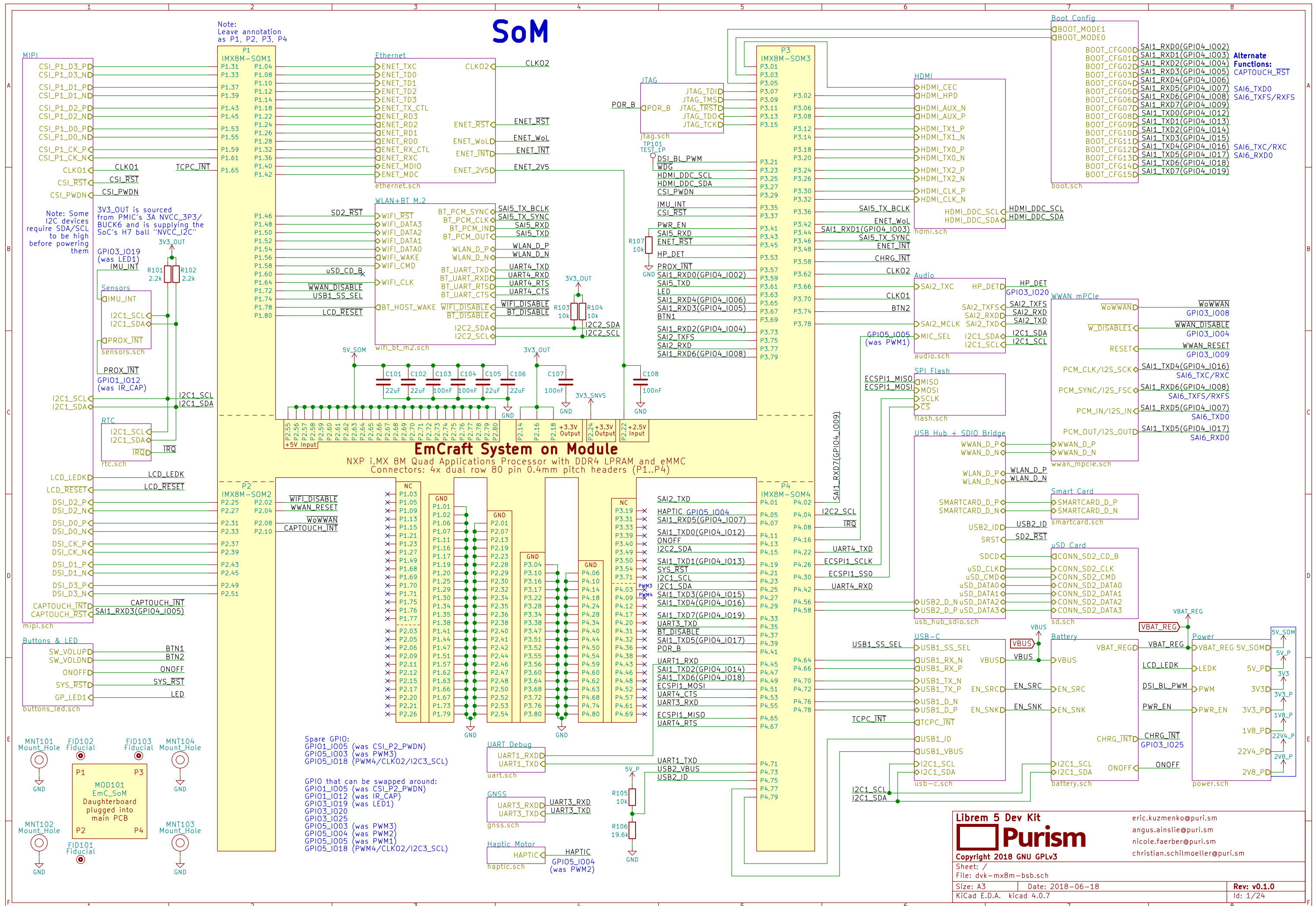


SoM

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



USB-C



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

Rev: v0.1.0
Id: 2/24



(interpret RSOC% based on this plot)

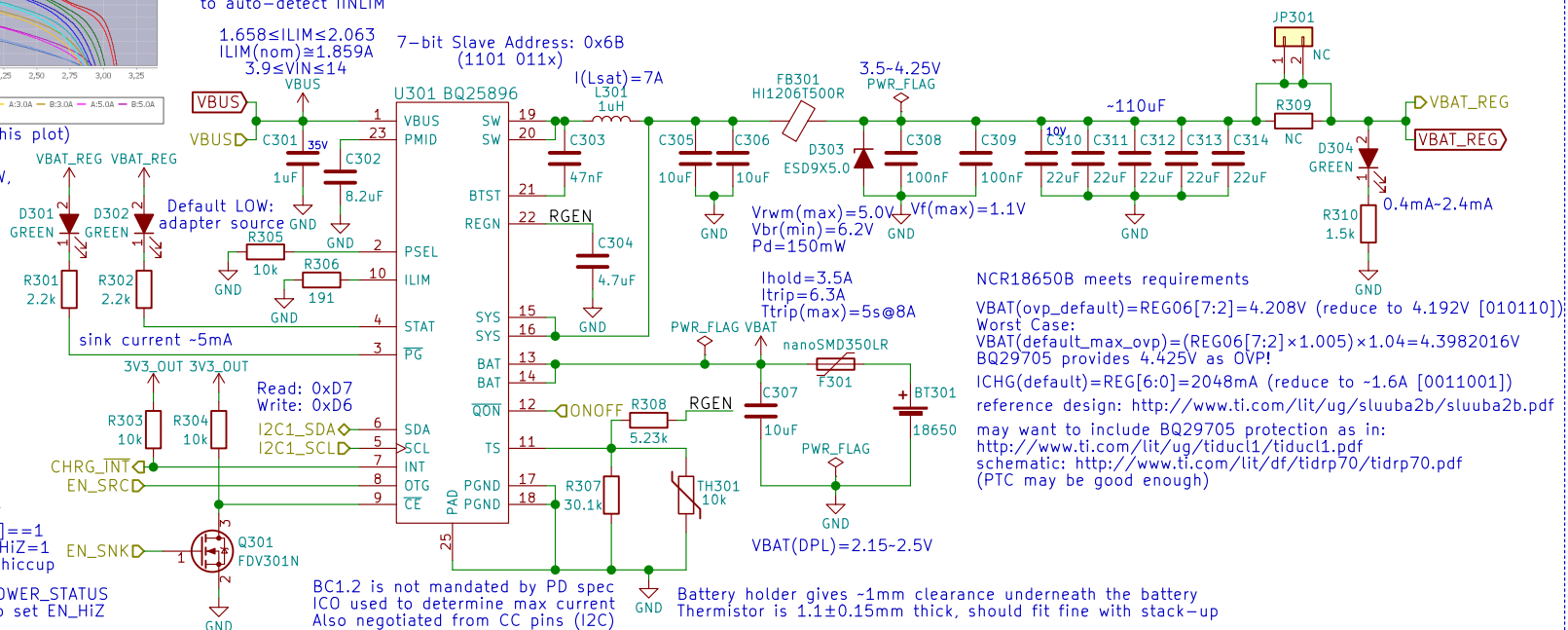
Drawing ~320mA, or consuming $\leq 1.152W$, should give close to 10 hours going from 100% to 0% charge

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

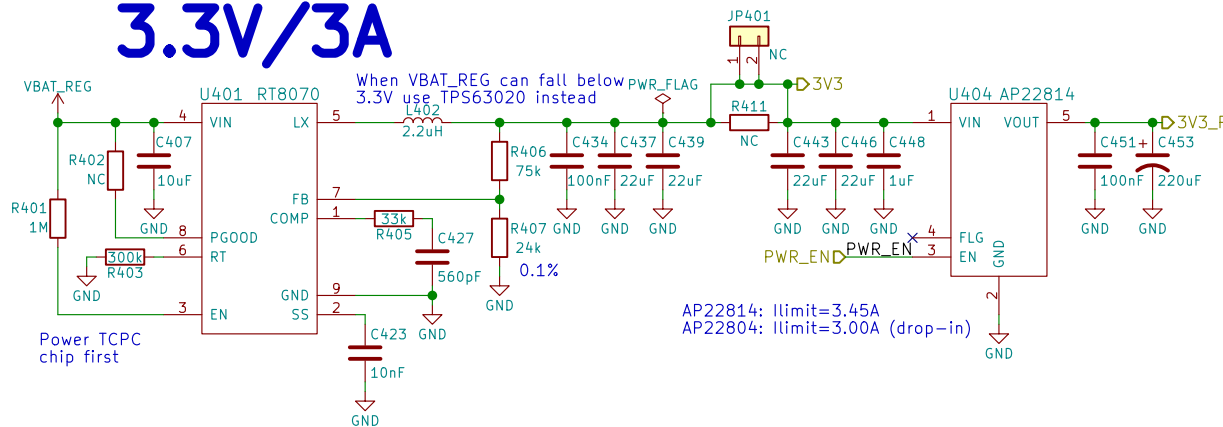
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 3/24

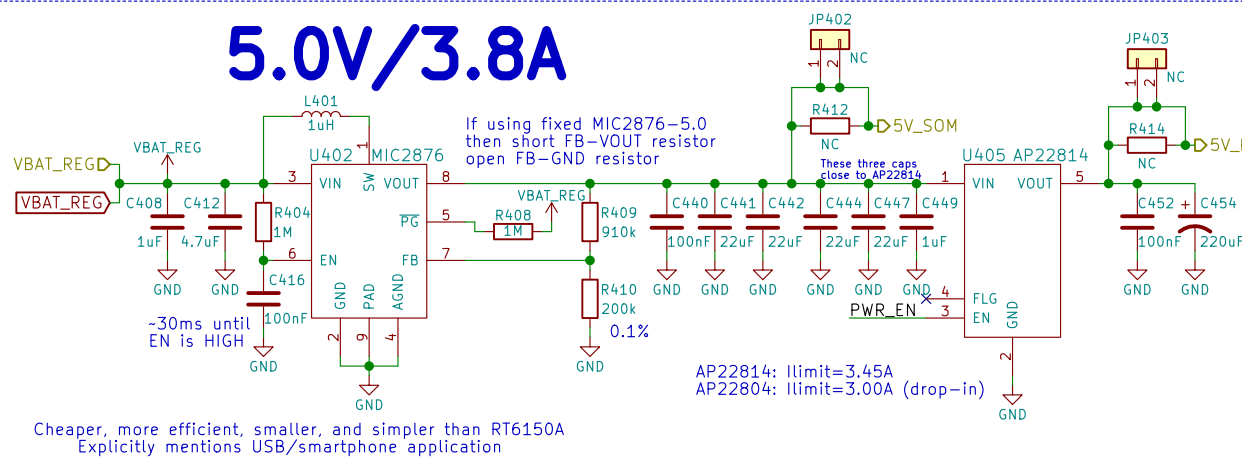
3.3V/3A



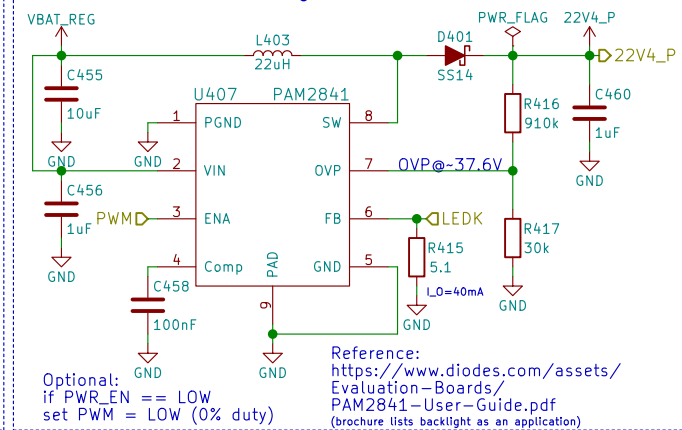
1.8V/600mA



5.0V/3.8A



22.4V/40mA



2.8V/150mA



Power

Power

Purism

Copyright 2018 GNU GPLv3

Sheet: /Power/
File: power.sch

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

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

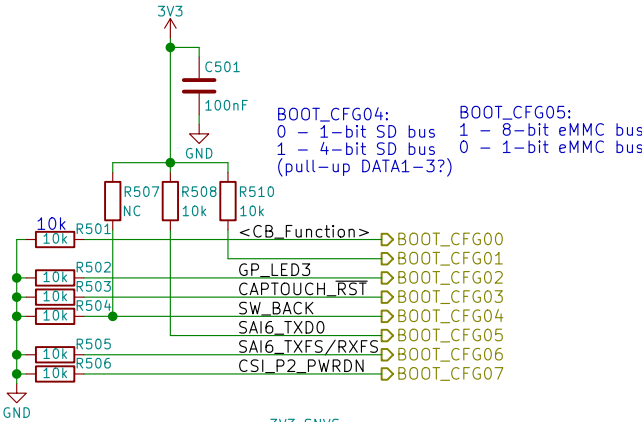
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

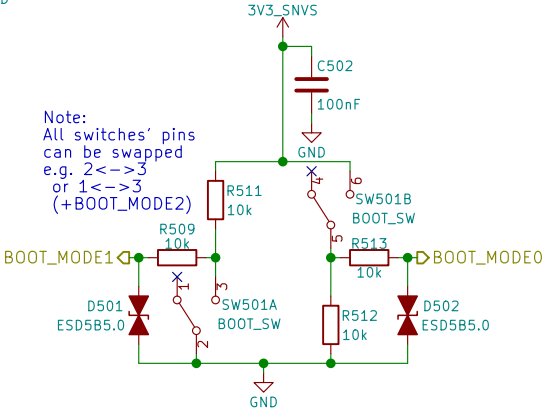
Rev: v0.1.0

Id: 4/24

Boot Config



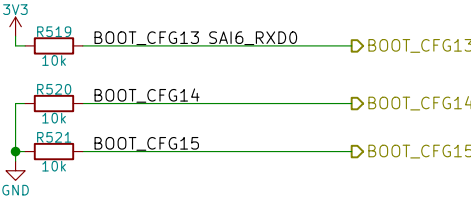
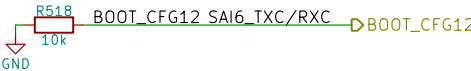
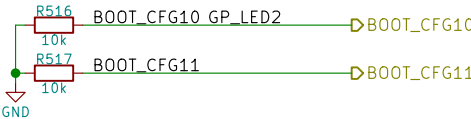
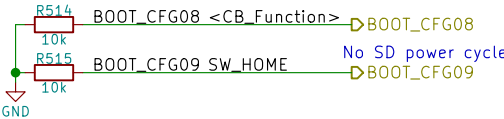
BOOT_CFG04: 0 - 1-bit SD bus
1 - 4-bit SD bus (pull-up DATA1-3?)
BOOT_CFG05: 1 - 8-bit eMMC bus
0 - 1-bit eMMC bus




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

Purism

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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

eric.kuzmenko@puri.sm
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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



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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

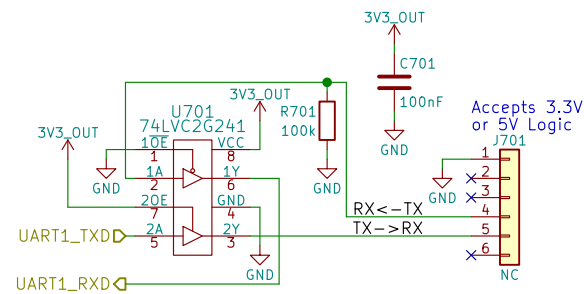
eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm

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

eric.kuzmenko@puri.sm

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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

angus.ainstlie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm

[illegible]

 Purism

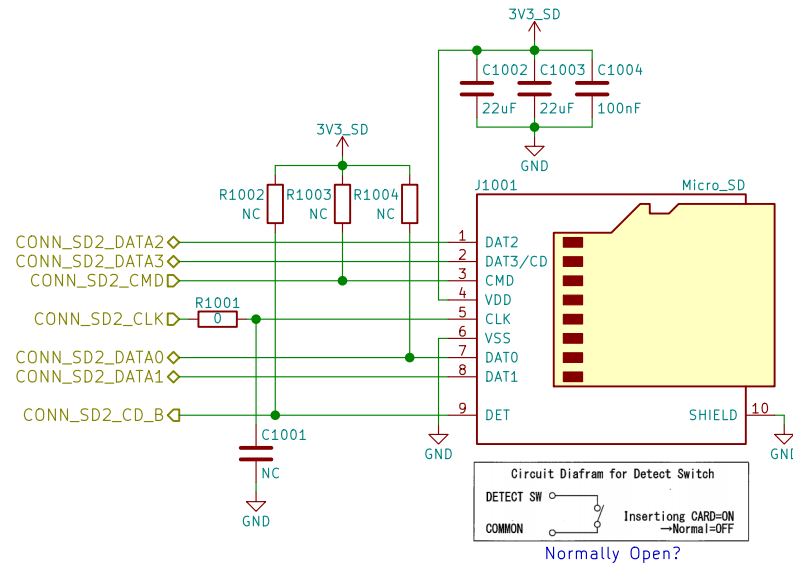
Sheet: /USB Hub + SDIO Bridge/
File: usb_hub_sdio.sch

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

christian.schille@univie.ac.at

Id: 9/24

μSD



uSD Card



Purism

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Sheet: /uSD Card/

File: sd.sch

Size: A4

Date: 2018-06-18

KiCad E.D.A. kicad 4.0.7

Rev: v0.1.0

Id: 10/24

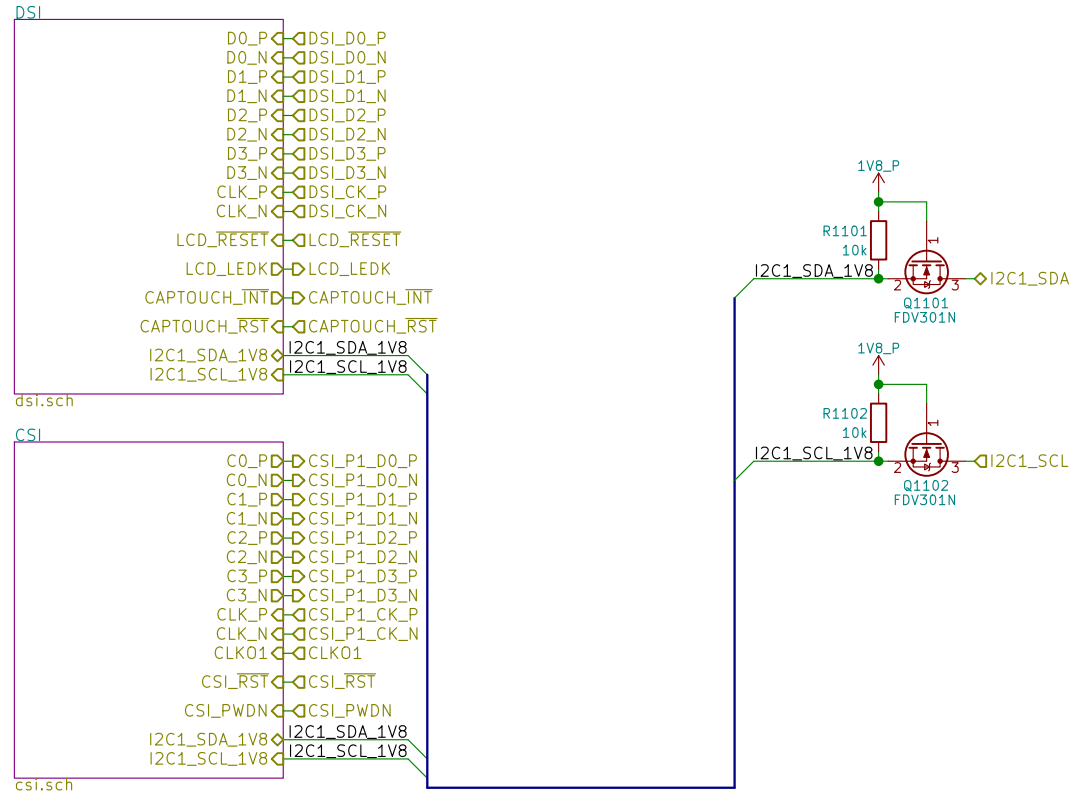
eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm

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

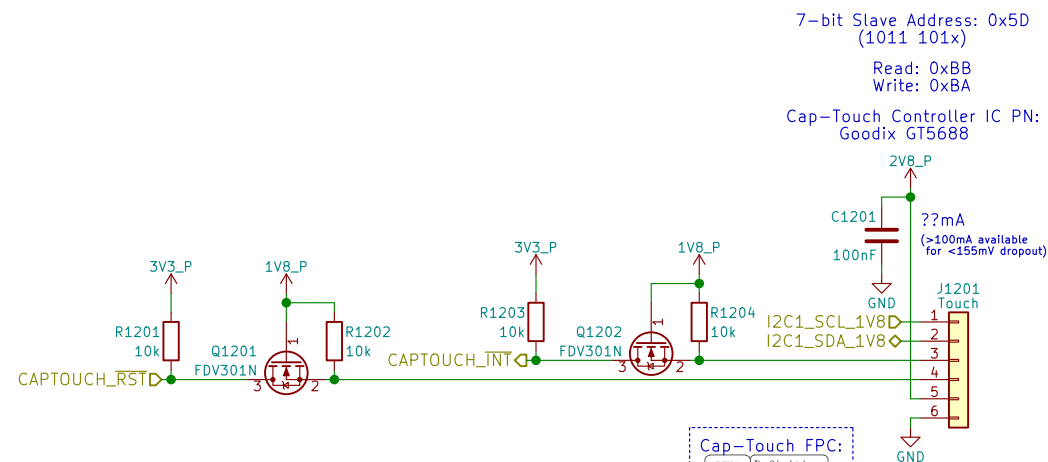
christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 11/24

Display & Touch Controller

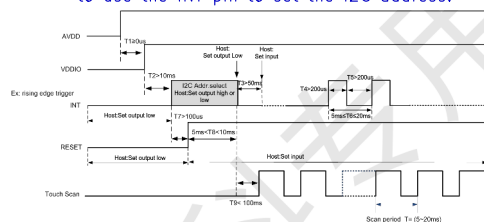
LCD PN:
Shenzhen Jinghong Electronics Co., Ltd.
JH057N00900



The upper 7 bits are the address,
and bit 0 is used to select read or write.
GT5688 has two slave device addresses to choose from:

	7-Bit Address	8-Bit Write Address	8-Bit Read Address
INT LOW	0x5D	0xBA	0xBB
INT HIGH	0x14	0x28	0x29

Every time you power on or reset, you need to
use the INT pin to set the I2C address:

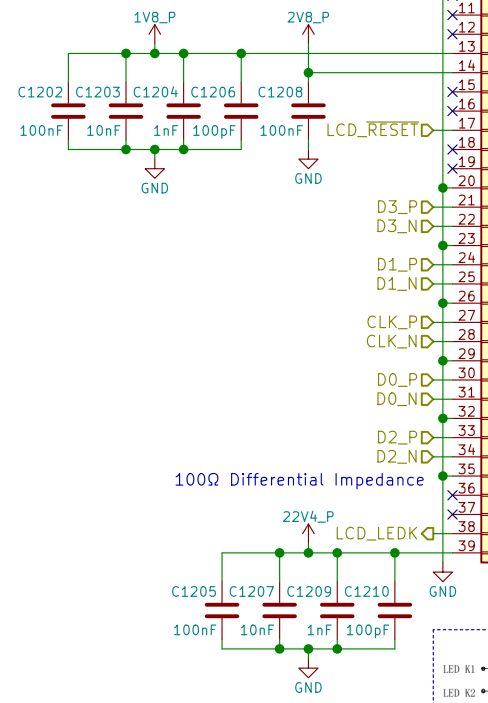


Cap-Touch FPC:

Pin#	Definition
1	SCL
2	SDA
3	INT
4	RESET
5	VID02, S5
6	GND

Front: Back:

Note:
No power-up sequence is
given in the spec sheet



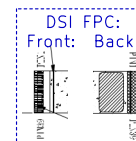
Display_JH057N00900

DISP1201

5.7 "
RGB
720 x 1440
pixels

FPC6
Touch

FPC39
Display +
Backlight



Backlight Array:



MIPI DSI



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

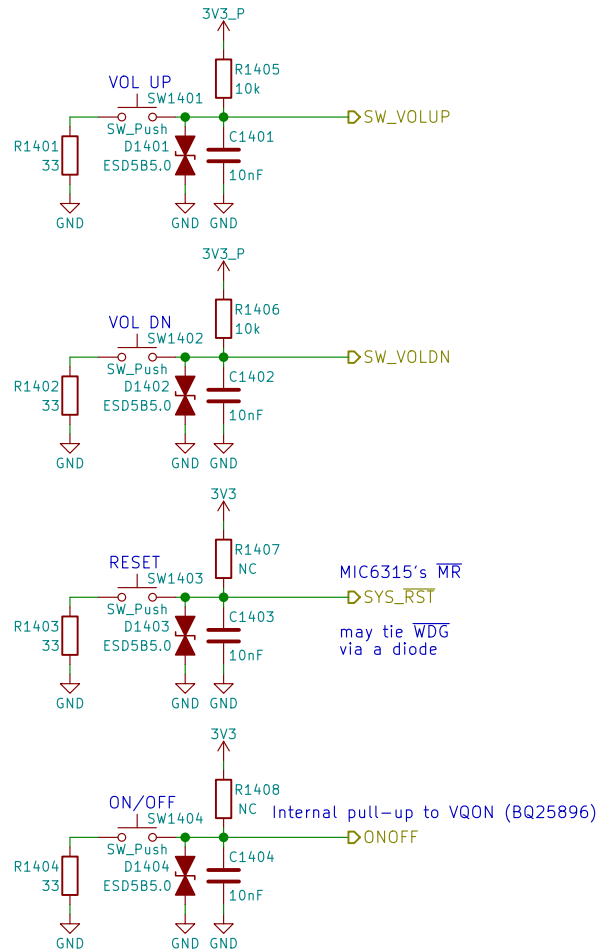
Size: A4 Date: 2018-06-18
KiCad E.D.A. kicad 4.0.7

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

Rev: v0.1.0
Id: 12/24



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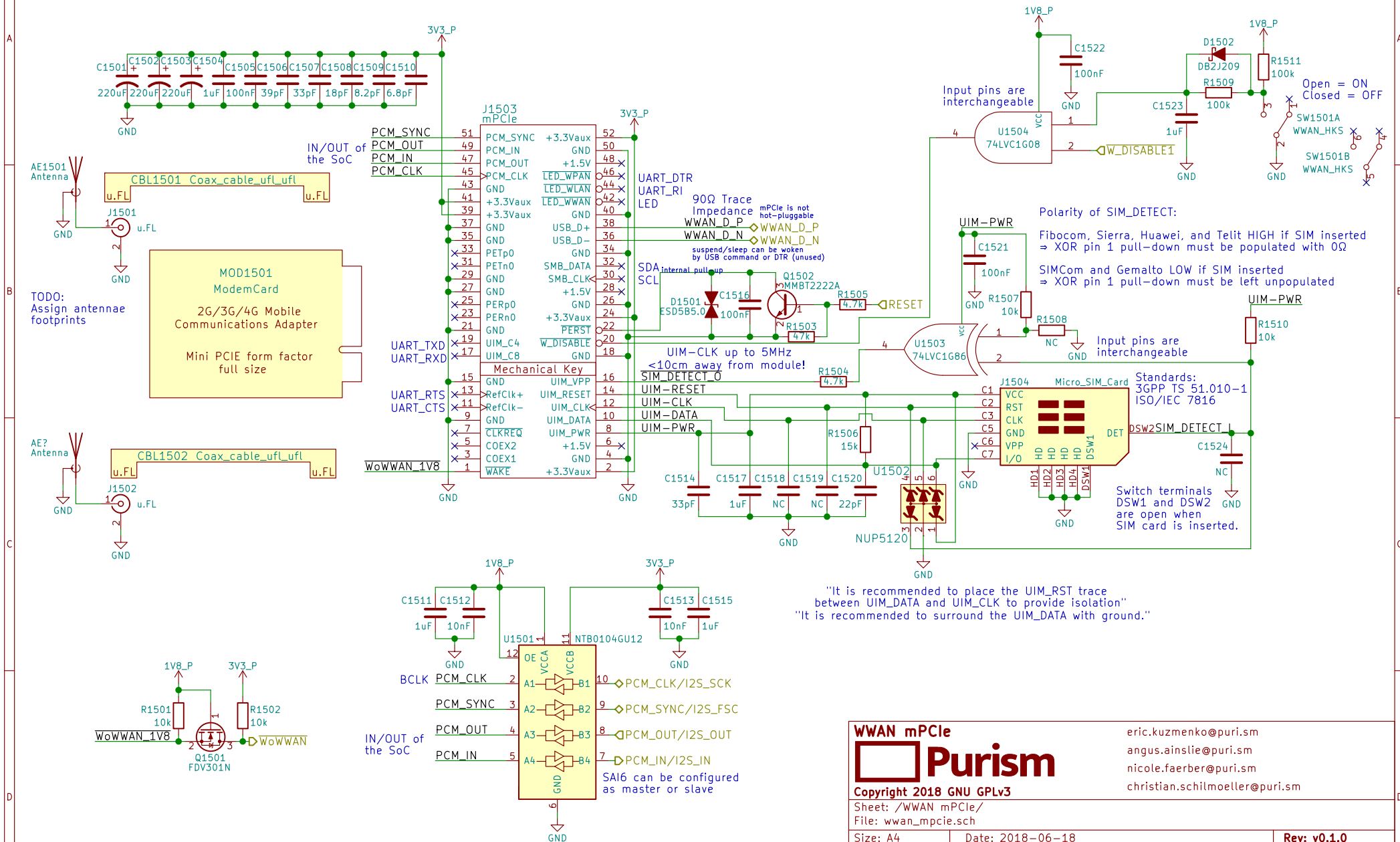
Sheet: /Buttons & LED/
 File: buttons_led.sch

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

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

Rev: v0.1.0
 Id: 14/24

WWAN mPCle



WWAN mPCIe



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Sheet: /WWAN mPCIe/
File: wwan_mpcie.sch

eric.kuzmenko@puri.sm

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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

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

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

Purism

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Sheet: /Audio/
 File: audio.sch

Size: A4

Date: 2018-06-18

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Rev: v0.1.0

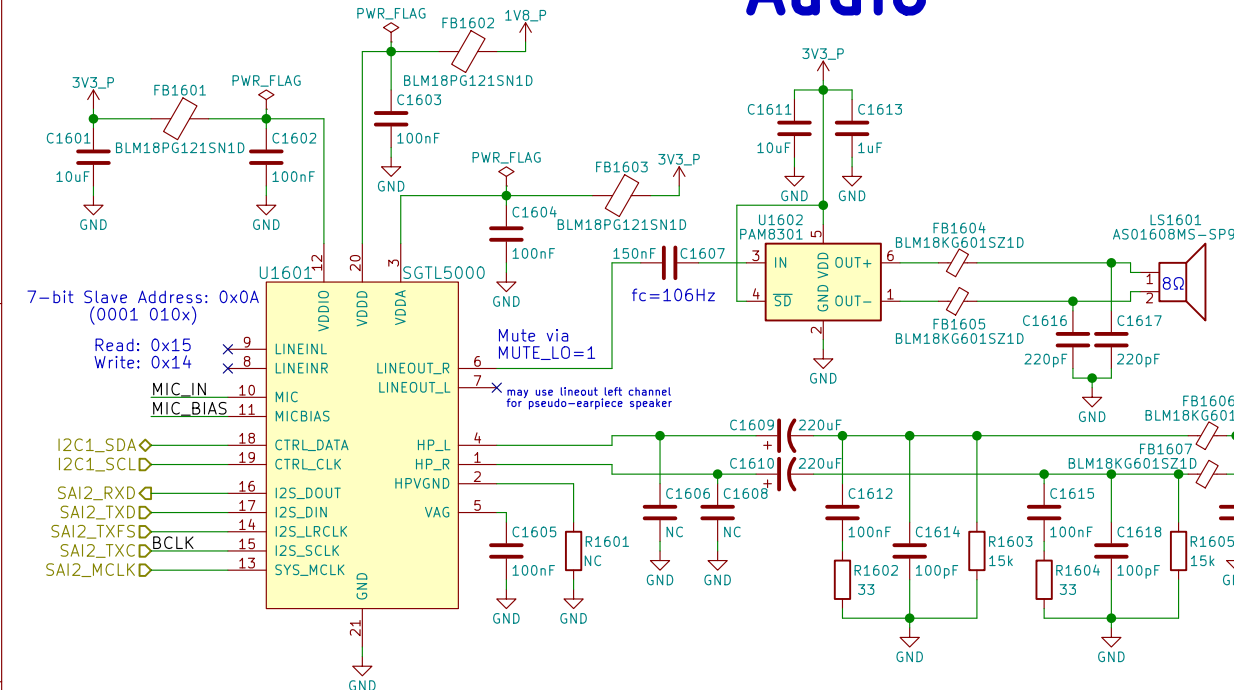
Id: 16/24

eric.kuzmenko@puri.sm

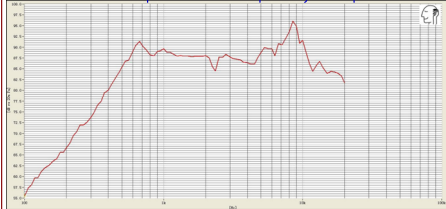
angus.ainslie@puri.sm

nicole.farber@puri.sm

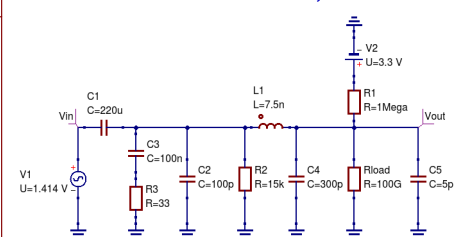
christian.schilmoeller@puri.sm



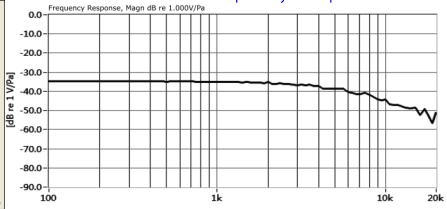
Built-In Speaker's Frequency Response:



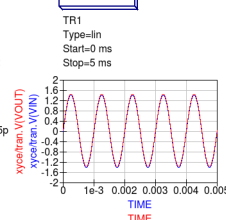
Simulation of HP_DET @ 1kHz output without HP jack inserted:



Built-In Mic's Frequency Response:



transient simulation



[illegible]

 **Purism**

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

Rev: v0.1.0
Id: 17/24

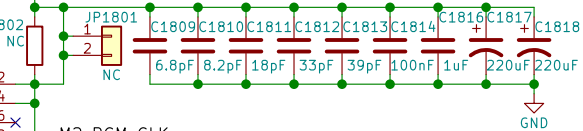
WLAN+BT M.2

RS9116 NC:
RTS, CTS, BT_HOST_WAKE

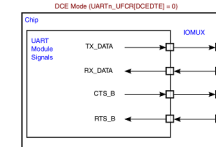
RS9116 datasheet says
no WIFI_WAKE
but the schematic has it

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

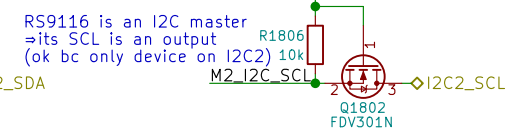
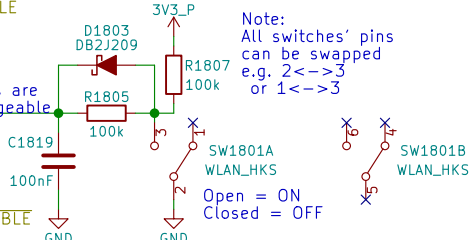
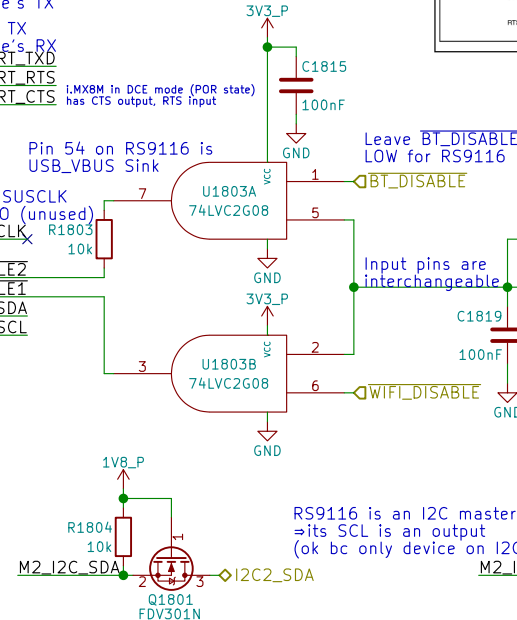
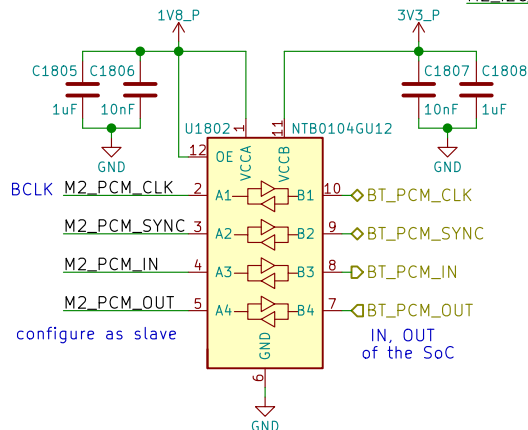
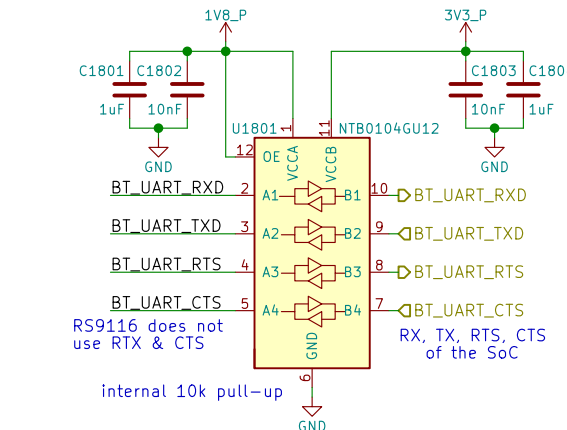
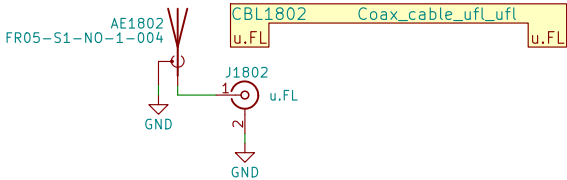
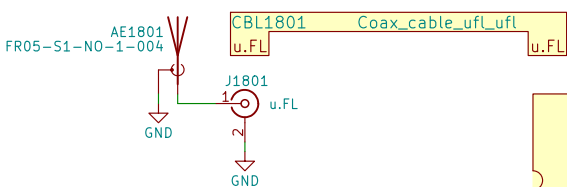


TX output
RX input
CTS output
RTS input
⇒ TX→RX
RX→TX
CTS→CTS
RTS→RTS

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



WLAN+BT M.2

Purism

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

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

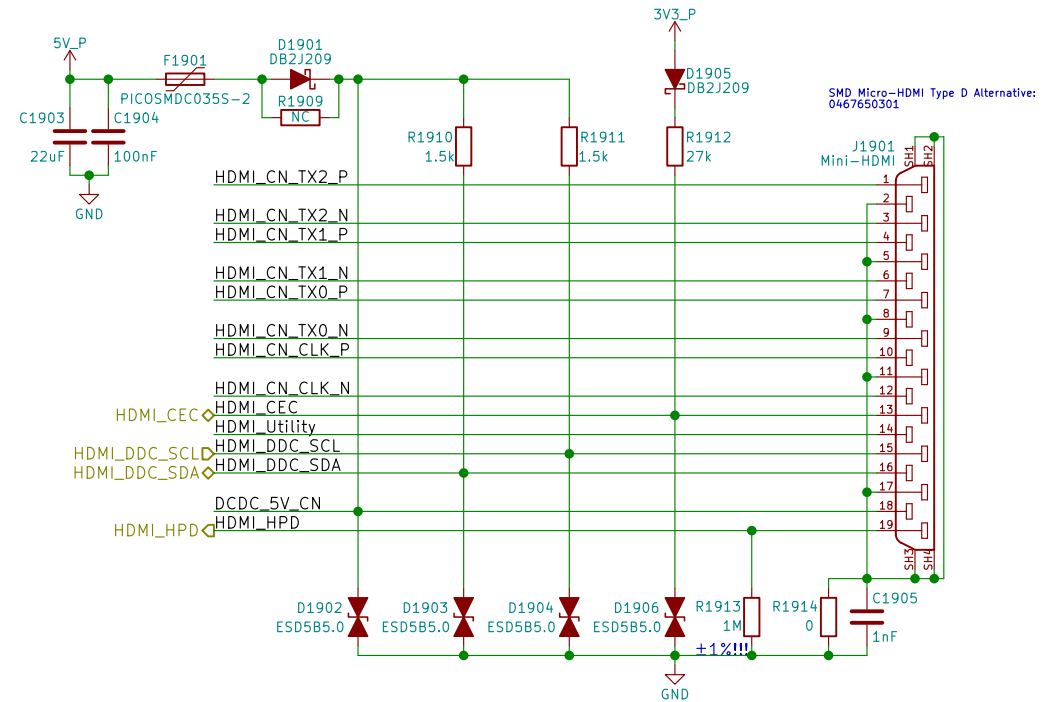
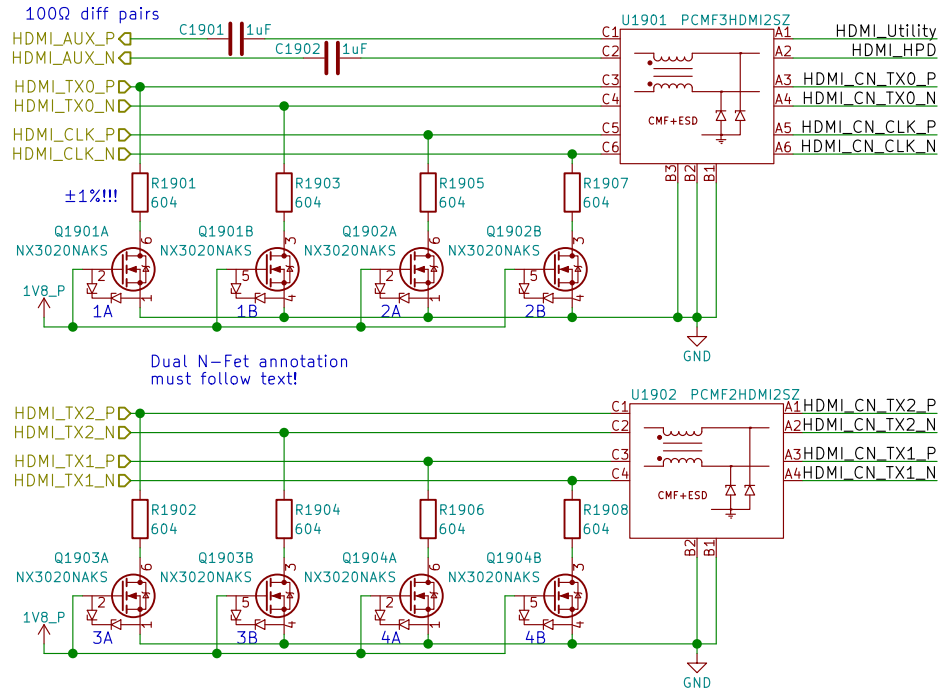
Size: A4
Date: 2018-06-18
KiCad E.D.A. kicad 4.0.7

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
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

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

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

<div> <div>Smart Card</div> <div>  <div>Purism</div> </div> </div> <div> <div>Copyright 2018 GNU GPLv3</div> <div> <div>Sheet: /Smart Card/</div> <div>File: smartcard.sch</div> </div> </div>		<div> <div>eric.kuzmenko@puri.sm</div> <div>angus.ainslie@puri.sm</div> <div>nicole.ferber@puri.sm</div> <div>christian.schilmoeller@puri.sm</div> </div>
<div>Size: A4</div> <div>Date: 2018-06-18</div>	<div>Rev: v0.1.0</div> <div>Id: 22/24</div>	
<div>KiCad E.D.A. kicad 4.0.7</div>		

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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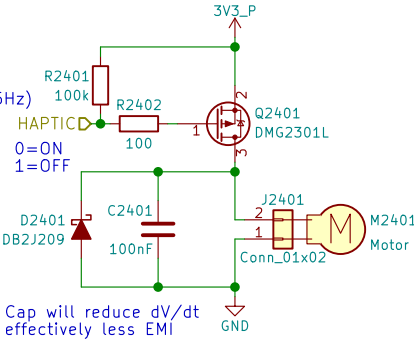
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Haptic Motor

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)

Haptic/Vibration Motor



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