ECE477 MIDTERM DESIGN REVIEW: TEAM #12

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OUTLINE

- Project Overview
- Major Components
- Block Diagram
- Packaging Design
- Electrical Schematic
- PCB Layout
- Prototyping Progress
- Software Development Status
- Project Timeline
- Questions

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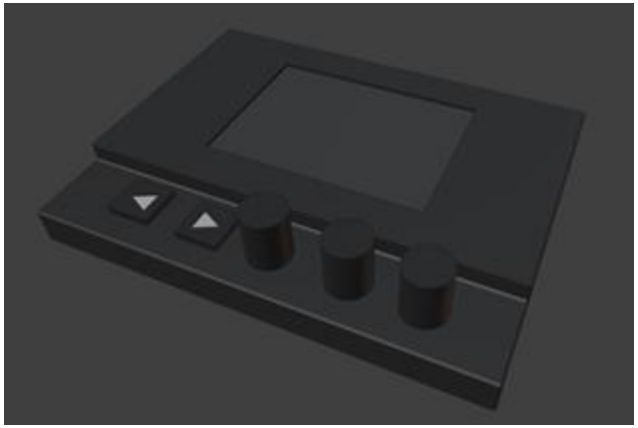
PROJECT OVERVIEW

- Apply digital signal processing effects to audio from an external microphone
  - Equalization
  - Delay
  - Distortion

- Audio input and output via TRS jacks

- Provide user interface via LCD screen, rotary encoders, and buttons



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PSDRS

- PSDR #1 (Hardware): An ability to send and receive an audio signal to and from a codec and a microcontroller via I2S.
- PSDR #2 (Software): An ability to apply five band EQ, distortion, and delay effects via DSP on an input audio.
- PSDR #3 (Hardware): An ability to control DSP parameters using input to a microcontroller from a set of rotary encoders and buttons.
- PSDR #4 (Hardware): An ability for the microcontroller to interface with an LCD display via SPI.
- PSDR #5 (Software): An ability to provide a GUI to display DSP parameters and corresponding audio effects.

Stretch PSDRS:

- PSDR #6 (hardware): An ability to control parameters and interact with the user interface via capacitive touch screen.
- PSDR #7 (hardware): An ability to send output audio data to a computer via USB.

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MAJOR COMPONENTS

Microcontroller

Selected: STM32F746ZGT6

- 216 MHz clock
- 320 KB SRAM
- 4 x I2C
- 3 x I2S
- 3.3v

Alternative: STM32F407

- 168 MHz clock
- 192 KB SRAM
- 3 x I2C
- 2 x I2S
- 3.3v

- Also briefly considered PIC32
- Preferred STM32 because of familiarity

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MAJOR COMPONENTS

Voltage Regulator and USB Connector

LD1117S33TR

- Low dropout Voltage
- 5V to 3.3V
- Output up to 800 mA
- 10 uF capacitor minimum
- ± 1 % at 25 °C

USB2.0 MICRO B SMD

- 5V, 500 mA

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MAJOR COMPONENTS

Codec

Selected: WM8731

- 3.3v
- 2 x I2S up to 32 bit
- ADC/DAC up to 96kHz
- Built in amplifier
- QFN package
- Dev board available

Alternative: CS4272

- 5.0v
- 2 x I2S up to 24 bit
- ADC/DAC up to 192kHz
- Requires external amplification
- SSOP package
- No dev board

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MAJOR COMPONENTS

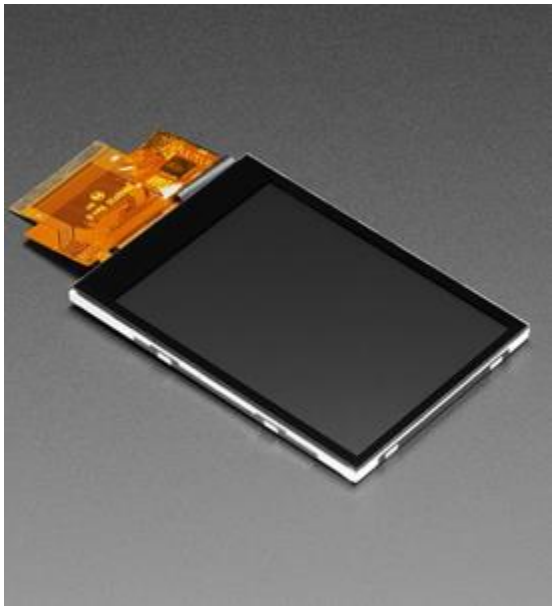
Screen

Selected: CH280QV10-CT

- 2.8” TFT w/ Capacitive Touch
- 240x320 (RGB)
- TFT Driver IC: ILI9341V (SPI)
- CTP Driver IC: CST026 (I2C)
- 3.3V
- Adafruit Breakout Board

Alternative: CH500WV05A-T

- 5.0” TFT w/ Resistive Touch
- 800x480 (RGB)
- 24-bit Parallel RGB Interface
- 3.3V



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MAJOR COMPONENTS

Rotary Encoders and Buttons

Rotary Encoders: PEC11R-4215F-S0024

- Quadrature Incremental Rotary Encoders
- 24 Pulses Per Revolution
- 3D printed knobs

Buttons: B3F-4050

- Operating Force: 130gf
- Pull-Down
- 3D printed caps

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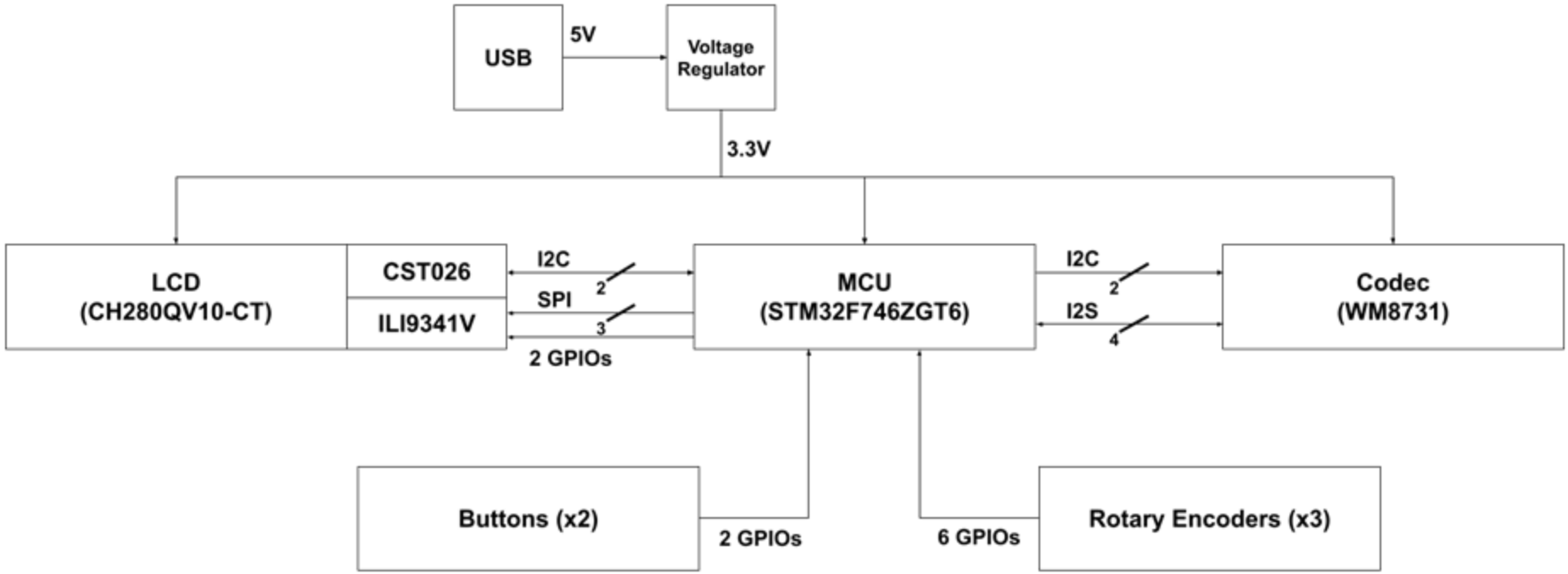
BLOCK DIAGRAM



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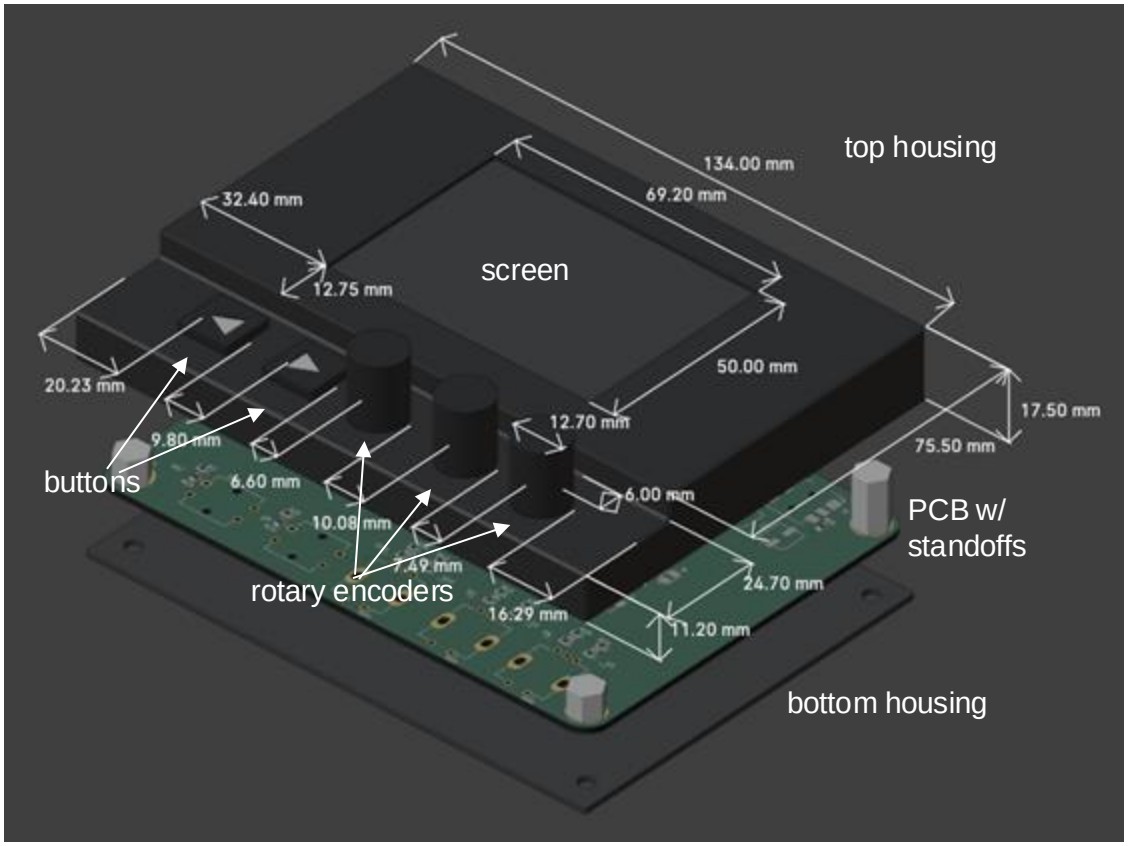
PACKAGING DESIGN

- 3D printed housing
- Nylon standoffs glued to top
- Screws through back plate
- Holes for ports in back



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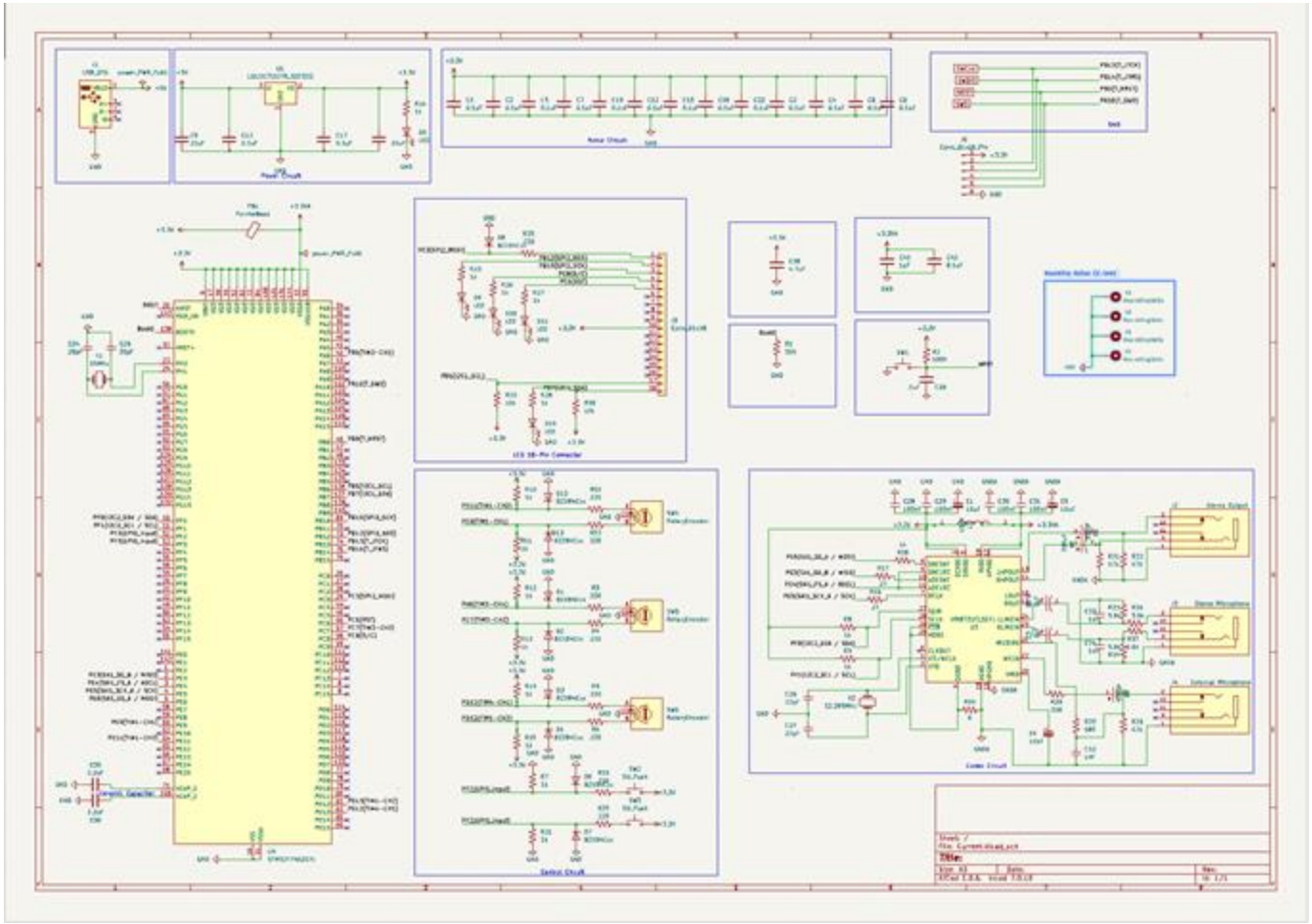
ELECTRICAL SCHEMATIC

General Overview



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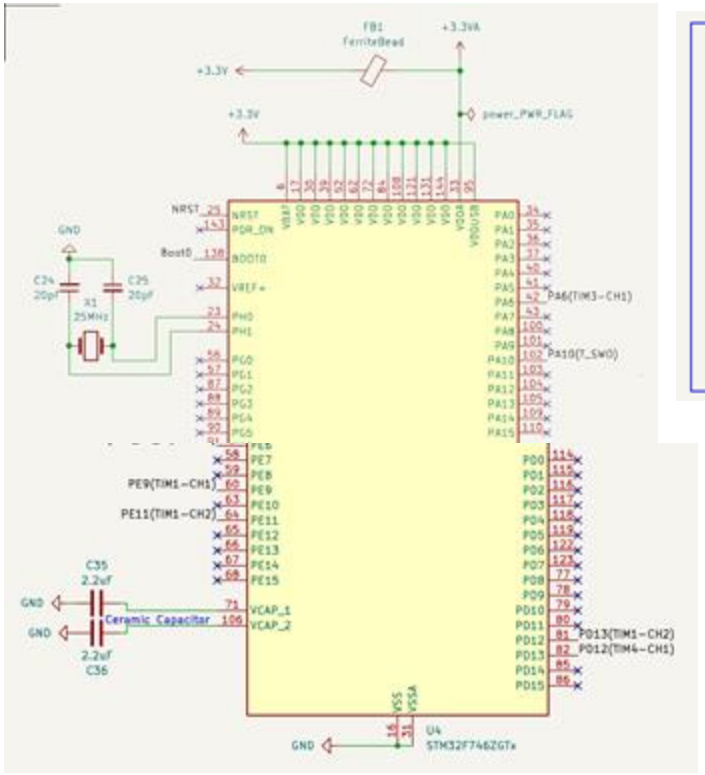
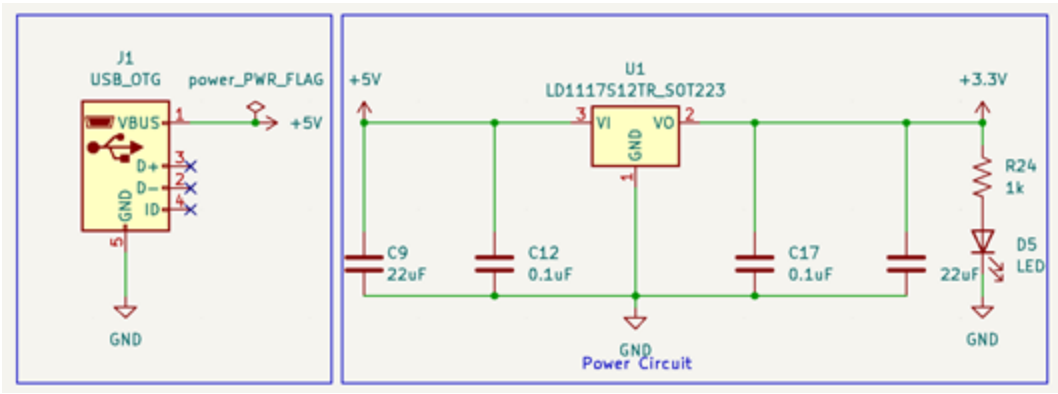
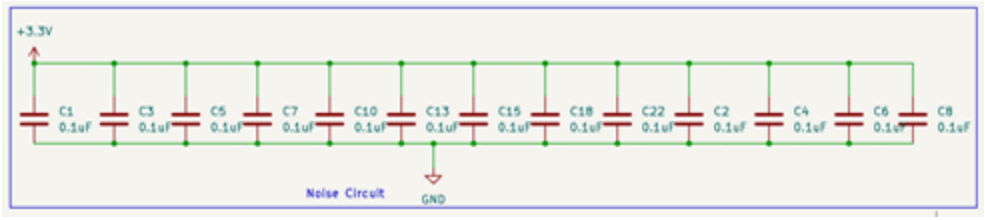
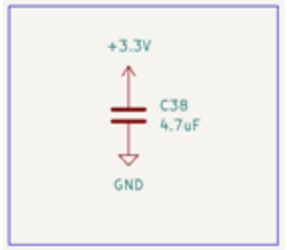
ELECTRICAL SCHEMATIC

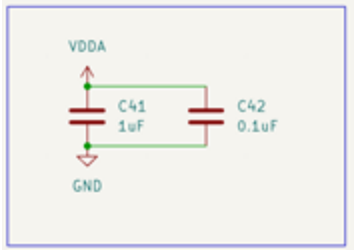
MCU











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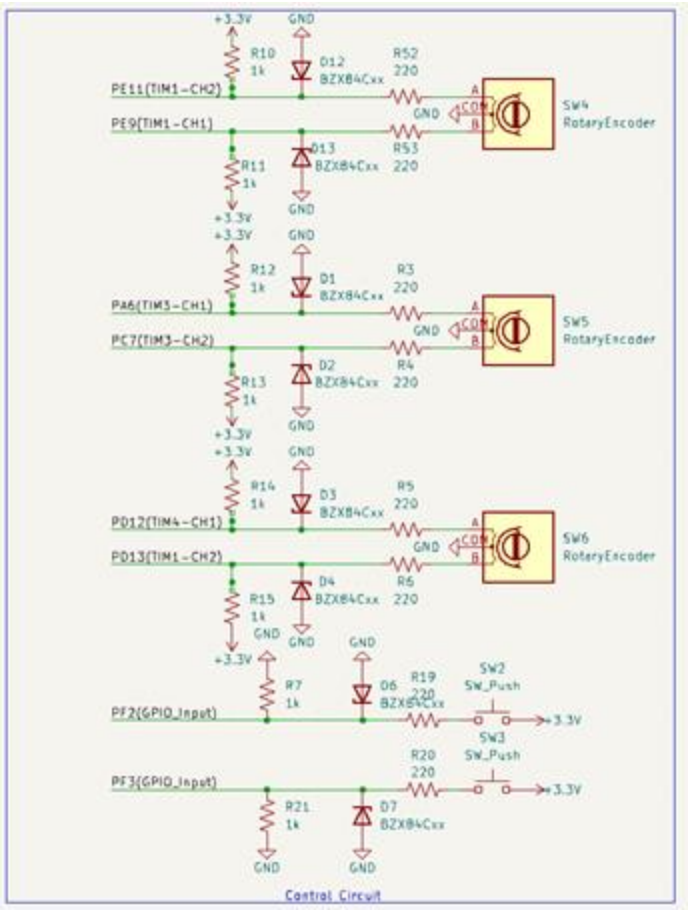
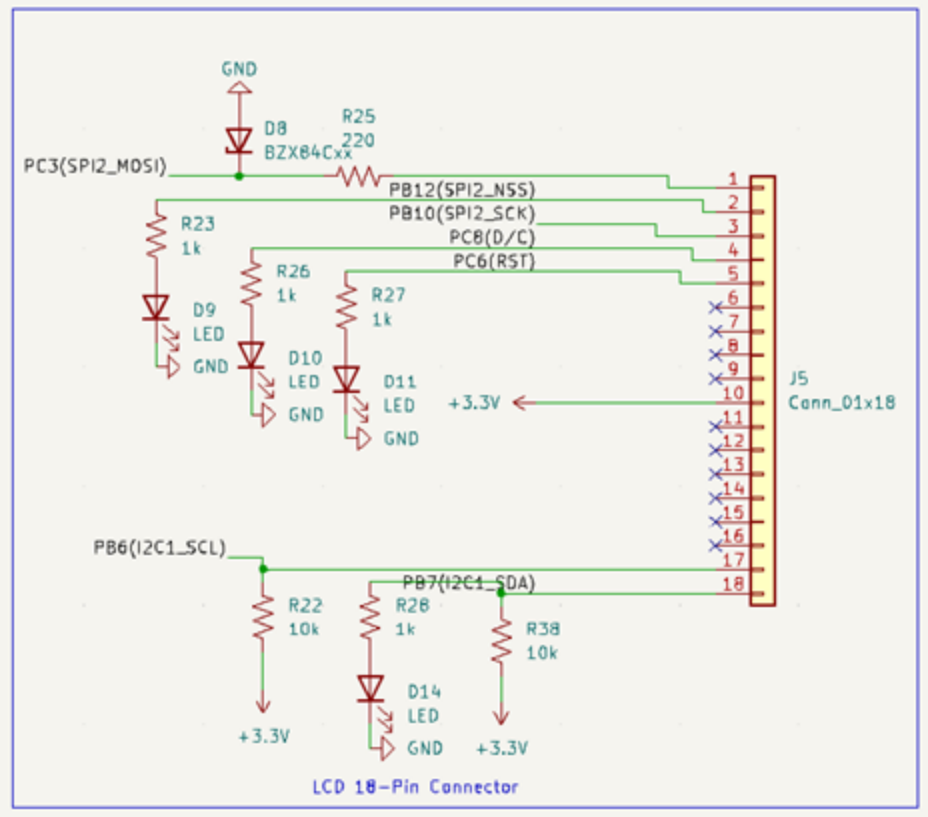
ELECTRICAL SCHEMATIC

Controls and LCD





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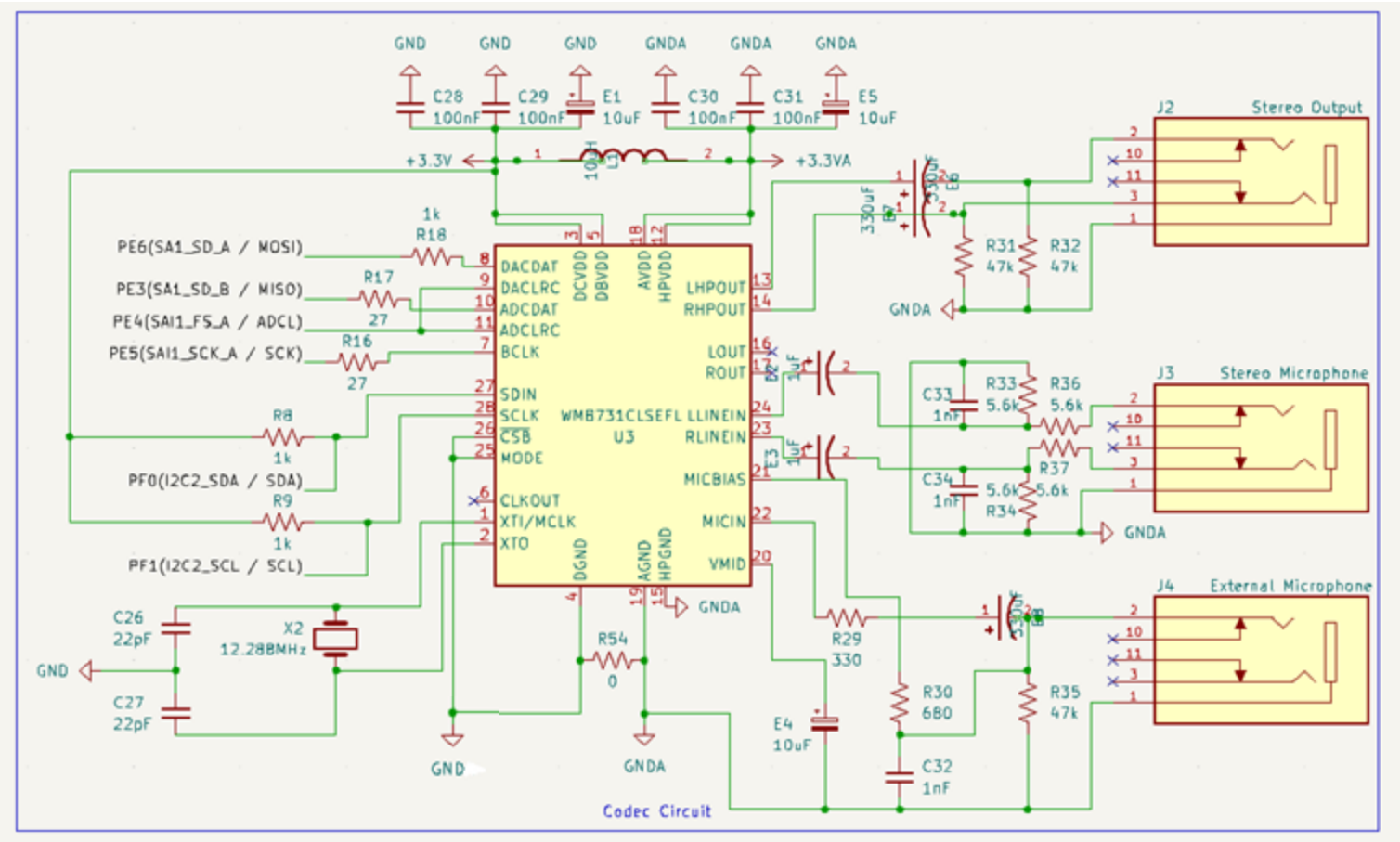
ELECTRICAL SCHEMATIC

Codec



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PCB LAYOUT

General Overview

Length: 130mm
Width: 95.2mm
Layers: 4

Trace Width:

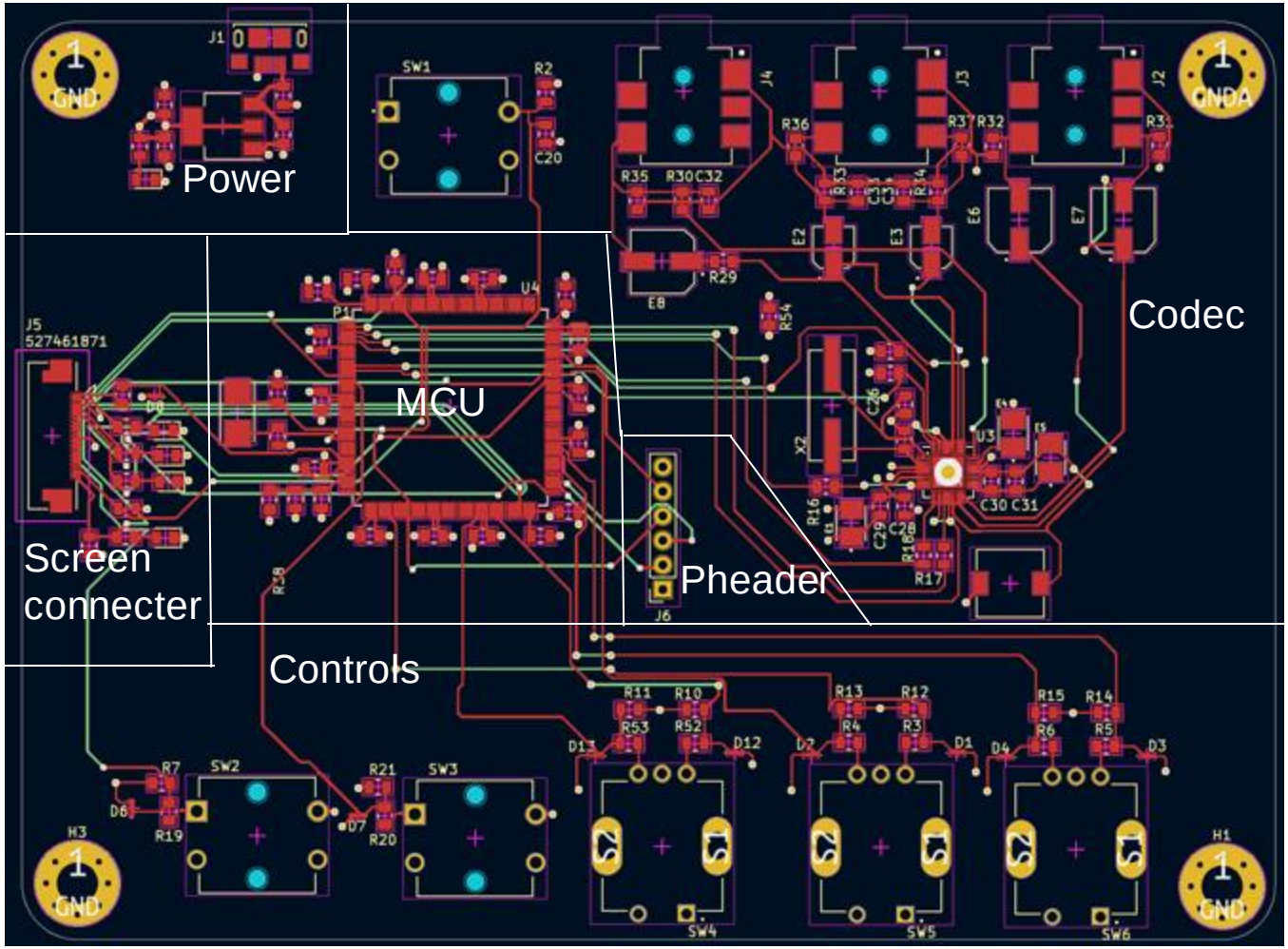
0.3mm

0.5mm

Mounting Holes: 4

Vias:

0.8mm
0.4mm



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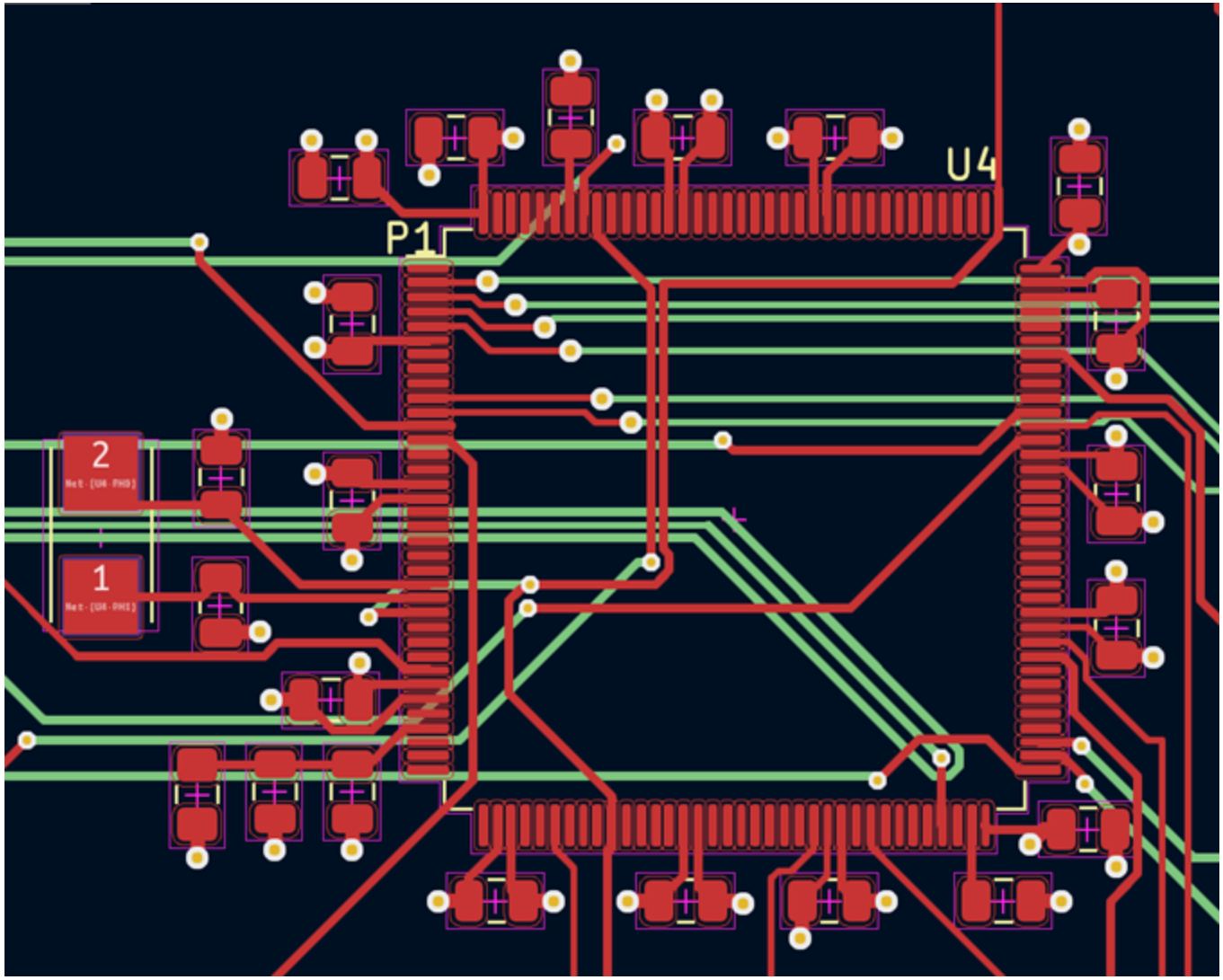
PCB LAYOUT

MCU



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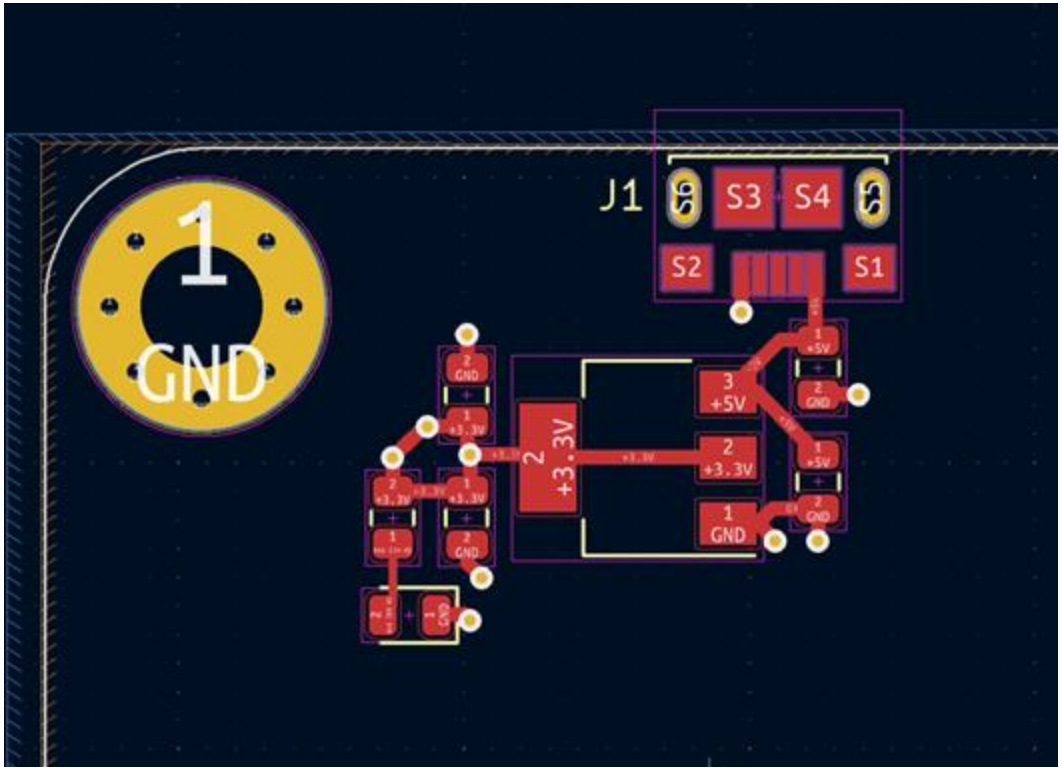
PCB LAYOUT

Power

Trace Width: 0.5mm



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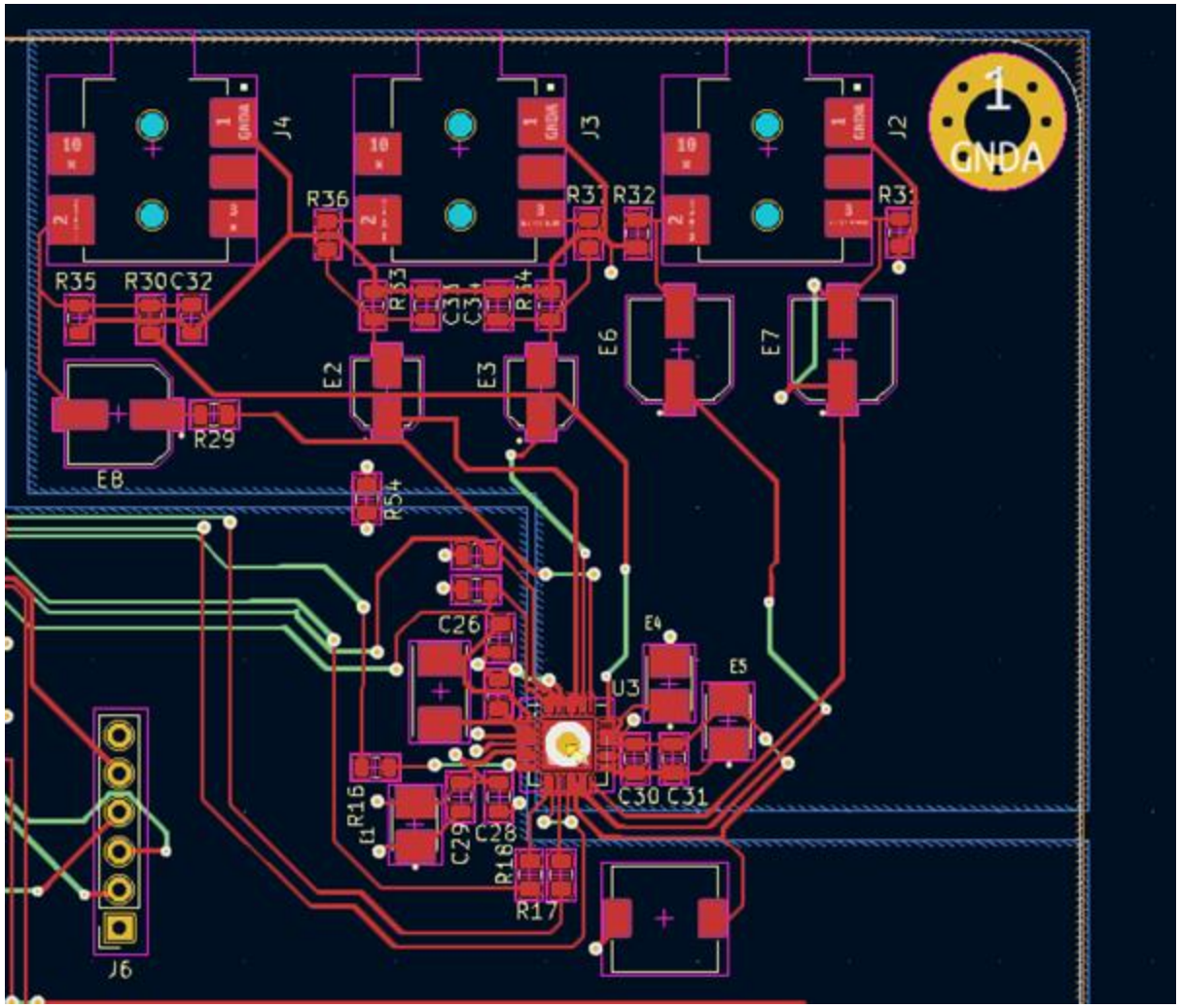
PCB LAYOUT

Codec

Separate analog ground plane

Via under QFN codec



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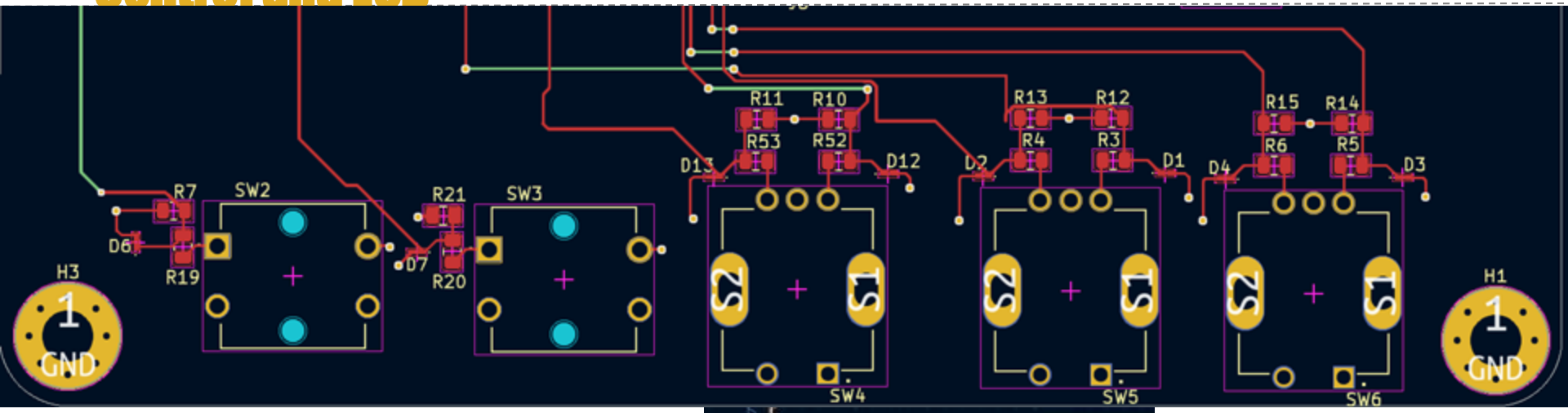
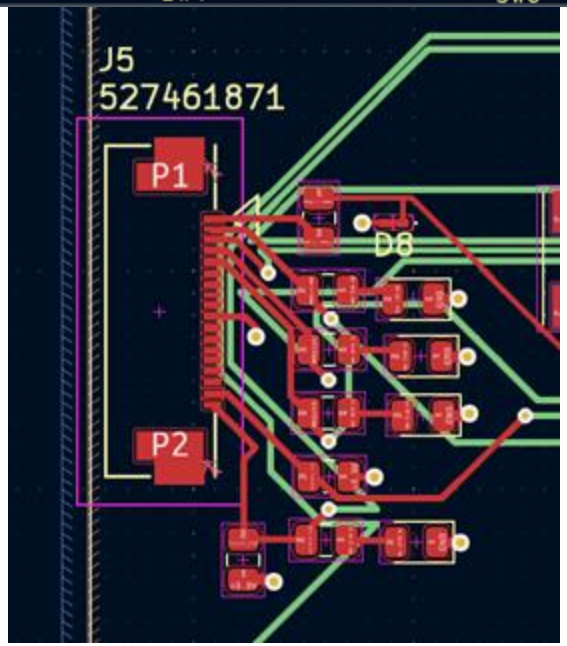
PCB LAYOUT

Control and LCD





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PROTOTYPING PROGRESS

- Power Circuit
  - Prototyped and fully tested on laptop and desktop port
- Touchscreen
  - Successfully interfaced dev board with STM32F7
  - Custom demo ran on it
- Codec
  - Successfully interfaced dev board with STM32F7
  - Custom setup driver written
  - Audio issues resolved
- Controls
  - Prototyped and tested on breadboard with STM32F4

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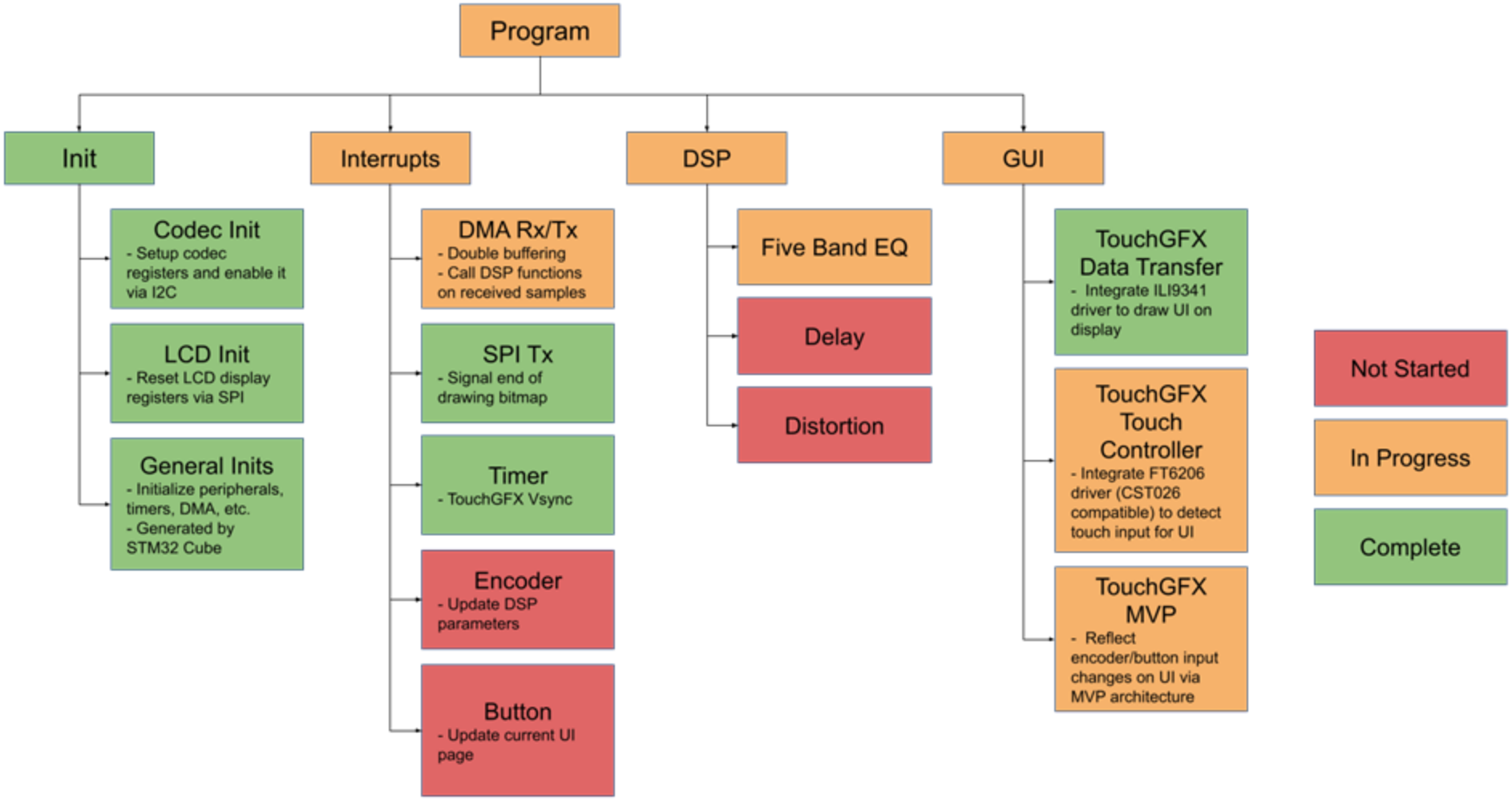
SOFTWARE DEVELOPMENT STATUS



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PROJECT TIMELINE

	March 3rd-10th	March 11th-17th	March 18th-24th	March 25th-30th	April 1st-7th	April 8th-14th	April 15th-21st	April 22nd-28th
Task	**Week 9**	**Week 10**	**Week 11**	**Week 12**	**Week 13**	**Week 14**	**Week 15**	**Week 16**
PCB Revision								
Touch Controller Prototyping								
UI Design								
DSP FX Development								
PCB Assembly / Testing								
Firmware Development								
Component Integration and Testing								
Packaging								
End User Testing								
Final Presentation								

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Questions?