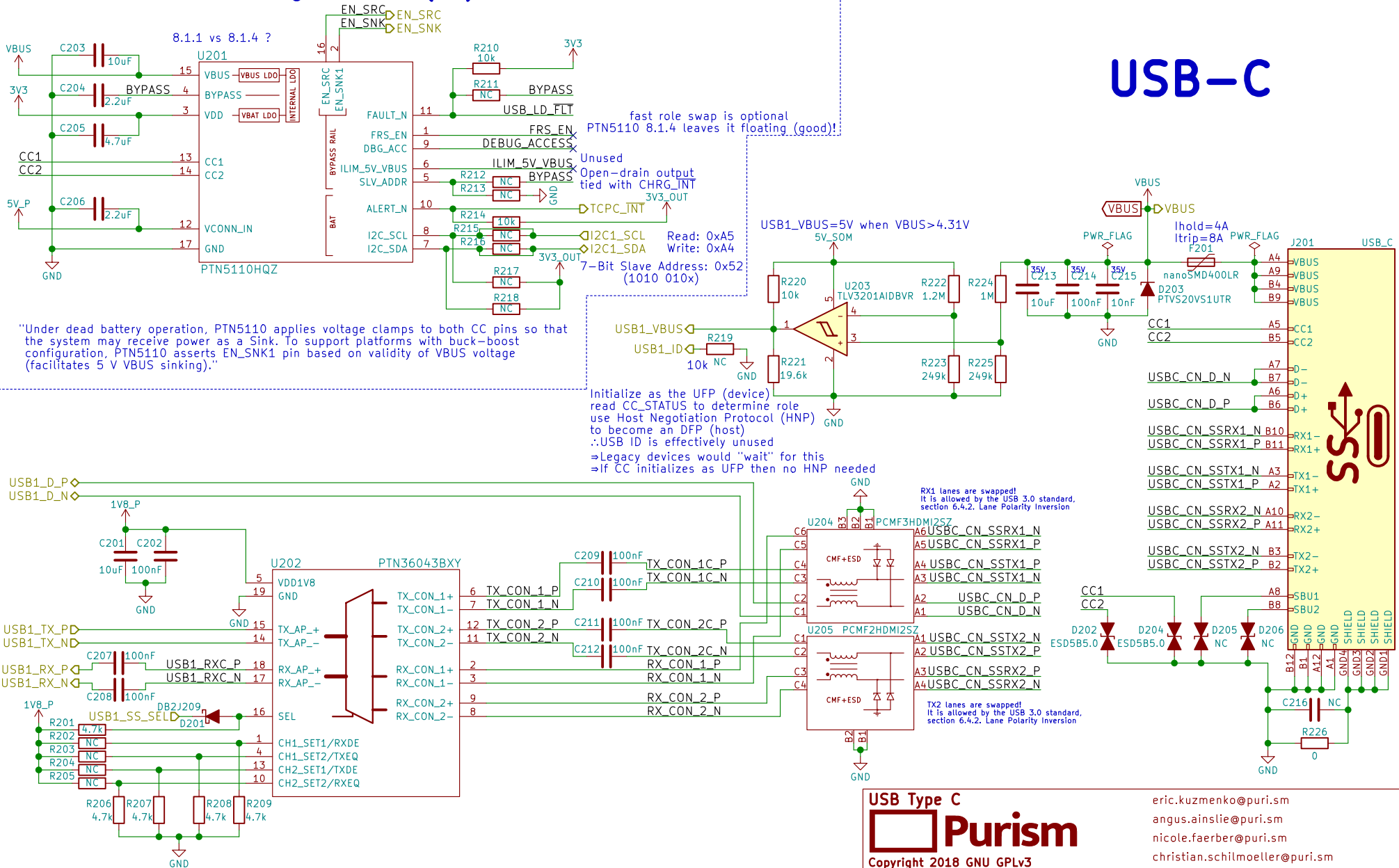


USB-C TCPC – Config Channel (CC) and PD Role Controller

USB-C





(interpret RSOC% based on this plot)

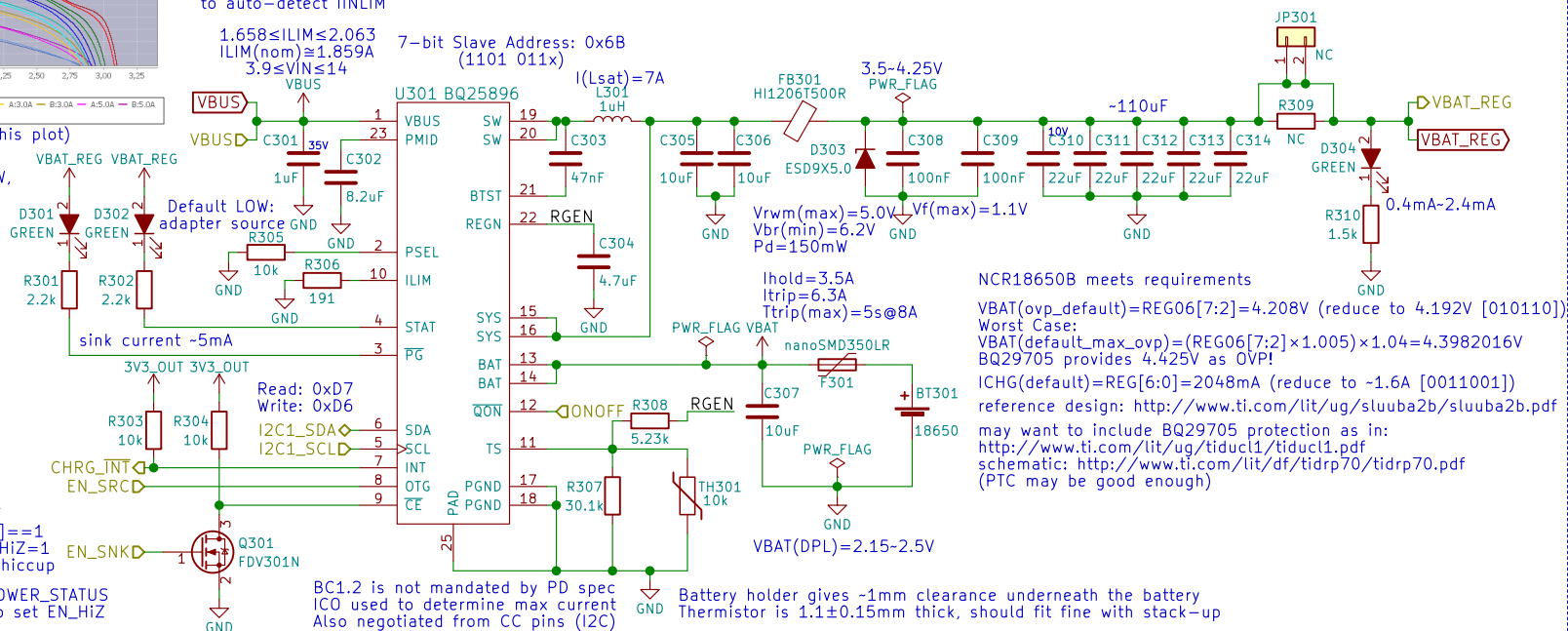
Drawing ~320mA, or consuming $\leq 1.152W$, should give close to 10 hours going from 100% to 0% charge

use AUTO_DPDM_EN to auto-detect IINLIM

$1.658 \leq I_{LIM} \leq 2.063$
 $I_{LIM}(nom) \approx 1.859A$
 $3.9 \leq V_{IN} \leq 14$

7-bit Slave Address: 0x6B (1101 011x)

Battery Charge Controller



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]×1.005)×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)

Reading PTN5110HQ's CC_STATUS and POWER_STATUS registers will tell TCPM (i.MX8M) when to set EN_HI_Z

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 gives ~1mm clearance underneath the battery
 Thermistor is 1.1±0.15mm thick, should fit fine with stack-up

Battery holder seems to fit up to ~68.88mm long batteries
 need to test 18650 protected cells which are ~69.35mm long

Battery

Purism

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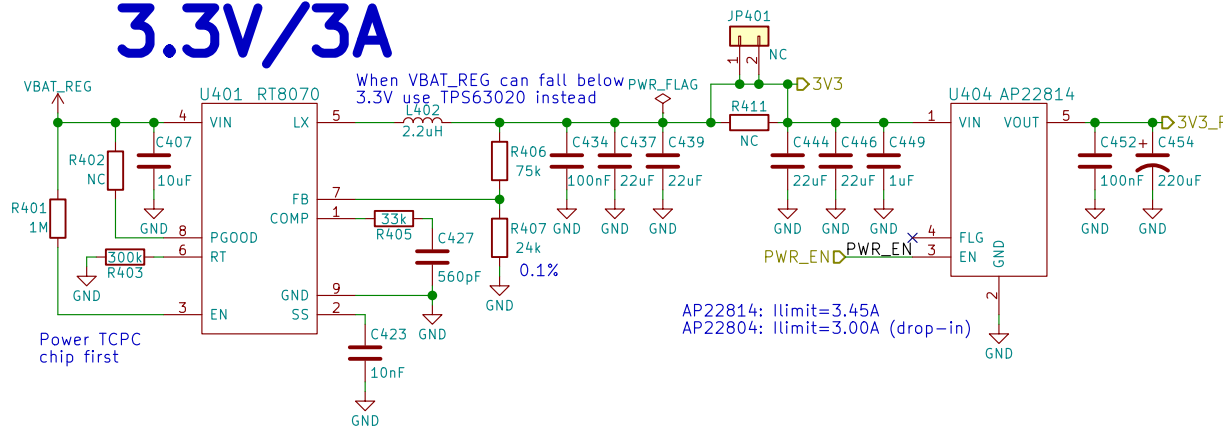
Sheet: /Battery/
 File: battery.sch

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

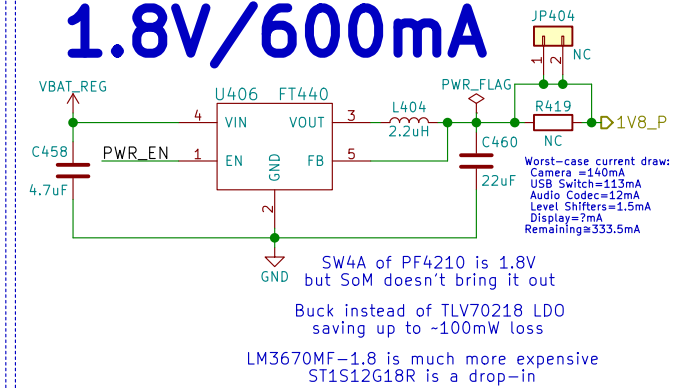
eric.kuzmenko@puri.sm
 angus.ainslie@puri.sm
 nicole.farber@puri.sm
 christian.schilmoeller@puri.sm

Rev: v0.1.0
 Id: 3/24

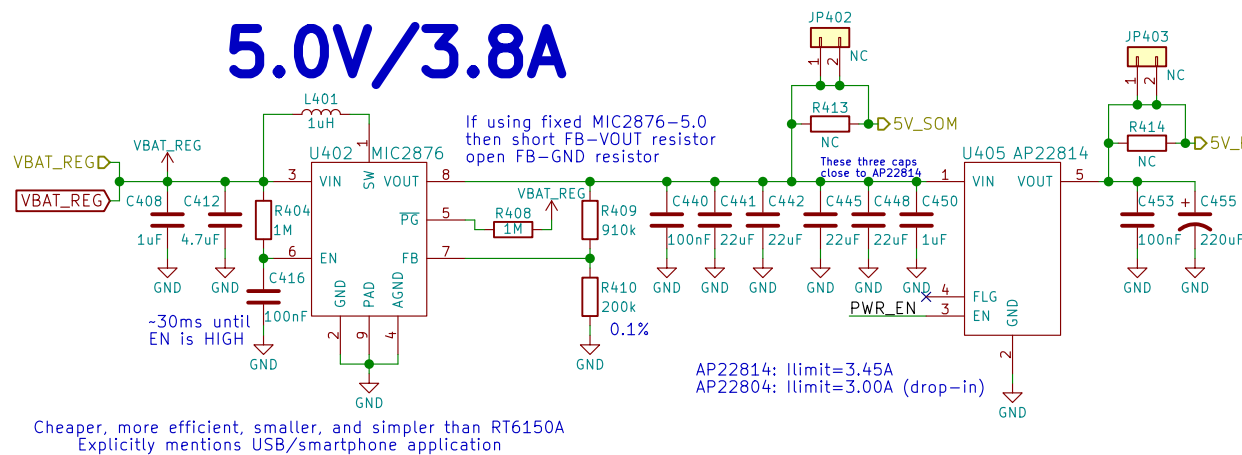
3.3V/3A



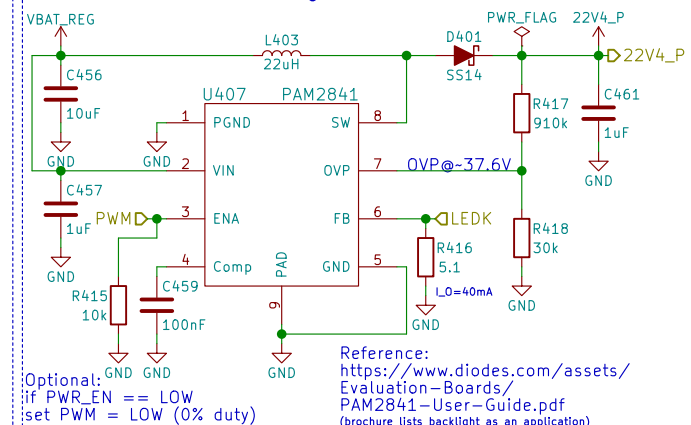
1.8V/600mA



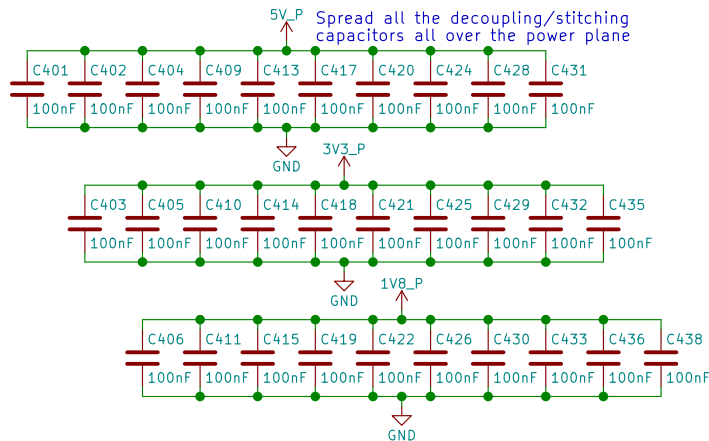
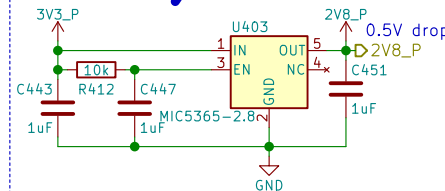
5.0V/3.8A



22.4V/40mA



2.8V/150mA



Power

Power



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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

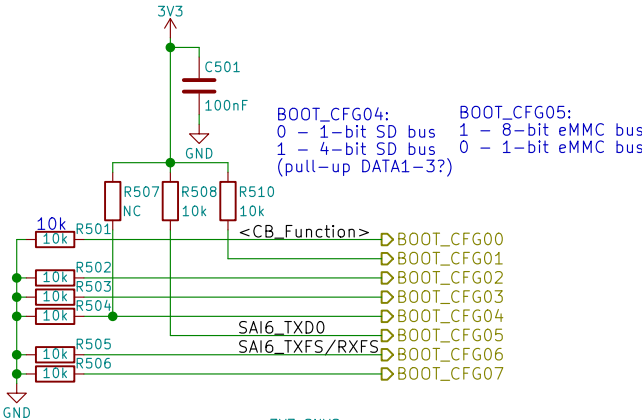
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

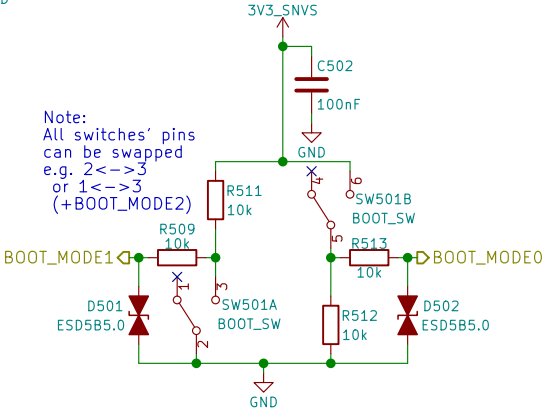
Rev: v0.1.0

Id: 4/24

Boot Config

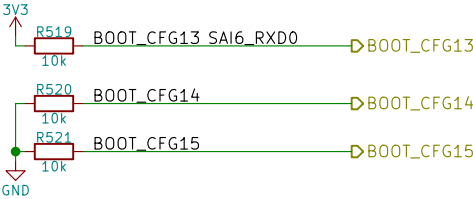
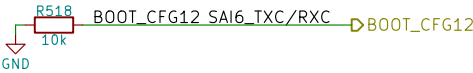
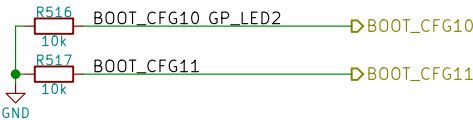
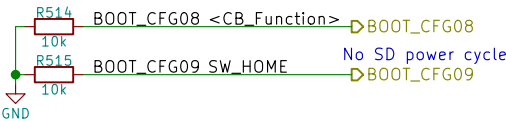


Note:
All switches' pins
can be swapped
e.g. 2<->3
or 1<->3
(+BOOT_MODE2)




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 ¹	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

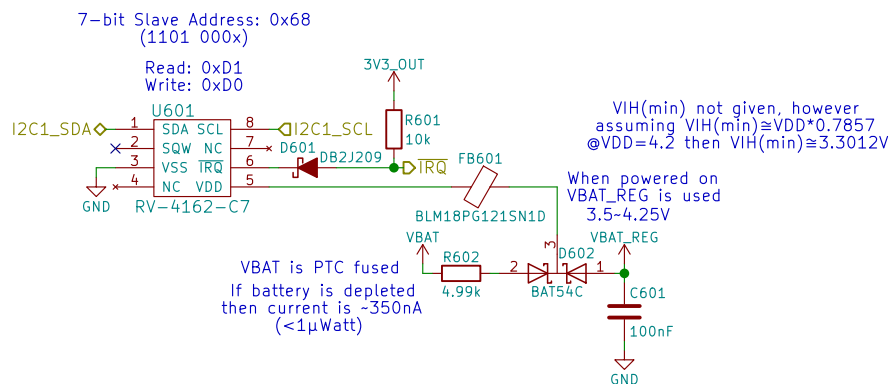
Size: A4
KiCad E.D.A. kicad 4.0.7

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

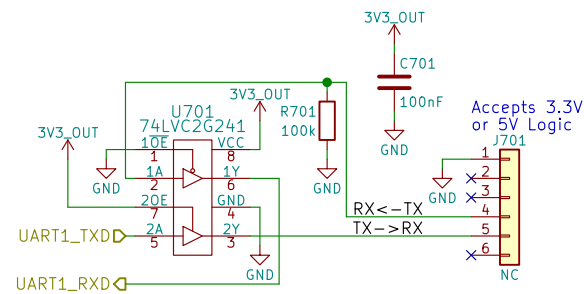


Note:
Datasheet says slave address is 0xD0
with a R/W bit appended, since 0xD0 must
be 4-bits wide the actual 7-bit address is
0x68 (110 1000), and becomes 0xD0 during a
write operation (1101 0000)

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

<div> <div>RTC</div> <div>  <div>Purism</div> </div> </div> <div> <p>Copyright 2018 GNU GPLv3</p> <p>Sheet: /RTC/ File: rtc.sch</p> <table border="1"> <tr> <td>Size: A4</td> <td>Date: 2018-06-18</td> <td>Rev: v0.1.0</td> </tr> <tr> <td>KiCad E.D.A. kicad 4.0.7</td> <td></td> <td>Id: 6/24</td> </tr> </table> </div>	Size: A4	Date: 2018-06-18	Rev: v0.1.0	KiCad E.D.A. kicad 4.0.7		Id: 6/24	<div> <div>eric.kuzmenko@puri.sm</div> <div>angus.ainslie@puri.sm</div> <div>nicole.fauber@puri.sm</div> <div>christian.schilmoeller@puri.sm</div> </div>
Size: A4	Date: 2018-06-18	Rev: v0.1.0					
KiCad E.D.A. kicad 4.0.7		Id: 6/24					

UART Debug



UART Debug



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Sheet: /UART Debug/

File: uart.sch

Size: A4

Date: 2018-06-18

KiCad E.D.A. kicad 4.0.7

Rev: v0.1.0

Id: 7/24

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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

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USB Hub + SDIO Bridge

USB Hub + SDIO Bridge

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USB Hub + SDIO Bridge

Purism

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Sheet: /USB Hub + SDIO Bridge/
File: usb_hub_sdio.sch

Size: A4	Date: 2018-06-18	Rev: v0.1.0
KiCad E.D.A.	kicad 4.0.7	Id: 9/24

 Purism

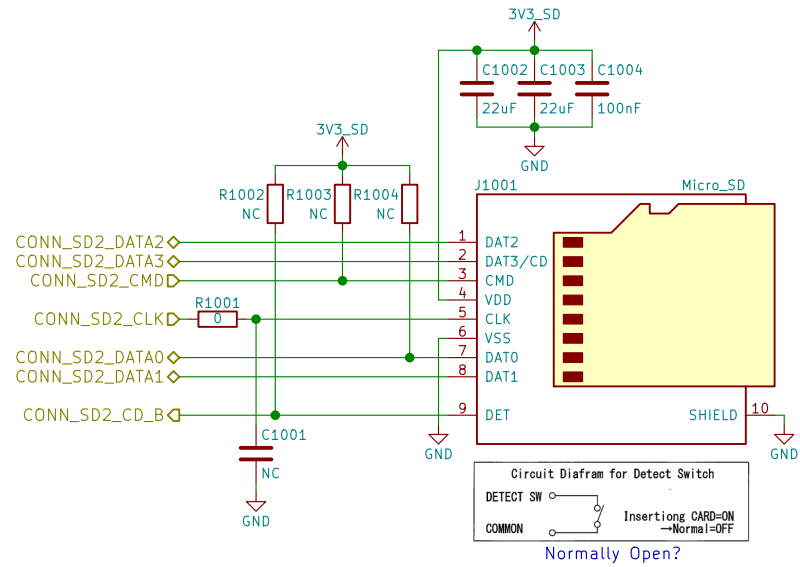
Sheet: /USB Hub + SDIO Bridge/
File: usb_hub_sdio.sch

SIZE: A1	DATE:
KiCad E.D.A.	kicad 4.0.7

christian.schilmeoller@uni-siegen.de

Id: 9/24

μSD



uSD Card



Purism

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Sheet: /uSD Card/
File: sd.sch

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

nicole.faerber@puri.sm

christian.schilmoeller@puri.sm

Size: A4

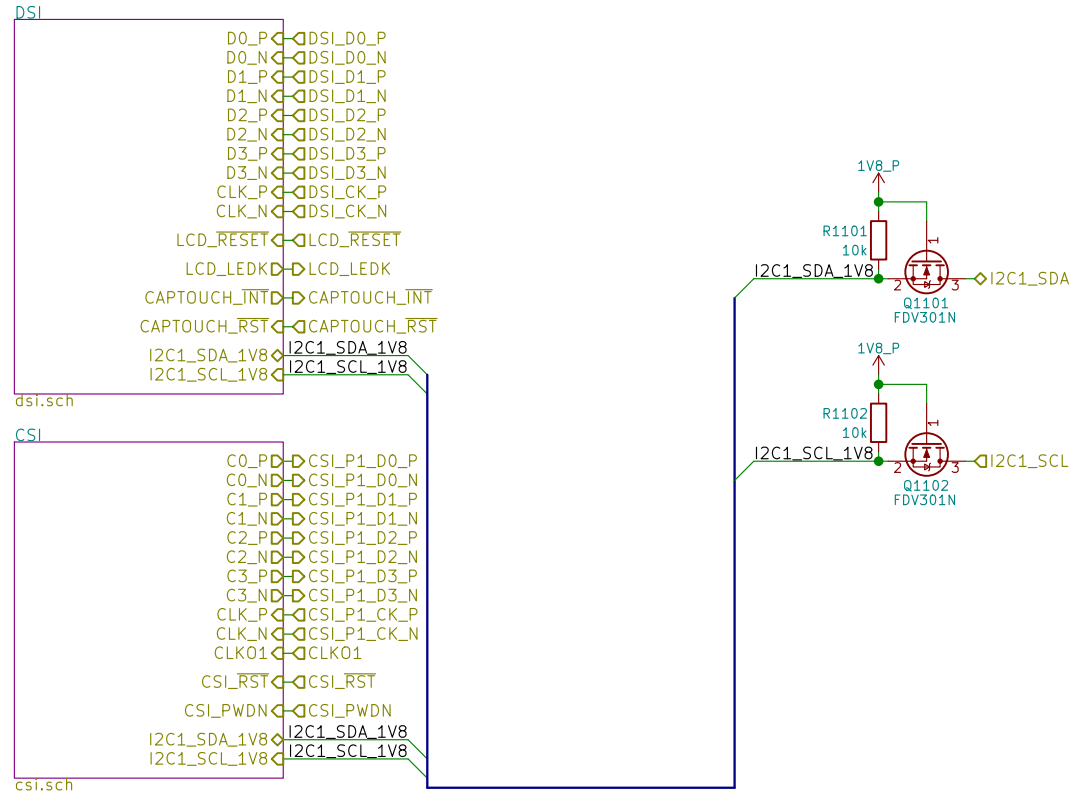
Date: 2018-06-18

Rev: v0.1.0

KiCad E.D.A.	kiCad 4.0.7
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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

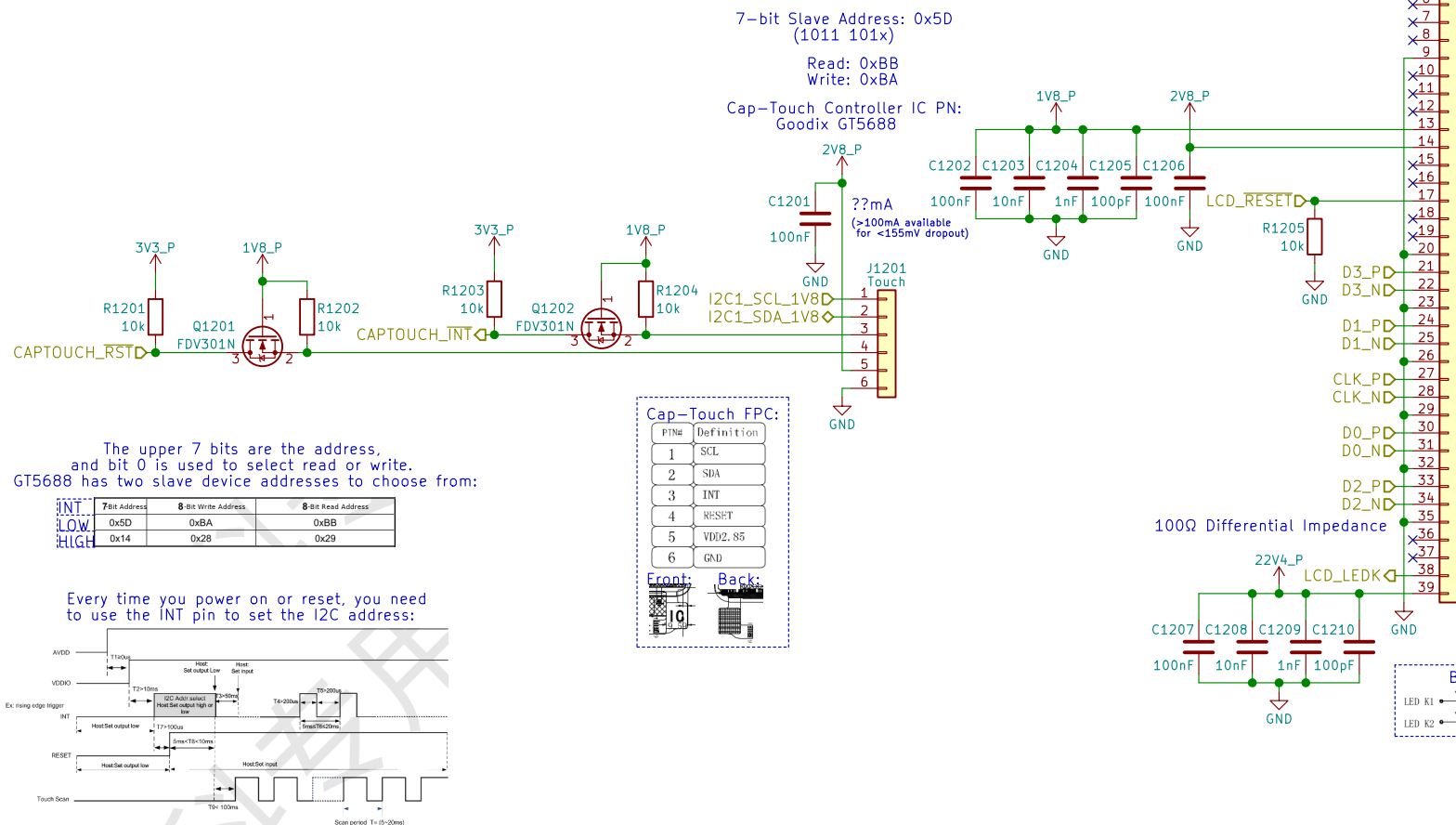
christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 11/24

Display & Touch Controller

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



Display_JH057N00900

DISP1201

5.7 "
RGB
720 x 1440
pixels

FPC6
Touch

FPC39
Display +
Backlight

DSI FPC:
Front: Back:

Backlight Array:

LED K1 LEDA1
LED K2 LEDA2

MIPI DSI

Purism

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Sheet: /MIPI/DSI/
File: dsi.sch

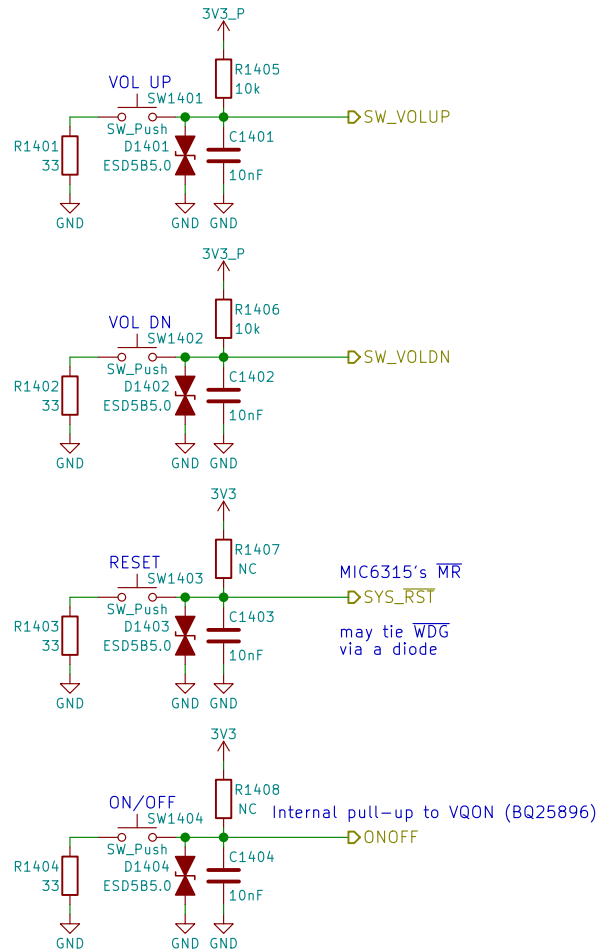
Size: A4 Date: 2018-06-18
KiCad E.D.A. kicad 4.0.7

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

Rev: v0.1.0
Id: 12/24

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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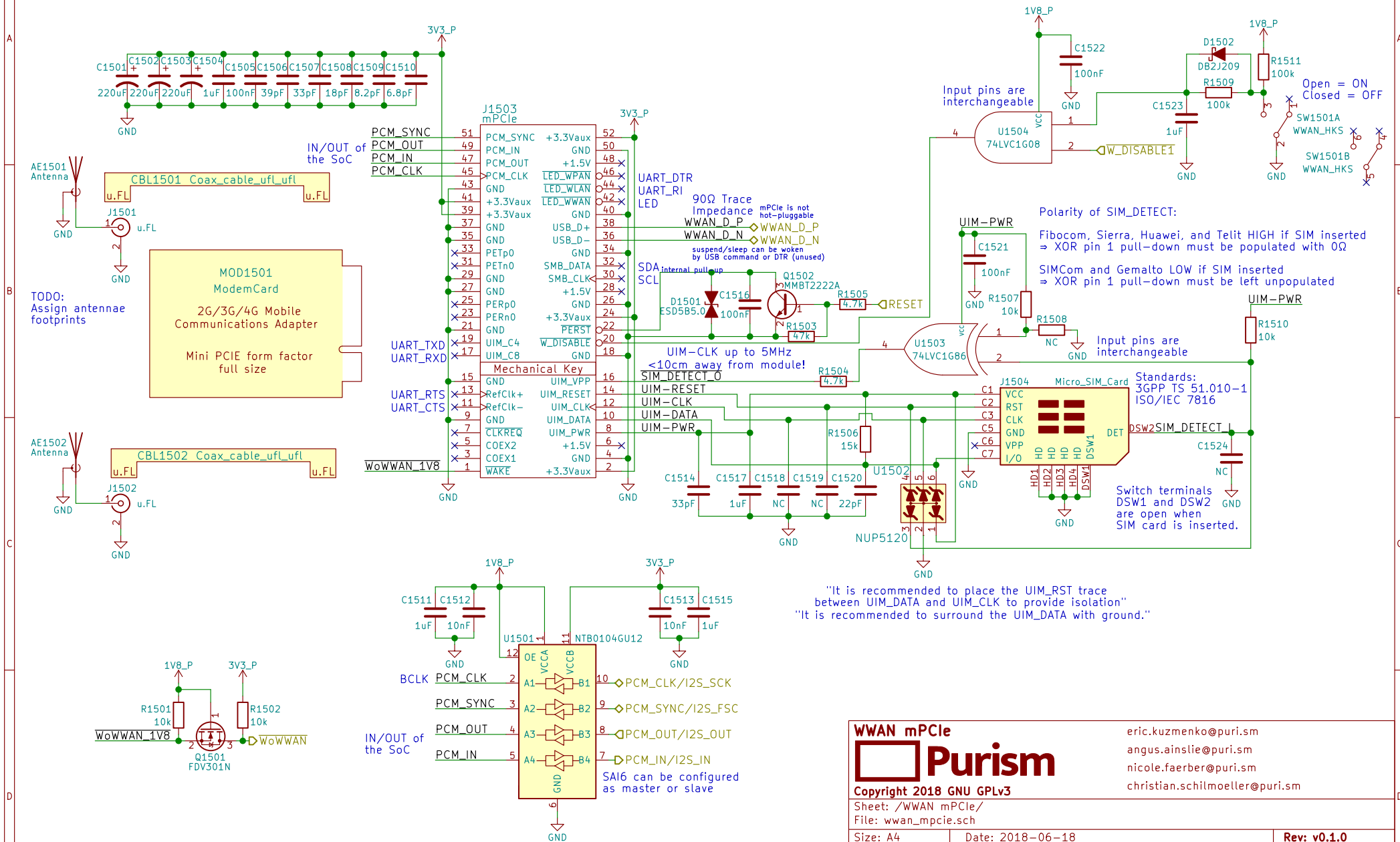
Sheet: /Buttons & LED/
File: buttons_led.sch

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

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

Rev: v0.1.0
Id: 14/24

WWAN mPCle



WWAN mPCIe



Purism

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Sheet: /WWAN mPCIe/

File: wwan_mpcie.sch

Size: A4	Date: 2018-06-18
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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.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)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

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5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

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5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

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5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

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5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

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5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

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5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

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5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

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5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

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5->6 = OFF

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e.g. 5<->4 or 5<->6 (+camera)

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5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

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5->4 = ON

5->6 = OFF

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5->6 = OFF

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e.g. 5<->4 or 5<->6 (+camera)

Note:

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5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<->4 or 5<->6 (+camera)

Note:

5->4 = ON

5->6 = OFF

All switches' pins can be swapped

e.g. 5<-

[illegible]

 Purism

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christian.schilmoeller@puri.sm

Rev: v0.1.0
Id: 17/24

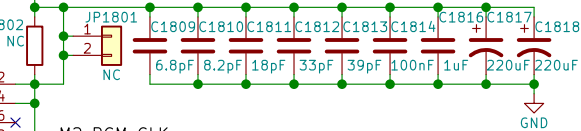
WLAN+BT M.2

RS9116 NC:
RTS, CTS, BT_HOST_WAKE

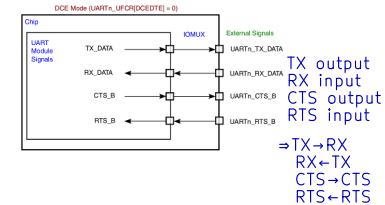
RS9116 datasheet says
no WIFI_WAKE
but the schematic has it

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

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



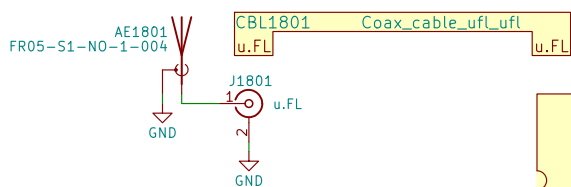
6.2 M.2 Signal Directions
UARTn_UFCR[DCEDTE]=0 on POR



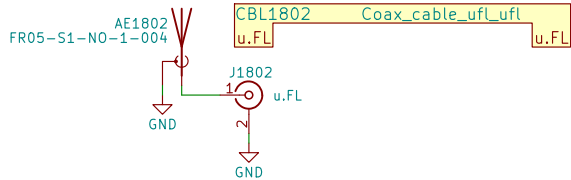
Note:
All switches' pins
can be swapped
e.g. 2<->3
or 1<->3

Open = ON
Closed = OFF

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

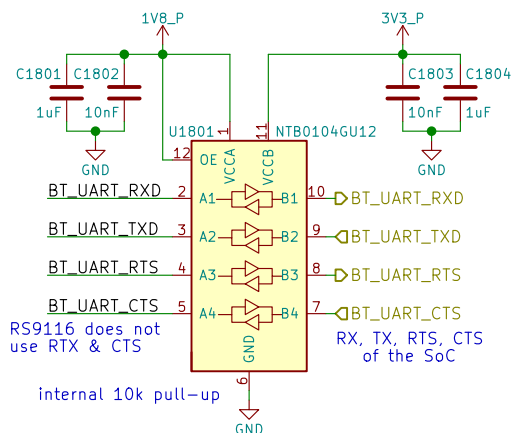


TODO:
Assign antennae
footprints



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

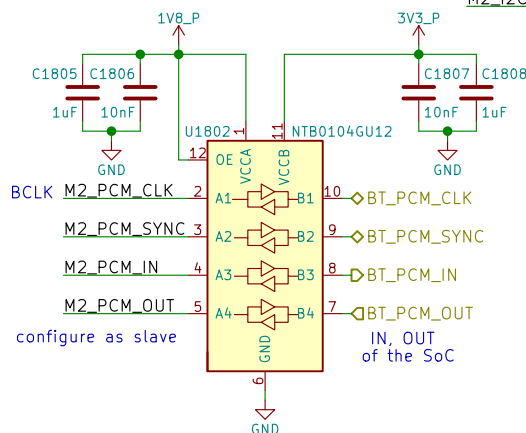
MOD1801
WifiBTCard
WiFi + Bluetooth
M.2 Form Factor
Key ID "E"
width: 22 mm
length: 30 mm



RS9116 does not
use RTX & CTS

internal 10k pull-up

RX, TX, RTS, CTS
of the SoC



configure as slave

IN, OUT
of the SoC

WLAN+BT M.2

Purism

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Sheet: /WLAN+BT M.2/
File: wifi_bt_m2.sch

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

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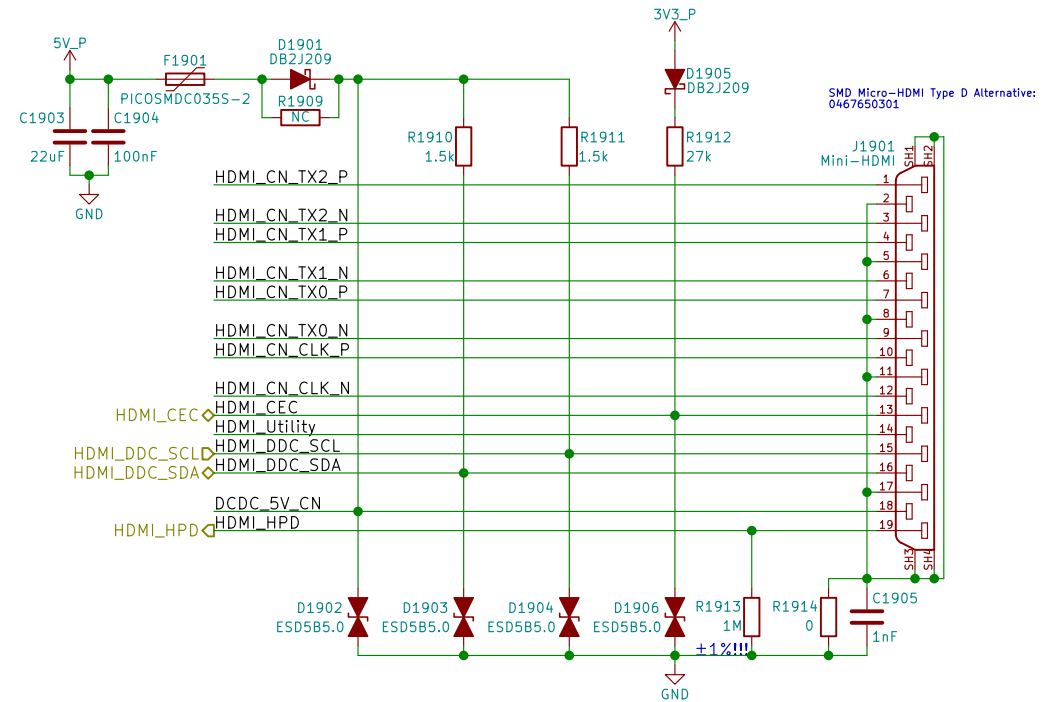
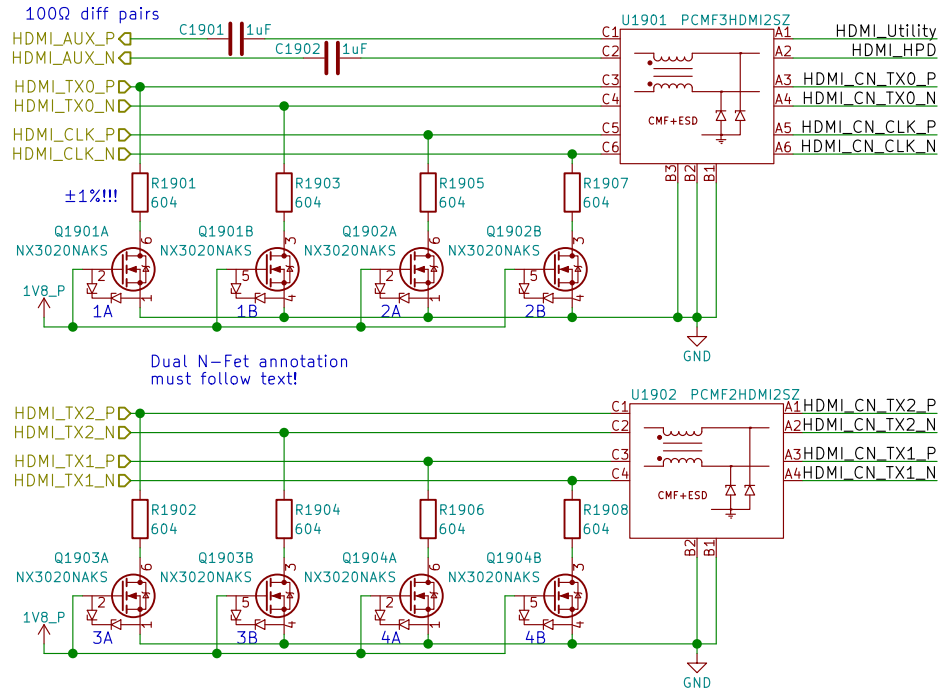
christian.schilmoeller@puri.sm

Rev: v0.1.0
Id: 18/24

TUSB1046 can be used for DP over USB-C

HDMI

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: 2018-06-18
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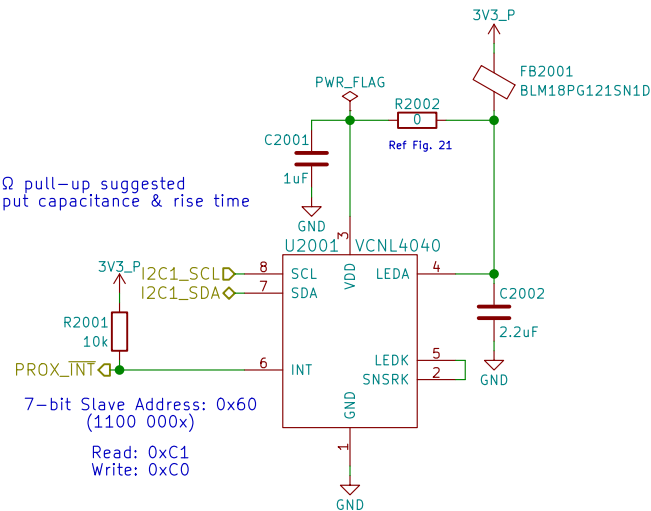
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nicole.farber@puri.sm
christian.schilmoeller@puri.sm

Rev: v0.1.0
Id: 19/24

Sensors

Proximity & Ambient Light

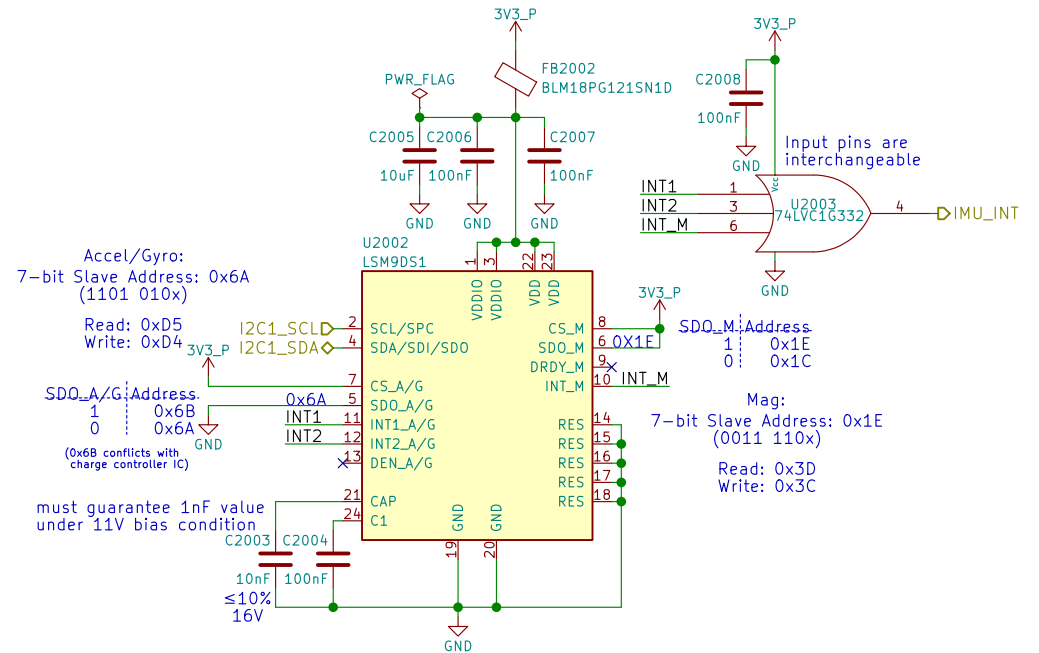
Note:
I2C 2.2kΩ pull-up suggested
check input capacitance & rise time



7-bit Slave Address: 0x60
(1100 000x)
Read: 0xC1
Write: 0xC0

Reference:
<https://www.vishay.com/docs/84307/designingvcnl4040.pdf>
<http://www.vishay.com/docs/84931/vcnl4040sensorboardfiles.pdf>

9-Axis IMU



Accel/Gyro:
7-bit Slave Address: 0x6A
(1101 010x)
Read: 0xD5
Write: 0xD4

SDO_A/G Address:
1 0x6B
0 0x6A
(0x6B conflicts with
charge controller IC)

must guarantee 1nF value
under 11V bias condition
C2003 10nF
C2004 100nF
≤10%
16V

Input pins are
interchangeable

U2003 74LVC1G332
INT1 1
INT2 3
INT_M 6
IMU_INT 4

SDO_M Address:
1 0x1E
0 0x1C

Mag:
7-bit Slave Address: 0x1E
(0011 110x)
Read: 0x3D
Write: 0x3C

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

Purism

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Sheet: /Sensors/
File: sensors.sch

Size: A4 Date: 2018-06-18

KiCad E.D.A. kicad 4.0.7

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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: 2018-06-18

KiCad E.D.A. kicad 4.0.7

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Rev: v0.1.0

Id: 21/24

[illegible]

Smart Card



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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-8-M8-FW3_HardwareIntegrationManual_L%28UBX-15030059%29.pdf

GNSS



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Sheet: /GNSS/

File: gnss.sch

Size: A4

Date: 2018-06-18

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Rev: v0.1.0

Id: 23/24

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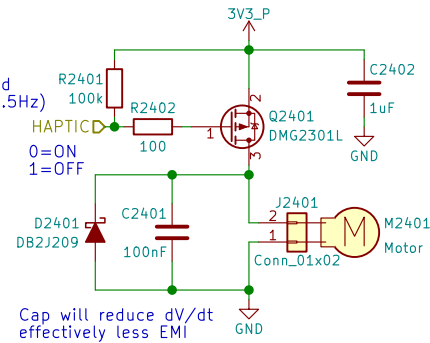
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Haptic Motor

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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Sheet: /Haptic Motor/
 File: haptic.sch

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

Rev: v0.1.0
 Id: 24/24