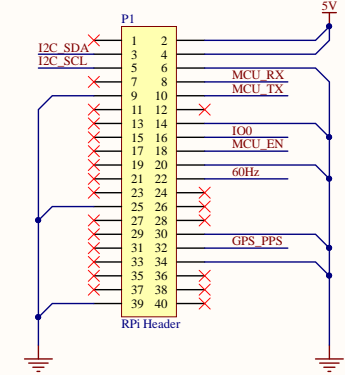
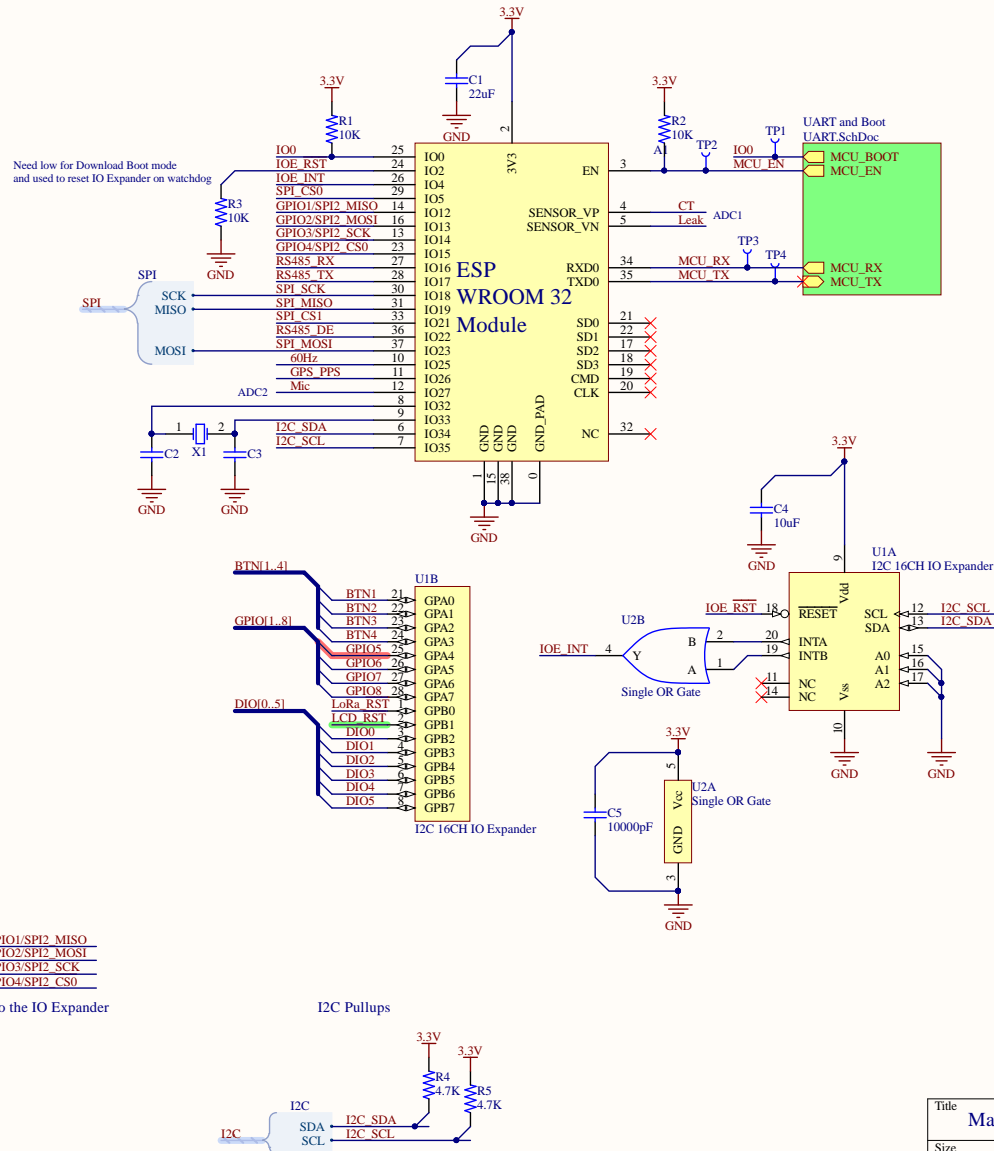


Peripherals Mapping
 U0(UART 0) - Debug/Prgrm
 U2(UART 2) - RS485 CEA2045
 VSPi(SPI3) - GPS and LCD (can do UART to GPS if desired)

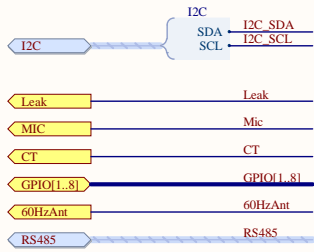
TODO:
 * Replace Crystal and crystal caps with own part - check crystal caps values



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 1
Date: 8/1/2017	Sheet of 1	Drawn By: Craig Hesling
File: C:\Users\Main\SchDoc		

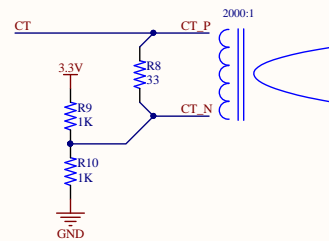
Main Board Interface



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

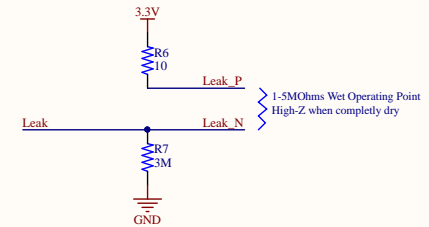
Other potentially useful protocols, like I2C, RS485, and sensor controls have also been exposed into the header.

Current Transformer

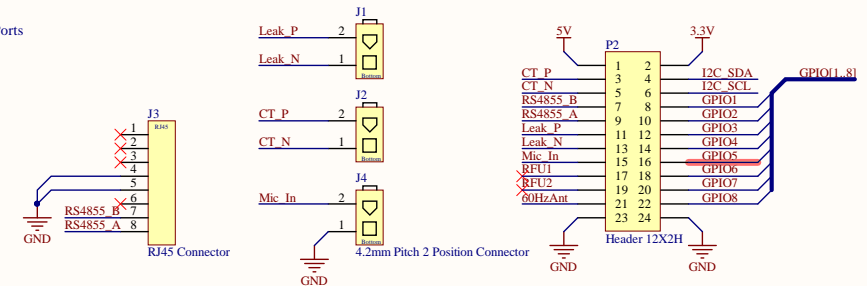


Leak Detection Cable

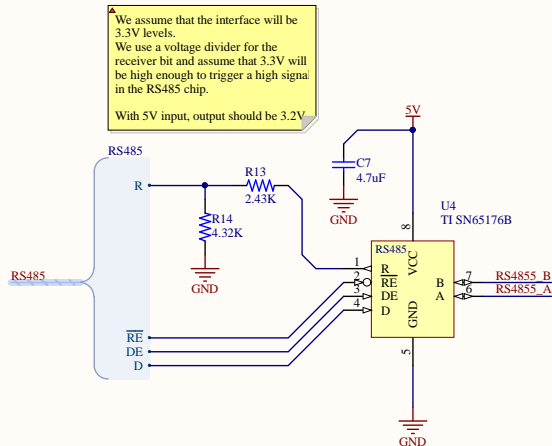
The cable seems to operate between 1 to 5MOhms
Note that it goes high-Z when completely dry



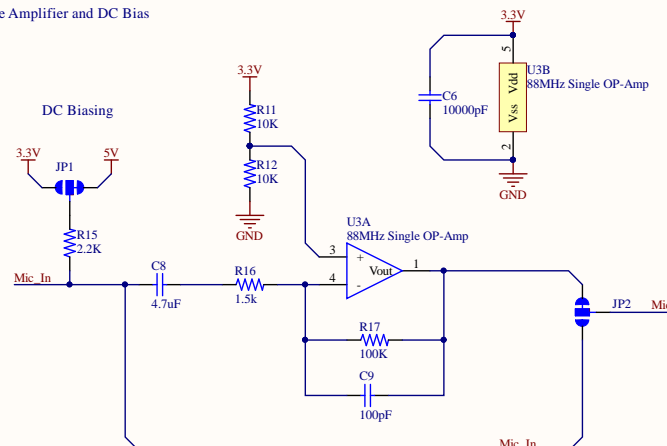
Accessory Ports



RS485 Transceiver



Microphone Amplifier and DC Bias

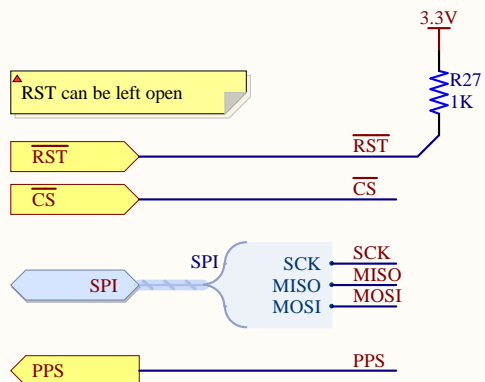


By Eva Rinaldi - Rubber Duck, CC BY-SA 2.0,
<https://commons.wikimedia.org/w/index.php?curid=24788549>

Title Accessories		
Size B	Number	Revision 1
Date: 8/1/2017	Sheet of	
File: C:\Users\...\Accessories.SchDoc	Drawn By: Craig Hesling	

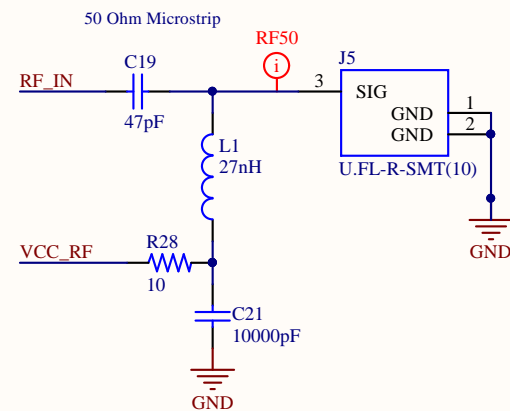
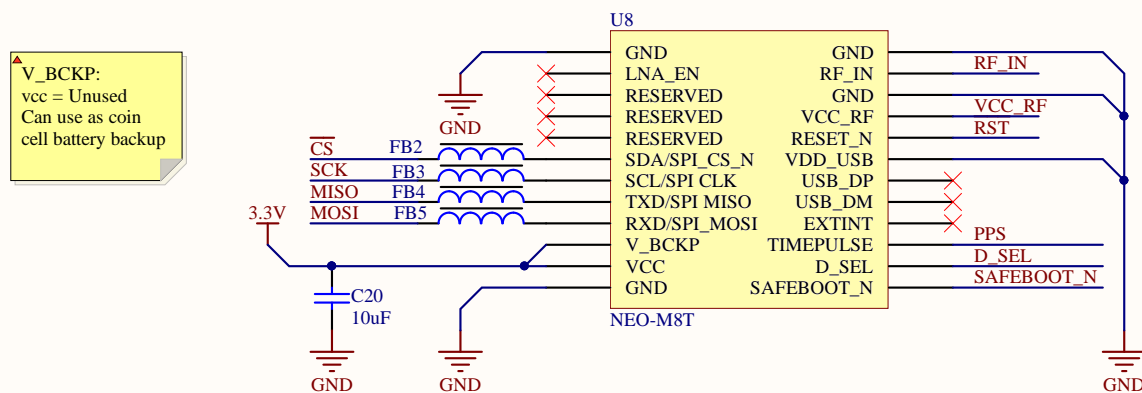
A

A



B

B



C

C

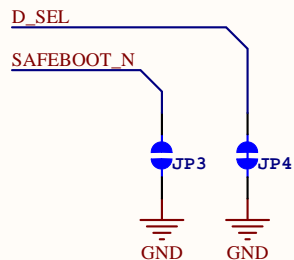
D

D

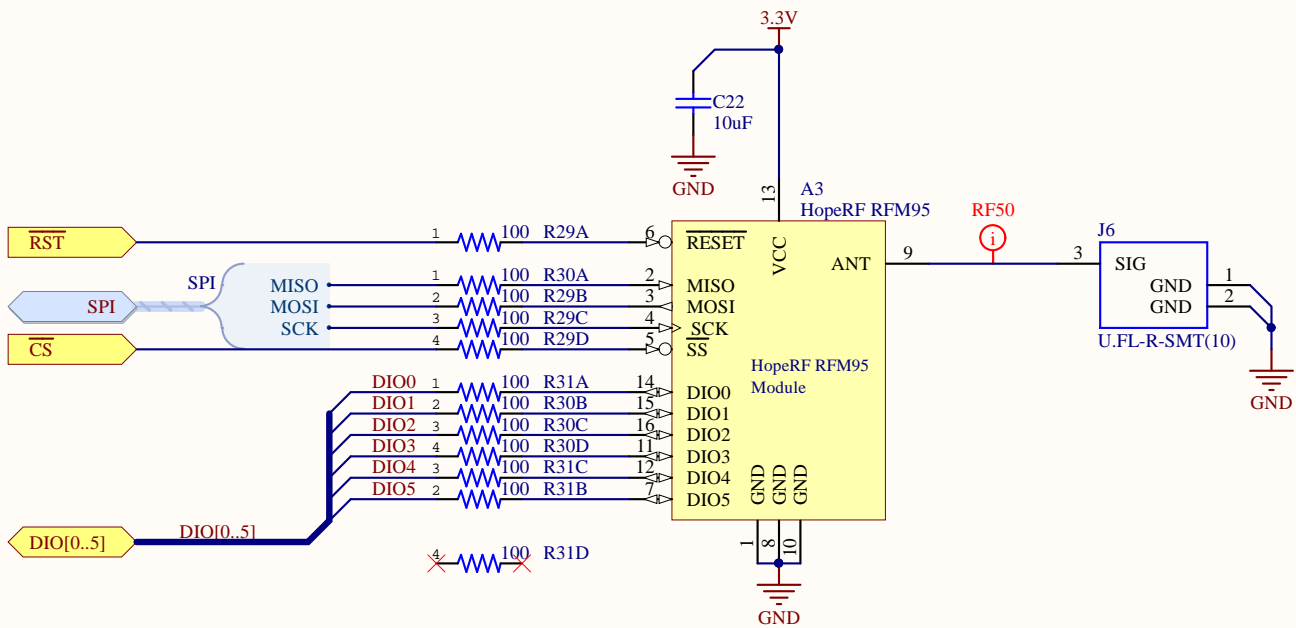
D_SEL:
open = UART/DDC
low = SPI

SAFEBOOT_N:
open = Unused
(do not pull low on boot)

VDD_USB:
LDO'ed 3.3V = USB Active
gnd = Unused

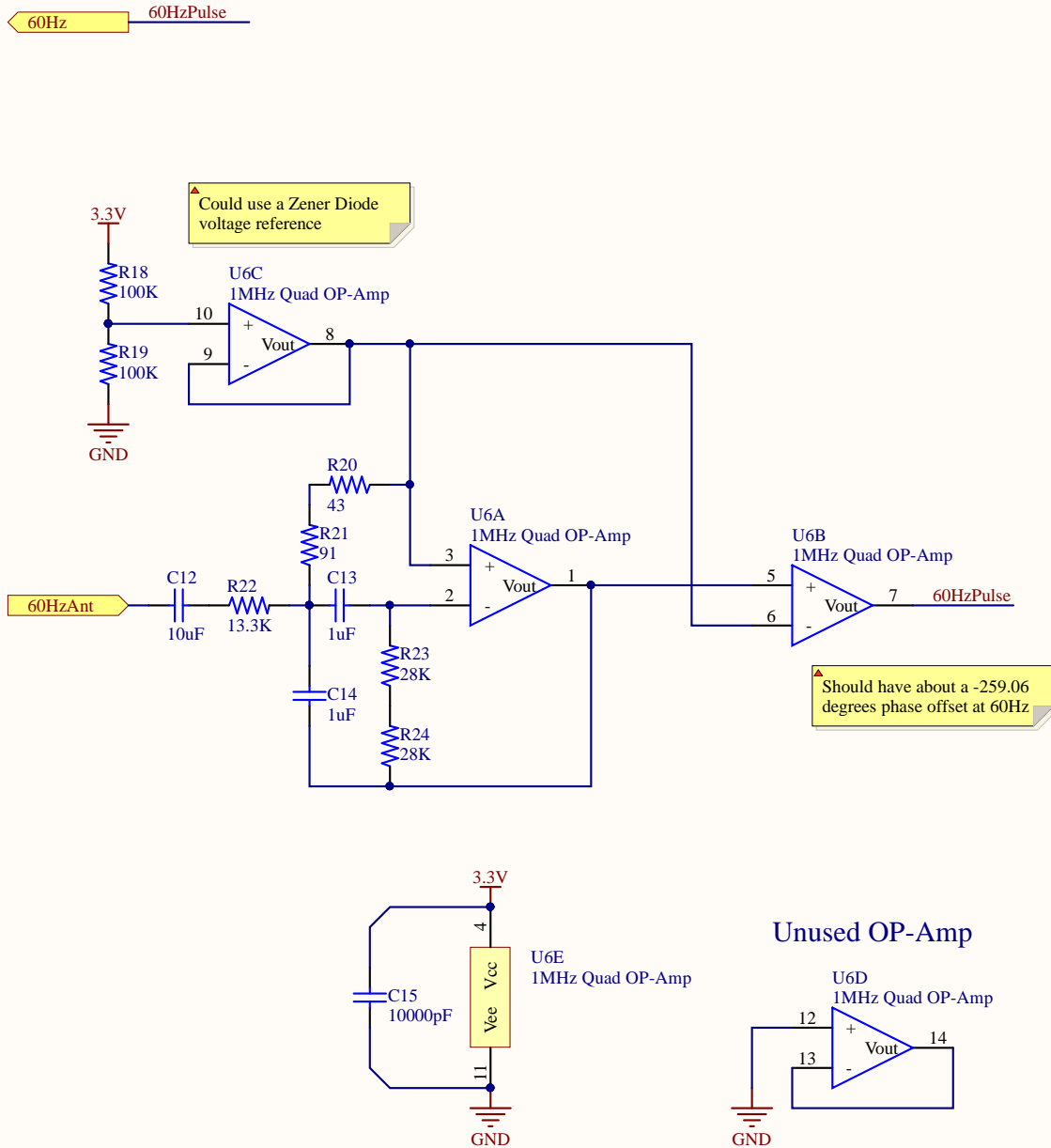


Title GPS		
Size A	Number	Revision 1
Date:	8/1/2017	Sheet of
File:	C:\Users\...\GPS.SchDoc	Drawn By: Craig Hesling

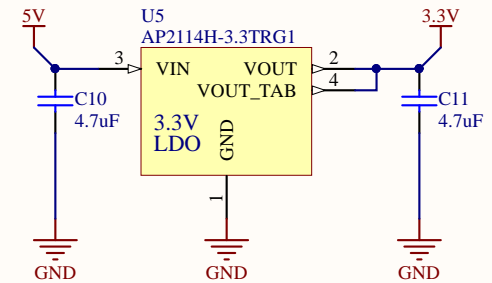


Title			LoRa	
Size	Number		Revision	
A			1	
Date:	8/1/2017		Sheet of	
File:	C:\Users\...\LoRa.SchDoc		Drawn By: Craig Hesling	

60Hz Zero Crossing Pulse



3.3V Regulation

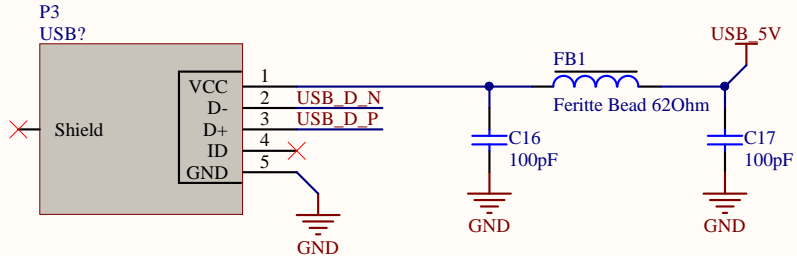


Title
Power

Size	Number	Revision
A		1
Date:	8/1/2017	Sheet of
File:	C:\Users\...\Power.SchDoc	Drawn By: Craig Hesling

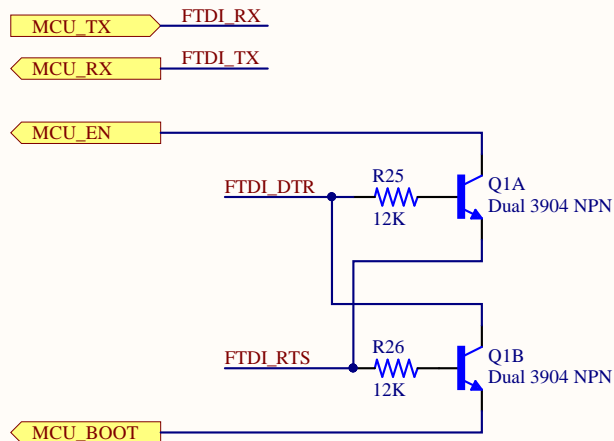
A

A



B

B

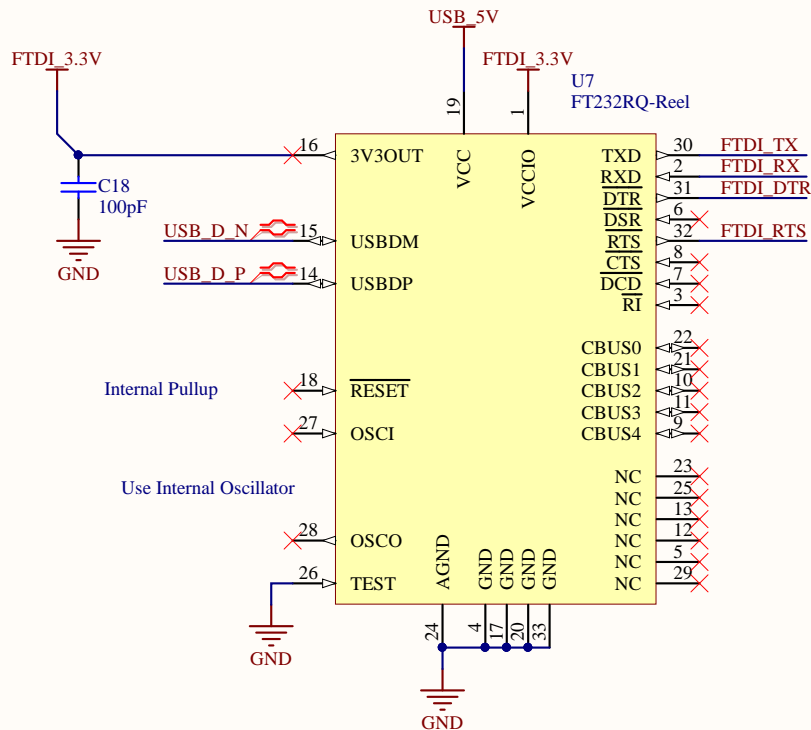


C

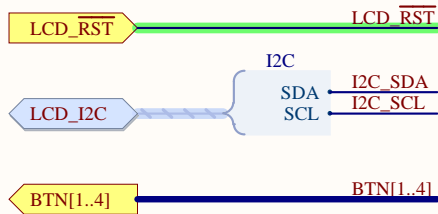
C

D

D



Title			UART	
Size	Number		Revision	
A			2	
Date:	8/1/2017		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:

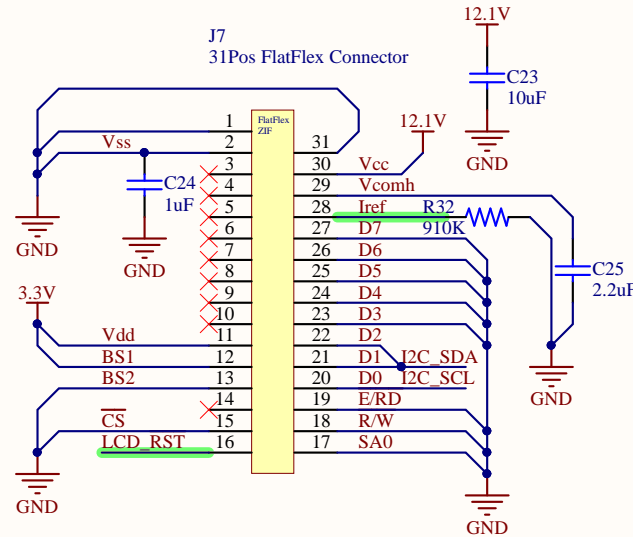
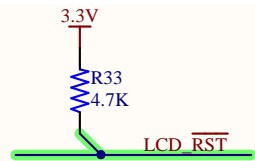
$$I_{ref_min} = [(V_{out_min} - 3V) - 0V] / (910k\Omega * (1+.01))$$

$$I_{ref_min} = 9.66523 \mu A$$

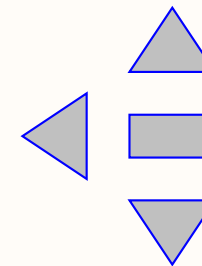
$$I_{ref_max} = [(V_{out_max} - 3V) - 0V] / (910k\Omega * (1-.01))$$

$$I_{ref_max} = 10.3431 \mu A$$

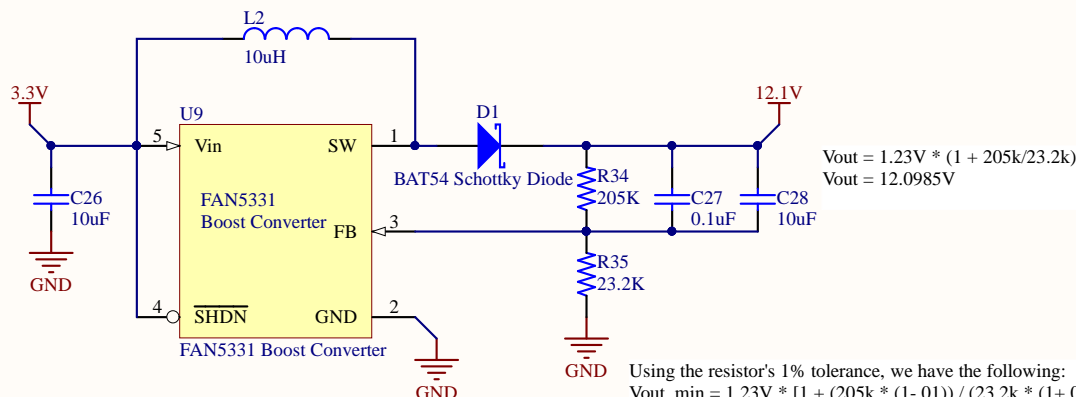
I_{ref_min} and I_{ref_max} are within $10\mu A \pm 2\mu A$.



Display Navigation Buttons



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



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

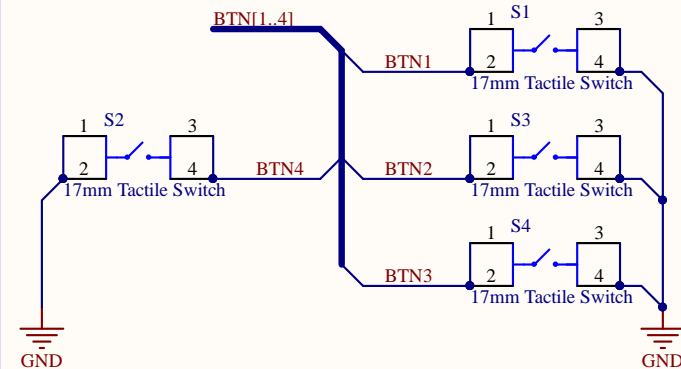
$$V_{out_min} = 1.23V * [1 + (205k * (1-.01)) / (23.2k * (1+.01))]$$

$$V_{out_min} = 11.8833V$$

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

$$V_{out_max} = 12.3181V$$

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



Title

User Interface

Size

A

Number

Revision

1

Date: 8/1/2017

File: C:\Users\...\UI.SchDoc

Sheet of

Drawn By: Craig Hesling