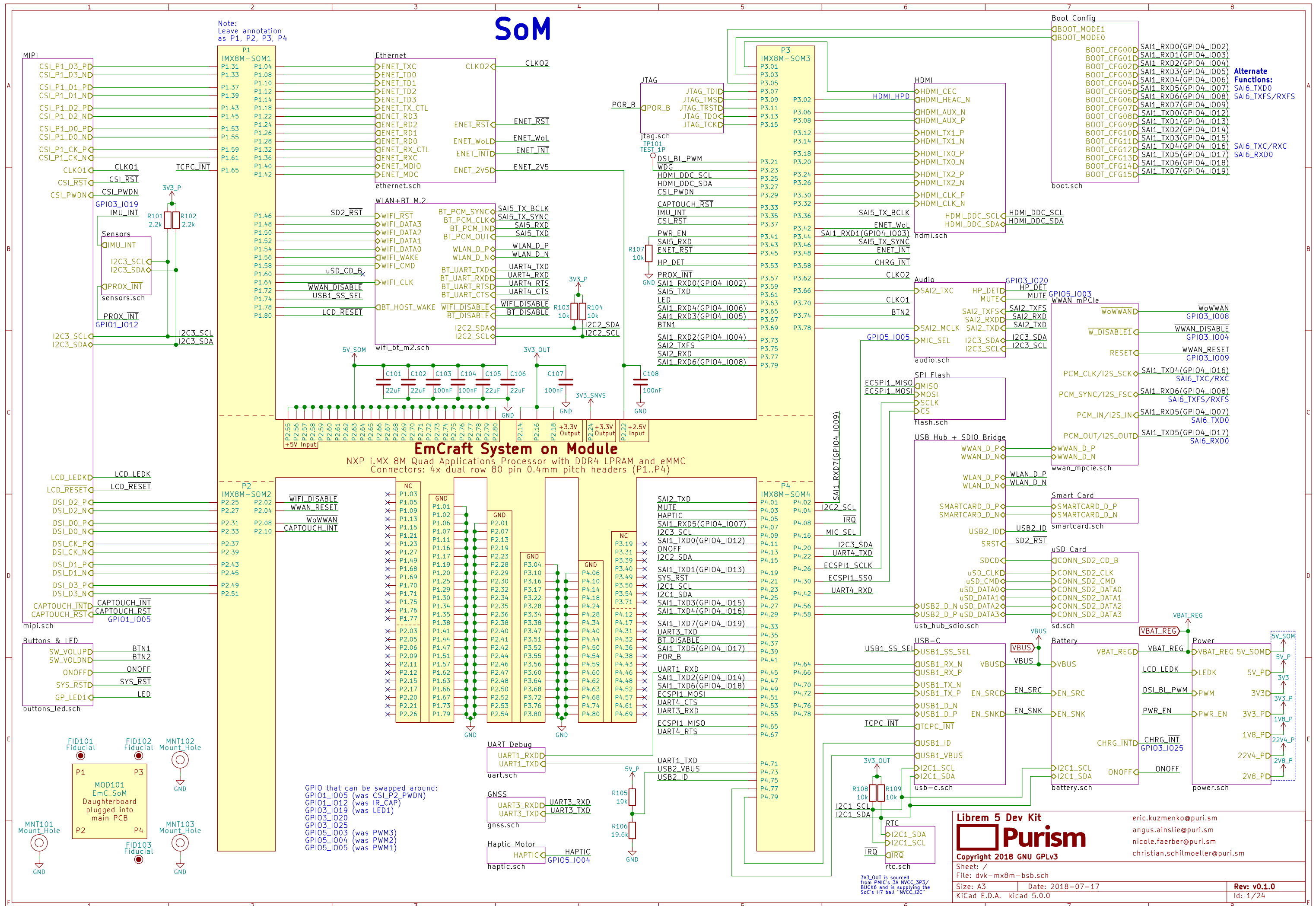


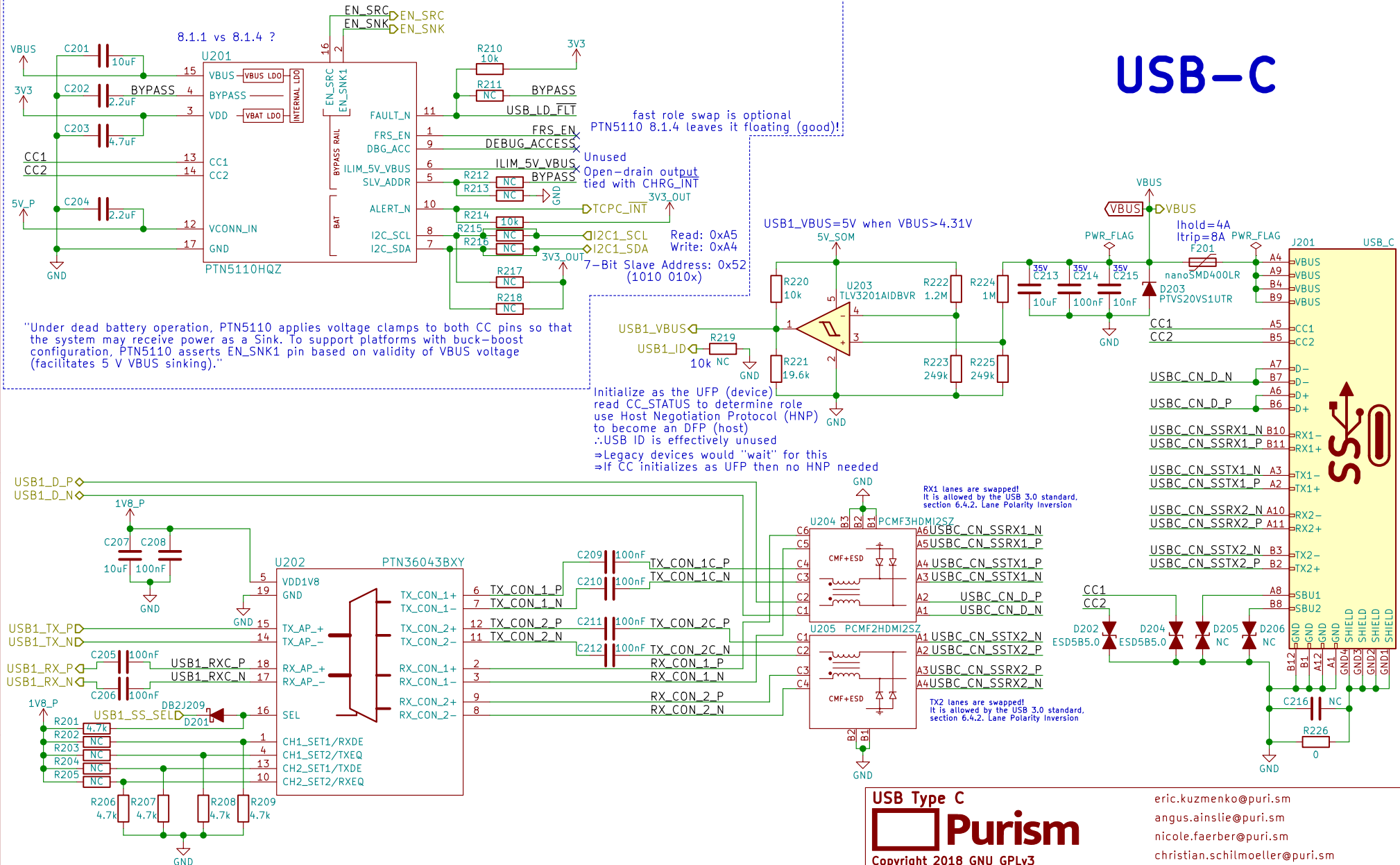
# SoM

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

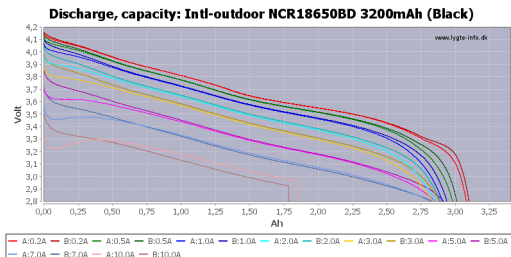
Sheet: /USB-C/  
File: usb-c.sch

Size: A4 Date: 2018-07-17

KiCad E.D.A. kicad 5.0.0

Rev: v0.1.0

Id: 2/24



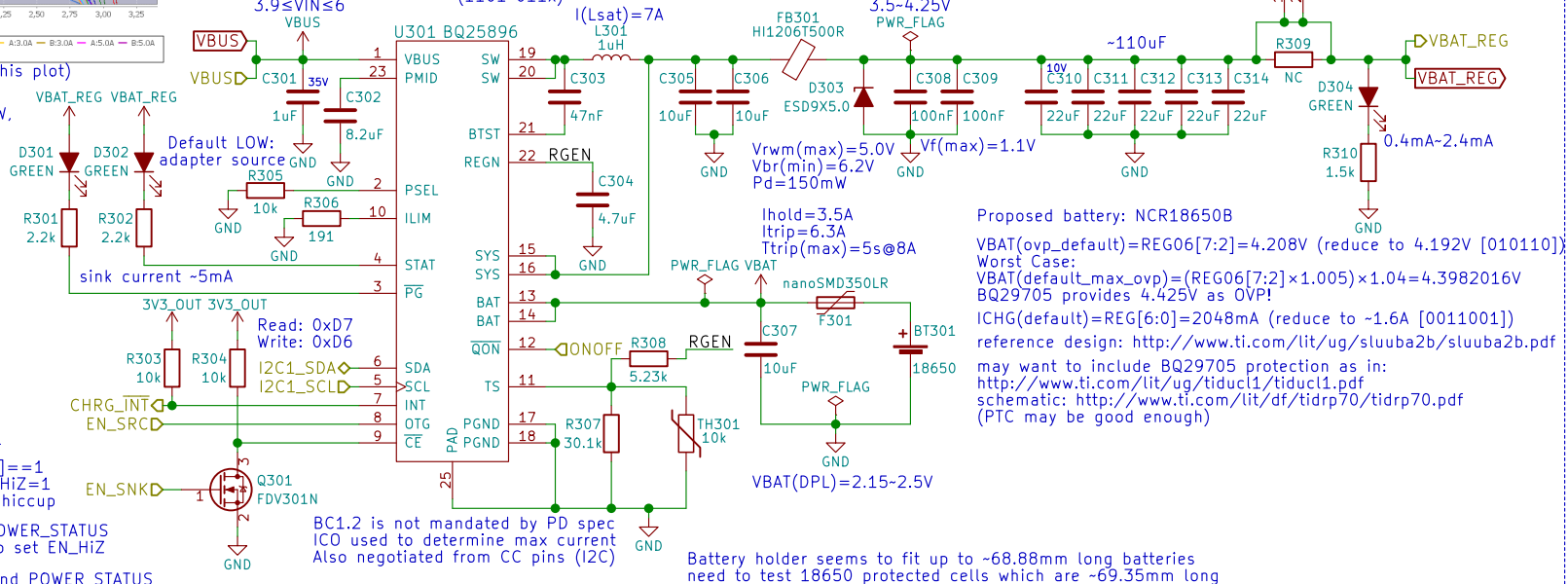
(interpret RSOC% based on this plot)

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



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**

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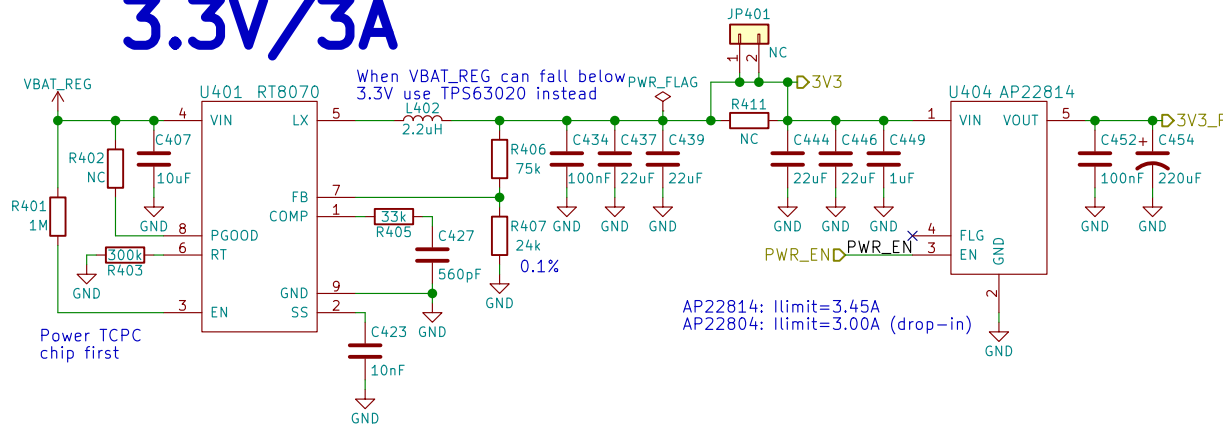
Sheet: /Battery/  
 File: battery.sch

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

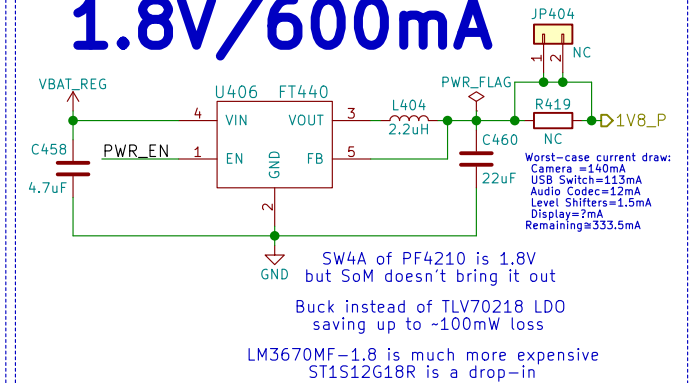
eric.kuzmenko@puri.sm  
 angus.ainslie@puri.sm  
 nicole.farber@puri.sm  
 christian.schilmoeller@puri.sm

Rev: v0.1.0  
 Id: 3/24

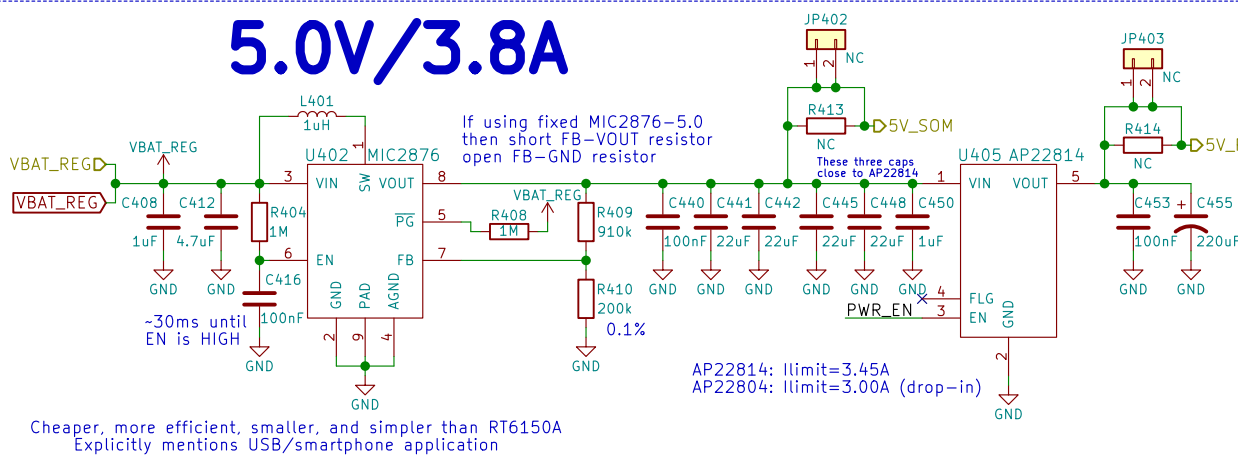
## 3.3V/3A



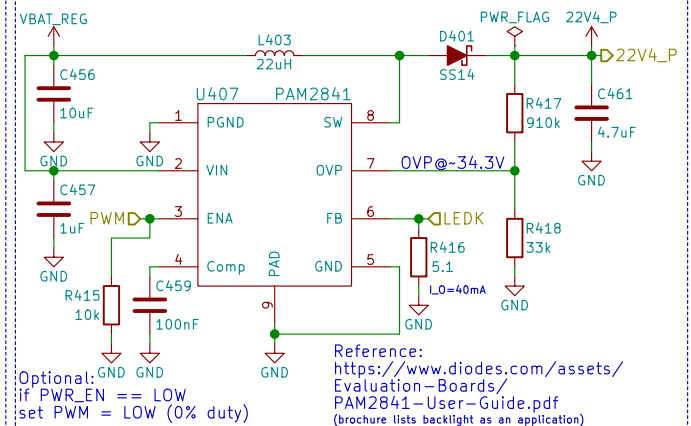
## 1.8V/600mA



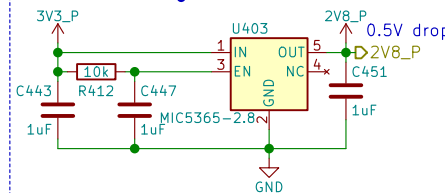
## 5.0V/3.8A



## 22.4V/40mA



## 2.8V/150mA



## Power

Power

**Purism**

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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

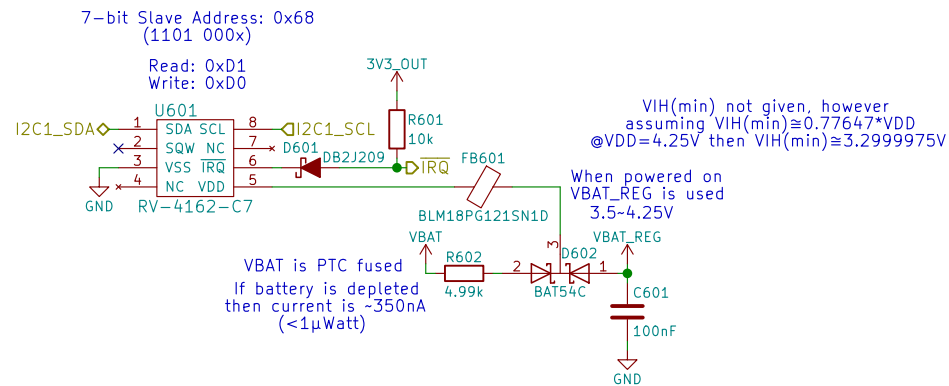
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 5/24

# Real-Time Clock



Note:  
Datasheet says slave address is 0xD0  
with a R/W bit appended, since 0xD 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)

RTC



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Sheet: /RTC/

File: rtc.sch

Size: A4

Date: 2018-07-17

KiCad E.D.A. kicad 5.0.0

Rev: v0.1.0

Id: 6/24


eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

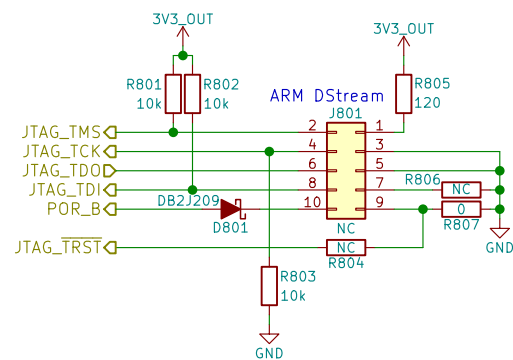
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

The diagram shows a 74LVC2G24 inverter (U701) used as a logic level converter. The inverter has two input/output pairs: 1A/1Y and 2A/2Y. The 1A input is connected to UART1\_TXDD (3.3V logic). The 1Y output is connected to 3V3\_OUT (5V logic). The 2A input is connected to UART1\_RXDD (5V logic). The 2Y output is connected to 3V3\_OUT (3.3V logic). A 100k resistor (R701) is connected between 3V3\_OUT and GND. A 100nF capacitor (C701) is connected between 3V3\_OUT and GND. A 20E capacitor is connected between 1A and GND. The inverter is powered by 3V3\_OUT. A note indicates that the circuit 'Accepts 3.3V or 5V Logic'.

<b>UART Debug</b>  <b>Purism</b> <b>Copyright 2018 GNU GPLv3</b>	eric.kuzmenko@puri.sm angus.ainslie@puri.sm nicole.ferber@puri.sm christian.schilmoeller@puri.sm
---	---

# JTAG



JTAG



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eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

nicole.faerber@puri.sm

christian.schilmoeller@puri.sm

Sheet: /JTAG/

File: jtag.sch

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

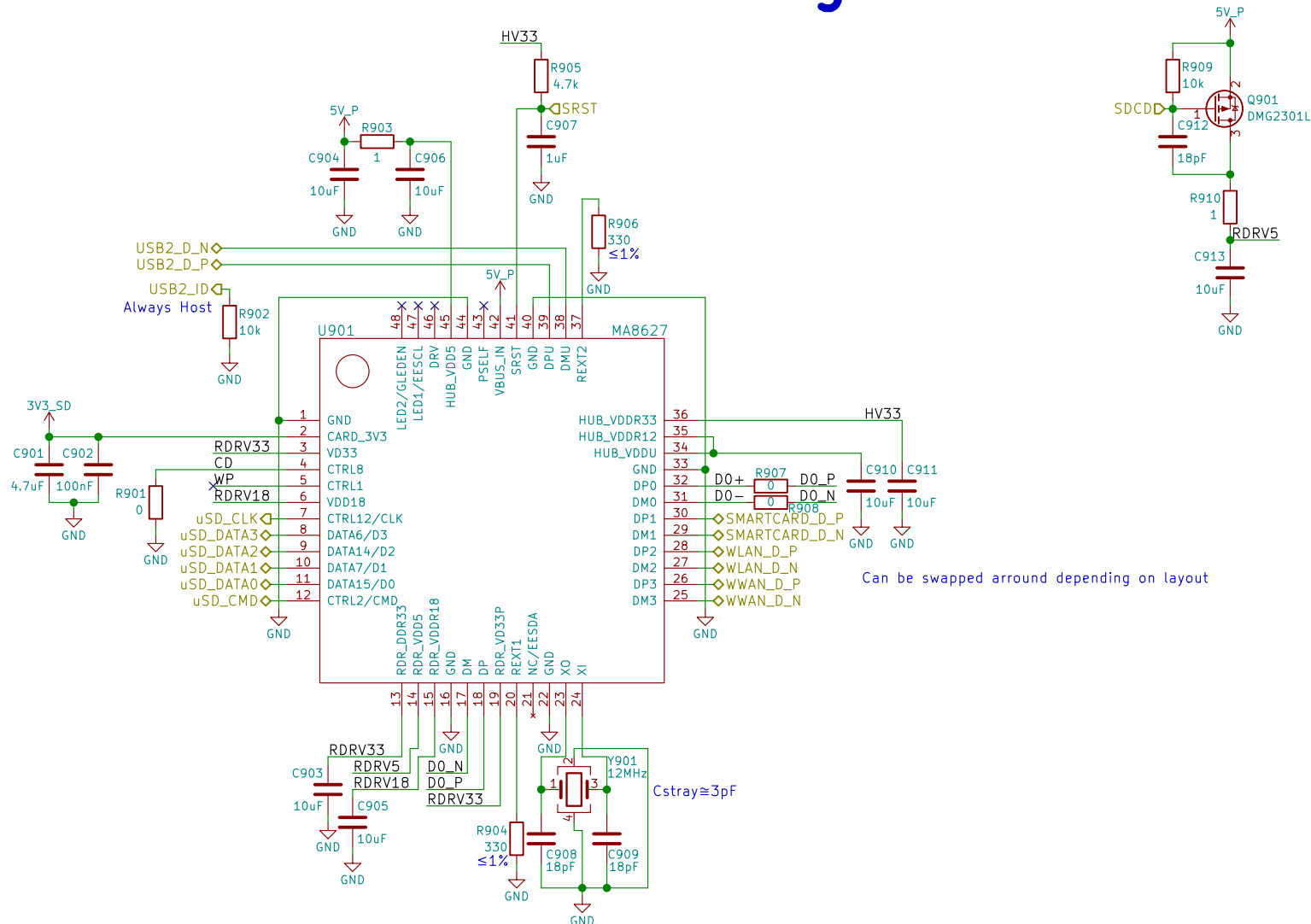
Size: A4	Date: 11/01/2025
KiCad E.D.A.	kicad 5.0.0

Rev: v0.1.0

Id: 8/24



# USB Hub + SDIO Bridge



## USB Hub + SDIO Bridge



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

Size: A4 Date: 2018-07-17

KiCad E.D.A. kicad 5.0.0

eric.kuzmenko@puri.sm

angus.ainstie@puri.sm

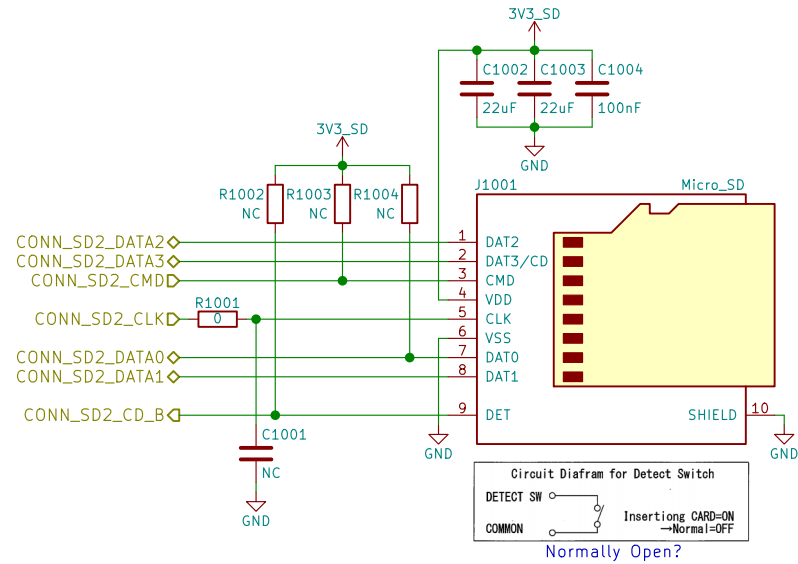
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 9/24

# μSD



uSD Card



**Purism**

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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



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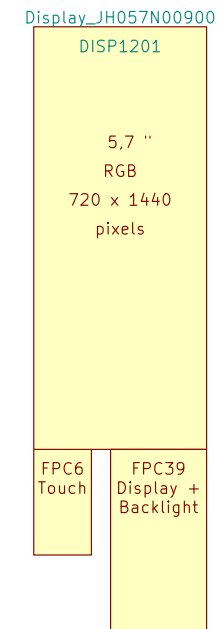
Sheet: /MIPI/  
File: mipi.sch

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

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



Pin#	Definition
1	SCL
2	SDA
3	INT
4	RESSET
5	VDD2.85
6	GND

**Front:**  **Back:** 

DSI FPC:  
Front: Back:

**Backlight Array:**

LED K1

LED K2

LED A1

LED A2

MIPI DSI  
 **Purism**  
 Copyright 2018 GNU GPLv3

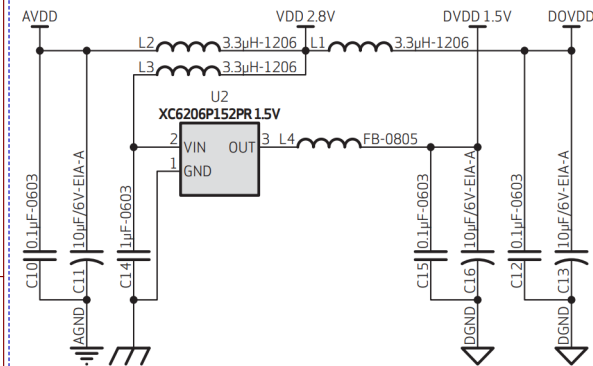
eric.kuzmenko@puri.sm  
angus.ainslie@puri.sm  
nicole.faeber@puri.sm  
christian.schilmoeller@puri.sm

Sheet: /MIPI/DSI/	
File: dsi.sch	
Size: A4	Date: 2018-07-17
KiCad E.D.A. kicad 5.0.0	

Rev: v0.1.0  
Id: 12/24

# Camera

## Using Internal DVDD 1.5V Regulator:



## 2.7 POWER UP SEQUENCE

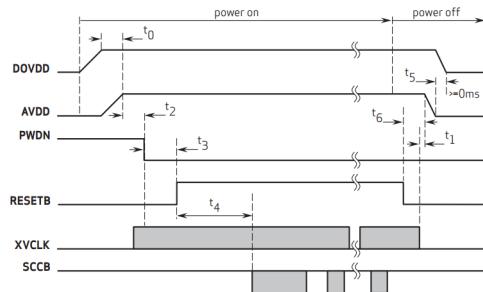
Based on the system power configuration (1.8V or 2.8V for I/O power, using external DVDD or internal DVDD, requiring access to the I2C during power up period or not), the power up sequence will differ. If 1.8V is used for I/O power, using the internal DVDD is preferred. If 2.8V is used for I/O power,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

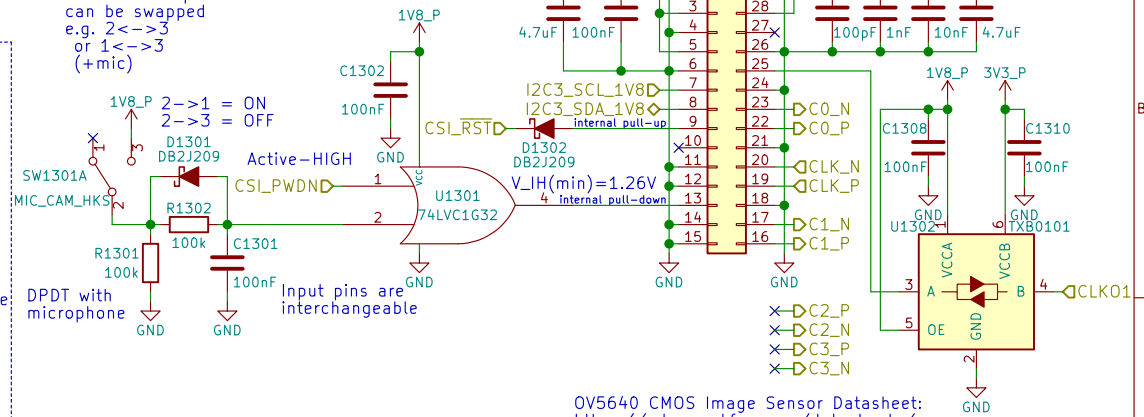
figure 2-3 power up timing with internal DVDD



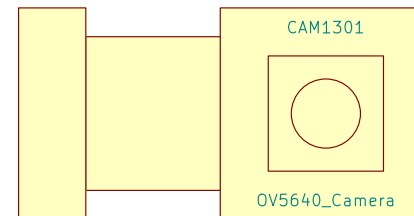
**note**  $t_0 \geq 0$ ms, delay from DOVDD stable to AVDD stable, it is recommended to power up AVDD shortly after DOVDD has been powered up  
 $t_1 \geq 0$ ms, delay from XVCLK off to AVDD off  
 $t_2 \geq 5$ ms, delay from AVDD stable to sensor power up stable, PWDN can be pulled low after this point, 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

# 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



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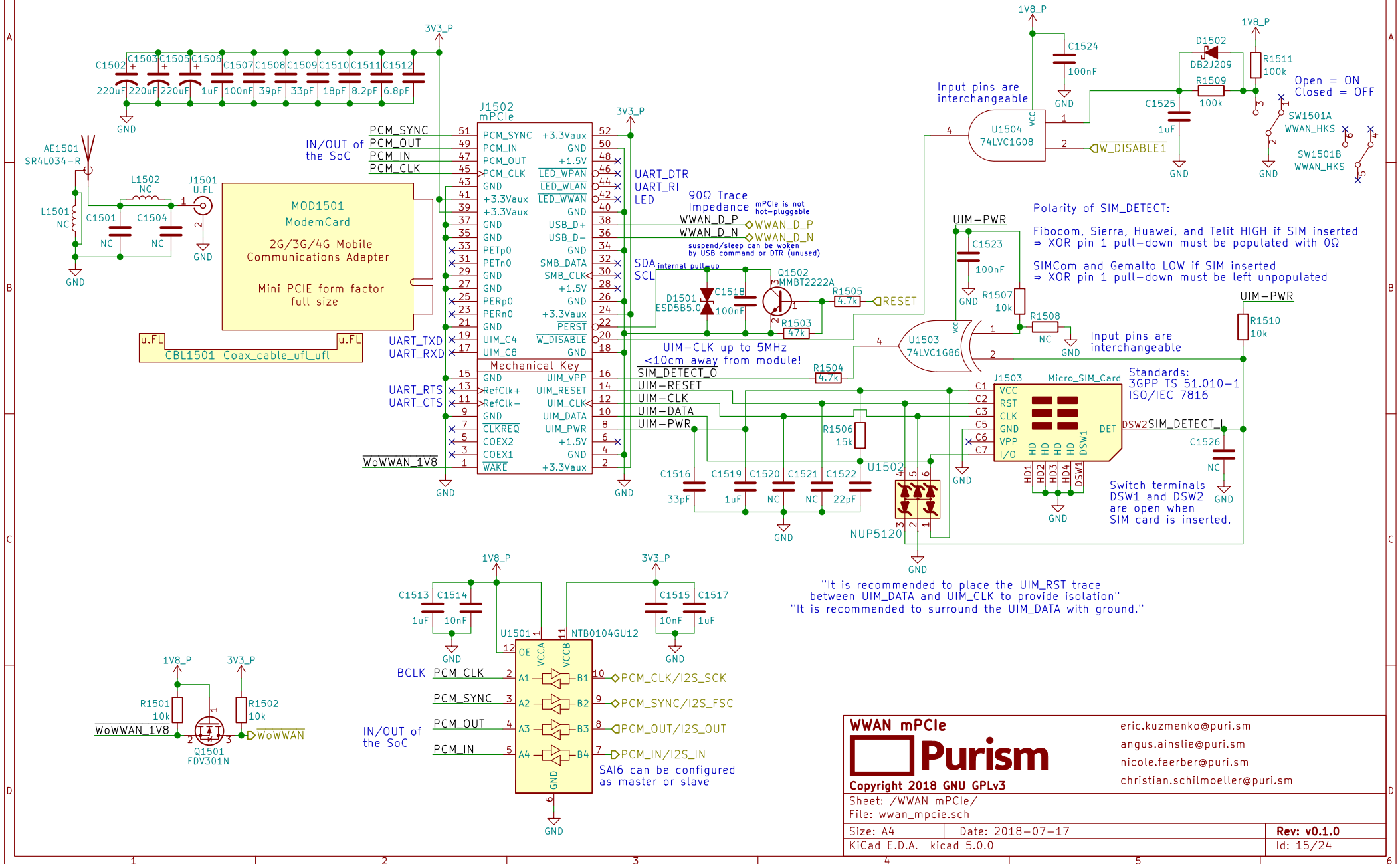
Sheet: /Buttons & LED/  
 File: buttons\_led.sch

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: 14/24

# WWAN mPCIe



WWAN mPCIe

**Purism**

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

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

eric.kuzmenko@puri.sm

angus.ainstie@puri.sm

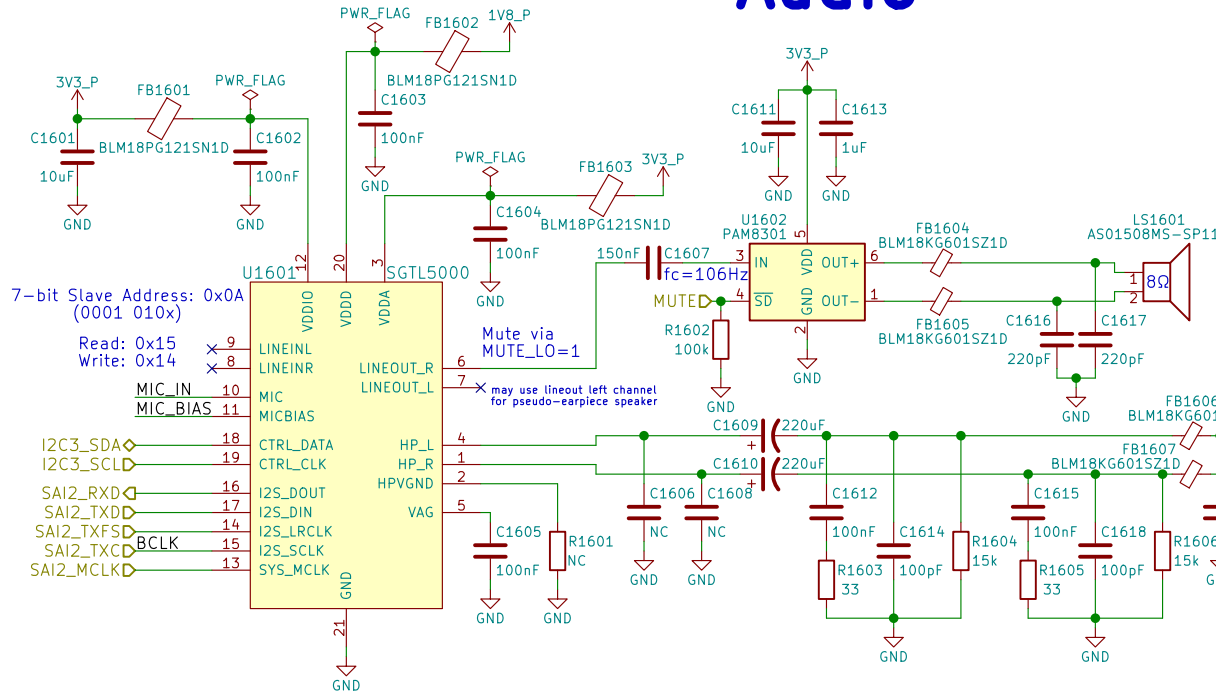
nicole.faeber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 15/24

# Audio



Reference:  
[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-circuitry>  
 +Zener diode to protect against ranges outside of -0.9V to 3.3V

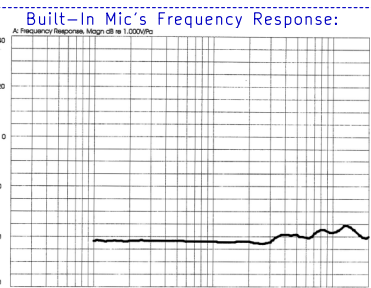
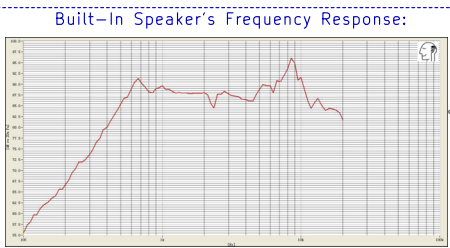
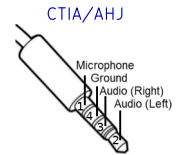
dB specs in datasheet is a unit of power gain (not dBu or VU) with respect to the DAC's unattenuated output

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

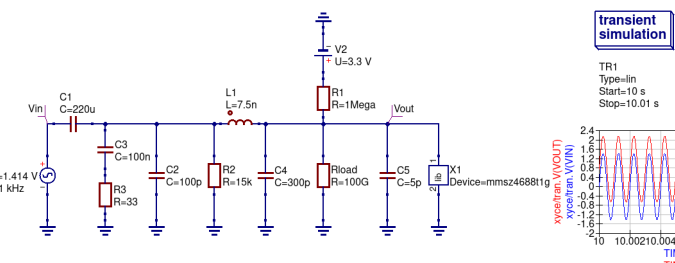
If HP\_DET is HIGH for >100ms then HPs are present

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: @1kHz Ls = 3.844mH Lp = 15.757H Cs = 6.583uF Cp = 1612.8pF Rs = 1.5465kOhms Rp = 1.5478kOhms θ = -0.8deg	Headset Speaker: @1kHz Ls = 244.4uH Lp = 141.99mH Cs = 103.6uF Cp = 178.77nF Rs = 36.860hms Rp = 36.860hms θ = -2.3deg	Earbud Speaker: @1kHz Ls = 25.2uH Lp = 311.0mH Cs = 1.0mF Cp = 81.95nF Rs = 17.030Ohms Rp = 17.034Ohms θ = 0.5deg
---	--	---

Audio

**Purism**

Copyright 2018 GNU GPLv3

Sheet: /Audio/  
File: audio.sch

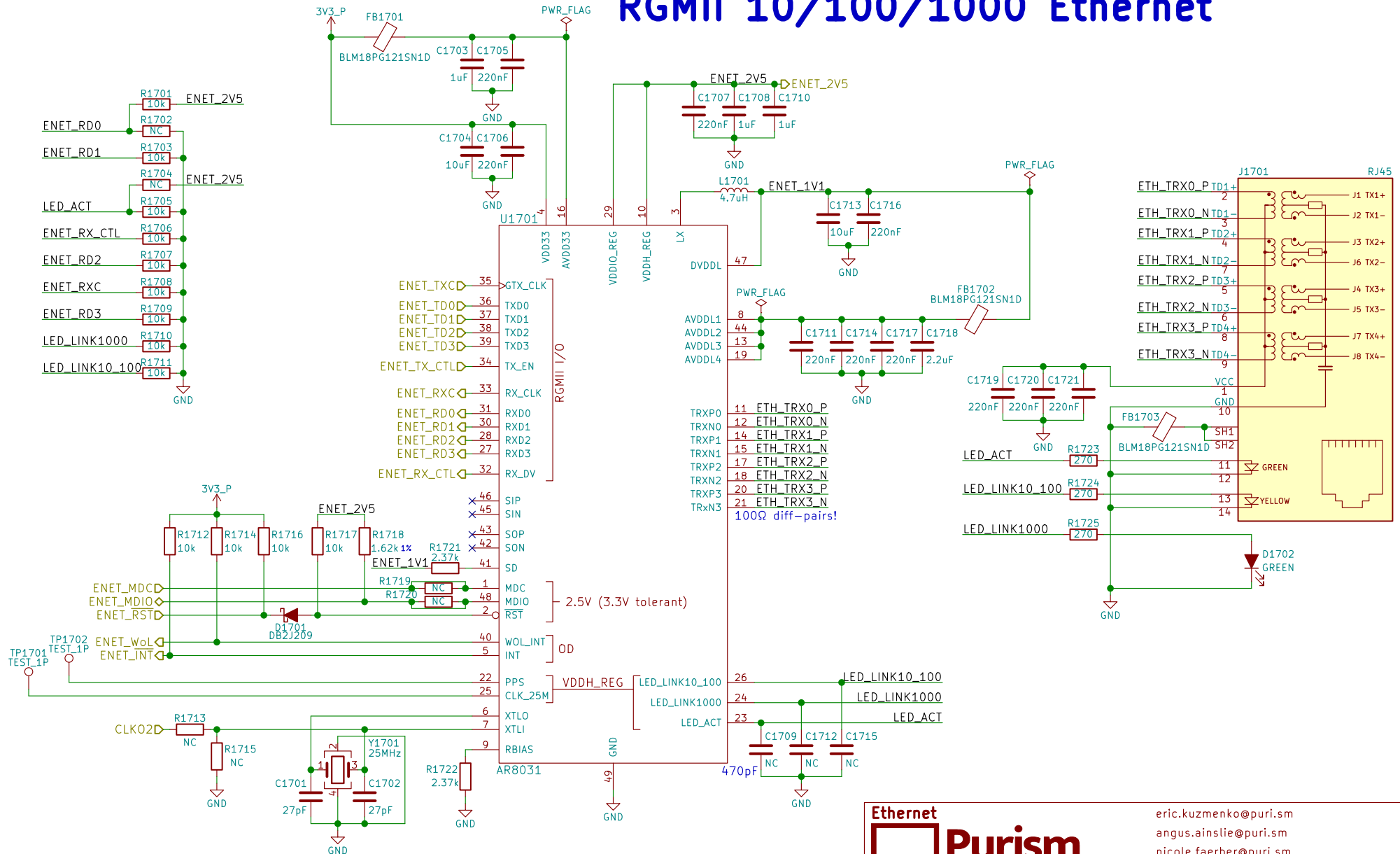
Size: A4  
KiCad E.D.A. kicad 5.0.0

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

Rev: v0.1.0  
Id: 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\_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

3V3\_P

1802 NC

JP1801

1 2

NC

6.8pF 8.2pF 18pF 33pF 39pF 100nF 1uF 220uF 220uF

GND

1V8\_P

VIH=2.31V

WIFI\_RST

W\_DISABLE1

1801 100k

DB2J209

1802

DB2J209

33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75

GND

GND

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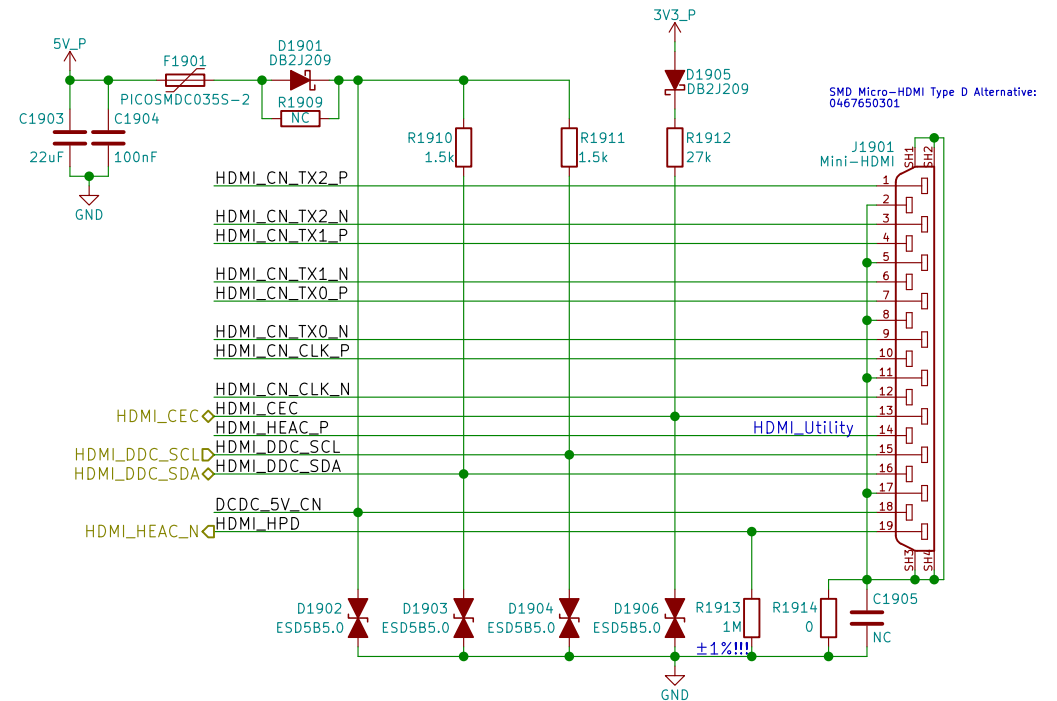
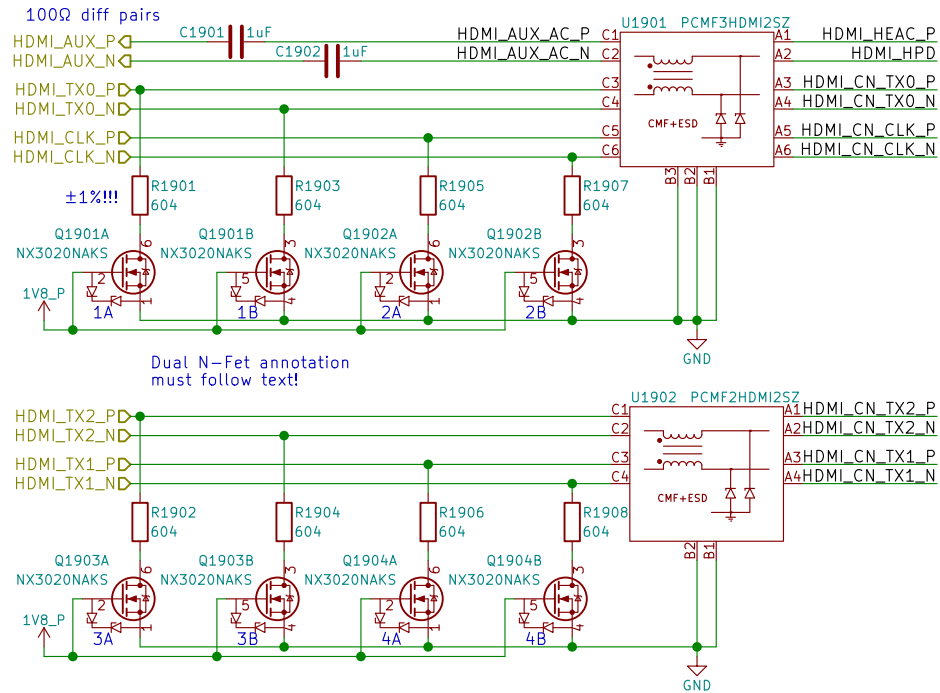
GND

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GND

TUSB1046 can be used for DP over USB-C

# HDMI



HDMI



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Sheet: /HDMI/  
File: hdmi.sch

Size: A4  
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Date: 2018-07-17

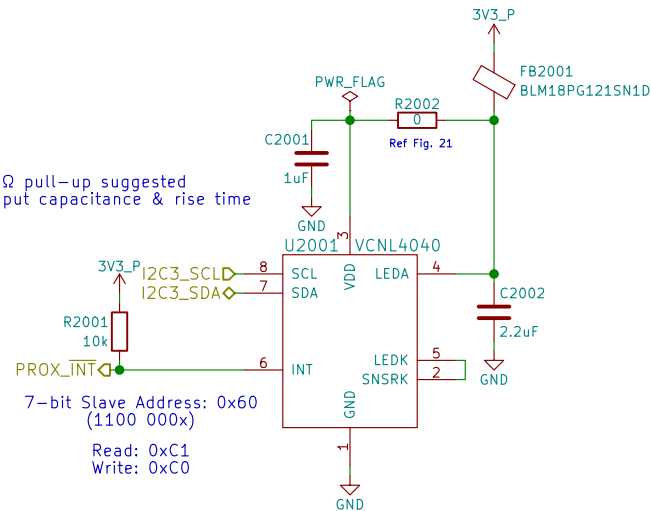
eric.kuzmenko@puri.sm  
angus.ainstie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 19/24

# Sensors

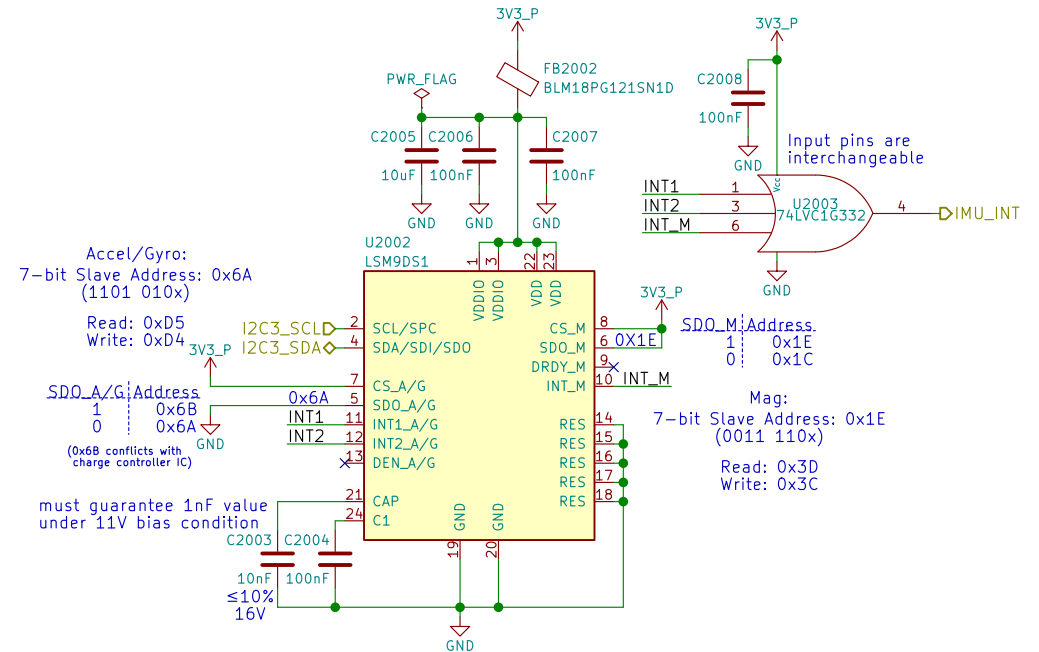
## Proximity & Ambient Light

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>

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



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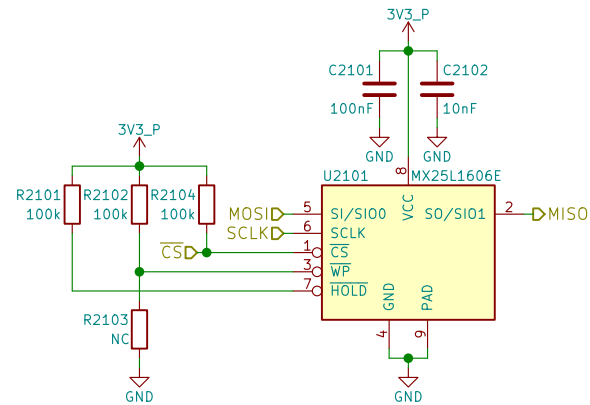
Sheet: /Sensors/  
File: sensors.sch

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: 20/24

# SPI NOR Flash



## SPI NOR Flash



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Sheet: /SPI Flash/

File: flash.sch

Size: A4 Date: 2018-07-17

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eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 21/24

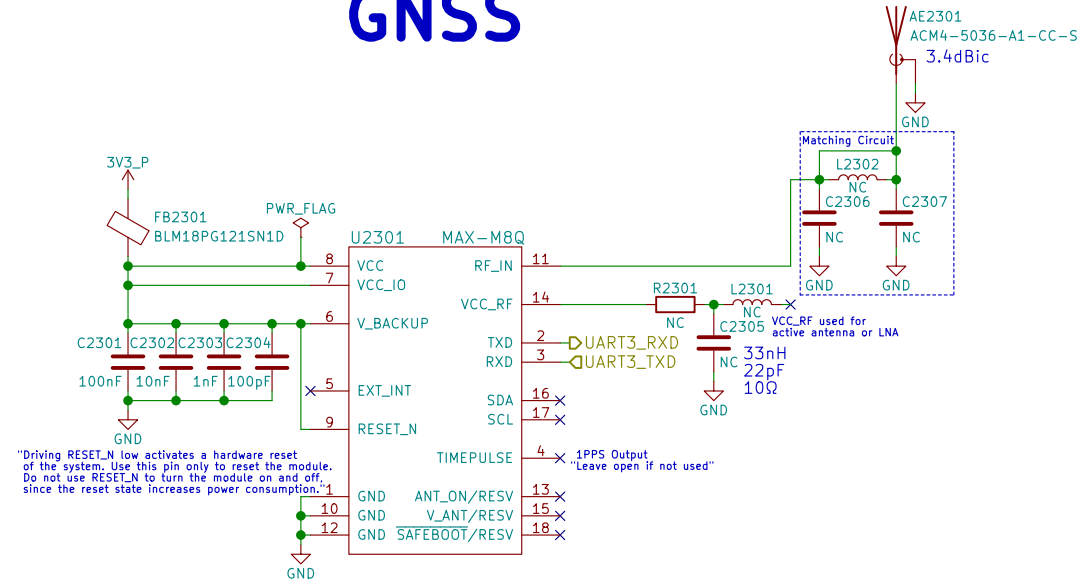
## Smart Card



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



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Sheet: /GNSS/  
 File: gnss.sch

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

Date: 2018-07-17

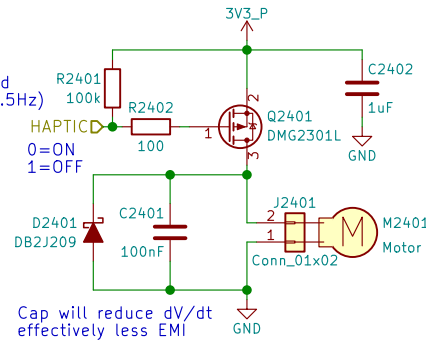
Rev: v0.1.0  
 Id: 23/24

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



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Sheet: /Haptic Motor/  
 File: haptic.sch

Size: A4 Date: 2018-07-17  
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eric.kuzmenko@puri.sm  
 angus.ainslie@puri.sm  
 nicole.farber@puri.sm  
 christian.schilmoeller@puri.sm

Rev: v0.1.0  
 Id: 24/24