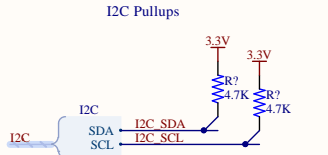
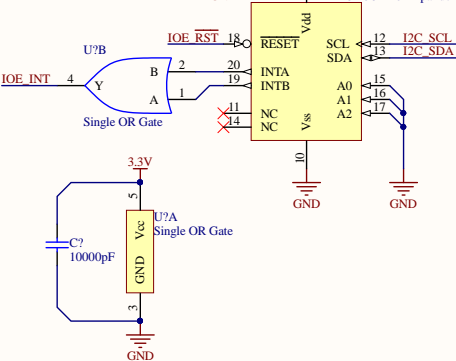
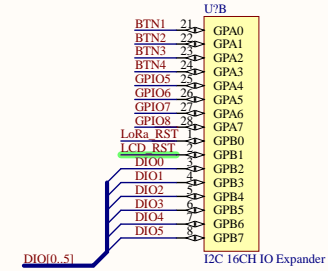
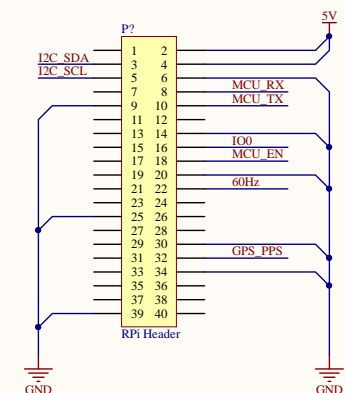
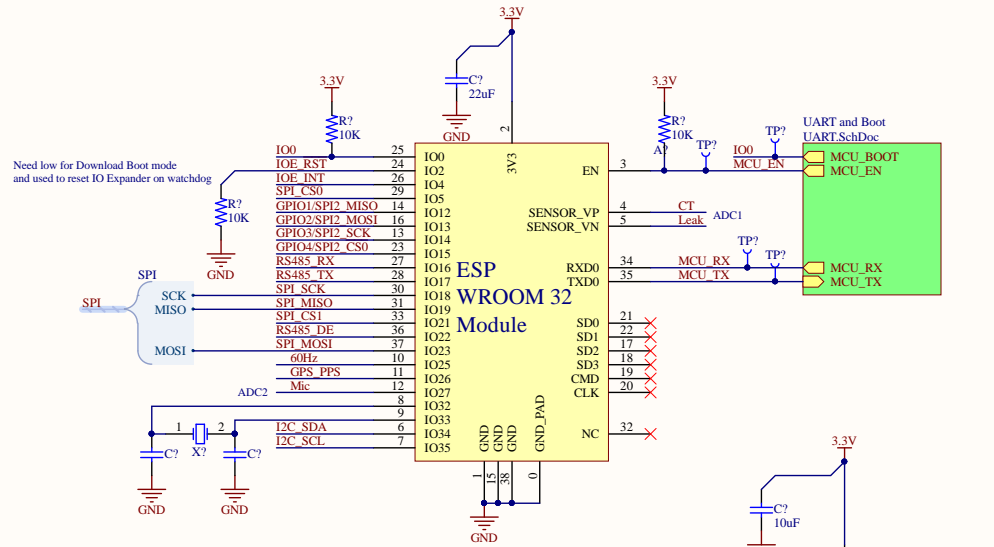


Peripherals Mapping  
 U0(UART 0) - Debug/Prgrm  
 U2(UART 2) - RS485 CEA2045  
 VSPi(SPI3) - GPS and LCD (can do UART to GPS if desired)

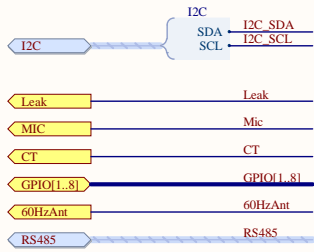
TODO:  
 \* Replace Crystal and crystal caps with own part - check crystal caps values



CTA2045 Low-Voltage Needs The Following:  
 SCK  
 MOSI  
 MISO  
 SELECT (SPI CS to slave module)  
 ATTENTION (interrupt to master)  
 RESET (to slave module)  
 CTA2045 High-Voltage Needs The Following:  
 RS485 +  
 RS485 -

Title		Main	
Size	B	Number	Revision
Date:	7/31/2017	Sheet of	1
File:	C:\Users\Main.SchDoc	Drawn By:	Craig Hesling

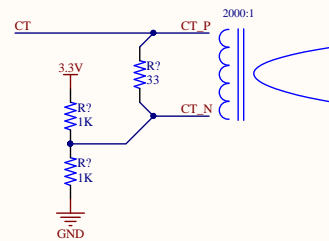
## Main Board Interface



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

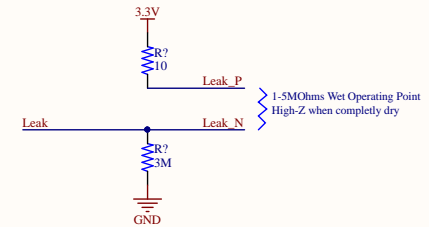
Other potentially useful protocols, like I2C, RS485, and sensor controls have also been exposed into the header.

## Current Transformer

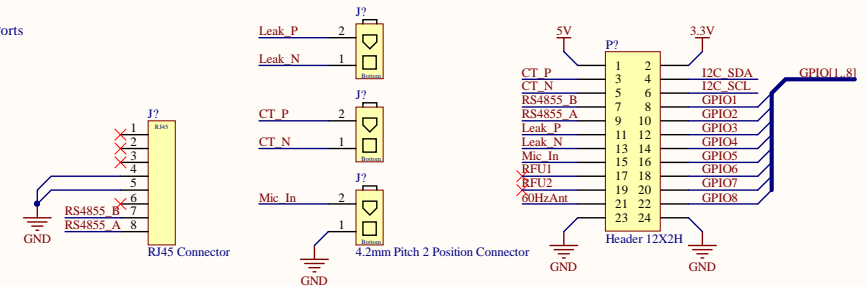


## Leak Detection Cable

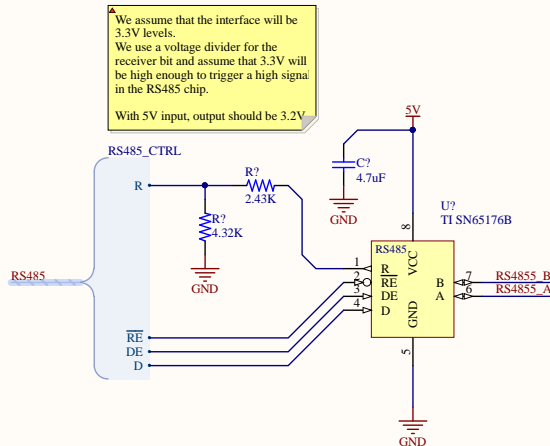
The cable seems to operate between 1 to 5MOhms  
Note that it goes high-Z when completely dry



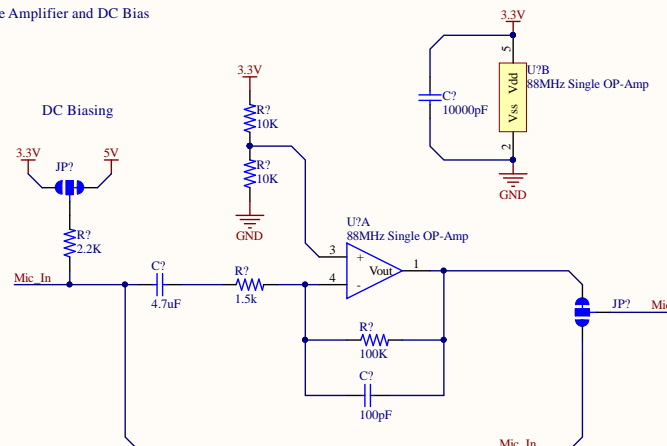
## Accessory Ports



## RS485 Transceiver



## Microphone Amplifier and DC Bias

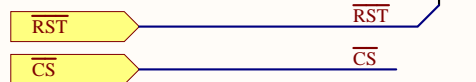


By Eva Rinaldi - Rubber Duck, CC BY-SA 2.0,  
<https://commons.wikimedia.org/w/index.php?curid=24788549>

Title			
Accessories			
Size	Number	Revision	
B		1	
Date:	7/31/2017	Sheet of	
File:	C:\Users\...\Accessories.SchDoc	Drawn By:	Craig Hesling

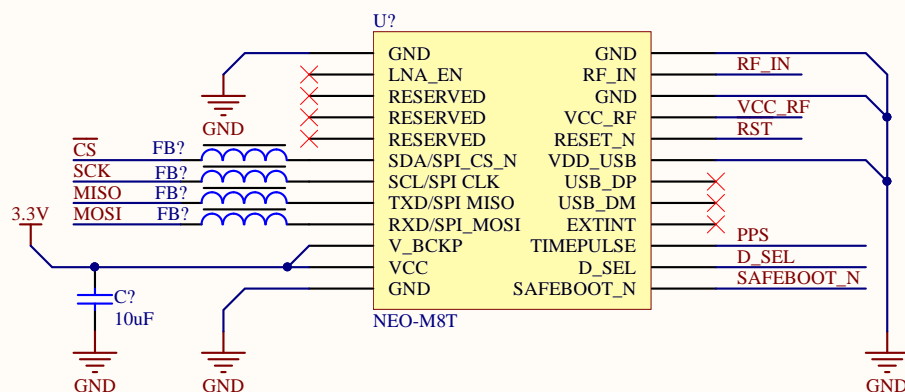
A

▲ RST can be left open



B

▲ V\_BCKP:  
vcc = Unused  
Can use as coin  
cell battery backup



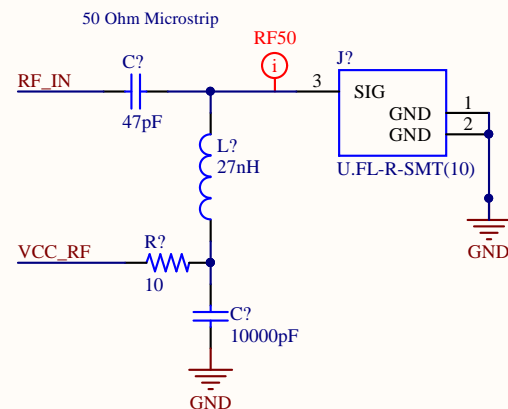
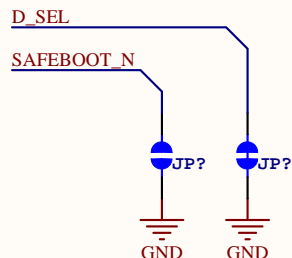
C

D

▲ D\_SEL:  
open = UART/DDC  
low = SPI

SAFEBOOT\_N:  
open = Unused  
(do not pull low on boot)

VDD\_USB:  
LDO'ed 3.3V = USB Active  
gnd = Unused



A

B

C

D

Title <b>GPS</b>		
Size A	Number	Revision <b>1</b>
Date:	7/31/2017	Sheet of
File:	C:\Users\...\GPS.SchDoc	Drawn By: <a href="#">Craig Hesling</a>

A

A

B

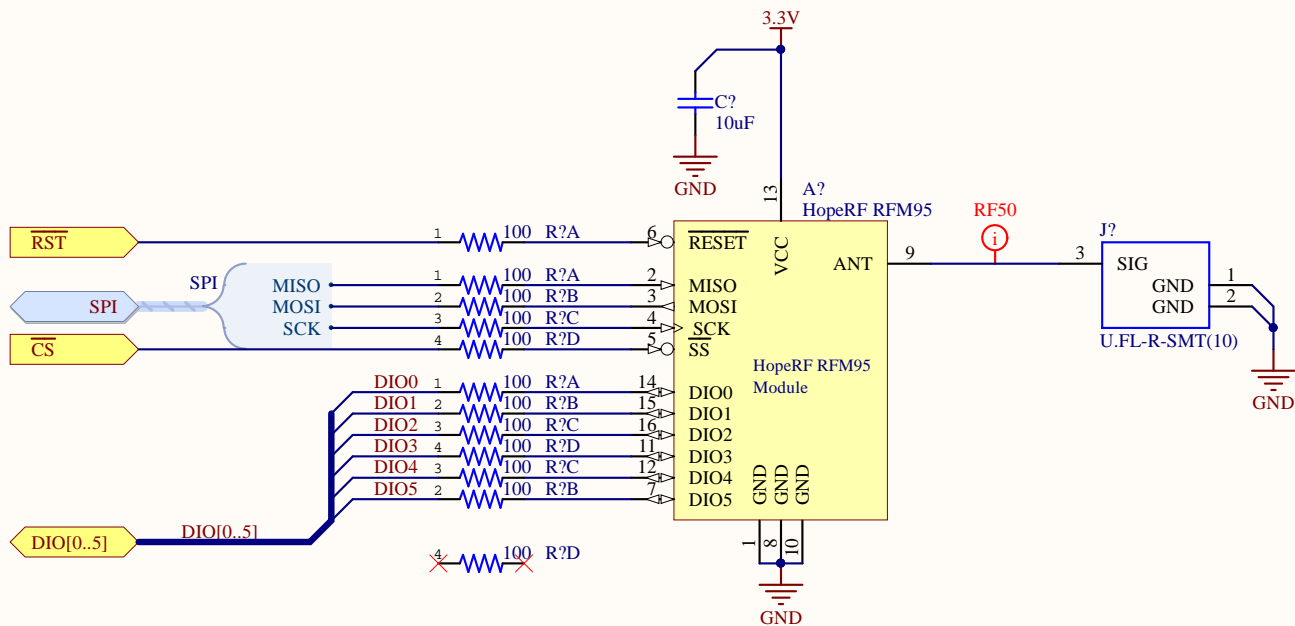
B

C

C

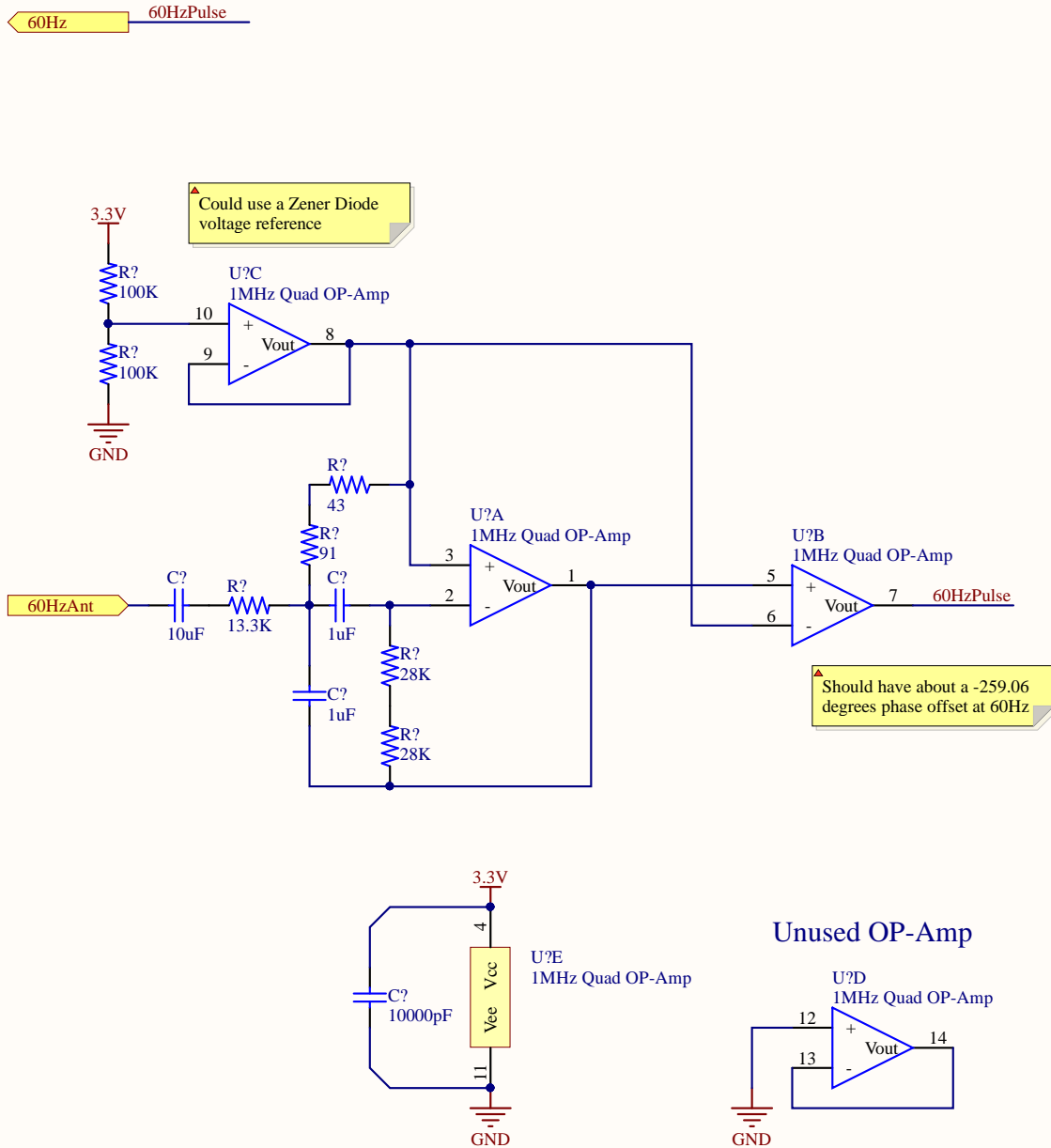
D

D

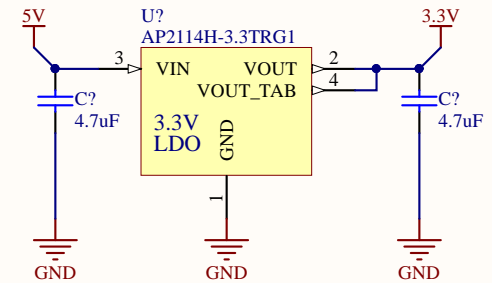


Title			LoRa	
Size	Number		Revision	
A			1	
Date:	7/31/2017		Sheet of	
File:	C:\Users\...\LoRa.SchDoc		Drawn By: Craig Hesling	

## 60Hz Zero Crossing Pulse



## 3.3V Regulation

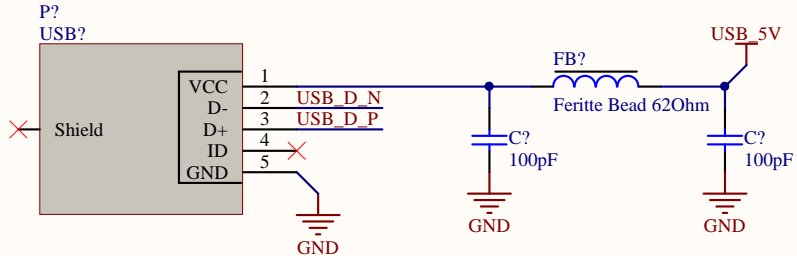


Title  
**Power**

Size	Number	Revision
A		1
Date:	7/31/2017	Sheet of
File:	C:\Users\...\Power.SchDoc	Drawn By: Craig Hesling

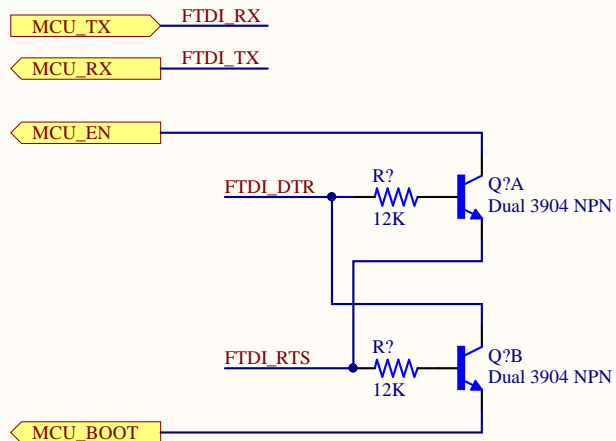
A

A



B

B

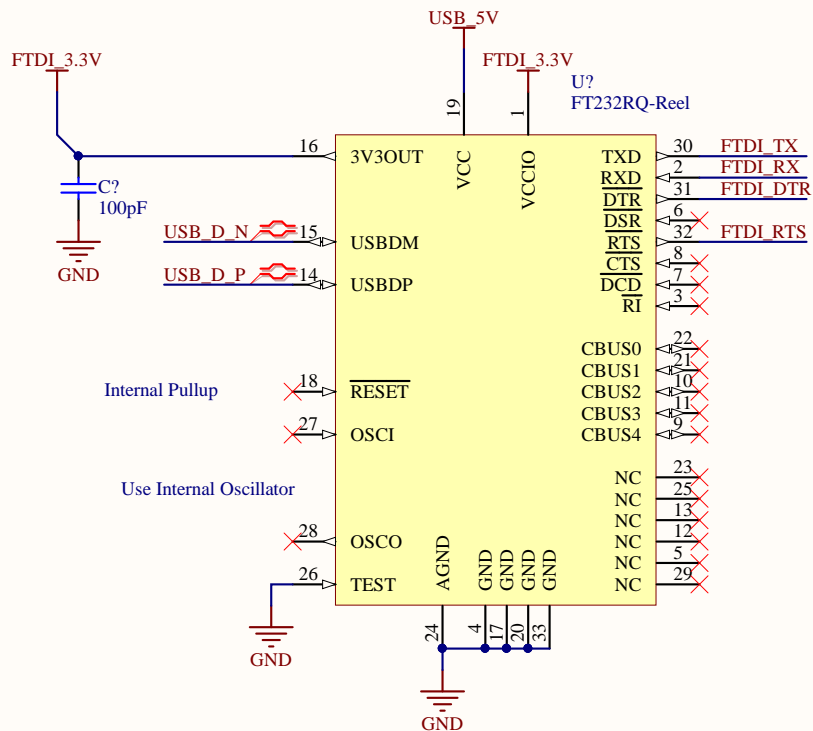


C

C

D

D



Title

UART

Size

A

Number

Revision

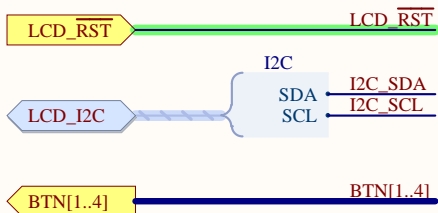
2

Date: 7/31/2017

Sheet of

File: C:\Users\...\UART.SchDoc

Drawn By: Craig Hesling



$$R1 = [(V_{out} - 3V) - 0V] / 10\mu A$$

$$R1 = [(12.0985V - 3V) - 0V] / 10\mu A$$

$$R1 = 909.853k\Omega$$

Using  $V_{out\_min}$ ,  $V_{out\_max}$ , and the 910kOhm 1% tolerance, we have the following:

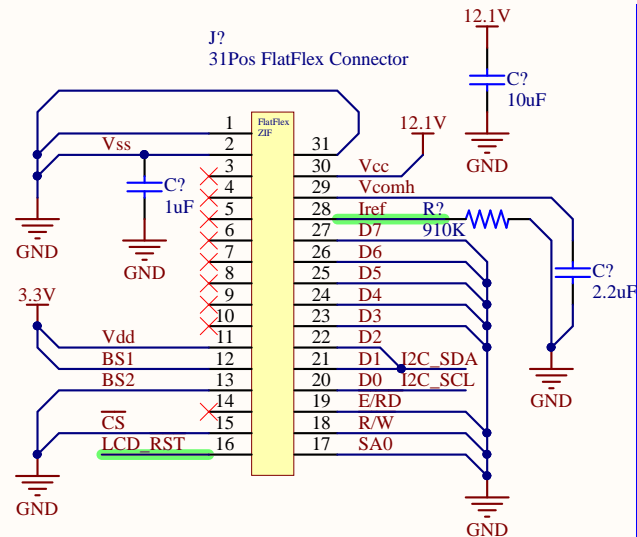
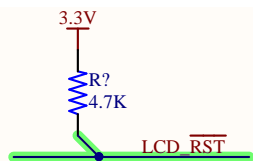
$$I_{ref\_min} = [(V_{out\_min} - 3V) - 0V] / (910k\Omega * (1+.01))$$

$$I_{ref\_min} = 9.66523 \mu A$$

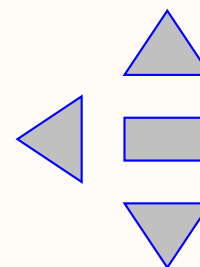
$$I_{ref\_max} = [(V_{out\_max} - 3V) - 0V] / (910k\Omega * (1-.01))$$

$$I_{ref\_max} = 10.3431 \mu A$$

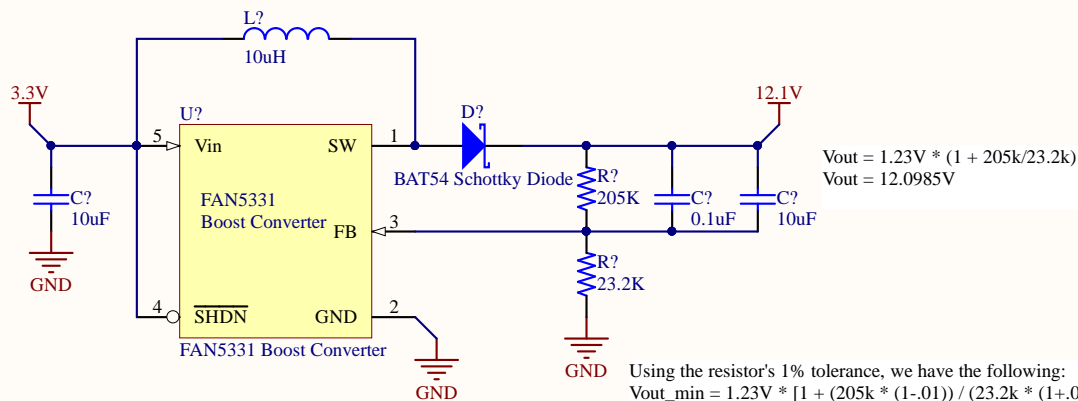
$I_{ref\_min}$  and  $I_{ref\_max}$  are within  $10\mu A \pm 2\mu A$ .



Display Navigation Buttons



This is the boost converter for the OLED 13V display voltage.



$$V_{out} = 1.23V * (1 + 205k/23.2k)$$

$$V_{out} = 12.0985V$$

Using the resistor's 1% tolerance, we have the following:

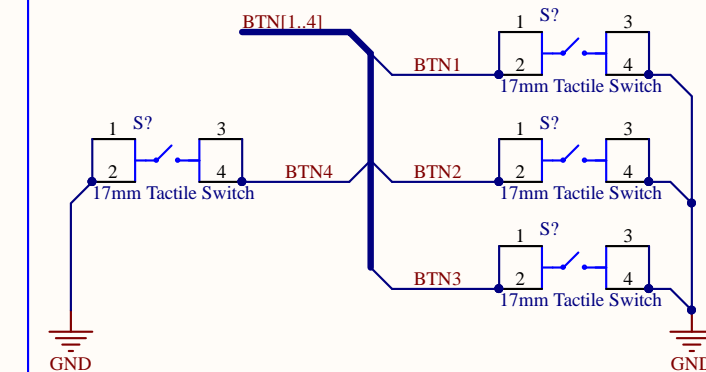
$$V_{out\_min} = 1.23V * [1 + (205k * (1-.01)) / (23.2k * (1+.01))]$$

$$V_{out\_min} = 11.8833V$$

$$V_{out\_max} = 1.23V * [1 + (205k * (1+.01)) / (23.2k * (1-.01))]$$

$$V_{out\_max} = 12.3181V$$

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



Title		
User Interface		
Size	Number	Revision
A		1
Date:	7/31/2017	Sheet of
File:	C:\Users\...\UI.SchDoc	Drawn By: Craig Hesling