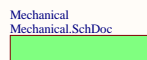
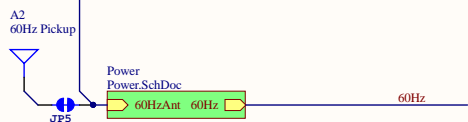
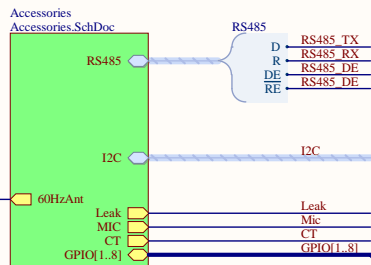
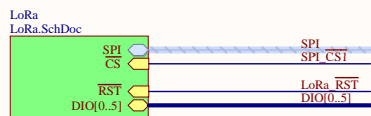
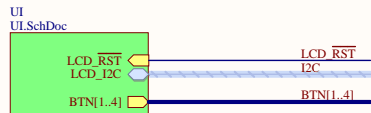
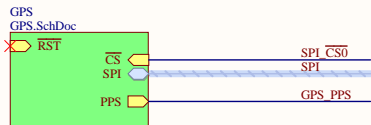
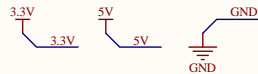
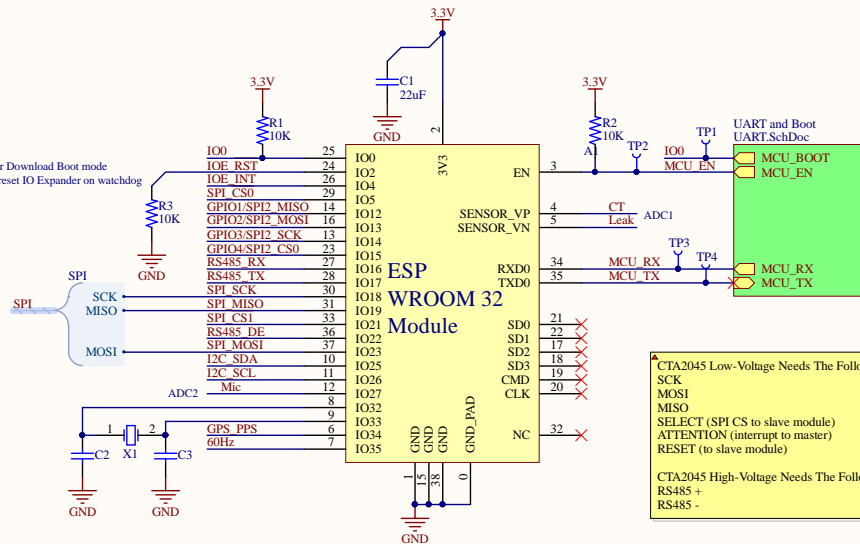


Peripherals Mapping
 U0(UART 0) - Debug/Prgrm
 U2(UART 2) - RS485 CEA2045
 VSP1(SPI3) - GPS and LCD (can do UART to GPS if desired)

Naming The Power Nets



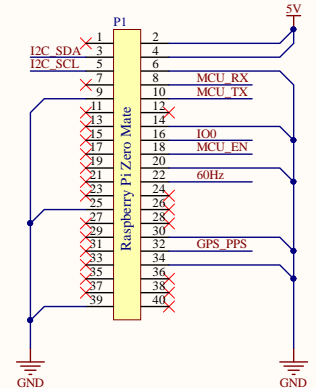
Need low for Download Boot mode
 and used to reset IO Expander on watchdog



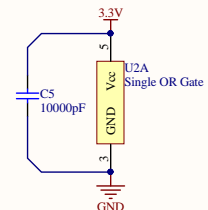
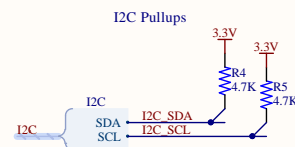
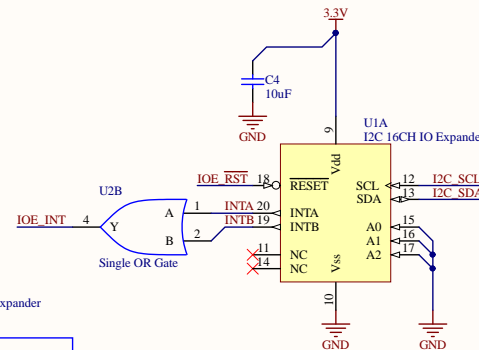
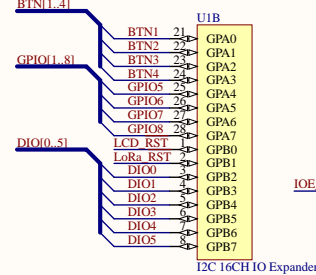
CTA2045 Low-Voltage Needs The Following:
 SCK
 MOSI
 MISO
 SELECT (SPI CS to slave module)
 ATTENTION (interrupt to master)
 RESET (to slave module)

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

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

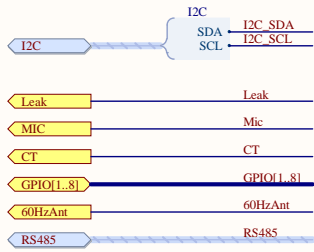


IO Expander



Title Main		
Size B	Number	Revision 1.1
Date: 2/7/2018	Sheet of	Drawn By: Craig Hesling
File: E:\Altium\Main.SchDoc		

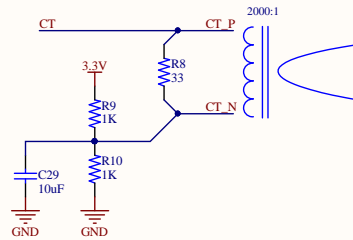
Main Board Interface



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

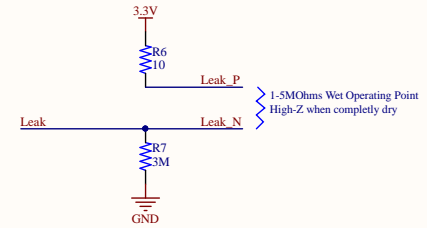
Other potentially useful protocols, like I2C, RS485, and sensor controls have also been exposed into the header.

Current Transformer

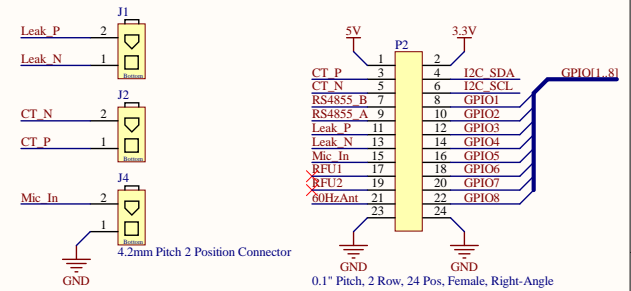
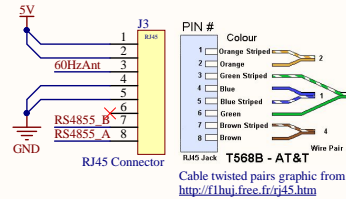


Leak Detection Cable

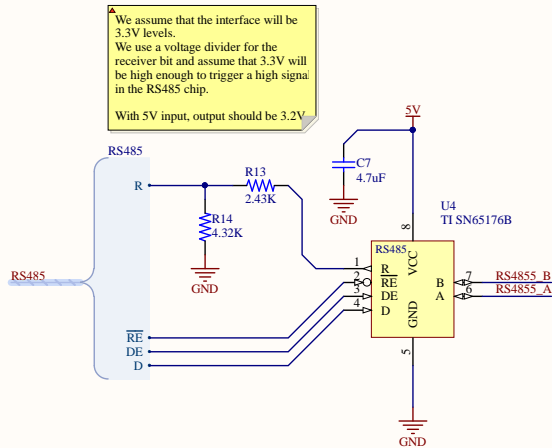
The cable seems to operate between 1 to 5MOhms
Note that it goes high-Z when completely dry



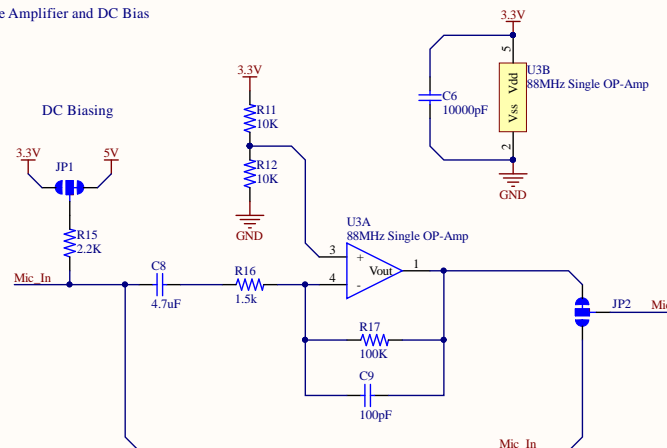
Accessory Ports



RS485 Transceiver



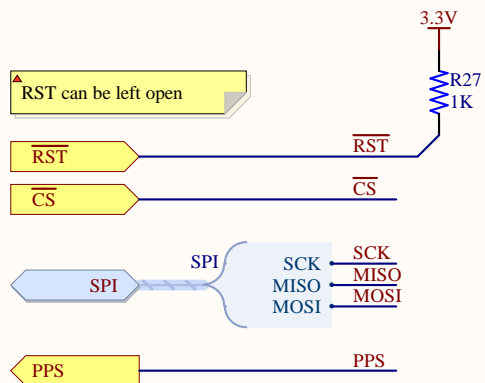
Microphone Amplifier and DC Bias



JASON COHN/REUTERS

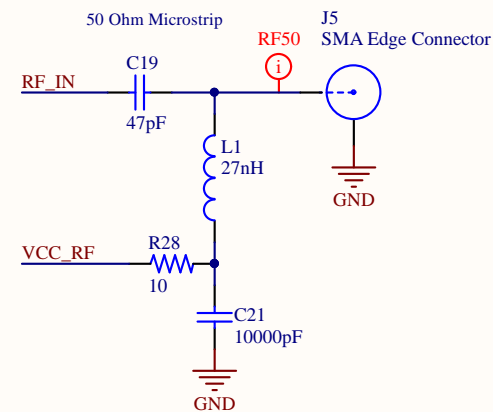
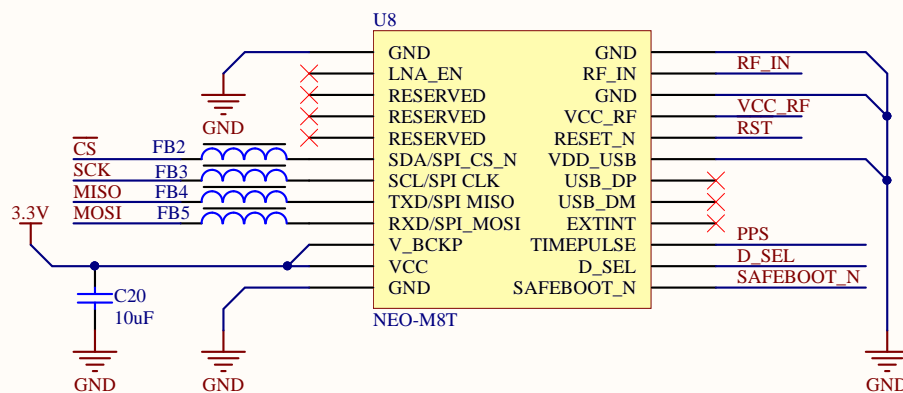
Title			
Accessories			
Size	Number	Revision	
B		1.1	
Date:	2/7/2018	Sheet	of
File:	E:\Altium\...Accessories.SchDoc	Drawn By:	Craig Hesling

A



B

▲ V_BCKP:
vcc = Unused
Can use as coin
cell battery backup



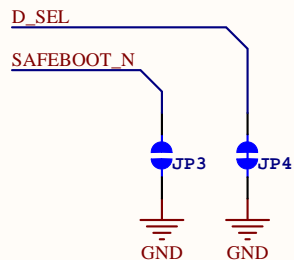
C

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



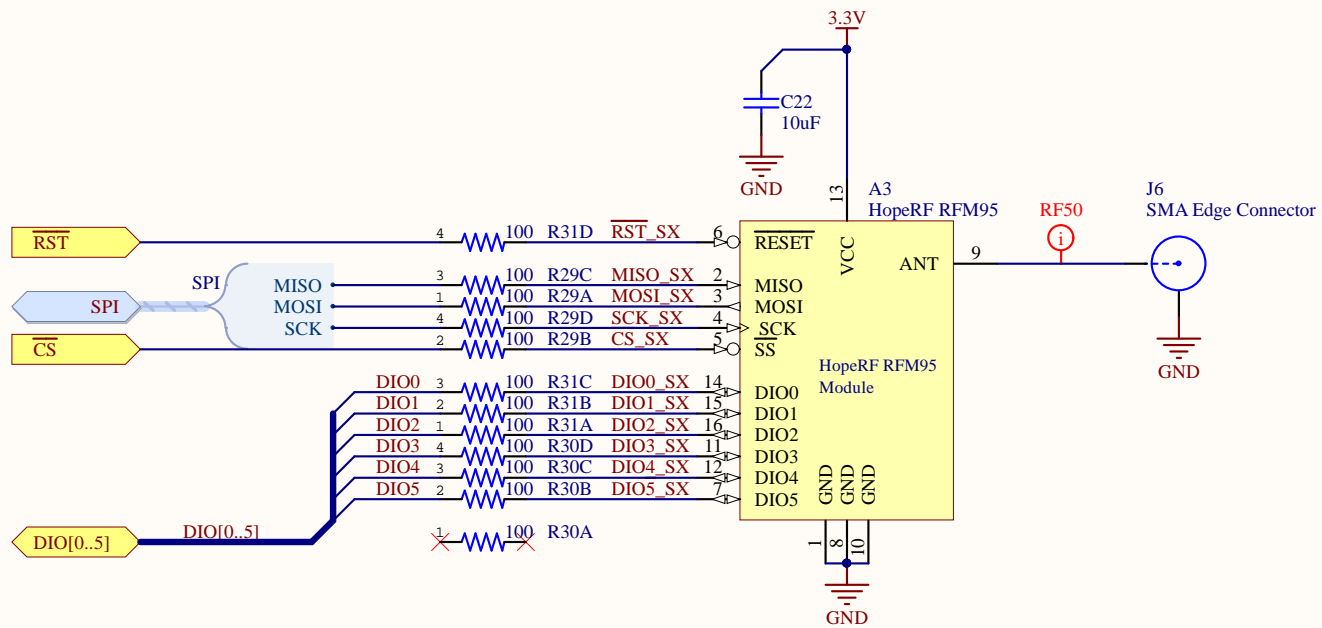
Title GPS		
Size A	Number	Revision 1
Date:	2/7/2018	Sheet of
File:	E:\Altium\...\GPS.SchDoc	Drawn By: Craig Hesling

A

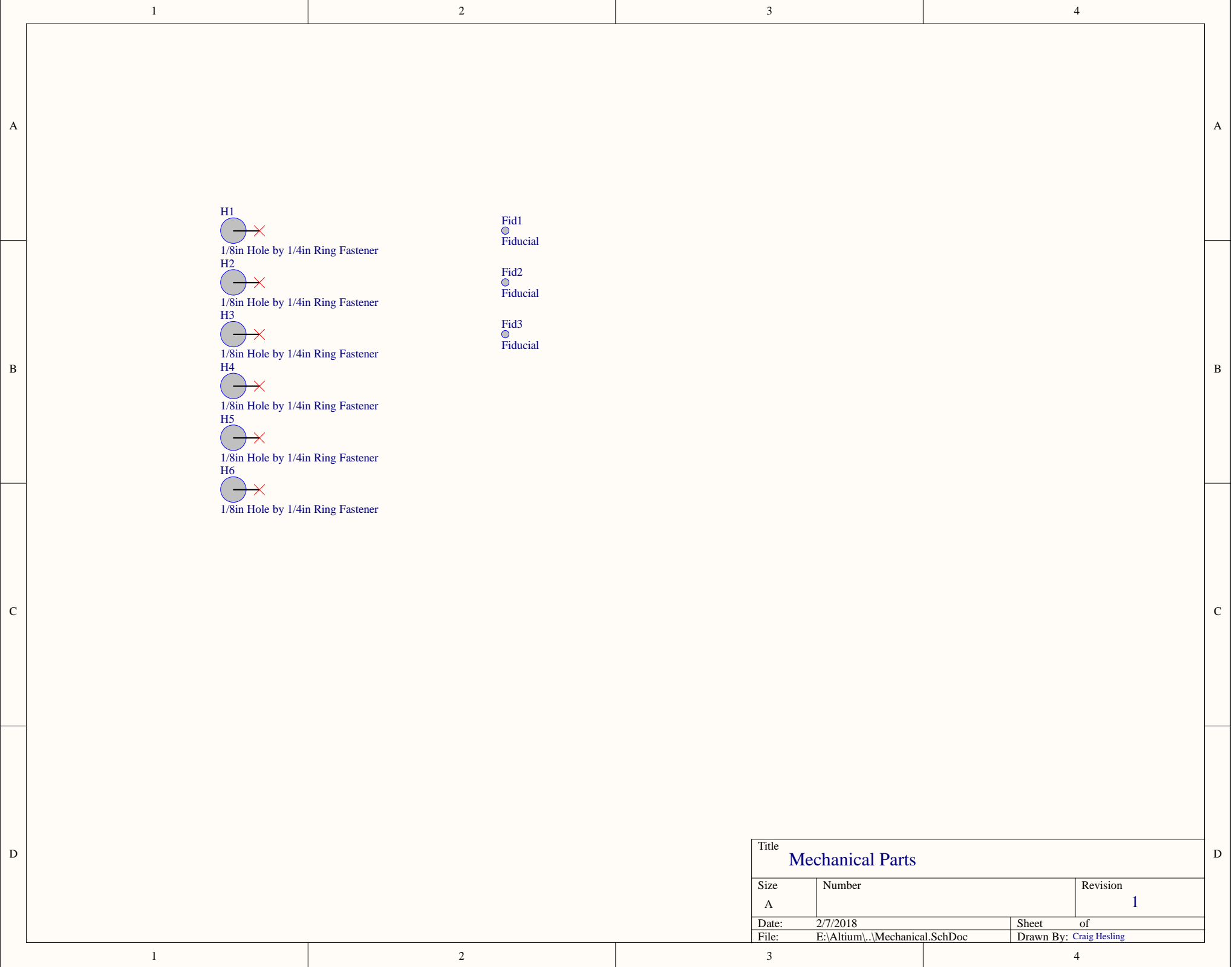
B

C

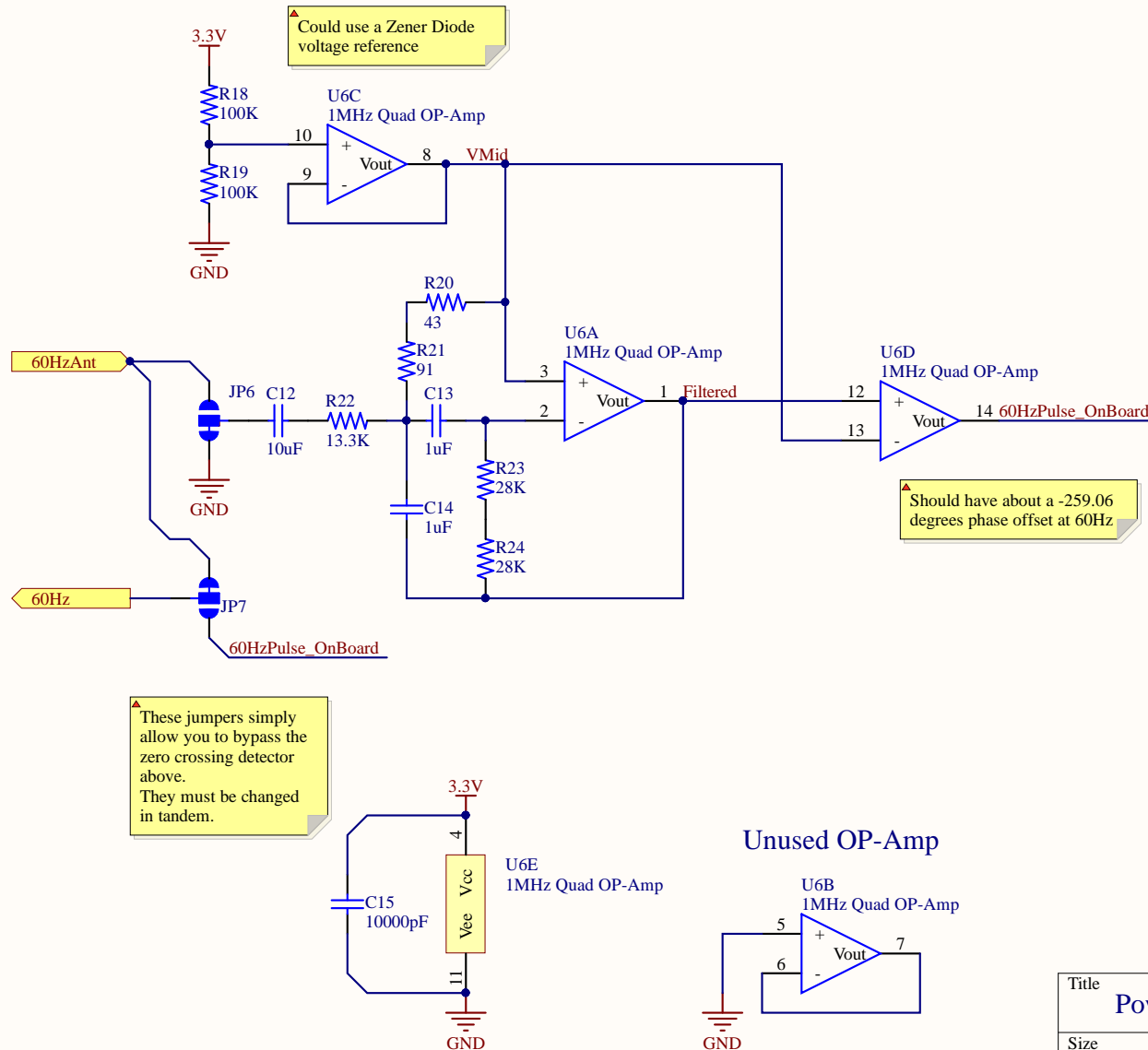
D



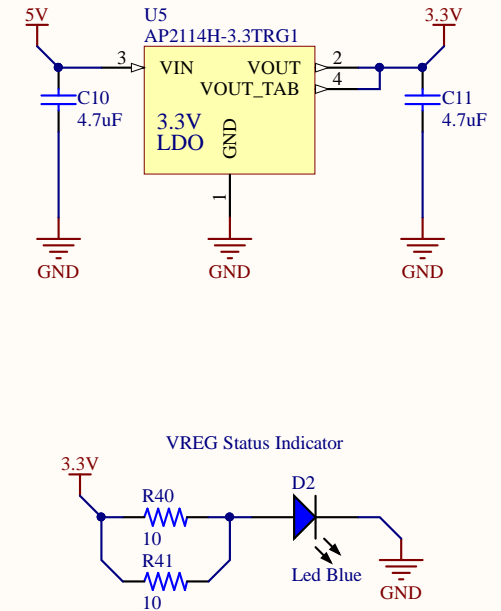
Title			
LoRa			
Size	Number	Revision	
A		1	
Date:	2/7/2018	Sheet	of
File:	E:\Altium\...\LoRa.SchDoc	Drawn By:	Craig Hesling



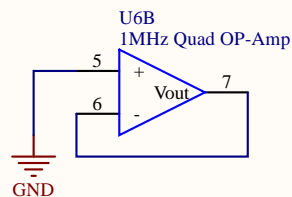
60Hz Zero Crossing Pulse



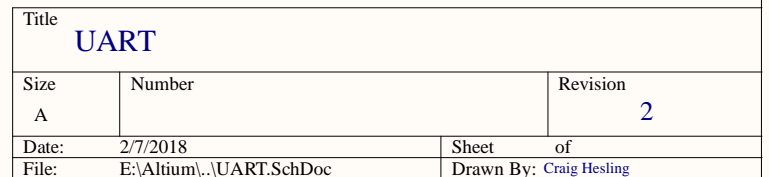
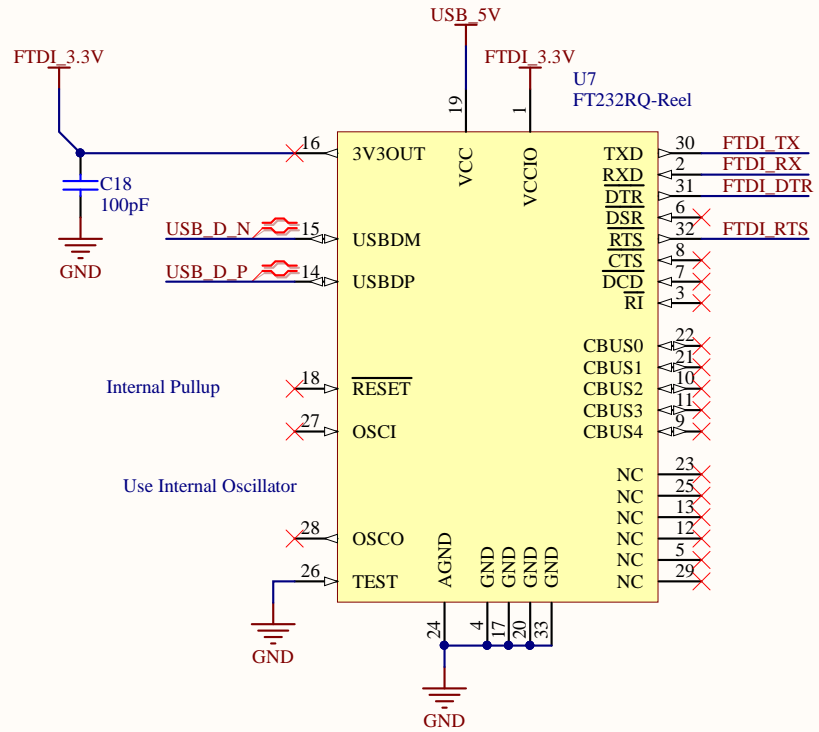
3.3V Regulation

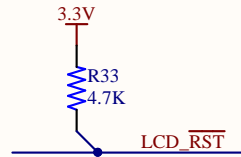
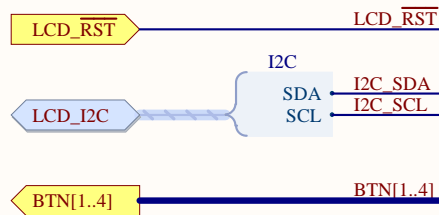


Unused OP-Amp



Title Power		
Size A	Number	Revision 1.1
Date:	2/7/2018	Sheet of
File:	E:\Altium\...\Power.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:

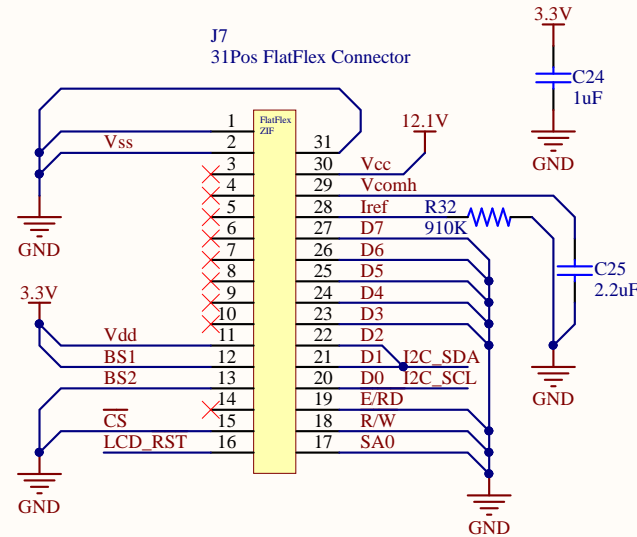
$$I_{ref_min} = [(V_{out_min} - 3V) - 0V] / (910k\Omega * (1+.01))$$

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

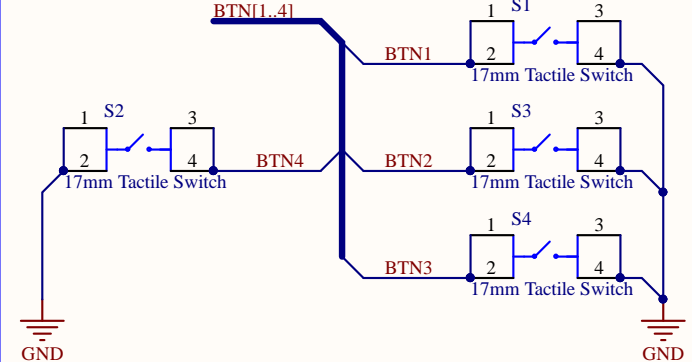
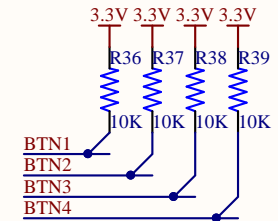
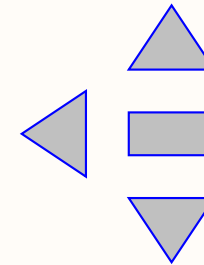
$$I_{ref_max} = [(V_{out_max} - 3V) - 0V] / (910k\Omega * (1-.01))$$

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

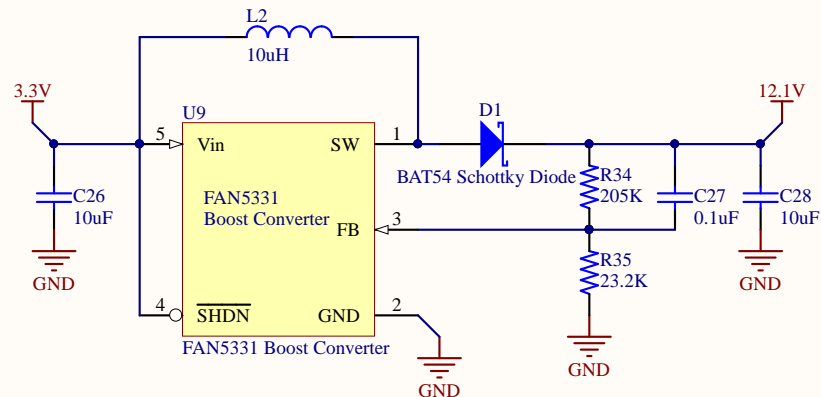
I_{ref_min} and I_{ref_max} are within 10uA+-2uA.



Display Navigation Buttons



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



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

$$V_{out} = 12.0985V$$

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

A

Number

Revision

1.1

Date: 2/7/2018

Sheet of

File: E:\Altium\...\UI.SchDoc

Drawn By: Craig Hesling

