

# LipSync

## ASSEMBLY MANUAL

---

Version 1.4.6

# CONTENTS

- 2 Part 0a - Obtaining Components and Files
- 3 Part 0b - Component Checklist
- 8 Part 0c - Equipment Checklist
- 9 Electrical Assembly
- 30 Joystick Assembly
- 51 Setting Up the Device

## PART 0a

### OBTAINING COMPONENTS AND FILES

**Components should be ordered at least 2 weeks in advance to allow for sufficient shipping time. See Part 0b for the full list of components and its purchase links.**

All components can be purchased through the links listed under each item. Required parts from Digikey can be purchased here:

**Canada:** <http://www.digikey.ca/short/qpbhpc>

**United States:** <http://www.digikey.com/short/qpbhpc>

Download all the necessary files and directories to assemble a LipSync:

<https://github.com/makersmakingchange/LipSync/blob/master/README.md>

**LipSync-master\Hardware\Housing\_design:** Contains all 3D printing files in STL format and its respective print settings

**LipSync-master\Hardware\PCB\_design:** Contains schematic and layout for the LipSync printed circuit boards

**LipSync-master\Software\LipSync\_Firmware:** Contains microcontroller code

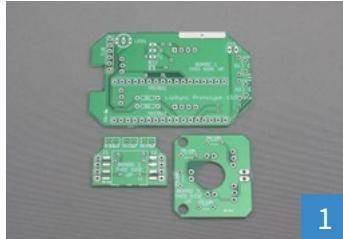
**LipSync-master\LipSync\_BOM.csv:** Contains LipSync Components in CSV format

# PART 0b

## COMPONENT CHECKLIST

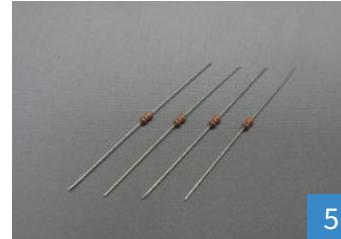
- 1** (1) LipSync Circuit Board Package (3 boards)
- 2** (1) Arduino Micro **OR**  
(1) Genuino Micro
- 3** (2) Right Angle Push Buttons
- 4** (2) 300 Ohm 1/4W T/H Resistors
- 5** (4) 10k Ohm Mini 1/4W T/H Resistors
- 6** (1) NXP Semiconductors Pressure Sensor
- 7** (1) 0.01uF Ceramic T/H Radial Capacitor
- 8** (1) 1.0uF Ceramic T/H Radial Capacitor
- 9** (1) 470pF Ceramic T/H Capacitor

<input type="checkbox"/> <b>10</b>	(2) 17-Position Straight Female T/H Headers	<input type="checkbox"/> <b>22</b>	(1) Joystick Rocker	<input type="checkbox"/> <b>34</b>	(1) Luer Lock Nut
<input type="checkbox"/> <b>11</b>	(2) 3-Position Right Angle Male Headers	<input type="checkbox"/> <b>23</b>	(1) Joystick Baseplate	<input type="checkbox"/> <b>35</b>	(4) Bumpers
<input type="checkbox"/> <b>12</b>	(2) 3-Position Straight Female Header	<input type="checkbox"/> <b>24</b>	(1) Rear Housing	<input type="checkbox"/> <b>36</b>	(4) Nuts M3
<input type="checkbox"/> <b>13</b>	(2) 4-Position Straight Female T/H Headers	<input type="checkbox"/> <b>25</b>	(2) Buttons	<input type="checkbox"/> <b>37</b>	(1) Tubing 3/32" ID x 45mm
<input type="checkbox"/> <b>14</b>	(1) Break Away Male Headers	<input type="checkbox"/> <b>26</b>	(1) Mouthpiece	<input type="checkbox"/> <b>38</b>	(1) Light Pipe
<input type="checkbox"/> <b>15</b>	(1) 5mm Bi-Color T/H LED	<input type="checkbox"/> <b>27</b>	(1) Filter	<input type="checkbox"/> <b>39</b>	(1) Threaded Insert 5/8"-27
<input type="checkbox"/> <b>16</b>	(1) Shunt Connector	<input type="checkbox"/> <b>28</b>	(1) Luer Lock Fitting	<input type="checkbox"/> <b>40</b>	(1) Threaded Adapter 5/8"-27
<input type="checkbox"/> <b>17</b>	(1) 2N3906 PNP-Type T/H Transistor	<input type="checkbox"/> <b>29</b>	(4) Force Resistive Sensor	<input type="checkbox"/> <b>41</b>	(1) USB Cable
<input type="checkbox"/> <b>18</b>	(1) 6-Position Straight Female T/H Header	<input type="checkbox"/> <b>30</b>	(4) Screws Phillips Head M3	<input type="checkbox"/> <b>42</b>	(1) USB Adapter
<input type="checkbox"/> <b>19</b>	<b>OPTIONAL</b> (1) 1-Position Straight Female T/H Header	<input type="checkbox"/> <b>31</b>	(6) Compression Springs	<input type="checkbox"/> <b>43</b>	(1) Cable Tie
<input type="checkbox"/> <b>20</b>	(1) Front Housing	<input type="checkbox"/> <b>32</b>	(2) Standoffs M3 10mm	<input type="checkbox"/> <b>44</b>	(10) Velcro Strap 0.5" x 6"
<input type="checkbox"/> <b>21</b>	(1) Joystick Front Plate	<input type="checkbox"/> <b>33</b>	(2) Standoffs M3 15mm	<input type="checkbox"/> <b>45</b>	<b>OPTIONAL</b> (1) Magic Arm 11" and Clamp



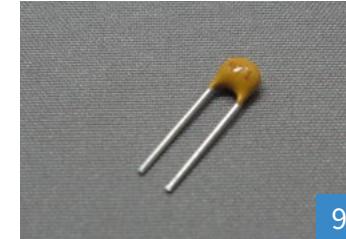
LipSync Circuit Board Pack:  
(1) Main Interface Board  
(1) Pressure Sensor Board  
(1) Joystick Board  
[LipSync GitHub](#)

1



(4) 10k Ohm Mini Axis  
Through Hole Resistors  
[Digikey.ca](#)  
[Digikey.com](#)  
\*or from any electronics shop

5



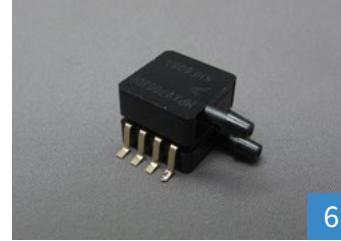
(1) 470pF Ceramic Through  
Hole Radial Capacitor  
[capacitor label: 471]  
[Digikey.ca](#)  
[Digikey.com](#)  
\*or from any electronics shop

9



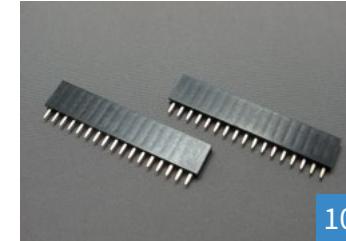
(1) Arduino Micro/ Genuino  
Micro microcontroller  
[Arduino](#) [Digikey](#) [Robotshop](#)  
[Adafruit](#) [Pololu](#)  
**COMPATIBILITY NOTE:** The  
"Arduino Micro" or "Genuino  
Micro" **MUST** be used.

2



(1) NXP Pressure Sensor  
[component label:  
MPXV7002DP]  
[Digikey.ca](#)  
[Digikey.com](#)

6



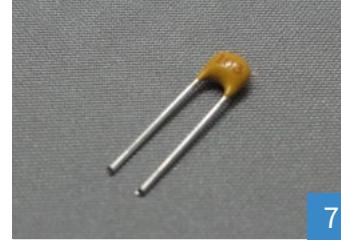
(2) 17-Position Straight  
Female Through Hole  
Headers  
[Digikey.ca](#)  
[Digikey.com](#)  
\*or from any electronics shop

10



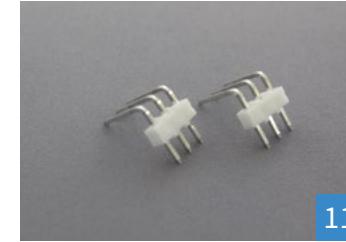
(2) Right Angle Push Buttons  
[Digikey.ca](#)  
[Digikey.com](#)

3



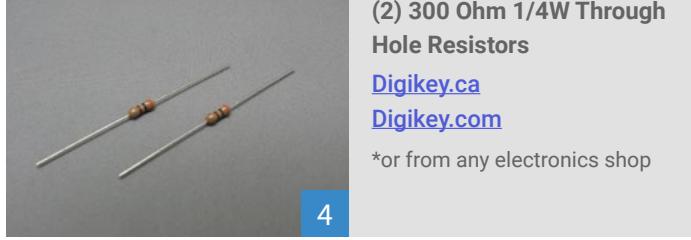
(1) 0.01uF Ceramic Capacitor  
[capacitor label: 103]  
[Digikey.ca](#)  
[Digikey.com](#)  
\*or from any electronics shop

7



(2) 3-Position Right Angle  
Male Header  
[Digikey.ca](#)  
[Digikey.com](#)  
\*or from any electronics shop

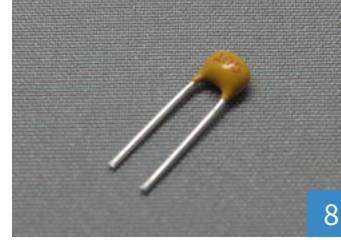
11



(2) 300 Ohm 1/4W Through  
Hole Resistors  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

4



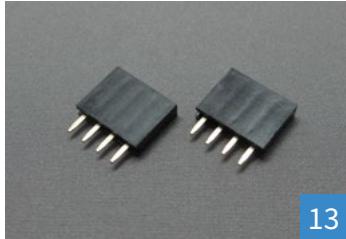
(1) 1.0uF Ceramic Capacitor  
[capacitor label: 105]  
[Digikey.ca](#)  
[Digikey.com](#)  
\*or from any electronics shop

8



(2) 3-Position Straight  
Female Header  
[Digikey.ca](#)  
[Digikey.com](#)  
**\*ONLY from the above source**

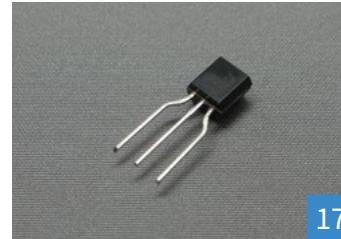
12



(2) 4-Position Straight Female Header  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

13



(1) 2N3906 PNP-Type T/H Transistor  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

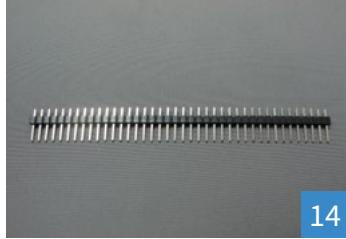
17



(1) Joystick Base Plate  
[LipSync GitHub](#)

**NOTE:** 3D printed files and print settings can be found in "Housing\_design.zip"

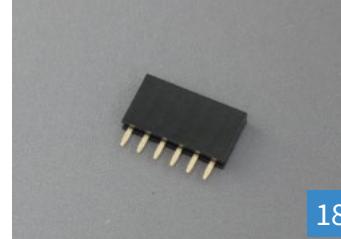
21



(1) Break Away Male Headers  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

14



(1) 6-Position Straight Female T/H Headers  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

18



(1) Joystick Rocker  
[LipSync GitHub](#)

**NOTE:** 3D printed files and print settings can be found in "Housing\_design.zip"

22



(1) 5mm Bi-Color T/H LED  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

15



(OPTIONAL) (1) 1-Position Straight Female T/H Header  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

19



(1) Joystick Top Plate  
[LipSync GitHub](#)

**NOTE:** 3D printed files and print settings can be found in "Housing\_design.zip"

23



(1) Shunt Connector  
[Digikey.ca](#)  
[Digikey.com](#)

\*or from any electronics shop

16



(1) Front Housing  
[LipSync GitHub](#)

**NOTE:** 3D printed files and print settings can be found in "Housing\_design.zip"

20



(1) Rear Housing  
[LipSync GitHub](#)

**NOTE:** 3D printed files and print settings can be found in "Housing\_design.zip"

24



(2) Buttons  
[LipSync Page](#)

25



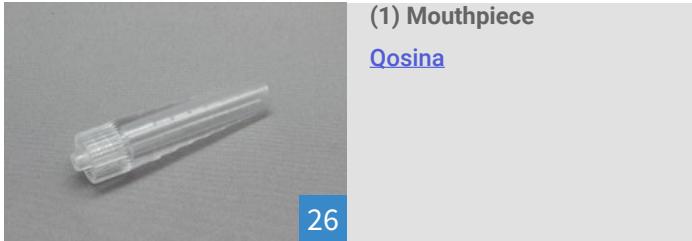
(4) Force Resistive Sensor  
[Digikey.ca](#)  
[Digikey.com](#)

29



(2) Standoffs M3 15mm  
[Digikey.ca](#)  
[Digikey.com](#)

33



(1) Mouthpiece  
[Qosina](#)

26



(4) Screws Phillips Head M3  
[Digikey.ca](#)  
[Digikey.com](#)

30



(1) Luer Lock Nut  
[Cole-Parmer](#)

34



(1) Filter  
[Qosina](#)

27



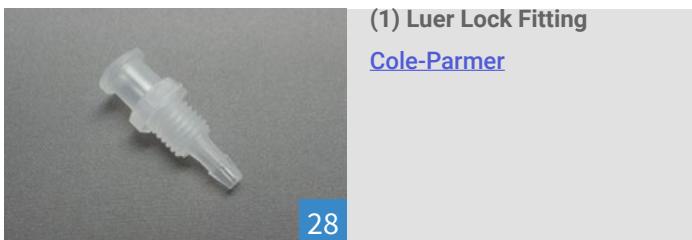
(6) Compression Springs  
[Lee Spring](#)

31



(4) Bumpers  
[Digikey.ca](#)  
[Digikey.com](#)

35



(1) Luer Lock Fitting  
[Cole-Parmer](#)

28



(2) Standoffs M3 10mm  
[Digikey.ca](#)  
[Digikey.com](#)

32



(4) Nuts M3  
[Digikey.ca](#)  
[Digikey.com](#)

36



37

(1) Tubing 3/32" ID x 45mm  
[US Plastic](#)



41

(1) USB Cable  
[Amazon.com](#)



45

(OPTIONAL) (1) Magic Arm  
11" and Clamp  
[Amazon.com](#)



38

(1) Light pipe  
[Mouser](#)



42

(1) USB Adapter  
[Amazon.com](#)



39

(1) Threaded Insert 5/8"-27  
[B&H Photo Video](#)



43

(1) Cable Tie  
[Digikey.ca](#)  
[Digikey.com](#)



40

(1) Threaded Adapter 5/8"-27  
[Amazon.com](#)



44

(10) Velcro Strap 0.5" x 6"  
[B&H Photo](#)

# PART 0c

## EQUIPMENT CHECKLIST

- Small spool of 60Pb/40Tn solder wire
- (1) Adjustable tabletop vise  
(if possible, PANAVISE Junior Vise with Base)
- Temperature adjustable soldering iron (350°C)
- Safety glasses
- Needle nose pliers
- Small fan (if possible, fume extractor)
- Fine file or sandpaper (150-220 grit)
- Hobby knife
- Baby powder
- Flush cutters
- Super glue
- ABS or high strength PLA filament 100g
- Desolder pump (or "solder sucker")



= Solder the part outlined in the white outline

21

= Component number

HOLE  
R1

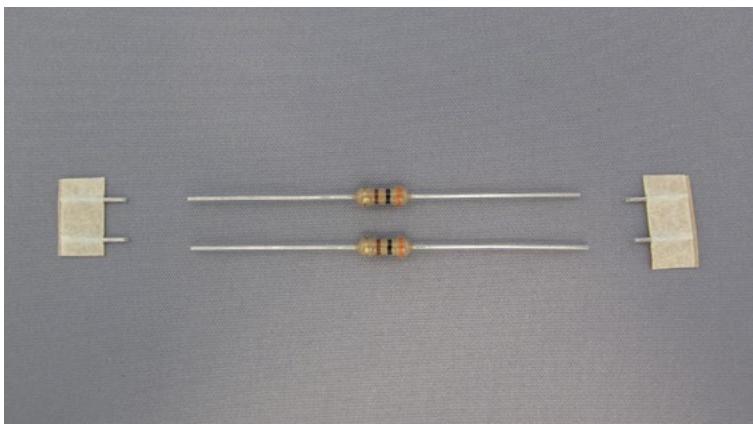
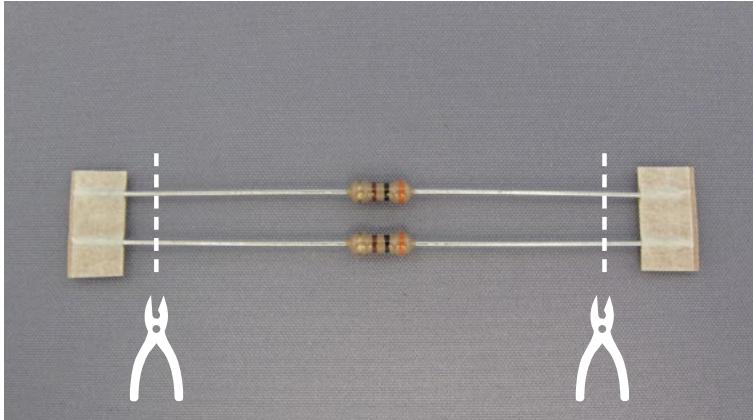
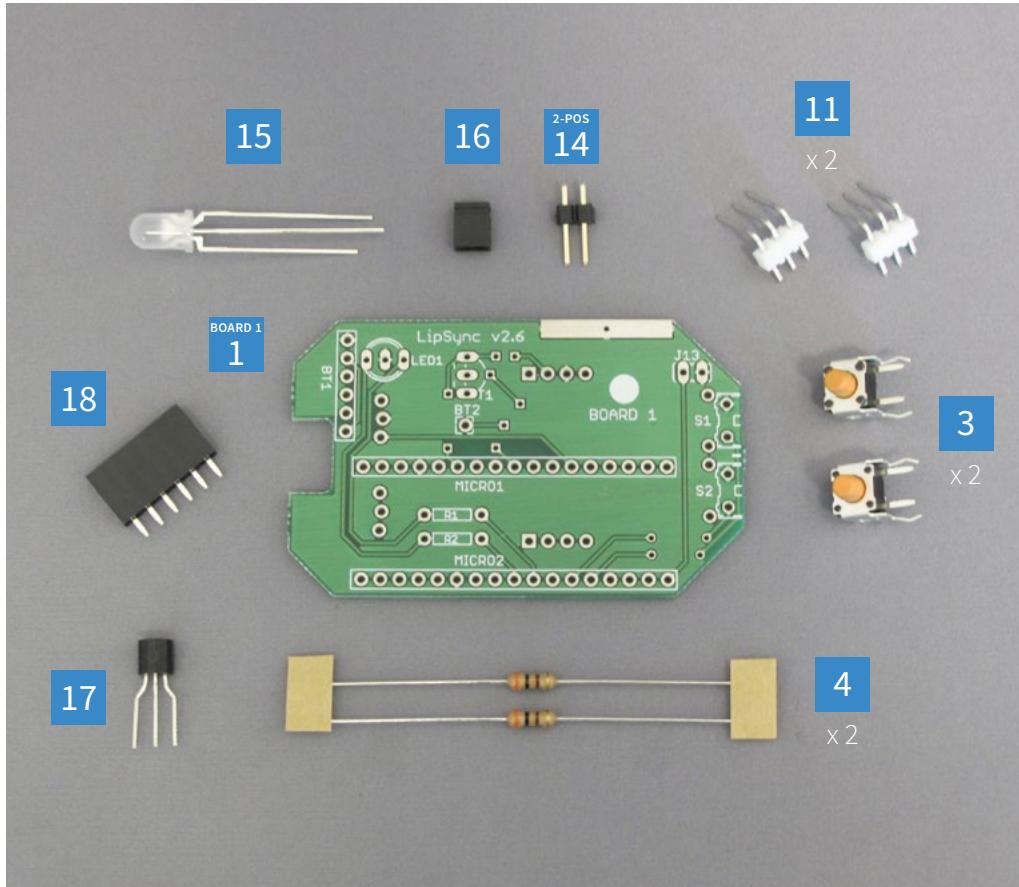
= Name of plated through-hole



### CAUTION

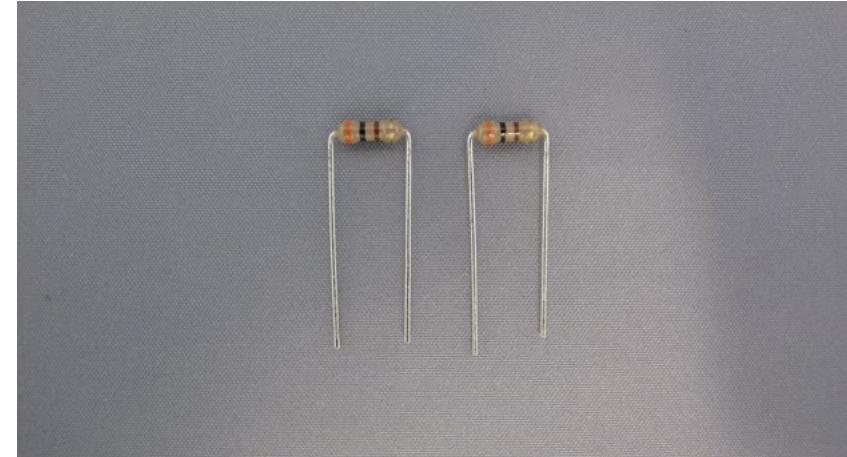
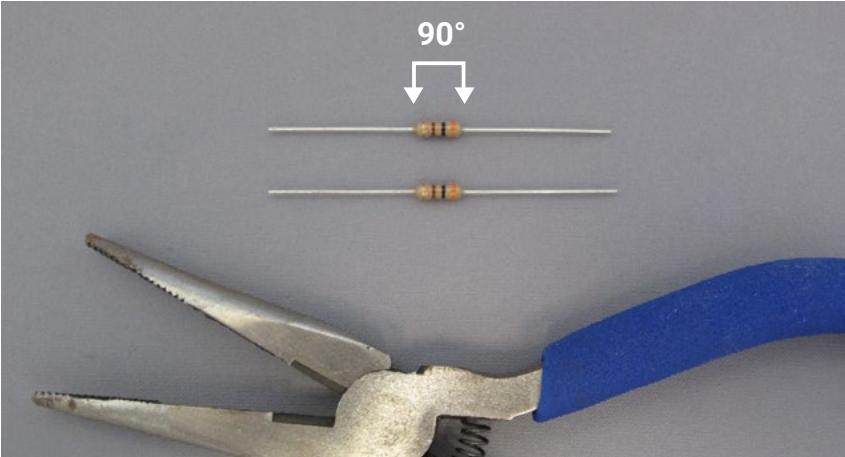
- Safety glasses should be worn at all times during the assembly.
- Be aware of electrostatic discharge when soldering
- Be aware that too much heat can damage component

# PART 1

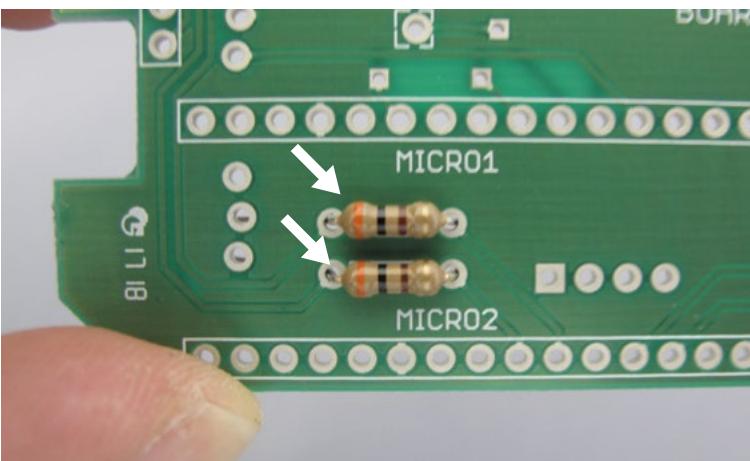


01.

**02.**



**03.**



BOARD 1

1

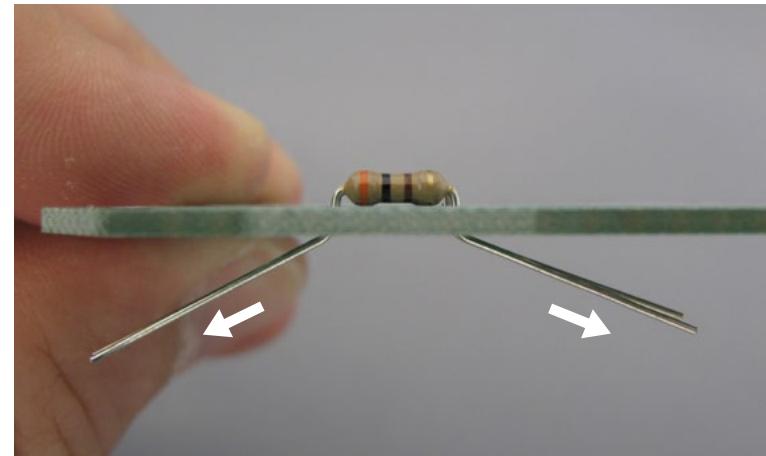
HOLE

R1

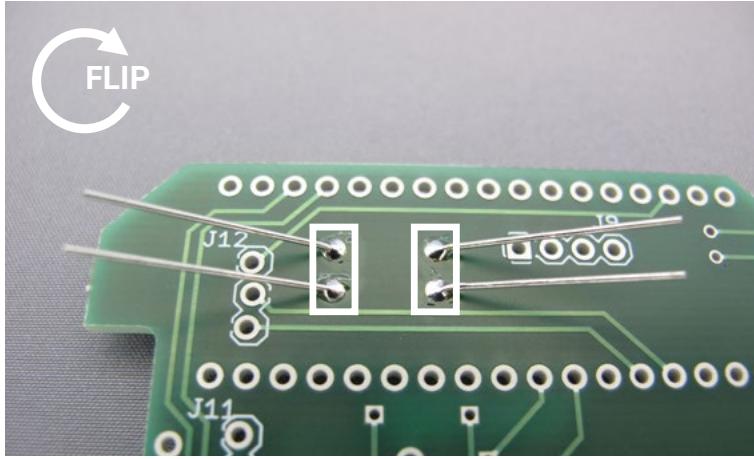
HOLE

R2

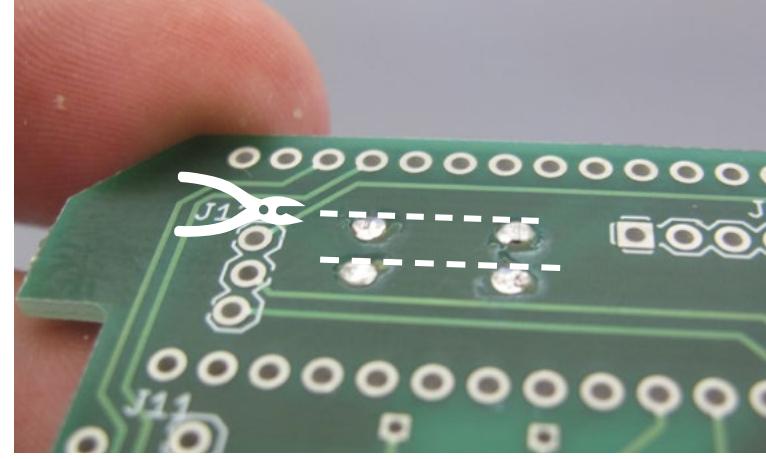
**04.**



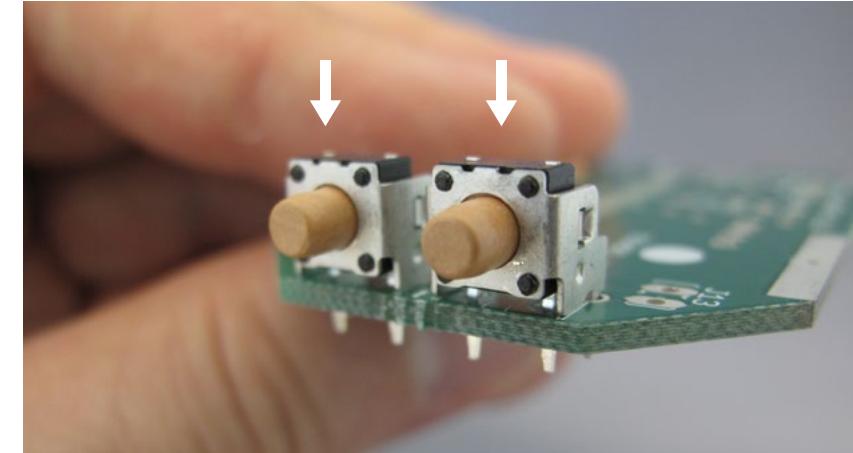
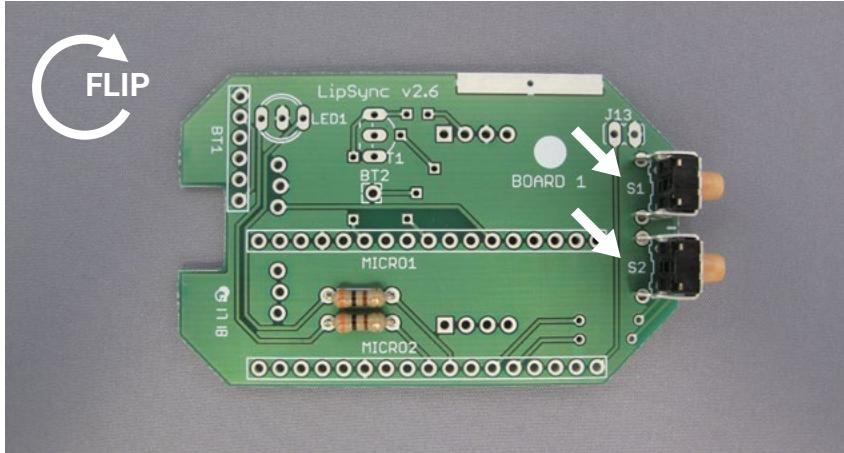
**05.**



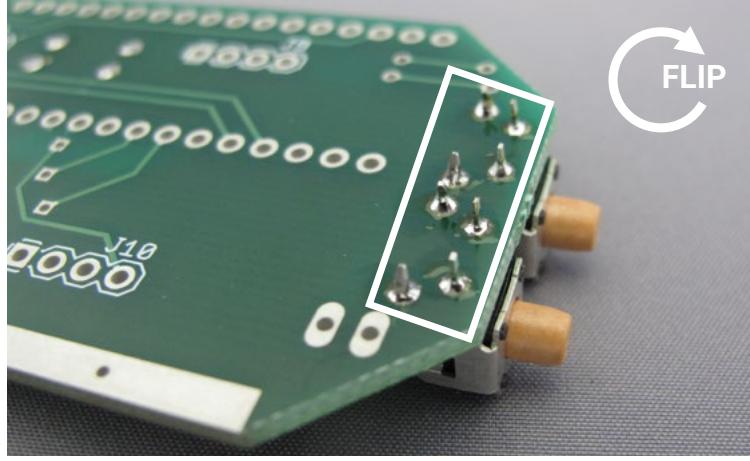
**06.**



**07.**



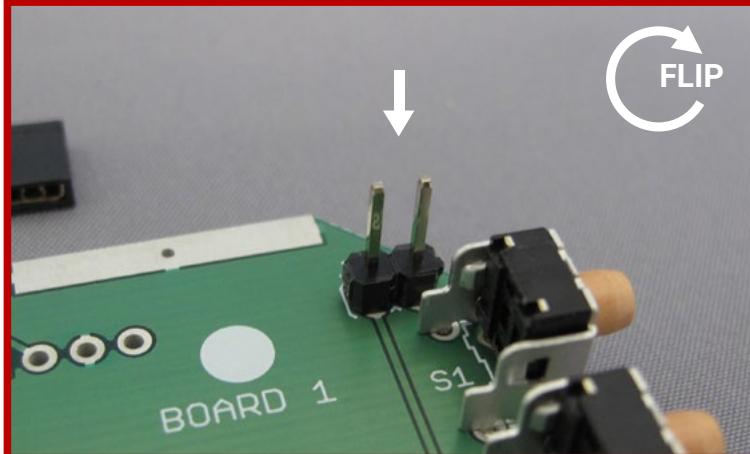
# 08.



x 8

14

# 10.

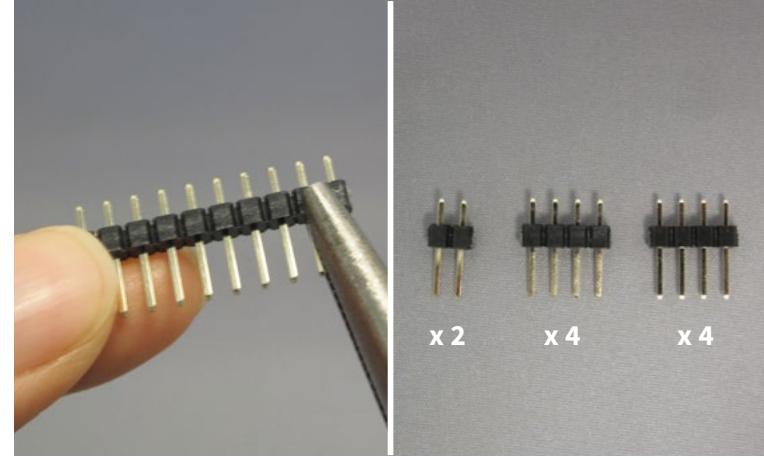


2-POS  
14  
HOLE  
J13

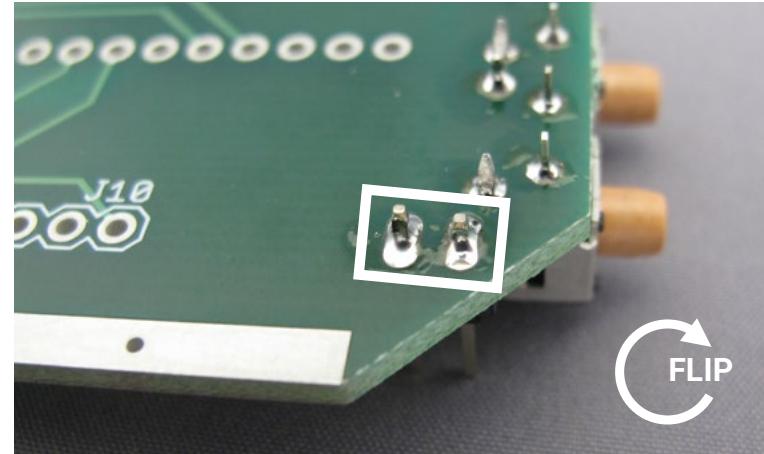
x 2

12

# 09.

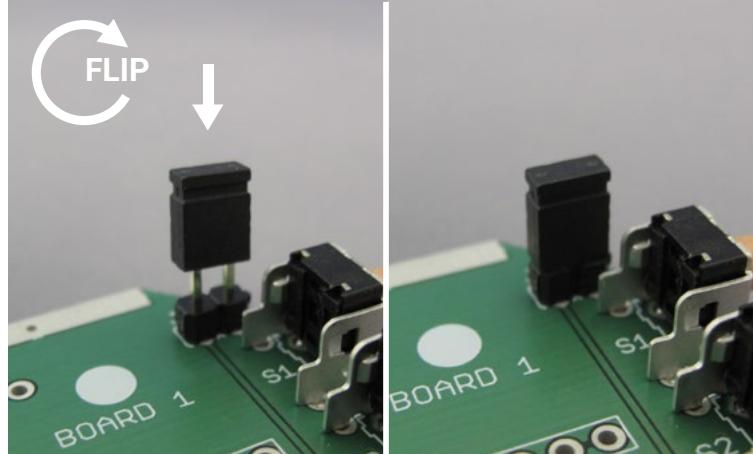


# 11.



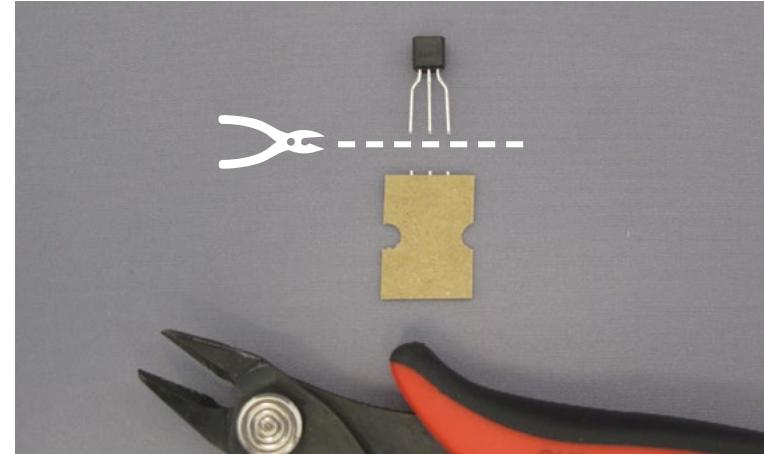
x 2

12.



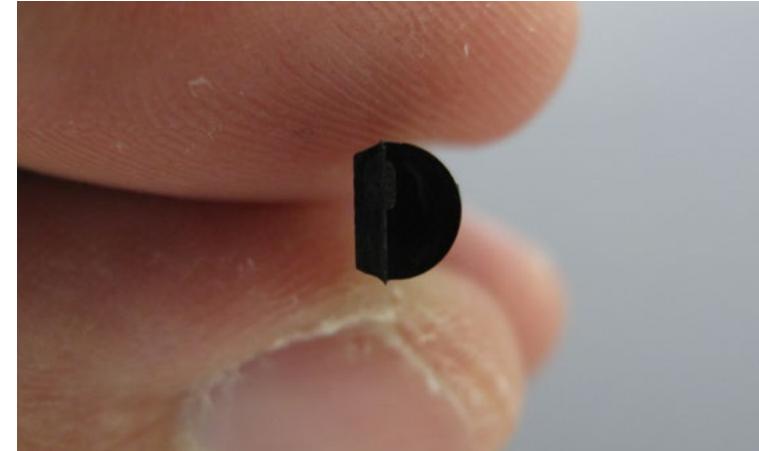
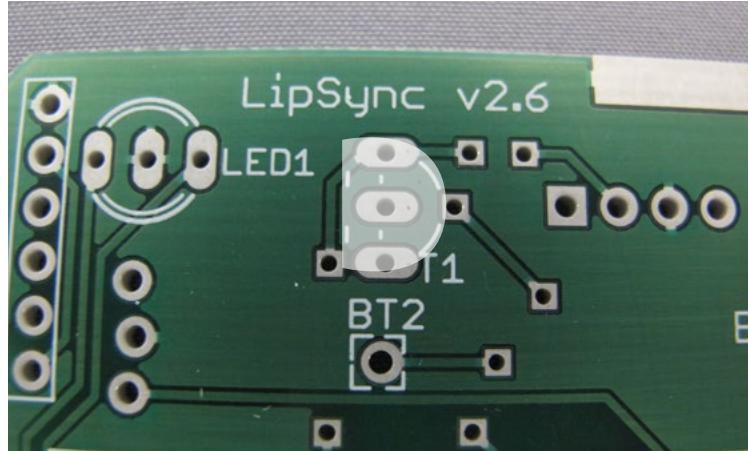
16

13.



17

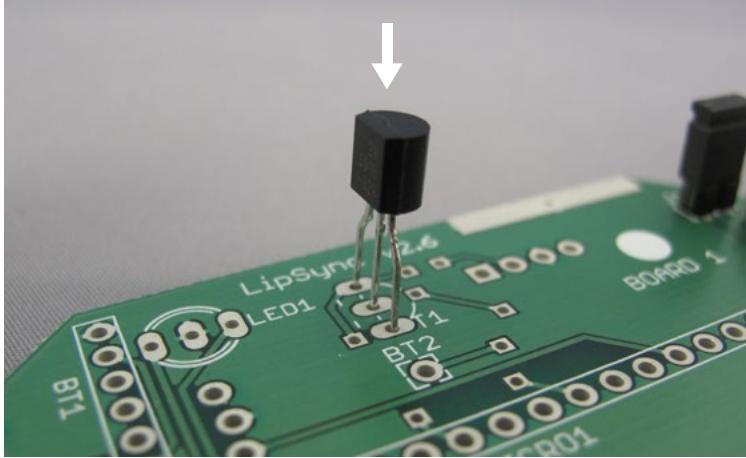
14.



HOLE  
T1

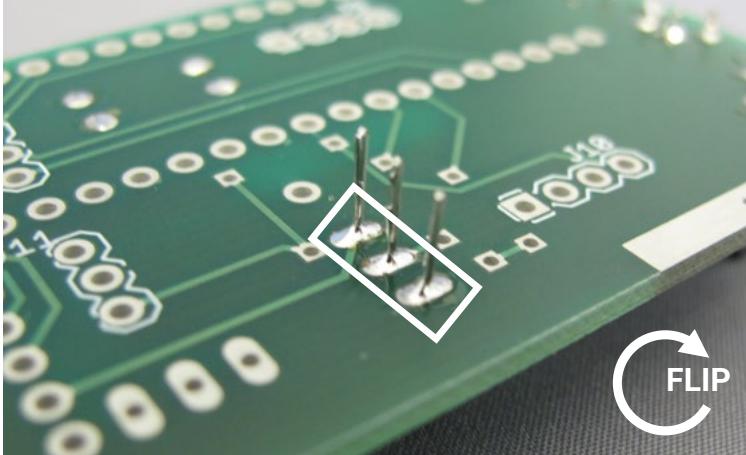
**NOTE:** The silkscreen outline for hole T1 on Board 1 matches the orientation of which the transistor is inserted.

**15.**



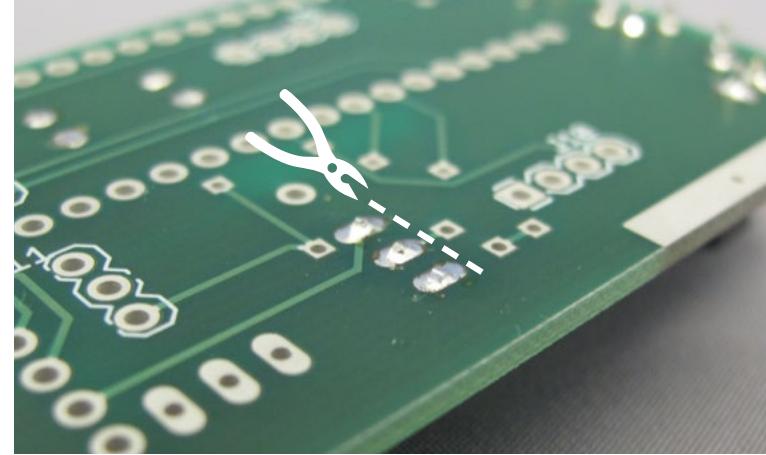
**i NOTE:** After inserting the transistor, there will be a gap between the transistor and Board 1

**16.**

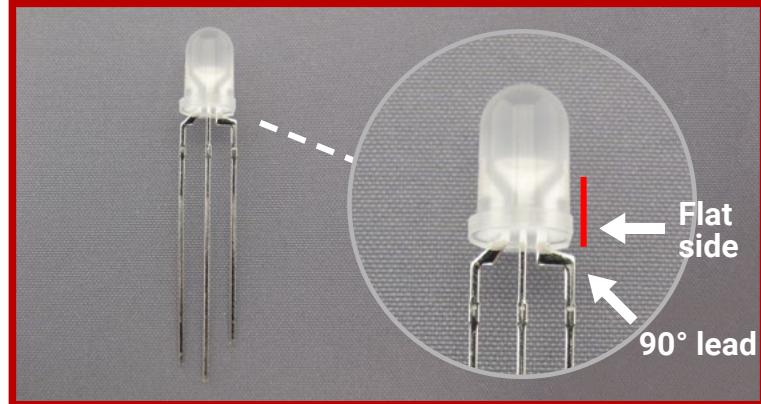


14

**17.**



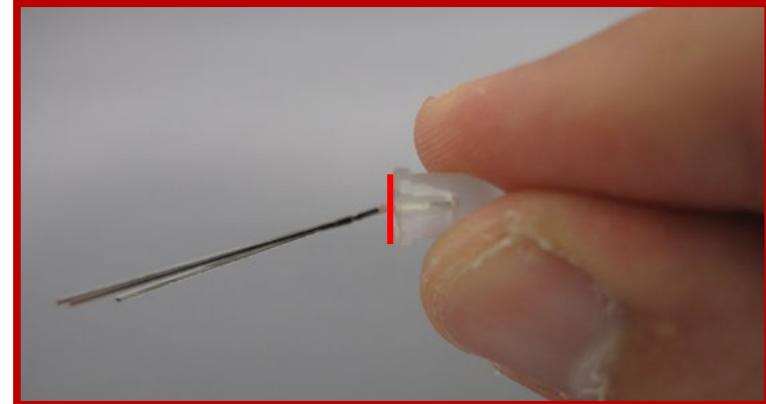
# 18.



**IMPORTANT:** The flat side of the LED head and the 90° lead should be on the **RIGHT** when installed.

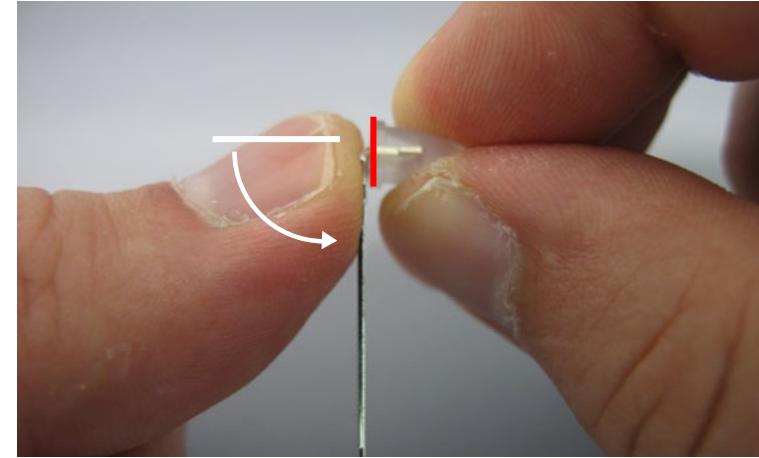
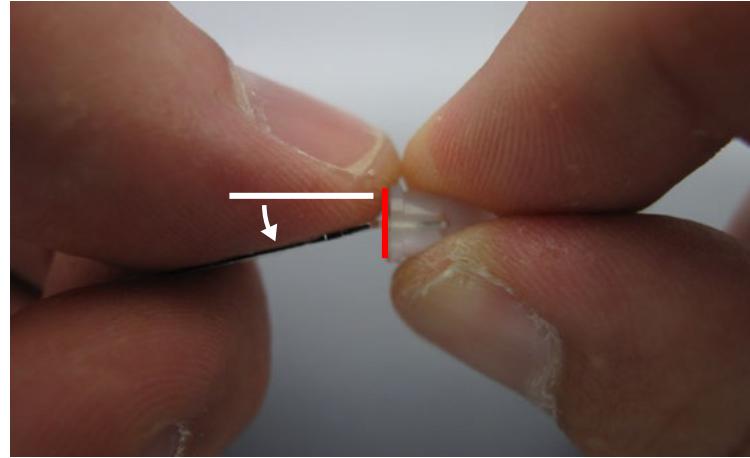
15

# 19.



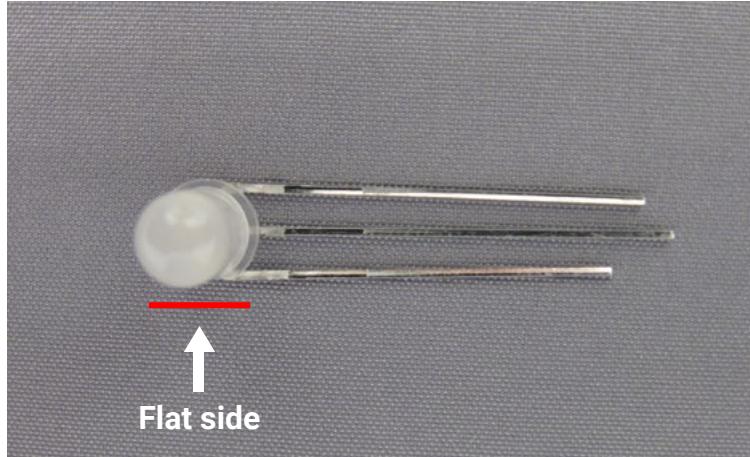
**IMPORTANT:** Hold the LED so that the flat side and the 90° lead is facing **TOWARDS** you.

# 20.



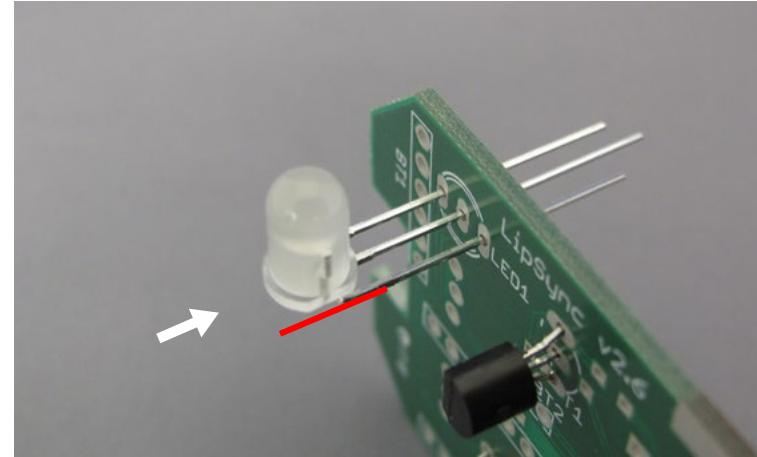
**NOTE:** Using a finger, bend the leads by 90° right at the base.

**21.**

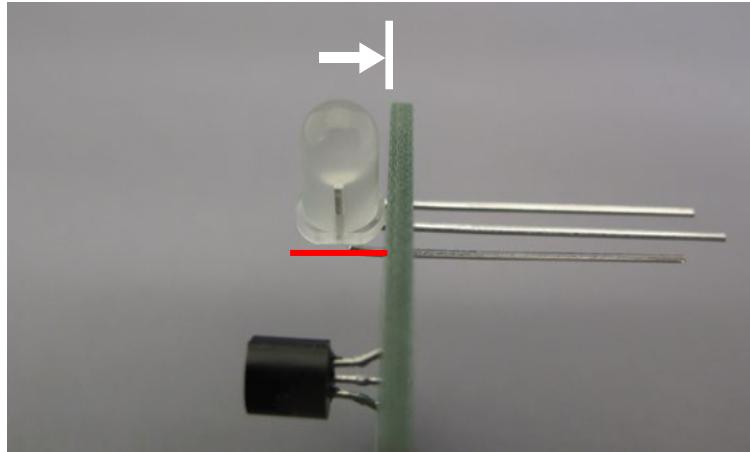


HOLE  
LED1

**22.**

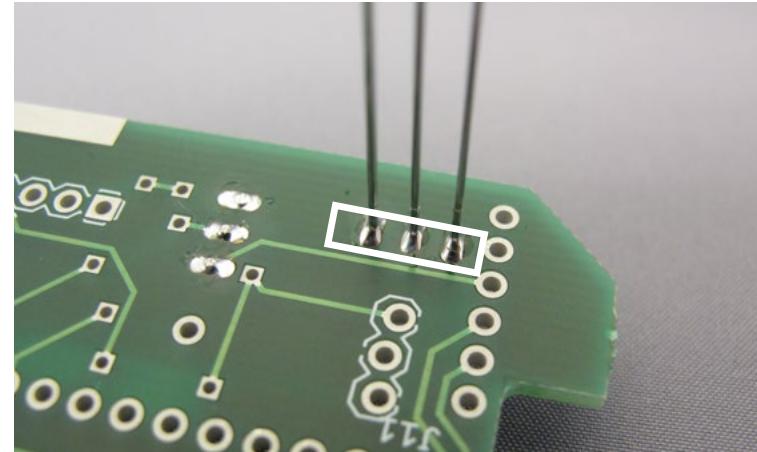


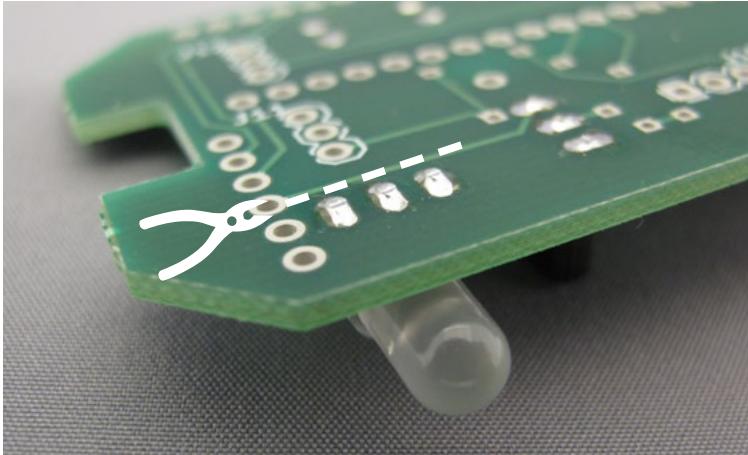
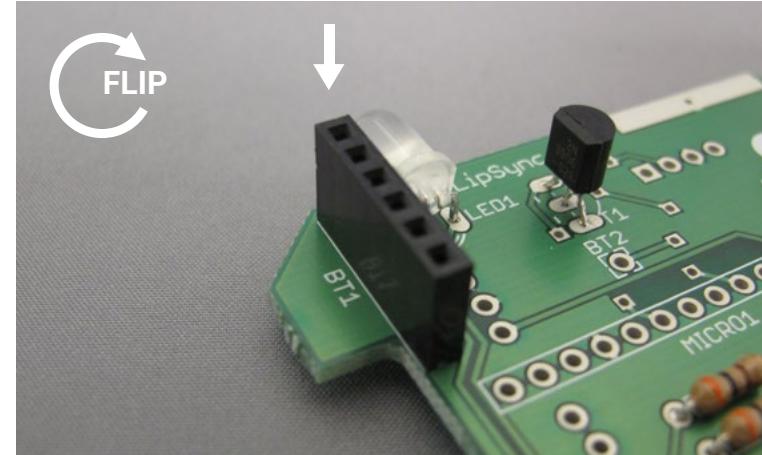
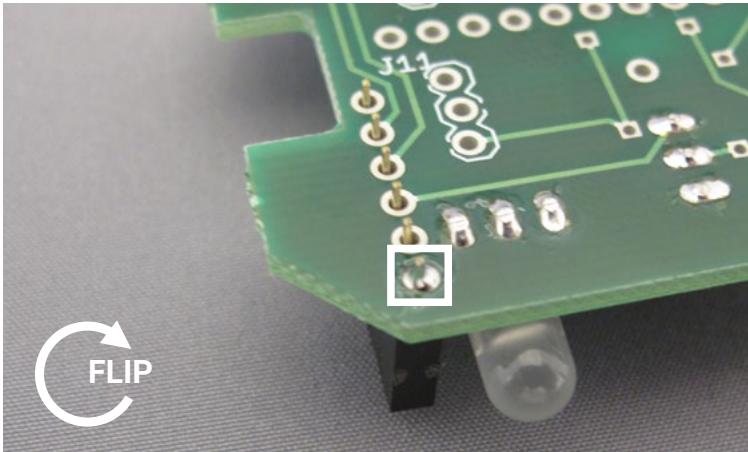
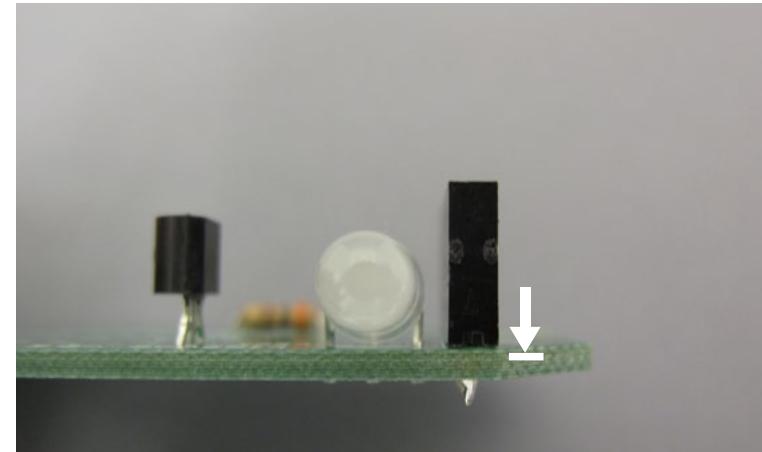
**23.**



x 3

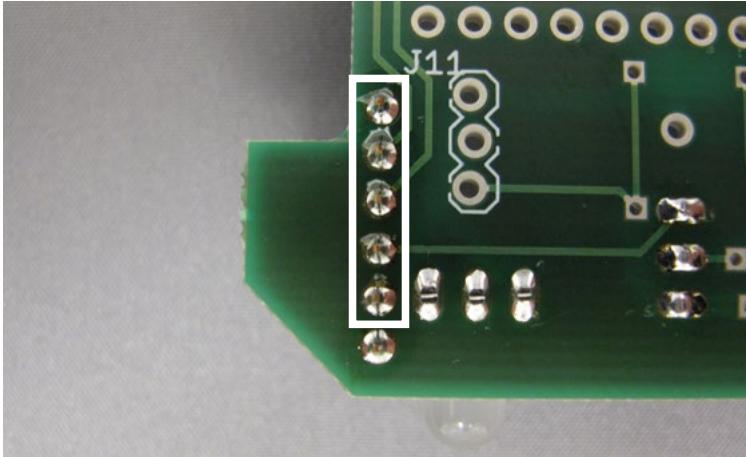
**24.**



**25.****26.****27.****28.**

**NOTE:** Check that component is flush to the board

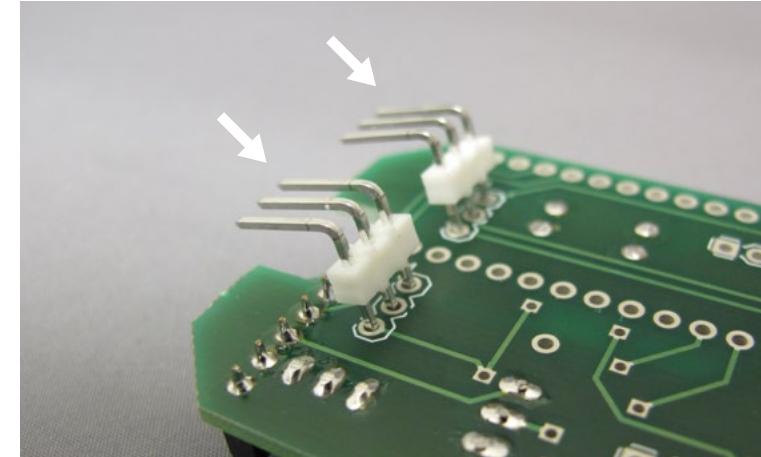
**29.**



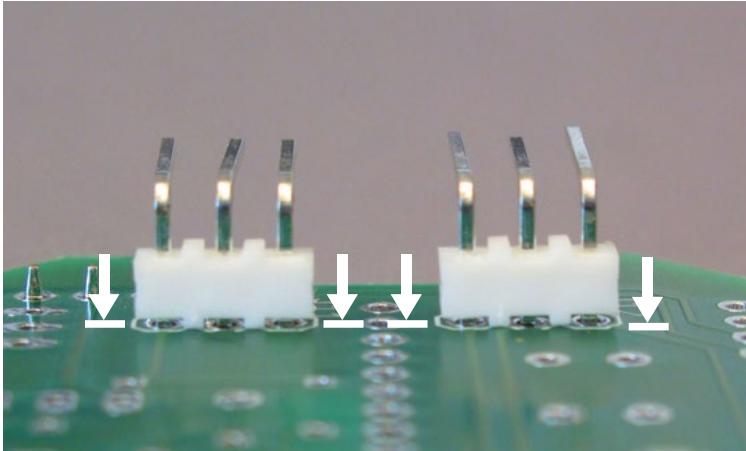
**11**  
x 2

SECTION  
**J11**  
SECTION  
**J12**

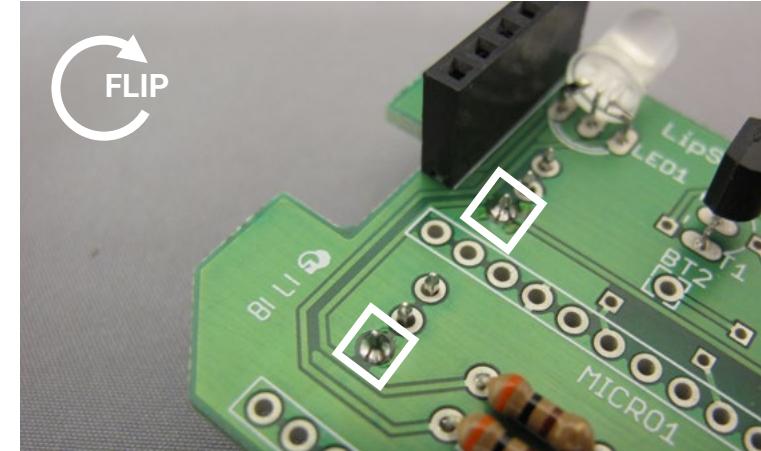
**30.**



**31.**

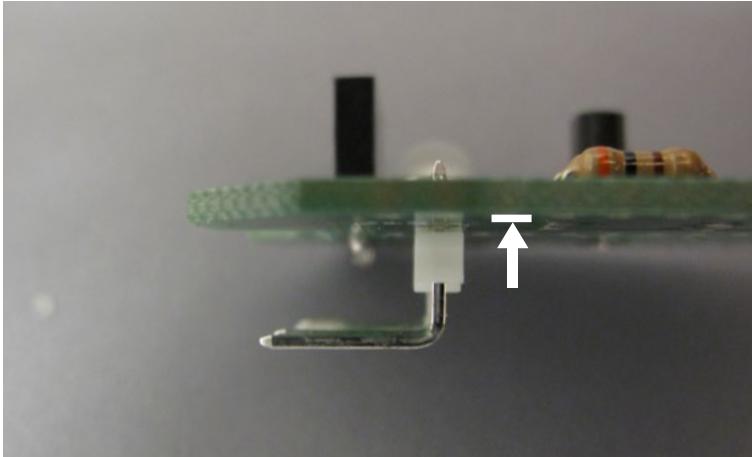


**32.**

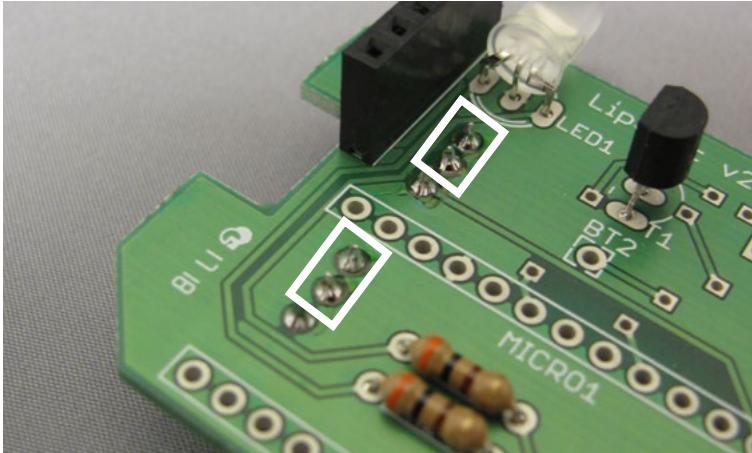


# PART 2

33.

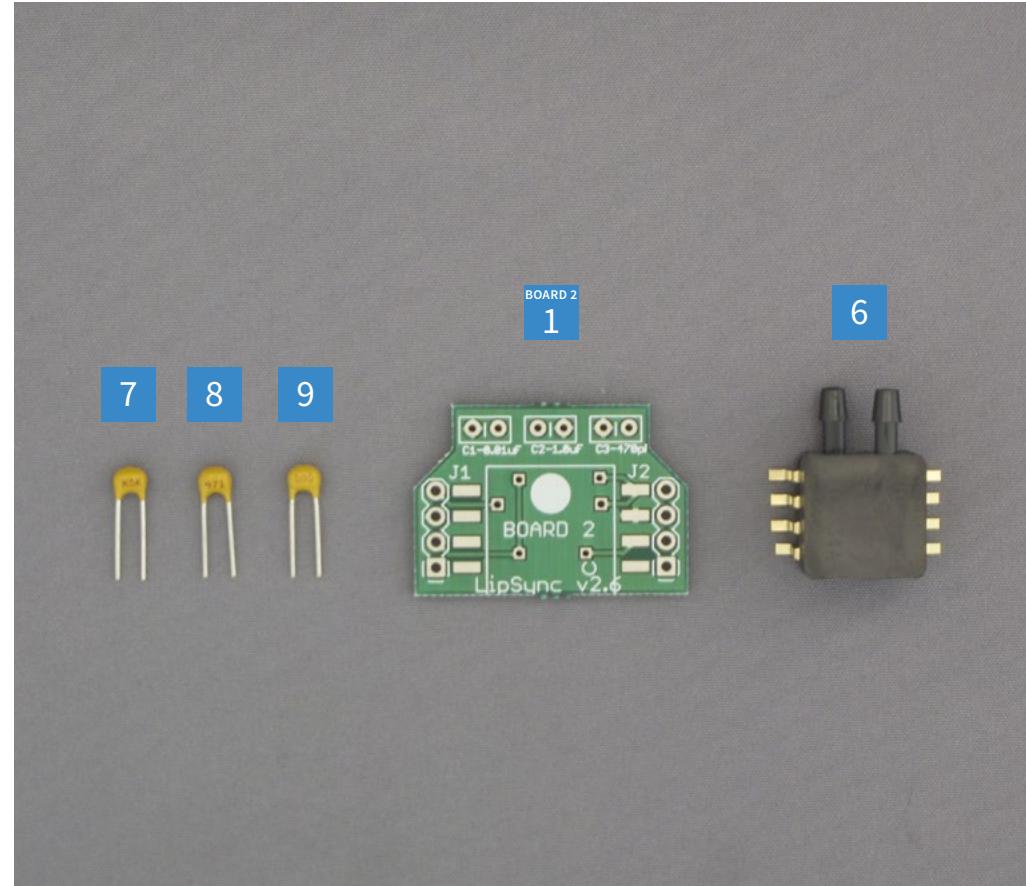


**i NOTE:** Check that component is flush to the board

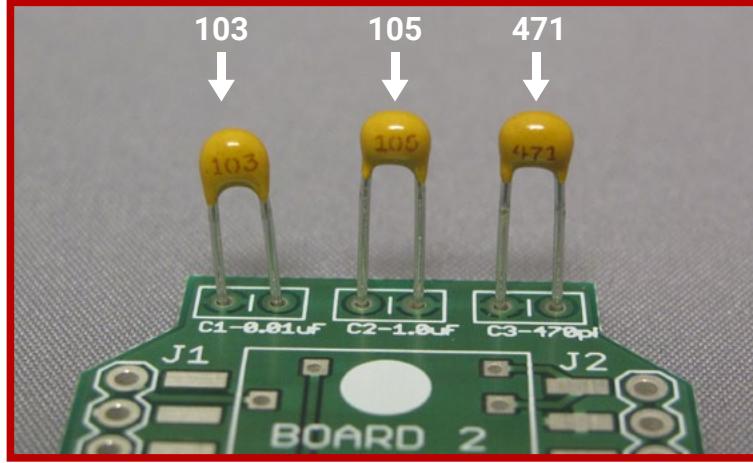


x 4

34.



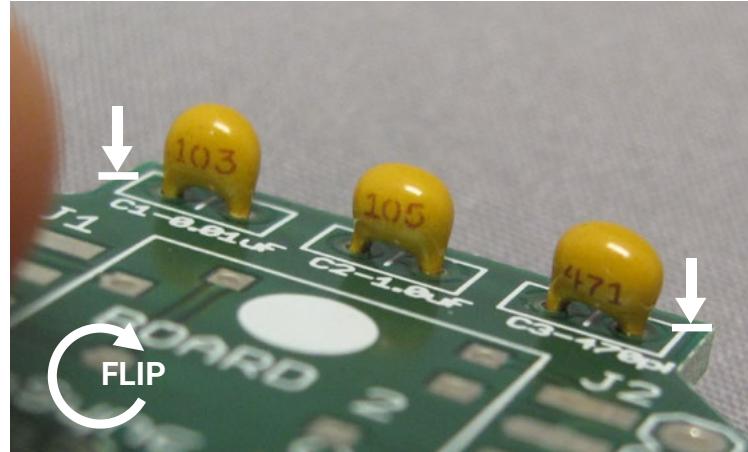
# 01.



**⚠ NOTE:** The capacitors **MUST** be inserted in the order shown.

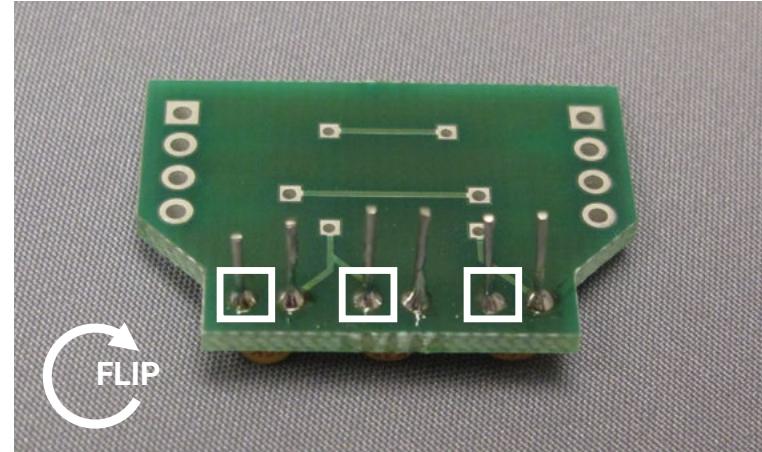
20

# 03.



**i NOTE:** Check that component is flush to the board

# 04.



x 3

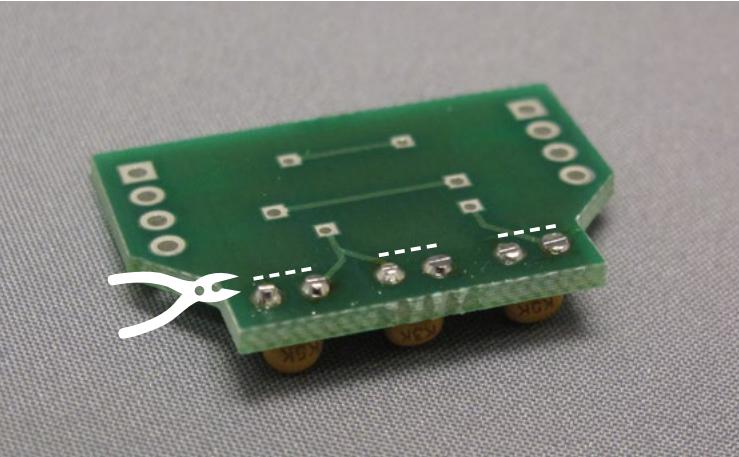


x 3

6

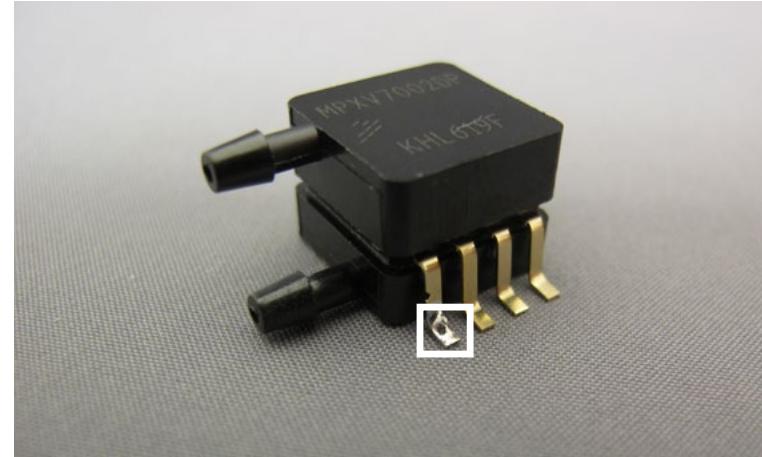


x 1

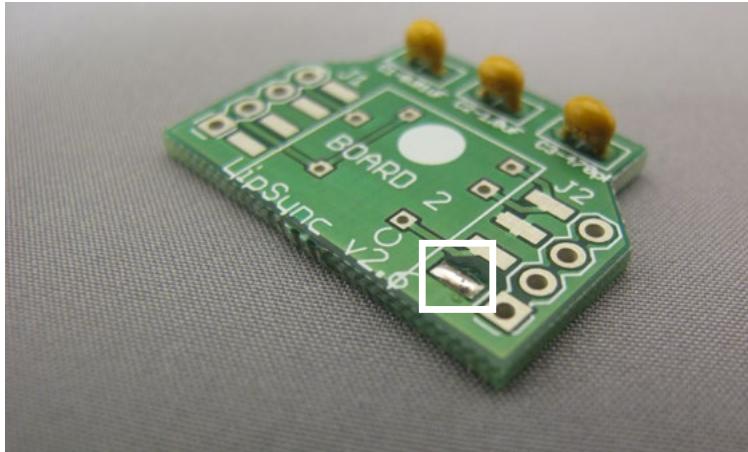


05.

06.

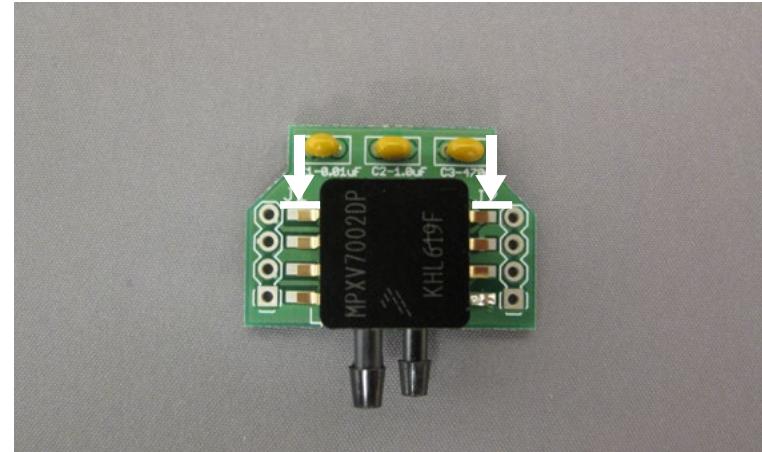


x 1

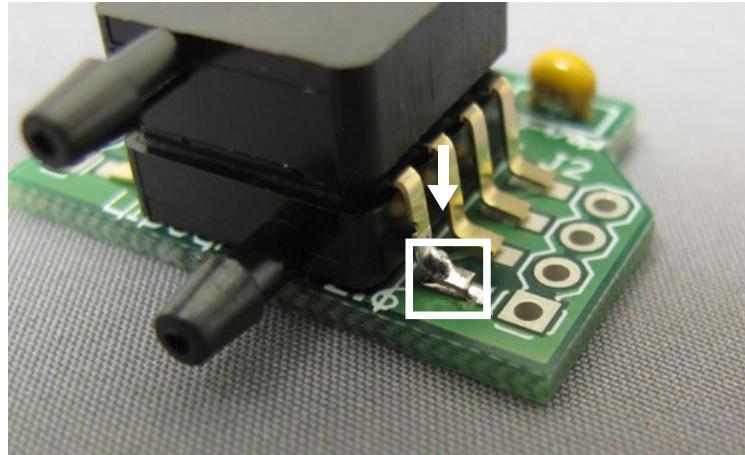
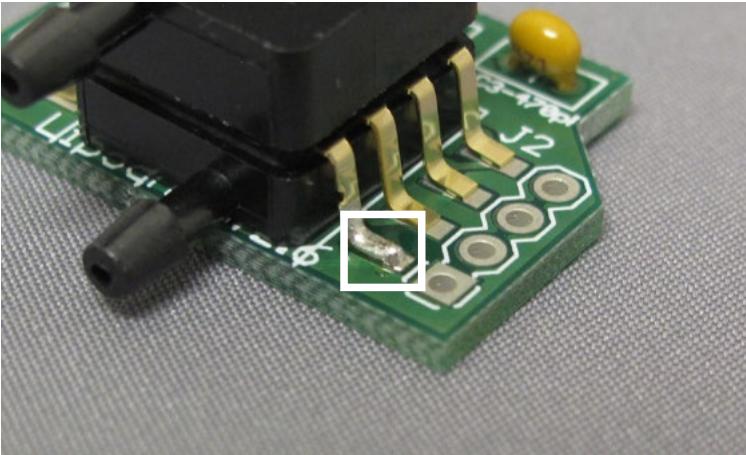


07.

08.

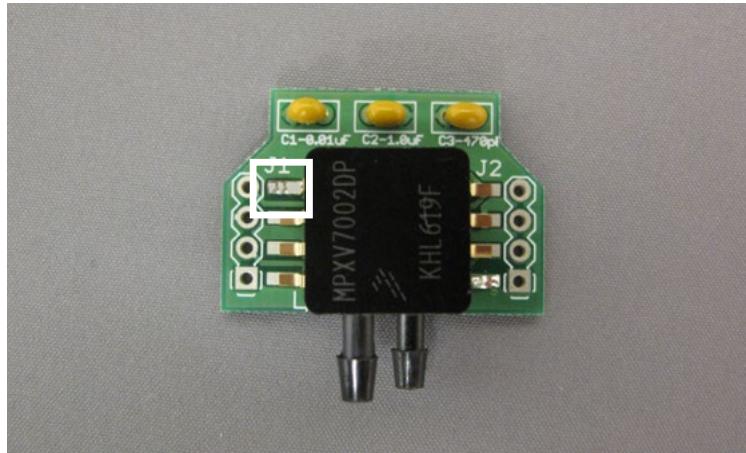


09.



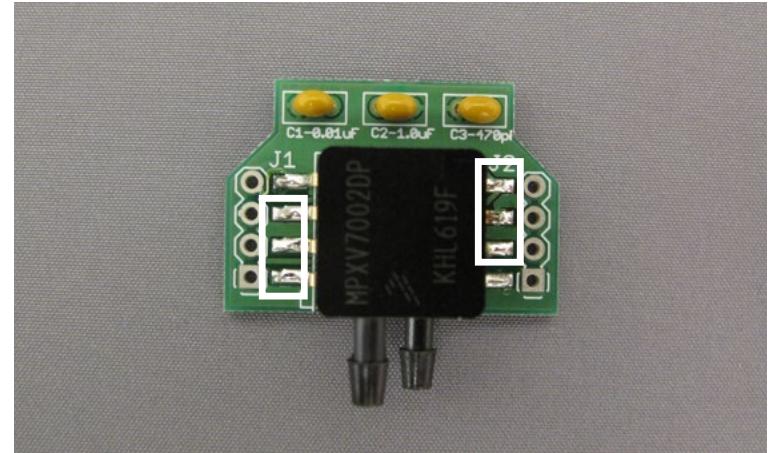
**NOTE:** Place the solder tip on the lead to reflow the solder on the two components. The pressure sensor should "drop" onto Board 2.

10.

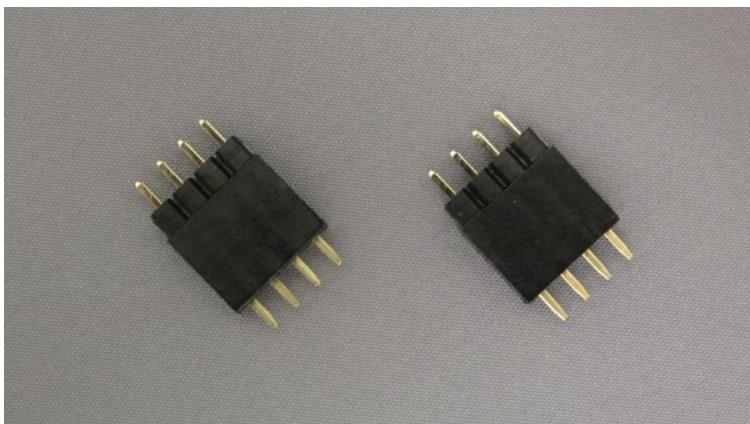
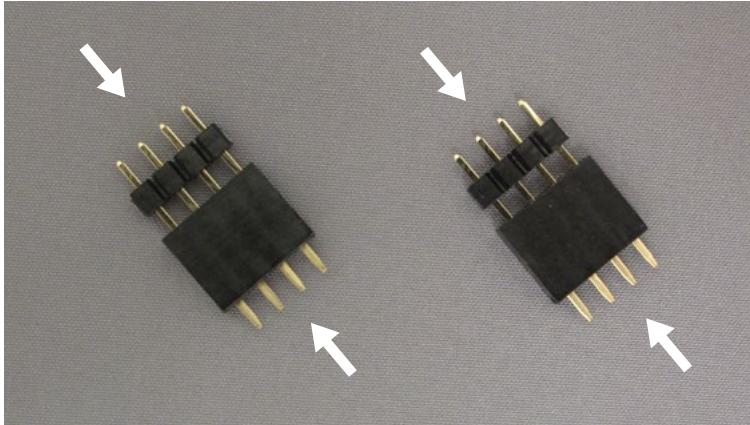
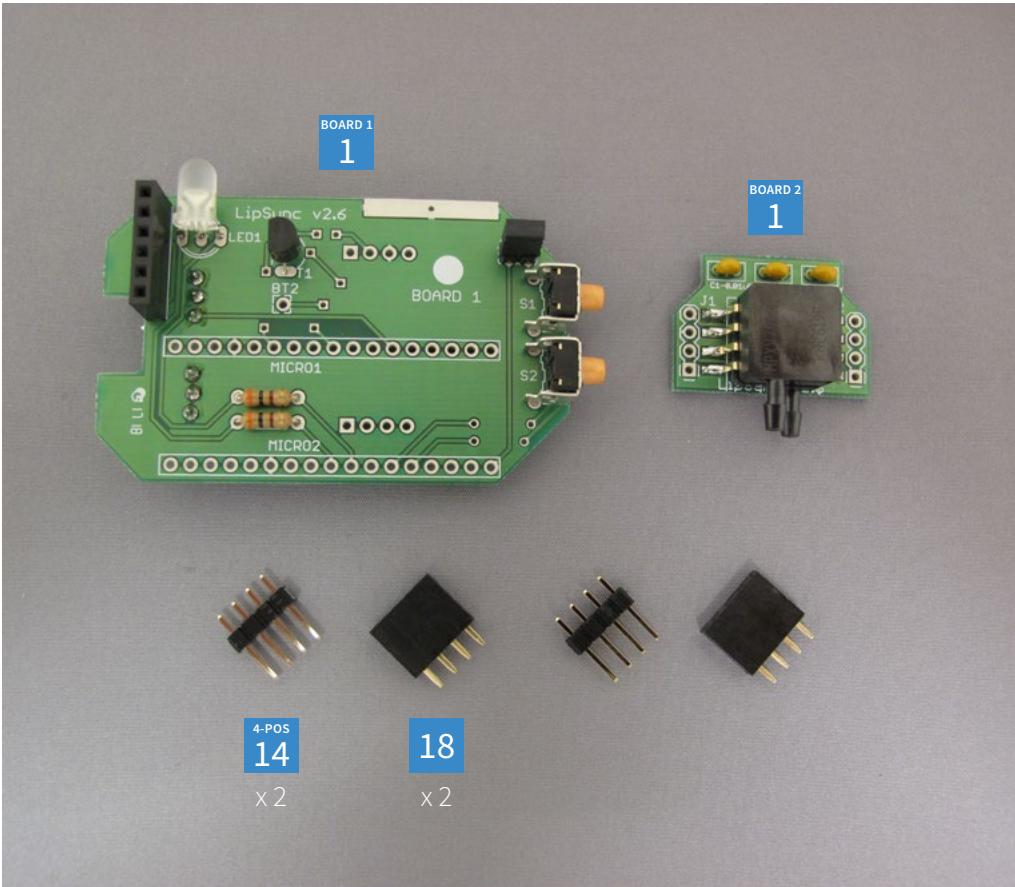


22

11.



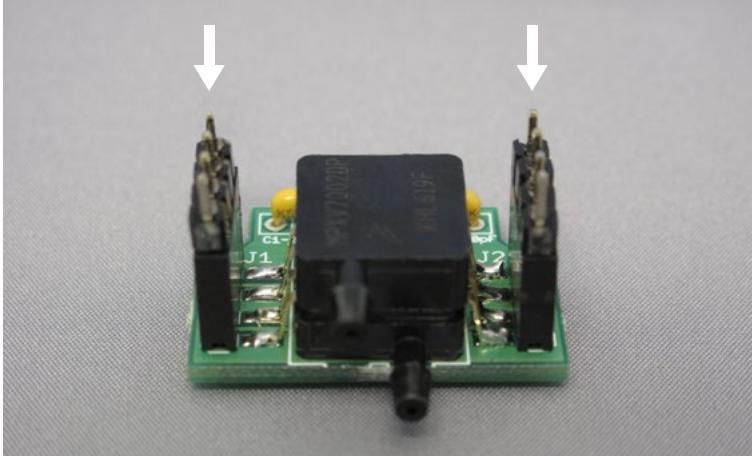
# PART 3



01.

4-POS  
14  
x 2  
18  
x 2

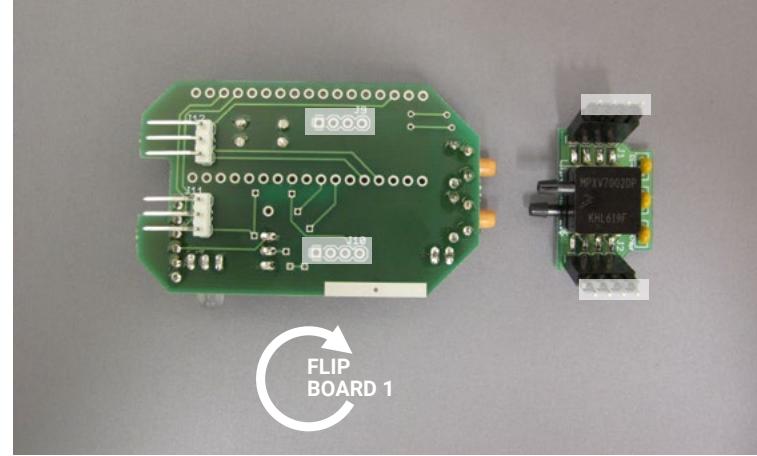
# 02.



BOARD 2  
1  
HOLE  
J1  
HOLE  
J2

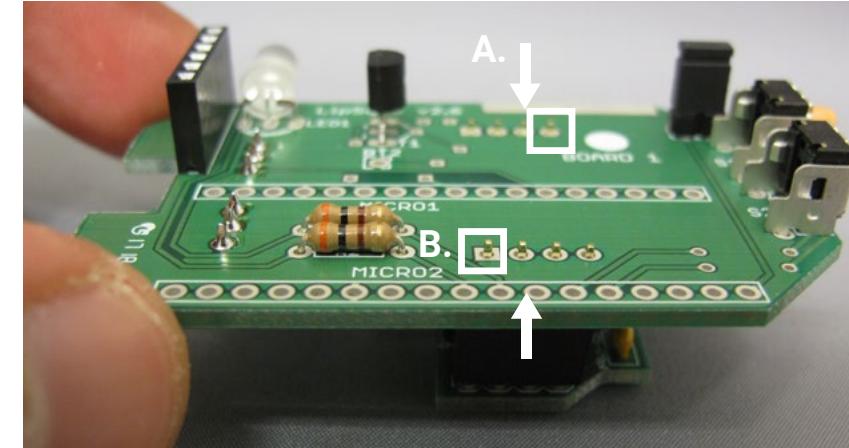
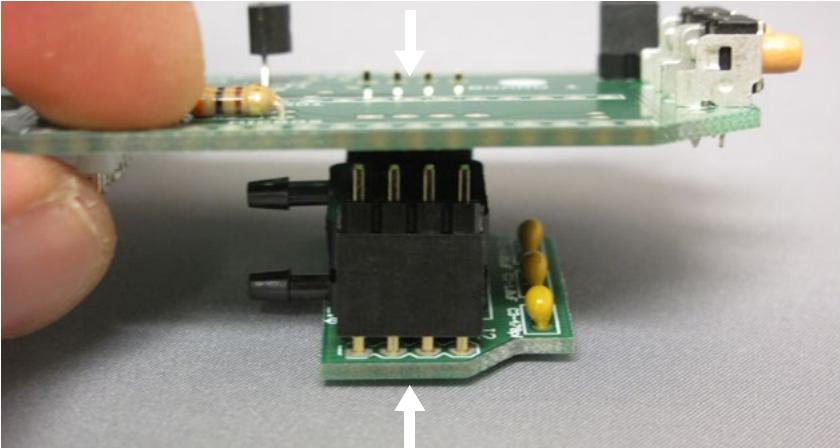
**i** **NOTE:** The 4-position female headers are inserted

# 03.

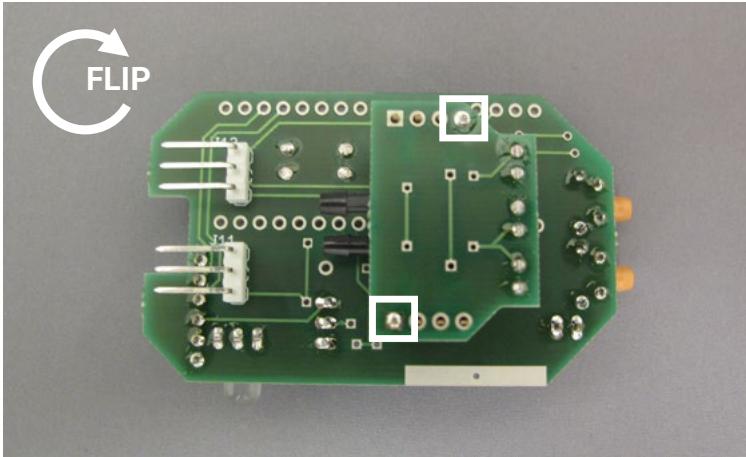


BOARD 1  
1

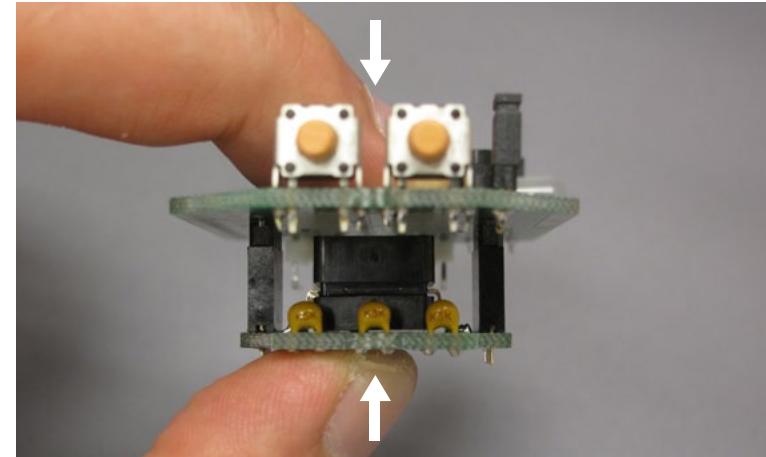
# 04.



05.

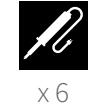
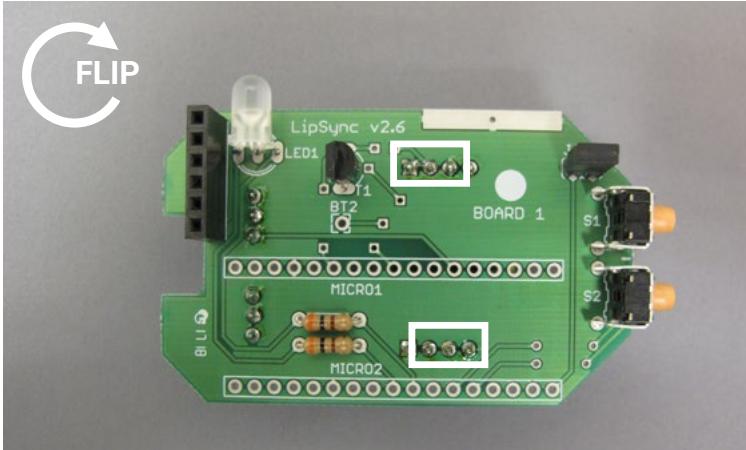


06.

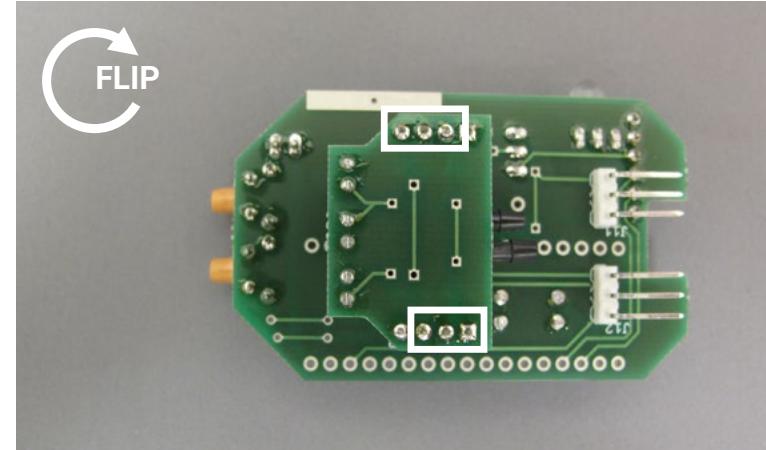


**i** NOTE: Check that component is flush to the board

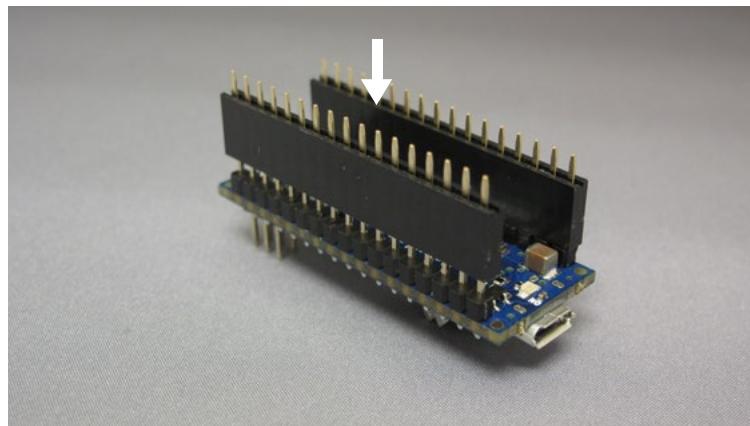
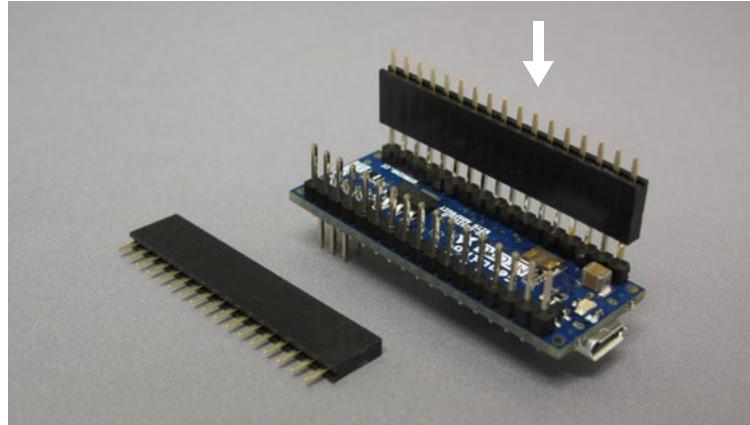
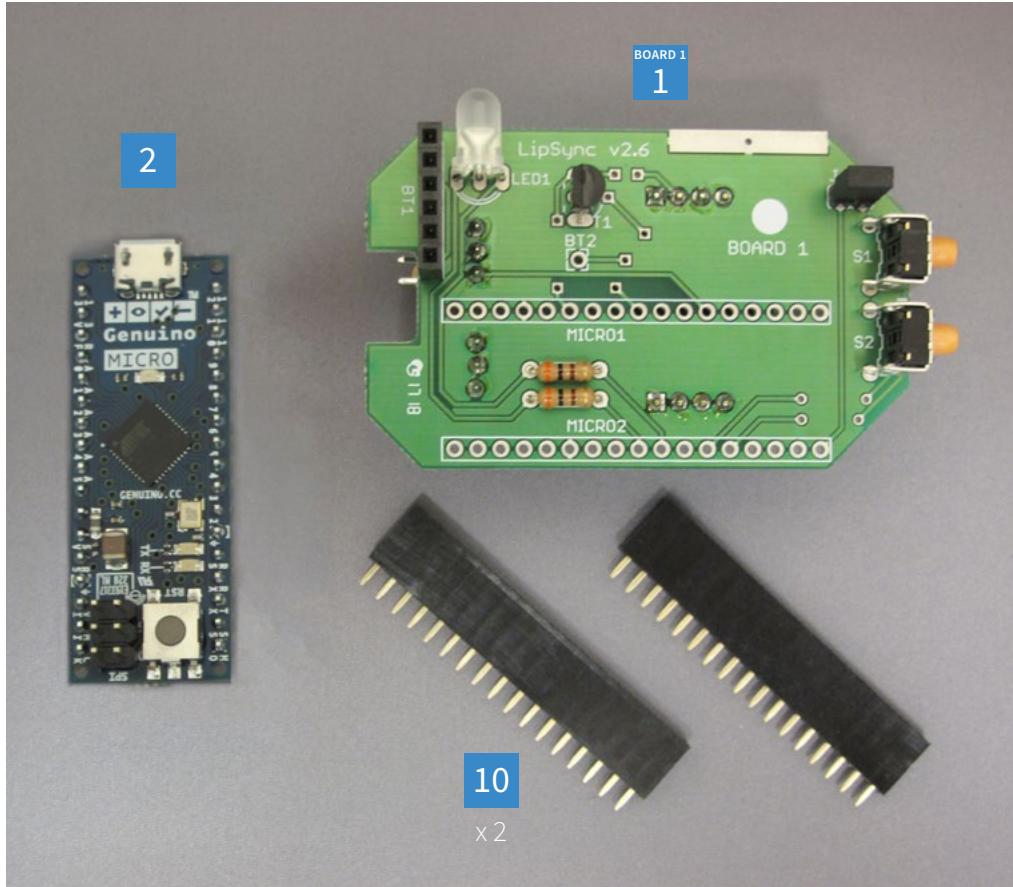
07.



08.



# PART 4



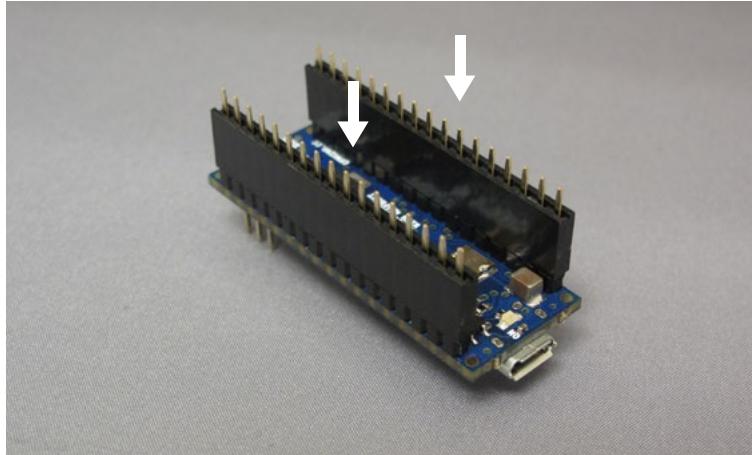
01.

2

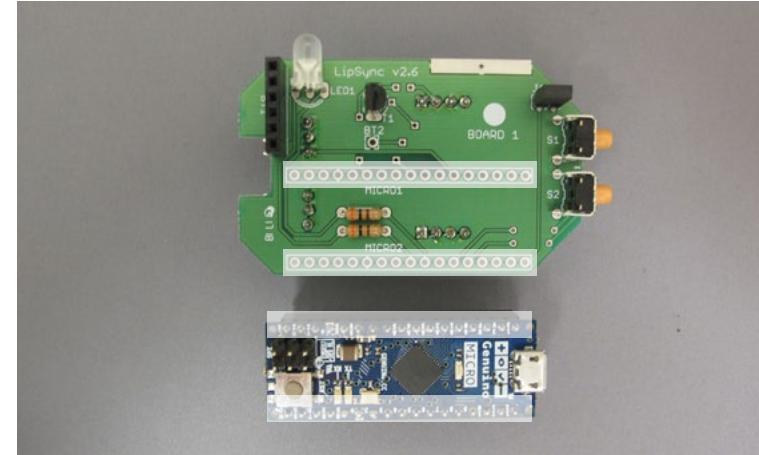
10

x2

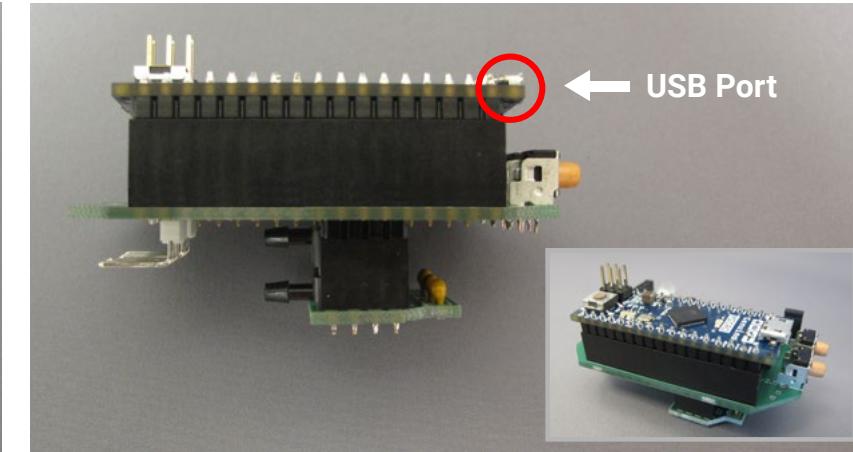
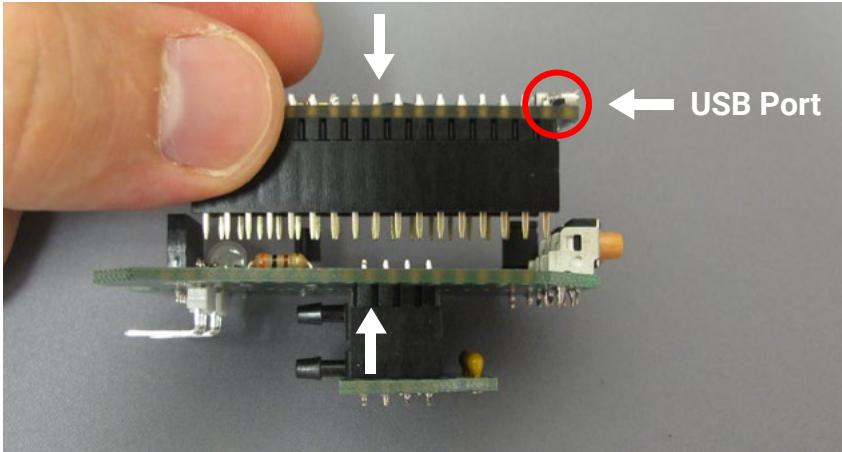
02.



03.

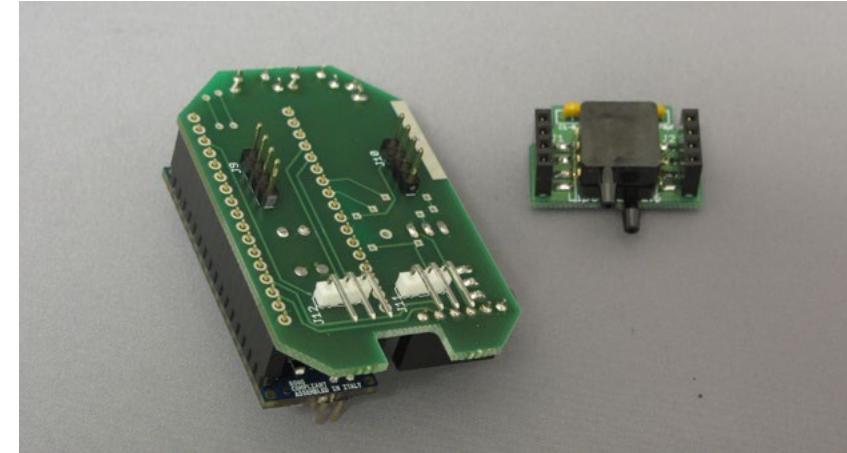
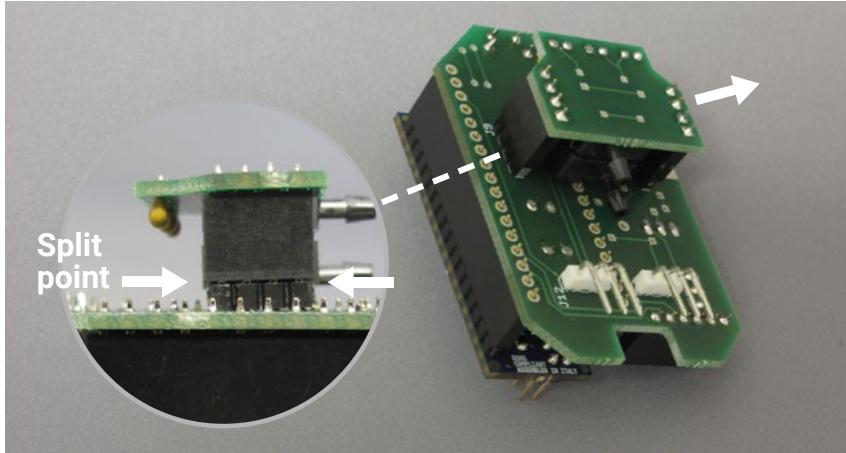


04.

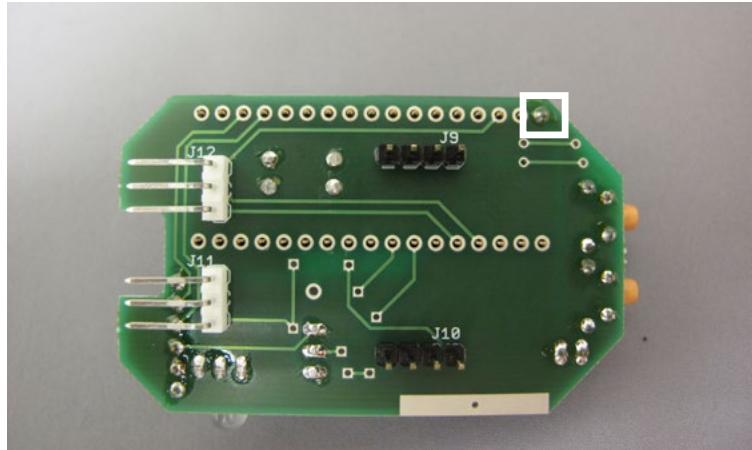


**i** NOTE: USB Port should be on the right side during installation

**05.**

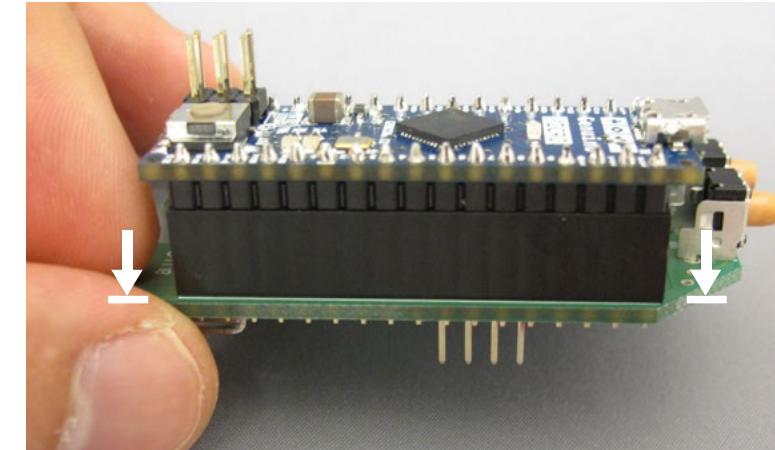


**06.**



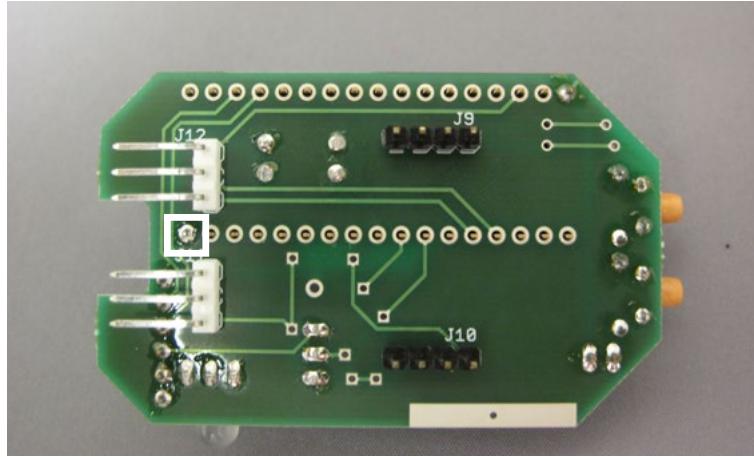
28

**07.**



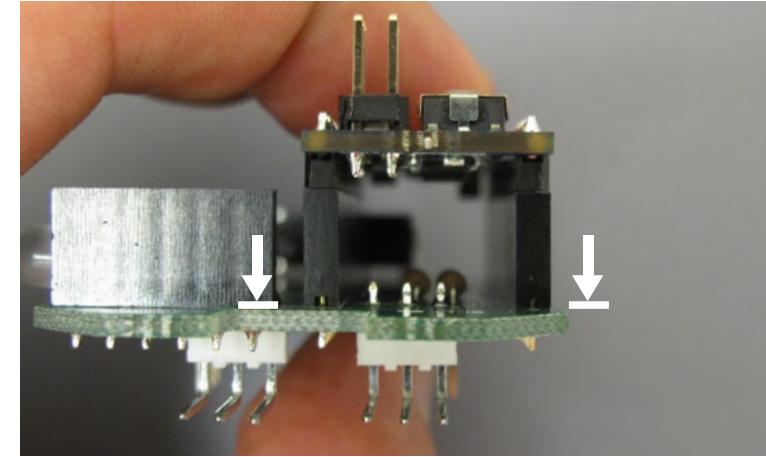
**NOTE:** Check that component is flush to the board

**08.**



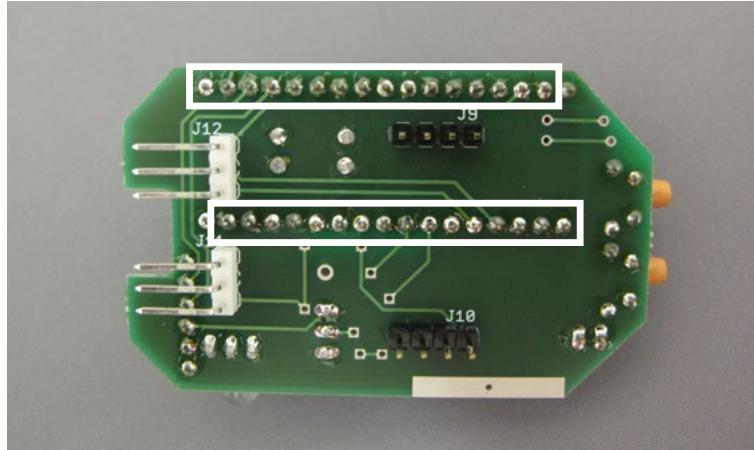
x 1

**09.**



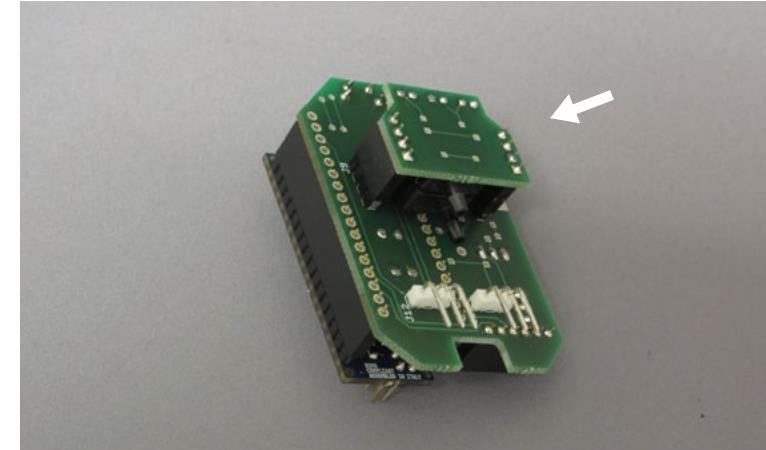
**NOTE:** Check that component is flush to the board

**10.**

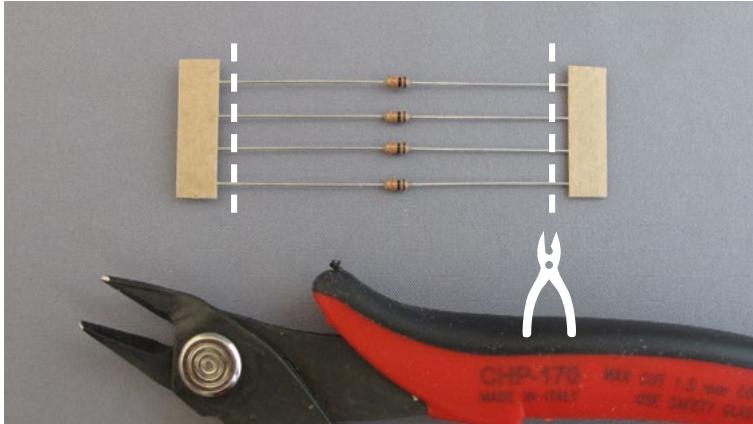
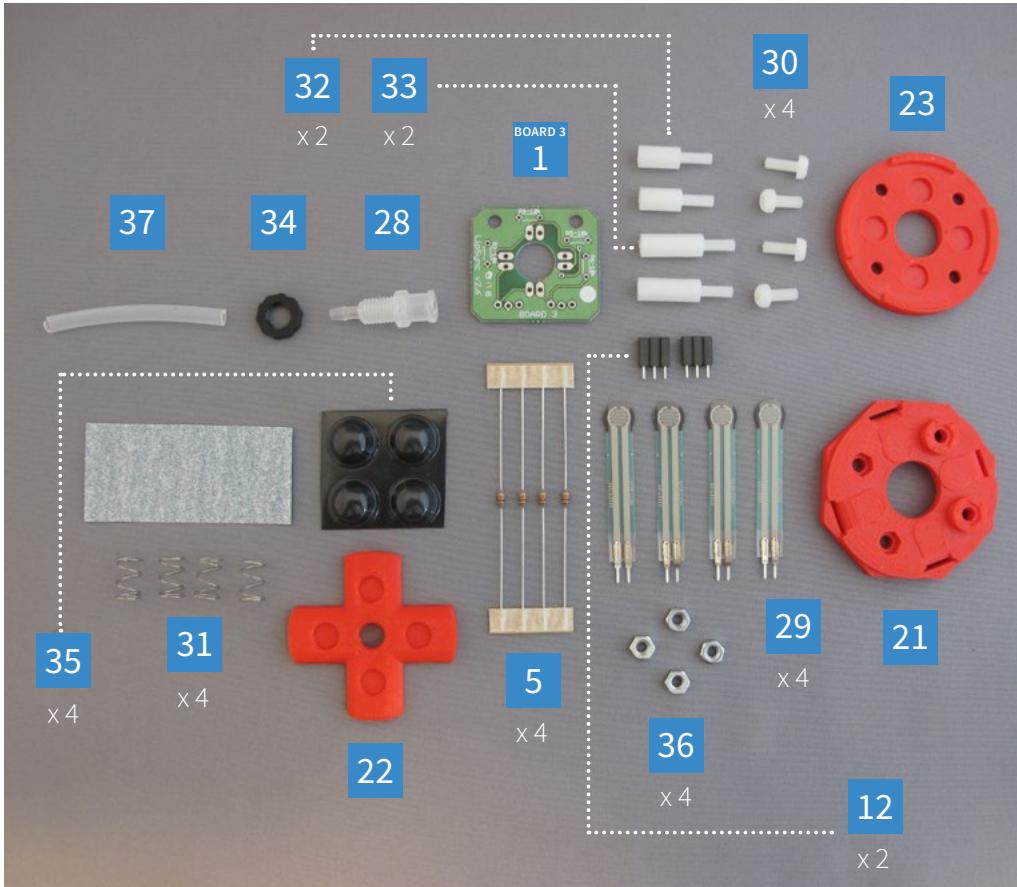


x 32

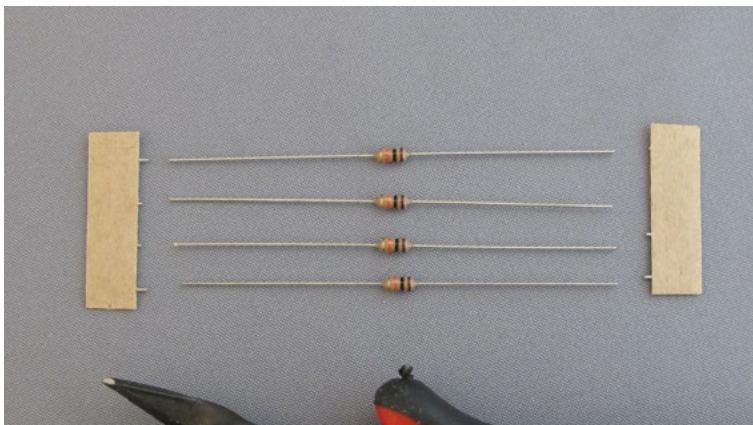
**11.**



# PART 5

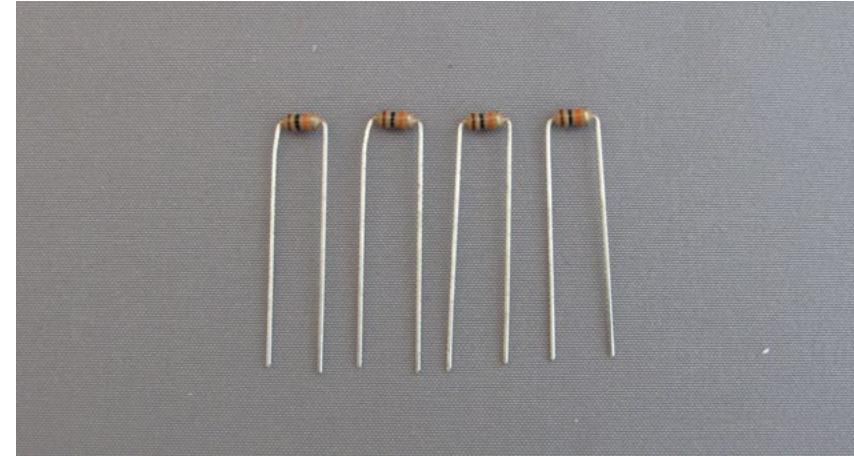
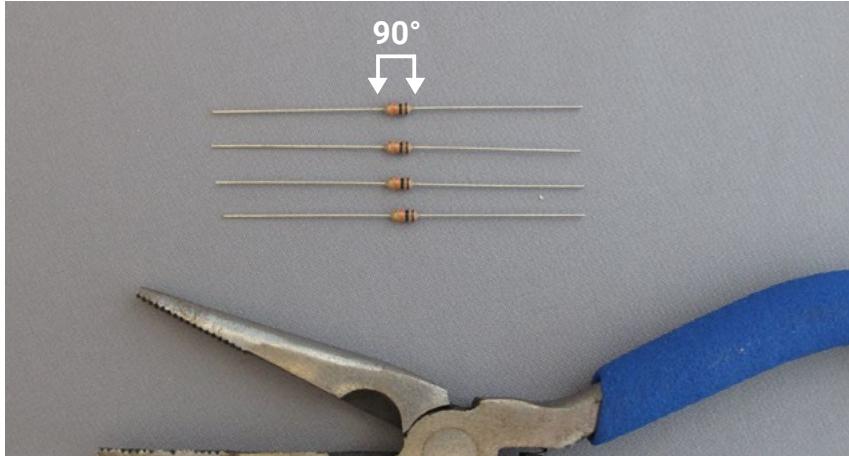


5  
x 4

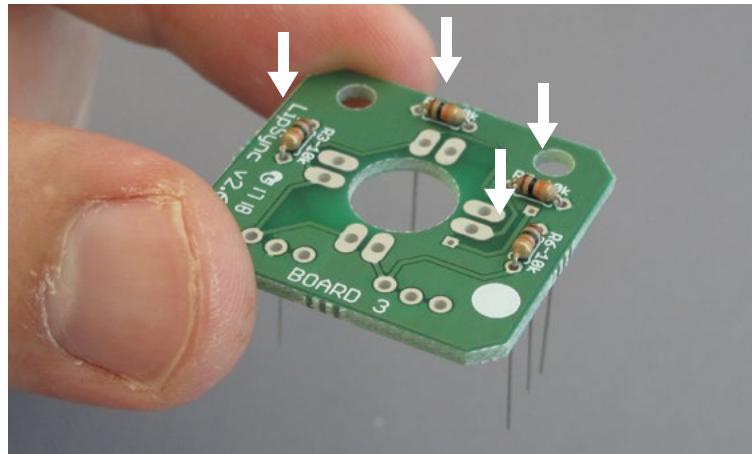


01.

**02.**



**03.**



BOARD 3

1  
x 4

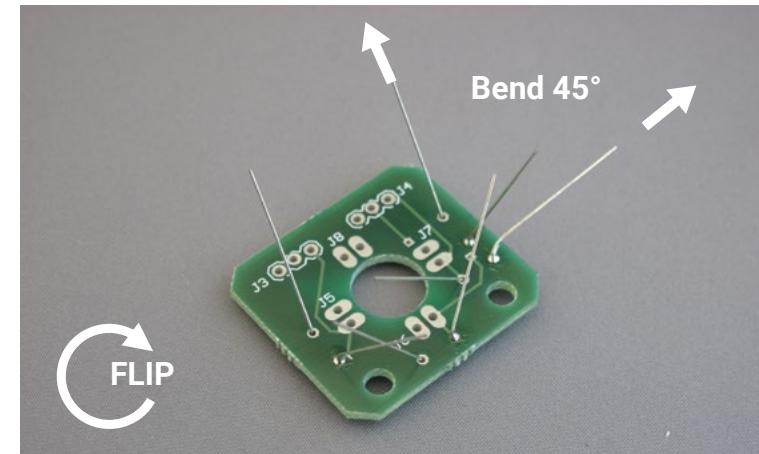
HOLE  
R3

HOLE  
R4

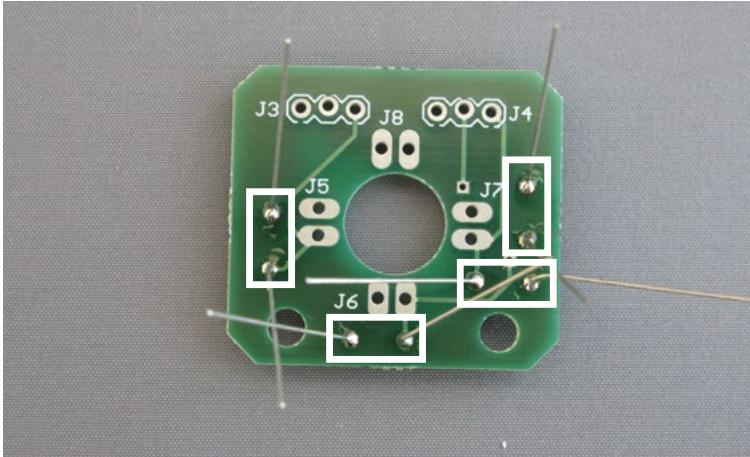
HOLE  
R5

HOLE  
R6

**04.**

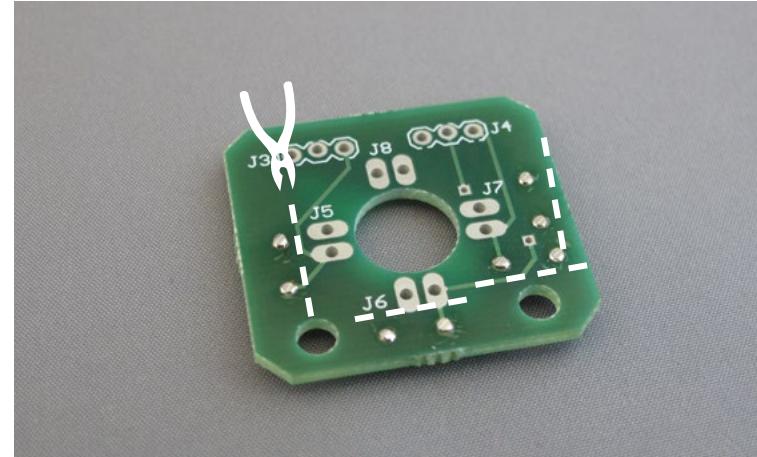


05.

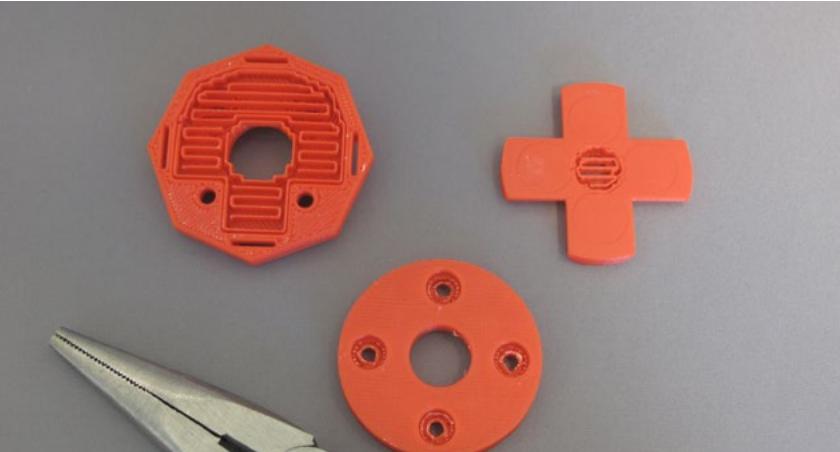


x 8

06.



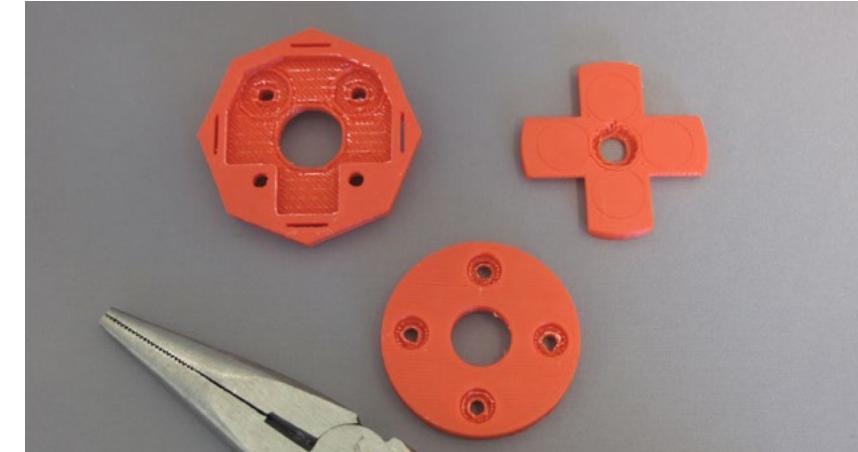
07.



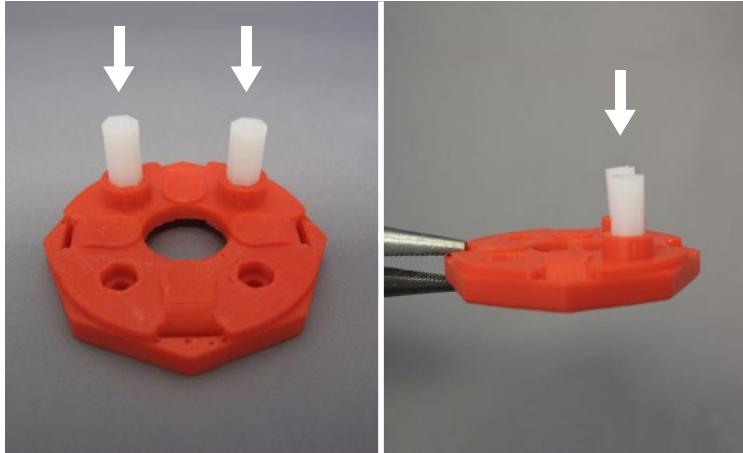
21

22

23



# 08.



**NOTE:** Insert the 10mm standoffs

32

x 2

# 09.



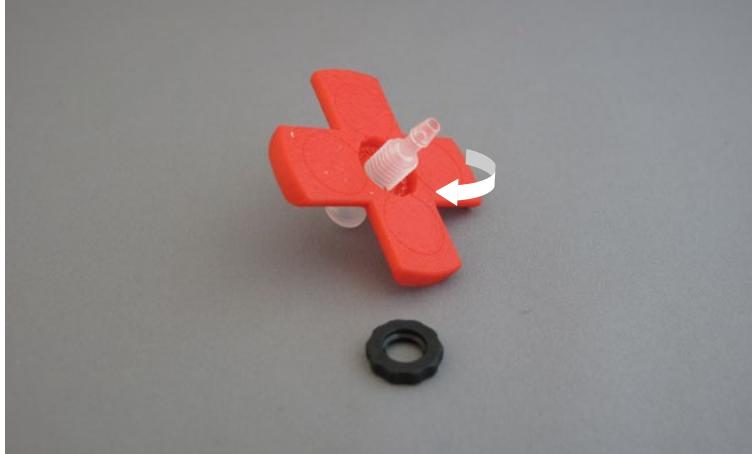
36

x 2

# 10.

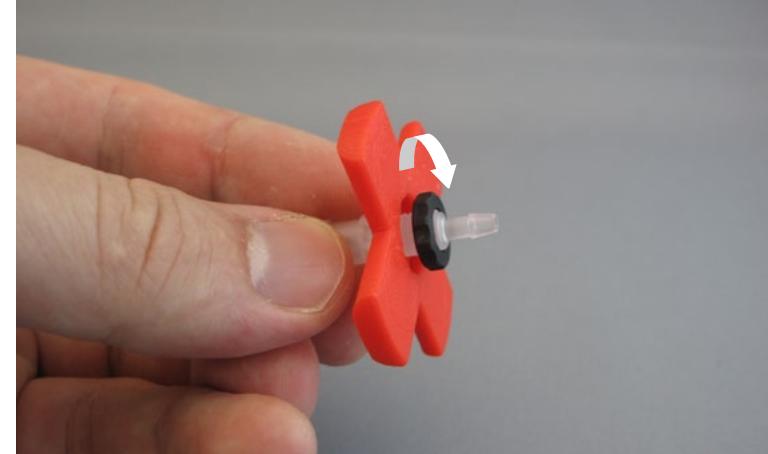


**11.**

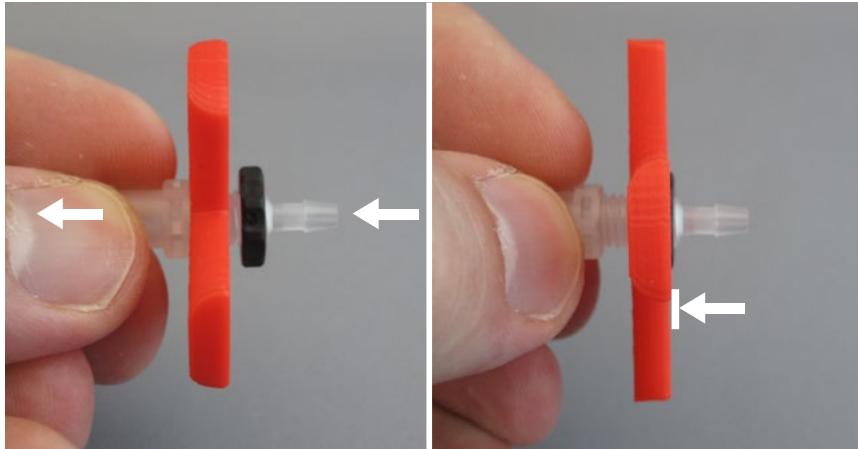


22  
28  
34

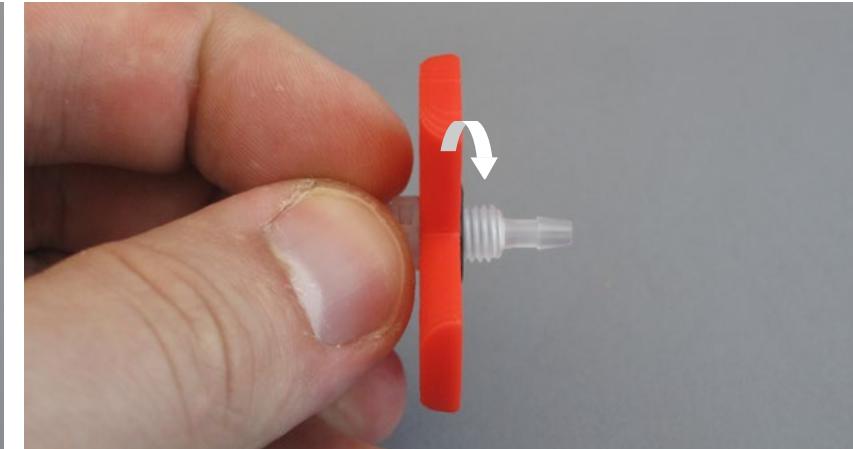
**12.**



**13.**

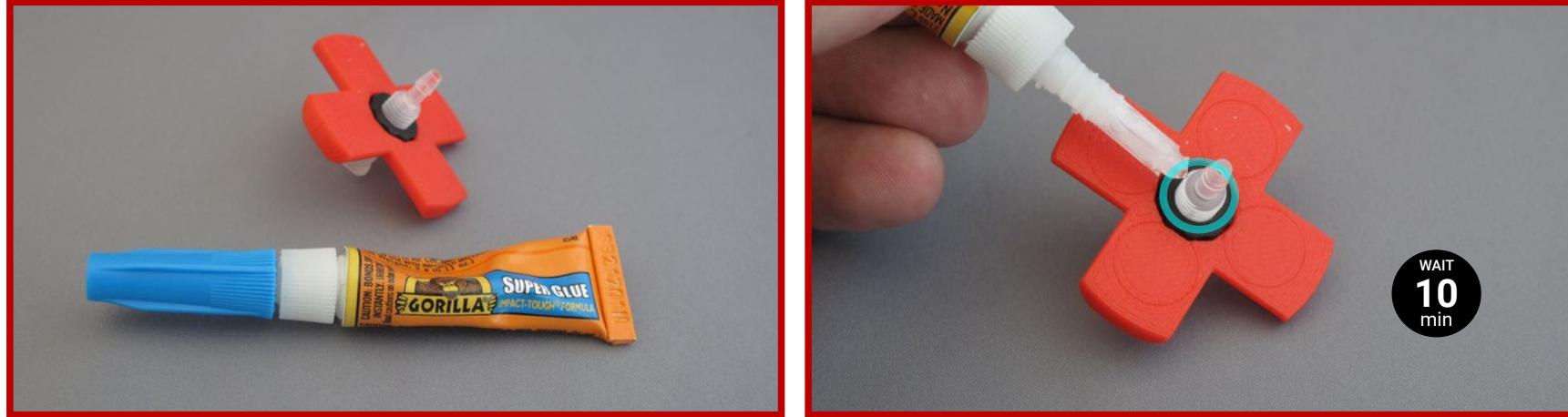


34



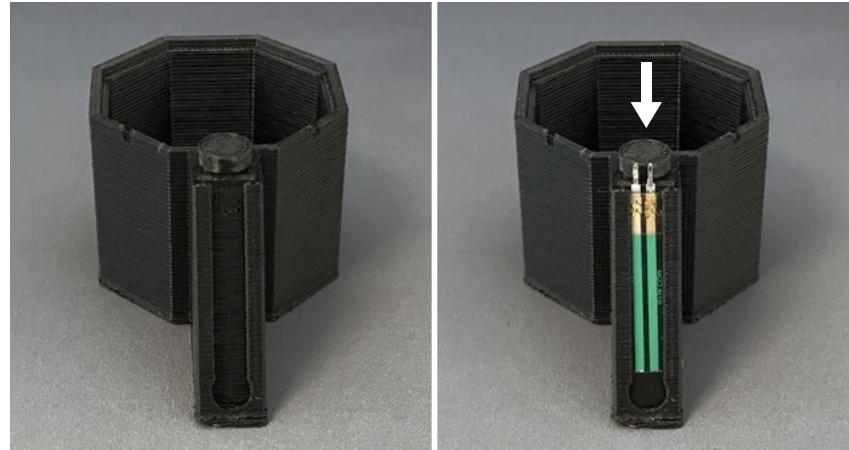
**NOTE:** The luer lock nut should sit flush to the rocker. Once flushed, twist the luer lock fitting the rest of the way.

14.



**⚠️ IMPORTANT:**  
Only add a small  
**DROP** of superglue  
where the filter and  
luer lock meet.

15.

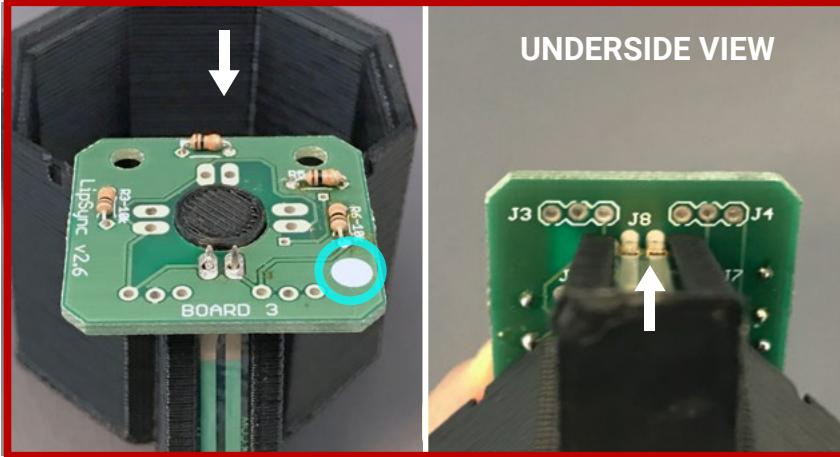


Use the joystick  
stand holder  
to assist with  
Steps 15-19

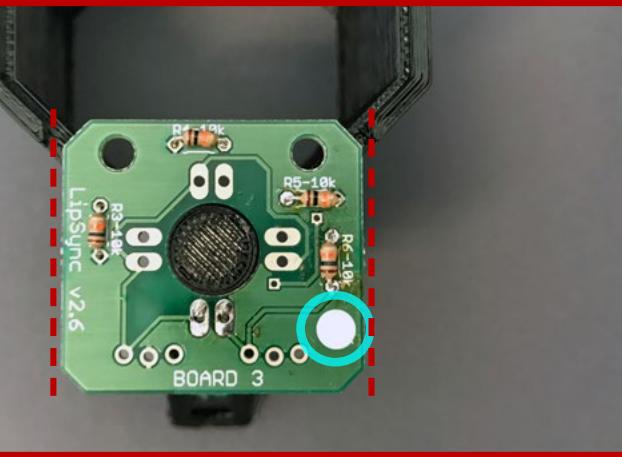
29

**⚠️ IMPORTANT:**  
Orient the FSR with  
the metallic side  
facing down

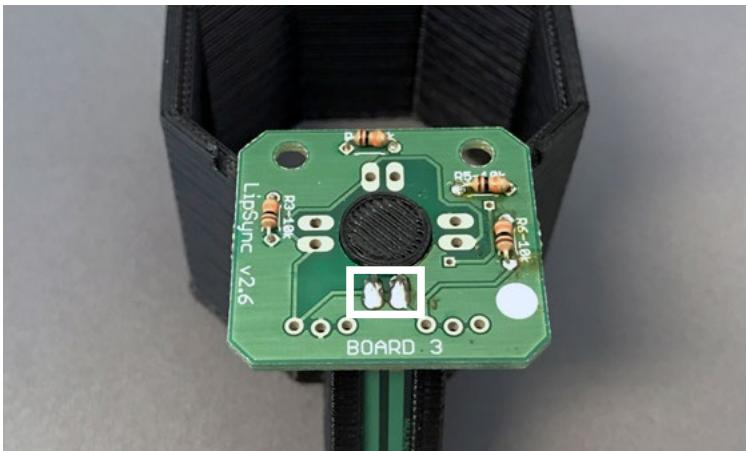
**16.**



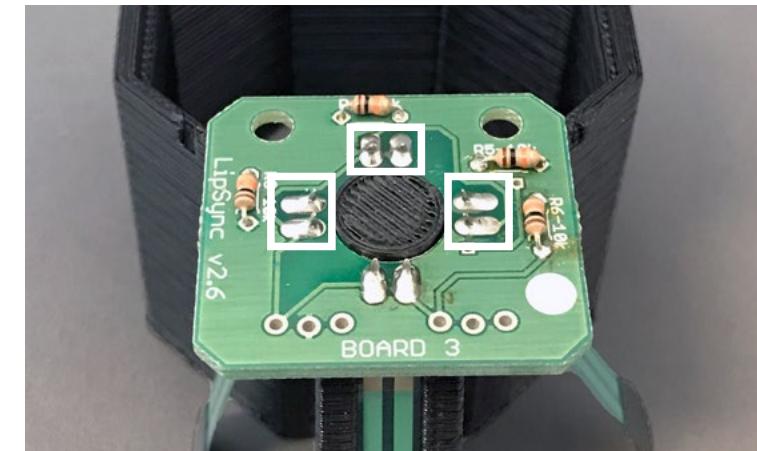
**18.**



**17.**



x 2



**29**

x 3

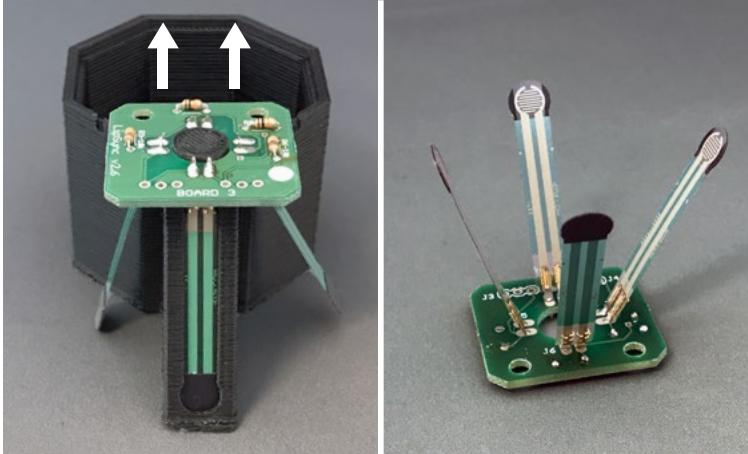
HOLE  
J6

HOLE  
J7

HOLE  
J8

Repeat steps 15-17 for the 3 remaining FSRs

**19.**



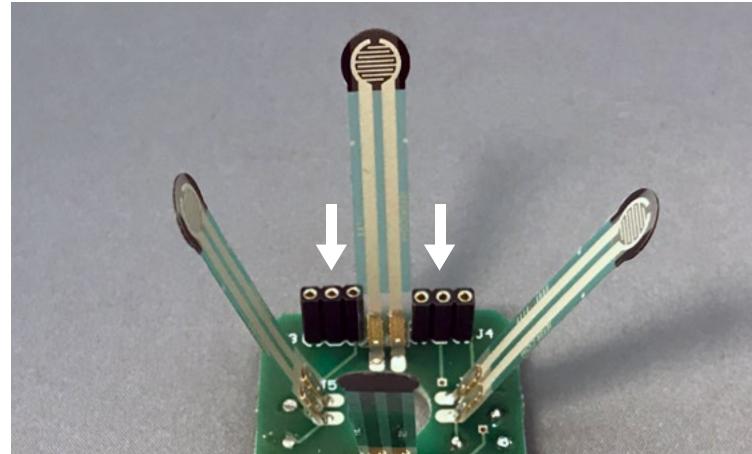
12

x 2

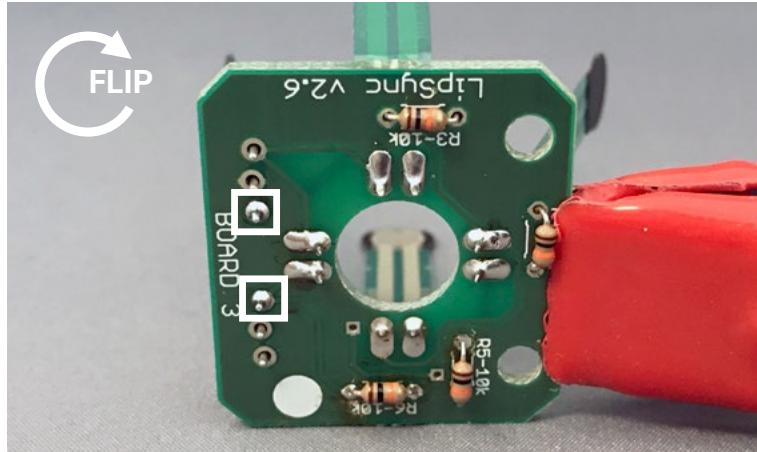
HOLE  
J3

HOLE  
J4

**20.**

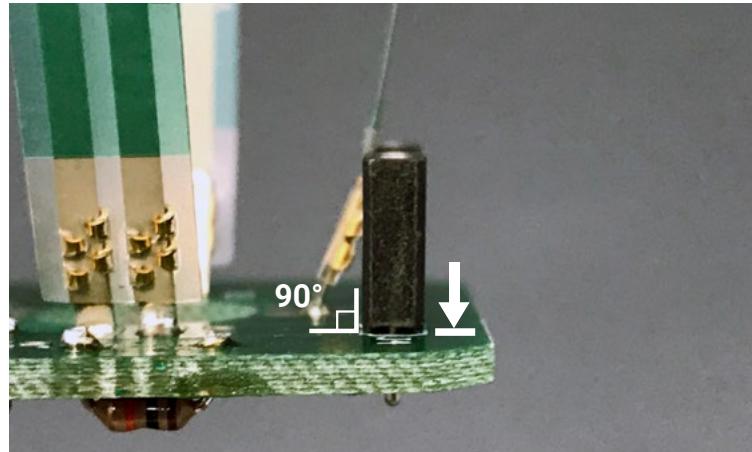


**21.**



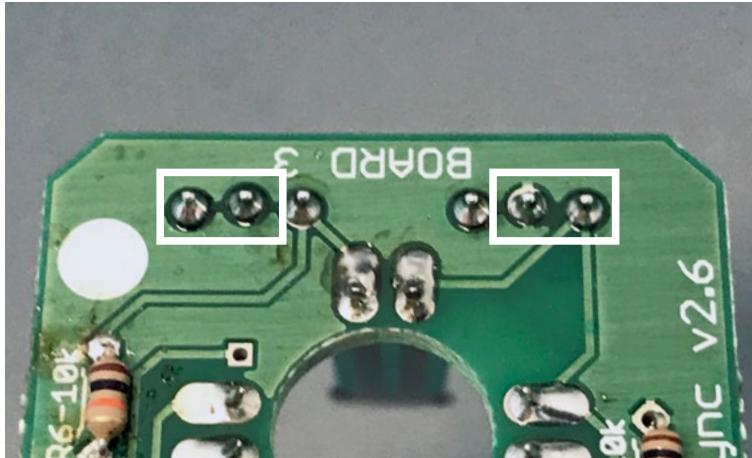
x 2

**22.**



**NOTE:** Check that component is flush to the board

**23.**

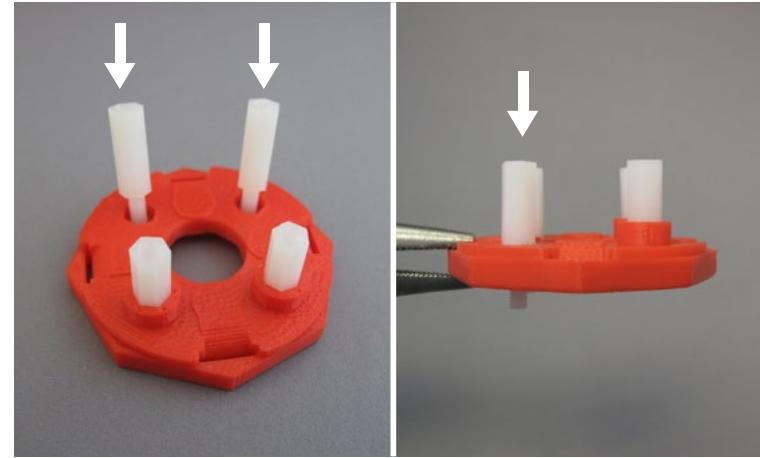


x 4

33

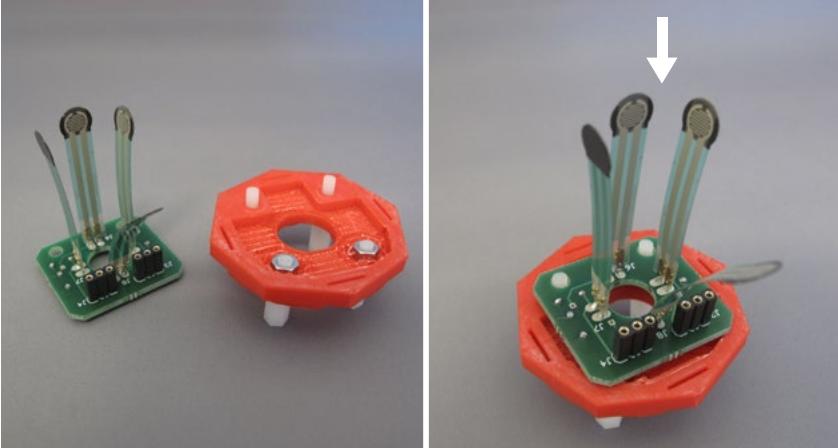
x 2

**24.**

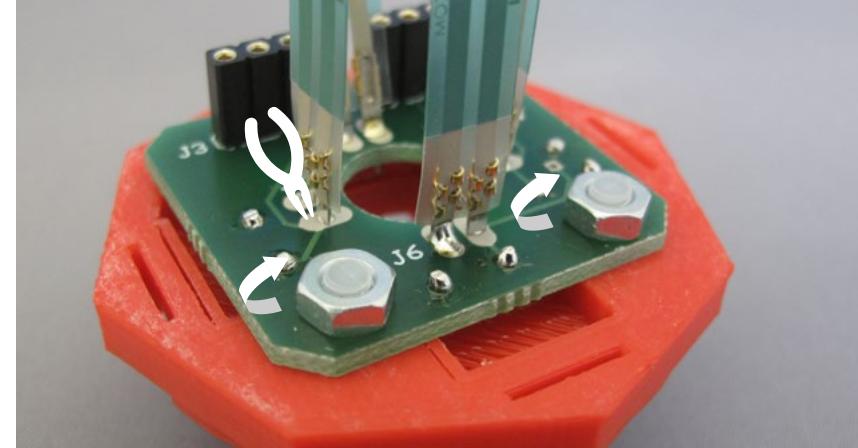


**NOTE:** Insert the 15mm standoffs

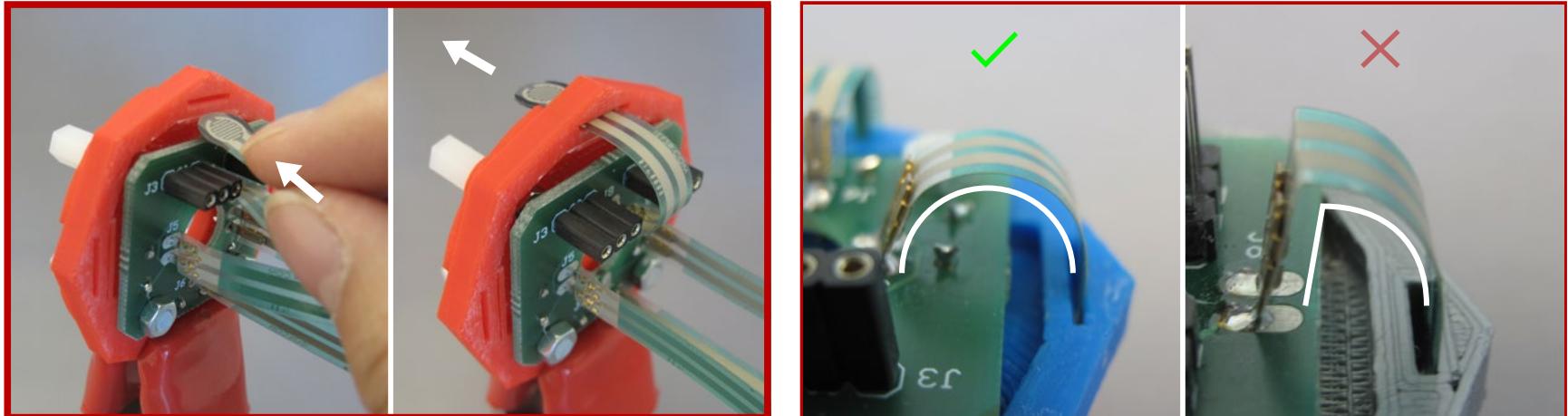
**25.**



**26.**



**27.**

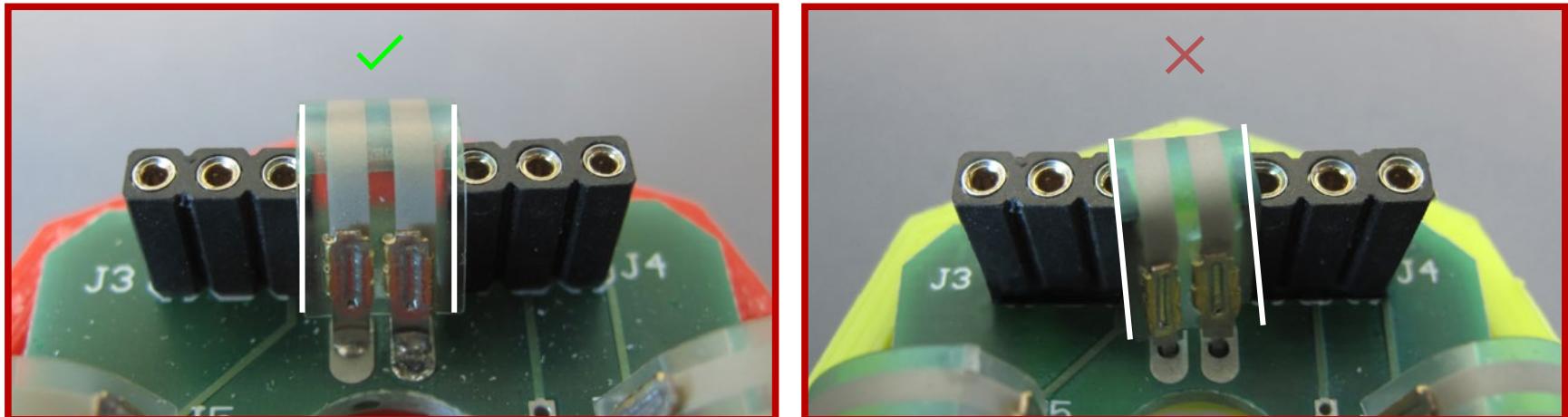


**CAUTION:**

Bend the FSR so it arcs

**GRADUALLY.** Do not fold or bend it abruptly as the ribbon breaks easily.

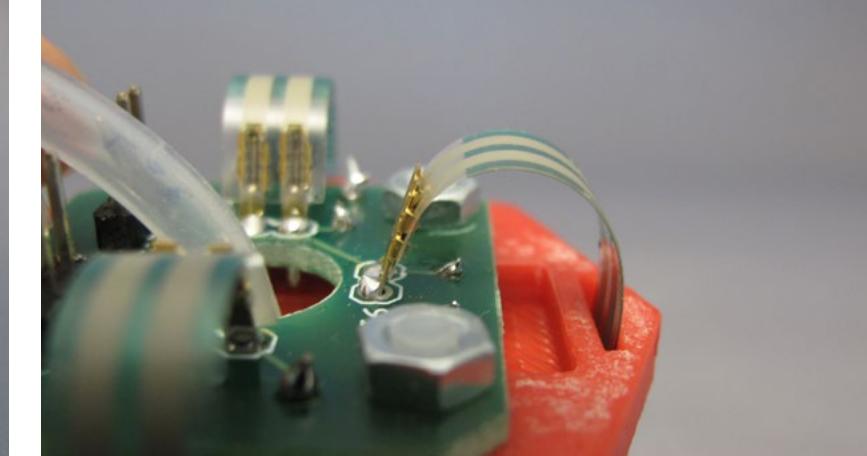
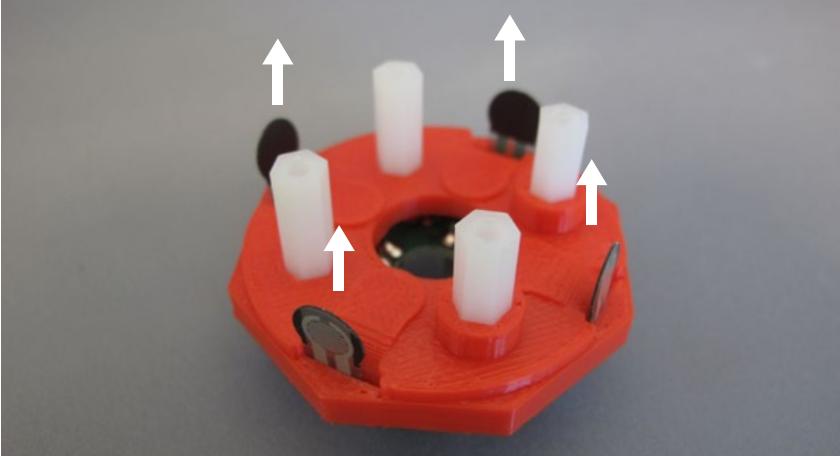
**28.**



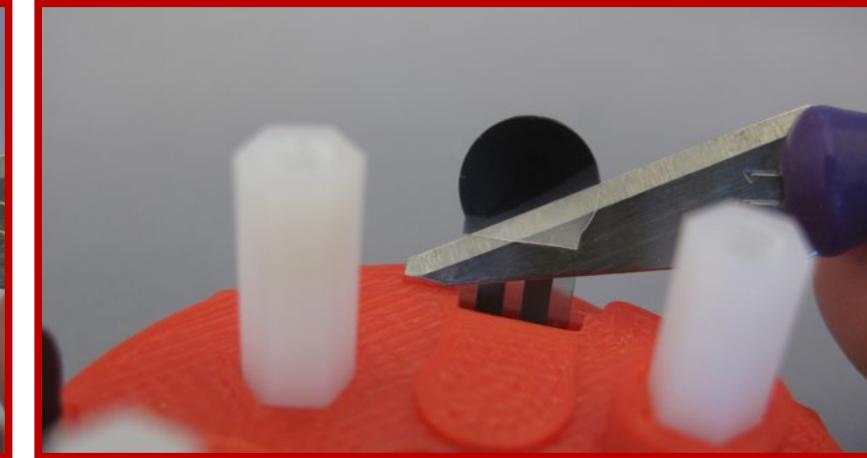
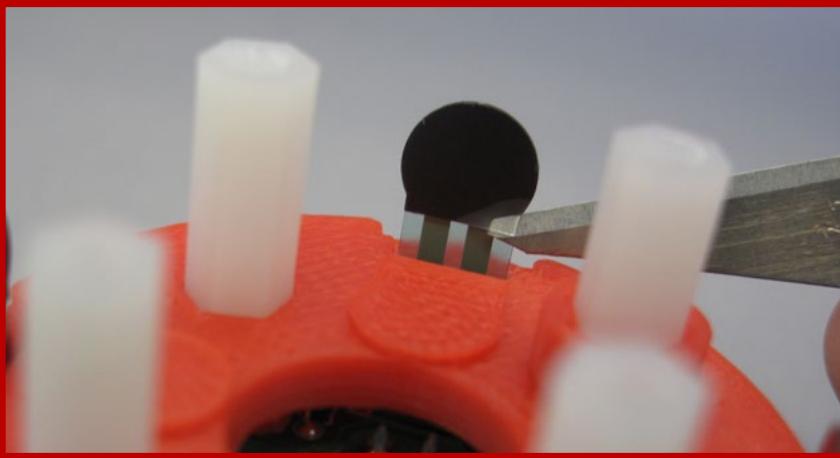
**CAUTION:**

One FSR ribbon will slightly overlap the 3-position female headers. The ribbon should not cover the through hole if soldered straight.

**29.**



**30.**

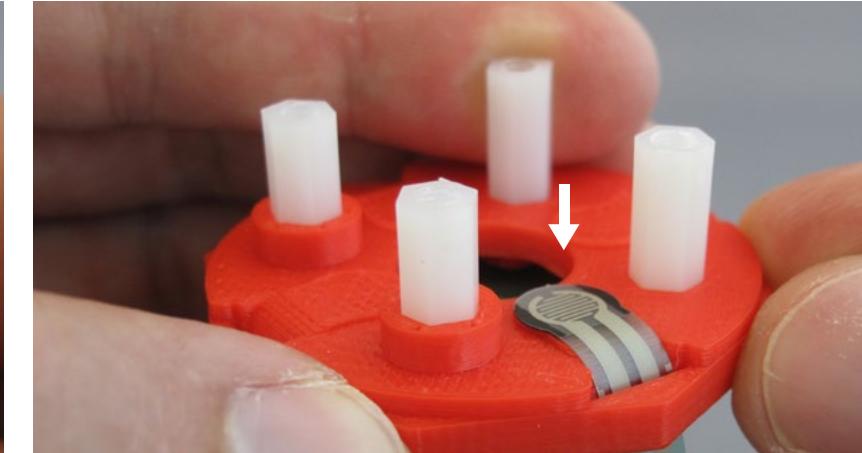
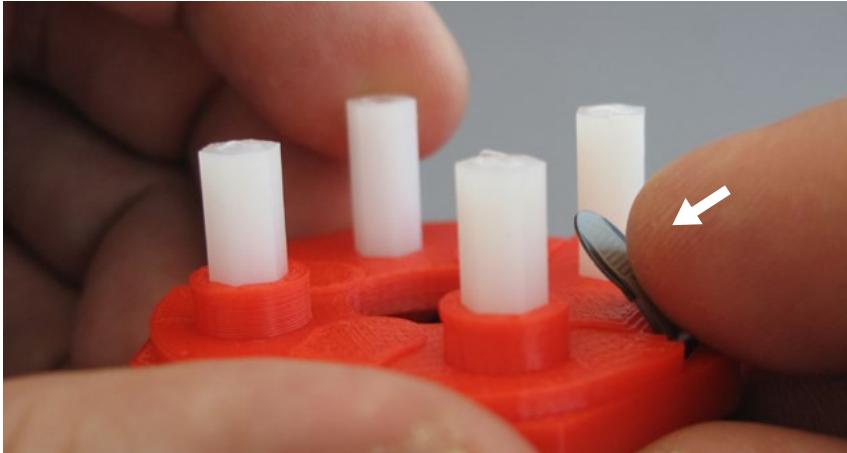


**⚠ CAUTION:**

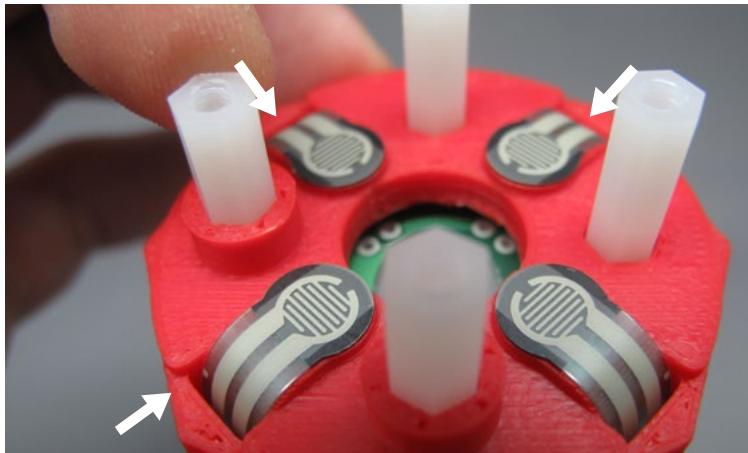
On the back of each FSR is a clear adhesive lining over the black pad.

**CAREFULLY**  
remove the lining with a hobby knife from the bottom corner.  
**Do not remove the black pad.**

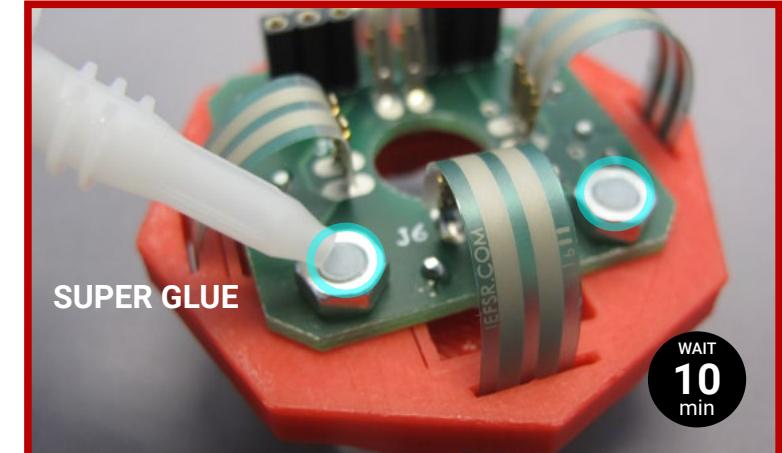
31.



32.

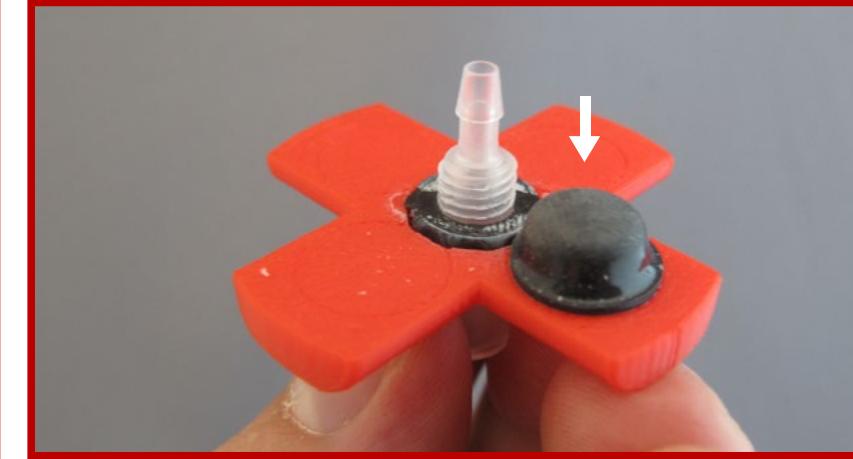
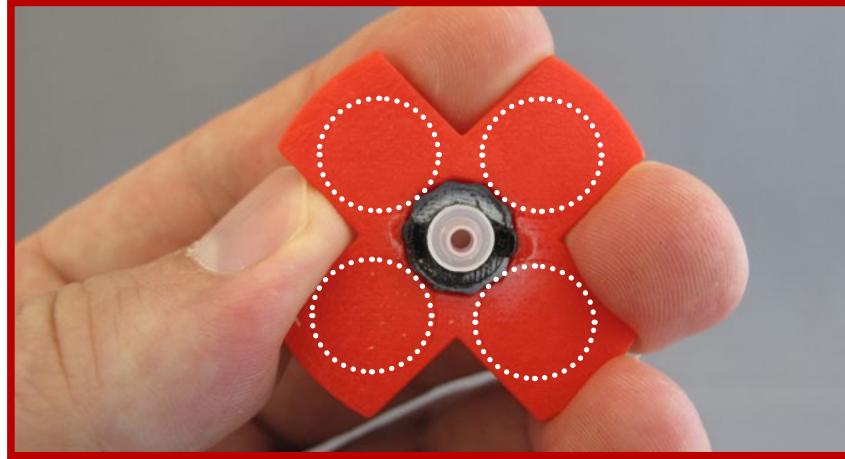


33.



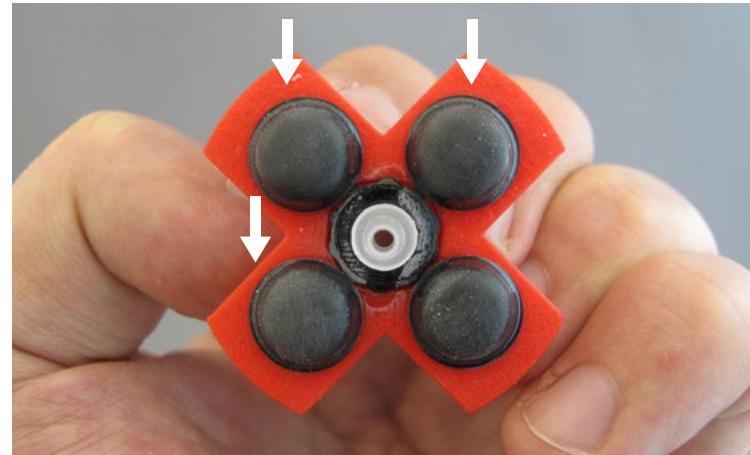
**IMPORTANT:** Only add a small **DROP** of superglue

**34.**

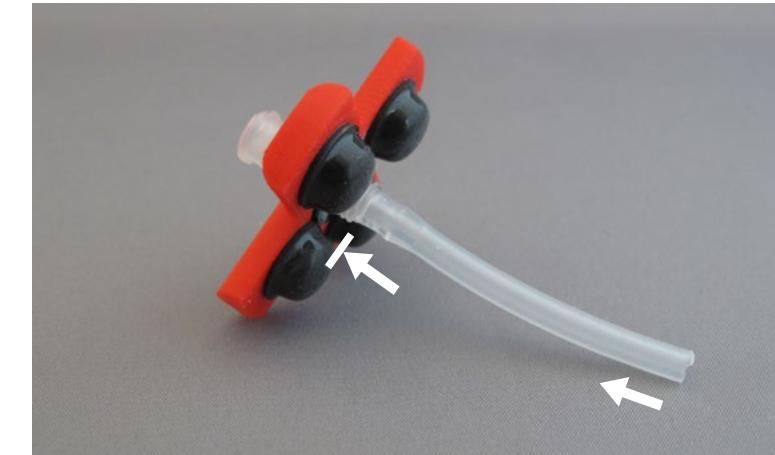


**IMPORTANT:**  
On the flat side of  
the rocker are 4  
circular outlines.  
Place a bumper  
directly on each  
outline.

**35.**

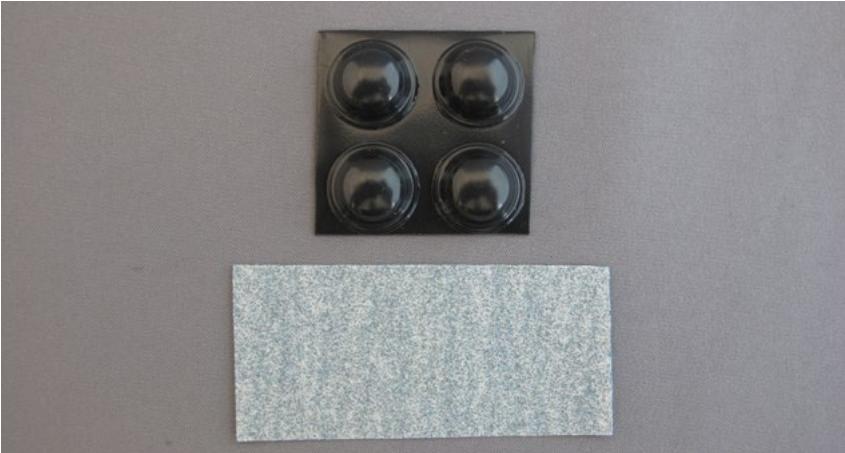


**36.**



**37**

37.



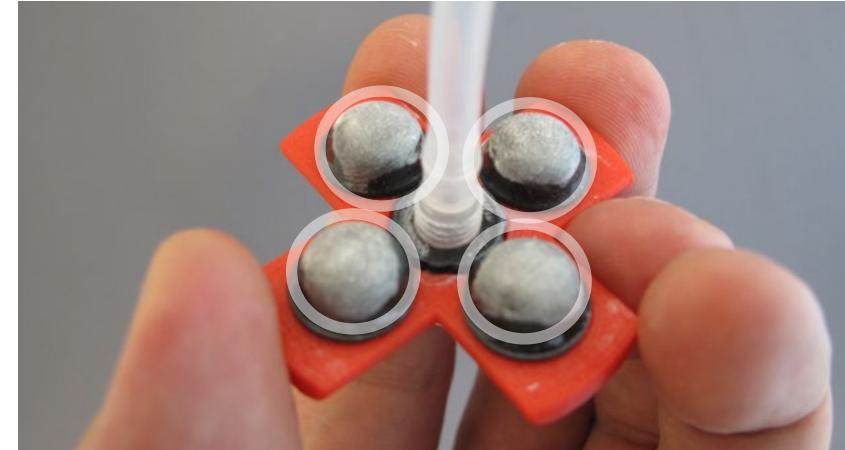
35

x4

**i NOTE:** Sand the top surface and around the bumpers

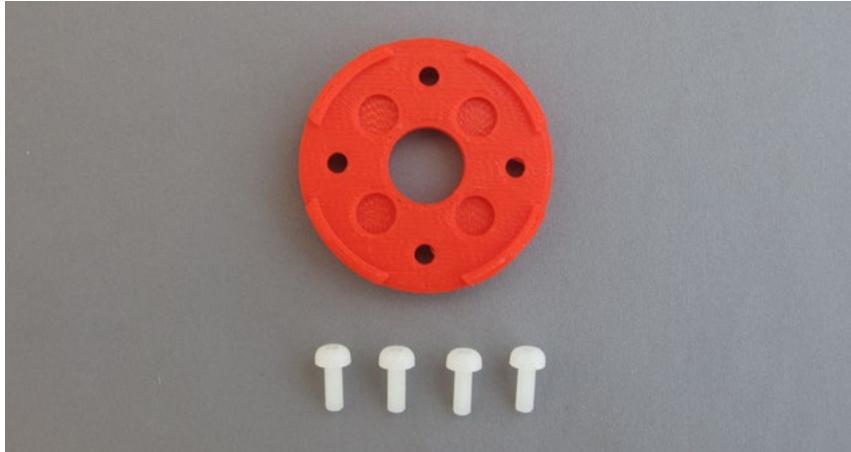


38.



**i NOTE:** Apply baby powder with your finger

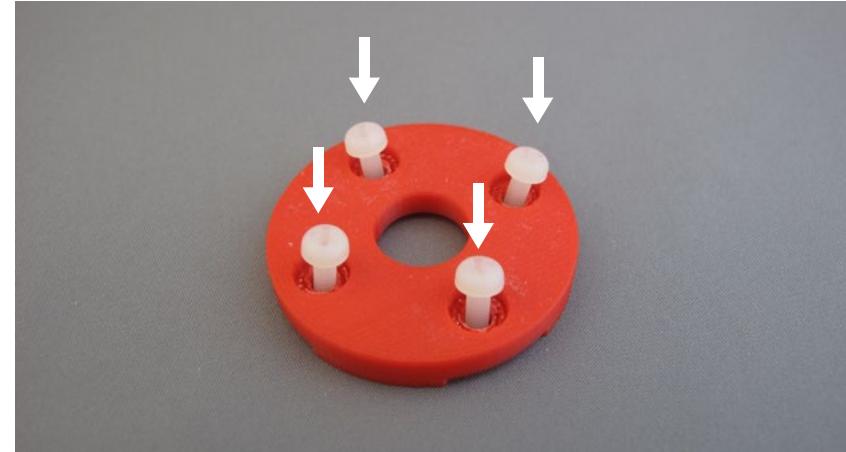
**39.**



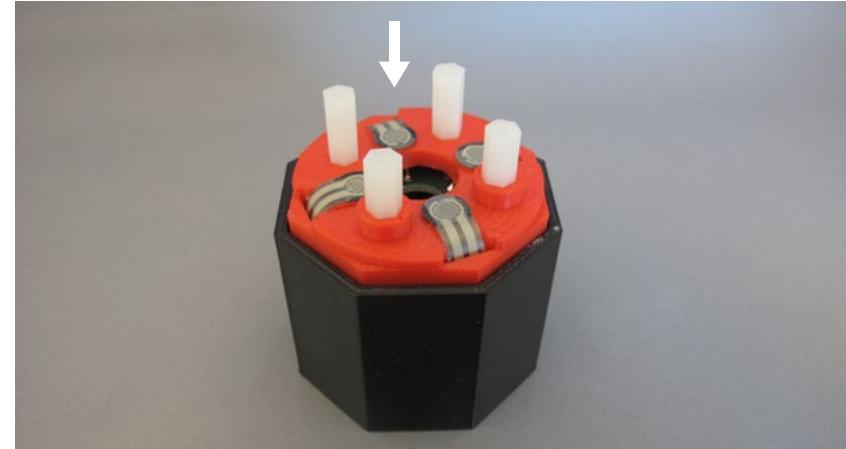
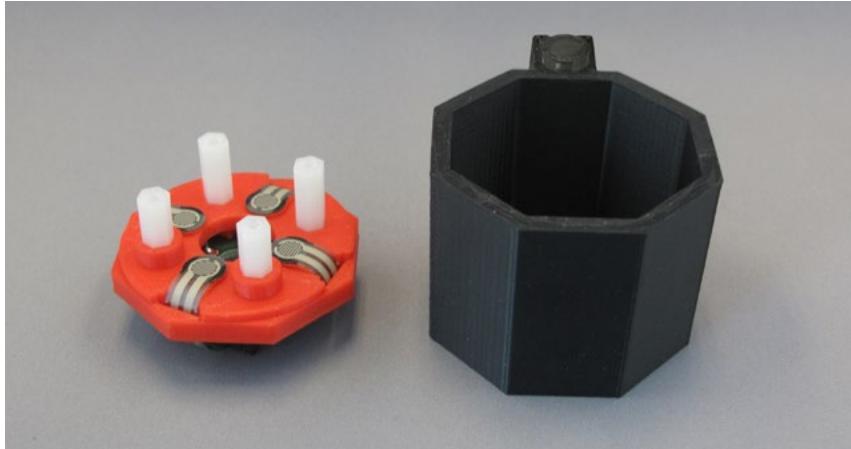
23

30

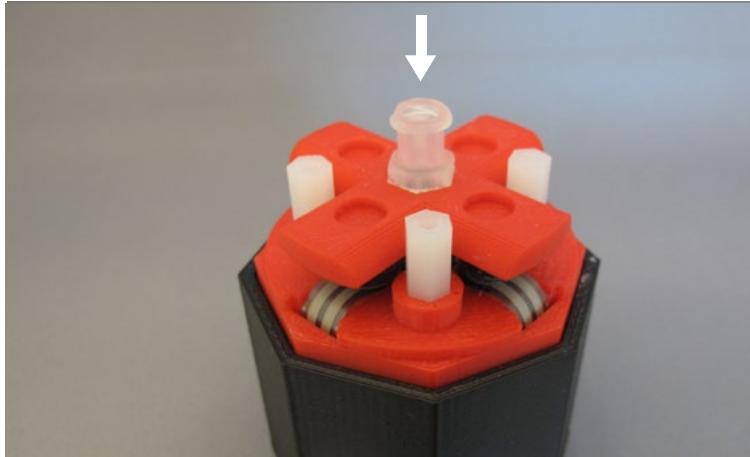
x 4



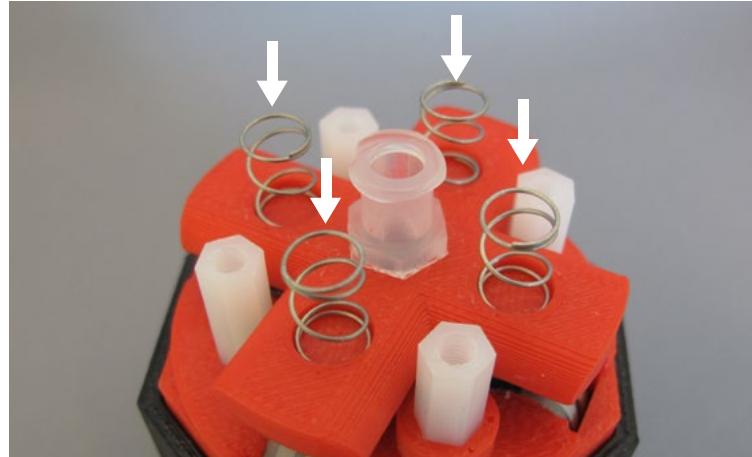
**40.**



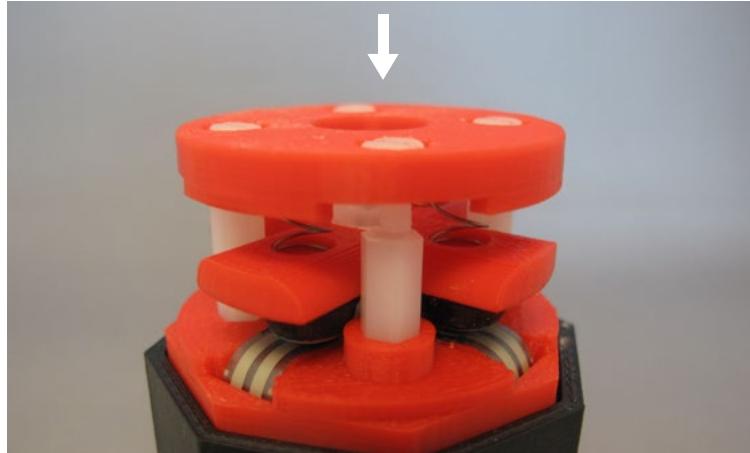
41.



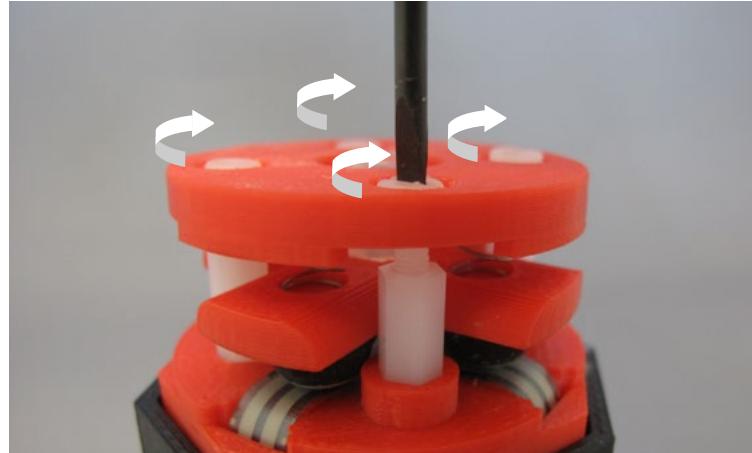
42.



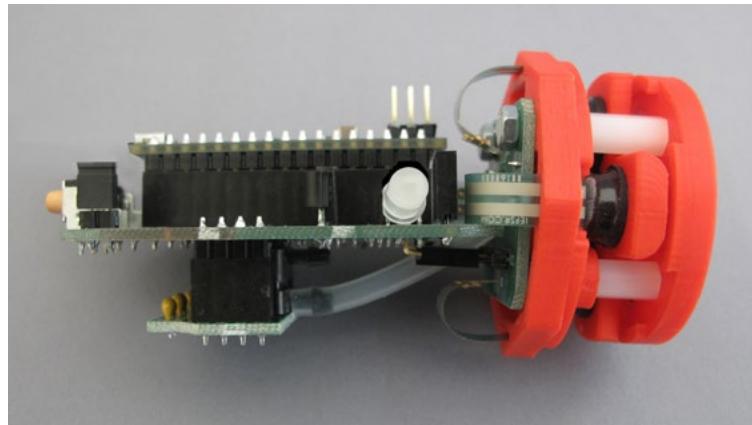
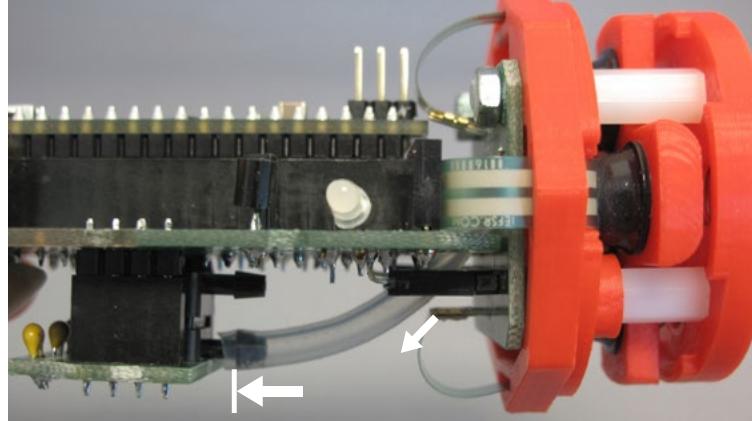
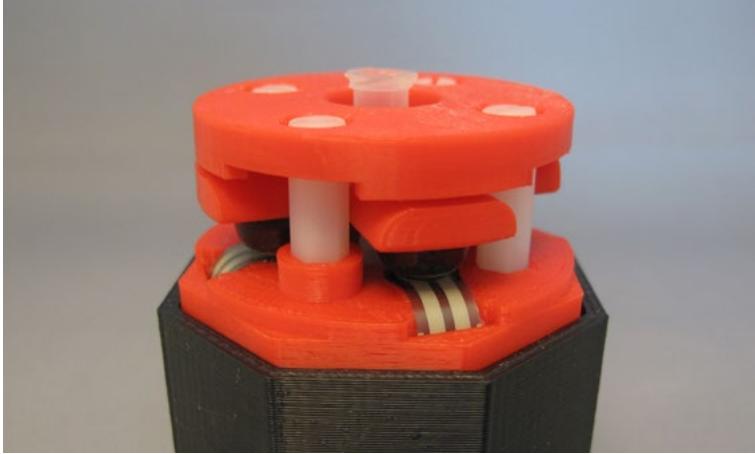
43.



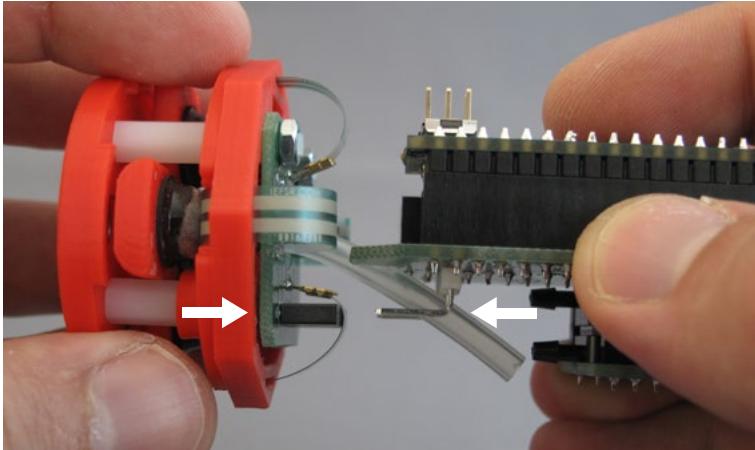
44.



**45.**



**46.**



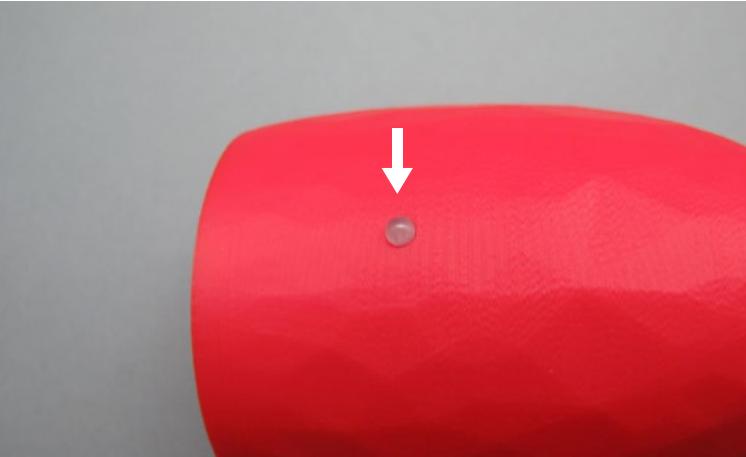
**47.**

# PART 6



24  
38

01.

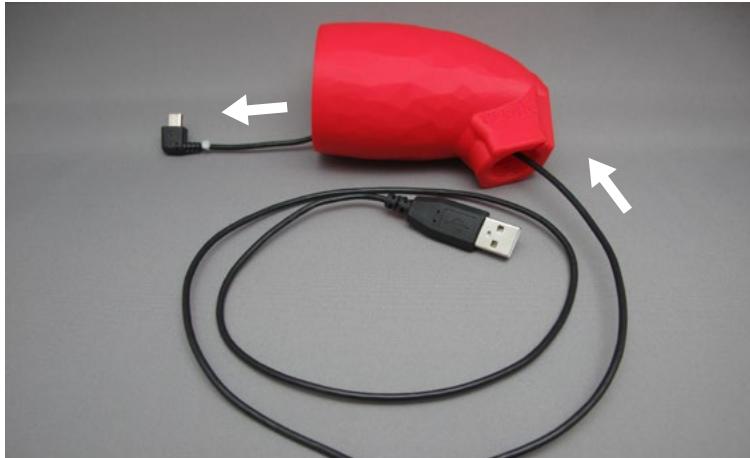
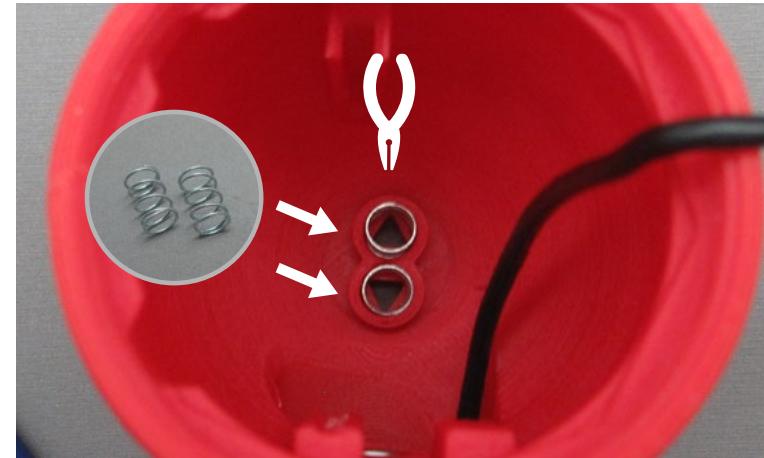


41  
43

02.



**NOTE:** Tighten the cable tie until snug

**03.****04.****05.**

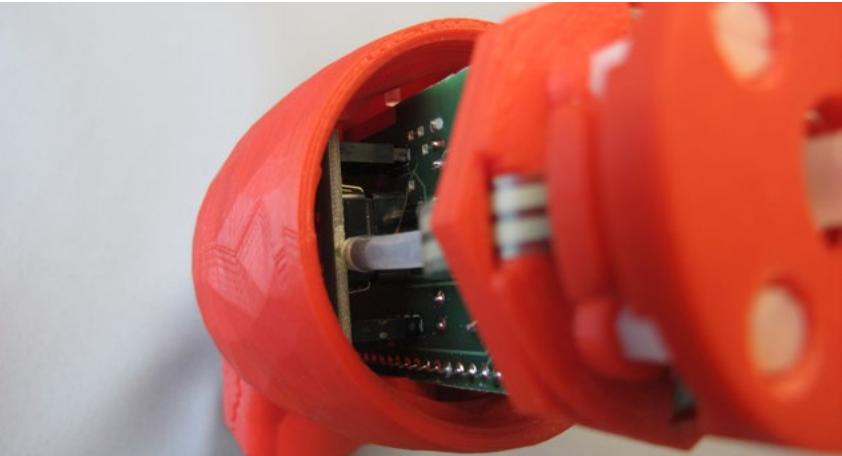
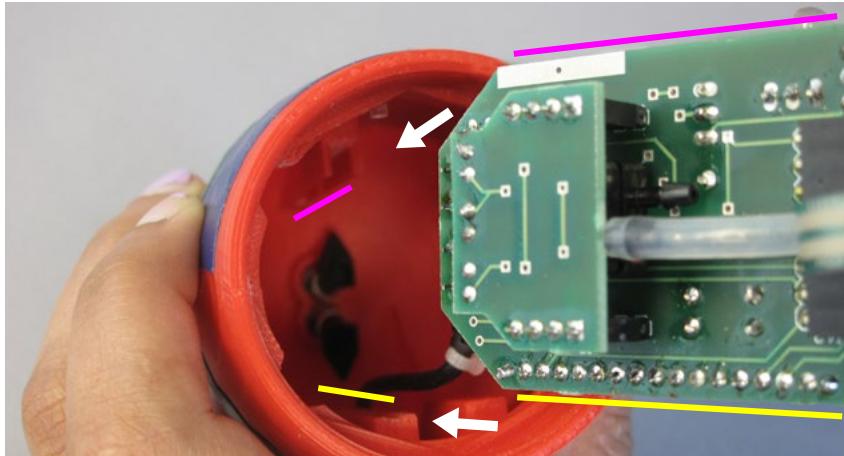
25

x 2

**06.**

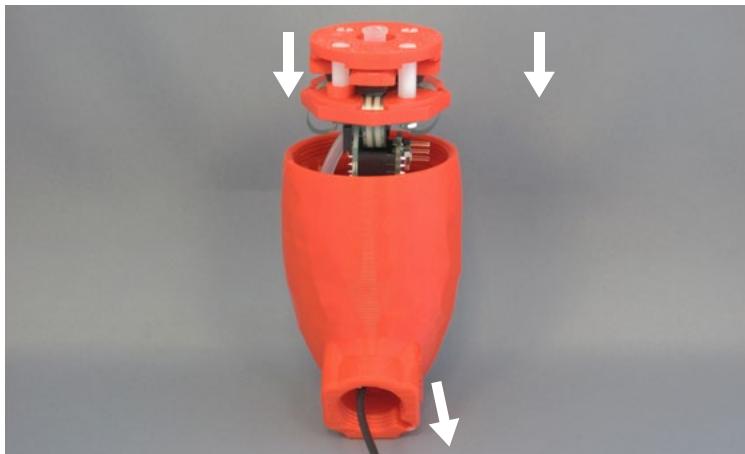
**CAUTION:** If need be, unplug cable gently while holding onto the port.

**07.**



**NOTE:** Slide the assembly along the internal tracks in the rear chamber housing.

**08.**



**09.**



**CAUTION:** Twist on hand tight

**10.**



27

**⚠ CAUTION:** Twist on hand tight

**11.**



26

**⚠ CAUTION:** Twist on hand tight

**12.**



39

**13.**



40

# PART 7

## SETTING UP THE DEVICE

**It is essential that the following steps are completed in the listed order to ensure that your device is properly set up before first using**

- A. Upload the microcontroller code.
- B. Calibrate the joystick.
- C. Read through the Startup Guide for complete information on using the LipSync:  
<https://github.com/makersmakingchange/LipSync/blob/master/README.md>

**NOTE:** In the startup guide is information about device compatibility, mounting, sip-and-puff functions, and speed control among others.

### A - UPLOADING THE MICROCONTROLLER CODE

1. Download and install the latest version of Arduino IDE:  
<https://wwwarduino.cc/en/main/software>
2. Download and save the latest LipSync microcontroller code:  
[https://raw.githubusercontent.com/makersmakingchange/LipSync/master/Software/LipSync\\_Firmware/LipSync\\_Firmware.ino](https://raw.githubusercontent.com/makersmakingchange/LipSync/master/Software/LipSync_Firmware/LipSync_Firmware.ino)

Right-click on the hyperlink of microcontroller code, select "Save Target As" (Internet explorer) or "Save Link As" (Chrome or Firefox) and save the microcontroller code (LipSync\_Firmware) to the computer directory or folder of your choice.
3. Open the Arduino IDE and click on **Tools** → **Board** → **Arduino/Genuino Micro**
4. Connect to the PC using the LipSync USB cable.
5. Click on **Tools** → **Port**
6. Click the right arrow at the top left of the Arduino IDE to upload the microcontroller code to the LipSync device.
7. Once upload is complete, a message saying "Upload Successful" will show at the bottom left of the Arduino IDE.

## B - JOYSTICK CALIBRATION

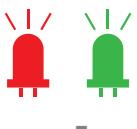
Calibrate your LipSync joystick before first using your device.

**⚠️ IMPORTANT:** Allow the LipSync to initialize for 3 seconds before moving the mouthpiece **each time** after it's plugged into a device.



1

Press both speed adjustment buttons on the back of the LipSync for a few seconds until LED comes on



x 5

2

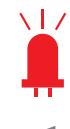
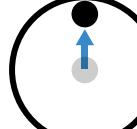
LED slowly blinks red & green 5 times



3 sec.  
pause



x 6



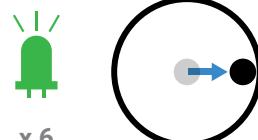
x 1

3

While LED blinks green 6 times, move the mouthpiece to the 12 o'clock position (up direction)

4

LED blinks red 1 time when position is measured



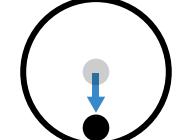
x 6



x 1

5

While LED blinks green 6 times, move the mouthpiece to the 3 o'clock position (right direction) time when position is measured



x 6

6

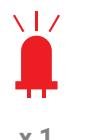
LED blinks red 1 time when position is measured  
While LED blinks green 6 times, move the mouthpiece to the 6 o'clock position (down direction) time when position is measured



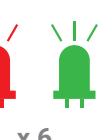
x 6

7

LED blinks red 1 time when position is measured  
While LED blinks green 6 times, move the mouthpiece to the 9 o'clock position (left direction) time when position is measured



x 1



x 6

11

LED rapidly blinks red and green 6 times when calibration is complete