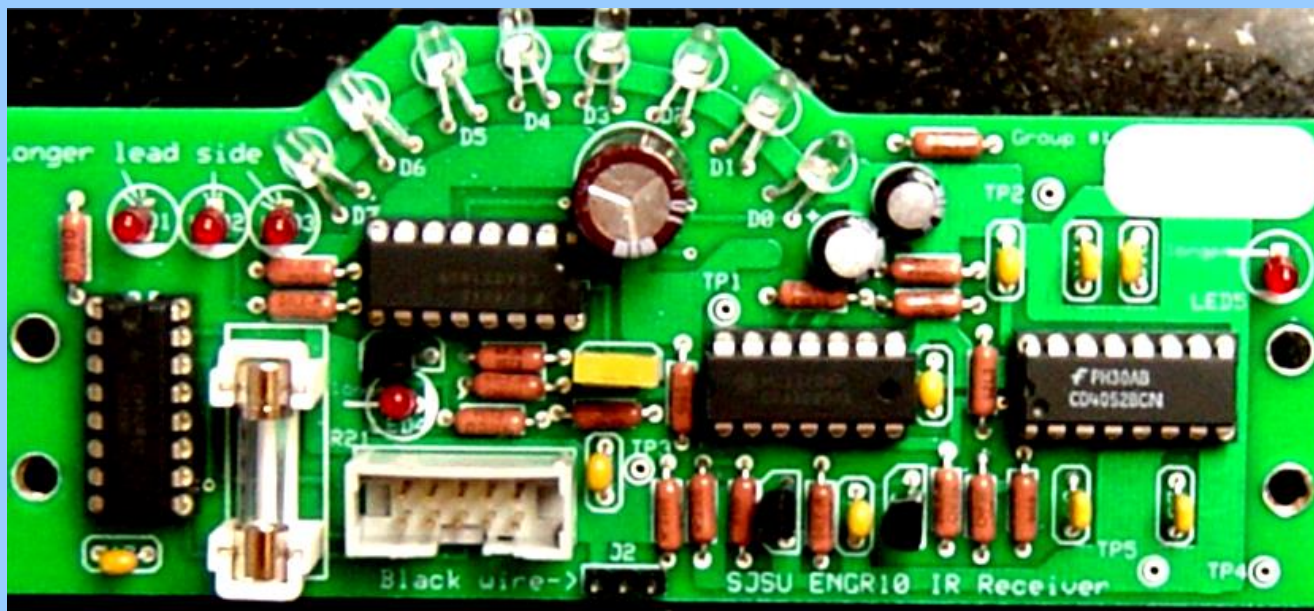
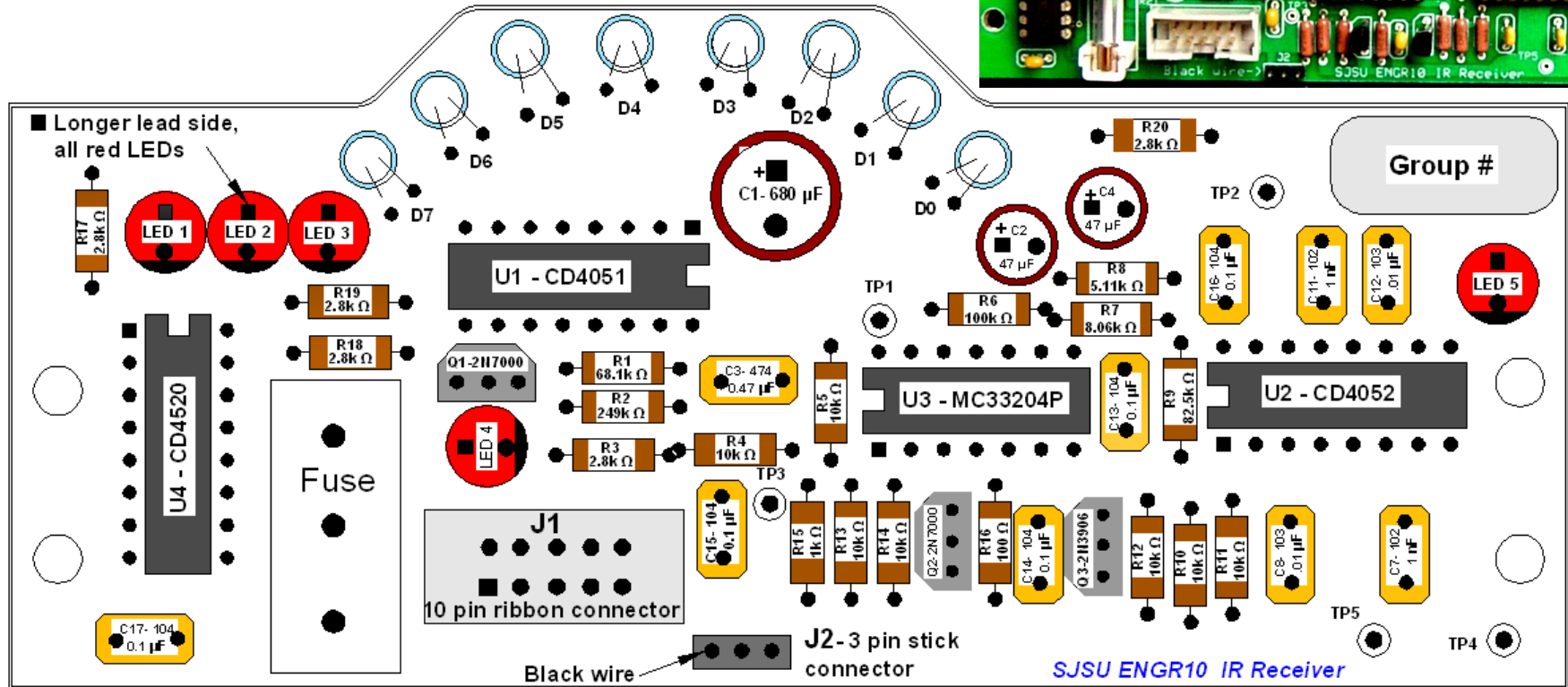
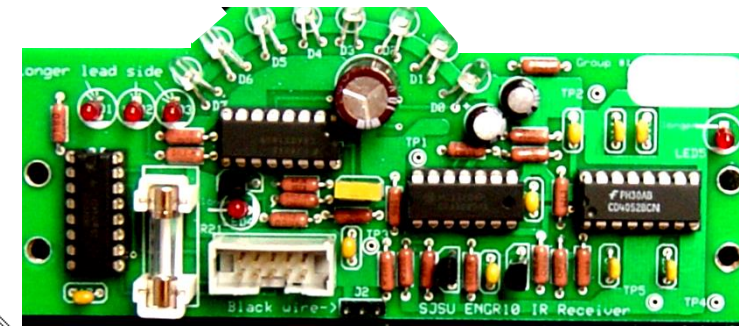


# Robot Electronics



# Robot Project - The IR board



ky

## Resistors



- |              |              |              |
|--------------|--------------|--------------|
| R1 = 68.1k Ω | R8 = 5.11k Ω | R15 = 1k Ω   |
| R2 = 249k Ω  | R9 = 82.5k Ω | R16 = 100 Ω  |
| R3 = 2.8k Ω  | R10 = 10k Ω  | R17 = 2.8k Ω |
| R4 = 10k Ω   | R11 = 10k Ω  | R18 = 2.8k Ω |
| R5 = 10k Ω   | R12 = 10k Ω  | R19 = 2.8k Ω |
| R6 = 100k Ω  | R13 = 10k Ω  | R20 = 2.8k Ω |
| R7 = 8.06k Ω | R14 = 10k Ω  |              |

## Capacitors

Polarized (+,-)



Non-Polarized



- |                  |                   |
|------------------|-------------------|
| C1 = 10v 680 μF  | C12 = 103, .01 μF |
| C2 = 10v 47 μF   | C13 = 104, .1 μF  |
| C3 = 474, .47 μF | C14 = 104, .1 μF  |
| C4 = 10v 47 μF   | C15 = 104, .1 μF  |
| C7 = 102, 1 nF   | C16 = 104, .1 μF  |
| C8 = 103, .01 μF | C17 = 104, .1 μF  |
| C11 = 102, 1 nF  |                   |

## Transistors



- Q1 = 2N7000  
 Q2 = 2N7000  
 Q3 = 2N3906

## Infrared Detectors



8 – white color

## LEDs



5 – red color

## Integrated Circuits



- U1 = CD4051, 16-pin  
 U2 = CD4052, 16-pin  
 U3 = MC33204P, 14-pin  
 U4 = CD4520, 16-pin

# Resistors

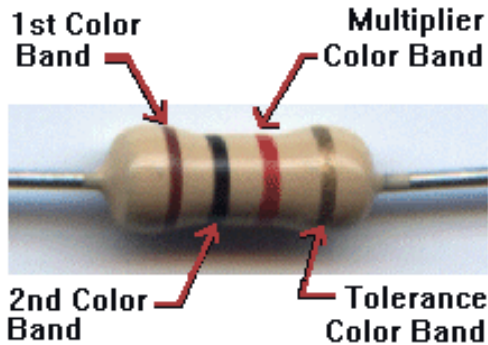
Resistors are passive elements that **oppose/restrict the flow of current.**

A voltage is developed across its terminal, proportional to the current through the resistor.

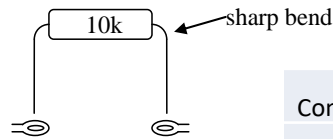
$$V = IR \quad \text{Units: Ohms } (\Omega)$$



Variable resistor (potentiometer)



Constant resistor



Resistor ID and values for the IRB

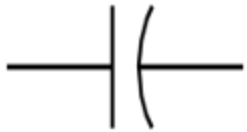
Component ID	Value	Marking
R15	1k $\Omega$	1k 1%
R4,5,10,11,12,13,14	10k $\Omega$	10k 1%
R6	100k $\Omega$	100k 1%
R16	100 $\Omega$	100 $\Omega$ 1%
R3, 17,18,19,20	2.8k $\Omega$	2.8k 1%
R2	249k $\Omega$	249k 1%
R8	5.11k $\Omega$	5.11k 1%
R1	68.1k $\Omega$	68.1k 1%
R7	8.06k $\Omega$	8.06k 1%
R9	82.5k $\Omega$	82.5k 1%

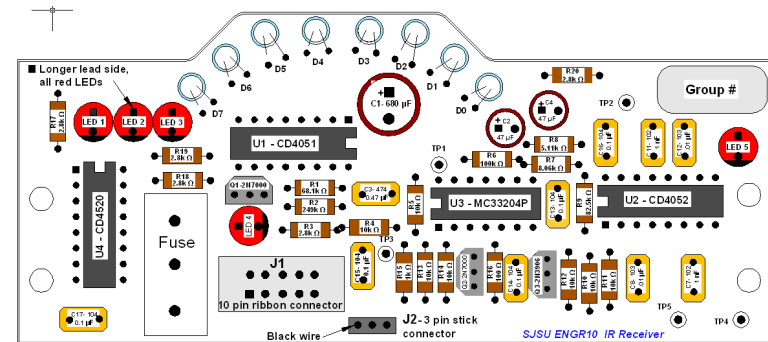
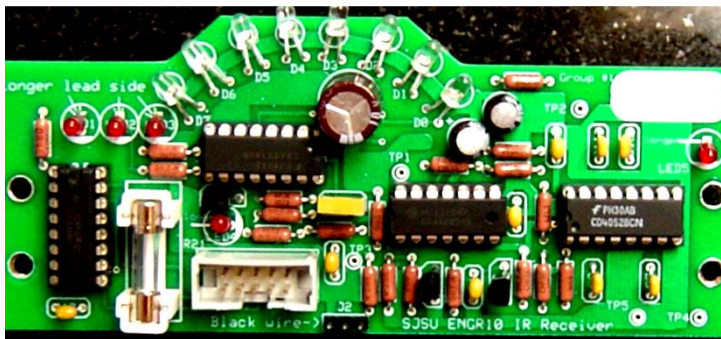
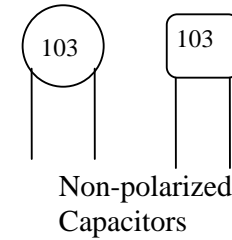
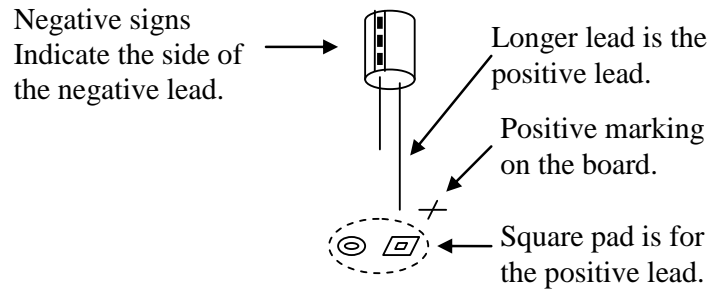
# Capacitors

- Store energy and release it later (small battery)  
**(store energy and release it later. )**
- are made of two parallel conductors separated by a dielectric.
- are used for **filtering, tuning, separating signals , etc.**
- The ability of a capacitor to store charge is called  
**“Capacitance”**

$$C = Q/V \quad (\text{amount of charge stored/applied voltage})$$

- The unit of capacitance is the **Farad**.  
Commonly used capacitances are much smaller than 1 Farad, micro-Farads ( $10^{-6}$  Farad,  **$\mu\text{F}$** ),  
nano-Farads ( $10^{-9}$  Farad, **nF**),  
pico-Farads ( $10^{-12}$  Farad, **pF**).





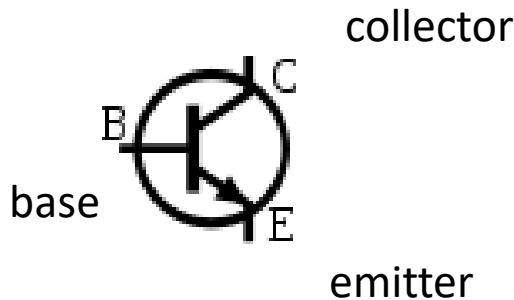
## Capacitor ID numbers, capacitances, and markings on the capacitors

Component ID	Value	marking	Remark
C2, 4	47 $\mu$ F	47 $\mu$ F 10v	polarized
C1	680uF	10v 480 $\mu$ F	polarized
C7, C11	1nF	102	Not polarized
C8, C12	.01 $\mu$ F	103	Not polarized
C13, 14, 15, 16, 17	0.1 $\mu$ F	104	Not polarized
C3	0.47 $\mu$ F	474	Not polarized

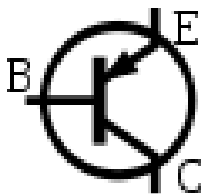
# Transistors

Transistors are commonly used for **signal amplification, switching, voltage regulation, etc.**

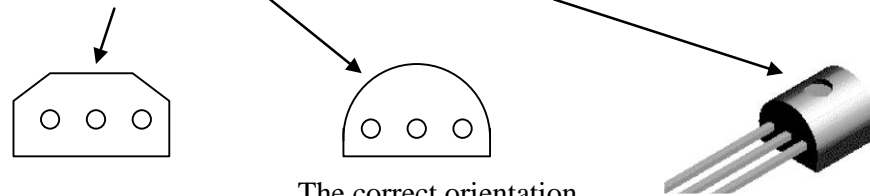
## Symbol for the NPN Transistor



## Symbol for the PNP Transistor



The curved side should be oriented the same way.

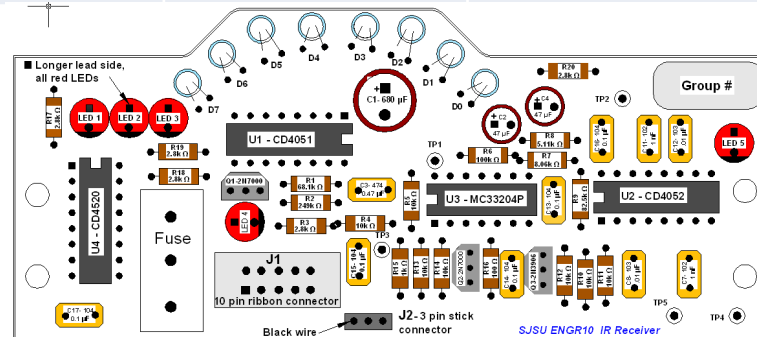


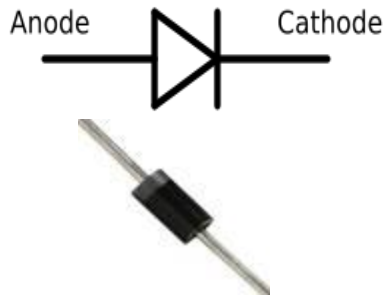
Marking on the board

The correct orientation for placing a transistor.

Transistor ID numbers, types, and markings on the transistors.

Transistor ID	Transistor type	Marking
Q1, Q2	2N7000	2N7000
Q3	2N3906	2N3906





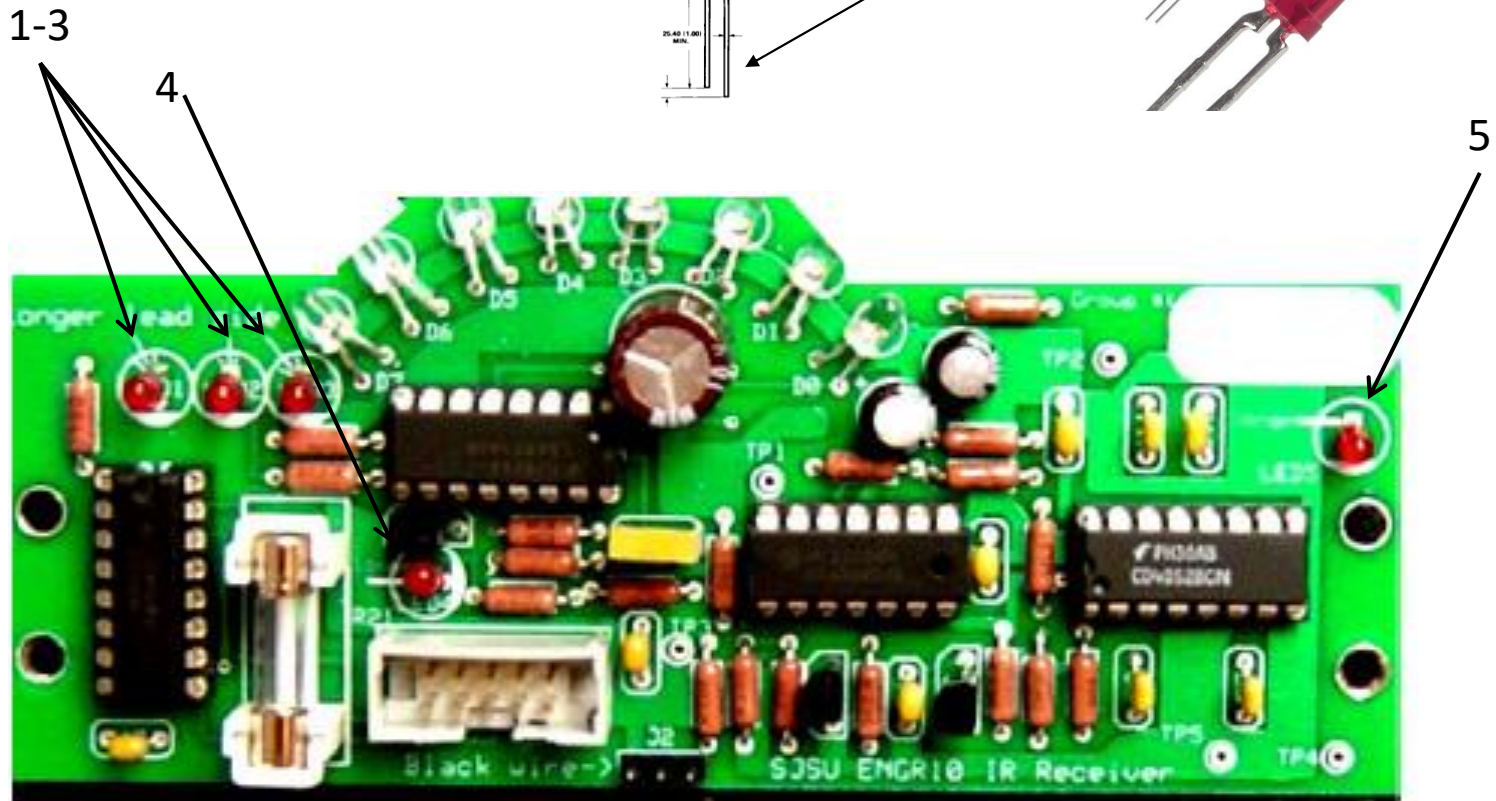
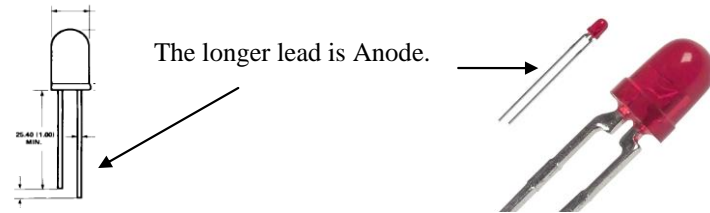
**Diodes** are semiconductor devices that **allow current in only one direction**



**Fuses** are devices that **protect the circuit from overload.**

## LEDs- Light Emitting Diodes:

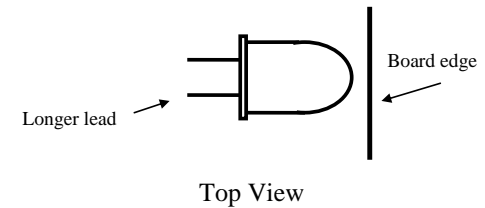
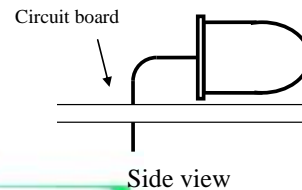
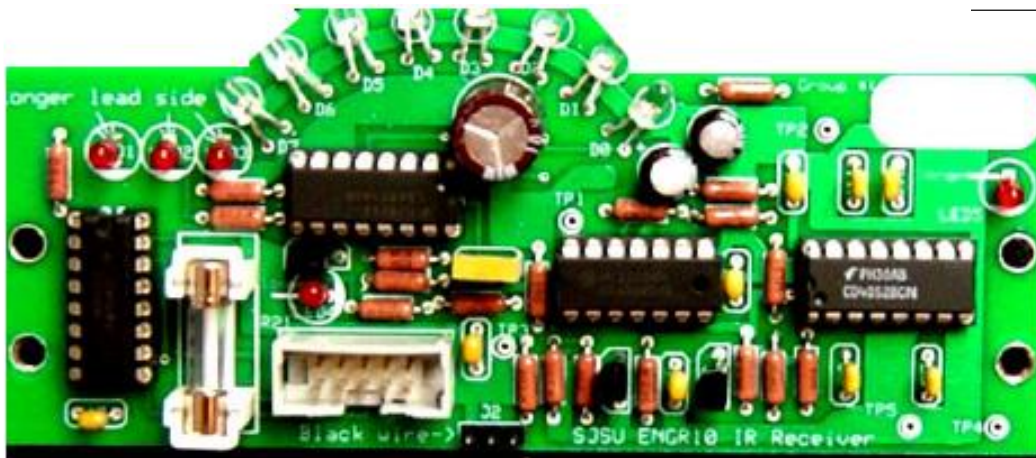
- A special kind of diode: They allow current to flow in one direction.
- The LED will light up when the proper amount of current passes through.





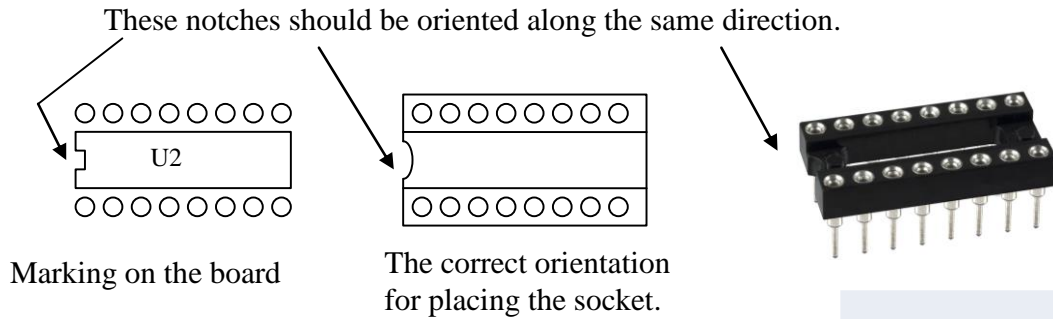
## Infrared Detectors

- The appearance of these infrared photo detectors and the internal structure is similar to that of an LED.
- The infrared photo detector has a focal direction, and the detection angle is about  $15^\circ$ . ( $8 \times 15 = 120^\circ$ )
- This small detection angle allows the controller to **tell the direction where the infrared light comes from.**



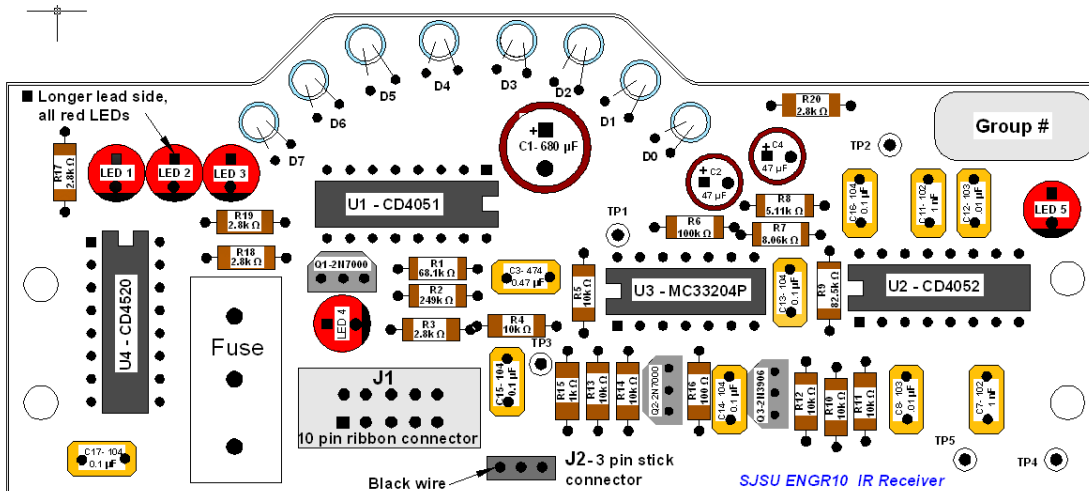
# Sockets for Integrated Circuits

Must be soldered in position before the ICs are inserted



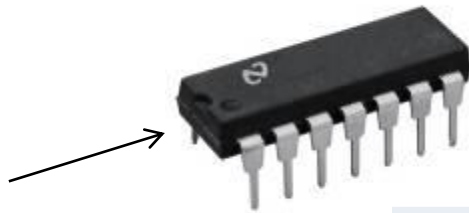
IC socket ID numbers and type.

Component ID	Type	Marking
U3	DIP14 socket	14-pin
U1, 2, 4	DIP16 socket	16-pin



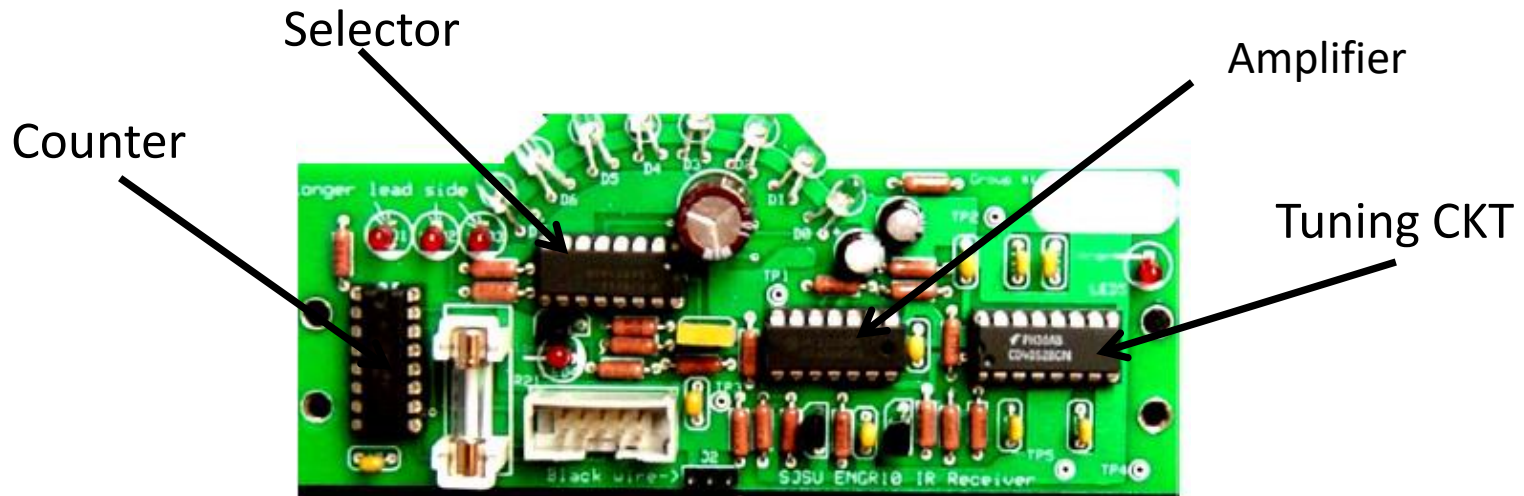
# Integrated Circuits

Orientation



IC parts number and function.

ID	Parts number	Function
U1	CD4051	8 to 1 multiplexer
U2	CD4052	Dec 4 to 1 multiplexer
U3	MC33204P	Rail-to-Rail Op Amp
U4	CD4520	Counter



# Connectors

There are two connectors on the board – J1 and J2. J1 is a 10-pin ribbon cable connector. J2 is a 3-pin stick connector. J1 should be placed according to Figure 12. J2 can be placed in either orientation but the shorter pin side should be placed into the holes. You will see a place on the circuit board labeled for J3. For this project, J3 is not used.

