

LipSync

ASSEMBLY MANUAL

Version 1.4.5.1

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 (Optional) Mounting the LipSync
- 54 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

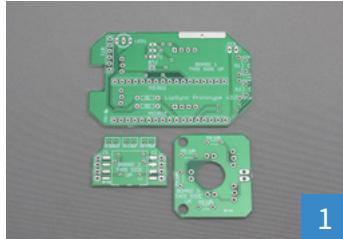
LipSync-master\LipSync_BOM.csv: Contains LipSync Components in CSV format

PART 0b

COMPONENT CHECKLIST

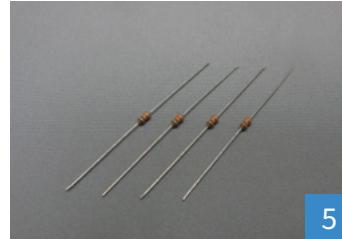
- 1** (1) LipSync Circuit Board Package (3 boards)
- 2** (1) Arduino Micro **OR**
(1) Genuino Micro
- 3** (2) Right Angle Push Buttons
- 4** (2) 300 Ohm 1/4W T/H Resistors
- 5** (4) 10k Ohm Mini 1/4W T/H Resistors
- 6** (1) NXP Semiconductors Pressure Sensor
- 7** (1) 0.01uF Ceramic T/H Radial Capacitor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

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



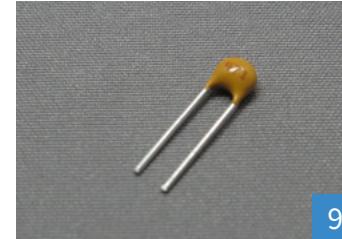
LipSync Circuit Board Pack:
(1) Main Interface Board
(1) Pressure Sensor Board
(1) Joystick Board
[LipSync Page](#)

1



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

5



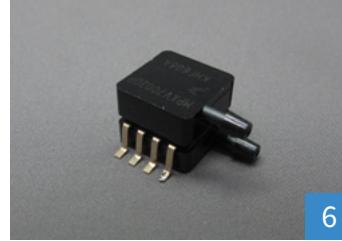
(1) 470pF Ceramic Through
Hole Radial Capacitor
[capacitor label: 471]
[Digikey.ca](#)
[Digikey.com](#)
*or from any electronics shop

9



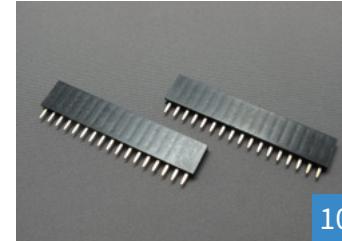
(1) Arduino Micro/ Genuino
Micro microcontroller
[Arduino](#) [Digikey](#) [Robotshop](#)
[Adafruit](#) [Pololu](#)
COMPATIBILITY NOTE: The
"Arduino Micro" or "Genuino
Micro" **MUST** be used.

2



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

6



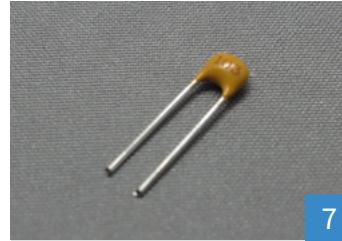
(2) 17-Position Straight
Female Through Hole
Headers
[Digikey.ca](#)
[Digikey.com](#)
*or from any electronics shop

10



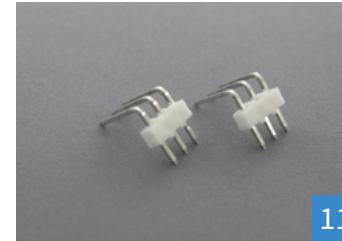
(2) Right Angle Push Buttons
[Digikey.ca](#)
[Digikey.com](#)

3



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

7



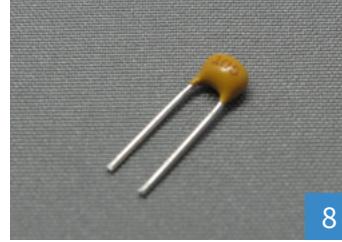
(2) 3-Position Right Angle
Male Header
[Digikey.ca](#)
[Digikey.com](#)
*or from any electronics shop

11



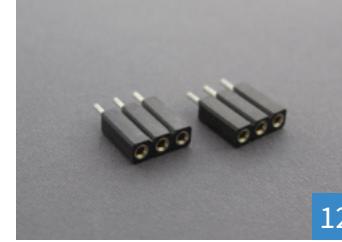
(2) 300 Ohm 1/4W Through
Hole Resistors
[Digikey.ca](#)
[Digikey.com](#)
*or from any electronics shop

4



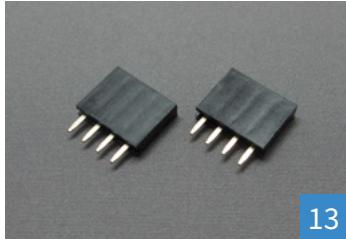
(1) 1.0uF Ceramic Capacitor
[capacitor label: 105]
[Digikey.ca](#)
[Digikey.com](#)
*or from any electronics shop

8



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

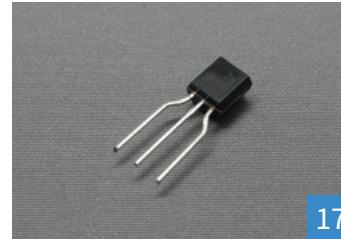
12



(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"

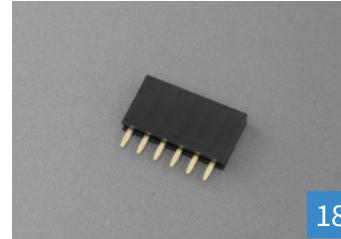
21



(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

NOTE: 3D printed files and print settings can be found in "LipSync_STL.zip"



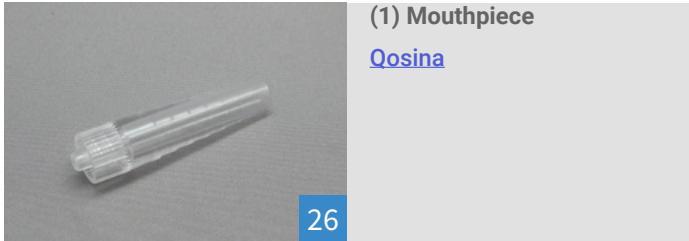
(4) Force Resistive Sensor
[Digikey.ca](#)
[Digikey.com](#)

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



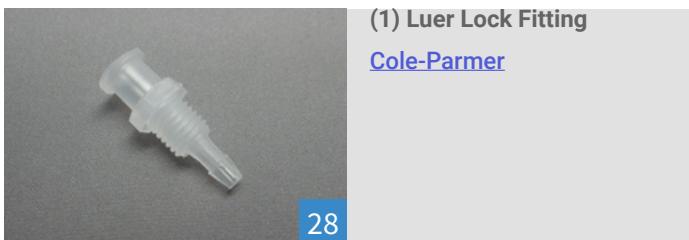
(6) Compression Springs
[Lee Spring](#)

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



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

37



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

41



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

45



(1) Light pipe
[Mouser](#)

38



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

42



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

39



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

43



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

40



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

44

PART 0c

EQUIPMENT CHECKLIST

- Small Spool of 60Pb/40Tn Solder Wire
- Desolder Pump (or "solder sucker")
- Temperature Adjustable Soldering Iron (350°C)
- (1) Adjustable Tabletop Vise
(if possible, PANAVISE Junior Vise with Base)
- Needle Nose Pliers
- Safety Glasses
- Fine File or Sandpaper
- Small Fan (if possible, fume extractor)
- Baby Powder
- Hobby Knife
- Super Glue
- Flush Cutters
- Medium Strength Threadlocker
- ABS or High Strength PLA Filament 100g



= Solder the part outlined in the white outline



= Component number



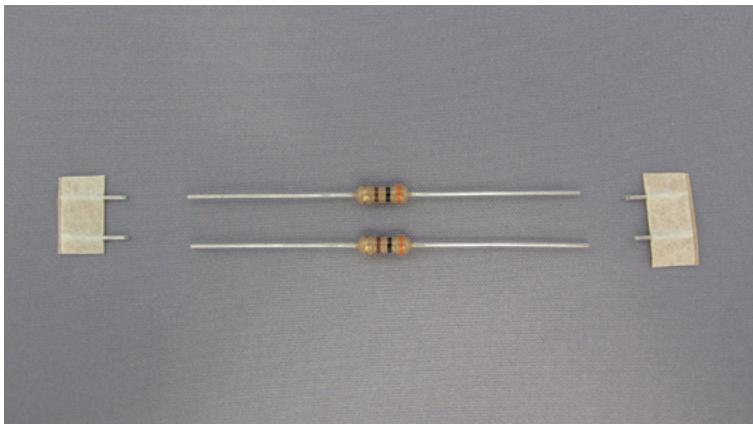
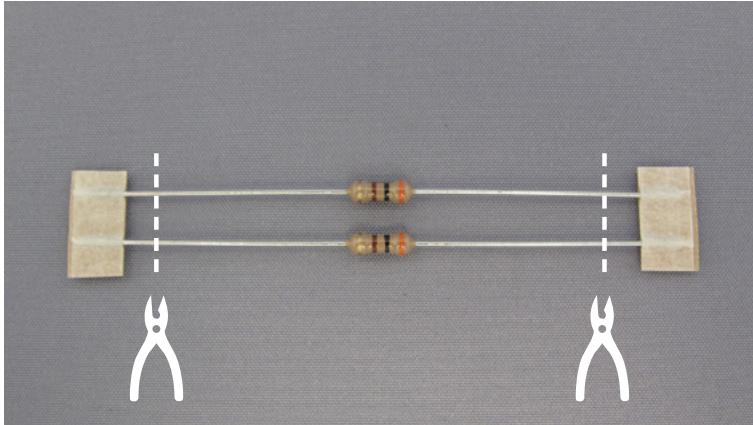
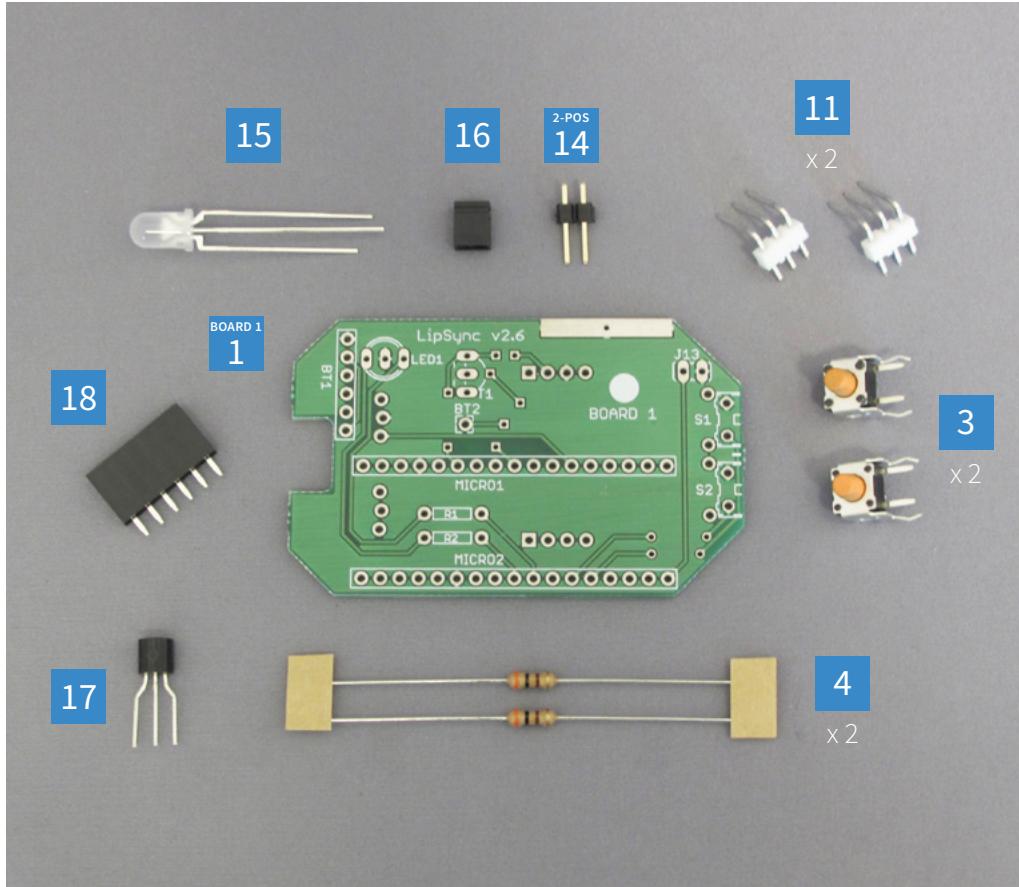
= Name of plated through-hole



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

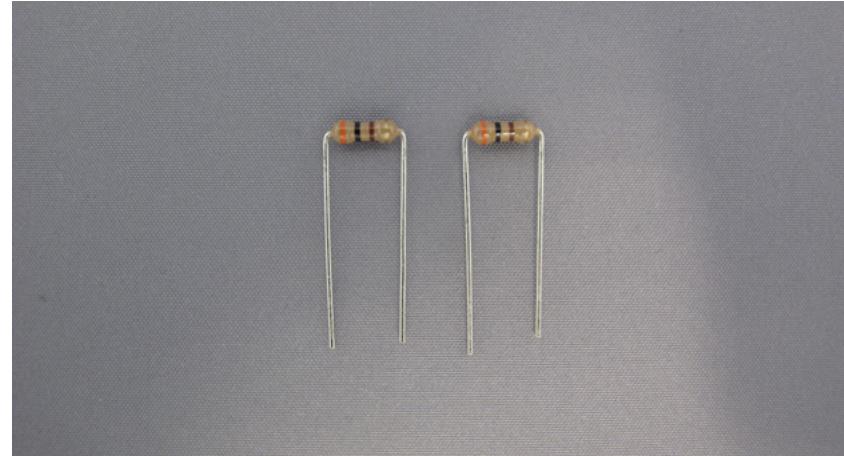
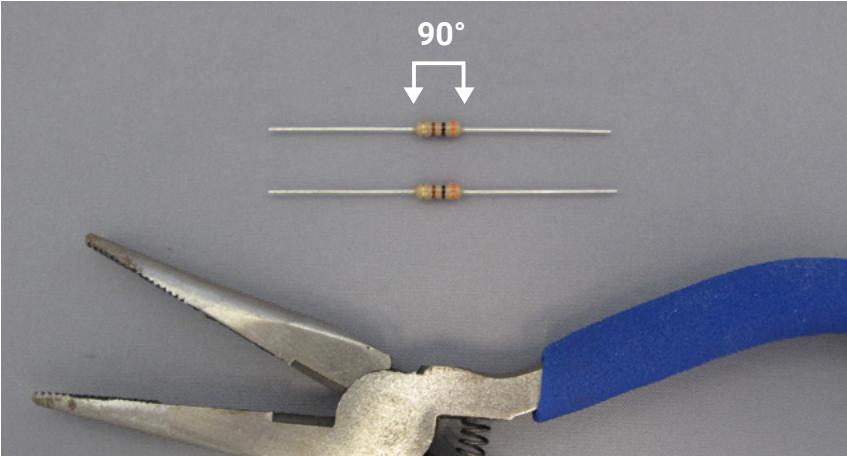
PART 1



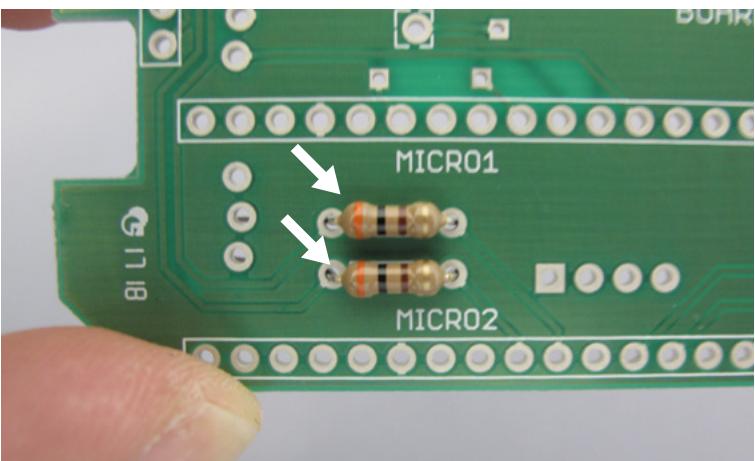
4
x 2

01.

02.

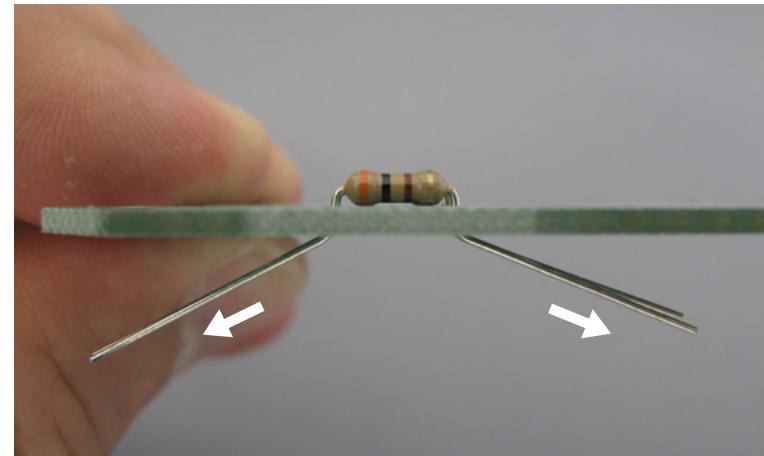


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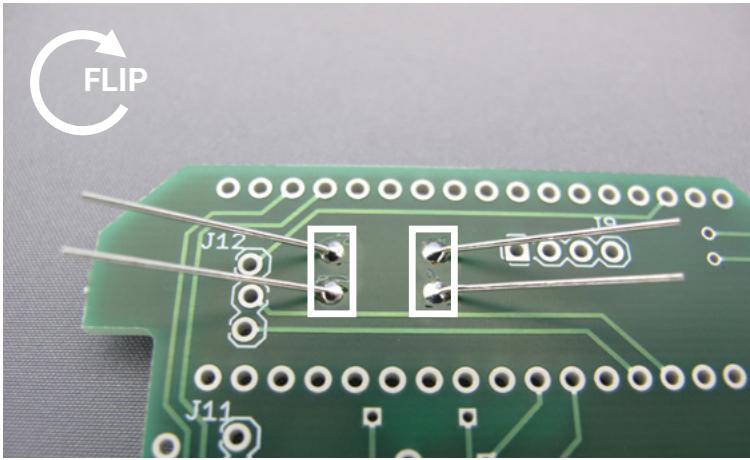


BOARD 1	1
HOLE	R1
HOLE	R2

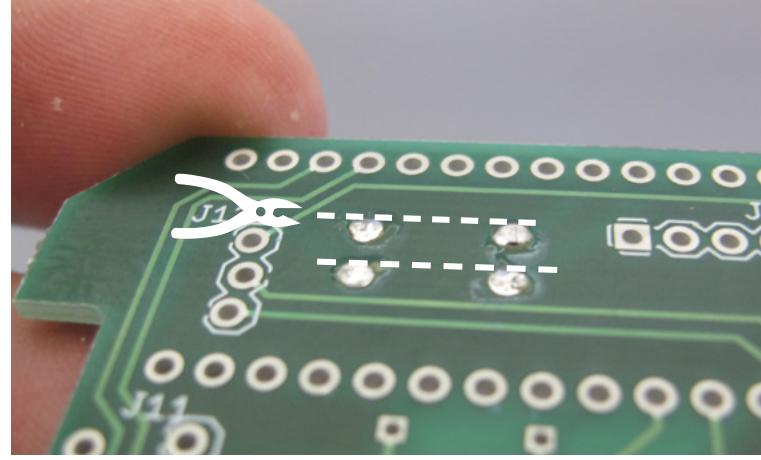
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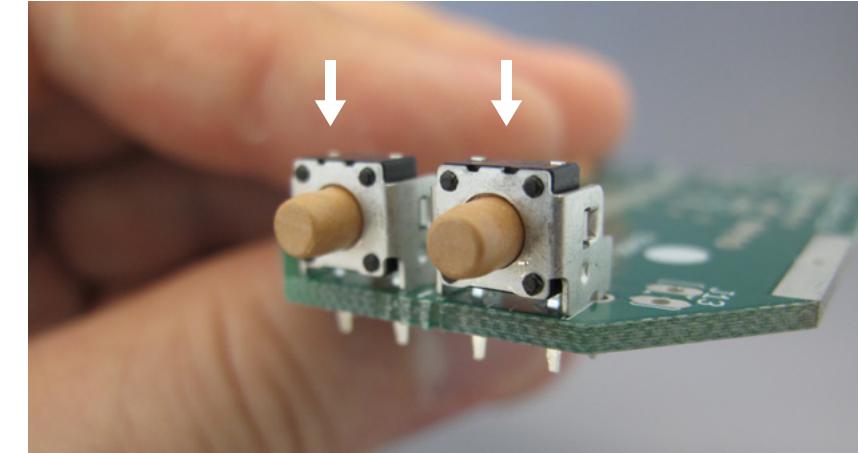
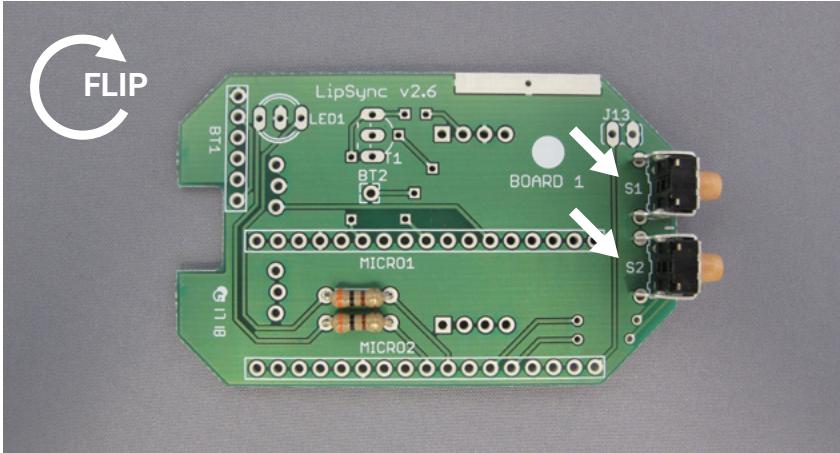
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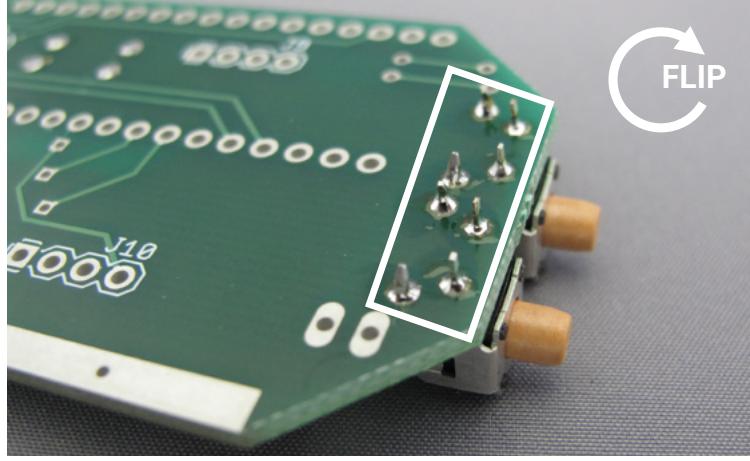
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07.

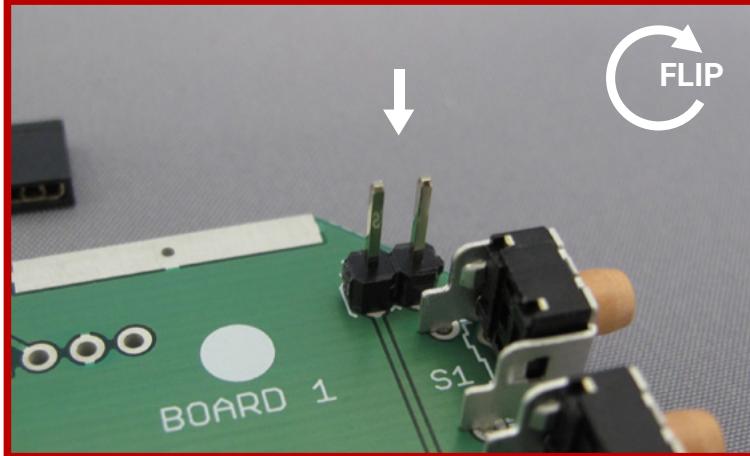


08.



14

10.

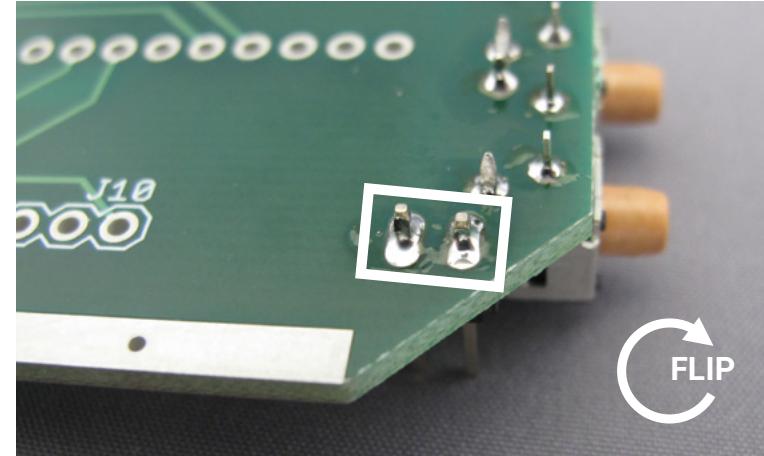


x 2

IMPORTANT: The **SHORT** leads are inserted.

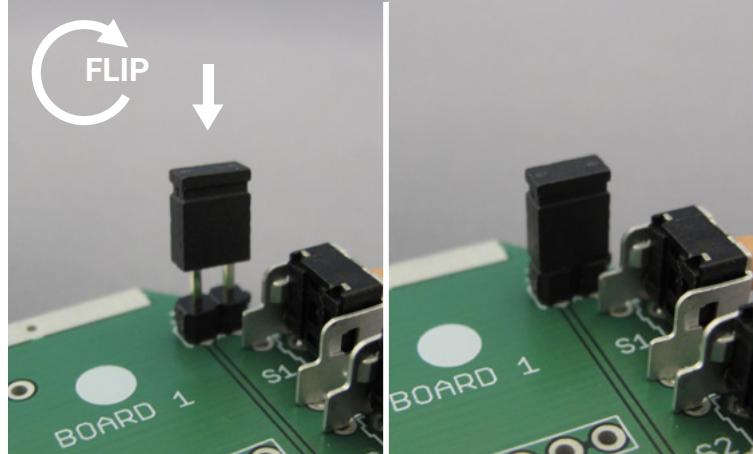
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11.



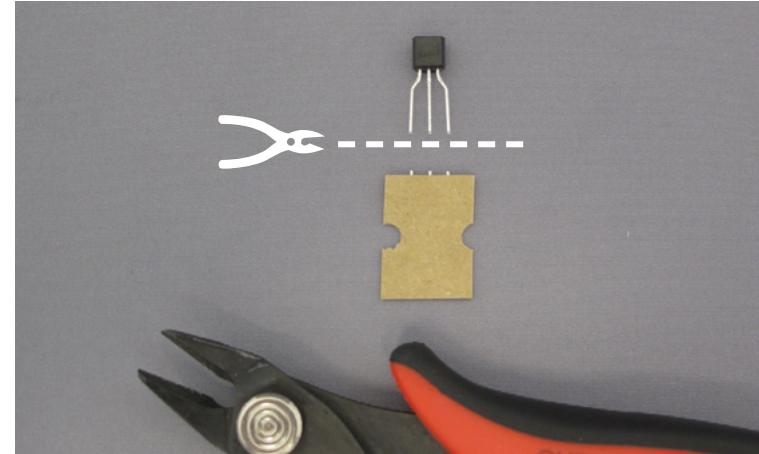
x 2

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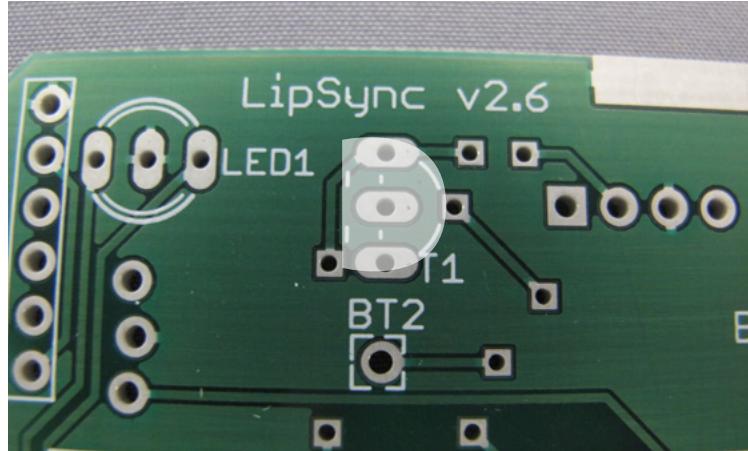
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13.



17

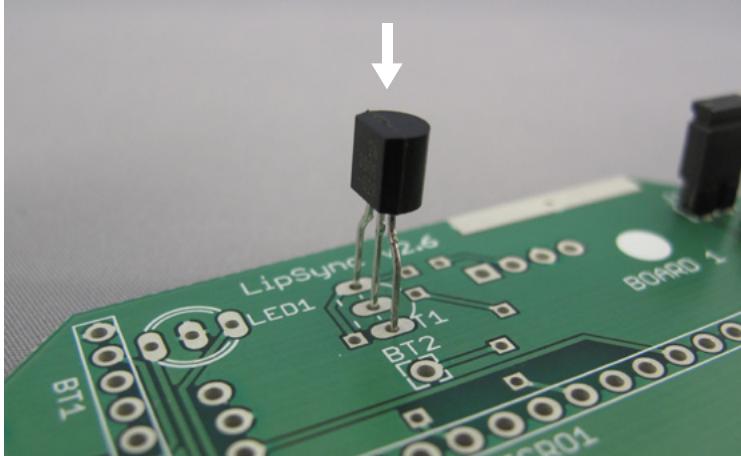
14.



HOLE
T1

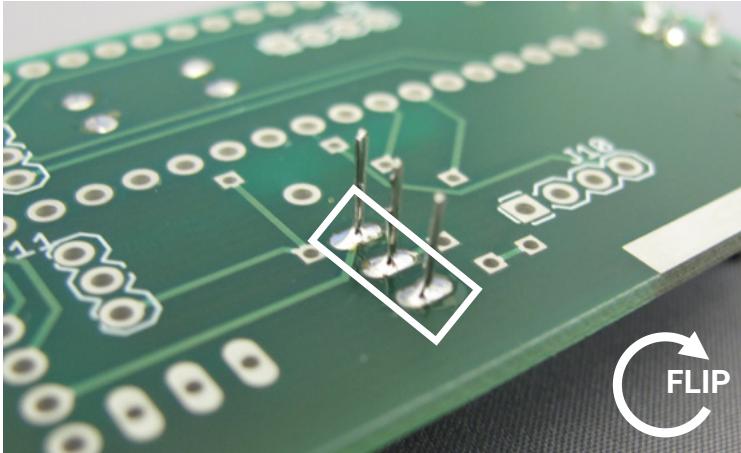
NOTE: The silkscreen outline for hole T1 on Board 1 matches the orientation of which the transistor is inserted.

15.



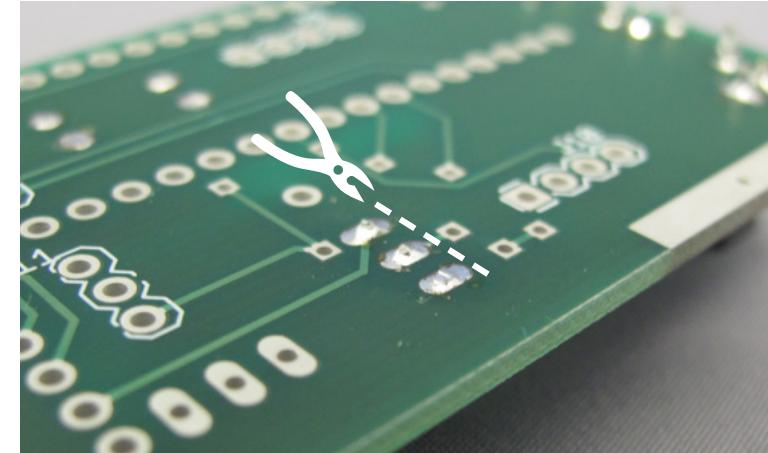
NOTE: After inserting the transistor, there will be a gap between the transistor and Board 1

16.

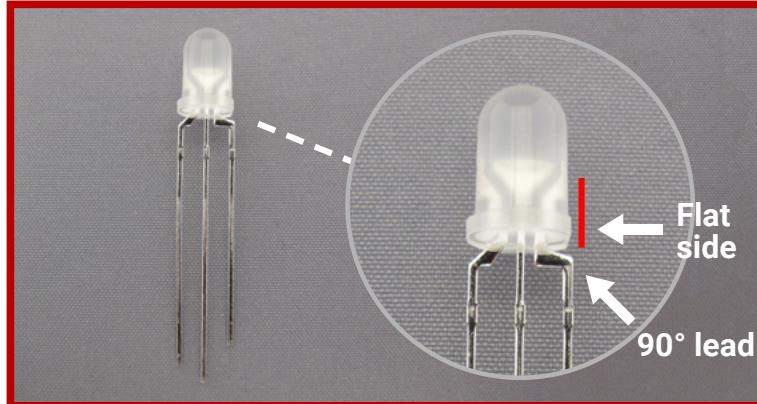


x 3

17.



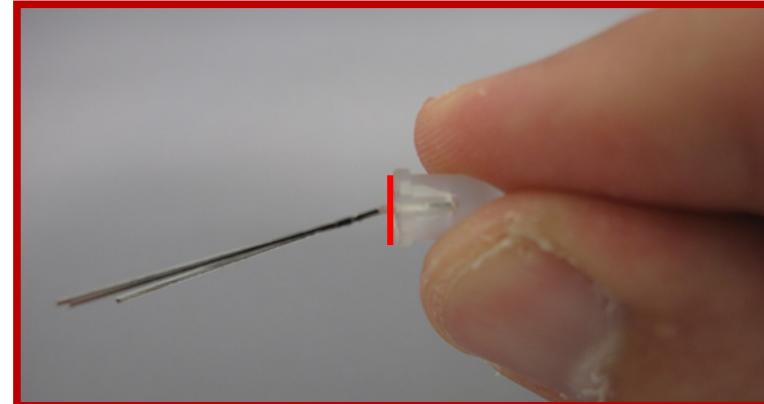
18.



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

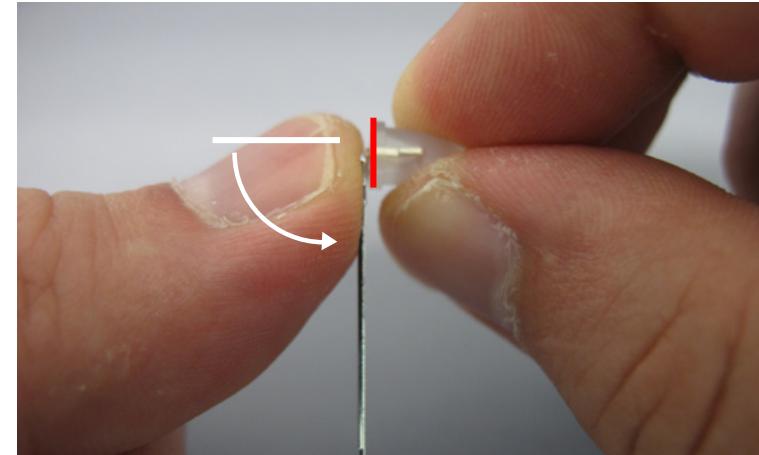
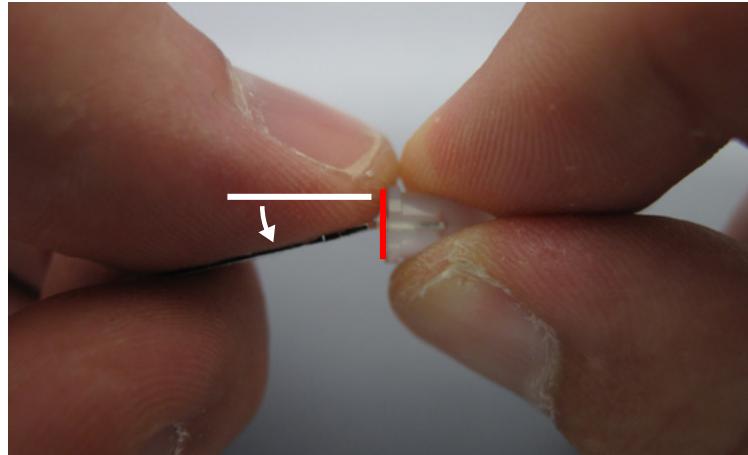
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19.



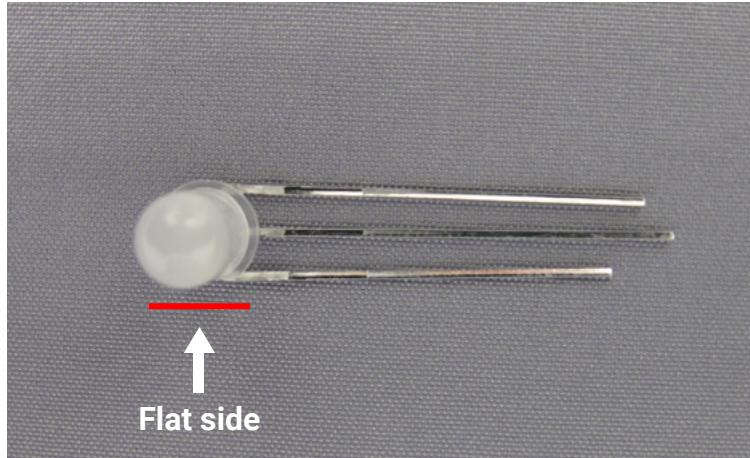
IMPORTANT: Hold the LED so that the flat side and the 90° lead is facing **TOWARDS** you.

20.



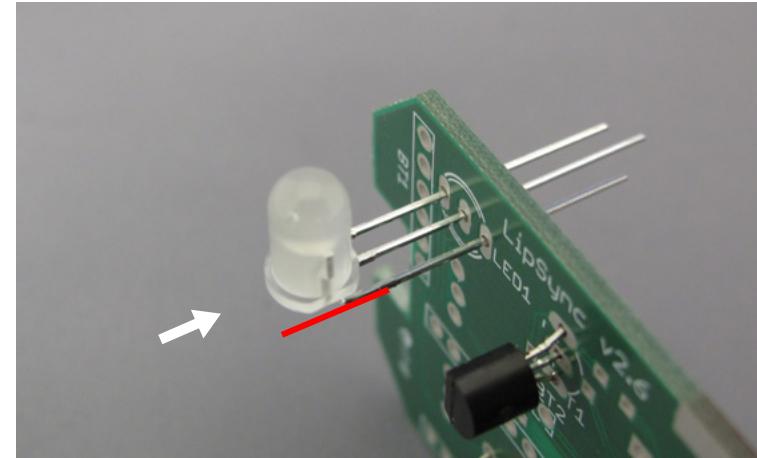
NOTE: Using a finger, bend the leads by 90° right at the base.

21.

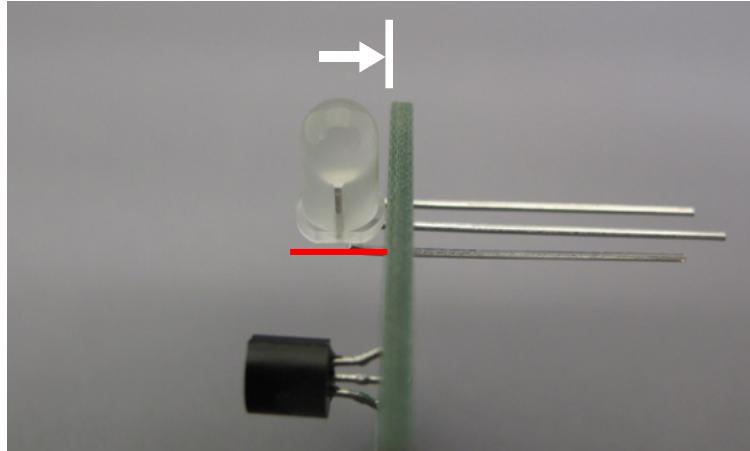


HOLE
LED1

22.

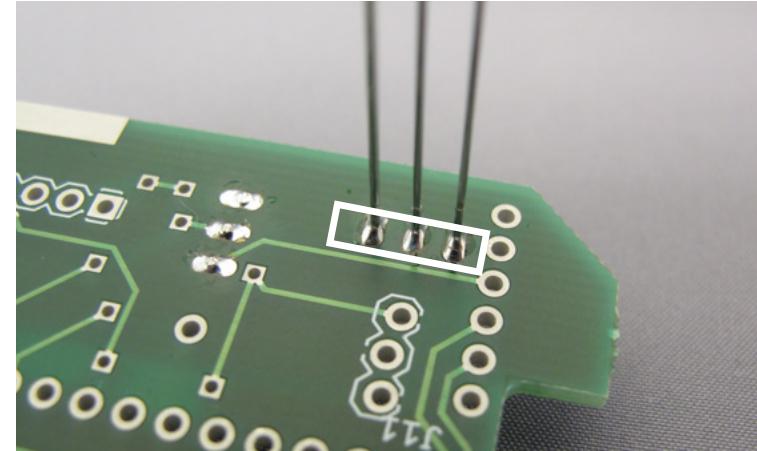


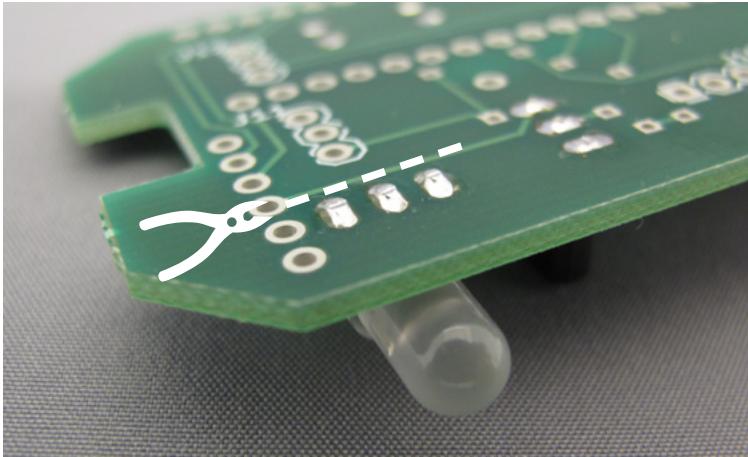
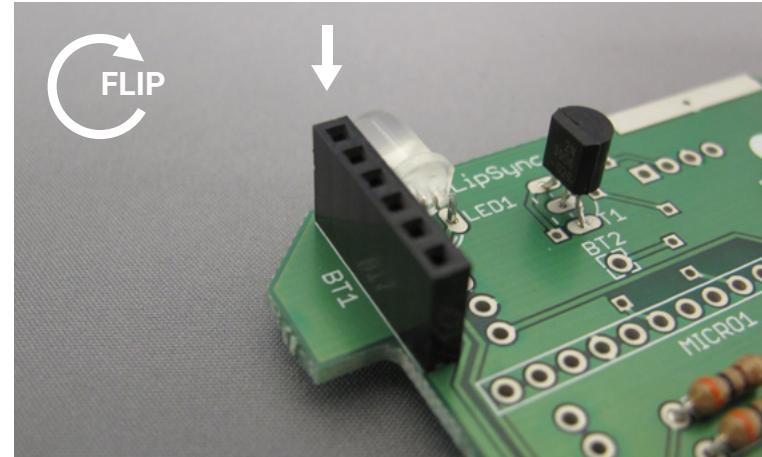
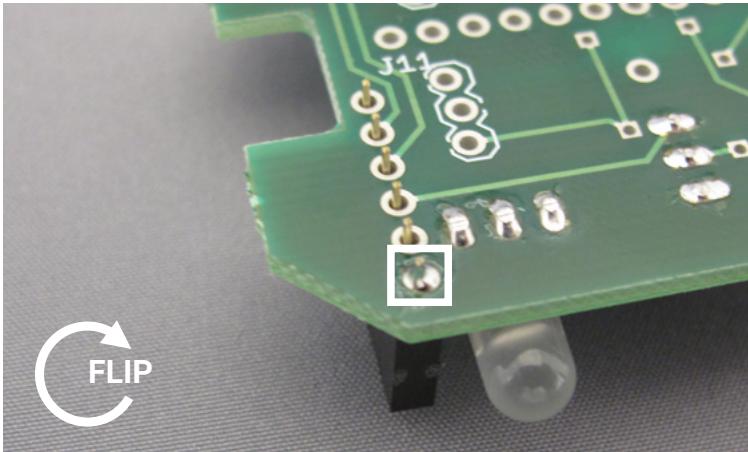
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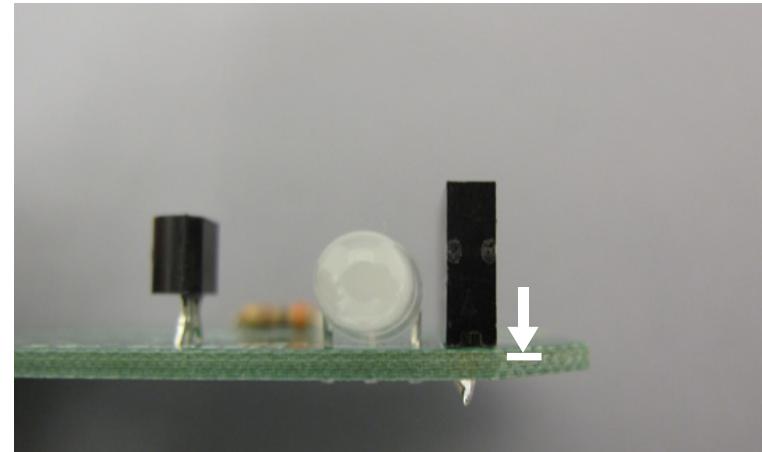
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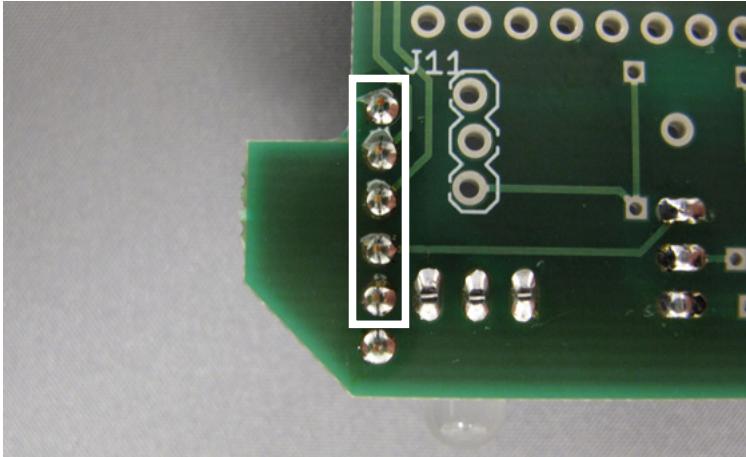
25.**26.****27.**

x 1

28.

NOTE: Check that component is flush to the board

29.



x 5

11

x 2

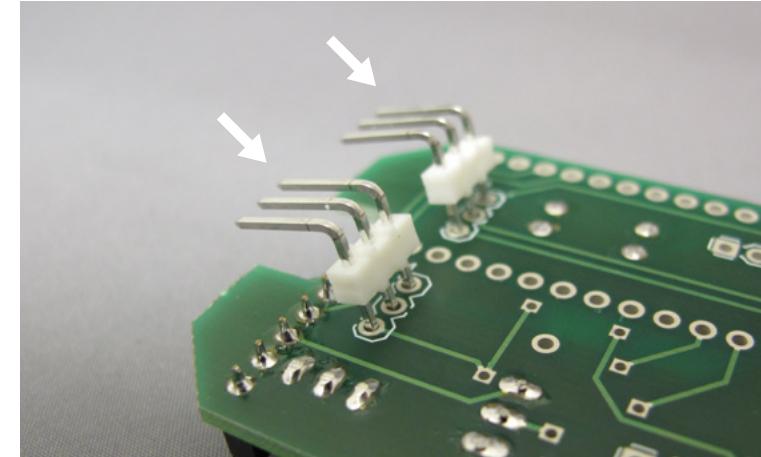
SECTION

J11

SECTION

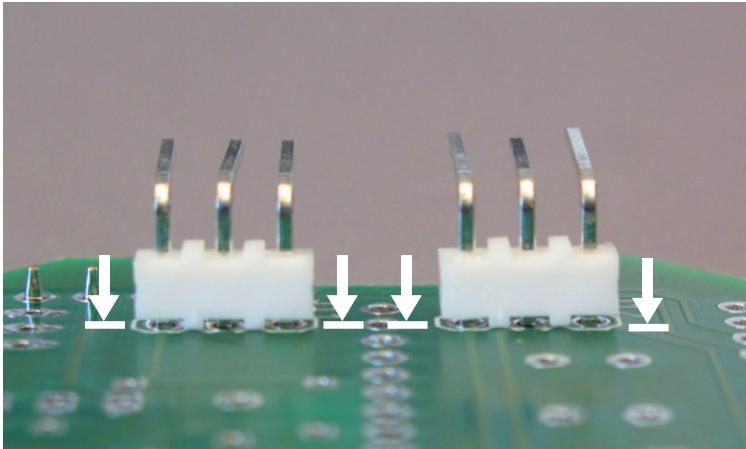
J12

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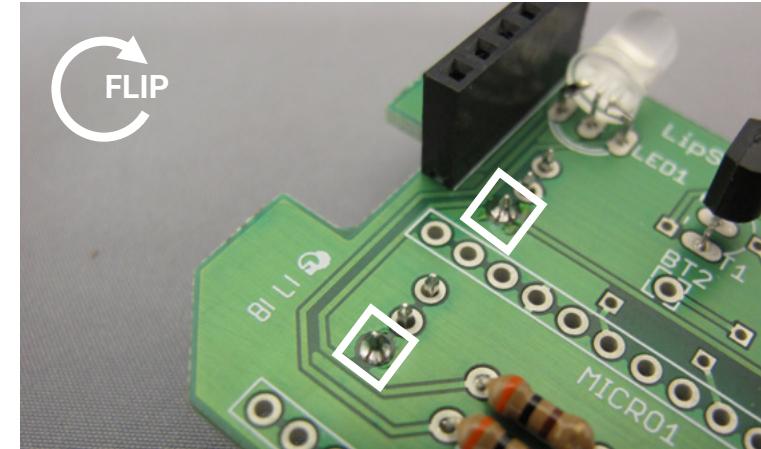


x 2

31.



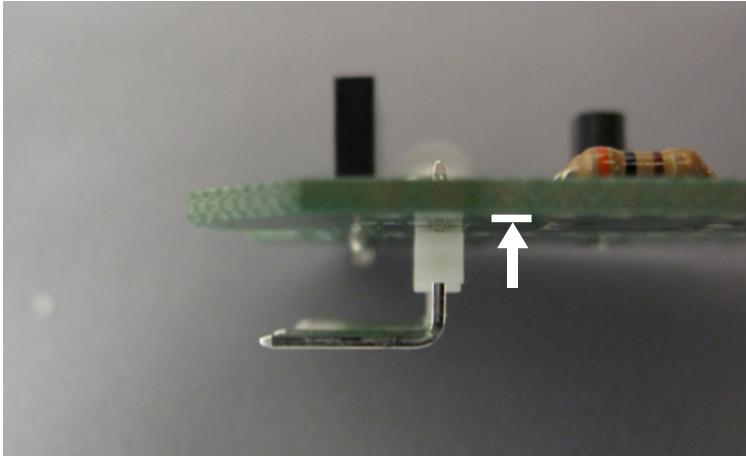
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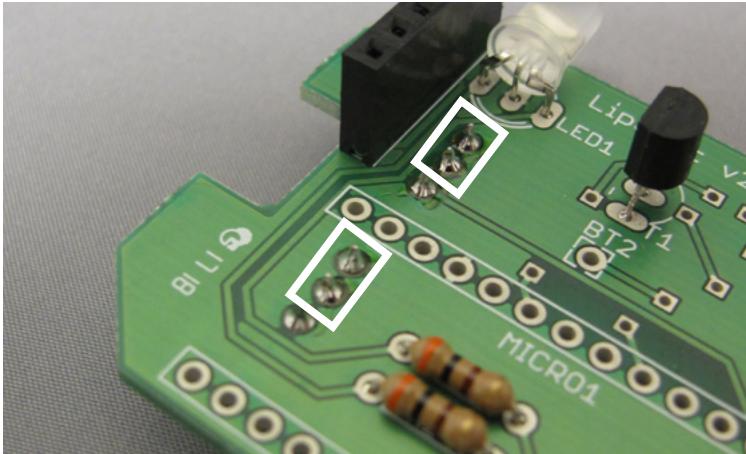
x 2

PART 2

33.

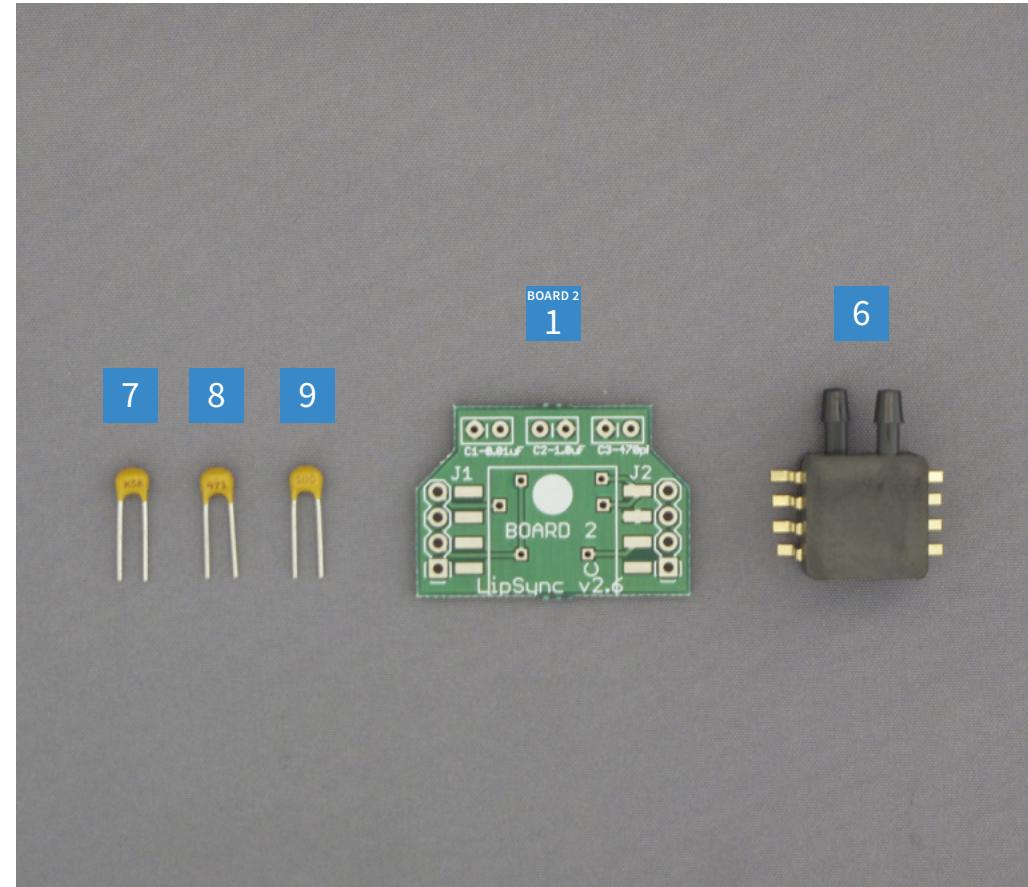


i NOTE: Check that component is flush to the board

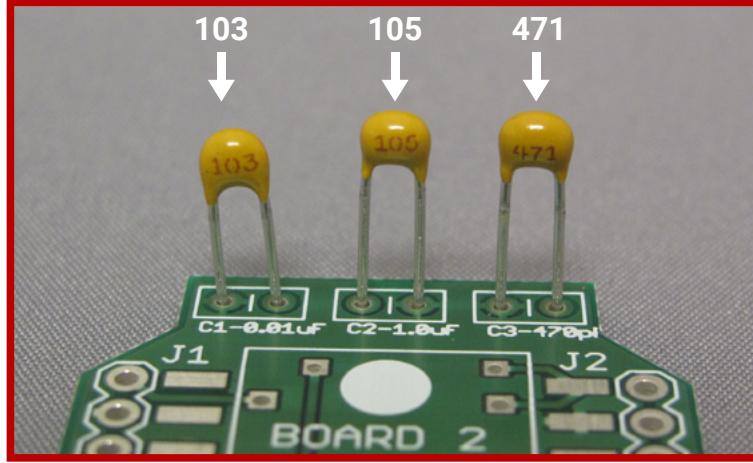


x 4

34.



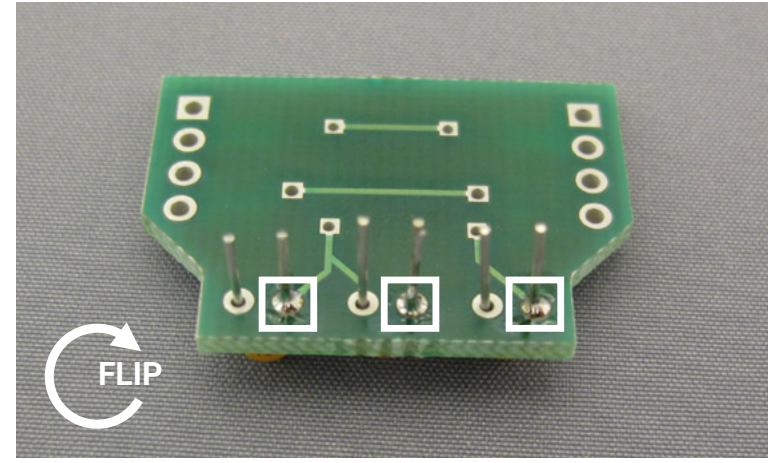
01.



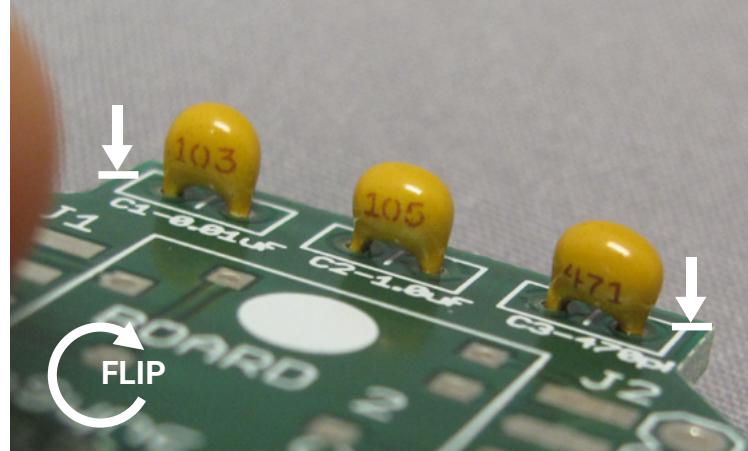
⚠ NOTE: The capacitors **MUST** be inserted in the order shown.

BOARD 2
1
7
8
9

02.



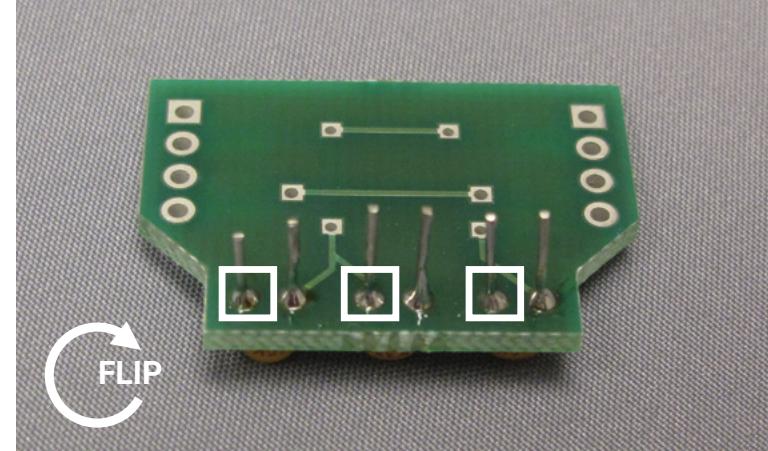
03.



i NOTE: Check that component is flush to the board

20

04.

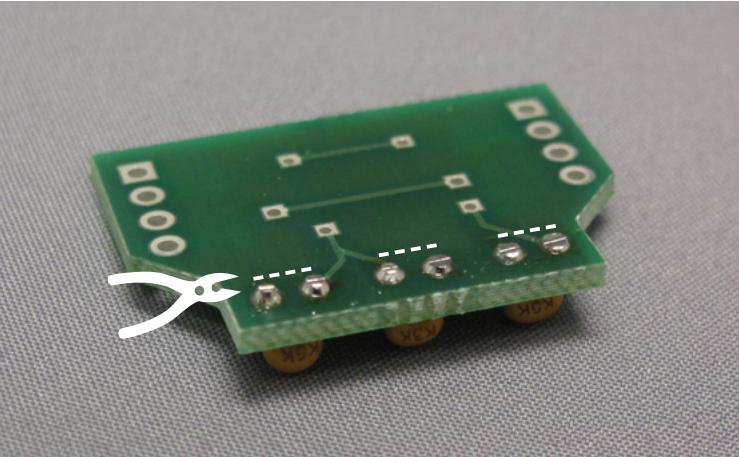


x 3

6

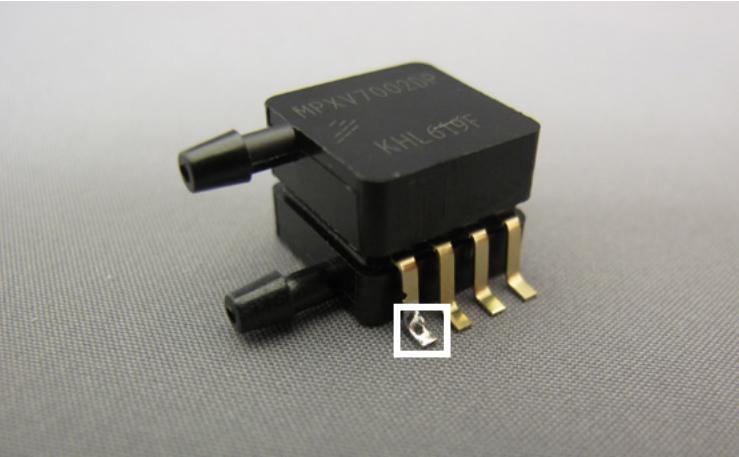


x 1

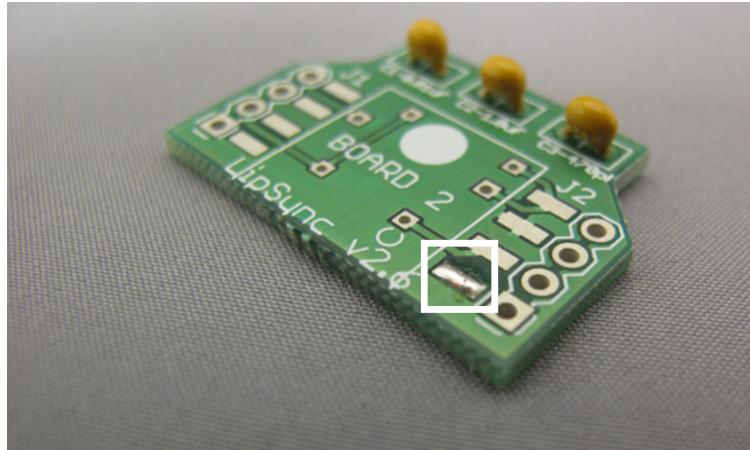


05.

06.

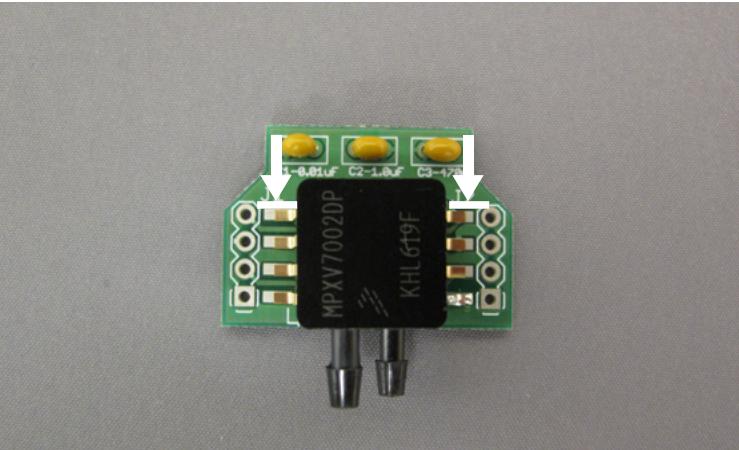


x 1

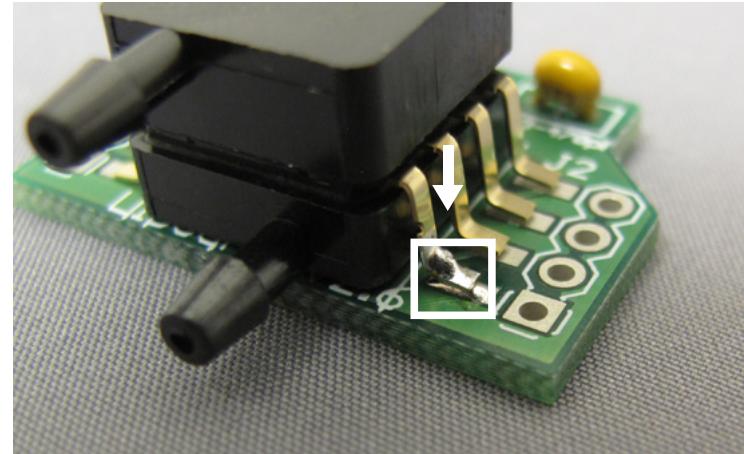
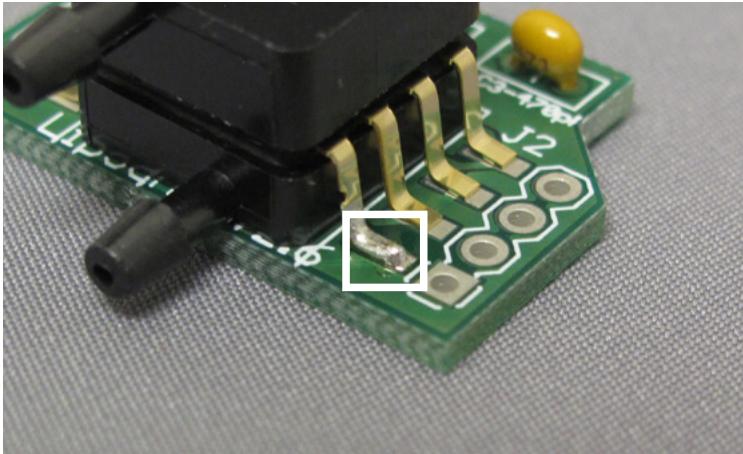


07.

08.



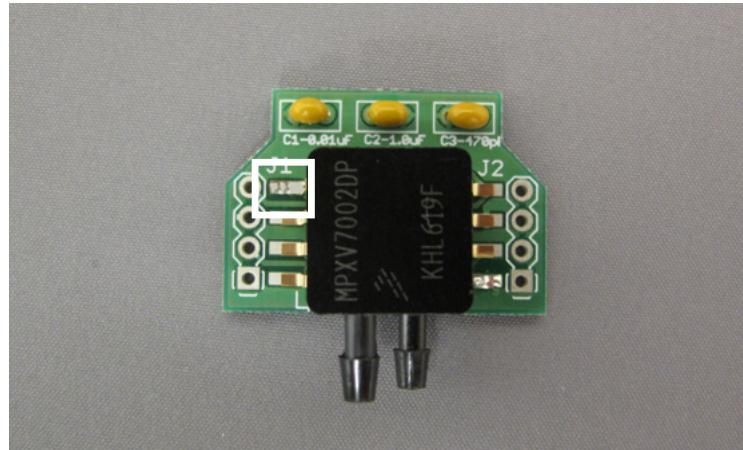
09.



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

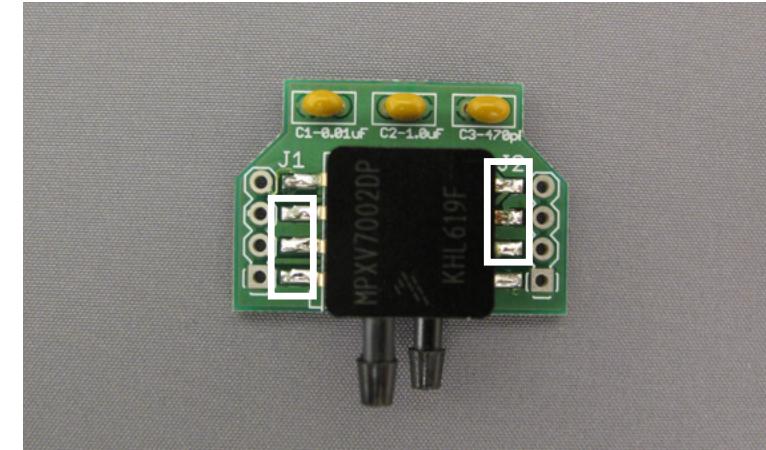
x 1

10.

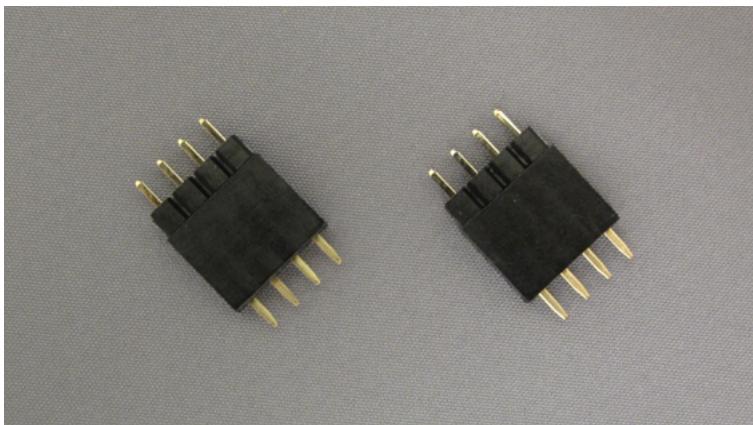
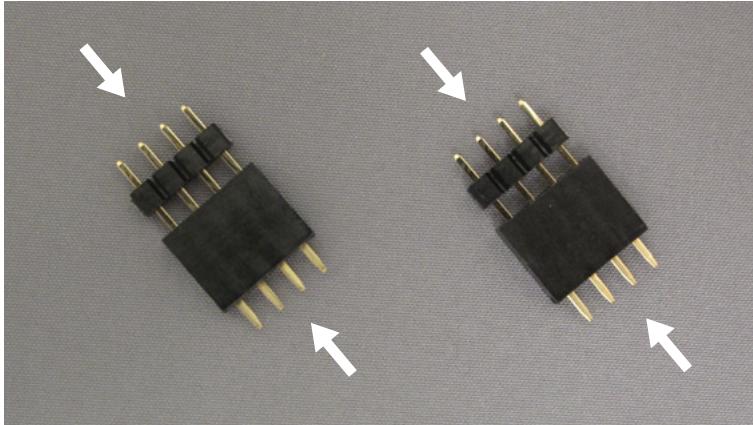
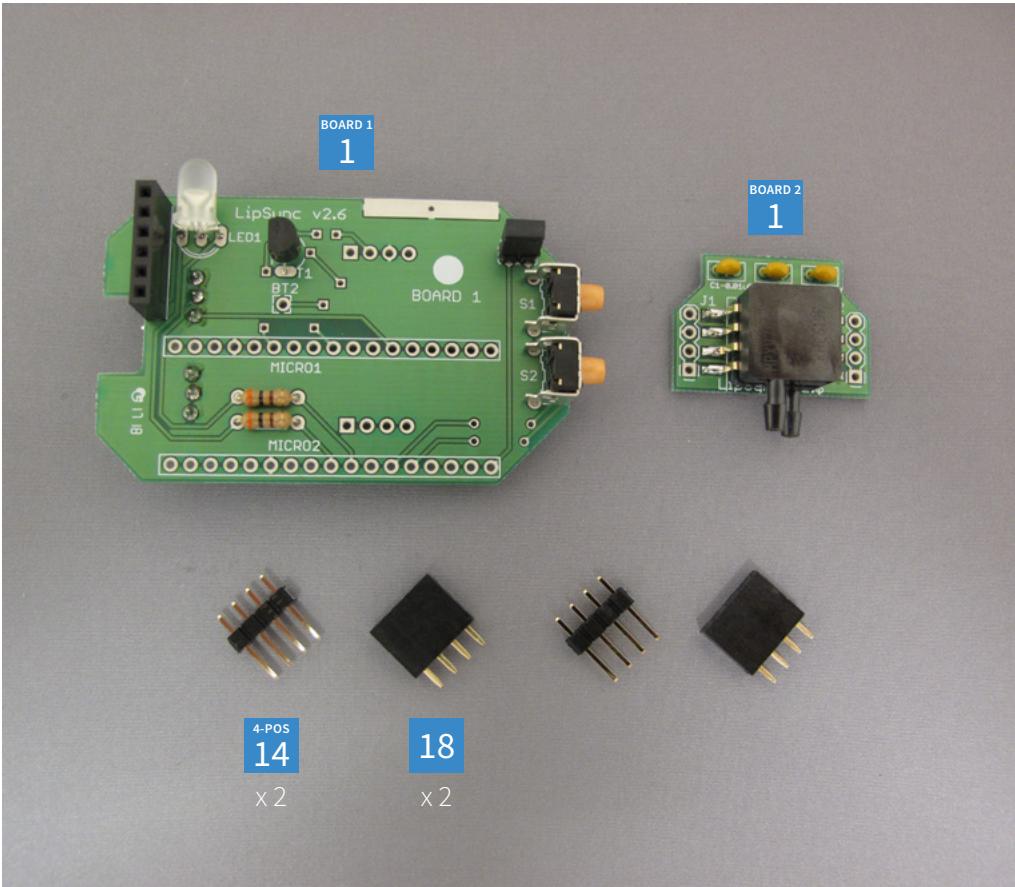


x 7

11.



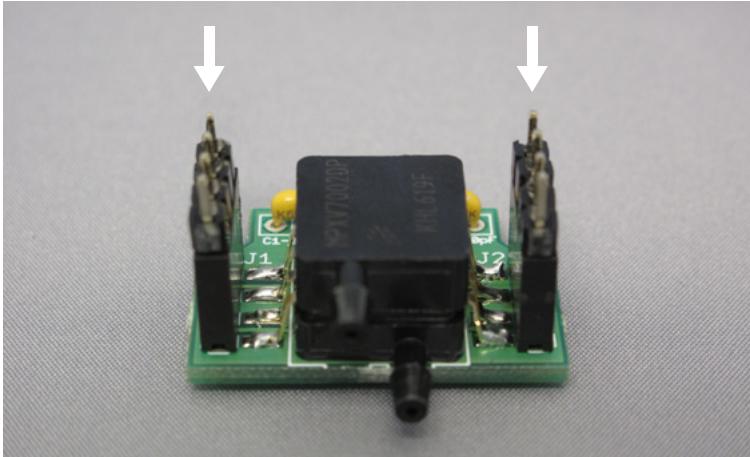
PART 3



01.

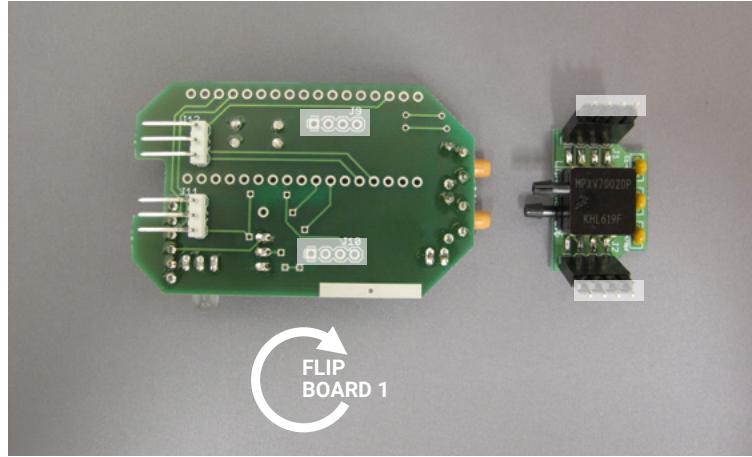
4-POS
14
x 2
18
x 2

02.



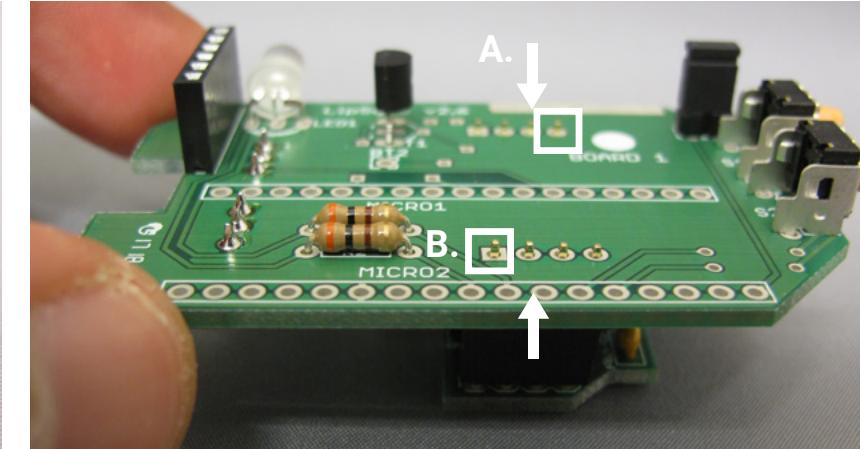
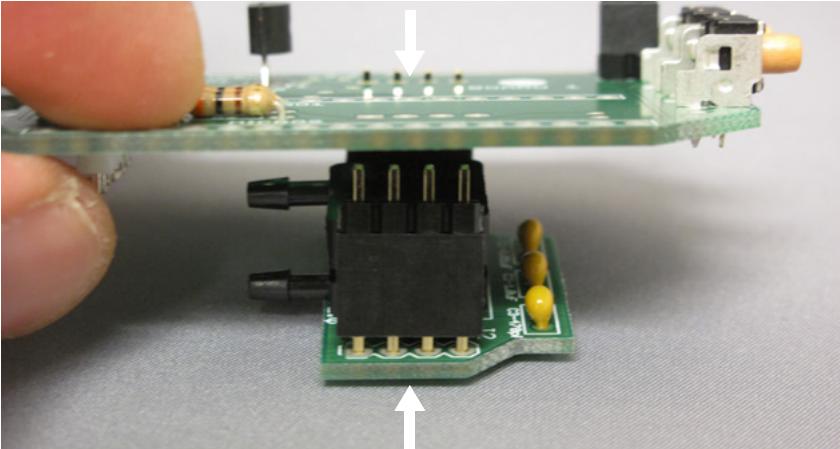
BOARD 2
1
HOLE
J1
HOLE
J2

03.



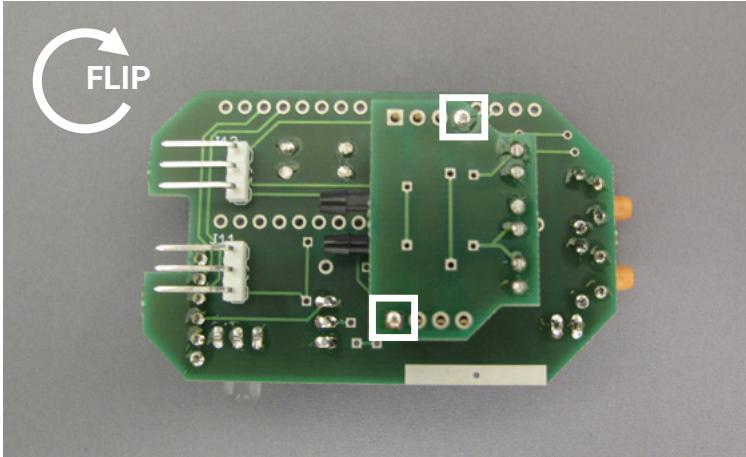
BOARD 1
1

04.



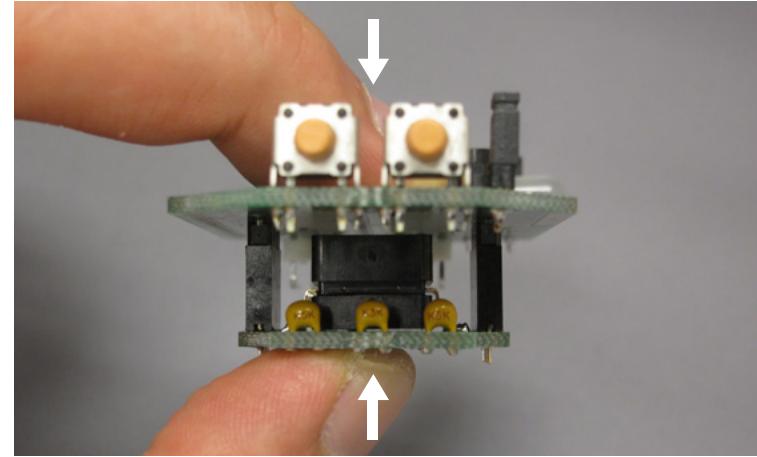
HOLE
J9
HOLE
J10
x2

05.



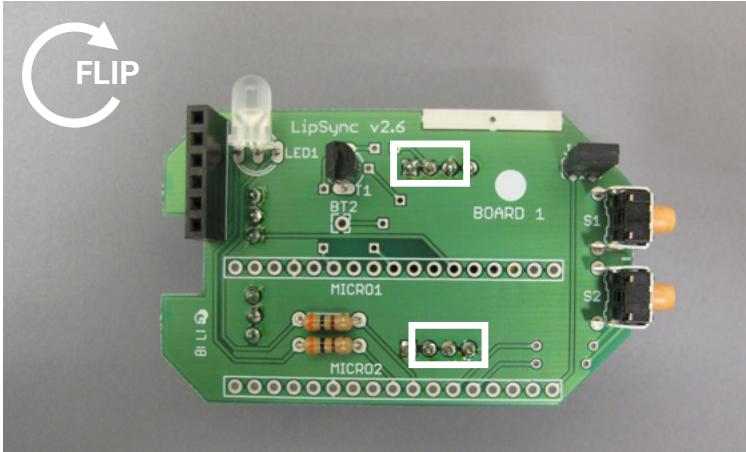
x 2

06.



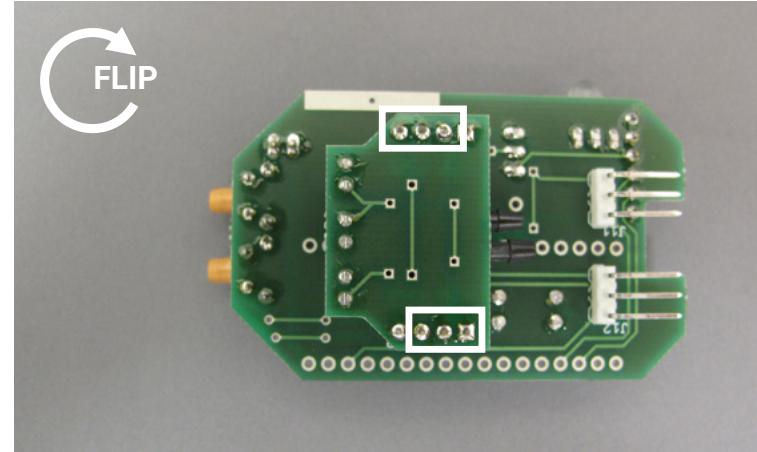
NOTE: Check that component is flush to the board

07.



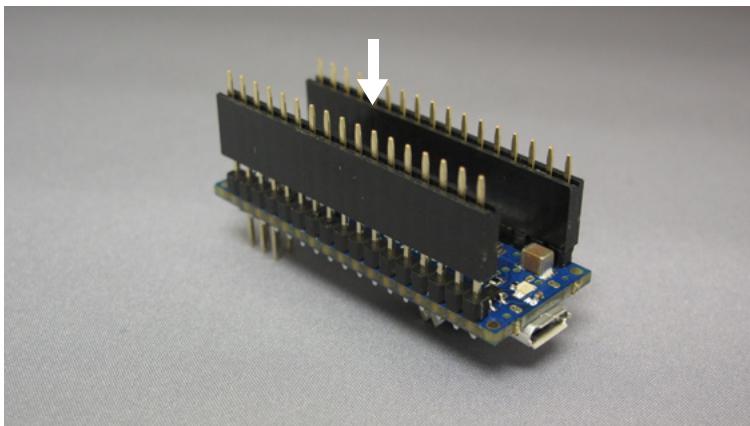
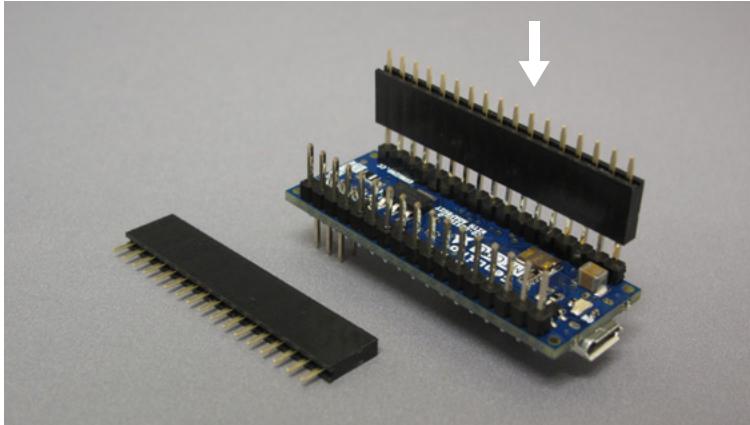
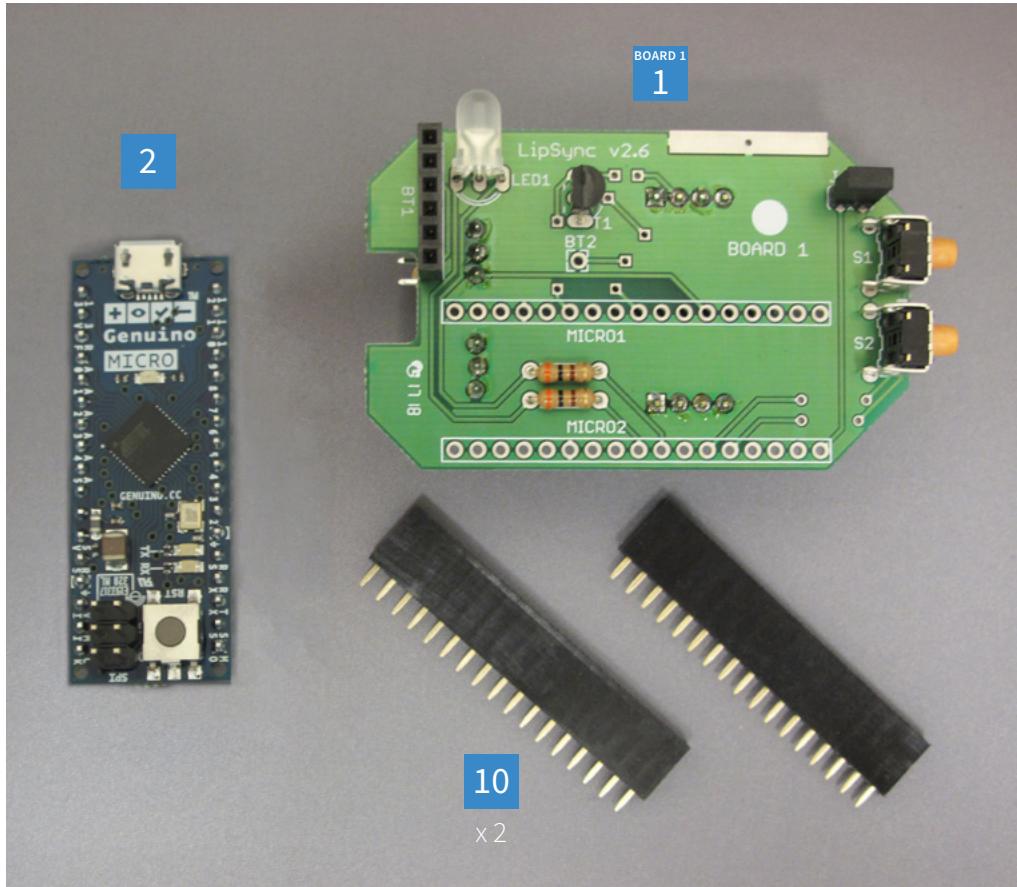
x 6

08.



x 6

PART 4



01.

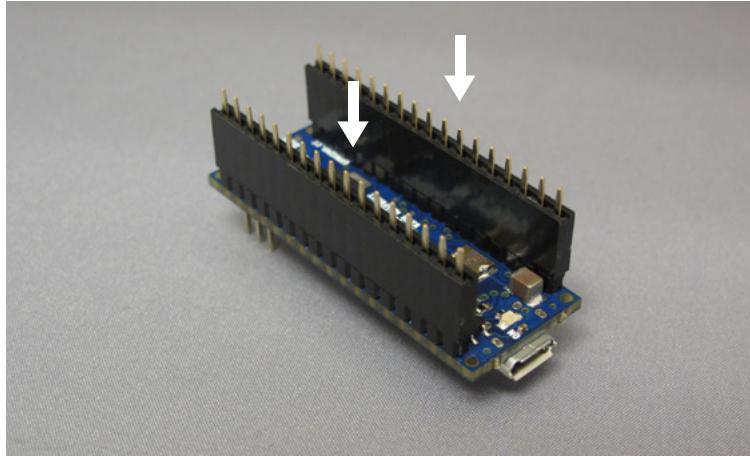
2

10

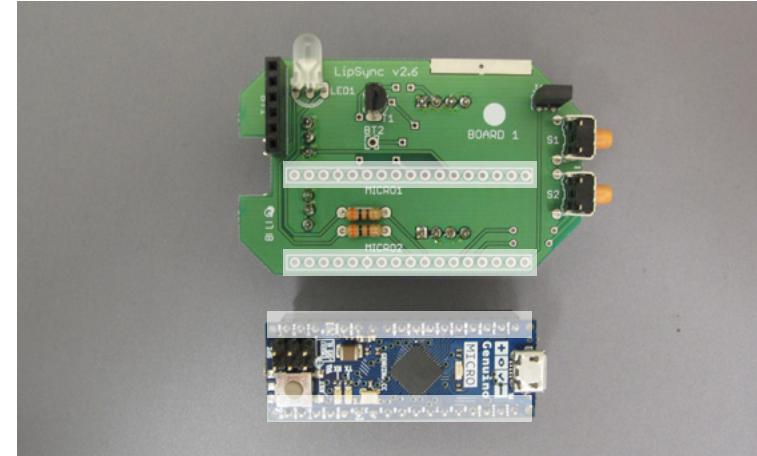
x2

BOARD 1
1
MICRO
1
MICRO
2

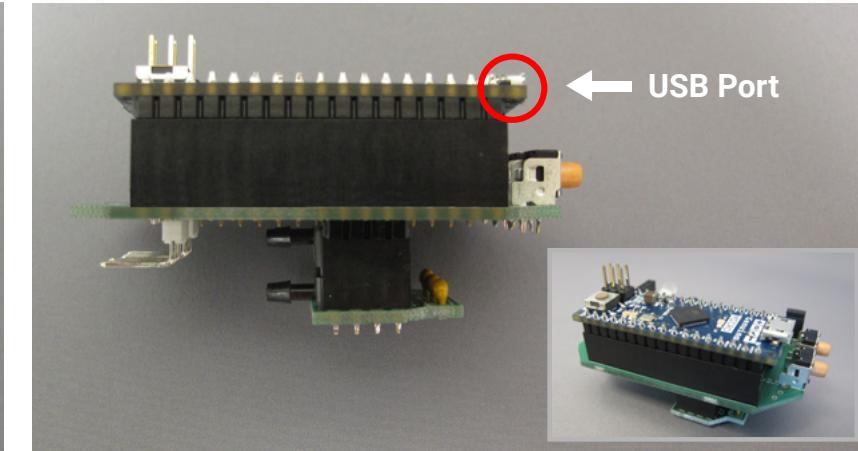
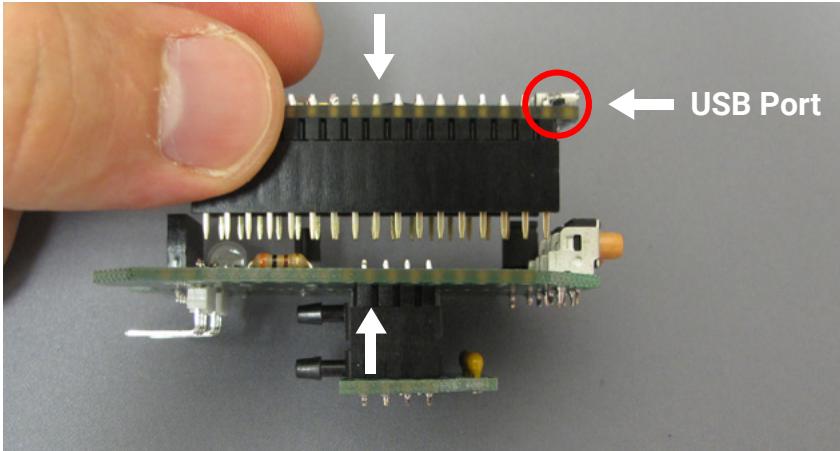
02.



03.

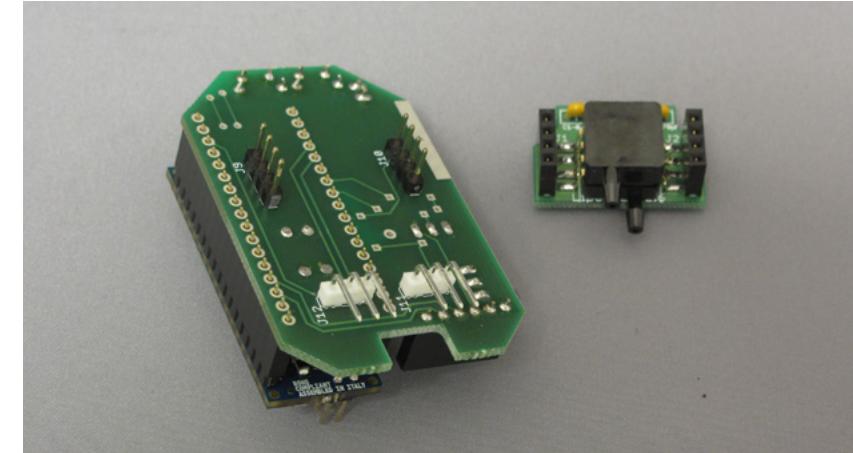
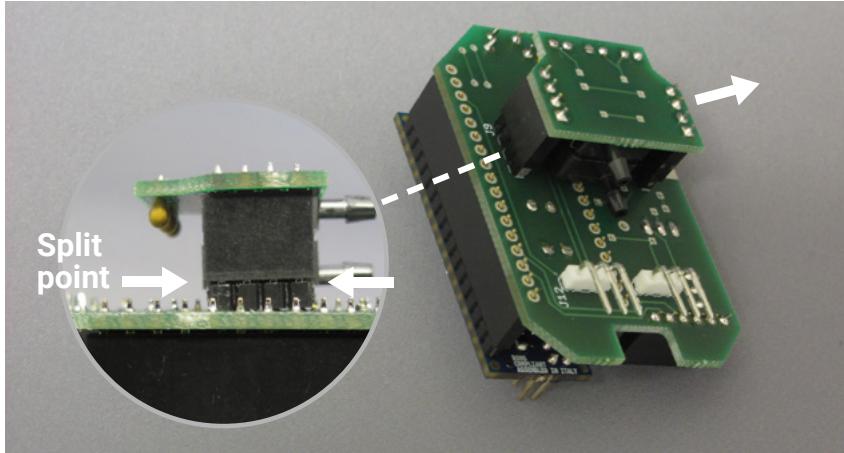


04.

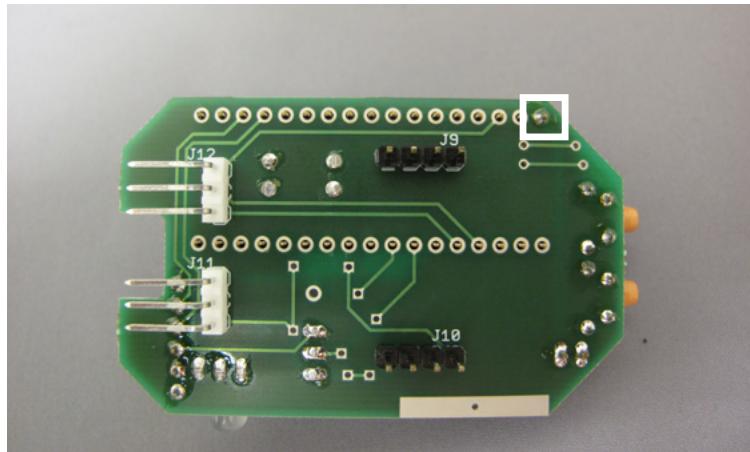


i NOTE: USB Port should be on the right side during installation

05.

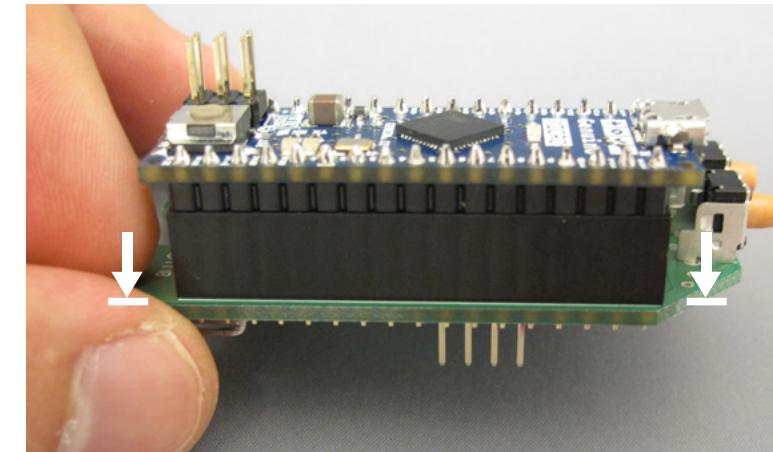


06.



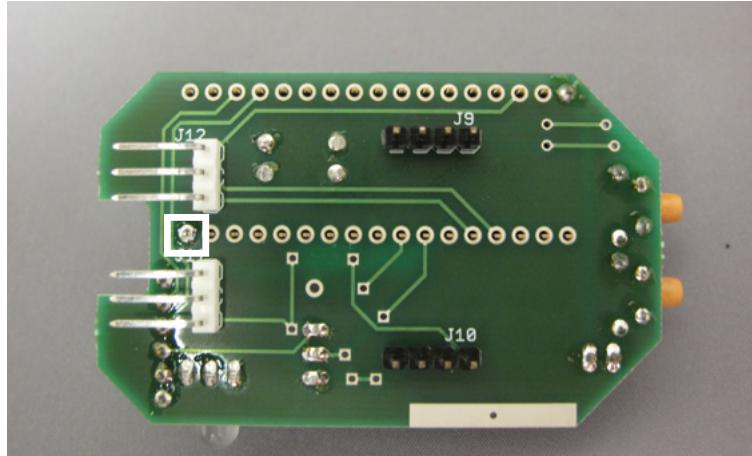
28

07.



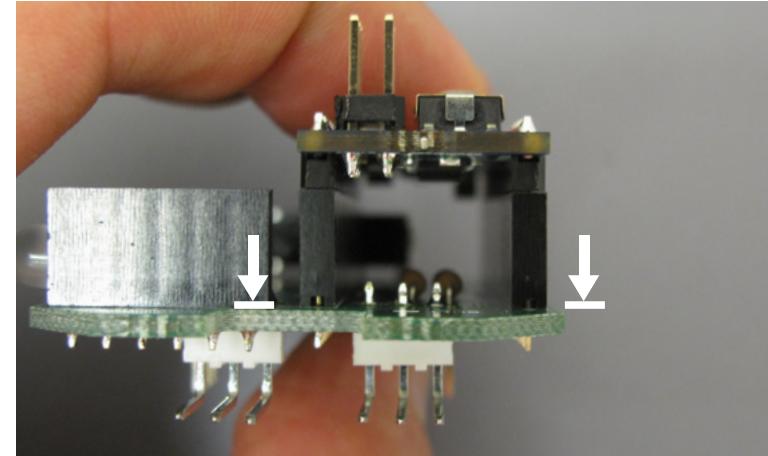
NOTE: Check that component is flush to the board

08.



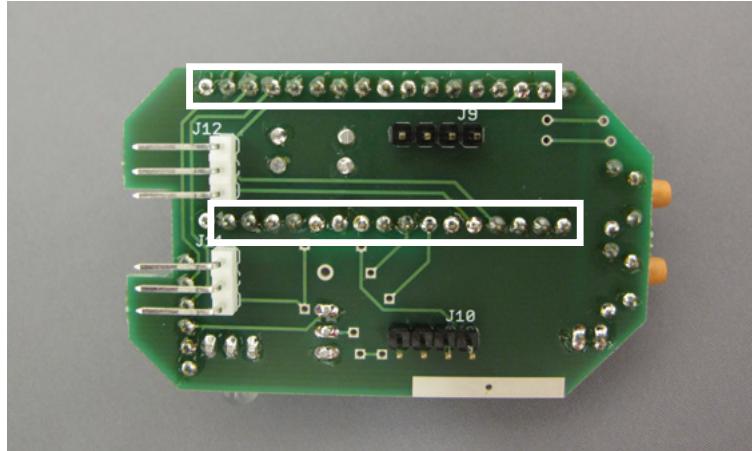
x 1

09.



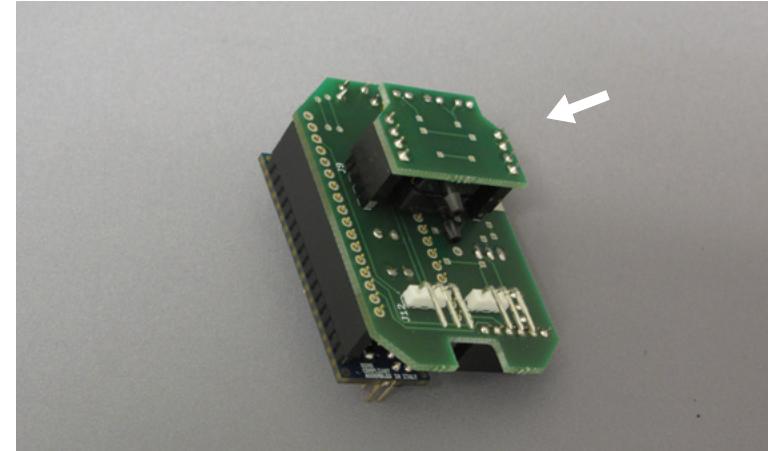
NOTE: Check that component is flush to the board

10.

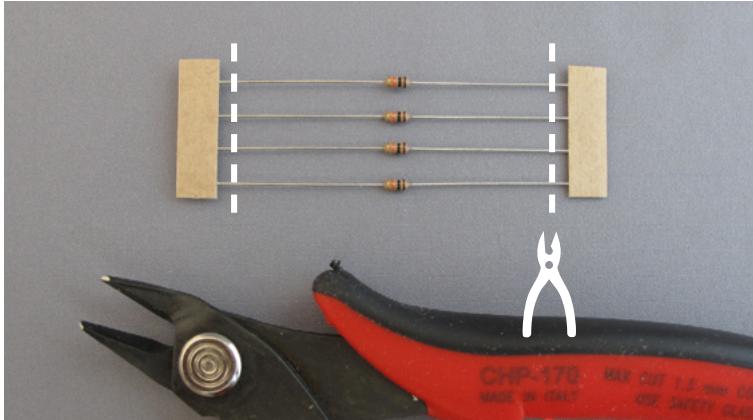
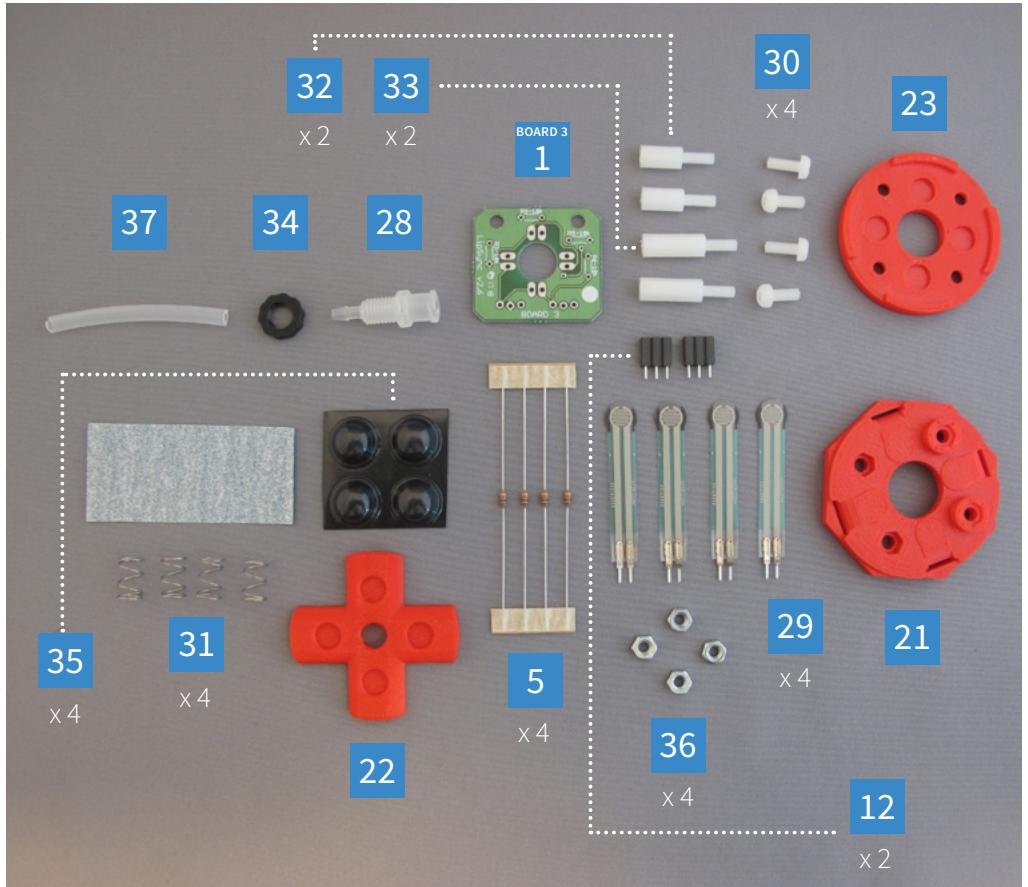


x 32

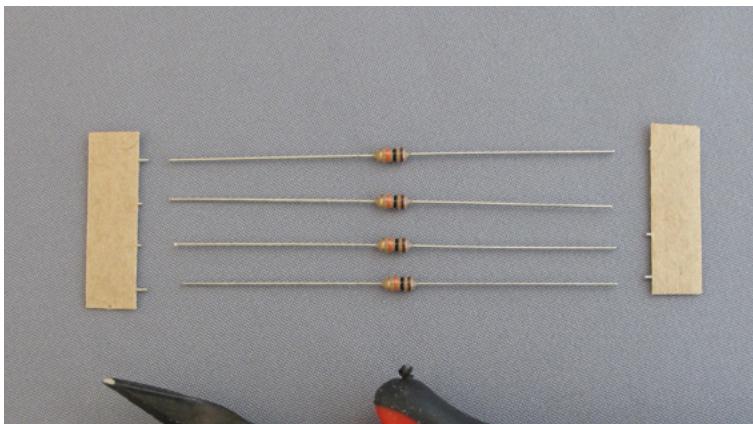
11.



PART 5

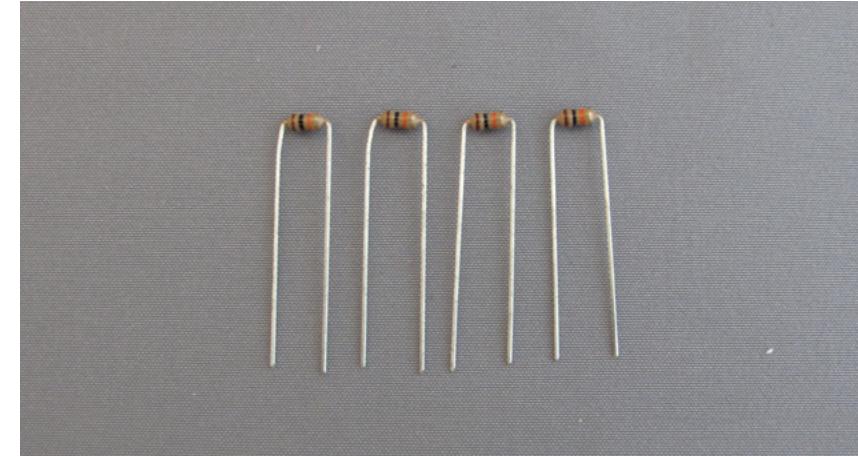
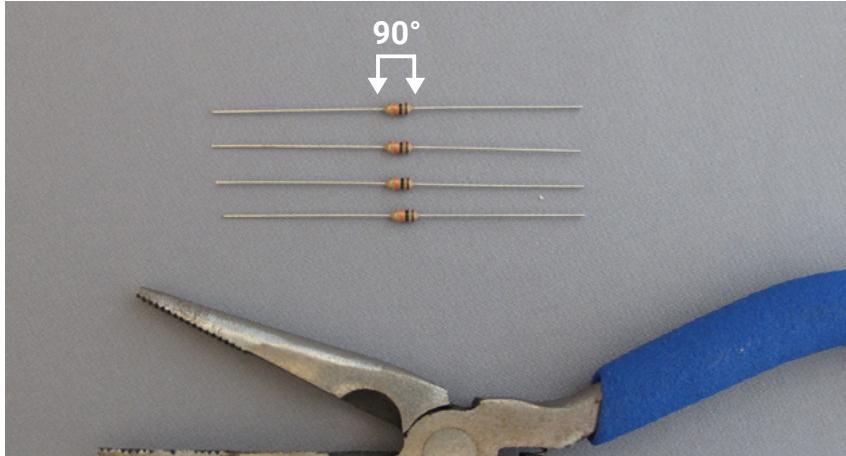


5
x 4

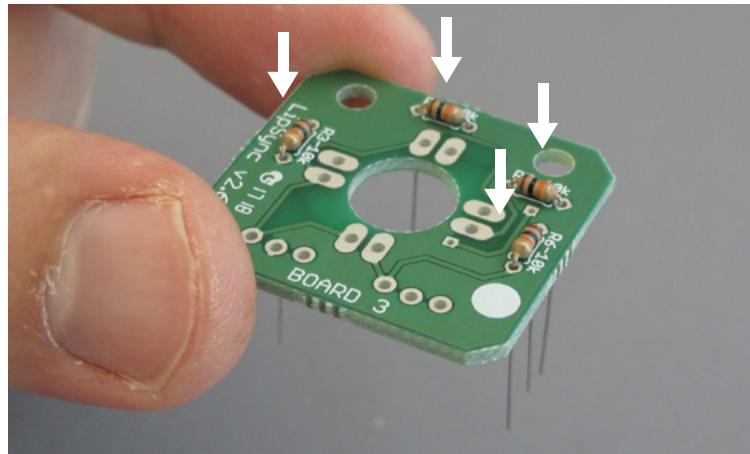


01.

02.



03.



BOARD 3

1
x 4

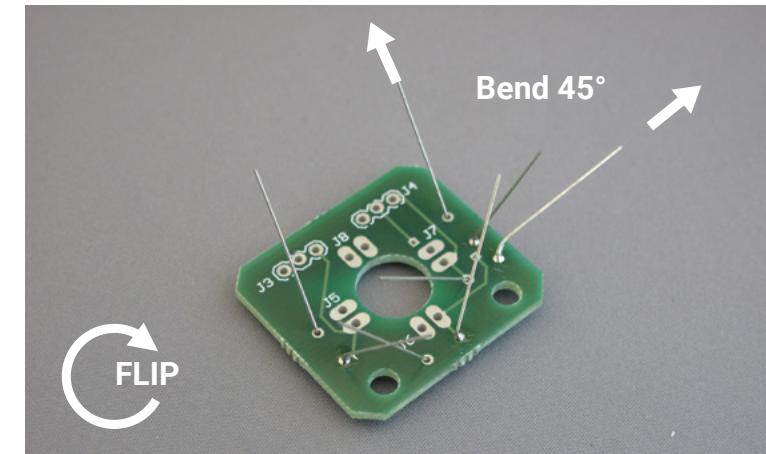
HOLE
R3

HOLE
R4

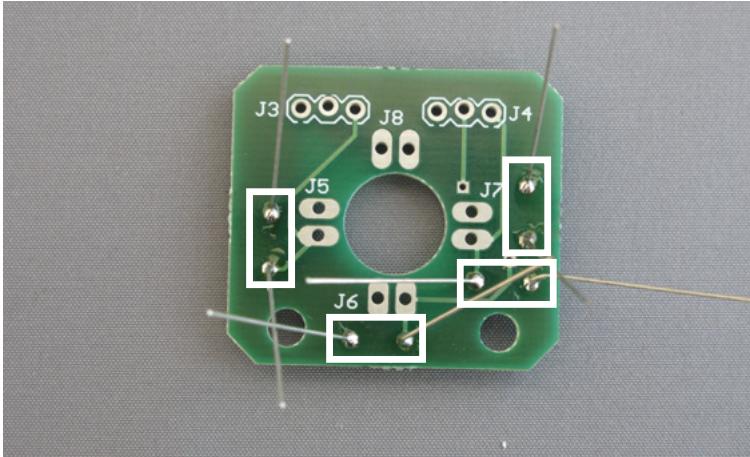
HOLE
R5

HOLE
R6

04.

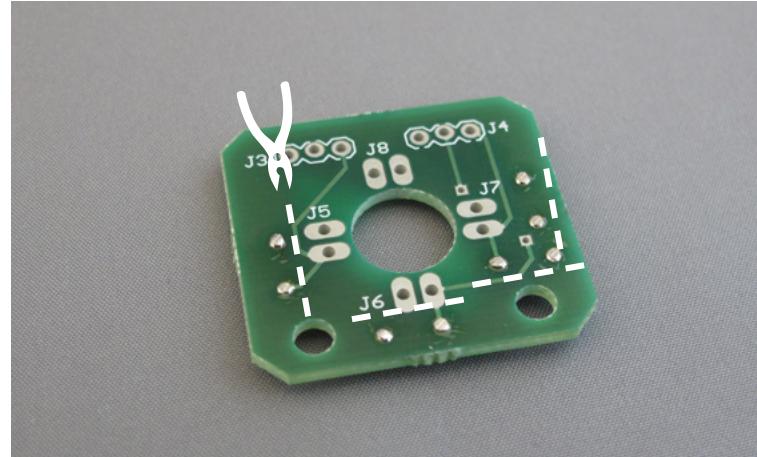


05.

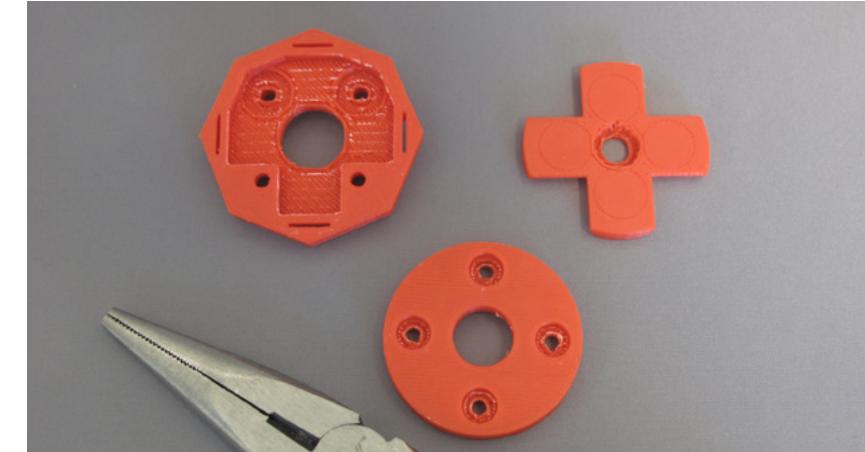
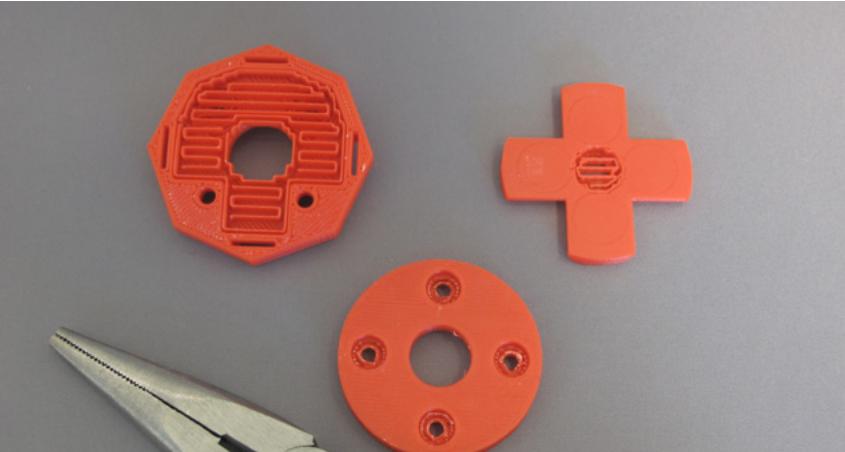


x 8

06.



07.

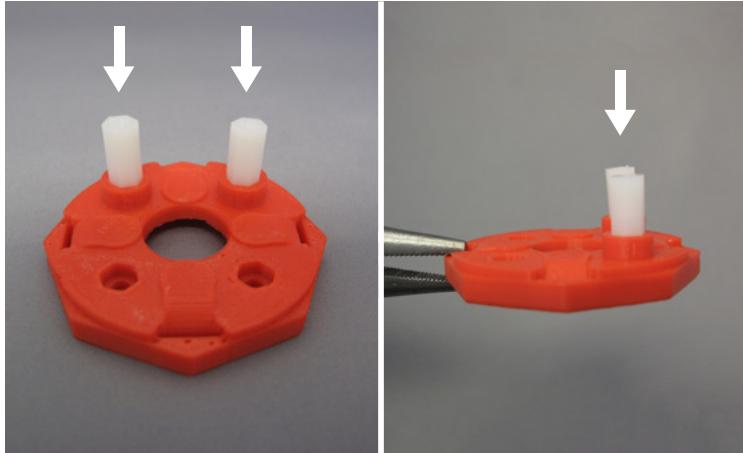


21

22

23

08.



NOTE: Insert the 10mm standoffs

32

x 2

36

x 2

09.

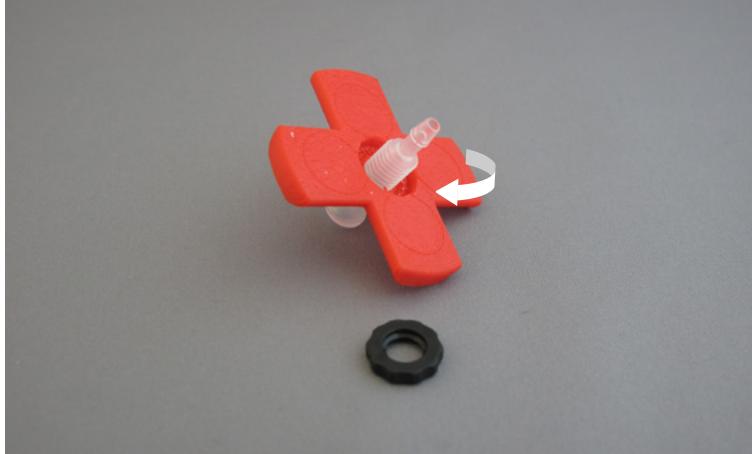


10.



IMPORTANT:
Only add a small
DROP of superglue

11.

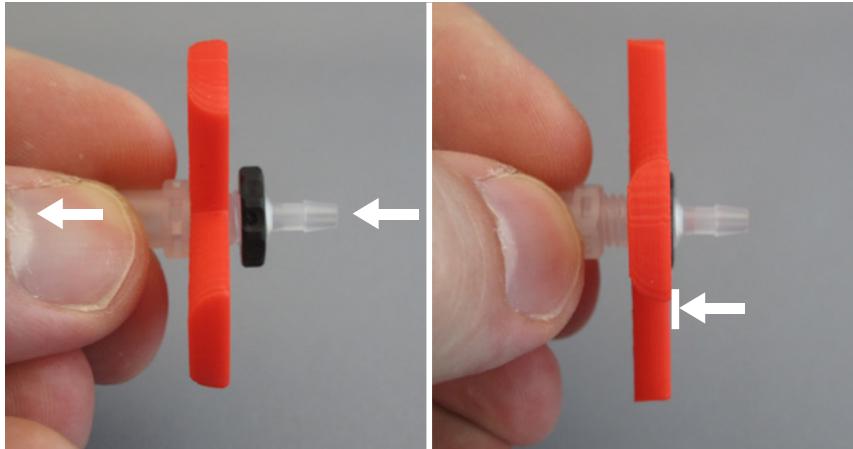


22
28
34

12.



13.



34

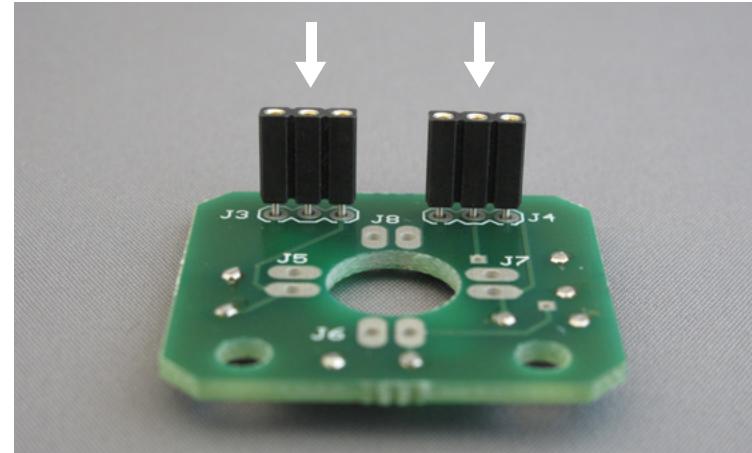
NOTE: The luer lock nut should sit flush to the rocker. Once flushed, twist the luer lock fitting the rest of the way.

14.



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

15.

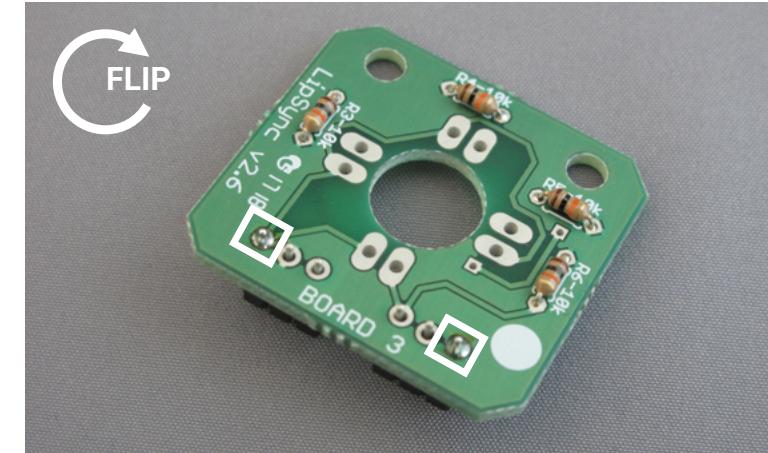


12
x 2

HOLE
J3

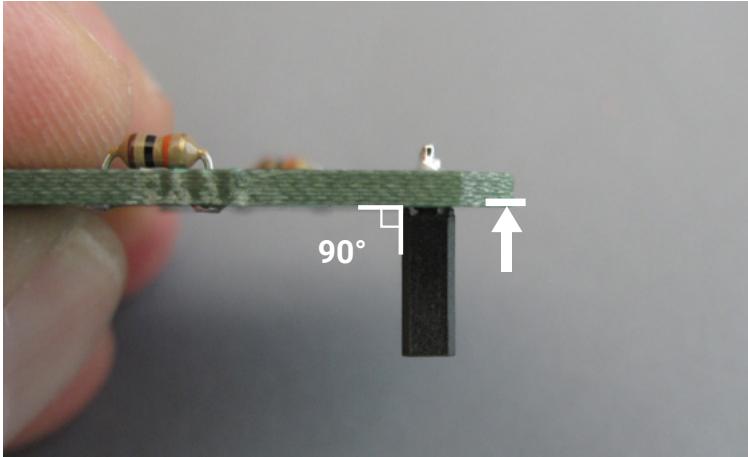
HOLE
J4

16.



x 2

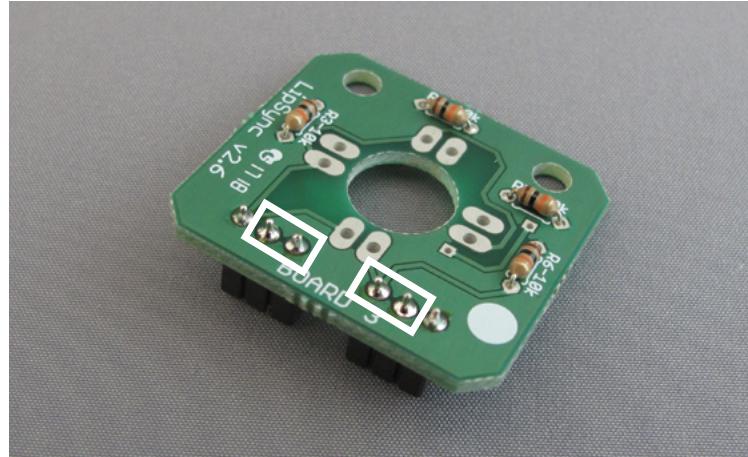
17.



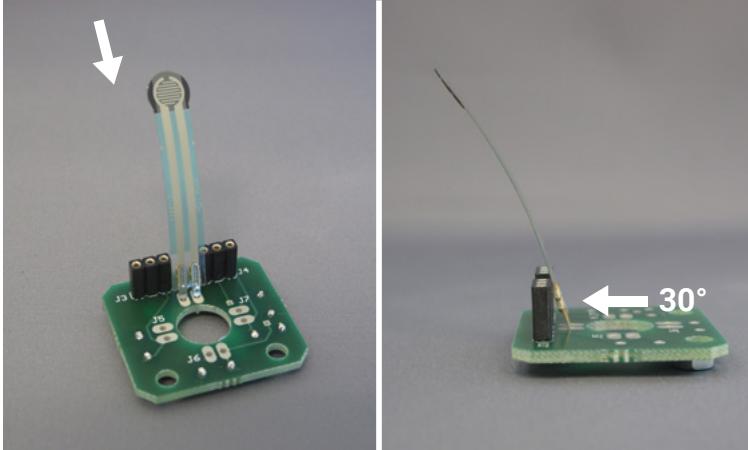
NOTE: Check that component is flush to the board

x 4

18.



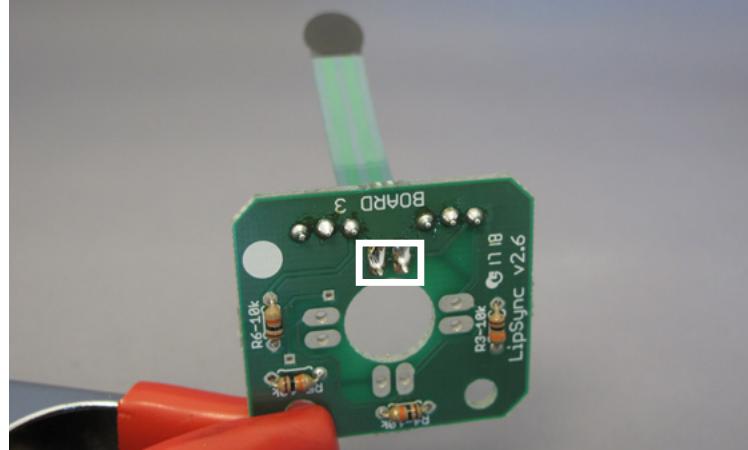
19.



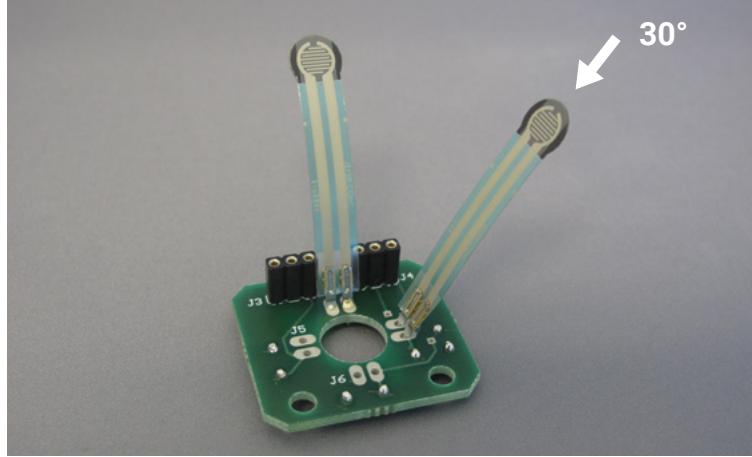
NOTE: Insert FSR at a 30° angle away from the centre of the board

x 2

20.



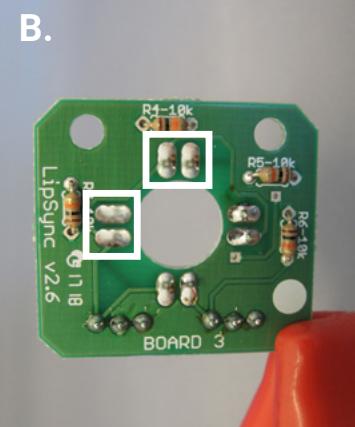
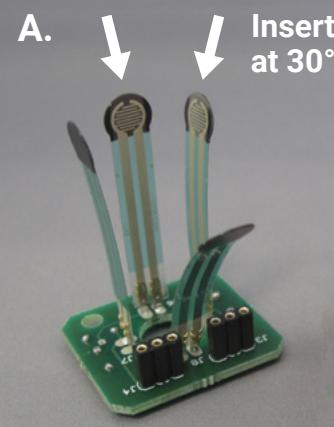
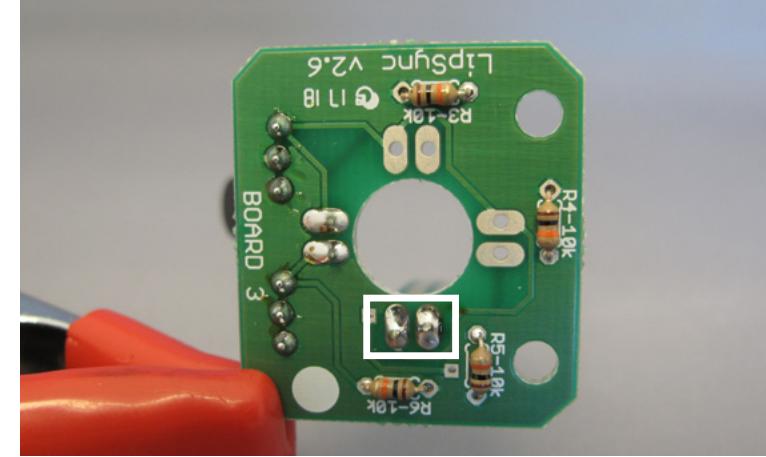
21.



29
HOLE
J7

x 2

22.

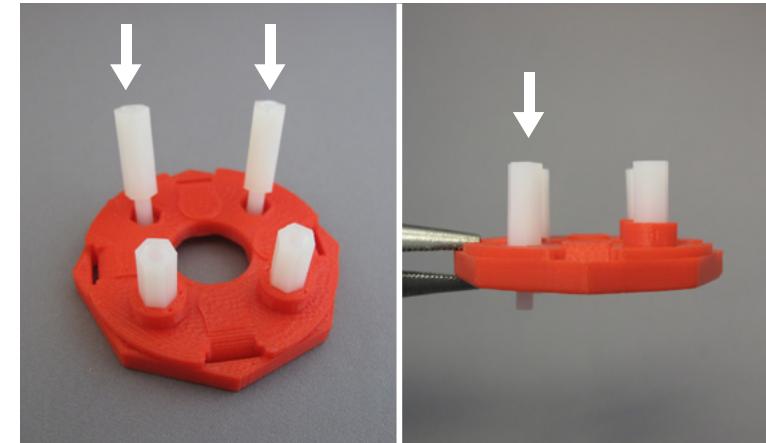


29
x 2
HOLE
J5
HOLE
J6

x 2

23.

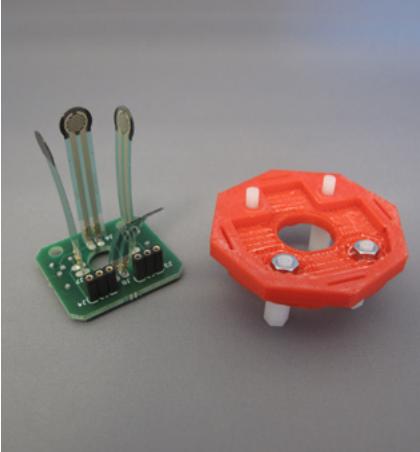
24.



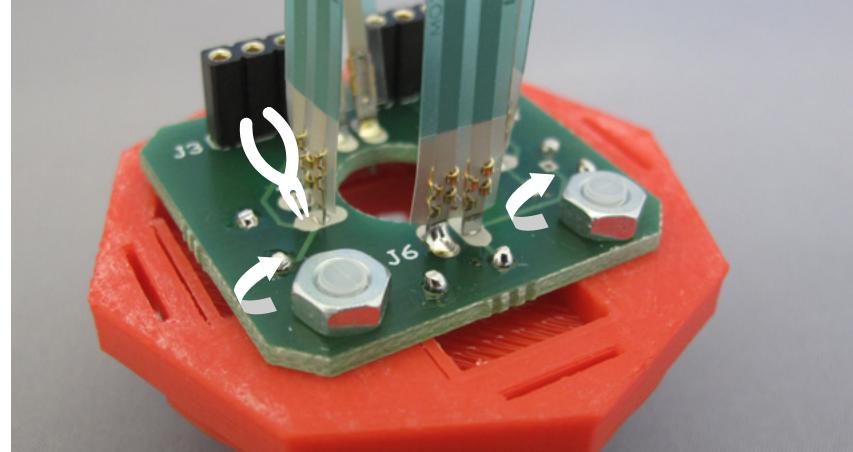
33
x 2

NOTE: Insert the 15mm standoffs

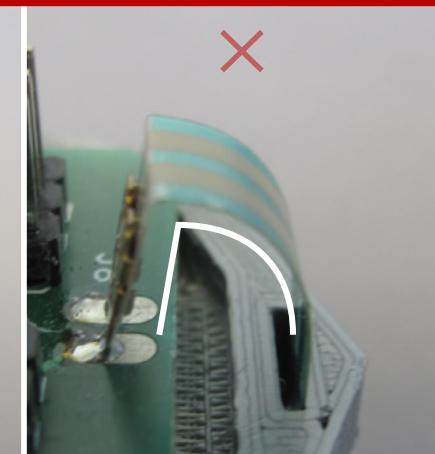
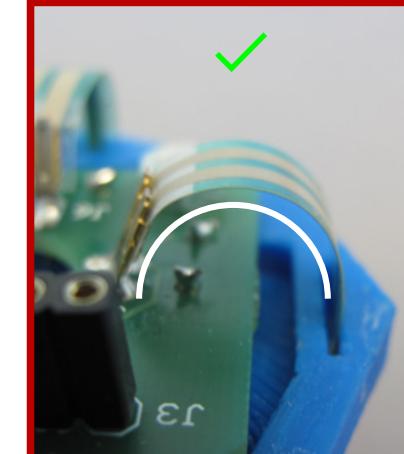
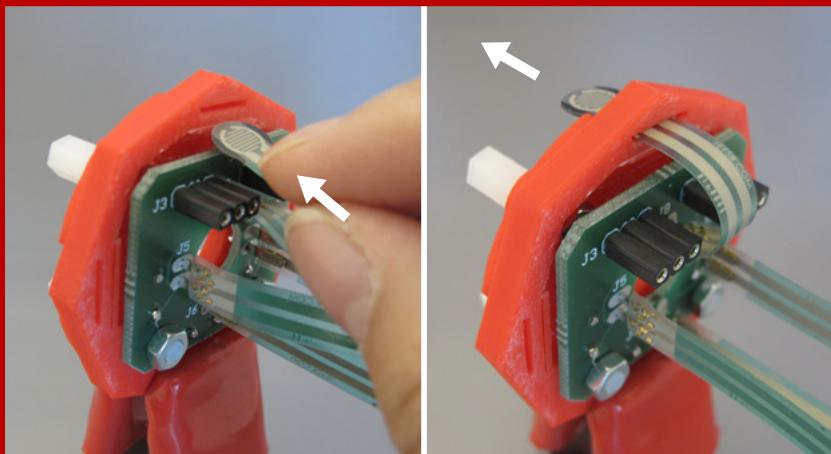
25.



26.

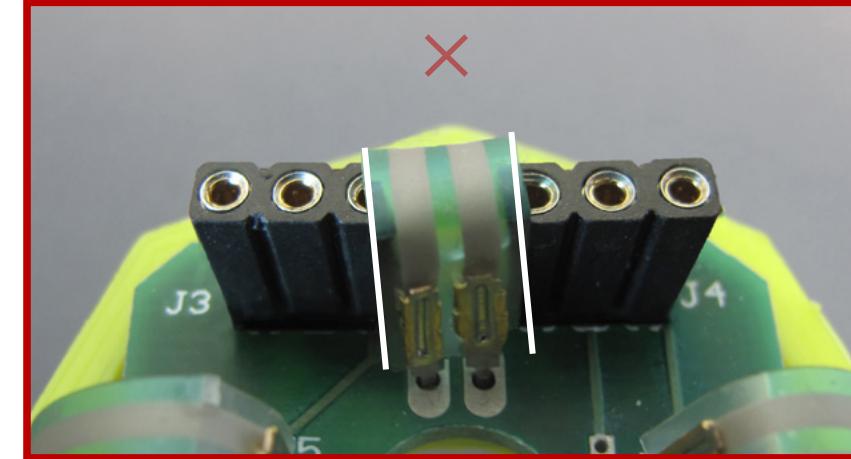
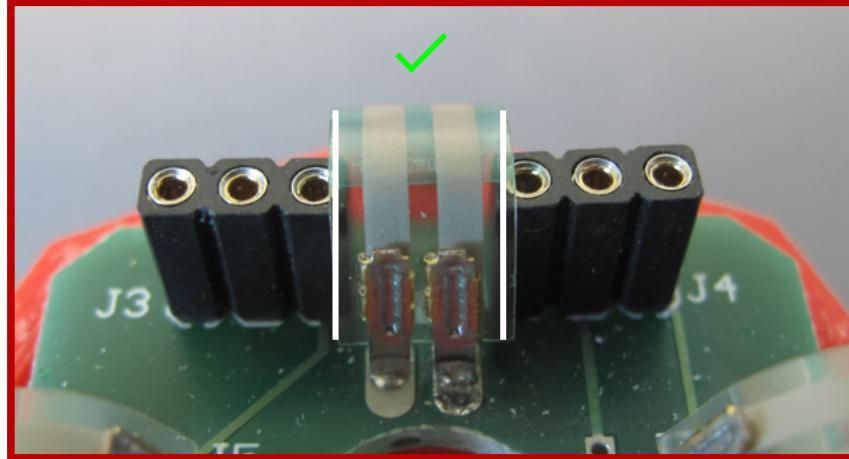


27.



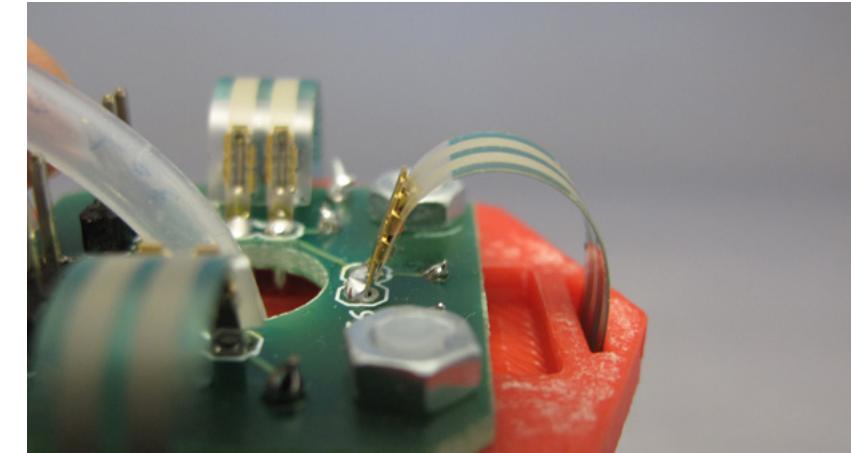
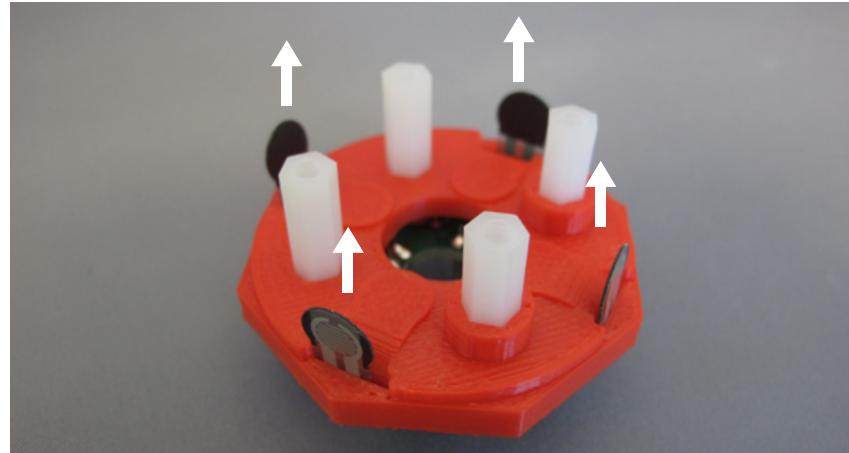
CAUTION:
Bend the FSR
so it arcs
GRADUALLY. Do
not fold or bend
it abruptly as the
ribbon breaks
easily.

28.

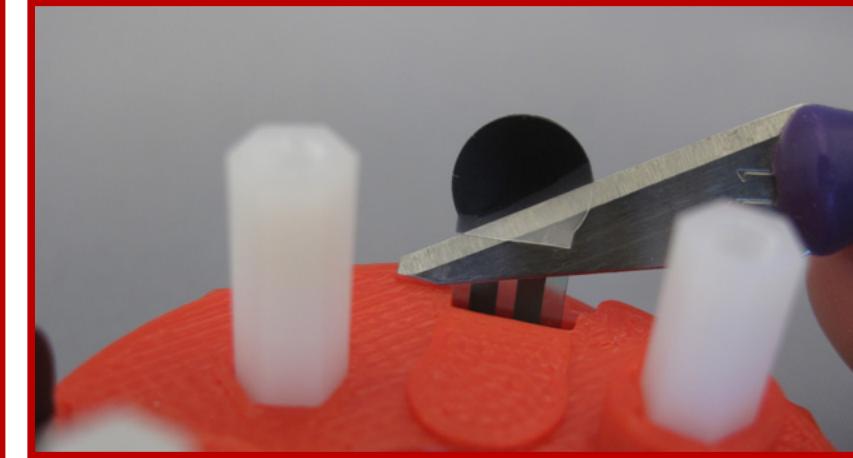
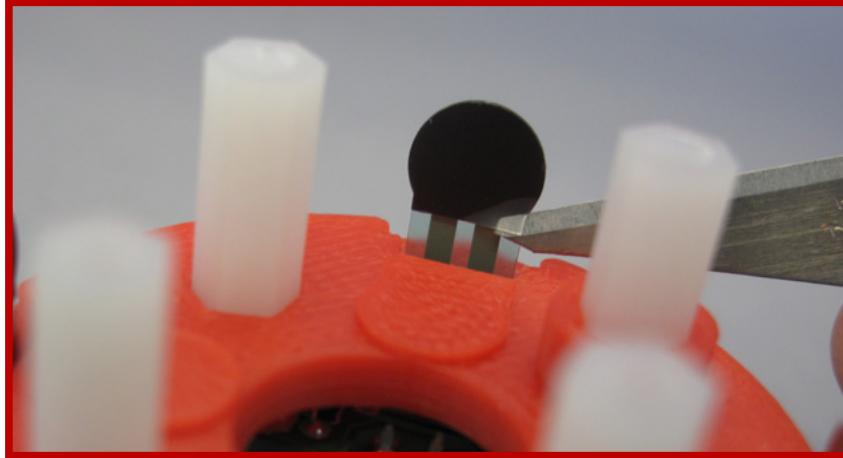


CAUTION:
One FSR ribbon
will slightly
overlap the
3-position female
headers. The
ribbon should not
cover the through
hole if placed
straight.

29.



30.



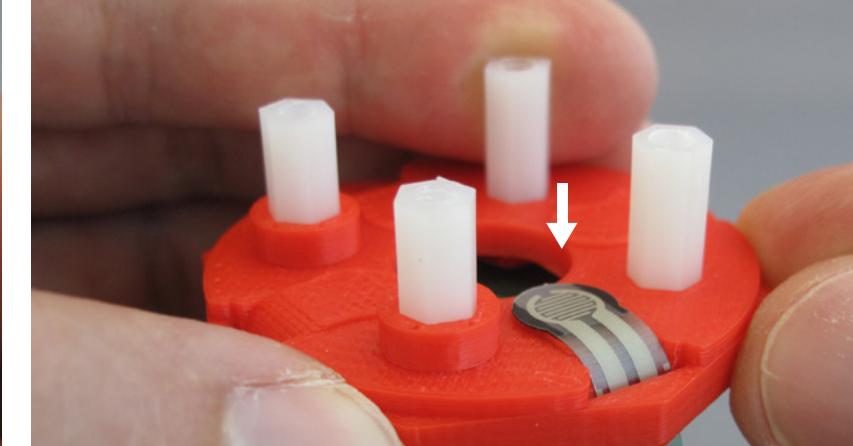
CAUTION:

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

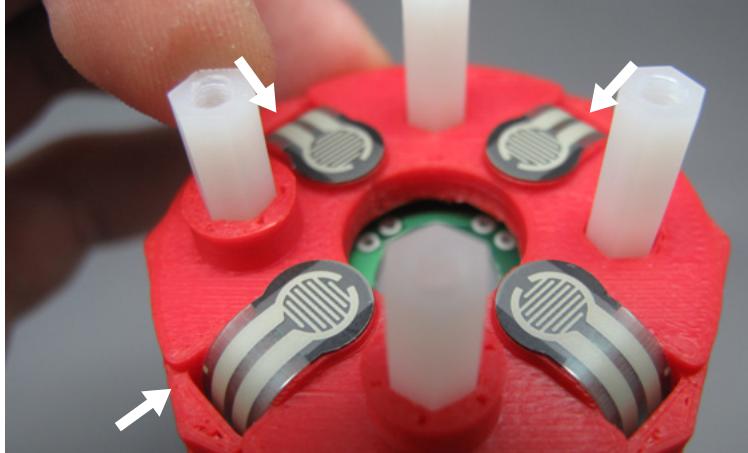
CAREFULLY
remove the lining with a hobby knife from the bottom corner.

**Do not remove
the black pad.**

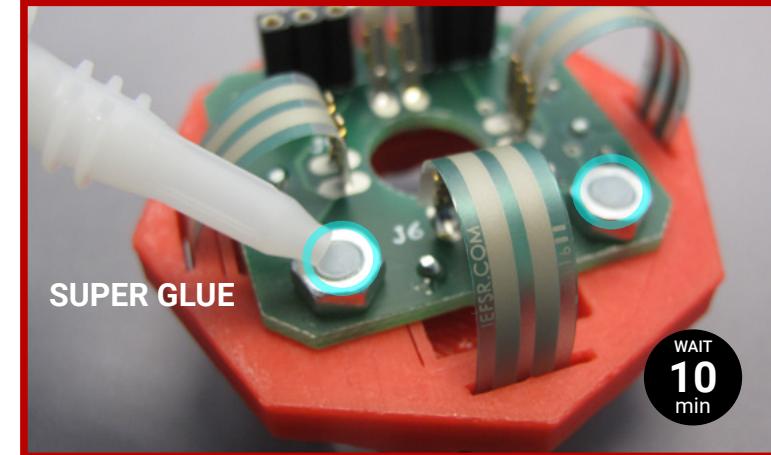
31.



32.

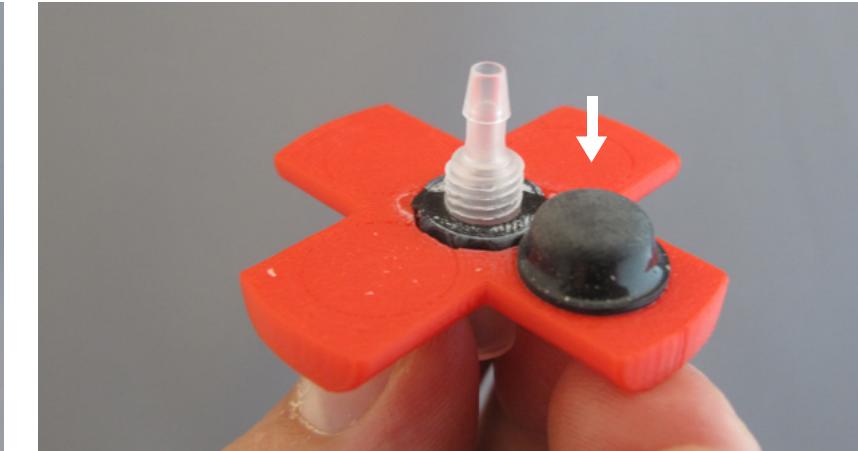
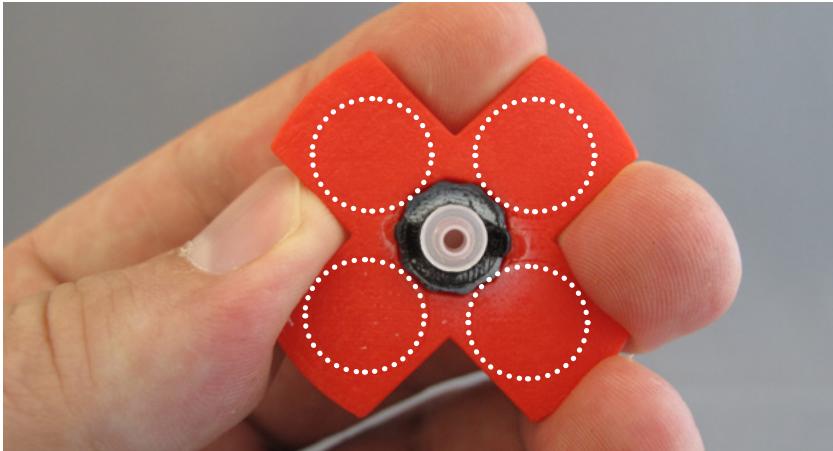


33.



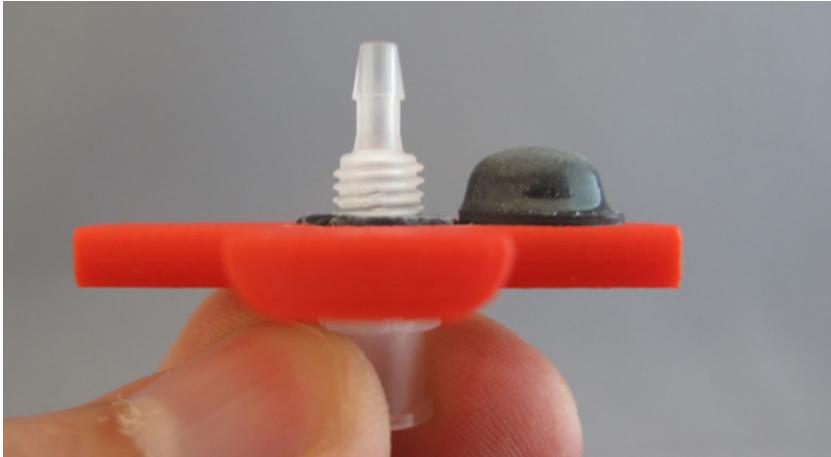
⚠️ IMPORTANT: Only add a small **DROP** of superglue

34.



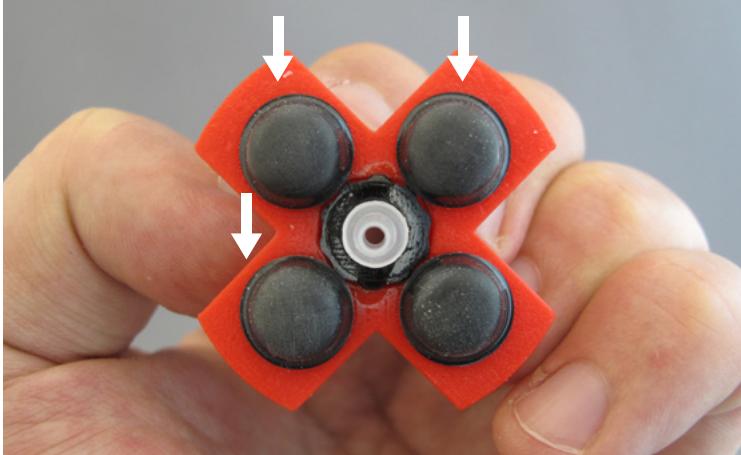
i NOTE: On the flat side of the rocker are 4 circles. Place one bumper inside each circle.

35.

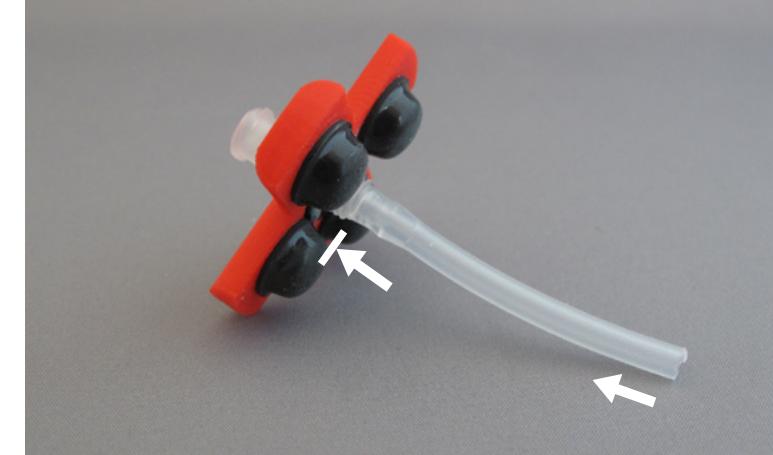


i NOTE: Ensure the bumpers are oriented with the high point of each bumper towards the centre. Stick them on the four circular outlines on the Joystick Rocker.

36.

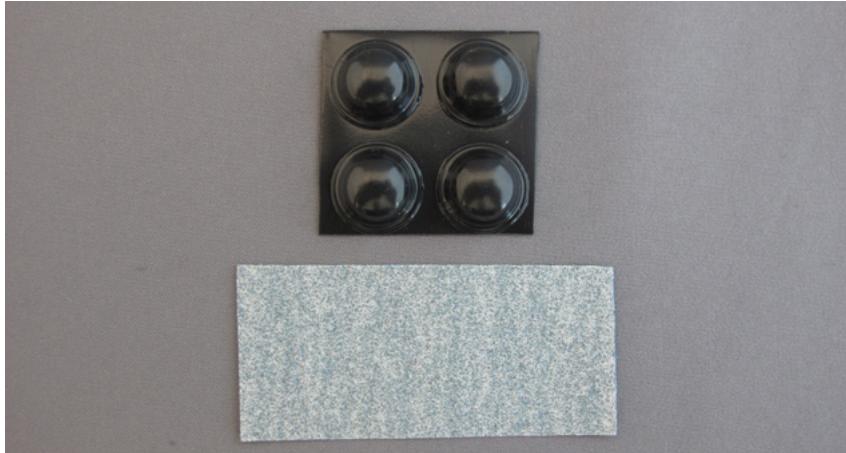


37.



37

38.



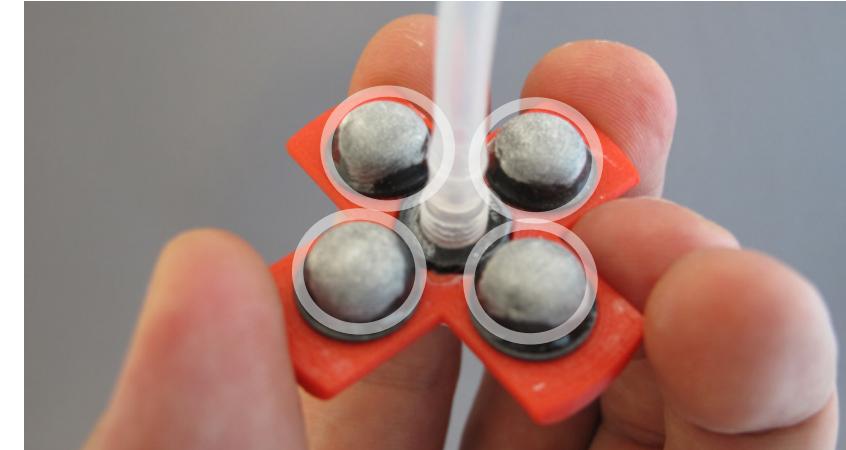
35

x4

i NOTE: Sand the top surface and around the bumpers

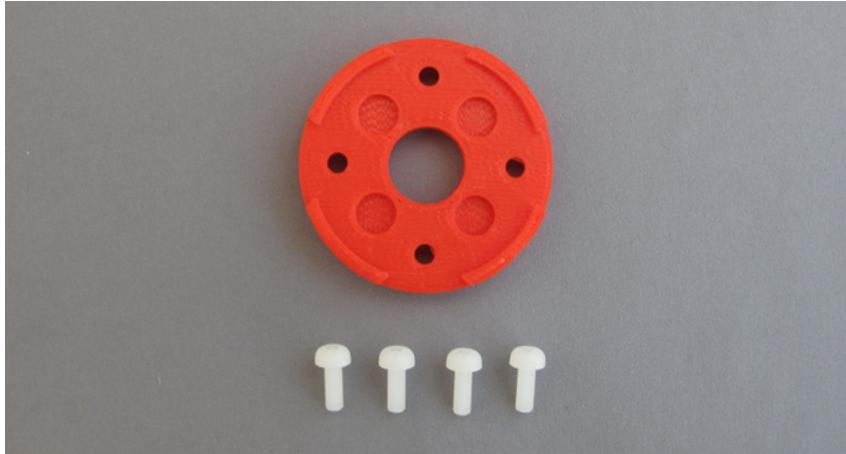


39.



i NOTE: Apply baby powder with your finger

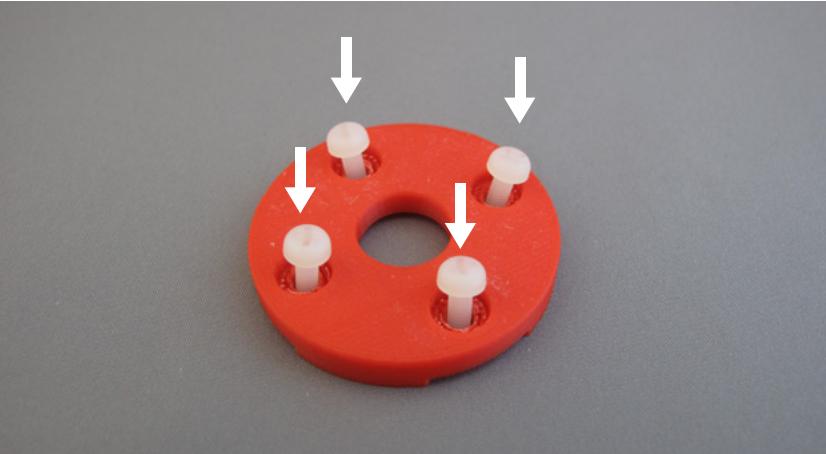
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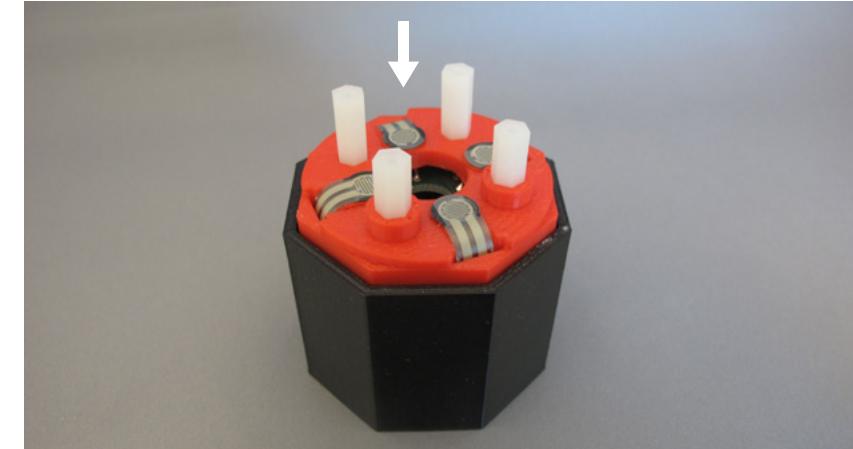
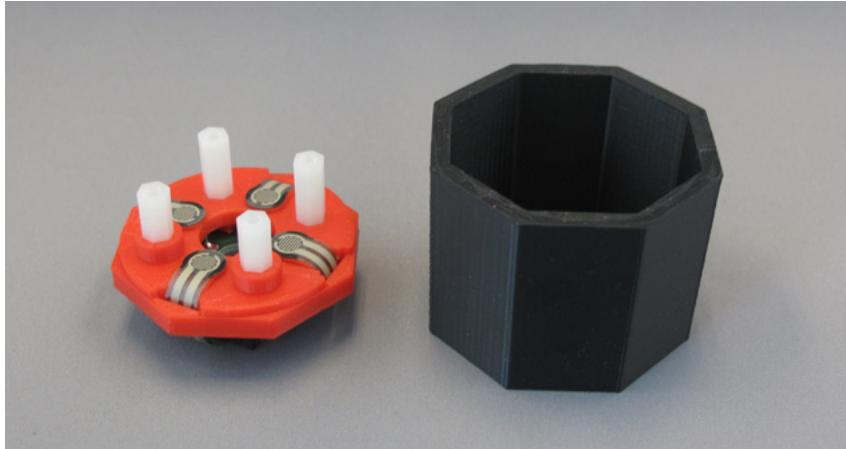
23

30

x 4

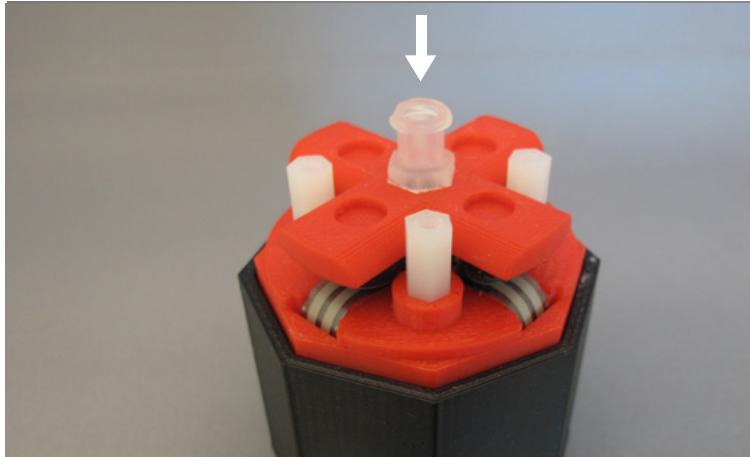


41.

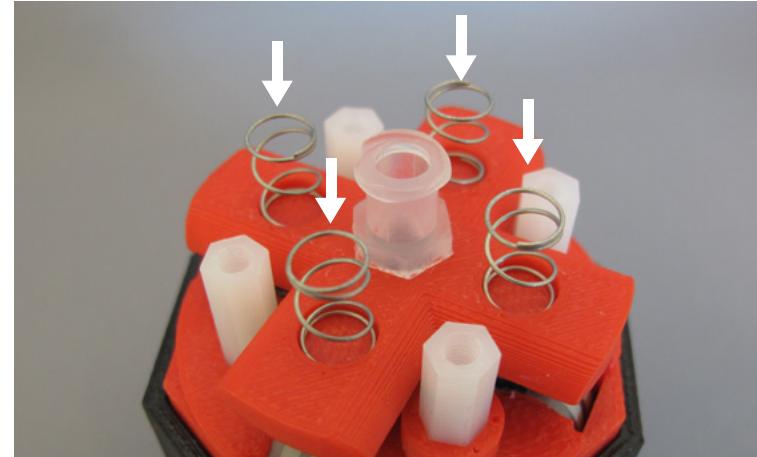


Use the joystick stand holder to assist with assembly for Steps 40 - 46

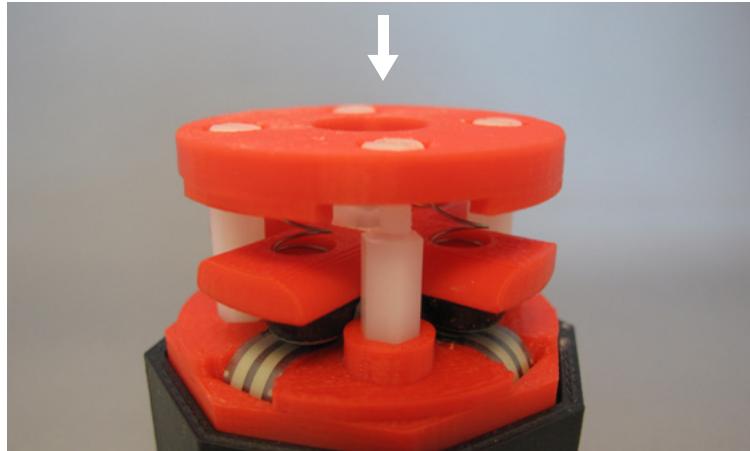
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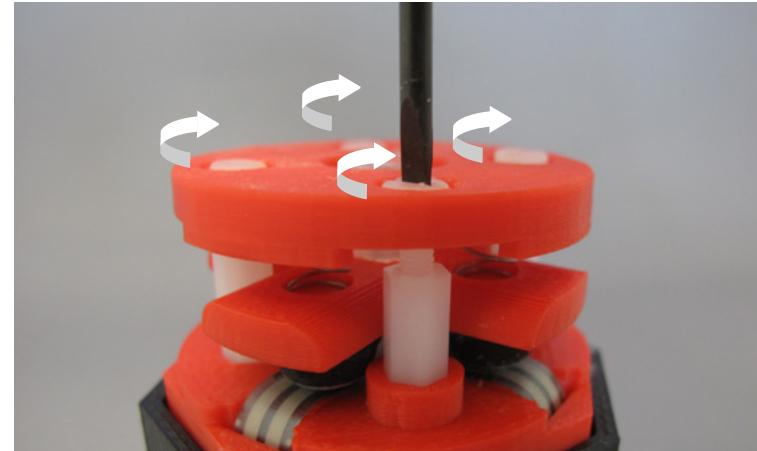
43.



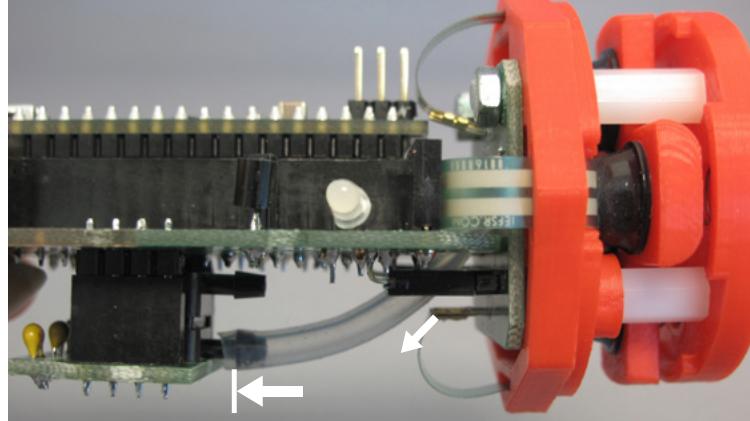
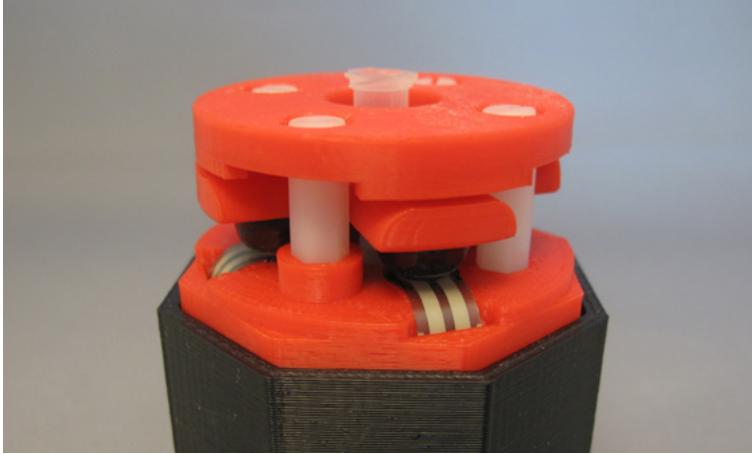
44.



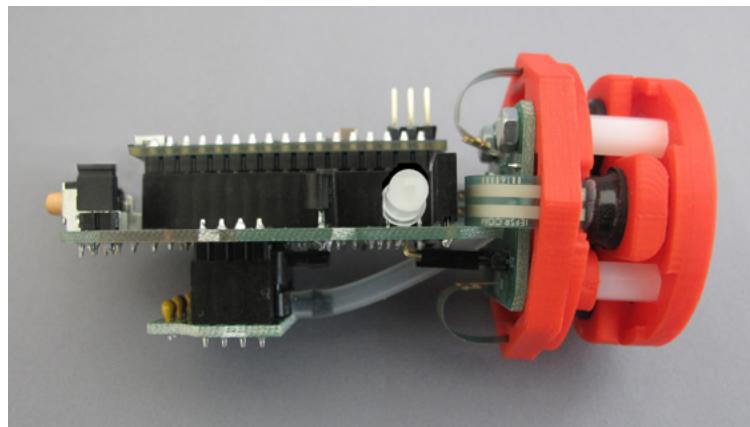
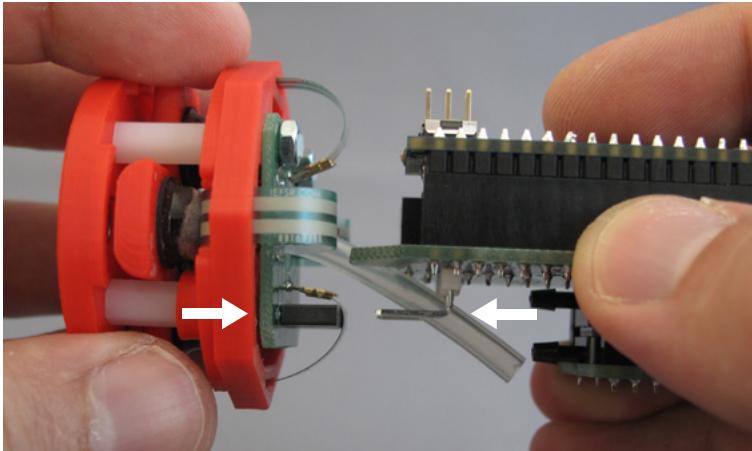
45.



46.



47.



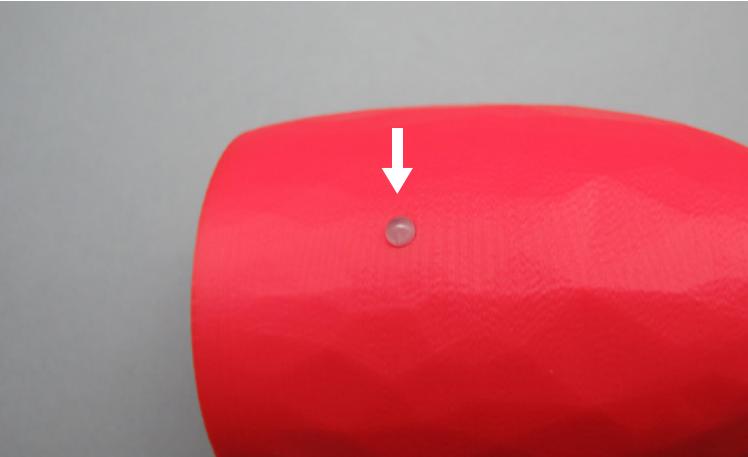
48.

PART 6



24
38

01.



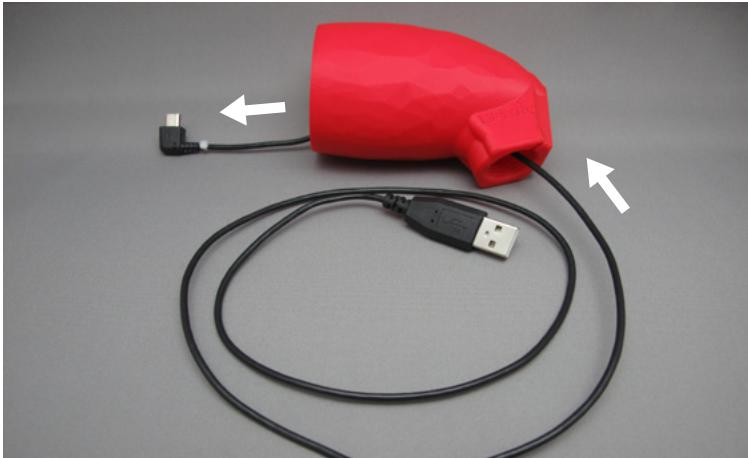
41
43

02.



NOTE: Tighten the cable tie until snug

03.



31
x 2

04.

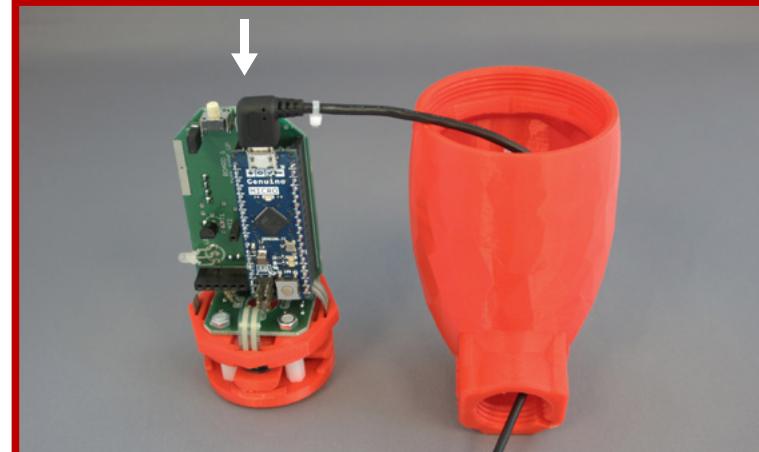


05.



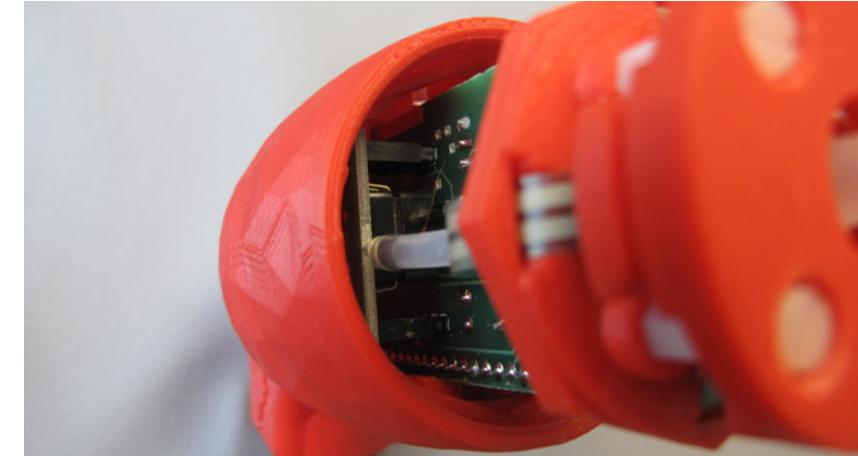
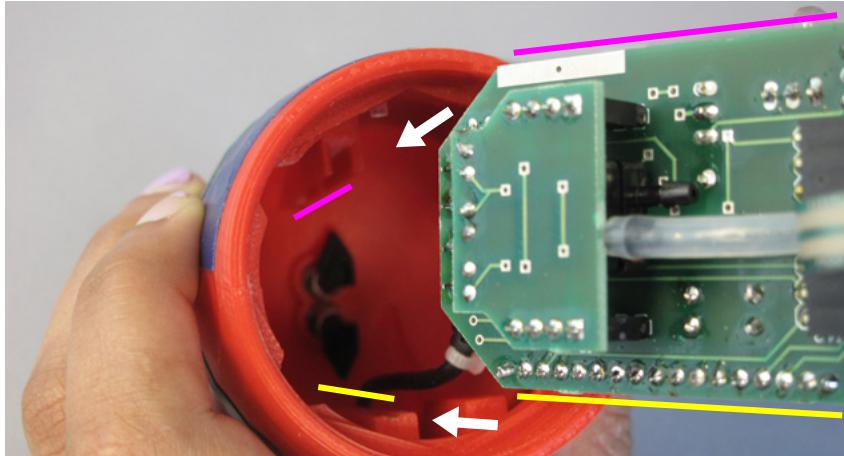
25
x 2

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.



CAUTION: Twist on hand tight

27

11.



CAUTION: Twist on hand tight

26

12.



39

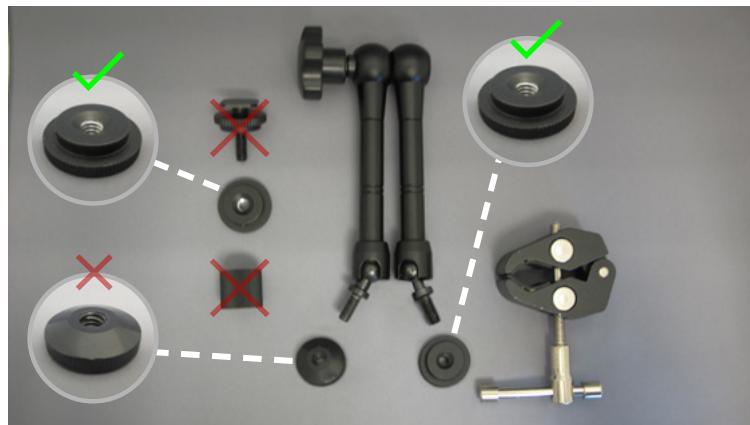
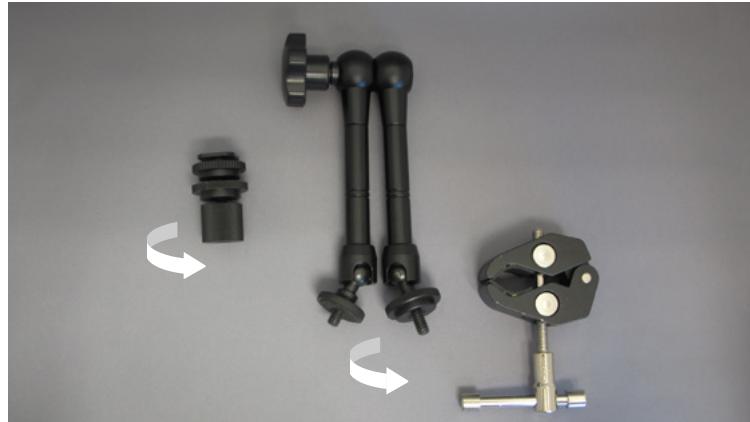
13.



42

PART 7

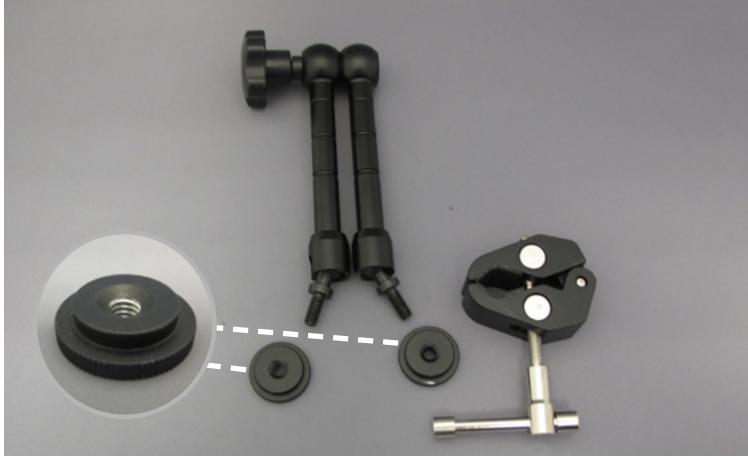
(OPTIONAL) MOUNTING THE LIPSYNC



01.

NOTE: Keep the two pieces that are marked with a green checkmark above it. The pieces with a "X" will not be needed.

02.



03.



40

04.



05.



06.



07.



08.



09.



PART 8

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

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

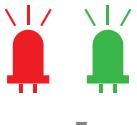
Calibrate your LipSync joystick before first using your device.

⚠️ 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

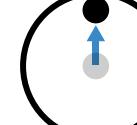
LED slowly blinks red & green 5 times



3 sec.
pause



x 6



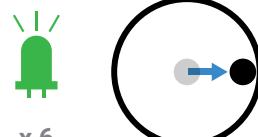
x 1

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



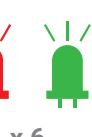
x 6

8

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