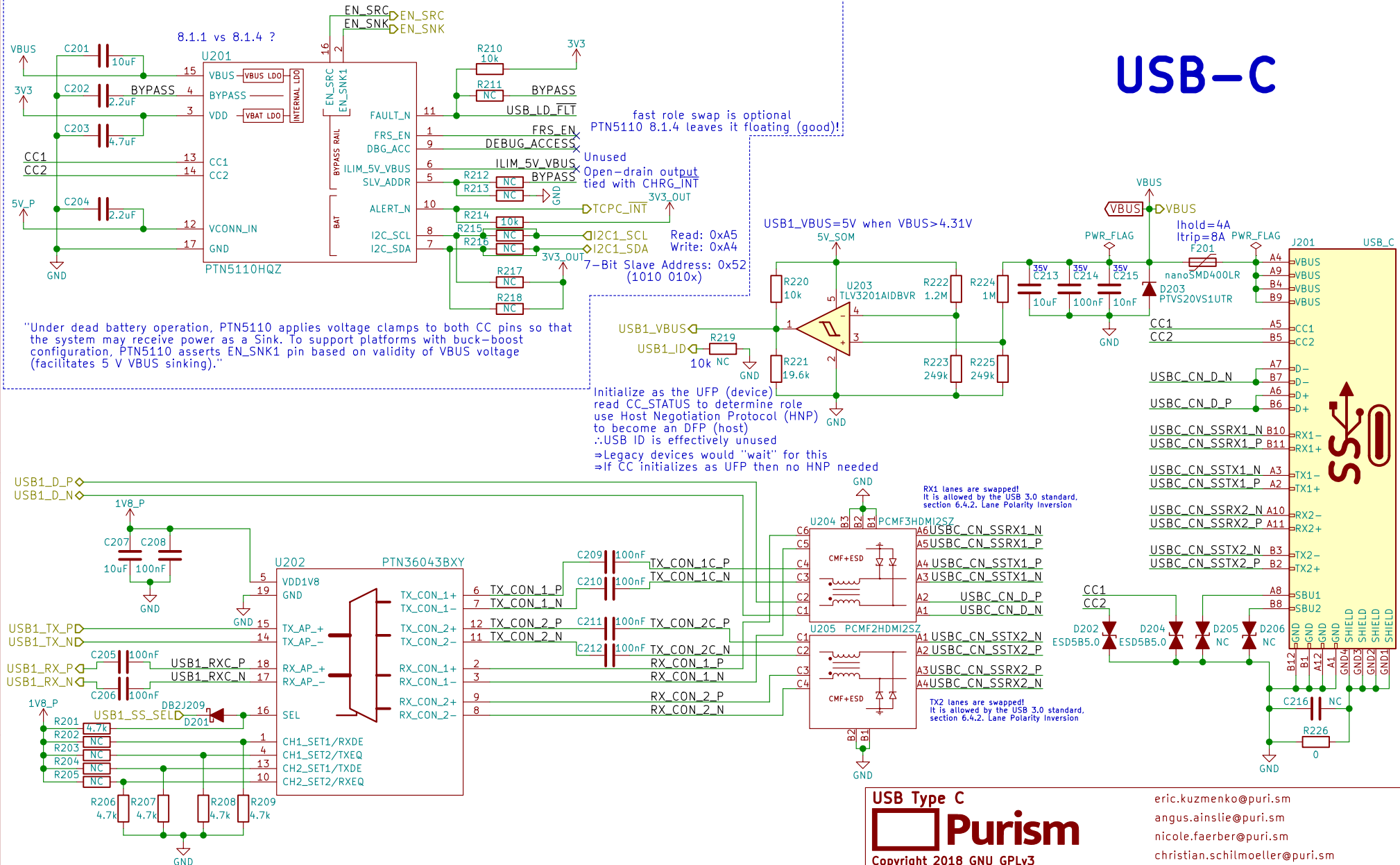


# USB-C TCPC - Config Channel (CC) and PD Role Controller

## USB-C



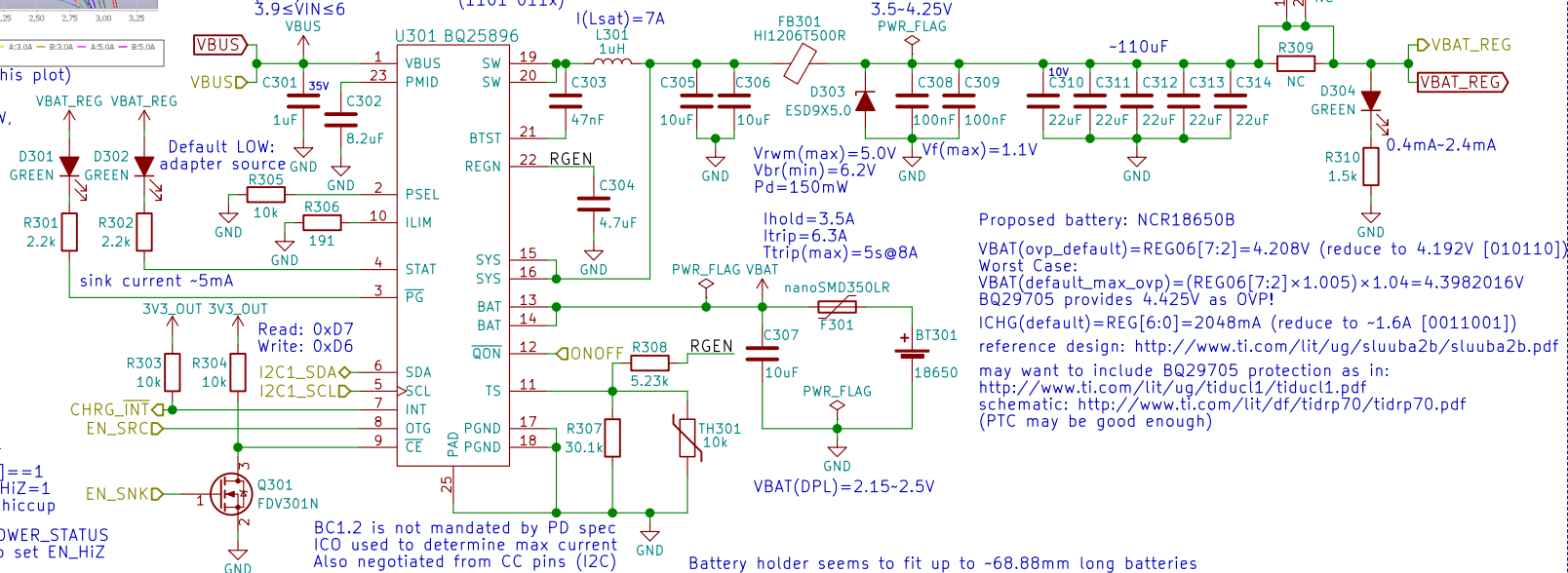


(interpret RSOC% based on this plot)

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

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



sink current ~5mA

3V3\_OUT 3V3\_OUT

Read: 0xD7 Write: 0xD6

I2C1\_SDA I2C1\_SCL

CHRG\_INT EN\_SRC

EN\_SNKD

Q301 FDS301N

GND

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

Proposed battery: NCR18650B

$V_{BAT}(ovp\_default) = REG06[7:2] = 4.208V$  (reduce to 4.192V [010110])  
 Worst Case:  
 $V_{BAT}(default\_max\_ovp) = (REG06[7:2] \times 1.005) \times 1.04 = 4.3982016V$   
 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>  
 schematic: <http://www.ti.com/lit/df/tidrp70/tidrp70.pdf>  
 (PTC may be good enough)

Battery

**Purism**

Copyright 2018 GNU GPLv3

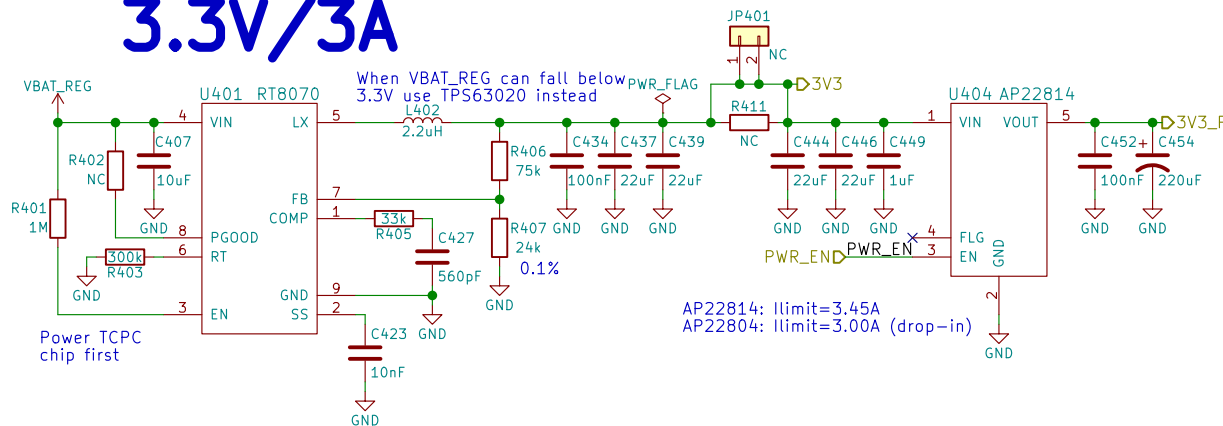
Sheet: /Battery/  
 File: battery.sch

Size: A4 Date: 2018-07-17  
 KiCad E.D.A. kicad 5.0.0

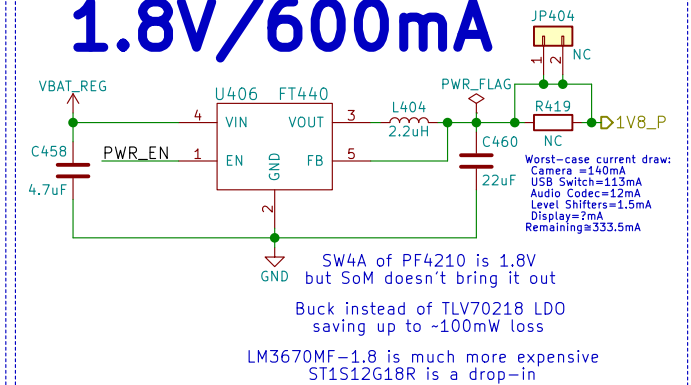
eric.kuzmenko@puri.sm  
 angus.ainslie@puri.sm  
 nicole.farber@puri.sm  
 christian.schilmoeller@puri.sm

Rev: v0.1.0  
 Id: 3/24

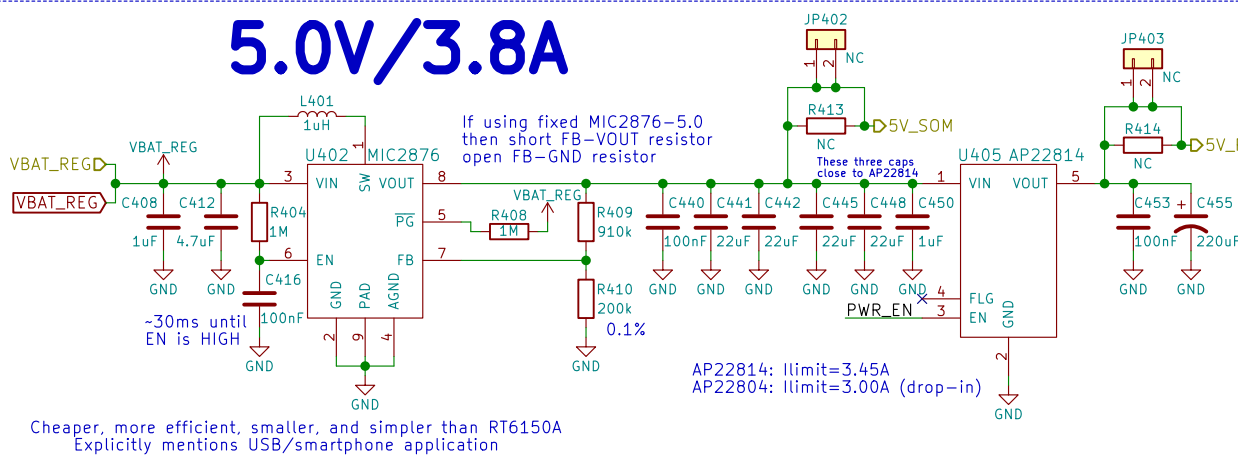
## 3.3V/3A



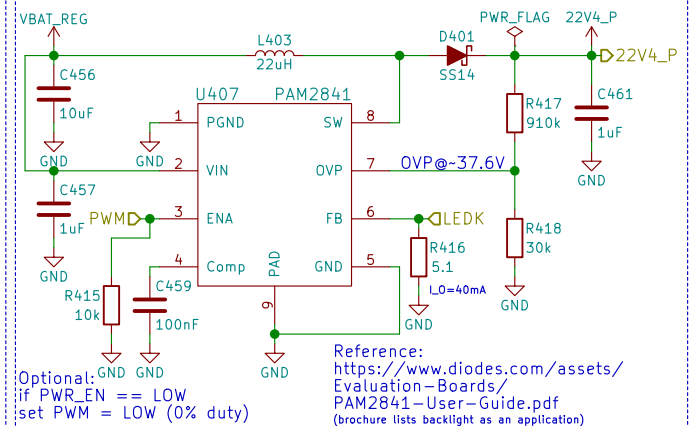
## 1.8V/600mA



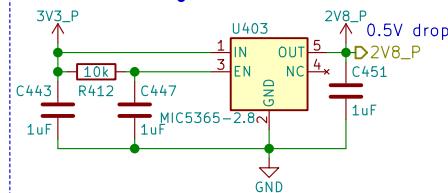
## 5.0V/3.8A



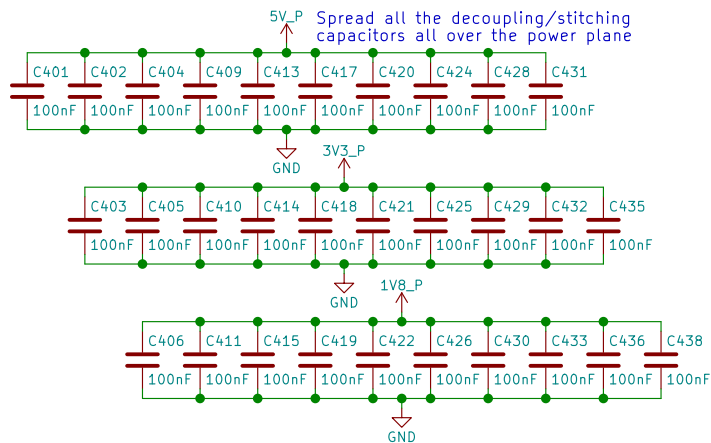
## 22.4V/40mA



## 2.8V/150mA



## Power



Power

**Purism**

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Sheet: /Power/  
File: power.sch

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

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Rev: v0.1.0  
Id: 4/24

# 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 <sup>1</sup>	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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christian.schilmoeller@puri.sm

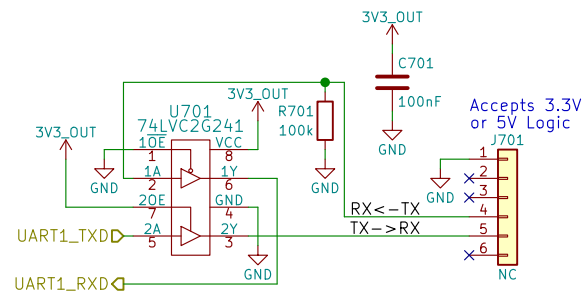
Rev: v0.1.0

Id: 5/24

[illegible]

<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>	
<div> <div>Copyright 2018 GNU GPLv3</div> <div> <div>Sheet: /RTC/</div> <div>File: rtc.sch</div> </div> </div>	
<div> <div>Size: A4</div> <div>Date: 2018-07-17</div> </div>	<div> <div>Rev:</div> <div>Id: 6</div> </div>
<div> <div>KiCad E.D.A.    kicad 5.0.0</div> </div>	

# UART Debug



## UART Debug



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Sheet: /UART Debug/

File: uart.sch

Size: A4

Date: 2018-07-17

KiCad E.D.A. kicad 5.0.0

Rev: v0.1.0

Id: 7/24

eric.kuzmenko@puri.sm

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**Purism**

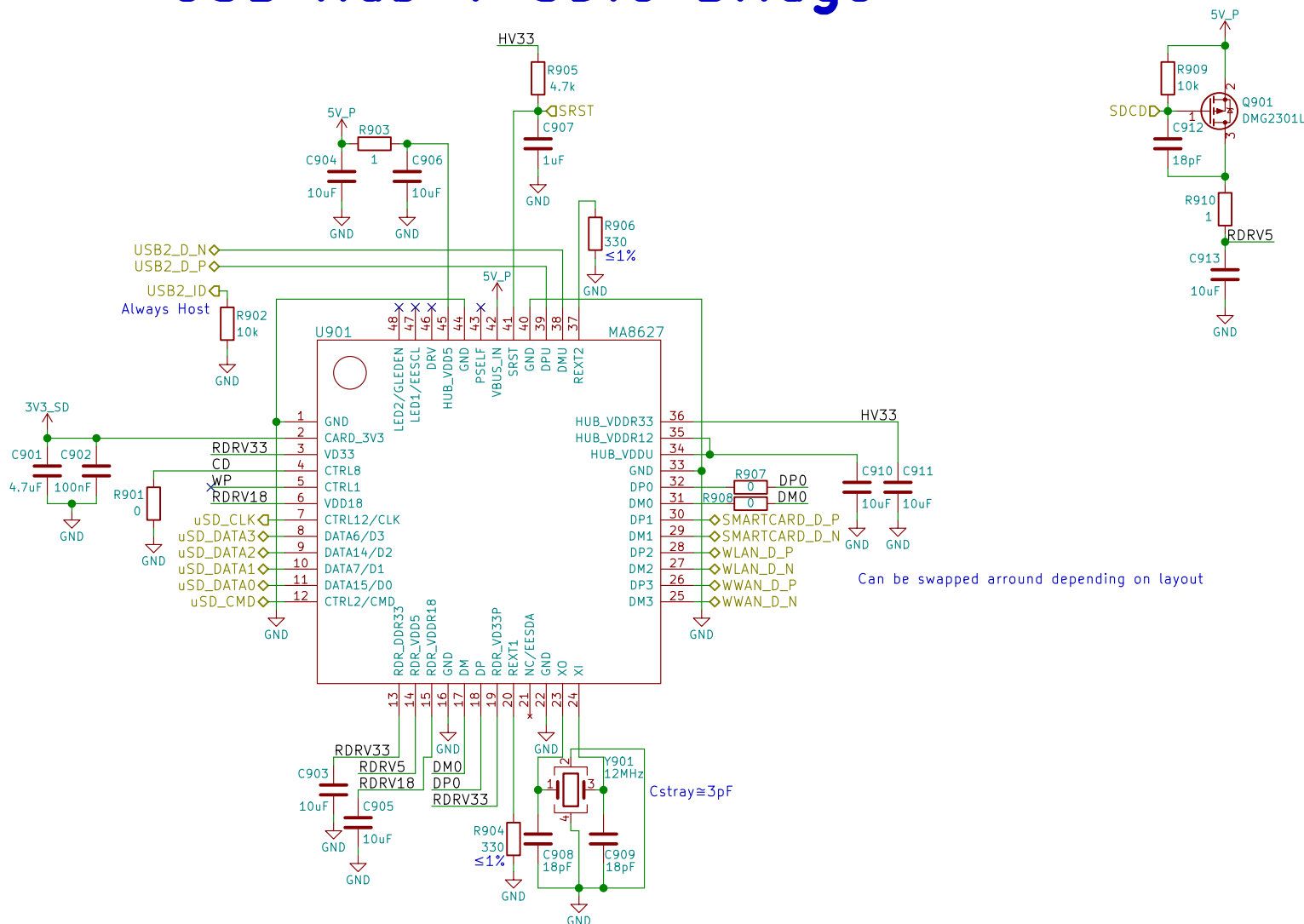
eric.kuzmenko@puri.sm  
angus.ainslie@puri.sm  
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christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 8/24



# USB Hub + SDIO Bridge



USB Hub + SDIO Bridge



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Sheet: /USB Hub + SDIO Bridge/

File: usb\_hub\_sdio.sch

Size: A4

Date: 2018-07-17

KiCad E.D.A. kicad 5.0.0

Rev: v0.1.0

Id: 9/24

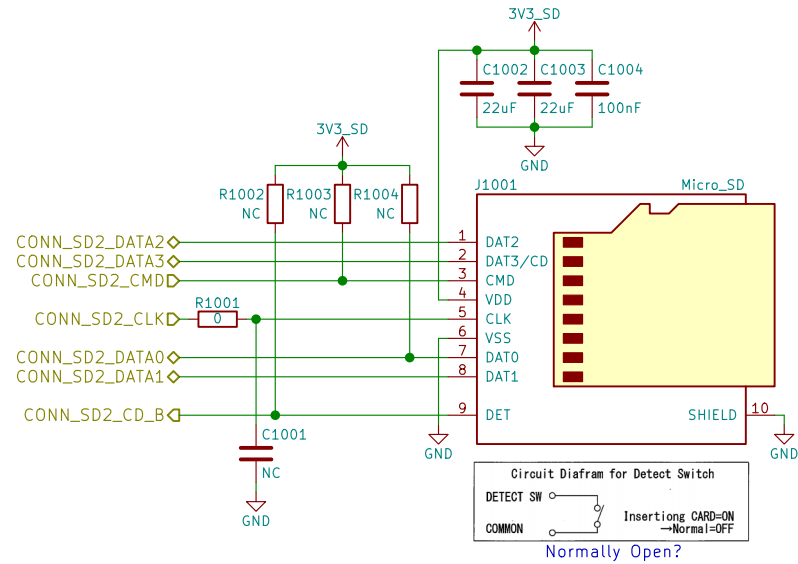
eric.kuzmenko@puri.sm

angus.ainstie@puri.sm

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# μSD



uSD Card



**Purism**

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Sheet: /uSD Card/

File: sd.sch

Size: A4 Date: 2018-07-17

KiCad E.D.A. kicad 5.0.0

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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: 2018-07-17  
KiCad E.D.A. kicad 5.0.0

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angus.ainstlie@puri.sm  
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christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 11/24

## A

B

C

D

1

1

2

7

---

---

**F**

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  
KiCad E.D.A. kicad 5.0.0

Date: 2018-07-17

Rev: v0.1.0

Id: 14/24

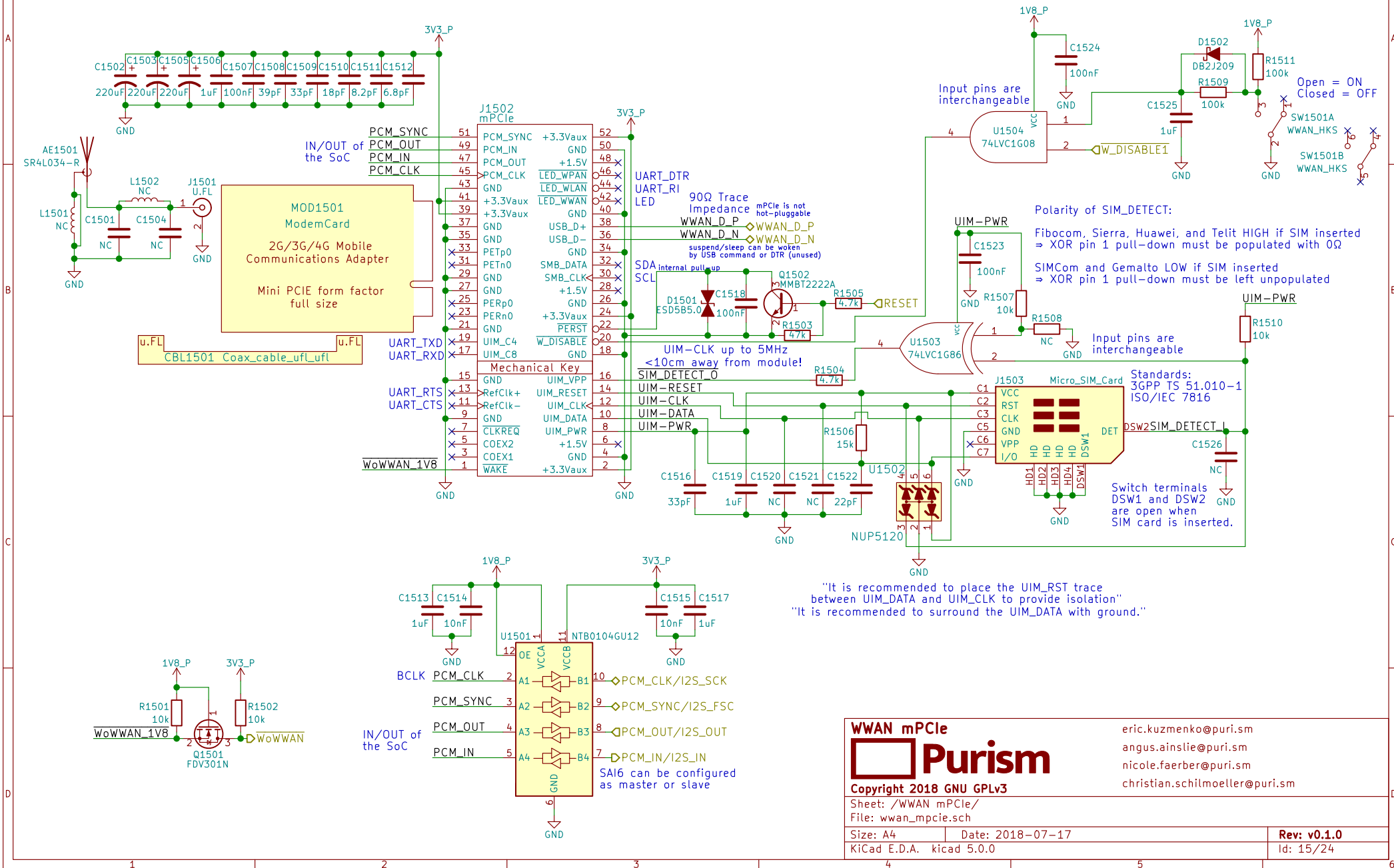
eric.kuzmenko@puri.sm

angus.ainstie@puri.sm

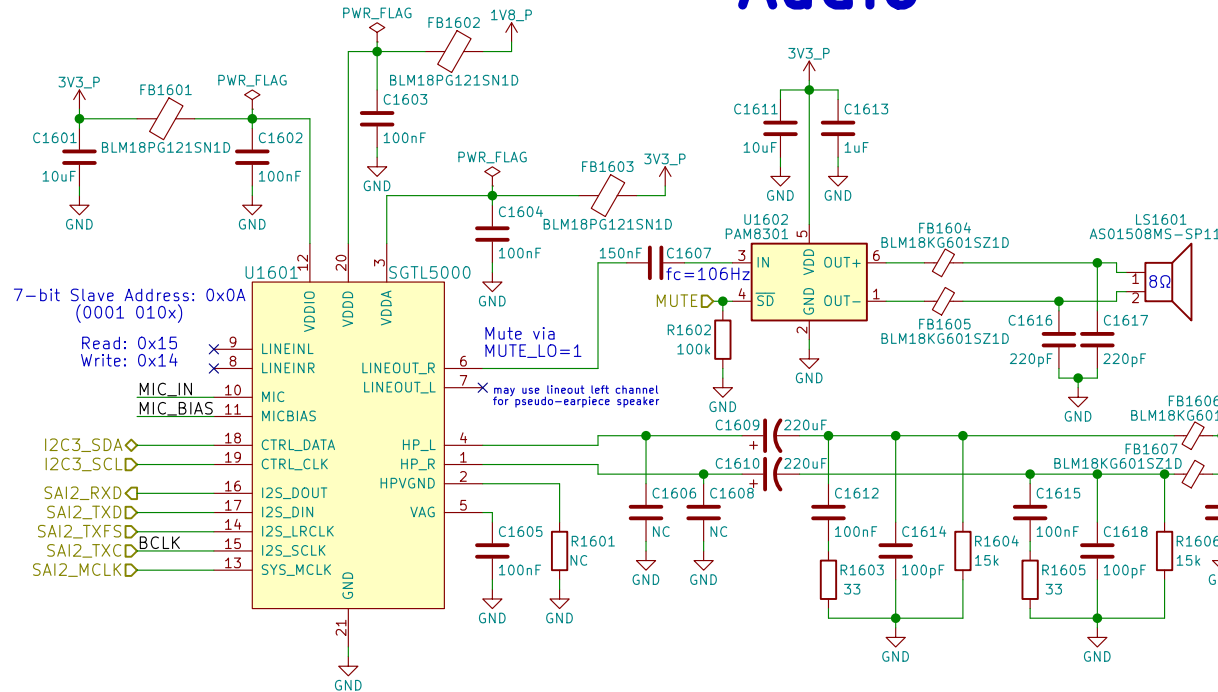
nicole.farber@puri.sm

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# WWAN mPCIe



# Audio



Reference:  
[http://www.52rd.com/S\\_txt/2011\\_3/TXT26685.htm](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-circuitry>  
 +Zener diode to protect against ranges outside of -0.9V to 3.3V

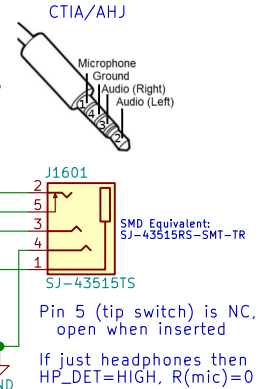
dB specs in datasheet is a unit of power gain (not dBu or VU) with respect to the DAC's unattenuated output

"HP Output - 62.5mW max, 1.02kHz sine into 16Ω load at 3.3 V"  
 $\Rightarrow (1V)^2 / (16\Omega) = 62.5mW$   
 $\therefore V_{rms} = 1V \Rightarrow V_p(\text{amplitude}) = 1.414V$   
 $\therefore I_{rms}(\text{max}) = 62.5mA$

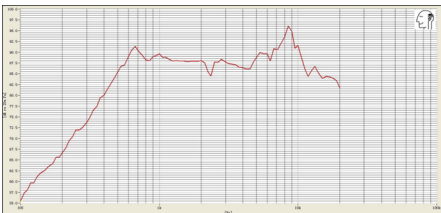
If HP\_DET is HIGH for >100ms then HPs are present

S/E button on earbud headsets shorts the mic for key function

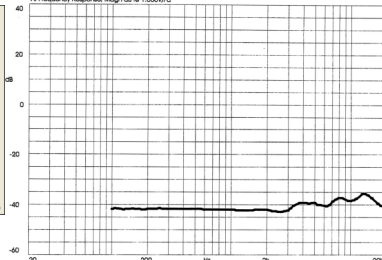
Could use FSA8008 to detect mic



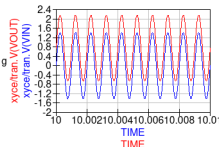
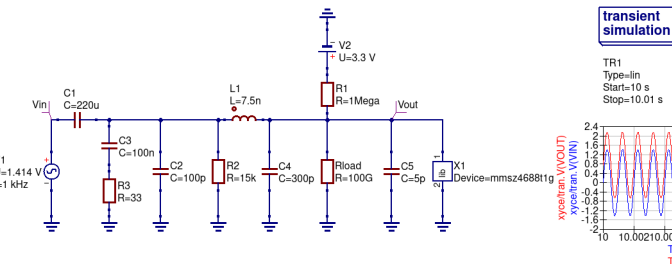
Built-In Speaker's Frequency Response:



Built-In Mic's Frequency Response:



Simulation of HP\_DET without HP jack inserted:



LCR Measurements:

Earbud Microphone:	Headset Speaker:	Earbud Speaker:
@1kHz	@1kHz	@1kHz
Rs = 3.844mH	Rs = 244.4μH	Rs = 25.2μH
Ls = 15.757H	Ls = 141.99mH	Ls = 311.0mH
Cs = 6.583uF	Cs = 103.6uF	Cs = 1.0mF
Cp = 1612.8pF	Cp = 178.77nF	Cp = 81.95nF
Rs = 1.5465kOhms	Rs = 36.860hms	Rs = 17.030Ohms
Rp = 1.5478kOhms	Rp = 36.860hms	Rp = 17.034Ohms
θ = -0.8deg	θ = -2.3deg	θ = 0.5deg

## Audio

**Purism**

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Sheet: /Audio/  
File: audio.sch

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

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Rev: v0.1.0

Id: 16/24



# RGMII 10/100/1000 Ethernet

The schematic illustrates the RGMII 10/100/1000 Ethernet interface. It features an AR8031 Ethernet PHY connected to an RJ45 connector (J1701) and a green LED (D1702). The power supply section includes 3V3\_P, ENET\_2V5, and ENET\_1V1, with various decoupling capacitors and fuses. Signal lines for TX, RX, and control signals (LED\_LINK, LED\_ACT) are shown with termination and routing. A test point (TP1701) is also included.

**Legend:**

- 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-

**Legend:**

- J1 TX1+
- J2 TX1-
- J3 TX2+
- J4 TX2-
- J5 TX3+
- J6 TX3-
- J7 TX4+
- J8 TX4-

**Legend:**

- GREEN
- YELLOW

**Legend:**

- D1702 GREEN

**Legend:**

- TP1701 TEST\_1P

**Legend:**

- TP1702 TEST\_1P

**Legend:**

- TP1703 TEST\_1P

**Legend:**

- TP1704 TEST\_1P

**Legend:**

- TP1705 TEST\_1P

**Legend:**

- TP1706 TEST\_1P

**Legend:**

- TP1707 TEST\_1P

**Legend:**

- TP1708 TEST\_1P

**Legend:**

- TP1709 TEST\_1P

**Legend:**

- TP1710 TEST\_1P

**Legend:**

- TP1711 TEST\_1P

**Legend:**

- TP1712 TEST\_1P

**Legend:**

- TP1713 TEST\_1P

**Legend:**

- TP1714 TEST\_1P

**Legend:**

- TP1715 TEST\_1P

**Legend:**

- TP1716 TEST\_1P

**Legend:**

- TP1717 TEST\_1P

**Legend:**

- TP1718 TEST\_1P

**Legend:**

- TP1719 TEST\_1P

**Legend:**

- TP1720 TEST\_1P

**Legend:**

- TP1721 TEST\_1P

**Legend:**

- TP1722 TEST\_1P

**Legend:**

- TP1723 TEST\_1P

**Legend:**

- TP1724 TEST\_1P

**Legend:**

- TP1725 TEST\_1P

**Legend:**

- TP1726 TEST\_1P

**Legend:**

- TP1727 TEST\_1P

**Legend:**

- TP1728 TEST\_1P

**Legend:**

- TP1729 TEST\_1P

**Legend:**

- TP1730 TEST\_1P

**Legend:**

- TP1731 TEST\_1P

**Legend:**

- TP1732 TEST\_1P

**Legend:**

- TP1733 TEST\_1P

**Legend:**

- TP1734 TEST\_1P

**Legend:**

- TP1735 TEST\_1P

**Legend:**

- TP1736 TEST\_1P

**Legend:**

- TP1737 TEST\_1P

**Legend:**

- TP1738 TEST\_1P

**Legend:**

- TP1739 TEST\_1P

**Legend:**

- TP1740 TEST\_1P

**Legend:**

- TP1741 TEST\_1P

**Legend:**

- TP1742 TEST\_1P

**Legend:**

- TP1743 TEST\_1P

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- TP1744 TEST\_1P

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- TP1745 TEST\_1P

**Legend:**

- TP1746 TEST\_1P

**Legend:**

- TP1747 TEST\_1P

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- TP1748 TEST\_1P

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- TP1749 TEST\_1P

**Legend:**

- TP1750 TEST\_1P

**Legend:**

- TP1751 TEST\_1P

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- TP1752 TEST\_1P

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- TP1753 TEST\_1P

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- TP1759 TEST\_1P

**Legend:**

- TP1760 TEST\_1P

**Legend:**

- TP1761 TEST\_1P

**Legend:**

- TP1762 TEST\_1P

**Legend:**

- TP1763 TEST\_1P

**Legend:**

- TP1764 TEST\_1P

**Legend:**

- TP1765 TEST\_1P

**Legend:**

- TP1766 TEST\_1P

**Legend:**

- TP1767 TEST\_1P

**Legend:**

- TP1768 TEST\_1P

**Legend:**

- TP1769 TEST\_1P

**Legend:**

- TP1770 TEST\_1P

**Legend:**

- TP1771 TEST\_1P

**Legend:**

- TP1772 TEST\_1P

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- TP1773 TEST\_1P

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- TP1774 TEST\_1P

**Legend:**

- TP1775 TEST\_1P

**Legend:**

- TP1776 TEST\_1P

**Legend:**

- TP1777 TEST\_1P

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- TP1778 TEST\_1P

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- TP1779 TEST\_1P

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- TP1780 TEST\_1P

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- TP1781 TEST\_1P

**Legend:**

- TP1782 TEST\_1P

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- TP1783 TEST\_1P

**Legend:**

- TP1784 TEST\_1P

**Legend:**

- TP1785 TEST\_1P

**Legend:**

- TP1786 TEST\_1P

**Legend:**

- TP1787 TEST\_1P

**Legend:**

- TP1788 TEST\_1P

**Legend:**

- TP1789 TEST\_1P

**Legend:**

- TP1790 TEST\_1P

**Legend:**

- TP1791 TEST\_1P

**Legend:**

- TP1792 TEST\_1P

**Legend:**

- TP1793 TEST\_1P

**Legend:**

- TP1794 TEST\_1P

**Legend:**

- TP1795 TEST\_1P

**Legend:**

- TP1796 TEST\_1P

**Legend:**

- TP1797 TEST\_1P

**Legend:**

- TP1798 TEST\_1P

**Legend:**

- TP1799 TEST\_1P

**Legend:**

- TP1800 TEST\_1P

**Legend:**

- TP1801 TEST\_1P

**Legend:**

- TP1802 TEST\_1P

**Legend:**

- TP1803 TEST\_1P

**Legend:**

- TP1804 TEST\_1P

**Legend:**

- TP1805 TEST\_1P

**Legend:**

- TP1806 TEST\_1P

**Legend:**

- TP1807 TEST\_1P

**Legend:**

- TP1808 TEST\_1P

**Legend:**

- TP1809 TEST\_1P

**Legend:**

- TP1810 TEST\_1P

**Legend:**

- TP1811 TEST\_1P

**Legend:**

- TP1812 TEST\_1P

**Legend:**

- TP1813 TEST\_1P

**Legend:**

- TP1814 TEST\_1P

**Legend:**

- TP1815 TEST\_1P

**Legend:**

- TP1816 TEST\_1P

**Legend:**

- TP1817 TEST\_1P

**Legend:**

- TP1818 TEST\_1P

**Legend:**

- TP1819 TEST\_1P

**Legend:**

- TP1820 TEST\_1P

**Legend:**

- TP1821 TEST\_1P

**Legend:**

- TP1822 TEST\_1P

**Legend:**

- TP1823 TEST\_1P

**Legend:**

- TP1824 TEST\_1P

**Legend:**

- TP1825 TEST\_1P

**Legend:**

- TP1826 TEST\_1P

**Legend:**

- TP1827 TEST\_1P



**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

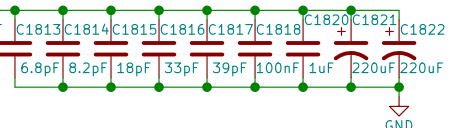
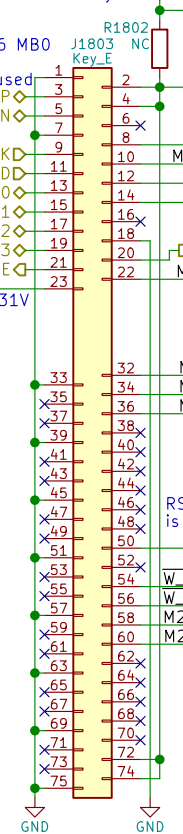
RedPine RS9116 MB0  
Requires 5V on  
Pin 54 if USB used

WLAN\_D\_P  
WLAN\_D\_N  
WIFI\_CLK  
WIFI\_CMD  
WIFI\_DATA0  
WIFI\_DATA1  
WIFI\_DATA2  
WIFI\_DATA3  
WIFI\_WAKE

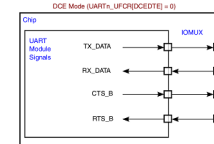
RedPine RS9116  
has 100k pull-up to  
3.3V making SDIO\_RST  
~2.55V when HIGH

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



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

SoC's IN/OUT  
M2\_PCM\_CLK  
M2\_PCM\_SYNC  
M2\_PCM\_IN  
M2\_PCM\_OUT  
M2\_UART\_RXD  
M2\_UART\_TXD  
M2\_UART\_RTS  
M2\_UART\_CTS

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

1V8\_P  
3V3\_P  
GND

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  
GND

internal 10k pull-up

WLAN+BT M.2  
**Purism**

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Sheet: /WLAN+BT M.2/  
File: wifi\_bt\_m2.sch

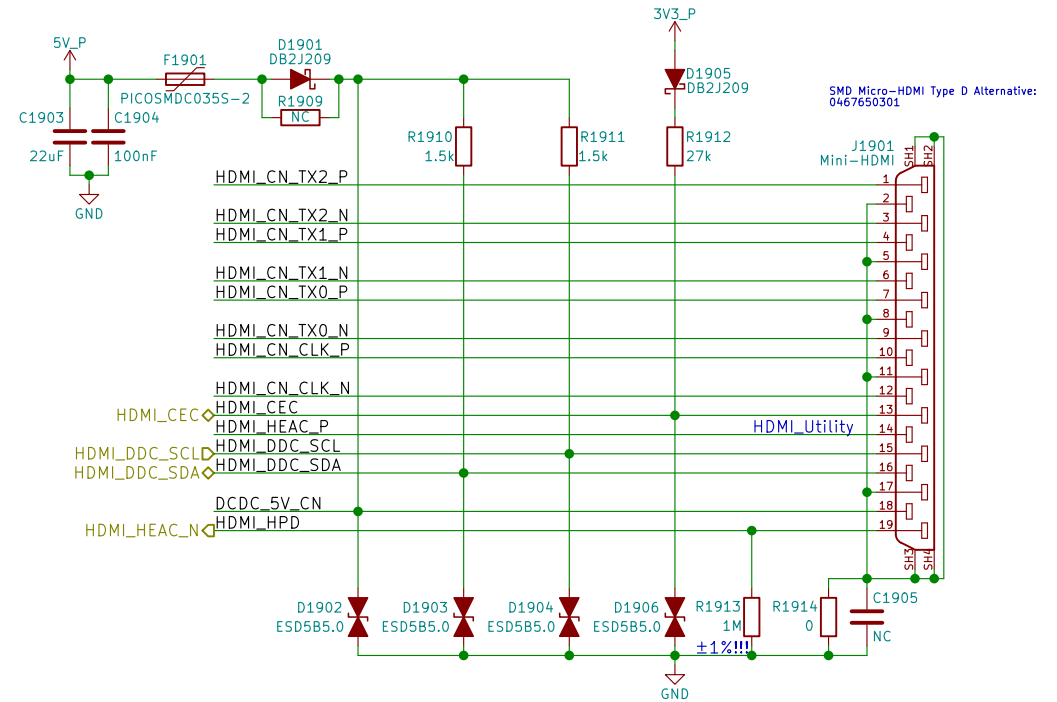
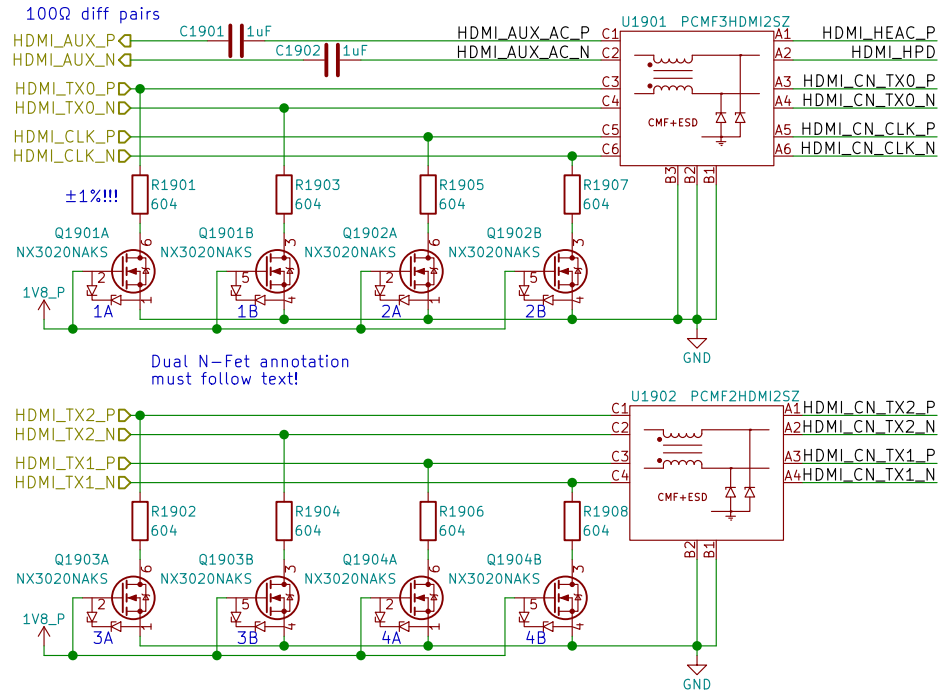
Size: A4  
KiCad E.D.A. kicad 5.0.0

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Rev: v0.1.0  
Id: 18/24

TUSB1046 can be used for DP over USB-C

# HDMI



HDMI



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Sheet: /HDMI/  
File: hdmi.sch

Size: A4 Date: 2018-07-17  
KiCad E.D.A. kicad 5.0.0

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Rev: v0.1.0  
Id: 19/24

10

## B



C

100



1

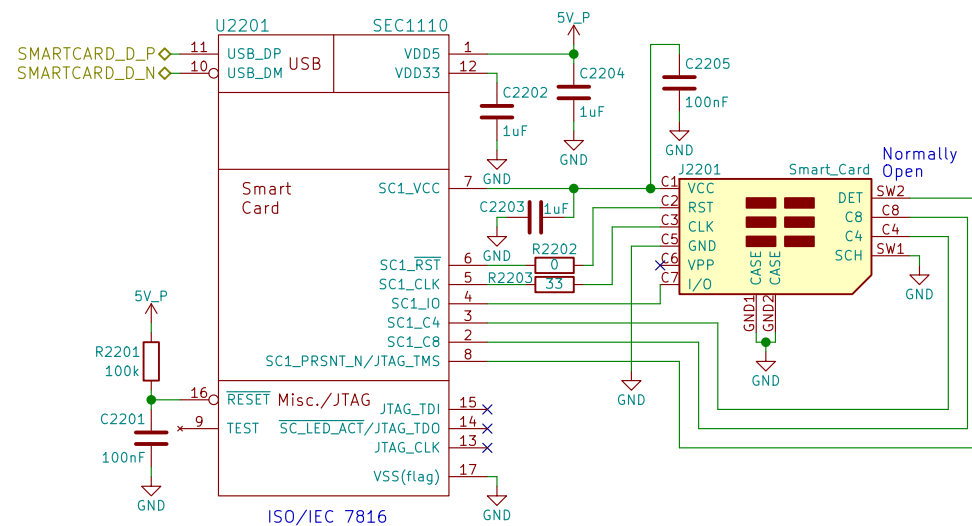
100

## D

[illegible]

Id: 21/24

# Smart Card



Reference:  
<http://www.microchip.com/DevelopmentTools/ProductDetails.aspx?PartNO=EVB-SEC1110>

## Smart Card



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Sheet: /Smart Card/

File: smartcard.sch

Size: A4 Date: 2018-07-17

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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-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](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: 2018-07-17

KiCad E.D.A. kicad 5.0.0

Rev: v0.1.0

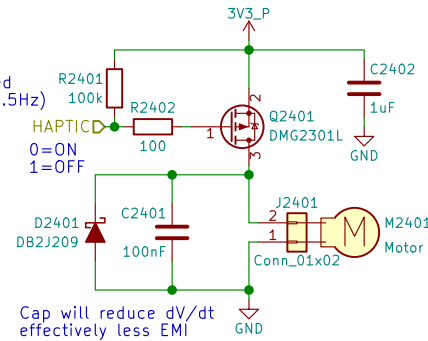
Id: 23/24

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# Haptic Motor

PWM pins occupied:  
 GPIO1\_I001 - LCD Backlight  
 GPIO1\_I013 - LED  
 GPIO1\_I014 - Ethernet (CLKO\_25MHz)  
 GPIO1\_I015 - CSI (CLKO2)

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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Sheet: /Haptic Motor/  
 File: haptic.sch

Size: A4 Date: 2018-07-17

KiCad E.D.A. kicad 5.0.0

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Rev: v0.1.0

Id: 24/24