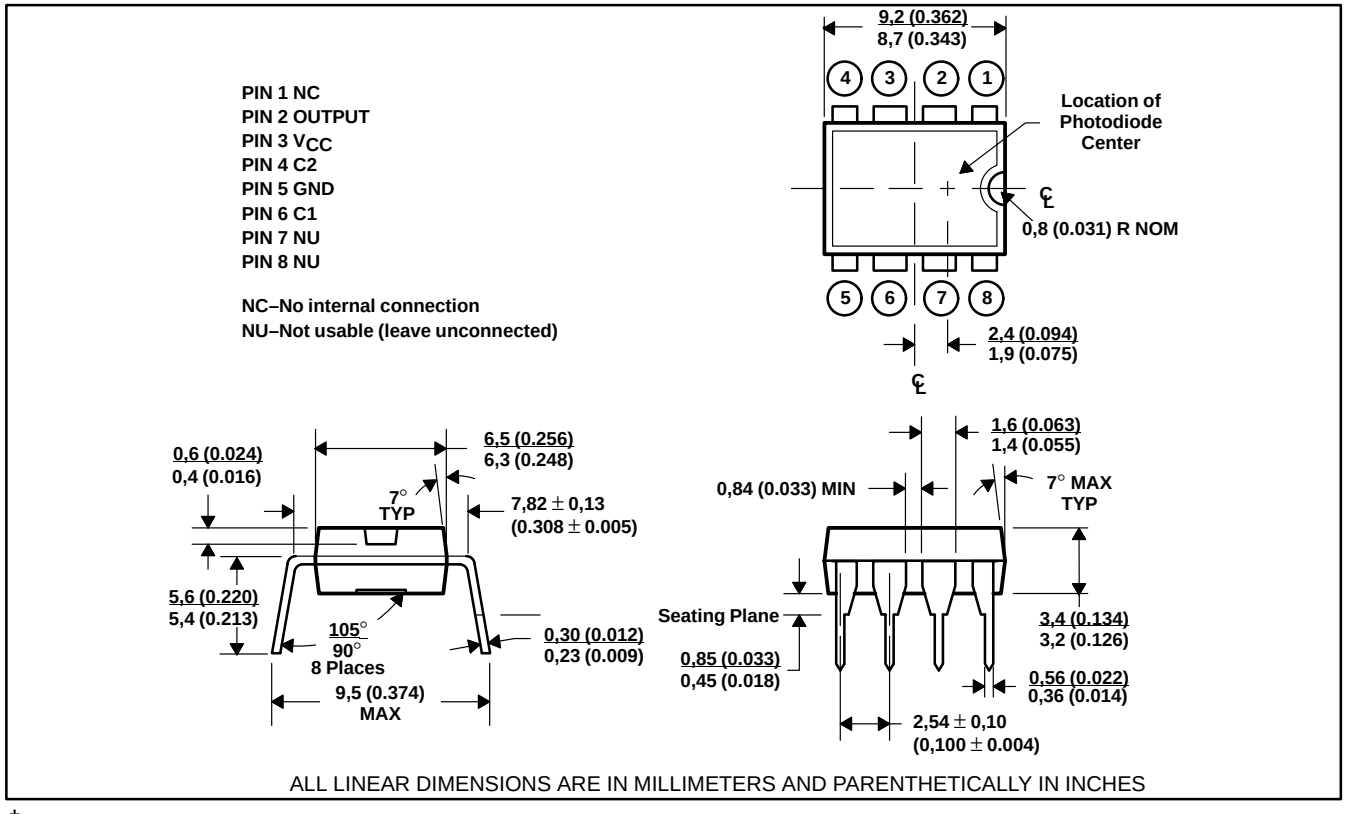
- **High-Resolution Conversion of Light Intensity to Frequency**
- **Wide Dynamic Range . . . 118 dB**
- **Variable (and Single) Supply Range . . . 5 V to 10 V**
- **High Linearity . . . Typically Within 2% of FSR (C = 100 pF)**
- **High Sensitivity . . . Can Detect Change of 0.01% of FSR**
- **CMOS Compatible Output for Digital Processing**
- **Minimum External Components**
- **Microprocessor Compatible**

description

The TSL220 consists of a large-area photodiode and a current-to-frequency converter. The output voltage is a pulse train and its frequency is directly proportional to the light intensity (irradiance) on the photodiode. The output is CMOS† compatible and its frequency may be measured using pulse counting, period timing, or integration techniques. The TSL220 is ideal for light-sensing applications requiring wide dynamic range, high sensitivity, and high noise immunity. The output frequency range is determined by an external capacitor; hence, the desired output frequency is adjustable for a given light intensity at the input. The TSL220 is characterized for operation over the temperature range of –25°C to 70°C.

mechanical data

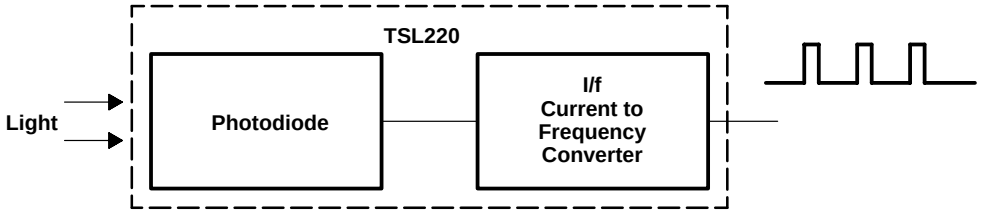
The photodiode and current-to-frequency converter are packaged in a clear plastic 8-pin dual-in-line package. The active chip area is typically 4,13 mm^2 (0.0064 in^2).



ALL LINEAR DIMENSIONS ARE IN MILLIMETERS AND PARENTHETICALLY IN INCHES

† Use of LSTTL logic families may require a 3300-Ω pulldown resistor on the output.

functional block diagram



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1) . . . . . 12 V
Operating free-air temperature, T_A . . . . . –25°C to 70°C
Storage temperature range . . . . . –25°C to 85°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . . 260°C

NOTE 1: All voltage values are with respect to GND (pin 5).

recommended operating conditions

	MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}	4	5	10	V
Output frequency, f_o ($C \leq 100$ pF)			750	kHz
Operating free-air temperature range, T_A	–25		70	°C

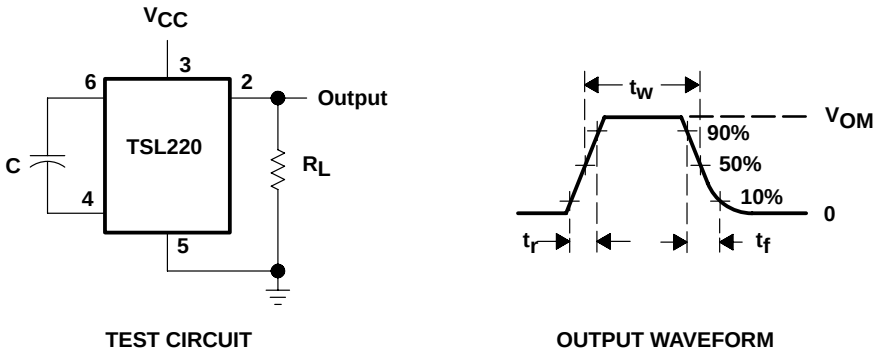
electrical characteristics at V_{CC} = 5 V, T_A = 25°C (see Figure 1)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{OM}	Peak output voltage	R_L = 50 kΩ	3	4		V
I_{CC}	Supply current	C = 100 pF, E_e = 0		7.5	10	mA

operating characteristics at V_{CC} = 5 V, T_A = 25°C (see Figure 1)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
f_o	Output frequency	E_e = 125 μW/cm^2, λ = 880 nm, C = 100 pF	50	150	250	kHz
		E_e = 0, C = 100 pF	0	1	50	Hz
t_w	Output pulse duration	C = 470 pF		1		μs
t_r	Output pulse rise time	C = 100 pF		20		ns
t_f	Output pulse fall time	C = 100 pF		120		ns

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT OUTPUT WAVEFORM

NOTE: Output waveform is monitored on an oscilloscope with the following characteristics: $R_i \geq 1$ MΩ, $C_i \leq 6.5$ pF.

Figure 1. Switching Times

TYPICAL CHARACTERISTICS

OUTPUT PULSE DURATION vs EXTERNAL CAPACITOR VALUE

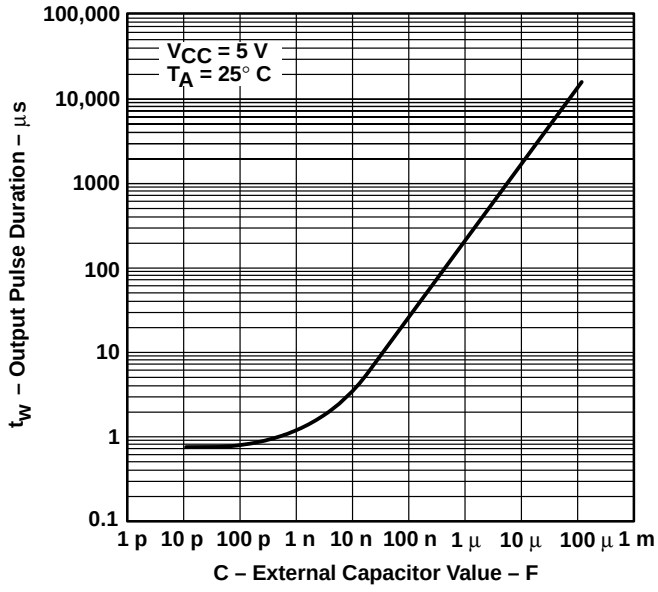


Figure 2

PEAK OUTPUT VOLTAGE vs LOAD RESISTANCE

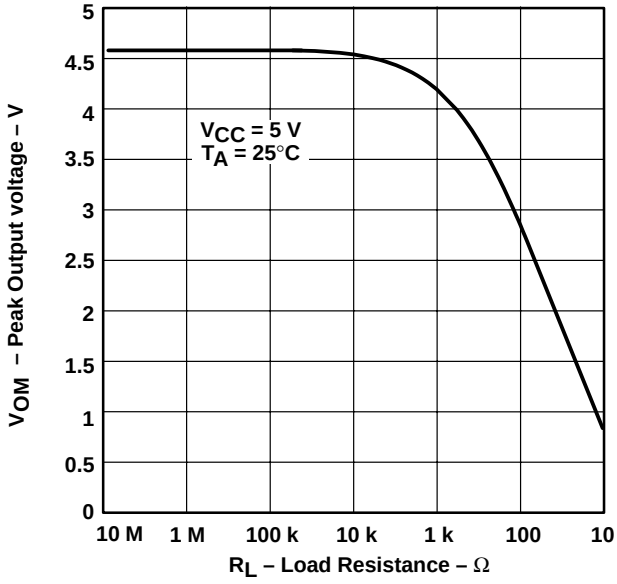


Figure 3

TYPICAL CHARACTERISTICS

OUTPUT FREQUENCY vs IRRADIANCE

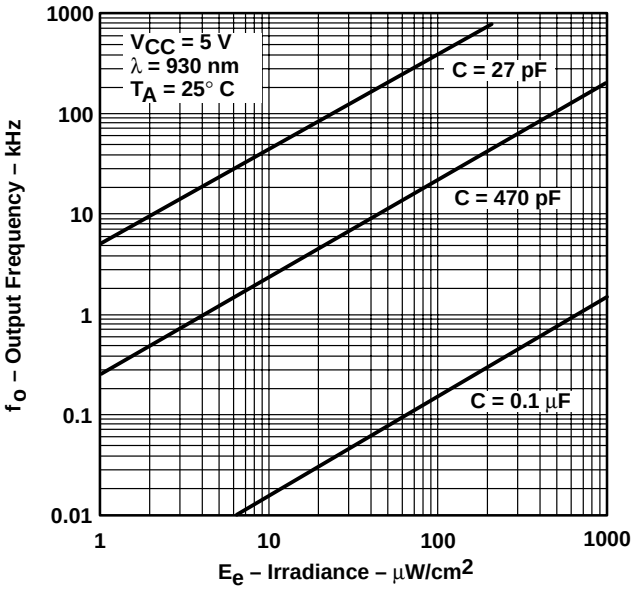


Figure 4

NORMALIZED OUTPUT FREQUENCY vs LOAD RESISTANCE

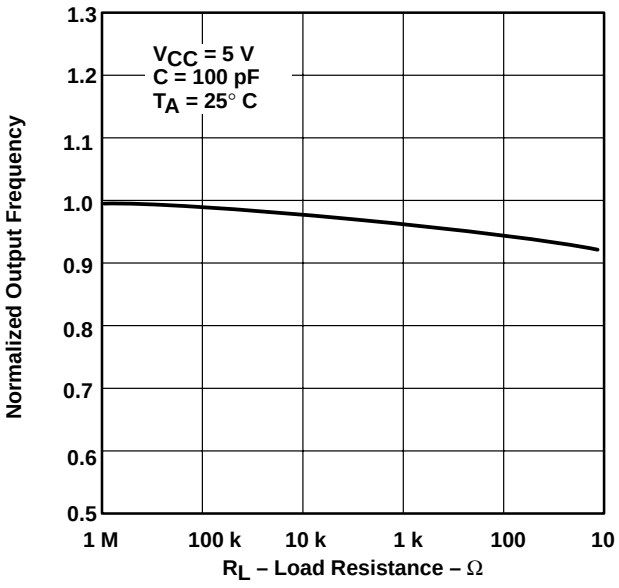


Figure 5

OUTPUT FREQUENCY vs EXTERNAL CAPACITOR VALUE

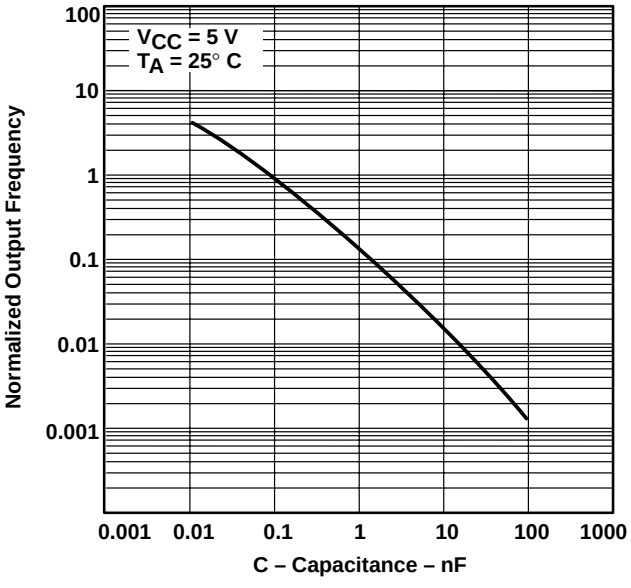


Figure 6

NORMALIZED OUTPUT FREQUENCY vs FREE-AIR TEMPERATURE

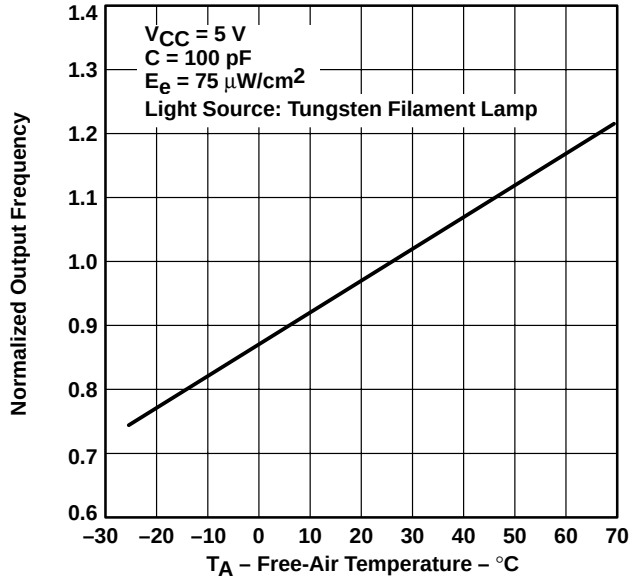


Figure 7

TYPICAL CHARACTERISTICS

**SUPPLY CURRENT
vs
SUPPLY VOLTAGE**

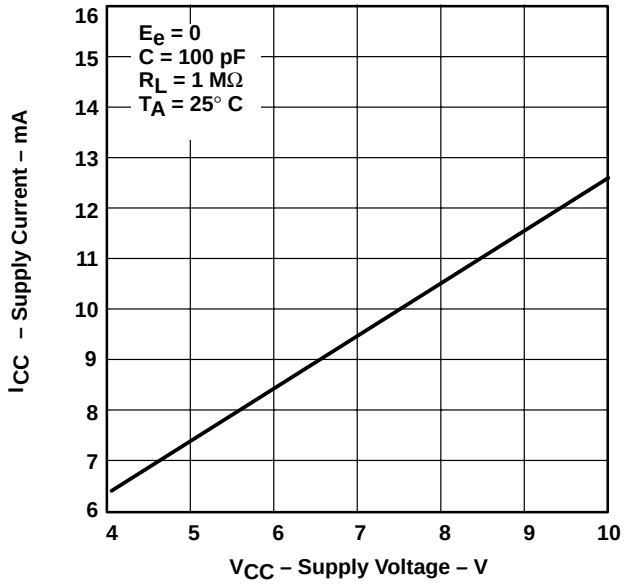


Figure 8

**SUPPLY CURRENT
vs
FREE-AIR TEMPERATURE**

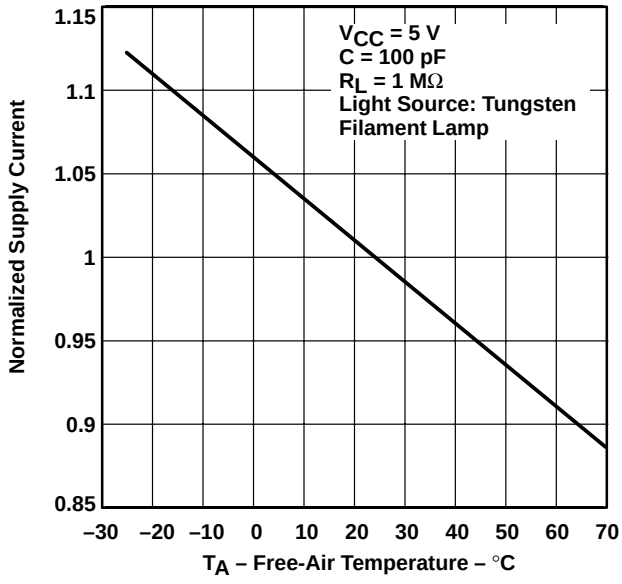


Figure 9

PHOTODIODE SPECTRAL RESPONSE

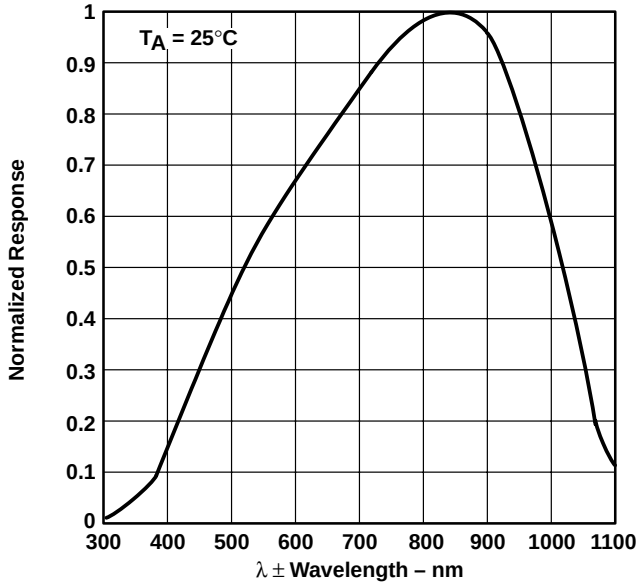


Figure 10

APPLICATION INFORMATION

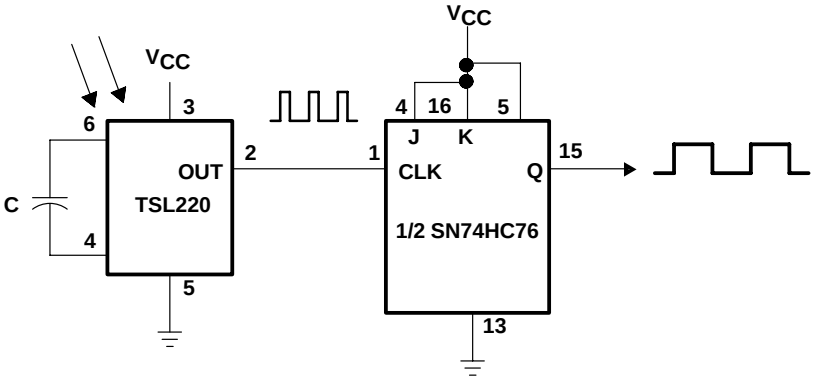
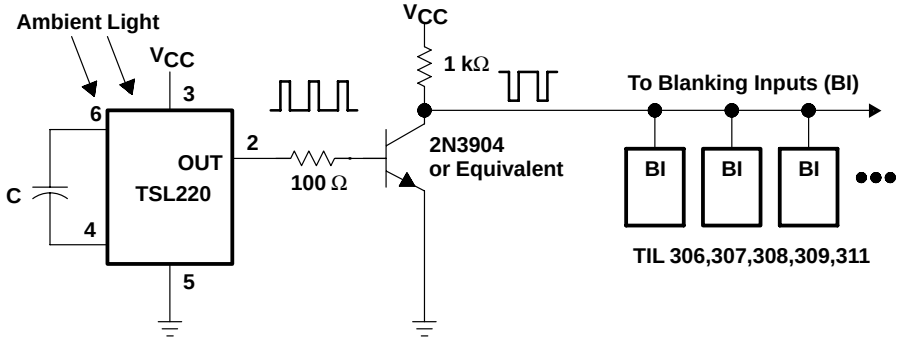


Figure 11. Light-to-Frequency Converter with Square-Wave Output



NOTE: Adjust C to set maximum and minimum brightness levels.

Figure 12. Automatic Display Dimming Circuit

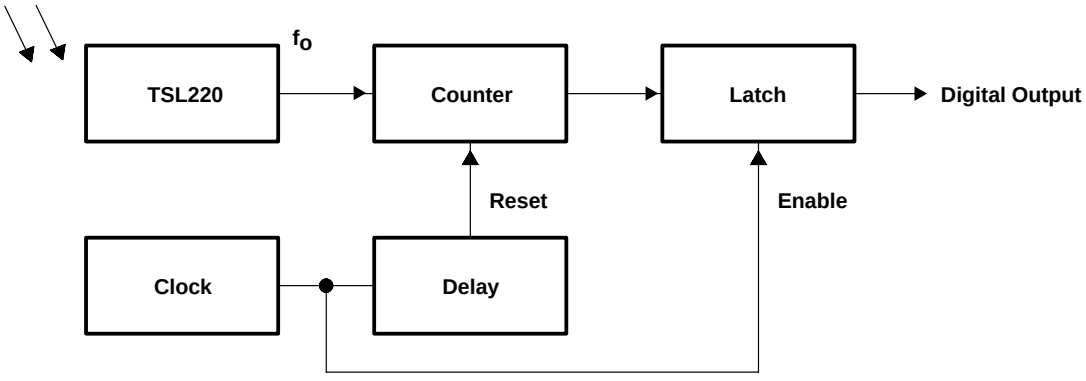


Figure 13. Light-to-Digital Converter

APPLICATION INFORMATION

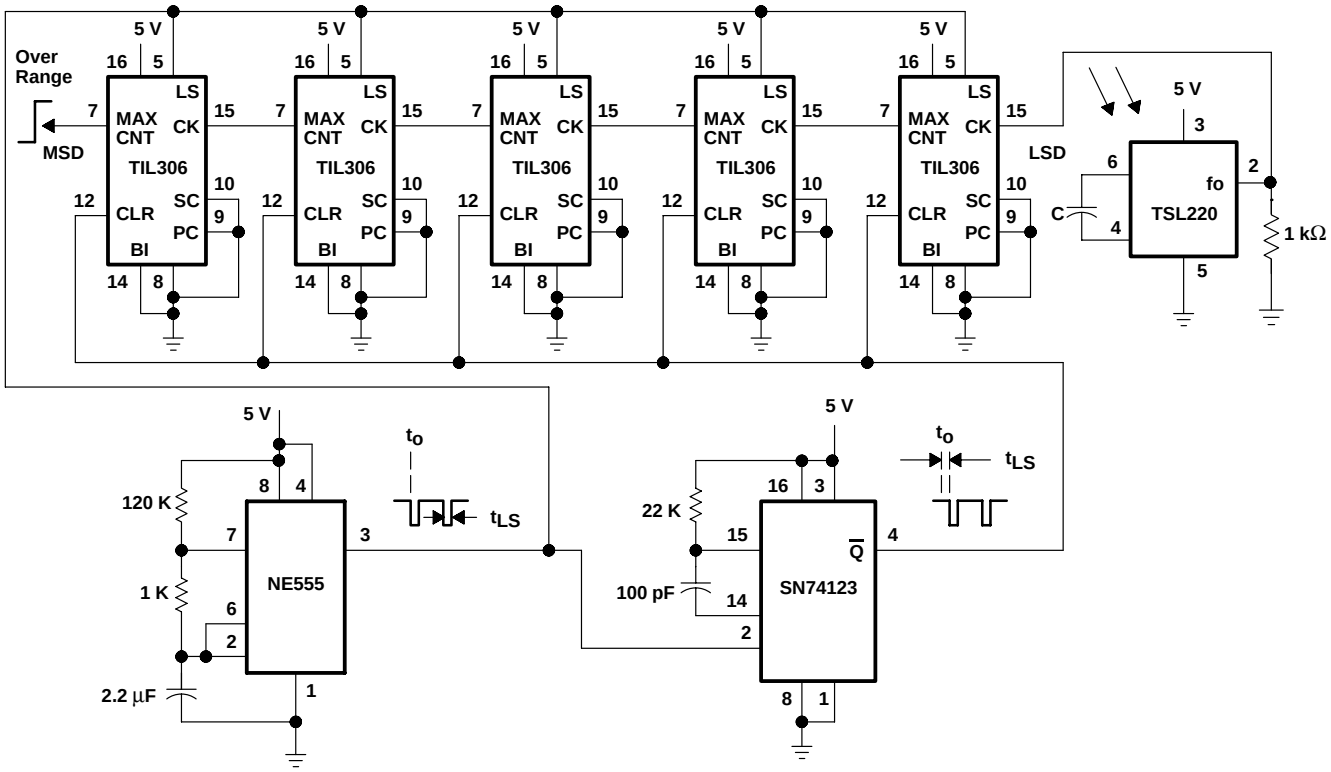


Figure 14. Simple Digital Light Meter

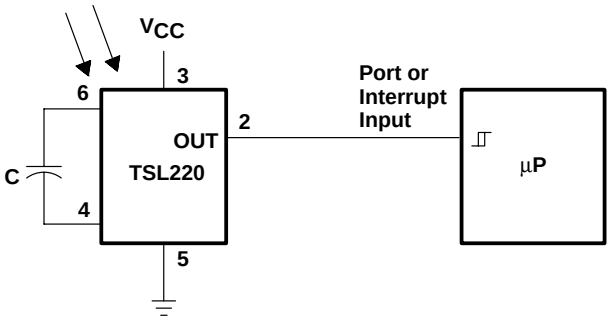
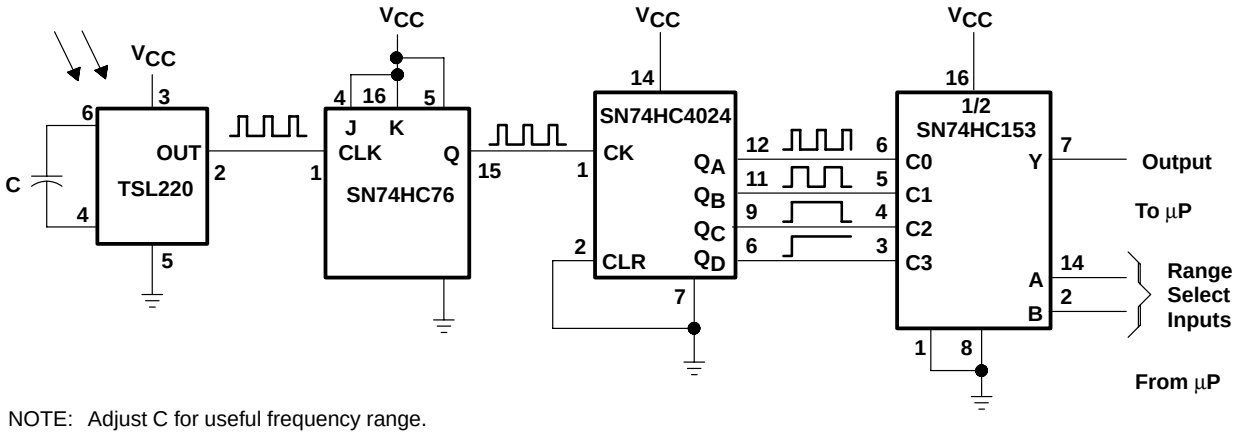


Figure 15. Light Detector with Direct Microprocessor Interface

APPLICATION INFORMATION



NOTE: Adjust C for useful frequency range.

Figure 16. Light Detector with Microprocessor (Microcontroller) and Autoranging Capability

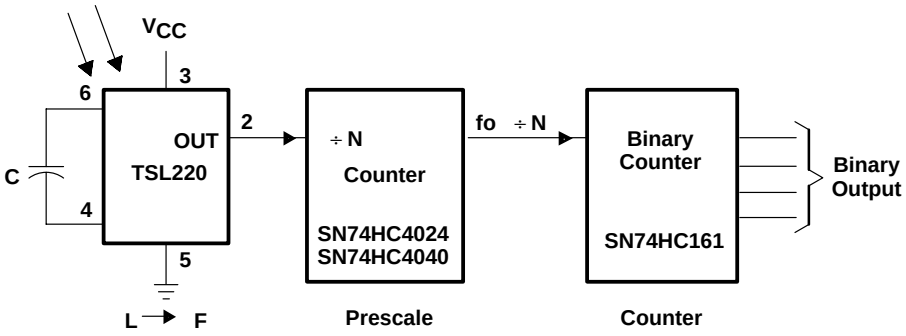


Figure 17. Digital Light Integrator

APPLICATION INFORMATION

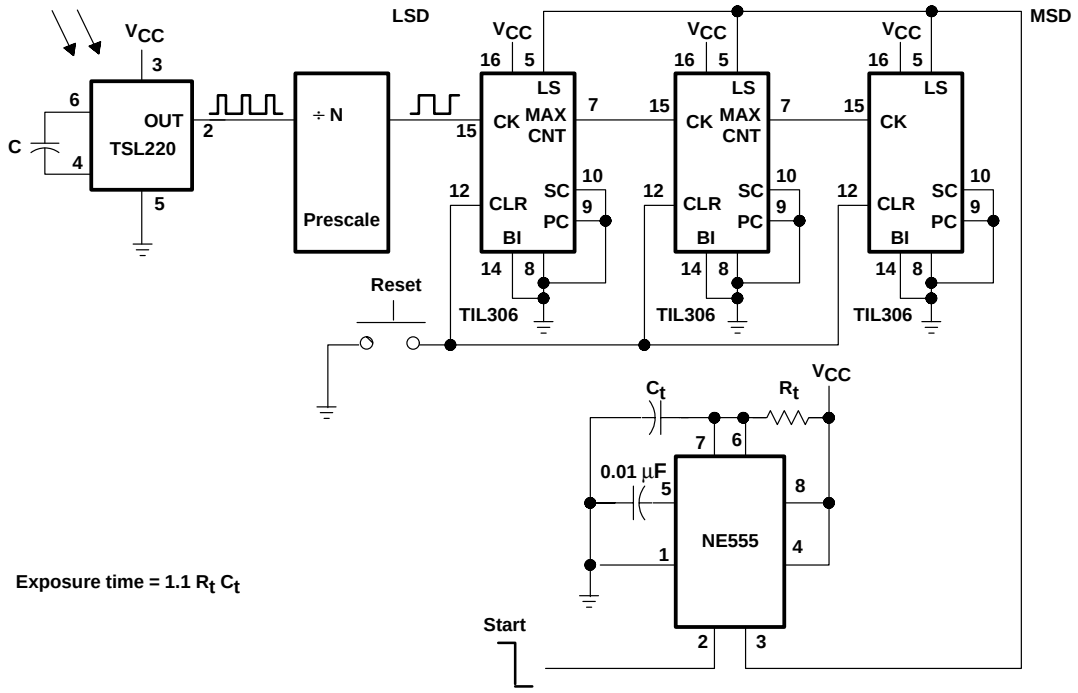


Figure 18. Digital Light Exposure Meter

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
TSL220	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI

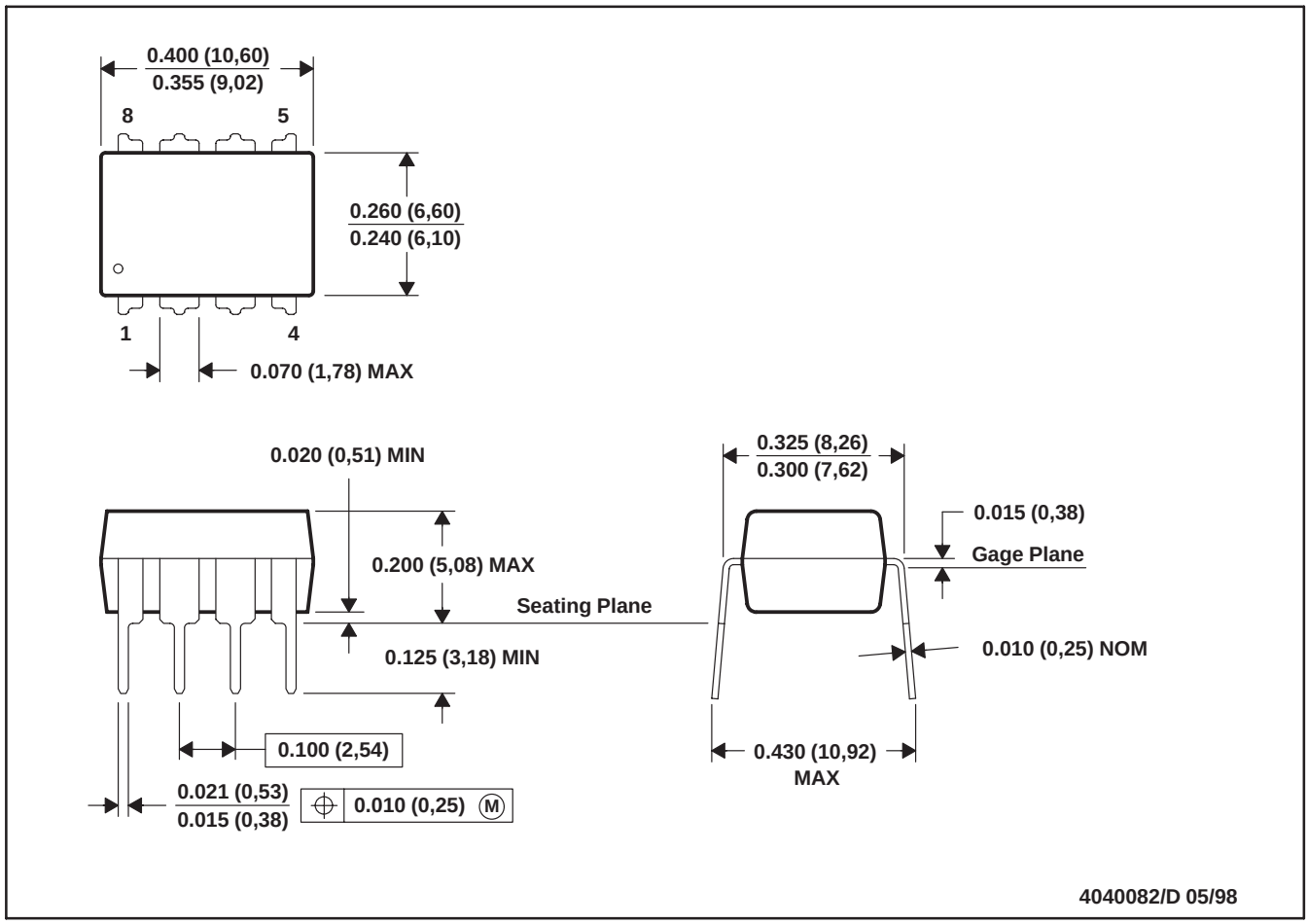
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

MPDI001A – JANUARY 1995 – REVISED JUNE 1999

P (R-PDIP-T8) **PLASTIC DUAL-IN-LINE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001

For the latest package information, go to http://www.ti.com/sc/docs/package/pkg_info.htm

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