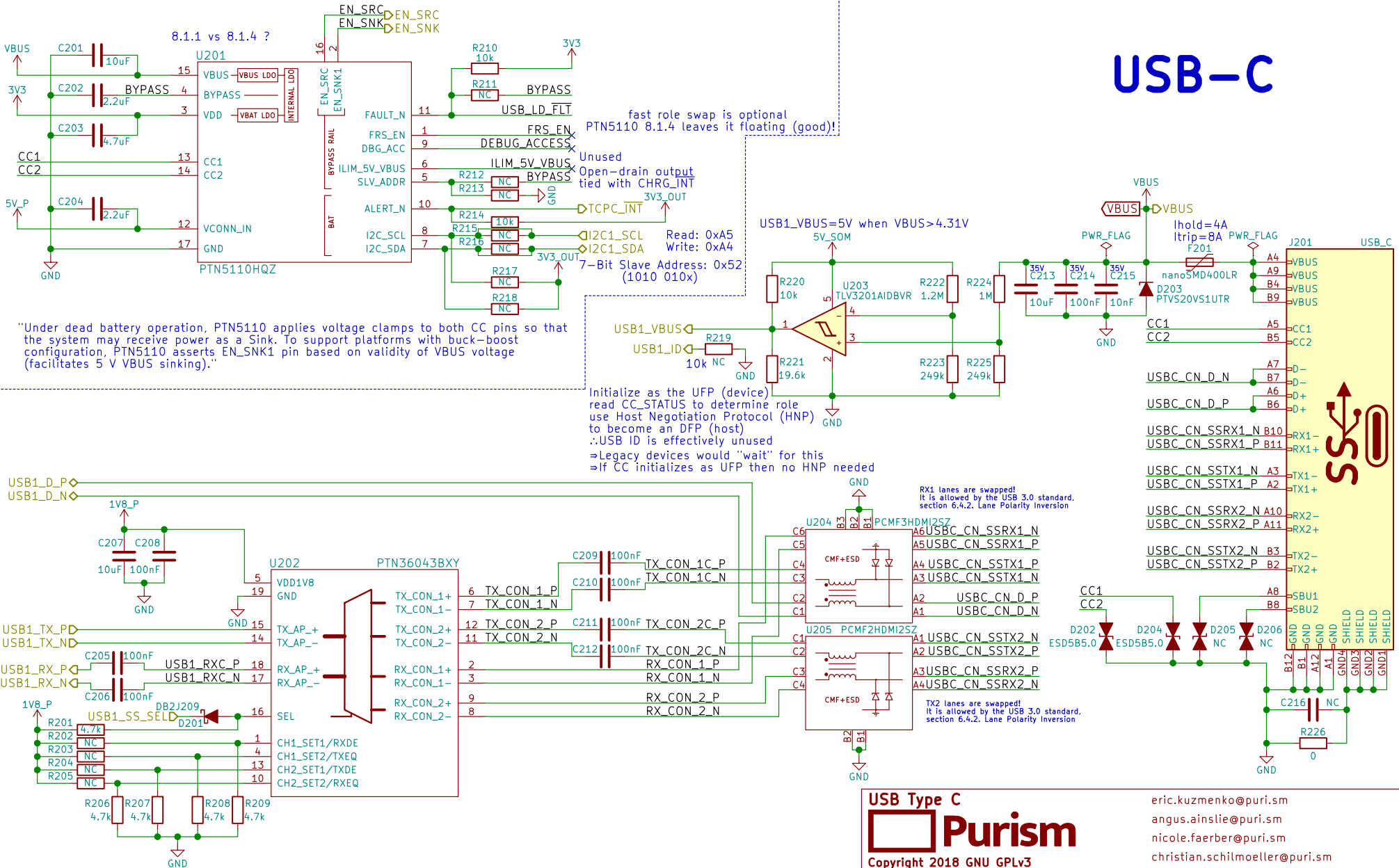


# USB-C TCPC - Config Channel (CC) and PD Role Controller

## USB-C



USB Type C

**Purism**

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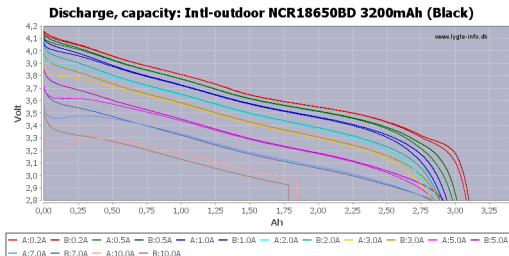
Sheet: /USB-C/  
File: usb-c.sch

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

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

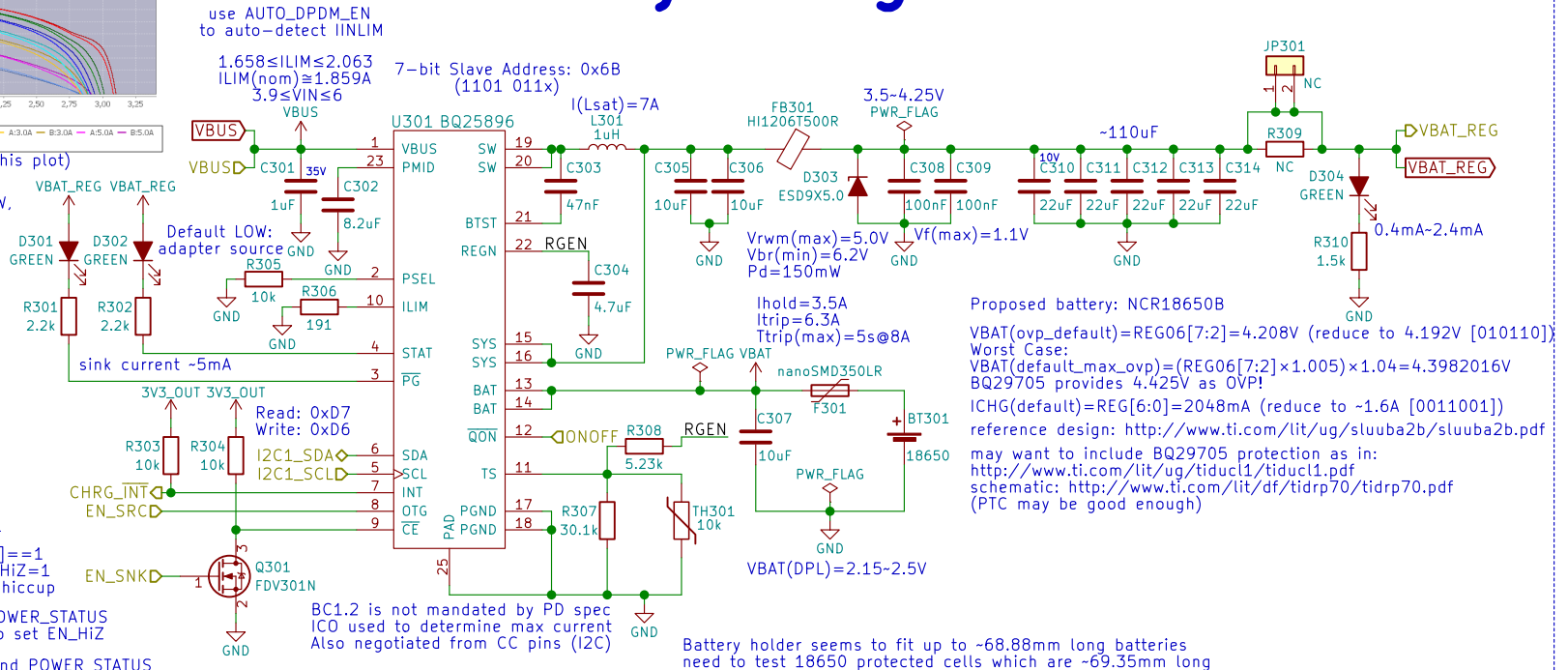
Rev: v0.1.0  
Id: 2/24

# Battery Charge Controller



(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



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**

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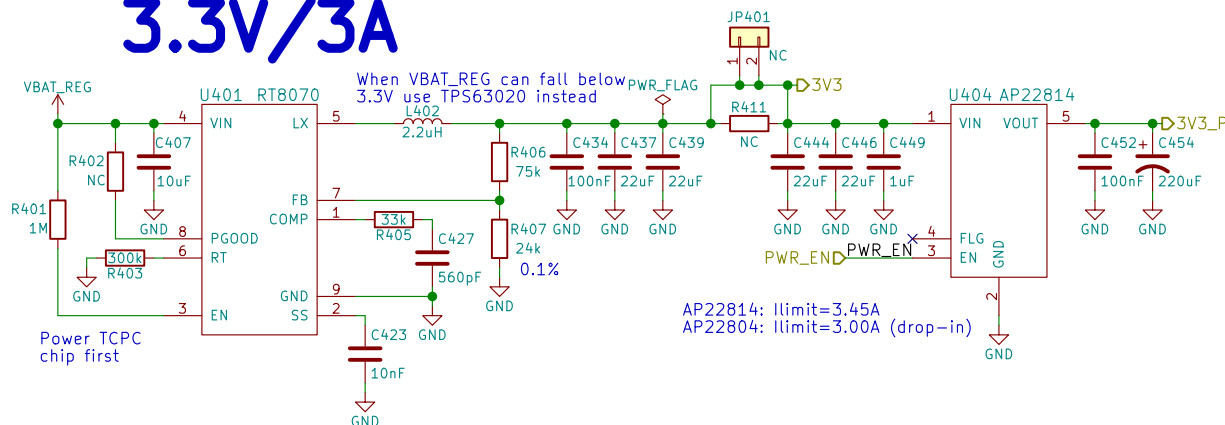
Sheet: /Battery/  
 File: battery.sch

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

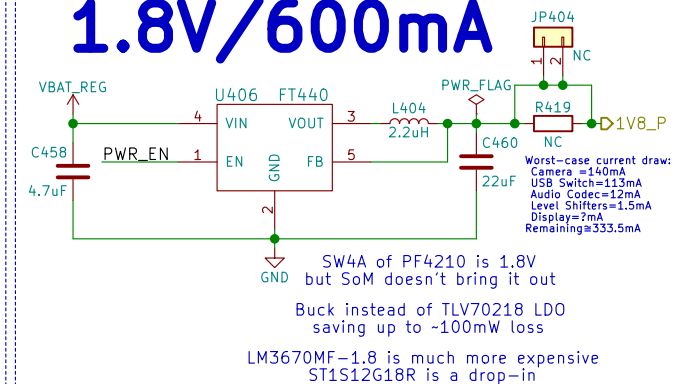
eric.kuzmenko@puri.sm  
 angus.ainslie@puri.sm  
 nicole.ferber@puri.sm  
 christian.schilmoeller@puri.sm

Rev: v0.1.0  
 Id: 3/24

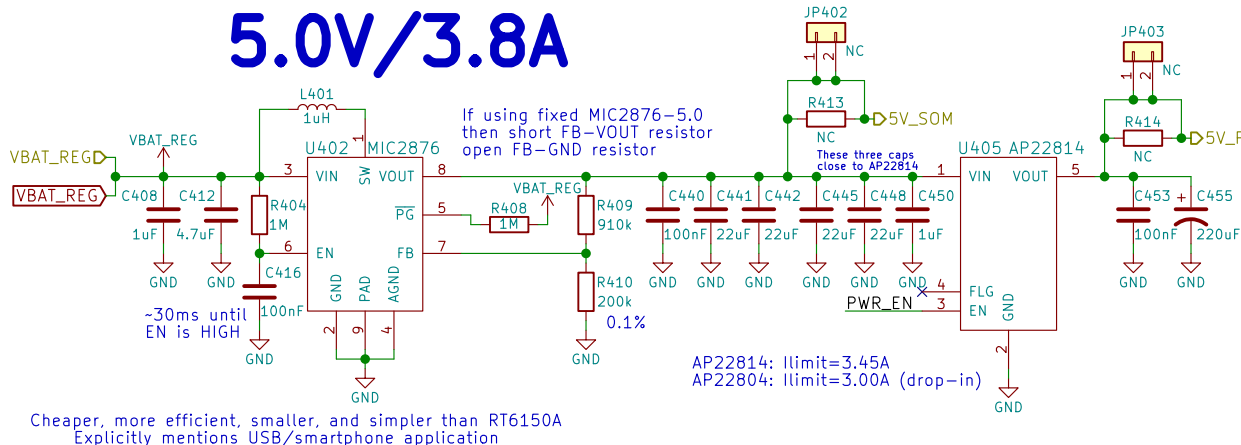
## 3.3V/3A



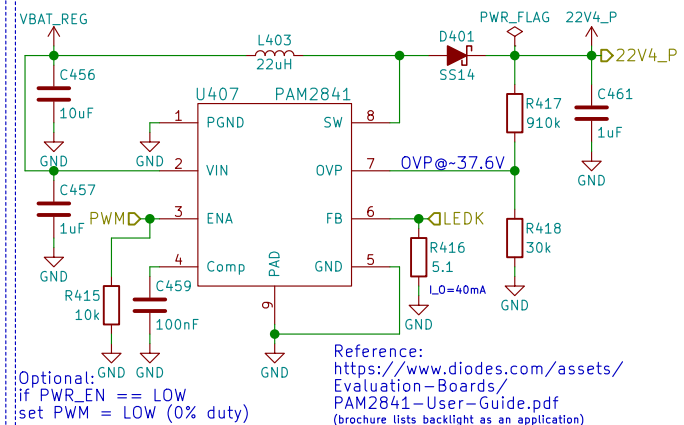
## 1.8V/600mA



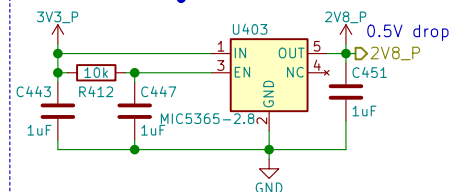
## 5.0V/3.8A



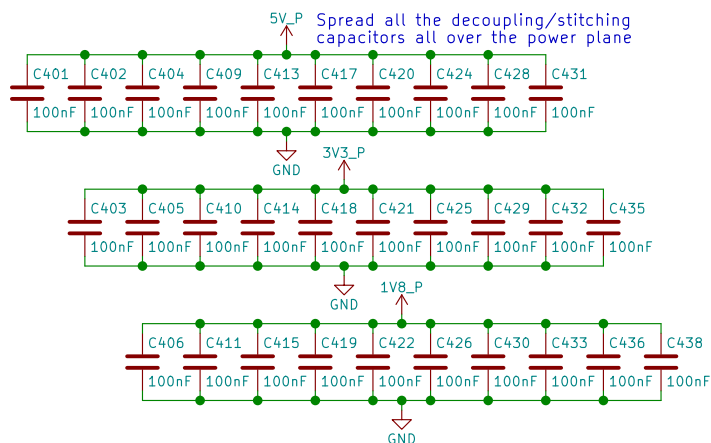
## 22.4V/40mA



## 2.8V/150mA



## Power



Power

**Purism**

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Sheet: /Power/  
File: power.sch

Size: A4  
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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  
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christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 5/24

7-bit Slave Address: 0x68  
(1101 000x)

Read: 0xD1  
Write: 0xD0

U601

I2C1\_SDA 1 SDA SCL 8 I2C1\_SCL 7 D601 DB2J209 3V3\_OUT R601 10k FB601

2 SQA NC 6 VSS IRQ 5 NC VDD 4


GND RV-4162-C7

VIH(min) not given, however  
assuming  $V_{IH(min)} \cong 0.77647 \cdot V_{DD}$   
@  $V_{DD} = 4.25V$  then  $V_{IH(min)} \cong 3.2999975V$


When powered on  
VBAT\_REG is used  
3.5-4.25V

VBAT is PTC fused  
If battery is depleted  
then current is  $\sim 350nA$   
( $< 1\mu Watt$ )

BLM18PG1215N1D VBAT R602 4.99k BAT54C VBAT\_REG C601 100nF GND

<div> <div>RTC</div> <div>  <div>Purism</div> </div> </div> <div> <div>Copyright 2018 GNU GPLv3</div> <div> <div>Sheet: /RTC/</div> <div>File: rtc.sch</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>
<div>Size: A4</div> <div>Date: 2018-07-17</div>	<div>Rev: v0.1.0</div> <div>Id: 6/24</div>	
<div>KiCad E.D.A.    kicad 5.0.0</div>		

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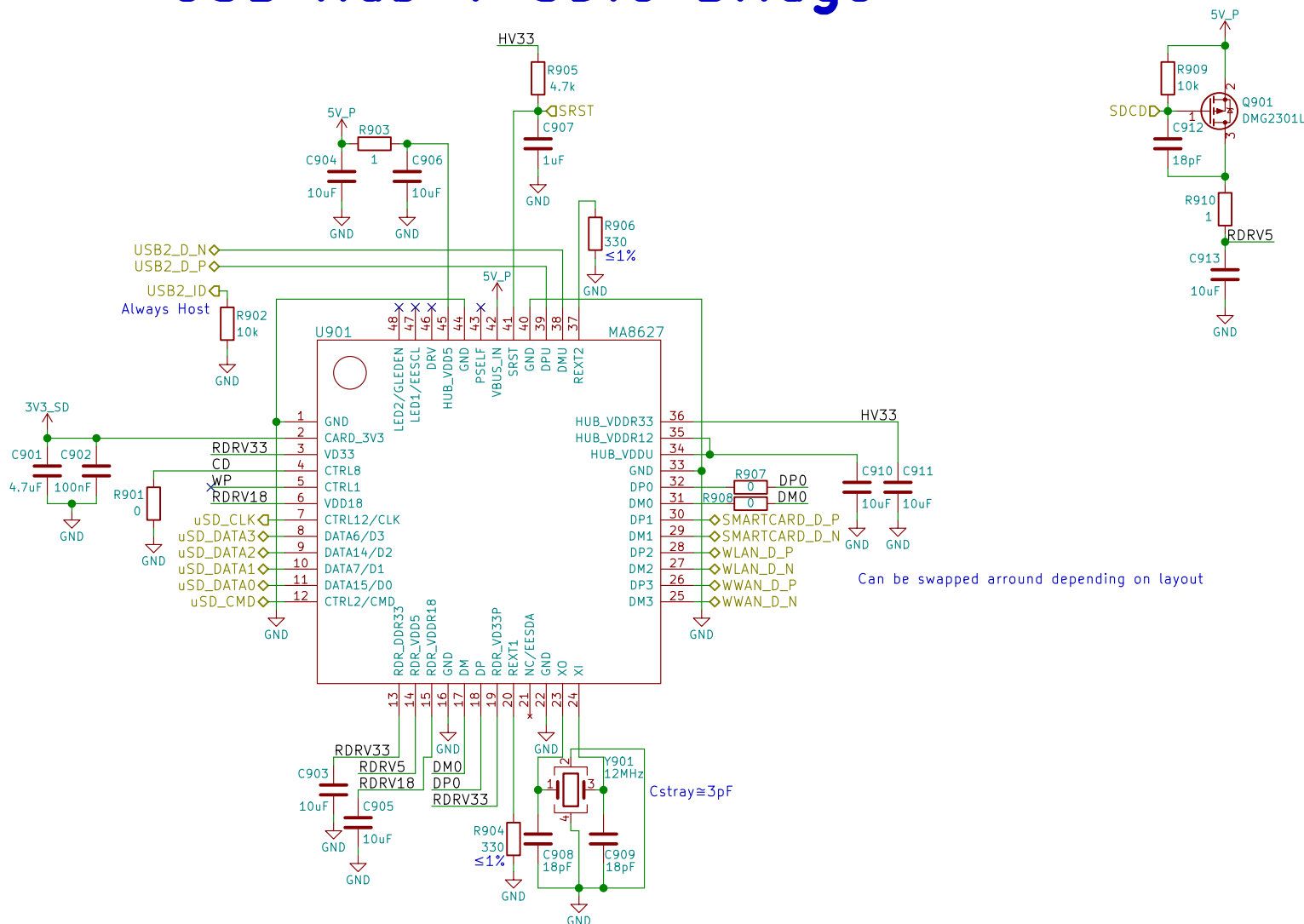
eric.kuzmenko@puri.sm  
angus.ainslie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 8/24



# USB Hub + SDIO Bridge



## USB Hub + SDIO Bridge



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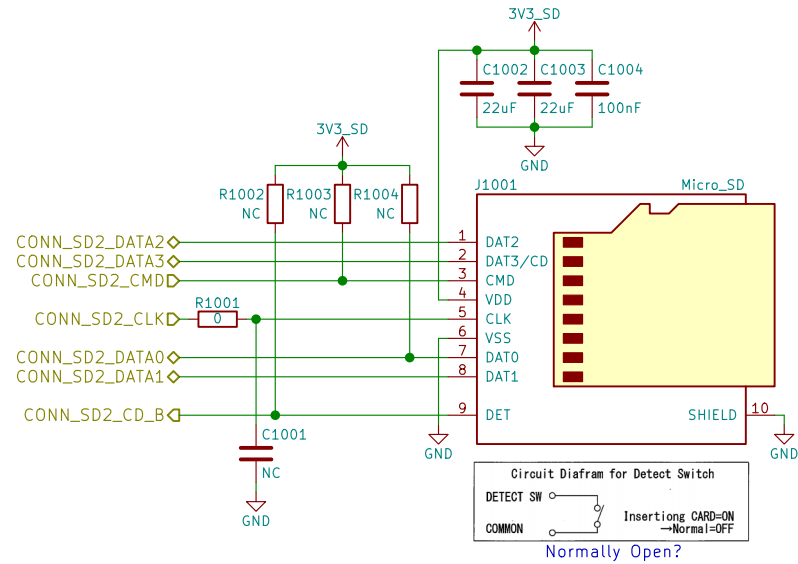
Sheet: /USB Hub + SDIO Bridge/  
File: usb\_hub\_sdio.sch

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

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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

Rev: v0.1.0

Id: 10/24

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# MIPI



MIPI



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Sheet: /MIPI/  
File: mipi.sch

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

Date: 2018-07-17

Rev: v0.1.0

Id: 14/24

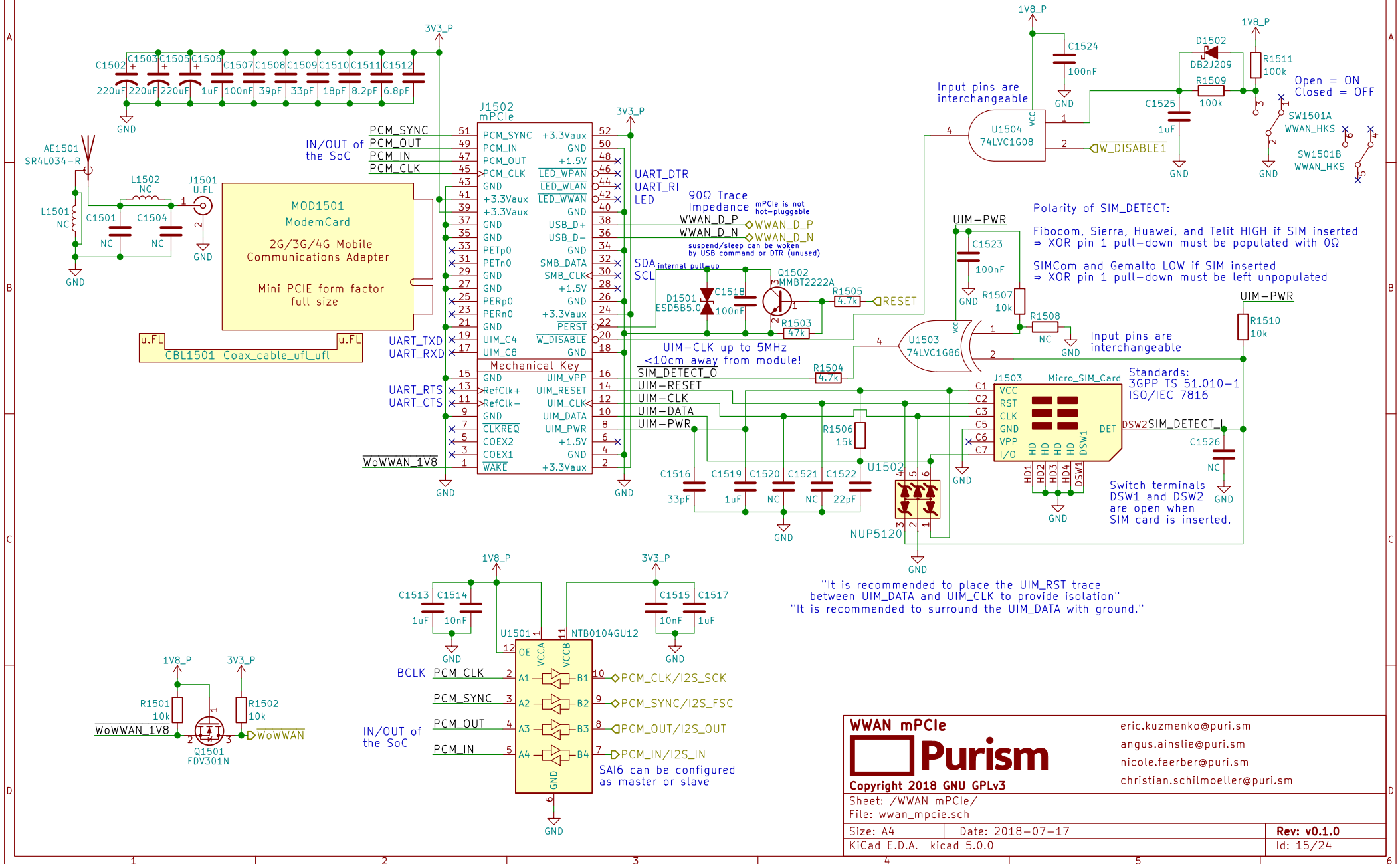
eric.kuzmenko@puri.sm

angus.ainstie@puri.sm

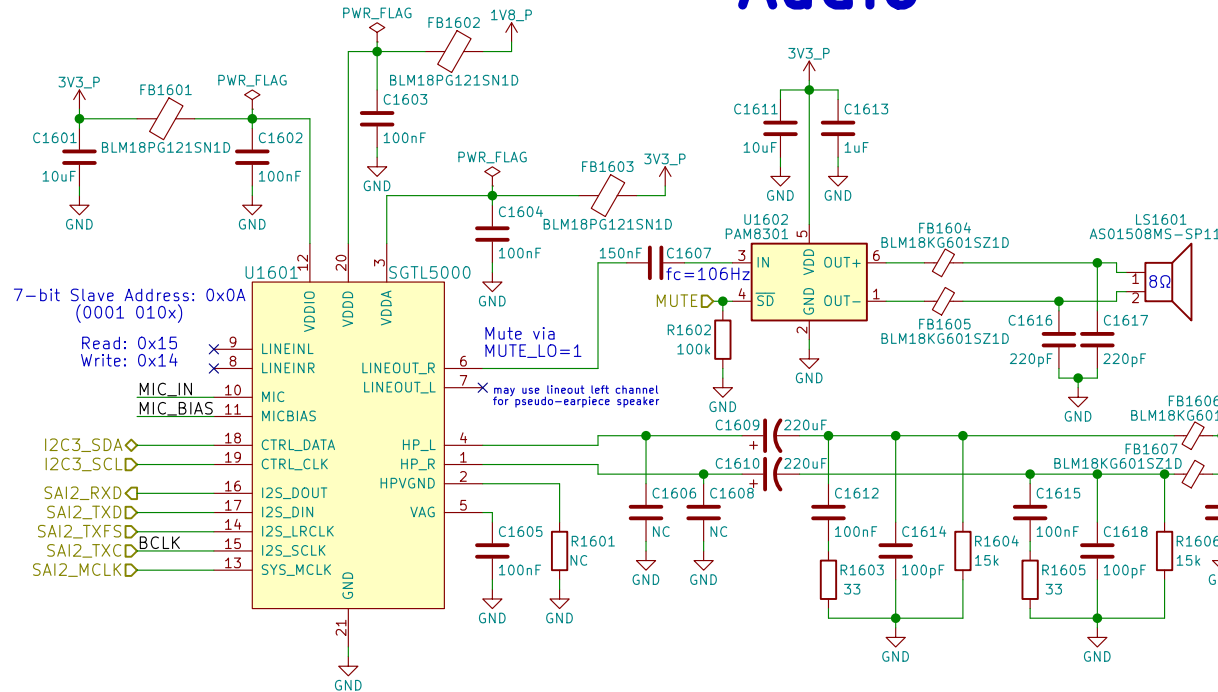
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

# WWAN mPCle



# 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-crc>  
 +Zener diode to protect against ranges outside of -0.9V to 3.3V

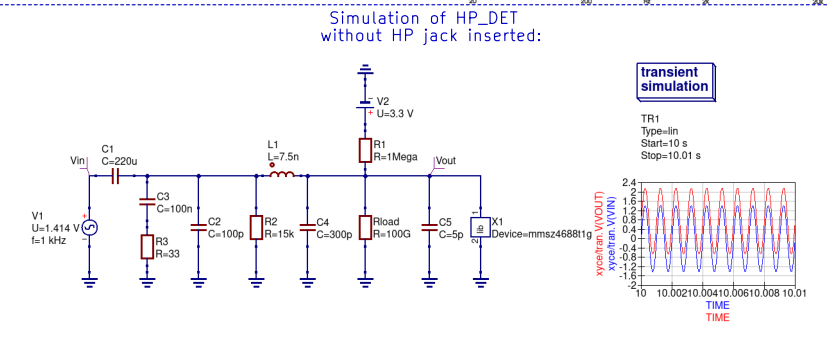
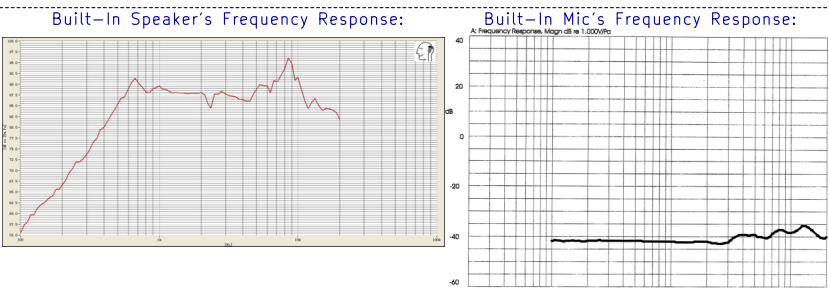
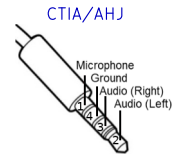
dB specs in datasheet is a unit of power gain (not dBu or VU) with respect to the DAC's unattenuated output

"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



## 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**

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Sheet: /Audio/  
File: audio.sch

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

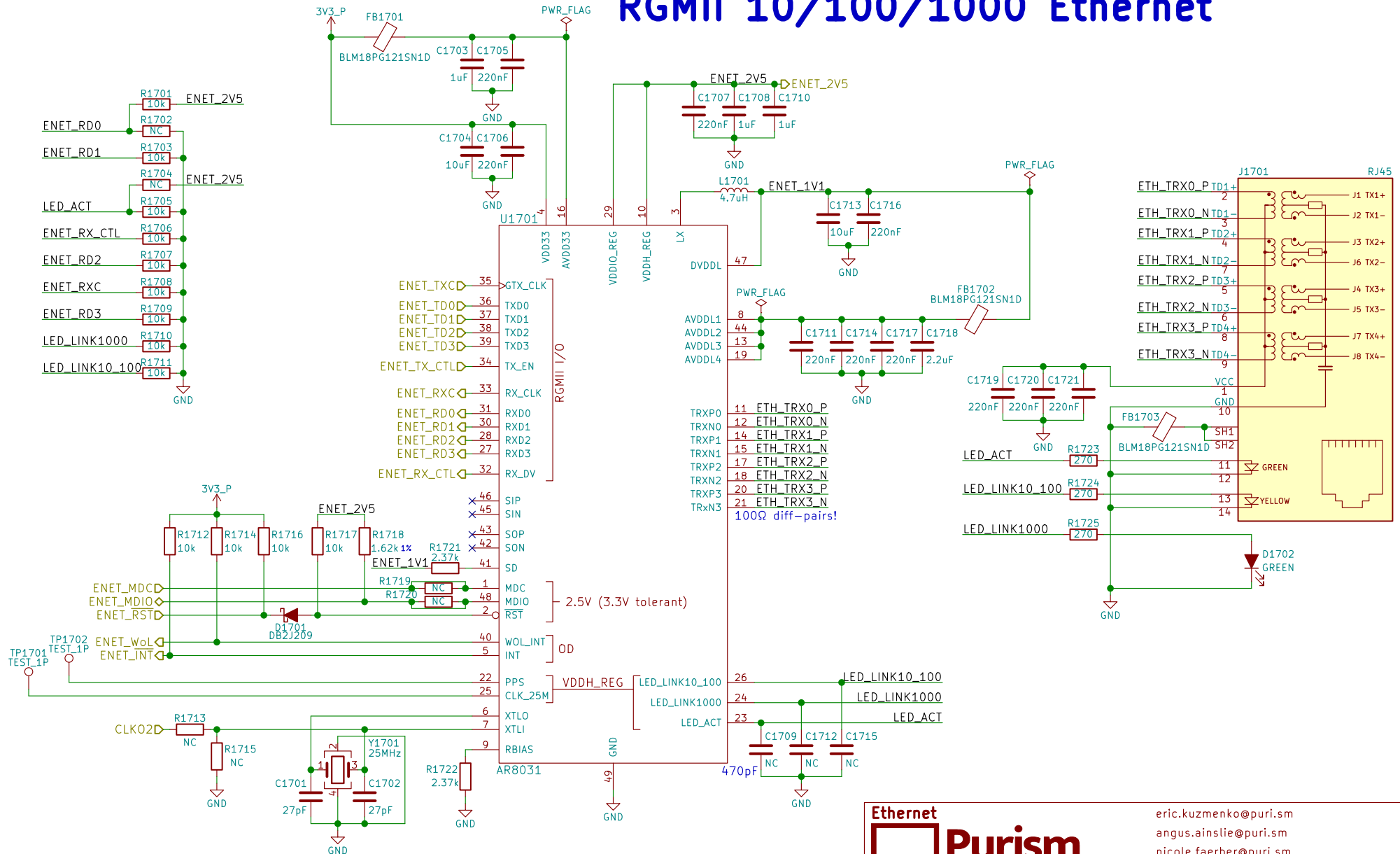
eric.kuzmenko@puri.sm  
angus.ainstlie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

-37dB=14.1254mV/Pa  
 $\therefore$  mic produces 14.1254mVrms when exposed to a 1kHz tone of 94dB-SPL at the capsule (or 19.98mV amplitude)  
 $\Rightarrow$  40dB gain would produce ~2V amplitude (4Vpp, clipping)  
 30dB gain would produce ~0.632V amplitude (1.264Vpp)  
 38.33dB gain would yield 3.3Vpp

Rev: v0.1.0  
Id: 16/24



# RGMII 10/100/1000 Ethernet



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

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

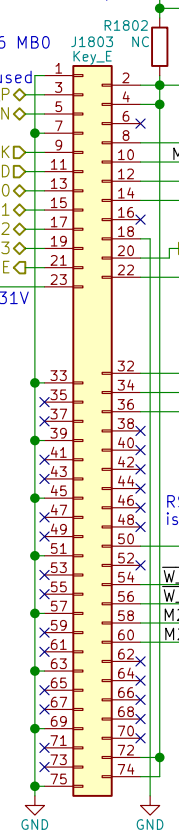
RedPine RS9116 MB0  
Requires 5V on  
Pin 54 if USB used

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

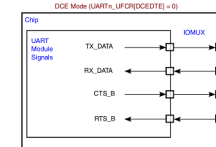
RedPine RS9116  
has 100k pull-up to  
3.3V making SDIO\_RST  
~2.55V when HIGH

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



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



TX output  
RX input  
CTS output  
RTS input  
TX<->RX  
RX<->CTS  
RTS<->RTS

Leave BT\_DISABLE  
LOW for RS9116

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

Input pins are  
interchangeable

BT\_DISABLE

WIFI\_DISABLE

SW1801A  
WLAN\_HKS  
Open = ON  
Closed = OFF

SW1801B  
WLAN\_HKS

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

M2\_I2C\_SDA  
M2\_I2C\_SCL

Q1801  
FDV301N

Q1802  
FDV301N

Q1803  
FDV301N

Q1804  
FDV301N

Q1805  
FDV301N

Q1806  
FDV301N

Q1807  
FDV301N

Q1808  
FDV301N

Q1809  
FDV301N

Q1810  
FDV301N

Q1811  
FDV301N

Q1812  
FDV301N

Q1813  
FDV301N

Q1814  
FDV301N

Q1815  
FDV301N

Q1816  
FDV301N

Q1817  
FDV301N

Q1818  
FDV301N

Q1819  
FDV301N

Q1820  
FDV301N

Q1821  
FDV301N

Q1822  
FDV301N

WLAN+BT M.2  
**Purism**

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

Size: A4 Date: 2018-07-17

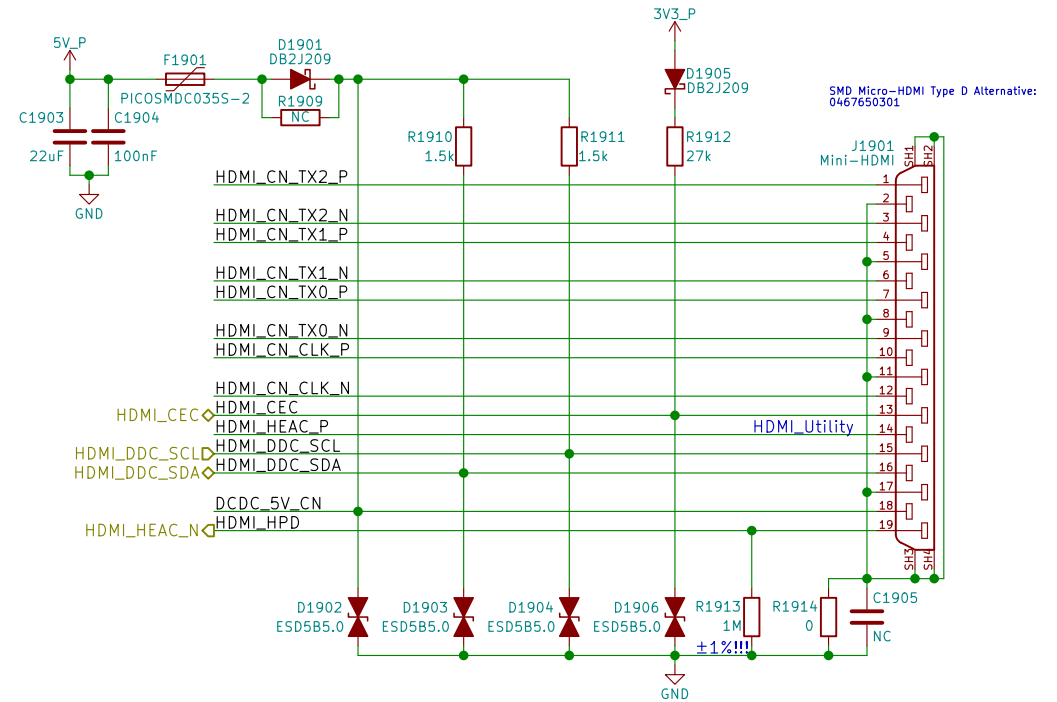
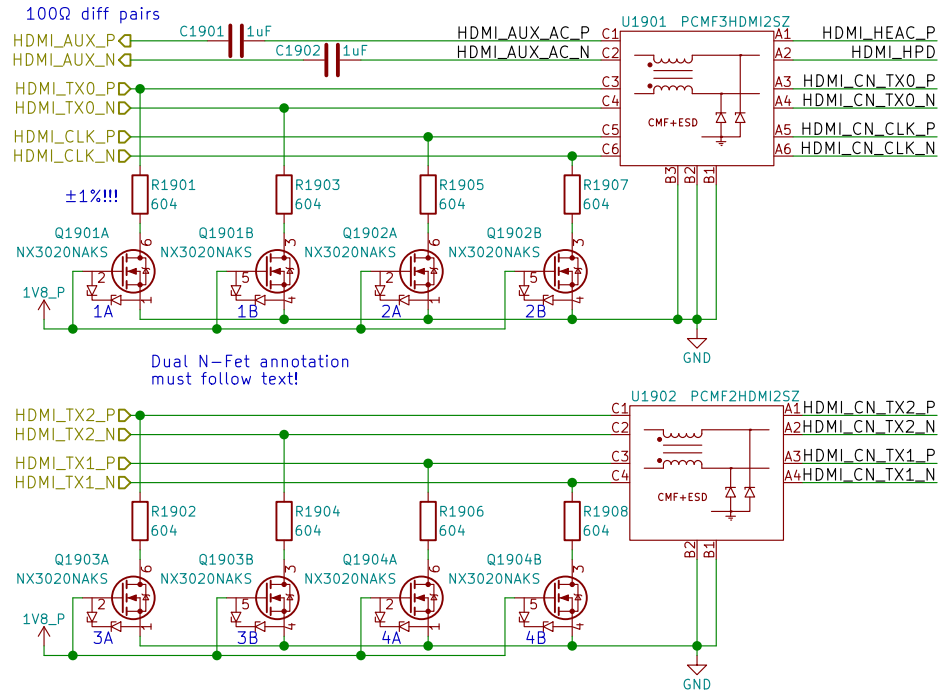
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eric.kuzmenko@puri.sm  
angus.ainstlie@puri.sm  
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christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 18/24

TUSB1046 can be used for DP over USB-C

# HDMI



HDMI



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Sheet: /HDMI/  
File: hdmi.sch

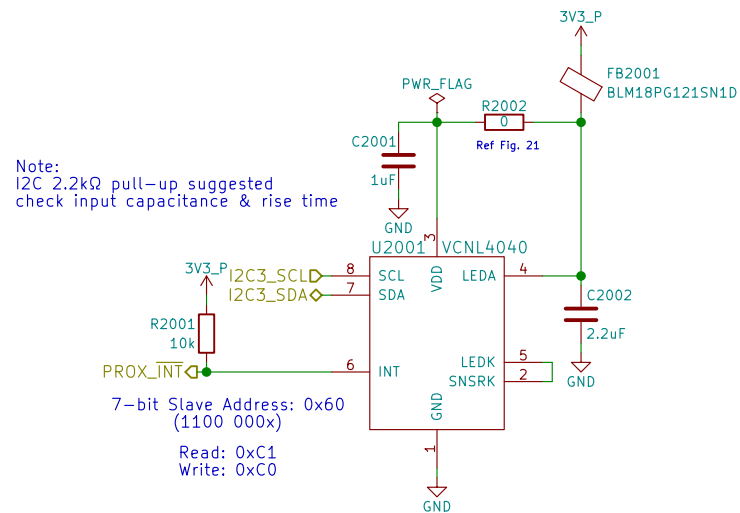
Size: A4 Date: 2018-07-17  
KiCad E.D.A. kicad 5.0.0

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

Rev: v0.1.0  
Id: 19/24

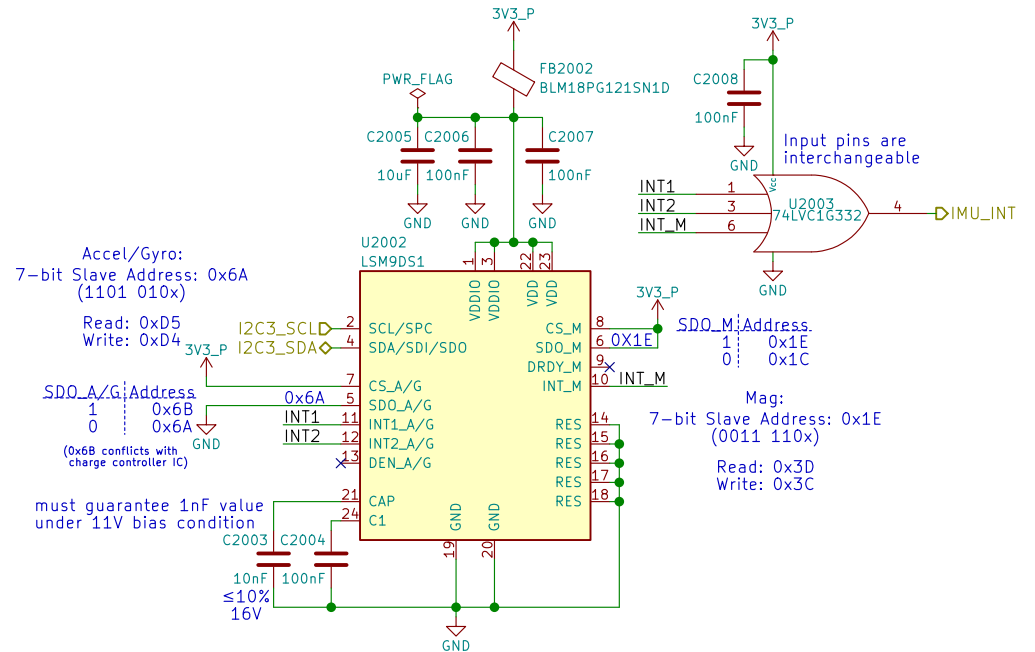
# Sensors

## Proximity & Ambient Light

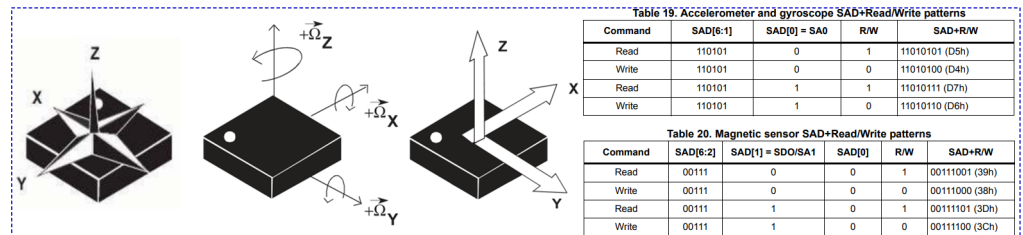


Reference:  
<https://www.vishay.com/docs/84307/designingvcnl4040.pdf>  
<http://www.vishay.com/docs/84931/vcni4040sensorboardfiles.pdf>

## 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

angus.ainslie@puri.sm

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christian.schilmoeller@puri.sm

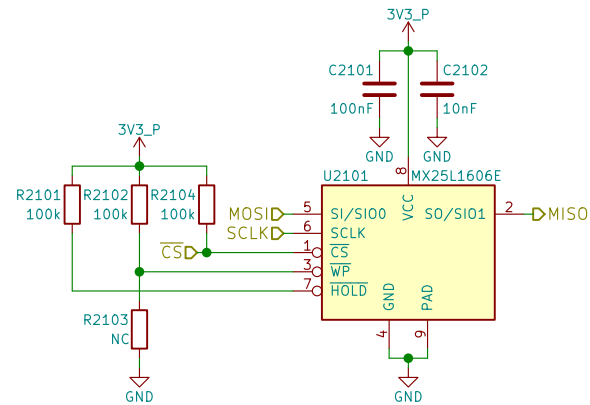
Size: A4	Date: 2018-07-17
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Size: 771	Date:
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Rev: v0.1.0

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

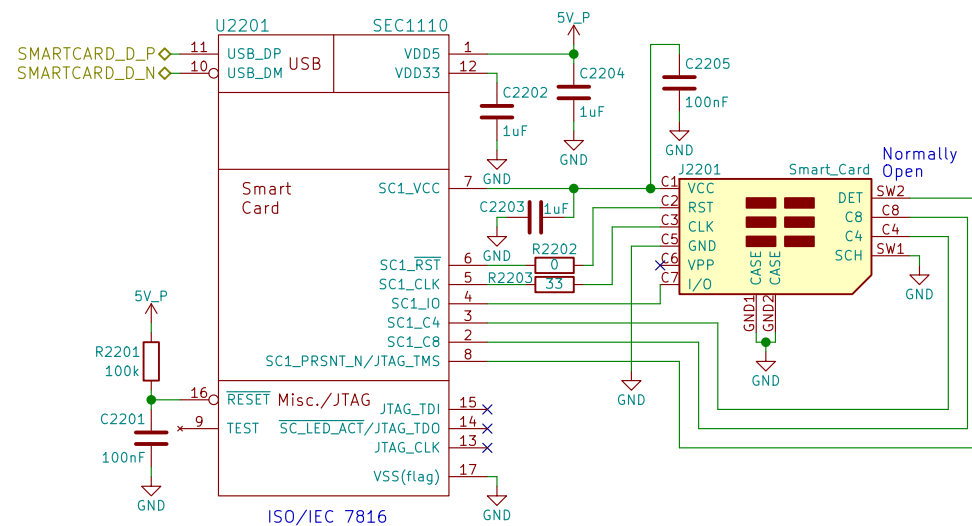
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 21/24

# Smart Card



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

Smart Card



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Sheet: /Smart Card/

File: smartcard.sch

Size: A4 Date: 2018-07-17

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christian.schilmoeller@puri.sm

Rev: v0.1.0

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

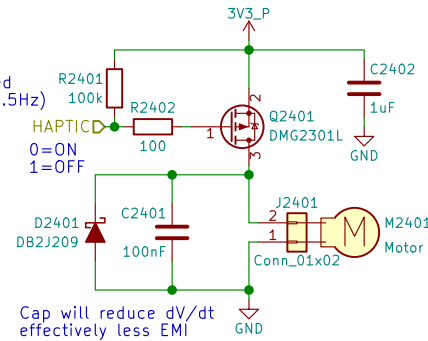
Id: 23/24

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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