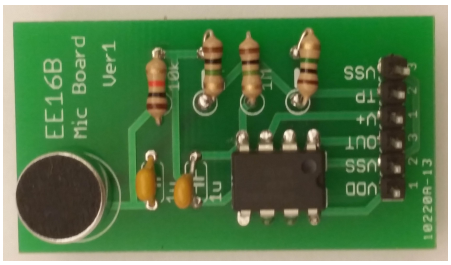
EE 16B
Fall 2016

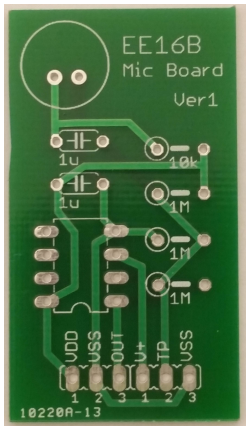
Mic Boards: A guide to Assembly



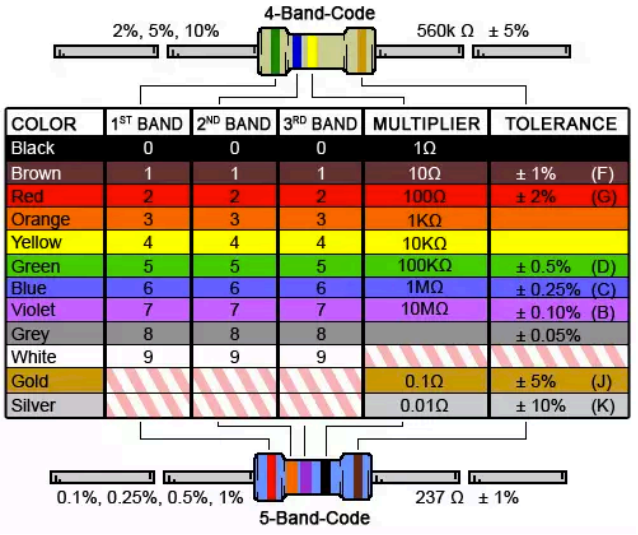
This week in lab, we will be assembling the mic board PCB (Printed Circuit Boards) that we will be using in the Color Organ Lab and for your final project, the robot car SIXT33N.

Materials:

- 1 x microphone
- 1 x Op Amp
- 1 x 8-pin socket
- 2 x 1 µF Capacitors
- 1 x 10 kΩ Resistor
- 3 x 1 MΩ Resistor
- 6 x Jumper pins (don't break apart!)
- 1 x MicBoard PCB



All of the above materials should be found in your parts kit. Check the resistors and capacitor values carefully! The two charts below should be helpful:



COLOR	1ST BAND	2ND BAND	3RD BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1Ω	
Brown	1	1	1	10Ω	± 1% (F)
Red	2	2	2	100Ω	± 2% (G)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	± 0.5% (D)
Blue	6	6	6	1MΩ	± 0.25% (C)
Violet	7	7	7	10MΩ	± 0.10% (B)
Grey	8	8	8		± 0.05%
White	9	9	9		
Gold				0.1Ω	± 5% (J)
Silver				0.01Ω	± 10% (K)

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
3300000	3300	3.3	335

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

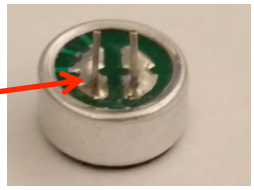
Each lab station should have a soldering station with an iron and a sponge. Some notes

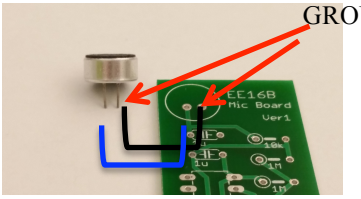
- Make sure the sponge is damp *before* wiping the hot iron – a squirt bottle can be found at the GSI desk
- TURN OFF the soldering station when leaving lab
- Make sure to solder in areas with proper ventilation (ie: don't breathe in the fumes!)
- Wash your hands before eating! (You should do this after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

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

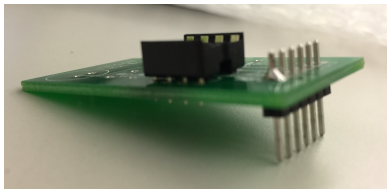
- The microphone is *polarized* – this means that it matters which way we install it on the board. Make sure that the 'ground side' is on the right (the mic should fit in the circle):

GROUND SIDE
(note the three wires)

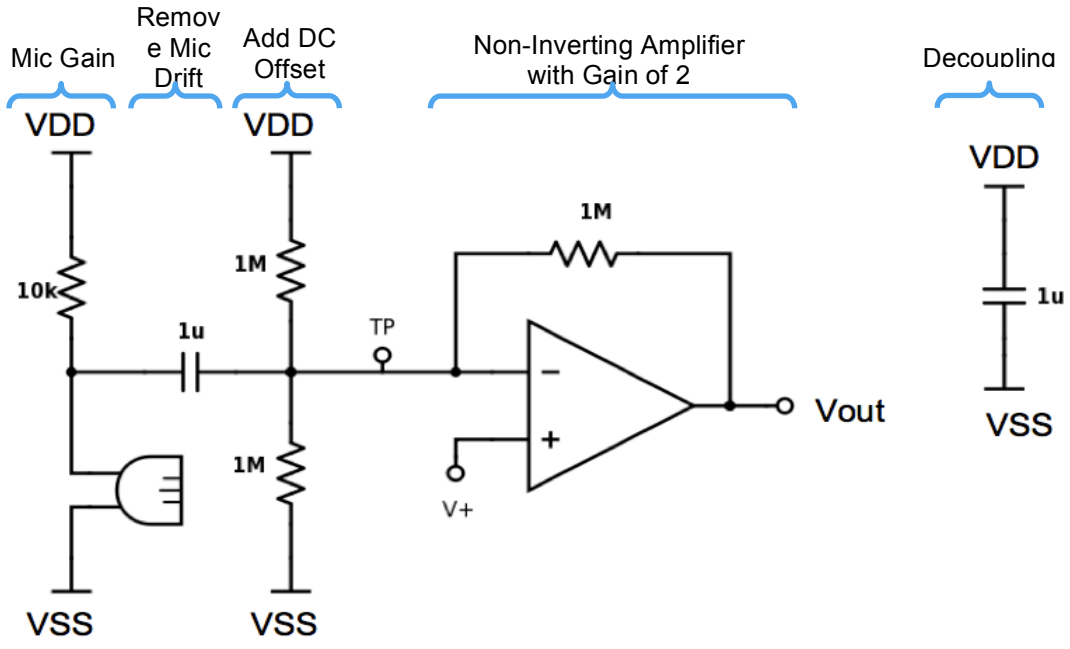




- Don't solder the op-amp directly! Solder the socket to the board, that way we can swap out op-amps.
- Keep all 6 jumper pins connected. This will make it a lot easier to solder them in.
- Make sure the long side (of the jumpers) is pointing *down*. This means that you will solder them **on top** of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



Testing:
The Mic Boards use the following schematic:



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.

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

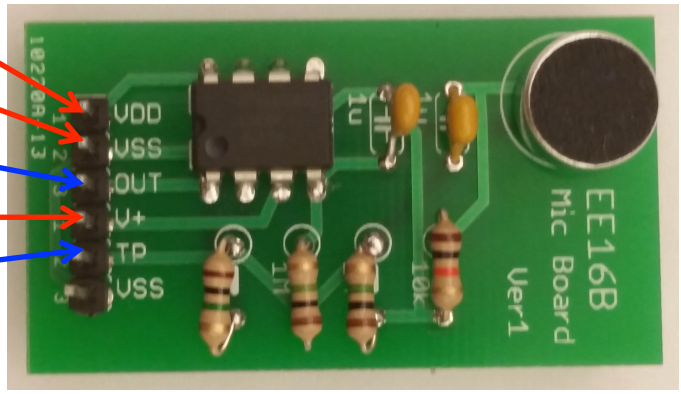
VDD – Set this at 3.3 V

VSS – Set this at -3.3 V

OUT – O-Scope Probe

V+ – Set this to GND

TP – O-Scope Probe



Test 1:

- Hook up VDD = 3.3V, VSS = -3.3 V, and O-Scope probe to the TP pin.
- Zoom out in time (~10 ms/Division)
- Signal will be small, but might be visible

The TP point is located just after the DC offset is added, but before amplification. We might be able to see some pretty loud noises on the oscilloscope, but normal talking might not show up. Try clapping near the mic, or tapping the mic directly. You should see some reaction, even if it is small.

Test 2:

- Hook up VDD = 3.3V, VSS = -3.3 V, and V+ = GND
- Connect the o-scope to the OUT pin
- Zoom out in time (~10 ms/Division)
- Signal should be visible (~1-2 V in amplitude)

As we can see in the schematic above, we can see that VOUT is after the amplifying stage. This will make the mic signal more obvious. You should be able to see a reaction when speaking at a normal volume 2-3 feet from the mic.

Alternatively, you can also play a pure tone (ie: a sine wave) using your phone/laptop. Here is a website that works really well: http://www.szynalski.com/tone-generator/

Since a pure tone only consists of one frequency, it can be readily seen on the oscilloscope. This makes measuring things like amplitude really easy.