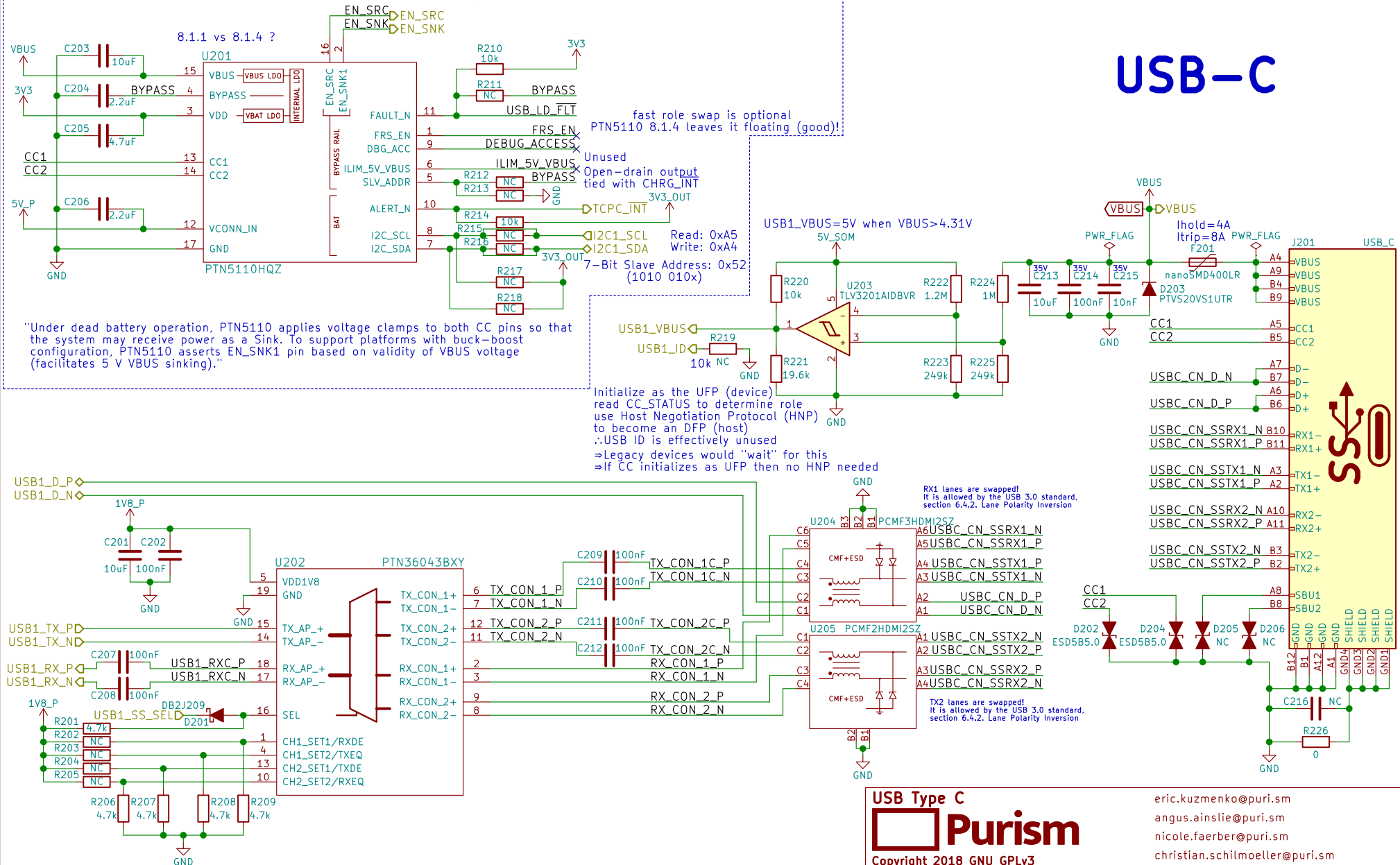


# USB-C TCPC - Config Channel (CC) and PD Role Controller

## USB-C



USB Type C

**Purism**

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

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

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angus.ainstie@puri.sm

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christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 2/24

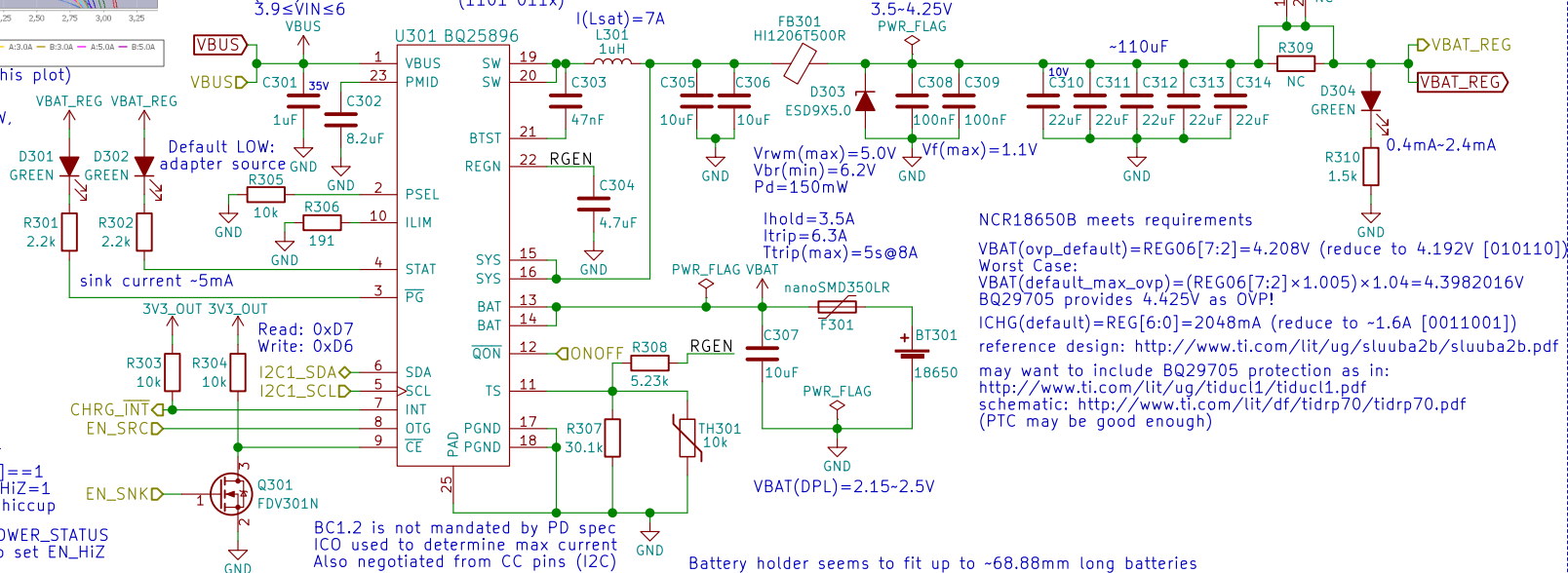


(interpret RSOC% based on this plot)

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)



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)

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

NCR18650B meets requirements

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!  
 $ICHG(default)=REG[6:0]=2048mA$  (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

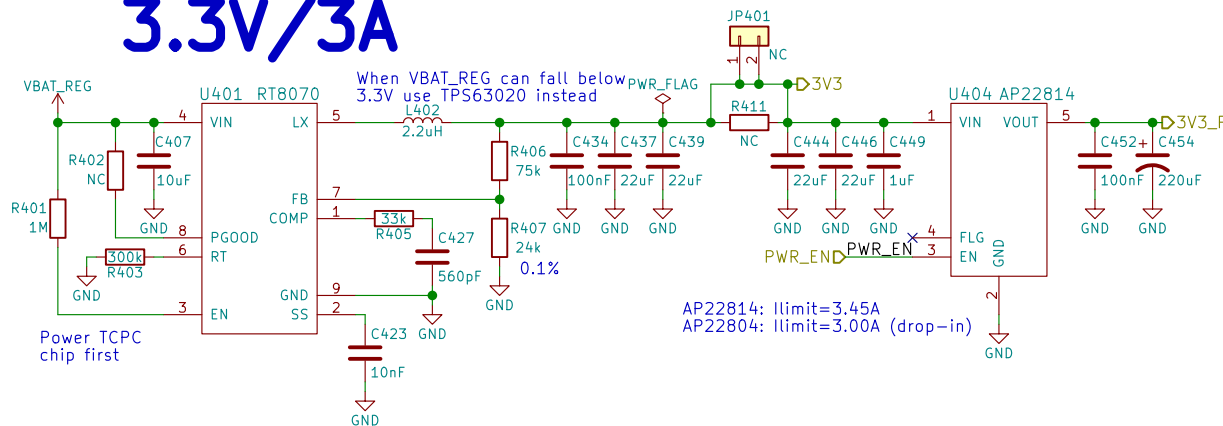
Sheet: /Battery/  
 File: battery.sch

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

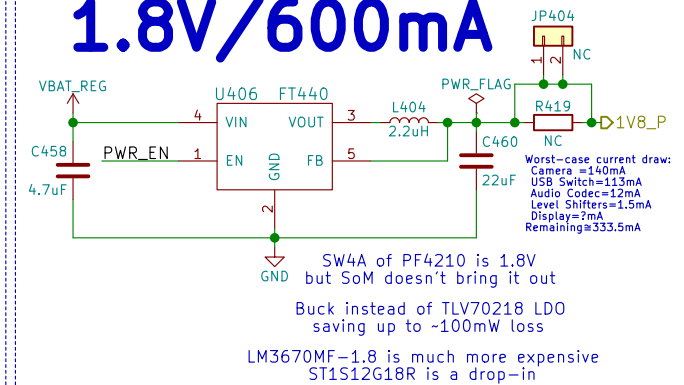
eric.kuzmenko@puri.sm  
 angus.ainslie@puri.sm  
 nicole.farber@puri.sm  
 christian.schilmoeller@puri.sm

Rev: v0.1.0  
 Id: 3/24

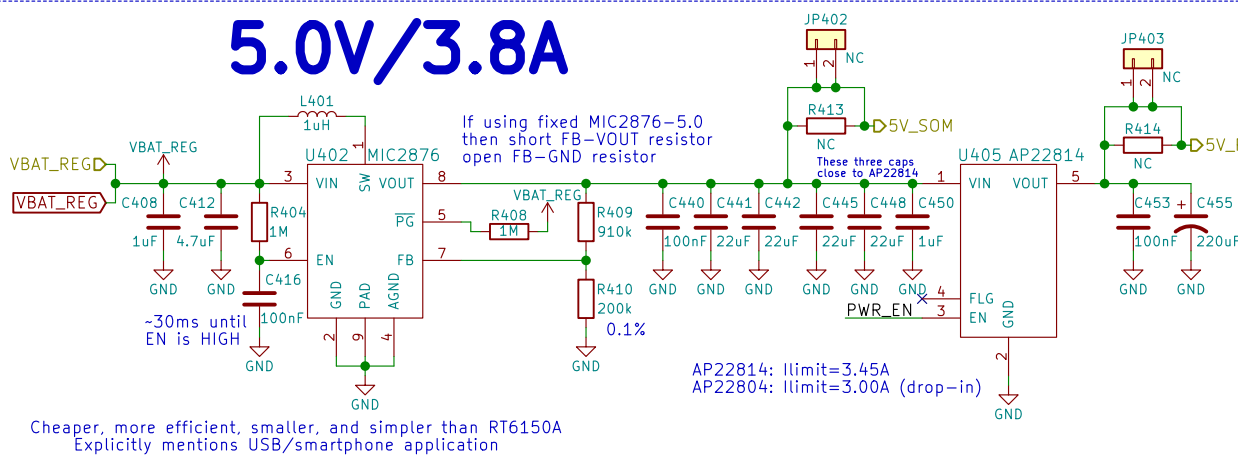
## 3.3V/3A



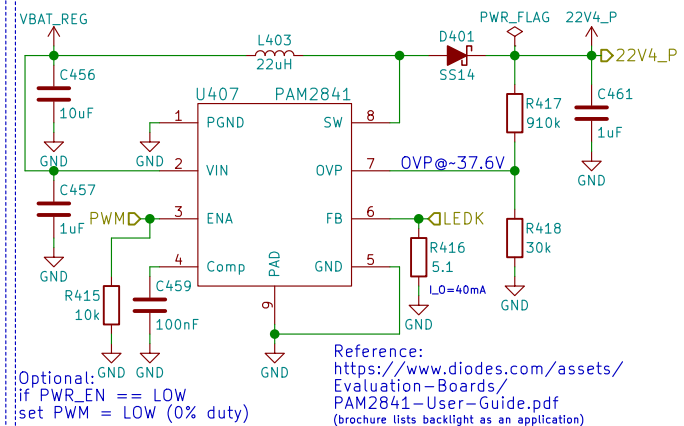
## 1.8V/600mA



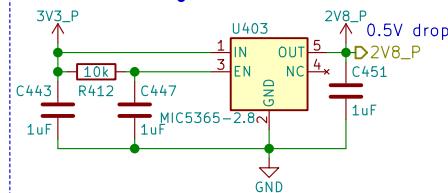
## 5.0V/3.8A



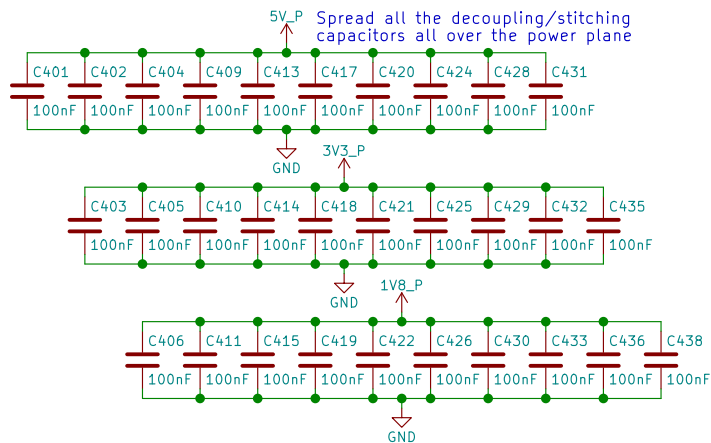
## 22.4V/40mA



## 2.8V/150mA



## Power



Power

**Purism**

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Sheet: /Power/  
File: power.sch

Size: A4 Date: 2018-07-17  
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eric.kuzmenko@puri.sm

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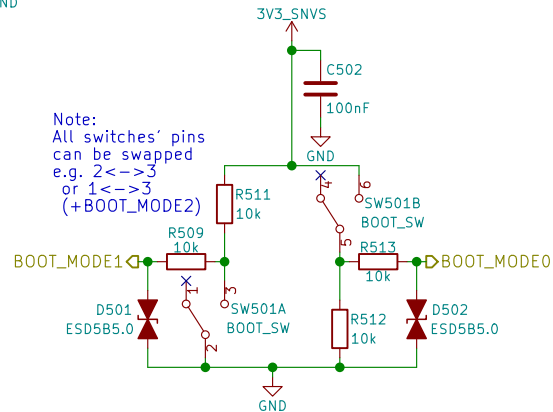
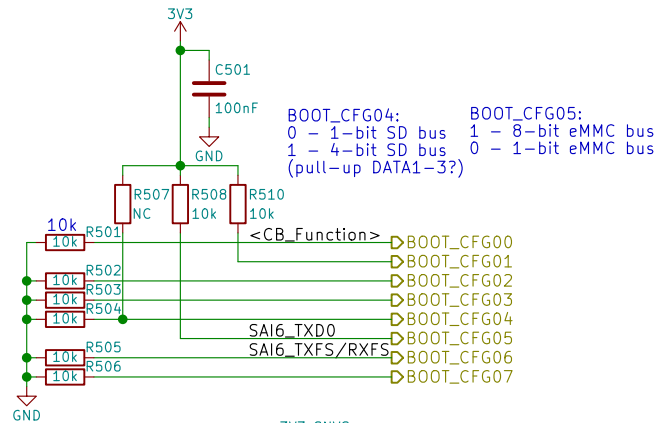
nicole.faeber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 4/24

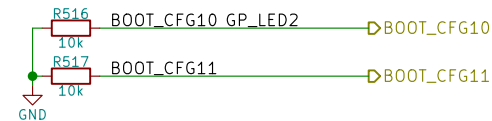
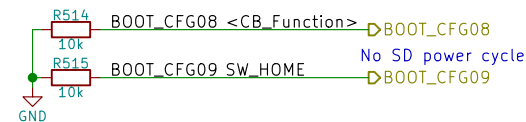
# Boot Config



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



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Sheet: /Boot Config/  
File: boot.sch

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

Date: 2018-07-17

Rev: v0.1.0

Id: 5/24

eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

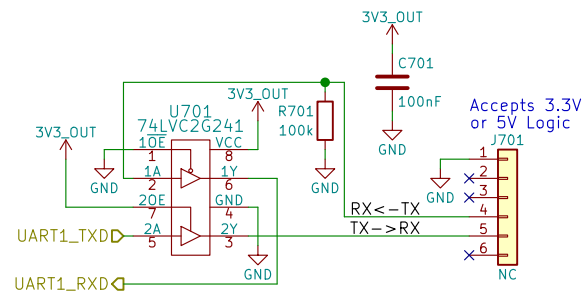
nicole.ferber@puri.sm

christian.schilmoeller@puri.sm

[illegible]

<div> <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.ferber@puri.sm</div> <div>christian.schilmoeller@puri.sm</div> </div> </div>	
<div> <div>Copyright 2018 GNU GPLv3</div> <div>Sheet: /RTC/</div> <div>File: rtc.sch</div> </div>	
<div> <div>Size: A4</div> <div>Date: 2018-07-17</div> </div>	<div> <div>Rev:</div> <div>Id: 6</div> </div>
<div> <div>KiCad E.D.A.    kicad 5.0.0</div> </div>	

# UART Debug



## UART Debug



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Sheet: /UART Debug/

File: uart.sch

Size: A4

Date: 2018-07-17

KiCad E.D.A. kicad 5.0.0

Rev: v0.1.0

Id: 7/24

eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

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**Purism**

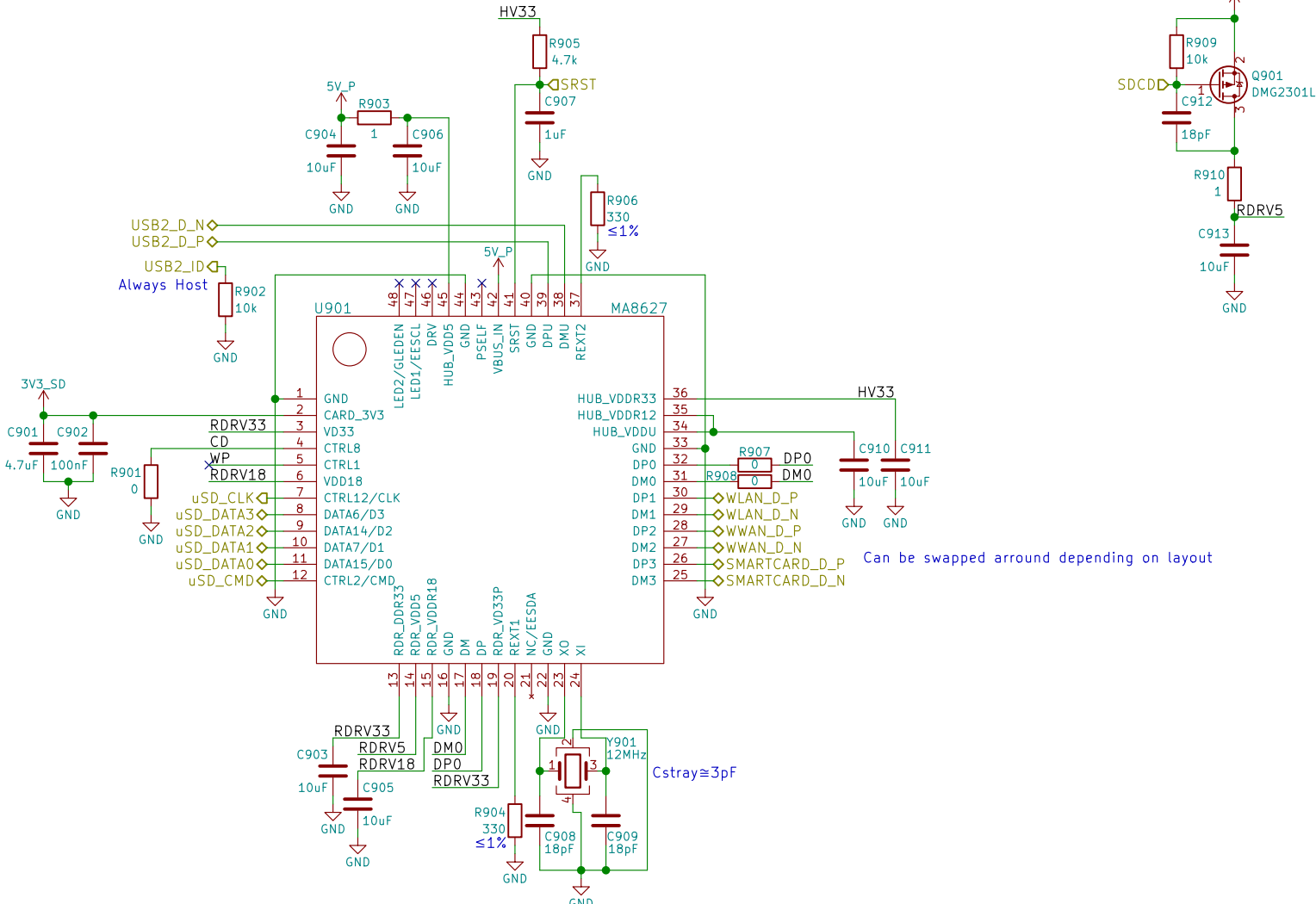
eric.kuzmenko@puri.sm  
angus.ainslie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 8/24



# USB Hub + SDIO Bridge



## USB Hub + SDIO Bridge



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Sheet: /USB Hub + SDIO Bridge/

Size: A4

Date: 2018-07-17

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

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

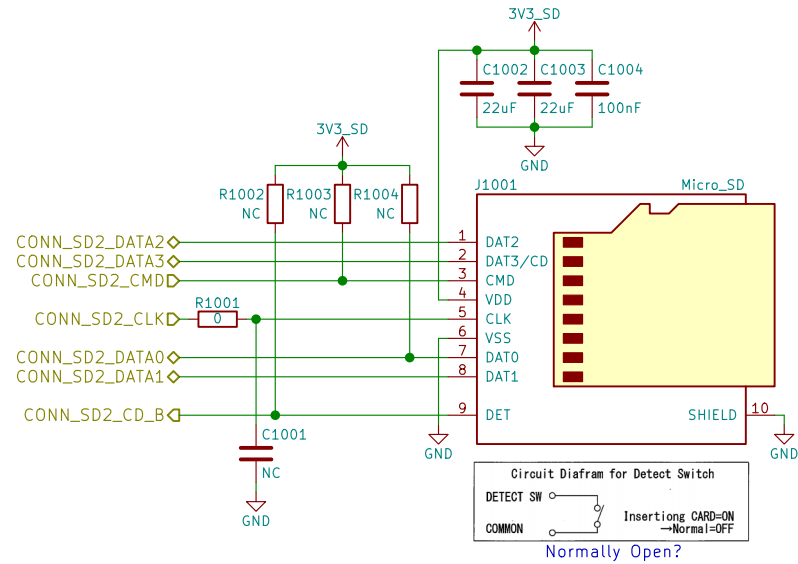
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Rev: v0.1.0

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

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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

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nicole.ferber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 11/24

## A

B

C

D

1

1

2

7

---

---

**F**



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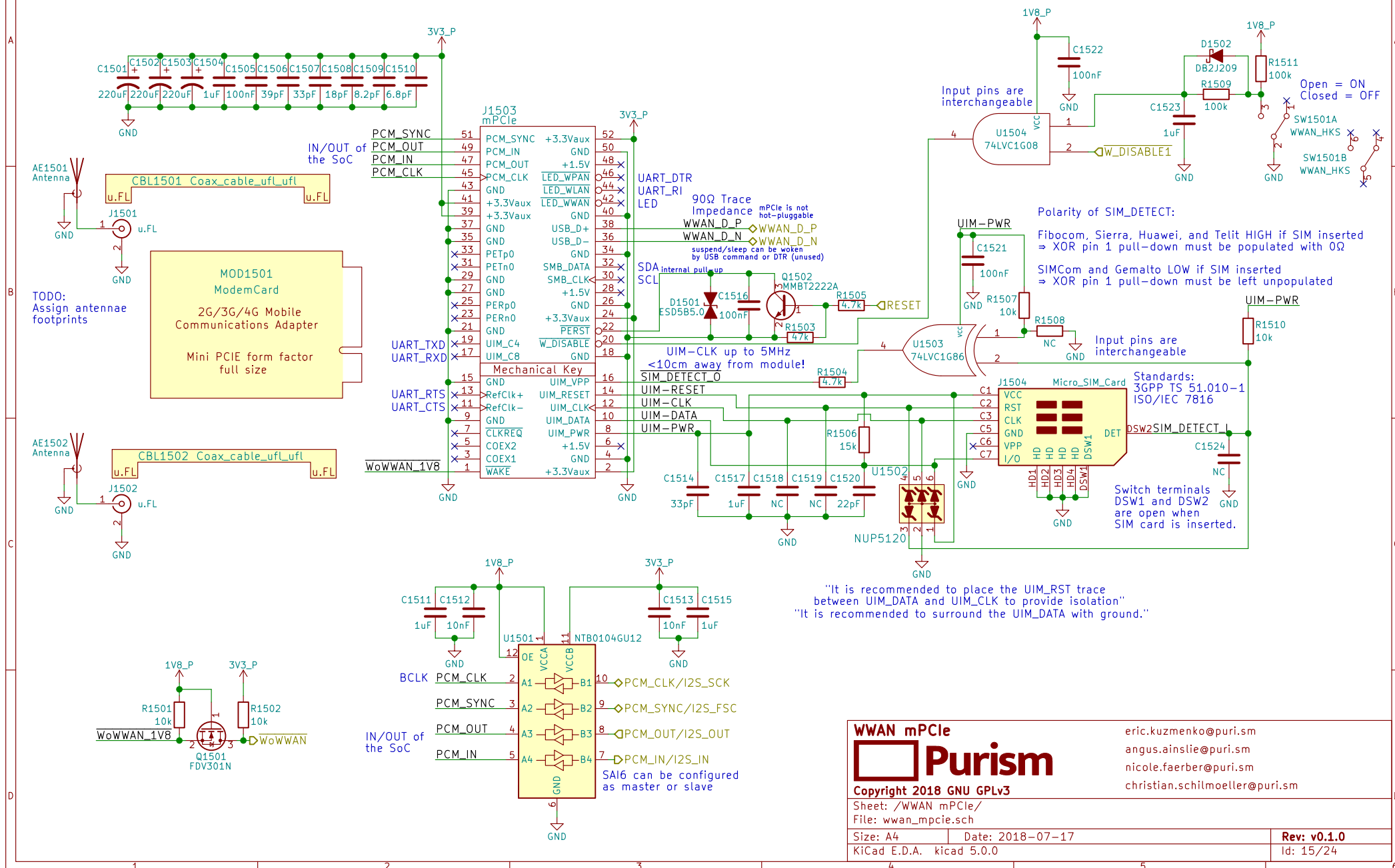
Sheet: /Buttons & LED/  
 File: buttons\_led.sch

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

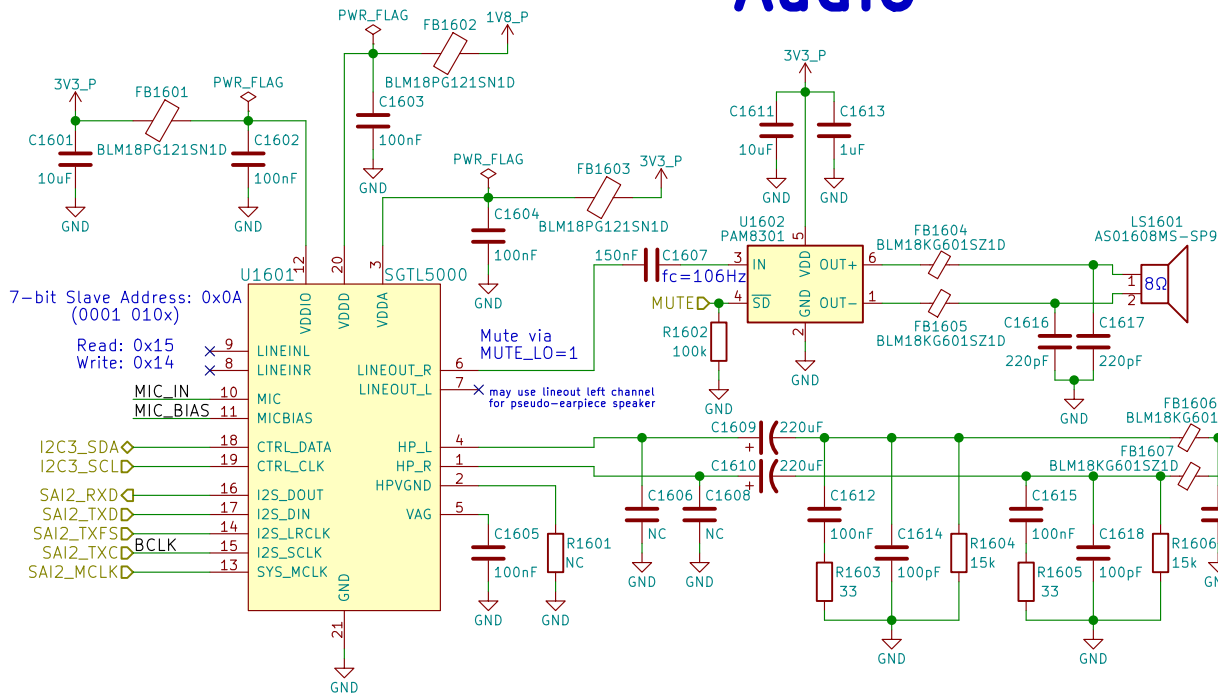
eric.kuzmenko@puri.sm  
 angus.ainstie@puri.sm  
 nicole.farber@puri.sm  
 christian.schilmoeller@puri.sm

Rev: v0.1.0  
 Id: 14/24

# WWAN mPCIe



## 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-creating-the-same-noise>  
 +Zener diode to protect against ranges outside of -0.9V to 3.3V

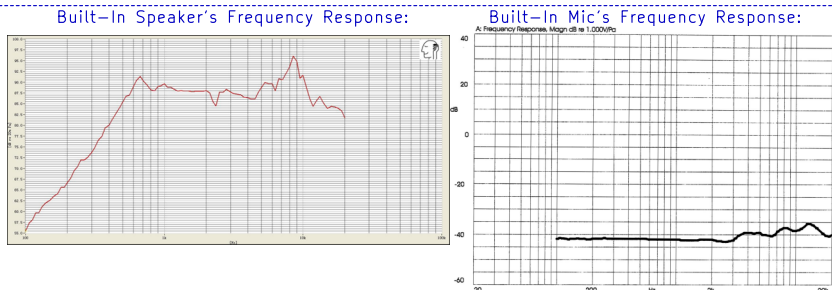
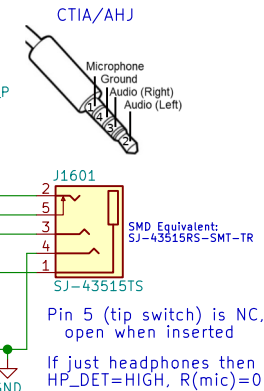
dB specs in datasheet is a unit of power gain (not dBu or VU)  
with respect to the DAC's unattenuated output

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

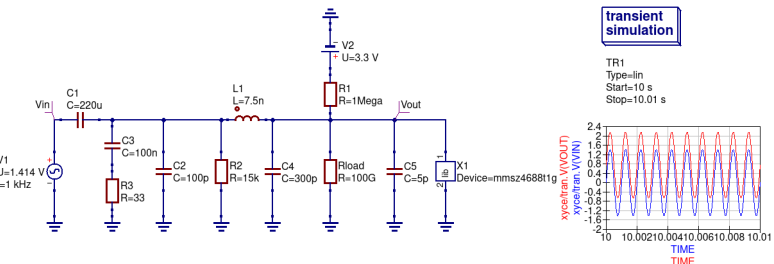
If HP\_DET is HIGH for >100ms then HPs are present

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**



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Sheet: /Audio/  
File: audio.sch

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

Rev: v0.1.0

Id: 16/24



# RGMII 10/100/1000 Ethernet

PCB schematic for RGMII 10/100/1000 Ethernet interface. The schematic shows the connection of an AR8031 Ethernet controller to an RJ45 connector (J1701) and various power and control signals. Key components include resistors (R1701-R1725), capacitors (C1701-C1725), inductors (L1701, L1702), and a crystal (Y1701). The controller pins are labeled with their functions: TX, RX, MDIO, RST, WOL, and clock signals. The RJ45 connector pins are labeled with their functions: TX+, TX-, TX2+, TX2-, TX3+, TX3-, TX4+, TX4-.

**Ethernet**

**Purism**

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Sheet: /Ethernet/  
File: ethernet.sch

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

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christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 17/24



**Purism**

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nicole.faeber@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

Socket: Table 46  
Module: Table 23

M.2 Key E

3V3\_P

NC

Key E

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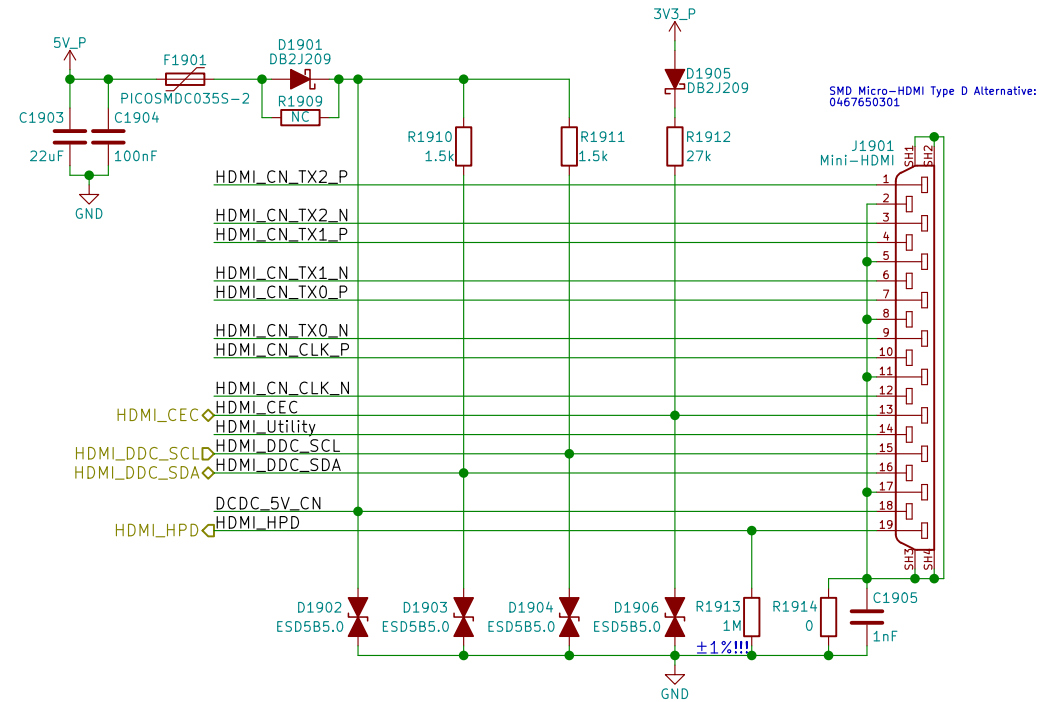
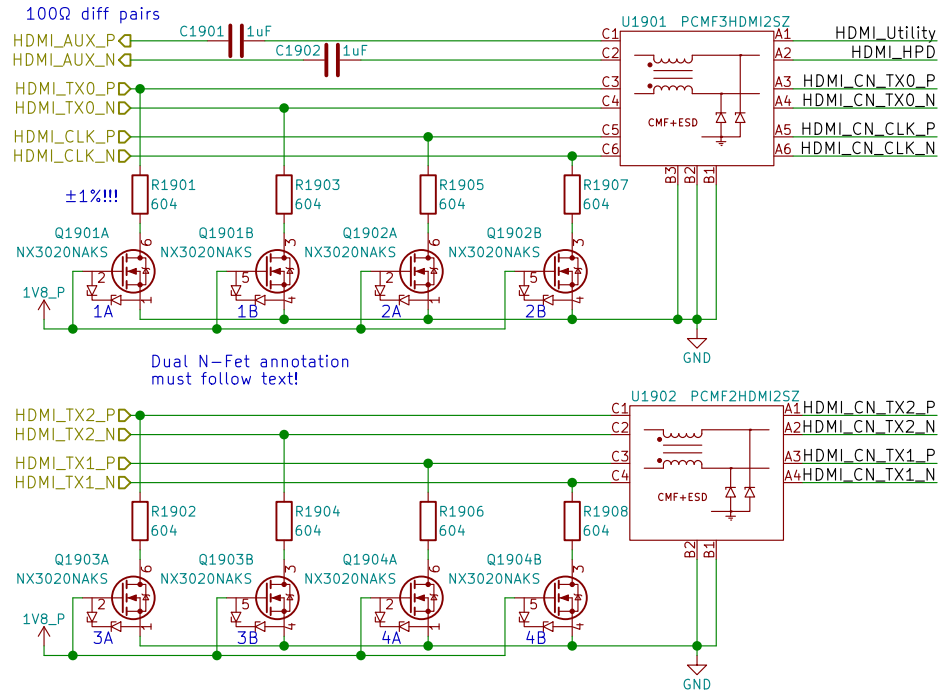
289

290

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



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Sheet: /HDMI/  
File: hdmi.sch

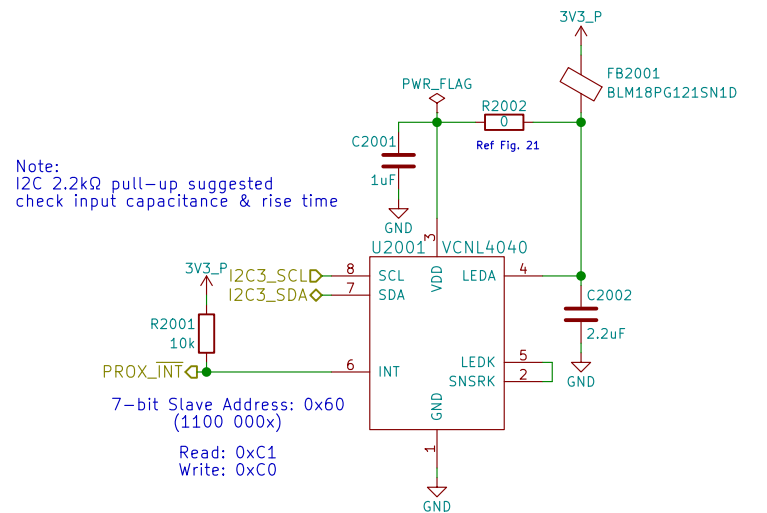
Size: A4 Date: 2018-07-17  
KiCad E.D.A. kicad 5.0.0

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

Rev: v0.1.0  
Id: 19/24

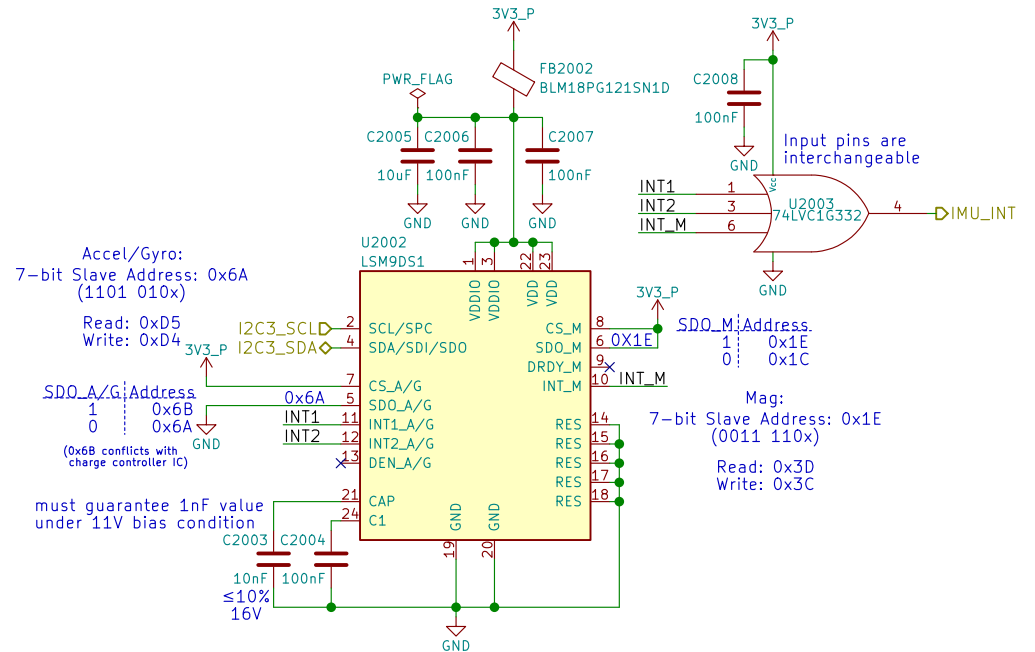
# Sensors

## Proximity & Ambient Light

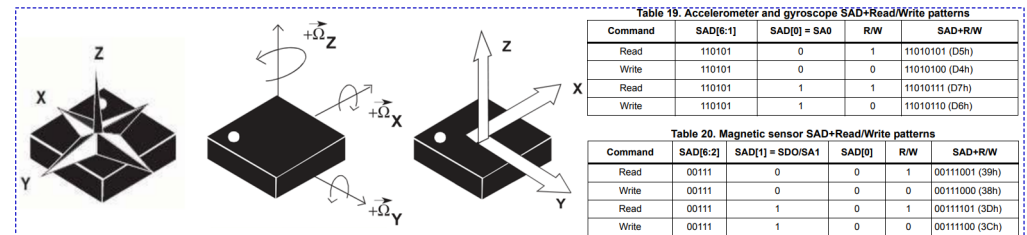


Reference:  
<https://www.vishay.com/docs/84307/designingvcnl4040.pdf>  
<http://www.vishay.com/docs/84931/vcni4040sensorboardfiles.pdf>

## 9-Axis IMU



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



## Sensors



## Purism

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Sheet: /Sensors/  
File: sensors.sch

eric.kuzmenko@puri.sm

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nicole.farber@puri.sm

christian.schilmoeller@puri.sm

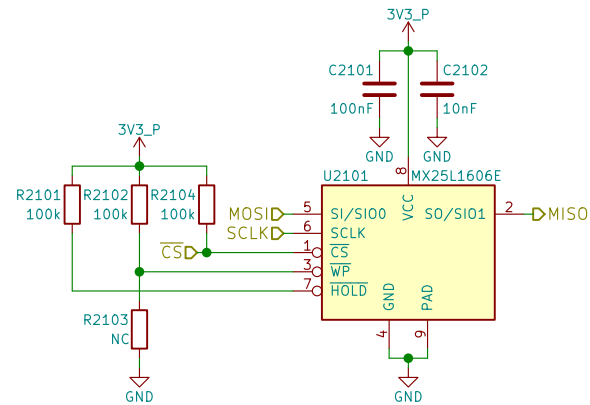
Size: A4	Date: 2018-07-17
----------	------------------

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

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

KiCad E.D.A. kicad 5.0.0

Rev: v0.1.0

Id: 21/24

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The schematic shows the connection between a microcontroller (U2201) and a Smart Card (J2201). The microcontroller has pins for SMARTCARD\_D\_P (11), SMARTCARD\_D\_N (10), USB\_DP (11), USB\_DM (10), VDD5, VDD33, SC1\_VCC (7), SC1\_RST (6), SC1\_CLK (5), SC1\_I/O (4), SC1\_C4 (3), SC1\_C8 (2), SC1\_PRSTN/JTAG\_TMS (8), RESET Misc./JTAG (16), TEST (9), JTAG\_TDI (15), JTAG\_TDO (14), JTAG\_CLK (13), and VSS(flag) (17). The Smart Card has pins for VCC (C1), RST (C2), CLK (C3), GND (C4), VPP (C5), I/O (C6), CASE (C7), DET (C8), C8, C4, SCH, SW2, C8, C4, SW1, and GND. The circuit includes decoupling capacitors (C2202, C2203, C2204, C2205), pull-up resistors (R2201, R2202, R2203), and a 5V\_P supply.

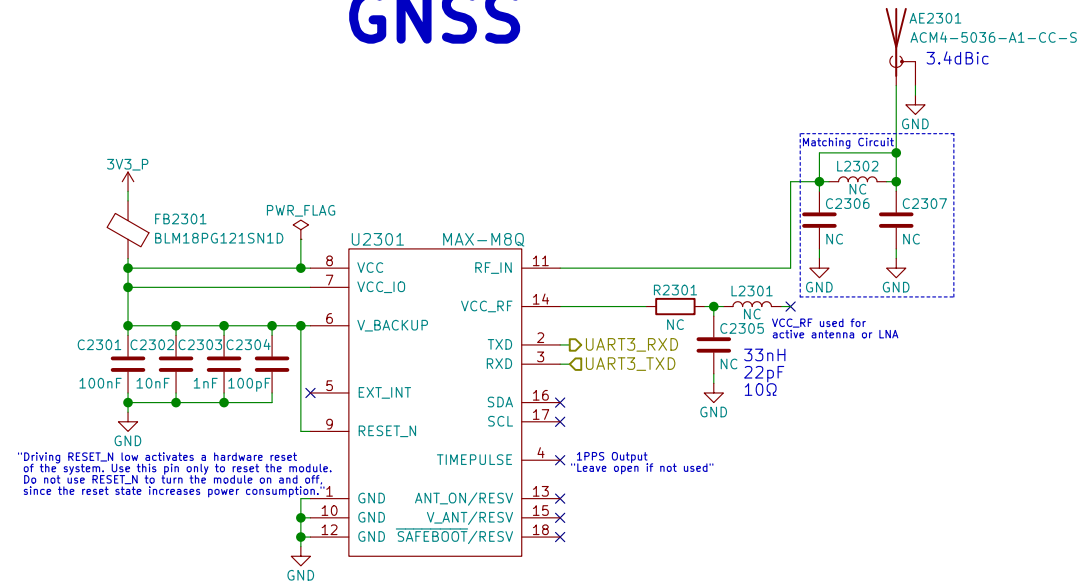
## Smart Card



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

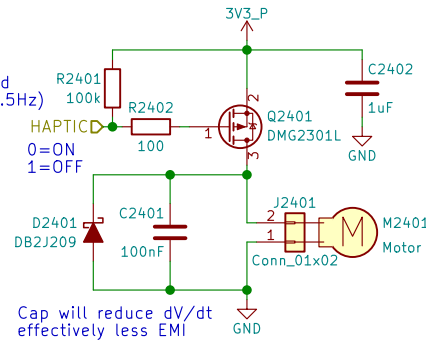
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Rev: v0.1.0  
Id: 23/24

# 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



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 File: haptic.sch

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