

List of Components: Flight Control with ARM Cortex M4

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List of Components for My Flight Controller

This document represents the list of components for my flight controller project.

- **Microcontroller:** STM32F405RGT6 (ARM Cortex-M4)
- **Voltage Regulators:**
 - Buck Converter for 5V and 3.3V power lines: TPS54302 (10V and 9V inputs)
 - Low Dropout (LDO) Regulator: RT9013-33GB for 3.3V
- **External Flash Memory:** 16MB external flash memory (W25Q128JVS) via SPI, used for storing audio with DAC output controlled by timers.
- **Battery:** LiPo battery
- **Frame:** QAV-S 2 Joshua Bardwell SE 5" frame
- **Sensors:**
 - MPU-6500 (Gyroscope/Accelerometer via SPI, replacing the obsolete MPU6000)
- **Wireless Module:** ESP8266 Wi-Fi module
- **Motor Control:** PWM signals to ESCs (Electronic Speed Controllers) for motor control
- **Radio Module:** RadioMaster TX16S MKII MAX transmitter using ExpressLRS protocol
- **Debugging Tools:** ST-Link/V2 or J-Link debugger for SWD programming and debugging
- **Power Distribution:**
 - Power Distribution Board (PDB) to efficiently supply power to ESCs and motors
 - Decoupling Capacitors: 0.1 μ F and 10 μ F ceramic capacitors for power stability
 - Reverse Voltage Protection: Schottky diode or MOSFET
 - Fuse for overcurrent protection
- **Optional Components:**
 - Barometer: BMP390 for altitude measurement
- **Vibration Dampening:** Rubber dampeners for flight controller isolation
- **Software Tools:** GNU ARM GCC and GDB, Makefiles, Vi/VSCode (text editor)

Schematic Diagram

The following is the schematic of the flight controller system:

Schematic Diagram

The following schematic illustrates the connections between components in the flight controller:

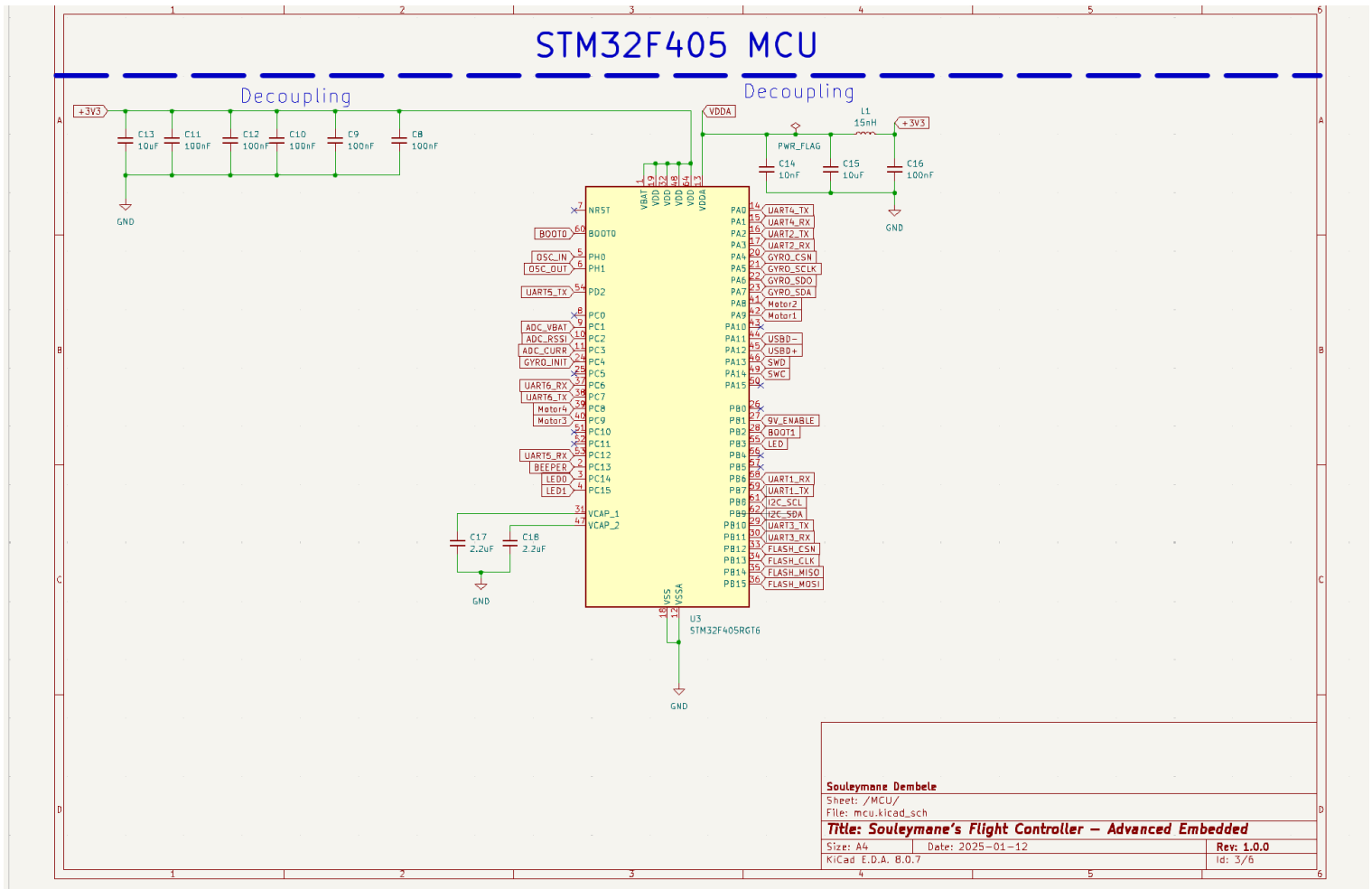


Figure 1: Represents the Schematic of the Flight Controller System Microcontroller Unit

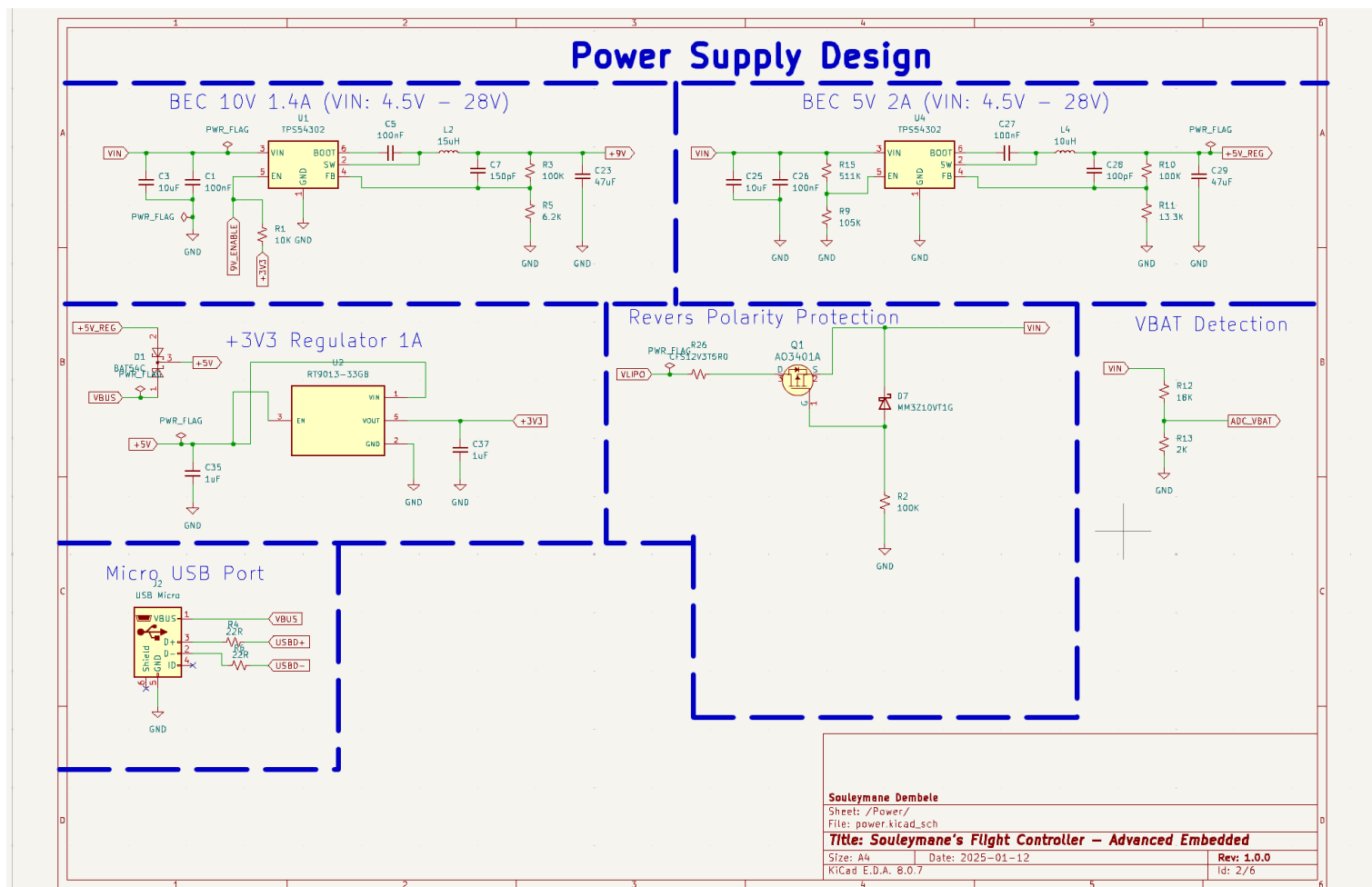


Figure 2: Represents the Schematic of the Flight Controller System Power System

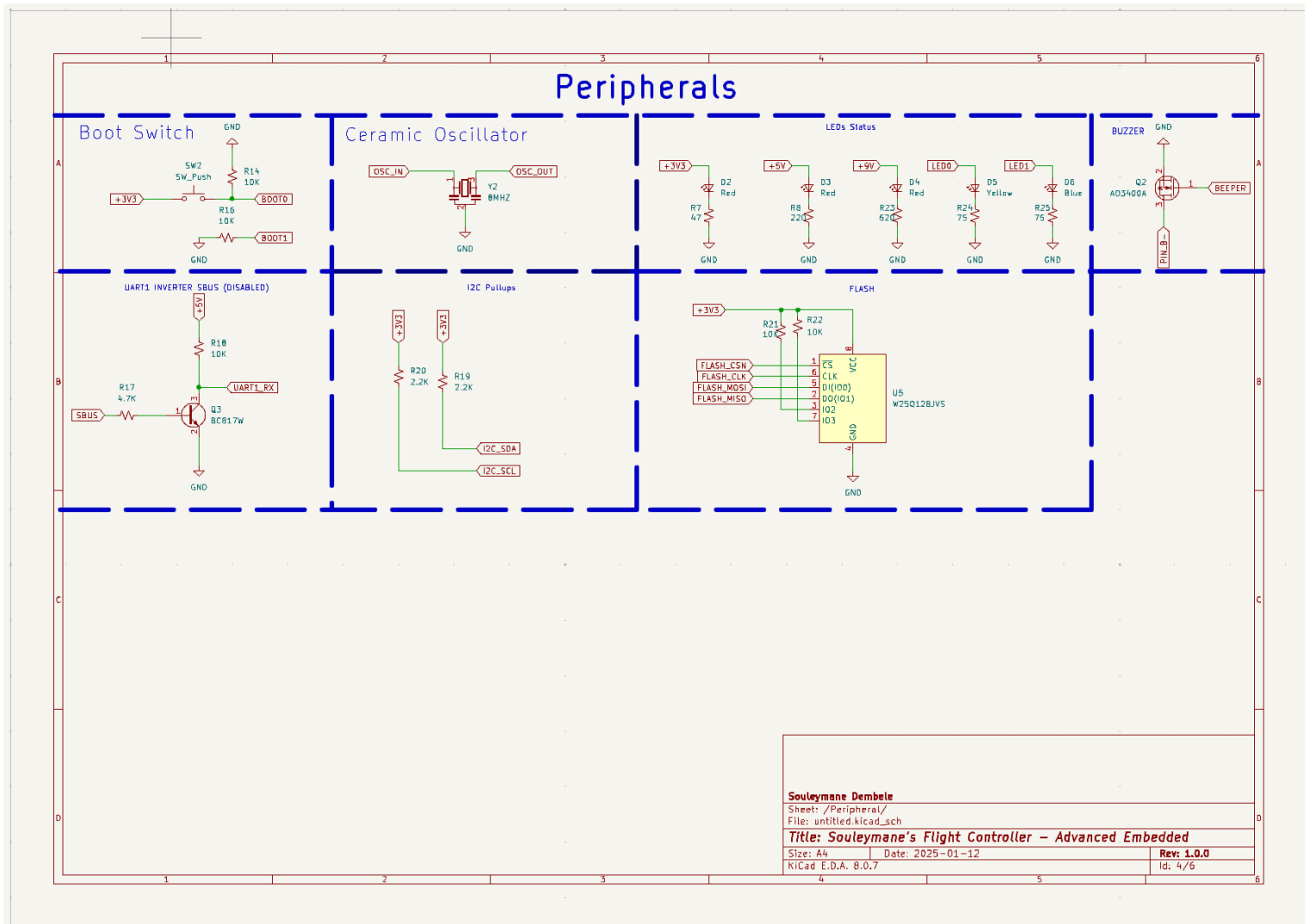


Figure 3: Represents the Schematic of the Various Peripherals of Flight Controller System

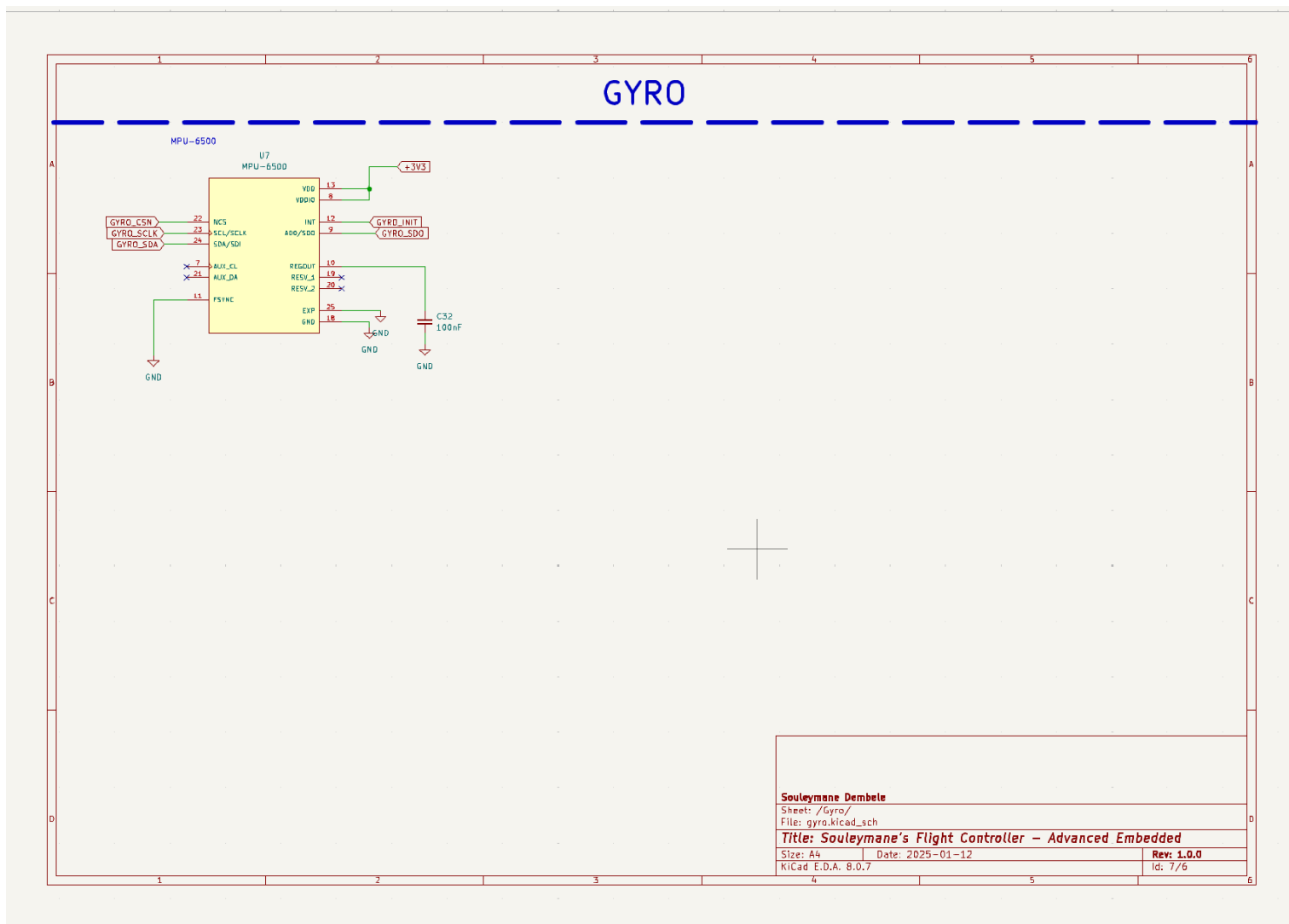


Figure 4: Represents the Schematic of the Various Peripherals of Flight Controller System

```

27 include $(C)/StdLib/StdLibs.mk
28
29 # Platform Overrides
30 # PLATFORM = msp432
31 PLATFORM = TM4C123GH6PM
32 PROJECT_NAME = skytech_firmware
33
34 # Architectures Specific Flags
35 ifeq ($(PLATFORM), HOST)
36     LINKER_FILE =
37     CPU =
38     ARCH =
39     SPECS =
40 else ifeq ($(PLATFORM), TM4C123GH6PM)
41     LINKER_FILE = linker/tm4c123gh6pm.ld
42     CPU = cortex-m4
43     THUMB = thumb
44     ARCH = armv7e-m
45     FLOAT_ABI = hard
46     FPU = fpv4-sp-d16
47     SPECS = nosys.specs
48 else ifeq ($(PLATFORM), STM32F4XX)
49     LINKER_FILE = linker/STM32F446RET_FLASH.ld
50     CPU = cortex-m4
51     THUMB = thumb
52     ARCH = armv7e-m
53     FLOAT_ABI = hard
54     FPU = fpv4-sp-d16
55     SPECS = nosys.specs
56 else
57     LINKER_FILE = linker/msp432p401r.lds
58     CPU = cortex-m4
59     THUMB = thumb
60     ARCH = armv7e-m
61     FLOAT_ABI = hard
62     FPU = fpv4-sp-d16
63     SPECS = nosys.specs
64 endif
65
66
67 # Create build directory
68 $(BUILD_DIR):
69     mkdir -p $(BUILD_DIR)
70
71
72 TARGET = $(PROJECT_NAME)_$(PLATFORM)
73 # C Standard
74 CSTD = c99
75 # Compiler Flags and Defines
76 ifeq ($(PLATFORM), HOST)
77     CC = gcc
78     LD = ld
79     LDFLAGS = -Wl,-Map=$(TARGET).map
80     CFLAGS = -Wall $(INCLUDES) -std=$(CSTD) -O0 -Werror -g -DHOST
81 else ifeq ($(PLATFORM), TM4C123GH6PM)
82     CC = arm-none-eabi-gcc
83     LD = arm-none-eabi-ld
84     LDFLAGS = -Wl,--gc-sections -Wl,-Map=$(TARGET).map -T $(LINKER_FILE)
85     CFLAGS = -mcpu=$(CPU) -m$(THUMB) -march=$(ARCH) -mfloat-abi=$(FLOAT_ABI) -mfpu=$(FPU) --specs=$(SPECS) -std=$(CSTD) -Wall -O0 -Werror -g $(INCLUDES) -DTM4C123GH6PM

```

Figure 5: Represents a screenshot of my make file