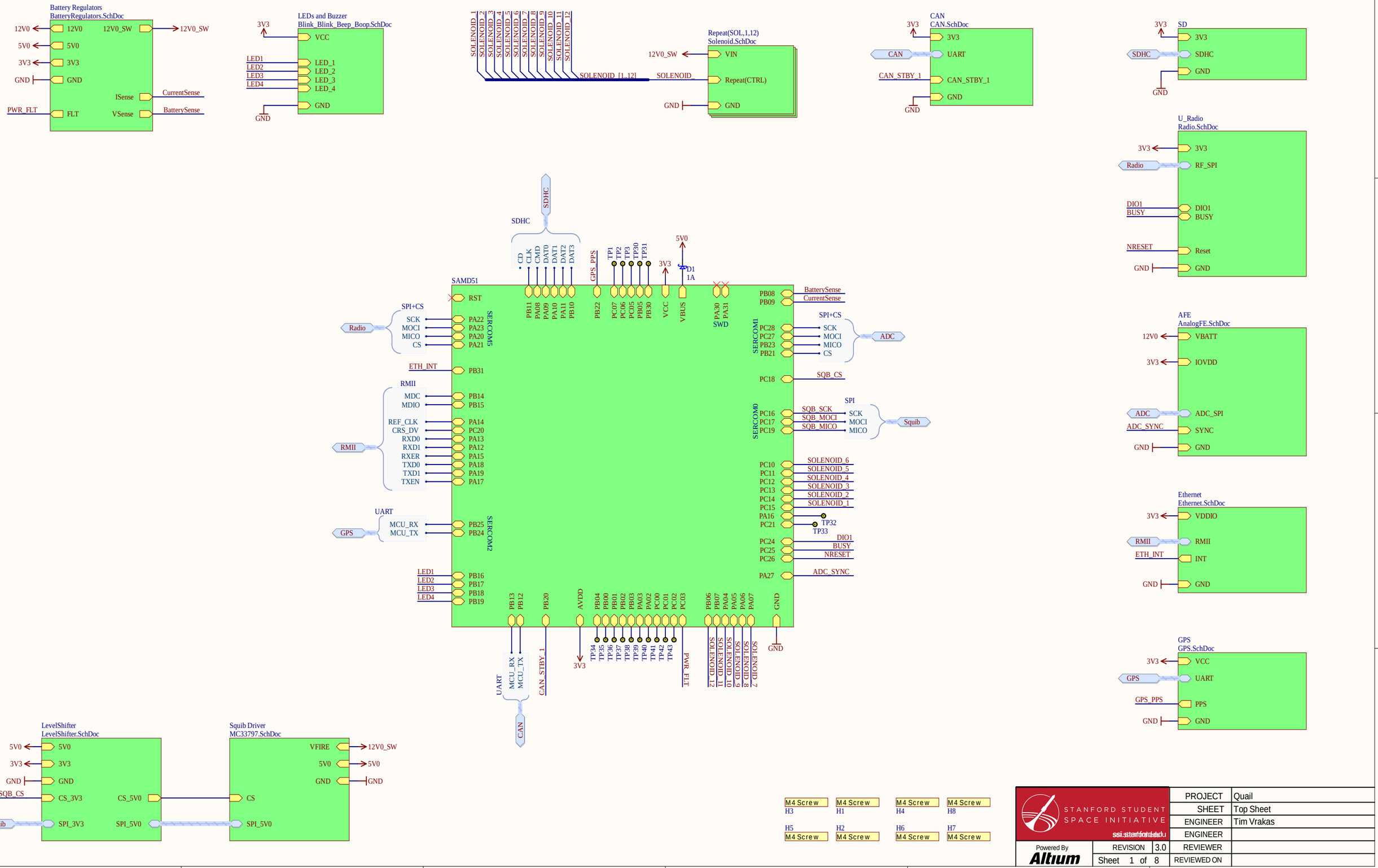
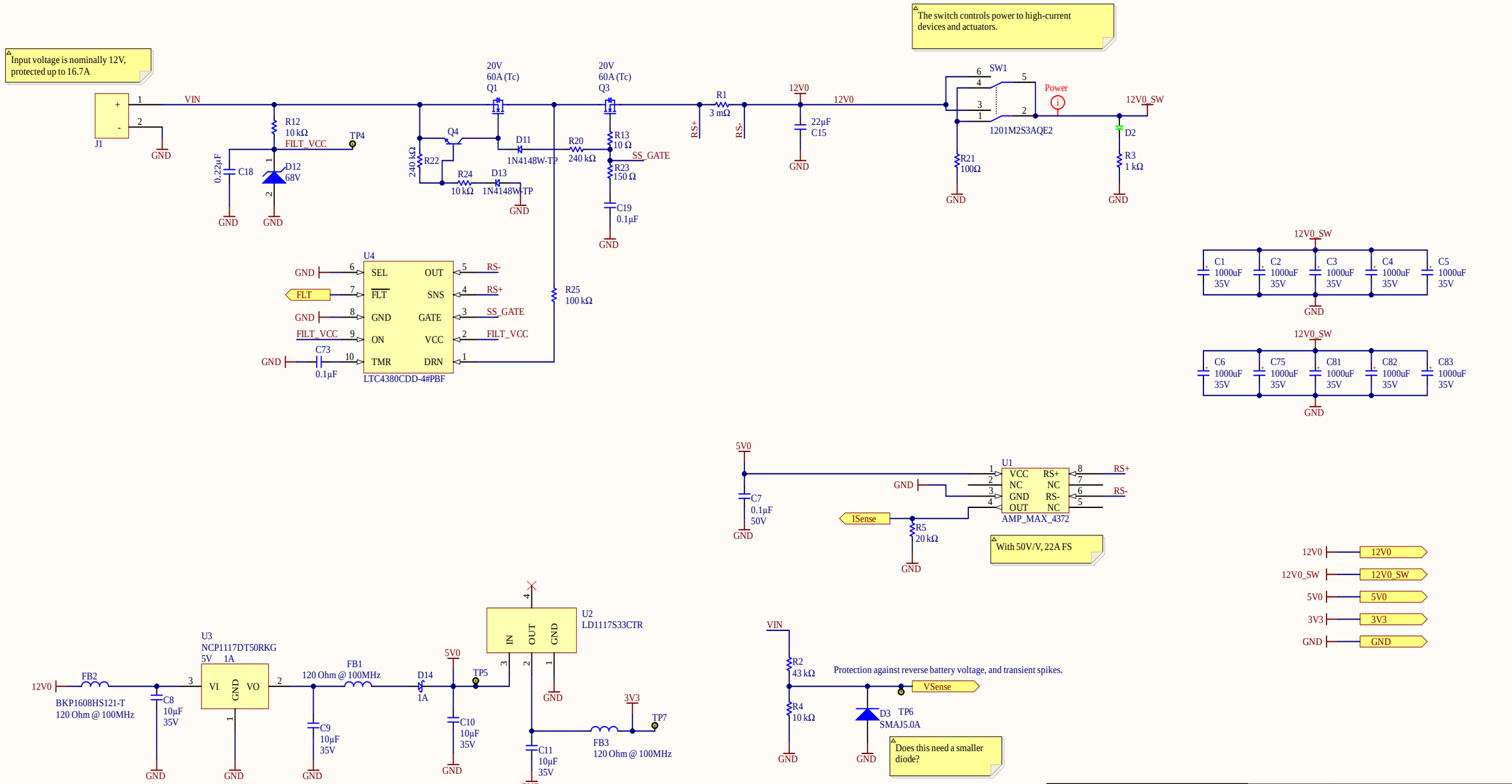

Battery Regulators
BatteryRegulators.SchDoc
12V0
5V0
3V3
GND
12V0_SW
ISense
FLT
VSense
CurrentSense
BatterySense
PWR_FLT
LEDs and Buzzer
Blink_Blink_Beep_Boop.SchDoc
VCC
LED_1
LED_2
LED_3
LED_4
LED1
LED2
LED3
LED4
Repeat(SOL,1,12)
Solenoid.SchDoc
VIN
Repeat(CTRL)
SOLENOID_1
SOLENOID_2
SOLENOID_3
SOLENOID_4
SOLENOID_5
SOLENOID_6
SOLENOID_7
SOLENOID_8
SOLENOID_9
SOLENOID_10
SOLENOID_11
SOLENOID_12
SOLENOID_[1,12]
SOLENOID_
CAN
CAN.SchDoc
UART
CAN_STBY_1
SD
SDHC
U_Radio
Radio.SchDoc
RF_SPI
Radio
DIO1
BUSY
Reset
NRESET
AFE
AnalogFE.SchDoc
VBATT
IOVDD
ADC_SPI
SYNC
ADC
ADC_SYNC
Ethernet
Ethernet.SchDoc
VDDIO
RMII
INT
ETH_INT
GPS
GPS.SchDoc
PPS
GPS_PPS
SAMD51
RST
SERCOM5
SPI+CS
SCK
MOCI
MICO
CS
PA22
PA23
PA20
PA21
PB31
ETH_INT
RMII
MDC
MDIO
REF_CLK
CRS_DV
RXD0
RXD1
RXER
TXD0
TXD1
TXEN
PB14
PB15
PA14
PC20
PA13
PA12
PA15
PA18
PA19
PA17
UART
MCU_RX
MCU_TX
SERCOM2
PB25
PB24
LED1
LED2
LED3
LED4
PB16
PB17
PB18
PB19
SDHC
CD
CLK
CMD
DAT0
DAT1
DAT2
DAT3
PB11
PA08
PA09
PA10
PA11
PB10
GPS_PPS
PB22
TP1
TP2
TP3
TP30
TP31
PC07
PC06
PC05
PB05
PB30
3V3
VCC
5V0
D1
1A
VBUS
PA30
PA31
SWD
PB13
PB12
PB20
AVDD
PB04
PB00
PB01
PB02
PB03
PA03
PA02
PC00
PC01
PC02
PC03
PB06
PB07
PA04
PA05
PA06
PA07
GND
TP34
TP35
TP36
TP37
TP38
TP39
TP40
TP41
TP42
TP43
PWR_FLT
SOLENOID_12
SOLENOID_11
SOLENOID_10
SOLENOID_9
SOLENOID_8
SOLENOID_7
CAN_STBY_1
CAN
PB08
PB09
BatterySense
CurrentSense
SERCOM1
PC28
PC27
PB23
PB21
PC18
SQB_CS
SERCOM0
PC16
PC17
PC19
SQB_SCK
SQB_MOCI
SQB_MICO
Squib
PC10
PC11
PC12
PC13
PC14
PC15
PA16
PC21
TP32
TP33
PC24
PC25
PC26
PA27
DIO1
BUSY
NRESET
LevelShifter
LevelShifter.SchDoc
CS_3V3
CS_5V0
SPI_3V3
SPI_5V0
Squib Driver
MC33797.SchDoc
VFIRE
12V0_SW
CS
M4 Screw
H3
H1
H4
H8
H5
H2
H6
H7
STANFORD STUDENT SPACE INITIATIVE
ssi.stanford.edu
Powered By
Altium
PROJECT
Quail
SHEET
Top Sheet
ENGINEER
Tim Vrakas
REVISION
3.0
Sheet 1 of 8
REVIEWER
REVIEWED ON

Input voltage is nominally 12V, protected up to 16.7A

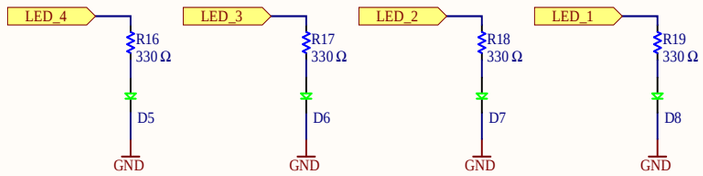
The switch controls power to high-current devices and actuators.

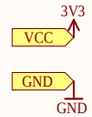


PROJECT	Quail
SHEET	Power Regulation
ENGINEER	Tim Vrakas
ENGINEER	
REVISION	3.0
REVIEWER	
Sheet 3 of 8	REVIEWED ON

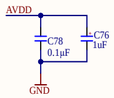
STANFORD STUDENT SPACE INITIATIVE

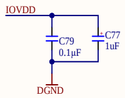
Powered By Altium

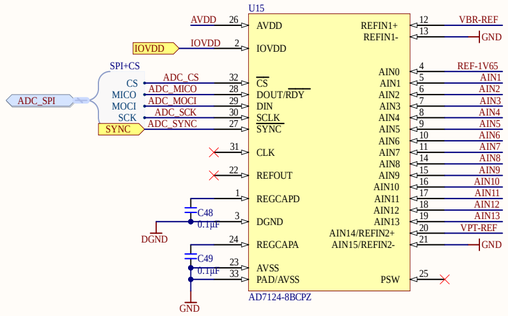


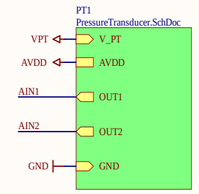


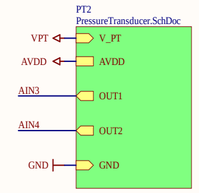
STANFORD STUDENT SPACE INITIATIVE ssi.stanford.edu		PROJECT	Quail
		SHEET	Blinks and Boops
		ENGINEER	Tim Vrakas
		ENGINEER	
Powered By Altium	REVISION 3.0	REVIEWER	
	Sheet 8 of 8	REVIEWED ON	

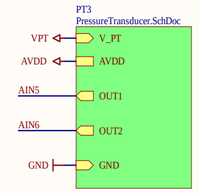


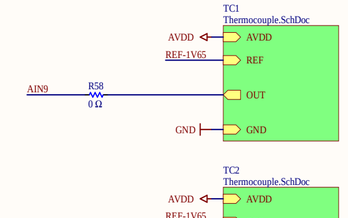


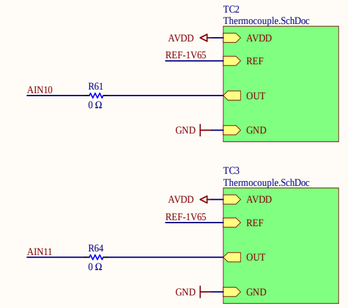




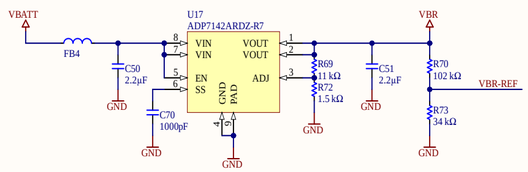




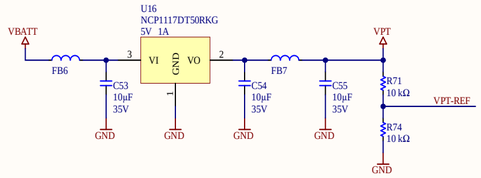


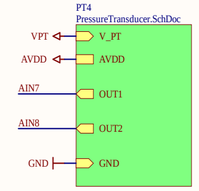


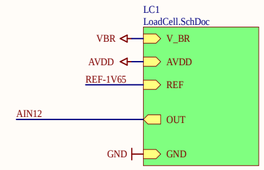
Bridge excitation voltage is 10V, and each load cell draws 35mA max

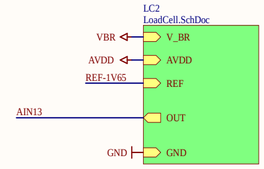


Presure transducer supply voltage. Unclear if PTs have amps or not? Unclear how much power they draw. Consider changing to an ADP7142 to simplify BOM

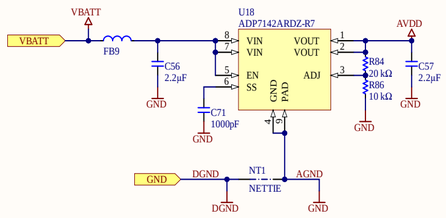




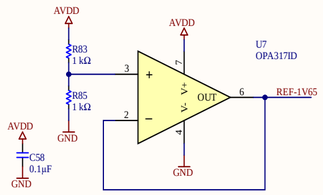




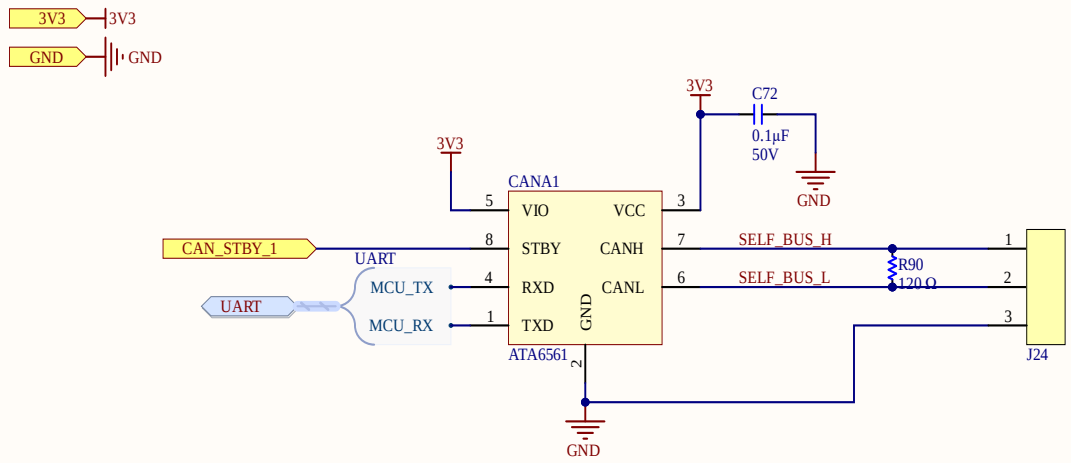
IOVDD is 3.3V, powered from top sheet
AVDD is unipolar, 3.6V from LDO



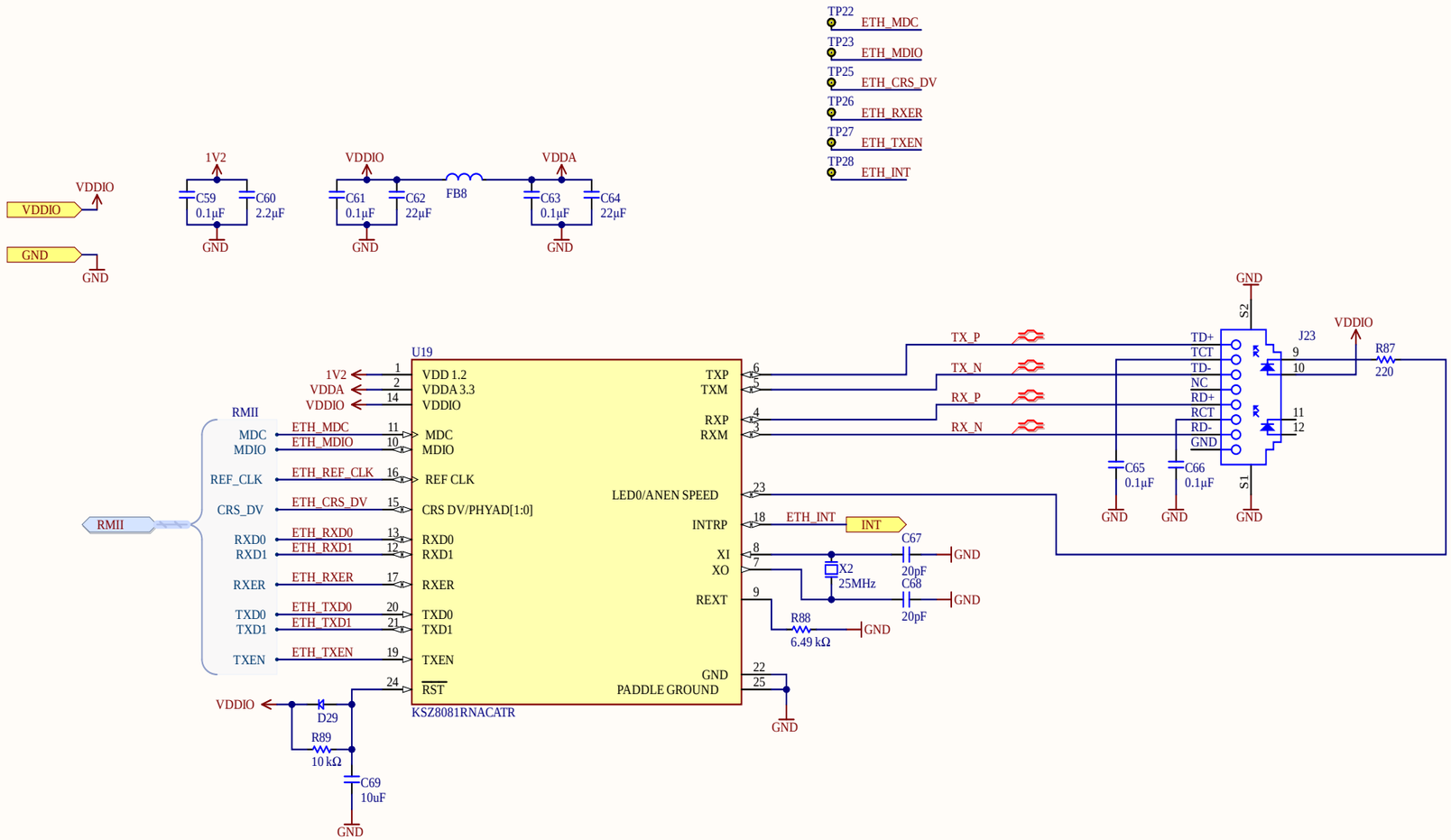
Mid-Rail reference voltage. The instrumentation amps need this to reference their outputs off of. It needs to be buffered, or the draw from connected devices will skew it.



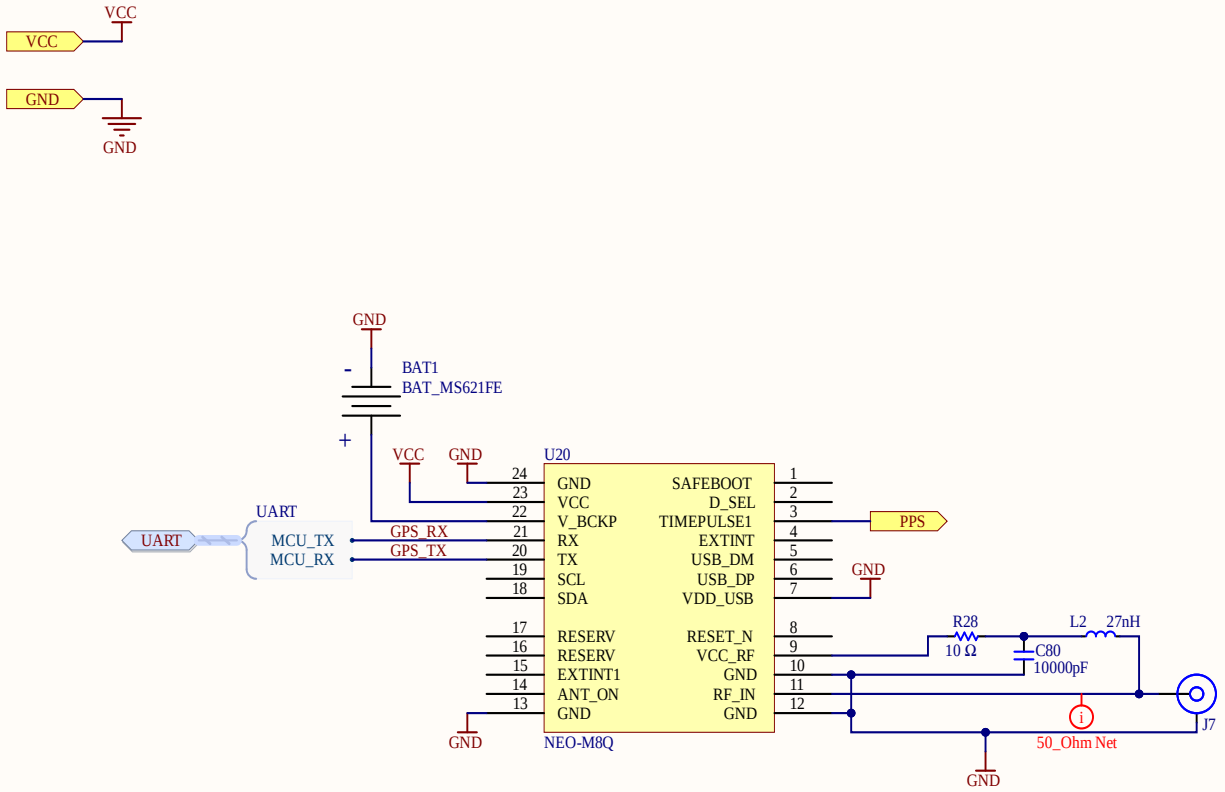
Title		
Size: A2	Number	Revision
Date: 4/10/2022		Sheet of
File: C:\Users\..\AnalogFE.SchDoc		Drawn By:



Title		
Size: A	Number:	Revision:
Date: 4/10/2022		Sheet of
File: C:\Users\..\CAN.SchDoc		Drawn By:



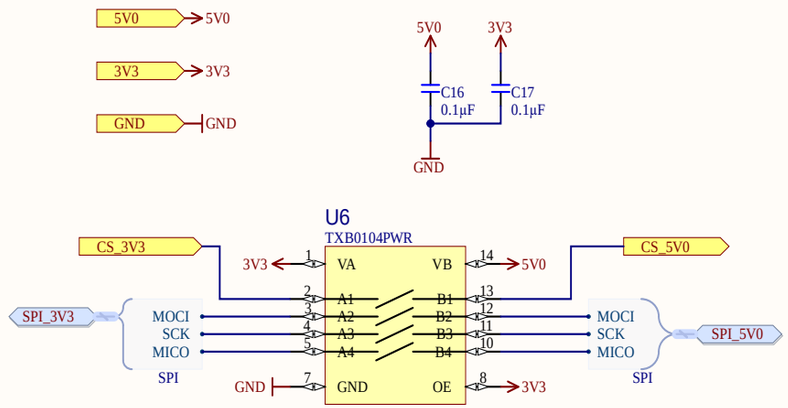
Title		
Size: A3	Number	Revision
Date: 4/10/2022		Sheet of
File: C:\Users\..\Ethernet.SchDoc		Drawn By:



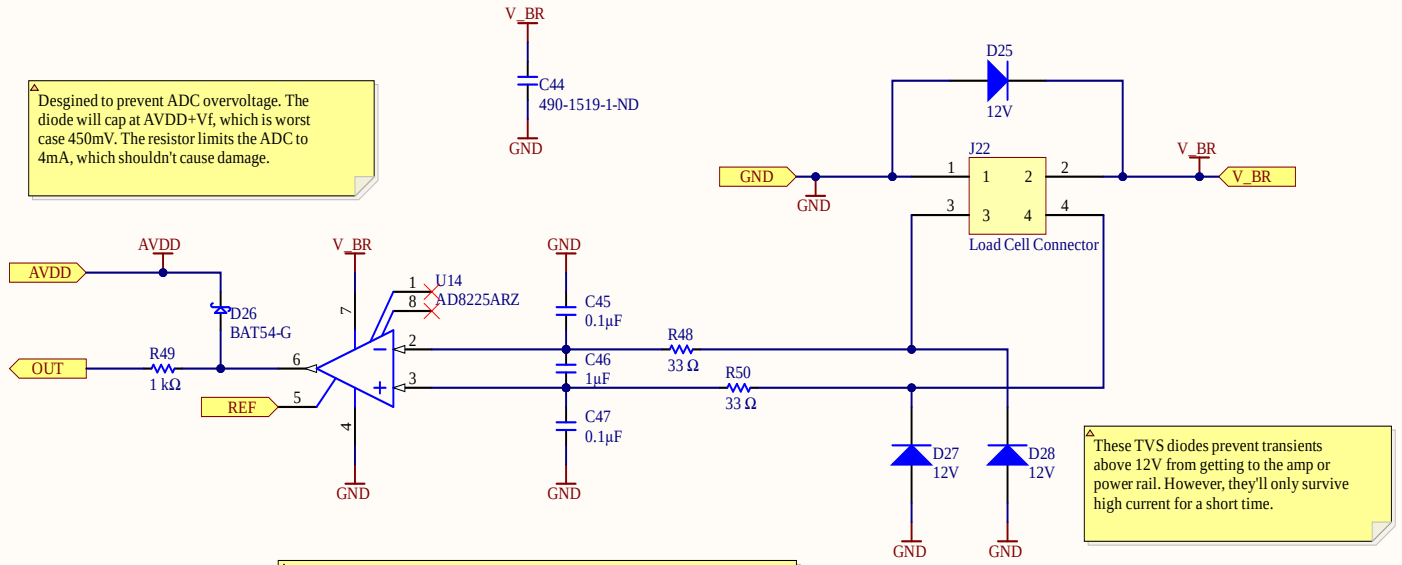
Title		
Size: A	Number	Revision
Date: 4/10/2022		Sheet of
File: C:\Users\..\GPS.SchDoc		Drawn By:

Level Shifters

The Squib Drivers operate using 5V logic, the MCU (SAMD51) uses 3.3V so the SPI interface between them needs to be converted



STANFORD STUDENT SPACE INITIATIVE ssi.stanford.edu		PROJECT	Quail
		SHEET	Misc
		ENGINEER	Tim Vrakas
		ENGINEER	
Powered By Altium	REVISION 3.0	REVIEWER	
	Sheet n of m	REVIEWED ON	

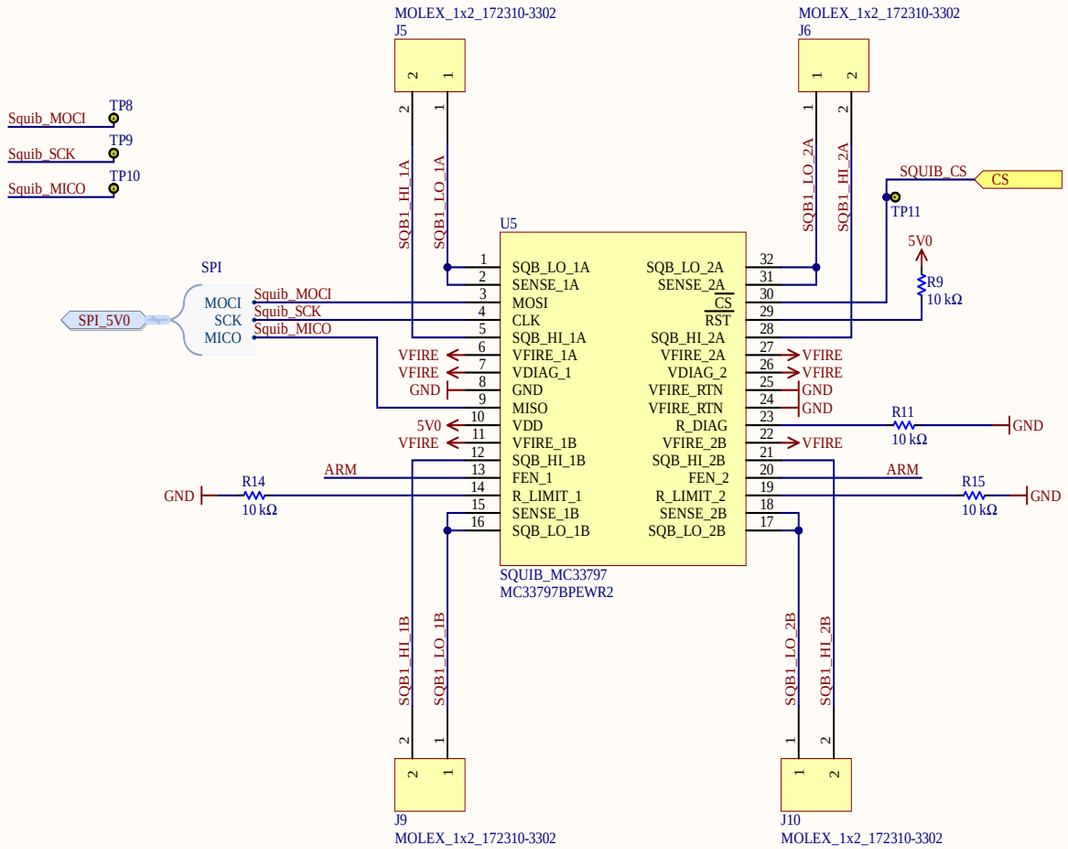


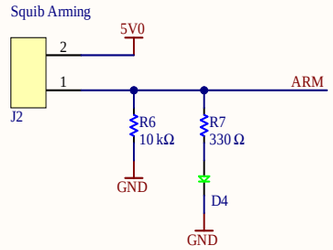
Title		
Size: A	Number	Revision
Date: 4/10/2022		Sheet of
File: C:\Users\..\LoadCell.SchDoc		Drawn By:

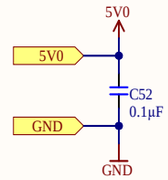
Squib Drivers

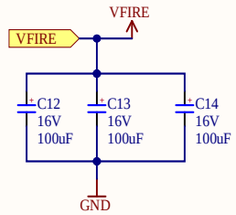
Pin 2 is Lo and Pin 1 is High on all connectors

R Limit Calc: Ematch R=2ohm, wire is around 2-5ohm depending on length.
Recommended current is around 1 A
RSet = 10k sets limit to 1.4A

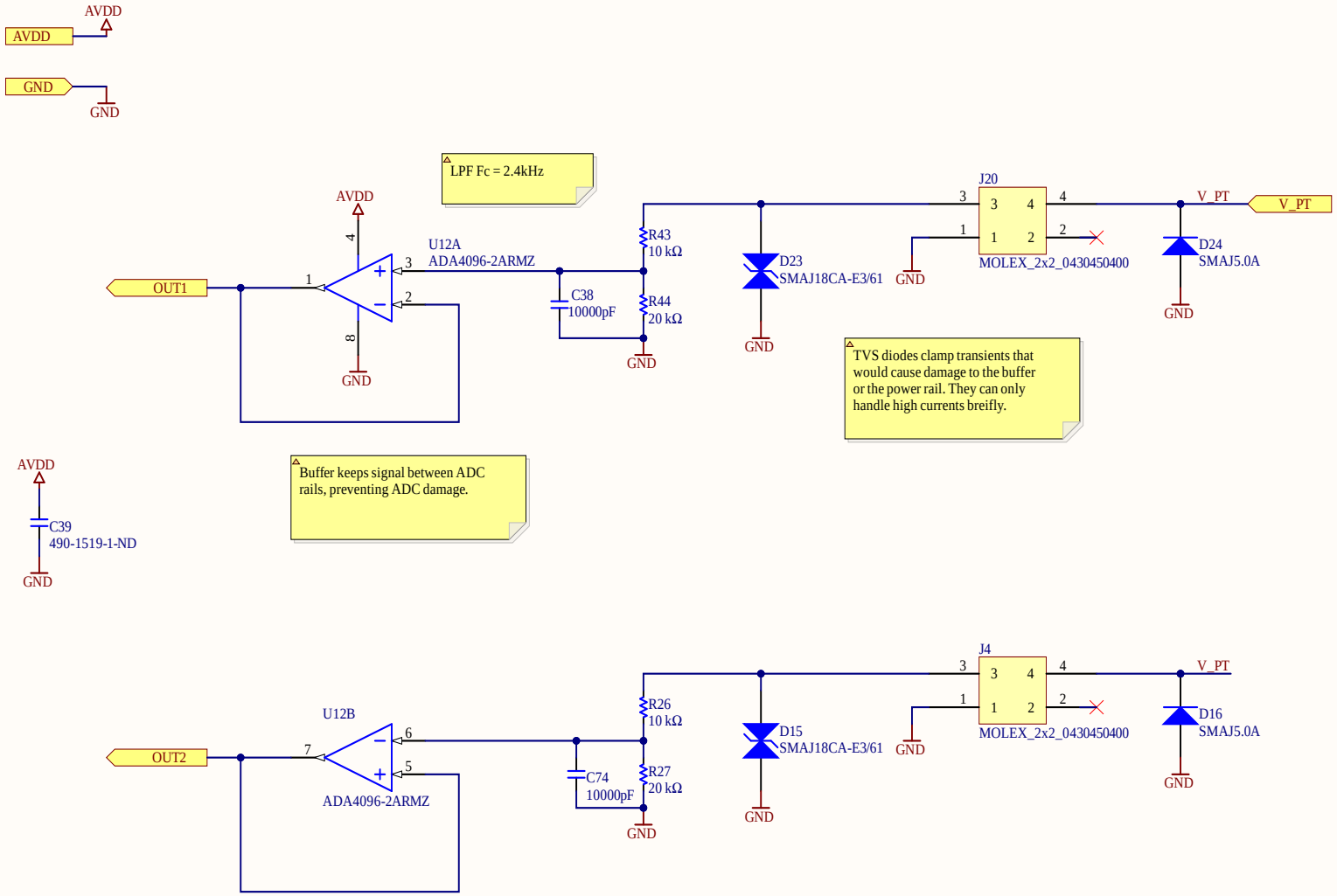








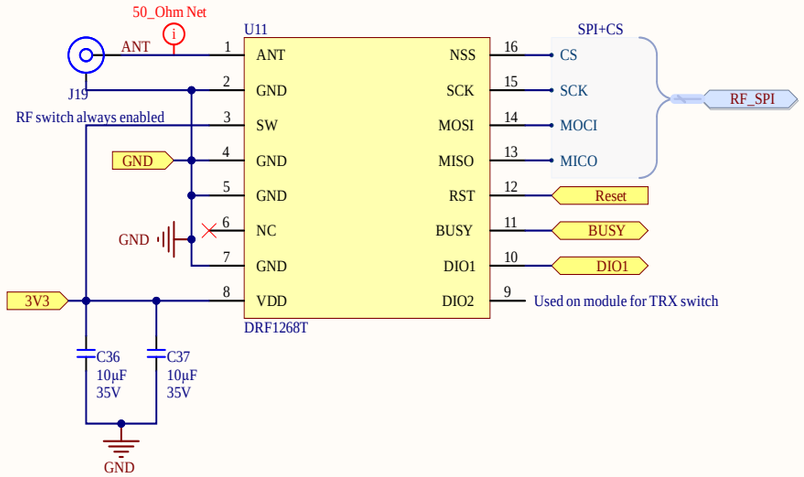
STANFORD STUDENT SPACE INITIATIVE ssi.stanford.edu		PROJECT	Quail
		SHEET	Squibs
		ENGINEER	Tim Vrakas
		ENGINEER	
Powered By Altium	REVISION 3.0	REVIEWER	
	Sheet n of m	REVIEWED ON	



Title		
Size: A	Number	Revision
Date: 4/10/2022		Sheet of
File: C:\Users\..\PressureTransducer.SchDoc		Drawn By:

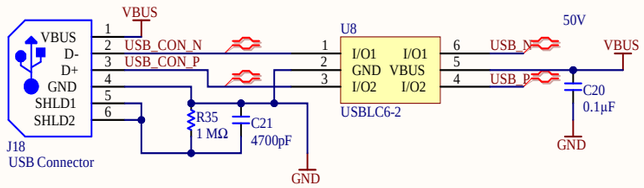
Radio Module

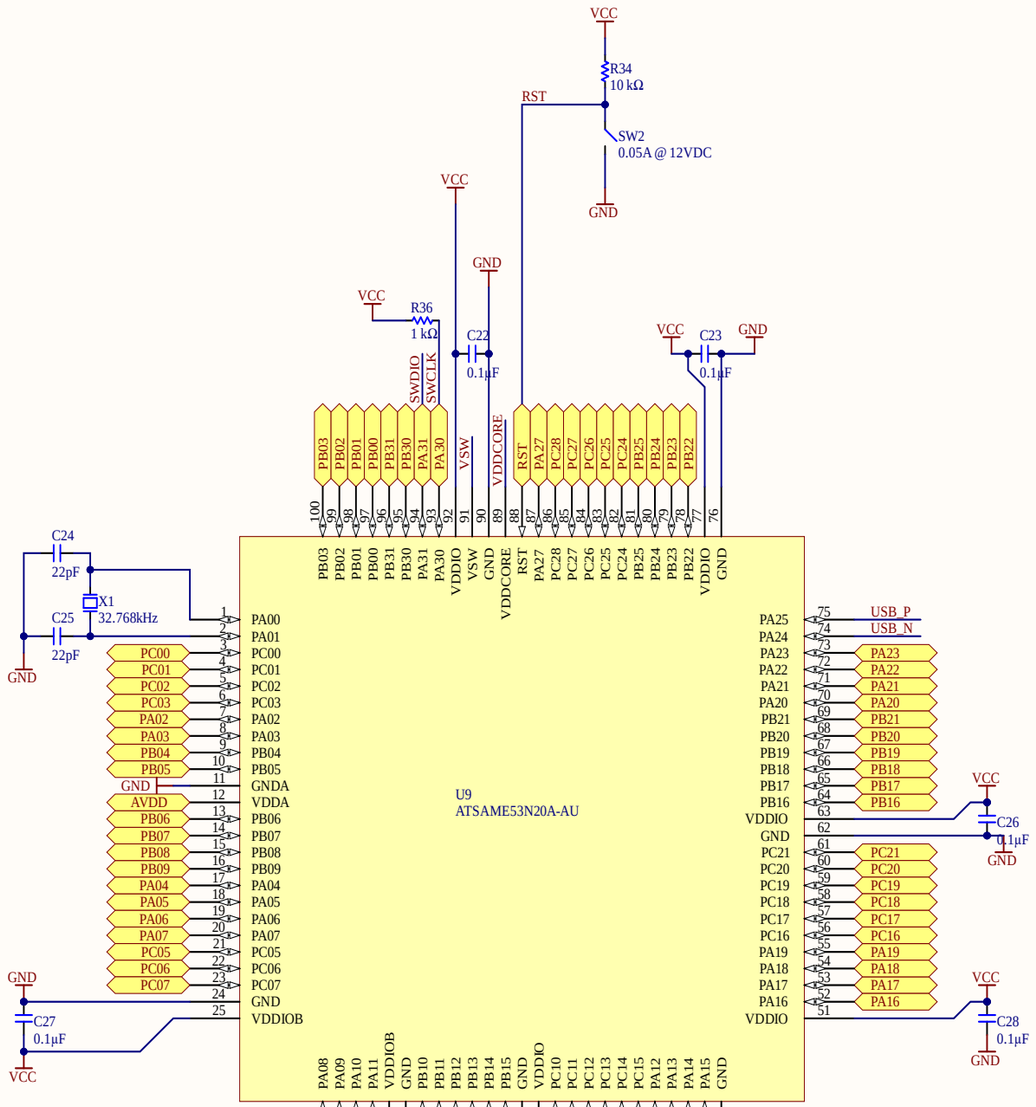
Radio for wireless communiactions
Dorji DRF1268T being used

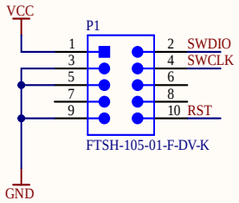


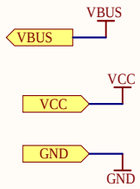
(G)FSK/4(G)FSK/LoRa Modulation
433Mhz transceiver
Max.22dBm output power
-147dBm sensitivity
Standard SPI interface
Low RX current: 5.7 mA
Automatic RF sense and CAD monitor
Data Rate: <300 kbps
Standby current: <1uA
Supply voltage: 3.3V

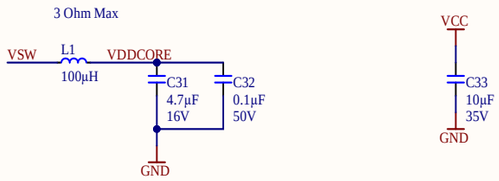
STANFORD STUDENT SPACE INITIATIVE ssi.stanford.edu		PROJECT	Quail
		SHEET	*
		ENGINEER	Tim Vrakas
		ENGINEER	
Powered By Altium	REVISION 3.0	REVIEWER	
	Sheet * of *	REVIEWED ON	


VBUS
VBUS
D-
D+
GND
SHLD1
SHLD2
USB_CON_N
USB_CON_P
R35
1 MΩ
C21
4700pF
J18
USB Connector
GND
U8
I/O1
GND
I/O2
I/O1
VBUS
I/O2
USBLC6-2
USB_N
USB_P
50V
VBUS
C20
0.1µF
GND

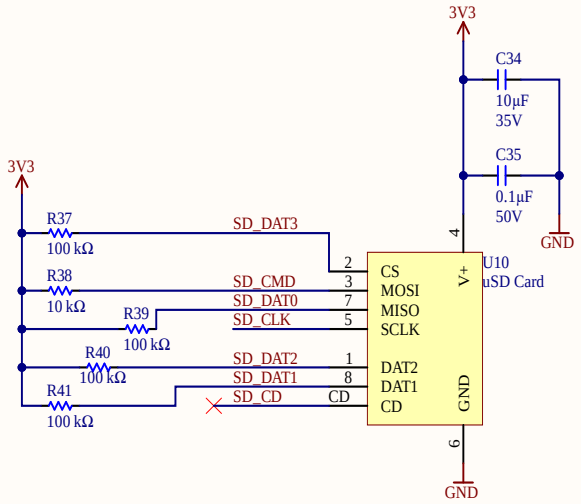

VCC
R34
10 kΩ
RST
SW2
0.05A @ 12VDC
GND
VCC
GND
VCC
R36
1 kΩ
C22
0.1µF
VCC
C23
GND
0.1µF
SWDIO
SWCLK
PB03
PB02
PB01
PB00
PB31
PB30
PA31
PA30
VSW
VDDCORE
RST
PA27
PC28
PC27
PC26
PC25
PC24
PB25
PB24
PB23
PB22
C24
22pF
X1
32.768kHz
C25
22pF
GND
PC00
PC01
PC02
PC03
PA02
PA03
PB04
PB05
GND
AVDD
PB06
PB07
PB08
PB09
PA04
PA05
PA06
PA07
PC05
PC06
PC07
GND
VDDIOB
PA00
PA01
PC00
PC01
PC02
PC03
PA02
PA03
PB04
PB05
GNDA
VDDA
PB06
PB07
PB08
PB09
PA04
PA05
PA06
PA07
PC05
PC06
PC07
GND
VDDIOB
U9
ATSAME53N20A-AU
PA25
PA24
PA23
PA22
PA21
PA20
PB21
PB20
PB19
PB18
PB17
PB16
VDDIO
GND
PC21
PC20
PC19
PC18
PC17
PC16
PA19
PA18
PA17
PA16
VDDIO
USB_P
USB_N
PA23
PA22
PA21
PA20
PB21
PB20
PB19
PB18
PB17
PB16
PC21
PC20
PC19
PC18
PC17
PC16
PA19
PA18
PA17
PA16
VCC
C26
0.1µF
GND
VCC
C28
0.1µF
GND
PA08
PA09
PA10
PA11
VDDIOB
GND
PB10
PB11
PB12
PB13
PB14
PB15
GND
VDDIO
PC10
PC11
PC12
PC13
PC14
PC15
PA12
PA13
PA14
PA15
GND
VCC
C29
0.1µF
GND
C30
0.1µF
50V
VCC

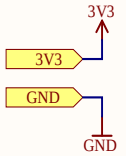

VCC
P1
SWDIO
SWCLK
RST
FTSH-105-01-F-DV-K
GND

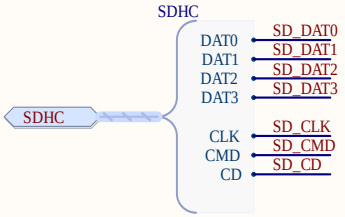

VBUS
VBUS
VCC
VCC
GND
GND


3 Ohm Max
VSW
L1
100µH
VDDCORE
C31
4.7µF
16V
C32
0.1µF
50V
GND

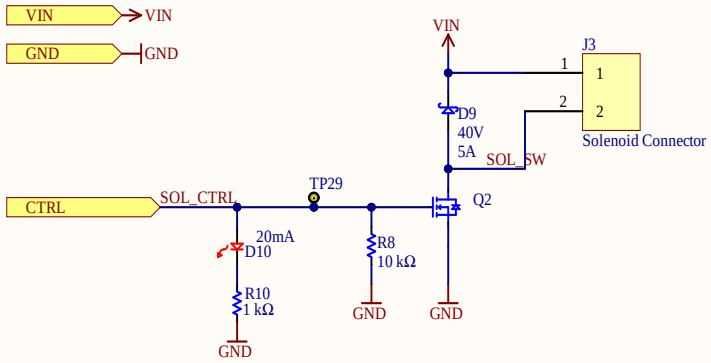
VCC
C33
10µF
35V
GND



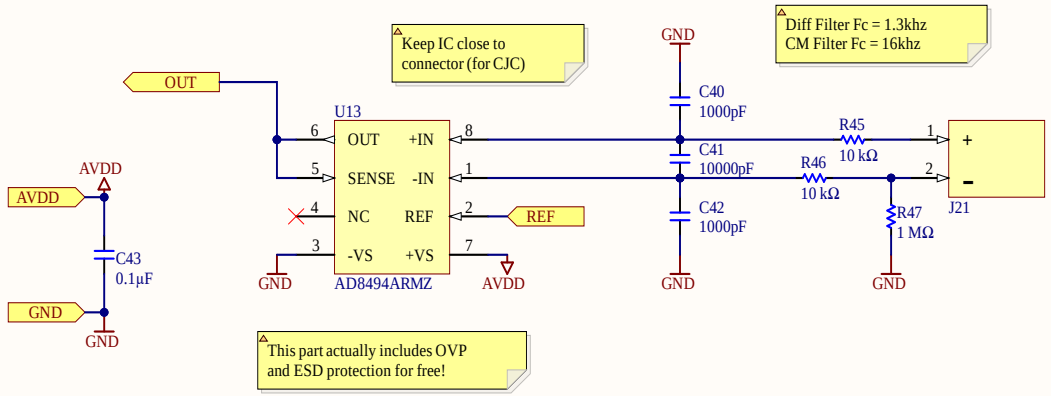




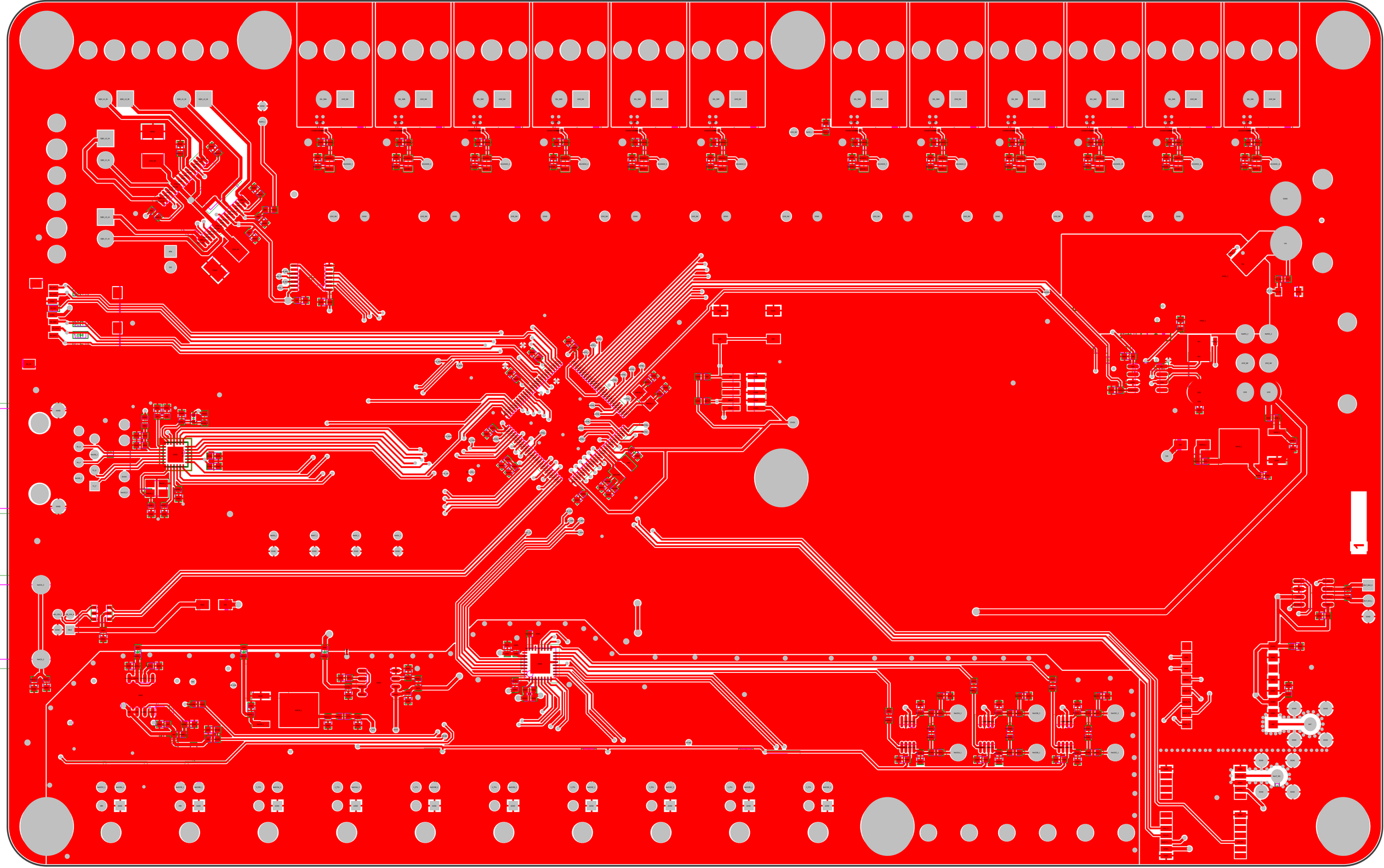
Title *			
Size: A4	Number: *	Revision: *	
Date: 4/10/2022	Time: 2:16:04 AM	Sheet * of *	
File: C:\Users\timv\Documents\Quail_Hardware\SD.SchDoc			

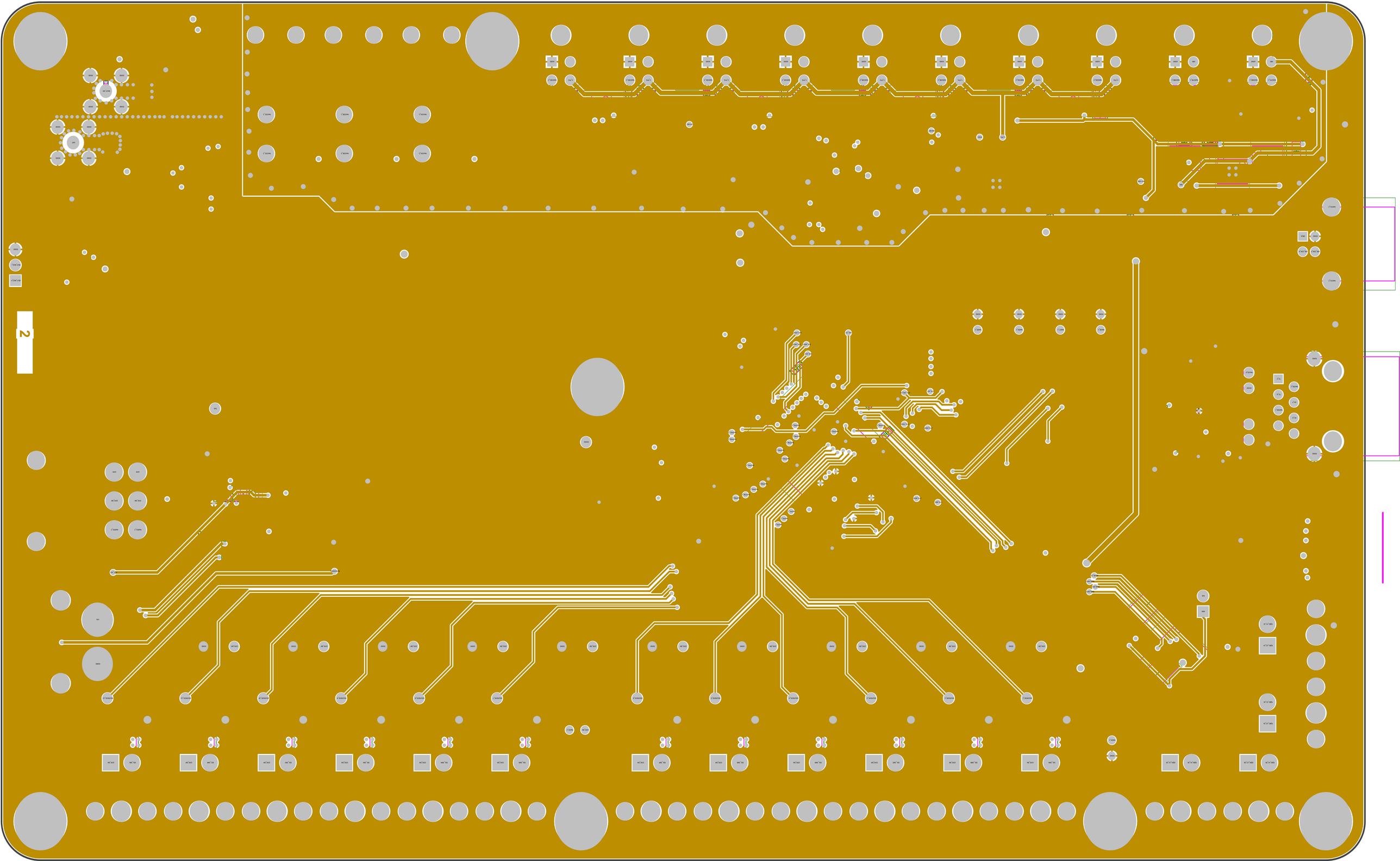


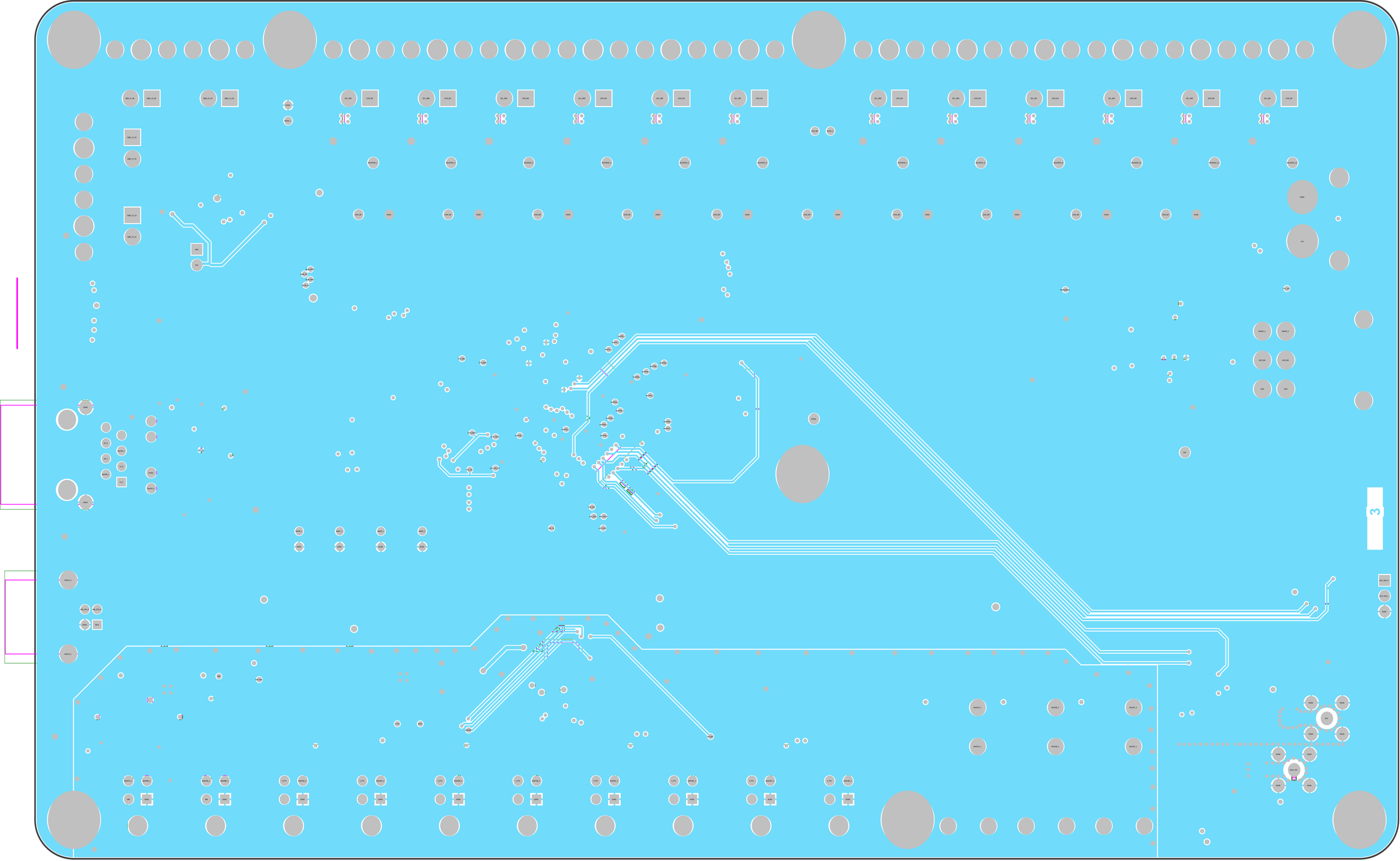
Title		
Size: A	Number	Revision
Date: 4/10/2022		Sheet of
File: C:\Users\..\Solenoid.SchDoc		Drawn By:

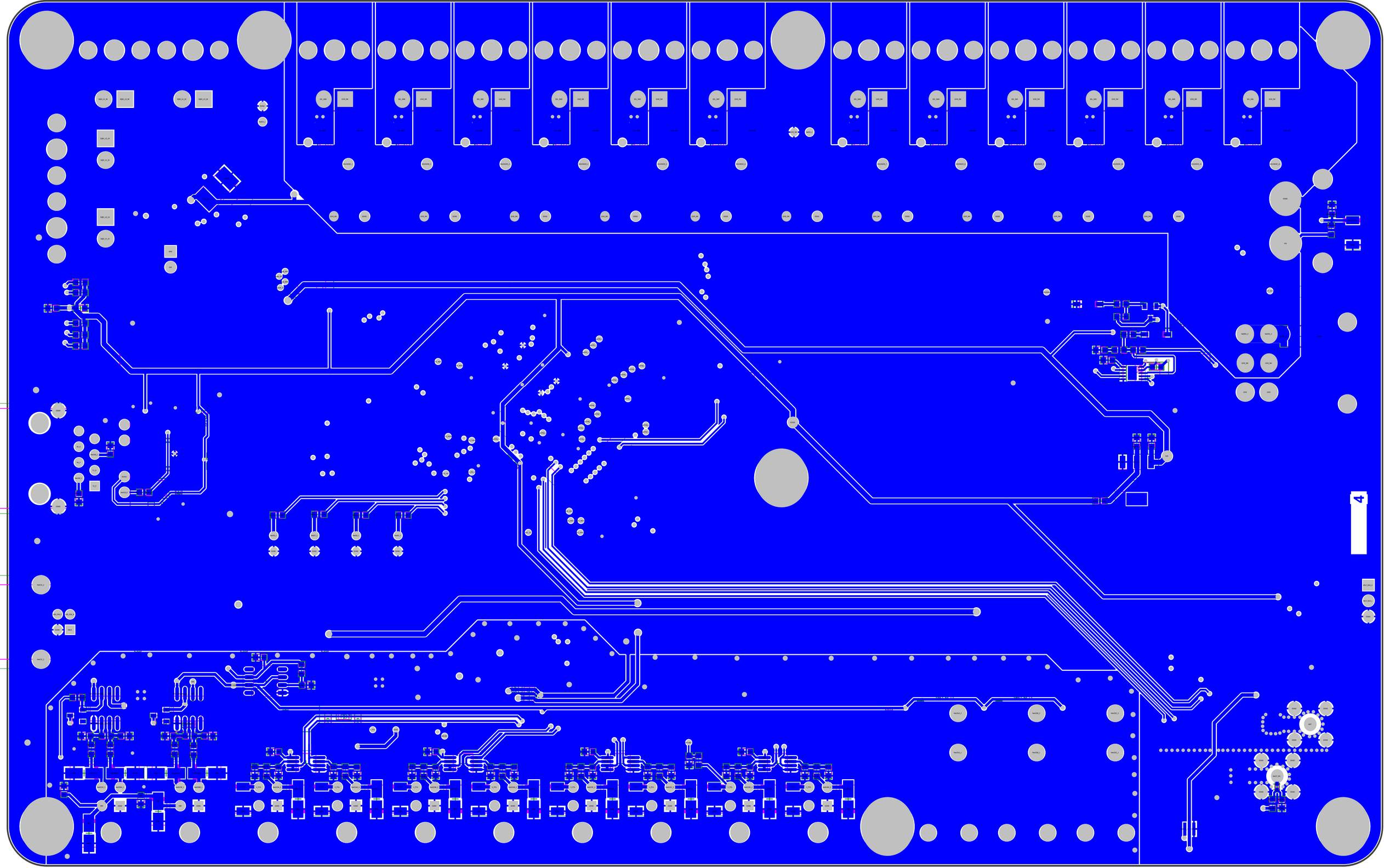


Title		
Size: A	Number	Revision
Date: 4/10/2022		Sheet of
File: C:\Users\..\Thermocouple.SchDoc		Drawn By:








4

Quail v3.1

Tim Vrakas

Bay Area CIRCUITS

KEYSIGHT TECHNOLOGIES

STANFORD STUDENT SPACE INITIATIVE

HARWiN

Altium

AUTODESK

E1 E2 E3 E4

S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12

12V IN

ON | OFF

RESET

SWD

ETHERNET

USB

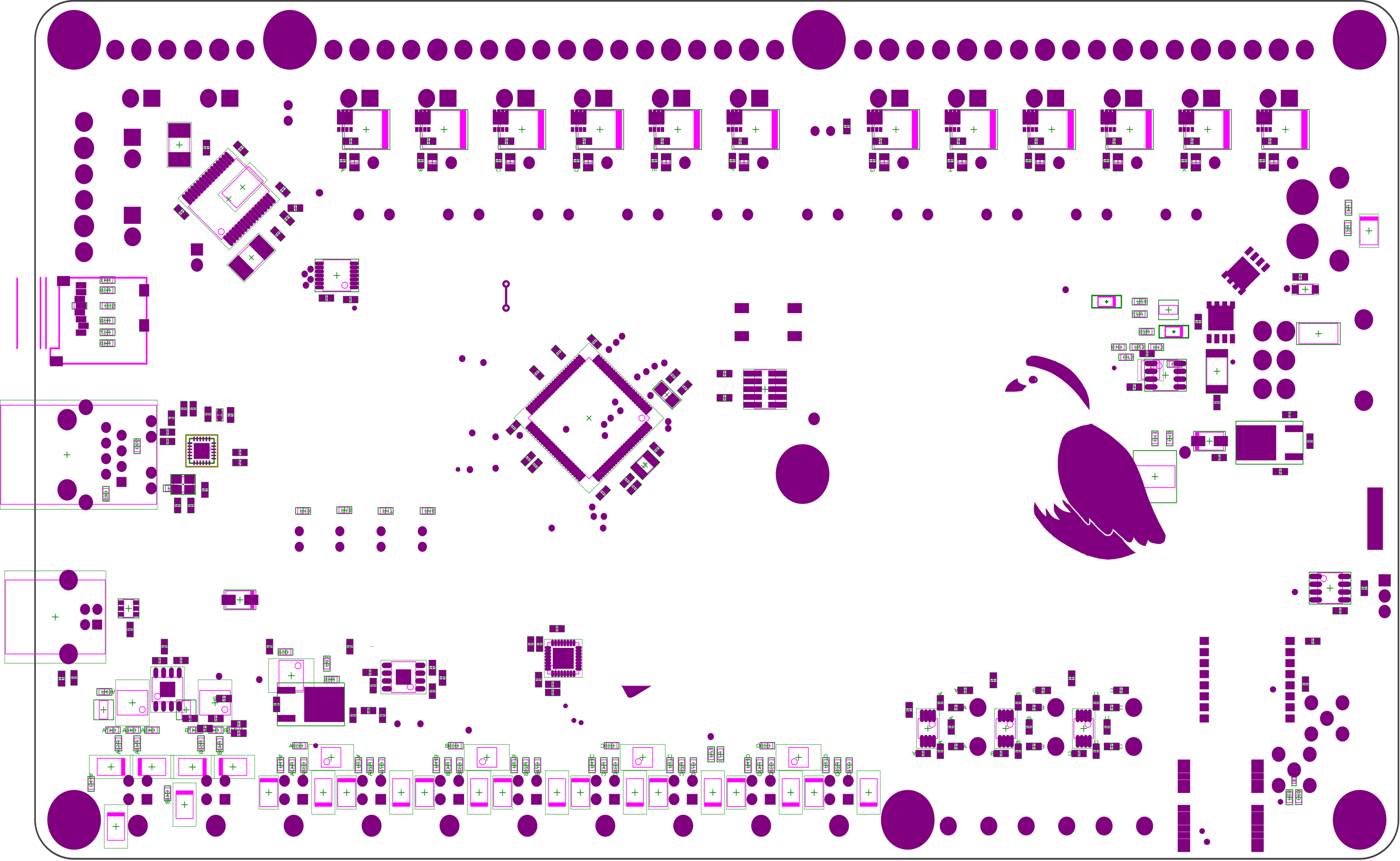
CAN

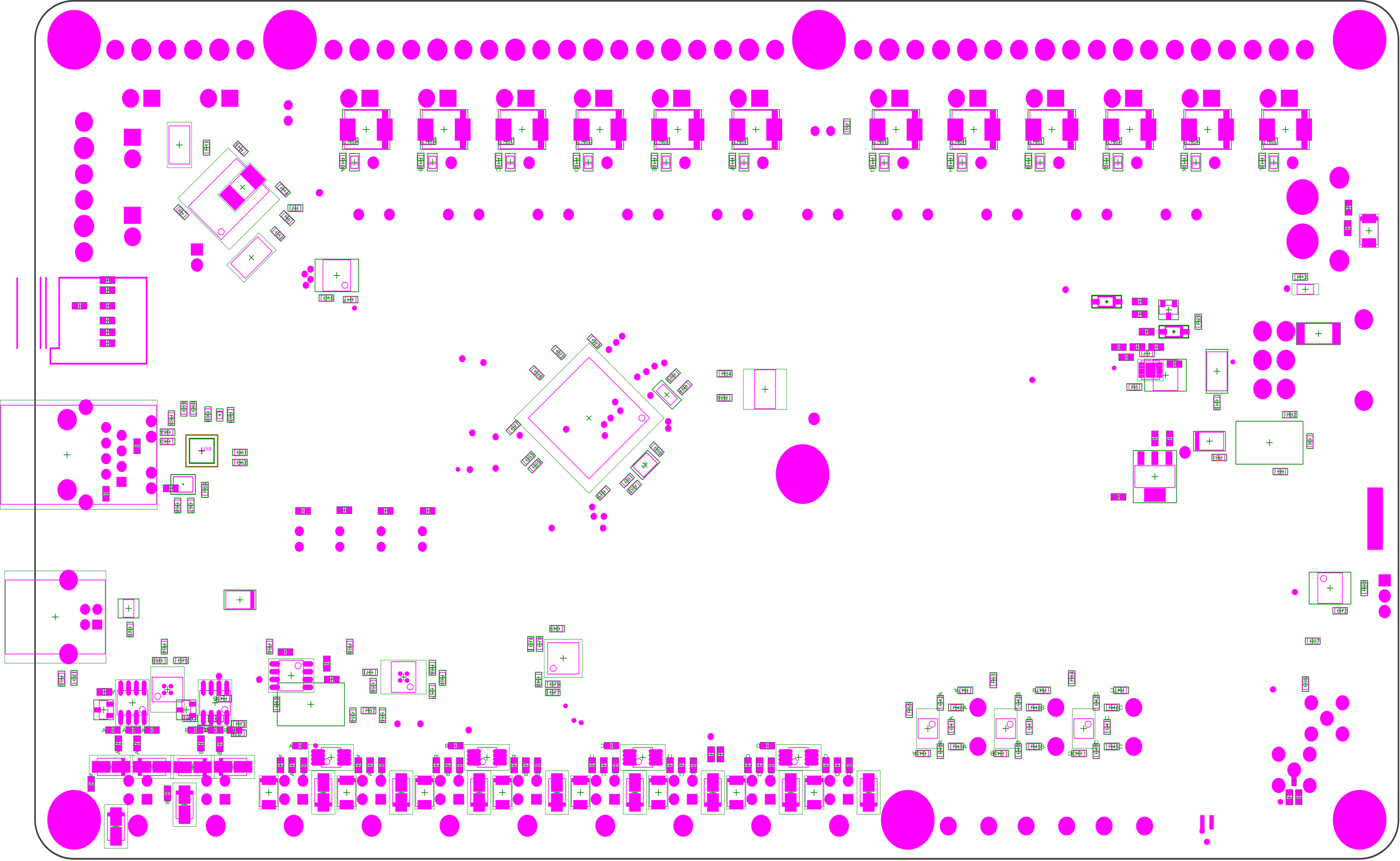
TELEM

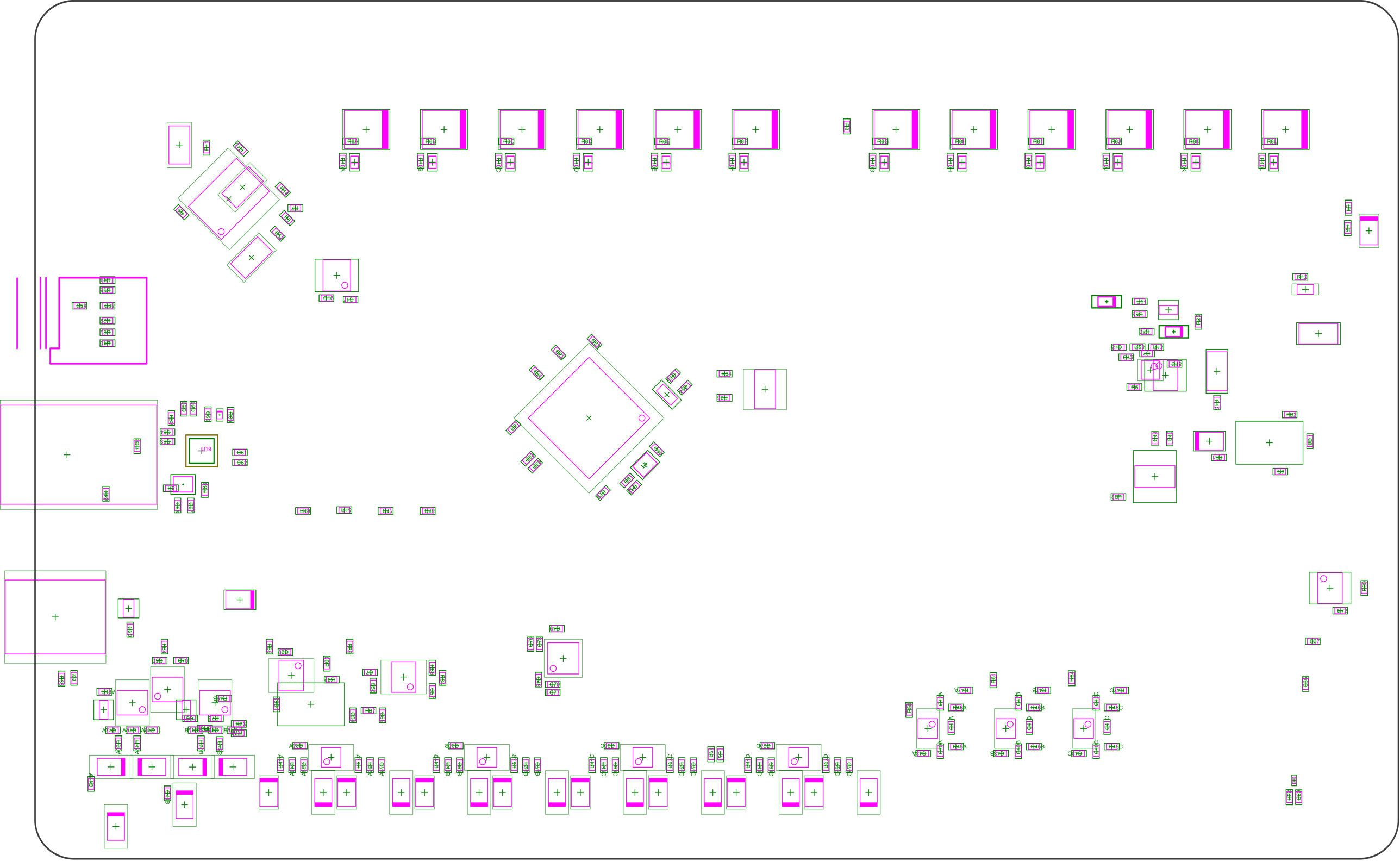
GPS

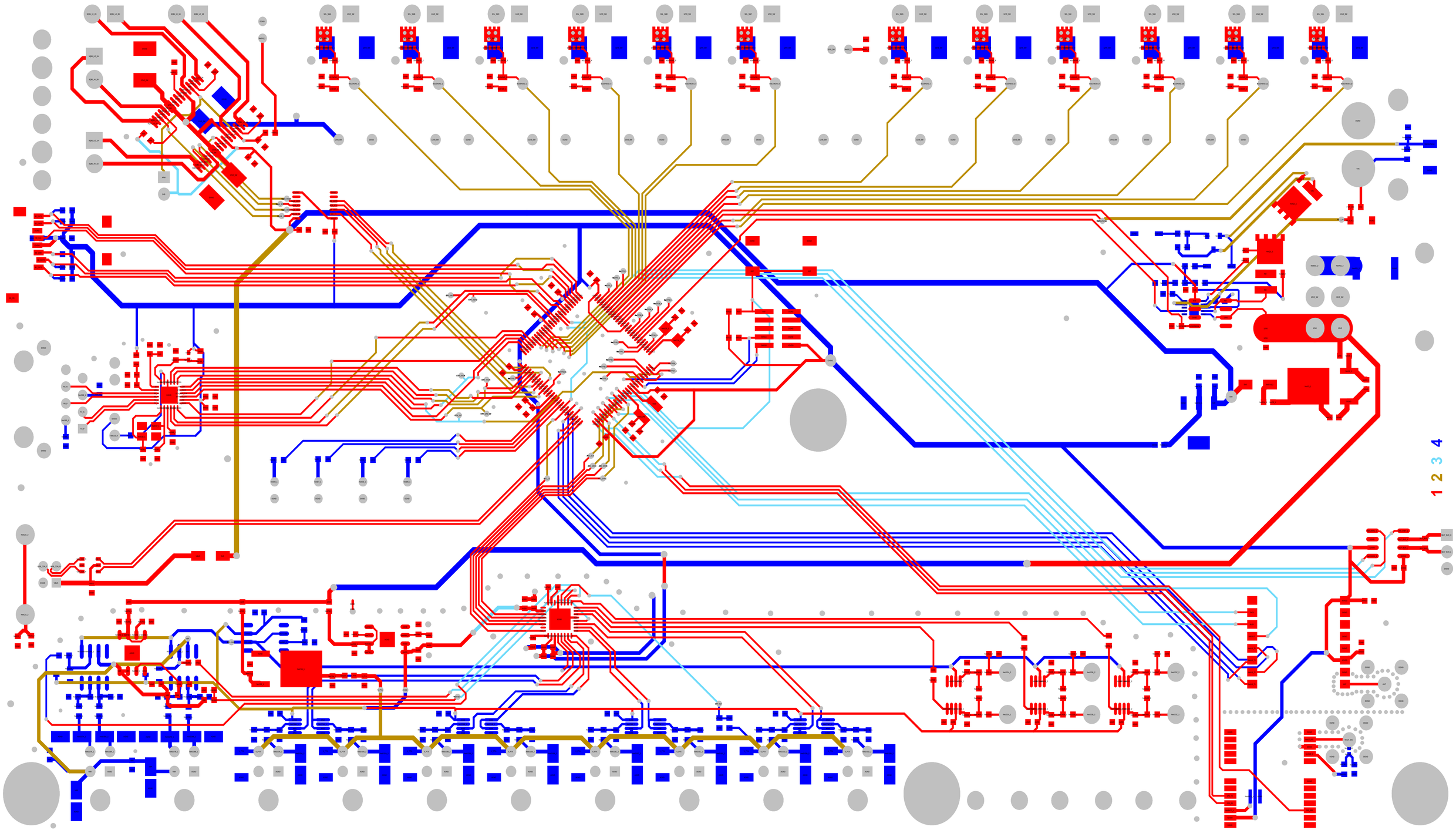
TC1 TC2 TC3

PT1 PT2 PT3 PT4 PT5 PT6 PT7 PT8








1
2
3
4