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# **Muscle BioAmp Shield**

**Upside Down Labs**

**Apr 19, 2024**

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All-in-one Arduino Uno Shield for EMG (Electromyography).

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**CHAPTER  
ONE**

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**OVERVIEW**

Muscle BioAmp Shield is an all-in-one Arduino Uno ElectroMyography (EMG) shield for learning neuroscience with ease. It is a DIY Electrophysiology/NeuroScience shield inspired from Back Yard Brains (BYB) Muscle Spiker shield and provides similar features like hobby servo output, user buttons, LED Bar, Audio output, and battery input. It is perfect for beginners as they can easily stack it on top of Arduino Uno to record, visualize and listen to their muscle signals to make amazing projects in the domain of Human-Computer Interface (HCI).

<https://youtu.be/w8yw12SUe6Q>

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**CHAPTER  
TWO**

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## **FEATURES & SPECIFICATIONS**

Muscle BioAmp Shield comes with various plug-and-play options so you can connect hundreds of extension boards like OLED screens, character displays, accelerometers, and servo controllers to name just a few using the STEMMA I2C interface. You also get STEMMA digital and STEMMA analog ports. On STEMMA analog port you can connect additional BioAmp EXG Pill or any other sensor with analog output. On STEMMA digital port you can connect any digital sensor or actuator of your choice.

Input Voltage	5V
Input Impedance	10^11 ohm
Fixed Gain	x2420
Bandpass filter	72 – 720 Hz
Compatible Hardware	Arduino UNO
BioPotentials	EMG (Electromyography)
No. of channels	1
Electrodes	3 (Positive, Negative, and Reference)
Dimensions	6.0 x 5.3 cm
Open Source	Hardware + Software

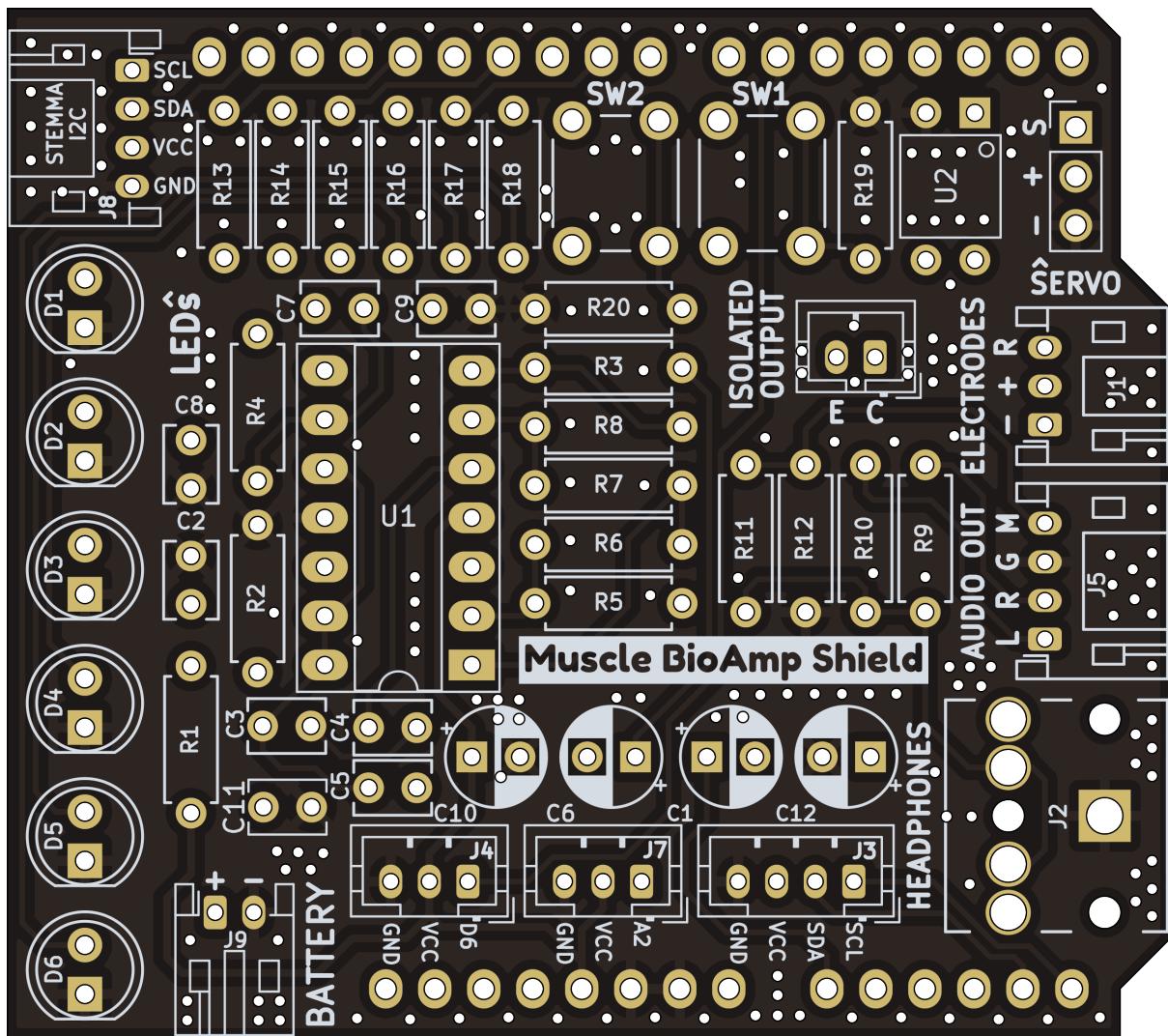
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## HARDWARE

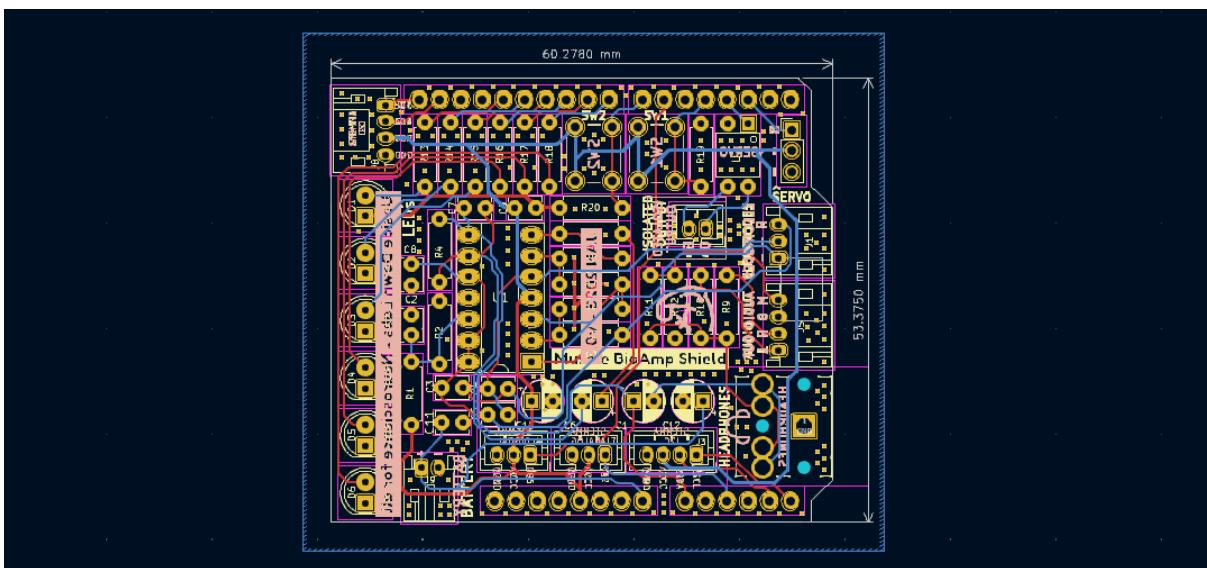
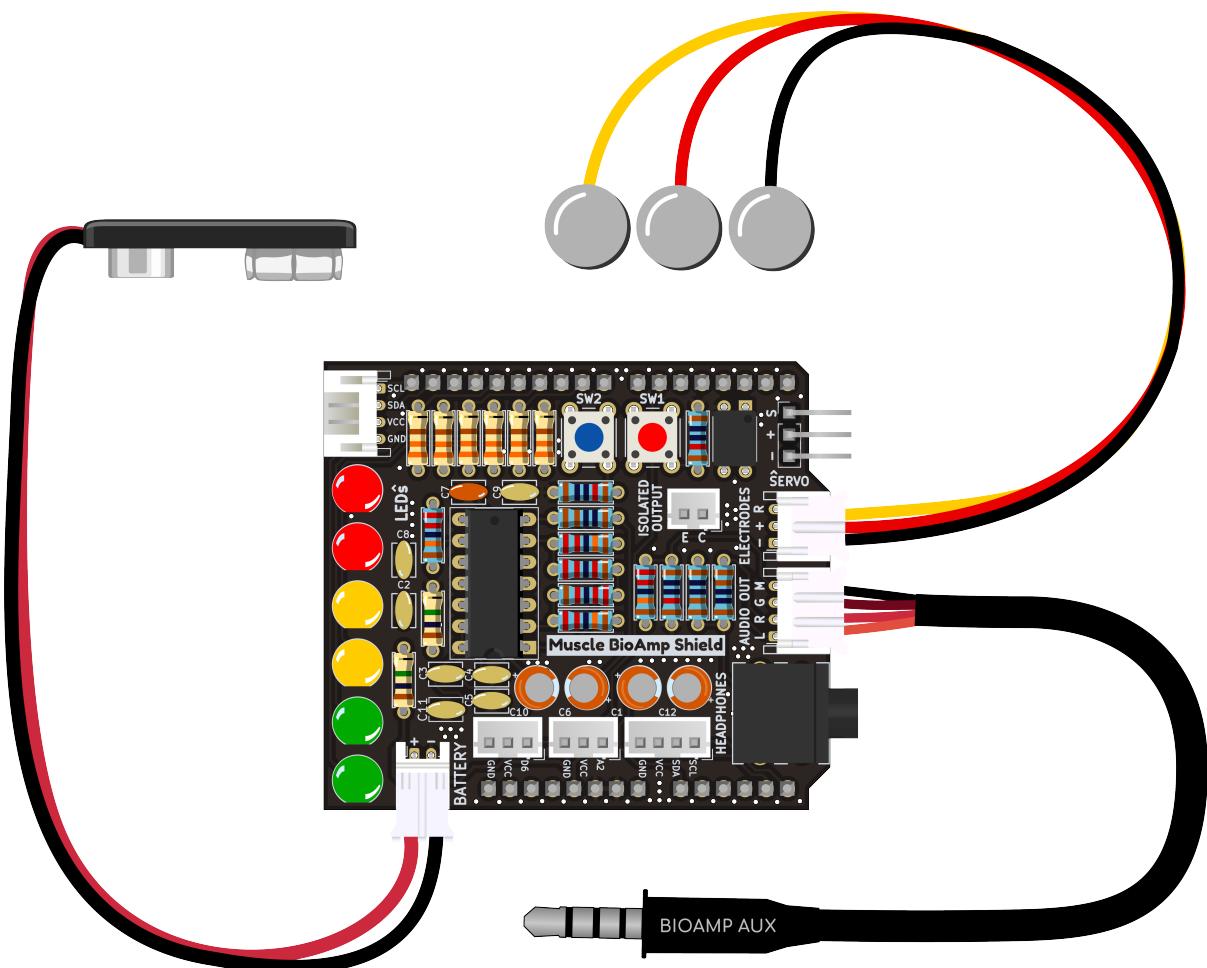
Images below shows a quick overview of the hardware design.

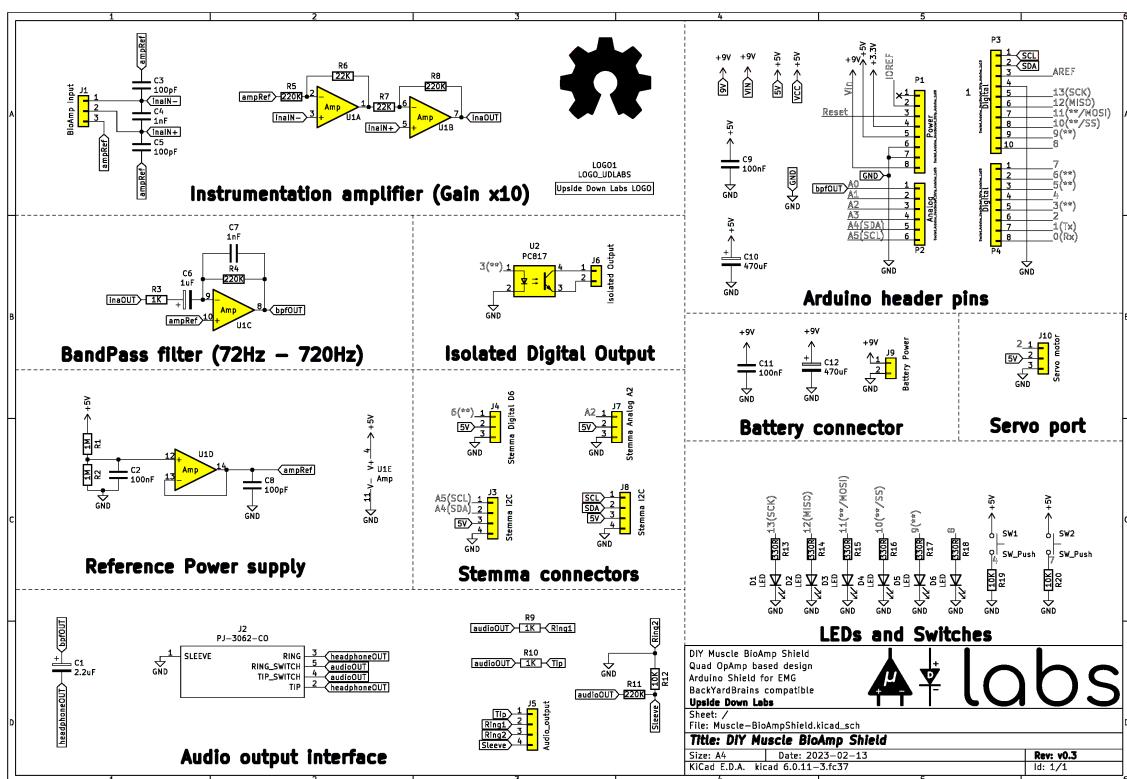
### PCB Front



### PCB Back







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CHAPTER  
FOUR

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## ASSEMBLYING THE KIT

You can get your own Muscle BioAmp Shield bag of parts from our [store](#) or [Tindie](#) and for assembling your shield you can take a look at [this interactive BOM](#) or the step by step guide below.

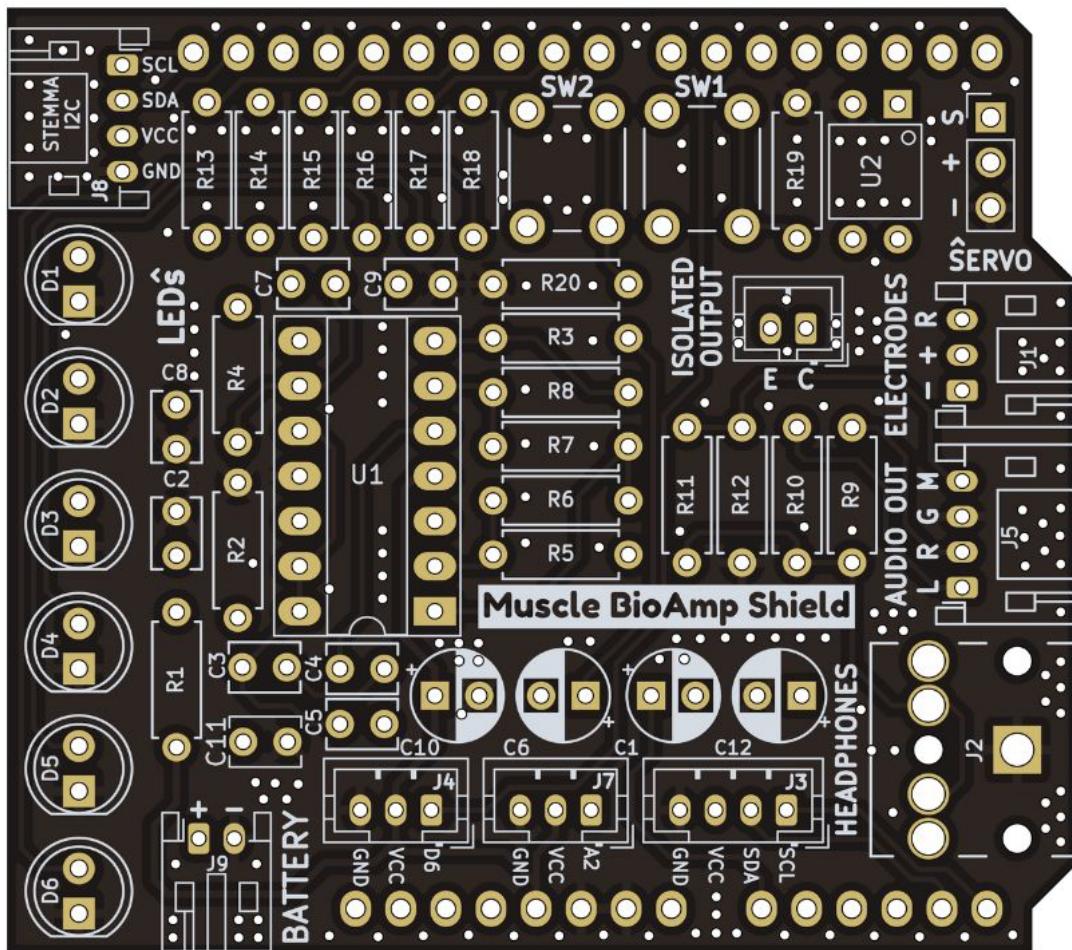


Fig. 1: Step 1 - Bare Board

Still can't figure out the assembly? You can follow the video provided below to assemble your Shield.

<https://youtu.be/dcuCihh3yn4>

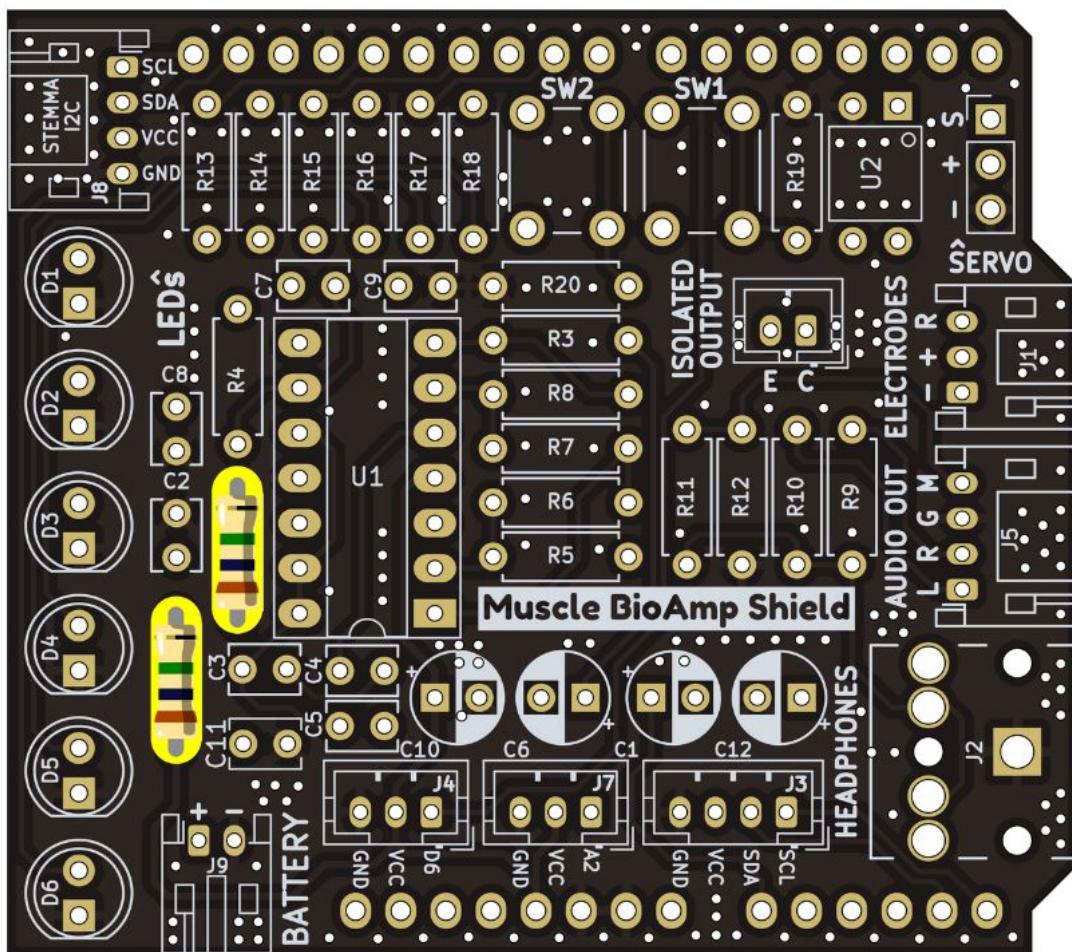


Fig. 2: Step 2 - 1M Resistors

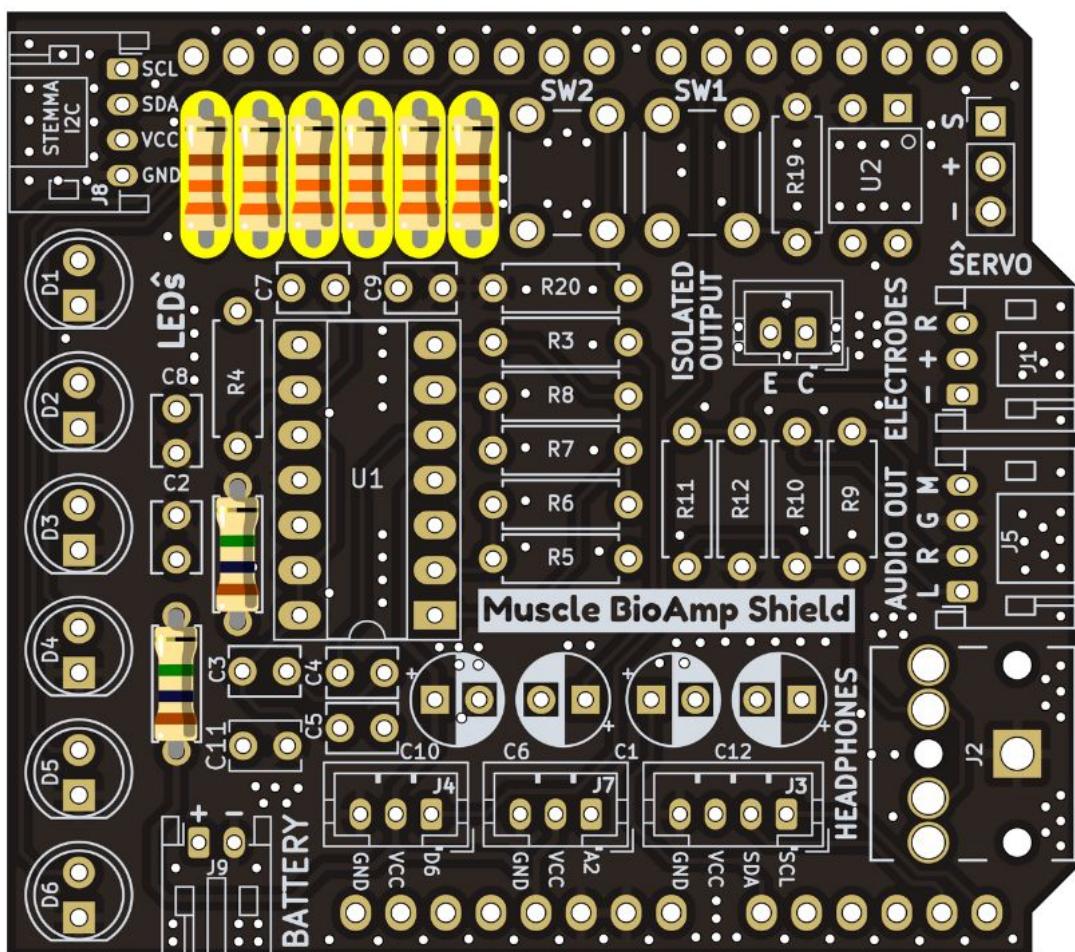


Fig. 3: Step 3 - 330R Resistors

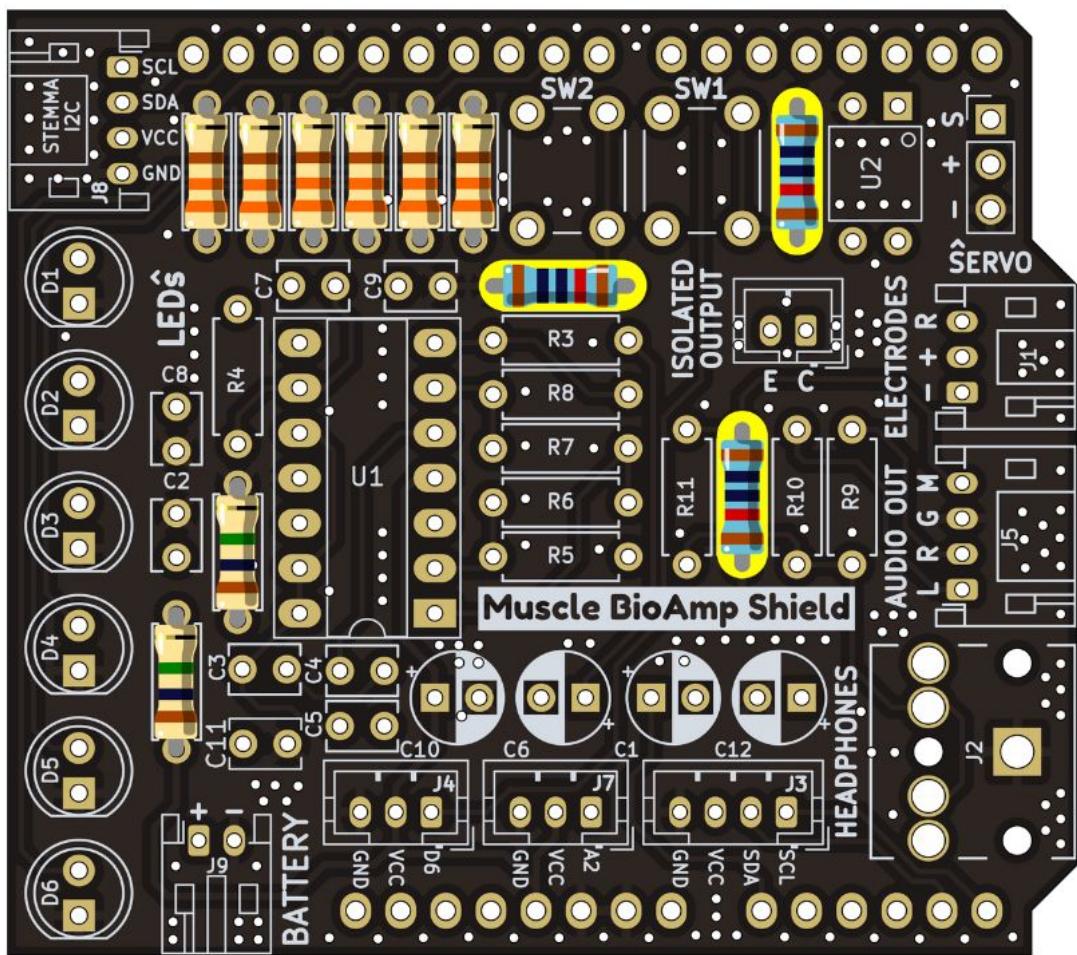


Fig. 4: Step 4 - 10K Resistors

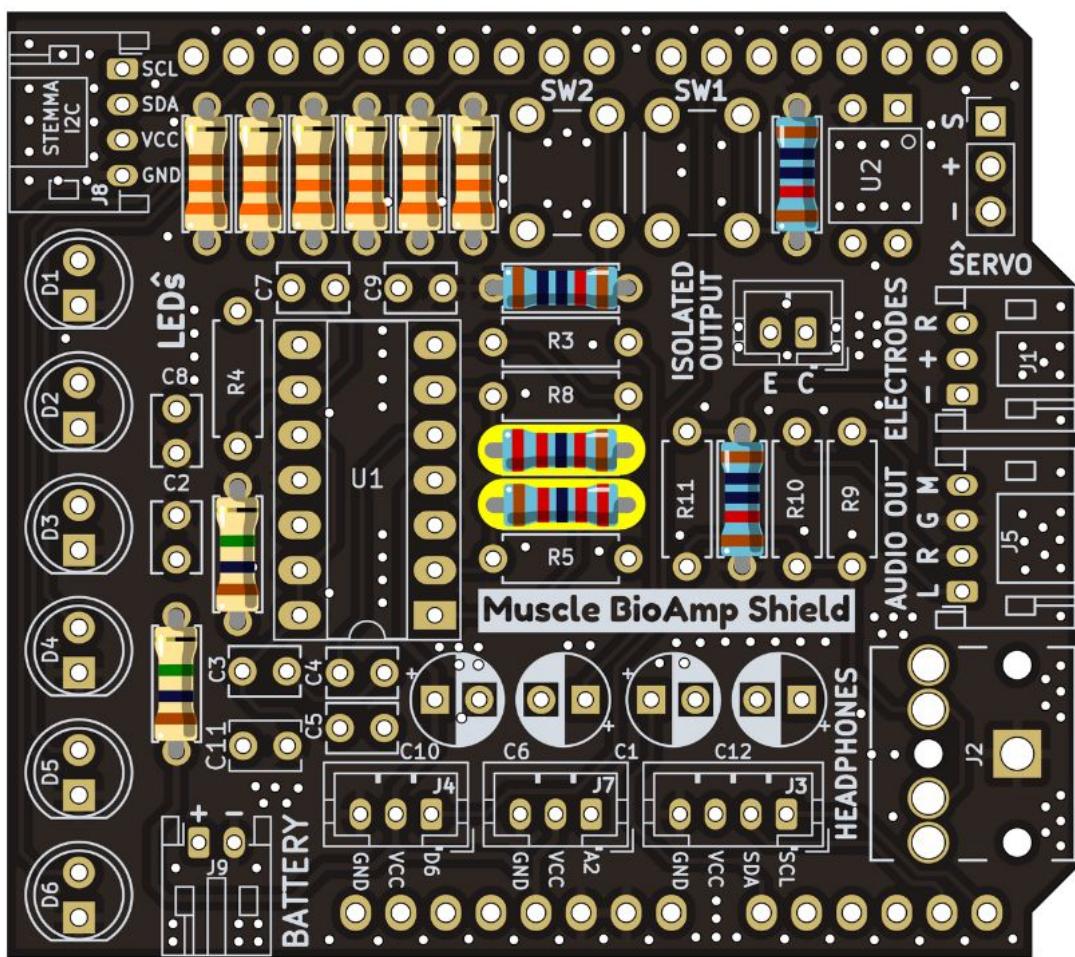


Fig. 5: Step 5 - 22K Resistors

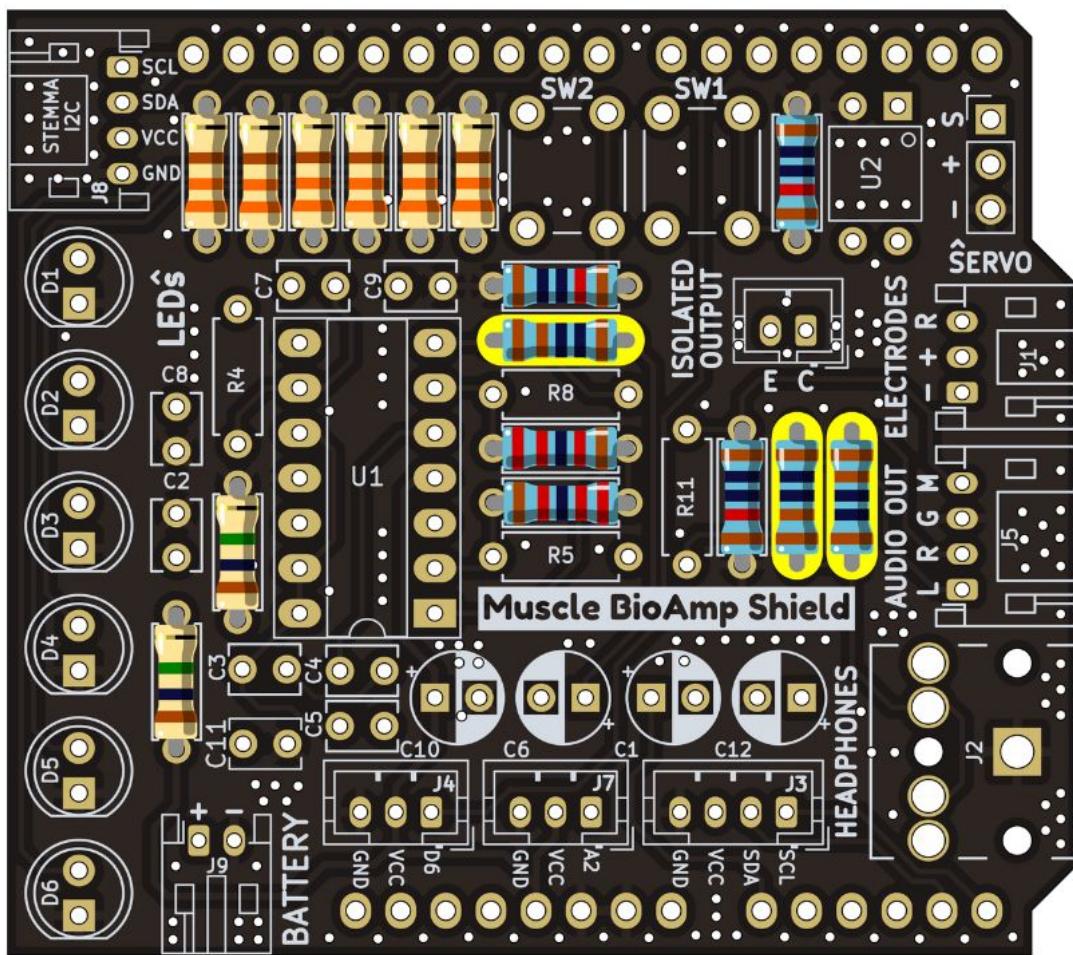


Fig. 6: Step 6 - 1K Resistors

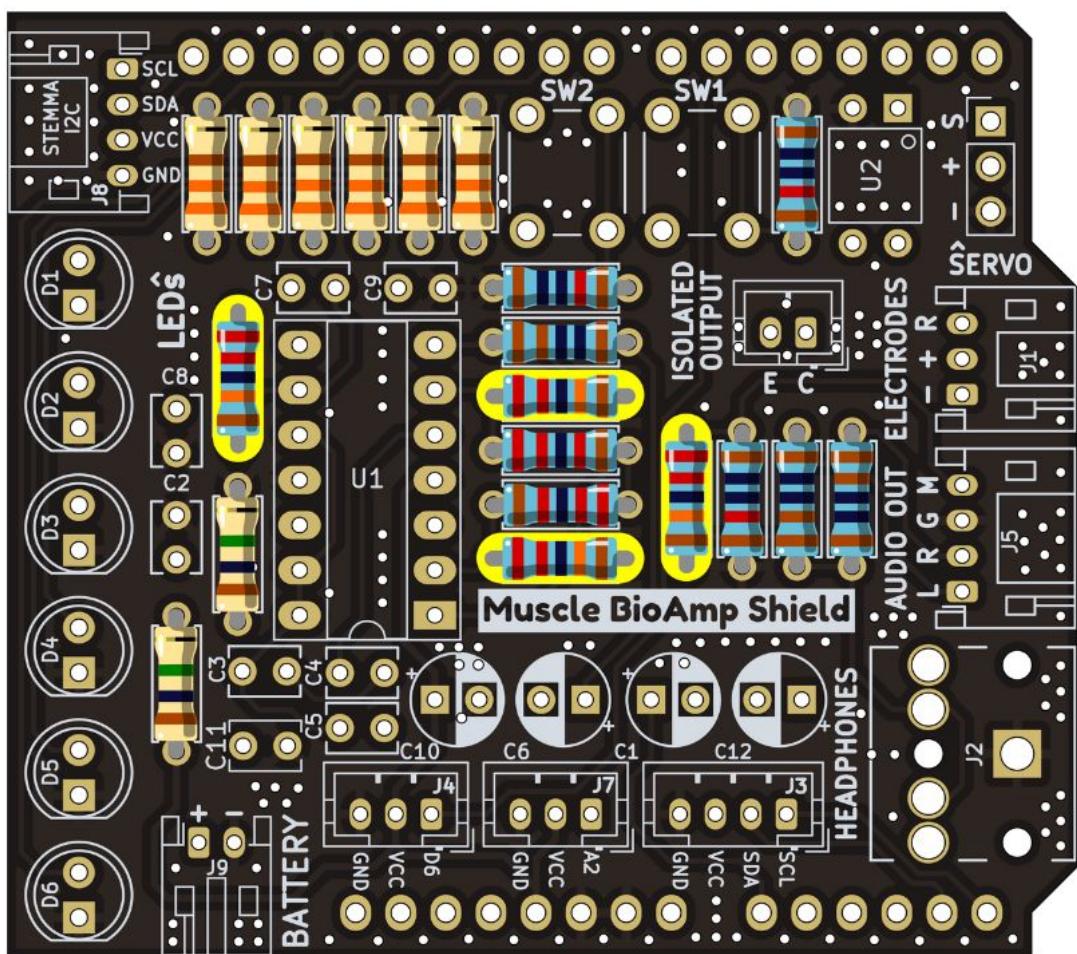


Fig. 7: Step 7 - 220K Resistors

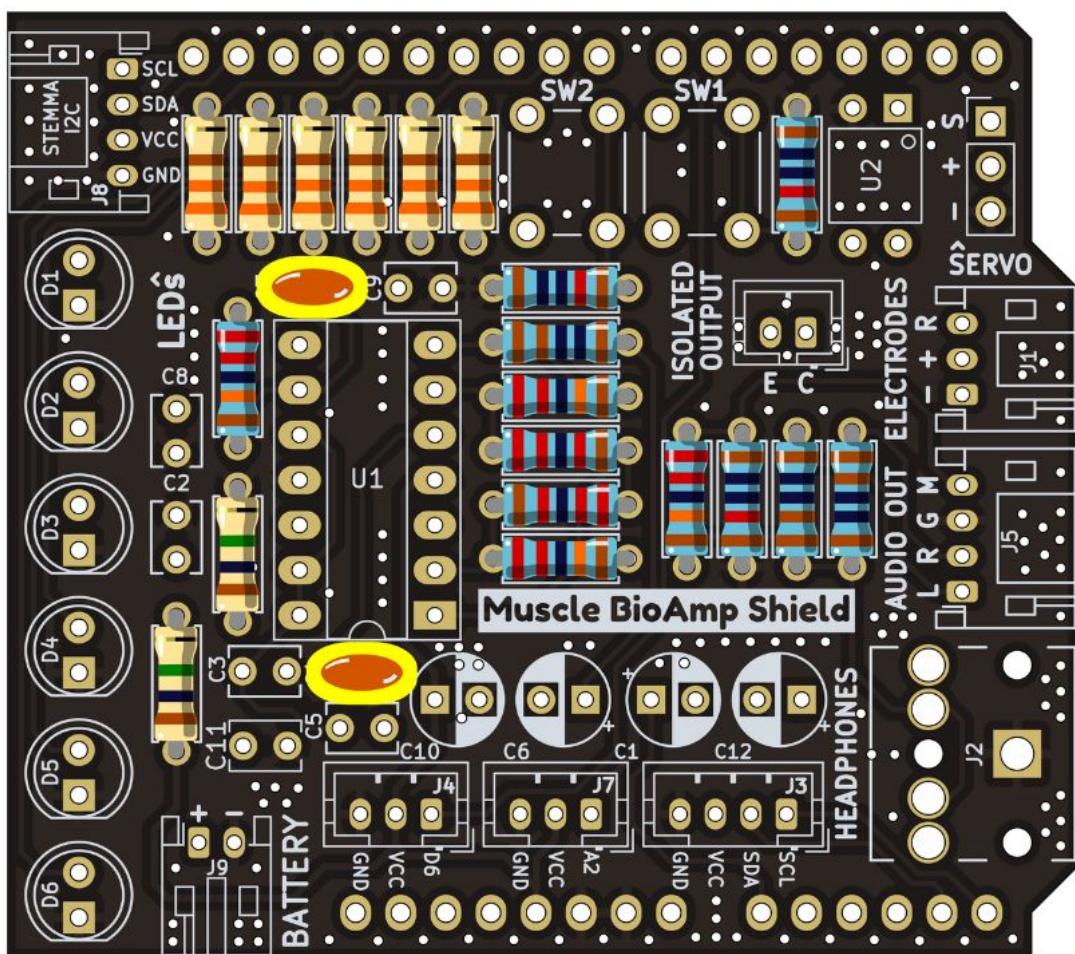


Fig. 8: Step 8 - 1nF Capacitors

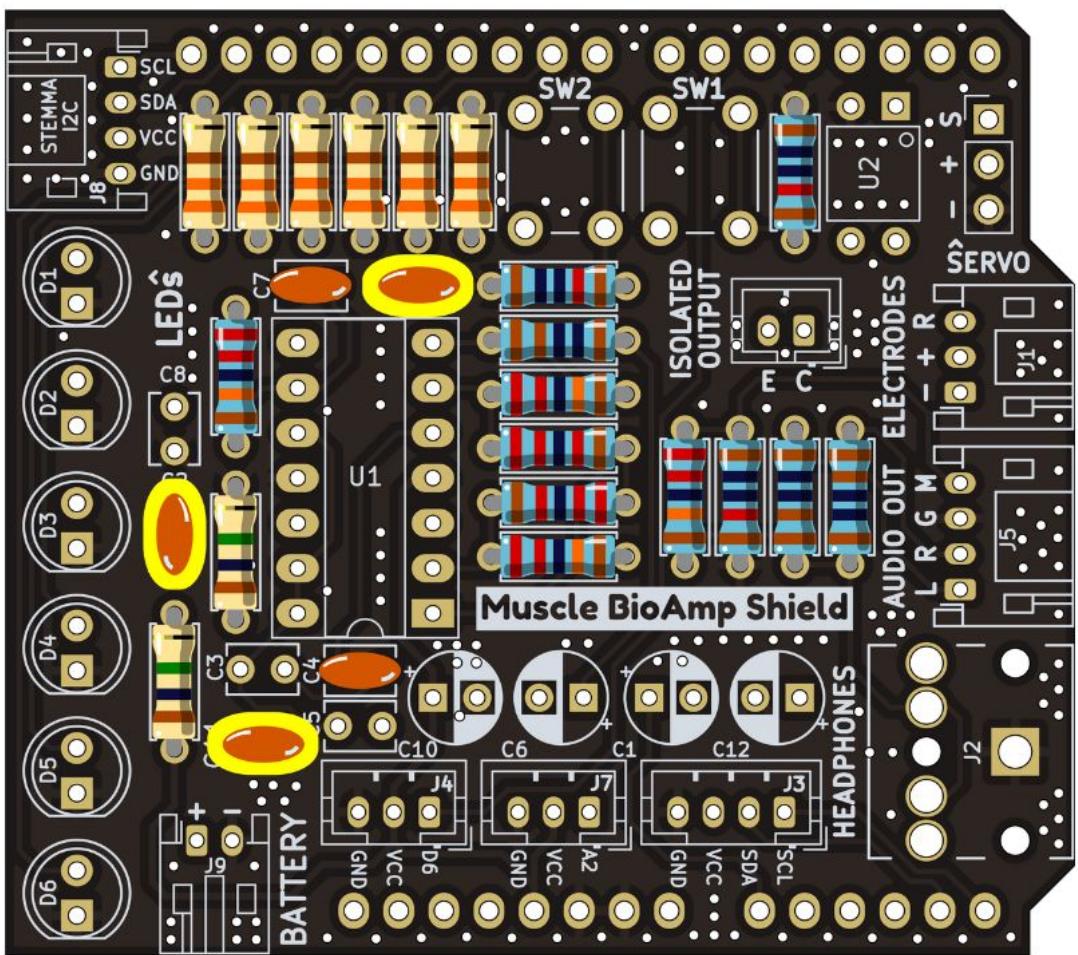


Fig. 9: Step 9 - 100nF Capacitors

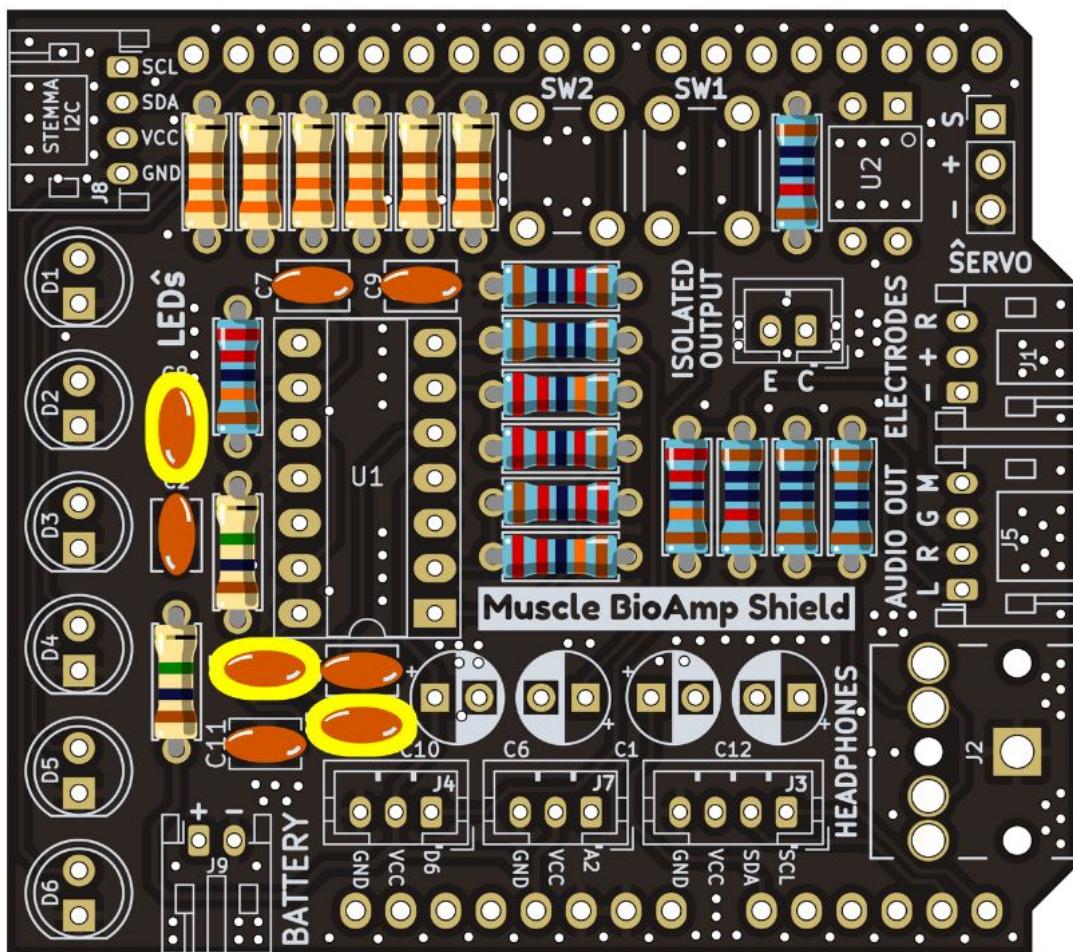


Fig. 10: Step 10 - 100pF Capacitors

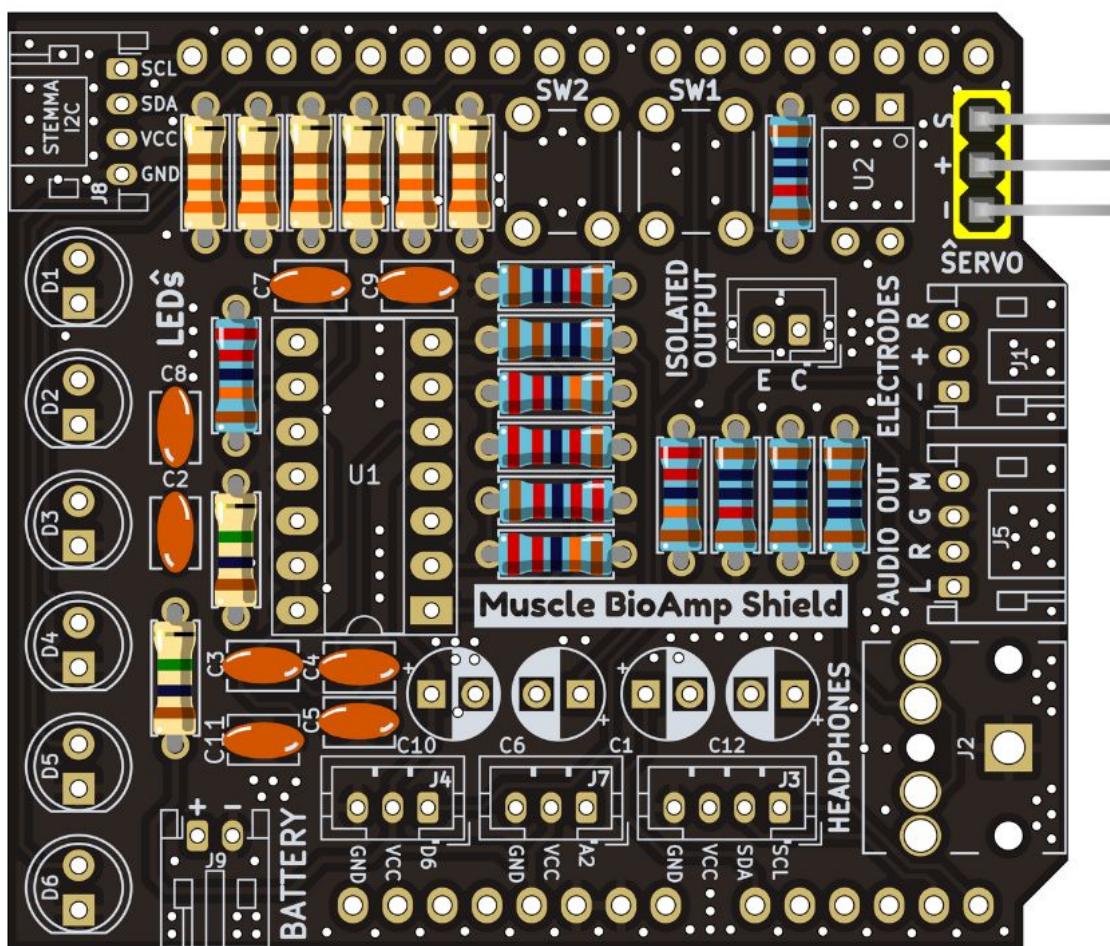


Fig. 11: Step 11 - Angled Header Pins

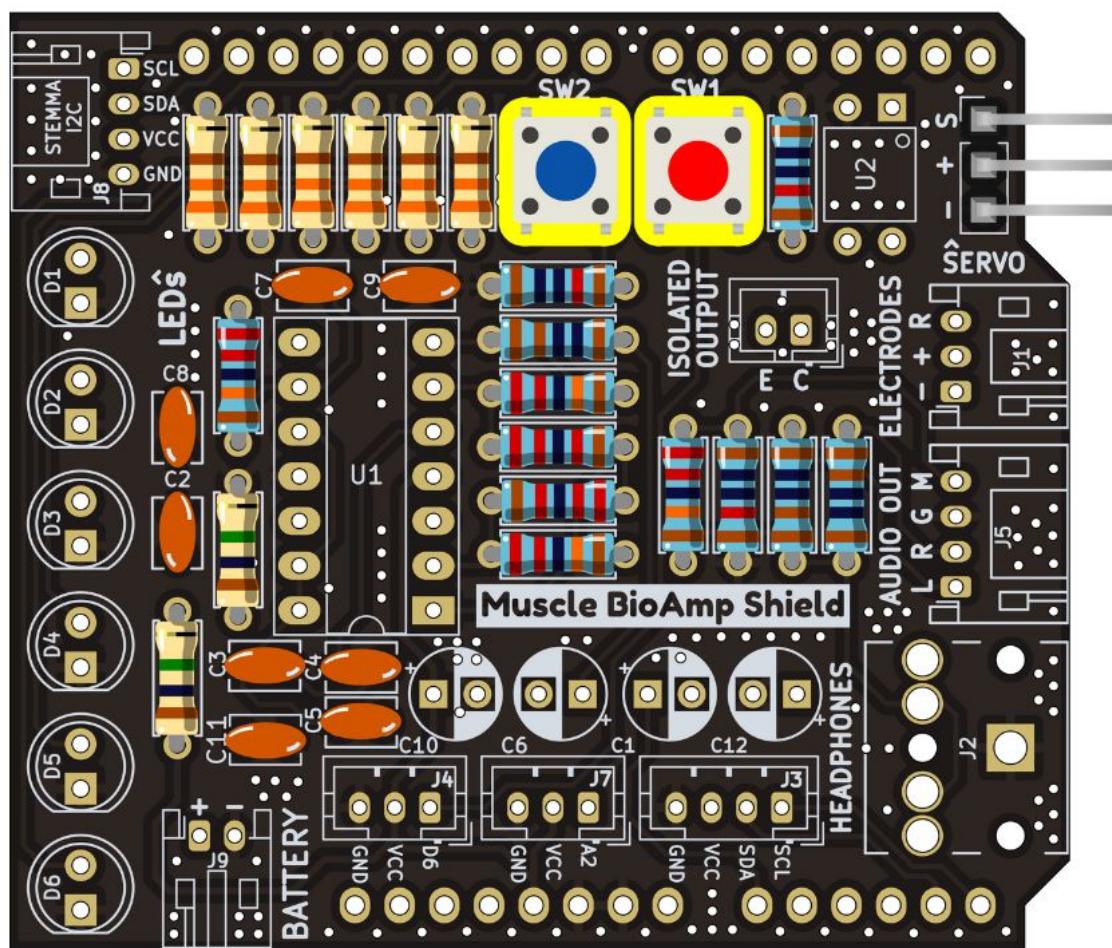


Fig. 12: Step 12 - 5x5mm Buttons

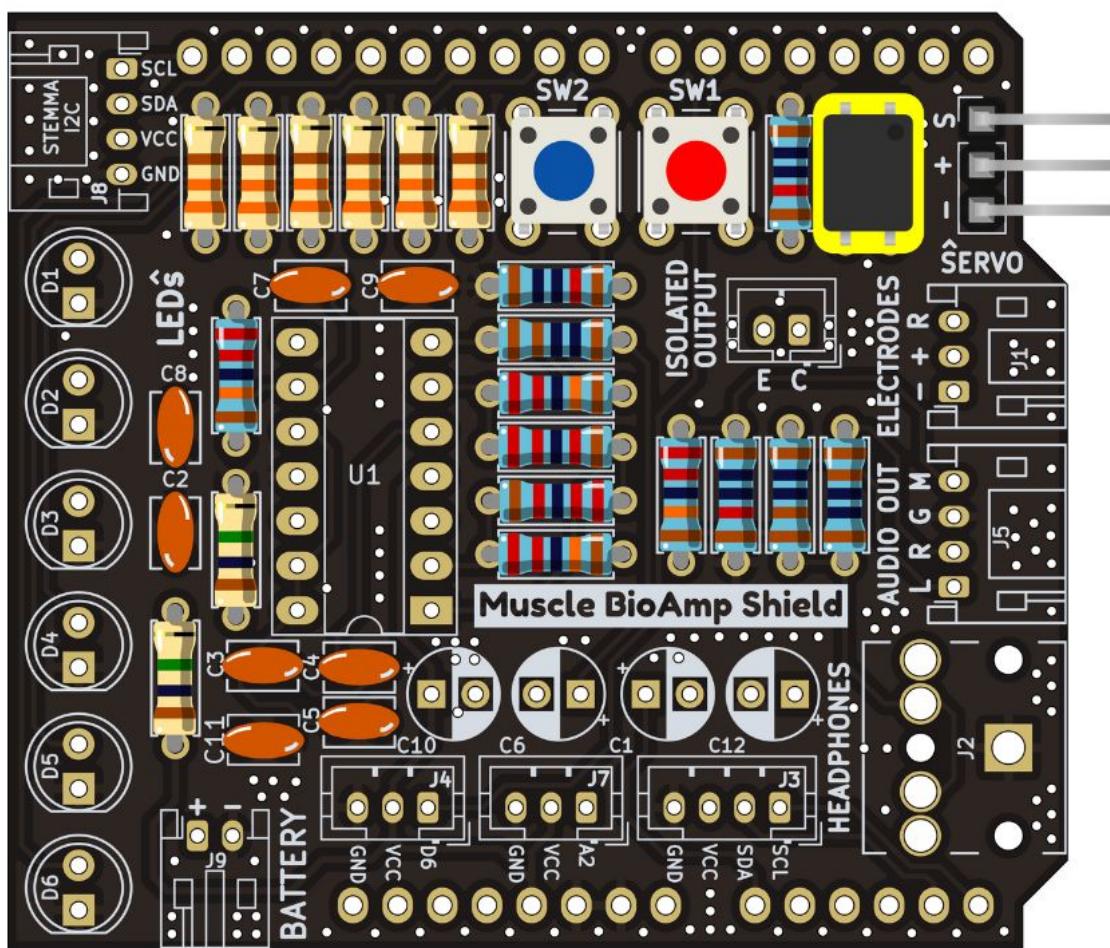


Fig. 13: Step 13 - OptoIsolator

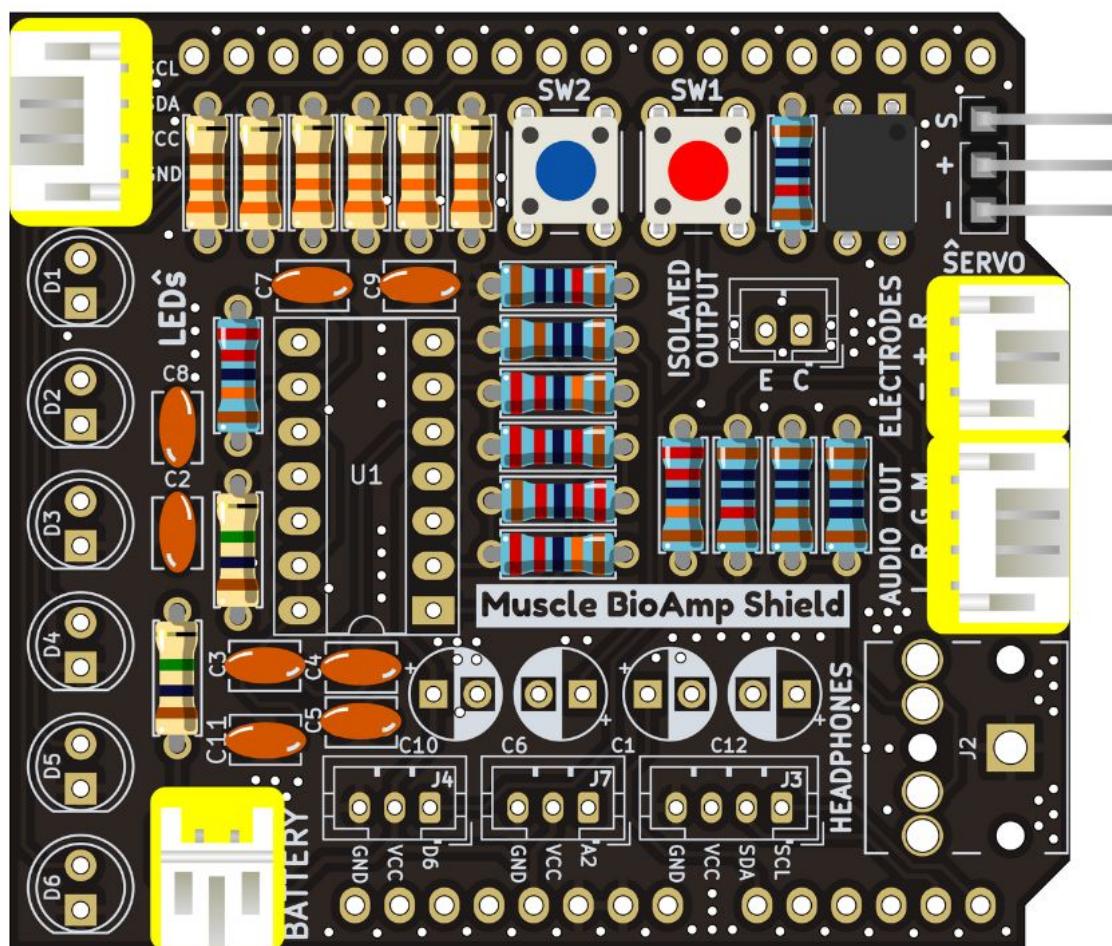


Fig. 14: Step 14 - JST PH Angled Connectors

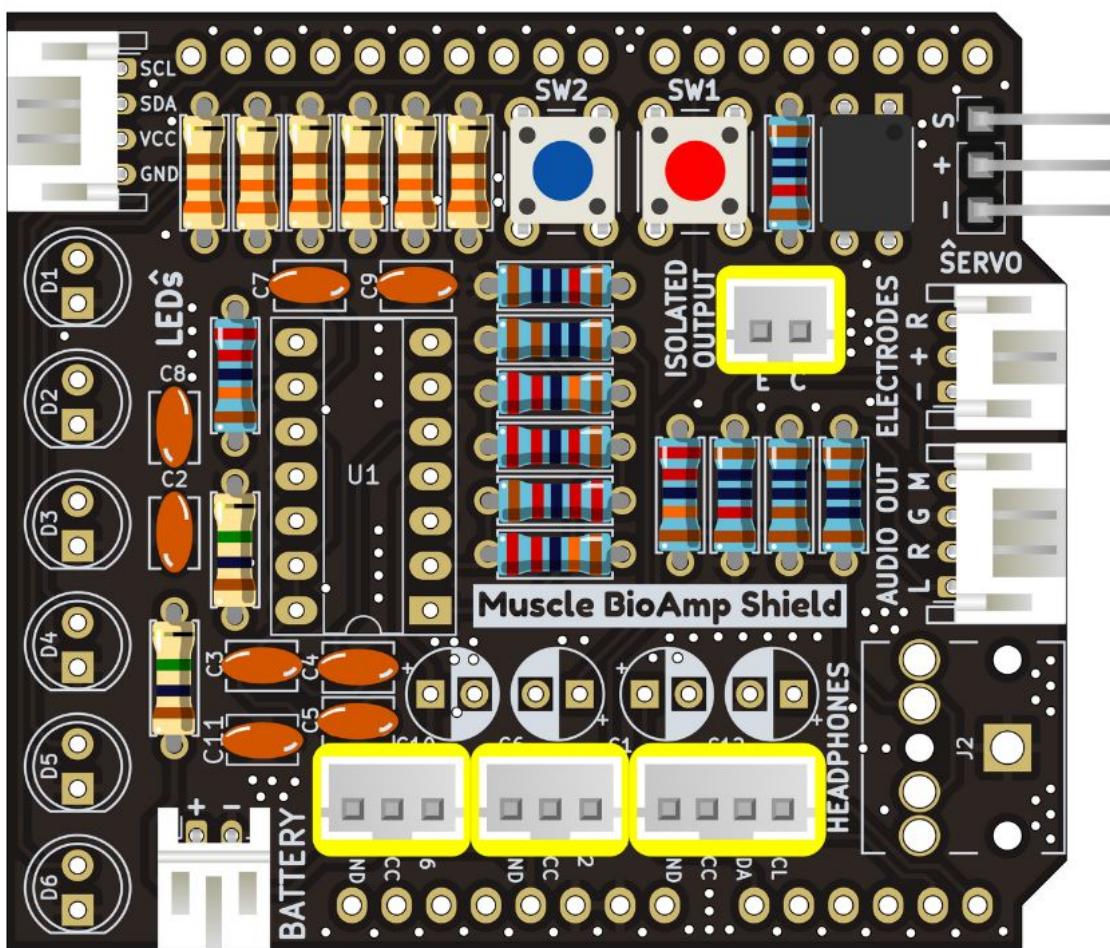


Fig. 15: Step 15 - JST PH Straight Connectors

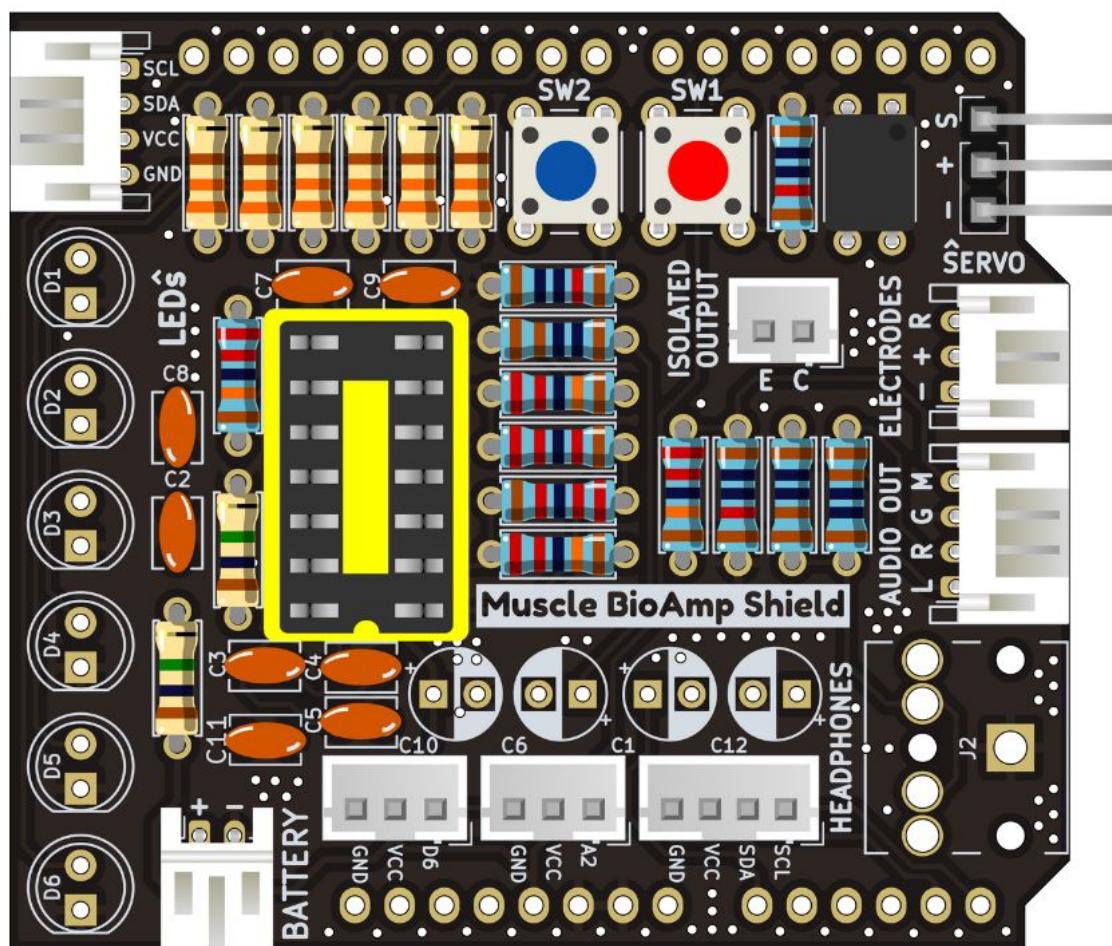


Fig. 16: Step 16 - IC Socket

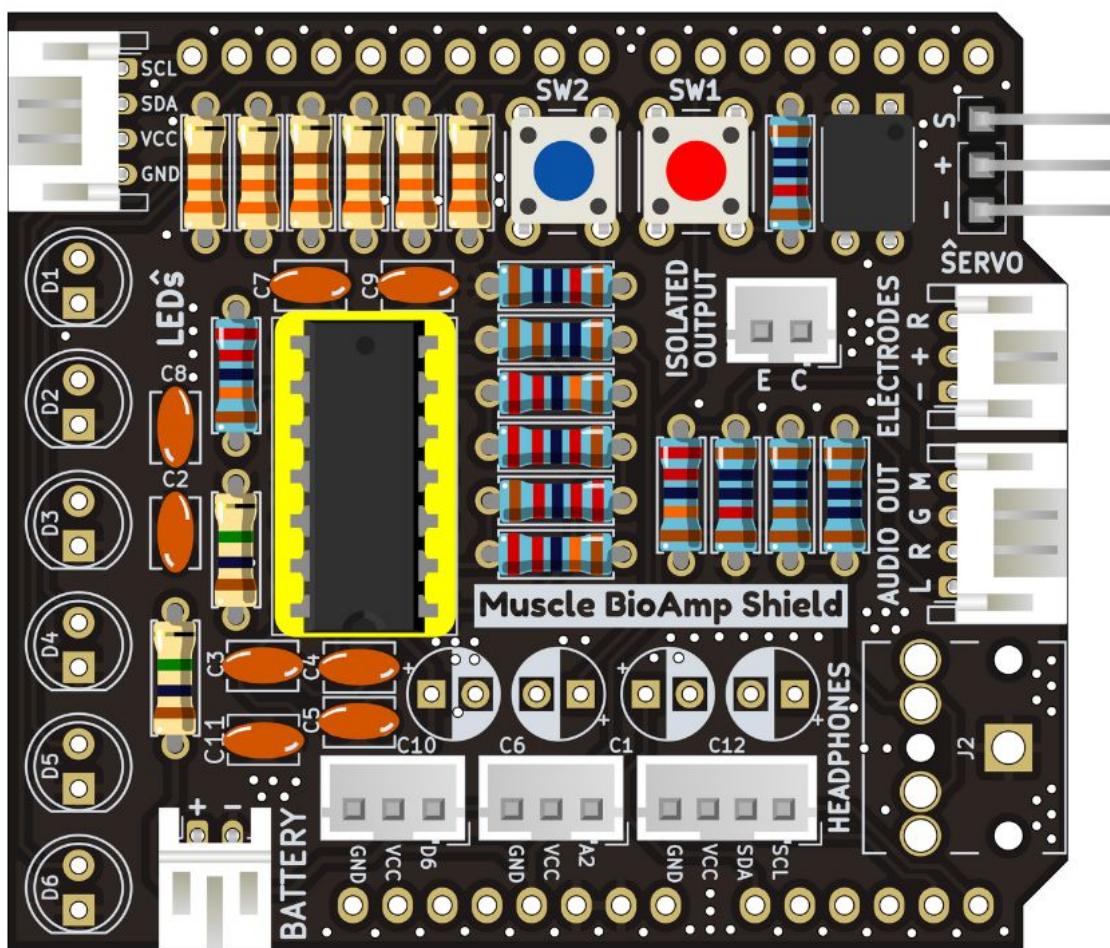


Fig. 17: Step 17 - IC

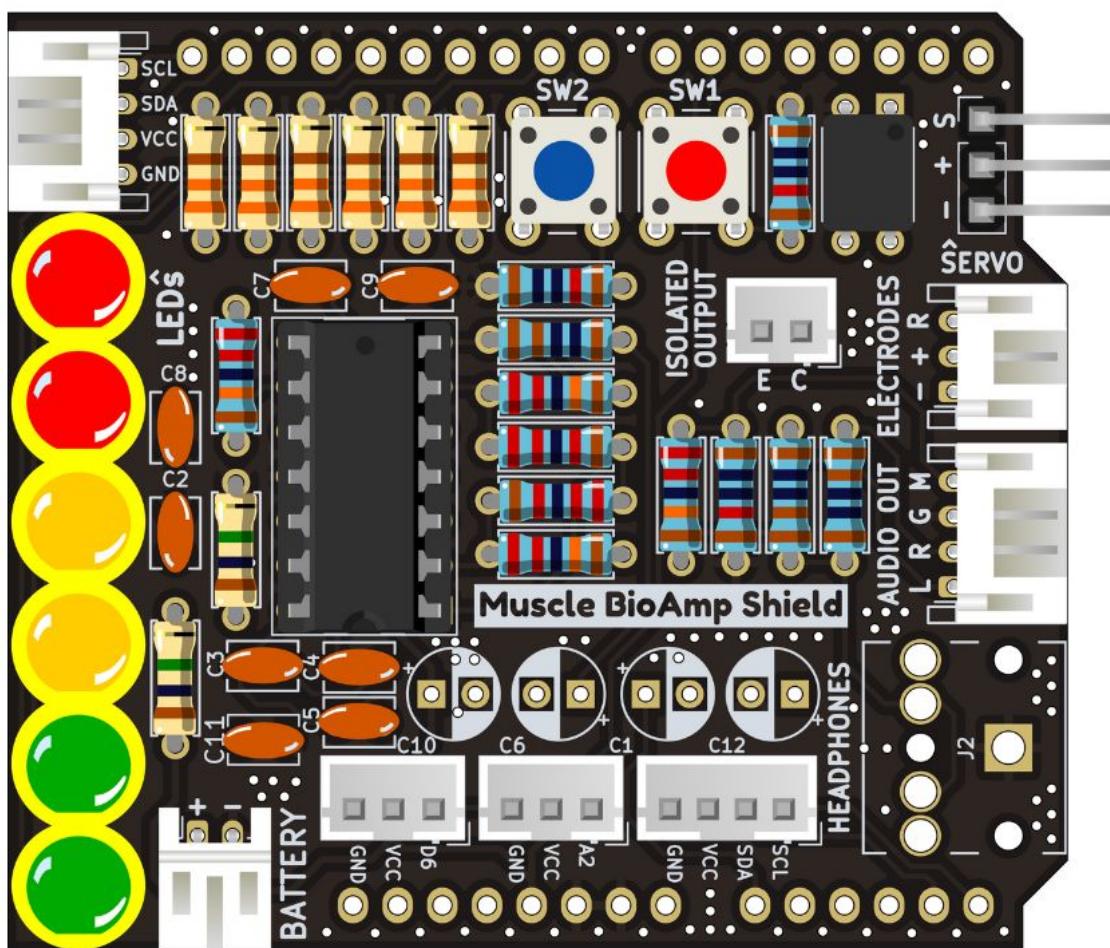


Fig. 18: Step 18 - LEDs

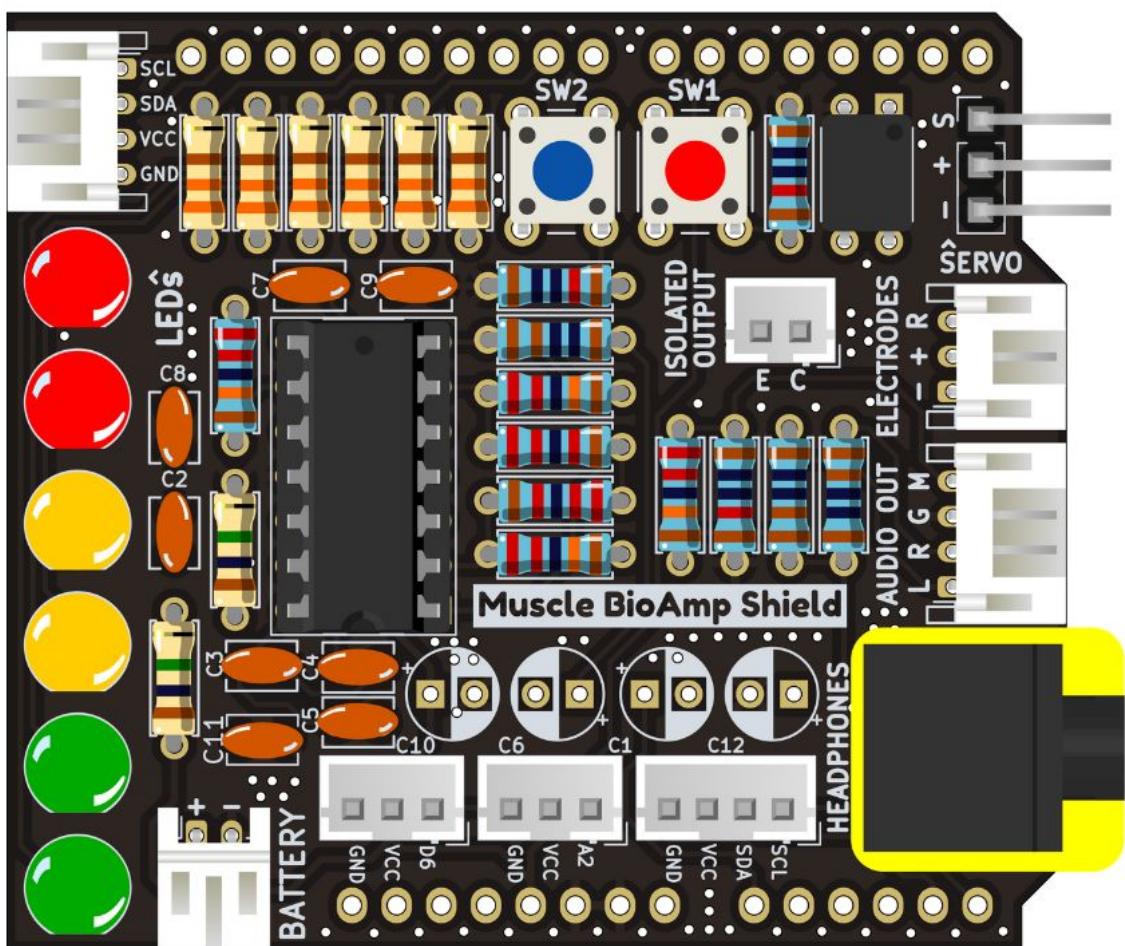


Fig. 19: Step 19 - 3.5mm Headphone Jack

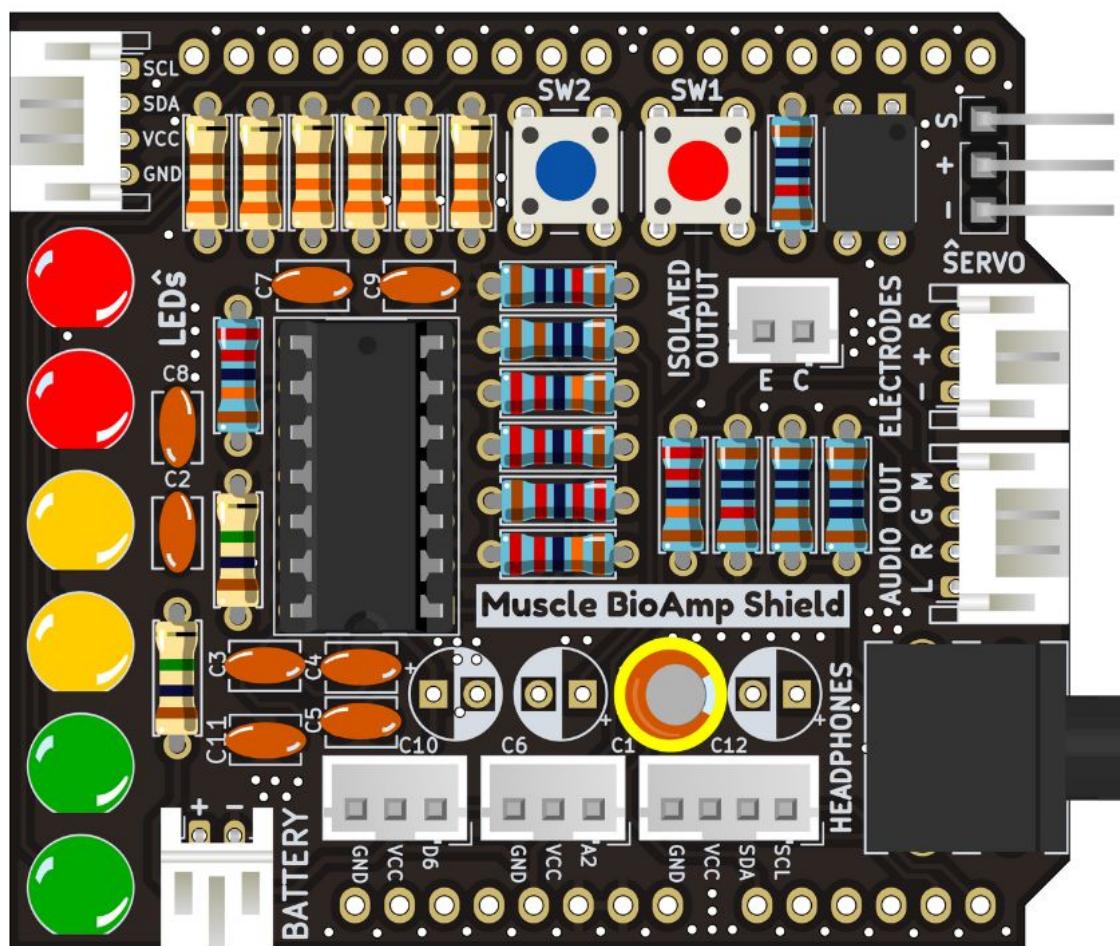


Fig. 20: Step 20 - 2.2uF Capacitor

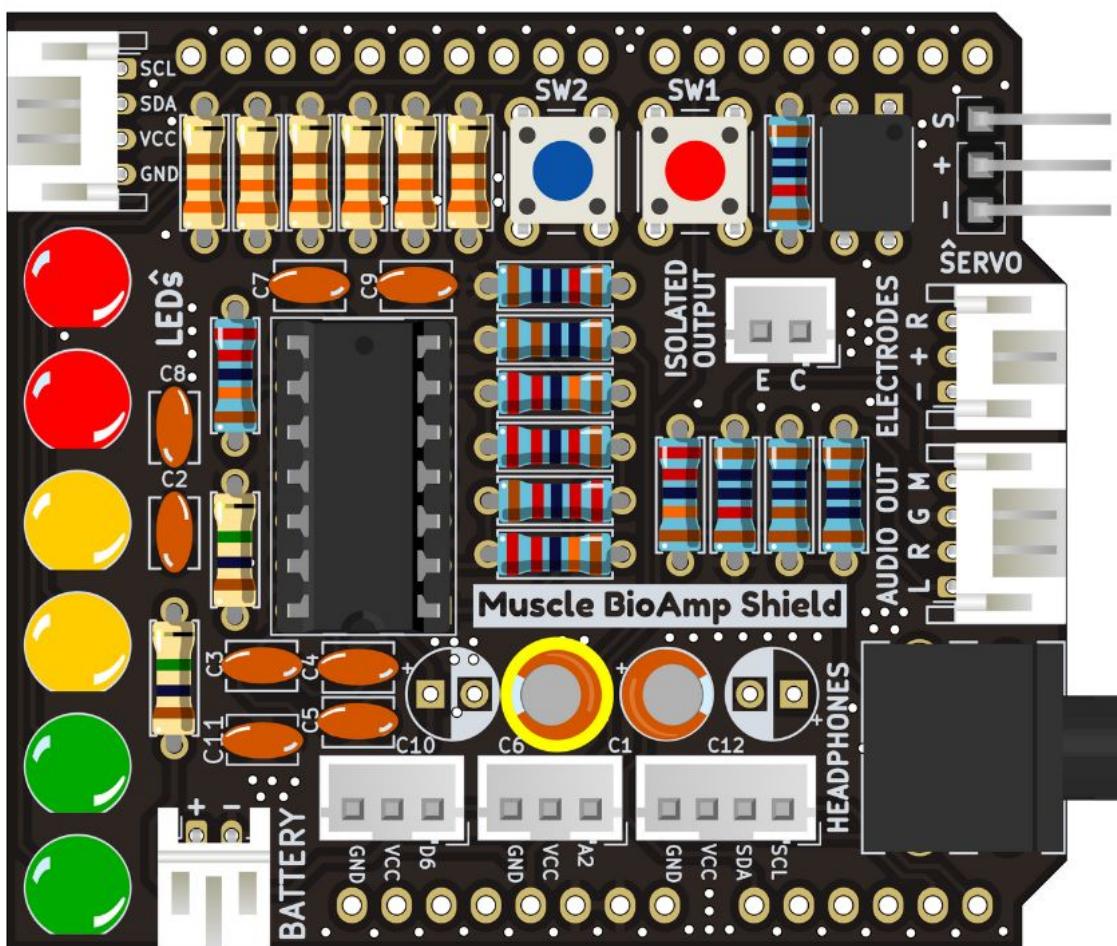


Fig. 21: Step 21 - 1uF Capacitor

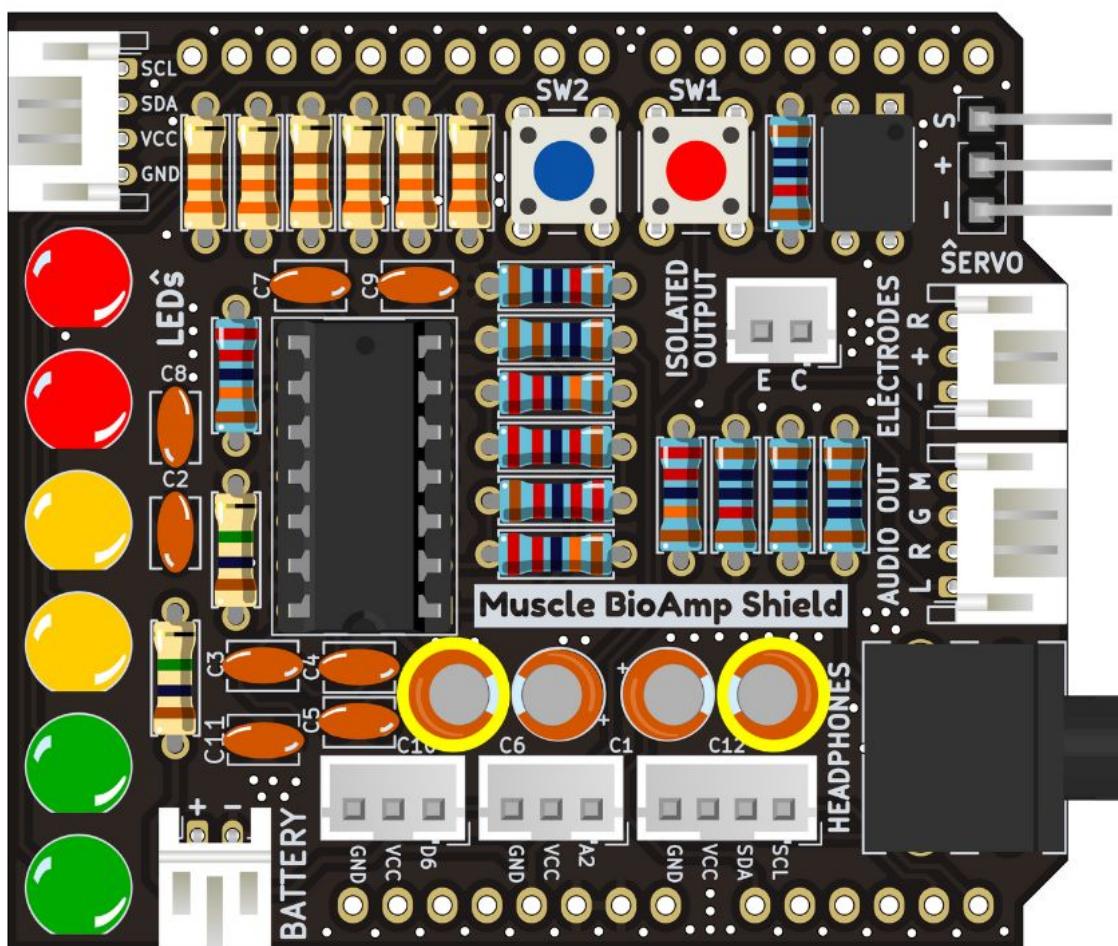


Fig. 22: Step 22 - 470uF Capacitor

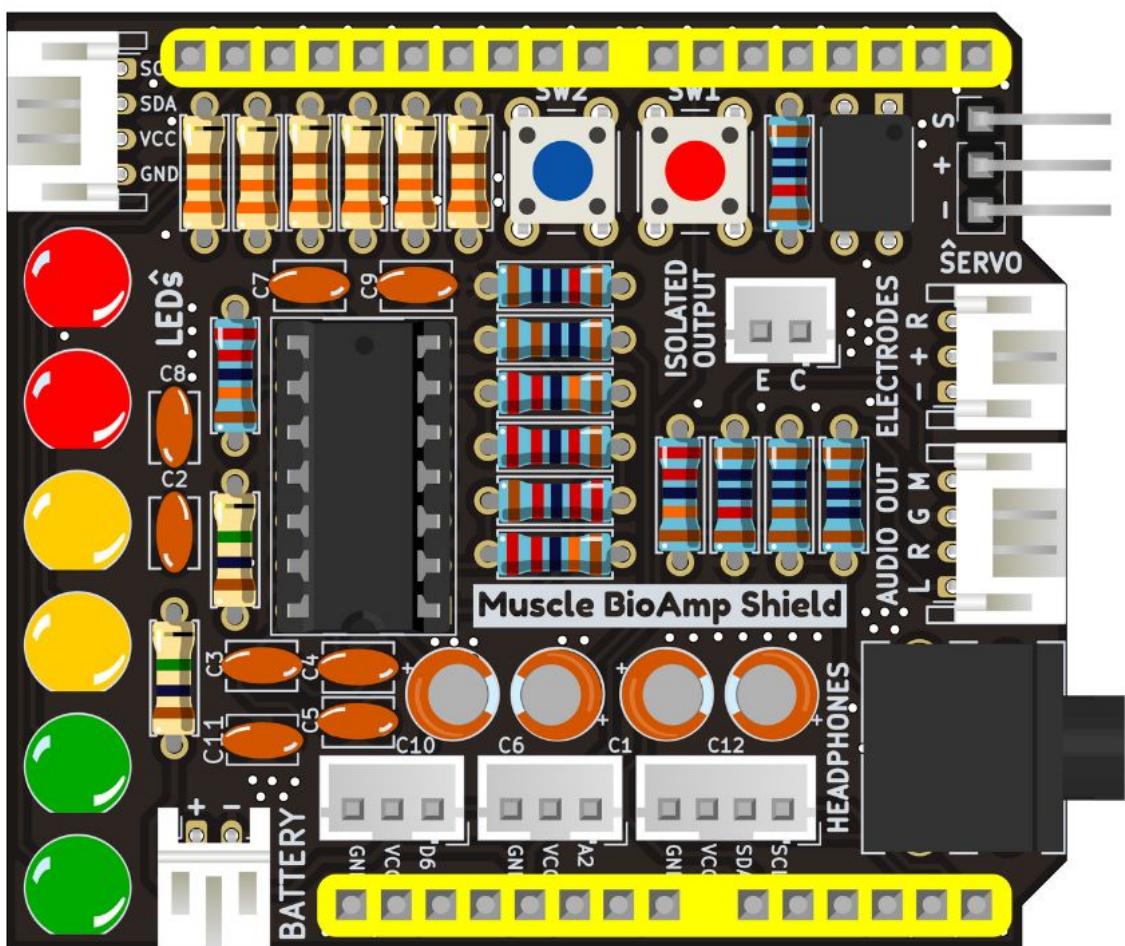


Fig. 23: Step 23 - Header Pins

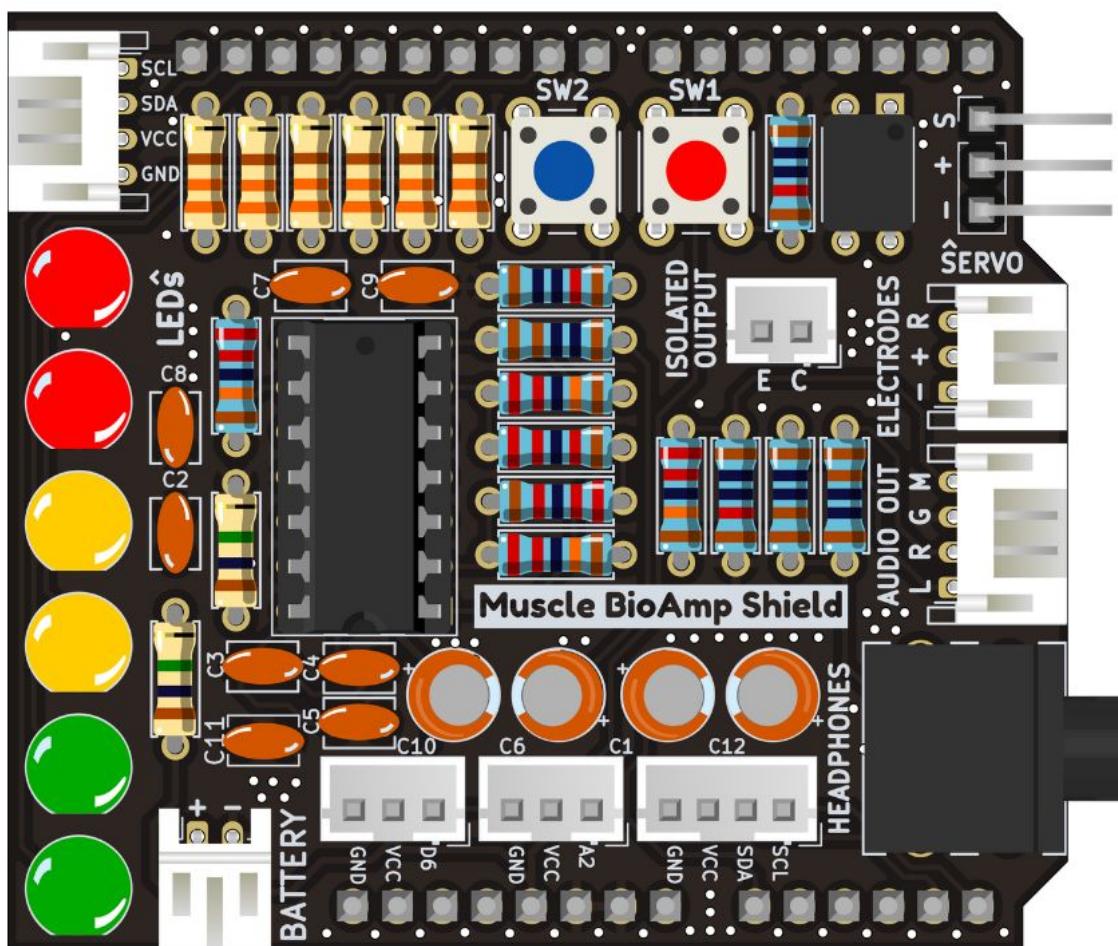


Fig. 24: Step 24 - Assembled Shield

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**CHAPTER  
FIVE**

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## **USING THE SENSOR**

The possibilities are endless as you can:

- Record the muscle signals (EMG) either using Gel Electrodes or BioAmp Bands (dry electrode based) via BioAmp Cable connected to a 3-pin JST PH 2mm connector.
- Listen to your muscle signals using wired headphones/earphones connected to a 3.5mm headphone jack.
- Connect hundreds of devices like OLED screens, character displays, temperature sensors, accelerometers, BioAmp Hardware, and much more using the two I2C interfaces.
- Connect Arduino Uno's D6 digital I/O pins and A2 analog input pins using STEMMA digital and STEMMA analog connectors respectively.
- Program the 2 user buttons according to your project requirements.

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**CHAPTER  
SIX**

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## **SOME PROJECT IDEAS**

These features make it the ultimate plug-and-play kit for students, researchers, and hobbyists alike who want to use muscle signals (EMG) to make amazing human-computer interface (HCI) projects like:

- 1. Controlling a Dino Game using your muscle signals (EMG)**

<https://youtu.be/66VOVqrFLoQ>

- 2. Scrolling Instagram Reels/YouTube Shorts by using your muscle signals (EMG)**

<https://youtu.be/ZzhrNyndky4>

- 3. Making a Muscle Strength Game Using Muscle BioAmp Shield & Arduino UNO**

<https://youtu.be/bSfTnFcCHYM>

- 4. Record, Visualize & Listen to Muscle Signals Using Muscle BioAmp Shield**

<https://youtu.be/kgvK51UIXdo>

- 5. Controlling Servo Claw With Muscle Signals Using Muscle BioAmp Shield**

<https://youtu.be/kgvK51UIXdo>