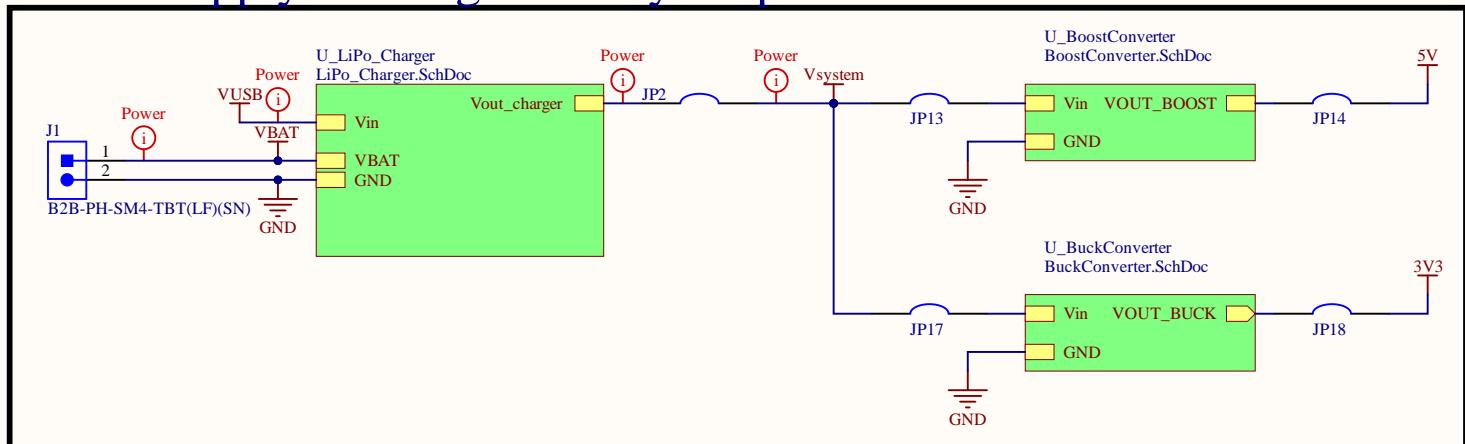
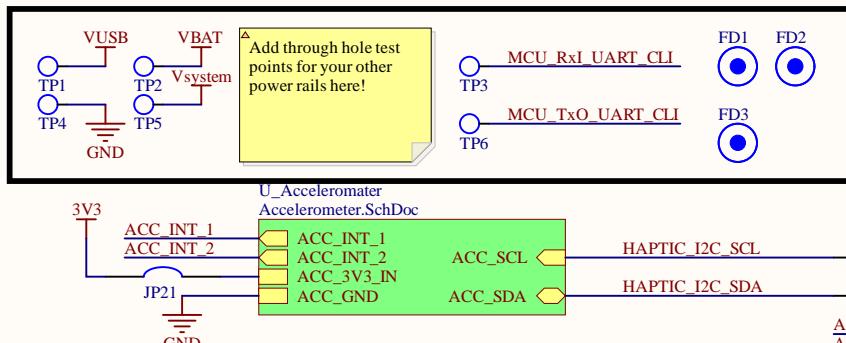


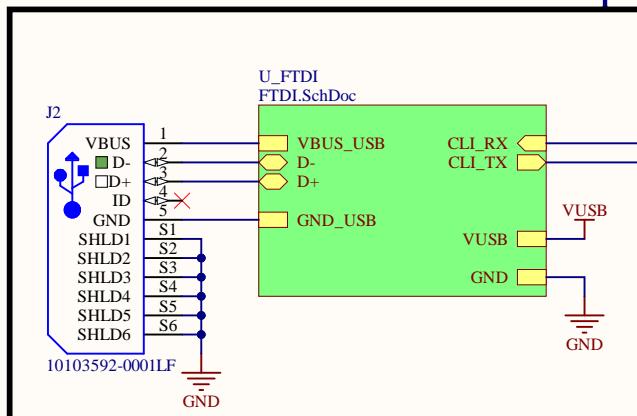
Power Supply - Change me to your power architecture



Test Points + Fiducials

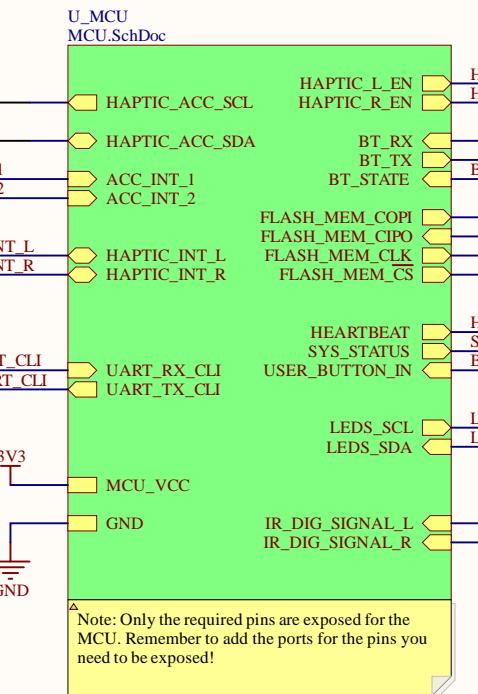


USB Connector + FTDI Chip



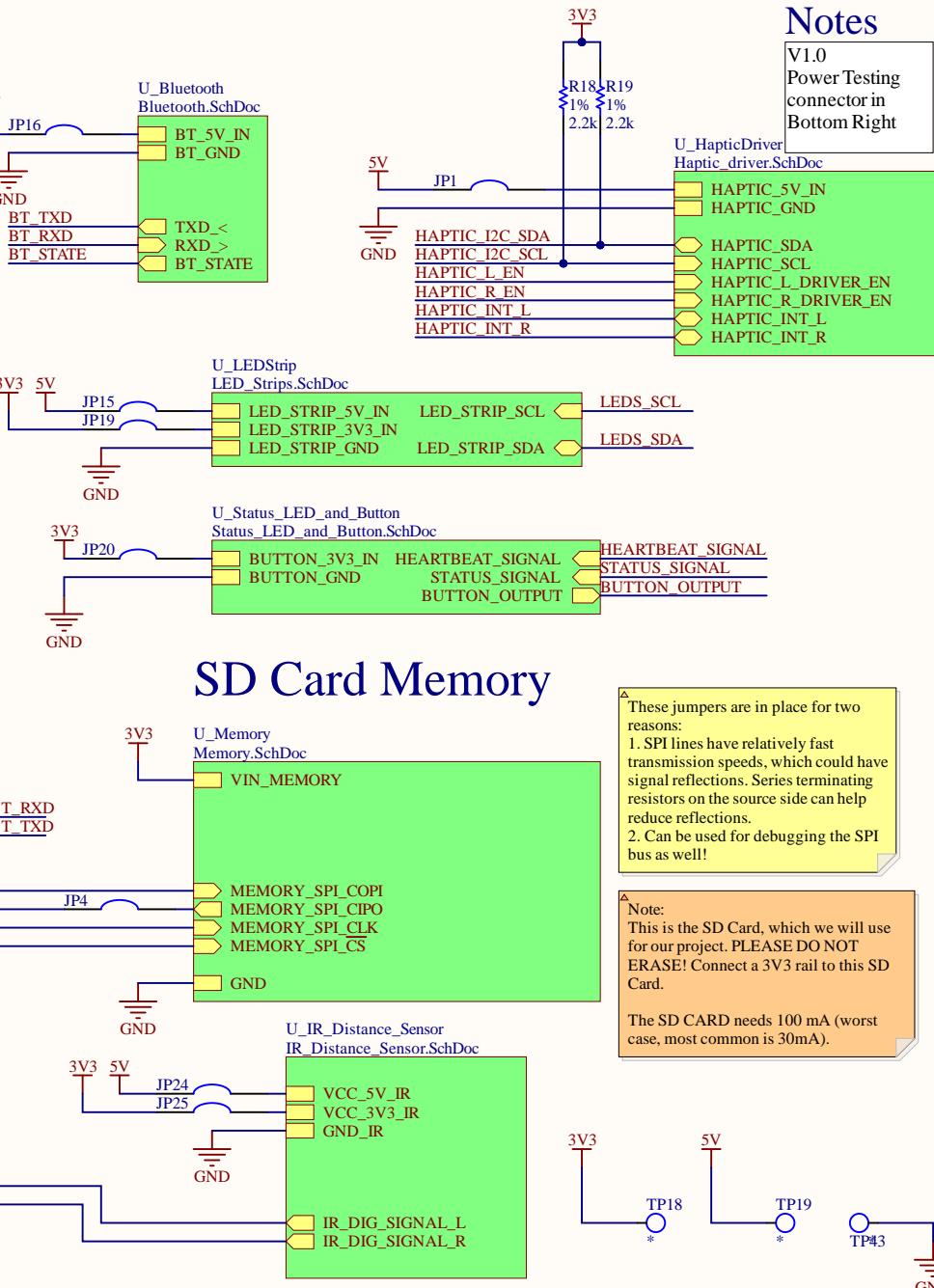
NOTE:
The FTDI Chip is an useful chip that allows us to convert USART cmessages into USB signals. It allows us to connect the MCU directly to the USB port of a computer and use the serial terminal (it is the same bridge used on the SAMW25 Xplained Board).The FTDI device also contains protection circuitry for the USB.

Microcontroller



▲ Note: Only the required pins are exposed for the MCU. Remember to add the ports for the pins you need to be exposed!

SD Card Memory



- These jumpers are in place for two reasons:
 - SPI lines have relatively fast transmission speeds, which could have signal reflections. Series terminating resistors on the source side can help reduce reflections.
 - Can be used for debugging the SPI bus as well!

⚠ Note:
This is the SD Card, which we will use for our project. PLEASE DO NOT ERASE! Connect a 3V3 rail to this SD Card.

The SD CARD needs 100 mA (worst case, most common is 20mA)

Title: *Main.SchDoc*

Desc:

Size: Letter Auth: Saurabh P. Binh N Proj: ESE5160_Circuit_Crusaders.PrjPcb

VCS: Not in version control

Date: 5/4/2024 12:30:05 AM AD Ver. Doc. * Sheet 1 of 15

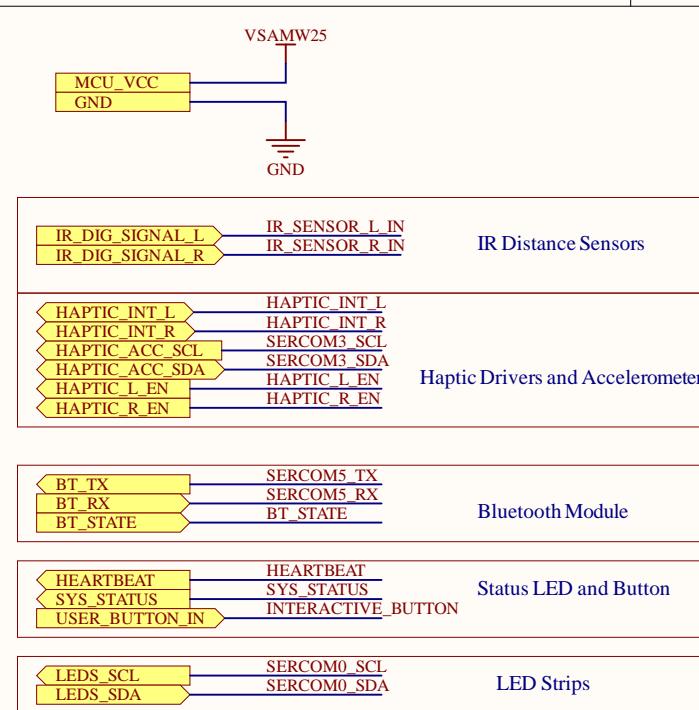
File: Main.SchDoc



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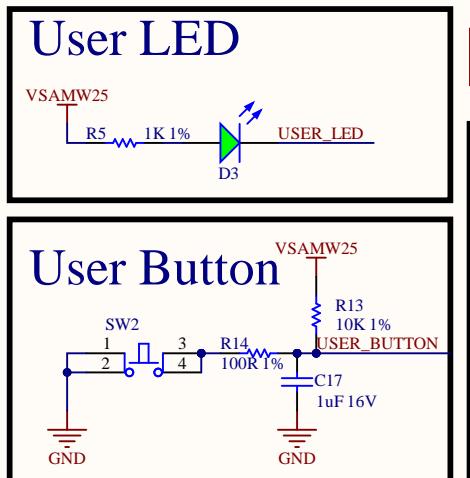
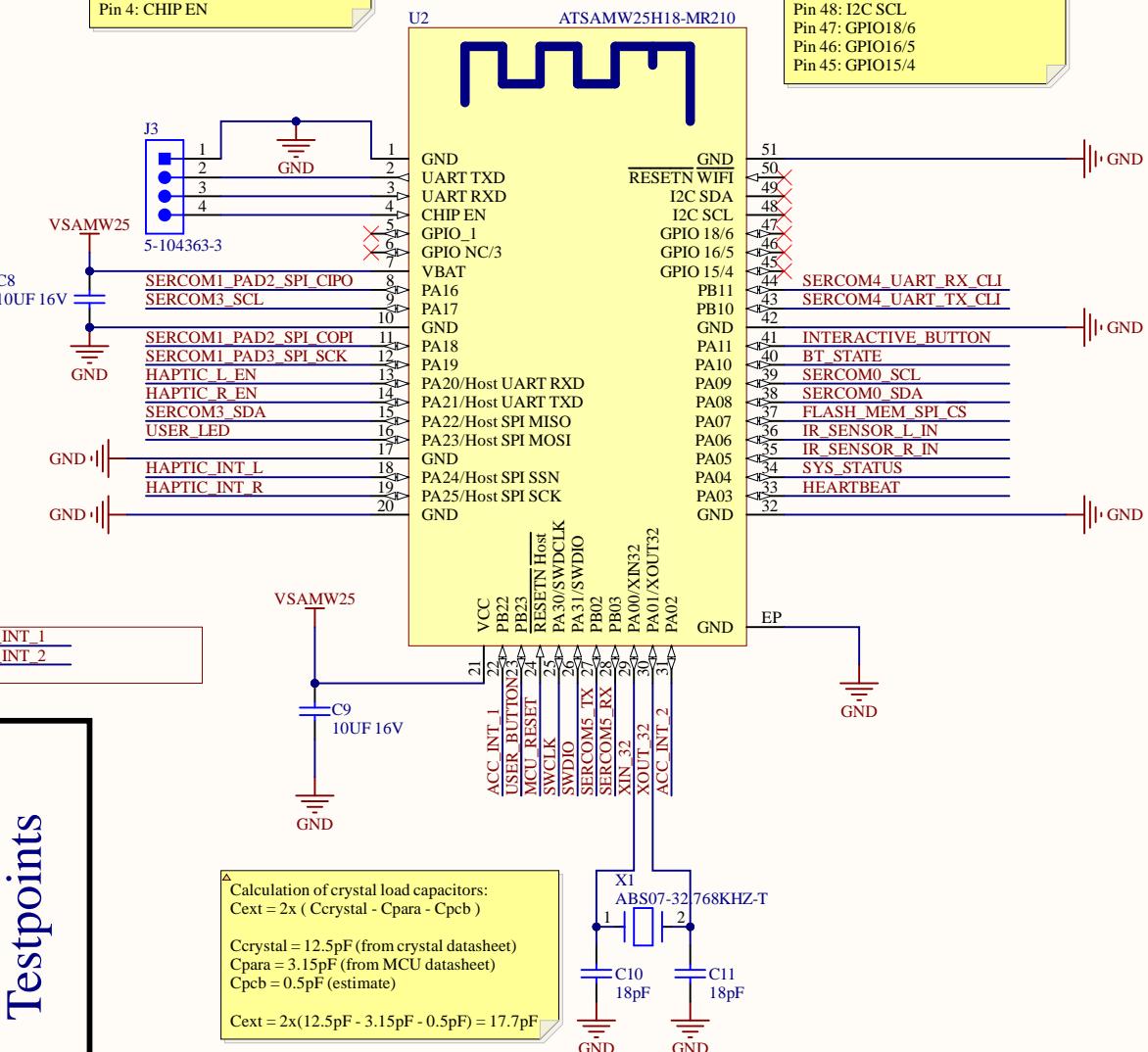
Electrical and Systems Engineering



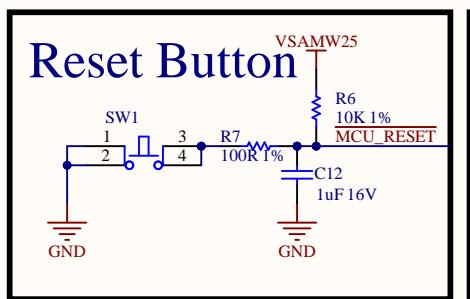
The following pins attach to the WINC1500, not the SAMD21, and must not be used in the design:
Pin 6: GPIO_NC/3
Pin 5: GPIO_1
Pin 4: CHIP_EN

The following pins attach to the WINC1500, not the SAMD21, and must not be used in the design:
Pin 50: RESETN_WIFI
Pin 49: I2C_SDA
Pin 48: I2C_SCL
Pin 47: GPIO18/6
Pin 46: GPIO16/5
Pin 45: GPIO15/4

SERCOM1_PAD2_SPI_CPO	FLASH_MEM_COPI
SERCOM1_PAD2_SPI_CPO	FLASH_MEM_CIPO
SERCOM1_PAD3_SPI_SCK	FLASH_MEM_CLK
	FLASH_MEM_SPI_CS
SERCOM4_UART_RX_CLI	UART_RX_CLI
SERCOM4_UART_RX_CLI	UART_TX_CLI



Testpoints



Title: *MCU.SchDoc*

Desc:

Size: Letter Auth: Saurabh P. Binh N Proj: ESE5160_Circuit_Crusaders.PrjPcb

VCS: Not in version control

Date: 5/4/2024 12:30:05 AM

AD Ver.

Doc. * Sheet 2 of 15

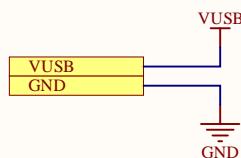
File: *MCU.SchDoc*



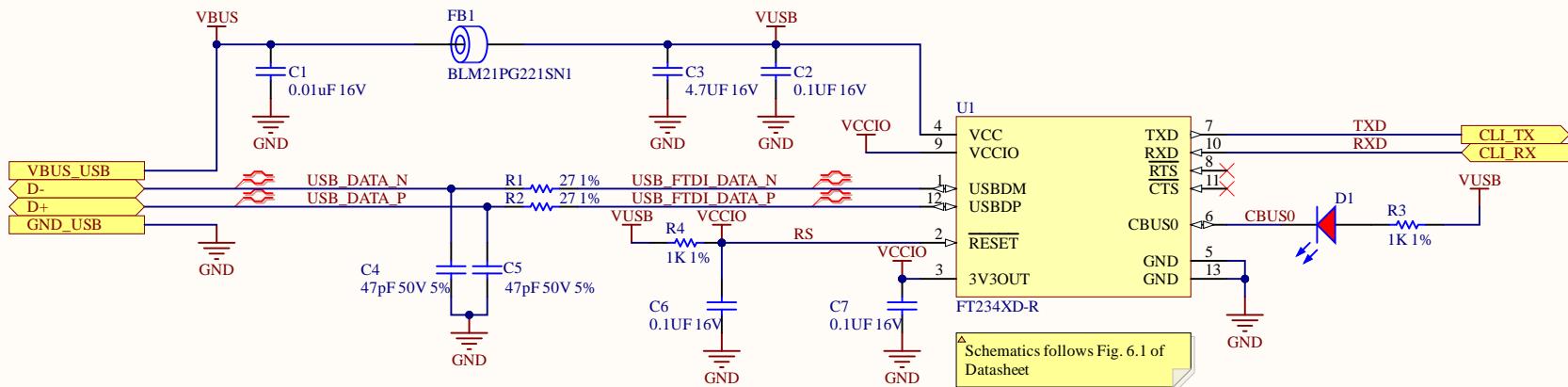
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A

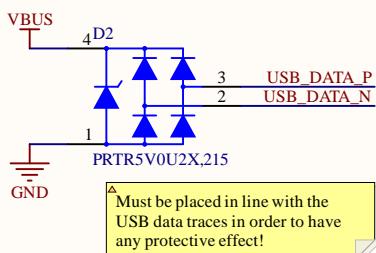


USB to Serial FTDI Chip



C

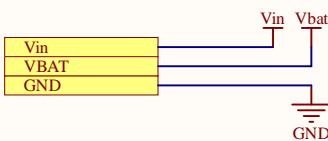
USB ESD Protection



Title: <i>FTDI.SchDoc</i>			
Desc:			
Size: Letter	Auth: Saurabh P. Binh N	Proj: ESE5160_Circuit_Crusaders.PrjPcb	
VCS: Not in version control			
Date: 5/4/2024 12:30:06 AM	AD Ver.	Doc. *	Sheet 3 of 15
File: FTDI.SchDoc			Electrical and Systems Engineering

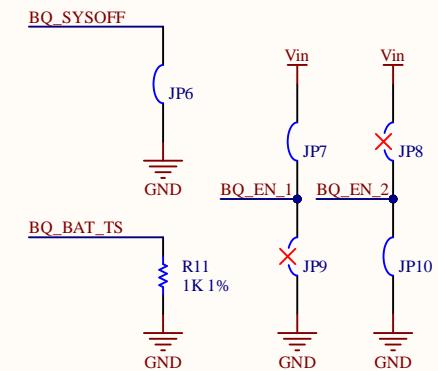
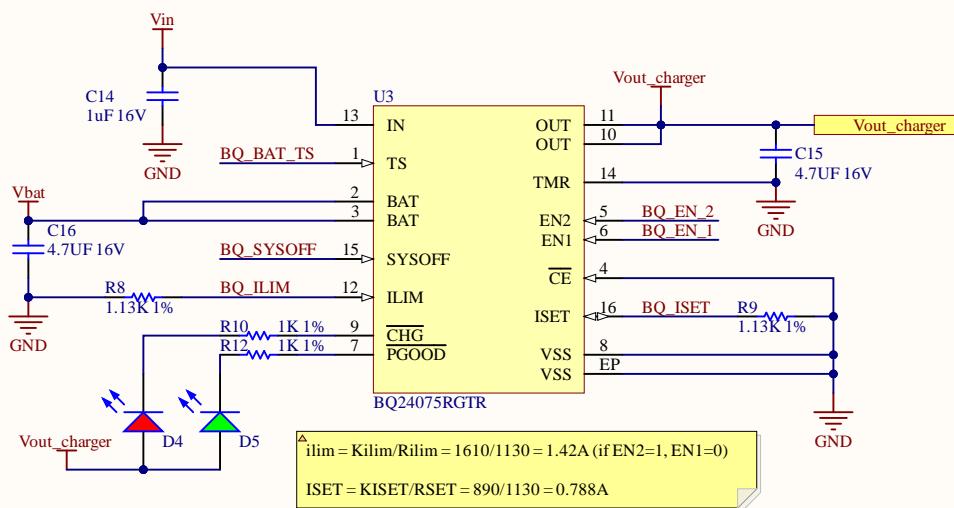


A



[▲]Please see Table 1 of BQ24075 FOR current setup. You can change BQ EN1 and BQ EN 2 if you want! Currently with BQ EN 1 = 1 and BQ EN 2 = 2, the current from the USB is limited to 500 mA.

B



C

D

Title: *LiPo_Charger.SchDoc*

Desc:

Size: Letter Auth: Saurabh P, Binh N Proj: ESE5160_Circuit_Crusaders.PrjPcb

VCS: Not in version control

Date: 5/4/2024 12:30:06 AM AD Ver.

Doc. * Sheet 4 of 15

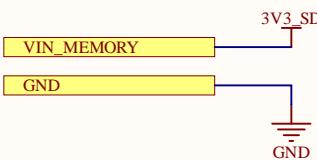
File: LiPo_Charger.SchDoc



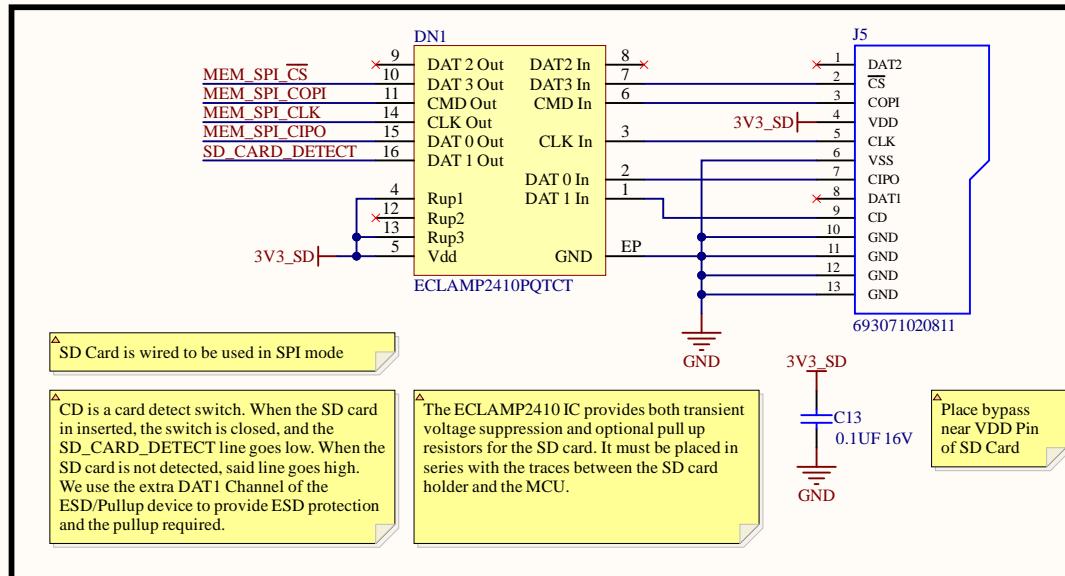
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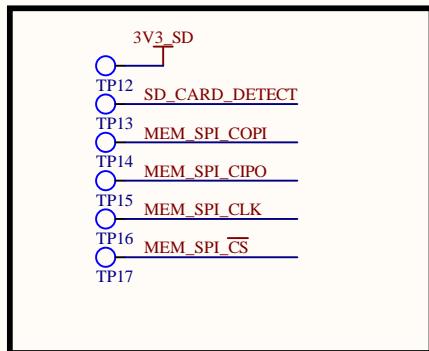
Electrical and Systems Engineering



SD CARD



TESTPOINTS



Title: *Memory.SchDoc*

Desc:

Size: Letter Auth: Saurabh P. Binh N

Proj: ESE5160_Circuit_Crusaders.PrjPcb

VCS: Not in version control

Date: 5/4/2024 12:30:06 AM AD Ver.

Doc. * Sheet 5 of 15

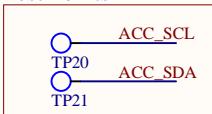
File: Memory.SchDoc

Accelerometer DataSheet: <https://datasheet.civva.com/pdfs/VipMasterIC/IC/SGST/SGST-S-A0003062475/SGST-S-A0003062475-1.pdf>

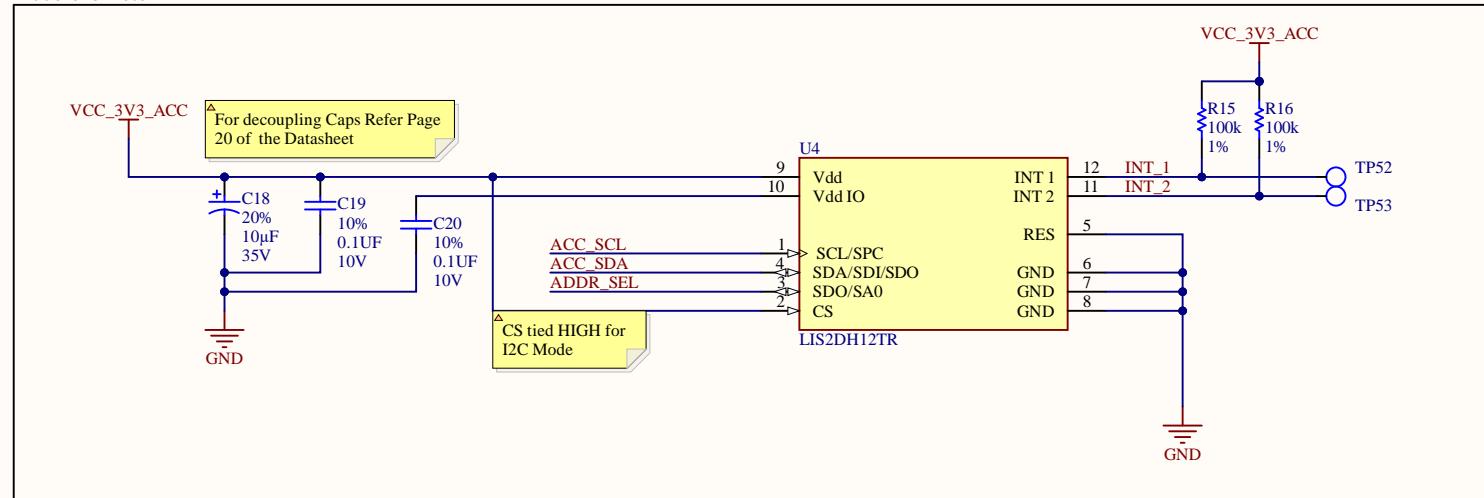
Dev Board Refer: <https://cdn.sparkfun.com/assets/a/c/e/2/d/Schematic.pdf>

A

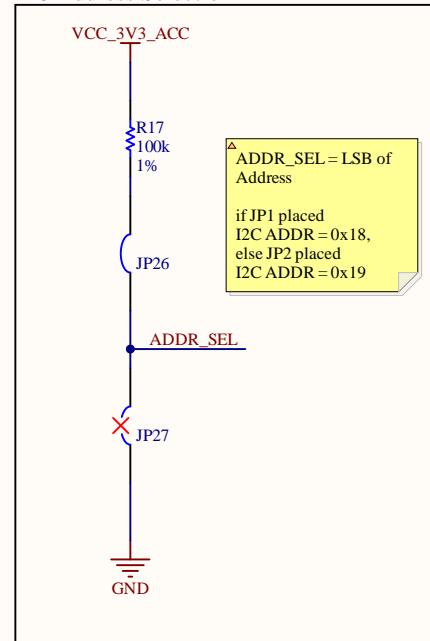
Test Points



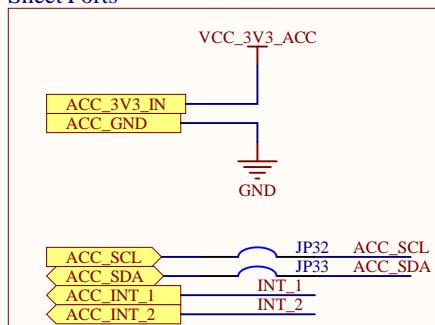
Accelerometer



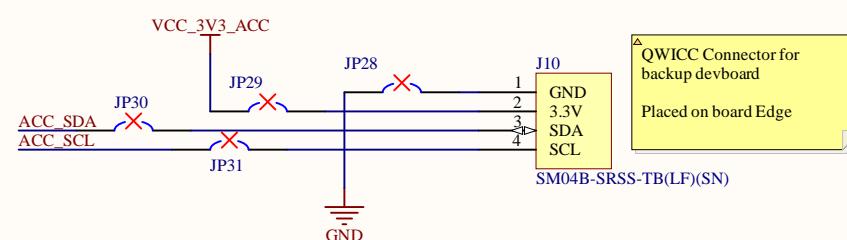
I2C Address Selection



Sheet Ports



Backup QWICC Connector



Title: Accelerometer.SchDoc

Desc:

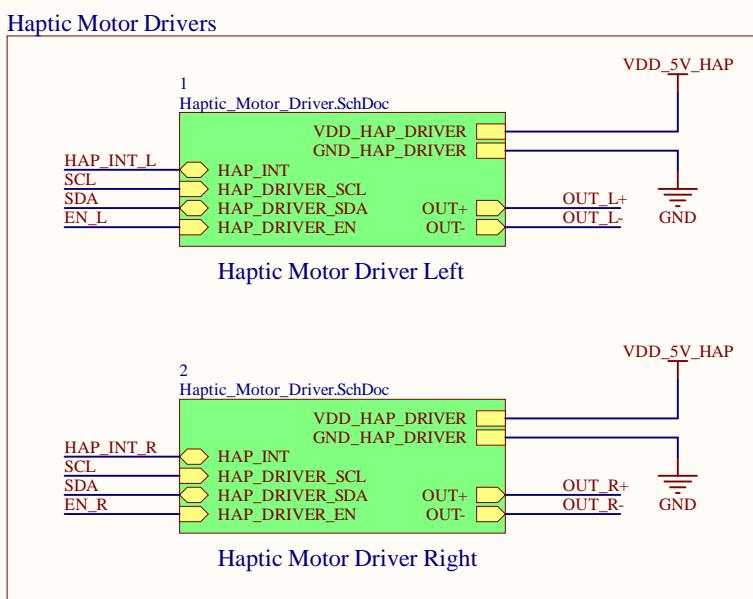
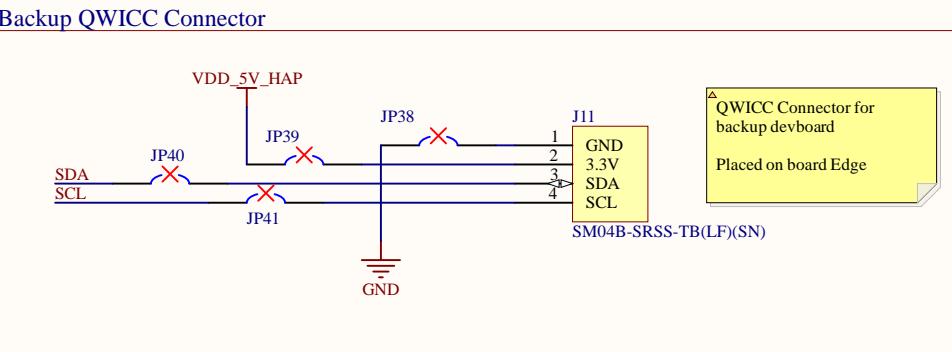
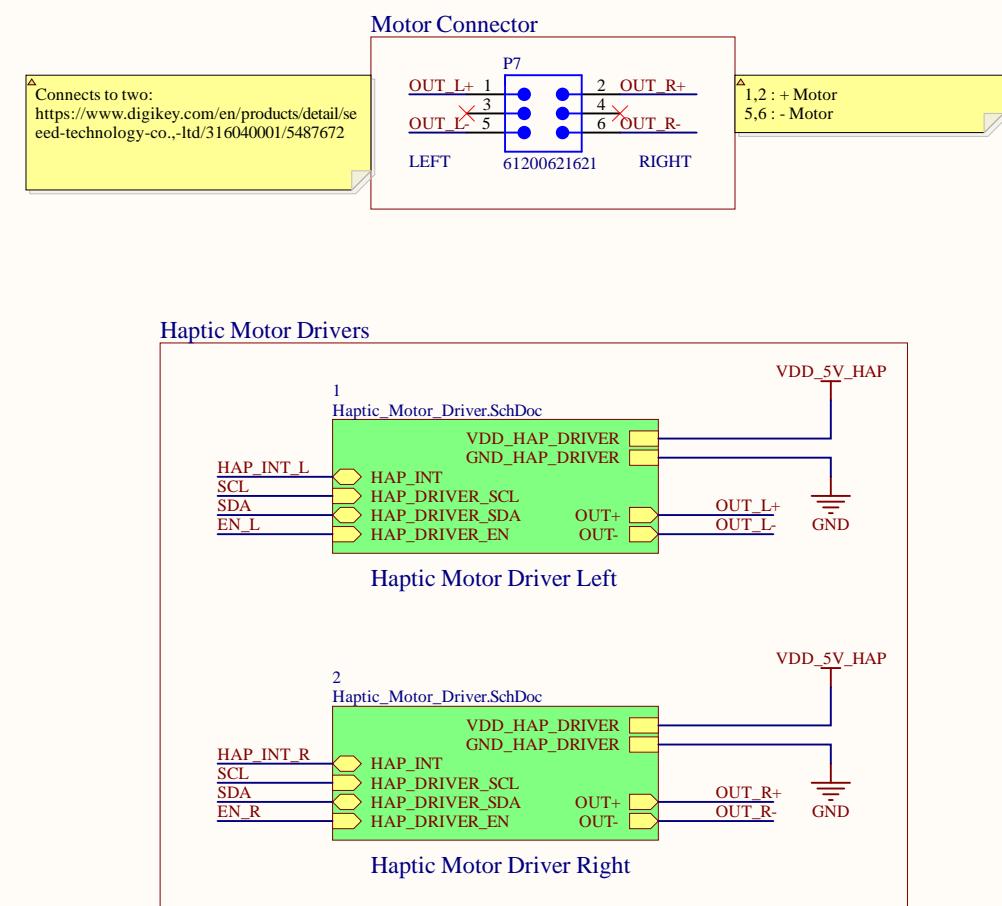
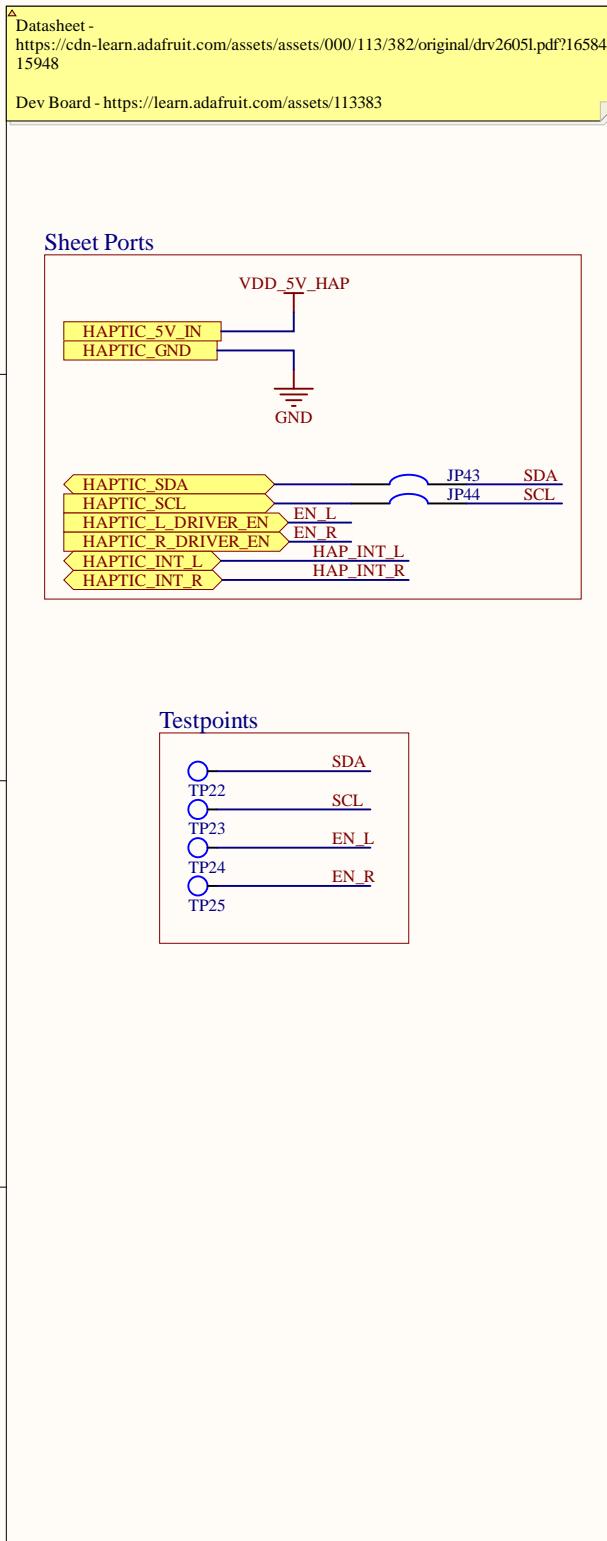
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VCS: Not in version control

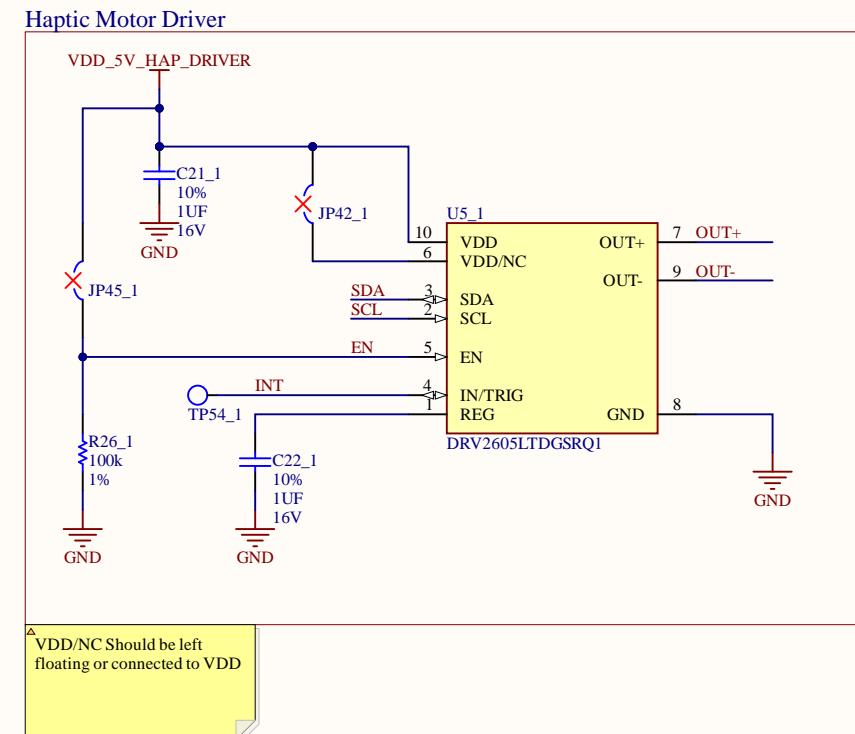
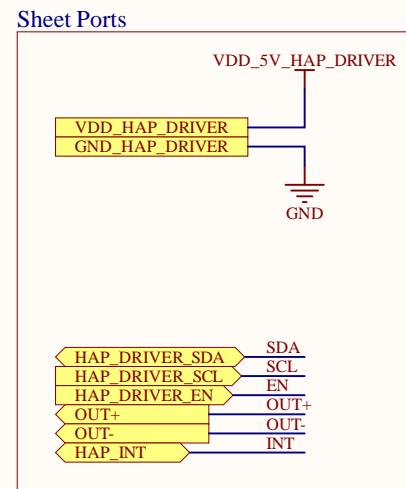
Date: 5/4/2024 12:30:06 AM AD Ver.

Doc. * Sheet 6 of 15

File: Accelerometer.SchDoc



Title: Haptic_Driver.SchDoc			Desc:		
Size: Letter	Auth: Saurabh P. Binh N	Proj: ESE5160_Circuit_Crusaders.PrjPcb			
CS: Not in version control					
Date: 5/4/2024 12:30:07 AM			AD Ver.	Doc. *	Sheet 7 of 15
File: Haptic_Driver.SchDoc			 Penn Engineering <i>UNIVERSITY of PENNSYLVANIA</i> www.seas.upenn.edu Electrical and Systems Engineering		



Title: *Haptic_Motor_Driver.SchDoc*

Desc:

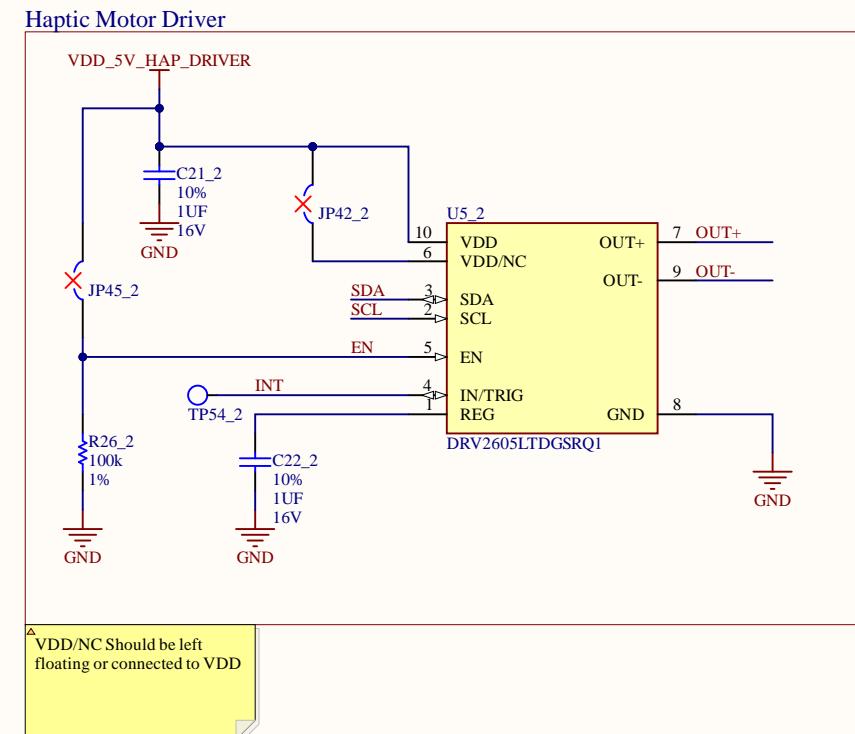
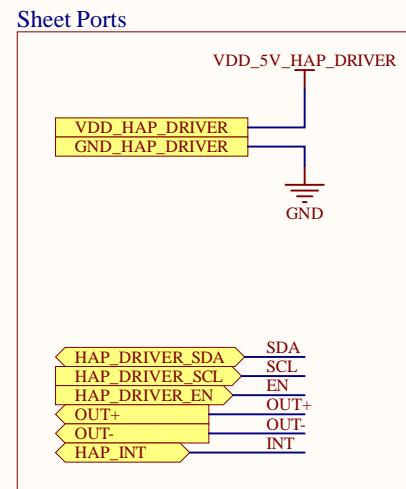
Size: Letter Auth: Saurabh P. Binh N Proj: ESE5160_Circuit_Crusaders.PrjPcb

VCS: Not in version control

Date: 5/4/2024 12:30:07 AM AD Ver.

Doc. * Sheet 8 of 15 Electrical and Systems Engineering

File: *Haptic_Motor_Driver.SchDoc*



Title: *Haptic_Motor_Driver.SchDoc*

Desc:

Size: Letter Auth: Saurabh P. Binh N Proj: ESE5160_Circuit_Crusaders.PrjPcb

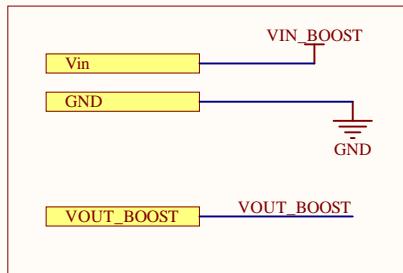
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Date: 5/4/2024 12:30:07 AM AD Ver.

Doc. * Sheet 8 of 15 Electrical and Systems Engineering

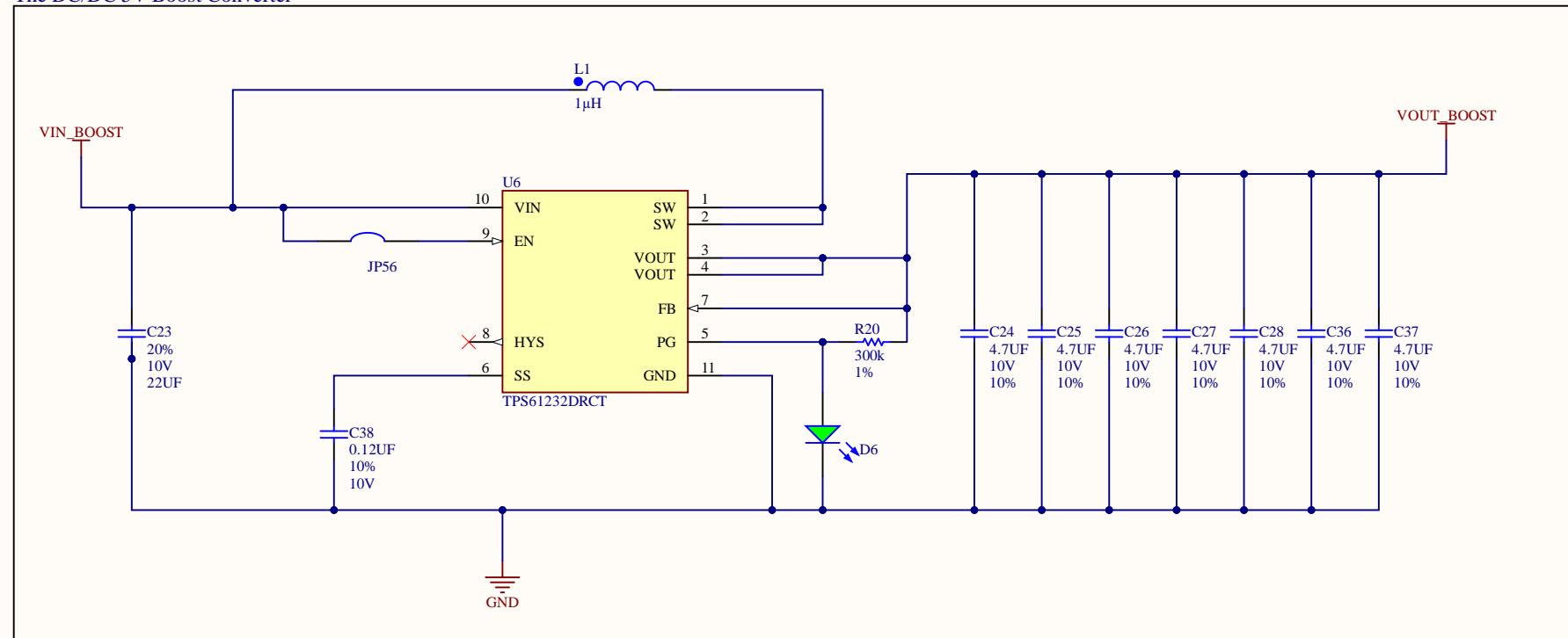
File: *Haptic_Motor_Driver.SchDoc*

Sheet Ports



[△] Please refer to datasheet for the boost design!
<https://www.ti.com/lit/ds/symlink/tps61232.pdf?ts=1707959039470>

The DC/DC 5V Boost Converter



Title: *BoostConverter.SchDoc*

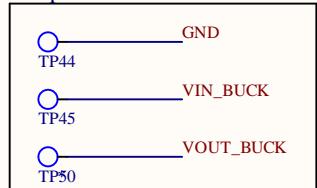
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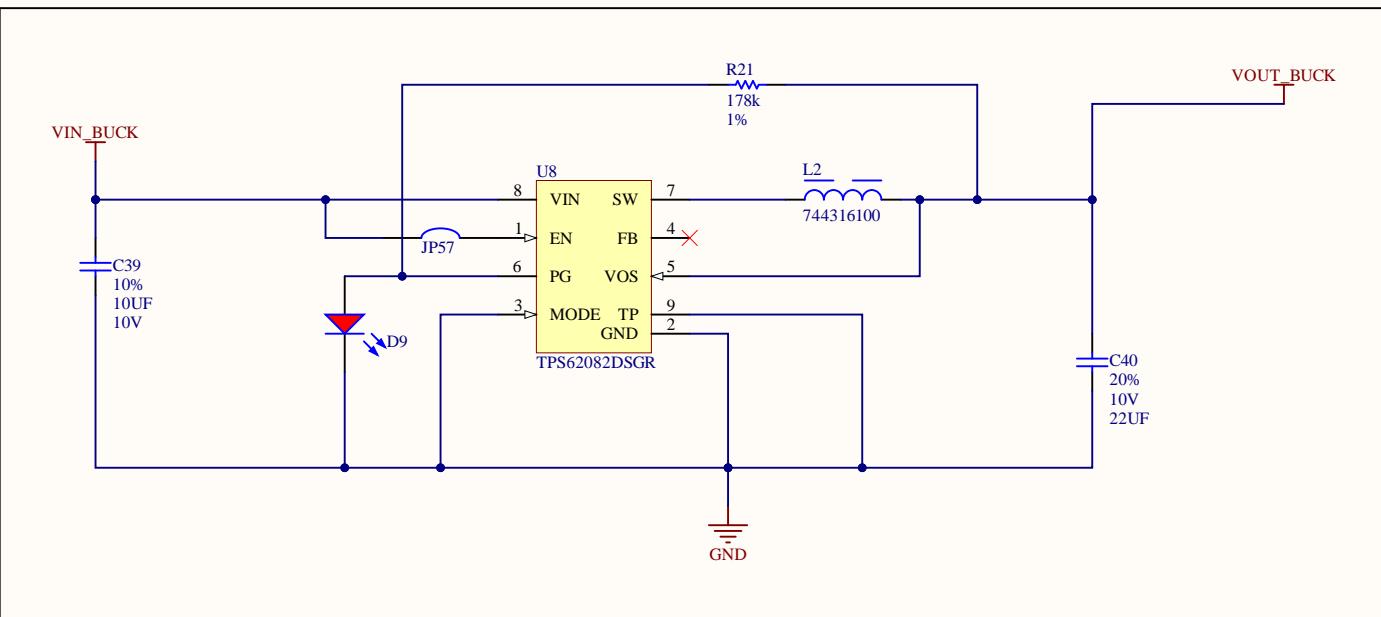
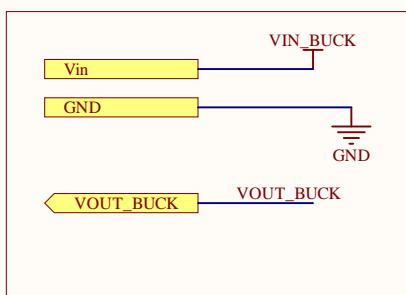
VCS: Not in version control

Date: 5/4/2024 12:30:07 AM AD Ver. Doc. * Sheet 9 of 15

File: *BoostConverter.SchDoc*

Testpoints

[▲] Please refer to datasheet for the buck converter design!
https://www.ti.com/lit/ds/symlink/tps62082.pdf?ts=1707337651293&rft_url=https%253A%252F%252Fwww.ti.com%252Fproduct%252FTPS62082

The 3.3V Buck Converter**Sheet Ports**

[▲] BOM for the design
 Cin = 10uF (C0805C106K9PACTU)
 L1 = 1mH (744316100)
 Rpg = 178kOhm (CRCW0402178KFKED)
 Cout = 22uF (GRM21BR61A226ME51L)

Title: *BuckConverter.SchDoc*

Desc:

Size: Letter Auth: Saurabh P, Binh N Proj: ESE5160_Circuit_Crusaders.PrjPcb

VCS: Not in version control

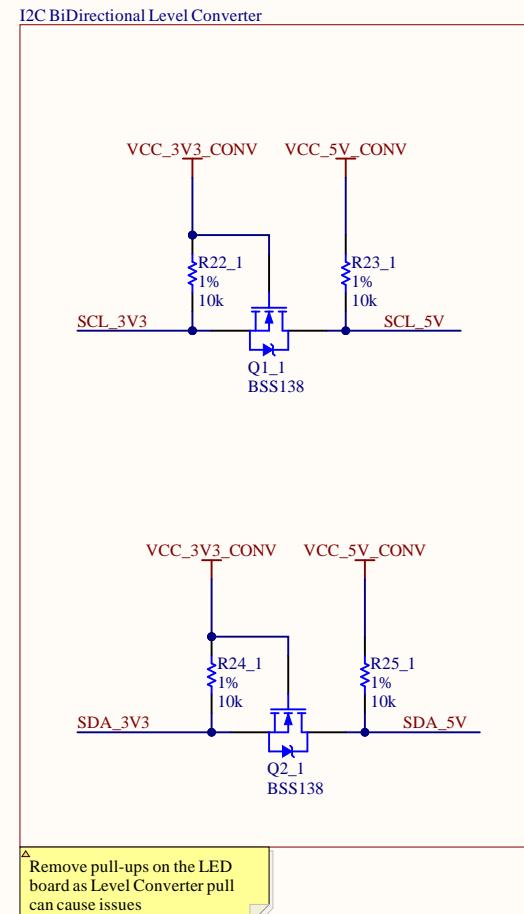
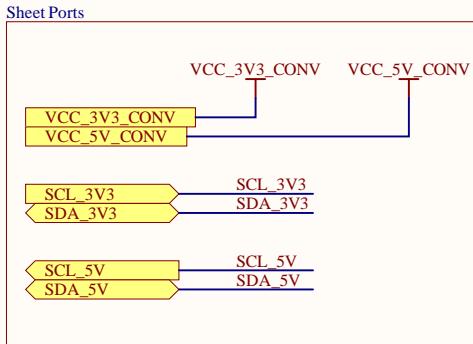
Date: 5/4/2024 12:30:07 AM AD Ver.

Doc. * Sheet 10 of 15

File: BuckConverter.SchDoc

To use this converter, the GND should be common between the HIGH and LOW logic voltages

Mosfet Datasheet:
https://cdn.sparkfun.com/datasheets/BreakoutBoards/BSS138.pdf?_gl=1*1d5rsu4*_ga*MzY1NjkwOTYuMTcwNjExMjExMQ..*_ga_T369JS7J9N*MTcwNzM0NzQ0Ny4yMC4xLjE3MDczNDc1NDUuNjAuMC4w



Title: *BiDirectional_Voltage_Converter.SchDoc*

Desc:

Size: Letter Auth: Saurabh P. Binh N Proj: ESE5160_Circuit_Crusaders.PrjPcb

VCS: Not in version control

Date: 5/4/2024 12:30:08 AM AD Ver. Doc. * Sheet 12 of 15

File: BiDirectional_Voltage_Converter.SchDoc

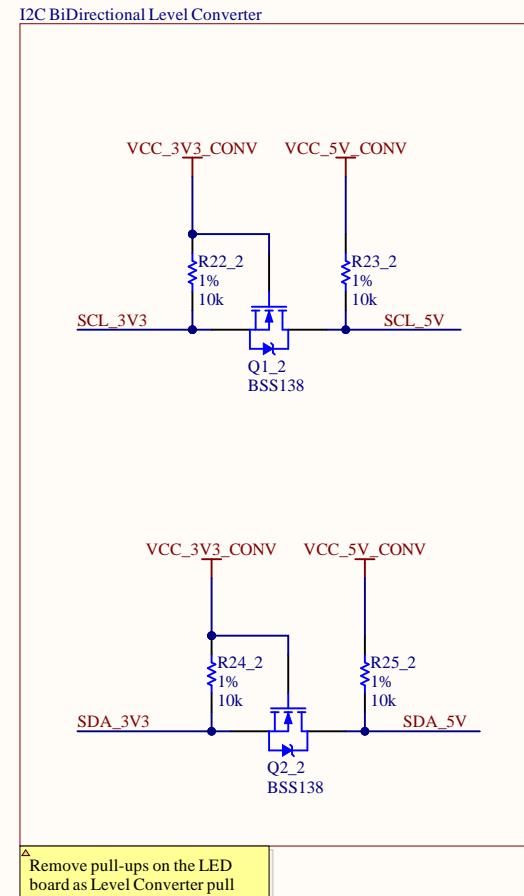
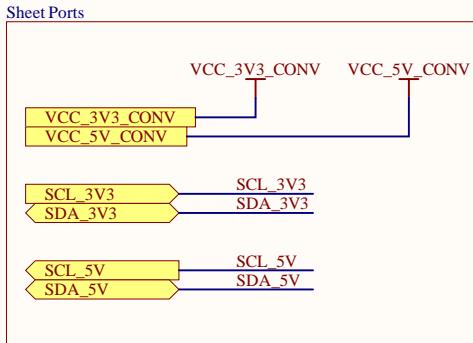


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To use this converter, the GND should be common between the HIGH and LOW logic voltages

Mosfet Datasheet:
https://cdn.sparkfun.com/datasheets/BreakoutBoards/BSS138.pdf?_gl=1*1d5rsu4*_ga*MzY1NjkwOTYuMTcwNjExMjExMQ..*_ga_T369JS7J9N*MTcwNzM0NzQ0Ny4yMC4xLjE3MDczNDc1NDUuNjAuMC4w



Title: *BiDirectional_Voltage_Converter.SchDoc*

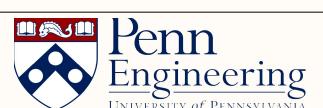
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VCS: Not in version control

Date: 5/4/2024 12:30:08 AM AD Ver. Doc. * Sheet 12 of 15

File: BiDirectional_Voltage_Converter.SchDoc



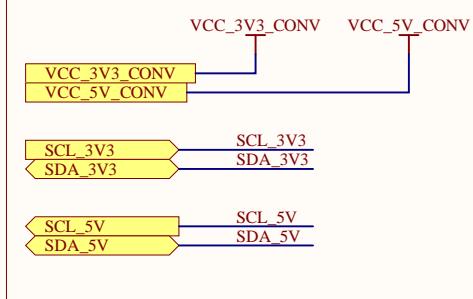
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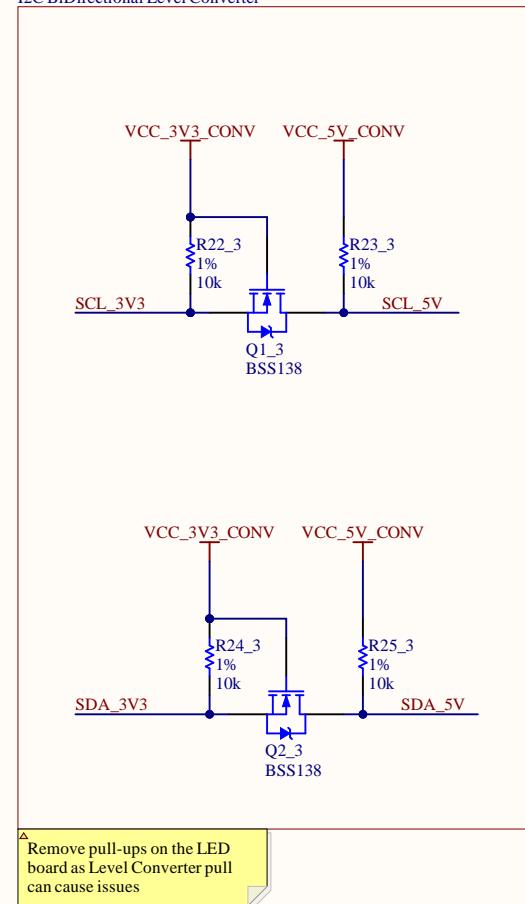
To use this converter, the GND should be common between the HIGH and LOW logic voltages

Mosfet Datasheet:
https://cdn.sparkfun.com/datasheets/BreakoutBoards/BSS138.pdf?_gl=1*1d5rsu4*_ga*MzY1NjkwOTYuMTcwNjExMjExMQ..*_ga_T369JS7J9N*MTcwNzM0NzQ0Ny4yMC4xLjE3MDczNDc1NDUuNjAuMC4w

A Sheet Ports



I2C BiDirectional Level Converter



Title: *BiDirectional_Voltage_Converter.SchDoc*

Desc:

Size: Letter Auth: Saurabh P. Binh N Proj: ESE5160_Circuit_Crusaders.PrjPcb

VCS: Not in version control

Date: 5/4/2024 12:30:08 AM AD Ver. Doc. * Sheet 12 of 15

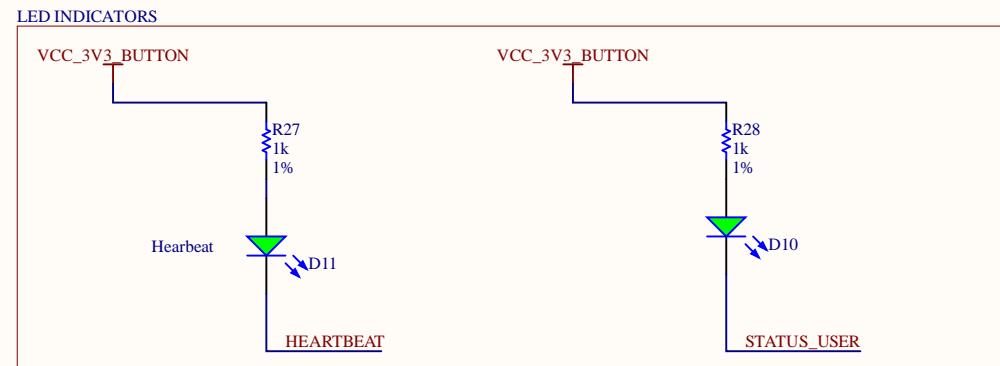
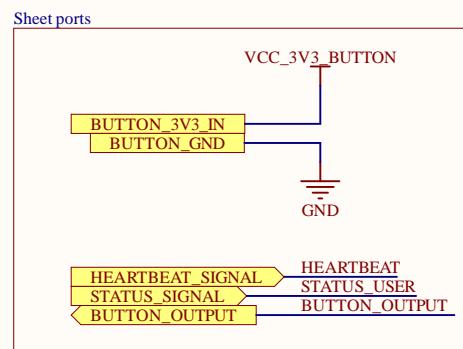
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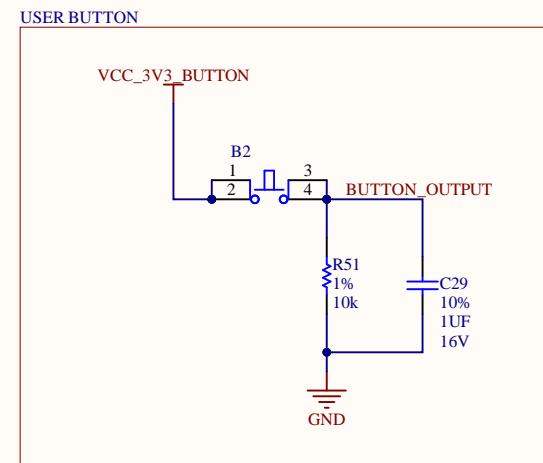
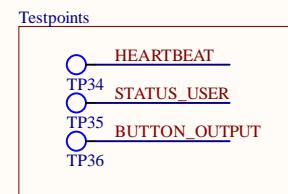
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A



B



C

D

Title: <i>Status_LED_and_Button.SchDoc</i>		
Desc:		
Size: Letter	Auth: Saurabh P. Binh N	Proj: ESE5160_Circuit_Crusaders.PrjPcb
VCS: Not in version control		
Date: 5/4/2024 12:30:08 AM	AD Ver.	Doc. * Sheet 13 of 15
File: Status_LED_and_Button.SchDoc		

A

A

B

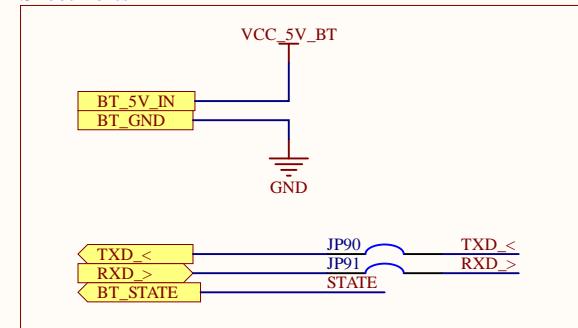
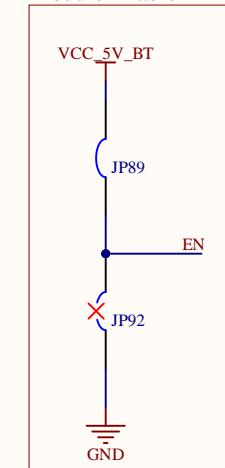
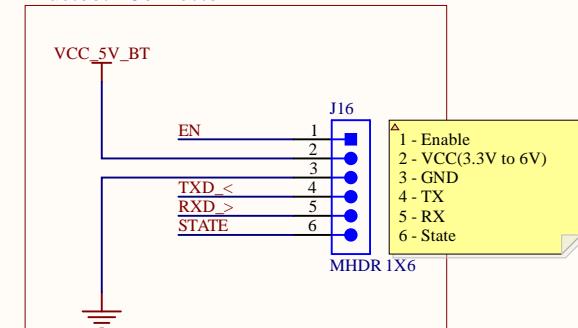
B

C

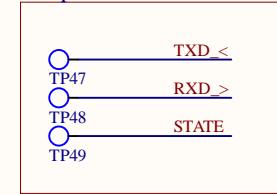
C

D

D

Sheet Ports**Module Enable****Bluetooth Connector**

Connects to:
https://www.amazon.com/Bluetooth-Converter-Wireless-Transceiver-Communication/dp/B08Z3J9Y8T/ref=asc_df_B08Z3J9Y8T

Testpoints

Title: *Bluetooth.SchDoc*

Desc:

Size: Letter Auth: Saurabh P. Binh N Proj: ESE5160_Circuit_Crusaders.PrjPcb

VCS: Not in version control

Date: 5/4/2024 12:30:09 AM AD Ver. Doc. * Sheet 14 of 15

File: Bluetooth.SchDoc



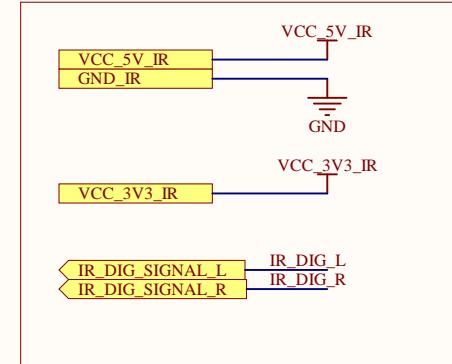
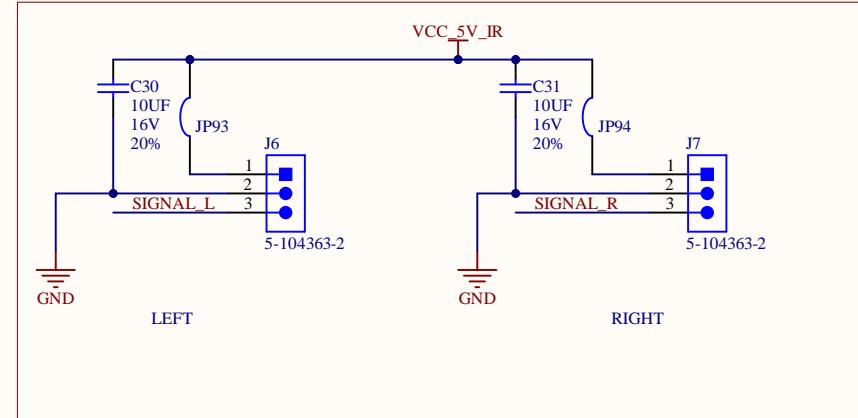
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Datasheet:
https://www.adafruit.com/product/164?gad_source=1&gclid=CjwKCAiAlJKuBhAdEiwAnZb7lcs68vuxYaCXdlPv4S_7kkNJ3DyIteso9FFyAww9JAN1ei8nJ4kTmBoCs14QAvD_BwE

A

A

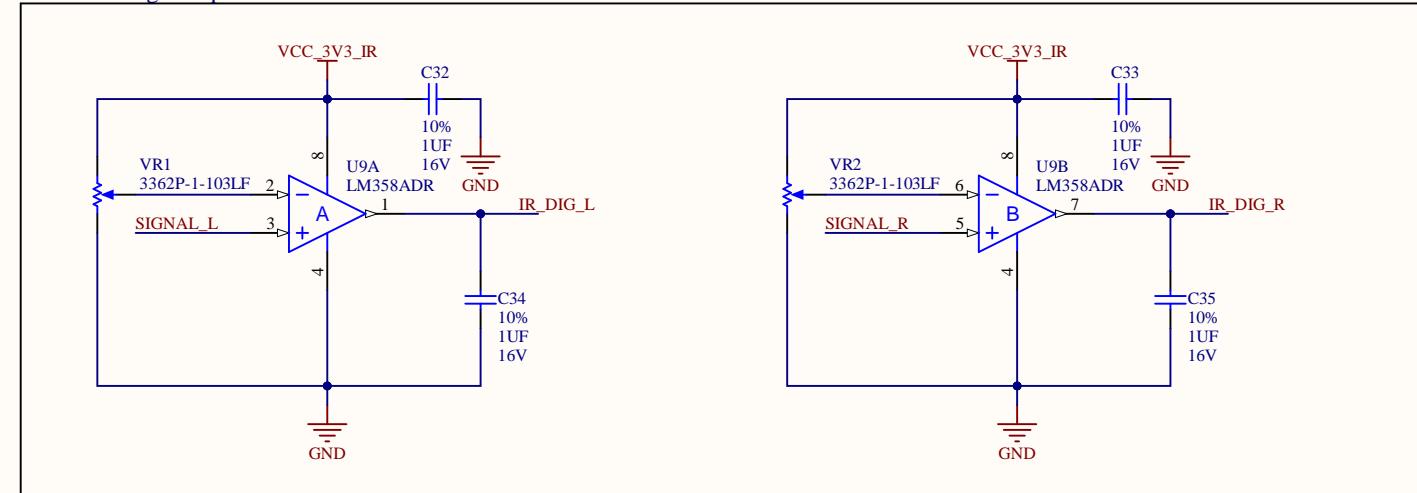
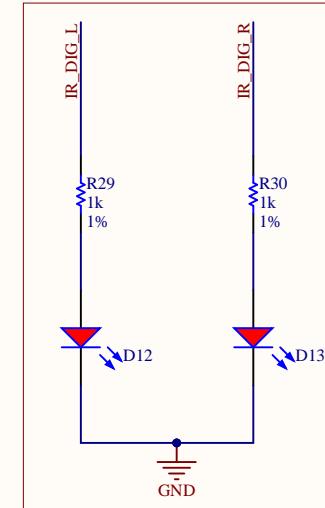
Sheet Ports**IR Sensor Connector**

Connects to two :
https://www.adafruit.com/product/164?gad_source=1&gclid=CjwKCAiAlJKuBhAdEiwAnZb7lcs68vuxYaCXdlPv4S_7kkNJ3DyIteso9FFyAww9JAN1ei8nJ4kTmBoCs14QAvD_BwE

1 - VCC (5V)
 3 - GND
 5 - ANALOG OUT(3.3V to 0.4V)

Testpoints

TP37	SIGNAL_L
TP38	SIGNAL_R
TP39	IR_DIG_L
TP40	IR_DIG_R

Non-Inverting Comparator**LED Indications**Title: *IR_Distance_Sensor.SchDoc*

Desc:

Size: Letter Auth: Saurabh P. Binh N Proj: ESE5160_Circuit_Crusaders.PrjPcb

VCS: Not in version control

Date: 5/4/2024 12:30:09 AM AD Ver.

Doc. * Sheet 15 of 15

File: IR_Distance_Sensor.SchDoc



www.seas.upenn.edu

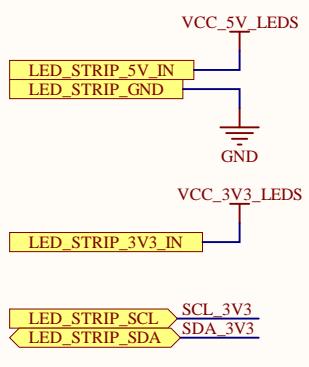
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Dev Board:
https://cdn.sparkfun.com/datasheets/BreakoutBoards/Logic_Level_Bidirectional.pdf?_gl=1*ewv7b1*_ga*MzY1NjkwO TYuMTcwNjExMjExMQ..*_ga_T369JS7J9N*MTcwNzMo0 NzQ0Ny4yMC4xLjE3MDczNDc1NTAuNTUuMC4w

Mosfet Datasheet:
https://cdn.sparkfun.com/datasheets/BreakoutBoards/BSS138.pdf?_gl=1*1d5rsu4*_ga*MzY1NjkwOTYuMTcwNjExMjExMQ..*_ga_T369JS7J9N*MTcwNzMo0Ny4yMC4xLjE3MDczNDc1NDUuNjAuMC4w

A

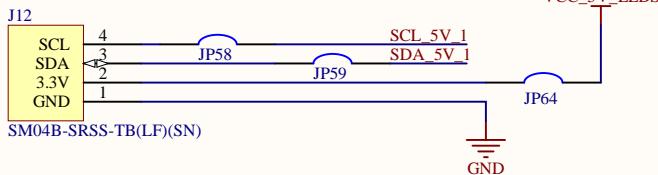
Sheet Ports



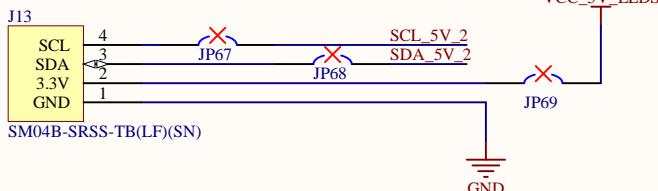
We are using QWICC connectors but supplying 5V instead of 3.3V
Connects to: <https://www.sparkfun.com/products/18354>

QWICC Connectors for Turn Indicators

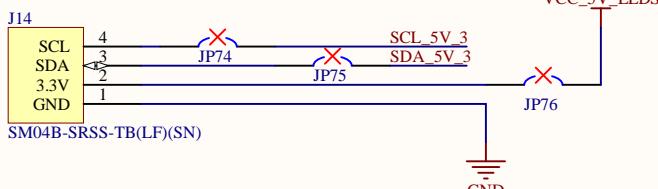
LEFT TURN INDICATOR OR DAISY CHAIN



BRAKE INDICATOR



RIGHT TURN INDICATOR



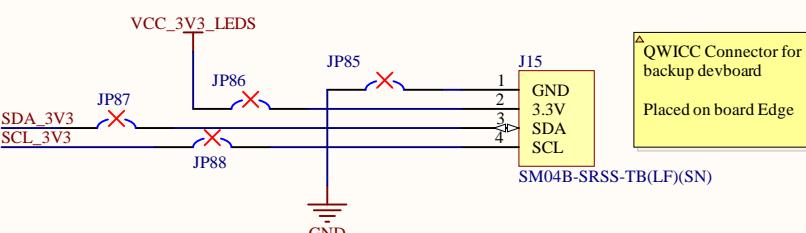
Indicator: I2C Address
LEFT: 0x23
RIGHT: 0x22
BRAKE: Need to reprogram the Attiny to 0x24

B

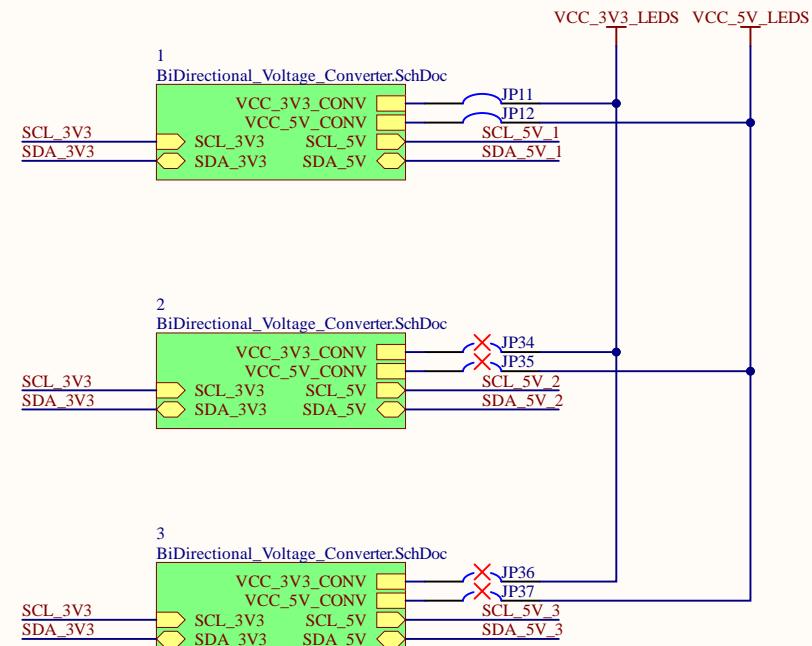
Testpoints

- SCL_3V3
- TP26 SDA_3V3
- TP27 SCL_5V_1
- TP28 SDA_5V_1
- TP29 SCL_5V_2
- TP30 SDA_5V_2
- TP31 SCL_5V_3
- TP32 SDA_5V_3
- TP33

Backup QWICC Connector



3.3V to 5V Bi-Directional Level Converters



If needed other level converters may be connected

Remove pull-ups on the LED board as Level Converter pull can cause issues

Title: *LED_Strips.SchDoc*

Desc:

Size: Letter Auth: Saurabh P. Binh N Proj: ESE5160_Circuit_Crusaders.PrjPcb

VCS: Not in version control Date: 5/4/2024 12:30:09 AM AD Ver. Doc. * Sheet * of 11

File: *LED_Strips.SchDoc*

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