Peripherals Mapping
U0(UART 0) - Debug/Prgm
U2(UART 2) - RS485 CEA2045
VSPI(SPI3) - GPS and LCD (can do UART to GPS if desired)

TODO:
* Replace Crystal and crystal caps with own part - check crystal caps values

Naming The Power Nets

3.3V 5V GND

GPS
GPS.SchDoc
RST CS SPI PPS
SPI_CS0 SPI GPS_PPS

UI
UI.SchDoc
LCD_RST LCD_I2C BTN[1..4]
LCD_RST I2C BTN[1..4]

LoRa
LoRa.SchDoc
SPI CS RST DIO[0..5]
SPI SPI_CS1 LoRa_RST DIO[0..5]

Accessories
Accessories.SchDoc
RS485 I2C 60HzAntRef 60HzAnt Leak MIC CT GPIO[1..8]
RS485_TX RS485_RX RS485_DE RS485_DE Leak Mic CT GPIO[1..8]

A2
60Hz Pickup

Power
Power.SchDoc
60HzAnt 60Hz 60HzAntRef
60Hz

JP5

Mechanical
Mechanical.SchDoc

Need low for Download Boot mode and used to reset IO Expander on watchdog

R1 10K
R3 10K
C1 22uF
C2 C3
X1

ESP WROOM 32 Module
IO0 IOE_RST IOE_INT SPI_CS0 GPIO1/SPI2_MISO GPIO2/SPI2_MOSI GPIO3/SPI2_SCK GPIO4/SPI2_CS0 RS485_RX RS485_TX SPI_SCK SPI_MISO SPI_CS1 RS485_DE SPI_MOSI I2C_SDA I2C_SCL Voltage GPS_PPS 60Hz
SPI SCK MISO MOSI
ADC2
EN SENSOR_VP SENSOR_VN RXD0 TXD0 SD0 SD1 SD2 SD3 CMD CLK NC GND_PAD

UART and Boot
UART.SchDoc
MCU_BOOT MCU_EN MCU_RX MCU_TX
IO0 MCU_EN MCU_RX MCU_TX
CT Leak/Mic ADC1

CTA2045 Low-Voltage Needs The Following:
SCK
MOSI
MISO
SELECT (SPI CS to slave module)
ATTENTION (interrupt to master)
RESET (slave module)

CTA2045 High-Voltage Needs The Following:
RS485 +
RS485 -

P1
Raspberry Pi Zero Mate
I2C_SDA I2C_SCL MCU_RX MCU_TX IO0 MCU_EN 60Hz GPS_PPS

IO Expander

U1B
I2C 16CH IO Expander
BTN[1..4] GPIO[1..8] DIO[0..5] LCD_RST LoRa_RST
GPA0 GPA1 GPA2 GPA3 GPA4 GPA5 GPA6 GPA7 GPB0 GPB1 GPB2 GPB3 GPB4 GPB5 GPB6 GPB7

U1A
I2C 16CH IO Expander
IOE_RST IOE_INT INTA INTB I2C_SCL I2C_SDA
RESET Vdd Vss SCL SDA INTA INTB A0 A1 A2 NC NC

U2B
Single OR Gate
IOE_INT A B Y

U2A
Single OR Gate

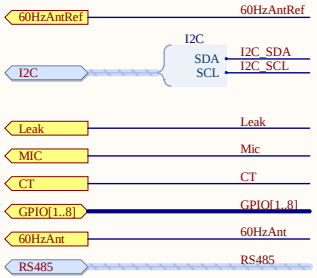
C4 10uF
C5 10000pF

U10
Mic Leak B2 GND B1 S VCC A BTN4 Leak/Mic

I2C Pullups
R4 4.7K R5 4.7K
I2C SDA SCL I2C_SDA I2C_SCL

Title	Main	
Size: B	Number:	Revision: 1.1
Date: 5/1/2018	Sheet of	
File: C:\Users\..\Main.SchDoc	Drawn By: Craig Hesling	

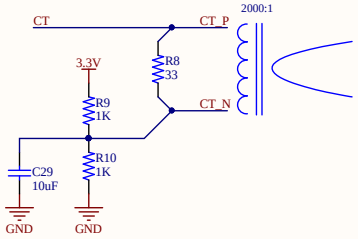
Main Board Interface



The accessories interface was designed around being able to run a CTA2045 Low Power interface(SPI + 2 IO pins) and two relays.

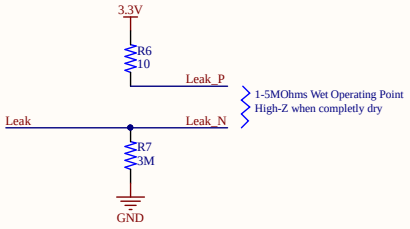
Other potentially useful protocols, like I2C, RS485, and sensor controls have also been exposed into the header.

Current Transformer

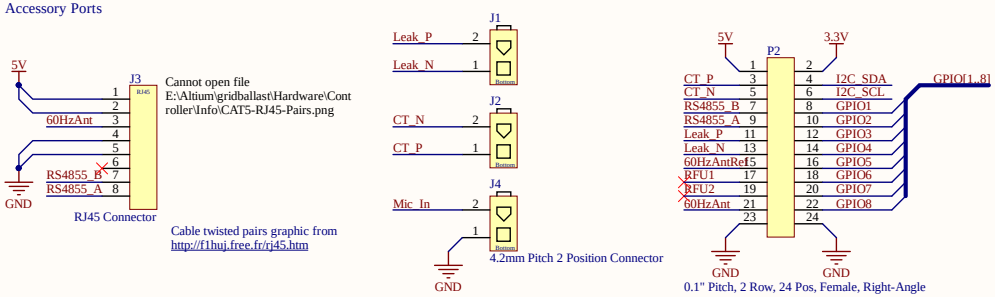


Leak Detection Cable

The cable seems to operate between 1 to 5MOhms
Note that it goes high-Z when completly dry



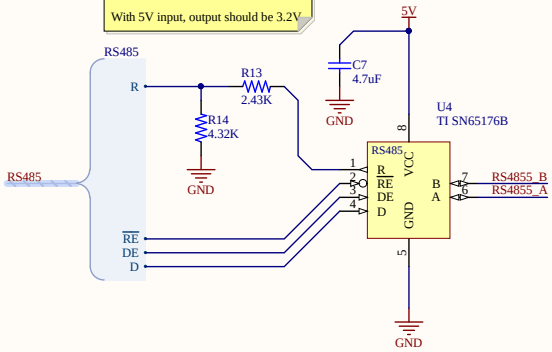
Accessory Ports



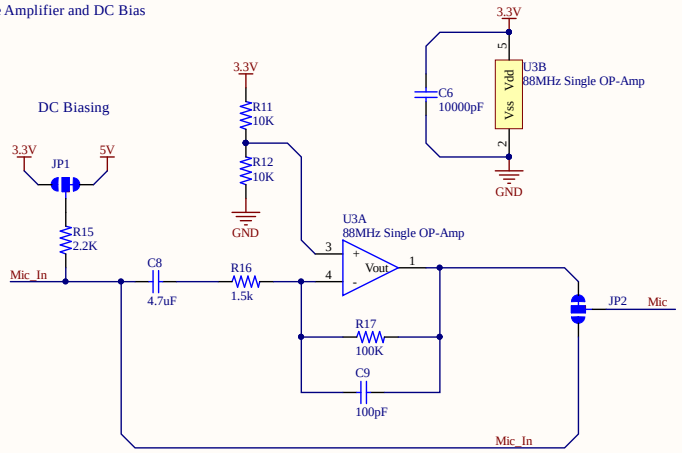
RS485 Tranceiver

We assume that the interface will be 3.3V levels.
We use a voltage divider for the receiver bit and assume that 3.3V will be high enough to trigger a high signal in the RS485 chip.

With 5V input, output should be 3.2V

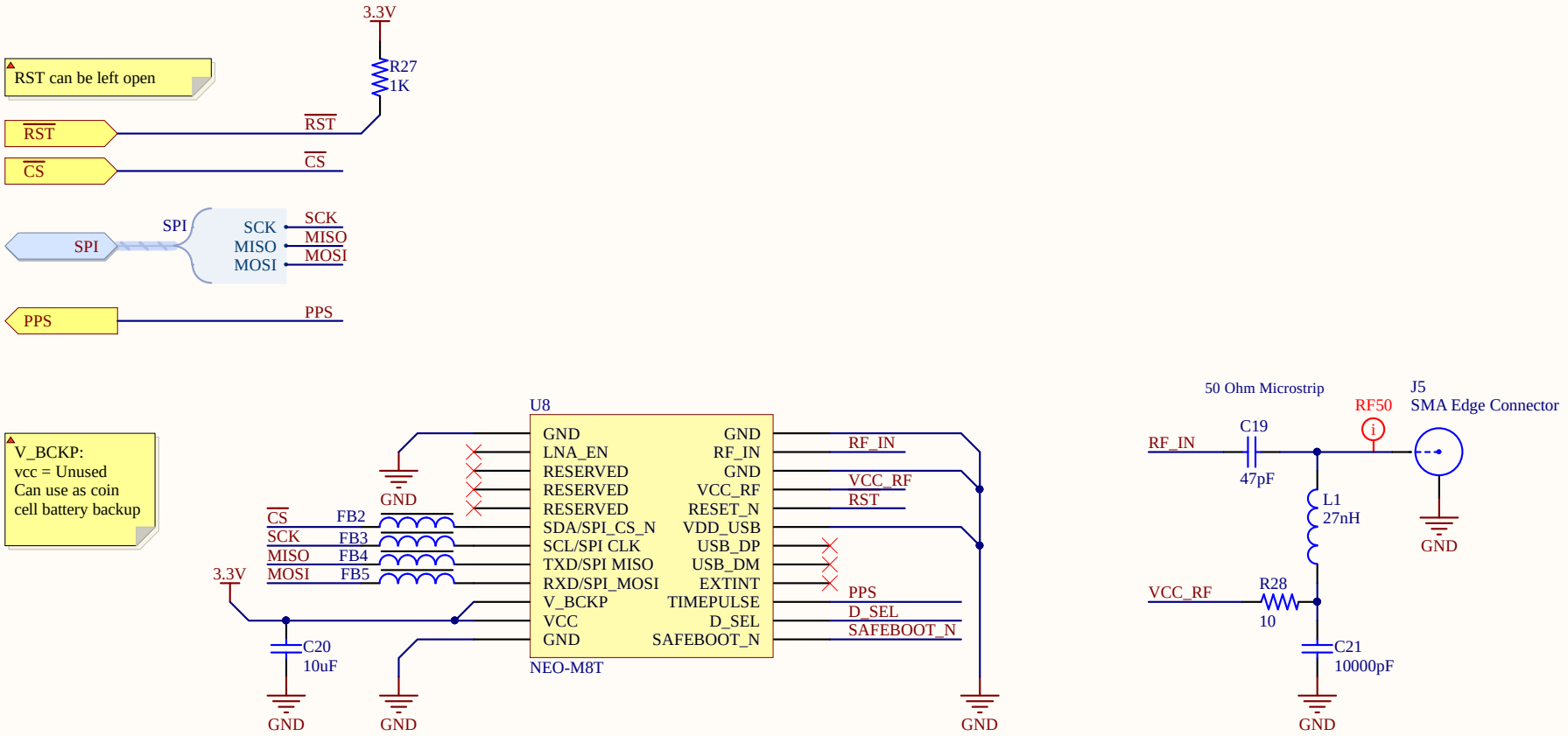


Microphone Amplifier and DC Bias

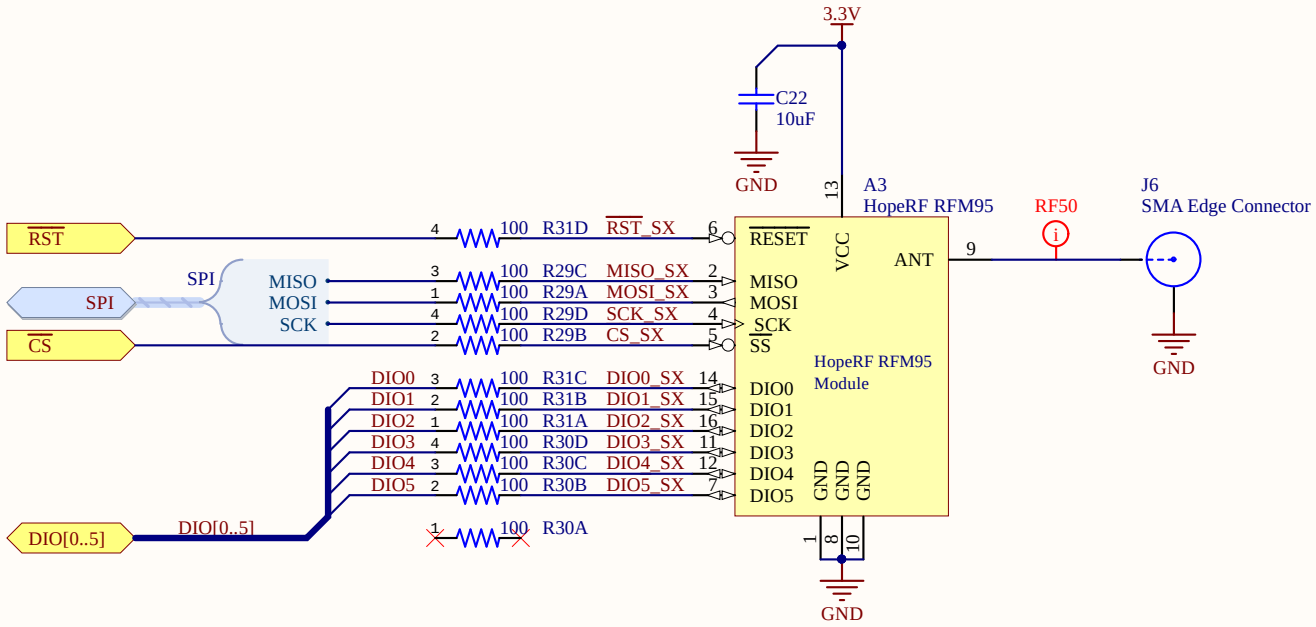


JASON COHN/REUTERS

Title: Accessories		
Size: B	Number:	Revision: 1.1
Date: 5/1/2018		Sheet of
File: C:\Users\..\Accessories.SchDoc		Drawn By: Craig Hesling



Title	GPS	
Size: A	Number:	Revision: 1
Date: 5/1/2018		Sheet of
File: C:\Users\..\GPS.SchDoc		Drawn By: Craig Hesling



Title	LoRa	
Size: A	Number:	Revision: 1
Date: 5/1/2018		Sheet of
File: C:\Users\..\LoRa.SchDoc		Drawn By: Craig Hesling

H1

1/8in Hole by 1/4in Ring Fastener

H2

1/8in Hole by 1/4in Ring Fastener

H3

1/8in Hole by 1/4in Ring Fastener

H4

1/8in Hole by 1/4in Ring Fastener

H5

1/8in Hole by 1/4in Ring Fastener

H6

1/8in Hole by 1/4in Ring Fastener

Fid1

Fiducial

Fid2

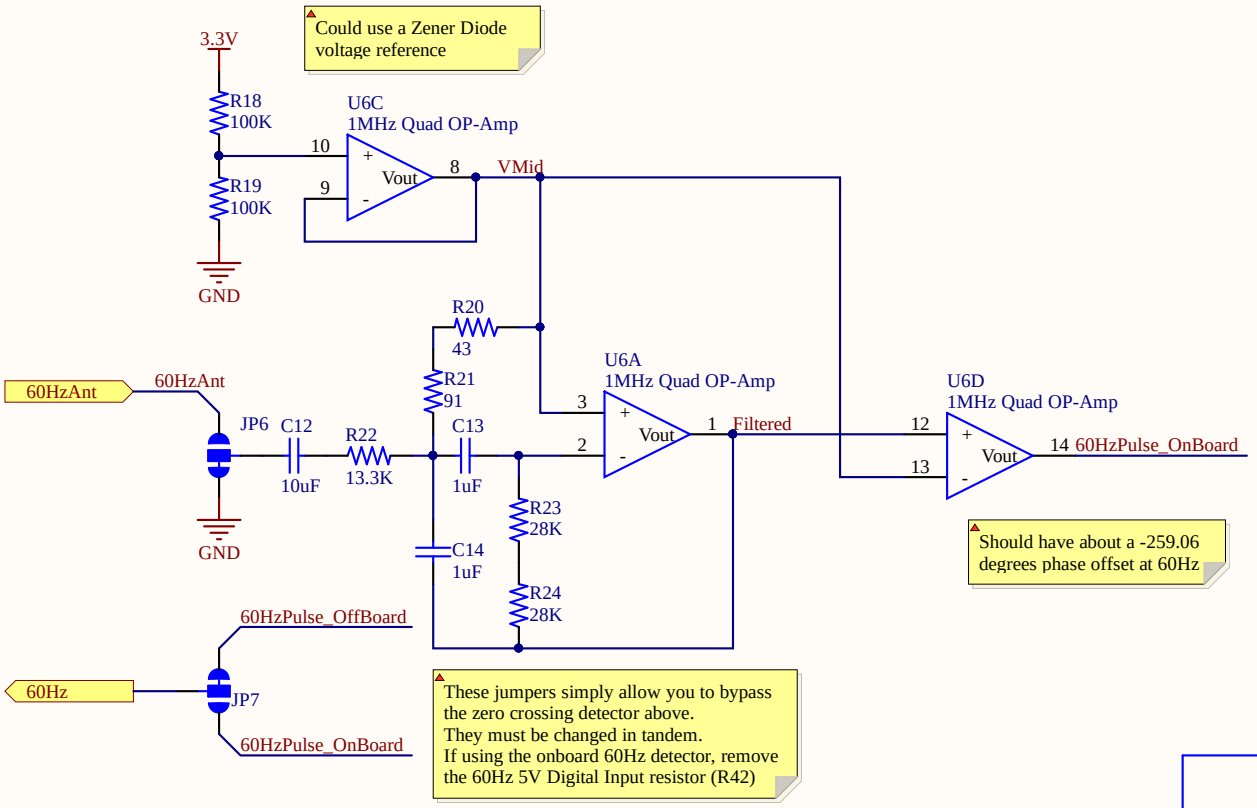
Fiducial

Fid3

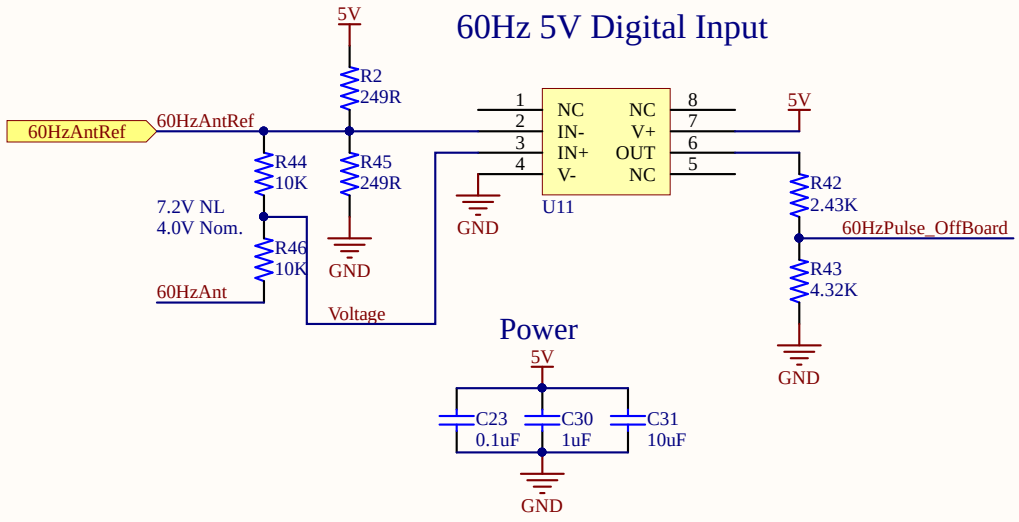
Fiducial

Title: Mechanical Parts		
Size: A	Number:	Revision: 1
Date: 5/1/2018		Sheet of
File: C:\Users\..\Mechanical.SchDoc		Drawn By: Craig Hesling

60Hz Zero Crossing Pulse

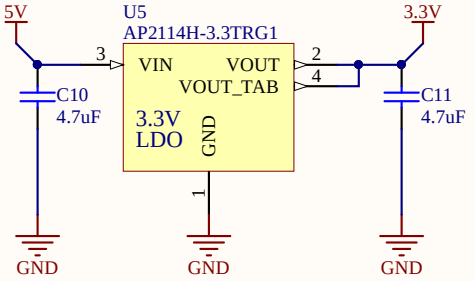


60Hz 5V Digital Input

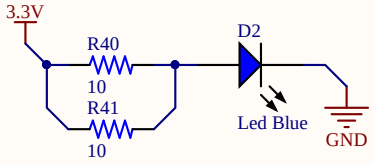


Power

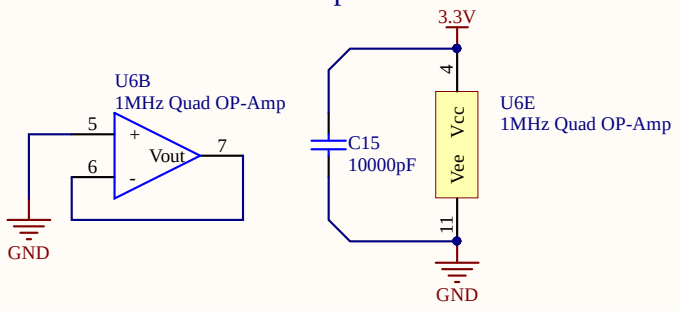
3.3V Regulation



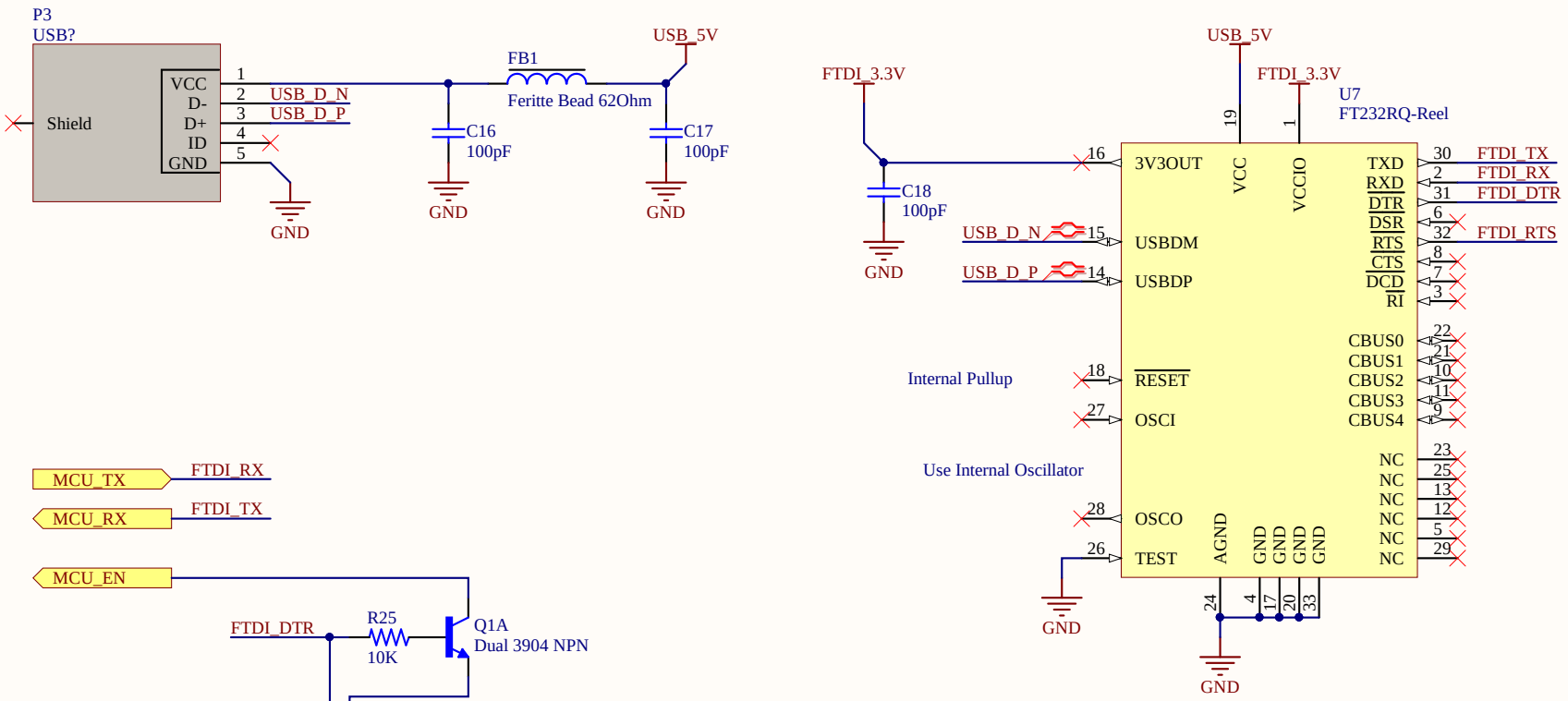
VREG Status Indicator



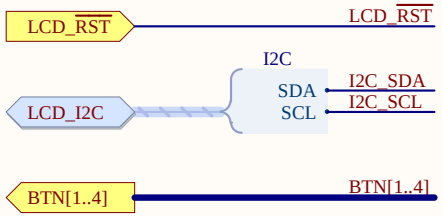
Unused OP-Amp

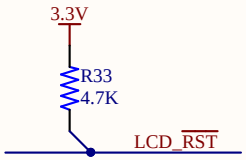


Title		
Size: A	Number:	Revision: 1.1
Date: 5/1/2018		Sheet of
File: C:\Users\..\Power.SchDoc		Drawn By: Craig Hesling



Title	UART	
Size: A	Number:	Revision: 2
Date: 5/1/2018		Sheet of
File: C:\Users\..\UART.SchDoc		Drawn By: Craig Hesling





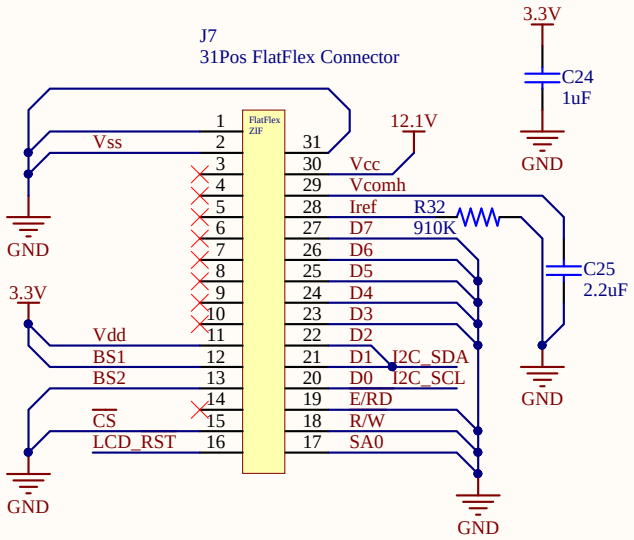
R1 = [(Vout - 3V) - 0V] / 10uA
R1 = [(12.0985V - 3V) - 0V] / 10uA
R1 = 909.853kOhms

Using Vout_min, Vout_max, and the 910kOhm 1% tolerance, we have the following:

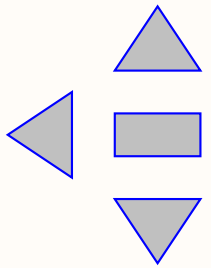
Iref_min = [(Vout_min - 3V) - 0V] / (910kOhm * (1+.01))
Iref_min = 9.66523 uA

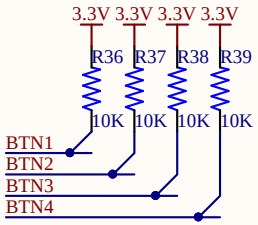
Iref_max = [(Vout_max - 3V) - 0V] / (910kOhm * (1-.01))
Iref_max = 10.3431 uA

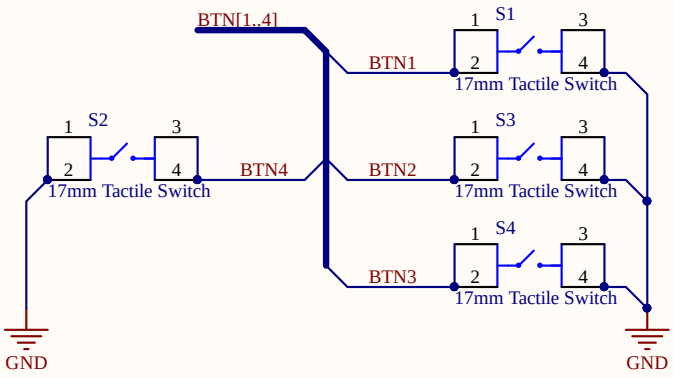
Iref_min and Iref_max are within 10uA+-2uA.



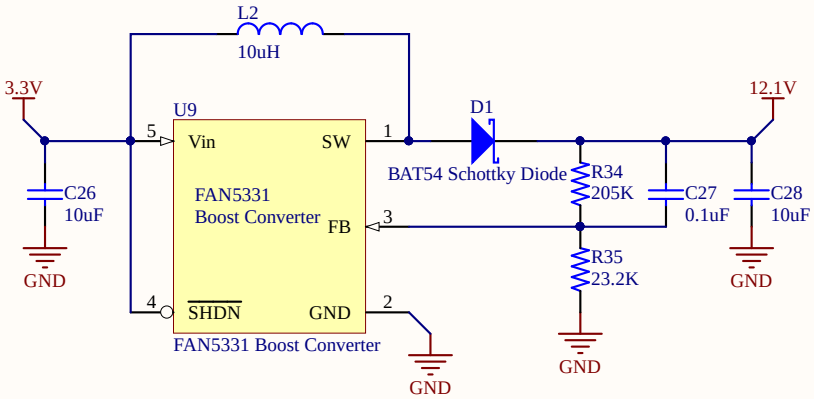
Display Navigation Buttons







This is the boost converter for the OLED's display 12.1V supply.



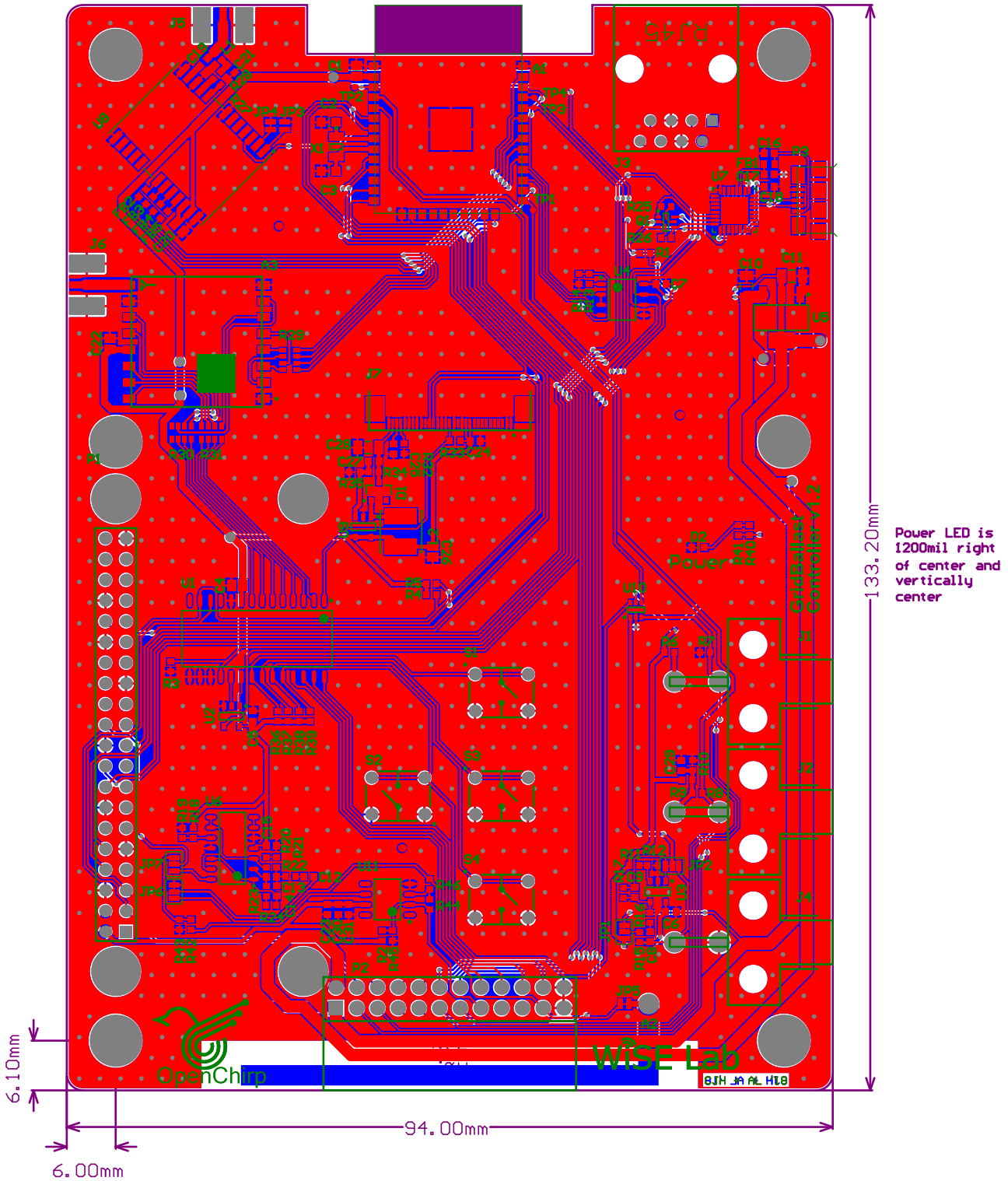
Vout = 1.23V * (1 + 205k/23.2k)
Vout = 12.0985V

Using the resistor's 1% tolerance, we have the following:
Vout_min = 1.23V * [1 + (205k * (1-.01)) / (23.2k * (1+.01))]
Vout_min = 11.8833V

Vout_max = 1.23V * [1 + (205k * (1+.01)) / (23.2k * (1-.01))]
Vout_max = 12.3181V

https://learn.adafruit.com/assets/27580

Title: User Interface		
Size: A	Number:	Revision: 1.1
Date: 5/1/2018		Sheet of
File: C:\Users\..\UI.SchDoc		Drawn By: Craig Hesling


133.20mm
Power LED is 1200mil right of center and vertically center
94.00mm
6.10mm
6.00mm
GridBlast Controller-V1.2
Power
OpenChirp
WiSE Lab