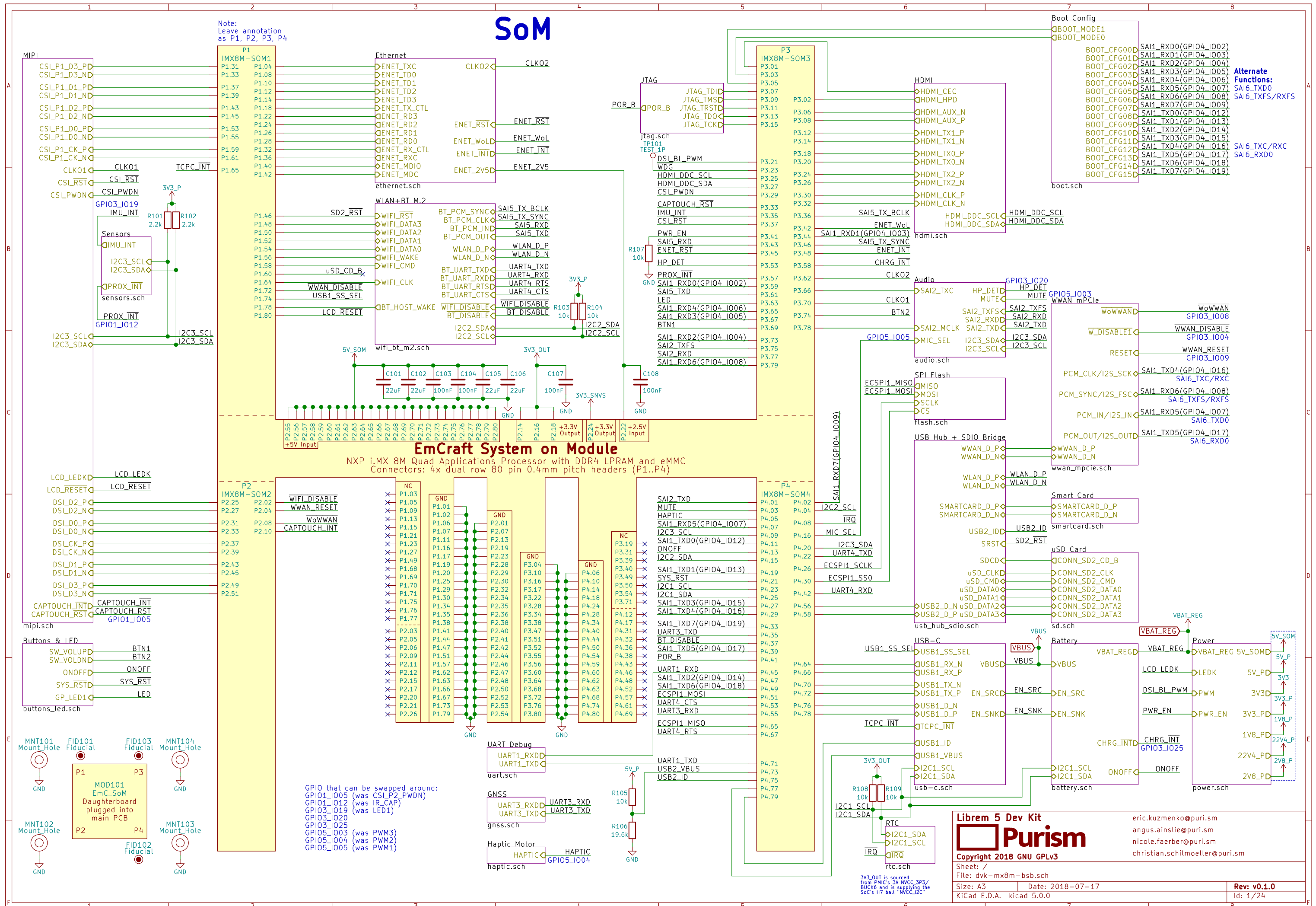


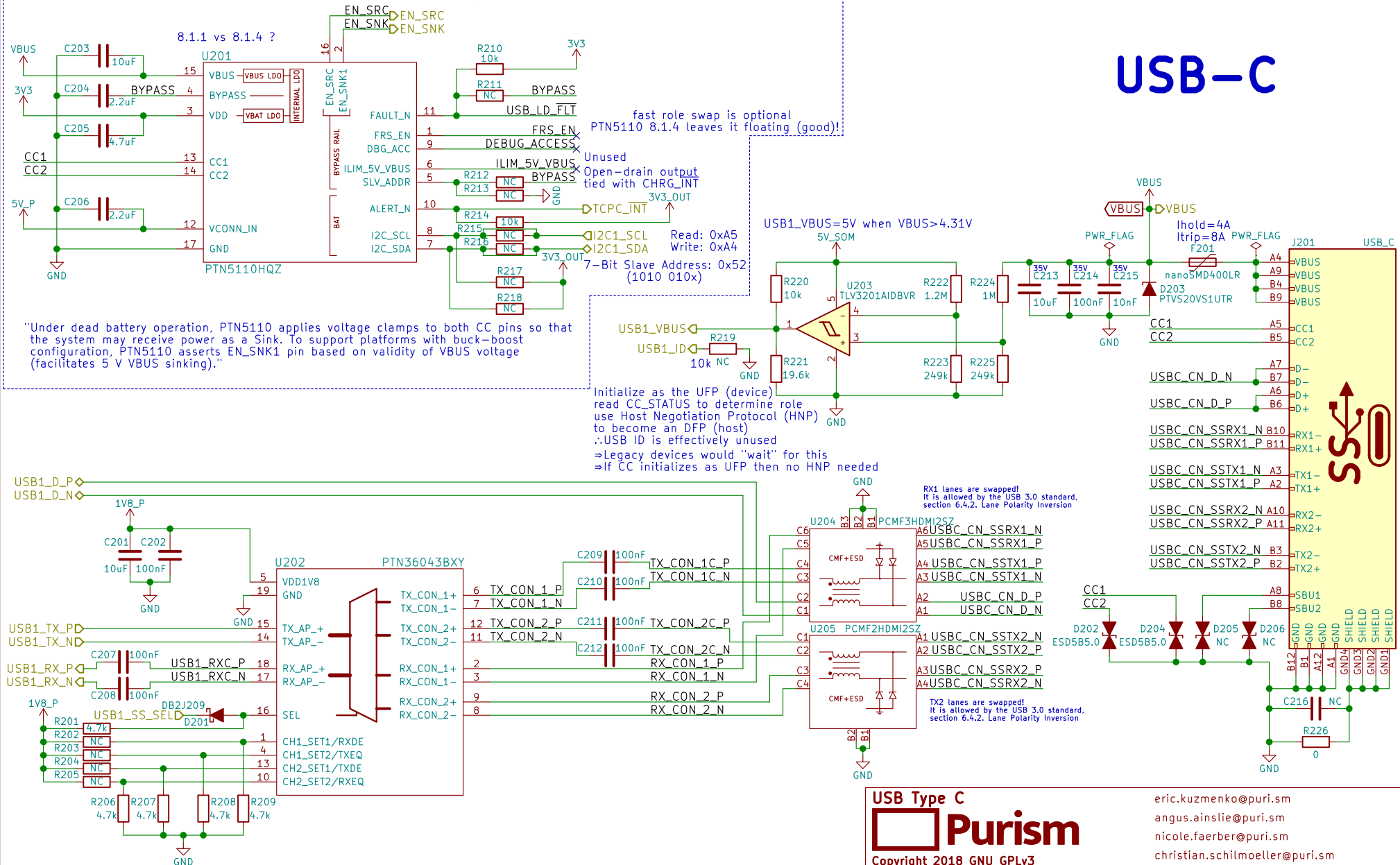
# SoM

Note:  
Leave annotation  
as P1, P2, P3, P4



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

## USB-C



USB Type C

**Purism**

Copyright 2018 GNU GPLv3

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

Size: A4 Date: 2018-07-17  
KiCad E.D.A. kicad 5.0.0

eric.kuzmenko@puri.sm

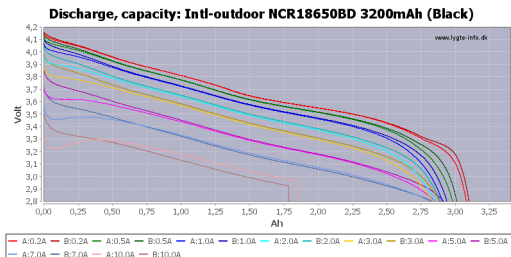
angus.ainstie@puri.sm

nicole.faeber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 2/24



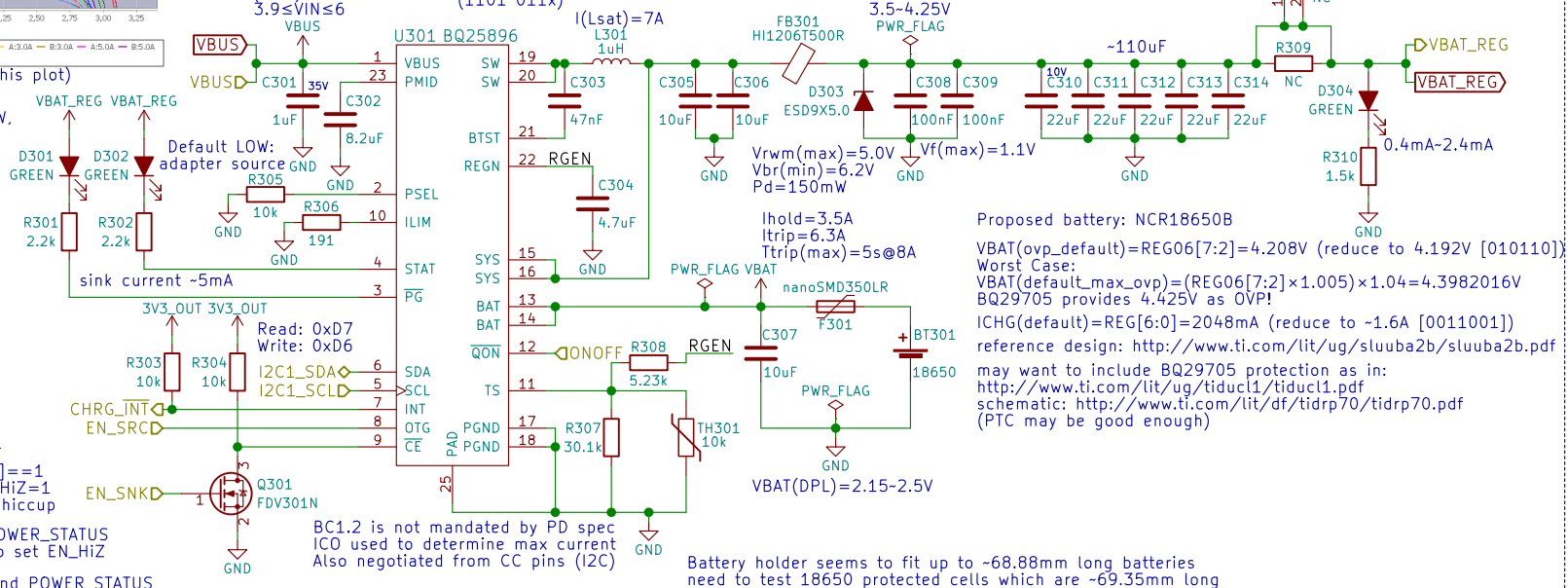
(interpret RSOC% based on this plot)

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)

# Battery Charge Controller



This disables charging but maybe not  $VBUS \rightarrow VOUT$  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)

Battery

**Purism**

Copyright 2018 GNU GPLv3

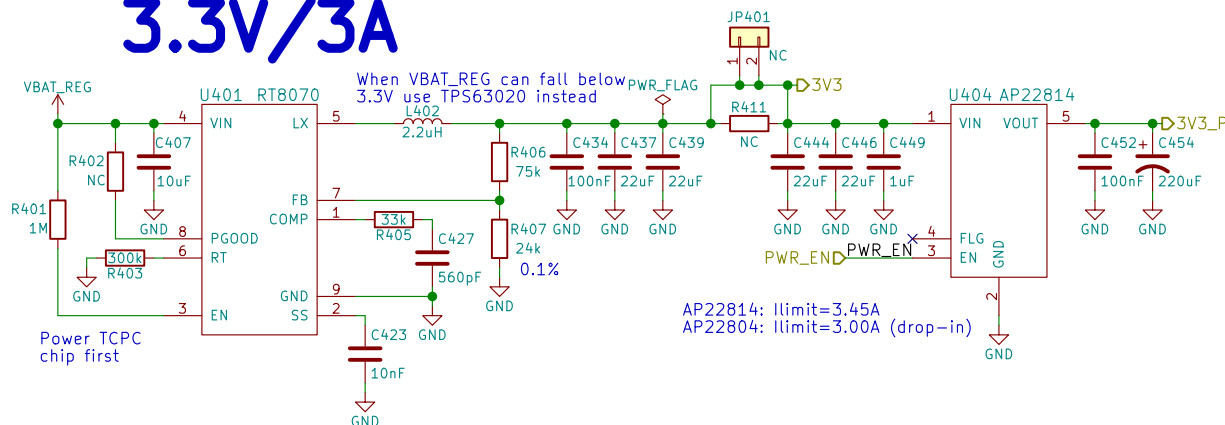
Sheet: /Battery/  
 File: battery.sch

Size: A4 Date: 2018-07-17  
 KiCad E.D.A. kicad 5.0.0

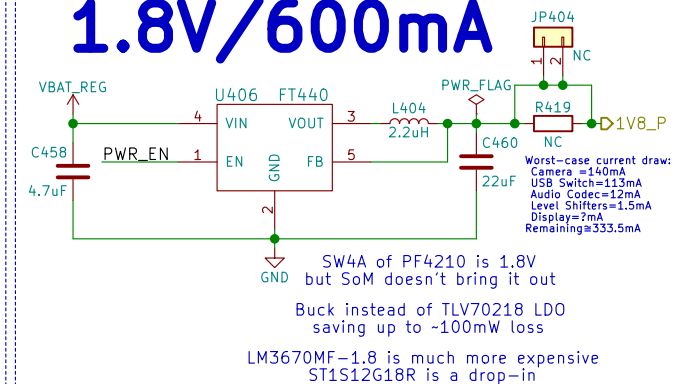
eric.kuzmenko@puri.sm  
 angus.ainslie@puri.sm  
 nicole.farber@puri.sm  
 christian.schilmoeller@puri.sm

Rev: v0.1.0  
 Id: 3/24

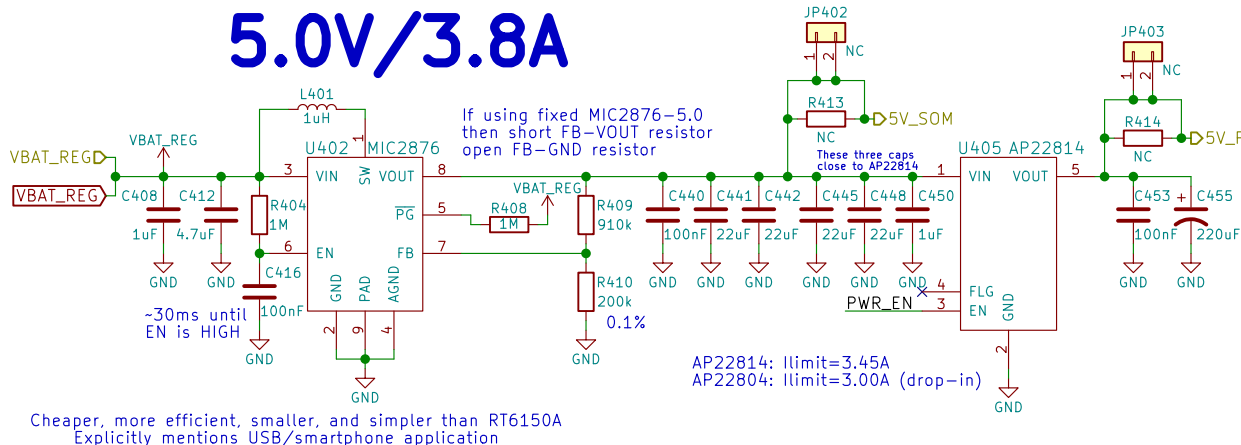
## 3.3V/3A



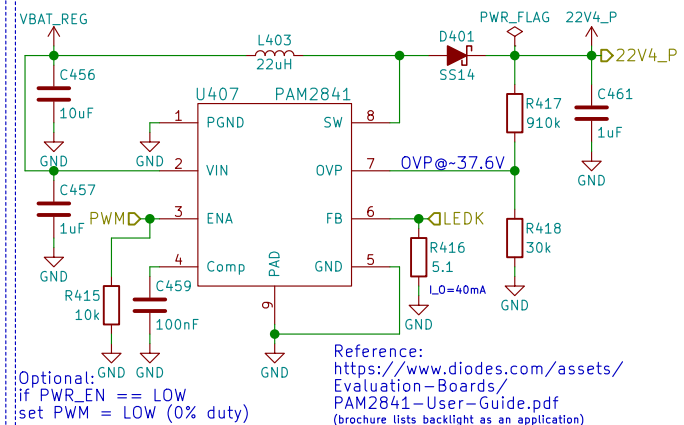
## 1.8V/600mA



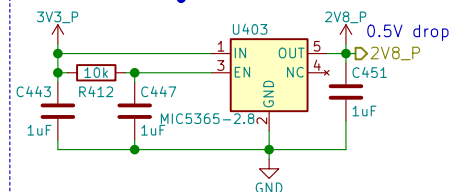
## 5.0V/3.8A



## 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

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

nicole.faeber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 4/24

# Boot Config



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

eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm


nicole.farber@puri.sm

christian.schilmoeller@puri.sm

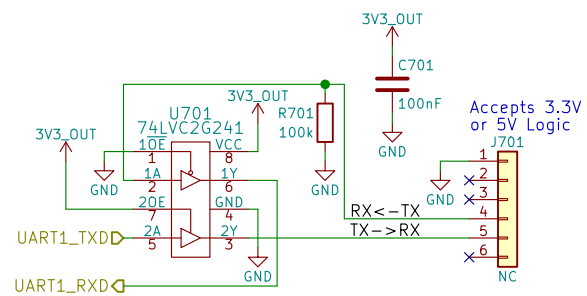
Rev: v0.1.0

Id: 5/24

[illegible]

<div> <div>RTC</div> <div>  <div>Purism</div> </div> </div>		<div> <div>eric.kuzmenko@puri.sm</div> <div>angus.ainslie@puri.sm</div> <div>nicole.faeerber@puri.sm</div> <div>christian.schilmoeller@puri.sm</div> </div>
Copyright 2018 GNU GPLv3		
Sheet: /RTC/		
File: rtc.sch		
Size: A4	Date: 2018-07-17	Rev: v0.1.0
KiCad E.D.A.    kicad 5.0.0		Id: 6/24

The diagram shows a 74LVC2G24 inverter (U701) configured as a level shifter. The input pin 1A is connected to UART1\_TXDD (3.3V logic). The output pin 1Y is connected to 3V3\_OUT (5V logic) through a 100k resistor (R701). The input pin 2A is connected to UART1\_RXDD (5V logic). The output pin 2Y is connected to 3V3\_OUT (3.3V logic). A 100nF capacitor (C701) is connected between 3V3\_OUT and GND. The circuit is labeled "Accepts 3.3V or 5V Logic" and "J701".



 Purism

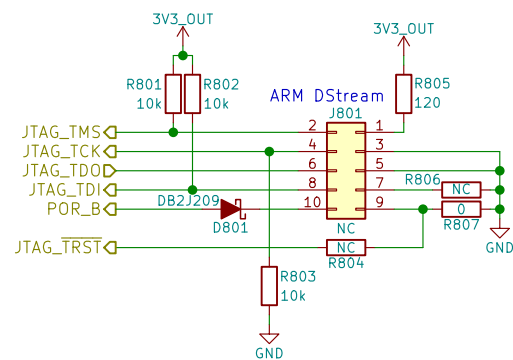
eric.kuzmenko@puri.sm  
angus.ainslie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

File: uart.sch

Rev: v0.1.0

Id: 7/24

# JTAG



JTAG



Copyright 2018 GNU GPLv3

Sheet: /JTAG/

File: jtag.sch

Size: A4	Date: 2018-07-17
----------	------------------

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

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

nicole.faerber@puri.sm

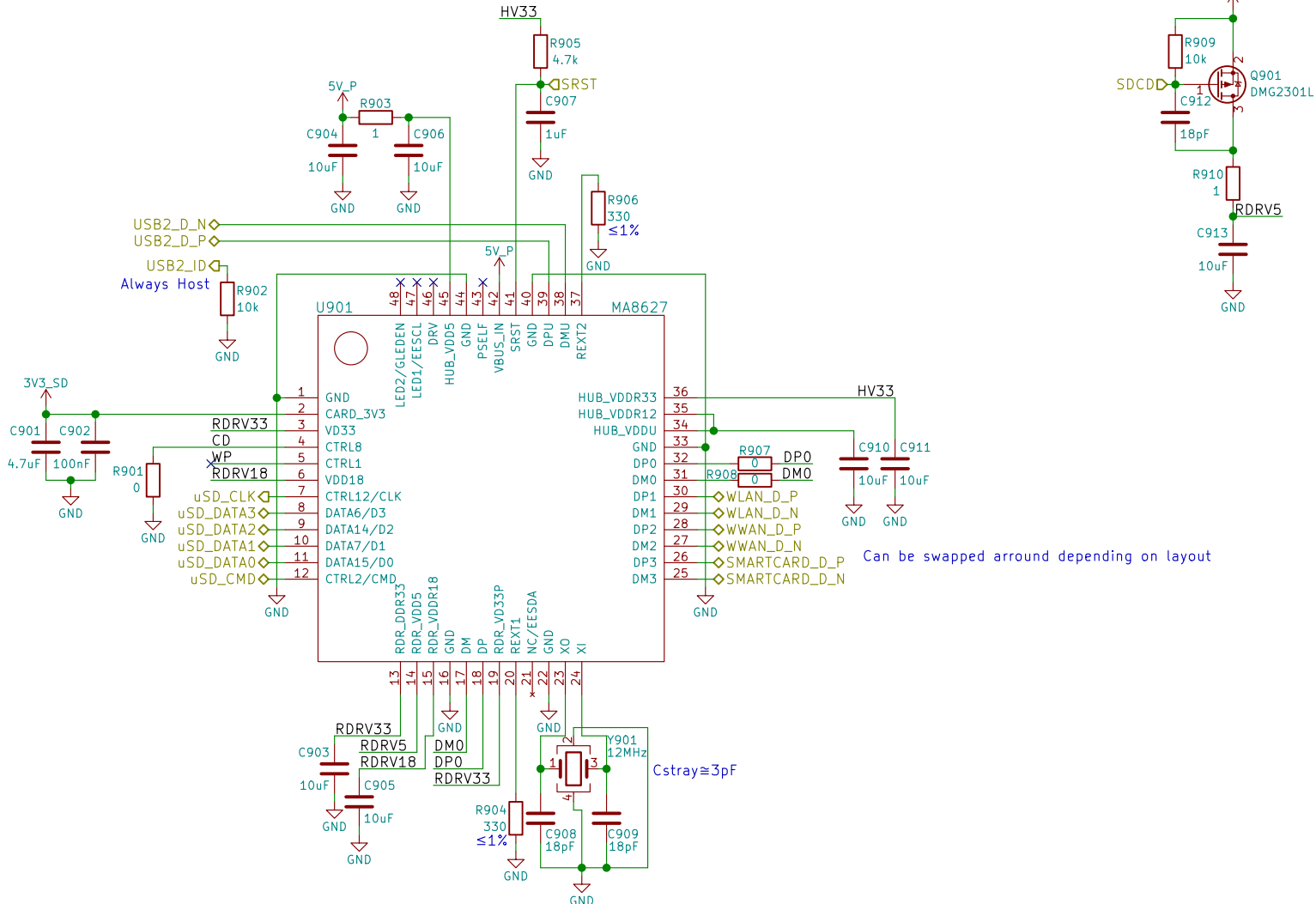
christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 8/24



# USB Hub + SDIO Bridge



## USB Hub + SDIO Bridge



Copyright 2018 GNU GPLv3

Sheet: /USB Hub + SDIO Bridge/

File: usb\_hub\_sdio.sch

Size: A4	Date: 2018-07-17
----------	------------------

Size: A1	Date:
KiCad E.D.A.	kicad 5.0.0

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

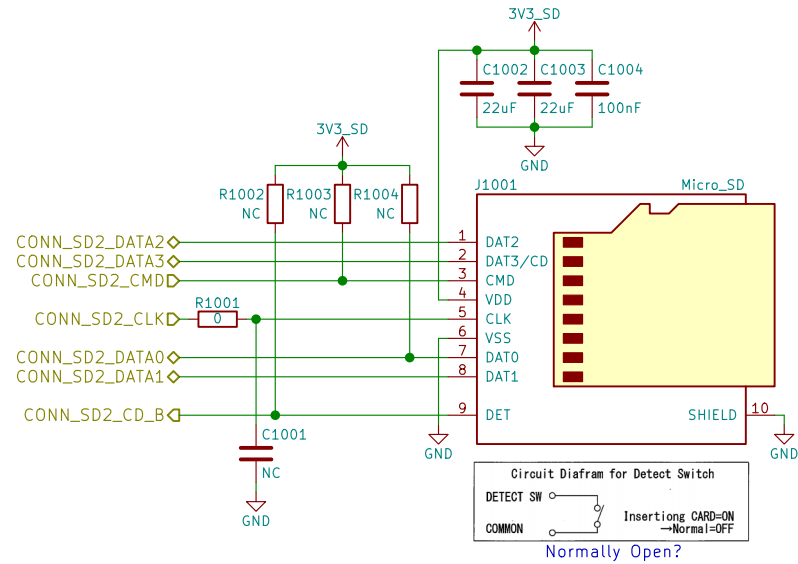
nicole.faeber@puri.sm

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: 2018-07-17

KiCad E.D.A. kicad 5.0.0

eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

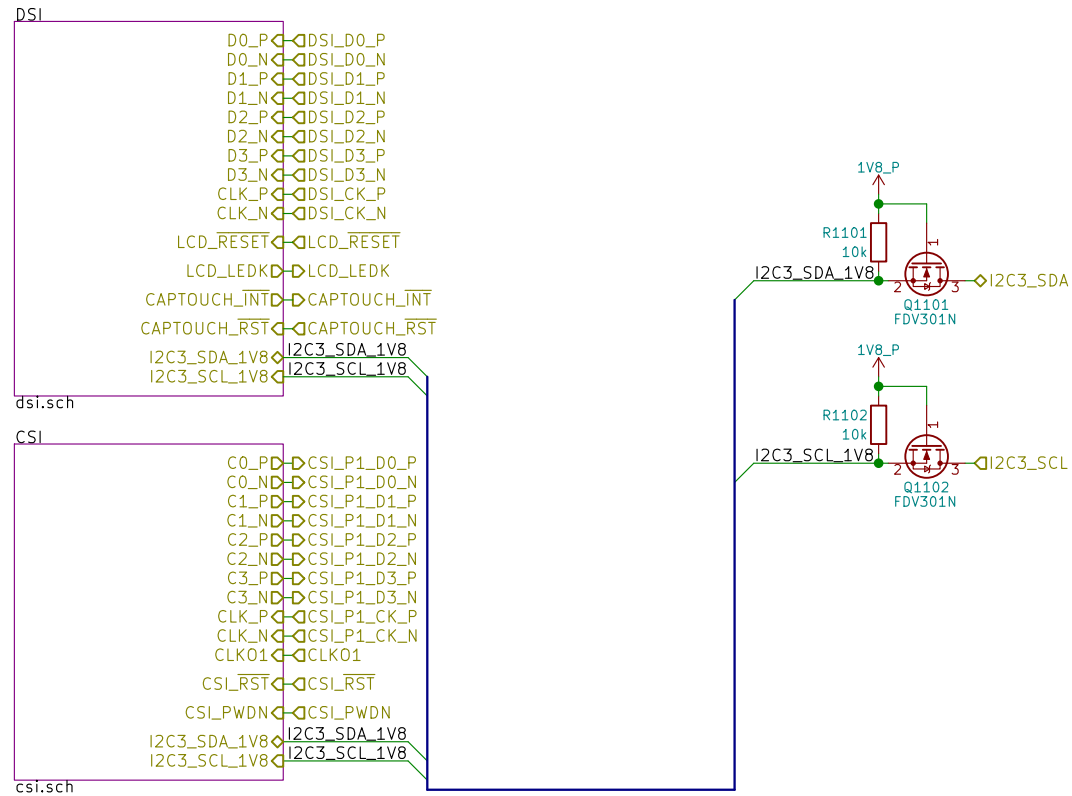
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 10/24

# MIPI



MIPI



Copyright 2018 GNU GPLv3

Sheet: /MIPI/  
File: mipi.sch

Size: A4 Date: 2018-07-17  
KiCad E.D.A. kicad 5.0.0

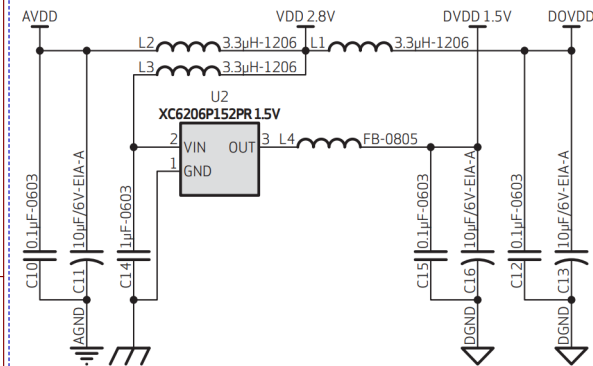
eric.kuzmenko@puri.sm  
angus.ainstlie@puri.sm  
nicole.ferber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 11/24



# Camera

## Using Internal DVDD 1.5V Regulator:



## 2.7 POWER UP SEQUENCE

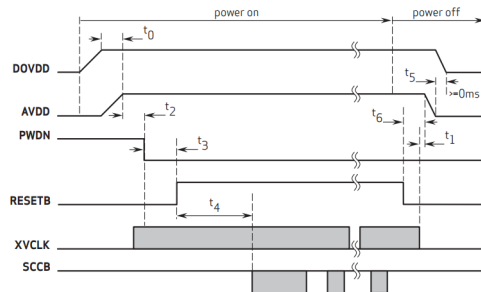
Based on the system power configuration (1.8V or 2.8V for I/O power, using external DVDD or internal DVDD, requiring access to the I2C during power up period or not), the power up sequence will differ. If 1.8V is used for I/O power, using the internal DVDD is preferred. If 2.8V is used for I/O power,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

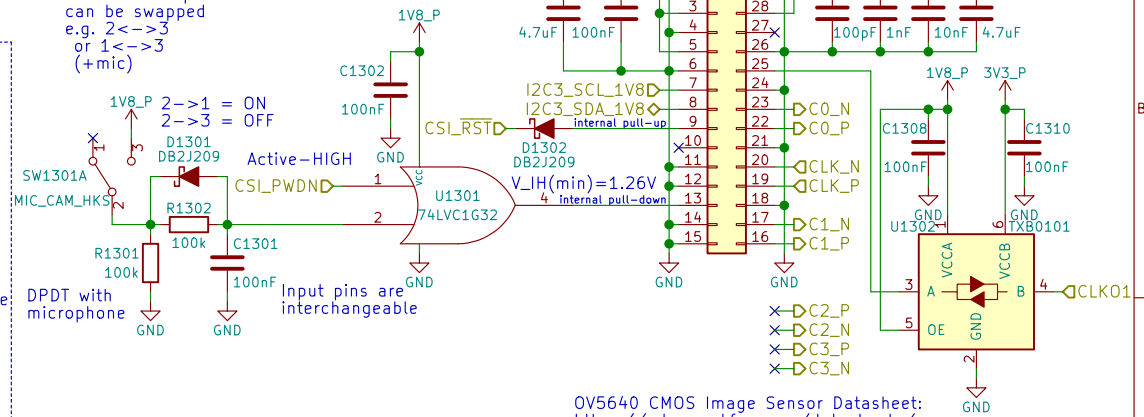
figure 2-3 power up timing with internal DVDD



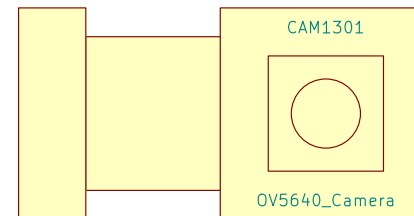
**note**  $t_0 \geq 0$ ms, delay from DOVDD stable to AVDD stable, it is recommended to power up AVDD shortly after DOVDD has been powered up  
 $t_1 \geq 0$ ms, delay from XVCLK off to AVDD off  
 $t_2 \geq 5$ ms, delay from AVDD stable to sensor power up stable, PWDN can be pulled low after this point, 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: 2018-07-17  
KiCad E.D.A. kicad 5.0.0

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

nicole.faeber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 13/24

## A

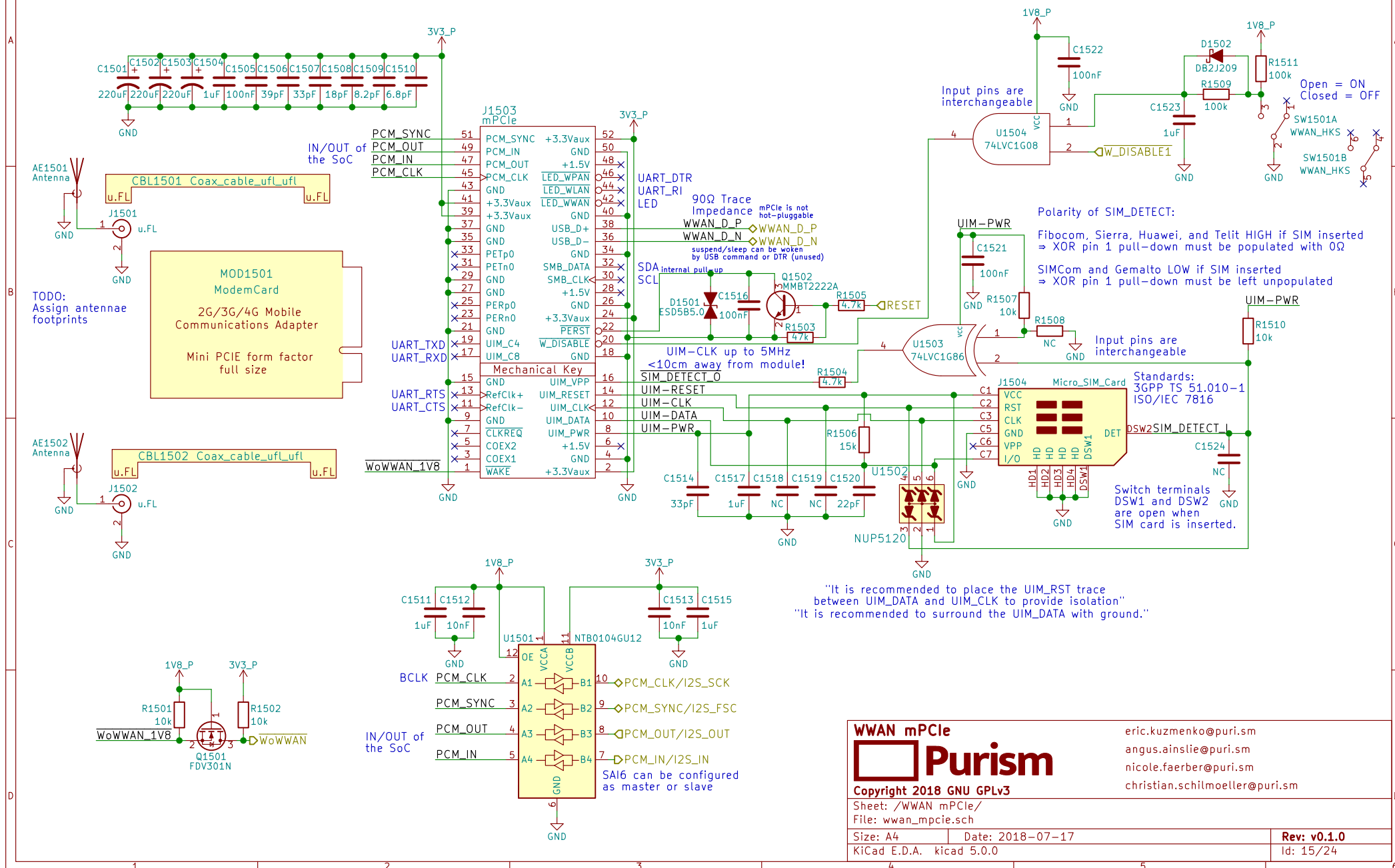


- Use PWM2\_PWMSAR to set the compare value (duty cycle)
- Use PWM2\_PWMCRR[15:4] to set the PRESCALER (frequency)
- Use PWM2\_PWMPR to set the top of the counter (frequency)

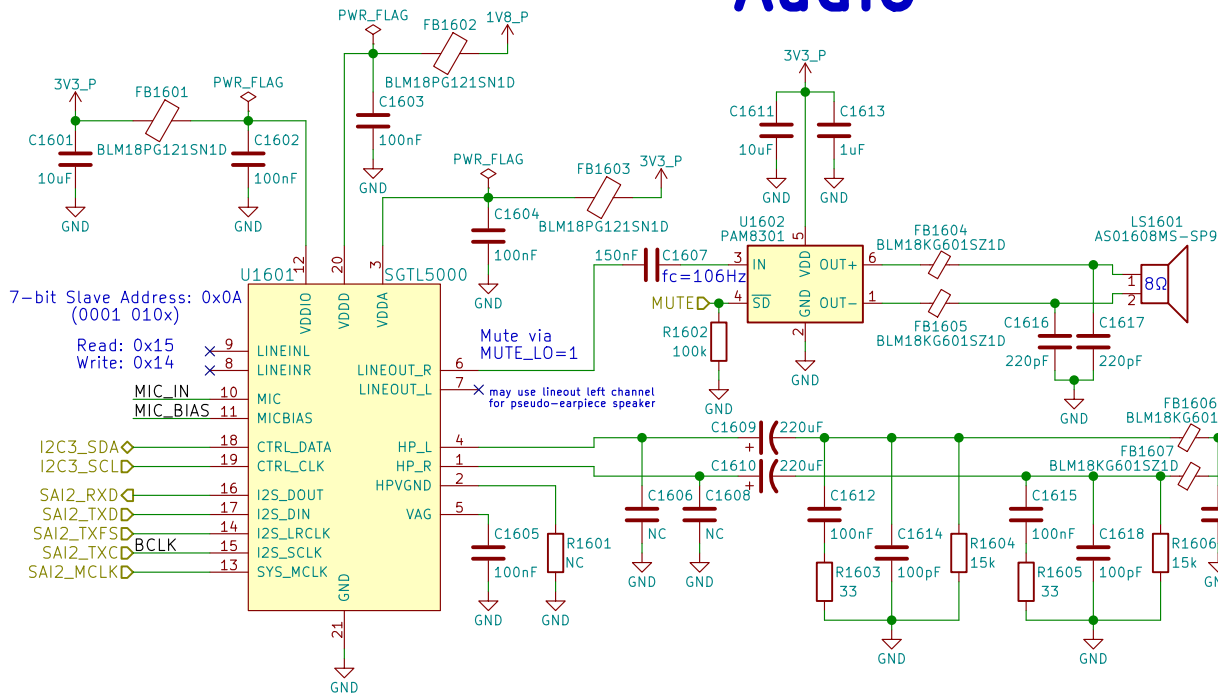


LD

# WWAN mPCIe



## 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-switching-point>  
 (Nitin6 does the same)  
 +Zener diode to protect against ranges outside of -0.9V to 3.3V

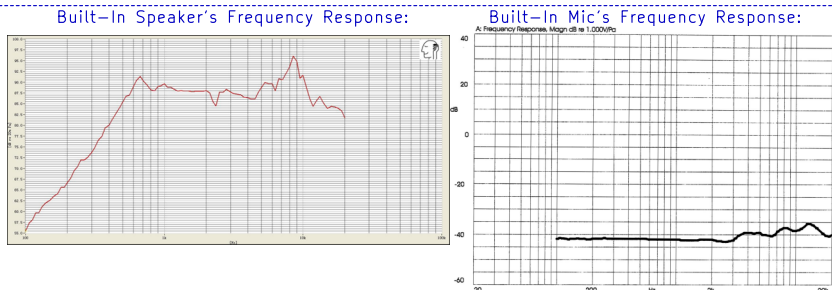
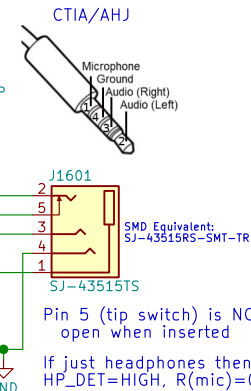
dB specs in datasheet is a unit of power gain (not dBu or VU) with respect to the DAC's unattenuated output

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

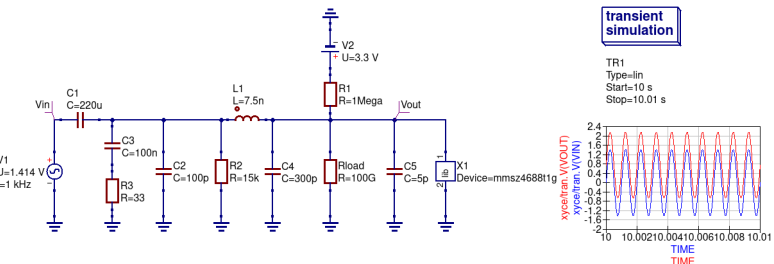
If HP\_DET is HIGH for >100ms then HPs are present

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:
$\leq 1\text{kHz}$ $L_s = 3.844\text{mH}$ $L_p = 15.757\text{H}$ $C_s = 6.583\mu\text{F}$ $C_p = 1612.8\text{pF}$ $R_s = 1.5465\text{k}\Omega\text{ms}$ $R_p = 1.5478\text{k}\Omega\text{ms}$ $\theta = -0.8\text{deg}$	$\leq 1\text{kHz}$ $L_s = 244.4\mu\text{H}$ $L_p = 141.99\text{mH}$ $C_s = 103.6\mu\text{F}$ $C_p = 178.77\text{nF}$ $R_s = 36.86\Omega\text{ms}$ $R_p = 36.86\Omega\text{ms}$ $\theta = -2.3\text{deg}$	$\leq 1\text{kHz}$ $L_s = 25.2\mu\text{H}$ $L_p = 311.0\text{mH}$ $C_s = 1.0\text{mF}$ $C_p = 81.95\text{nF}$ $R_s = 17.030\Omega\text{ms}$ $R_p = 17.034\Omega\text{ms}$ $\theta = 0.5\text{deg}$

**Audio**



**Purism**

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: 2018-07-17
----------	------------------

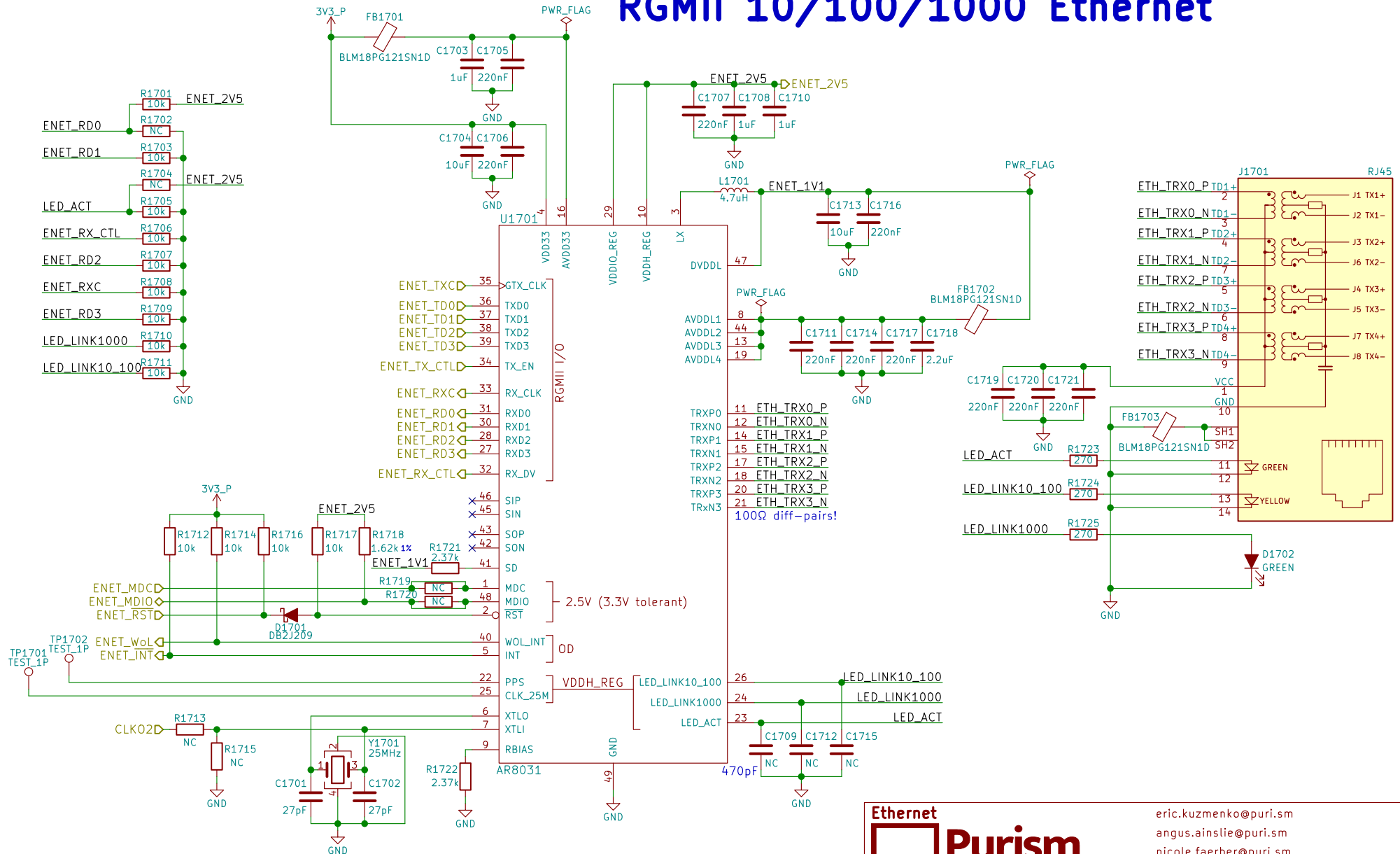
KiCad E.D.A.	kicad 5.0.0
--------------	-------------

Rev: v0.1.0

Id: 16/24



# RGMII 10/100/1000 Ethernet



Ethernet

**Purism**

Copyright 2018 GNU GPLv3

Sheet: /Ethernet/  
File: ethernet.sch

Size: A4 Date: 2018-07-17  
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: 17/24

# WLAN+BT M.2

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

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

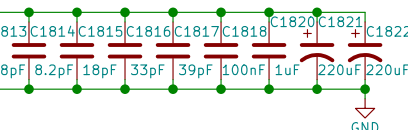
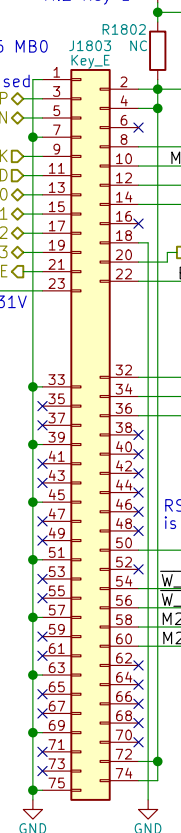
RedPine RS9116 MB0  
Requires 5V on  
Pin 54 if USB used

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

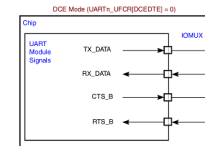
RedPine RS9116  
has 100k pull-up to  
3.3V making SDIO\_RST  
~2.55V when HIGH

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

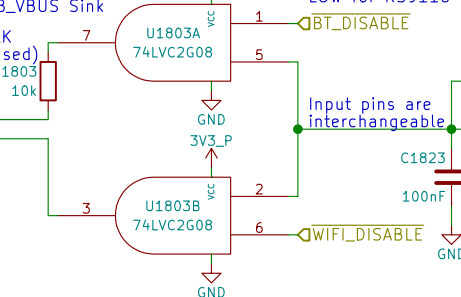


6.2 M.2 Signal Directions  
UARTn\_UFCR[DCEDTE]=0 on POR



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

Pin 54 on RS9116 is  
USB\_VBUS Sink



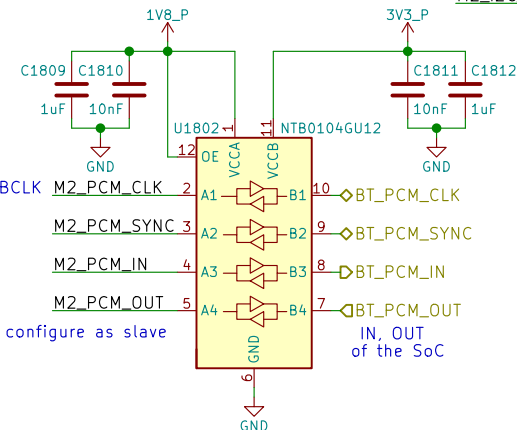
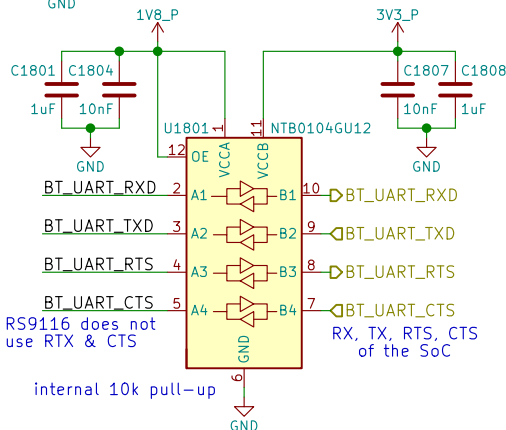
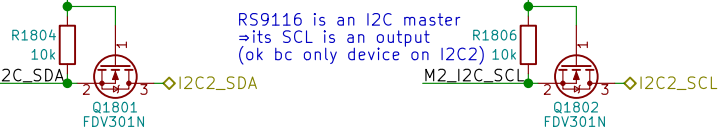
Leave BT\_DISABLE  
LOW for RS9116

Input pins are  
interchangeable

Note:  
All switches' pins  
can be swapped  
e.g. 2<->3  
or 1<->3

SW1801A  
WLAN\_HKS  
Open = ON  
Closed = OFF

RS9116 is an I2C master  
⇒ its SCL is an output  
(ok bc only device on I2C2)



WLAN+BT M.2

Purism

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

Copyright 2018 GNU GPLv3  
Sheet: /WLAN+BT M.2/  
File: wifi\_bt\_m2.sch

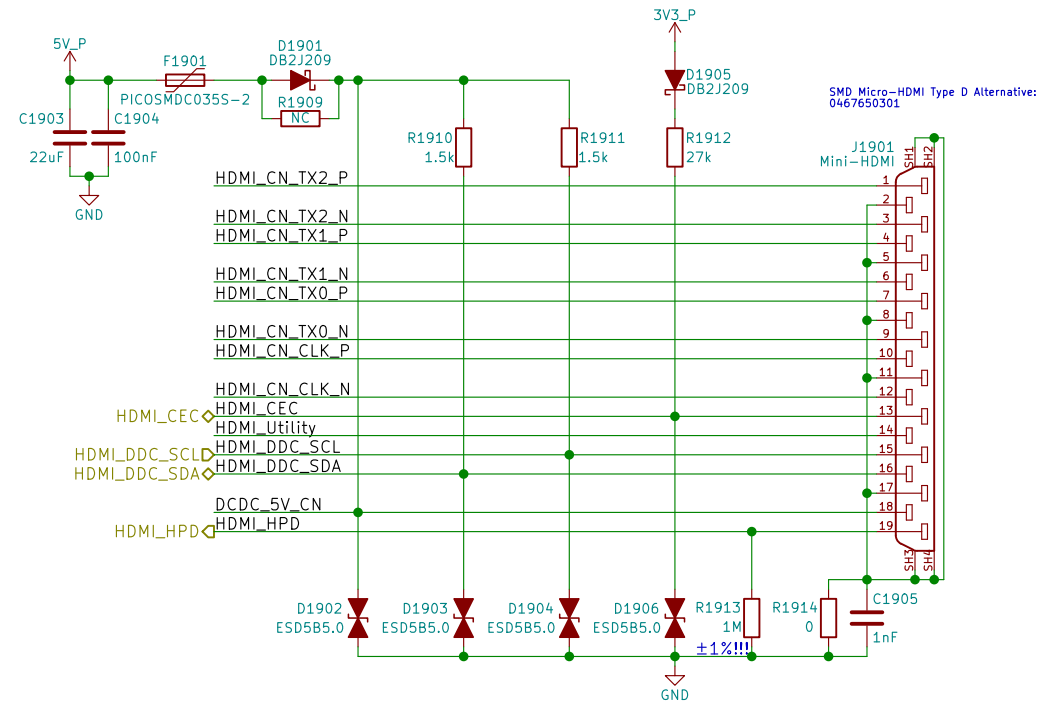
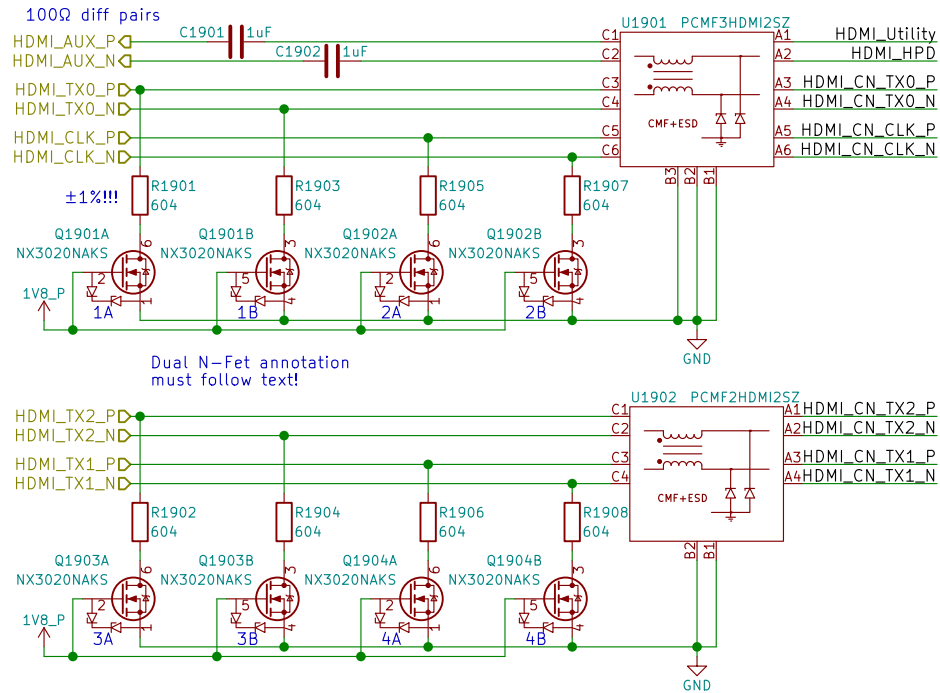
Size: A4  
KiCad E.D.A. kicad 5.0.0

Date: 2018-07-17  
Rev: v0.1.0  
Id: 18/24

TUSB1046 can be used for DP over USB-C

# HDMI

Layout Note:  
May need swap some signals  
due to micro-HDMI pinout diff  
depending on pin location/routing



HDMI



Copyright 2018 GNU GPLv3

Sheet: /HDMI/  
File: hdmi.sch

Size: A4 Date: 2018-07-17  
KiCad E.D.A. kicad 5.0.0

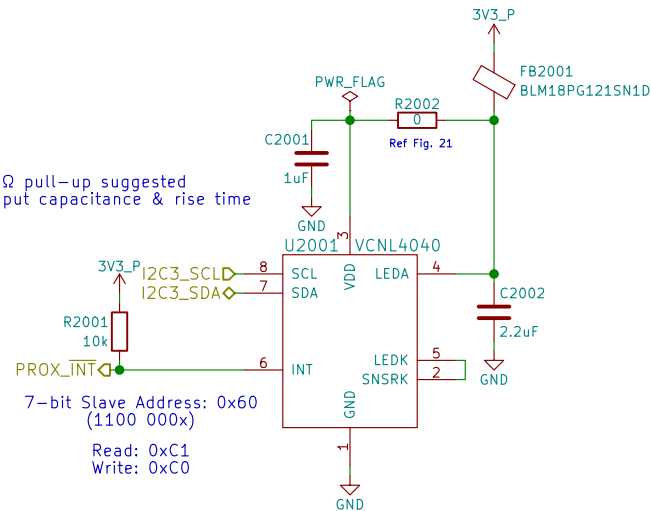
eric.kuzmenko@puri.sm  
angus.ainstie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 19/24

# Sensors

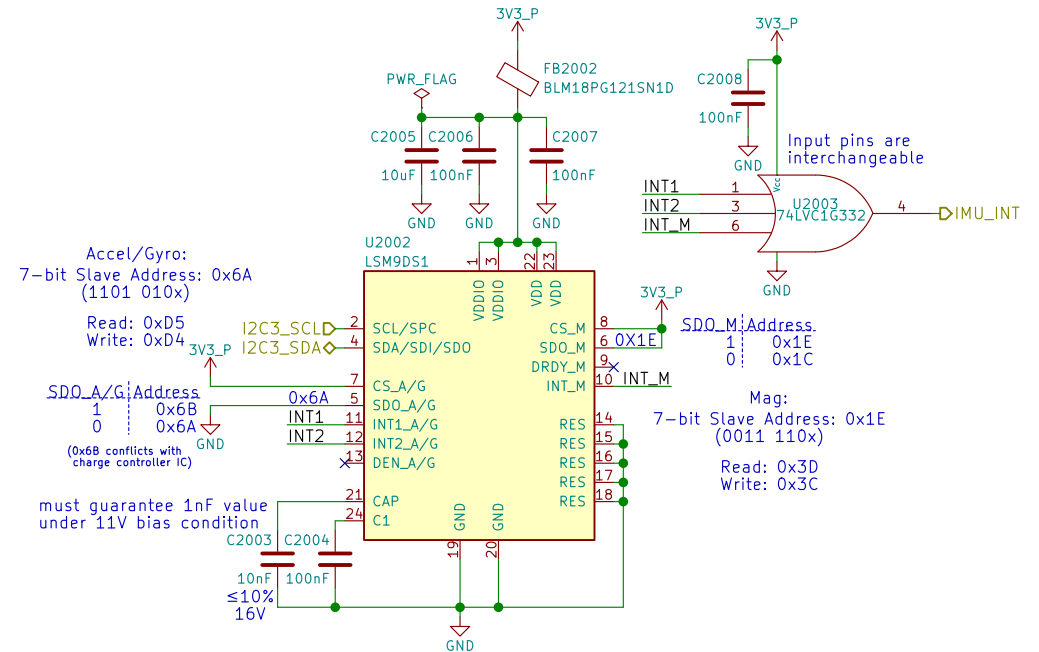
## Proximity & Ambient Light

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/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]	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

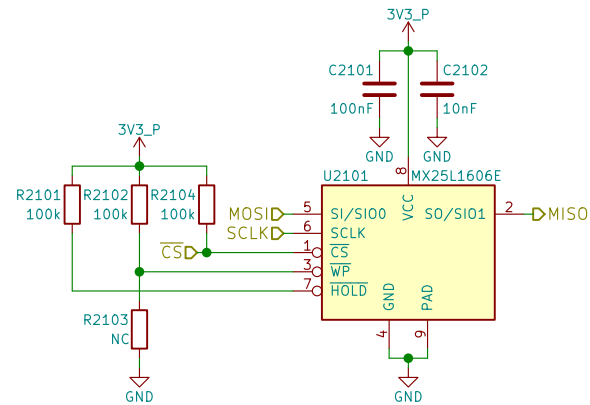
Sheet: /Sensors/  
File: sensors.sch

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: 2018-07-17

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



christian.schilmoeller@puri.sm

Id: 22/24

# 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 Date: 2018-07-17  
 KiCad E.D.A. kicad 5.0.0

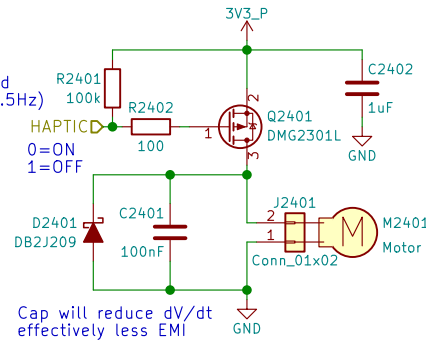
eric.kuzmenko@puri.sm  
 angus.ainstlie@puri.sm  
 nicole.farber@puri.sm  
 christian.schilmoeller@puri.sm

Rev: v0.1.0  
 Id: 23/24

# 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: 2018-07-17  
 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