

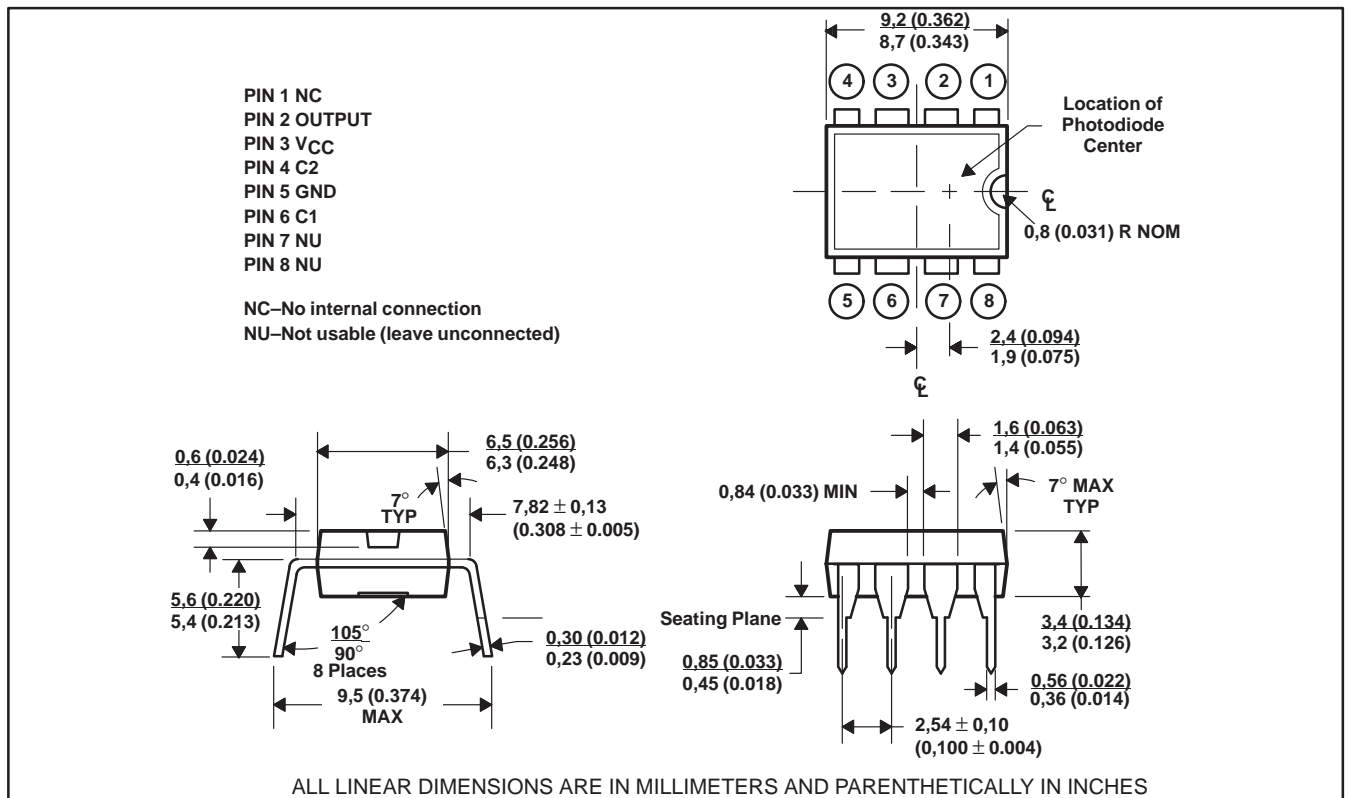
- High-Resolution Conversion of Light Intensity to Frequency
- Wide Dynamic Range . . . 118 dB
- Variable (and Single) Supply Range . . . 5 V to 10 V
- High Linearity . . . Typically Within 2% of FSR (C = 100 pF)
- High Sensitivity . . . Can Detect Change of 0.01% of FSR
- CMOS Compatible Output for 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 $4,13\text{ mm}^2$ (0.0064 in^2).

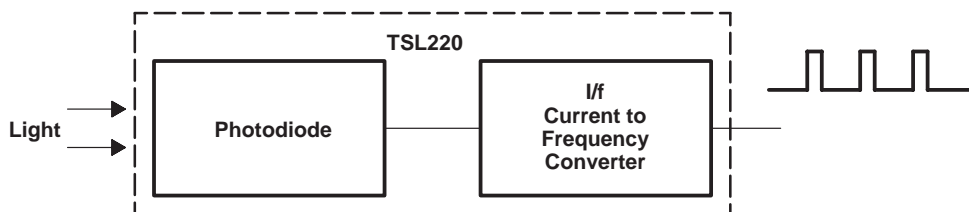


† Use of LSTTL logic families may require a 3300-Ω pulldown resistor on the output.

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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

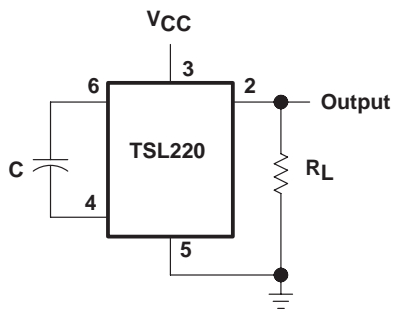
electrical characteristics at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$ (see Figure 1)

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

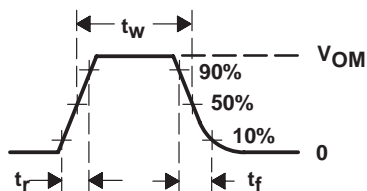
operating characteristics at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$ (see Figure 1)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
f_o	Output frequency	$E_e = 125$ $\mu\text{W}/\text{cm}^2$, $\lambda = 880$ 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: $R_i \geq 1 \text{ M}\Omega$, $C_i \leq 6.5 \text{ pF}$.

Figure 1. Switching Times

TYPICAL CHARACTERISTICS

OUTPUT PULSE DURATION
vs
EXTERNAL CAPACITOR VALUE

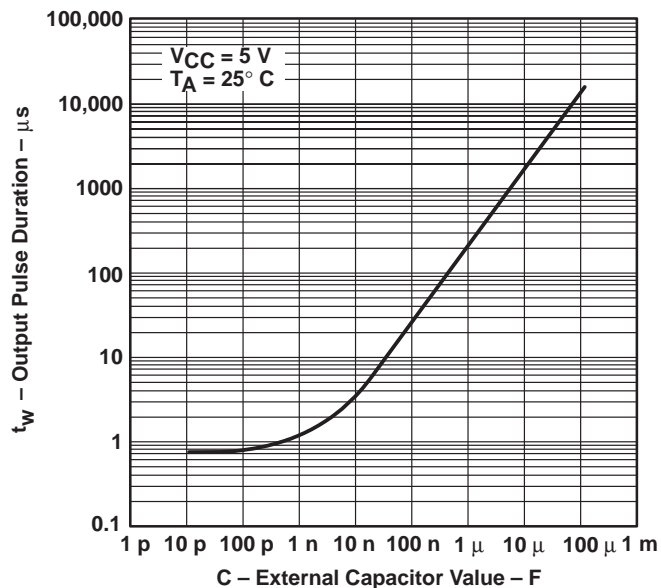


Figure 2

PEAK OUTPUT VOLTAGE
vs
LOAD RESISTANCE

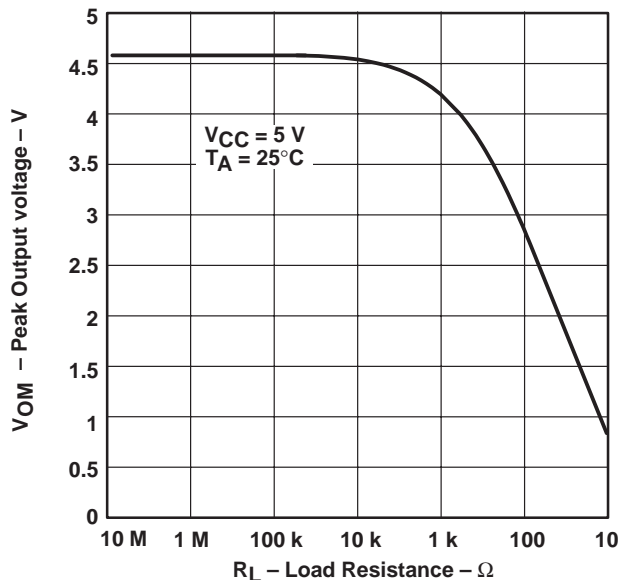


Figure 3

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TYPICAL CHARACTERISTICS

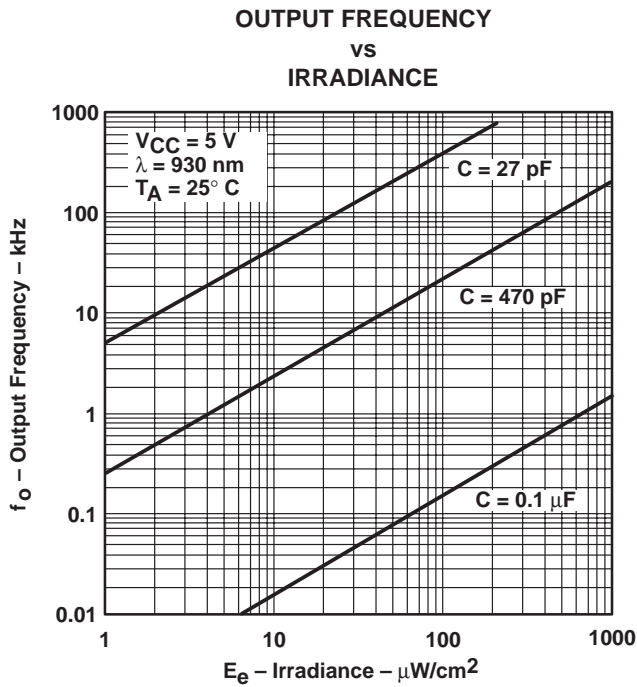


Figure 4

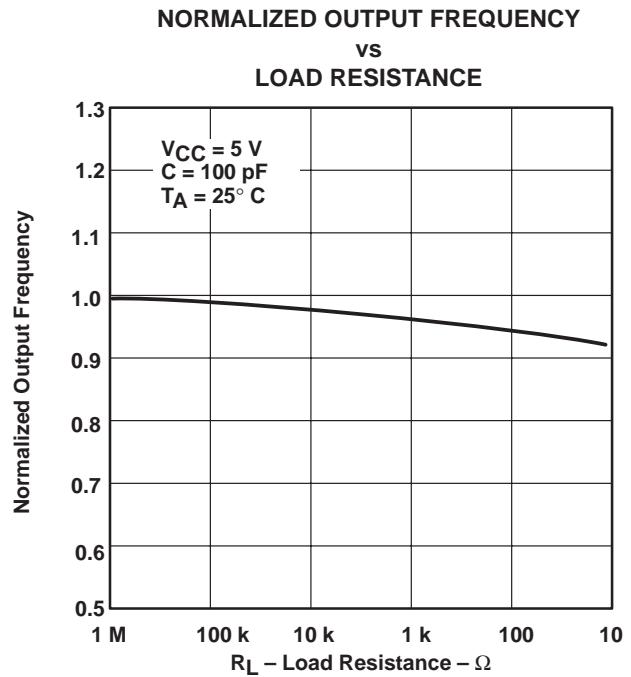


Figure 5

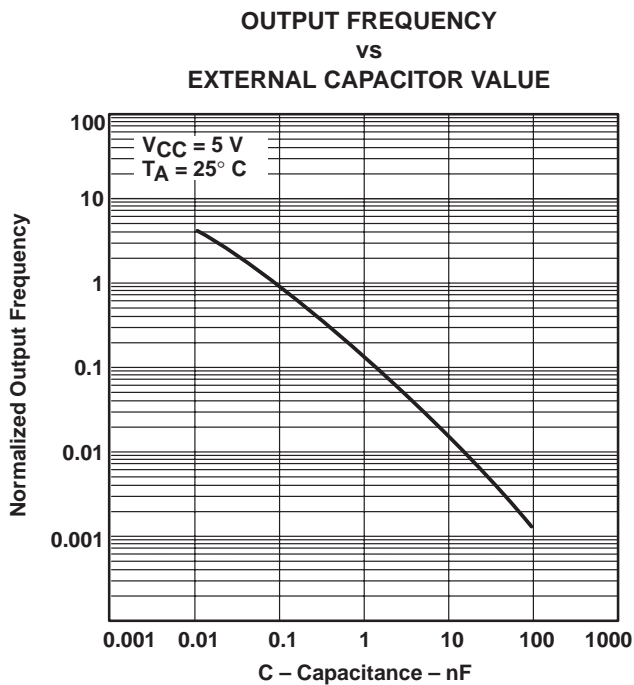


Figure 6

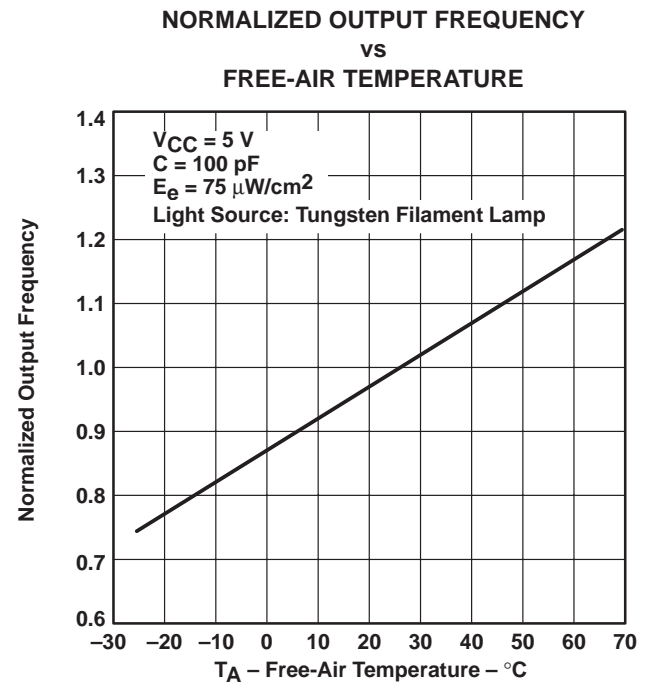


Figure 7

TYPICAL CHARACTERISTICS

SUPPLY CURRENT
 vs
 SUPPLY VOLTAGE

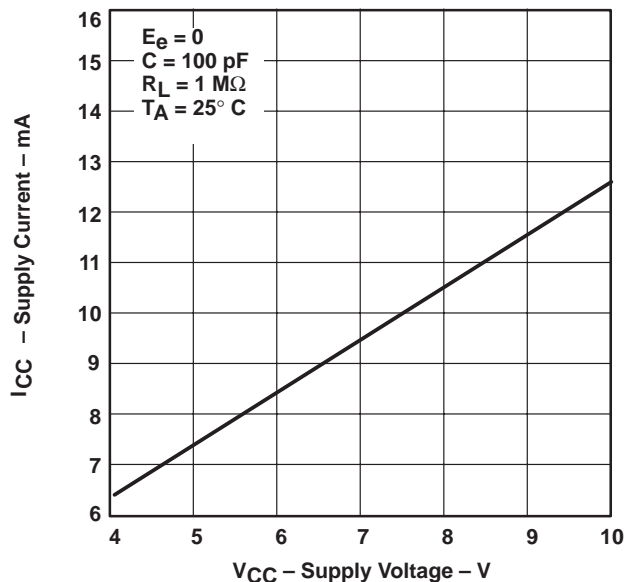


Figure 8

SUPPLY CURRENT
 vs
 FREE-AIR TEMPERATURE

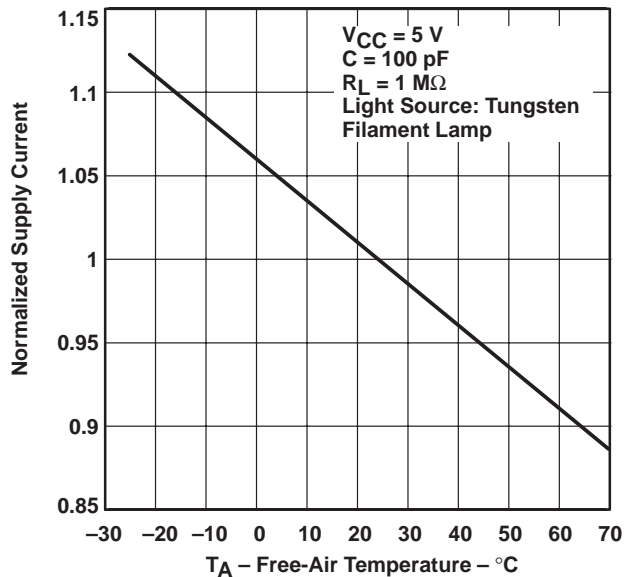


Figure 9

PHOTODIODE SPECTRAL RESPONSE

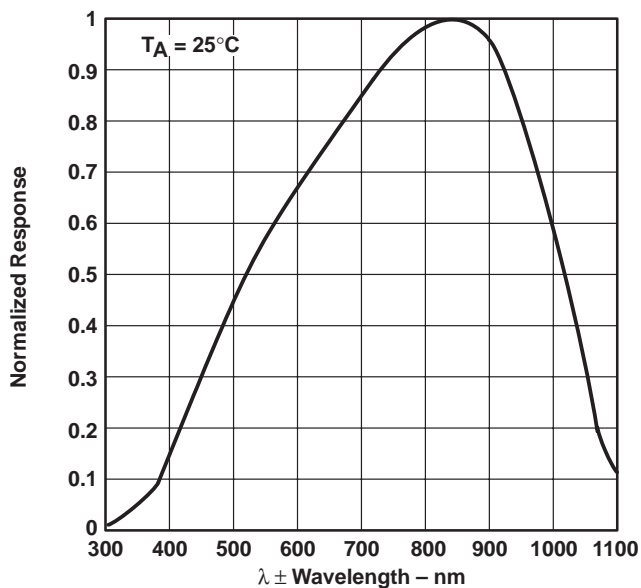


Figure 10

TSL220 LIGHT-TO-FREQUENCY CONVERTER

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APPLICATION INFORMATION

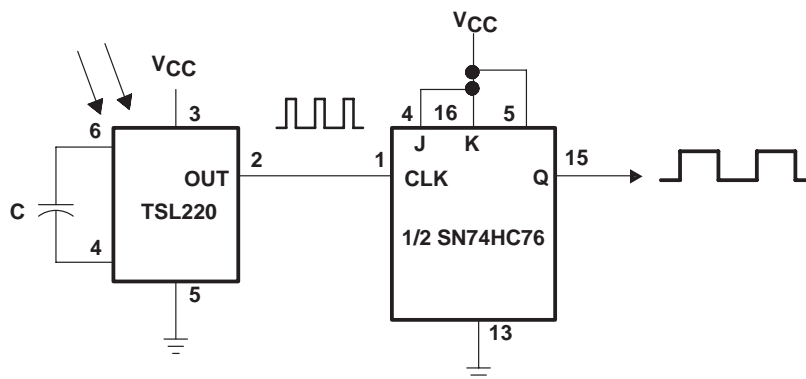
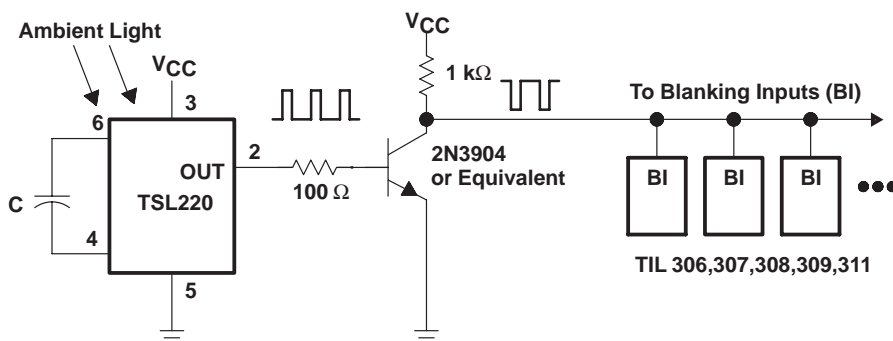


Figure 11. Light-to-Frequency Converter with Square-Wave Output



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

Figure 12. Automatic Display Dimming Circuit

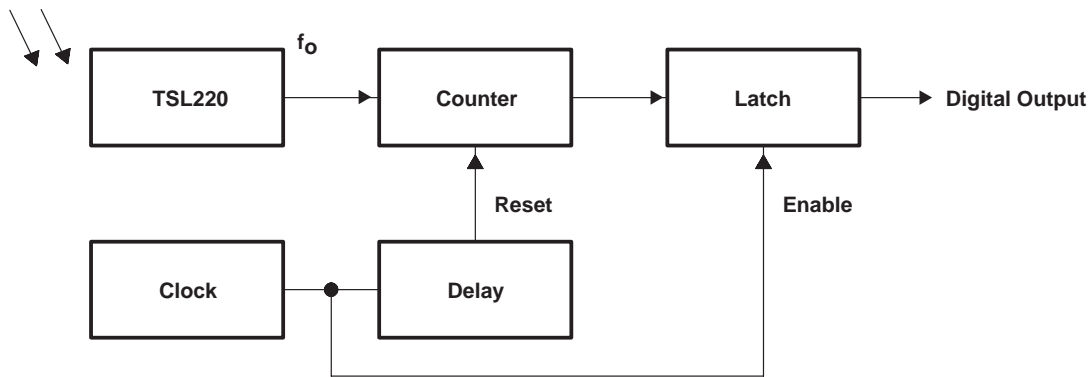
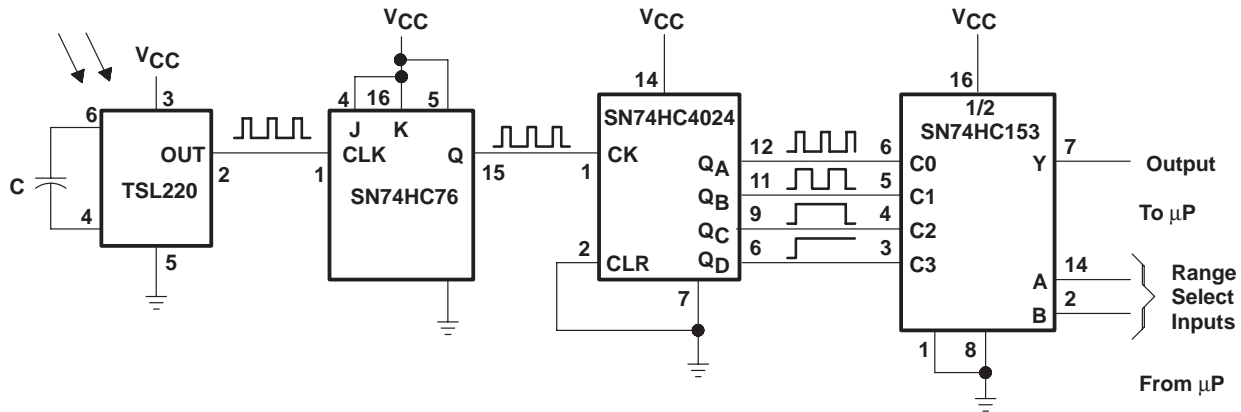


Figure 13. Light-to-Digital Converter

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APPLICATION INFORMATION



NOTE: Adjust C for useful frequency range.

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

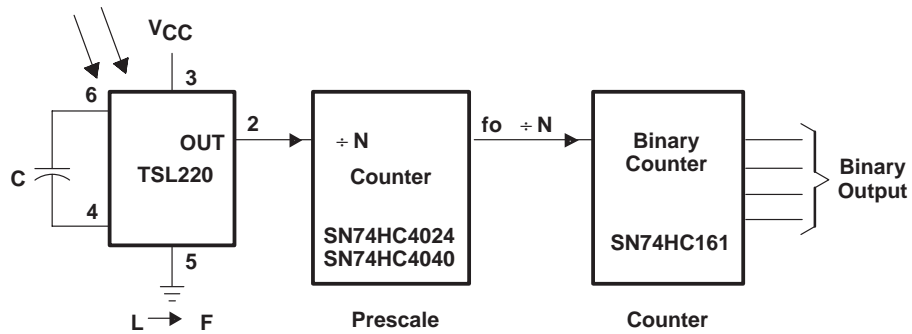


Figure 17. Digital Light Integrator

APPLICATION INFORMATION

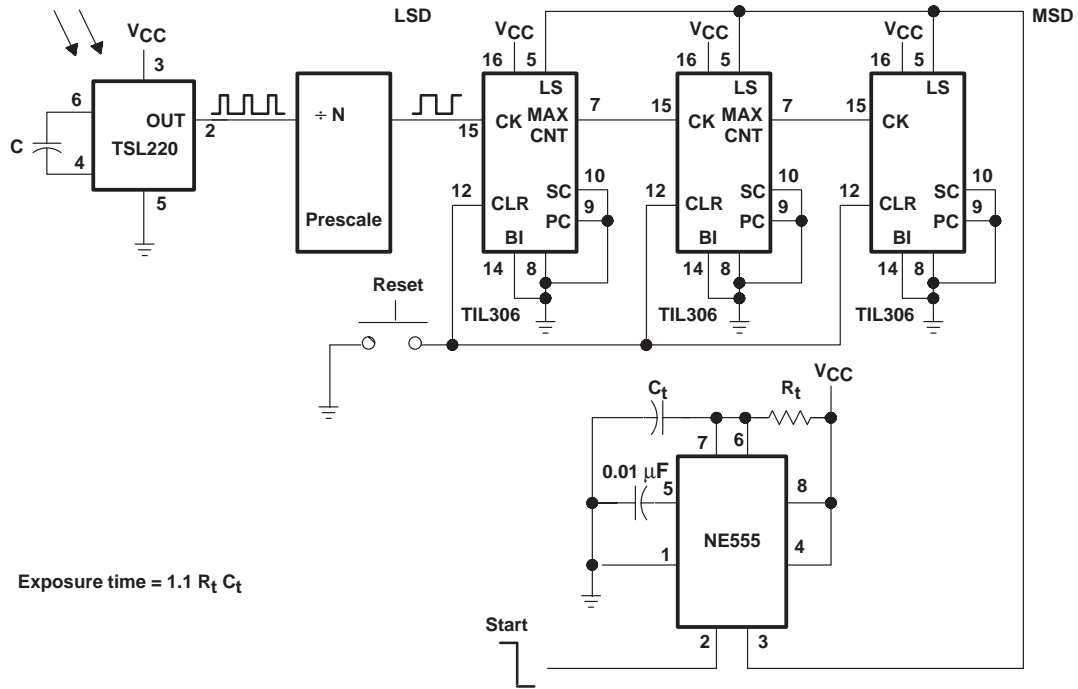


Figure 18. Digital Light Exposure Meter

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