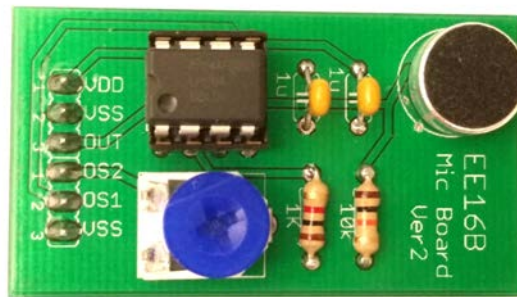


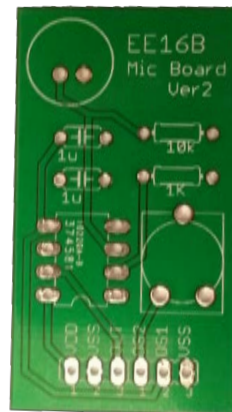
## Mic Boards: A Guide to Assembly



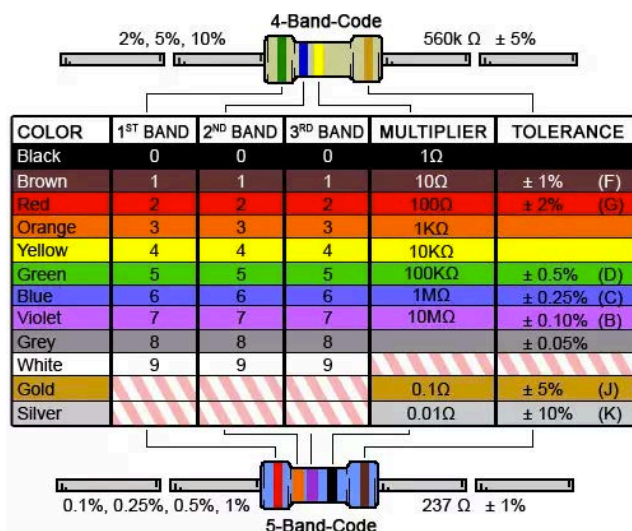
This week in lab, we will be assembling the mic board PCB (Printed Circuit Boards) that we will be using in the Color Organ Lab and for your final project, the robot car SIXT33N.

### Materials:

- 1 x microphone
- 1 x Op Amp
- 1 x 8-pin socket
- 2 x 1  $\mu$ F Capacitors
- 1 x 10 k $\Omega$  Resistor
- 1 x 1 k $\Omega$  Resistor
- 1 x 50 k $\Omega$  potentiometer
- 6 x Jumper pins (don't break apart!)
- 1 x MicBoard PCB



All of the above materials (except for the potentiometer and PCB) should be found in your parts kit. **Check the resistors and capacitor values carefully! The two charts below should be helpful.**



Picofarad (pF)	Nanofarad (nF)	Microfarad (uF)	Code
4700	4.7	0.0047	472
5000	5.0	0.005	502
5600	5.6	0.0056	562
6800	6.8	0.0068	682
10000	10	0.01	103
15000	15	0.015	153
22000	22	0.022	223
33000	33	0.033	333
47000	47	0.047	473
68000	68	0.068	683
100000	100	0.1	104
150000	150	0.15	154
200000	200	0.2	254
220000	220	0.22	224
330000	330	0.33	334
470000	470	0.47	474
680000	680	0.68	684
1000000	1000	1.0	105
1500000	1500	1.5	155
2000000	2000	2.0	205
2200000	2200	2.2	225

## Assembly:

You can review how to solder parts here: <https://www.youtube.com/watch?v=eU4t0Yko9Uk>

Each lab station should have a soldering station with an iron and a sponge. Some notes

- Make sure the sponge is damp *before* wiping the hot iron – a squirt bottle can be found at the GSI desk
- TURN OFF the soldering station when leaving lab
- Make sure to solder in areas with proper ventilation (ie: don't breathe in the fumes!)
- Wash your hands before eating! (You should do this after lab anyway)

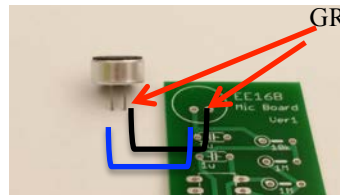
Each component is marked on the PCB – make sure to put them in the right spots! A few things to be aware of:

- The microphone is *polarized* – this means that it matters which way we install it on the board. Make sure that the 'ground side' is on the right (the mic should fit in the circle):

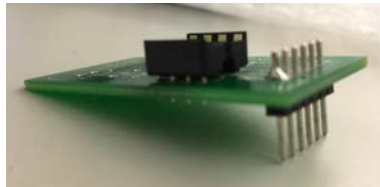
GROUND SIDE  
(note the three wires)



GROUND SIDE



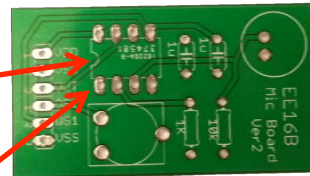
- Don't solder the op-amp directly! Solder the socket to the board, that way we can swap out op-amps.
- Keep all 6 jumper pins connected. This will make it a lot easier to solder them in.
- Make sure the long side (of the jumpers) is pointing *down*. This means that you will solder them **on top** of the board (we will use these to plug the mic board into our breadboards)



- Note which way the op-amp needs to be placed in the socket. Pin one should be in the **lower right hand corner!** You can tell which way the op amp needs to be by looking at the white outline on the board. The little notch on the bottom tells us that this is where the "top" of the op amp should be

Notch

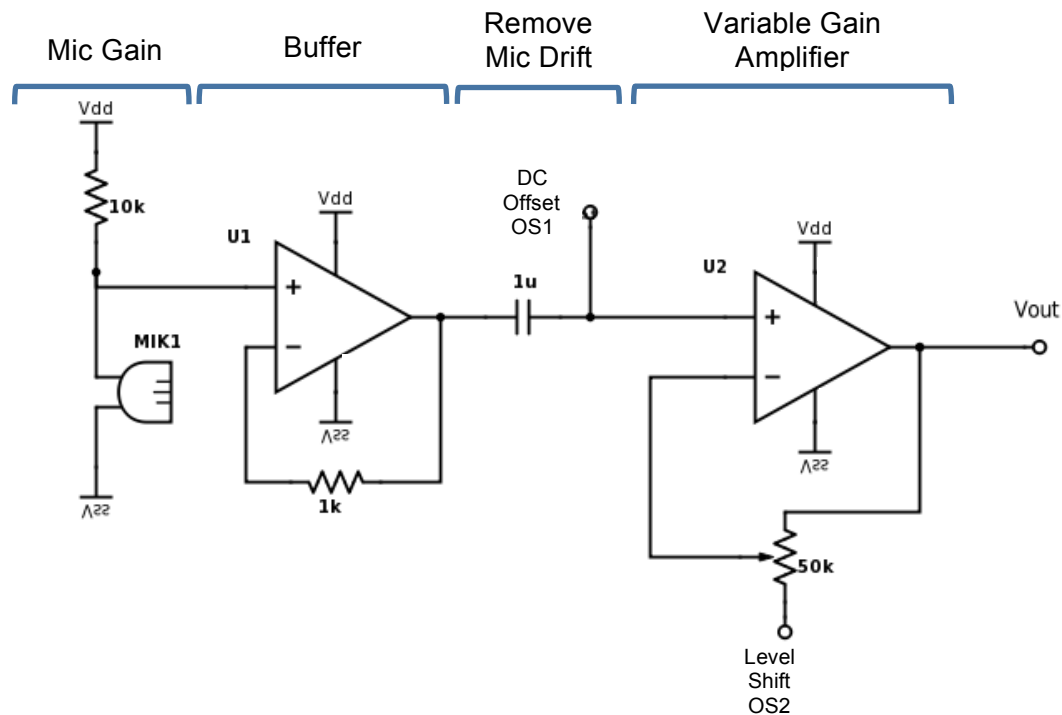
Pin 1



- Make sure you use enough solder to make a solid connection. There should be a little blob that's big enough to cover the entire metal contact on the board. If you aren't sure, ask your GSI.

### Operation:

The Mic Boards use the following schematic:



You might have also noticed that there is another 1 uF capacitor on your mic board. This is known as a “decoupling capacitor” and is used to help filter out noise that might be present in the power rails. It is connected directly between VDD and VSS.

Don’t worry too much about what each of the stages do right now – we will be looking into them in more depth in a couple of weeks.

The microphone can be thought of as a variable current source – it produces current in reaction to sound input. Since we want to work with voltages, we put the mic in series with the 10 k $\Omega$  resistor, then pick off the voltage drop across the resistor.

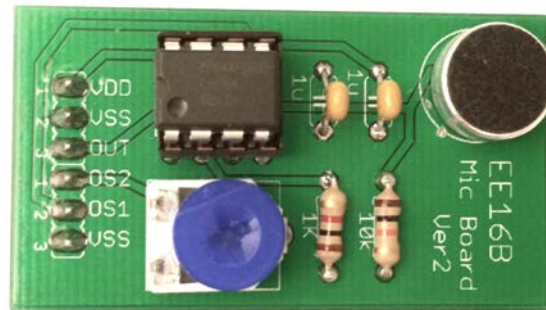
The next stage is a buffer to keep the rest of the circuit from influencing our mic signal. After that, the 1 uF capacitor is used to remove the DC offset from the microphone signal (we will discuss this more during the project). This is essentially a high-pass filter.

The last stage is a variable non-inverting amplifier. The 50 k $\Omega$  potentiometer can be used to tune the gain to whatever is needed. We will talk more about what the DC offset and Level Shift terminals mean when we start the project, but for now we will connect them to ground.

### Testing:

To test that your mic board is functioning properly, we will hook it up the oscilloscope. We will need to use four of the six pins we soldered in.

VDD – Set this at 5V  
VSS – Set this at -5V  
Only 1 must be connected  
OUT – O-Scope Probe  
OS2 – Set this to GND  
OS1 – 100k $\Omega$  resistor to ground



Note: set the time step to 10 ms/division!

Probe at the OUT terminal of the mic board, and try speaking into the microphone. You may not see anything at first. That's ok! The potentiometer sets the gain of our board. If the gain is too low, we won't see a signal, and if the gain is too high, it might rail.

Turn the potentiometer counter-clockwise for more gain and clockwise for less. There are screwdrivers at the TA desk. When adjusted appropriately, you should see a signal that responds when you make noise, centered around ground.