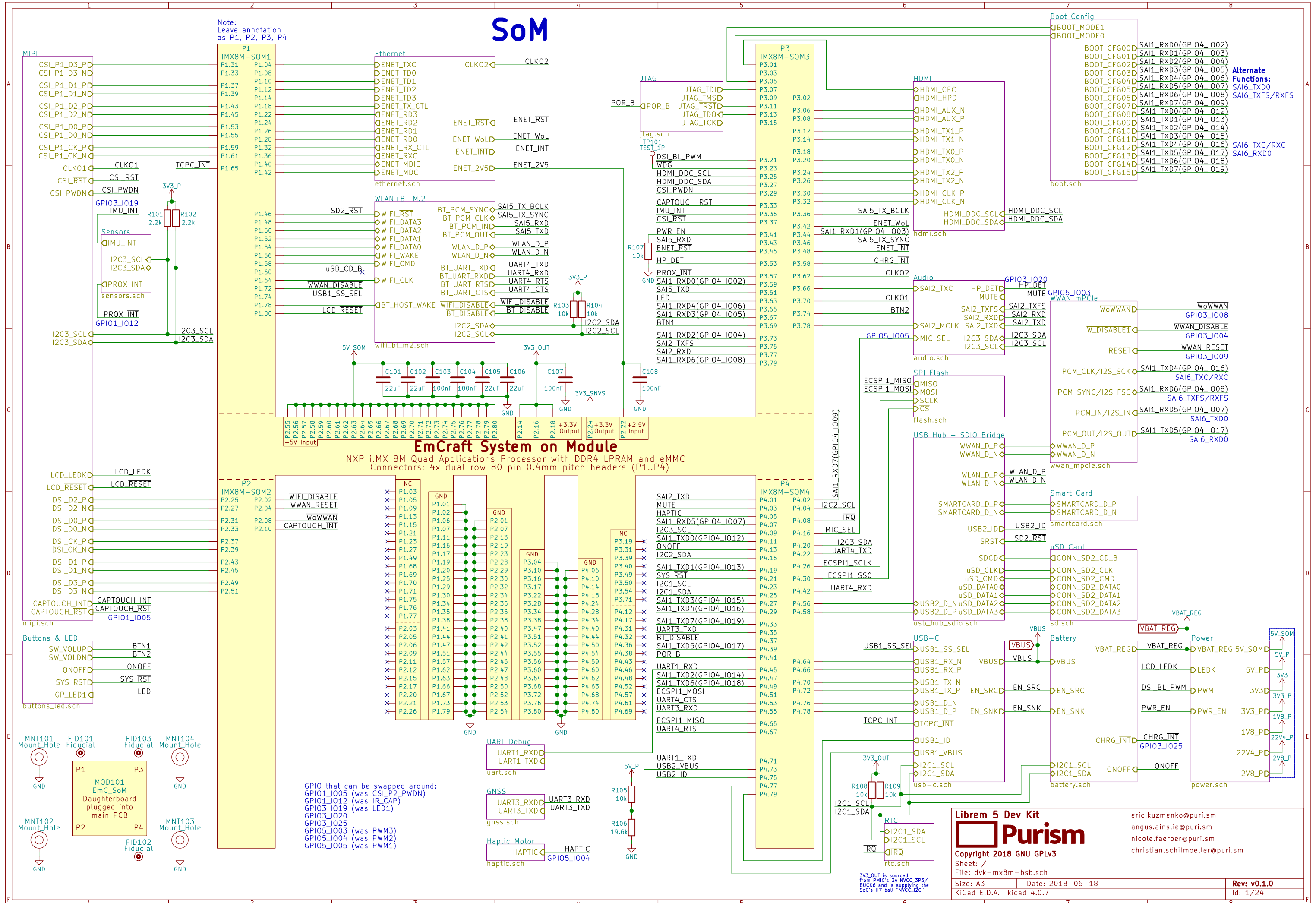


# SoM

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

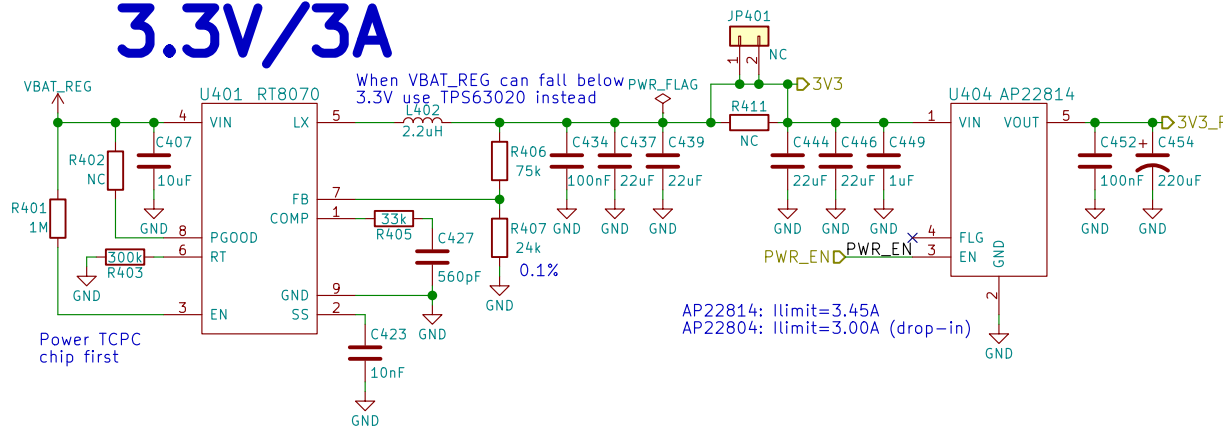


## USB-C

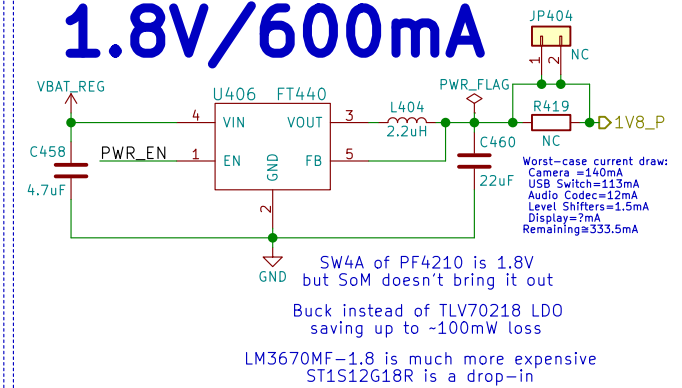


Size: A4	Date: 2018-06-18	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.7		Id: 3/24

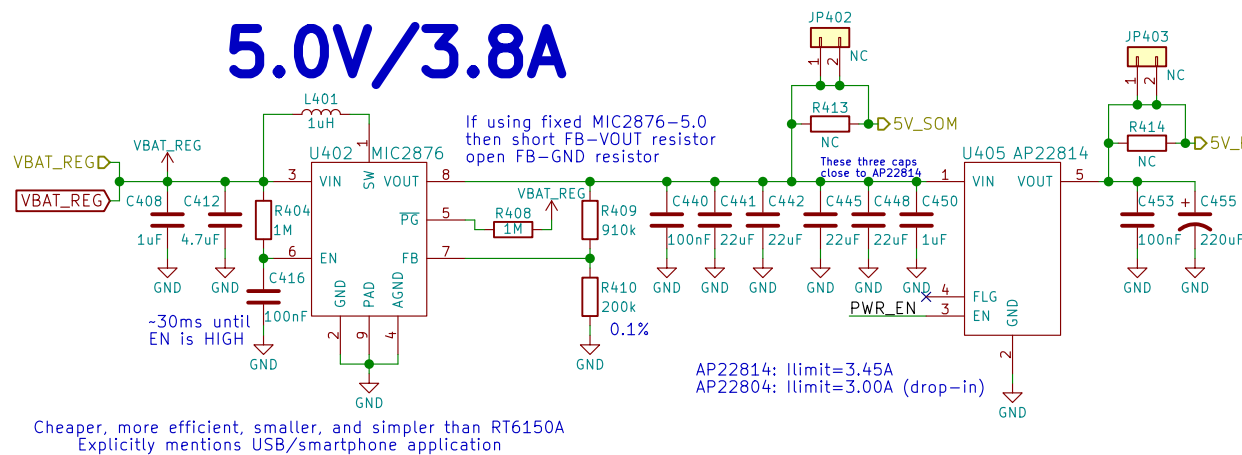
## 3.3V/3A



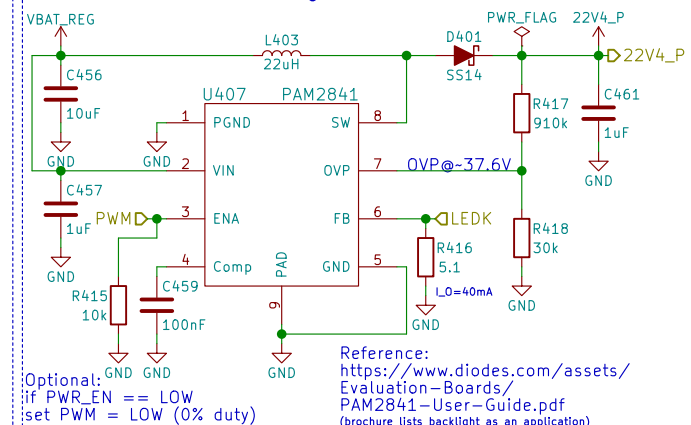
## 1.8V/600mA



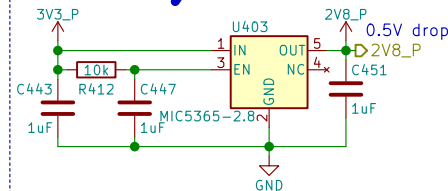
## 5.0V/3.8A



## 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 4.0.7

Date: 2018-06-18

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

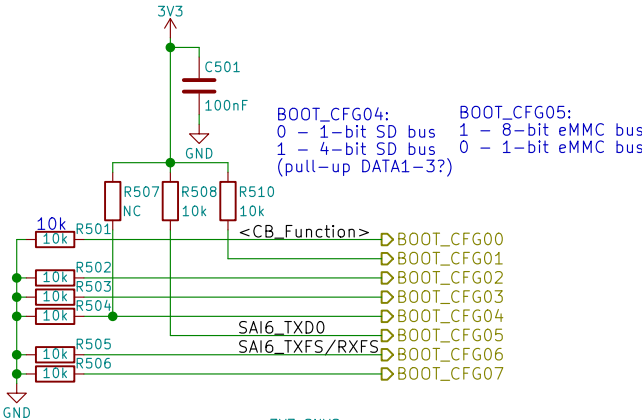
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

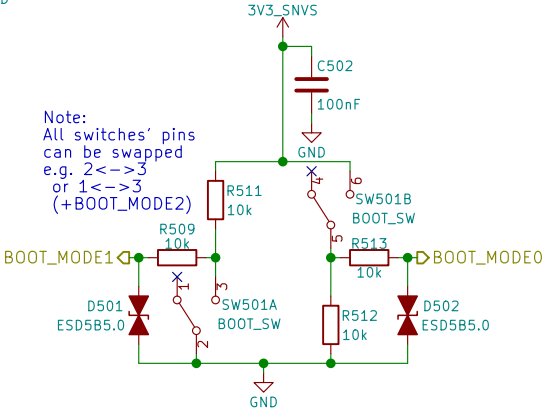
Rev: v0.1.0

Id: 4/24

# Boot Config



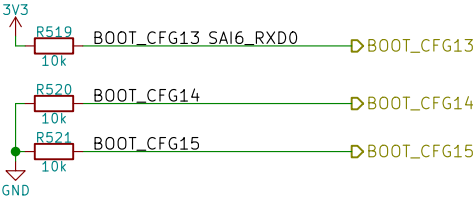
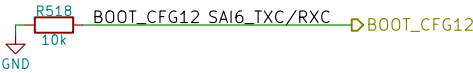
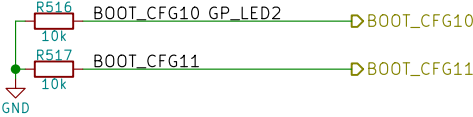
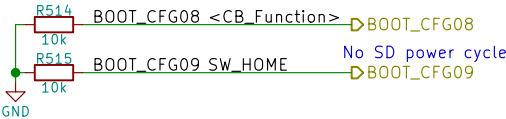
Note:  
All switches' pins  
can be swapped  
e.g. 2<->3  
or 1<->3  
(+BOOT\_MODE2)



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



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Sheet: /Boot Config/  
File: boot.sch

Size: A4  
KiCad E.D.A. kicad 4.0.7

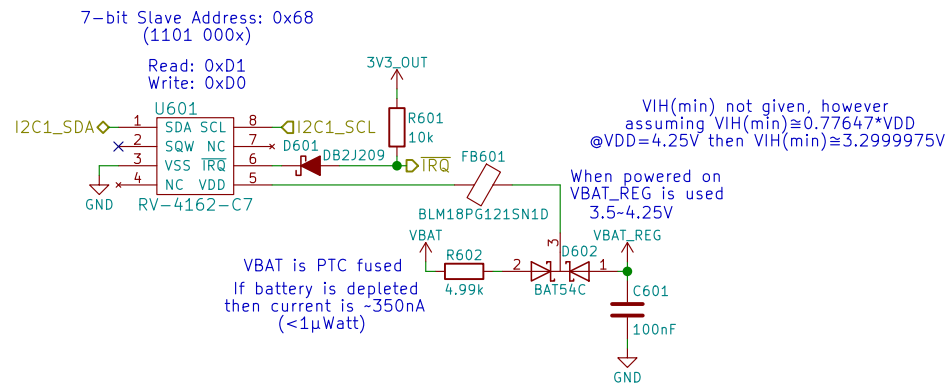
Date: 2018-06-18

Rev: v0.1.0

Id: 5/24

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

# 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



Copyright 2018 GNU GPLv3

Sheet: /RTC/

File: rtc.sch

Size: A4

Date: 2018-06-18

KiCad E.D.A. kicad 4.0.7

Rev: v0.1.0

Id: 6/24

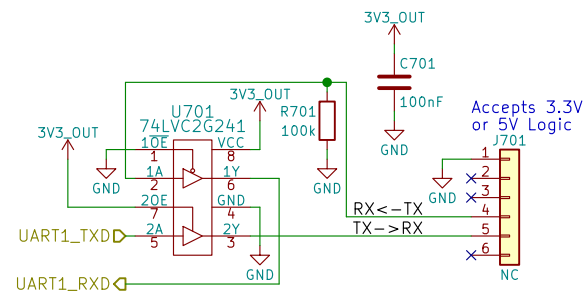
eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm

# UART Debug



## UART Debug



Copyright 2018 GNU GPLv3

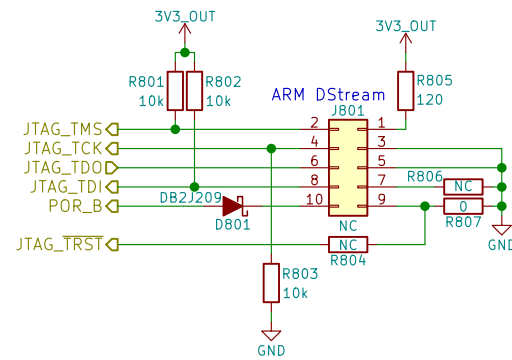
Sheet: /UART Debug/  
File: uart.sch

Size: A4 Date: 2018-06-18  
KiCad E.D.A. kicad 4.0.7

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



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Sheet: /JTAG/

File: jtag.sch

Size: A4

Date: 2018-06-18

KiCad E.D.A. kicad 4.0.7

Rev: v0.1.0

Id: 8/24

eric.kuzmenko@puri.sm

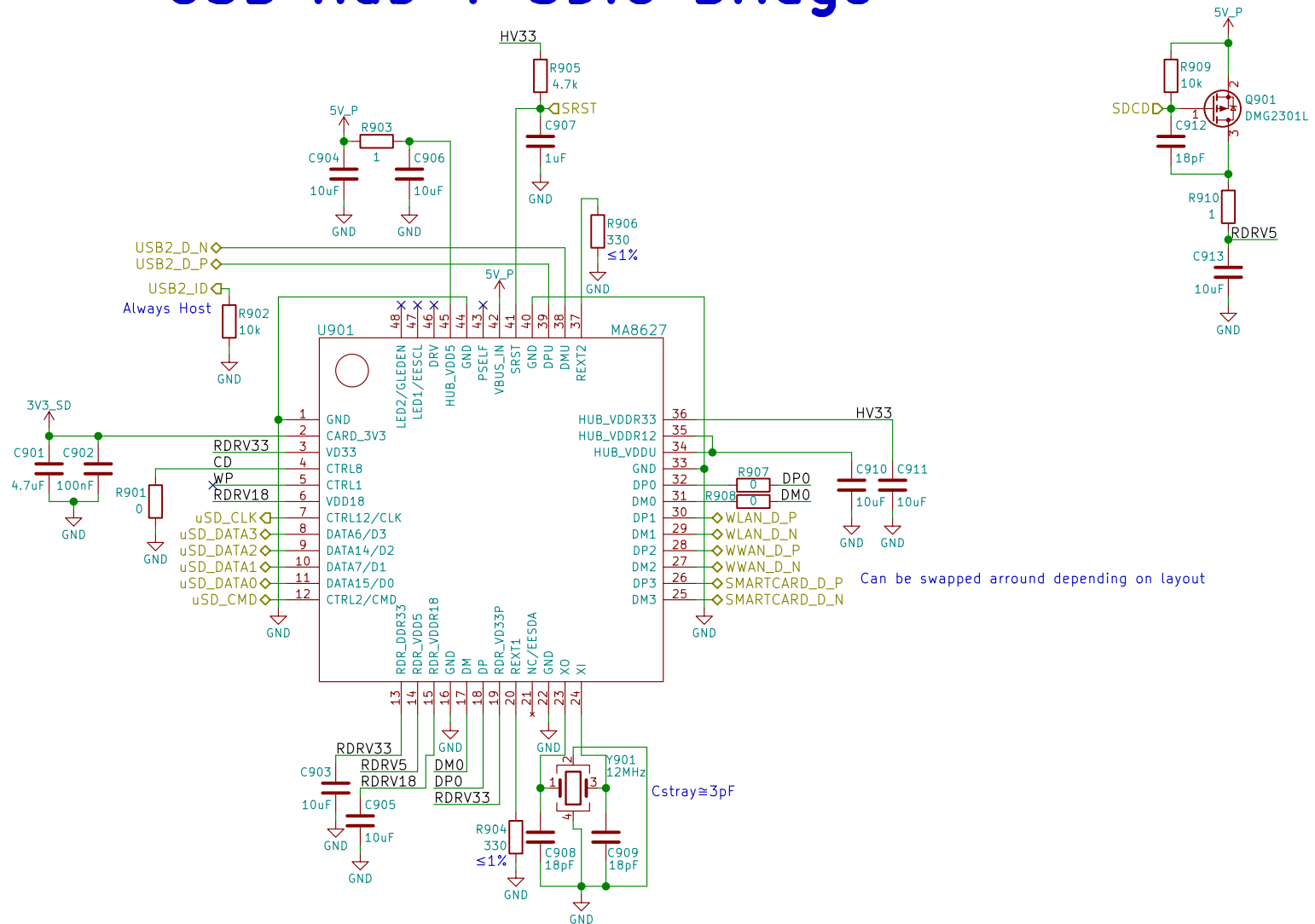
angus.ainstlie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm



# 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: 2018-06-18

KiCad E.D.A. kicad 4.0.7

eric.kuzmenko@puri.sm

angus.ainstie@puri.sm

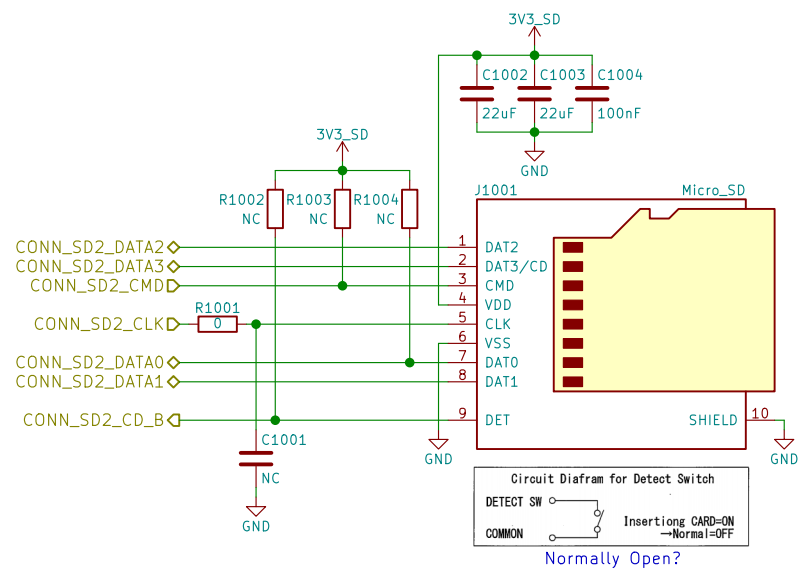
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 9/24

$\mu$ SD



uSD Card



## Purism

Copyright 2018 GNU GPLv3

Sheet: /uSD Card/

File: sd.sch

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

nicole.ferber@puri.sm

christian.schilmoeller@puri.sm

Size: A4

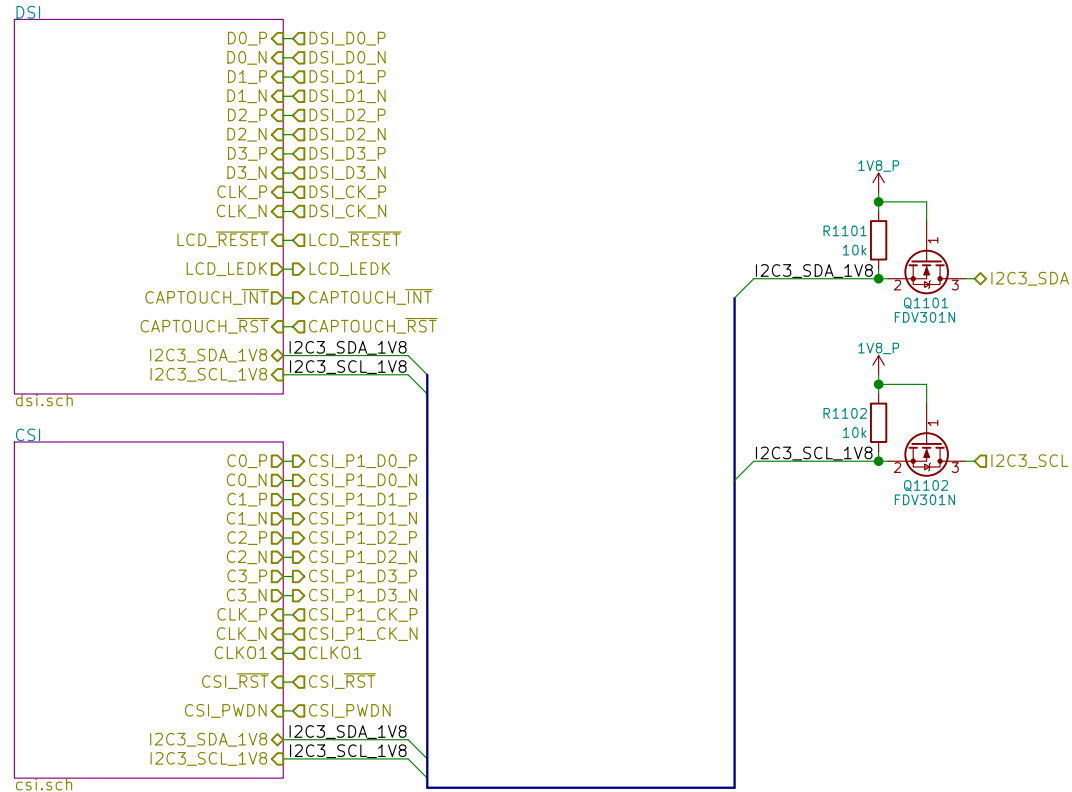
Date: 2018-06-18

Rev: v0.1.0

Size: A4	Date:
KiCad E.D.A.	kicad 4.0.7

Id: 10/24

# MIPI



MIPI



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Sheet: /MIPI/  
File: mipi.sch

Size: A4 Date: 2018-06-18  
KiCad E.D.A. kicad 4.0.7

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

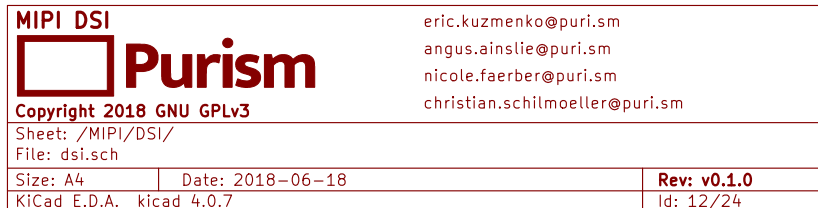
Rev: v0.1.0  
Id: 11/24

## A

B

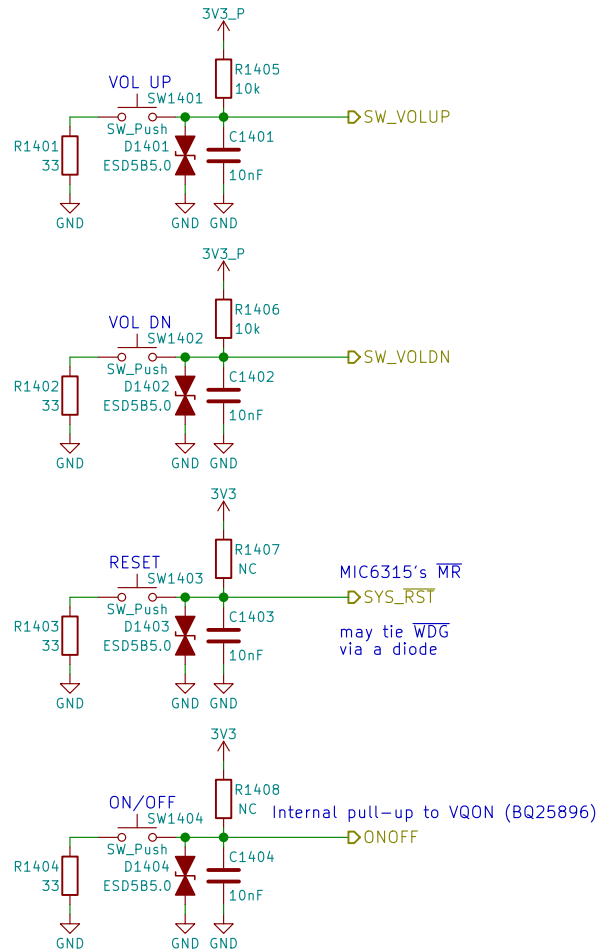
C

D



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

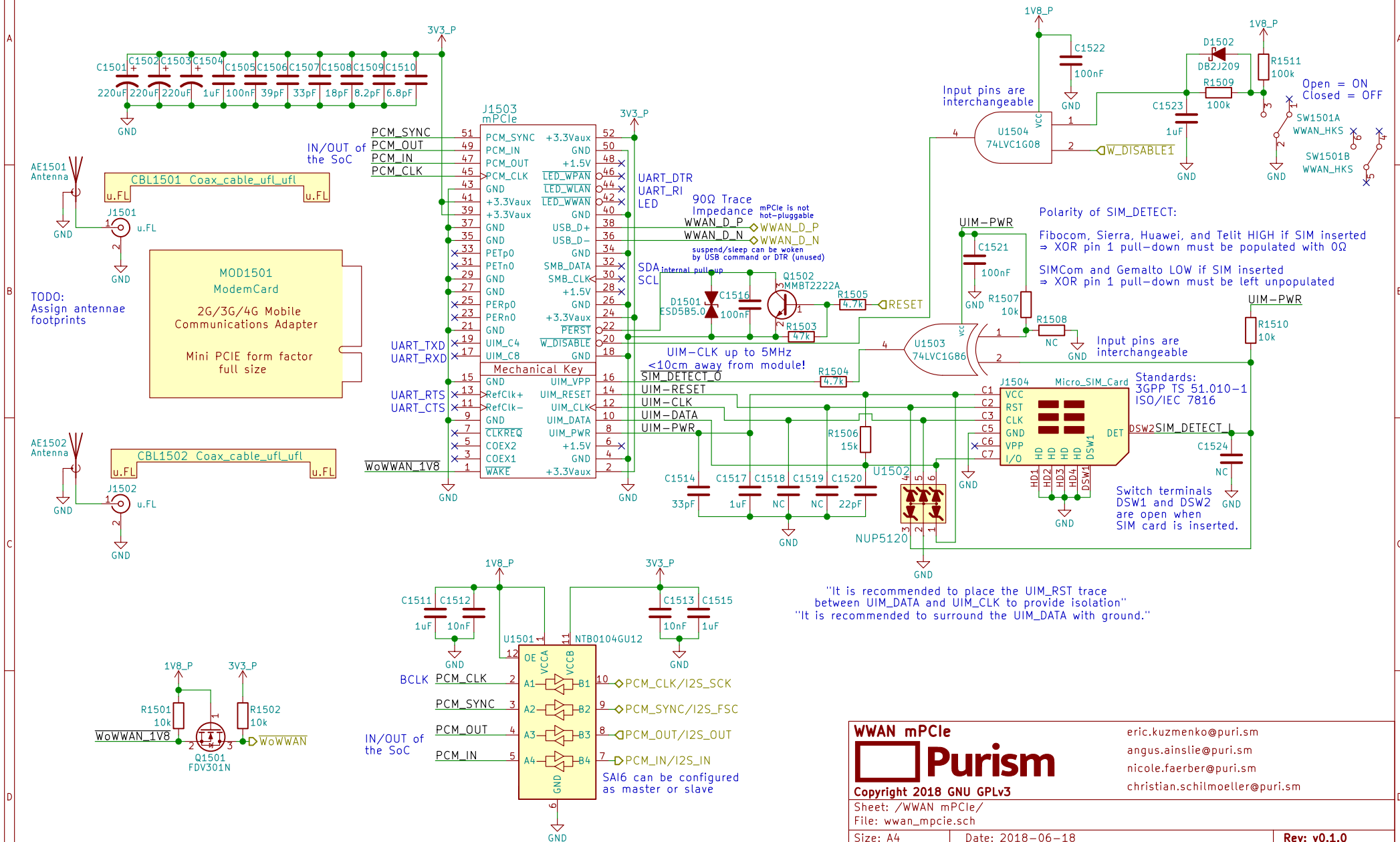
Sheet: /Buttons & LED/  
File: buttons\_led.sch

Size: A4 Date: 2018-06-18  
KiCad E.D.A. kicad 4.0.7

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

Rev: v0.1.0  
Id: 14/24

# WWAN mPCle



WWAN mPCIe



Copyright 2018 GNU GPLv3

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

Size: A4	Date:
----------	-------

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

nicole.faerber@puri.sm

christian.schilmoeller@puri.sm

Date: 2018-06-18

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-cre>  
 (Nit6 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



Pin 5 (tip switch) is NC, open when inserted  
 If just headphones then HP\_DET=HIGH, R(mic)=0  
 may add ~220uF cap parallel to Zener

Ext-Mic enabled MIC\_SEL=HIGH  
 Int-Mic enabled MIC\_SEL=LOW  
 Add TVS next to int-mic? (OpenMoko does this)  
 $-37dB = 14.1254mV/Pa$   
 $\therefore \text{mic produces } 14.1254mV_{rms} \text{ when exposed to a } 1kHz \text{ tone of } 94dB-SPL \text{ at the capsule (or } 19.98mV \text{ amplitude)}$   
 $\Rightarrow 40dB \text{ gain would produce } -2V \text{ amplitude (4Vpp, clipping)}$   
 $30dB \text{ gain would produce } -0.632V \text{ amplitude (1.264Vpp)}$   
 $38.33dB \text{ gain would yield } 3.3V_{pp}$

SW Mute Mic: MUTE\_ADC=1

MIC\_IN

MIC\_BIAS

C1619

1uF

GND

C1620

100nF

GND

FB1608

BLM18KG601SZ1D

GND

C1622

270pF

GND

SW1301B

MIC\_CAM\_HKS

DPDT with camera

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4

or 5<->6

(+camera)

## 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

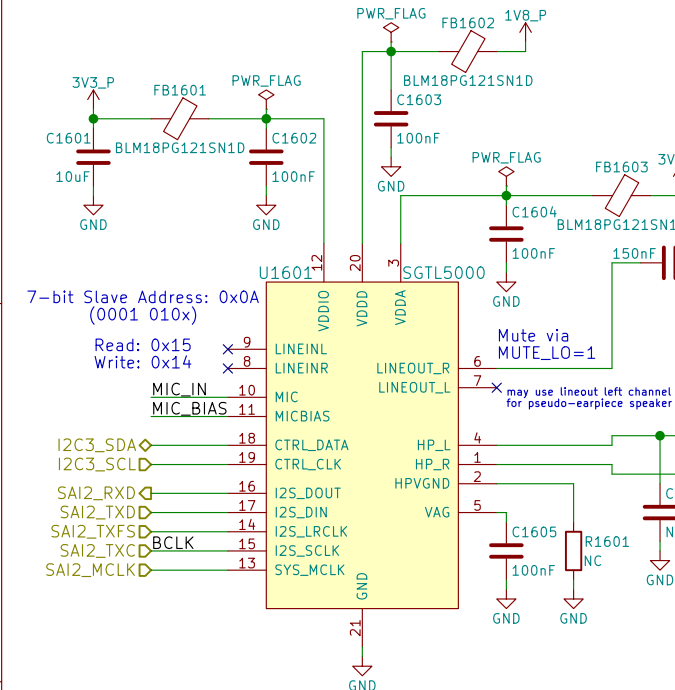
Cs = 1.0mF

Cp = 81.95nF

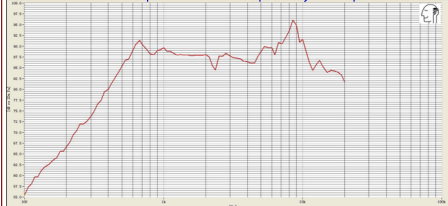
Rs = 17.0300hms

Rp = 17.0340hms

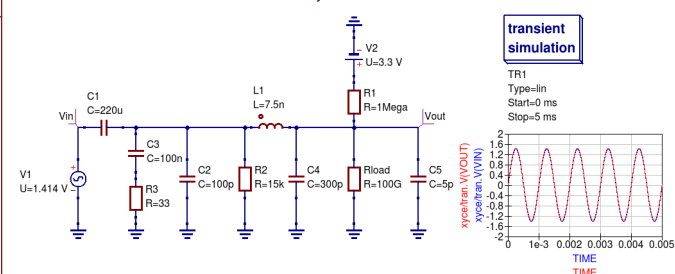
θ = 0.5deg



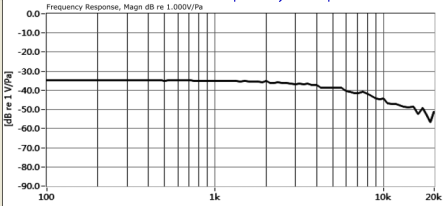
## Built-In Speaker's Frequency Response:



Simulation of HP\_DET @ 1kHz output without HP jack inserted:



## Built-In Mic's Frequency Response:



## Audio

**Purism**

Copyright 2018 GNU GPLv3

Sheet: /Audio/  
 File: audio.sch

Size: A4

KiCad E.D.A. kicad 4.0.7

Date: 2018-06-18

Rev: v0.1.0

Id: 16/24

eric.kuzmenko@puri.sm

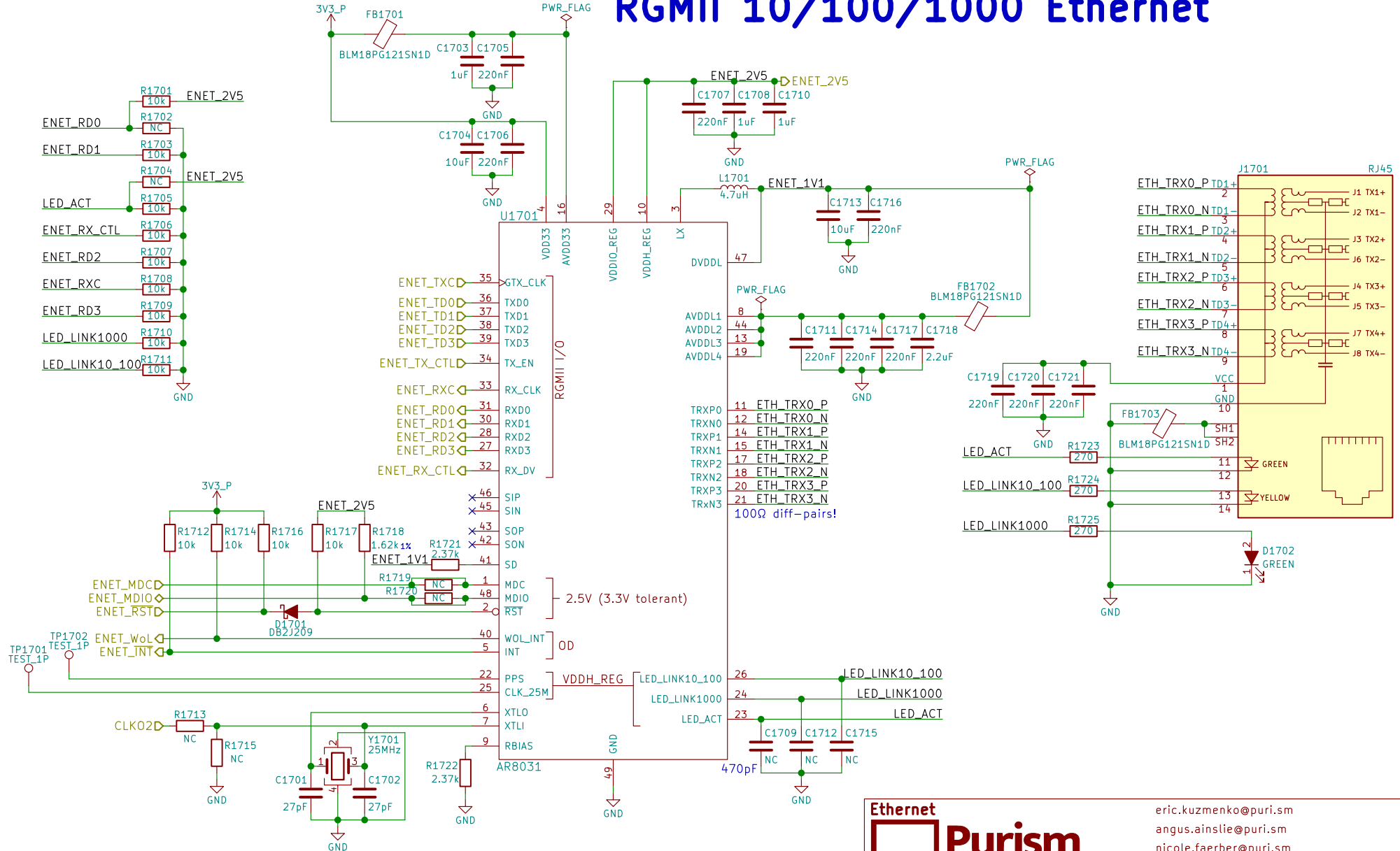
angus.ainslie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm



# RGMII 10/100/1000 Ethernet



Ethernet

**Purism**

Copyright 2018 GNU GPLv3

Sheet: /Ethernet/  
File: ethernet.sch

Size: A4 Date: 2018-06-18  
KiCad E.D.A. kicad 4.0.7

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 17/24

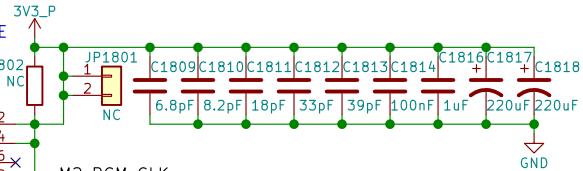
# WLAN+BT M.2

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

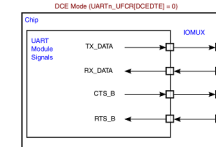
RS9116 datasheet says  
no WIFI\_WAKE  
but the schematic has it

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

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



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

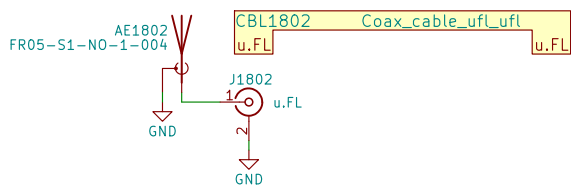
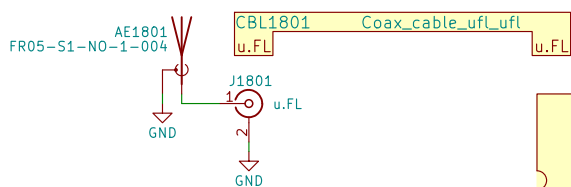


TX output  
RX input  
CTS output  
RTS input  
⇒ TX→RX  
RX→TX  
CTS→CTS  
RTS→RTS

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

TODO:  
Assign antennae  
footprints



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  
74LVC2G08  
U1803B  
74LVC2G08

BT\_DISABLE  
WIFI\_DISABLE

1V8\_P  
3V3\_P  
GND

R1804  
10k  
Q1801  
FDV301N

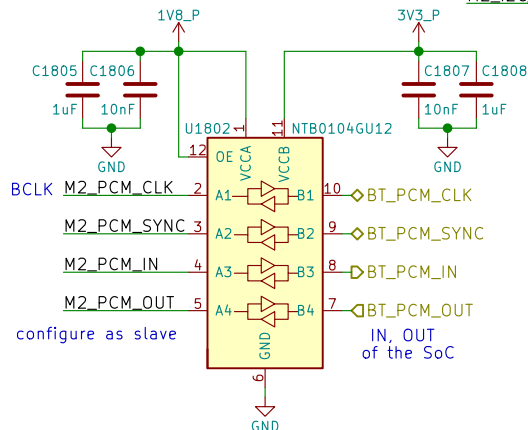
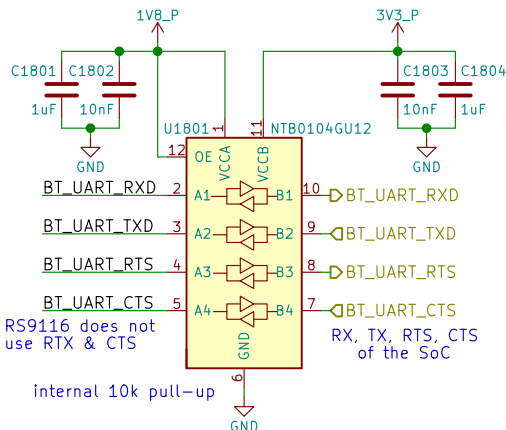
M2\_I2C\_SDA  
M2\_I2C\_SCL

I2C2\_SDA  
I2C2\_SCL

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

1V8\_P  
3V3\_P  
GND

R1806  
10k  
Q1802  
FDV301N



WLAN+BT M.2  
**Purism**

Copyright 2018 GNU GPLv3

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

Size: A4  
KiCad E.D.A. kicad 4.0.7

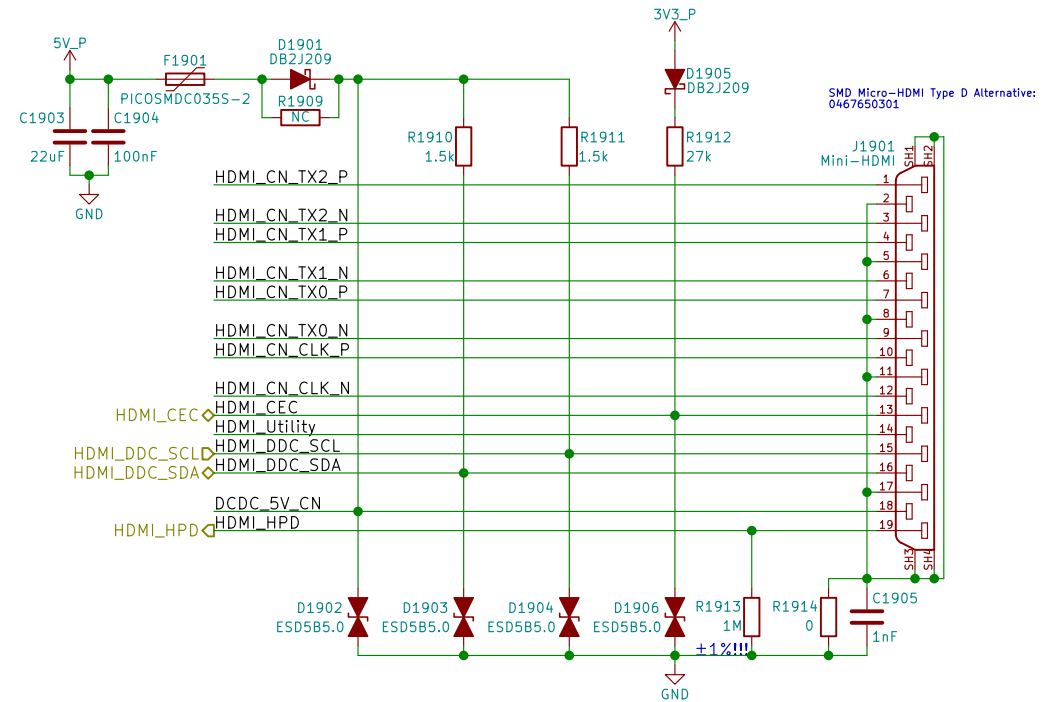
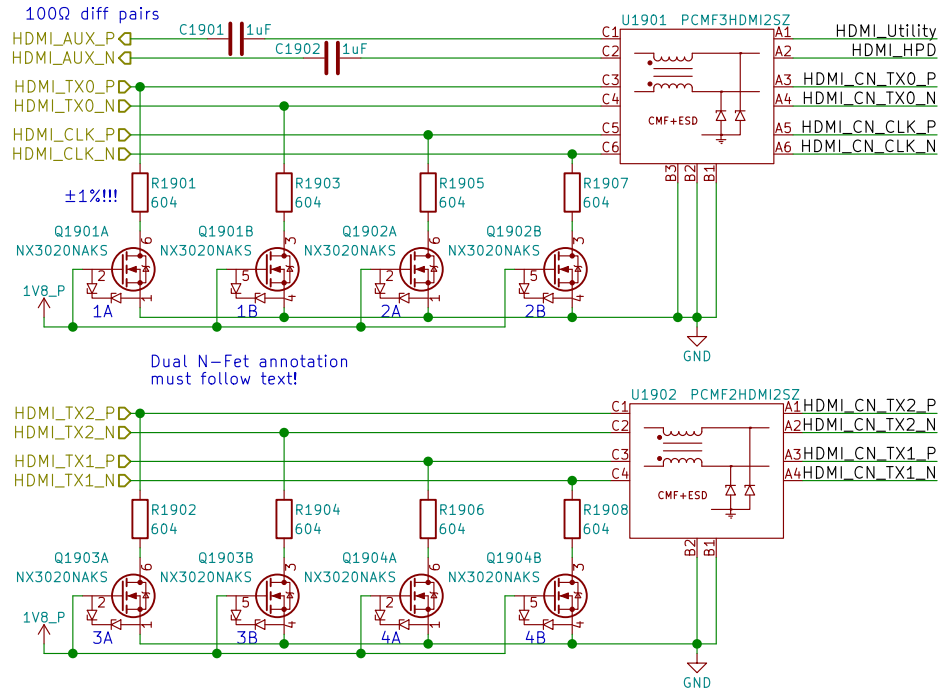
eric.kuzmenko@puri.sm  
angus.ainslie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 18/24

TUSB1046 can be used for DP over USB-C

# HDMI

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: 2018-06-18  
KiCad E.D.A. kicad 4.0.7

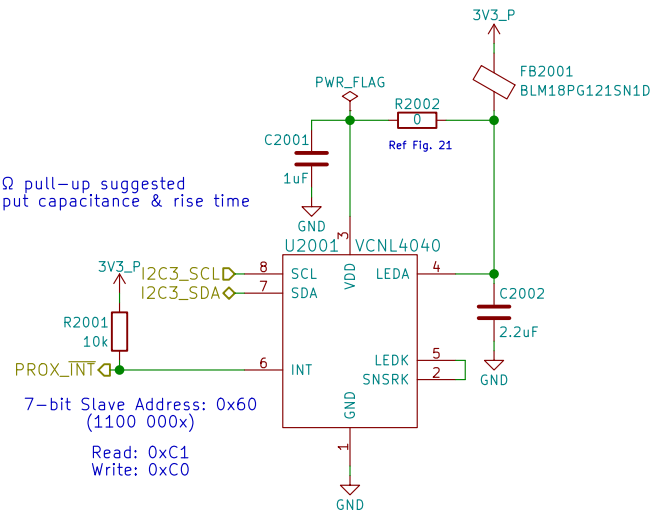
eric.kuzmenko@puri.sm  
angus.ainstie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 19/24

# Sensors

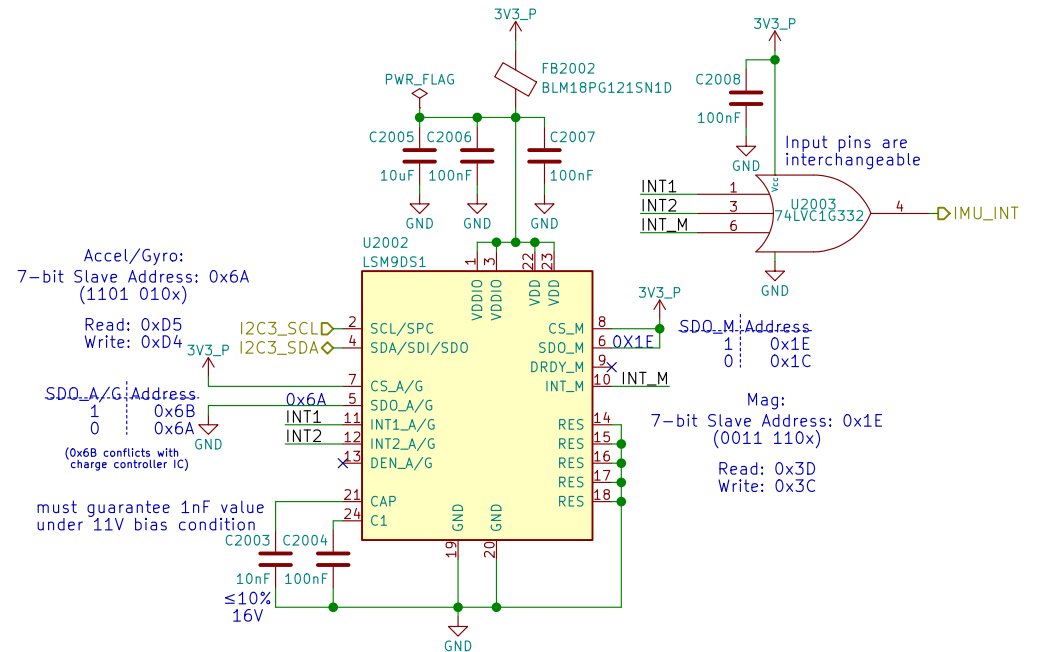
## Proximity & Ambient Light

Note:  
I2C 2.2kΩ 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: 2018-06-18

KiCad E.D.A. kicad 4.0.7

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: 2018-06-18

KiCad E.D.A. kicad 4.0.7

eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 21/24

[illegible]

## Smart Card



eric.kuzmenko@puri.sm  
angus.ainslie@puri.sm  
nicole.faeber@puri.sm  
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/

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KiCad E.D.A. kicad 4.0.7

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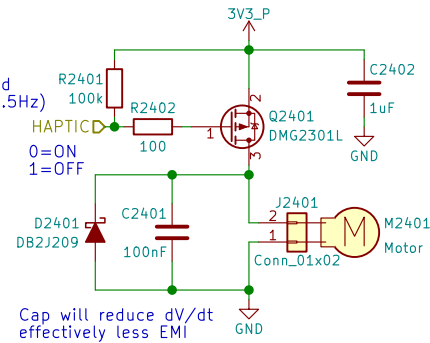
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# Haptic Motor

PWM pins occupied:  
 GPIO1\_I001 - LCD Backlight  
 GPIO1\_I013 - LED  
 GPIO1\_I014 - Ethernet (CLK0\_25MHz)  
 GPIO1\_I015 - CSI (CLK02)

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)

Cap will reduce dV/dt  
 effectively less EMI

Haptic/Vibration Motor



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