

USB-C





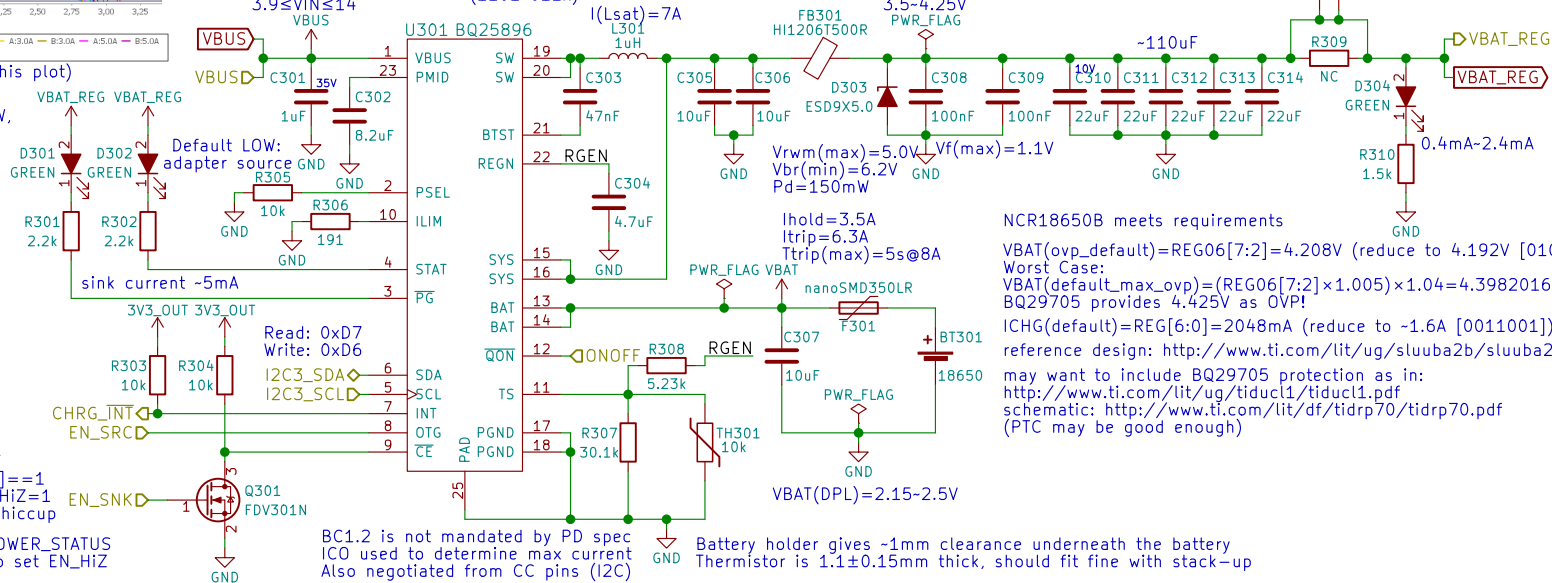
(interpret RSOC% based on this plot)
 Drawing ~320mA, or consuming $\leq 1.152W$, should give close to 10 hours going from 100% to 0% charge

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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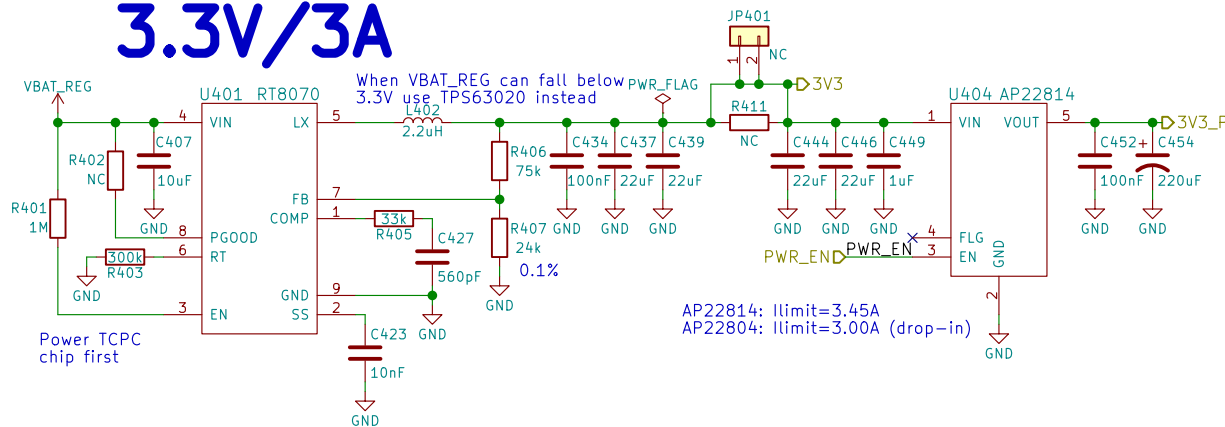
Sheet: /Battery/
 File: battery.sch

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

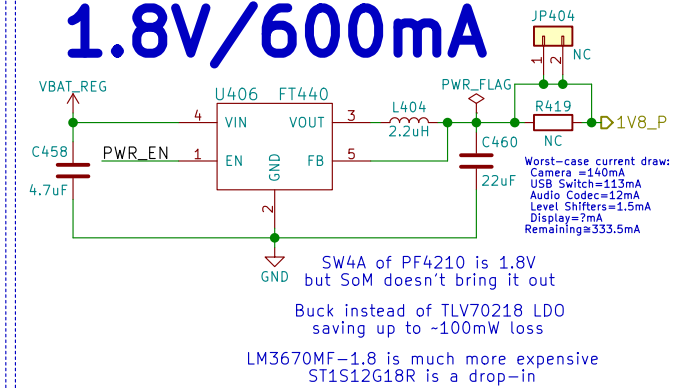
eric.kuzmenko@puri.sm
 angus.ainslie@puri.sm
 nicole.farber@puri.sm
 christian.schilmoeller@puri.sm

Rev: v0.1.0
 Id: 3/24

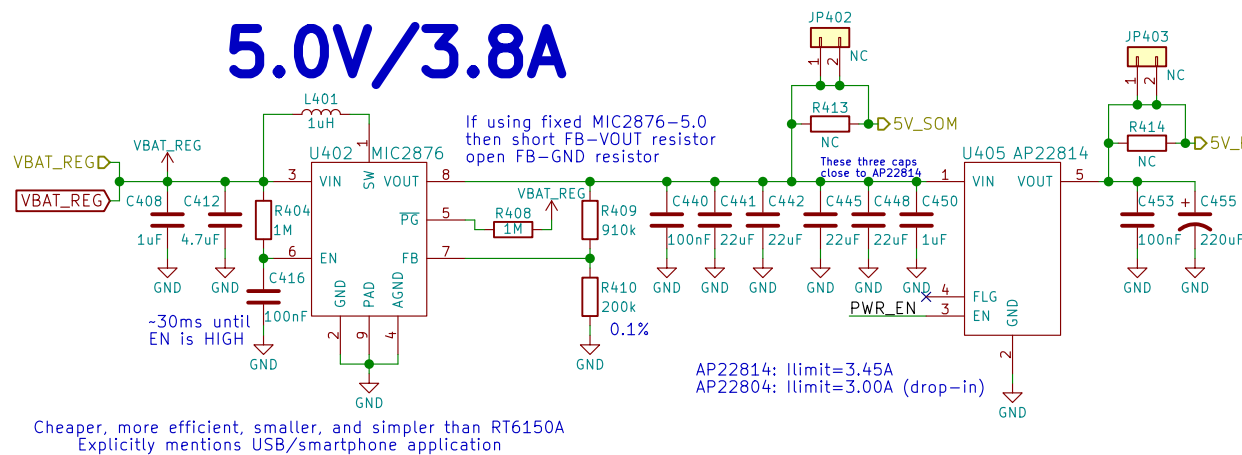
3.3V/3A



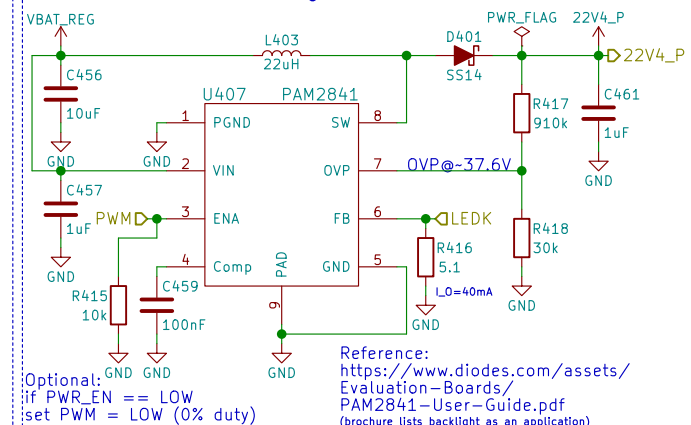
1.8V/600mA



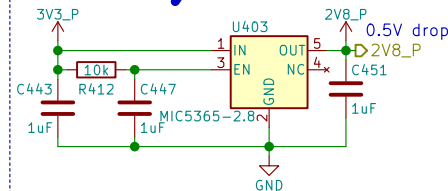
5.0V/3.8A



22.4V/40mA



2.8V/150mA



Power

Power

Purism

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Sheet: /Power/
File: power.sch

Size: A4
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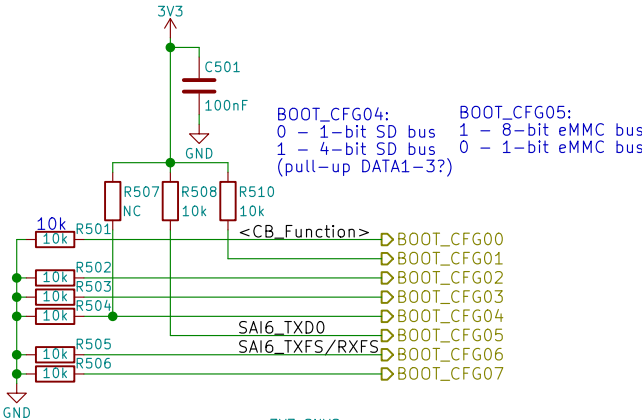
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

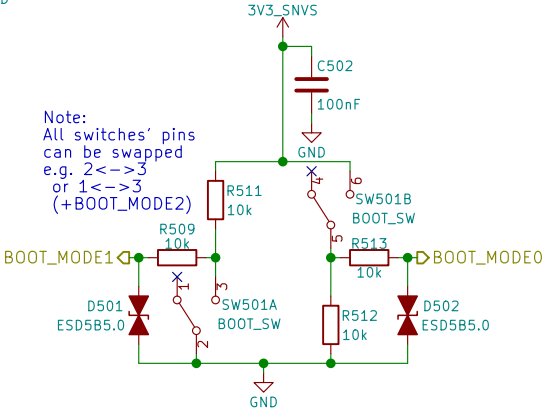
Rev: v0.1.0

Id: 4/24

Boot Config

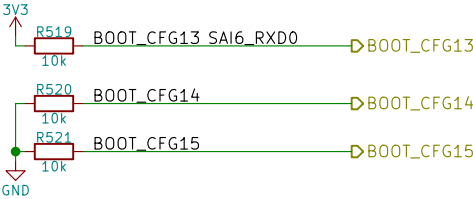
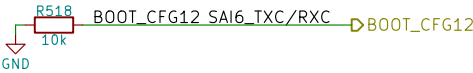
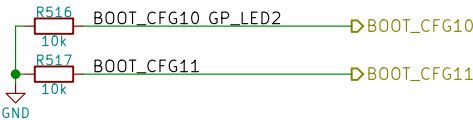
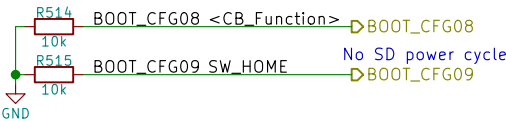


Note:
All switches' pins
can be swapped
e.g. 2<->3
or 1<->3
(+BOOT_MODE2)




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

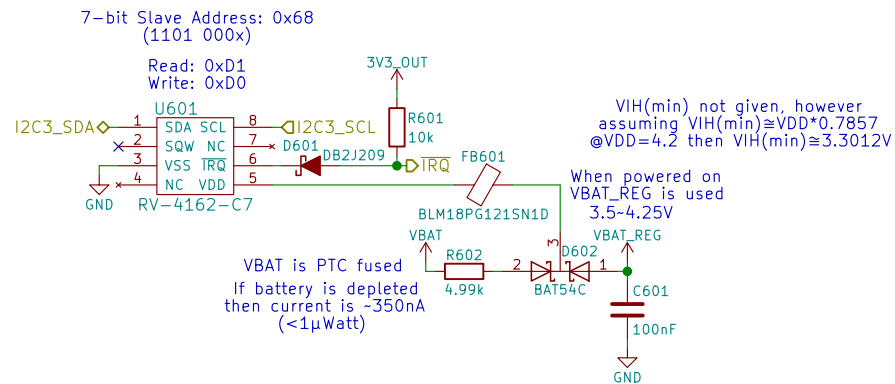
Size: A4
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Date: 2018-06-18

Rev: v0.1.0
Id: 5/24


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Real-Time Clock

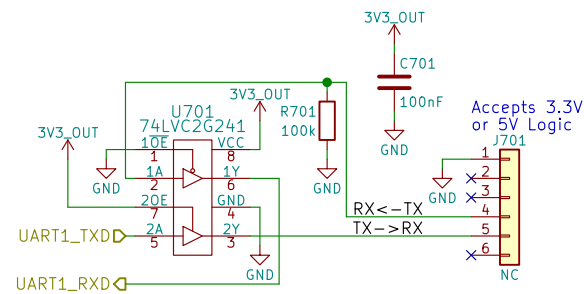


Note:
Datasheet says slave address is 0xD0
with a R/W bit appended, since 0xD0 must
be 4-bits wide the actual 7-bit address is
0x68 (110 1000), and becomes 0xD0 during a
write operation (1101 0000)

Reference:
https://github.com/HIO-Project/linux-imx6-nano-imx_3.10.17-1.0.1_ga/blob/8848e94b2f889fe44f6736e2d4c98851a2282275/arch/arm/boot/dts/linux6qdl-mtp.dtsi#L351

<div> <div> <div>RTC</div> <div>  <div>Purism</div> </div> </div> <div> <div>eric.kuzmenko@purism</div> <div>angus.ainslie@purism</div> <div>nicole.faeber@purism</div> <div>christian.schilmoeller@purism</div> </div> </div>	
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Sheet: /RTC/	
File: rtc.sch	
Size: A4	Rev: v0.1.0
Date: 2018-06-18	
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UART Debug



UART Debug



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Sheet: /UART Debug/
File: uart.sch

Size: A4 Date: 2018-06-18
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Rev: v0.1.0
Id: 7/24

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File: jtag.sch

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 pins. Key components include resistors (R901-R910), capacitors (C901-C913), and a diode (Q901). The MA8627 IC has multiple pins connected to external components, including USB signals (USB2_D_N, USB2_D_P, USB2_ID), SDIO signals (SDCD), and various control and data lines. A note indicates that the DP0 and DM0 pins can be swapped depending on the layout.

USB Hub + SDIO Bridge

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

Size: A4 Date: 2018-06-18
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Rev: v0.1.0
Id: 9/24

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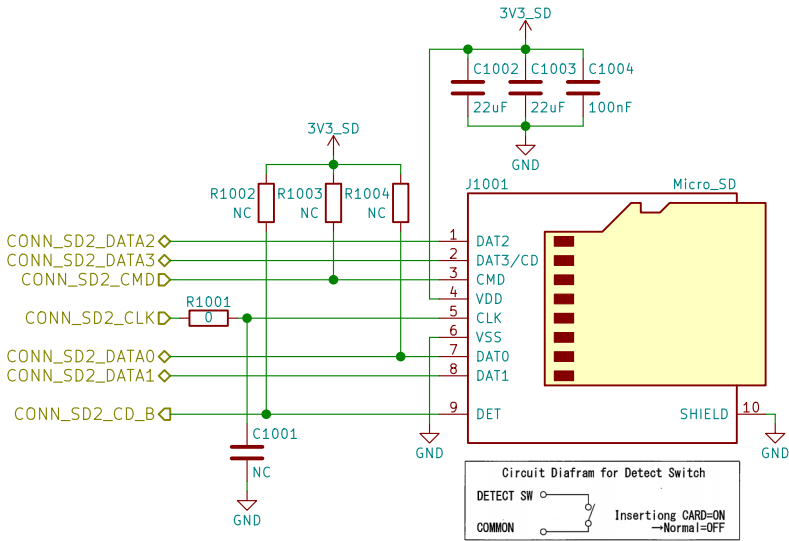
Sheet: /USB Hub + SDIO Bridge/
File: usb_hub_sdio.sch

Size: 711	Date:
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μSD



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Sheet: /uSD Card/

File: sd.sch

Size: A4	Date: 2018-06-18
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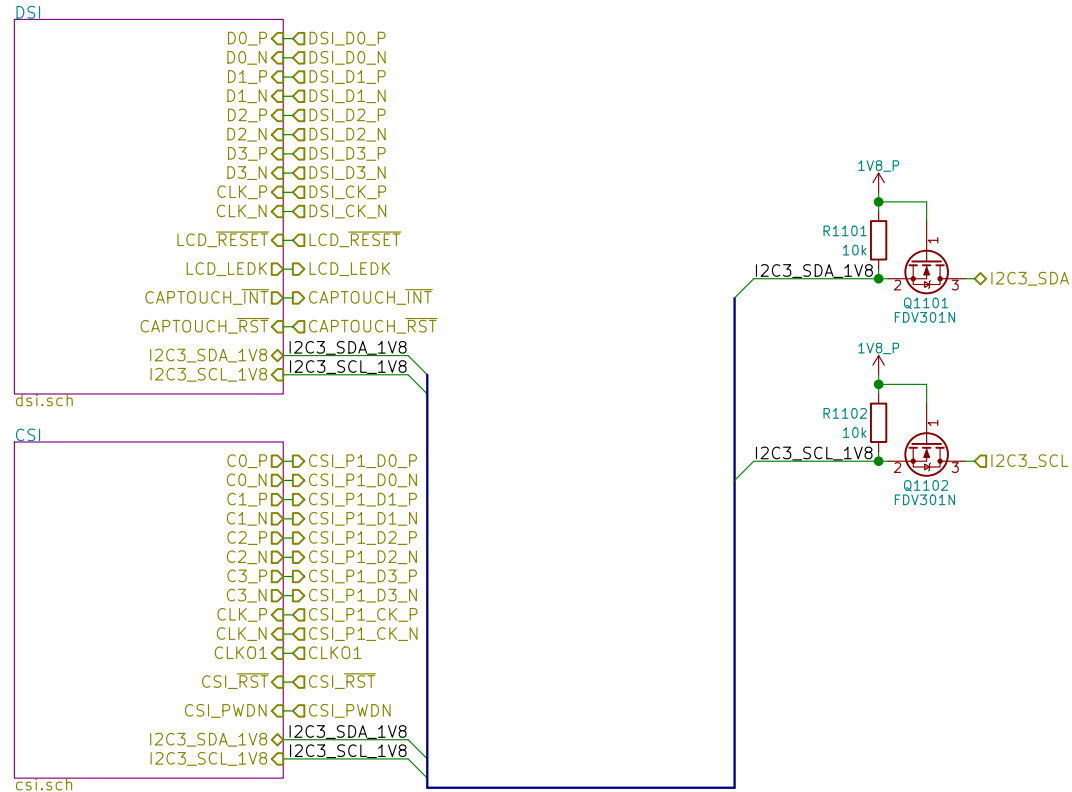
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Rev: v0.1.0

Id: 10/24

MIPI



MIPI



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Sheet: /MIPI/
File: mipi.sch

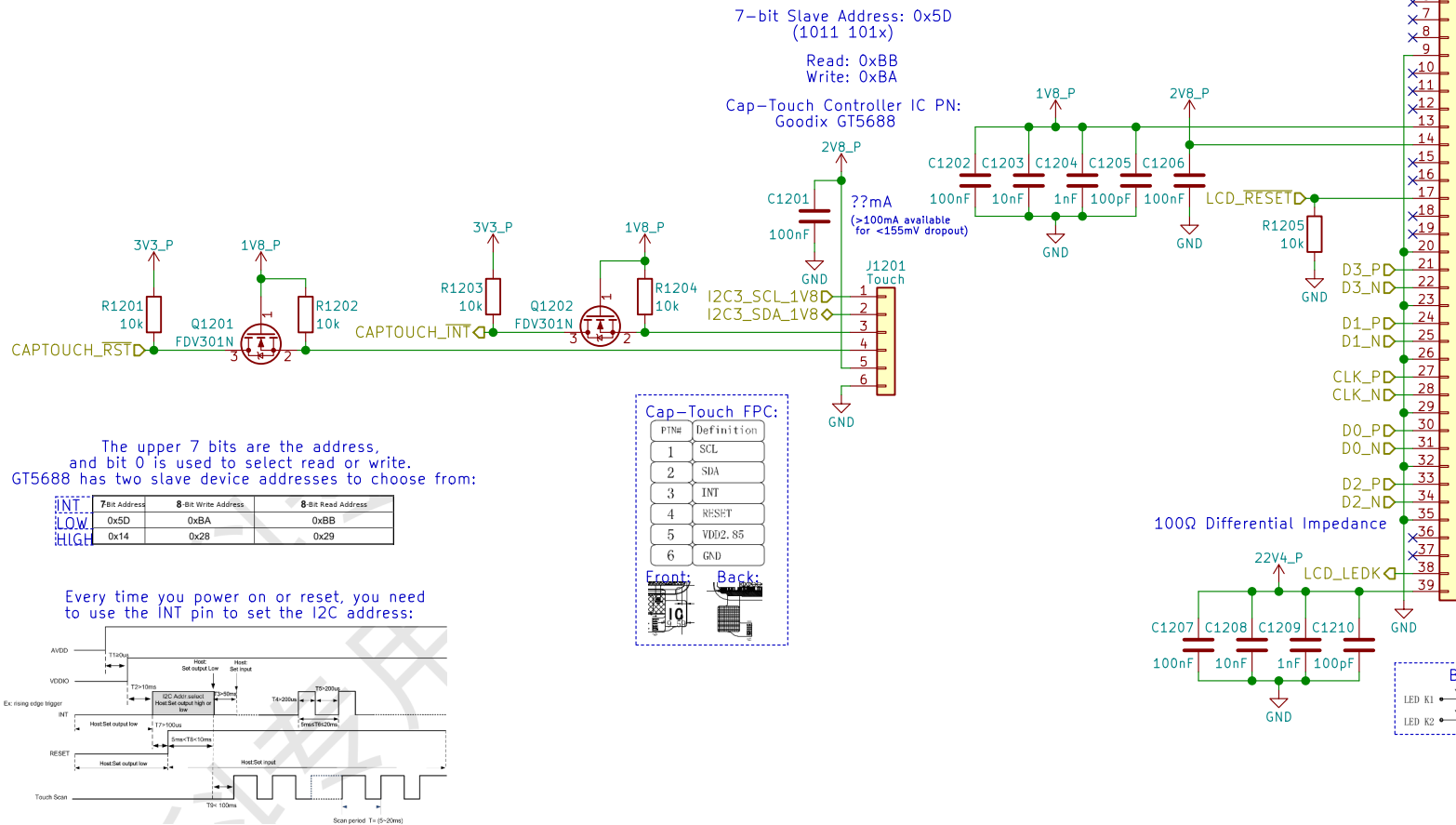
Size: A4 Date: 2018-06-18
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Rev: v0.1.0
Id: 11/24

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

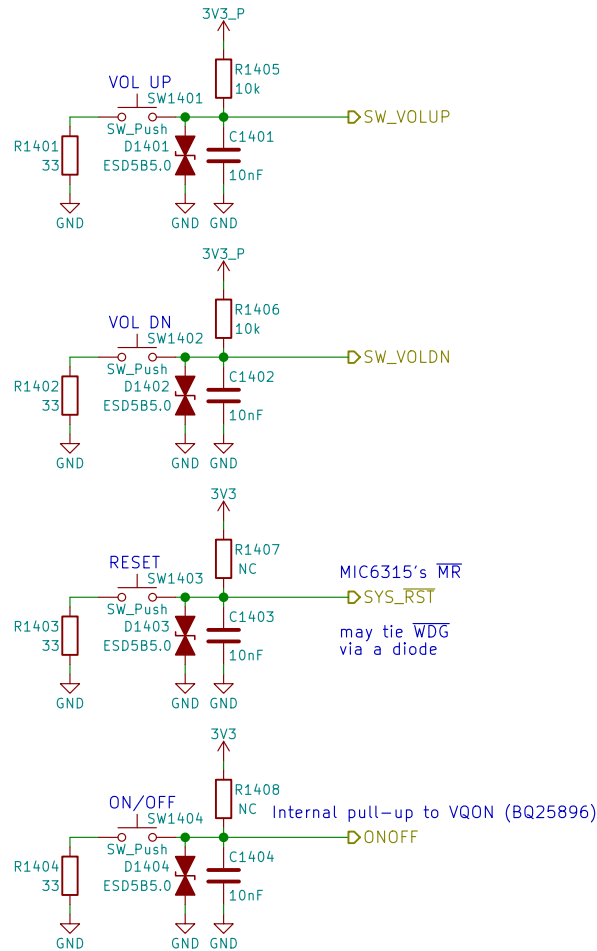
Size: A4 Date: 2018-06-18
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Rev: v0.1.0
Id: 12/24

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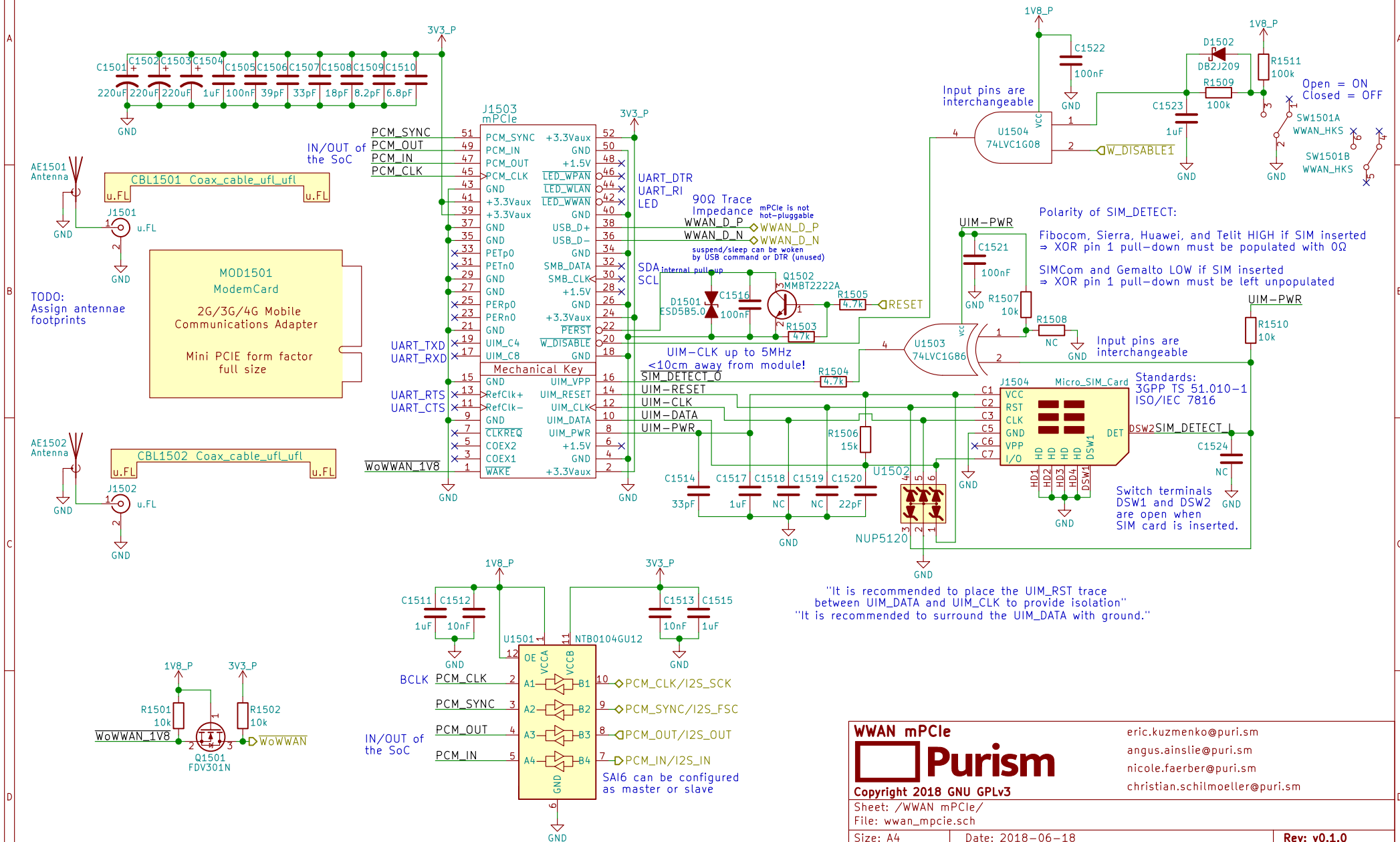
Sheet: /Buttons & LED/
 File: buttons_led.sch

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

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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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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



$Z_{hp} \geq 16\Omega$

HP_DET
 SMD Equivalents:
 SJ-43515RS-SMT-TR
 SJ-43515TS
 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)
 $-37dB = 14.1254mV/Pa$
 $\therefore \text{mic produces } 14.1254mV_{rms} \text{ when exposed to a } 1kHz \text{ tone of } 94dB-SPL \text{ at the capsule (or } 19.98mV \text{ amplitude)}$
 $\Rightarrow 40dB \text{ gain would produce } -2V \text{ amplitude (4Vpp, clipping)}$
 $30dB \text{ gain would produce } -0.632V \text{ amplitude (1.264Vpp)}$
 $38.33dB \text{ gain would yield } 3.3V_{pp}$

LCR Measurements:

Earbud Microphone: @1kHz
 $L_s = 3.844mH$
 $L_p = 15.757H$
 $C_s = 6.583uF$
 $C_p = 1612.8pF$
 $R_s = 1.5465k\Omega$
 $R_p = 1.5478k\Omega$
 $\theta = -0.8deg$

Headset Speaker: @1kHz
 $L_s = 244.4uH$
 $L_p = 141.99mH$
 $C_s = 103.6uF$
 $C_p = 178.77nF$
 $R_s = 36.860\Omega$
 $R_p = 36.860\Omega$
 $\theta = -2.3deg$

Earbud Speaker: @1kHz
 $L_s = 25.2uH$
 $L_p = 311.0mH$
 $C_s = 1.0mF$
 $C_p = 81.95nF$
 $R_s = 17.0300\Omega$
 $R_p = 17.0340\Omega$
 $\theta = 0.5deg$

Audio

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Sheet: /Audio/
 File: audio.sch

Size: A4 Date: 2018-06-18

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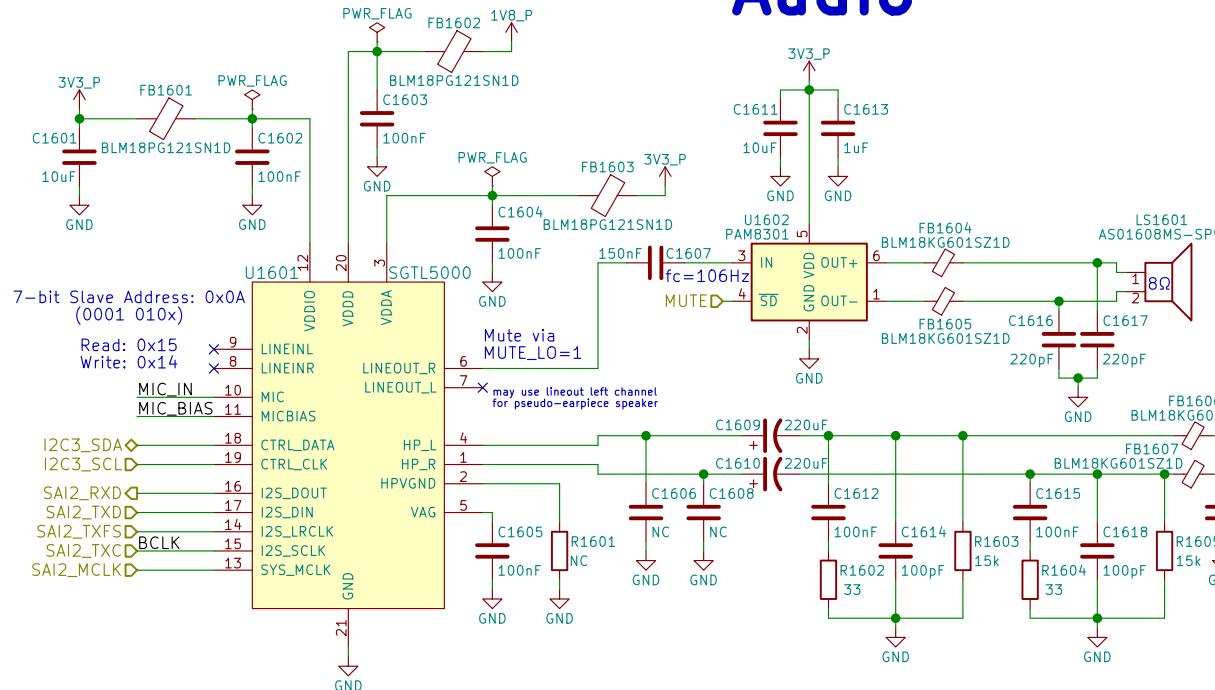
angus.ainslie@puri.sm

nicole.farber@puri.sm

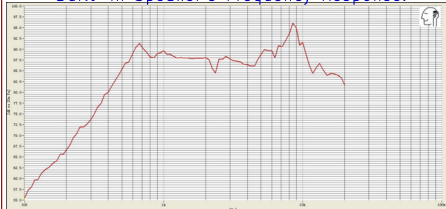
christian.schilmoeller@puri.sm

Rev: v0.1.0

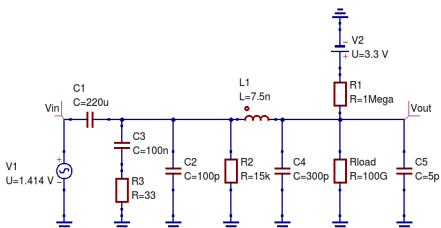
Id: 16/24



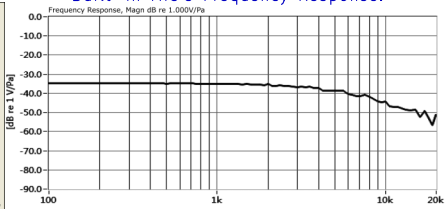
Built-In Speaker's Frequency Response:



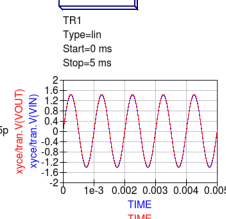
Simulation of HP_DET @ 1kHz output without HP jack inserted:



Built-In Mic's Frequency Response:



transient simulation



[illegible]

 **Purism**

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Rev: v0.1.0
Id: 17/24

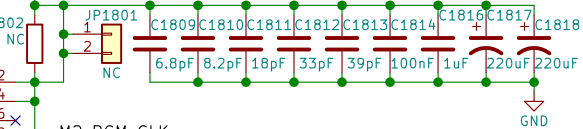
WLAN+BT M.2

RS9116 NC:
RTS, CTS, BT_HOST_WAKE

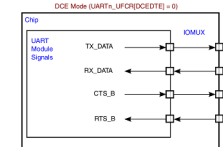
RS9116 datasheet says
no WIFI_WAKE
but the schematic has it

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

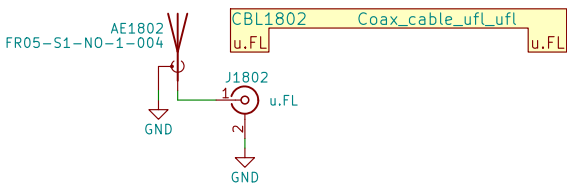
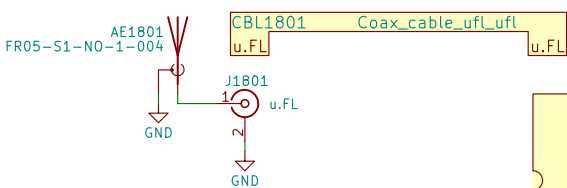


TX output
RX input
CTS output
RTS input
⇒ TX→RX
RX→TX
CTS→CTS
RTS→RTS

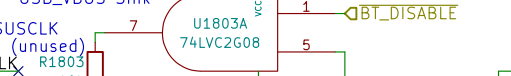
RedPine RS9116
has 100k pull-up to
3.3V making SDIO_RST
~2.55V when HIGH

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

TODO:
Assign antennae
footprints

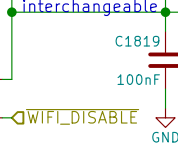


Pin 54 on RS9116 is
USB_VBUS Sink



Leave BT_DISABLE
LOW for RS9116

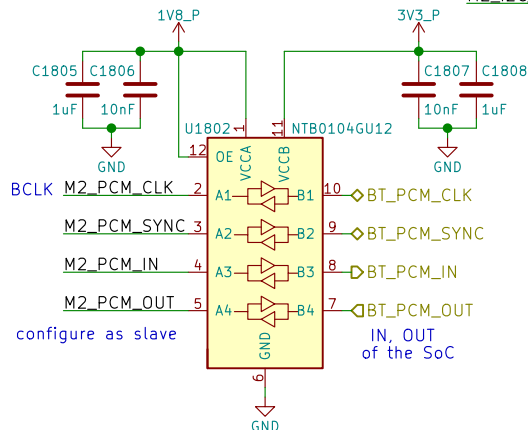
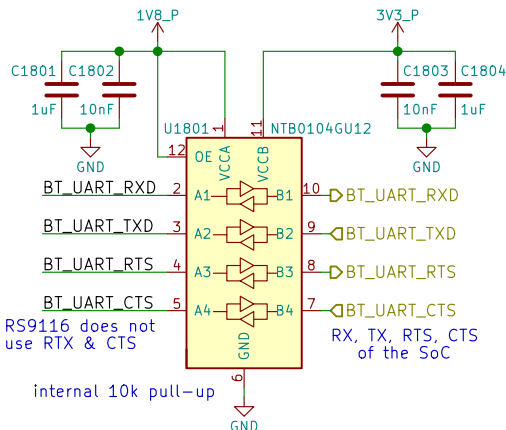
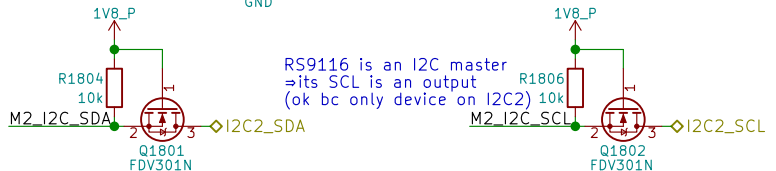
Input pins are
interchangeable



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)



WLAN+BT M.2

Purism

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

Size: A4
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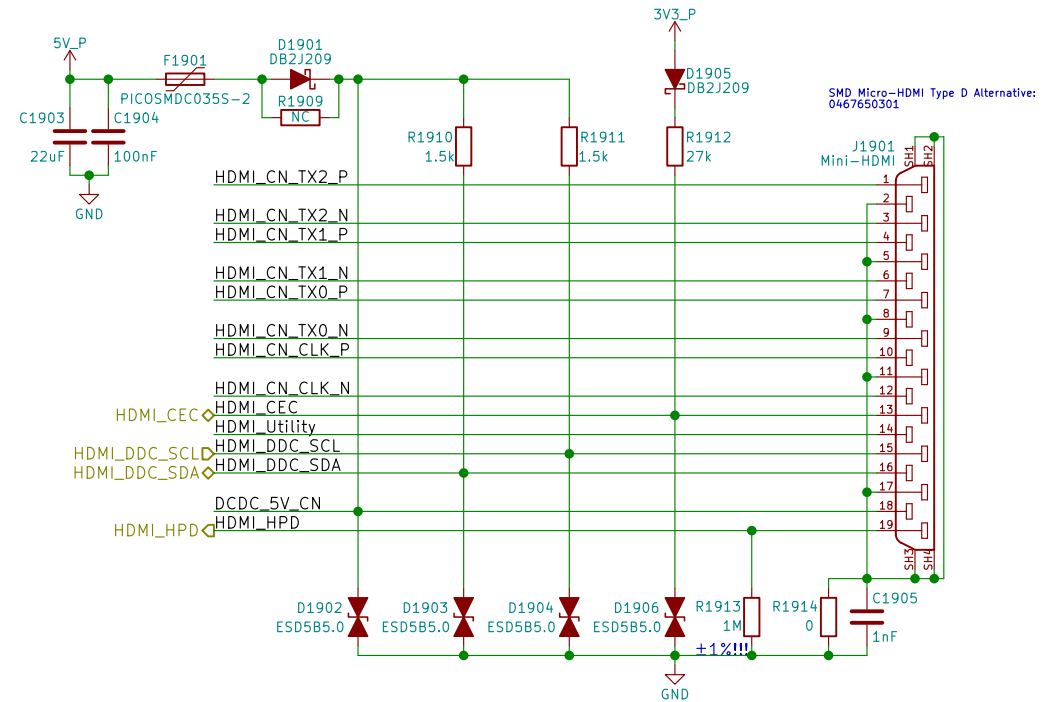
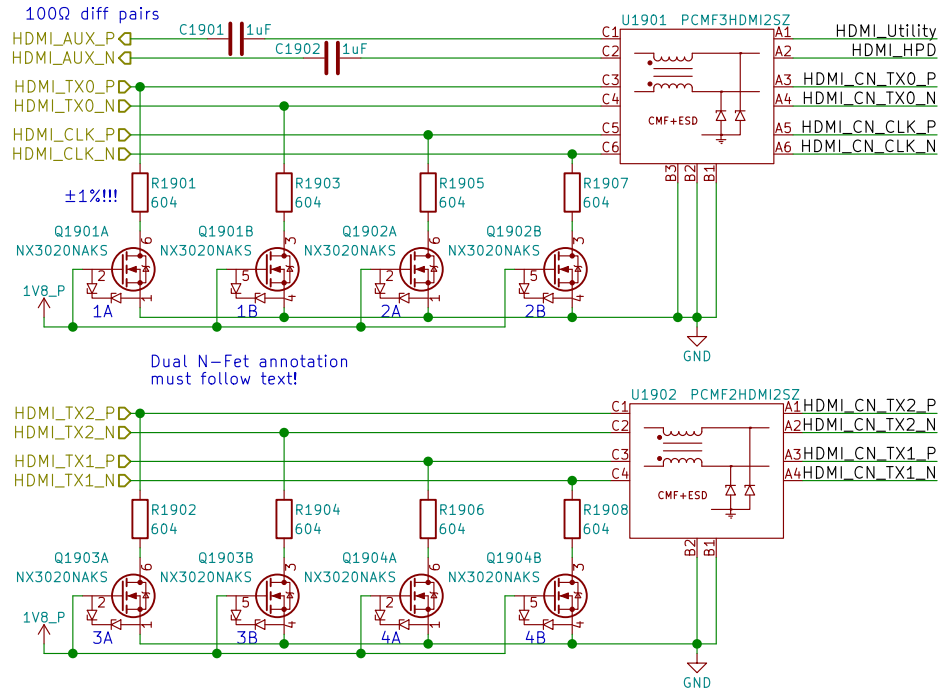
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nicole.farber@puri.sm
christian.schilmoeller@puri.sm

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



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Sheet: /HDMI/
File: hdmi.sch

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

Date: 2018-06-18

Rev: v0.1.0
Id: 19/24

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1

B



C

D

1



1



1

SPI NOR Flash



SPI NOR Flash



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Sheet: /SPI Flash/

File: flash.sch

Size: A4 Date: 2018-06-18

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Rev: v0.1.0

Id: 21/24

[illegible]

Smart Card



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Id: 22/24

GNSS



GNSS



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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

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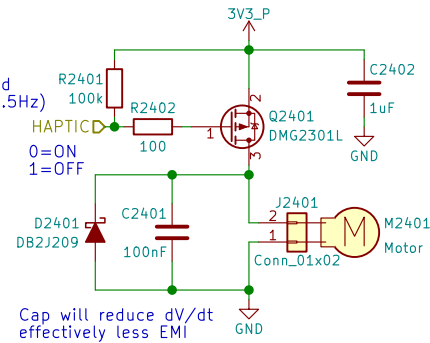
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Haptic Motor

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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