

# TSL230R Light-to-Frequency Converter (#27924)

## General Description

The Texas Advanced Optical Systems (TAOS) TSL230R measures light intensity using an array of photodiodes and outputs a square wave whose frequency is proportional to light intensity striking the surface of the chip.

## Features

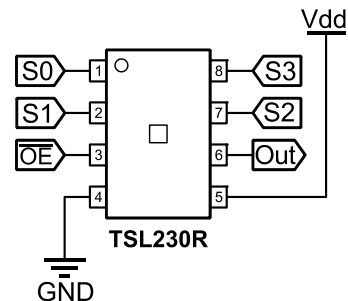
- High-resolution conversion of light intensity to frequency with no external components
- Programmable for three sensitivity levels
- Convenient 8-pin 0.1" DIP package
- 3.3 V or 5 V operation
- Absolute output frequency tolerance of +/- 20%
- Easy to interface directly with microcontrollers

## Application Ideas

- Flash detection
- Cloud detection
- Laser beam interruption detector

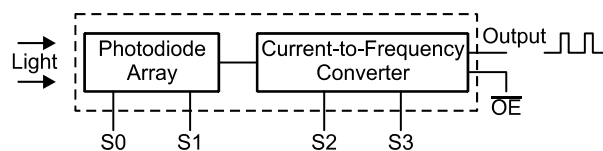
## Pin Definitions and Ratings

Pin	Name	Function
1	S0	Sensitivity select input
2	S1	Sensitivity select input
3	OE	Output Enable
4	GND	Ground 0 V
5	Vdd	+3 to +5 VDC supply voltage
6	Out	Scaled-frequency output
7	S2	Scaling select input
8	S3	Scaling select input



Please see the TSL230R Manufacturer Datasheet for complete device information; it is available from the 27924 product page at [www.parallax.com](http://www.parallax.com).

## Functional Diagram



## Selectable Option Configurations

### Sensitivity

The TSL230R provides three levels of sensitivity (in addition to an off state) to accommodate the measurement of nearly any light intensity. This is accomplished by dividing the photodiode array into sections which can be enabled or disabled to provide the needed sensitivity. The sensitivity is set by setting the appropriate levels on control pins S0 and S1.

S1 S0	Sensitivity
0 0	off
0 1	x 1
1 0	x 10
1 1	x 100

### Output Frequency Scaling

The raw output frequency can vary from approximately 1 Hz to over 1 MHz. Since the top frequency output is so high that some microcontrollers, such as the BASIC Stamp, are unable to measure the frequency, two pins (S2 and S3) on the TSL230R are provided as a frequency divider setting making it possible to measure the output frequency with slower microcontrollers.

S3 S2	Divide output by
0 0	1
0 1	2
1 0	10
1 1	100

### Output Enable

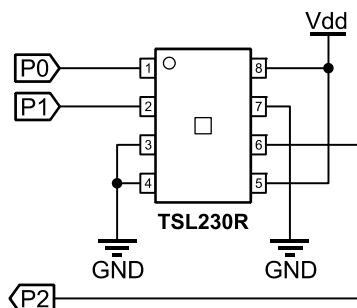
Output enable is provided to disable the chip and drive the output pin to high impedance. This permits shared use of lines for other TSL230s or completely different devices. The pin may be tied to ground if the output enable is not needed. The TSL230R's operating voltage is 2.7V to 5.5V, enabling it to be interfaced directly with any microcontroller which operates in this voltage range; this includes all Parallax microcontrollers.

## Connecting and Testing

The following examples are provided for interfacing the TSL230R with a BASIC Stamp 2 series microcontroller and the Propeller chip. These are rudimentary examples of interfacing with the TSL230R, a robust auto-scaling example for the BASIC Stamp is available for download from the Parallax product page, and the auto-scaling example for the Propeller is available from the Propeller Object Exchange at <http://obex.parallax.com>.

### BASIC Stamp 2 Series

Pins 1 and 2 connected to P0 and P1 respectively set the sensitivity of the TSL230R. For this example these pins are explicitly set to the middle range x10. These can be set to any sensitivity required for the application. Pin 6 is the output and connected to P2, the output is a square wave whose frequency is dependant upon the amount of light striking the TSL230R. This frequency is measured by the BASIC Stamp and output to the debug terminal.



- √ Build the circuit shown above, connecting to the BS2 I/O pins as shown.
- √ Enter and run TSL230R-Test.bs2, listed below.
- √ Pass a flashlight over the TSL230R; you should see the value in the Debug Terminal rise as the TSL230R receives brighter light.

```
' TSL230R-Test.bs2
' Configures TSL230R for x10 sensitivity
' Displays output in Debug Terminal

' {$STAMP BS2}
' {$PBASIC 2.5}

'-----Define variables, set status of pins-----

x  VAR  Word
cnt VAR  Word

'-----Constant declarations-----

S0  PIN 0          'Sensitivity selection pins
S1  PIN 1
In  PIN 2          'TSL230R output pin

'-----Program Start-----

LOW S0             'Set sensitivity pins (S0,S1) to x10
HIGH S1

'-----Main program loop-----

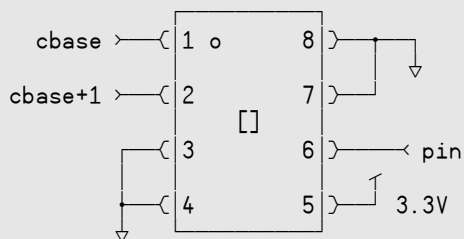
FOR x = 1 TO 2000
  COUNT In, 100, cnt  'COUNT on P2 FOR 100 ms, store value in cnt
  DEBUG HOME, DEC5 cnt 'Display value of cnt as a decimal
NEXT

END
```

## Propeller Example – TSL230 Simple Demo.spin

This example reads the frequency output on pin 6 and displays the number on a television, and it makes use of the TV\_Text object that is included in the home folder of the Propeller Tool software. (If you are not using a Propeller Demo Board, see its schematic for information on connecting a TV to the Propeller chip.) Pins 1 and 2 of the TSL230R are connected to two consecutive pins on the Propeller and set the sensitivity of the TSL230R. For this example the pins are explicitly set to the middle range x10. These can be set to any sensitivity required for the application.

```
{*****
Taos TSL230 light to frequency sensor v1.0 simple demo
```



```

          Coded by Paul Baker (Parallax)
*****}}
CON
  _clkmode = xtall + pll16x
  _XinFREQ = 5_000_000

  pin = 0           'pin connected to tsl230 output
  cbase = 1         'pin connected to S0 (S1 connected to cbase + 1)
  scale = %10       'scale value for tsl230 (%00=off,%01=x1,%10=x10,%11=x100)
  ctrmode = $28000000 'mode value for counter to operate as a frequency counter

OBJ
  term : "tv_text"

PUB go | old
  dira := %11 << cbase 'set scale pins to output
  outa := scale << cbase 'set scale value
  term.start(12)        'start terminal
  frqa := 1             'set counter to increment by one
  ctra := ctrmode + pin 'start counter
  repeat
    waitcnt(80_000_000 / 10 + cnt) 'wait for 100ms
    term.dec(phsa)                'output counter value
    term.out($00)                 'line feed
    phsa := 0                     'reset counter value

```

## Resources and Downloads

The BASIC Stamp and Propeller code and the manufacturer's datasheet, more example applications can be downloaded from the TSL230R product page. Go to [www.parallax.com](http://www.parallax.com), then enter 27924 in the Search field.