RoHS
2002/95/EC

NTE7231
Integrated Circuit
Light−to−Frequency Converter

Description:

The NTE7231 light−to−frequency converter combines a silicon photodiode and a current−to−frequency converter on a single monolithic CMOS integrated circuit. Outut is a square wave (50% duty cycle) with frequency directly proportional to light intensity (irradiance) on the phoodiode. The digital output allows direct interface to a microcontroller of other logic circuitry. The device has been temperature compensated for the ultraviolet−to−visible light range of 320nm to 700nm and responds over the light range of 320nm to 1050nm.

The NTE7231 is characterized for operation over the temperature range of −25° to +70°C and is supplied in a 3−Lead clear plastic side−looker type package with an integral lens.

Features:

● High−Resolution Conversion of Light Intensity to Frequency with No External Components
● Communicate Directly with a Microcontroller
● Compact 3−Leaded Clear Plastic Package
● Single−Supply Operation down to 2.7V
● Nonlinearity Error Typically 0.2% at 100kHz
● Stable 150ppm/°C Temperature Coefficient
● Single−Supply Operation

Absolute Maximum Ratings: (T_A = −25° to +70°C, Note 1 unless otherwise specified)

Supply Voltage (Note 2), V_{DD} 6V

Operating Free−Air Temperature Range, T_A .... −25° to +70°C

Storage Temperature Range, T_{stg} .... −25° to +85°C

Lead Temperature (During Soldering, 1/16" from case, 10sec max), T_L .... +260°C

Note 1. 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 2. All voltage values are with respect to GND.

Recommended Operating Conditions:

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{DD}		2.7	5.0	5.5	V
Operating Free−Air Temperature	T_A		−25	−	+70	°C

Electrical Characteristics: (V_{DD} = 5V, T_A = +25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
High−Level Output Voltage	V_{OH}	I_{OH} = −4mA	4.0	4.5	−	V
Low−Level Output Voltage	V_{OL}	I_{OL} = 4mA	−	0.25	0.4	V
Supply Current	I_{DD}		−	2	3	mA
Full−Scale Frequency		Note 3	500	−	−	kHz
Temperature Coefficient of Output Frequency		Wavelength < 700nm	−	±150	−	ppm/°C
Supply−Voltage Sensitivity	k_{SVS}	V_{DD} = 5V ±10%	−	±0.5	−	%/V
Output Frequency	f_O	E_e = 430° W/cm², $±_p$ = 635nm	200	250	300	kHz
		E_e = 0° W/cm²	−	0.4	10	Hz
Nonlinearity (Note 4)		f_O = 0kHz to 10kHz	−	±0.1%	−	%F.S.
		f_O = 0kHz to 100kHz		±0.2%		%F.S.
Step Response to Full−Scale Step Input			1 pulse of new frequency plus 1° s			

Note 3. Full−scale frequency is the maximum operating frequency of the device without saturation.
Note 4. Nonlinearity is defined as the deviation of f_O fro a straight line between zero and full scale, expressed as a percent of full scale.

Power Supply Considerations:

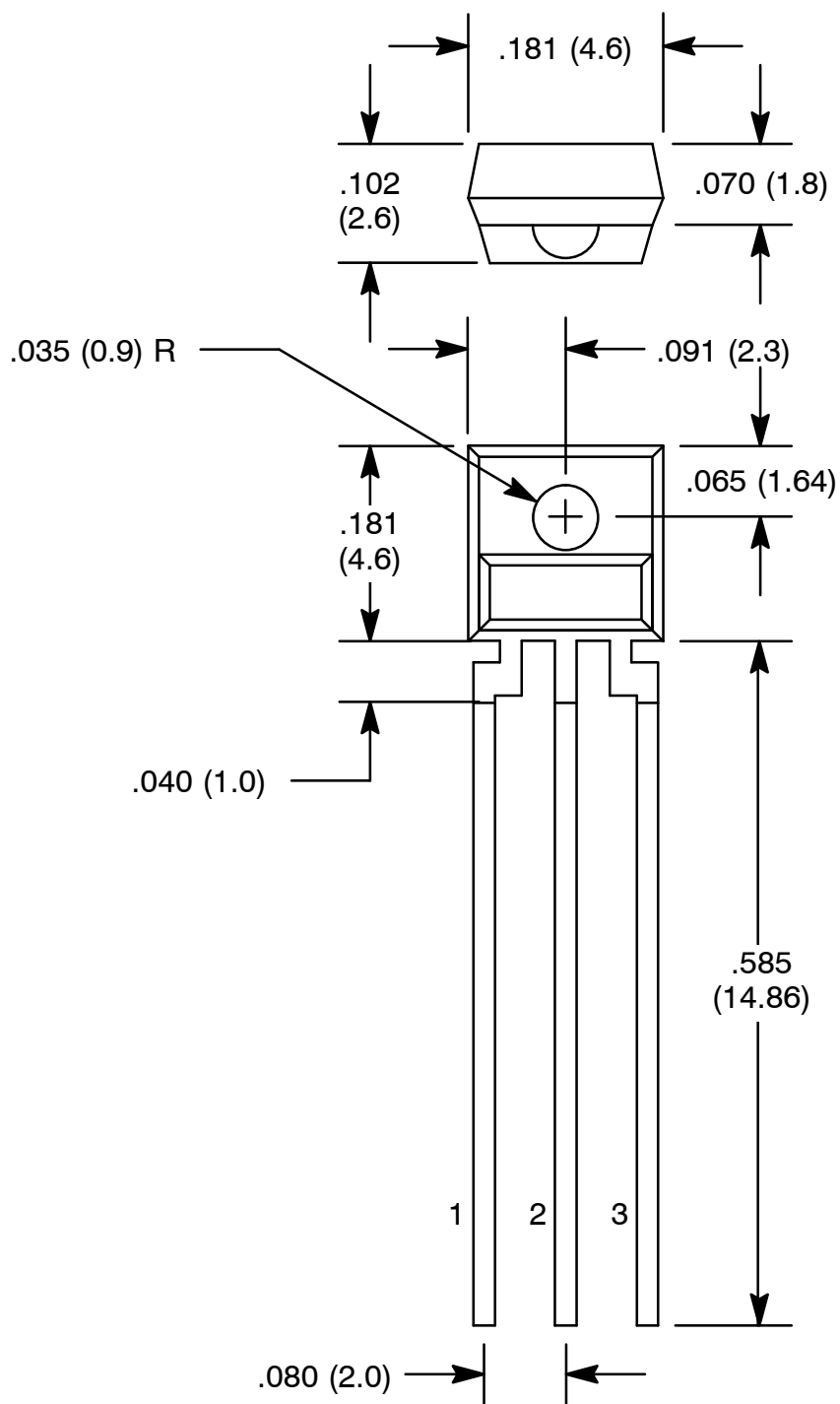Power−supply lines must be decoupled by a 0.01° F to 0.1° F capacitor with short leads placed close to the NTE7231..

Output Interface:

The output of the device is designed to drive a standard TTL or CMOS logic input over short distances. If lines greater than 12 inches are used on the output, a buffer or line driver is recommended..

Measuring the Frequency:

The choice of interface and measurement technique depends on the desired resolution and data−acquisition rate. For maximum data−acquisition rate, period−measurement techniques are used.

Period measurement requires the use of a fast reference clock with available resolution directly related to reference−clock rate. The technique is employed to measure rapidly varying light levels or to make a fast measurement of a constant light source.

Maximum resolution and accuracy may be obtained using frequency−measurement, pulse−accumulation, or integration techniques. Frequency measurements provide the added benefit of averaging out random− or high-frequency variations (jitter) resulting from noise in the light signal. Resolution is limited mainly by available counter registers an allowable measurement time. Frequency measurement is well suited for slowly varying or constant light levels and for reading average light levels over short periods of time. Integration, the accumulation of pulses over a very long period of time, can be used to measure exposure — the amount of light present in an area over a given time period.

.181 (4.6)

.102
(2.6)

.070 (1.8)

.035 (0.9) R

.091 (2.3)

.181
(4.6)

.065 (1.64)

.040 (1.0)

.585
(14.86)

1   2   3

.080 (2.0)

Pin 1. GND
Pin 2. V$_{DD}$
Pin 3. OUT