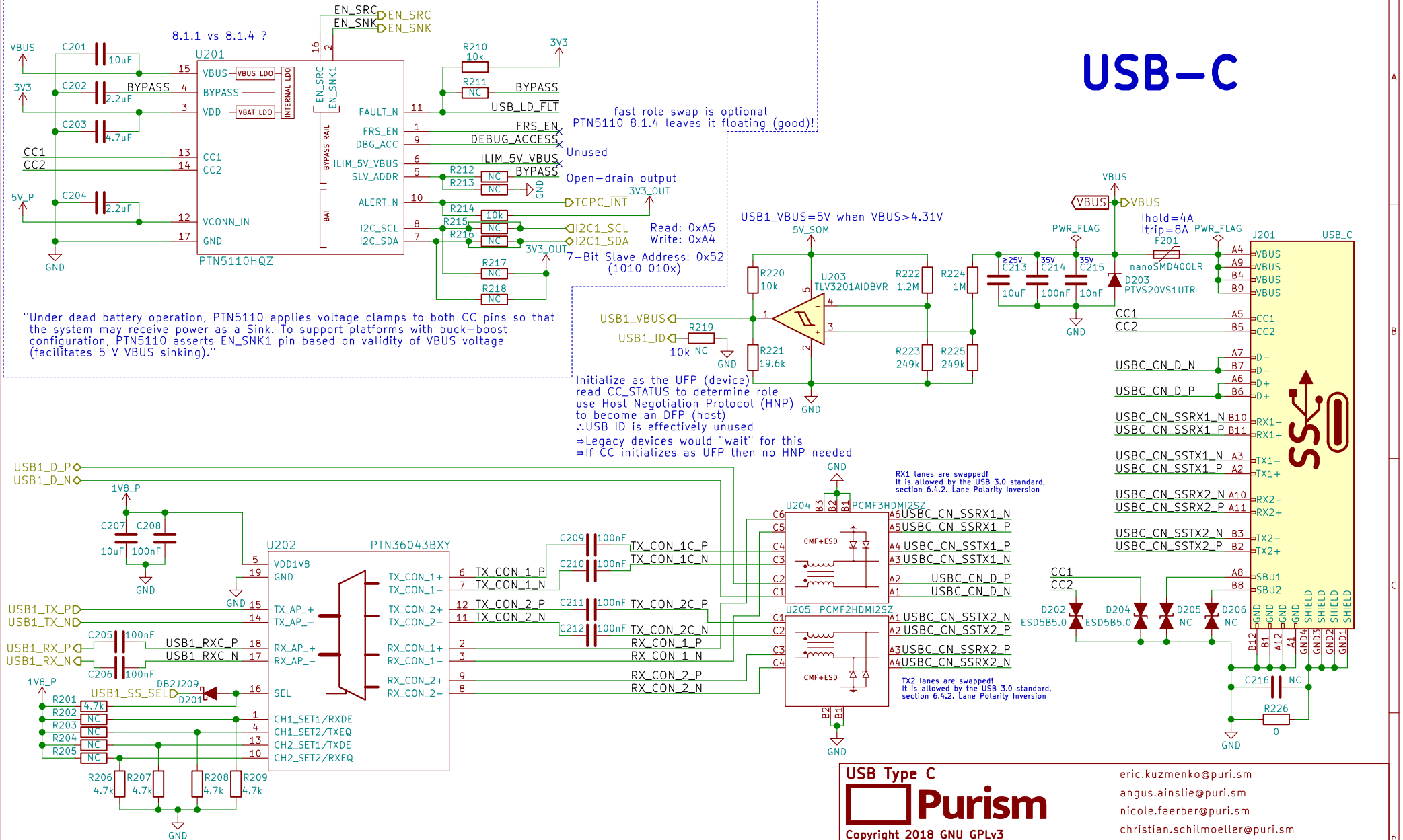




# USB-C TCPC - Config Channel (CC) and PD Role Controller

## USB-C



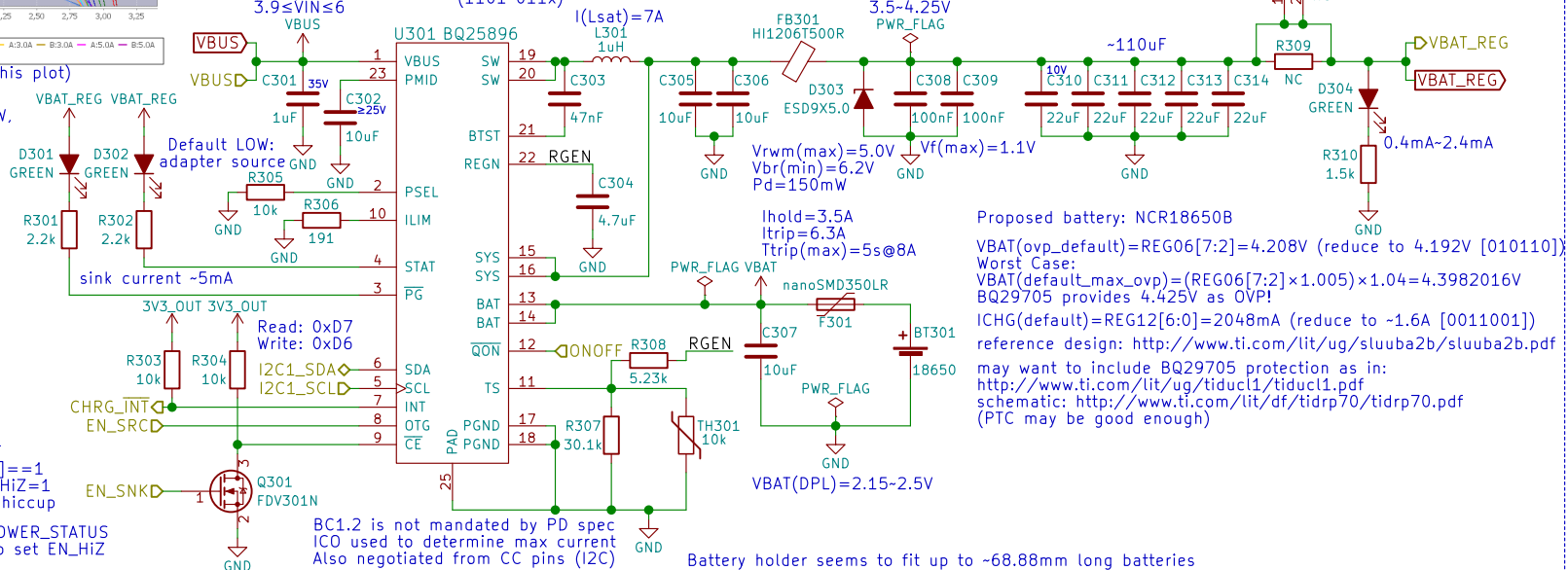


(interpret RSOC% based on this plot)

Drawing ~320mA, or consuming  $\leq 1.152W$ , should give close to 10 hours going from 100% to 0% charge

use AUTO\_DPDM\_EN to auto-detect IINLIM

$1.658 \leq ILIM \leq 2.063$   
 $ILIM(nom) \approx 1.859A$   
 $3.9 \leq VIN \leq 6$   
 7-bit Slave Address: 0x6B (1101 011x)



sink current ~5mA

Read: 0xD7  
 Write: 0xD6

This disables charging but maybe not VBUS->VOUT if PTN5110HQ's FAULT\_STATUS[6]=1 (Force Off VBUS bit) then set EN\_HiZ=1 EN\_HiZ may be auto-set when in hiccup

Reading PTN5110HQ's CC\_STATUS and POWER\_STATUS registers will tell TCPM (i.MX8M) when to set EN\_HiZ

Also, reading PTN5110HQ's CC\_STATUS and POWER\_STATUS registers will tell TCPM (i.MX8M) when to set OTG\_CONFIG=1 (this will also happen when PTN5110HQ sets EN\_SRC HIGH)

BC1.2 is not mandated by PD spec  
 ICO used to determine max current  
 Also negotiated from CC pins (I2C)

Battery holder seems to fit up to ~68.88mm long batteries  
 need to test 18650 protected cells which are ~69.35mm long

Proposed battery: NCR18650B

$VBAT(ovp\_default) = REG06[7:2] = 4.208V$  (reduce to 4.192V [010110])  
 Worst Case:  
 $VBAT(default\_max\_ovp) = (REG06[7:2] \times 1.005) \times 1.04 = 4.3982016V$   
 BQ29705 provides 4.425V as OVP!  
 $ICHG(default) = REG12[6:0] = 2048mA$  (reduce to ~1.6A [0011001])  
 reference design: <http://www.ti.com/lit/ug/sluuba2b/sluuba2b.pdf>  
 may want to include BQ29705 protection as in:  
<http://www.ti.com/lit/ug/tiduc1/tiduc1.pdf>  
 schematic: <http://www.ti.com/lit/df/tidrp70/tidrp70.pdf>  
 (PTC may be good enough)

Battery

**Purism**

Copyright 2018 GNU GPLv3

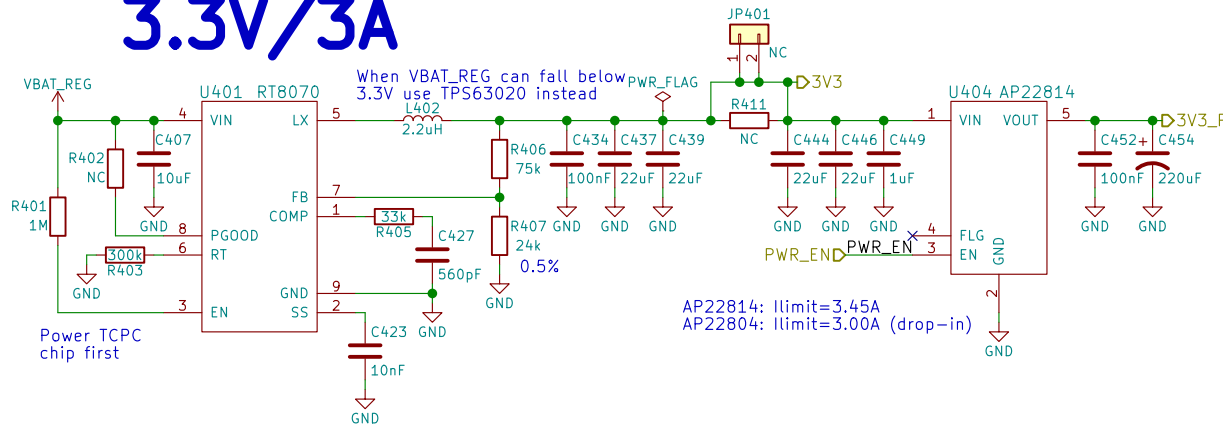
Sheet: /Battery/  
 File: battery.sch

Size: A4 Date: 2018-08-14  
 KiCad E.D.A. kicad 5.0.0

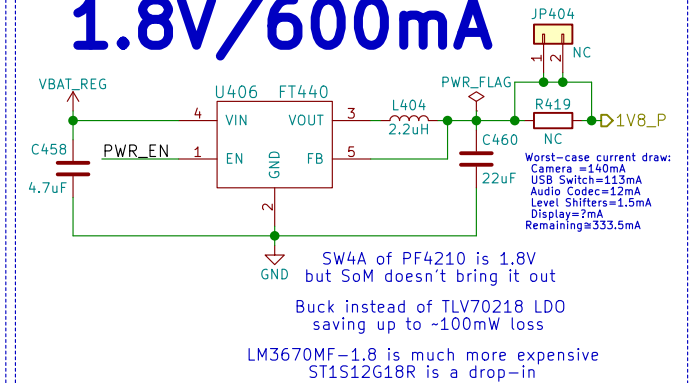
eric.kuzmenko@puri.sm  
 angus.ainslie@puri.sm  
 nicole.farber@puri.sm  
 christian.schilmoeller@puri.sm

Rev: v0.1.0  
 Id: 3/24

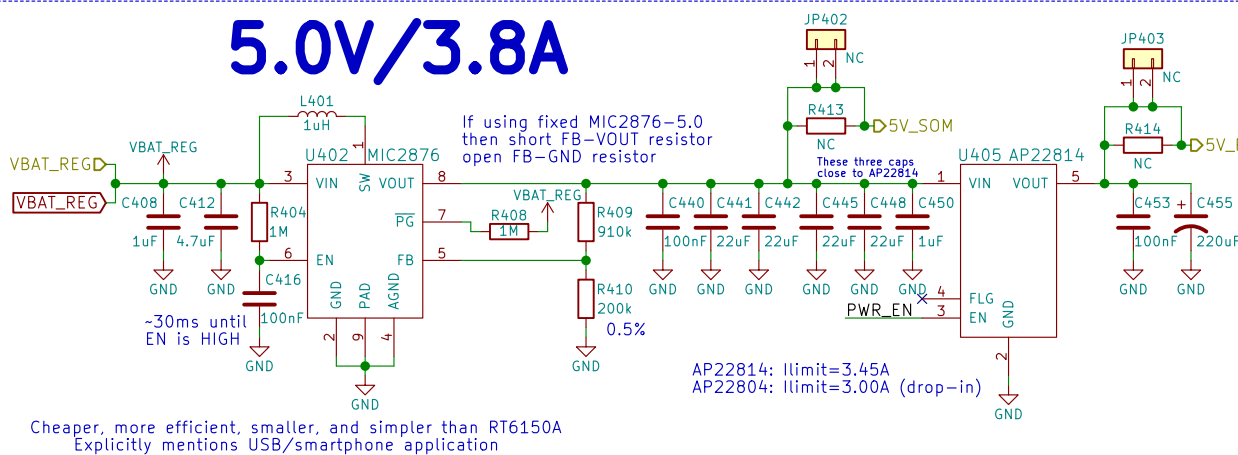
## 3.3V/3A



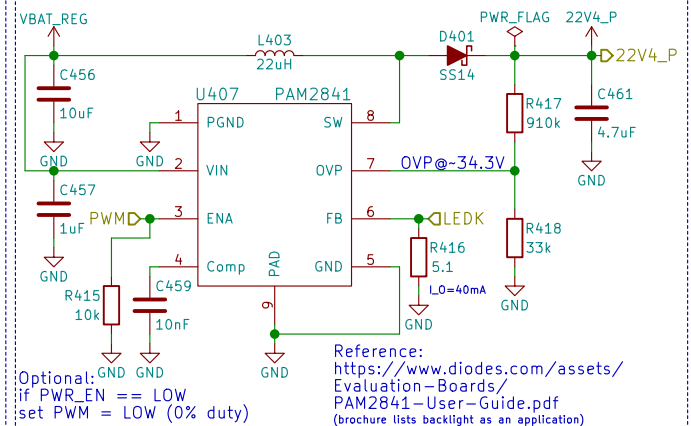
## 1.8V/600mA



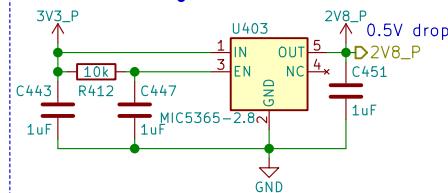
## 5.0V/3.8A



## 22.4V/40mA



## 2.8V/150mA



## Power

Power

**Purism**

Copyright 2018 GNU GPLv3

Sheet: /Power/  
File: power.sch

Size: A4  
KiCad E.D.A. kicad 5.0.0

Date: 2018-08-14

Rev: v0.1.0

Id: 4/24

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

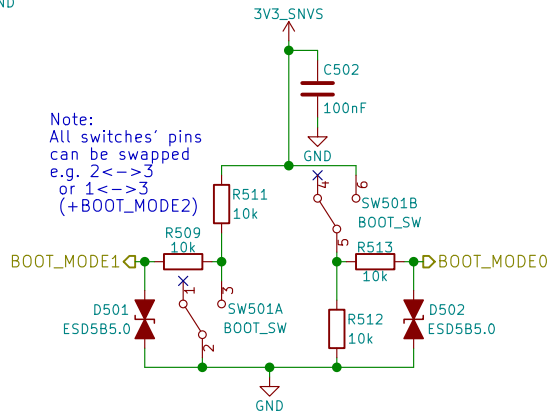
nicole.faeber@puri.sm

christian.schilmoeller@puri.sm

# Boot Config



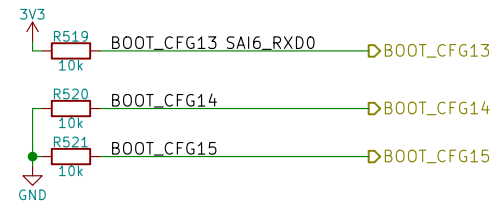
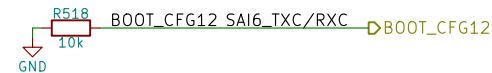
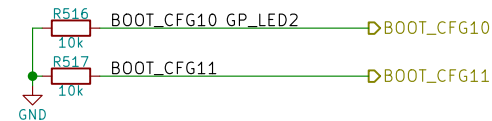
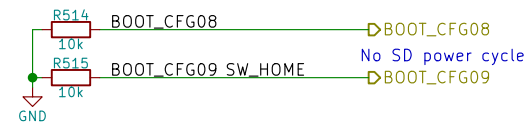
Note:  
All switches' pins  
can be swapped  
e.g. 2<->3  
or 1<->3  
(+BOOT\_MODE2)



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



## Boot Configuration



Copyright 2018 GNU GPLv3

Sheet: /Boot Config/  
File: boot.sch

Size: A4  
KiCad E.D.A. kicad 5.0.0

Date: 2018-08-14

Rev: v0.1.0

Id: 5/24

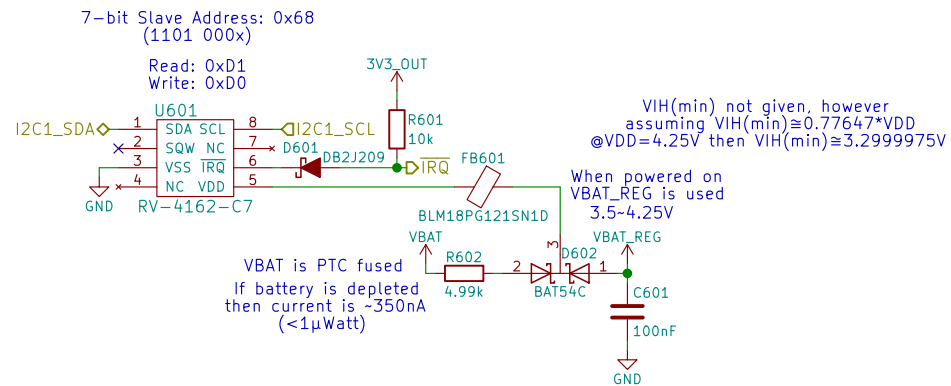
eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

nicole.ferber@puri.sm


christian.schilmoeller@puri.sm

# Real-Time Clock

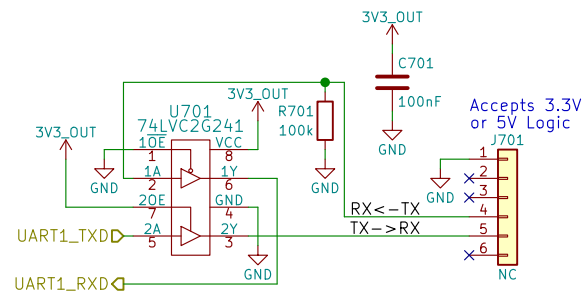


Note:  
 Datasheet says slave address is 0xD0  
 with a R/W bit appended, since 0xD0 must  
 be 4-bits wide the actual 7-bit address is  
 0x68 (110 1000), and becomes 0xD0 during a  
 write operation (1101 0000)

Reference:  
[https://github.com/HIO-Project/linux-imx6-nano-imx\\_3.10.17\\_1.0.1\\_ga/blob/8848e94b2f889fe44f6736e2d4c98851a2282275/arch/arm/boot/dts/imx6qdl-mtp.dtsi#L351](https://github.com/HIO-Project/linux-imx6-nano-imx_3.10.17_1.0.1_ga/blob/8848e94b2f889fe44f6736e2d4c98851a2282275/arch/arm/boot/dts/imx6qdl-mtp.dtsi#L351)

 <b>Purism</b>		eric.kuzmenko@purism angus.ainslie@purism nicole.faeber@purism christian.schilmoeller@purism
<b>Copyright 2018 GNU GPLv3</b>		
Sheet: /RTC/ File: rtc.sch		
Size: A4	Date: 2018-08-14	<b>Rev: v0.1.0</b>
KiCad E.D.A.    kicad 5.0.0		Id: 6/24

# UART Debug



## UART Debug



Copyright 2018 GNU GPLv3

Sheet: /UART Debug/

File: uart.sch

Size: A4 Date: 2018-08-14

KiCad E.D.A. kicad 5.0.0

eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

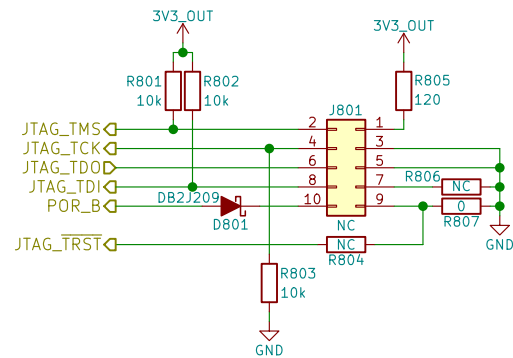
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 7/24

# JTAG



JTAG



Copyright 2018 GNU GPLv3

Sheet: /JTAG/

File: jtag.sch

Size: A4 Date: 2018-08-14

KiCad E.D.A. kicad 5.0.0

eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

nicole.farber@puri.sm

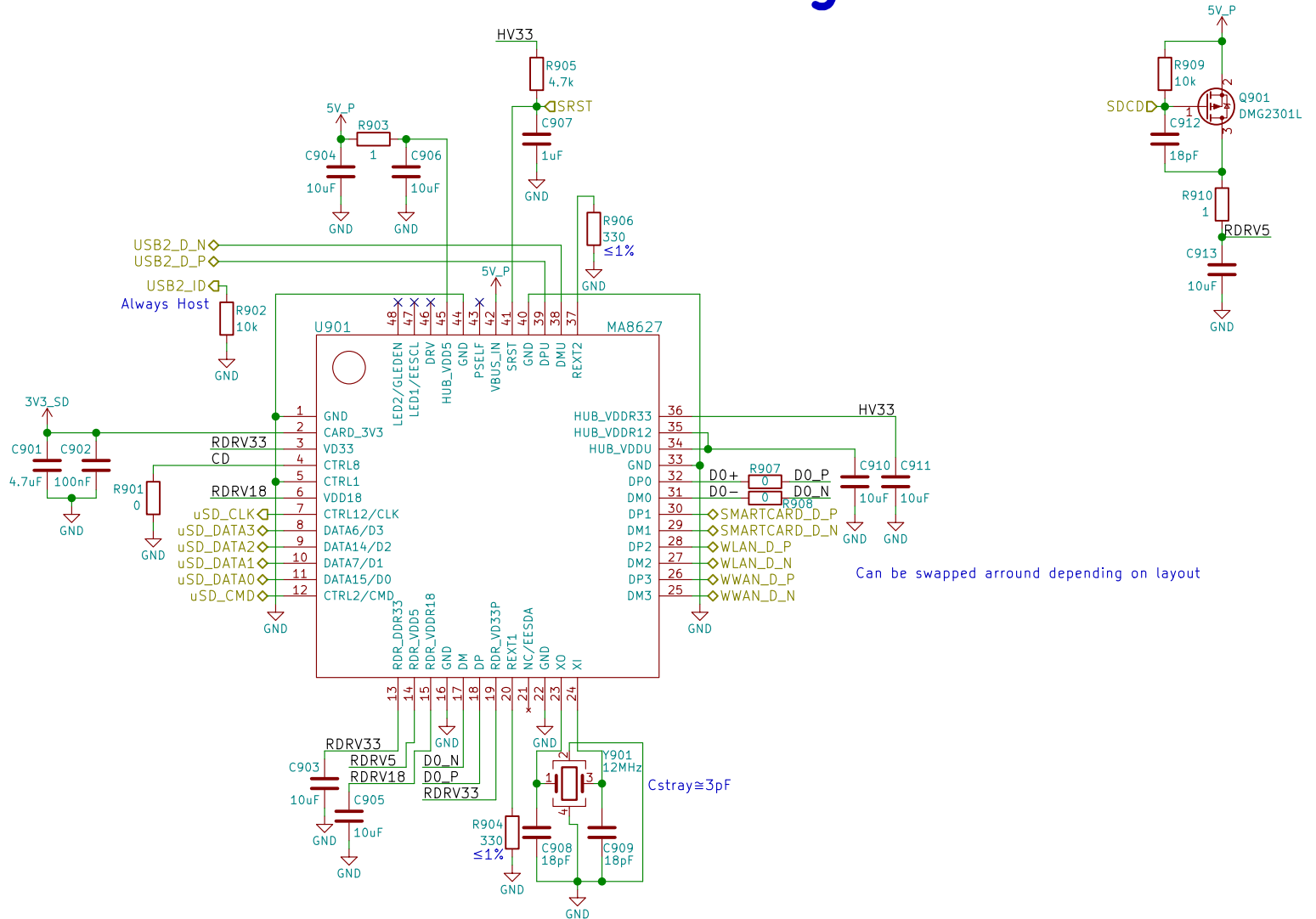
christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 8/24



## USB Hub + SDIO Bridge



## USB Hub + SDIO Bridge



Copyright 2018 GNU GPLv3

Sheet: /USB Hub + SDIO Bridge/

Size: A4

Date: 2018-08-14

KiCad E.D.A.	kicad 5.0.0
--------------	-------------

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

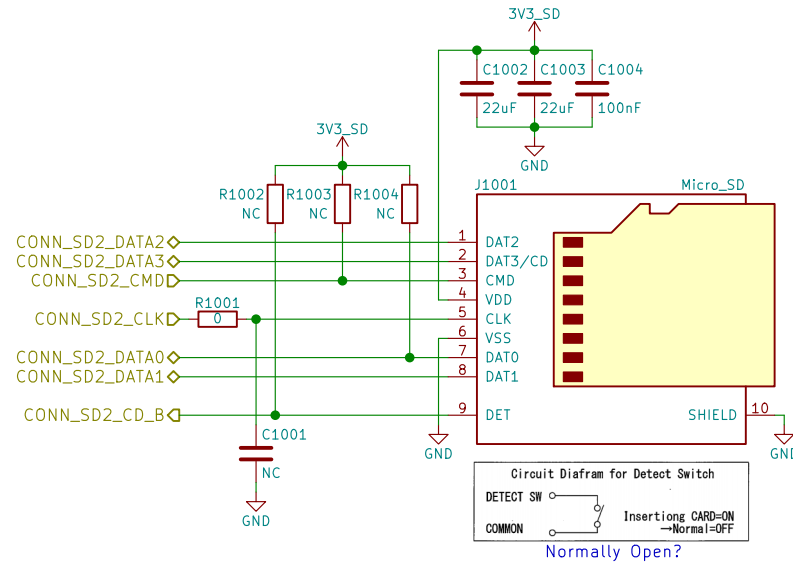
nicole.faerber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 9/24

# μSD



uSD Card



**Purism**

Copyright 2018 GNU GPLv3

Sheet: /uSD Card/

File: sd.sch

Size: A4 Date: 2018-08-14

KiCad E.D.A. kicad 5.0.0

eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 10/24

# MIPI



MIPI



Copyright 2018 GNU GPLv3

Sheet: /MIPI/  
File: mipi.sch

Size: A4  
KiCad E.D.A. kicad 5.0.0

Date: 2018-08-14

Rev: v0.1.0  
Id: 11/24

eric.kuzmenko@puri.sm  
angus.ainstlie@puri.sm  
nicole.ferber@puri.sm  
christian.schilmoeller@puri.sm

# Display & Touch Controller

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

Display Driver IC PN:  
Sitronix ST7703

Display\_JH057N00900

DISP1201

5.7 "  
RGB  
720 x 1440  
pixels

FPC6  
Touch

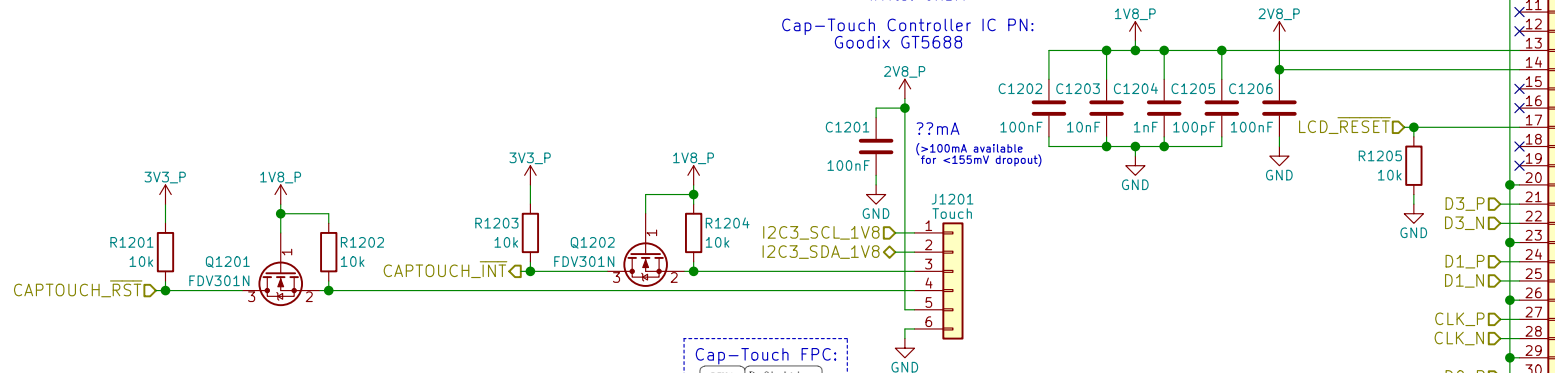
FPC39  
Display +  
Backlight

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

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

Read: 0xBB  
Write: 0xBA

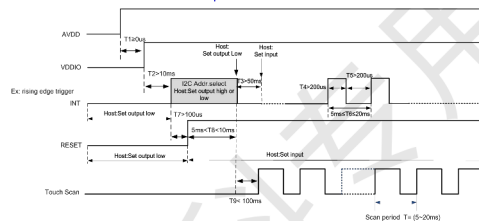
Cap-Touch Controller IC PN:  
Goodix GT5688



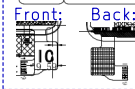
The upper 7 bits are the address,  
and bit 0 is used to select read or write.  
GT5688 has two slave device addresses to choose from:

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

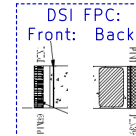
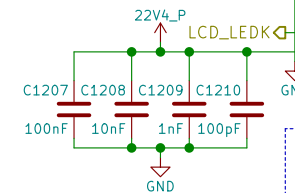
Every time you power on or reset, you need  
to use the INT pin to set the I2C address:



Pin#	Definition
1	SCL
2	SDA
3	INT
4	RESET
5	VDD2, 85
6	GND



100Ω Differential Impedance



Backlight Array:



MIPI DSI



Copyright 2018 GNU GPLv3

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

Size: A4  
KiCad E.D.A. kicad 5.0.0

Date: 2018-08-14

Rev: v0.1.0  
Id: 12/24

eric.kuzmenko@puri.sm

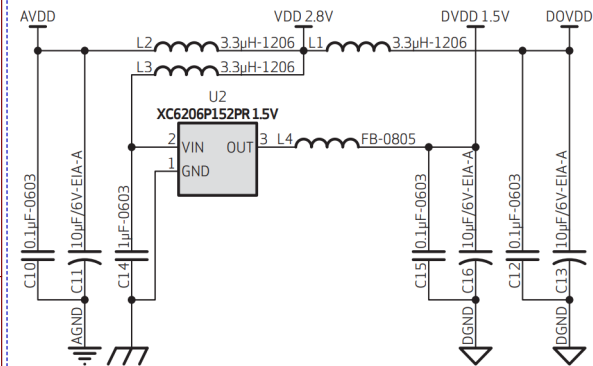
angus.ainstie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm

# Camera

## Using Internal DVDD 1.5V Regulator:



## 2.7 POWER UP SEQUENCE

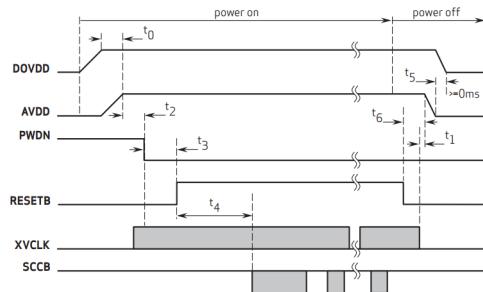
Based on the system power configuration (1.8V or 2.8V for I/O power, using external DVDD or internal DVDD, requiring access to the I2C during power up period or not), the power up sequence will differ. If 1.8V is used for I/O power, using the internal DVDD is preferred. If 2.8V is used for I/O power, 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 asynchronous 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 asynchronous 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

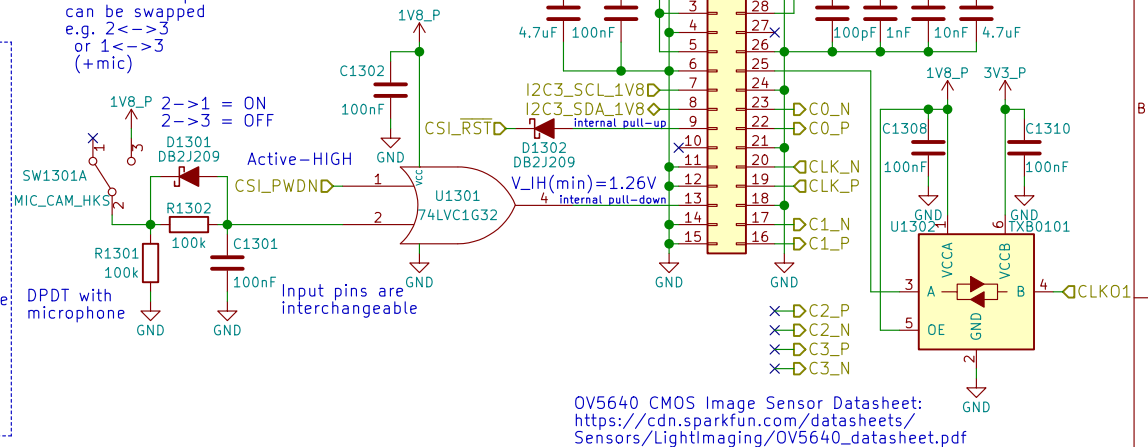
figure 2-3 power up timing with internal DVDD



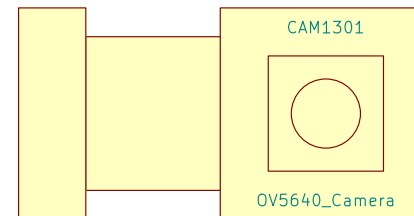
**note**  $t_0 \geq 0$ ms, delay from DOVDD stable to AVDD stable, it is recommended to power up AVDD shortly after DOVDD has been powered up  
 $t_1 \geq 0$ ms, delay from XVCLK off to AVDD off  
 $t_2 \geq 5$ ms, delay from AVDD stable to sensor power up stable, PWDN can be pulled low after this point, 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<->3  
or 1<->3  
(+mic)



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)



MIPI CSI

**Purism**

Copyright 2018 GNU GPLv3

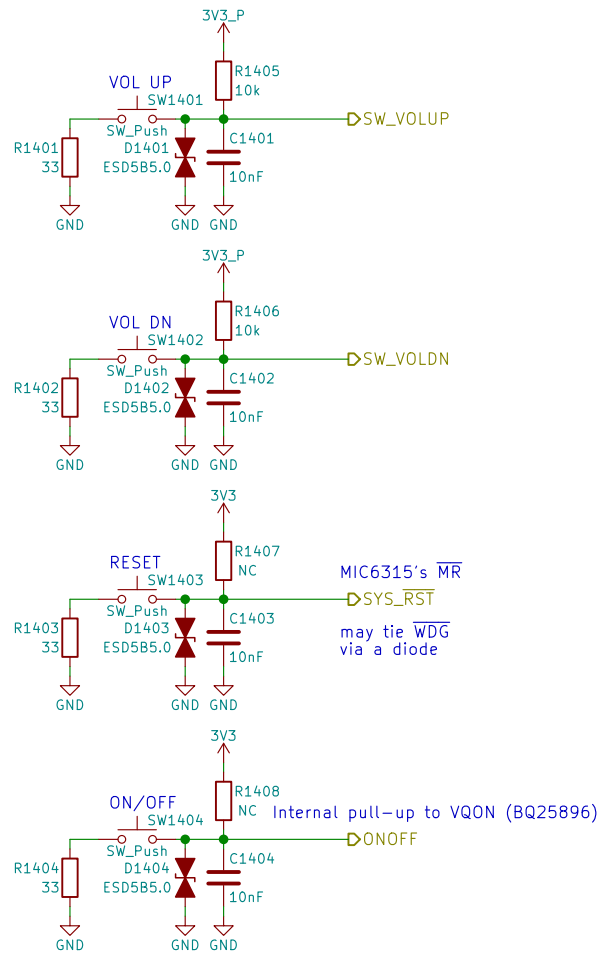
Sheet: /MIPI/CSI/  
File: csi.sch

Size: A4 Date: 2018-08-14  
KiCad E.D.A. kicad 5.0.0

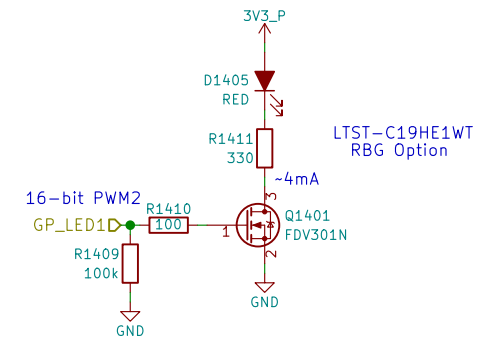
eric.kuzmenko@puri.sm  
angus.ainslie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 13/24

# Buttons & LED



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)



## Buttons & LED



Copyright 2018 GNU GPLv3

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

Size: A4  
KiCad E.D.A. kicad 5.0.0

Date: 2018-08-14

Rev: v0.1.0

Id: 14/24

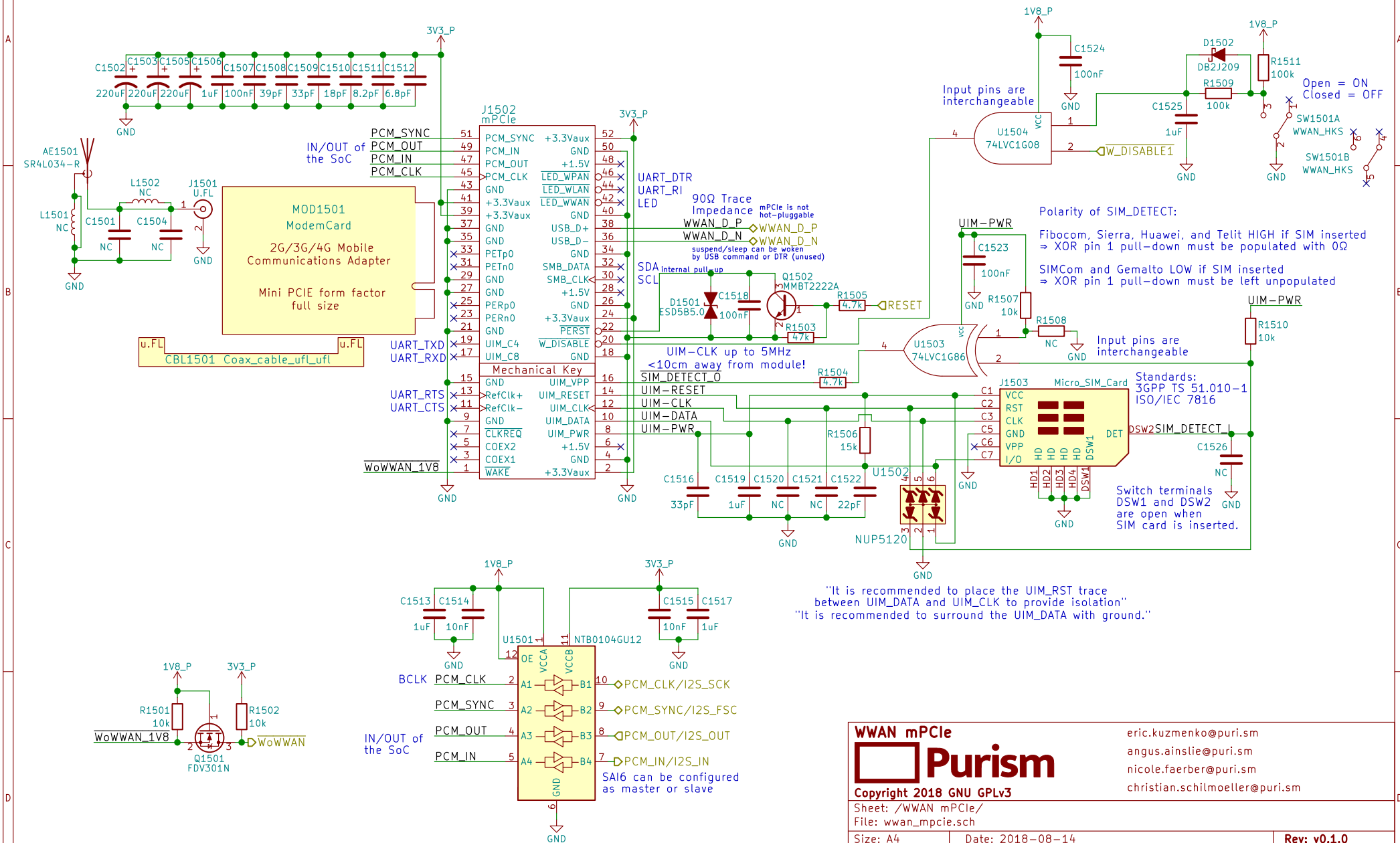
eric.kuzmenko@puri.sm

angus.ainstie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm

# WWAN mPCIe



**Purism**

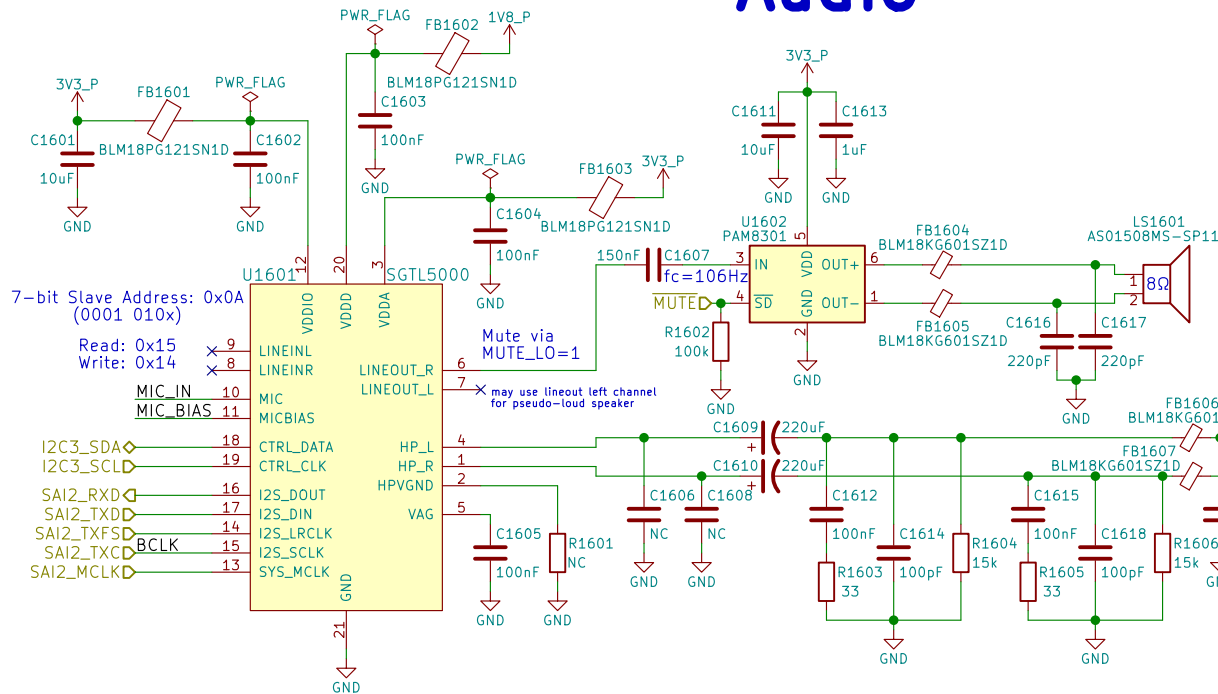
Sheet: /WWAN mPCIe/  
File: wwan\_mpcie.sch

Size: A4	Date: 2018-08-14
KiCad E.D.A. kicad 5.0.0	

eric.kuzmenko@puri.sm  
angus.ainslie@puri.sm  
nicole.ferber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 15/24

## Audio



[http://www.52rd.com/S.txt/2011\\_3/TXT26685.htm](http://www.52rd.com/S.txt/2011_3/TXT26685.htm)  
<http://www.sengpielaudio.com/calculator-transferfactor.htm>  
<https://electronics.stackexchange.com/questions/31442/how-can-i-switch-this-audio-jack-using-its-own-mechanical-switches-without-creating-a-short-circuit>  
 (N16 does the same)  
 +Zener diode to protect against ranges outside of -0.9V to 3.3V

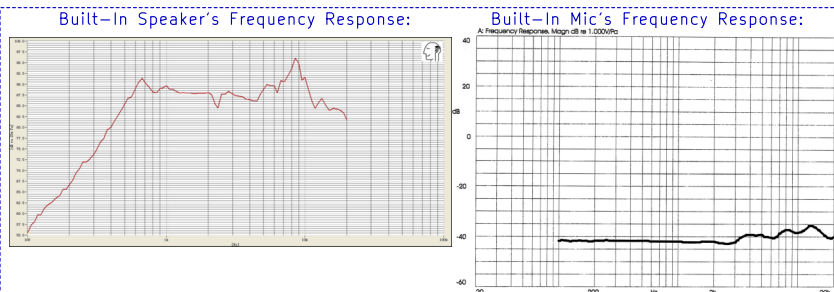
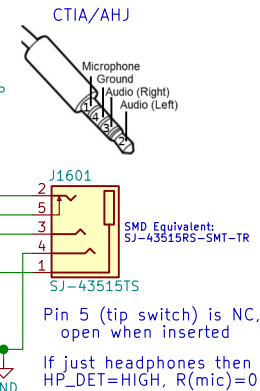
dB specs in datasheet is a unit of power gain (not dBu or VU) with respect to the DAC's unattenuated output

"HP Output – 62.5mW max, 1.02kHz sine into 16Ω load at 3.3 V"  
 $\Rightarrow (1V)^2 / (16\Omega) = 62.5mW$   
 $\therefore V_{rms} = 1V \Rightarrow V_p(\text{amplitude}) = 1.414V$   
 $\therefore I_{rms}(\text{max}) = 62.5mA$

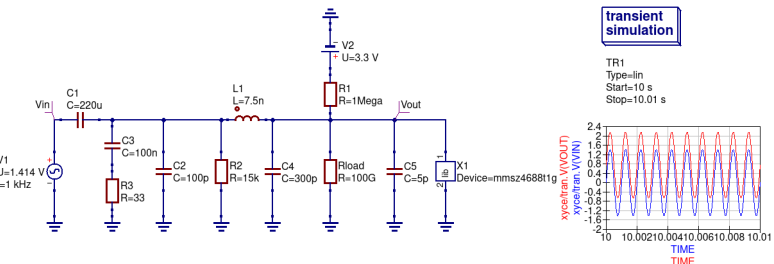
If HP\_DET is HIGH for >100ms then HPs are present

S/E button on earbud headsets shorts the mic for key function

Could use FSA8008 to detect mic



Simulation of HP\_DET  
without HP jack inserted:



LCR Measurements:

Earbud Microphone:	Headset Speaker:	Earbud Speaker:
①1kHz	①1kHz	①1kHz
Ls = 3.844mH	Ls = 244.4uH	Ls = 25.2uH
Lp = 15.757H	Lp = 141.99mH	Lp = 311.0mH
Cs = 6.583uF	Cs = 103.6uF	Cs = 1.0mF
Cp = 1612.8pF	Cp = 178.77nF	Cp = 81.95nF
Rs = 1.5465kOhms	Rs = 36.86kOhms	Rs = 17.030kOhms
Rp = 1.5478kOhms	Rp = 36.86kOhms	Rp = 17.034kOhms
θ = -0.8deg	θ = -2.3deg	θ = 0.5deg

**Audio**



Copyright 2018 GNU GPLv3

Sheet: /Audio/  
File: audio.sch

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

nicole.ferber@puri.sm

christian.schilmoeller@puri.sm

Size: A4	Date: 2018-08-14
----------	------------------

KiCad E.D.A.	kicad 5.0.0
--------------	-------------

Rev: v0.1.0

Id: 16/24



[illegible]

**Purism**

eric.kuzmenko@puri.sm  
angus.ainslie@puri.sm  
nicole.fauber@puri.sm  
christian.schilmoeller@puri.sm

# WLAN+BT M.2

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

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

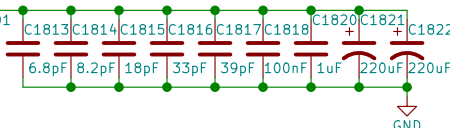
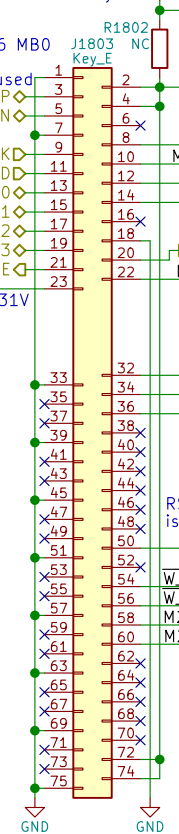
RedPine RS9116 MB0  
Requires 5V on  
Pin 54 if USB used

WLAN\_D\_P  
WLAN\_D\_N  
WIFI\_CLK  
WIFI\_CMD  
WIFI\_DATA0  
WIFI\_DATA1  
WIFI\_DATA2  
WIFI\_DATA3  
WIFI\_WAKE

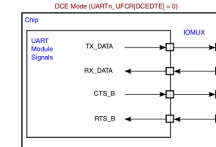
RedPine RS9116  
has 100k pull-up to  
3.3V making SDIO\_RST  
~2.55V when HIGH

MOD1801  
WifiBTCard  
WiFi + Bluetooth  
M.2 Form Factor  
Key ID "E"  
width: 22 mm  
length: 30 mm

Socket: Table 46  
Module: Table 23  
M.2 Key E



6.2 M.2 Signal Directions  
UARTn\_UFCR[DCEDTE]=0 on POR



TX output  
RX input  
CTS output  
RTS input  
⇒ TX→RX  
RX→TX  
CTS→CTS  
RTS→RTS

SoC's IN/OUT

i.MX8M in DCE mode  
(POR state)  
has CTS output, RTS input

Pin 54 on RS9116 is  
USB\_VBUS Sink

RS9116 SUSCLK  
is a GPIO (unused)  
SUSCLK

W\_DISABLE2  
W\_DISABLE1  
M2\_I2C\_SDA  
M2\_I2C\_SCL

U1803A  
74AUP2G08

U1803B  
74AUP2G08

U1801  
FDV301N

U1802  
FDV301N

U1801  
FDV301N

U1802  
FDV301N

U1801  
FDV301N

U1802  
FDV301N

U1801  
FDV301N

U1802  
FDV301N

U1801  
FDV301N

U1802  
FDV301N

WLAN+BT M.2

Purism

Copyright 2018 GNU GPLv3

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

Size: A4 Date: 2018-08-14  
KiCad E.D.A. kicad 5.0.0

eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

nicole.farber@puri.sm

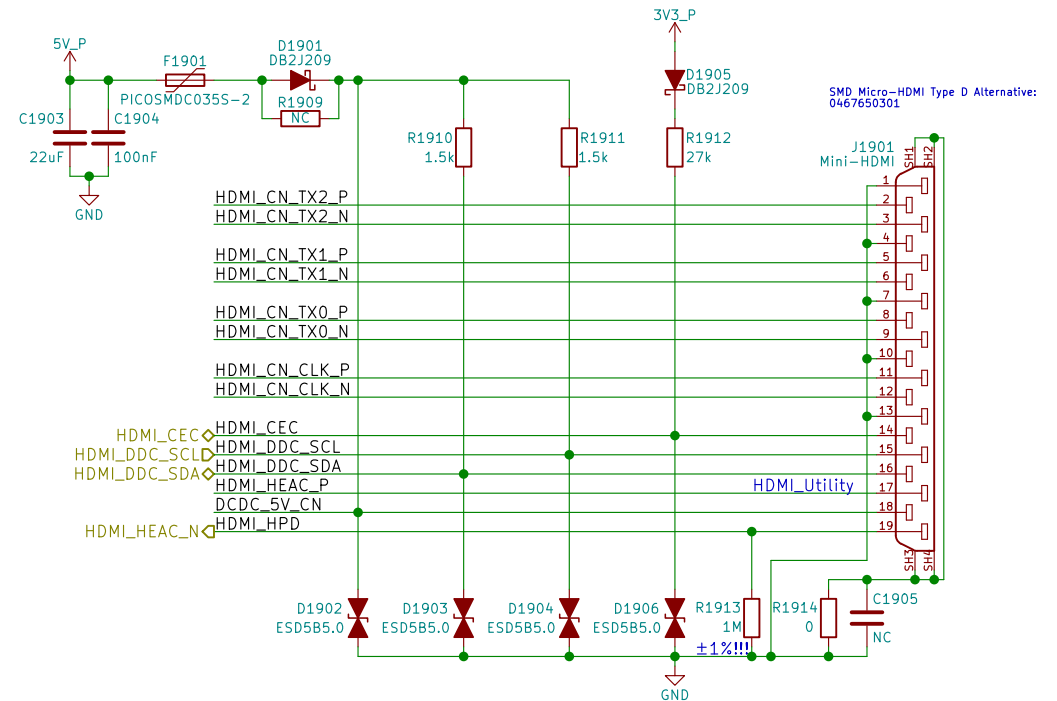
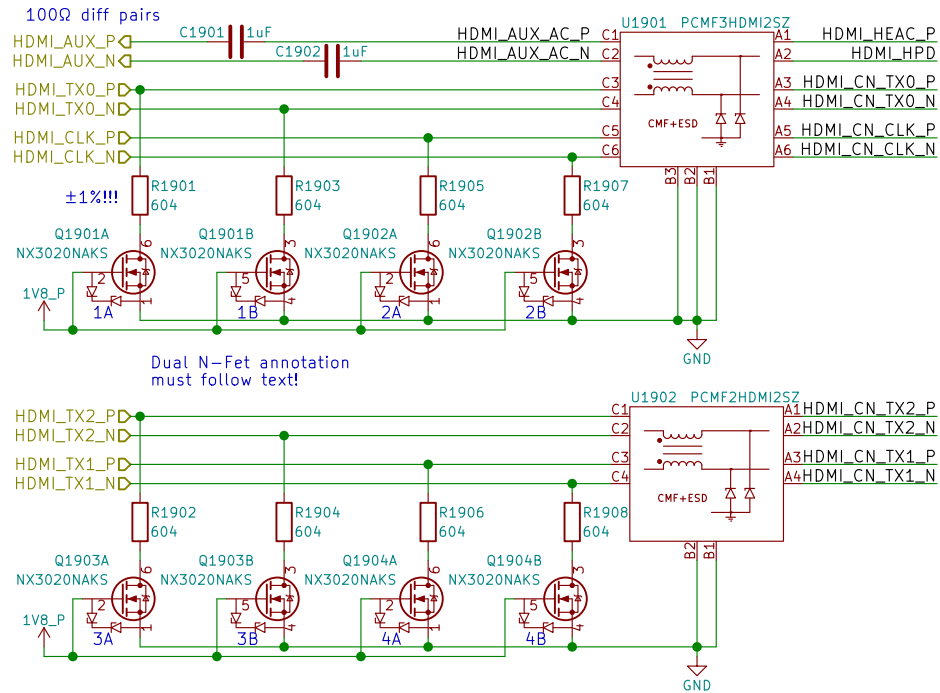
christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 18/24

TUSB1046 can be used for DP over USB-C

# HDMI



HDMI



Copyright 2018 GNU GPLv3

Sheet: /HDMI/  
File: hdmi.sch

Size: A4  
KiCad E.D.A. kicad 5.0.0

Date: 2018-08-14

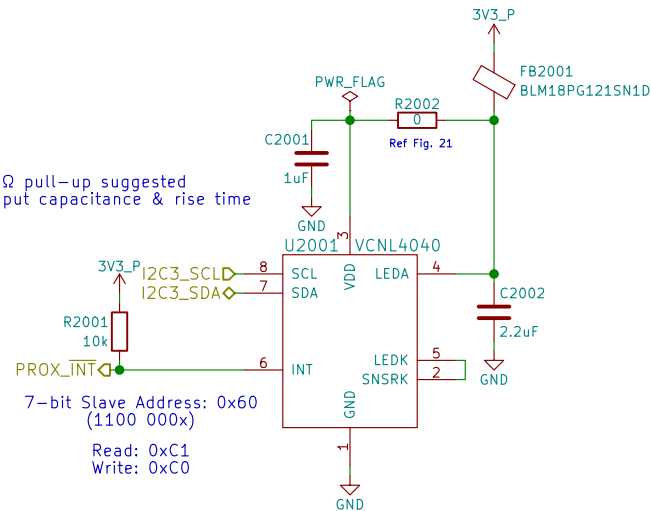
eric.kuzmenko@puri.sm  
angus.ainstlie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 19/24

# Sensors

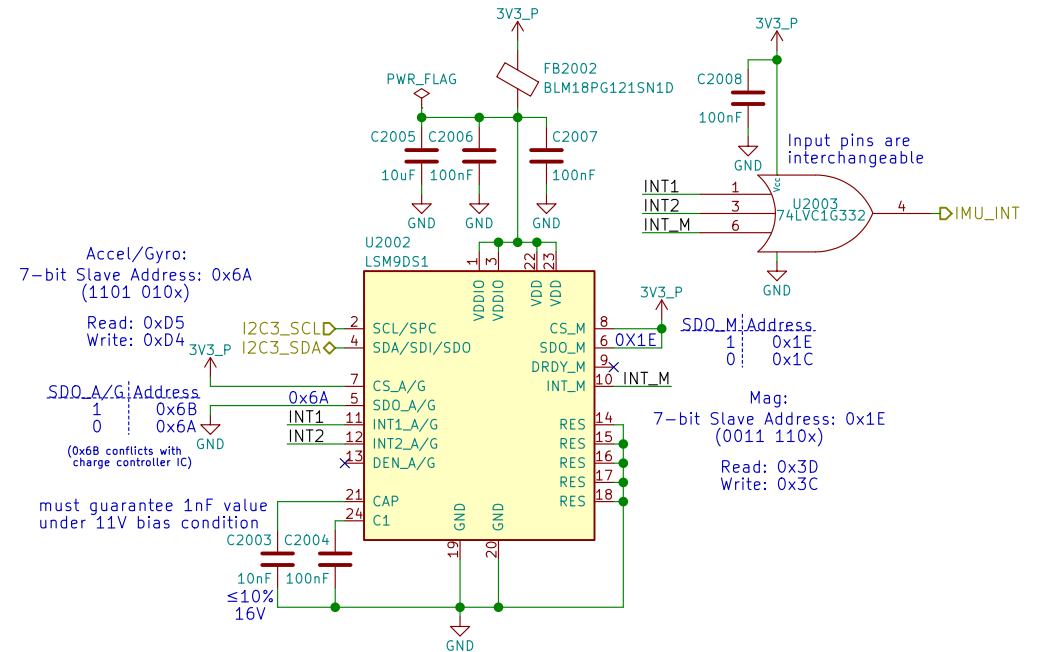
## Proximity & Ambient Light

Note:  
I2C 2.2k $\Omega$  pull-up suggested  
check input capacitance & rise time



Reference:  
<https://www.vishay.com/docs/84307/designingvcnl4040.pdf>  
<http://www.vishay.com/docs/84931/vcni4040sensorboardfiles.pdf>

## 9-Axis IMU



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

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)

Command	SAD[6:2]	SAD[1] = SDO/SA1	SAD[0]	R/W	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)

### Sensors



Copyright 2018 GNU GPLv3

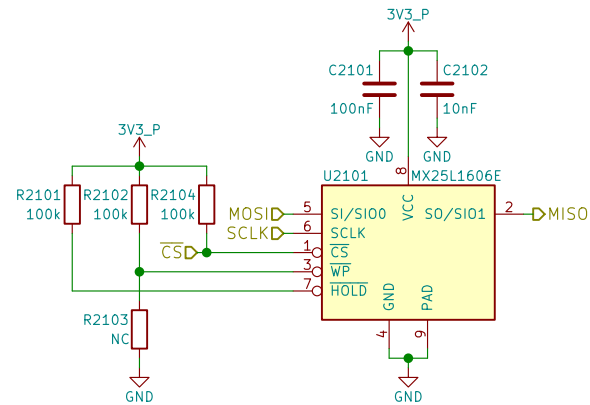
Sheet: /Sensors/  
File: sensors.sch

Size: A4  
KiCad E.D.A. kicad 5.0.0

eric.kuzmenko@puri.sm  
angus.ainslie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 20/24

# SPI NOR Flash



## SPI NOR Flash



Copyright 2018 GNU GPLv3

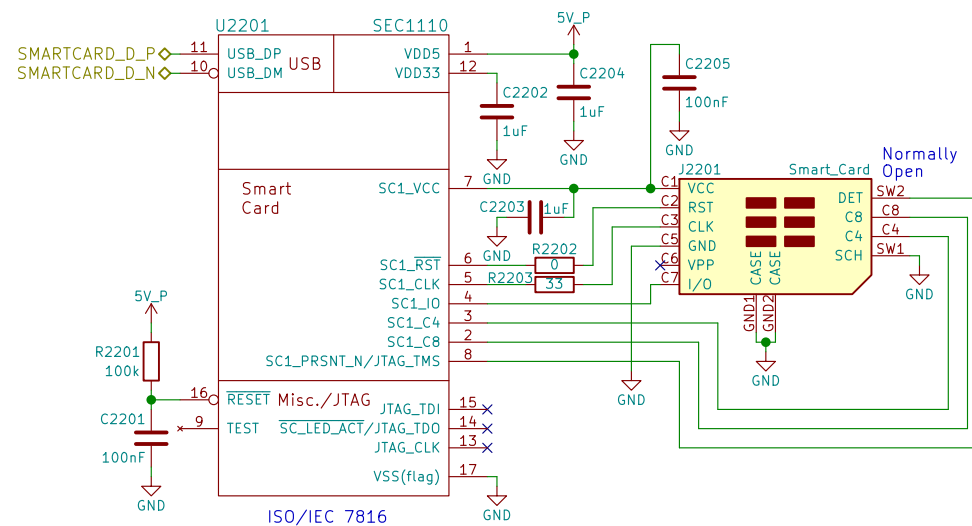
Sheet: /SPI Flash/  
File: flash.sch

Size: A4 Date: 2018-08-14  
KiCad E.D.A. kicad 5.0.0

eric.kuzmenko@puri.sm  
angus.ainstlie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 21/24

# Smart Card



Reference:  
<http://www.microchip.com/DevelopmentTools/ProductDetails.aspx?PartNO=EVB-SEC1110>

## Smart Card



Copyright 2018 GNU GPLv3

Sheet: /Smart Card/

File: smartcard.sch

Size: A4 Date: 2018-08-14

KiCad E.D.A. kicad 5.0.0

Rev: v0.1.0

Id: 22/24

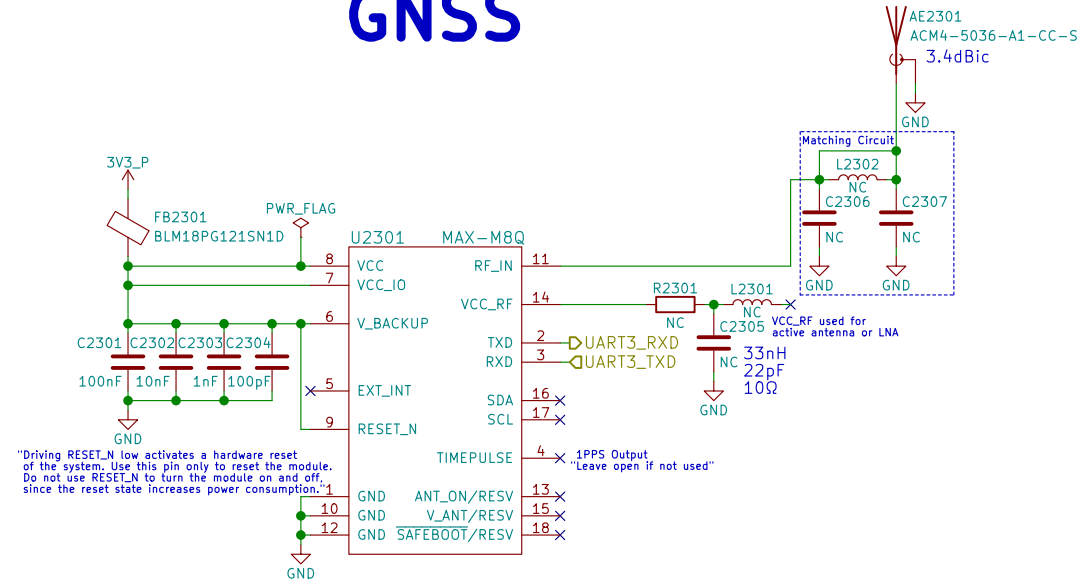
eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm

# GNSS



References:  
[https://www.u-blox.com/sites/default/files/MAX-M8\\_HardwareIntegrationManual\\_L%28UBX-13004876%29.pdf](https://www.u-blox.com/sites/default/files/MAX-M8_HardwareIntegrationManual_L%28UBX-13004876%29.pdf)  
[https://www.u-blox.com/sites/default/files/MAX-8-M8-FW3\\_HardwareIntegrationManual\\_L%28UBX-15030059%29.pdf](https://www.u-blox.com/sites/default/files/MAX-8-M8-FW3_HardwareIntegrationManual_L%28UBX-15030059%29.pdf)

GNSS



Copyright 2018 GNU GPLv3

Sheet: /GNSS/  
 File: gnss.sch

Size: A4  
 KiCad E.D.A. kicad 5.0.0

Date: 2018-08-14

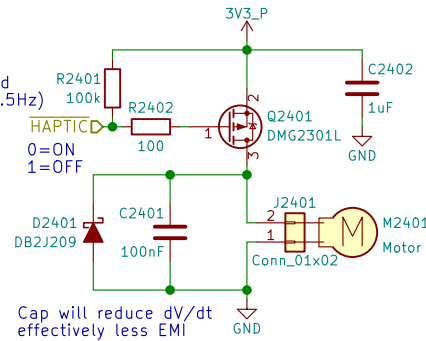
Rev: v0.1.0  
 Id: 23/24

eric.kuzmenko@puri.sm  
 angus.ainstlie@puri.sm  
 nicole.ferber@puri.sm  
 christian.schilmoeller@puri.sm

# Haptic Motor

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  
 thick adhesive layer underneath  
 (not connected to either pin)

Haptic/Vibration Motor



Copyright 2018 GNU GPLv3

Sheet: /Haptic Motor/  
 File: haptic.sch

Size: A4 Date: 2018-08-14  
 KiCad E.D.A. kicad 5.0.0

eric.kuzmenko@puri.sm  
 angus.ainslie@puri.sm  
 nicole.farber@puri.sm  
 christian.schilmoeller@puri.sm

Rev: v0.1.0  
 Id: 24/24