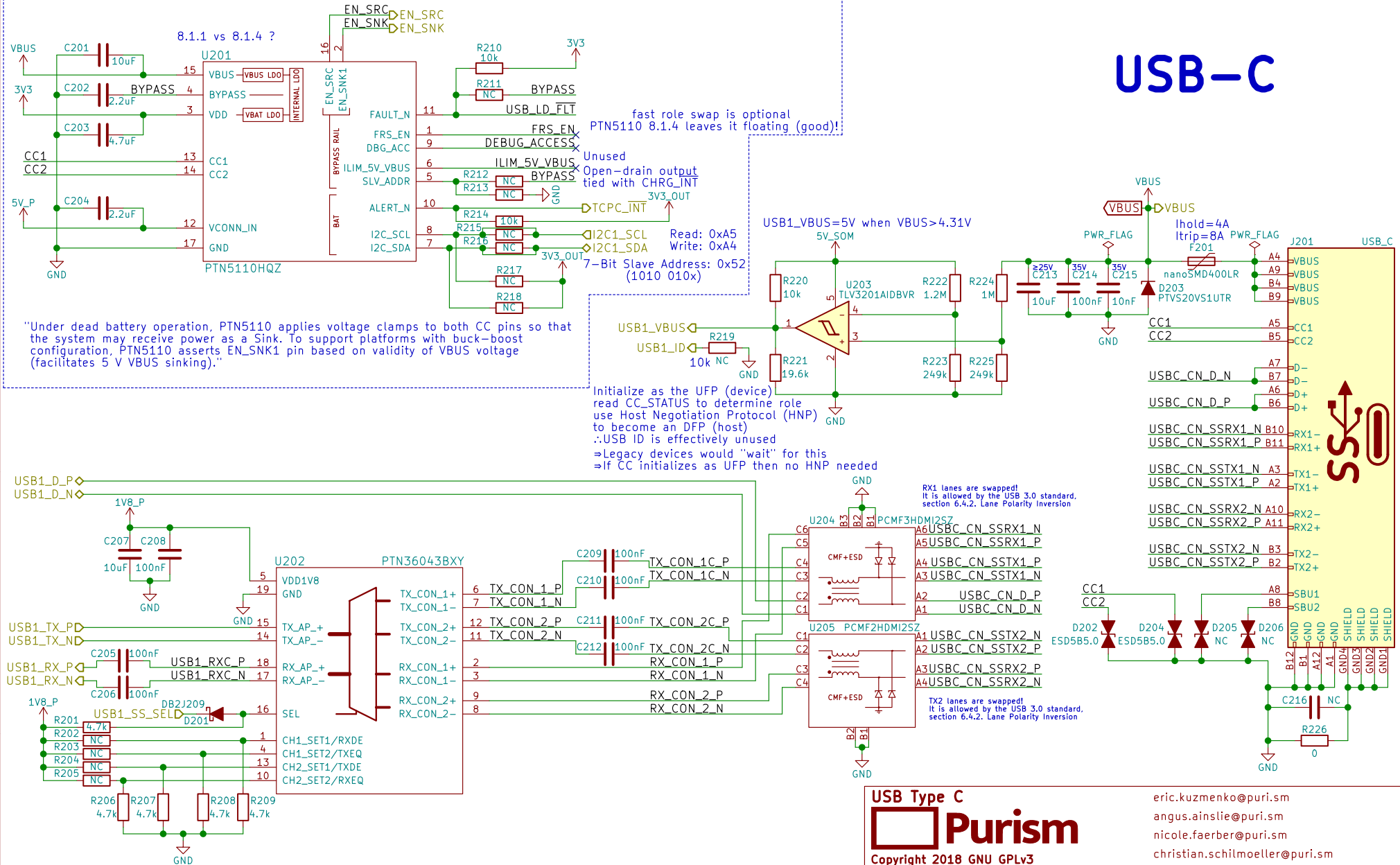


USB-C TCPC - Config Channel (CC) and PD Role Controller

USB-C



USB Type C

Purism

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

Size: A4
KiCad E.D.A. kicad 5.0.0

eric.kuzmenko@puri.sm

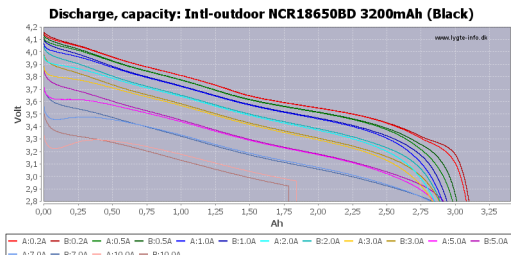
angus.ainstie@puri.sm

nicole.faeber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 2/24



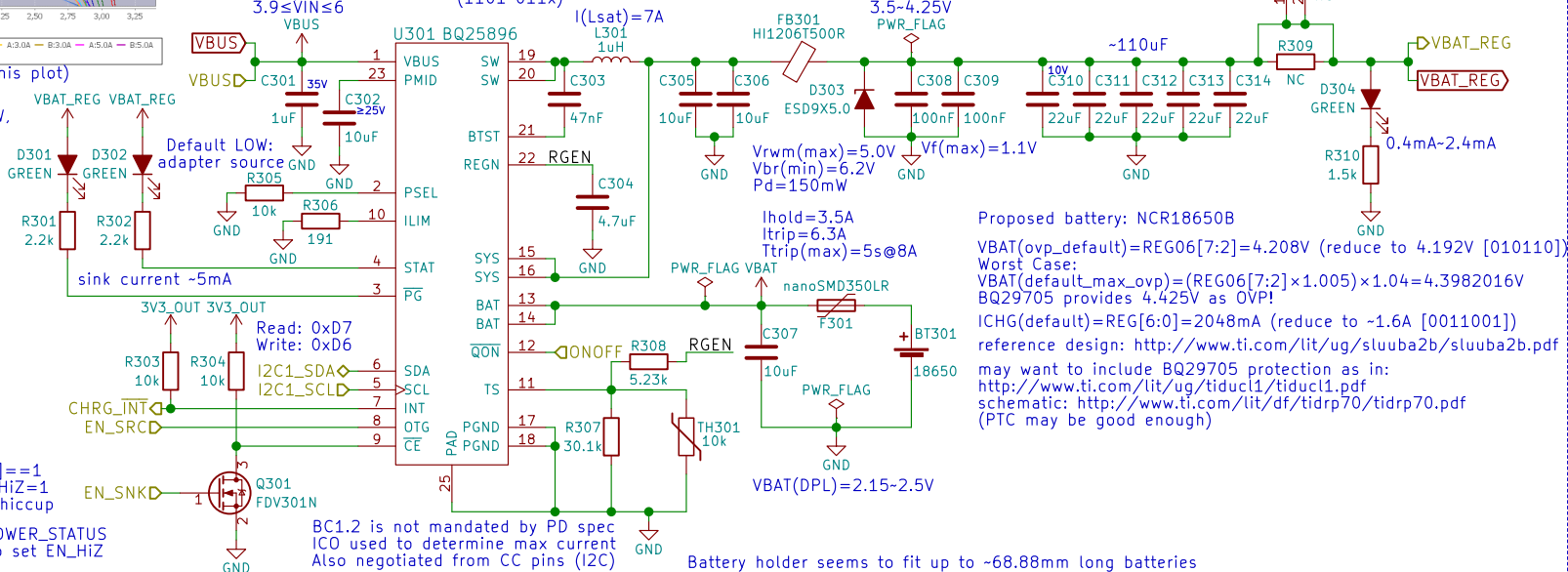
(interpret RSOC% based on this plot)

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

$1.658 \leq ILIM \leq 2.063$
 $ILIM(nom) \approx 1.859A$
 $3.9 \leq VIN \leq 6$
 7-bit Slave Address: 0x6B (1101 011x)

Battery Charge Controller



Proposed battery: NCR18650B

$VBAT(ovp_default) = REG06[7:2] = 4.208V$ (reduce to 4.192V [010110])
 Worst Case:
 $VBAT(default_max_ovp) = (REG06[7:2] \times 1.005) \times 1.04 = 4.3982016V$
 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>
<http://www.ti.com/lit/df/tidrp70/tidrp70.pdf> (PTC may be good enough)

This disables charging but maybe not $VBUS \rightarrow VOUT$ if PTN5110HQ's $FAULT_STATUS[6] = 1$ (Force Off VBUS bit) then set $EN_HiZ = 1$ EN_HiZ may be auto-set when in hiccup

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

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 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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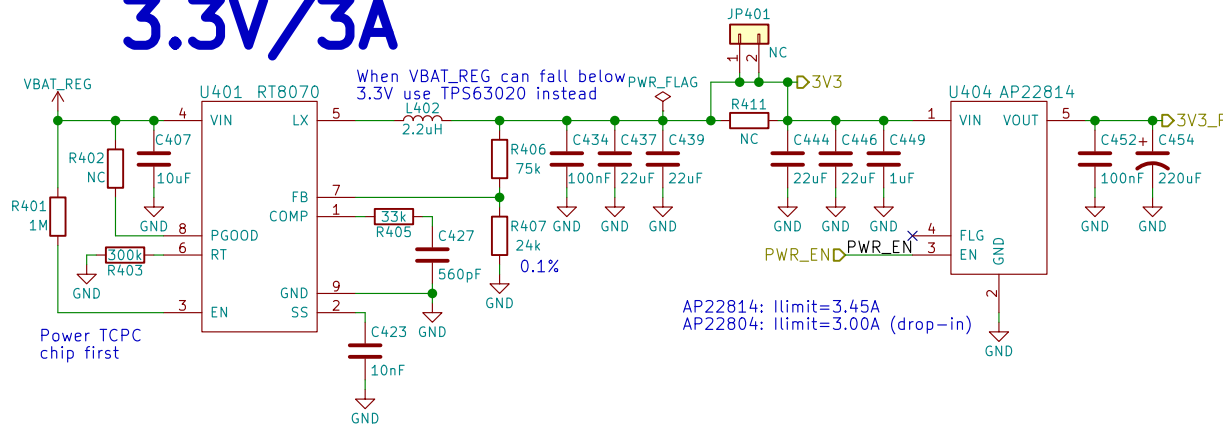
Sheet: /Battery/
 File: battery.sch

Size: A4 Date: 2018-08-14
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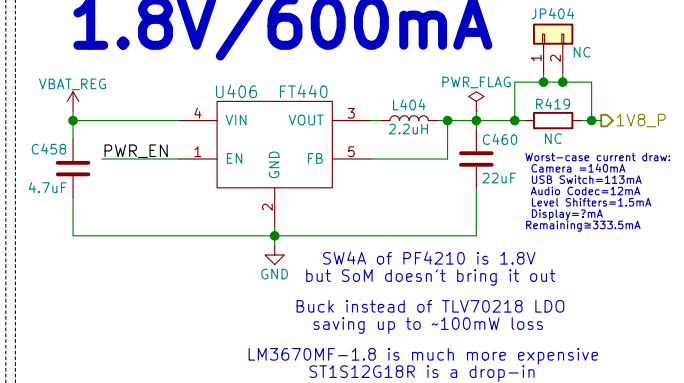
eric.kuzmenko@puri.sm
 angus.ainslie@puri.sm
 nicole.farber@puri.sm
 christian.schilmoeller@puri.sm

Rev: v0.1.0
 Id: 3/24

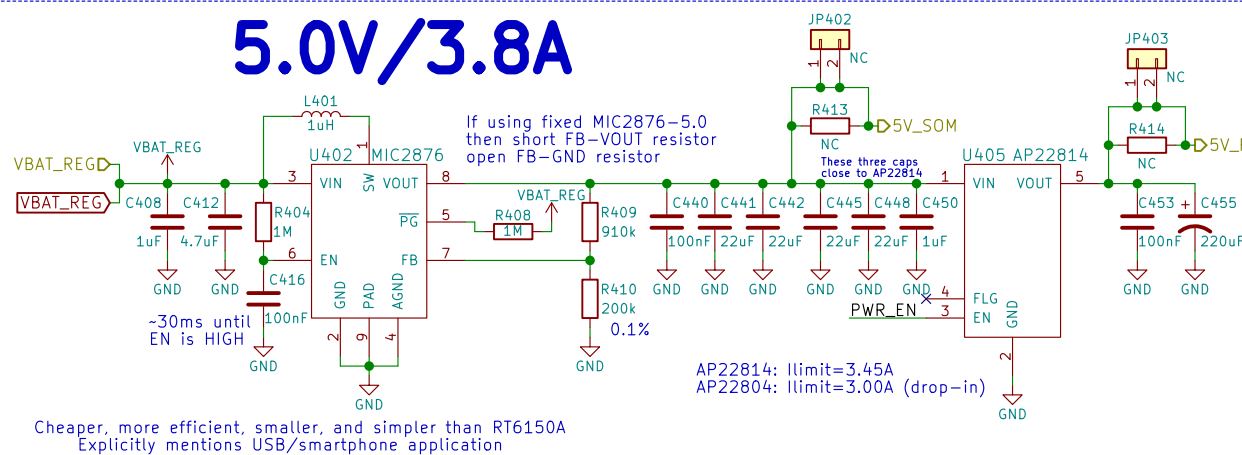
3.3V/3A



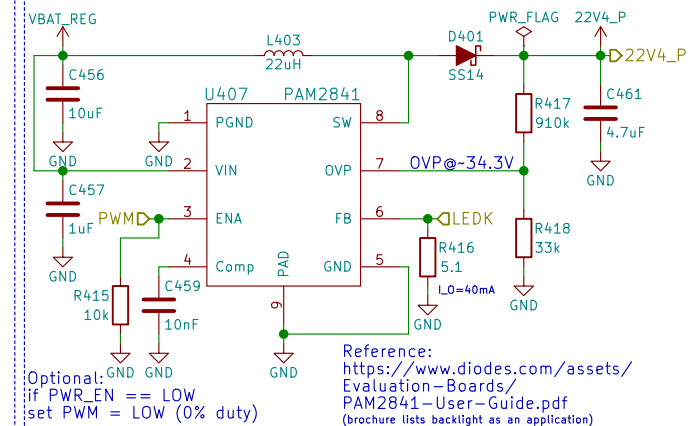
1.8V/600mA



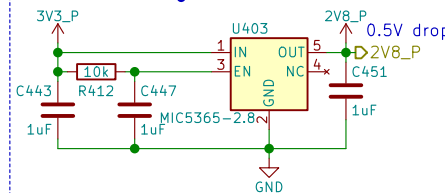
5.0V/3.8A



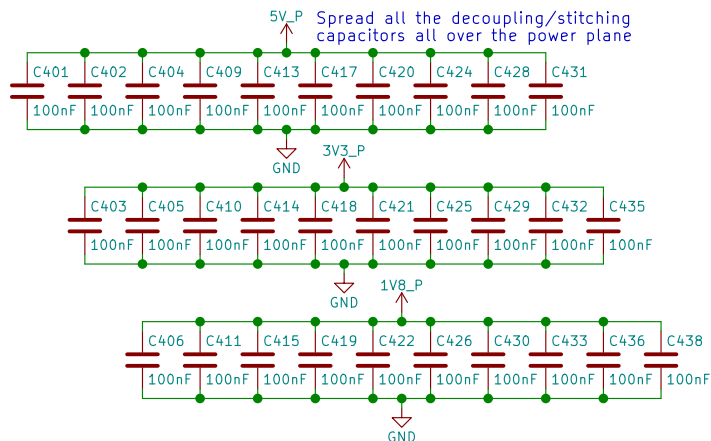
22.4V/40mA



2.8V/150mA



Power



Power

Purism

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Sheet: /Power/
File: power.sch

Size: A4
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Rev: v0.1.0
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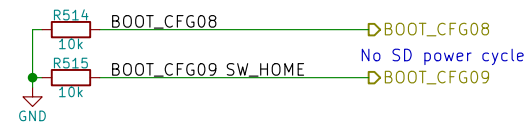
Boot Config



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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Rev: v0.1.0

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christian.schilmoeller@puri.sm

7-bit Slave Address: 0x68
(1101 000x)

Read: 0xD1
Write: 0xD0

U601

I2C1_SDA 1 SDA SCL 8 I2C1_SCL 7 D601 DB2J209 3V3_OUT R601 10k FB601

2 SQA NC 6 VSS IRQ 5 NC VDD 4

GND RV-4162-C7

VIH(min) not given, however
assuming $V_{IH(min)} \cong 0.77647 \cdot V_{DD}$
@ $V_{DD} = 4.25V$ then $V_{IH(min)} \cong 3.2999975V$

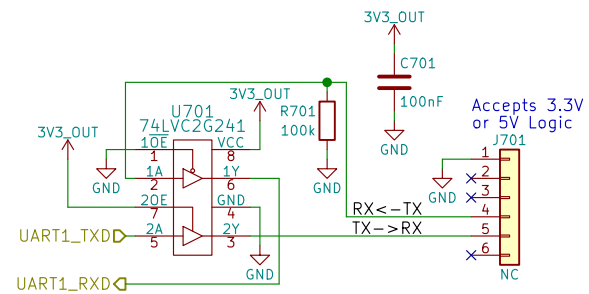
When powered on
VBAT_REG is used
3.5-4.25V

VBAT is PTC fused
If battery is depleted
then current is $\sim 350nA$
($< 1\mu Watt$)

BLM18PG1215N1D VBAT R602 4.99k BAT54C VBAT_REG C601 100nF GND

<div> <div> <div>RTC</div> <div>  <div>Purism</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>	
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Sheet: /RTC/	
File: rtc.sch	
Size: A4	Date: 2018-08-14
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UART Debug



UART Debug



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Sheet: /UART Debug/

File: uart.sch

Size: A4

Date: 2018-08-14

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Rev: v0.1.0

Id: 7/24

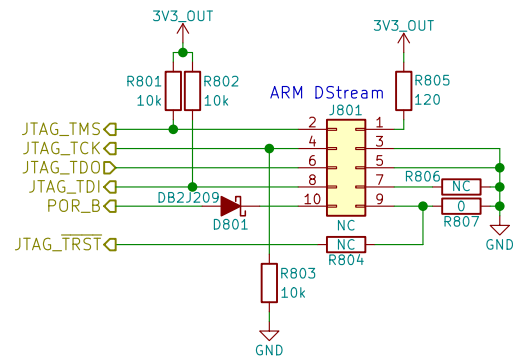
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angus.ainstlie@puri.sm

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christian.schilmoeller@puri.sm

JTAG



JTAG



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Sheet: /JTAG/

File: jtag.sch

Size: A4 Date: 2018-08-14

KiCad E.D.A. kicad 5.0.0

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angus.ainstlie@puri.sm

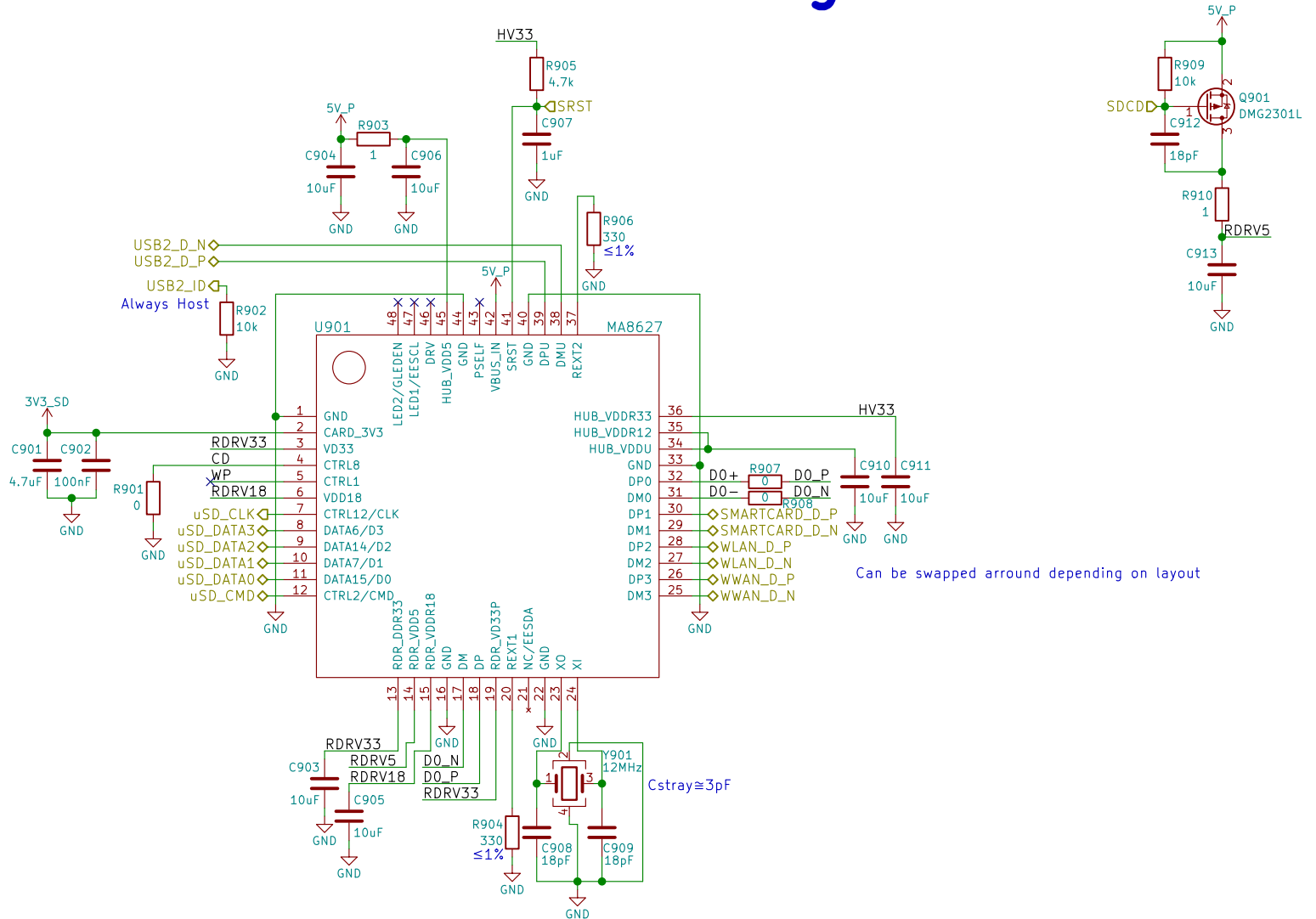
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 8/24

USB Hub + SDIO Bridge



USB Hub + SDIO Bridge



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Sheet: /USB Hub + SDIO Bridge/

Size: A4

Date: 2018-08-14

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angus.ainslie@puri.sm

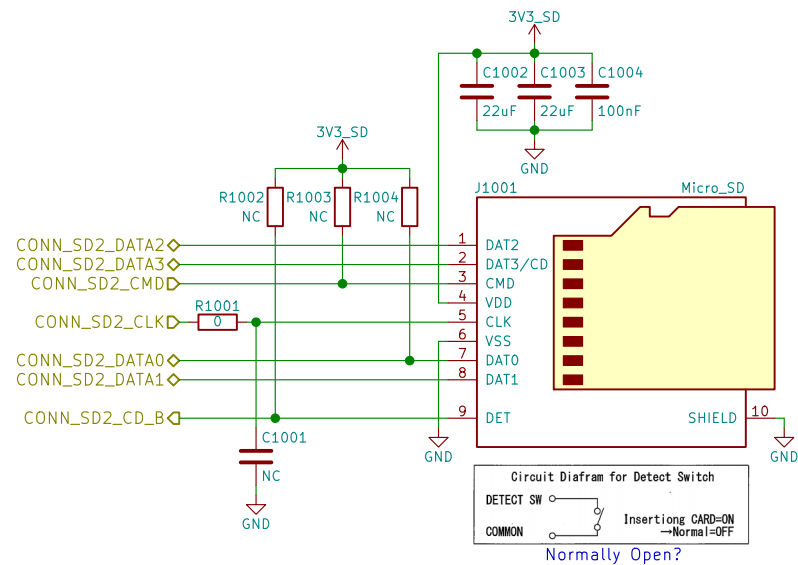
nicole.faerber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

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: 2018-08-14
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Size: A4	Date: 11/01/2025
KiCad E.D.A.	kicad 5.0.0

Rev: v0.1.0

Id: 10/24

MIPI



MIPI



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Sheet: /MIPI/
File: mipi.sch

Size: A4 Date: 2018-08-14

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christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 11/24

A

B

C

D

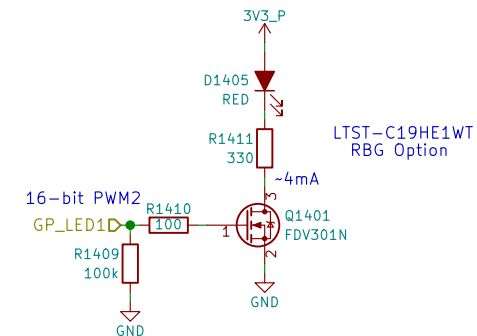
Id: 12/24

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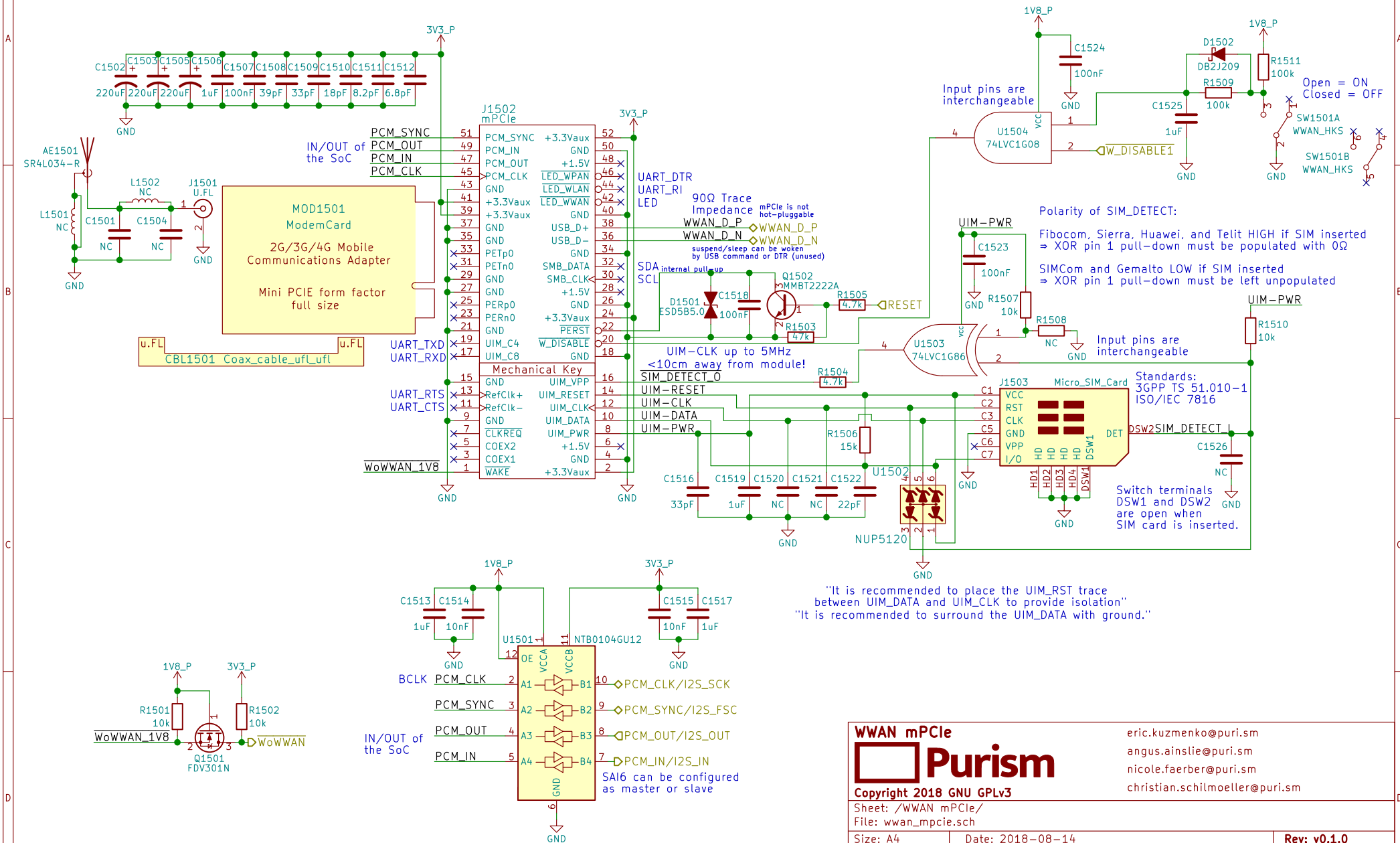
Sheet: /Buttons & LED/
 File: buttons_led.sch

Size: A4 Date: 2018-08-14
 KiCad E.D.A. kicad 5.0.0

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

Rev: v0.1.0
 Id: 14/24

WWAN mPCIe



Purism

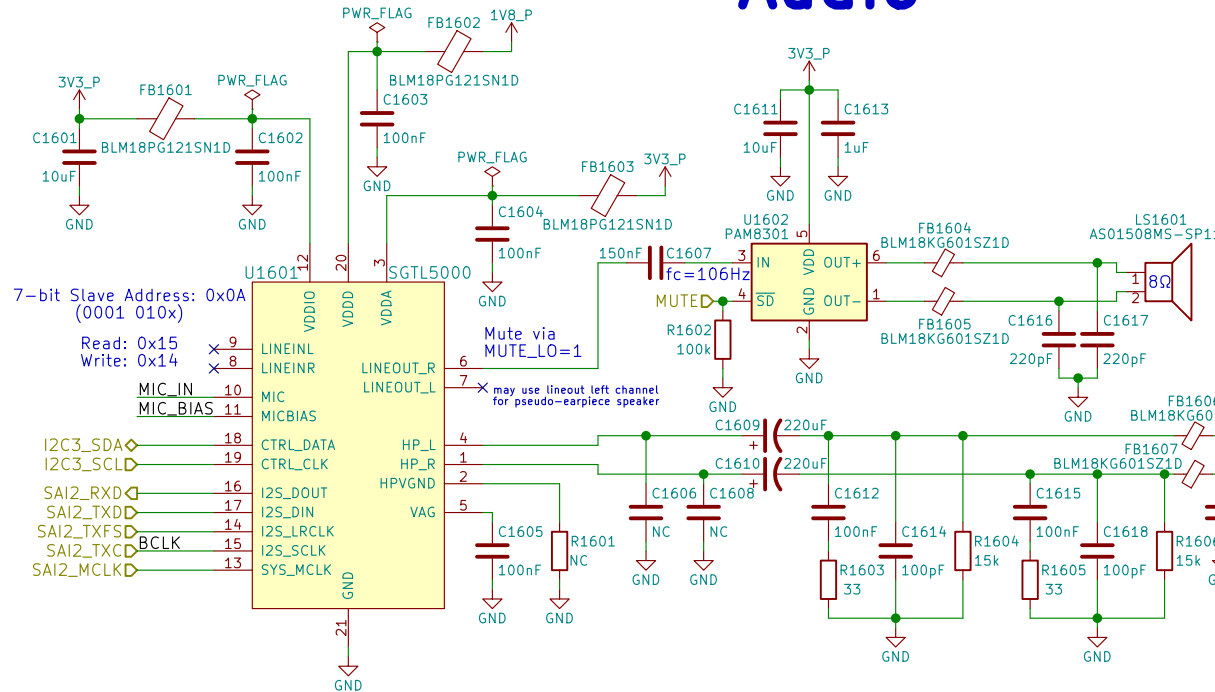
Sheet: /WWAN mPCIe/
File: wwan_mpcie.sch

Size: A4	Date: 2018-08-14
KiCad E.D.A. kicad 5.0.0	

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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-crc>
 -switch-this-audio-jack-using-its-own-mechanical-switches-without-crc (Nit6 does the same)
 +Zener diode to protect against ranges outside of -0.9V to 3.3V

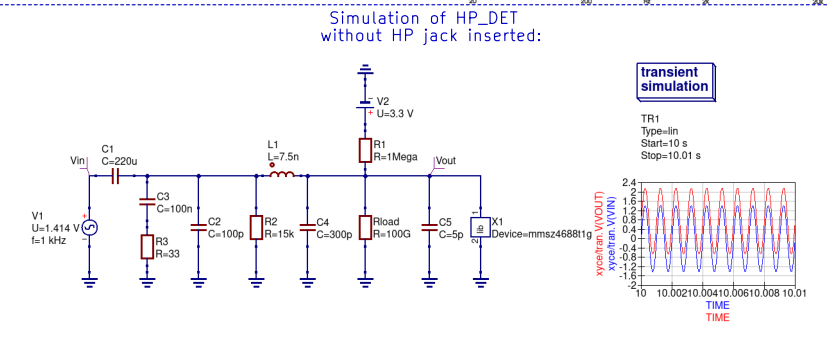
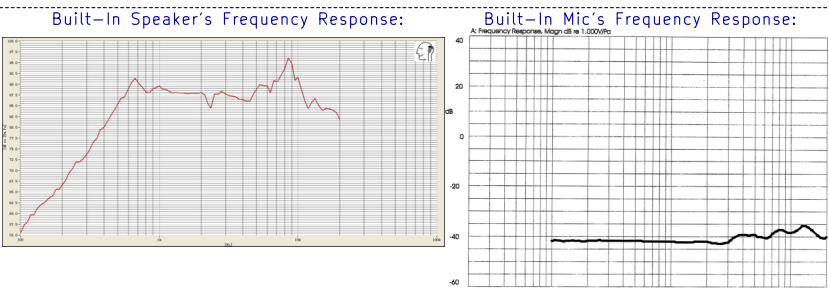
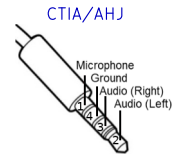
dB specs in datasheet is a unit of power gain (not dBu or VU) with respect to the DAC's unattenuated output

"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



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 = 36.86Ohms Rp = 36.86Ohms θ = -2.3deg	Earbud Speaker: @1kHz Ls = 25.2uH Lp = 311.0mH Cs = 1.0mF Cp = 81.95nF Rs = 17.030Ohms Rp = 17.034Ohms θ = 0.5deg
---	--	---

Audio

Purism

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Sheet: /Audio/
File: audio.sch

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

Rev: v0.1.0
Id: 16/24

RGMII 10/100/1000 Ethernet

3V3_P FB1701 BLM18PG121SN1D C1703 1uF C1705 220nF GND C1704 10uF C1706 220nF GND U1701 4 VDD33 AVDD33 VDDIO_REG VDDH_REG LX 29 10 3 47 8 44 13 19 AVDDL1 AVDDL2 AVDDL3 AVDDL4 35 36 37 38 39 34 33 31 30 28 27 32 46 45 43 42 41 48 2 40 5 22 25 6 7 9 49 GND ENET_2V5 ENET_2V5 C1707 220nF C1708 1uF C1710 1uF GND L1701 4.7uH ENET_1V1 C1713 10uF C1716 220nF GND PWR_FLAG FB1702 BLM18PG121SN1D C1711 220nF C1714 220nF C1717 220nF C1718 2.2uF GND 11 12 14 15 17 18 20 21 100Ω diff-pairs! ETH_TRX0_P ETH_TRX0_N ETH_TRX1_P ETH_TRX1_N ETH_TRX2_P ETH_TRX2_N ETH_TRX3_P ETH_TRX3_N LED_ACT LED_LINK10_100 LED_LINK1000 LED_ACT C1719 220nF C1720 220nF C1721 220nF GND FB1703 BLM18PG121SN1D SH1 SH2 GREEN YELLOW D1702 GREEN J1701 RJ45 ETH_TRX0_P_TD1+ ETH_TRX0_N_TD1- ETH_TRX1_P_TD2+ ETH_TRX1_N_TD2- ETH_TRX2_P_TD3+ ETH_TRX2_N_TD3- ETH_TRX3_P_TD4+ ETH_TRX3_N_TD4- VCC GND 1 10 11 12 13 14 100Ω diff-pairs! LED_ACT LED_LINK10_100 LED_LINK1000 LED_ACT C1709 NC C1712 NC C1715 NC GND 470pF GND 26 24 23 LED_LINK10_100 LED_LINK1000 LED_ACT 270 270 270 270 R1723 R1724 R1725 2.5V (3.3V tolerant) 1 48 2 40 5 22 25 6 7 9 49 GND ENET_2V5 ENET_2V5 R1712 10k R1714 10k R1716 10k R1717 10k R1718 1.62k 1x R1721 2.37k R1719 NC R1720 NC D1701 DB2J209 ENET_MDIO ENET_RST ENET_WOL ENET_INT TP1701 TEST_1P TP1702 TEST_1P CLK02 NC R1713 NC R1715 NC GND C1701 27pF C1702 27pF GND R1722 2.37k GND Y1701 25MHz 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Ethernet
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Sheet: /Ethernet/
File: ethernet.sch
Size: A4
Date: 2018-08-14
KiCad E.D.A. kicad 5.0.0
Rev: v0.1.0
Id: 17/24

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

Size: A4	Date: 2018-08-14	Rev: v0.1.0
KiCad E.D.A. kicad 5.0.0		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

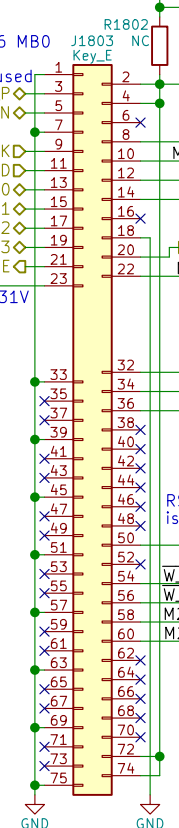
RedPine RS9116 MBO
Requires 5V on
Pin 54 if USB used

WLAN_D_P
WLAN_D_N
WIFI_CLK
WIFI_CMD
WIFI_DATA0
WIFI_DATA1
WIFI_DATA2
WIFI_DATA3
WIFI_WAKE

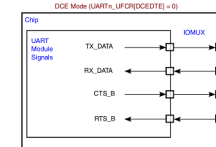
RedPine RS9116
has 100k pull-up to
3.3V making SDIO_RST
~2.55V when HIGH

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

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



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



Leave BT_DISABLE
LOW for RS9116

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

Input pins are
interchangeable

BT_DISABLE

WIFI_DISABLE

SW1801A
WLAN_HKS

SW1801B
WLAN_HKS

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)

M2_I2C_SDA

M2_I2C_SCL

I2C2_SDA

I2C2_SCL

internal 10k pull-up

internal 10k pull-up

internal 10k pull-up

internal 10k pull-up

internal 10k pull-up

internal 10k pull-up

internal 10k pull-up

internal 10k pull-up

internal 10k pull-up

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internal 10k pull-up

internal 10k pull-up

internal 10k pull-up

WLAN+BT M.2

Purism

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Sheet: /WLAN+BT M.2/

File: wifi_bt_m2.sch

Size: A4

Date: 2018-08-14

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Rev: v0.1.0

Id: 18/24

eric.kuzmenko@puri.sm

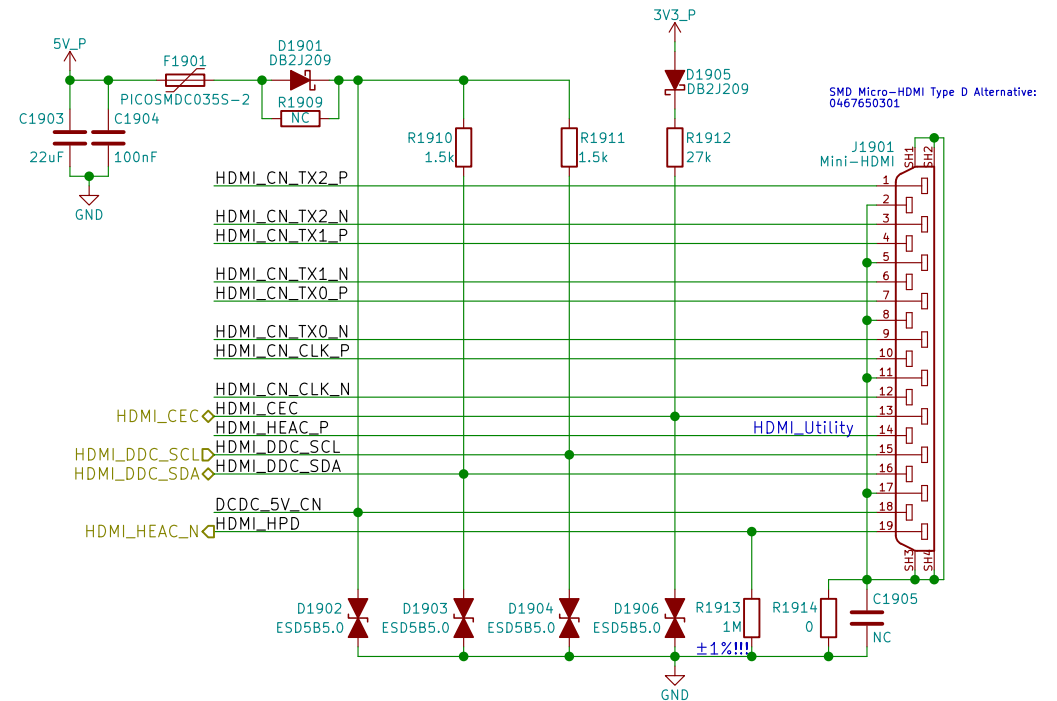
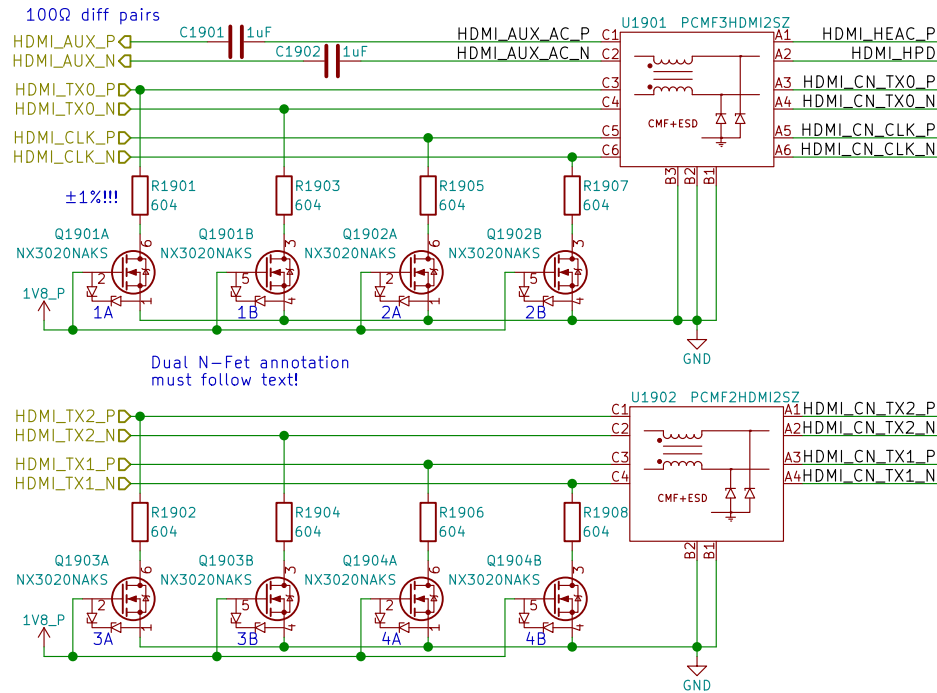
angus.ainstlie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm

TUSB1046 can be used for DP over USB-C

HDMI



HDMI



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Sheet: /HDMI/
File: hdmi.sch

Size: A4
KiCad E.D.A. kicad 5.0.0

Date: 2018-08-14

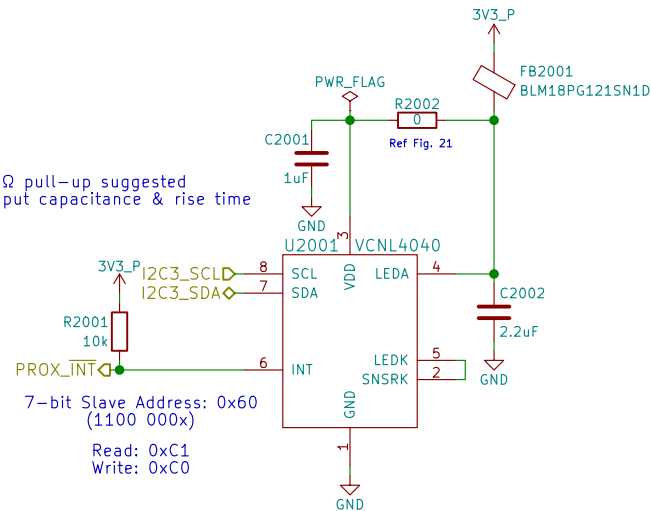
Rev: v0.1.0
Id: 19/24

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angus.ainstie@puri.sm
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christian.schilmoeller@puri.sm

Sensors

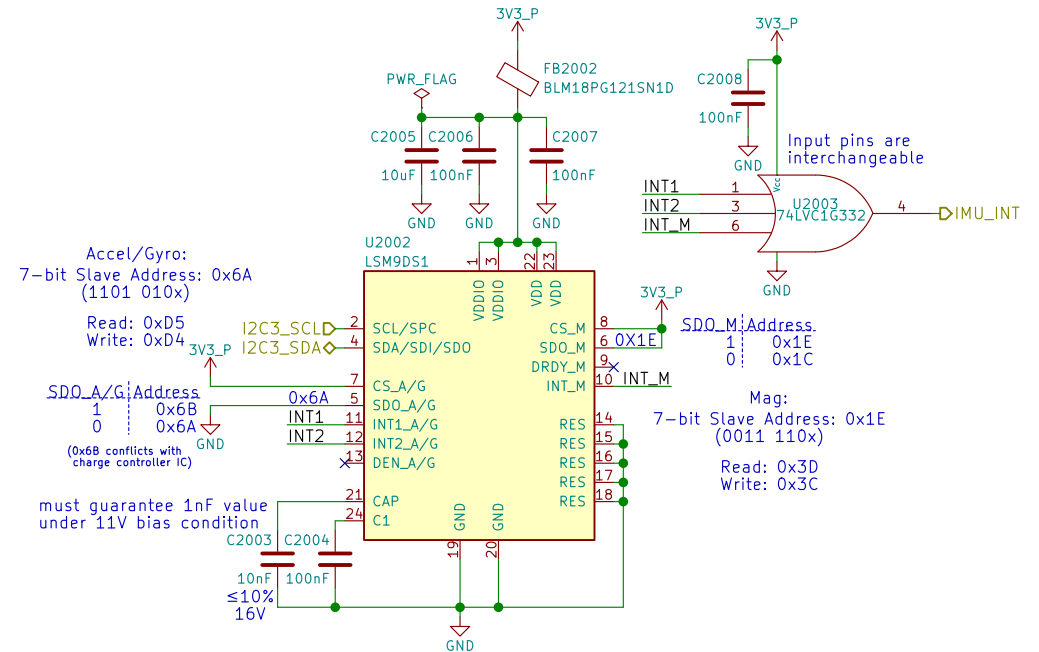
Proximity & Ambient Light

Note:
I2C 2.2k Ω 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>

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



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Sheet: /Sensors/
File: sensors.sch

Size: A4 Date: 2018-08-14
KiCad E.D.A. kicad 5.0.0

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Rev: v0.1.0
Id: 20/24

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/

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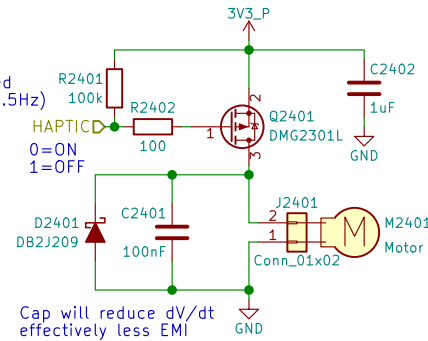
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Haptic Motor

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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