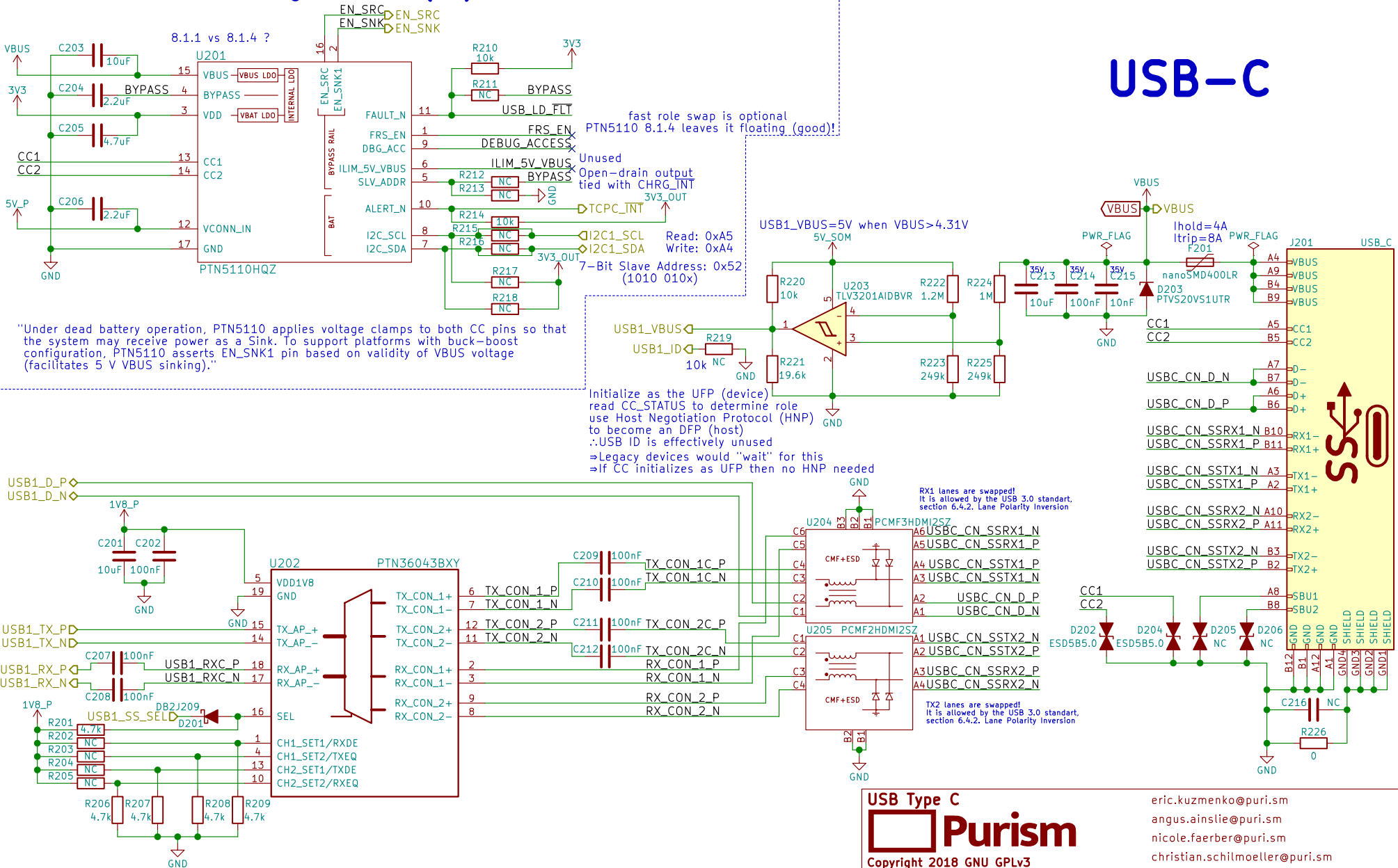


USB-C TCPC – Config Channel (CC) and PD Role Controller

USB-C



USB Type C

Purism

Copyright 2018 GNU GPLv3

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

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

Rev: v0.1.0 Id: 2/24



(interpret RSOC% based on this plot)

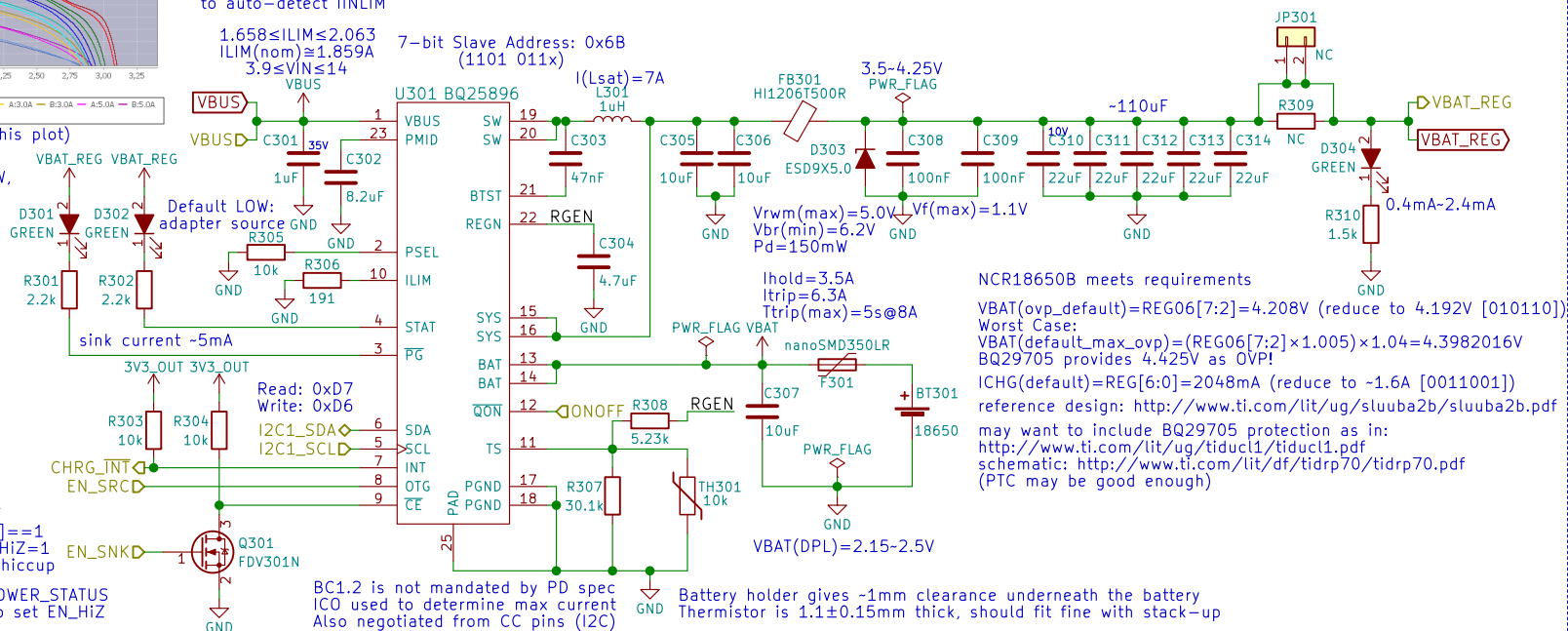
Drawing ~320mA, or consuming $\leq 1.152W$, should give close to 10 hours going from 100% to 0% charge

use AUTO_DPDM_EN to auto-detect IINLIM

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

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

Copyright 2018 GNU GPLv3

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

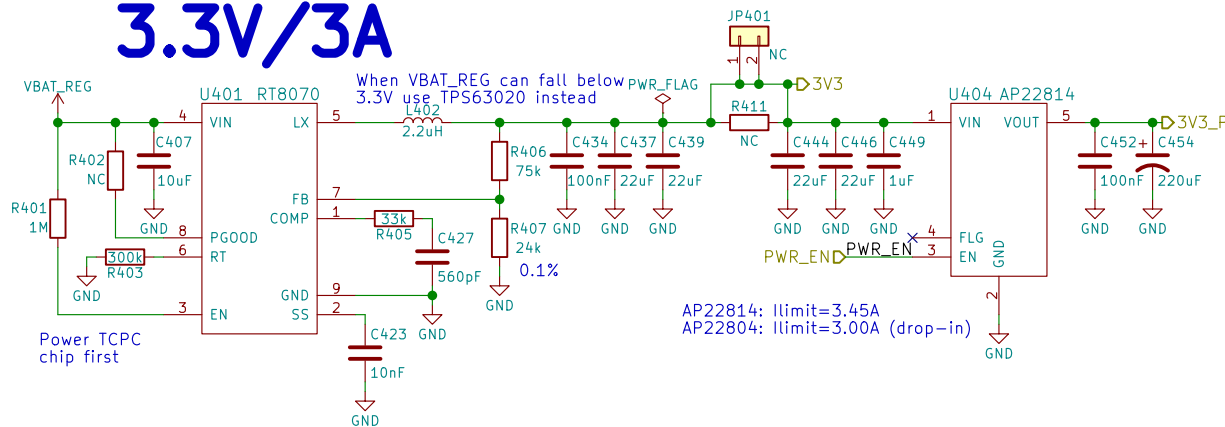
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

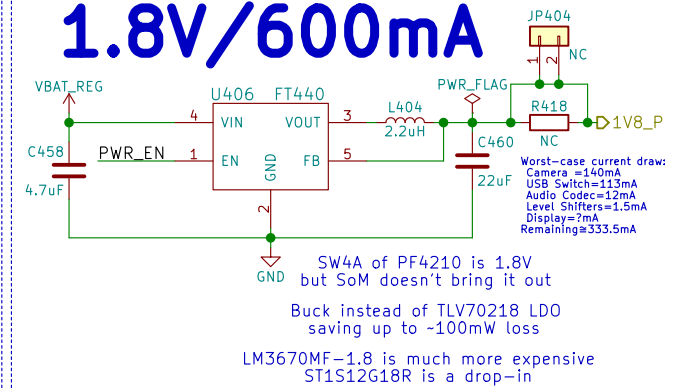
Rev: v0.1.0

Id: 3/24

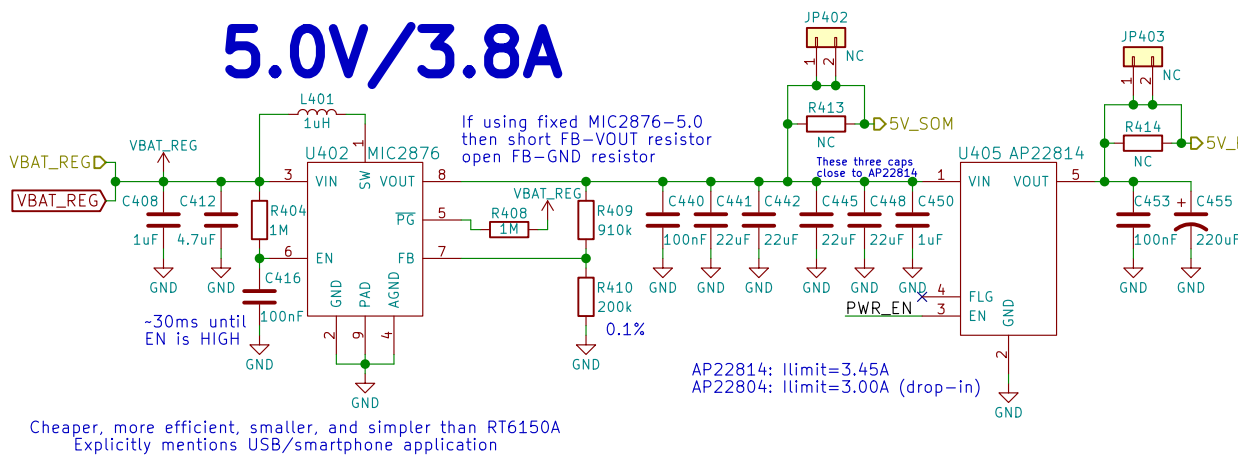
3.3V/3A



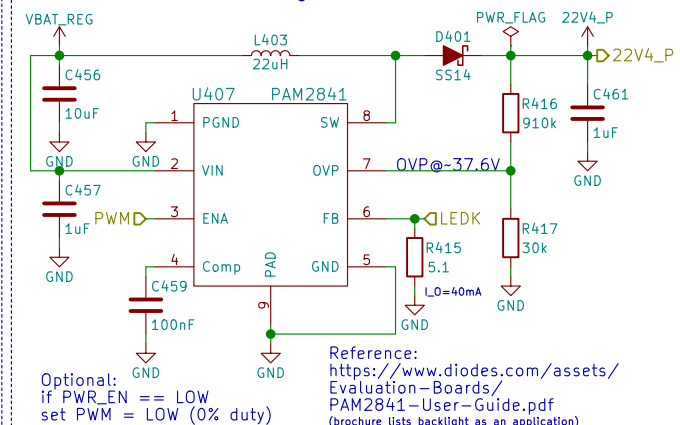
1.8V/600mA



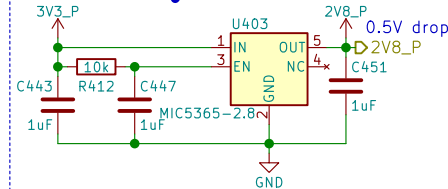
5.0V/3.8A



22.4V/40mA



2.8V/150mA



Power

Power

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

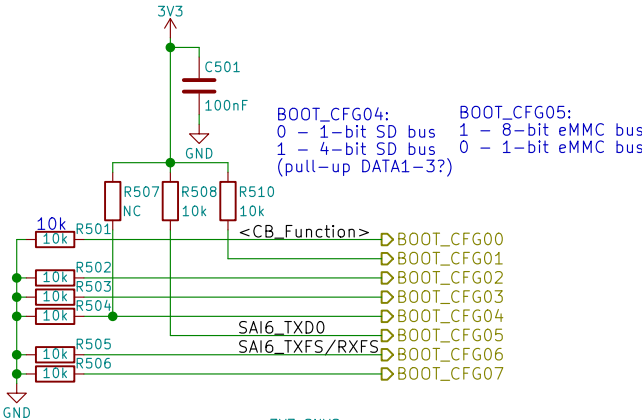
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

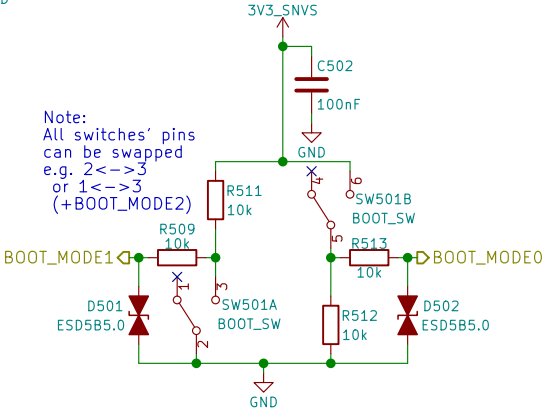
Rev: v0.1.0

Id: 4/24

Boot Config



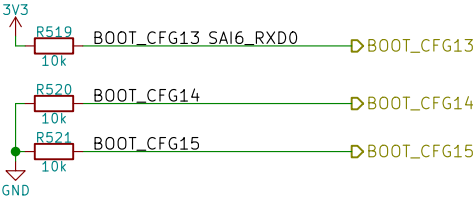
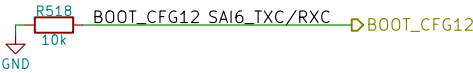
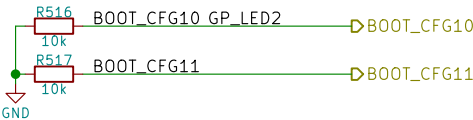
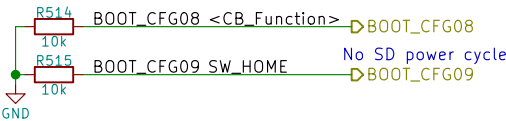
Note:
All switches' pins
can be swapped
e.g. 2<->3
or 1<->3
(+BOOT_MODE2)



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 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



Copyright 2018 GNU GPLv3

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

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

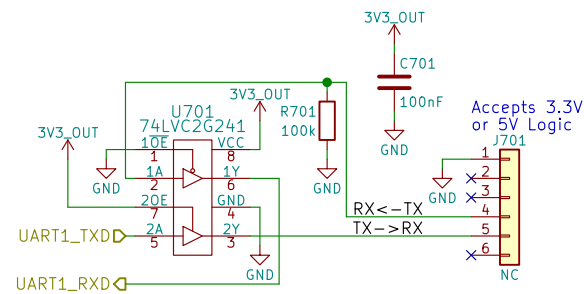
eric.kuzmenko@puri.sm

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

Rev: v0.1.0

Id: 7/24

eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm

JTAG



JTAG



Copyright 2018 GNU GPLv3

Sheet: /JTAG/

File: jtag.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: 8/24

USB Hub + SDIO Bridge

The schematic diagram illustrates a USB Hub + SDIO Bridge circuit centered around the MA8627 IC (U901). The circuit includes various power supply rails (5V_P, 3V3_SD, HV33), ground connections, and signal lines. Key components include resistors (R901-R910), capacitors (C901-C913), and a diode (Q901). The MA8627 IC has multiple pins connected to these components, including GND, CARD_3V3, VD33, CTRL8, CTRL1, VDD18, uSD_CLK, uSD_DATA3, uSD_DATA2, uSD_DATA1, uSD_DATA0, uSD_CMD, RDR_V33, RDR_V5, RDR_V18, DP0, DM0, DP1, DM1, DP2, DM2, DP3, DM3, HUB_VDDR33, HUB_VDDR12, HUB_VDDU, GND, DP0, DM0, DP1, DM1, DP2, DM2, DP3, DM3, SMARTCARD_D_P, SMARTCARD_D_N, RDR_V33, RDR_V5, RDR_V18, DP0, DM0, DP1, DM1, DP2, DM2, DP3, DM3, SMARTCARD_D_P, SMARTCARD_D_N.

USB Hub + SDIO Bridge

Purism

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.ainslie@puri.sm
nicole.faeber@puri.sm
christian.schilmoeller@puri.sm

Rev: v0.1.0
Id: 9/24

 Purism

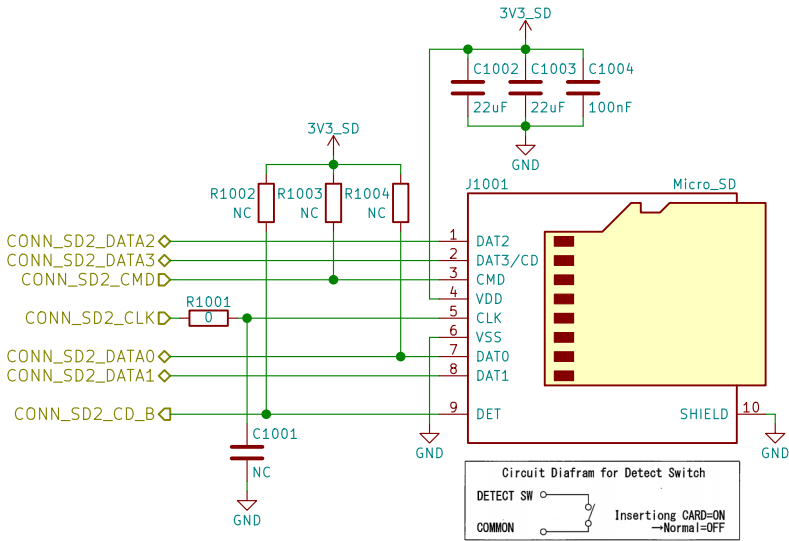
Sheet: /USB Hub + SDIO Bridge/
File: usb_hub_sdio.sch

Size: 711	Date:
KiCad E.D.A.	kicad 4.0.7

christian.schilmoeller@puri.sm

Id: 9/24

μSD



Purism

Copyright 2018 GNU GPLv3

Sheet: /uSD Card/

File: sd.sch

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

KiCad E.D.A. kicad 4.0.7

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

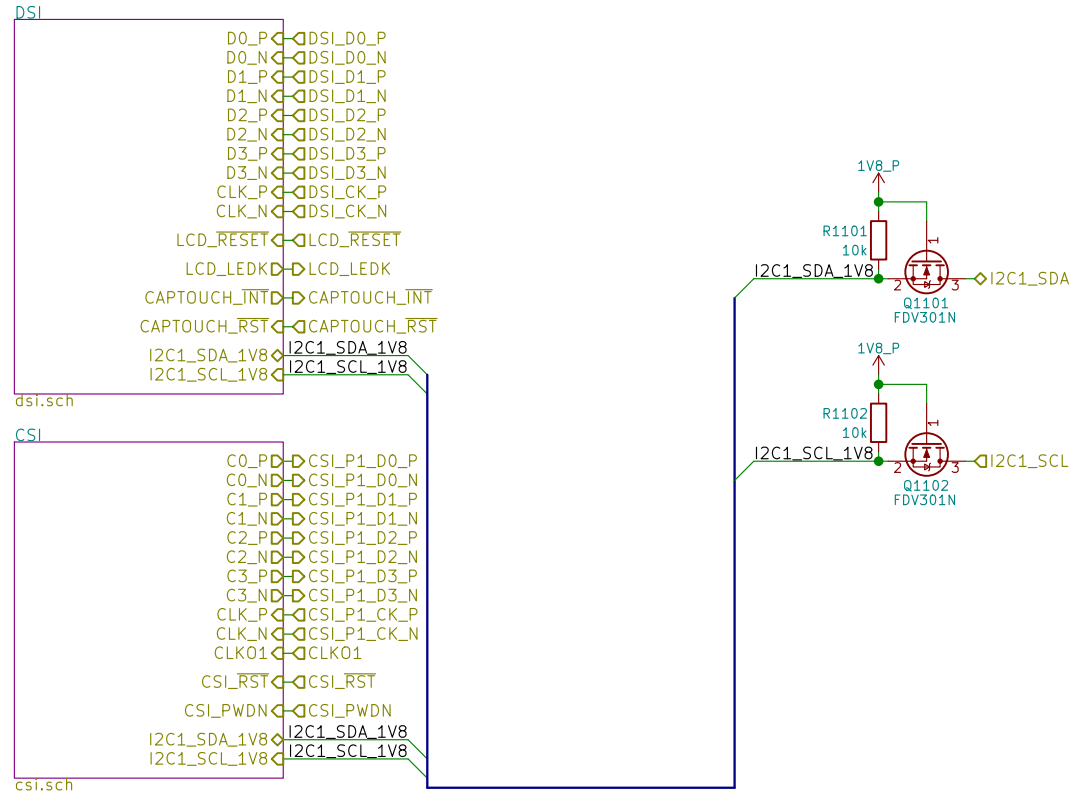
nicole.faerber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 10/24

MIPI



MIPI



Copyright 2018 GNU GPLv3

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

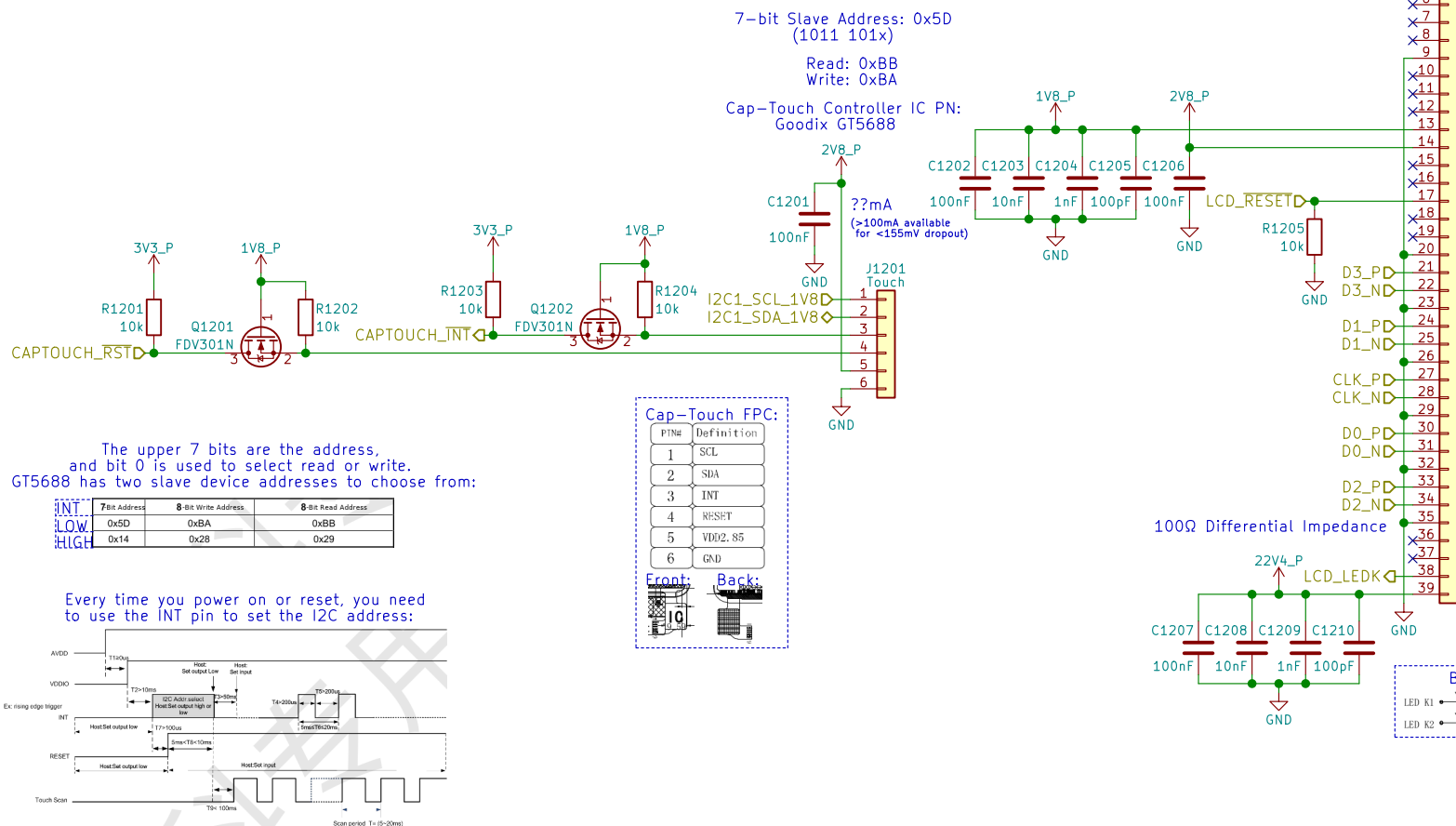
christian.schilmoeller@puri.sm

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

Copyright 2018 GNU GPLv3

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

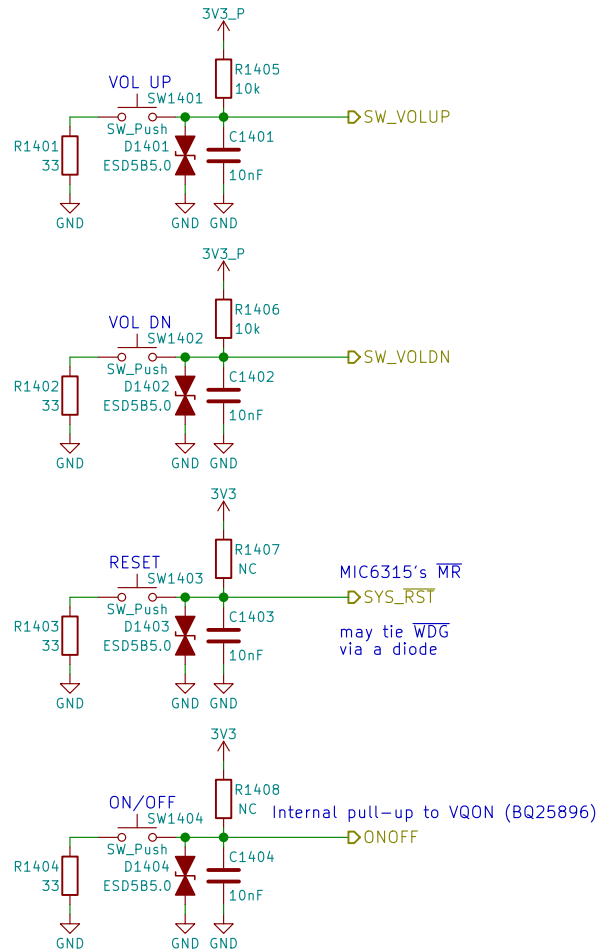
Size: A4 Date: 2018-06-18
KiCad E.D.A. kicad 4.0.7

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



Copyright 2018 GNU GPLv3

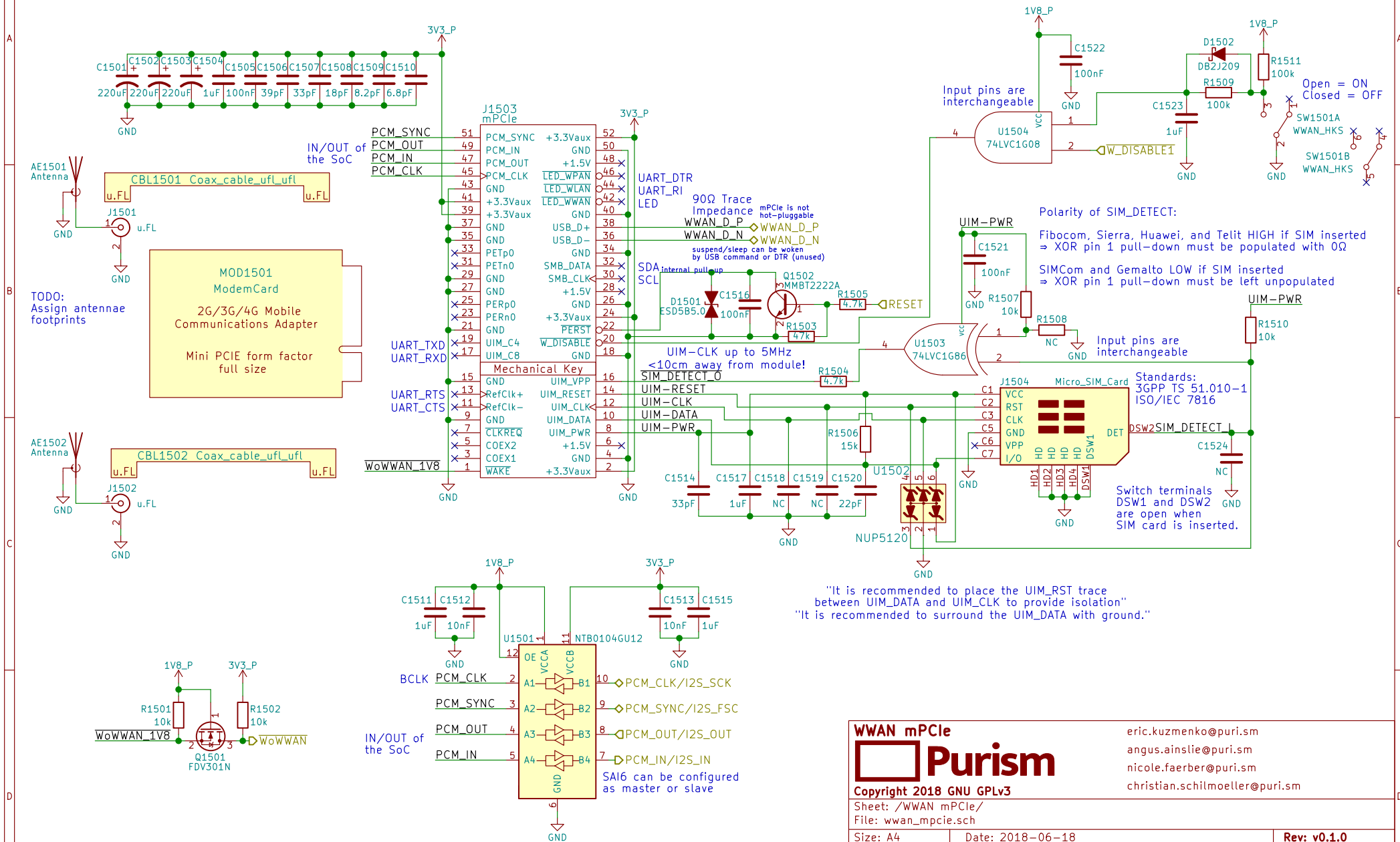
Sheet: /Buttons & LED/
 File: buttons_led.sch

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



Purism

Copyright 2018 GNU GPLv3

Sheet: /WWAN mPCIe/

File: wwan_mpcie.sch

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

eric.kuzmenko@puri.sm

angus.ainslie@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.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 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

SW Mute Mic: MUTE_ADC=1

MIC_IN

MIC_BIAS

C1619

1uF

GND

C1620

100nF

GND

FB1608

BLM18KG601SZ1D

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)

GND

GND

FB1608

BLM18KG601SZ1D

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)

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

FB1608

BLM18KG601SZ1D

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)

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

FB1608

BLM18KG601SZ1D

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)

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

FB1608

BLM18KG601SZ1D

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)

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

FB1608

BLM18KG601SZ1D

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)

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

FB1608

BLM18KG601SZ1D

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)

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

FB1608

BLM18KG601SZ1D

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)

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

FB1608

BLM18KG601SZ1D

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)

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

FB1608

BLM18KG601SZ1D

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)

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

GND

FB1608

BLM18KG601SZ1D

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)

GND

GND

GND

GND

GND

RGMII 10/100/1000 Ethernet

Ethernet

Purism

Copyright 2018 GNU GPLv3

Sheet: /Ethernet/
File: ethernet.sch

Size: A4 Date: 2018-06-18 Rev: v0.1.0
KiCad E.D.A. kicad 4.0.7 Id: 17/24

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

 Purism

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

Id: 17/24

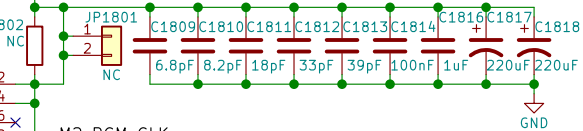
WLAN+BT M.2

RS9116 NC:
RTS, CTS, BT_HOST_WAKE

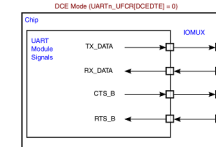
RS9116 datasheet says
no WIFI_WAKE
but the schematic has it

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

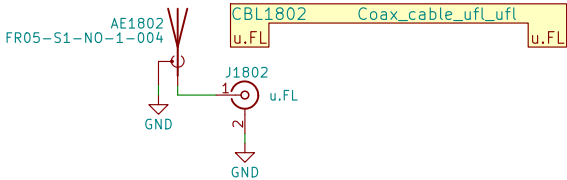
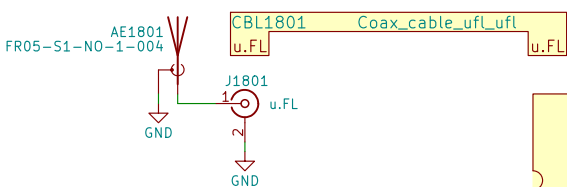


TX output
RX input
CTS output
RTS input
⇒ TX→RX
RX→TX
CTS→CTS
RTS→RTS

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

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

1V8_P
3V3_P

BT_UART_RXD
BT_UART_TXD
BT_UART_RTS
BT_UART_CTS

BT_UART_RXD
BT_UART_TXD
BT_UART_RTS
BT_UART_CTS

BT_UART_RXD
BT_UART_TXD
BT_UART_RTS
BT_UART_CTS

BT_UART_RXD
BT_UART_TXD
BT_UART_RTS
BT_UART_CTS

BT_UART_RXD
BT_UART_TXD
BT_UART_RTS
BT_UART_CTS

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

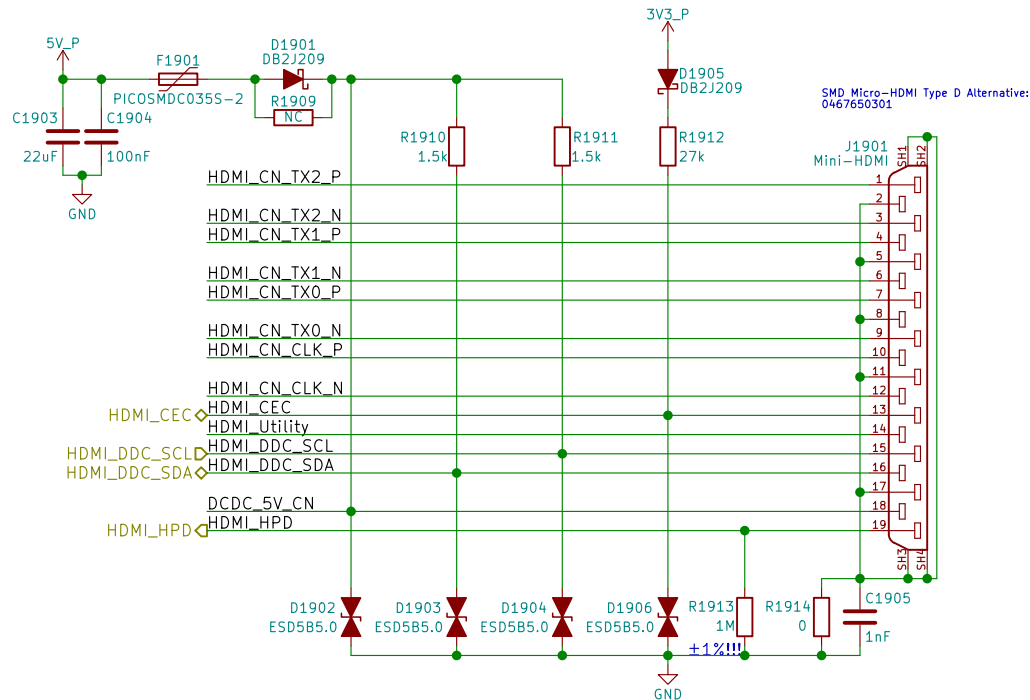
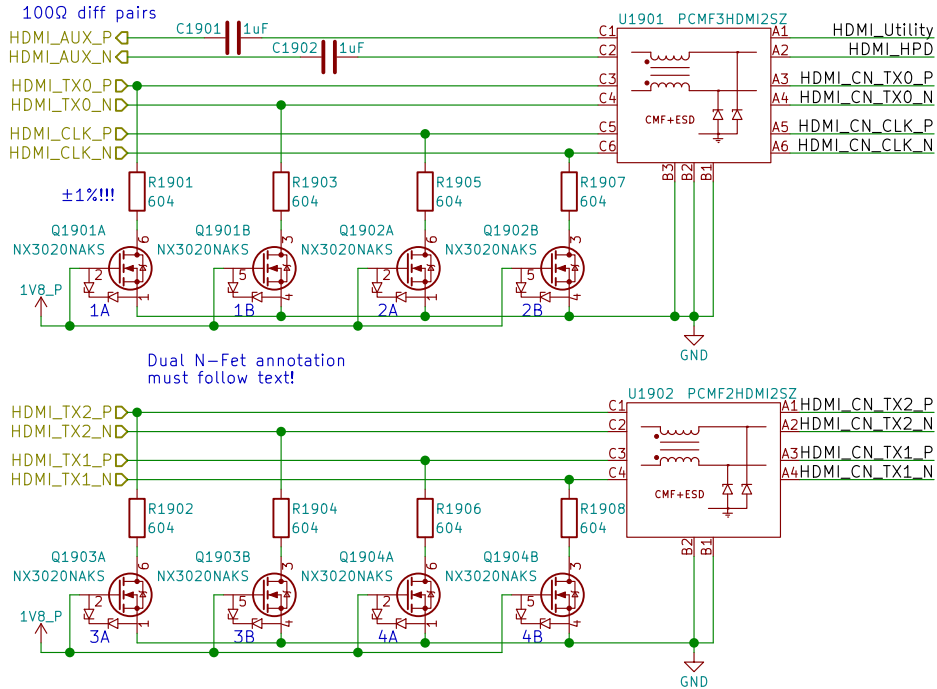
eric.kuzmenko@puri.sm
angus.ainslie@puri.sm
nicole.farber@puri.sm
christian.schilmoeller@puri.sm

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.ainslie@puri.sm

nicole.ferber@puri.sm

christian.schilmoeller@puri.sm

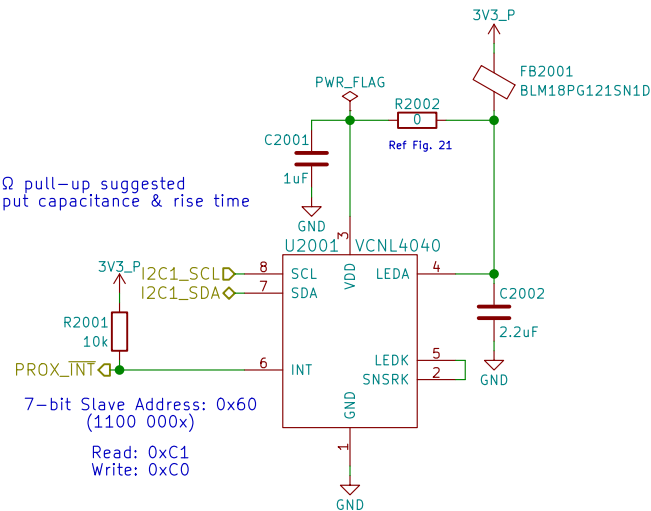
Rev: v0.1.0

Id: 19/24

Sensors

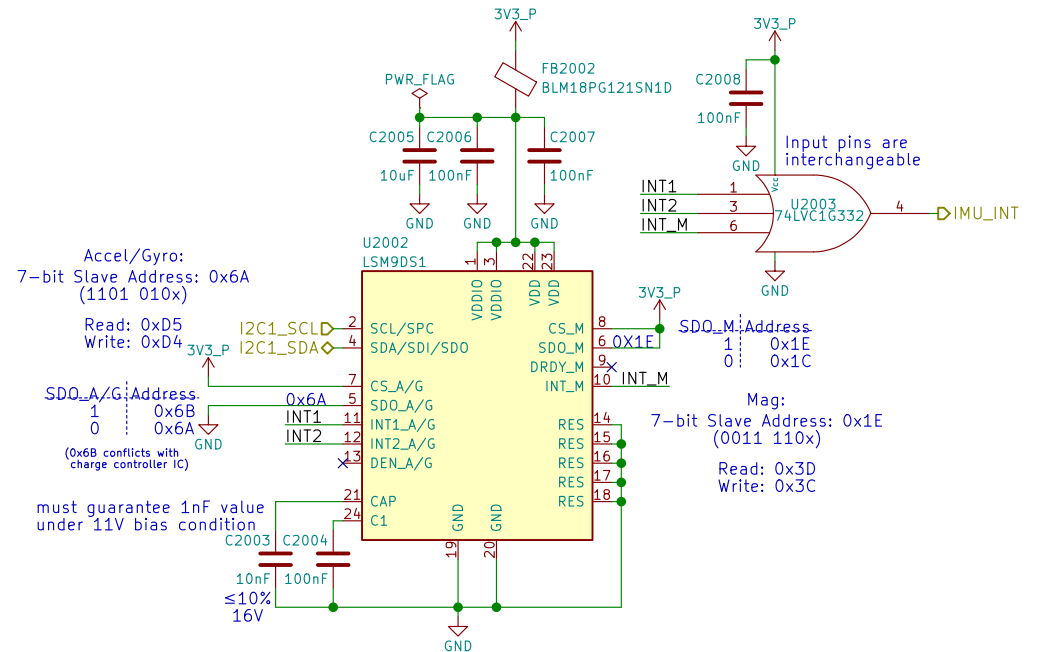
Proximity & Ambient Light

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



Reference:
<https://www.vishay.com/docs/84307/designingvnc4040.pdf>
<http://www.vishay.com/docs/84931/vcnl4040sensorboardfiles.pdf>

9-Axis IMU



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

Table 19. Accelerometer and gyroscope SAD*Read/Write patterns

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)

Table 20. Magnetic sensor SAD*Read/Write patterns

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



Copyright 2018 GNU GPLv3

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

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

GNSS



Copyright 2018 GNU GPLv3

Sheet: /GNSS/

File: gnss.sch

Size: A4

Date: 2018-06-18

KiCad E.D.A. kicad 4.0.7

Rev: v0.1.0

Id: 23/24

eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

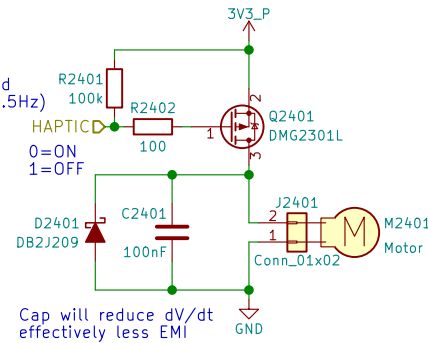
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Haptic Motor

PWM pins occupied:
 GPIO1_I001 - LCD Backlight
 GPIO1_I013 - LED
 GPIO1_I014 - Ethernet (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)

Haptic/Vibration Motor



Copyright 2018 GNU GPLv3

Sheet: /Haptic Motor/
 File: haptic.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: 24/24