Muscle BioAmp Shield

Upside Down Labs

Apr 11, 2024

CONTENTS

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

CHAPTER

ONE

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

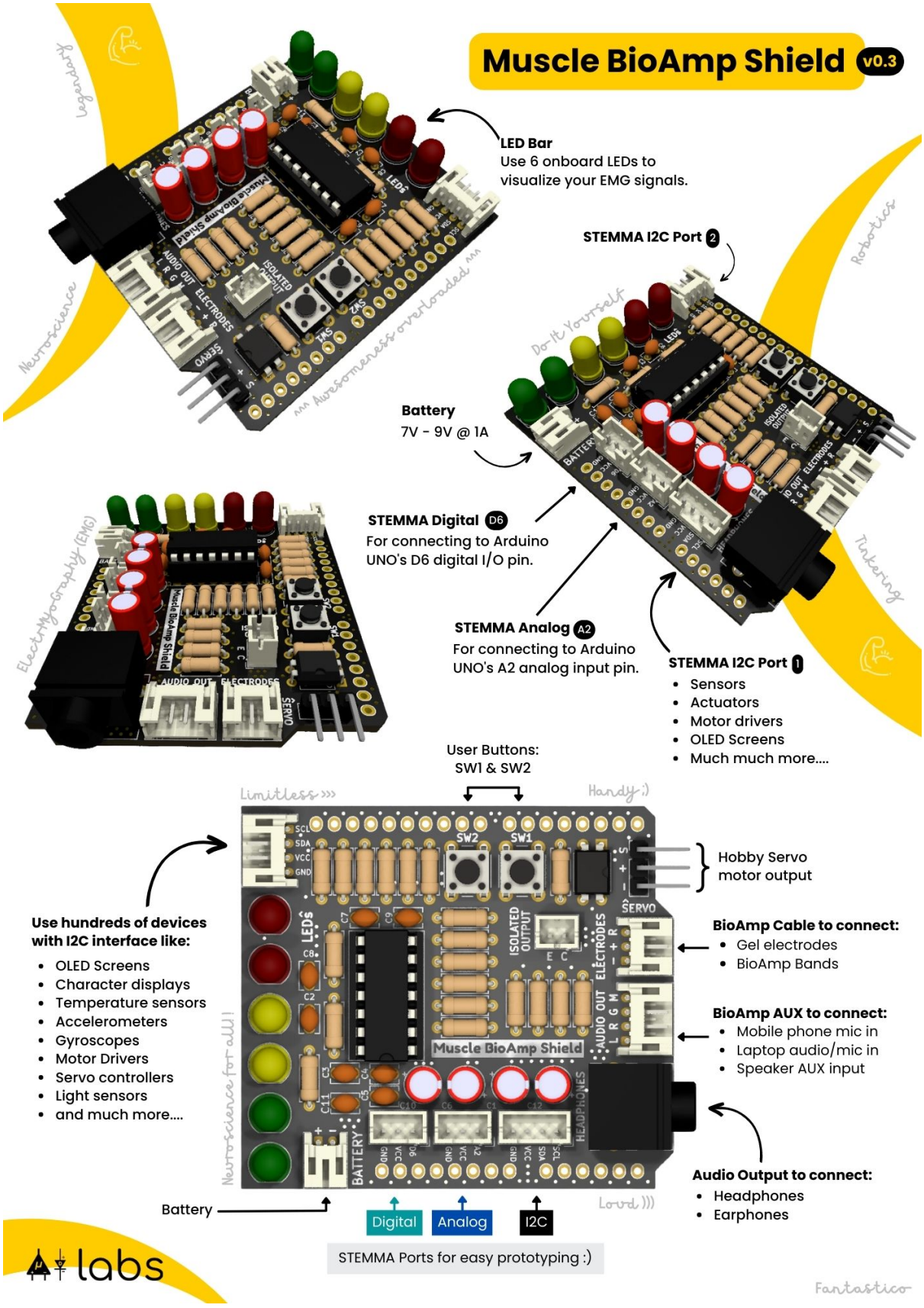
CHAPTER

TWO

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


Muscle BioAmp Shield v0.3
LED Bar
Use 6 onboard LEDs to visualize your EMG signals.
STEMMA I2C Port 2
Battery
7V - 9V @ 1A
STEMMA Digital D6
For connecting to Arduino UNO's D6 digital I/O pin.
STEMMA Analog A2
For connecting to Arduino UNO's A2 analog input pin.
STEMMA I2C Port 1
Sensors
Actuators
Motor drivers
OLED Screens
Much much more....
User Buttons: SW1 & SW2
Hobby Servo motor output
BioAmp Cable to connect:
Gel electrodes
BioAmp Bands
BioAmp AUX to connect:
Mobile phone mic in
Laptop audio/mic in
Speaker AUX input
Audio Output to connect:
Headphones
Earphones
Use hundreds of devices with I2C interface like:
OLED Screens
Character displays
Temperature sensors
Accelerometers
Gyroscopes
Motor Drivers
Servo controllers
Light sensors
and much more....
Battery
Digital
Analog
I2C
STEMMA Ports for easy prototyping :)
Muscle BioAmp Shield
Limitless
Handy ;)
Loved
Neuroscience for all!
Legendary
Awesomeness overloaded
Robotics
Do-It-Yourself
Tinkering
ElectroMyoGraphy (EMG)
labs
Fantastico

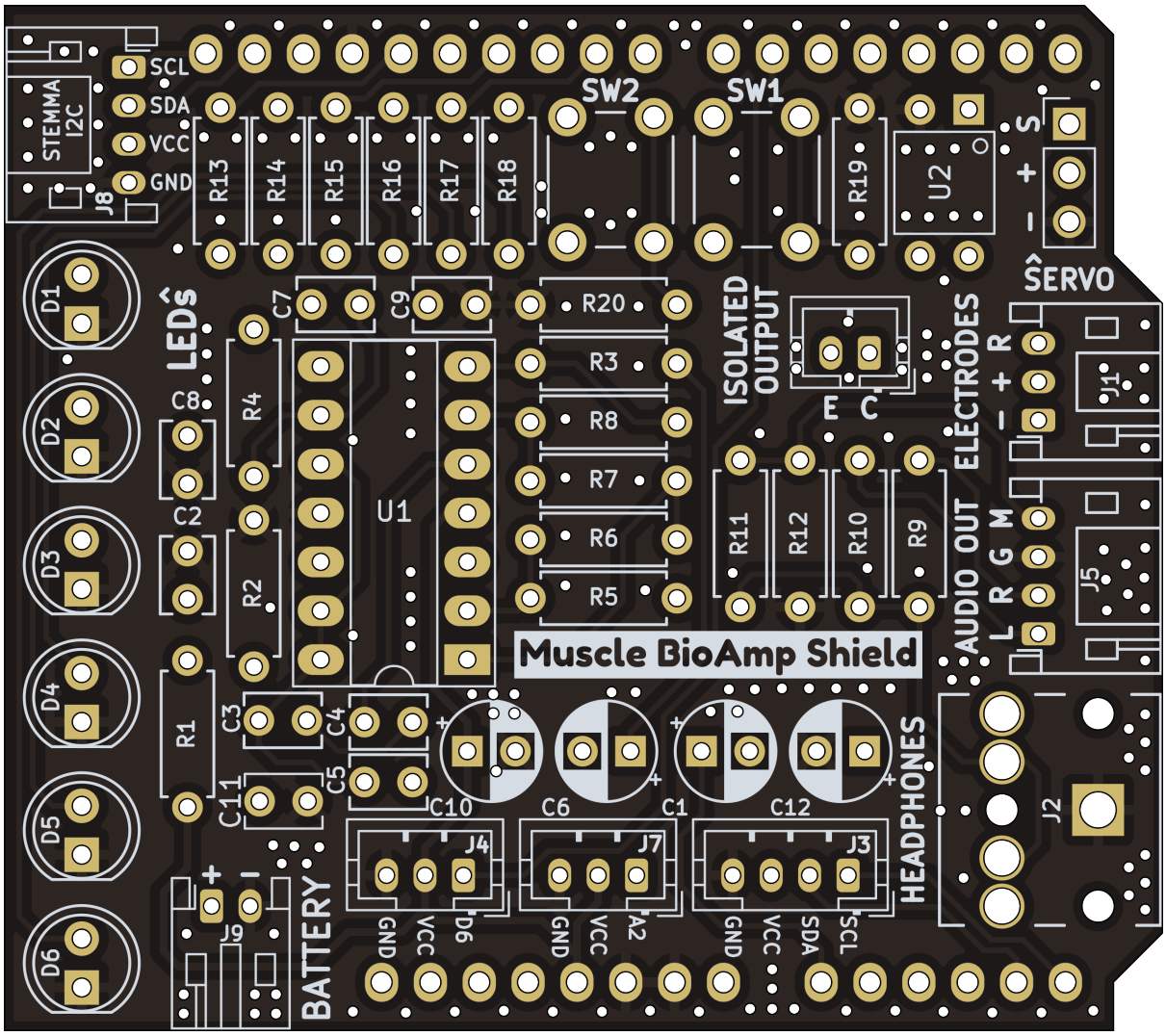
CHAPTER

THREE

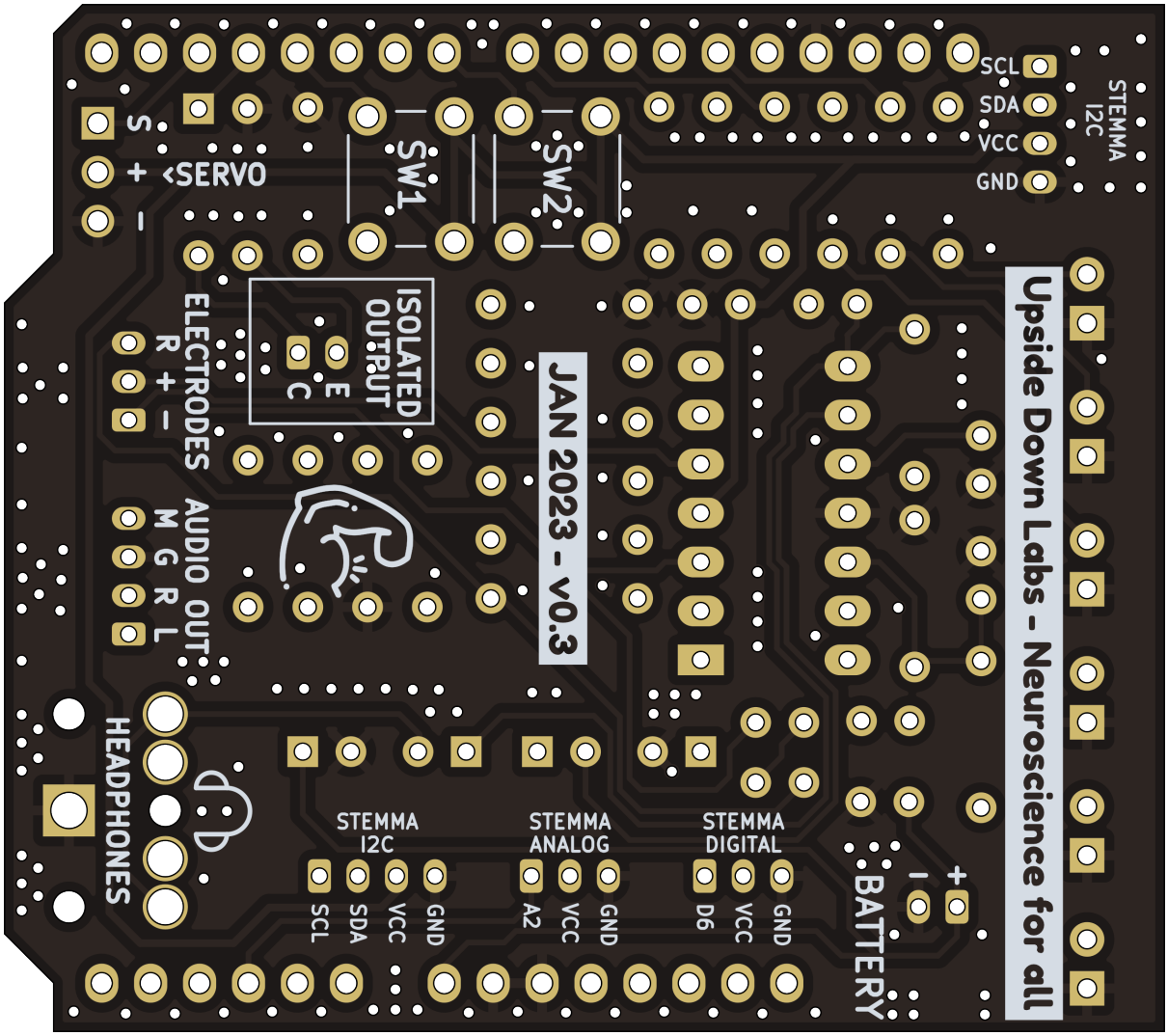
HARDWARE

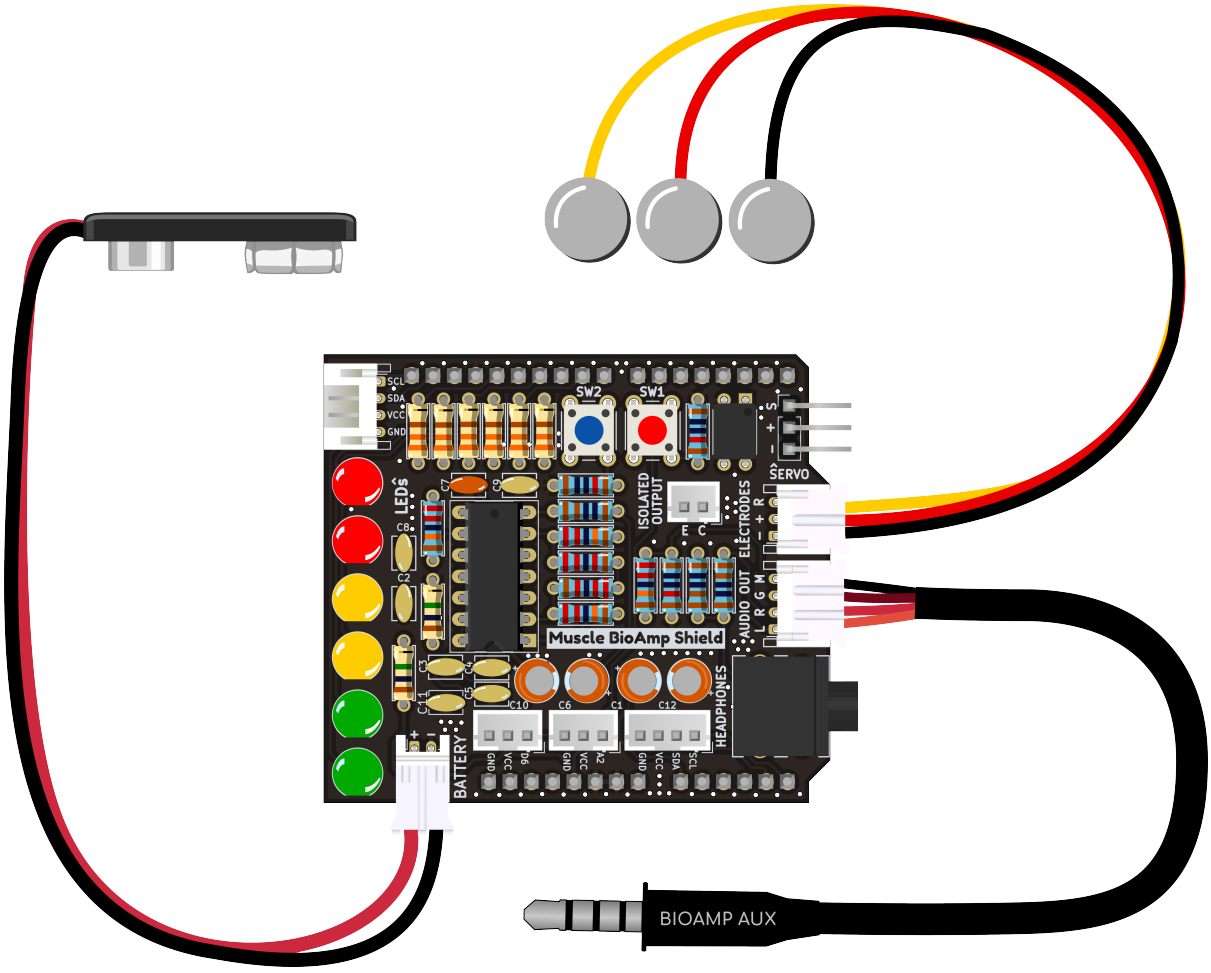
Images below shows a quick overview of the hardware design.

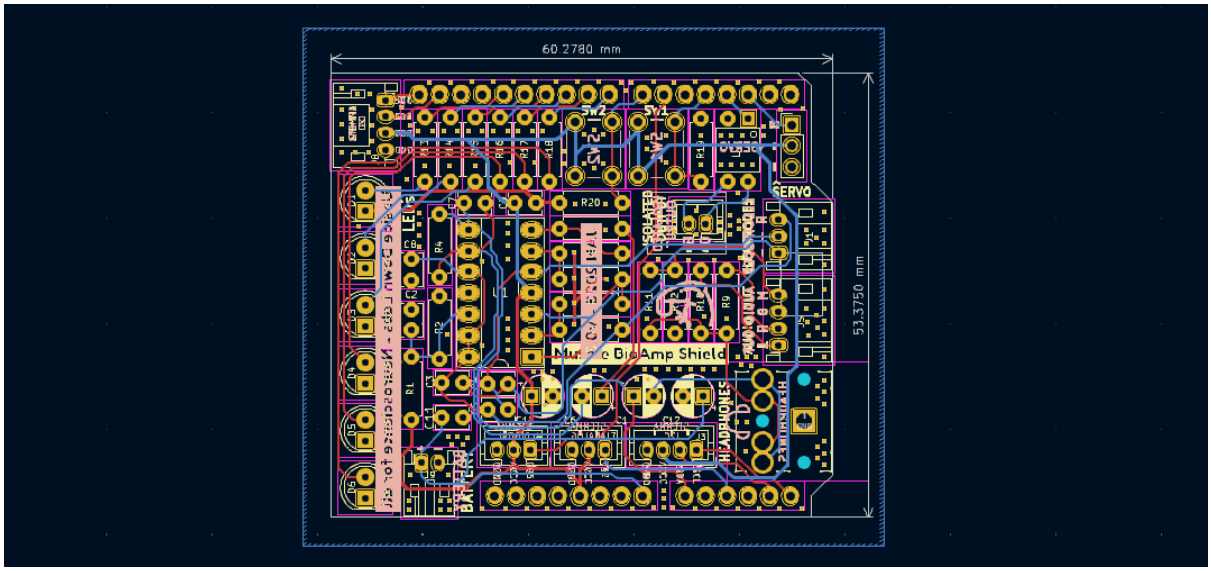
PCB Front

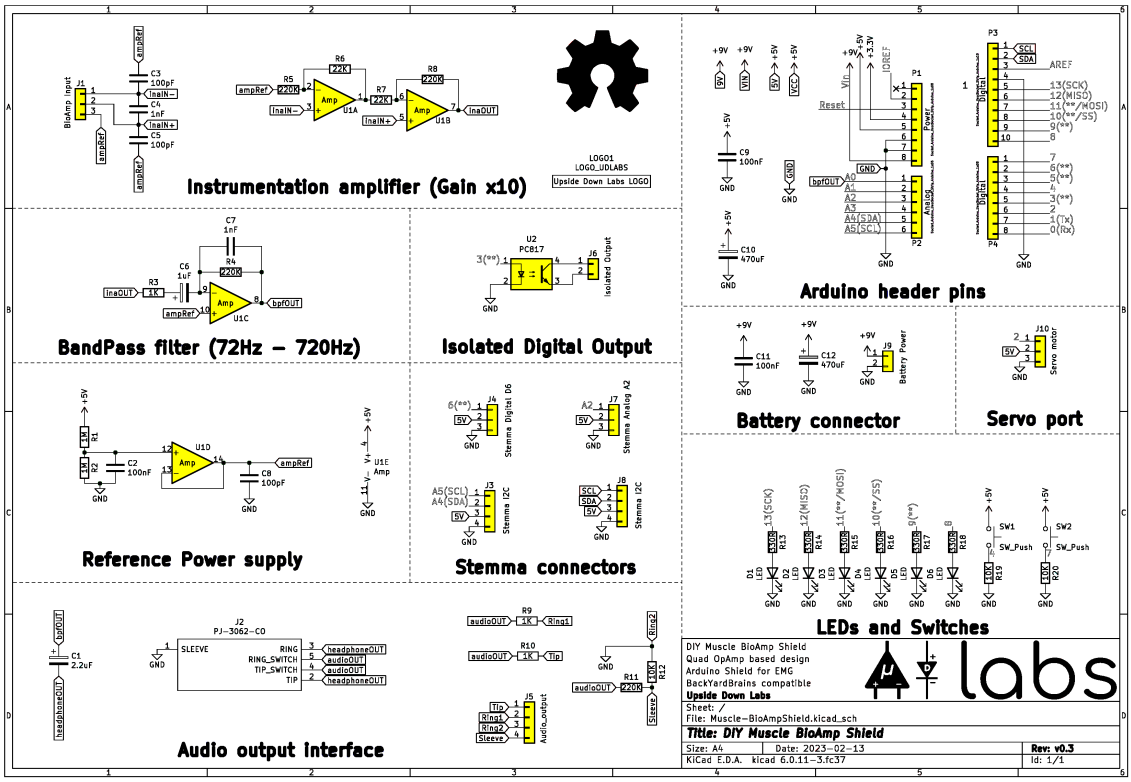


PCB Back


SCL
SDA
VCC
GND
STEMMA I2C
SERVO
S + −
SW1
SW2
ISOLATED OUTPUT
E
C
ELECTRODES
R + −
AUDIO OUT
M G R L
HEADPHONES
JAN 2023 - v0.3
Upside Down Labs - Neuroscience for all
STEMMA I2C
SCL SDA VCC GND
STEMMA ANALOG
A2 VCC GND
STEMMA DIGITAL
D6 VCC GND
BATTERY
+
−


SCL
SDA
VCC
GND
SW2
SW1
SERVO
LEDs
ISOLATED OUTPUT
ELECTRODES
AUDIO OUT
Muscle BioAmp Shield
HEADPHONES
BATTERY
BIOAMP AUX


60.2780 mm
53.3750 mm
SERVO
Muscle BioAmp Shield
HEADPHONES


Instrumentation amplifier (Gain x10)
BandPass filter (72Hz – 720Hz)
Isolated Digital Output
Reference Power supply
Stemma connectors
Arduino header pins
Battery connector
Servo port
LEDs and Switches
Audio output interface
DIY Muscle BioAmp Shield
Quad OpAmp based design
Arduino Shield for EMG
BackYardBrains compatible
Upside Down Labs
Sheet: /
File: Muscle-BioAmpShield.kicad_sch
Title: DIY Muscle BioAmp Shield
Size: A4
Date: 2023-02-13
Rev: v0.3
KiCad E.D.A. kicad 6.0.11-3.fc37
Id: 1/1

CHAPTER

FOUR

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.

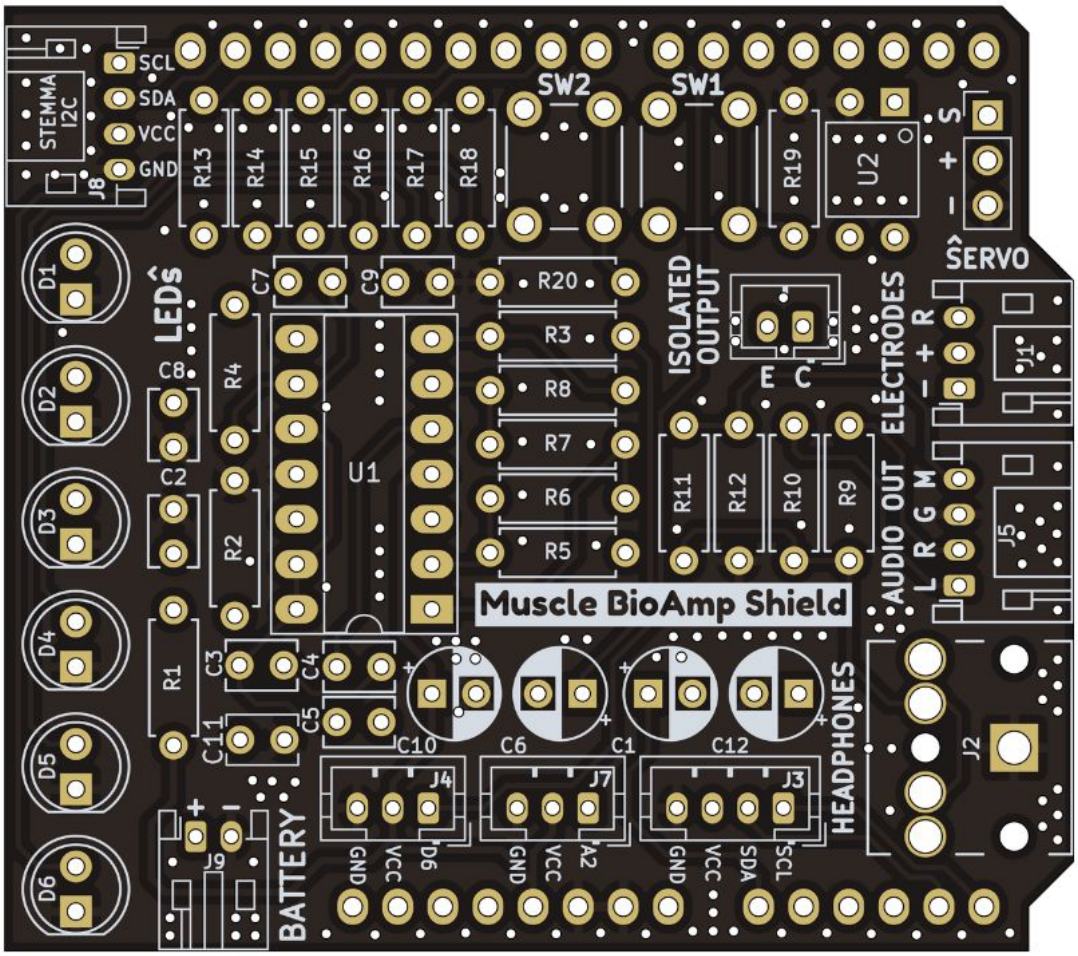


Fig. 1: **Step 1 - Bare Board**

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

https://youtu.be/dcuCihh3yn4

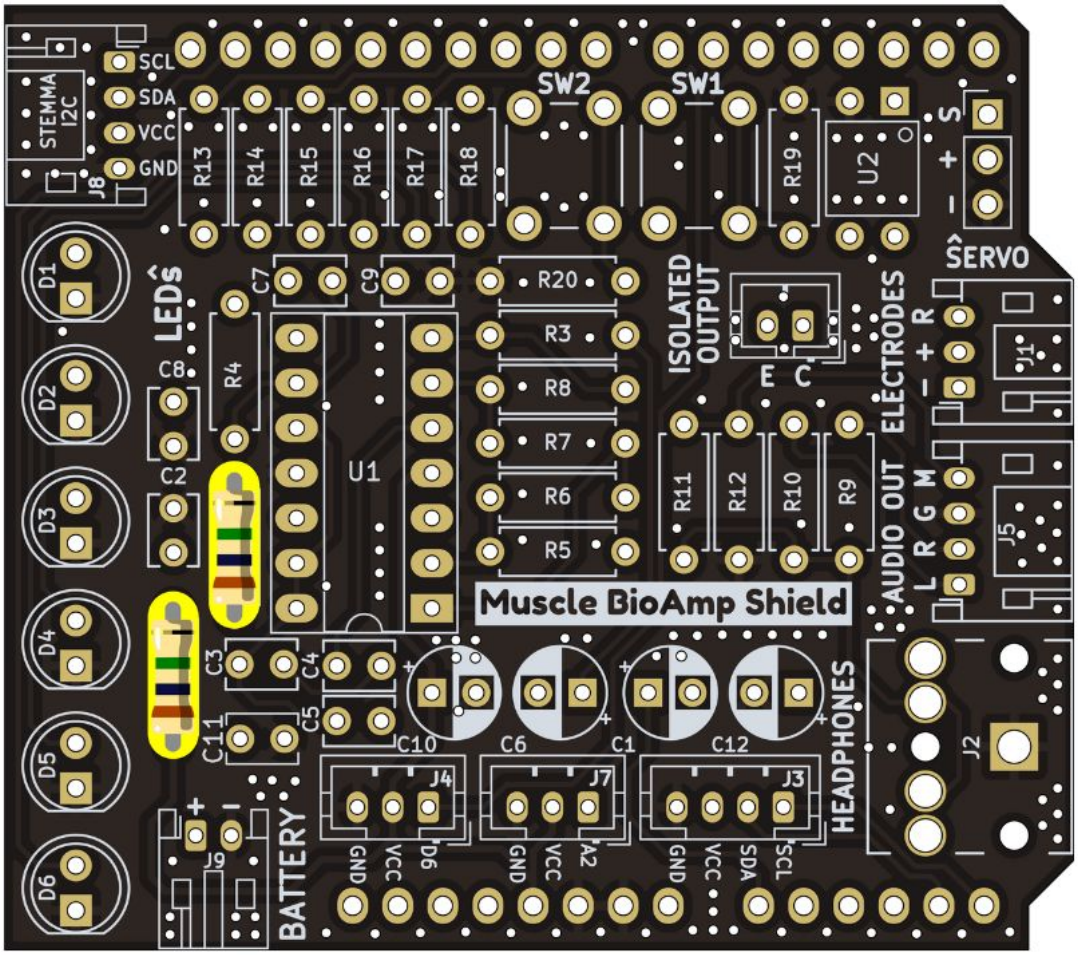


Fig. 2: **Step 2 - 1M Resistors**

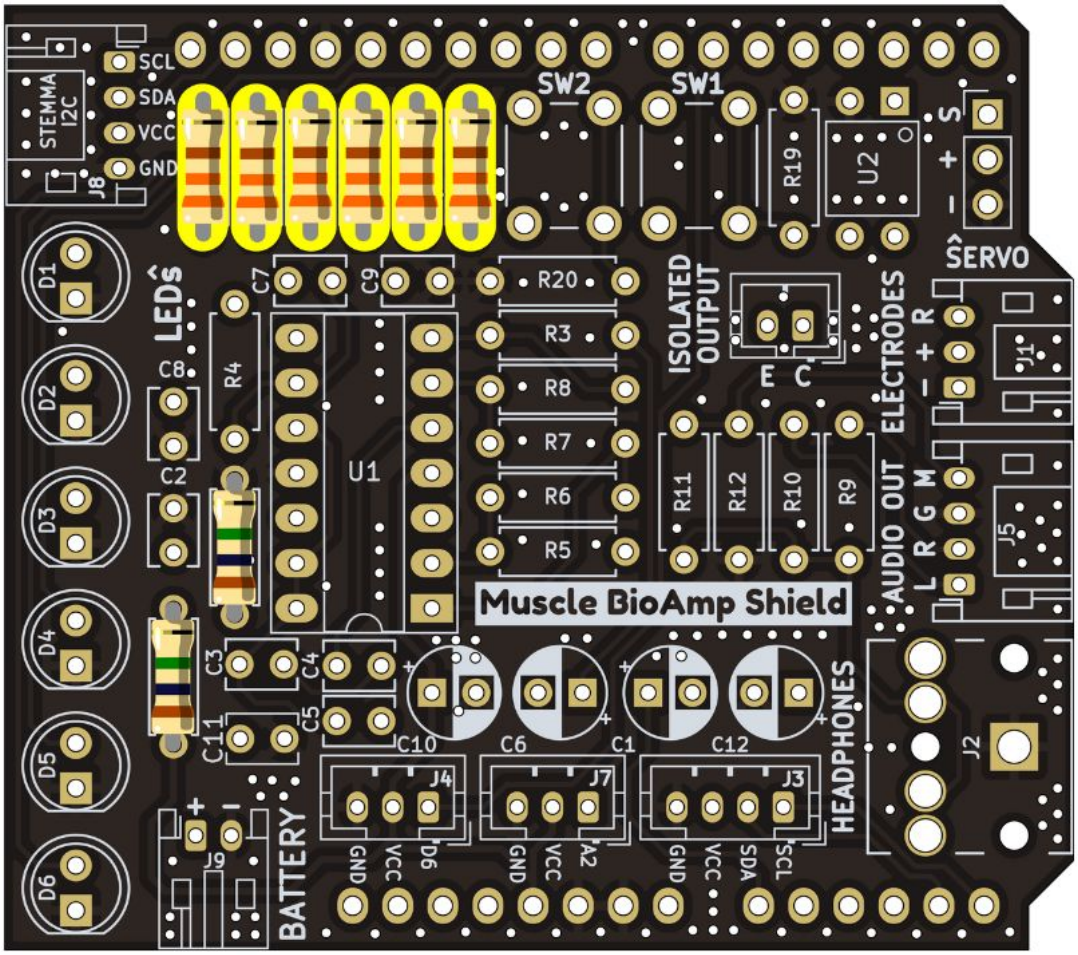


Fig. 3: **Step 3 - 330R Resistors**

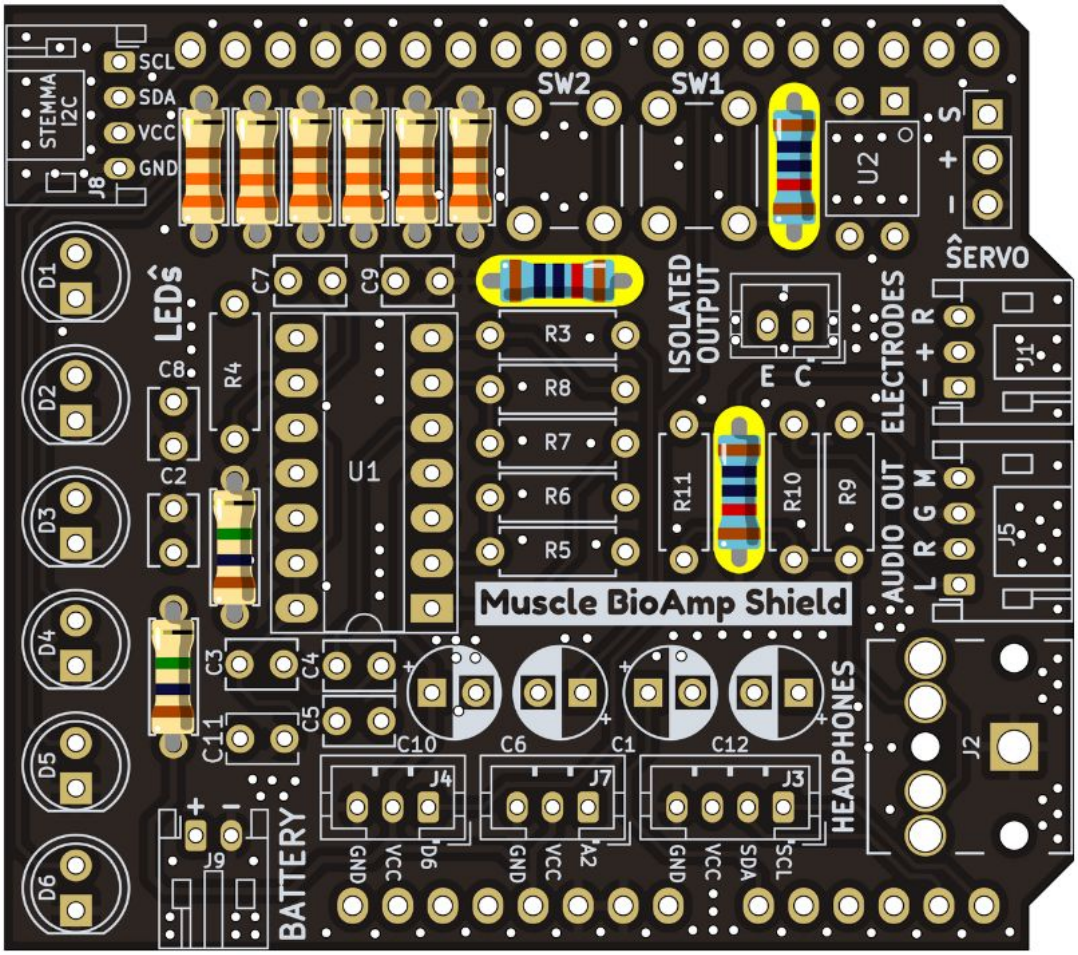


Fig. 4: **Step 4 - 10K Resistors**

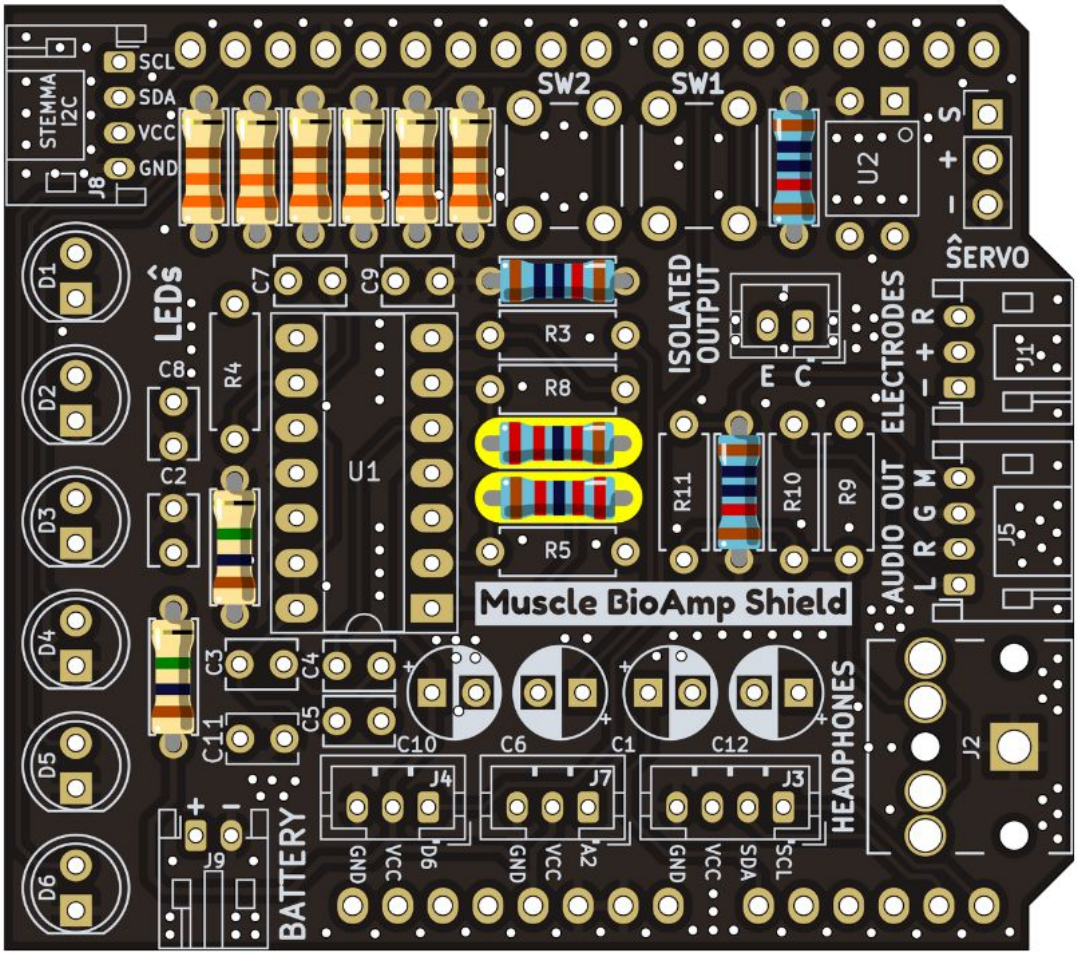


Fig. 5: **Step 5 - 22K Resistors**

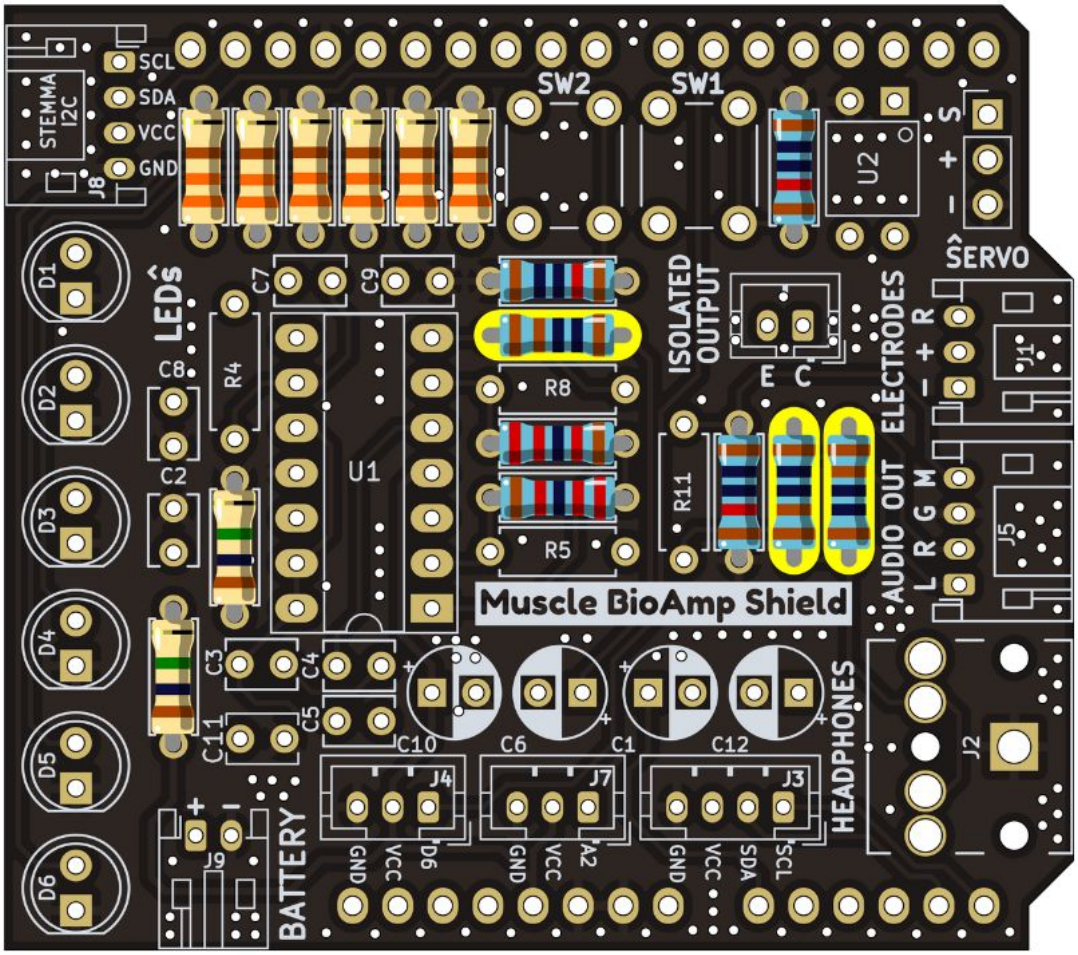


Fig. 6: **Step 6 - 1K Resistors**

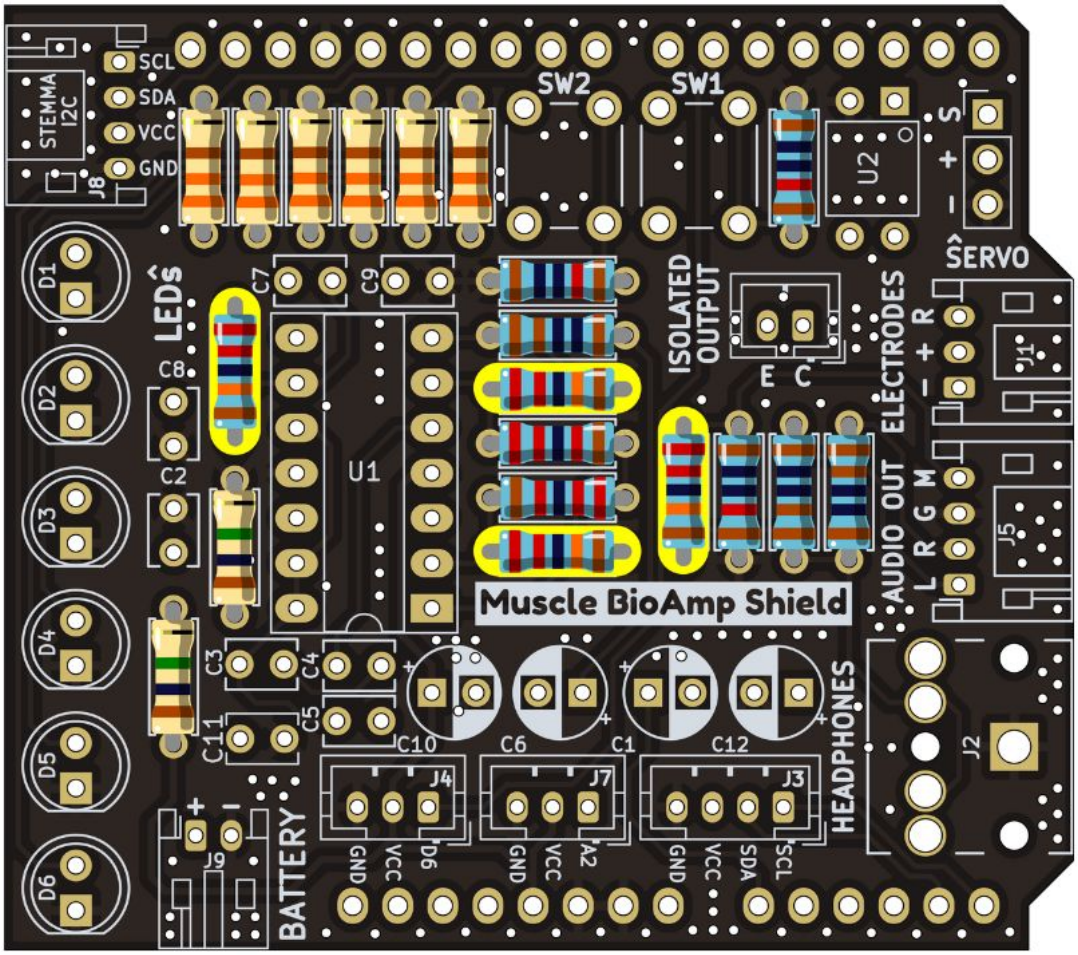


Fig. 7: **Step 7 - 220K Resistors**

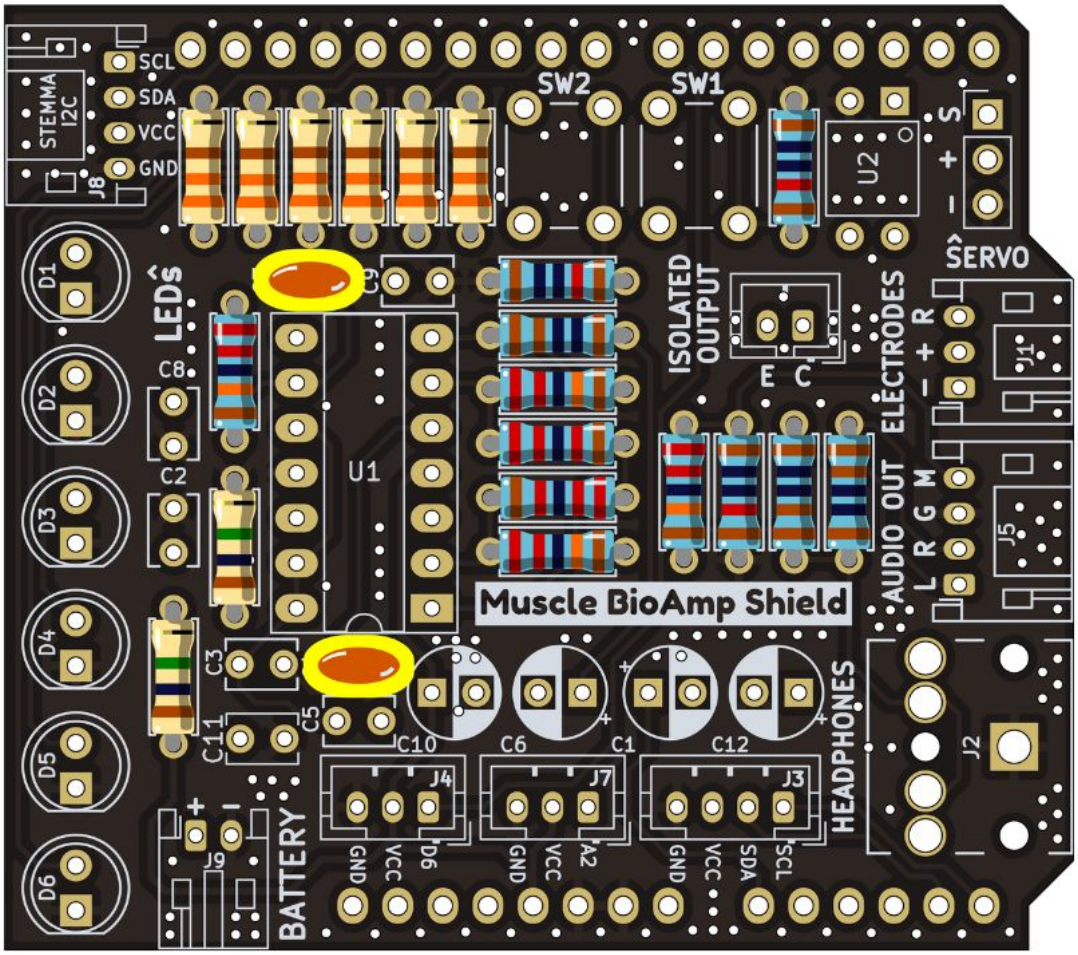


Fig. 8: **Step 8 - 1nF Capacitors**

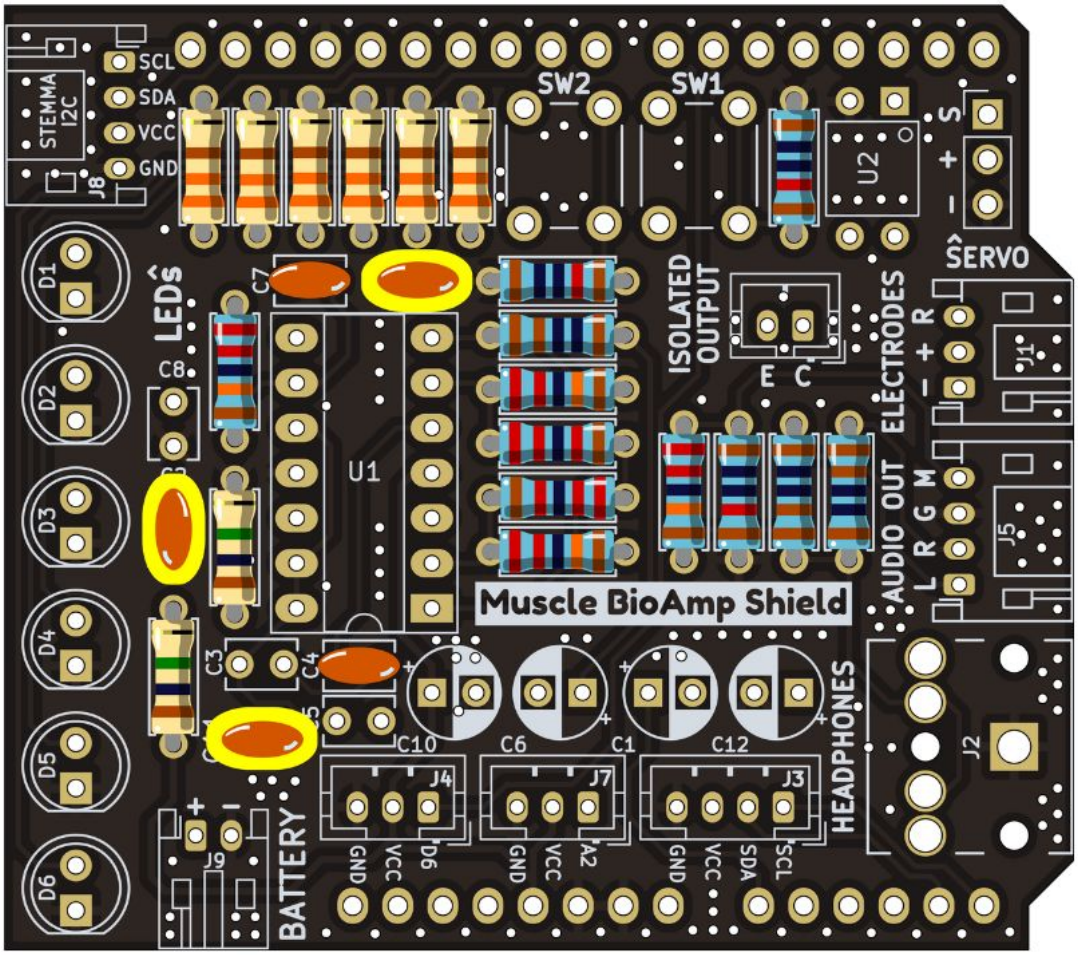


Fig. 9: **Step 9 - 100nF Capacitors**

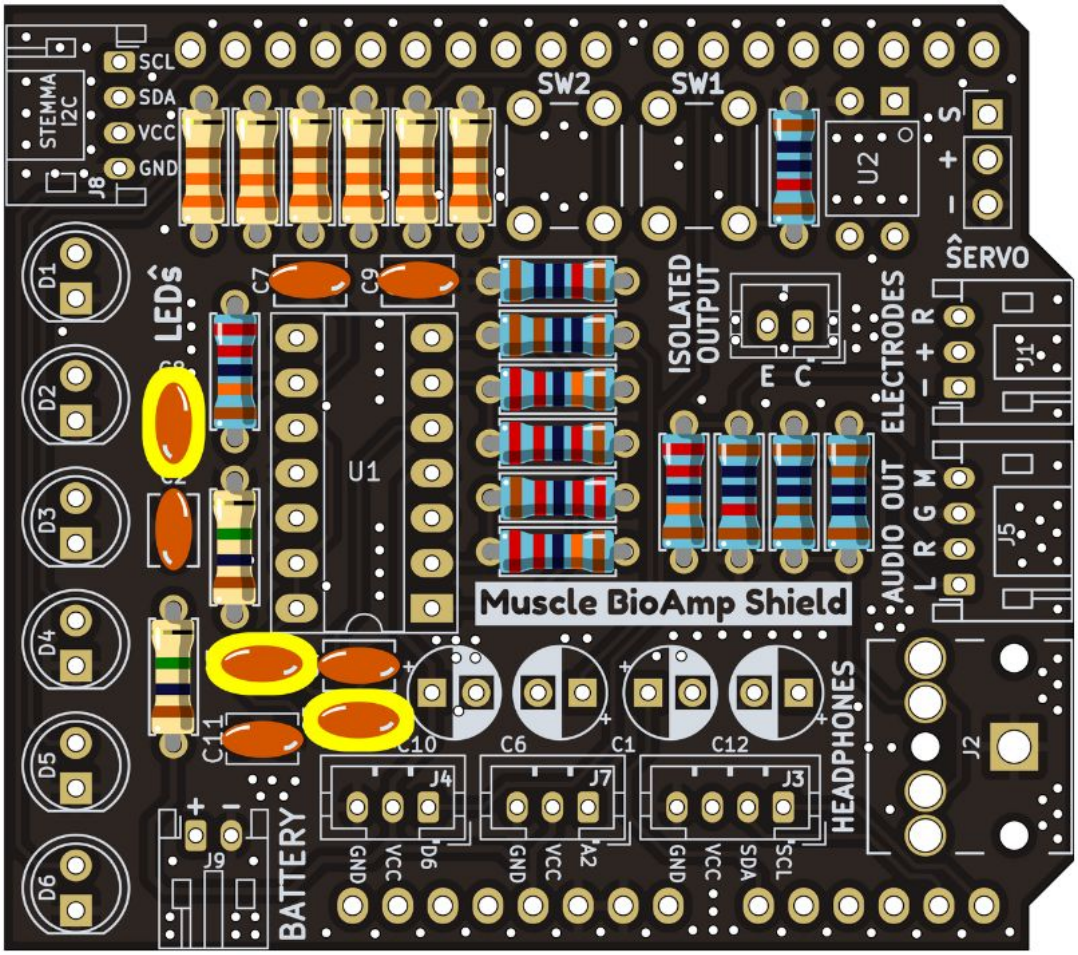


Fig. 10: **Step 10 - 100pF Capacitors**

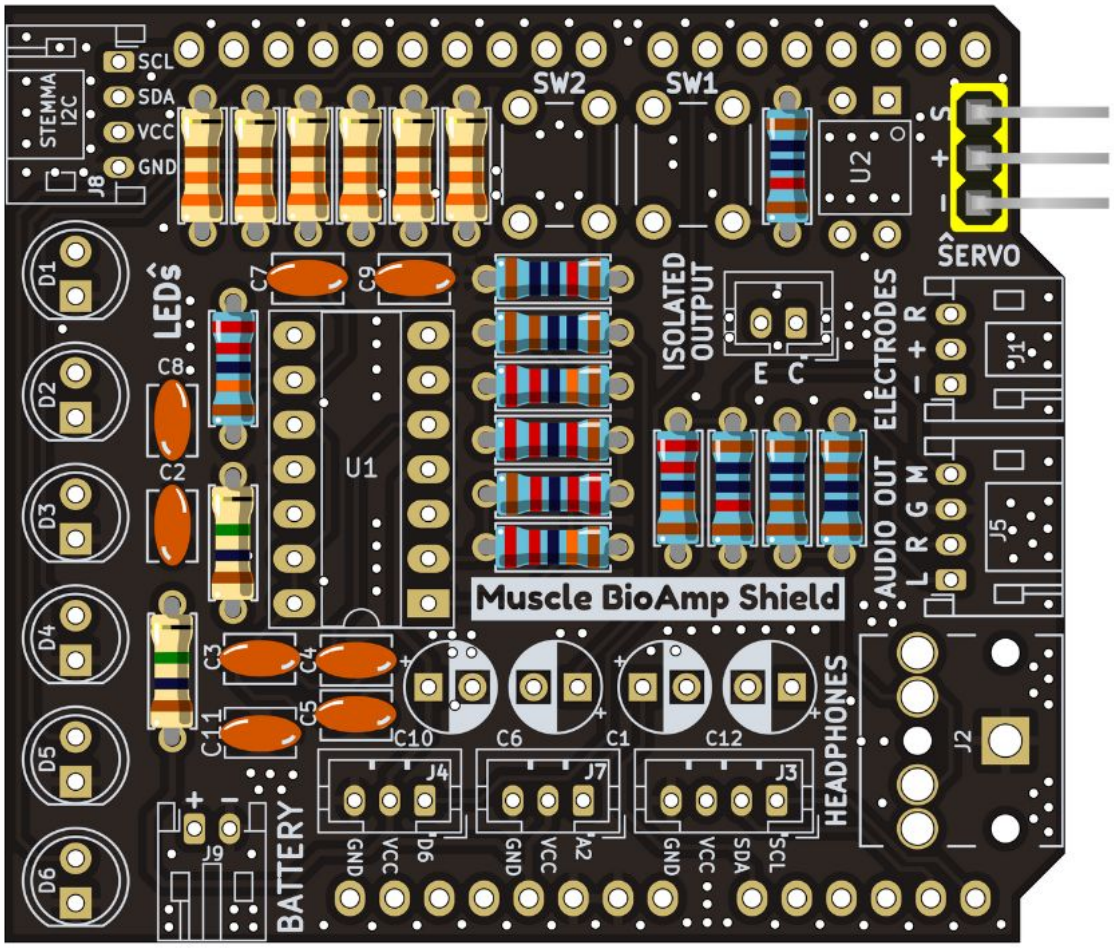


Fig. 11: **Step 11 - Angled Header Pins**

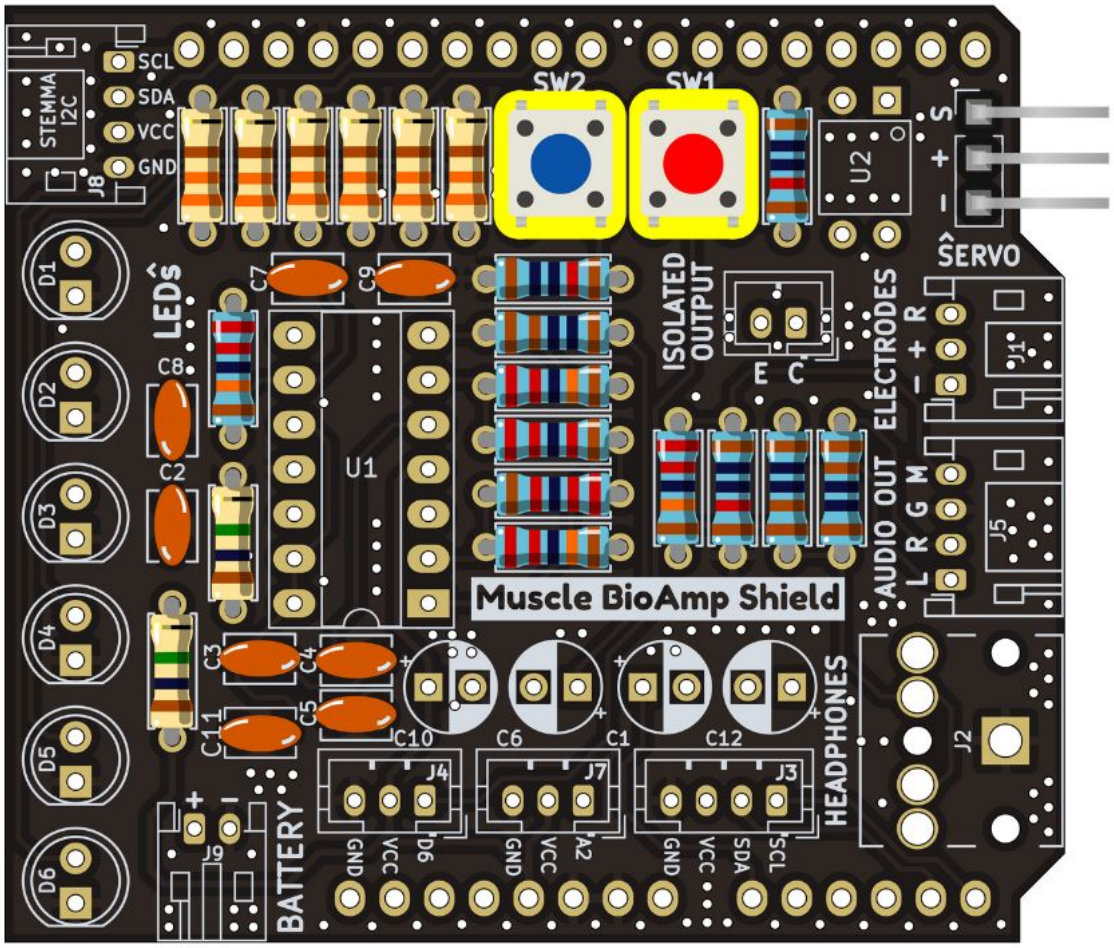


Fig. 12: **Step 12 - 5x5mm Buttons**

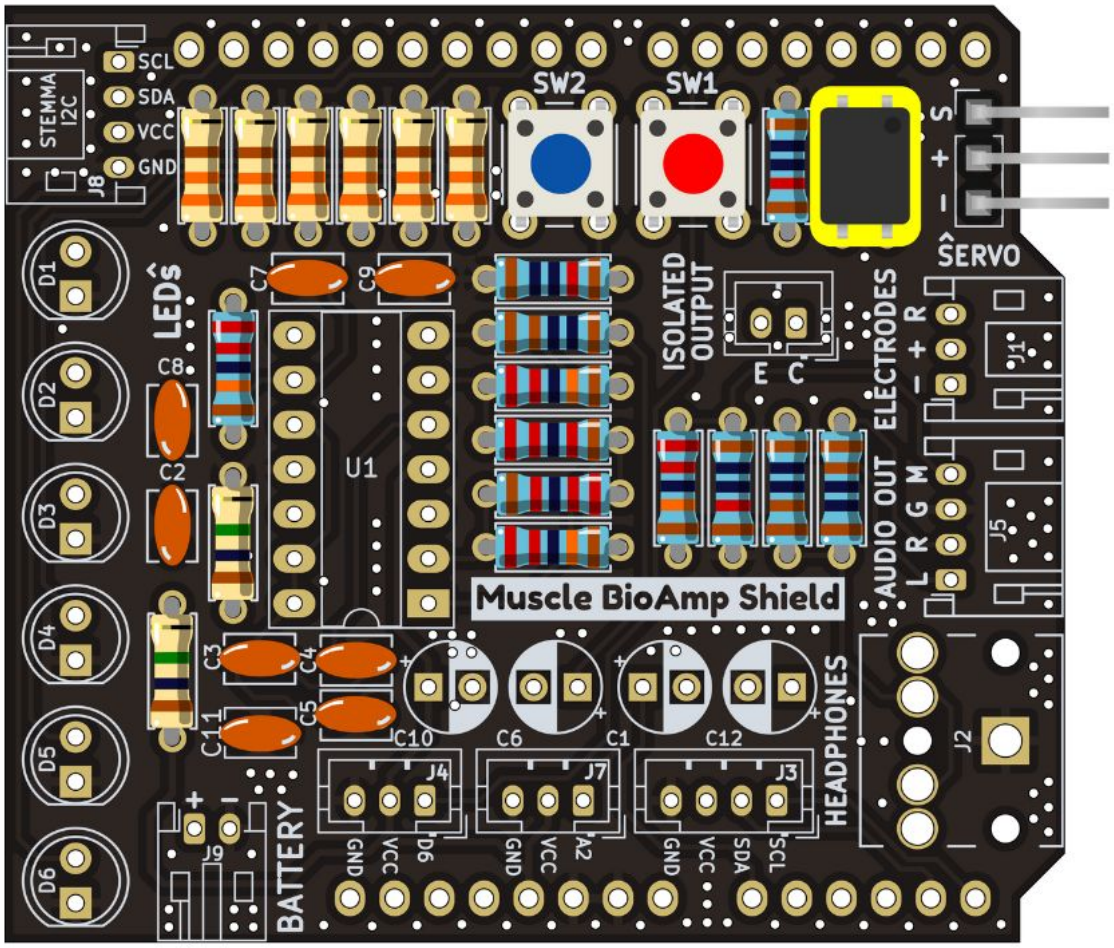


Fig. 13: **Step 13 - OptoIsolator**

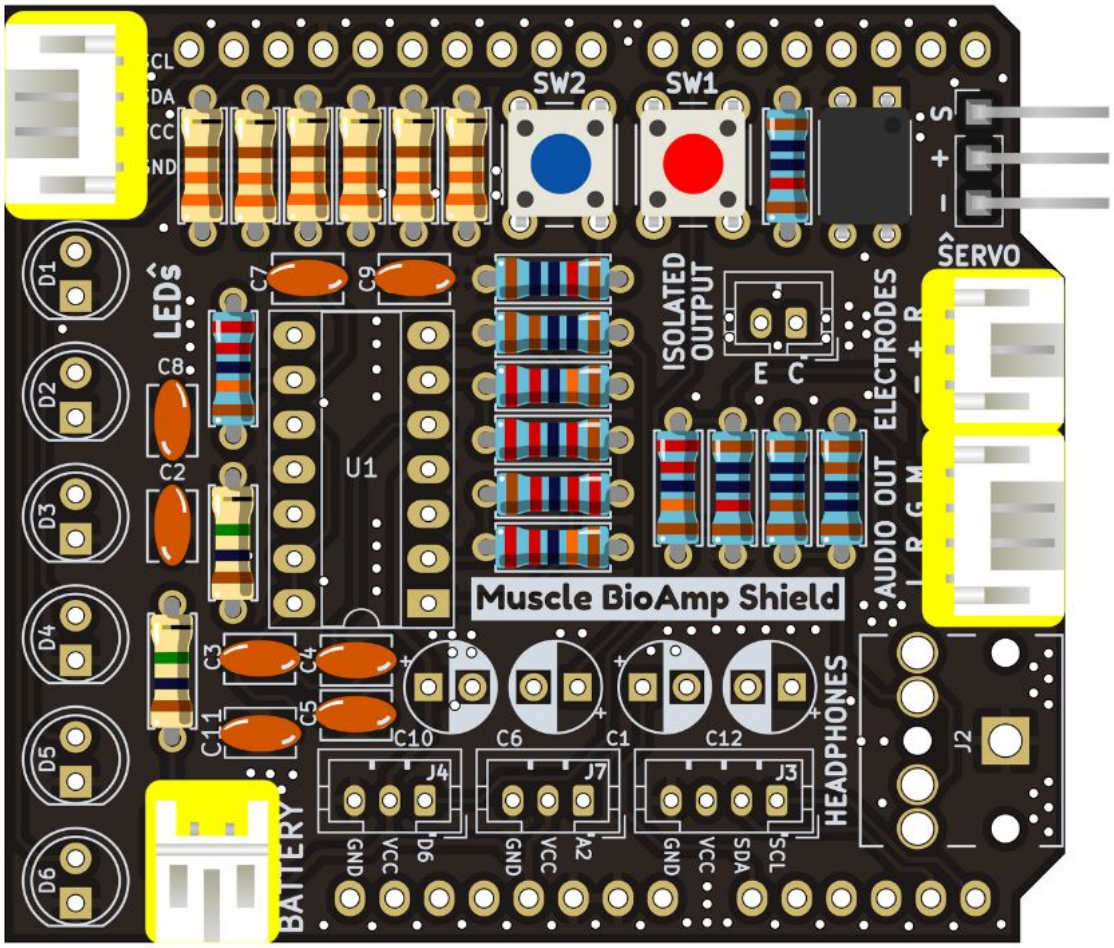


Fig. 14: **Step 14 - JST PH Angled Connectors**

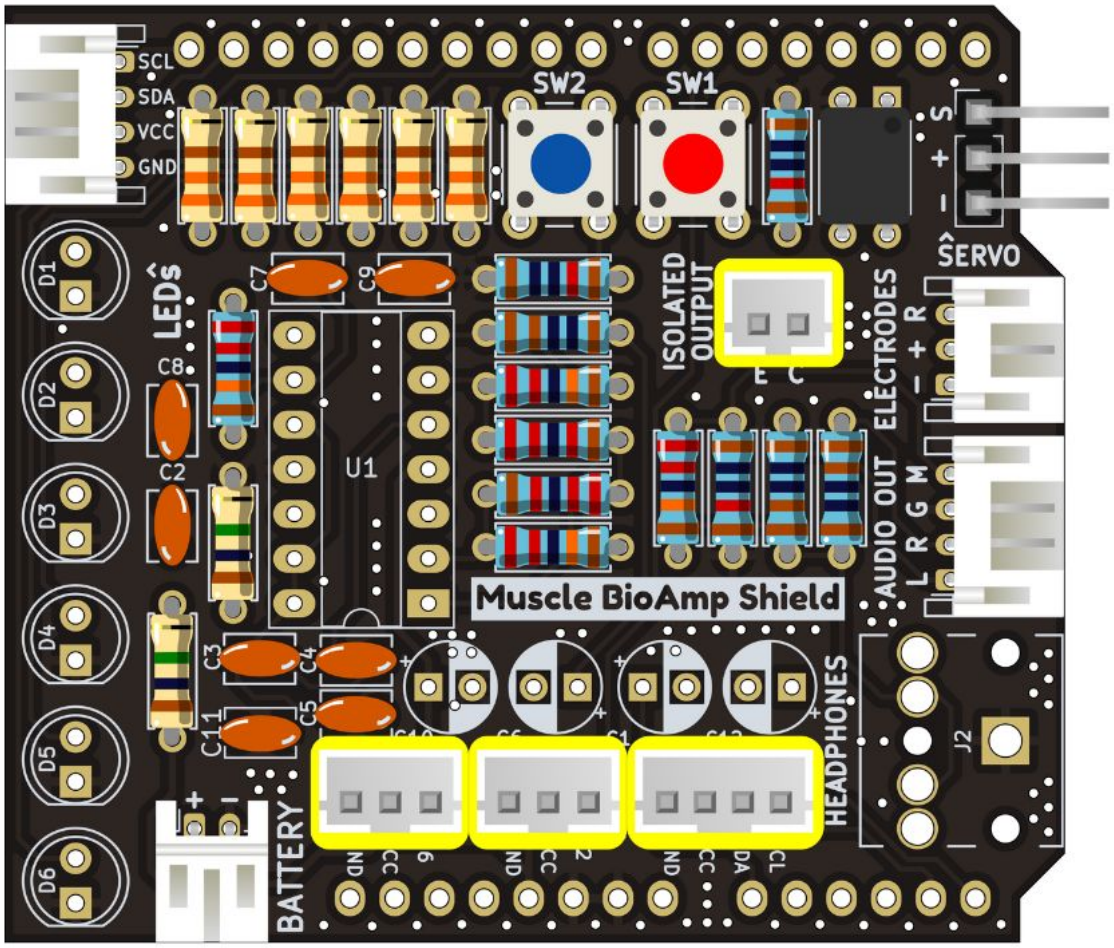


Fig. 15: **Step 15 - JST PH Straight Connectors**

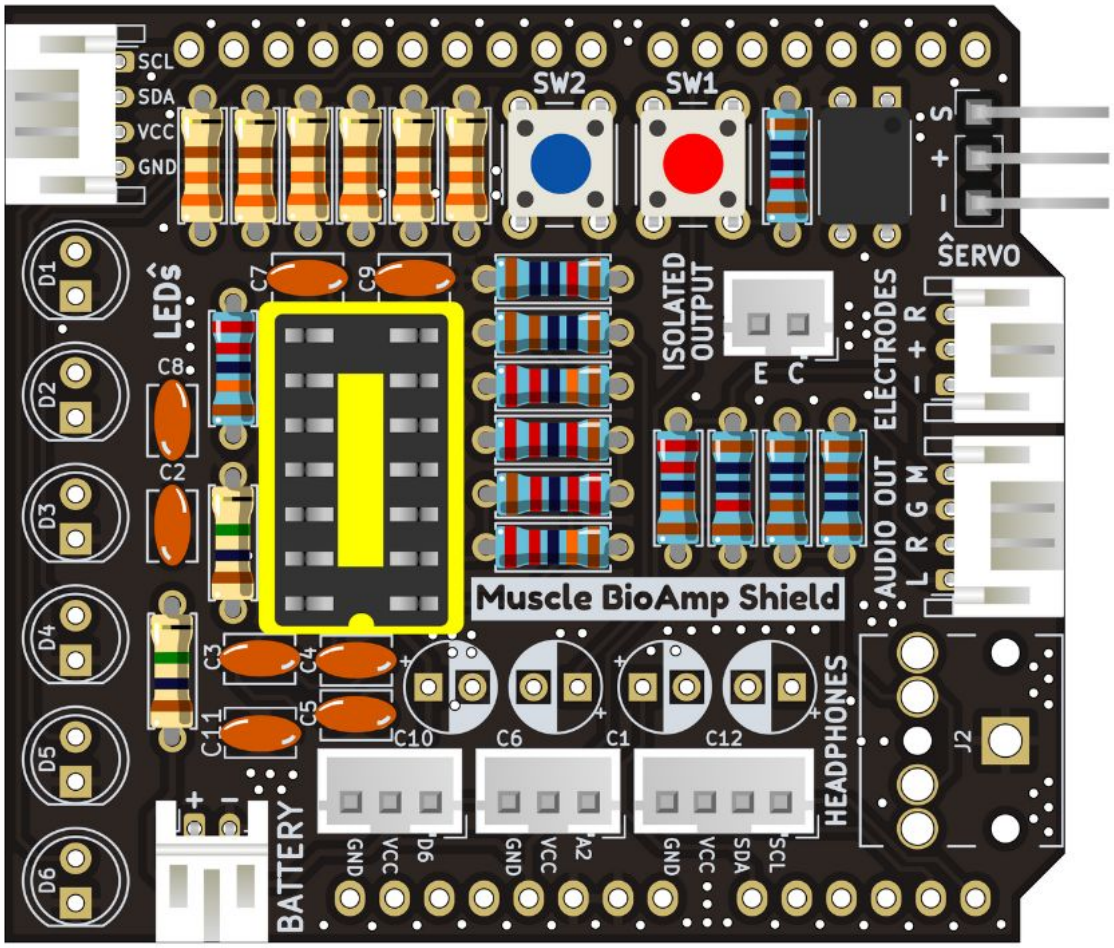


Fig. 16: **Step 16 - IC Socket**

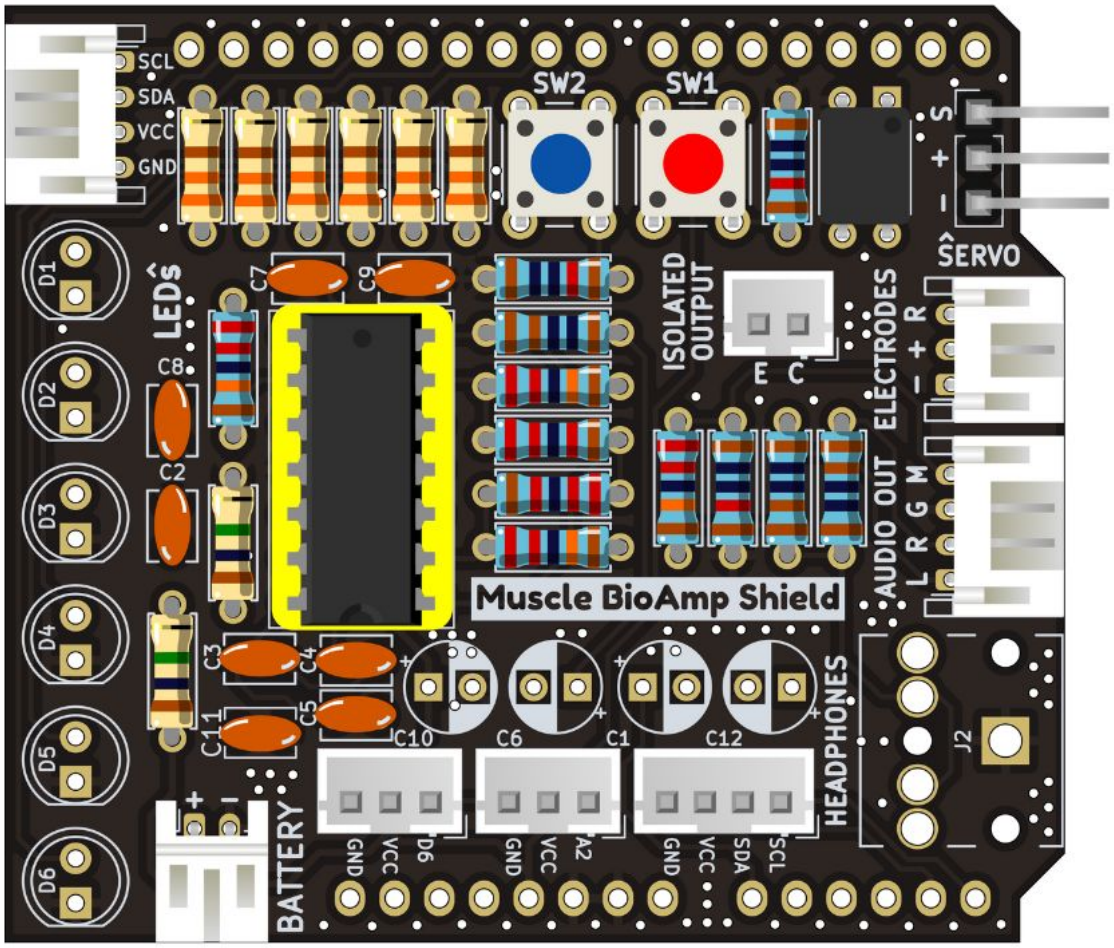


Fig. 17: **Step 17 - IC**

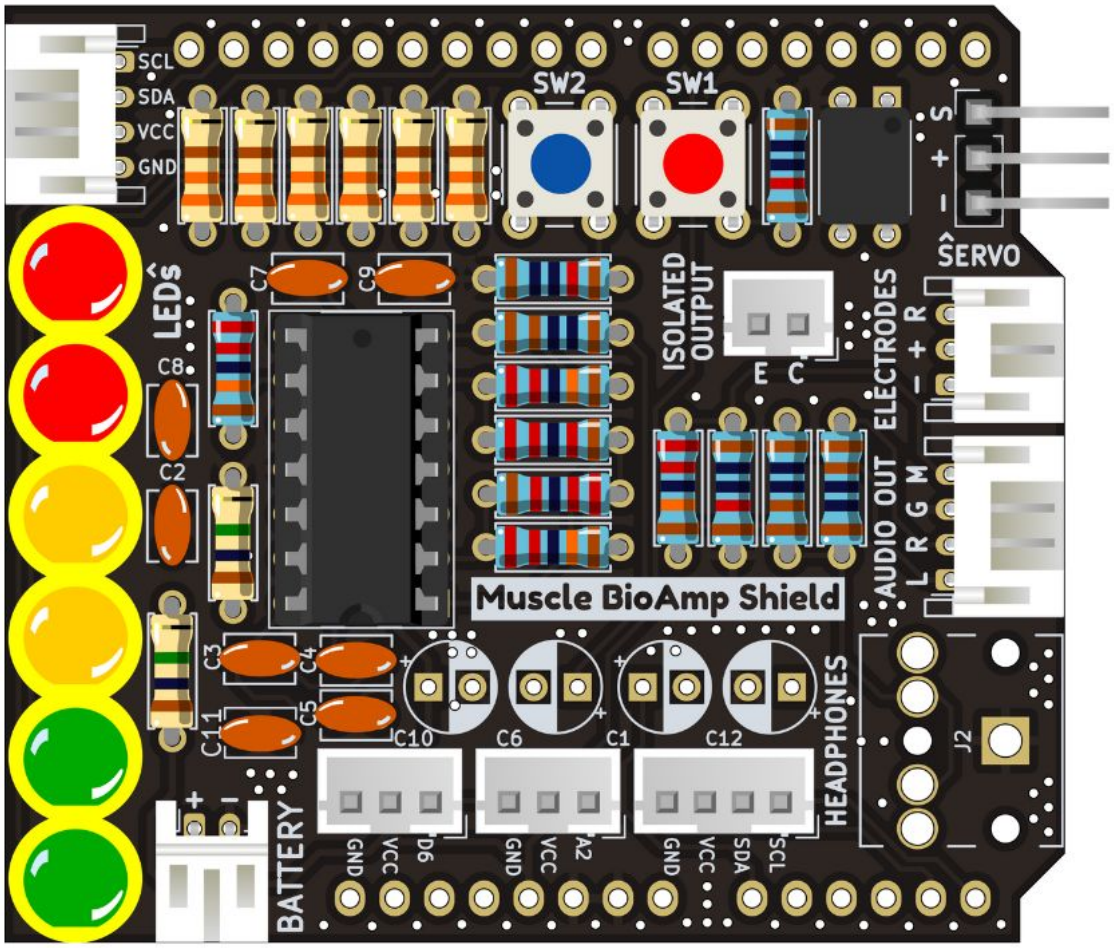


Fig. 18: **Step 18 - LEDs**

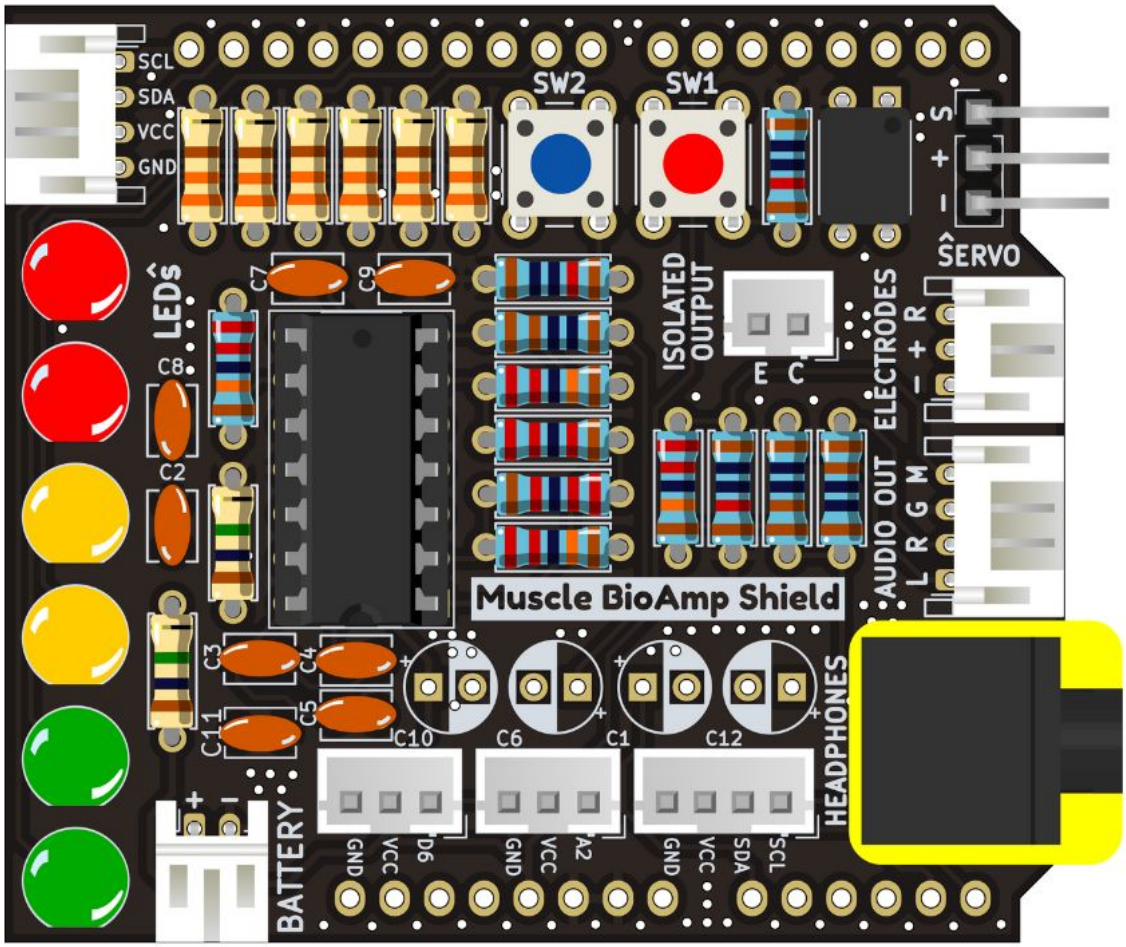


Fig. 19: **Step 19 - 3.5mm Headphone Jack**

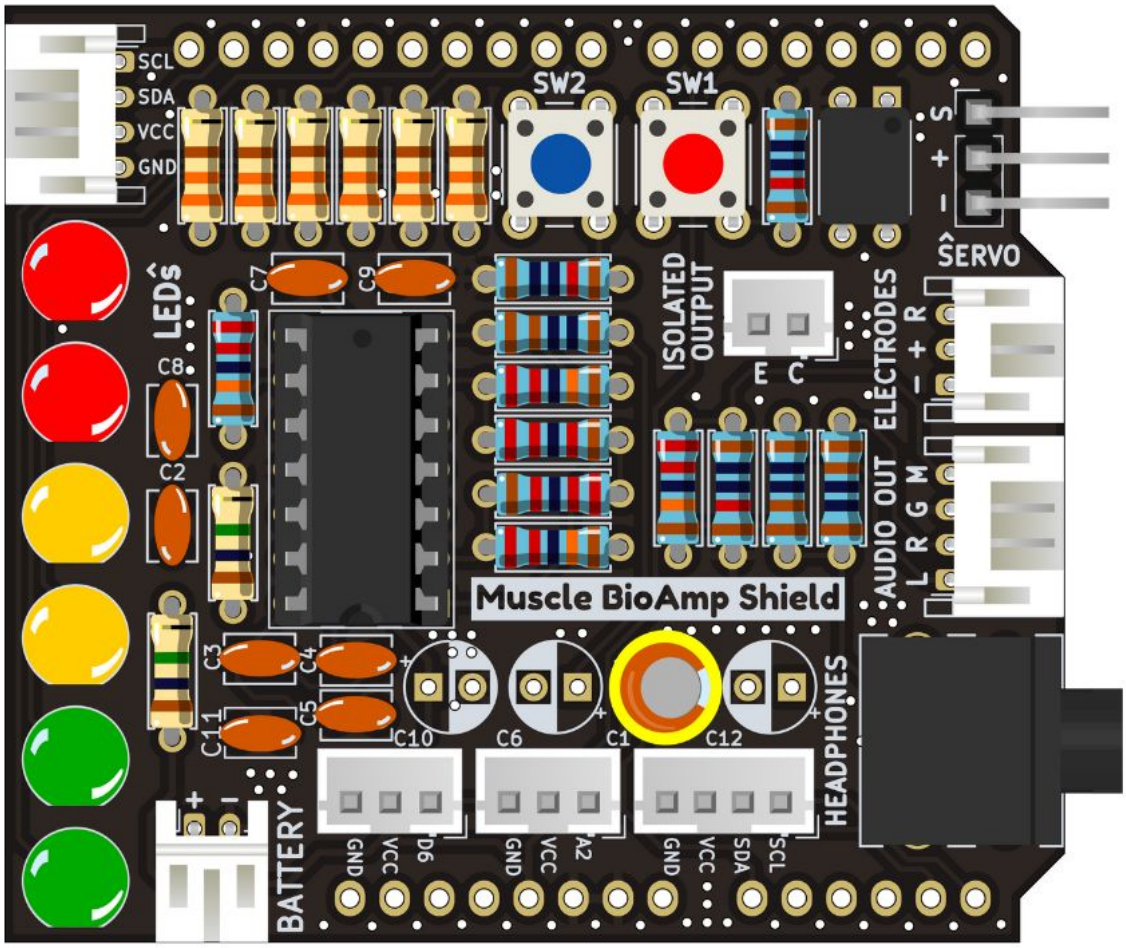


Fig. 20: **Step 20 - 2.2uF Capacitor**

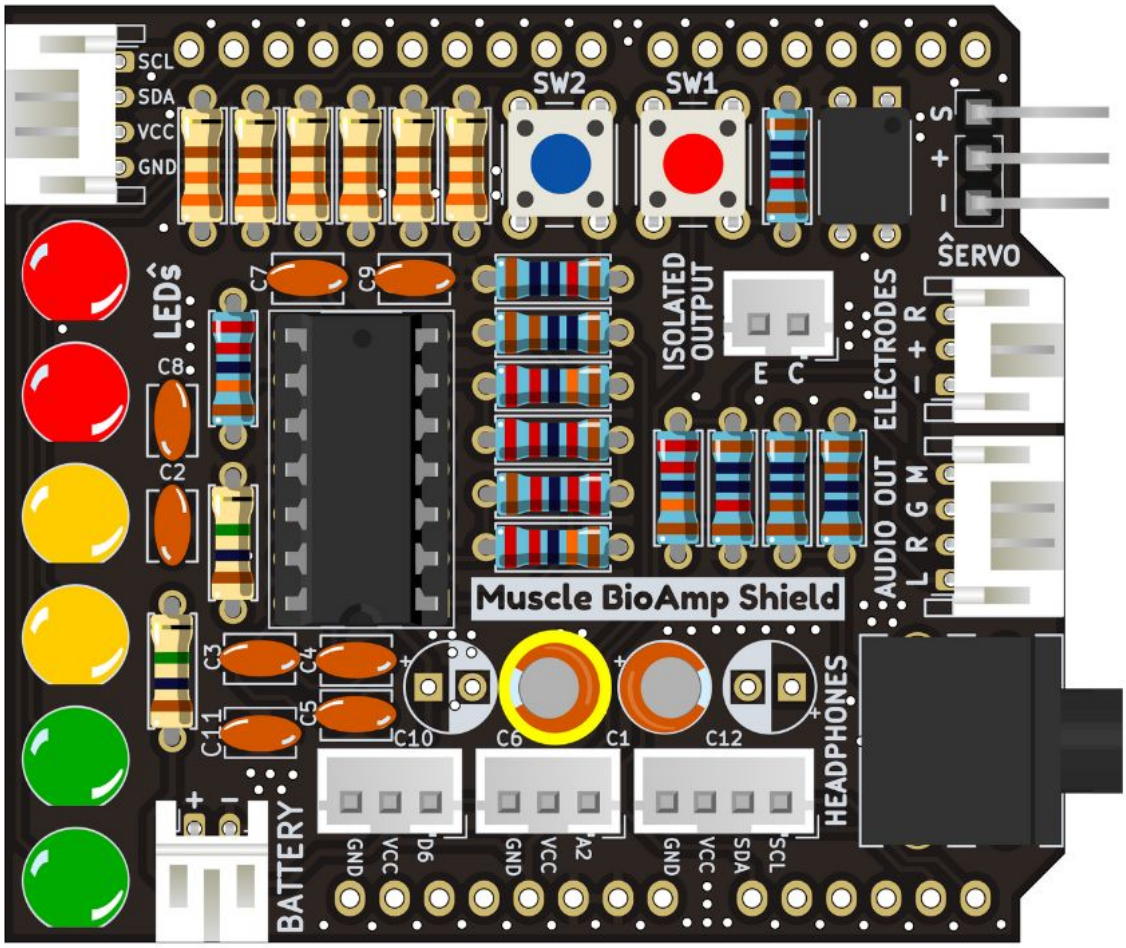


Fig. 21: **Step 21 - 1uF Capacitor**

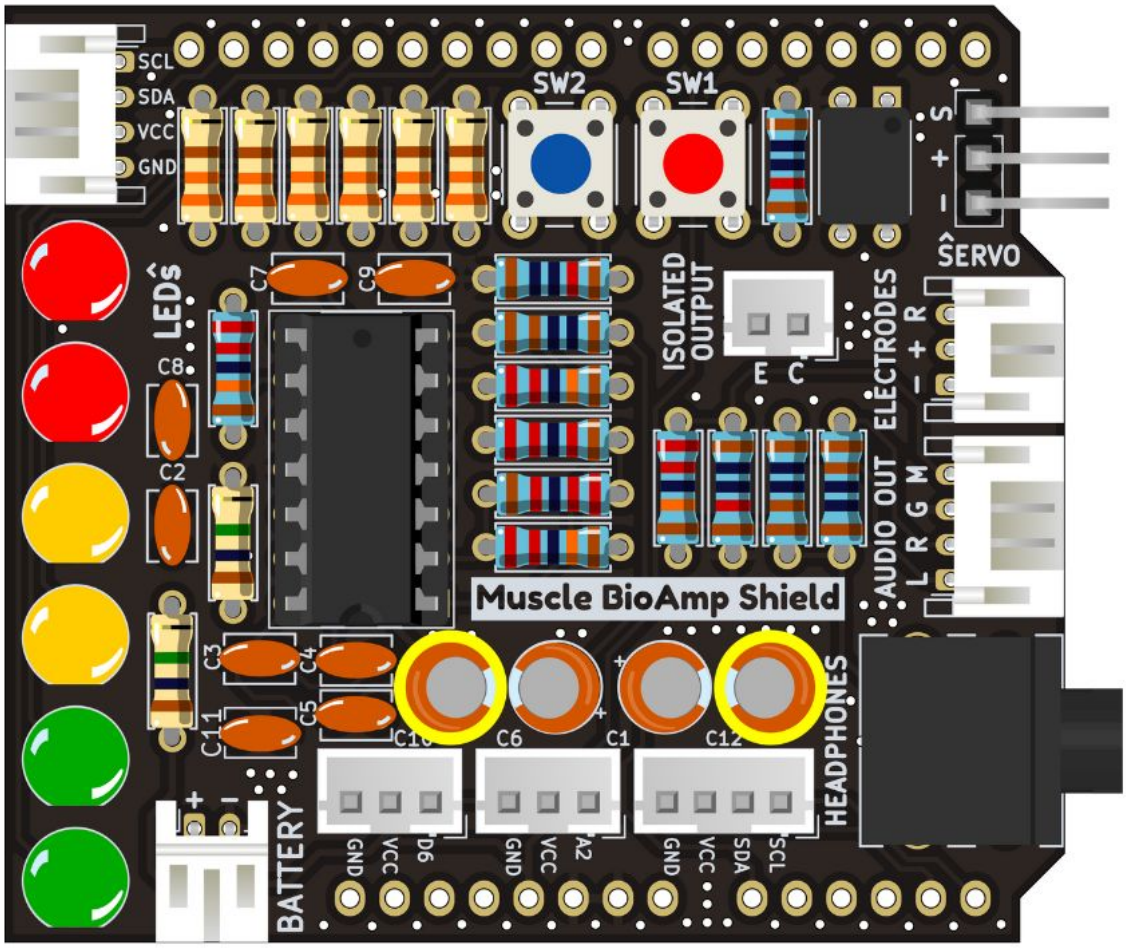


Fig. 22: **Step 22 - 470uF Capacitor**

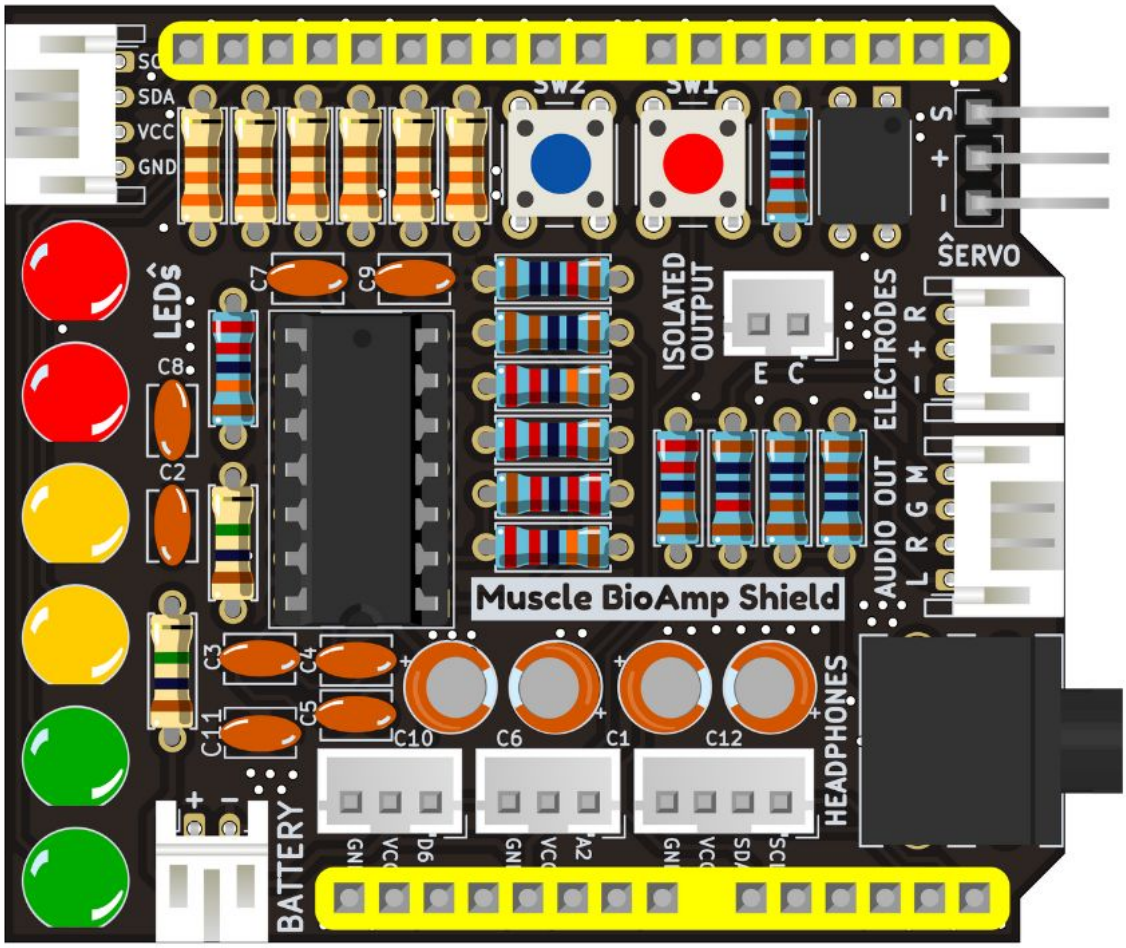


Fig. 23: **Step 23 - Header Pins**

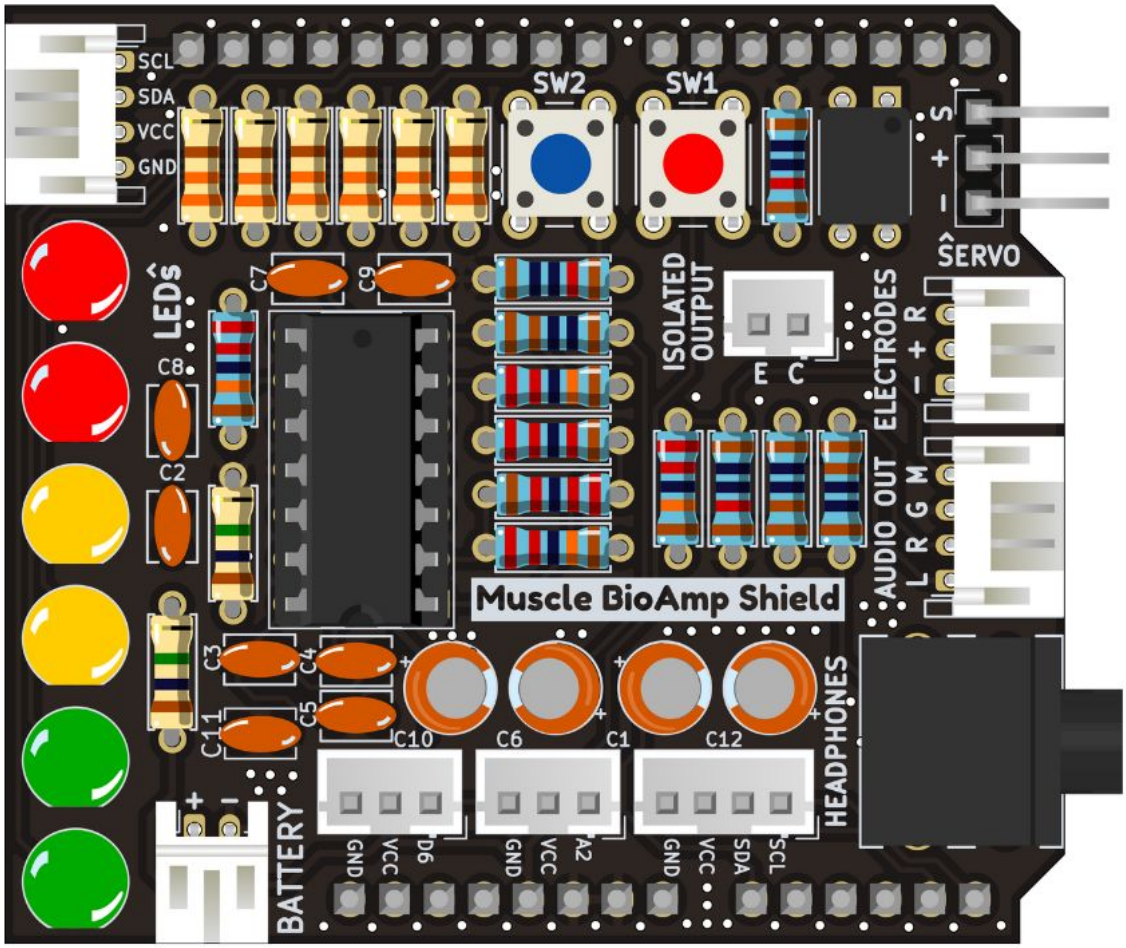


Fig. 24: **Step 24 - Assembled Shield**

CHAPTER

FIVE

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.

CHAPTER

SIX

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