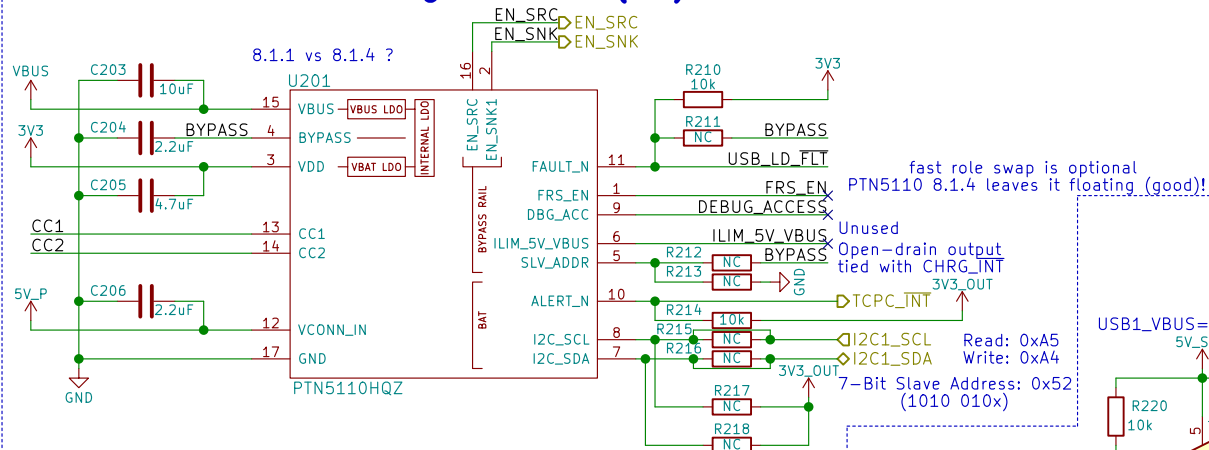
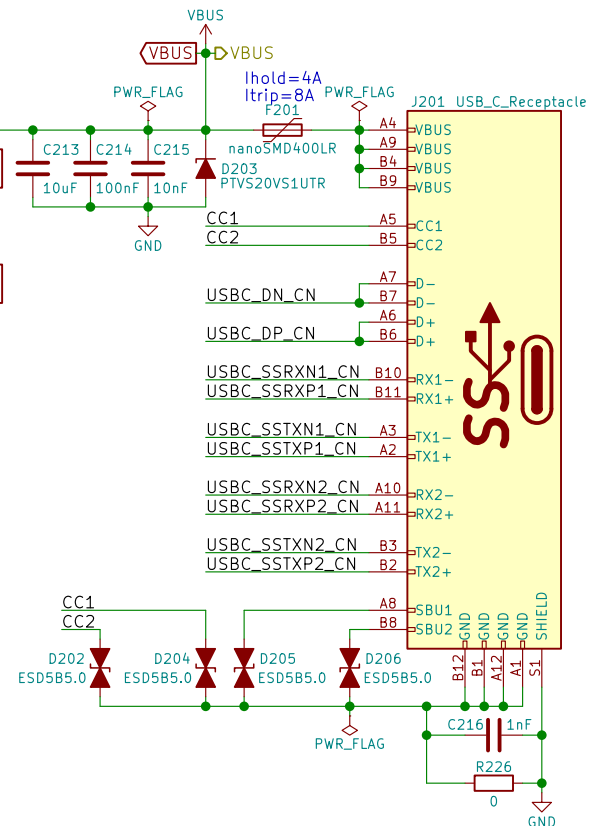
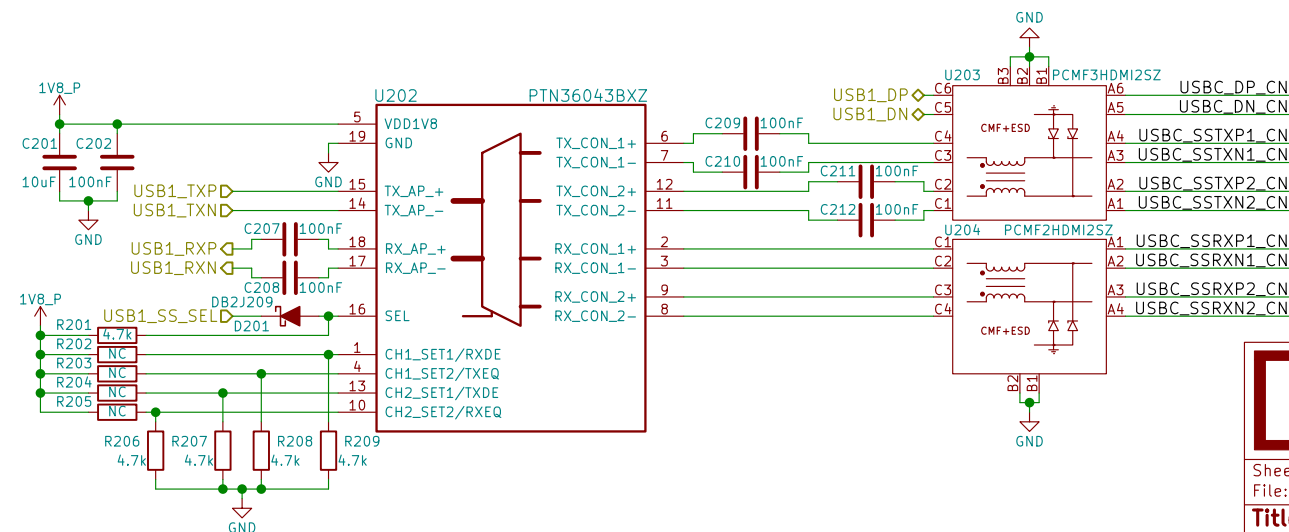


# USB-C TCPC – Config Channel (CC) and PD Role Controller



"Under dead battery operation, PTN5110 applies voltage clamps to both CC pins so that the system may receive power as a Sink. To support platforms with buck-boost configuration, PTN5110 asserts EN\_SNK1 pin based on validity of VBUS voltage (facilitates 5 V VBUS sinking)."

Initialize as the UFP (device)  
read CC\_STATUS to determine role  
use Host Negotiation Protocol (HNP)  
to become an DFP (host)  
∴ USB ID is effectively unused  
⇒ Legacy devices would "wait" for this  
⇒ If CC initializes as UFP then no HNP needed



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christian.schilmoeller@purism

Sheet: /USB-C/  
File: usb-c.sch

Title: LibreM5 development kit

Size: A4 Date: 2018-06-11

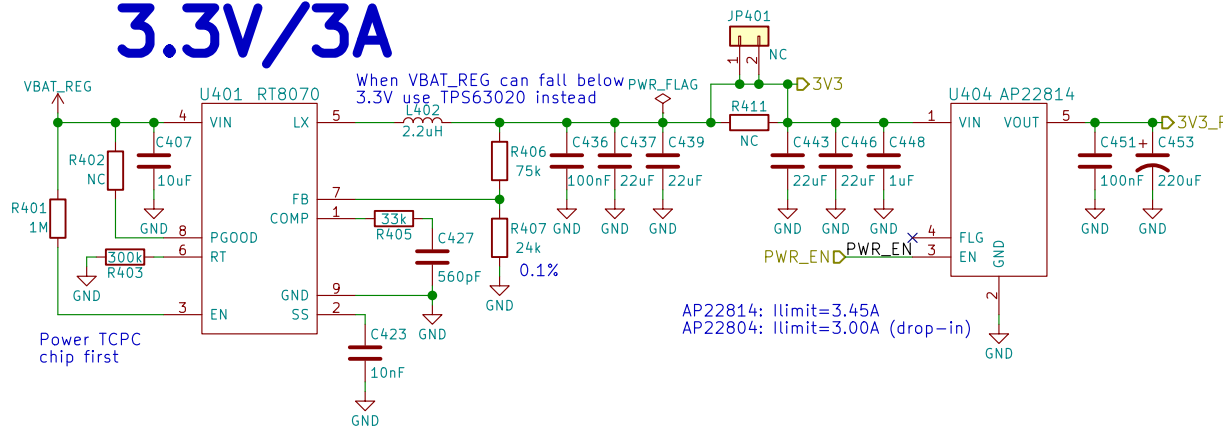
KiCad E.D.A. kicad 4.0.6

Rev: v0.1.0

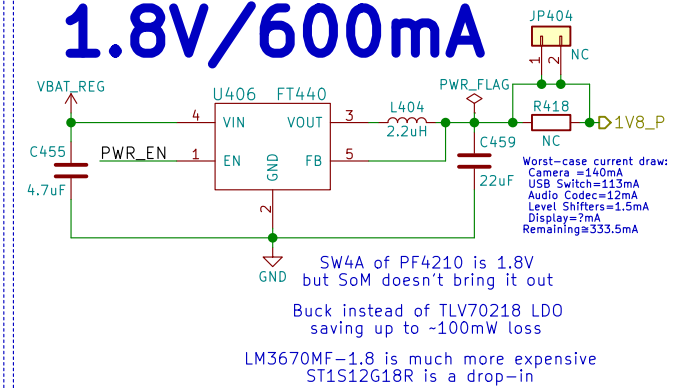
Id: 2/24



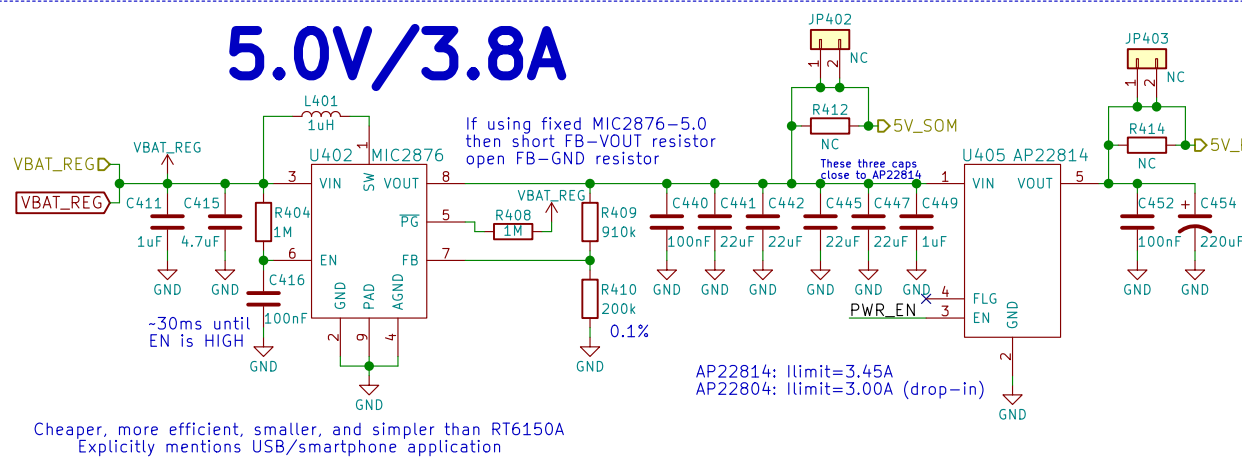
## 3.3V/3A



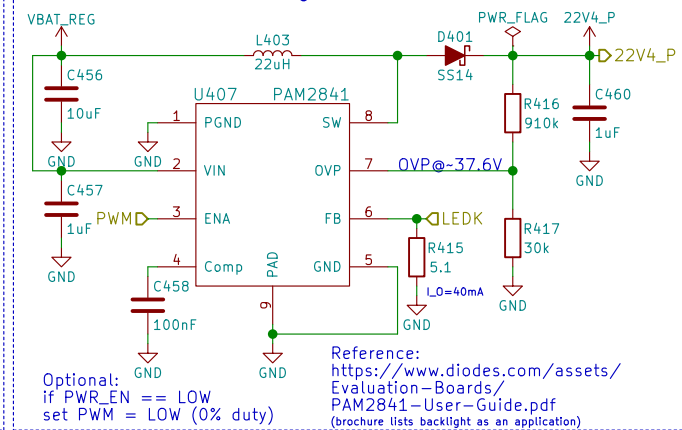
## 1.8V/600mA



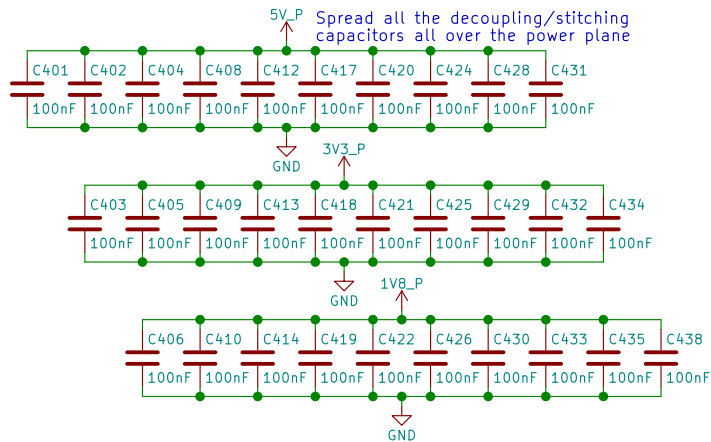
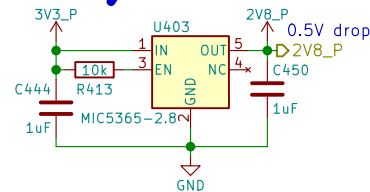
## 5.0V/3.8A



## 22.4V/40mA



## 2.8V/150mA



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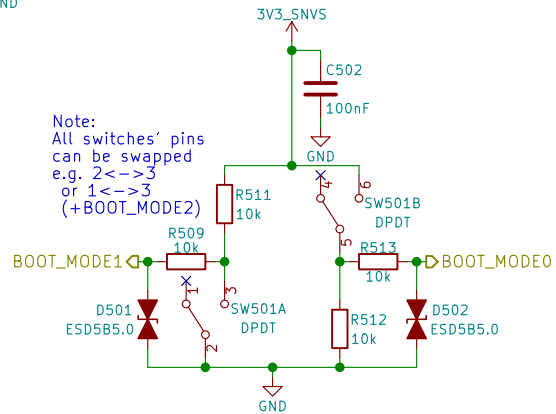
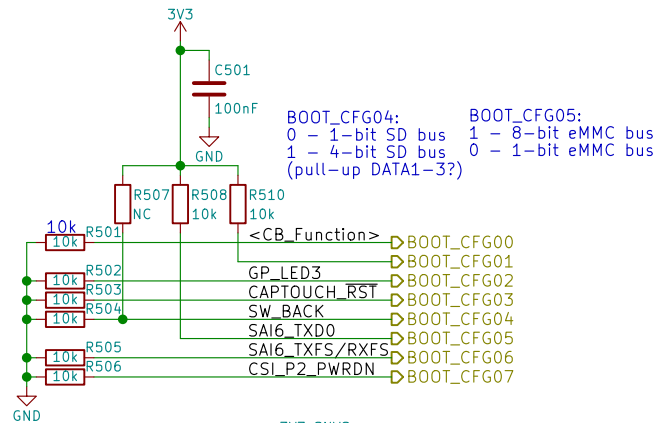
Copyright 2018 GNU GPLv3  
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angus.ainstie@purism  
nicole.farber@purism  
christian.schilmoeller@purism

Sheet: /Power/  
File: power.sch

Title: Librem5 development kit

Size: A4  
Date: 2018-06-11  
KiCad E.D.A. kicad 4.0.6

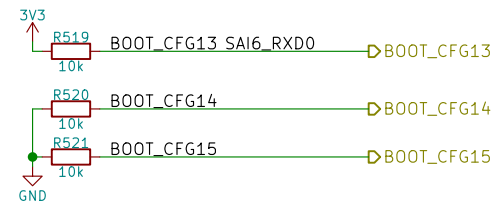
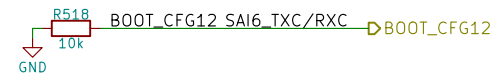
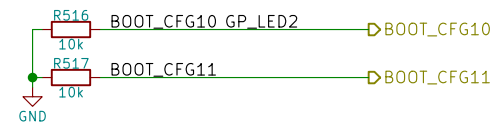
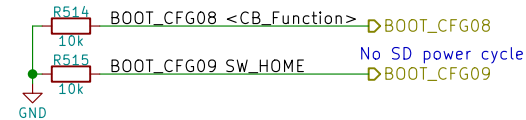
Rev: v0.1.0  
Id: 4/24



2->1: eMMC 2->3: USB (Serial Downloader)	
BOOT_MODE[1:0]	Boot Type
00	Boot From Fuses
01	Serial Downloader
10	Internal Boot
11	Reserved

Only eMMC	
BOOT_CFG[14:12]	Boot device
001	SD/eSD
010	MMC/eMMC
011	NAND

Fuse	Config	Definition	GPIO <sup>1</sup>	Shipped value	Settings
BOOT_CFG[11:10]	OEM	USDHC port selection	Yes	00	00 - USDHC-1 01 - USDHC-2 10 - USDHC-3 else - reserved





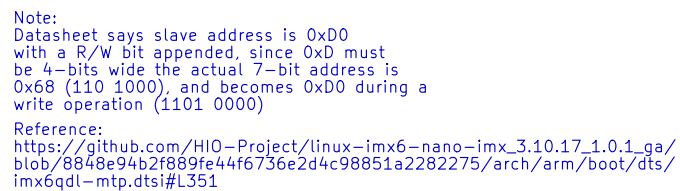
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Sheet: /Boot Config/  
File: boot.sch

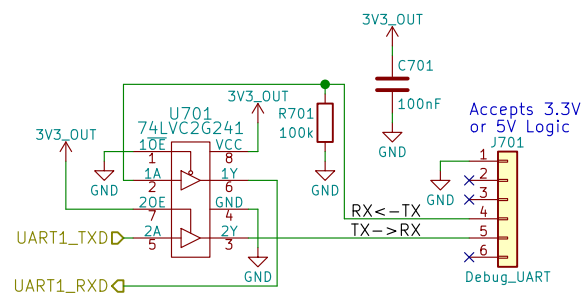
**Title: Libre5 development kit**

Size: A4	Date: 2018-06-11	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6		Id: 5/24



Id: 6/24





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nicole.farber@puri.sm  
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Sheet: /UART Debug/  
File: uart.sch

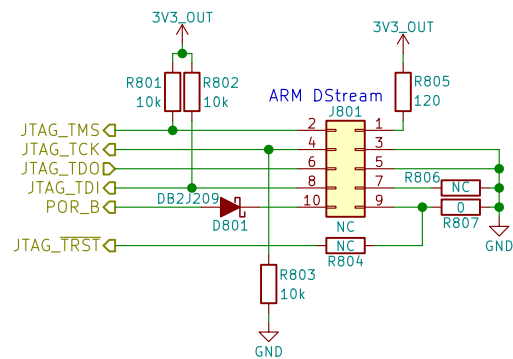
**Title: Librem5 development kit**

Size: A4 Date: 2018-06-11

KiCad E.D.A. kicad 4.0.6

**Rev: v0.1.0**

Id: 7/24



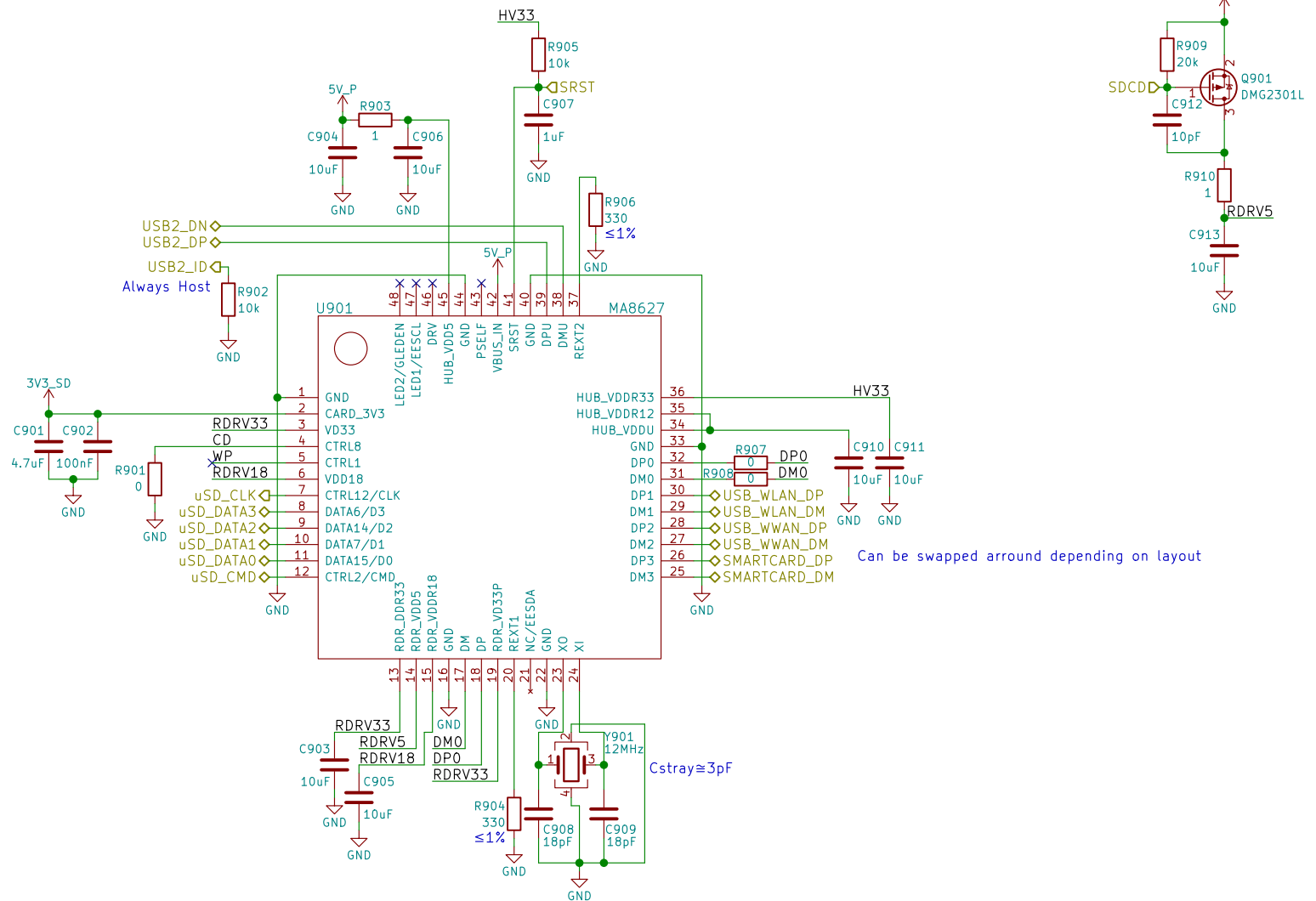


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nicole.farber@puri.sm  
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Sheet: /JTAG/ File: jtag.sch		
<b>Title: Librem5 development kit</b>		
Size: A4	Date: 2018-06-11	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6		Id: 8/24





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Sheet: /USB Hub + SDIO Bridge/  
File: usb\_hub\_sdio.sch

Title: Librem5 development kit

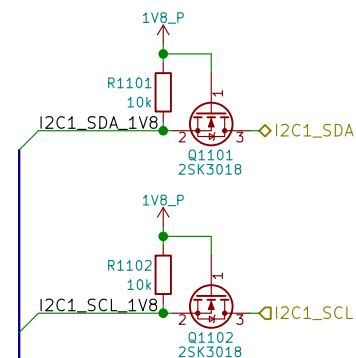
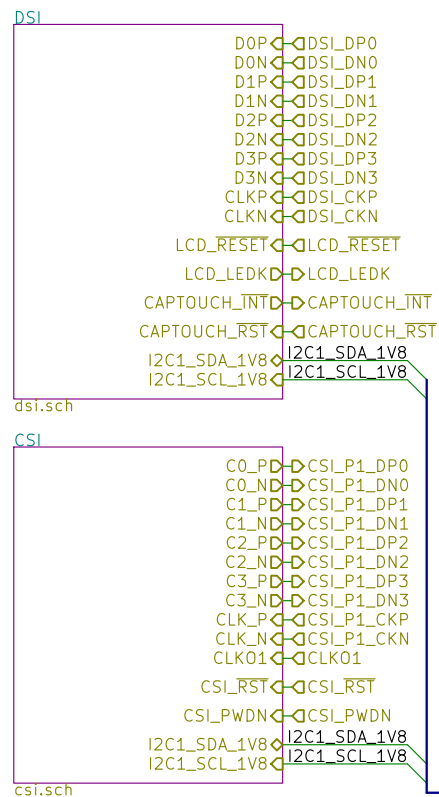
Size: A4 Date: 2018-06-11

KiCad E.D.A. kicad 4.0.6

Rev: v0.1.0

Id: 9/24





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Sheet: /MIPI/  
File: mipi.sch

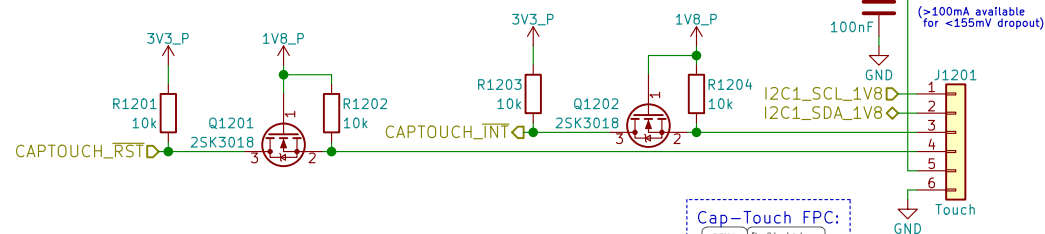
**Title: Librem5 development kit**

Size: A4 Date: 2018-06-11

KiCad E.D.A. kicad 4.0.6

**Rev: v0.1.0**

Id: 11/24



7-bit Slave Address: 0x5D  
(1011 101x)

Read: 0xBB  
Write: 0xBA

Cap-Touch Controller IC PN:  
Goodix GT5688

Cap-Touch FPC:

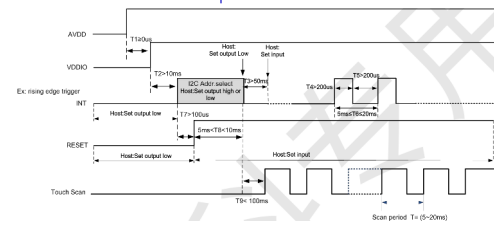
Pin#	Definition
1	SCL
2	SDA
3	INT
4	RESET
5	VDD2_R5
6	GND

Front: Back:

The upper 7 bits are the address,  
and bit 0 is used to select read or write.  
GT5688 has two slave device addresses to choose from:

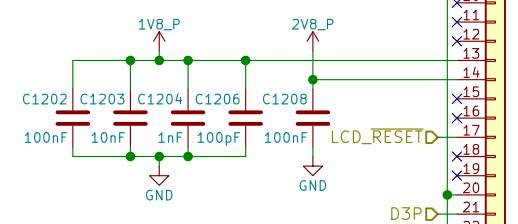
	7-bit Address	8-bit Write Address	8-bit Read Address
INT LOW	0x5D	0xBA	0xBB
INT HIGH	0x14	0x28	0x29

Every time you power on or reset, you need  
to use the INT pin to set the I2C address:

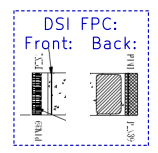
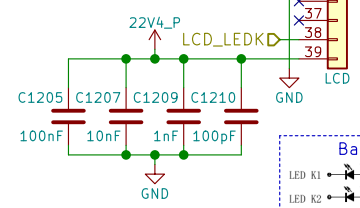


LCD PN:  
Shenzhen Jinghong Electronics Co., Ltd.  
JH057N00900

Note:  
No power-up sequence is  
given in the spec sheet



100Ω Differential Impedance





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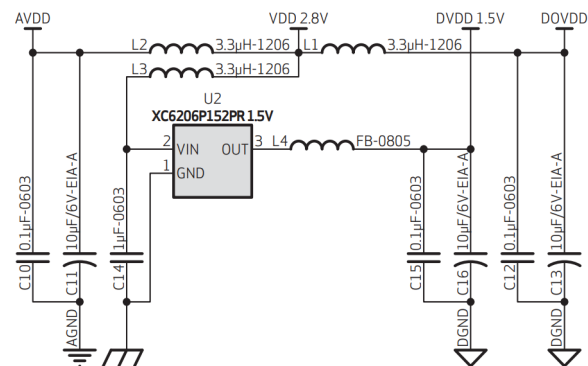
Sheet: /MIPI/DSI/  
File: dsi.sch

**Title: Libre5 development kit**

Size: A4      Date: 2018-06-11  
KiCad E.D.A.    kicad 4.0.6

**Rev: v0.1.0**  
Id: 12/24

### Using Internal DVDD 1.5V Regulator:



### 2.7 POWER UP SEQUENCE

Based on the system power configuration (1.8V or 2.8V for I/O power, using external DVDD or internal DVDD, requiring access to the I2C during power up period or not), the power up sequence will differ. If 1.8V is used for I/O power, using the internal DVDD is preferred. If 2.8V is used for I/O power, due to a high voltage drop at the internal DVDD regulator, there is a potential heat issue. Hence, for a 2.8V power system, OmniVision recommends using an external DVDD source. Due to the higher power down current when using an external DVDD source, OmniVision strongly recommends cutting off all powers, including the external DVDD, when the sensor is not in use in the case of 2.8V I/O and external DVDD.

#### 2.7.1 POWER UP WITH INTERNAL DVDD

For powering up with the internal DVDD and I2C access during the power ON period, the following conditions must occur:

1. when DOVDD and AVDD are turned ON, make sure DOVDD becomes stable before AVDD becomes stable
2. PWDN is active high with an asynchronized design (does not need clock)
3. PWDN pin tied to digital ground if it is not controlled.
4. if PWDN pin is controlled as below, for PWDN to go low, power must first become stable (AVDD to PWDN  $\geq 5$  ms)
5. RESETB is active low with an asynchronized design
6. master clock XVCLK should provide at least 1 ms before host accesses the sensor's registers
7. host can access I2C bus (if shared) during entire period. 20ms after RESETB goes high, host can access the sensor's registers to initialize sensor

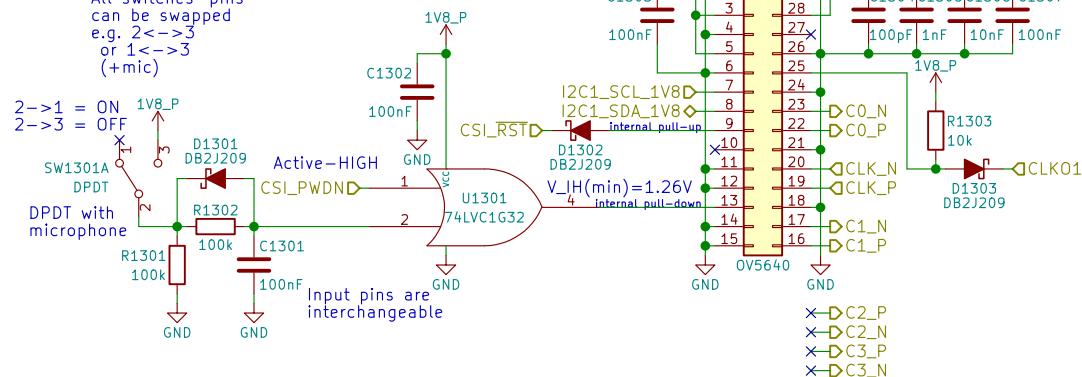
figure 2-3 power up timing with internal DVDD



**note**  $t_0 \geq 0$ ms, delay from DOVDD stable to AVDD stable, it is recommended to power up AVDD shortly after DOVDD has been powered up  
 $t_1 \geq 0$ ms, delay from XVCLK off to AVDD off  
 $t_2 \geq 5$ ms, delay from AVDD stable to sensor power up stable, PWDN can be pulled low after this point, XVCLK can be turned on after power on  
 $t_3 \geq 1$ ms, delay from sensor power up stable to RESETB pull up  
 $t_4 \geq 20$ ms, delay from RESETB pull high to SCCB initialization  
 $t_5 \geq 0$ ms, delay from AVDD off to DOVDD off  
 $t_6 \geq 0$ ms, delay from RESETB pull low to AVDD off

5640\_05\_2.2

Note:  
All switches' pins  
can be swapped  
e.g. 2 $\leftrightarrow$ 3  
or 1 $\leftrightarrow$ 3  
(+mic)



Camera PN:  
Truly C08725-B5SA-E  
7-bit Slave Address: 0x78  
(1111 000x)  
Read: 0xF1  
Write 0xF0

OV5640 CMOS Image Sensor Datasheet:  
[https://cdn.sparkfun.com/datasheets/Sensors/LightImaging/OV5640\\_datasheet.pdf](https://cdn.sparkfun.com/datasheets/Sensors/LightImaging/OV5640_datasheet.pdf)



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Sheet: /MIPI/CSI/  
File: csi.sch

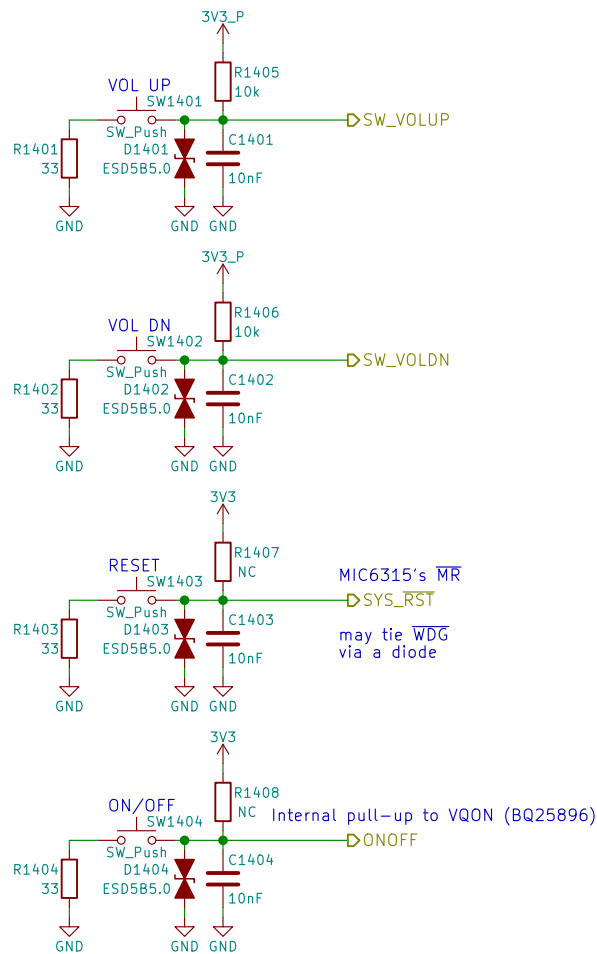
Title: Libre5 development kit

Size: A4 Date: 2018-06-11

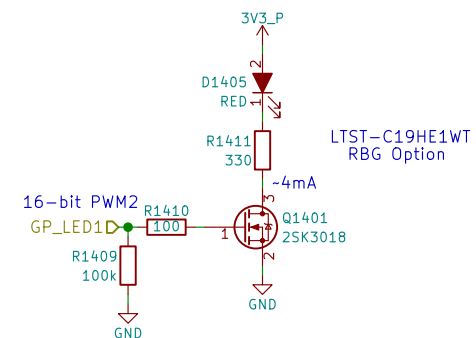
KiCad E.D.A. kicad 4.0.6

Rev: v0.1.0

Id: 13/24



Use PWM2\_PWMSAR to set the compare value (duty cycle)  
Use PWM2\_PWMCR[15:4] to set the PRESCALER (frequency)  
Use PWM2\_PWMPR to set the top of the counter (frequency)



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Sheet: /Buttons & LED/  
File: buttons\_led.sch

Title: Librem5 development kit

Size: A4 Date: 2018-06-11

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Rev: v0.1.0

Id: 14/24







# RGMII 10/100/1000 Ethernet

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Sheet: /Ethernet/  
File: ethernet.sch

**Title: Librem5 development kit**

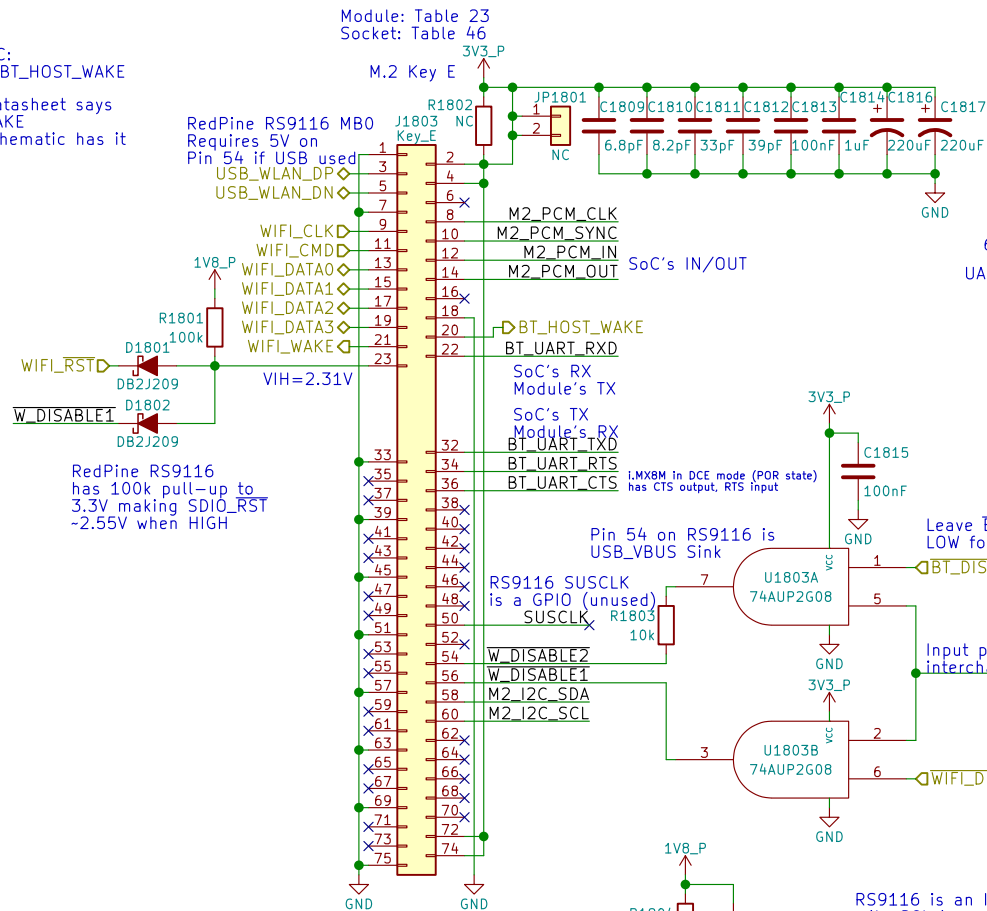
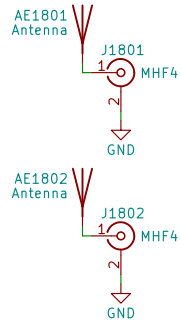
Size: A4	Date: 2018-06-11	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6		Id: 17/24

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Id: 17/24

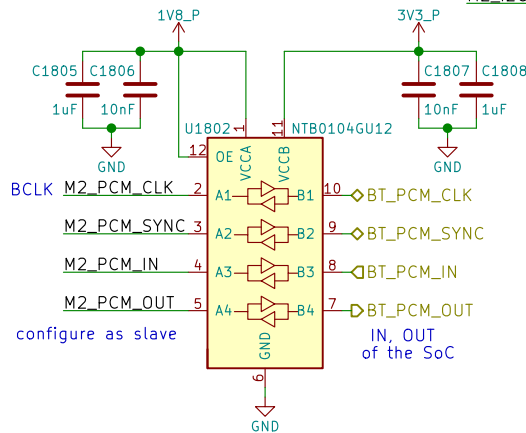
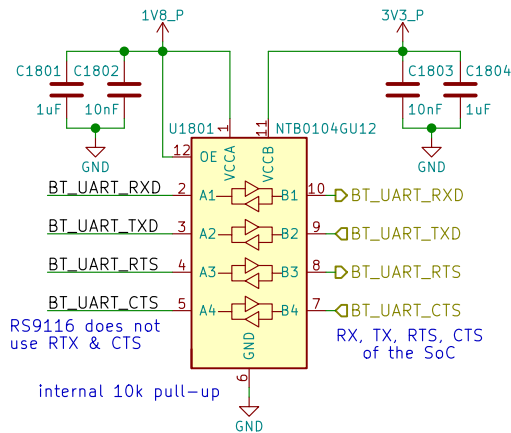
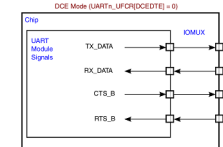
RS9116 NC:  
RTS, CTS, BT\_HOST\_WAKE

RS9116 datasheet says  
no WIFI\_WAKE  
but the schematic has it



## 6.2 M.2 Signal Directions

### UARTn\_UFCR[DCEDTE]=0 on POR



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Sheet: /WLAN+BT M.2/  
File: wifi\_bt\_m2.sch

Title: Librem5 development kit

Size: A4 Date: 2018-06-11

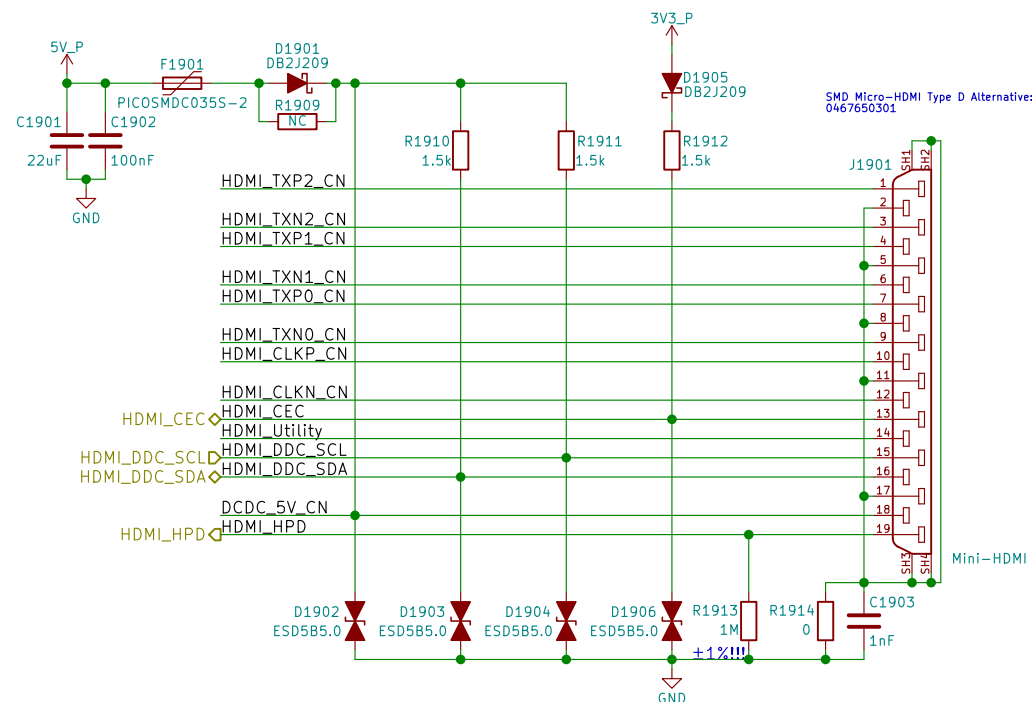
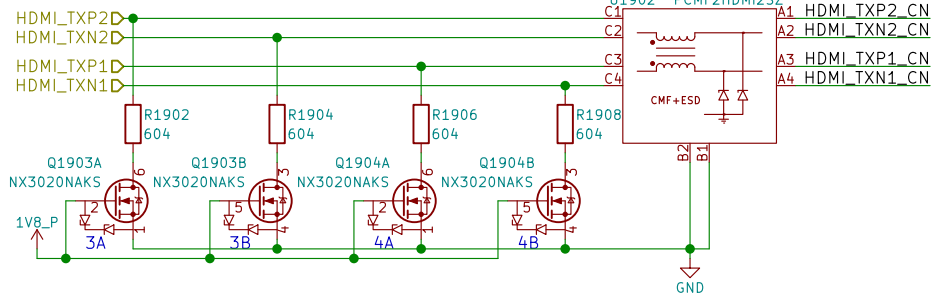
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Rev: v0.1.0

Id: 18/24

100Ω diff pairs

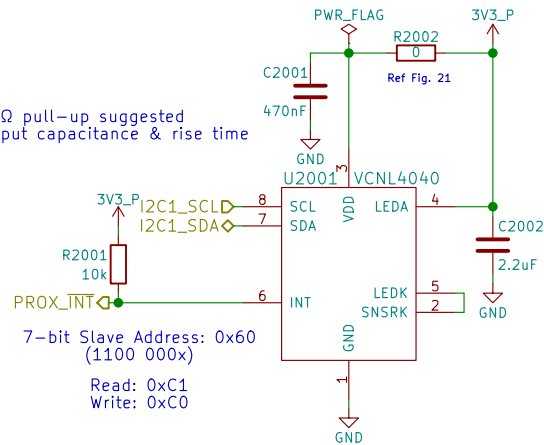
Pin	Signal
C1	A1 HDMI_Utility
C2	A2 HDMI_HPD
C3	A3 HDMI_TXP0_CN
C4	A4 HDMI_TXN0_CN
C5	A5 HDMI_CLKP_CN
C6	A6 HDMI_CLKN_CN



Id: 19/24

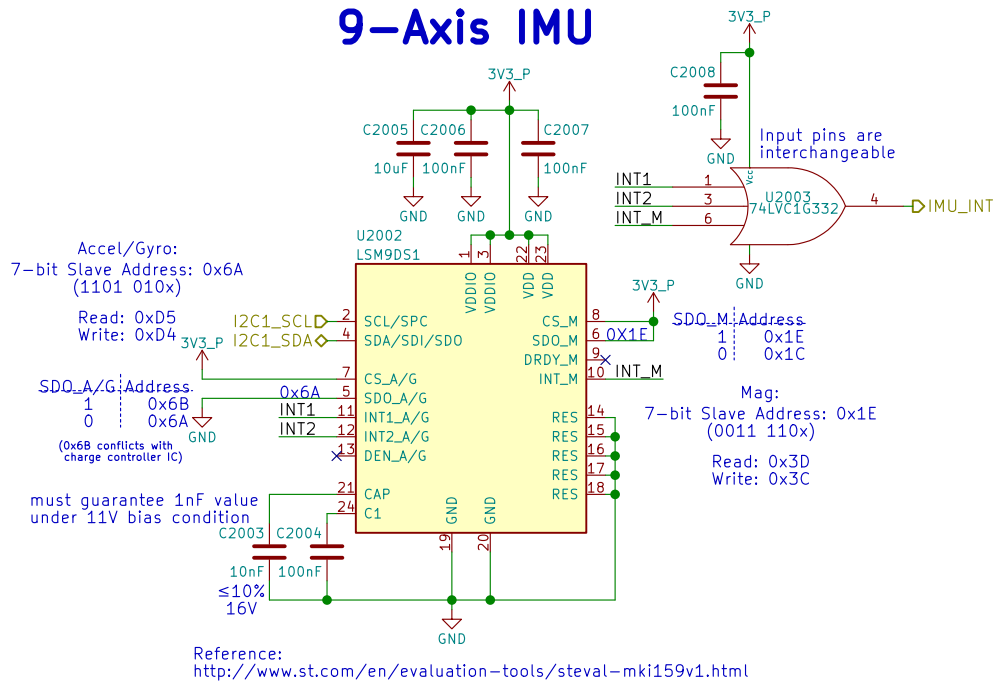
## Proximity & Ambient Light

Note:  
I2C 2.2kΩ pull-up suggested  
check input capacitance & rise time



Reference:  
<https://www.vishay.com/docs/84307/designingvcnl4040.pdf>  
<http://www.vishay.com/docs/84931/vcnl4040sensorboardfiles.pdf>

## 9-Axis IMU



Reference:  
<http://www.st.com/en/evaluation-tools/steval-mki159v1.html>

Table 19. Accelerometer and gyroscope SAD•Read/Write patterns				
Command	SAD[6:1]	SAD[0] = SA0	R/W	SAD•R/W
Read	110101	0	1	11010101 (D5h)
Write	110101	0	0	11010100 (D4h)
Read	110101	1	1	11010111 (D7h)
Write	110101	1	0	11010110 (D6h)

Table 20. Magnetic sensor SAD•Read/Write patterns				
Command	SAD[6:2]	SAD[1] = SDO/SA1	SAD[0]	SAD•R/W
Read	00111	0	0	1 00111001 (39h)
Write	00111	0	0	0 00111000 (38h)
Read	00111	1	0	1 00111101 (3Dh)
Write	00111	1	0	0 00111100 (3Ch)



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Sheet: /Sensors/  
File: sensors.sch

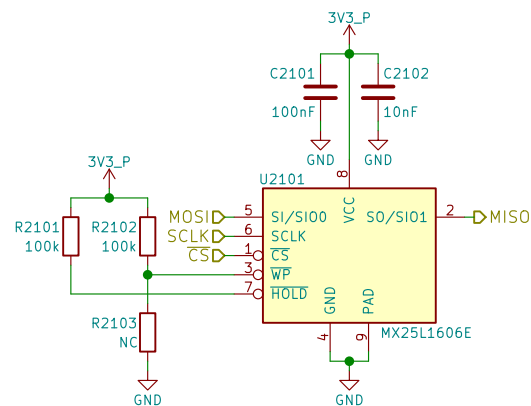
Title: LibreM5 development kit

Size: A4 Date: 2018-06-11

KiCad E.D.A. kicad 4.0.6

Rev: v0.1.0

Id: 20/24





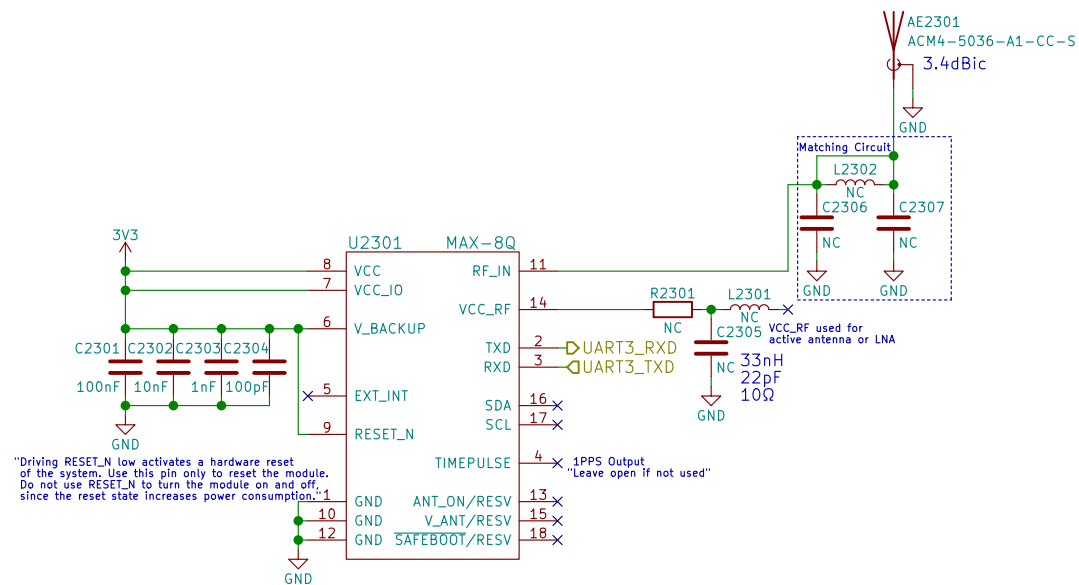
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nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Sheet: /SPI Flash/		
File: flash.sch		
<b>Title: Librem5 development kit</b>		
Size: A4	Date: 2018-06-11	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6		Id: 21/24







Reference:  
[https://www.u-blox.com/sites/default/files/MAX-8-M8-FW3\\_HardwareIntegrationManual\\_15030059\\_29.pdf](https://www.u-blox.com/sites/default/files/MAX-8-M8-FW3_HardwareIntegrationManual_15030059_29.pdf)



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 angus.ainstie@puri.sm  
 nicole.farber@puri.sm  
 christian.schilmoeller@puri.sm

Sheet: /GNSS/  
 File: gnss.sch

Title: Librem5 development kit

Size: A4 Date: 2018-06-11

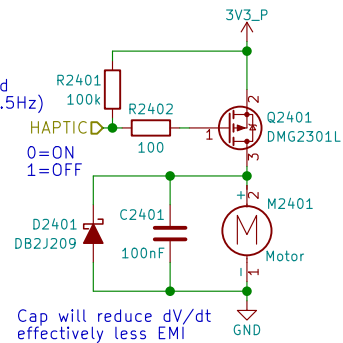
KiCad E.D.A. kicad 4.0.6

Rev: v0.1.0

Id: 23/24

PWM pins occupied:  
 GPIO1\_I001 - LCD Backlight  
 GPIO1\_I013 - LED  
 GPIO1\_I014 - Ethernet (CLKO\_25MHz)  
 GPIO1\_I015 - CSI (CLKO2)

PWM needed?  
 Only needs to be toggled  
 ON 1 sec, OFF 1 sec (0.5Hz)  
 Can MUX as either  
 GPIO or PWM2  
 swapping with LED



When the motor is off  
 both terminals are at GND

Motor will have wire leads  
 with a 2-pin Molex or Boom Precision  
 connector installed (by request)!  
 Metal housing is floating  
 (not connected to either pin)  
 => could connect housing to GND

Cheaper Motor Connector:  
[https://lcsc.com/product-detail/1-25T-Connectors\\_1-25T-1-2AW\\_C10832.html](https://lcsc.com/product-detail/1-25T-Connectors_1-25T-1-2AW_C10832.html)

Motor Source:  
[https://www.alibaba.com/product-detail/Coin-motor-vibration-dc-motor-cellphone\\_1994583657.html?spm=a2700.8443308.0.0.5aa13e5f1wxHgs](https://www.alibaba.com/product-detail/Coin-motor-vibration-dc-motor-cellphone_1994583657.html?spm=a2700.8443308.0.0.5aa13e5f1wxHgs)

Motor Datasheet:  
<https://cloud.puri.sm/s/z8JR6DJ4KrJYzoW>

Motor PN:  
 BY0820Z021L20



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 File: haptic.sch

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