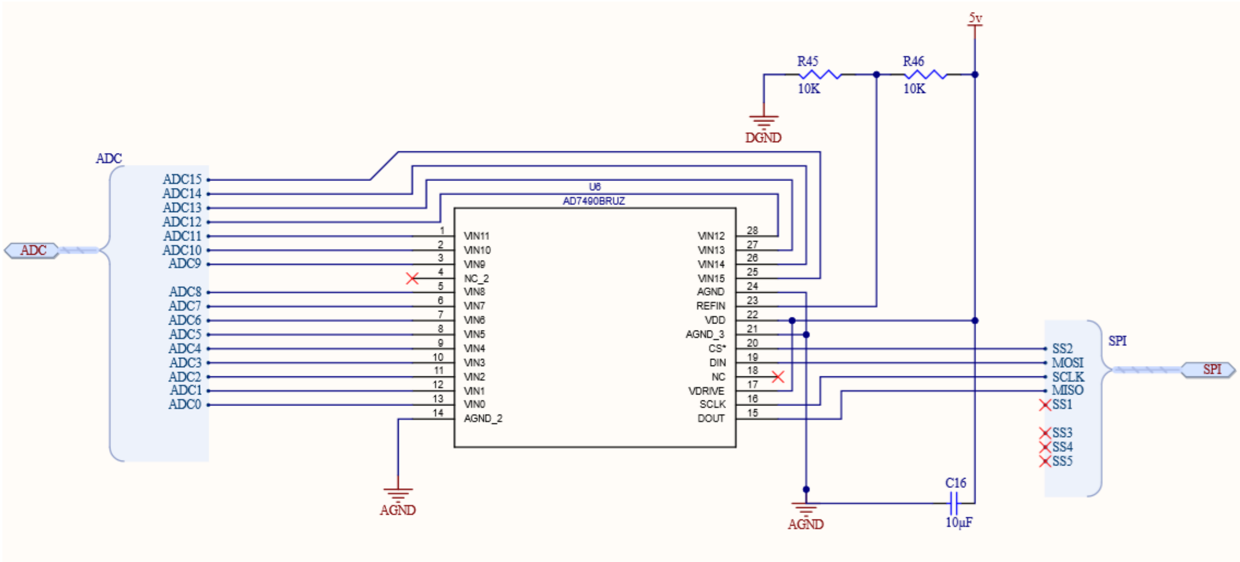
Schematic Information

Rev 0.0.1 Pre-Alpha

Index

ADC



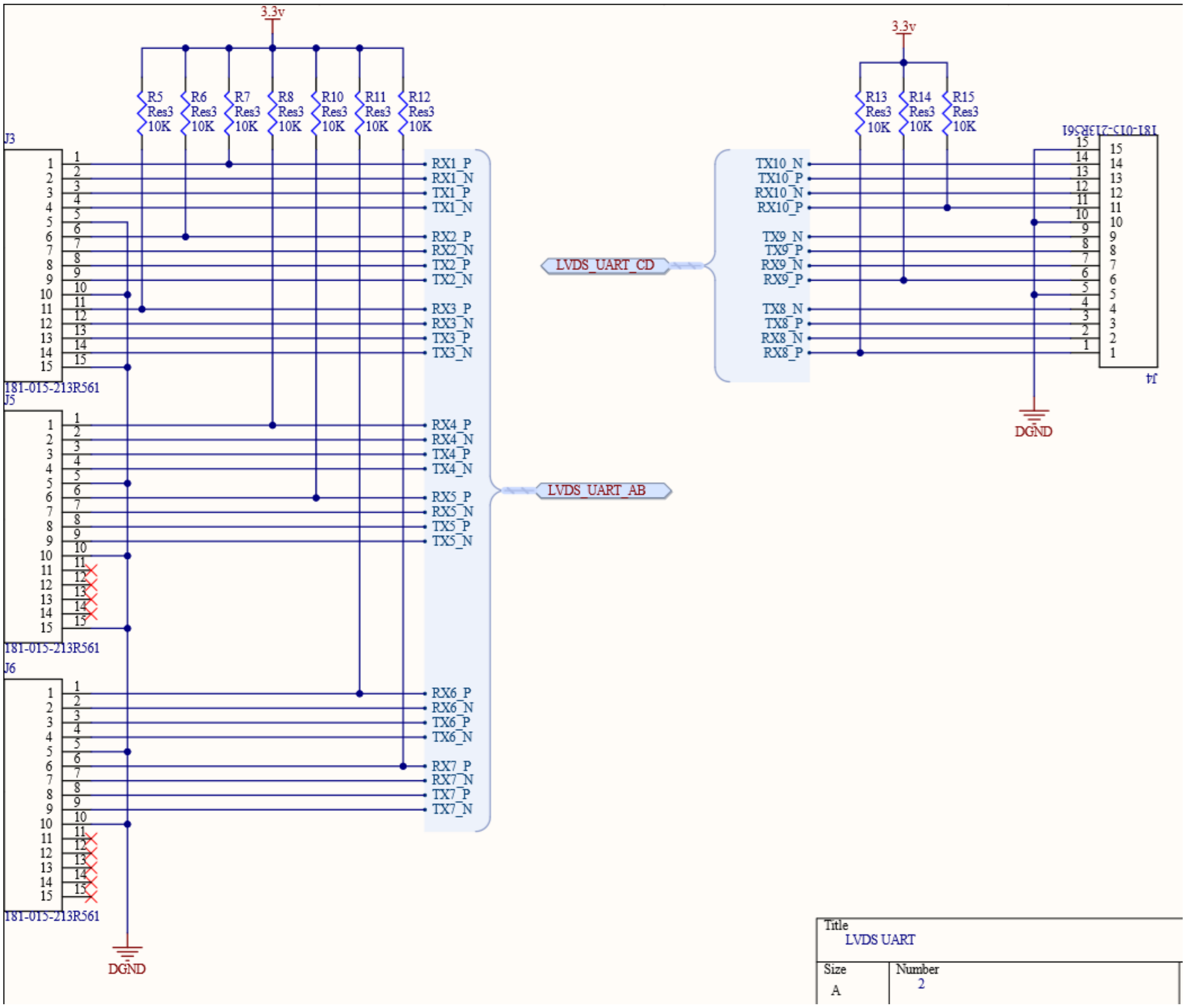
Description:

[AD7490 – 16-Channel, 1 MSPS, 12-Bit ADC with Sequencer in 28-Lead TSSOP]

The AD7490 is a 12-bit high speed, low power, 16-channel, successive approximation ADC. The part operates from a single 2.7 V to 5.25 V power supply and features throughput rates up to 1 MSPS. The part contains a low noise, wide bandwidth track-and-hold amplifier that can handle input frequencies in excess of 1 MHz. This ADC is used to take analog input voltages from multiple sensors and send the data to the FPGA. The ADC communicates over a SPI protocol.

Designer: Max Bakes

LVDS UART

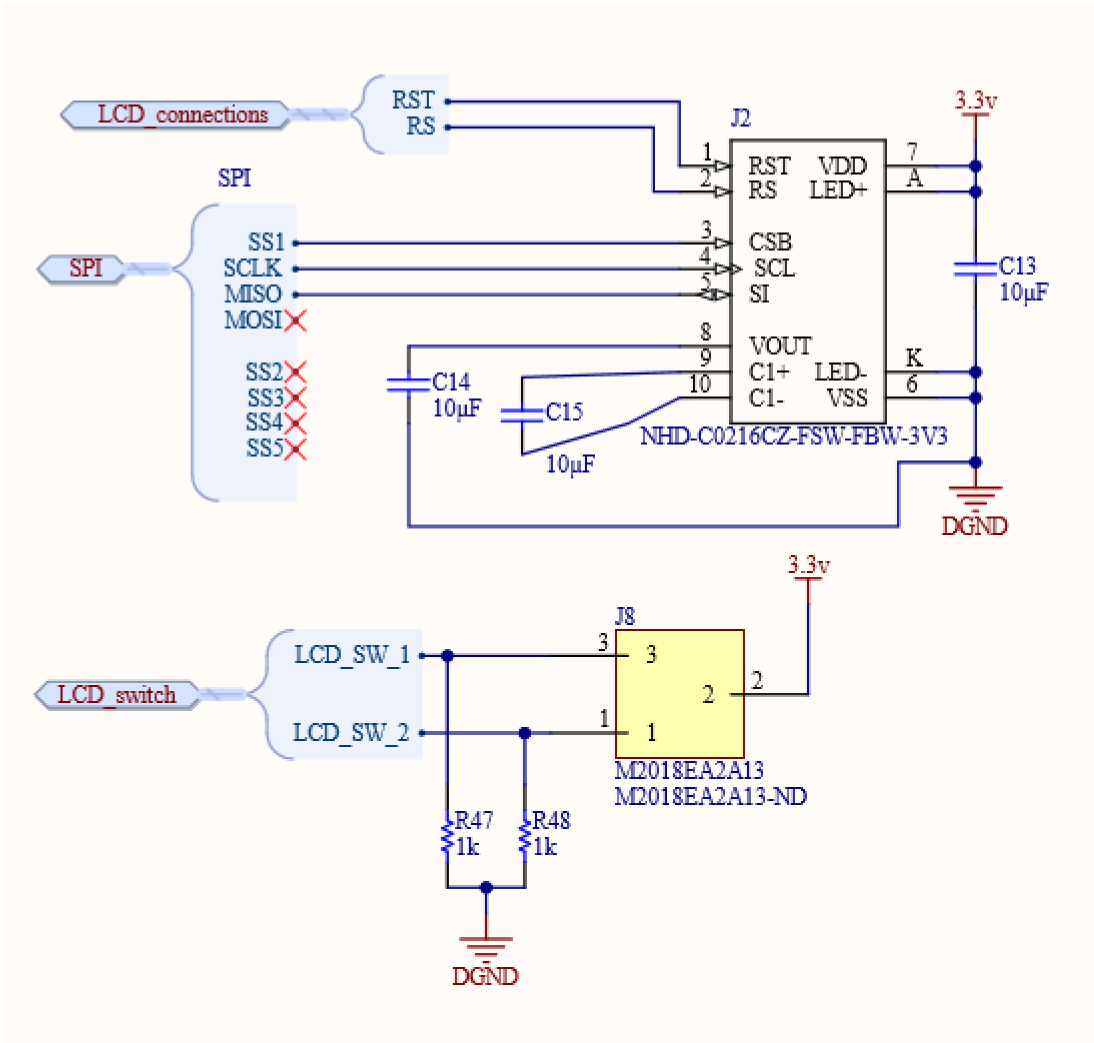


Description:

The LVDS UART has 10 full-duplex LVDS UARTs. They are connected to 4 HD 15 connectors with three UARTs on two connectors and two UARTs on the other two. All positive RX pins have a pull-up resistor added to them to limit noise when they are not connected.

Designer: James Thomas

LCD Screen



Description:

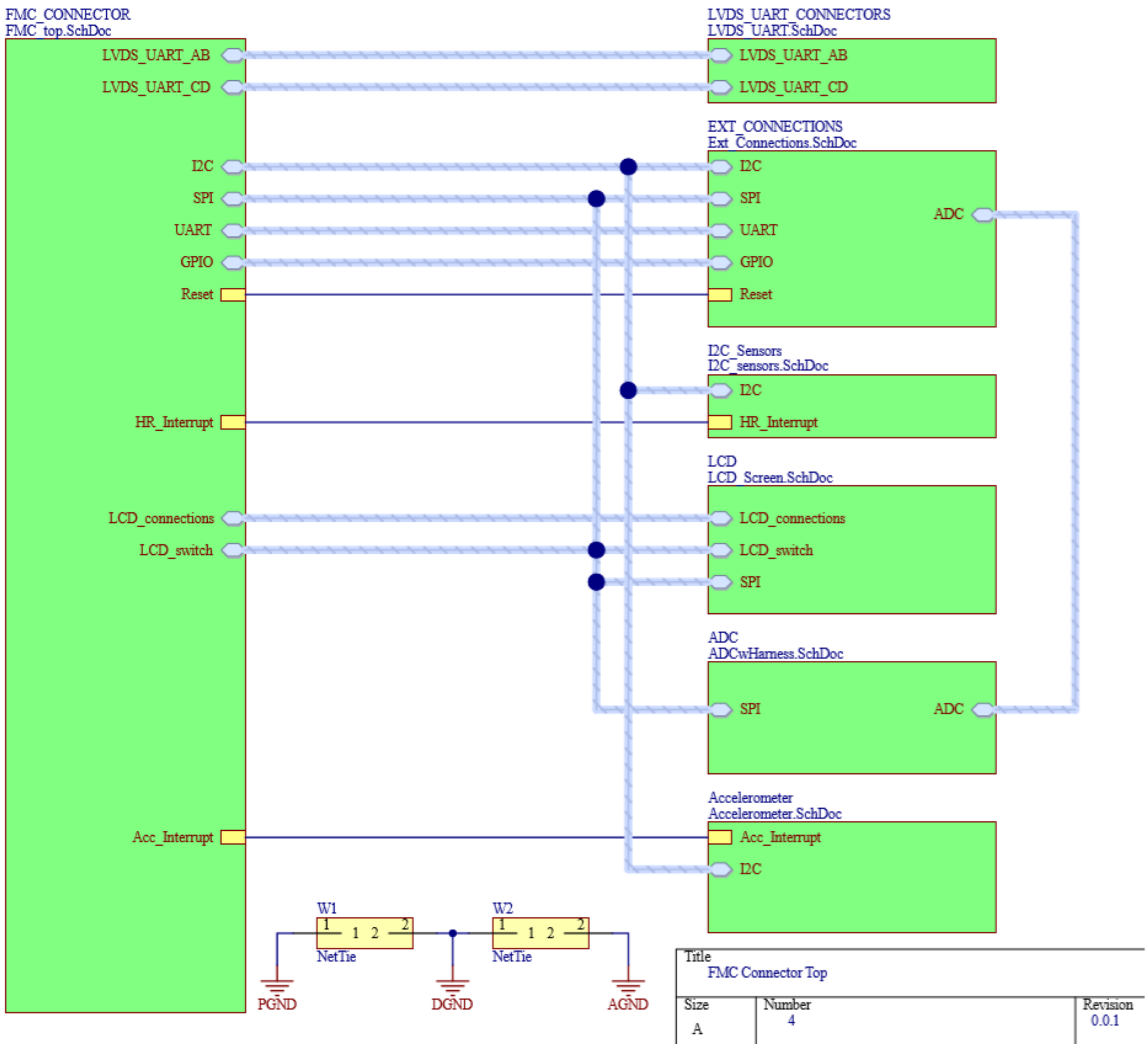
LCD Screen and bidirectional paddle switch.

The switch is hooked up to 3.3V power, with pull down resistors on both outputs. When either side is toggled, it sends a high enabled signal to its respective pin on the FMC connector which plugs into the FPGA. The LCD is hooked up according to the PDF found here.

The device is connected to the first SPI enable pin. You cannot read data from here, only write using SPI. The various capacitors were used as suggested by the documentation above. We took some liberty in deciding to use 3.3V for the backlight instead of the suggested 3V. RST is the reset pin that can be called. This Reset is low enabled, so the signal needs to stay high until it is called. RS is the register select. This tells the LCD whether it is receiving a command or data to be written to the screen. The SoftConsole project has code written for both scenarios.

Designer: Michael Ashford

Top

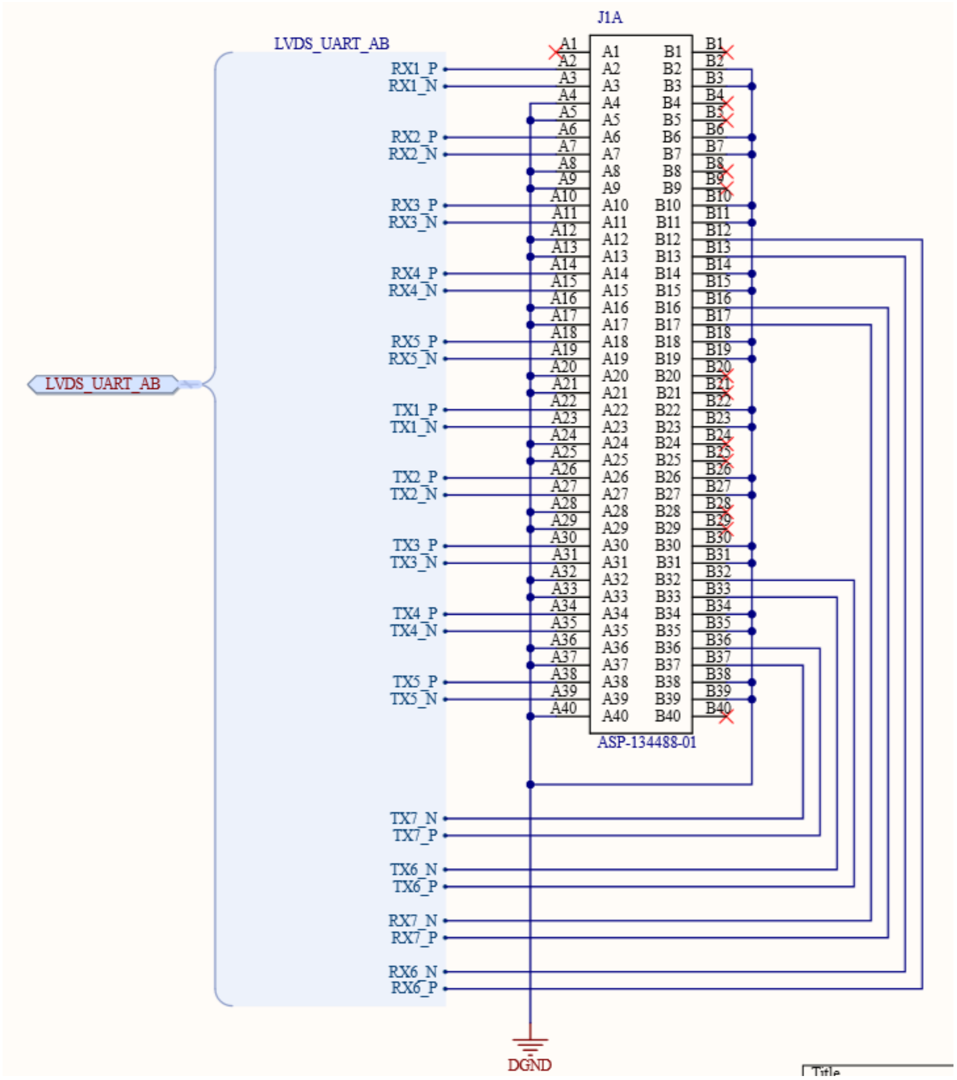


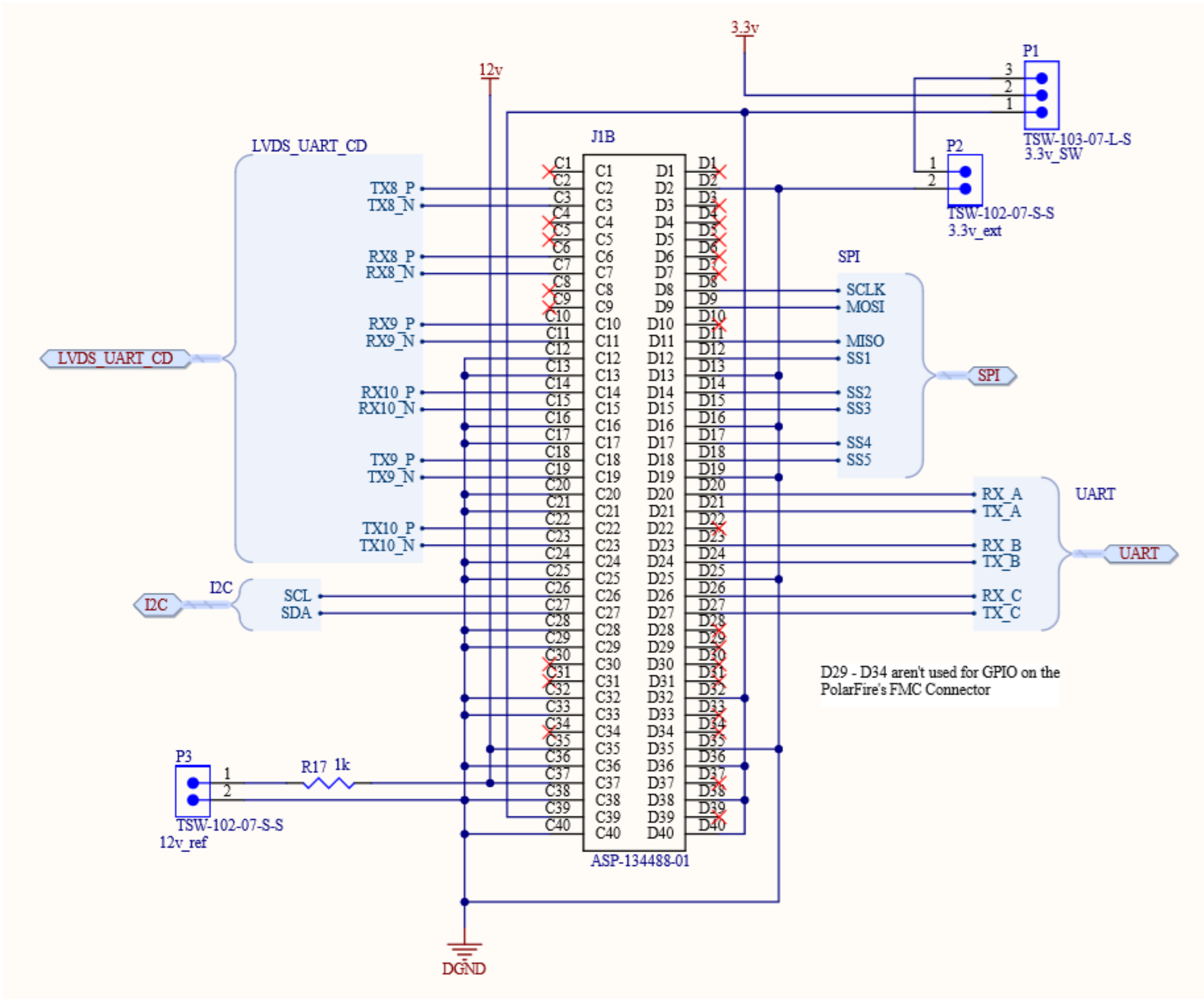
Description:

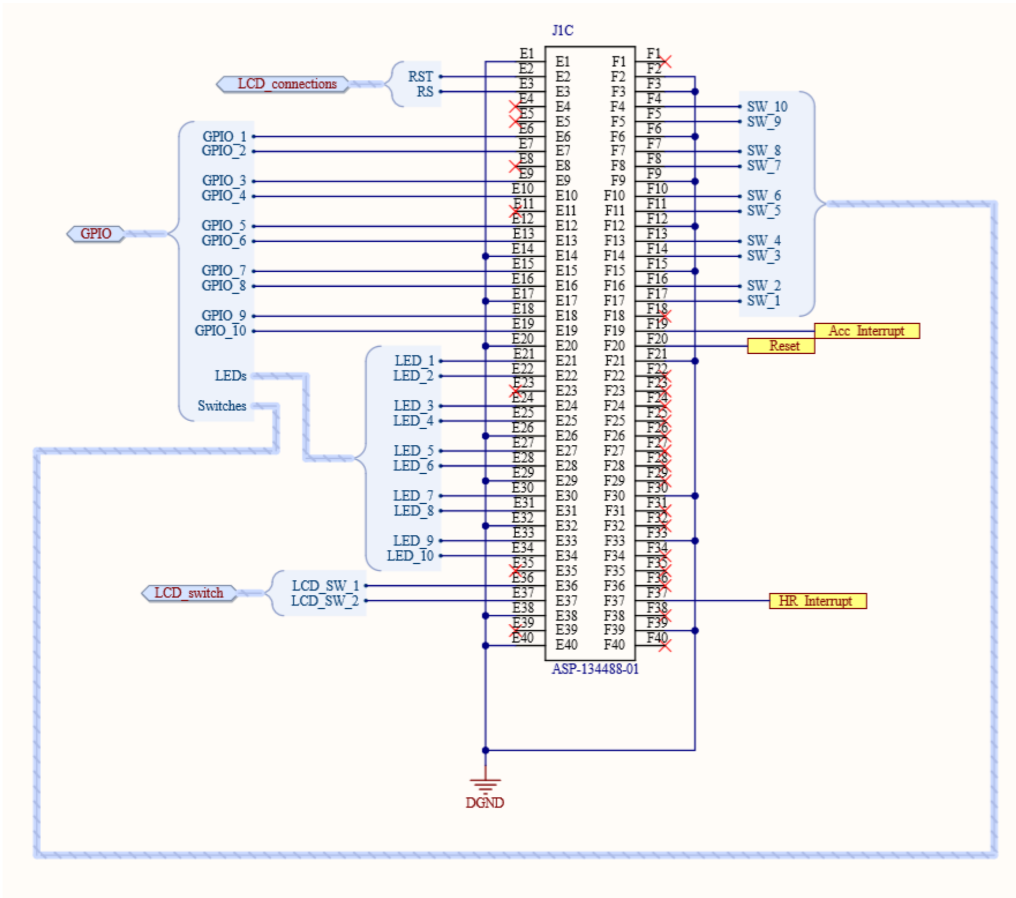
This sheet connects all other schematic sheets together. W1 and W2 are ground ties to connect the different ground planes together.

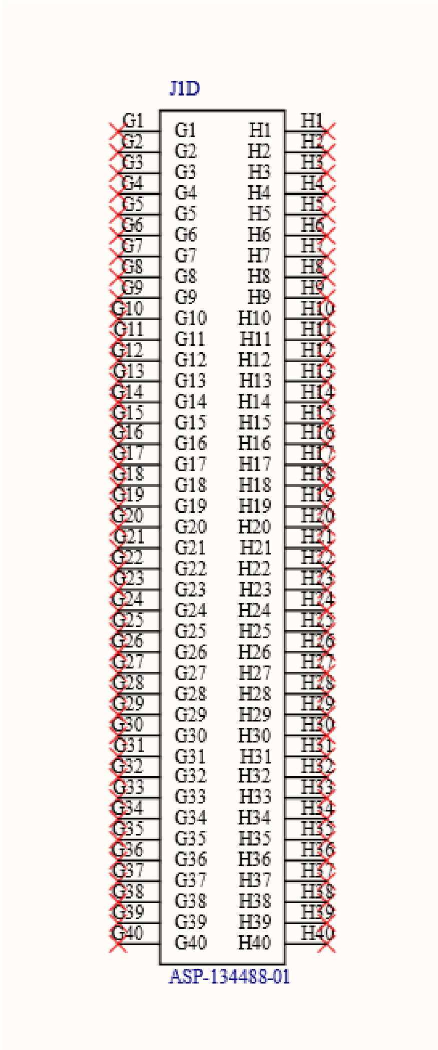
Designers: Zac Carico, James Thomas

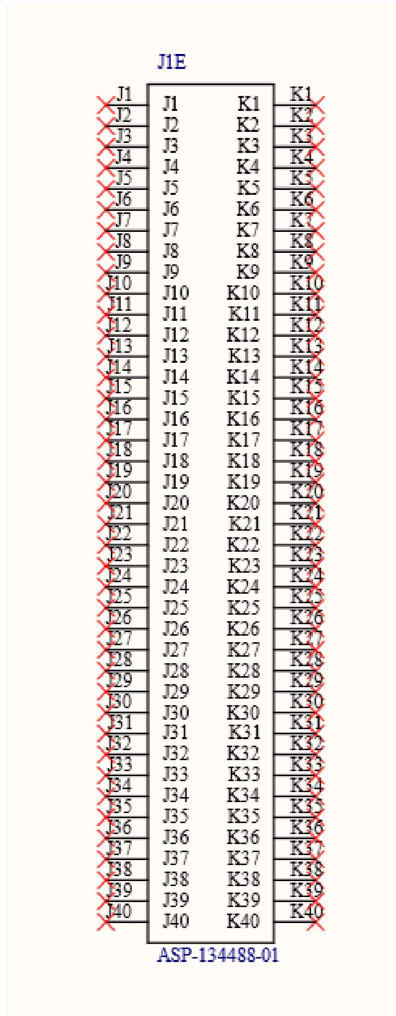
FMC Connector




3.3v
12v
P1
TSW-103-07-L-S
3.3v_SW
P2
TSW-102-07-S-S
3.3v_ext
J1B
ASP-134488-01
LVDS_UART_CD
TX8_P
TX8_N
RX8_P
RX8_N
RX9_P
RX9_N
RX10_P
RX10_N
TX9_P
TX9_N
TX10_P
TX10_N
I2C
SCL
SDA
SPI
SCLK
MOSI
MISO
SS1
SS2
SS3
SS4
SS5
UART
RX_A
TX_A
RX_B
TX_B
RX_C
TX_C
D29 - D34 aren't used for GPIO on the PolarFire's FMC Connector
P3
R17 1k
TSW-102-07-S-S
12v_ref
DGND


J1C
ASP-134488-01
LCD_connections
RST
RS
GPIO
GPIO_1
GPIO_2
GPIO_3
GPIO_4
GPIO_5
GPIO_6
GPIO_7
GPIO_8
GPIO_9
GPIO_10
LEDs
Switches
LED_1
LED_2
LED_3
LED_4
LED_5
LED_6
LED_7
LED_8
LED_9
LED_10
LCD_switch
LCD_SW_1
LCD_SW_2
SW_10
SW_9
SW_8
SW_7
SW_6
SW_5
SW_4
SW_3
SW_2
SW_1
Acc_Interrupt
Reset
HR_Interrupt
DGND



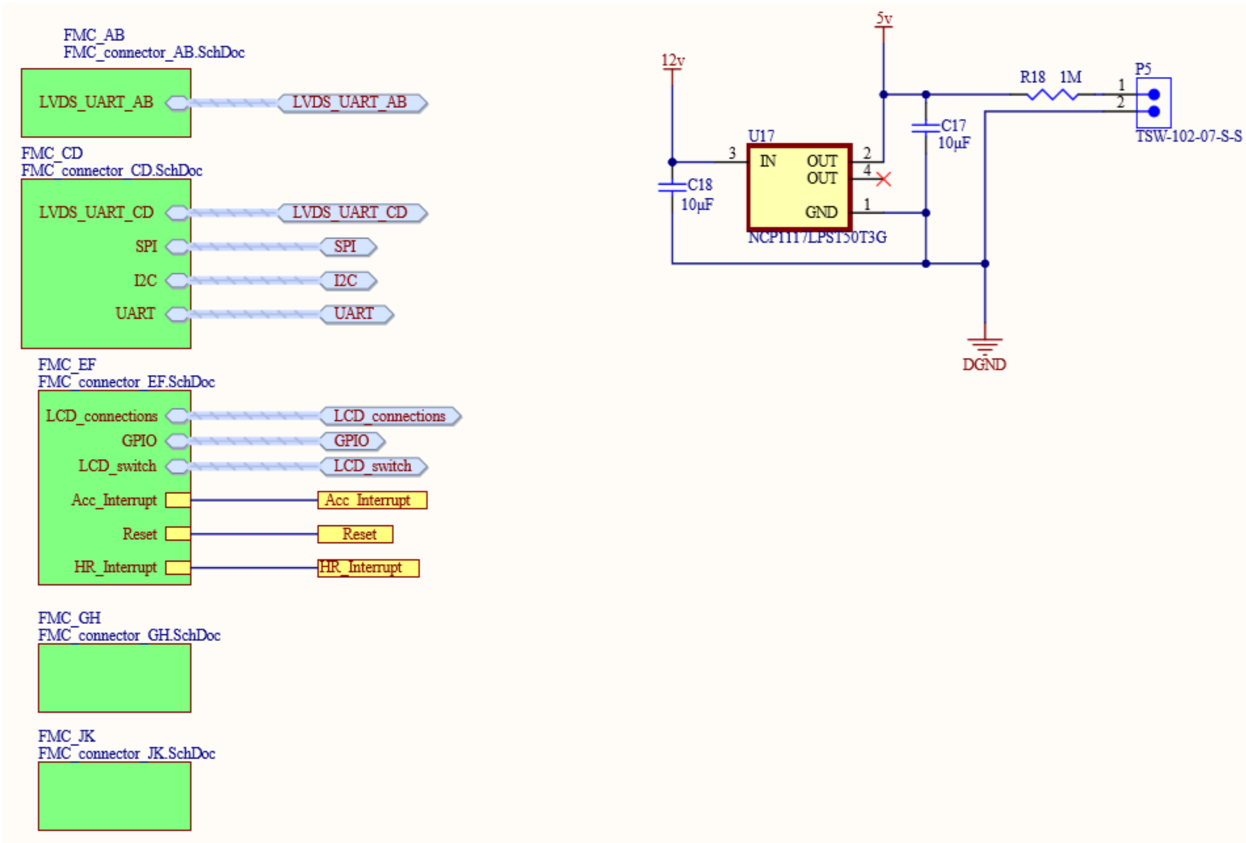


Description:

The FMC connector is what connects this PCB to the FPGA development board. Most connections were added to connect to other schematics. The three exceptions are the 12V reference (P3), and the 3.3V switcher (P1 and P2). These two make it possible to switch between the power coming from the FMC if pins 1 and 2 are connected on P1, and external power connected to P2 if pins 2 and 3 are connected on P1. Some ground connections were removed from the schematic due to limiting factors on the layout of the PCB itself. Sections 4 and 5 of the connector are not currently being used.

Designer: James Thomas

FMC Top

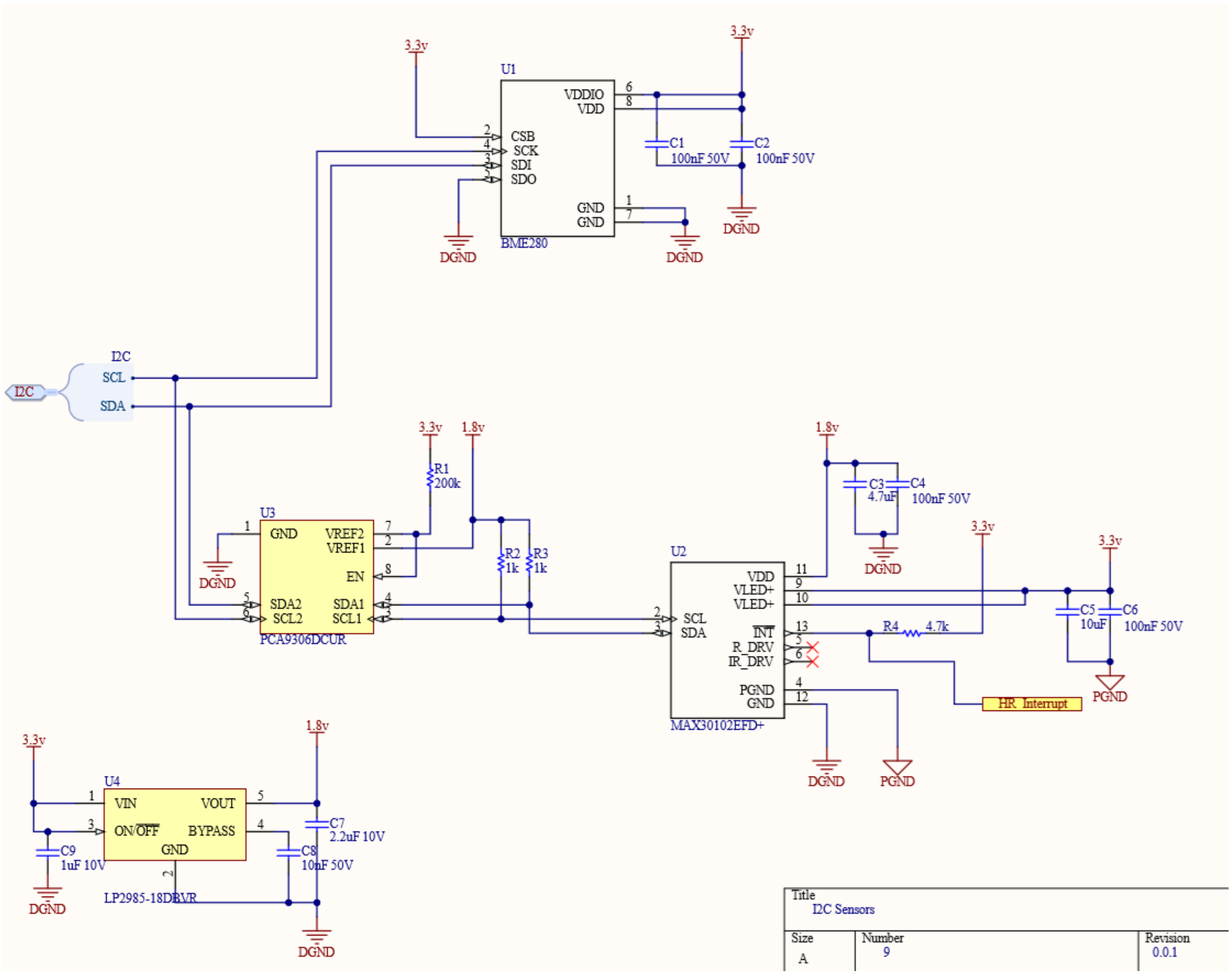


Description:

This sheet combines all the FMC sheets onto one top sheet. There is also a 12V to 5V voltage regulator added to this sheet for the components that need 5V to function properly. This regulator connects two male header pins that can be used as a 5V reference.

Designer: James Thomas

I2C Sensors



Description:

BME280 – Humidity Temperature Sensor

The BME is a sensor which has multiple functions built in, providing data on humidity, temperature, and air pressure. It can communicate via I2C or SPI. In this project's implementation it is set up to exclusively use I2C.

MAX30102 - Oximeter/Heart Rate Sensor I²C Output

The MAX30102 sensor can provide blood oxygen level and heart rate data. Its logic circuitry operates at a lower voltage than 3.3V I2C interface that is used for the other I2C communications on the PCB so there is a bi-directional voltage level converter that shifts the 3.3 volt I2C down to 1.8 volts and a 1.8 volt voltage regulator to provide power.

The MAX30102 also has an interrupt pin which is routed to one of the processor's GPIO pins. This is used to inform the processor that there is data ready to be sent.

LP2985 – Voltage Regulator

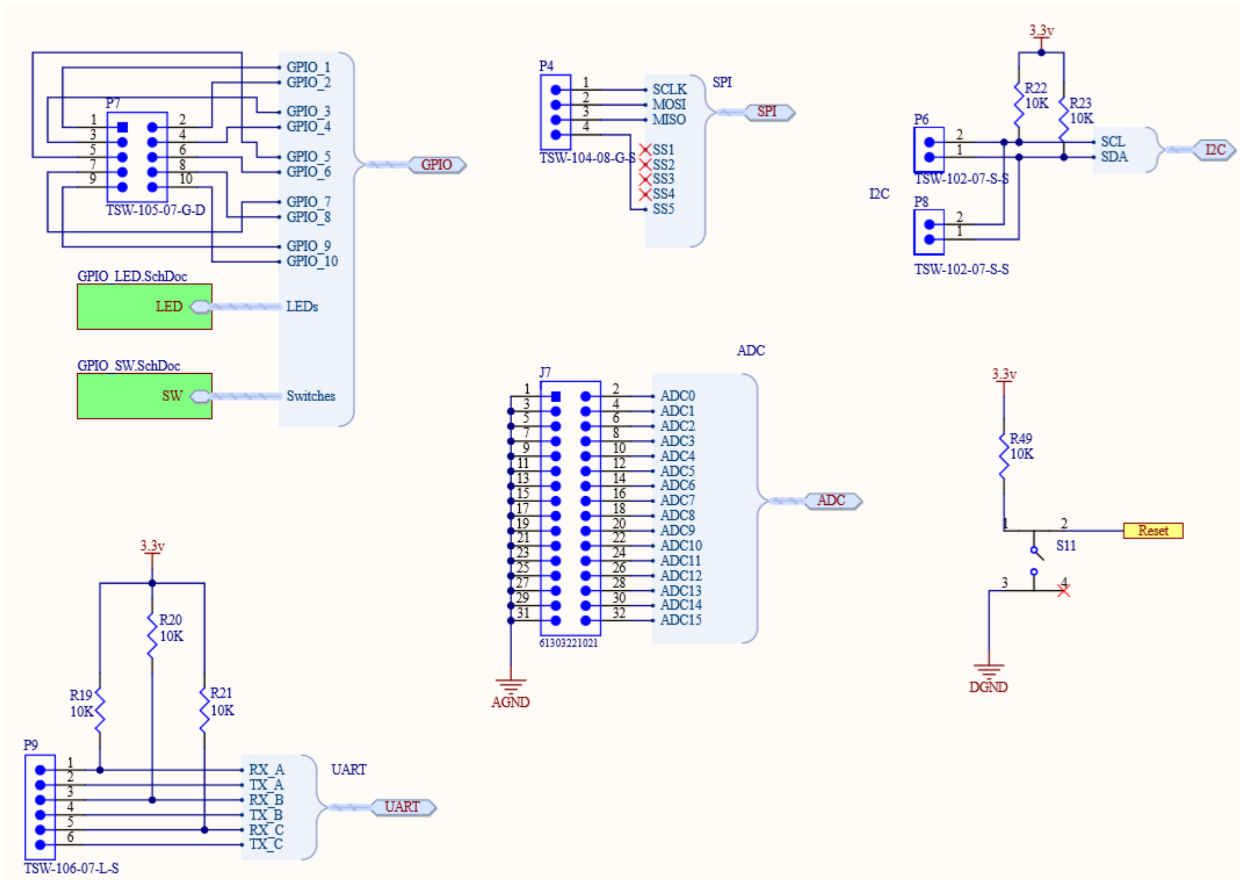
This component was included to provide power to the MAX30102 and as a reference voltage to PCA9306. Its implementation is based off the typical application outlined in section 8.1 of the manufacturer datasheet.

PCA9306 - Dual Bidirectional I2C Bus and SMBus Voltage-Level Translator

This component allows the MAX30102 to interface with the 3.3V I2C by translating between the 1.8V of the MAX30102. This circuit was designed based on the specifications in section 9.2 of the PCA9306 datasheet but being modified according to section 8.1.6 of the datasheet which states that the I2C master side and the I2C bus side can be swapped. This was done because unlike the typical application that the datasheet references, this circuit uses 3.3V on the master and 1.8V for the I2C slave.

Designer: Sam Bagley

External Connections

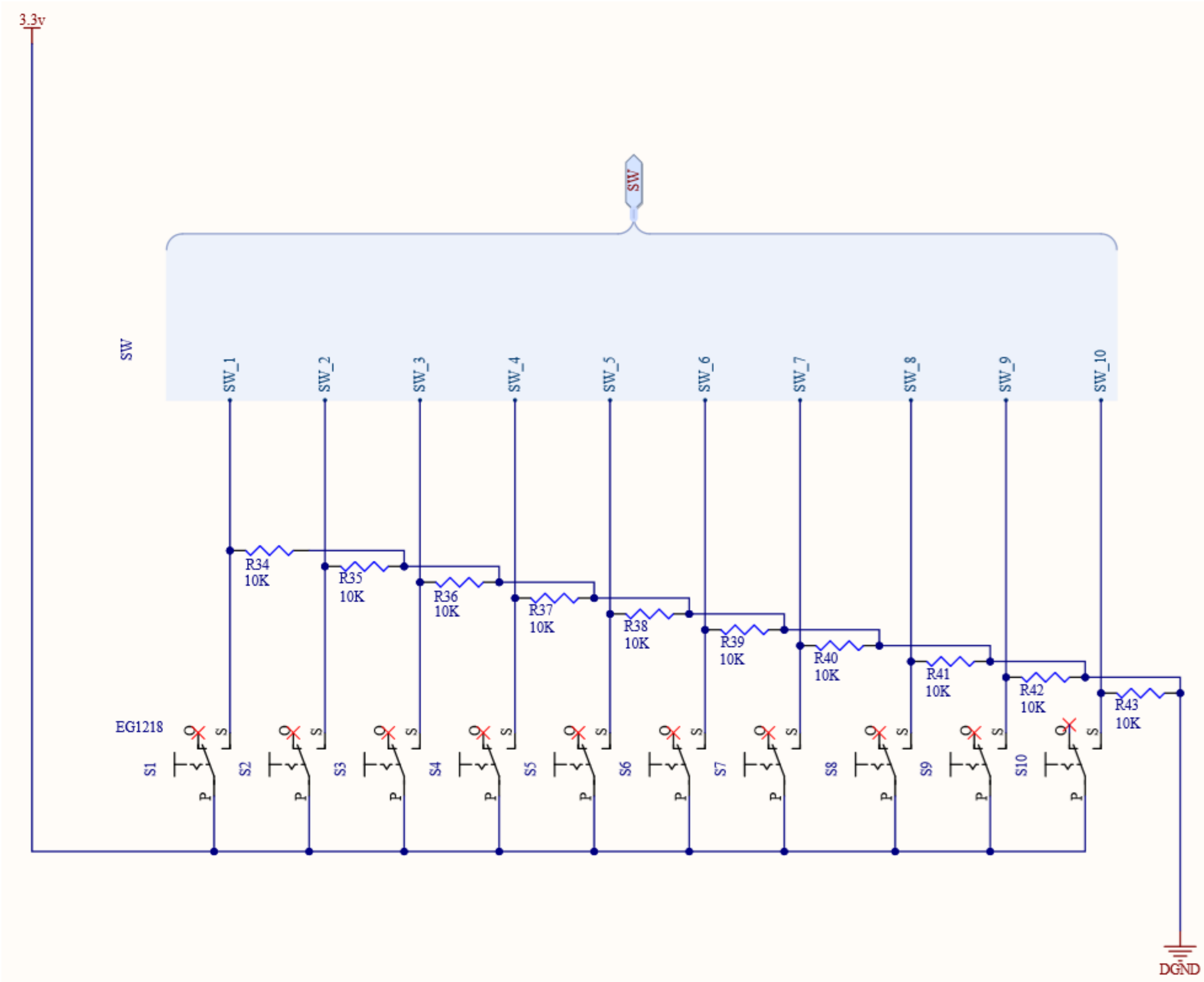


Description:

This sheet has all the external connector pins on the PCB and a reset button for the RISC-V processor. The I2C pins and the RX pins for the UART all have pull-up resistors to reduce noise. The SPI pins have been given one select pin (SS5) for external connections.

Designer: James Thomas

GPIO Switches

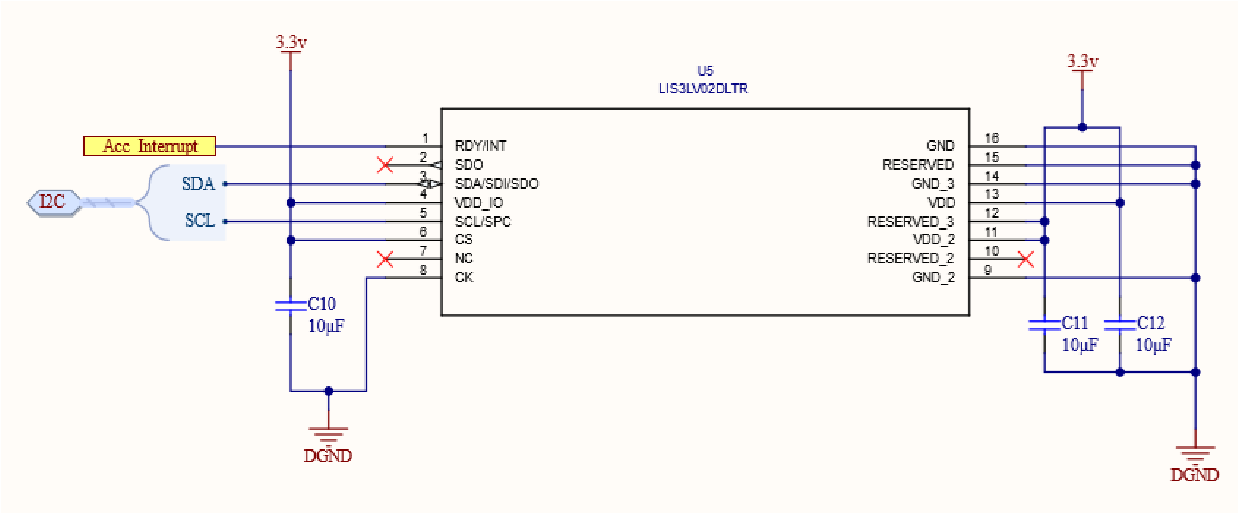


Description:

There are 10 switches that can be used for input to the FPGA. There are pull-down resistors connected to the FPGA inputs so when the switch is on it is pulled up to 3.3V.

Designer: James Thomas

Accelerometer

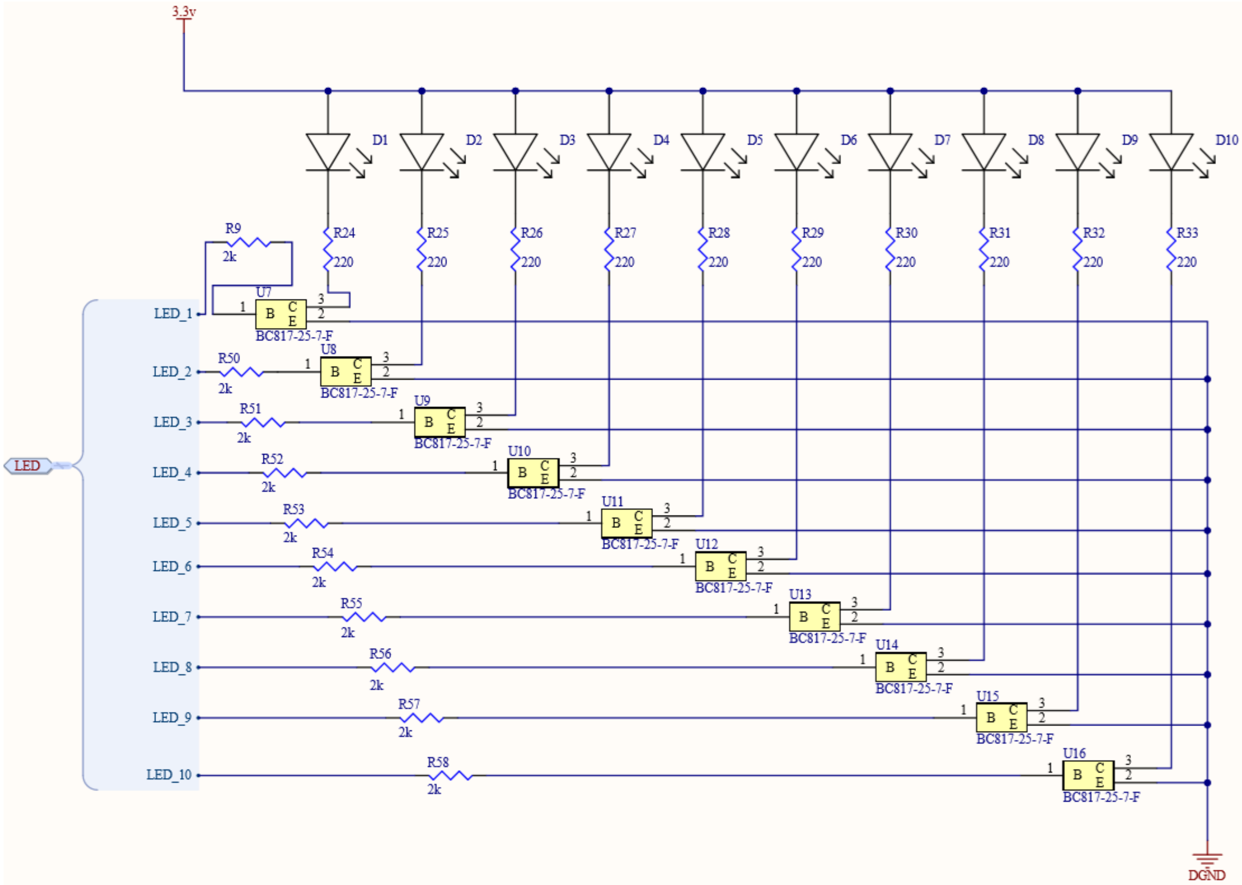


Description:

The accelerometer can use both SPI and I2C to communicate but has been wired to use SPI. There is no Soft Console code written for it, but the data sheet goes over the commands that can be given to the device. The SPI test program may be used to help test the communication to the accelerometer.

Designer: Zac Carico

GPIO LEDs



Description:

There are 10 LEDs that can be used for output from the FPGA. Each LED is driven by 3.3V power and the FPGA pins are connected to an npn transistor to turn the LED on when the pin is high.

Designer: James Thomas