21M.370 Digital Instrument Design
Lab assignment 8 - Due April 26 at 2:00pm

Deliverables:

1. A short video showing your photo sensor readings in both transmission mode and reflection mode

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Assignment description:

This lab will be working with a photo sensor to create some kind of custom mechanical interface. The lab will consist of the following parts:

1. Watch an introductory video to optical sensing giving an overview of techniques and applications
2. Solder the sensor from your kit and test in Arduino
3. You should probably screw your sensor and LED down for these tests, and experiment with transmission and reflection mode.

Next weeks lab will continue:

4. Design a mechanical housing for your photo sensor - watch the introductory video for some ideas.
5. Implement a minimal viable instrument using just your photosensor.

Video tutorials for this week

6. Introduction and overview of optical sensing
7. Soldering your sensor
8. Testing in Arduino

Links:

1. Optical light photocells

2. Transmission mode vs reflection mode
3. Optical sensors and elevator doors
4. Optical heart rate sensor
5. Piano Key Sensing
6. Roland D-Beam, and Schematic
7. optical rotary encoder
8. Vibrating string sensors
    1. Violin
    2. Guitar 1 2 3 4 5
9. Alphasphere
10. Ballagumi

Determining LED resistor Value

Guide to determining resistor value for LEDs
Sparkfun guide

For our IR LED, here are some relevant specs:

1. Forward Voltage (Vf) = 1.2V (from the datasheet)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Units
Forward Voltage	V_F	I_F=20mA		1.2	1.5	V

2. Test current (If) = 20mA

Resistor value (Ohms) = (Supply Voltage (V) – LED forward voltage (Vf)) / desired LED current (I, in amps).
R = (V - Vf) / I
R = (3.3v - 1.2v) / 0.02A = 105 ohms

So our resistor for the LED should be 100 ohms.

(FYI, there is actually a 100 ohm resistor in series with all of the pins on our board already. This is to protect the ESP32 pins from static shocks. When you add a 2nd 100 ohm resistor you will decrease the LED current to ~10mA, which is still totally acceptable. If you really need max LED brightness you could omit the resistor on the LED breakout, but don't do that unless you really need to.)

Determining the Bias value for the transistor

Choosing the right value for the transistor circuit is highly dependent upon the application. For our purposes, try a 10k resistor.

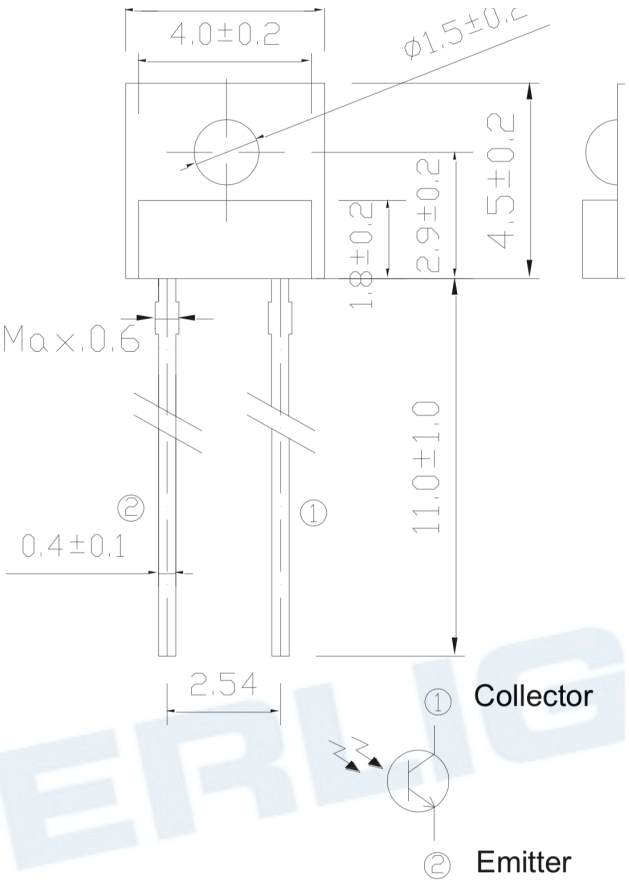
Phototransistor pinout

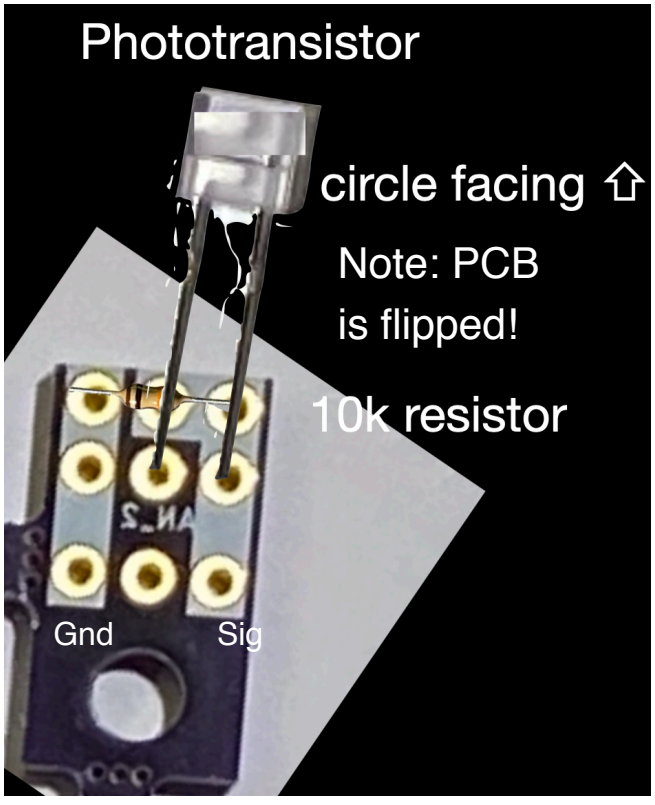
With circle facing towards you collector is on the right

Collector is positive, emitter is negative

Note - PCB is flipped - pay attention to where Signal and Ground are

- L shape on breakout is signal
- straight line is ground





LED pinout

With circle facing you cathode is on the left

Anode is positive, cathode is negative