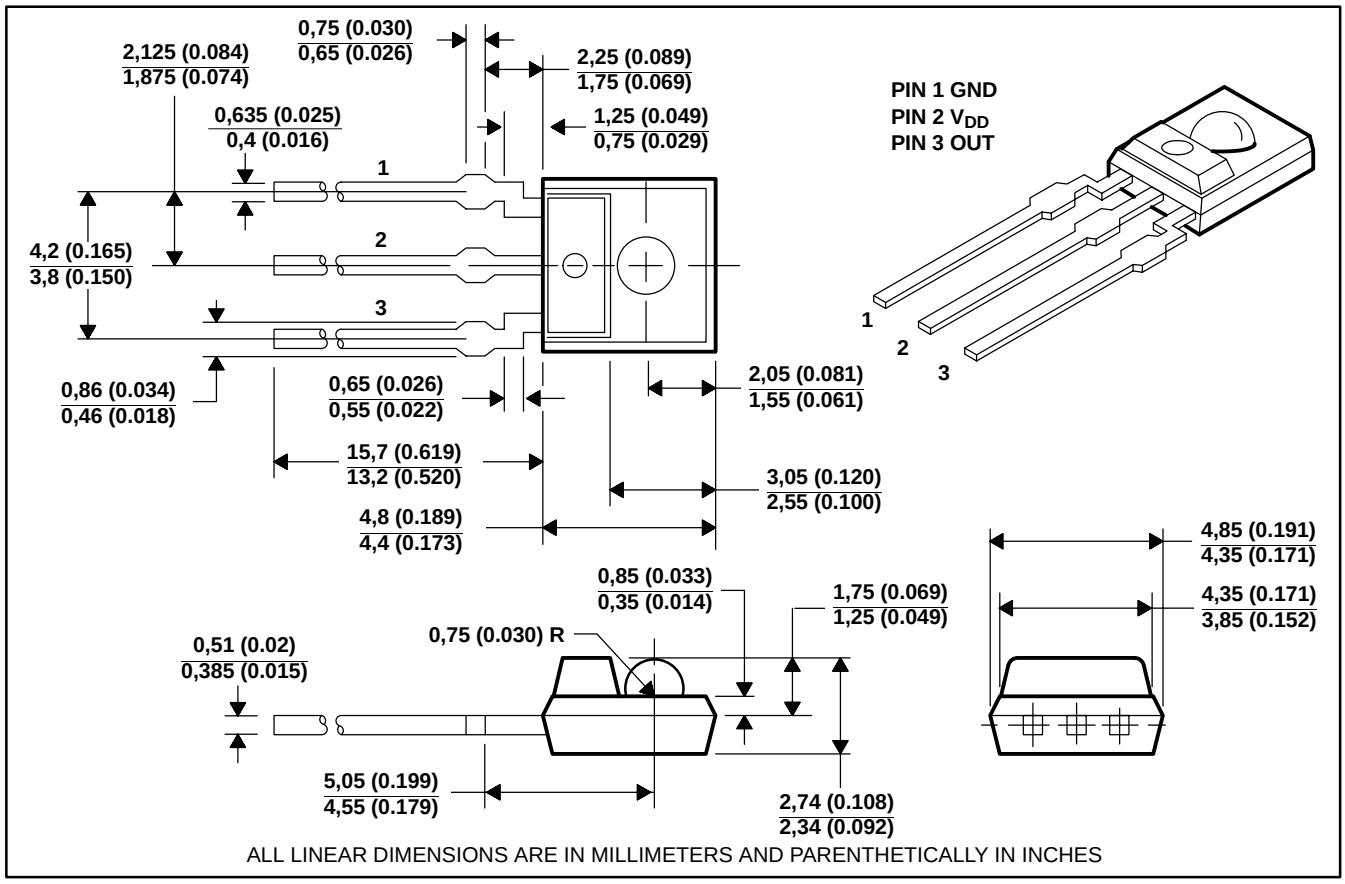
MECHANICAL DATA

The photodiode/amplifier chip is packaged in a black, infrared-transmissive plastic package. The integrated photodiode active area is typically 1.0 mm^2 (0.0016 in^2), 0.5 mm^2 (0.00078 in^2), and 0.26 mm^2 (0.0004 in^2) for the TSL260, TSL261, and TSL262, respectively.



ALL LINEAR DIMENSIONS ARE IN MILLIMETERS AND PARENTHETICALLY IN INCHES

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