

USB-C





(interpret RSOC% based on this plot)

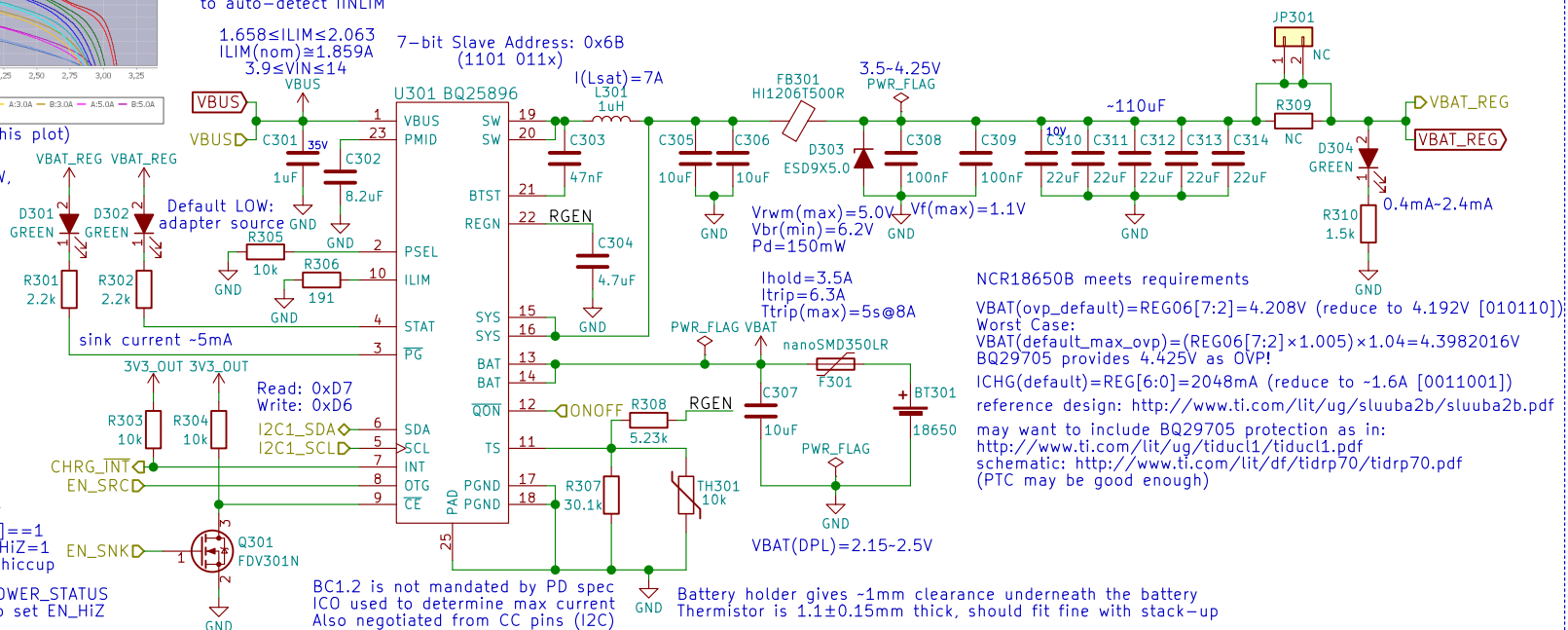
Drawing ~320mA, or consuming $\leq 1.152W$, should give close to 10 hours going from 100% to 0% charge

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



Battery

Purism

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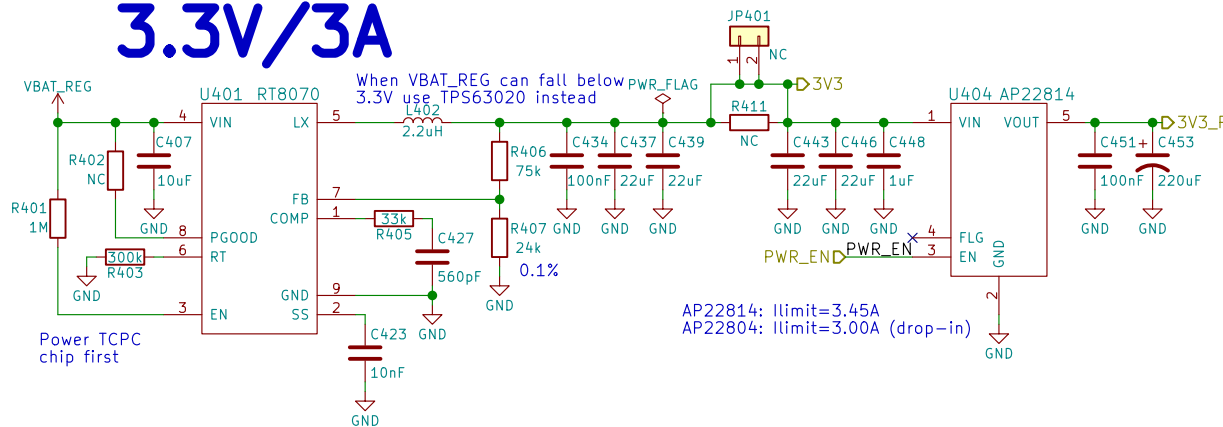
Sheet: /Battery/
File: battery.sch

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

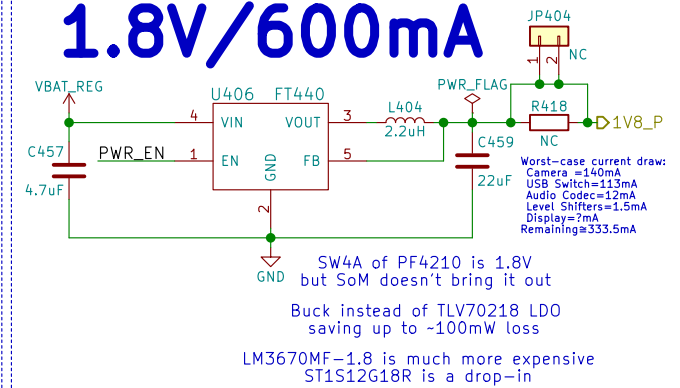
eric.kuzmenko@puri.sm
angus.ainslie@puri.sm
nicole.farber@puri.sm
christian.schilmoeller@puri.sm

Rev: v0.1.0
Id: 3/24

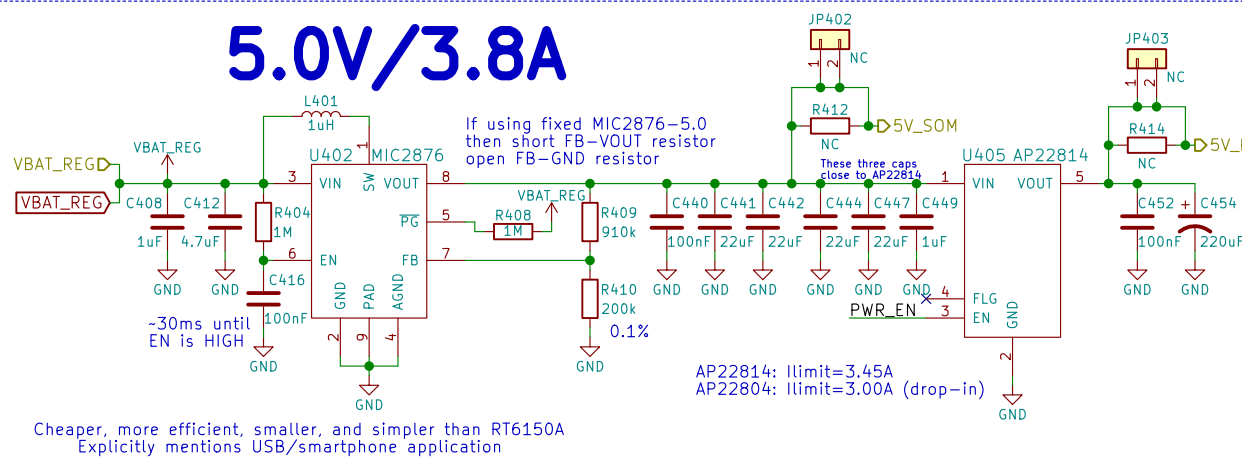
3.3V/3A



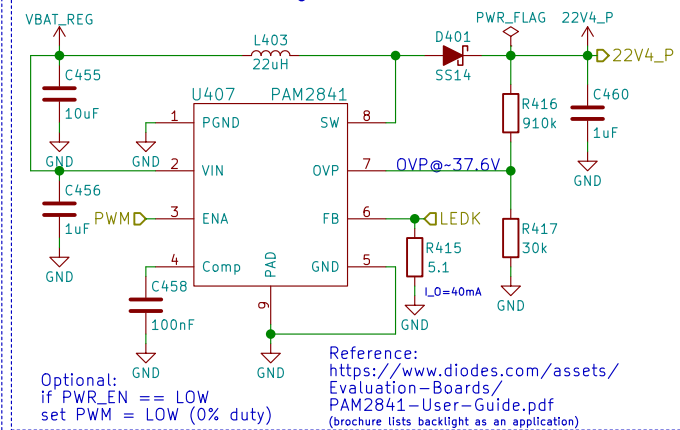
1.8V/600mA



5.0V/3.8A



22.4V/40mA



2.8V/150mA



Power

Power

Purism

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Sheet: /Power/
File: power.sch

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

Date: 2018-06-18

Rev: v0.1.0

Id: 4/24

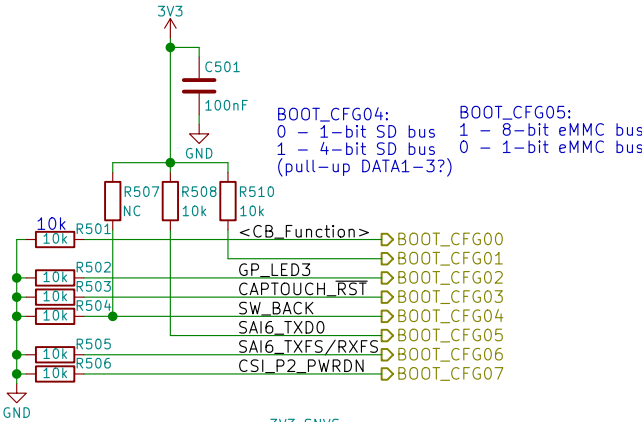
eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

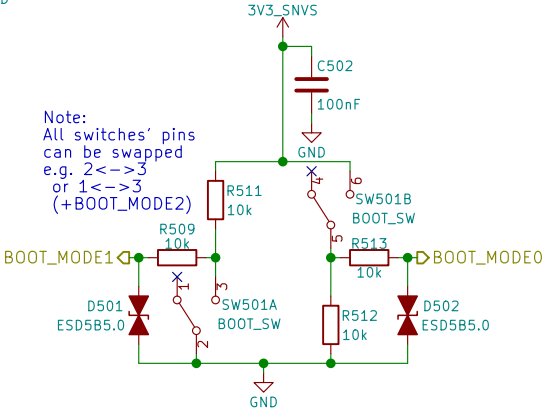
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Boot Config



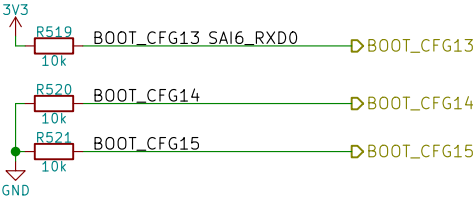
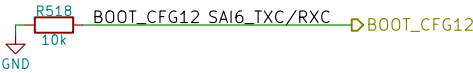
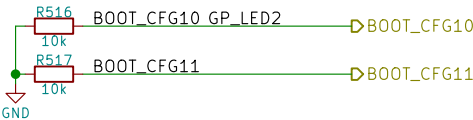
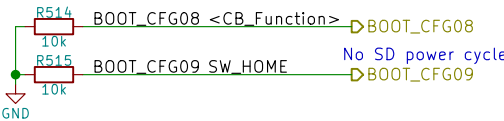
BOOT_CFG04: 0 - 1-bit SD bus
1 - 4-bit SD bus (pull-up DATA1-3?)
BOOT_CFG05: 1 - 8-bit eMMC bus
0 - 1-bit eMMC bus




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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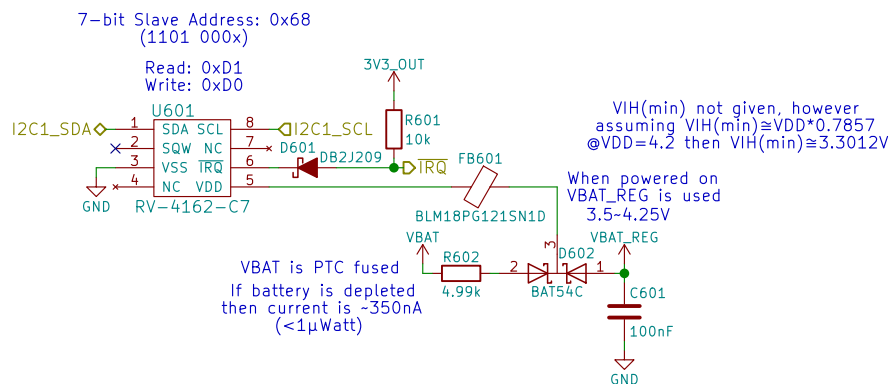
Sheet: /Boot Config/
File: boot.sch

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

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

Rev: v0.1.0
Id: 5/24

Real-Time Clock

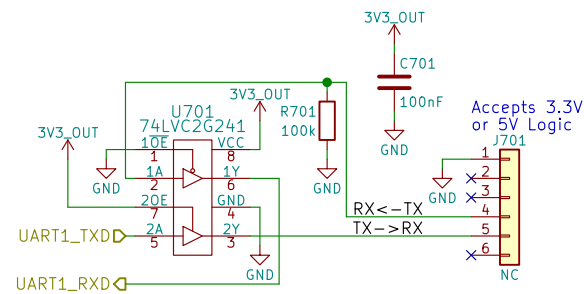


Note:
Datasheet says slave address is 0xD0
with a R/W bit appended, since 0xD0 must
be 4-bits wide the actual 7-bit address is
0x68 (110 1000), and becomes 0xD0 during a
write operation (1101 0000)

Reference:
https://github.com/HIO-Project/linux-imx6-nano-imx_3.10.17_1.0.1_ga/blob/8848e94b2f889fe44f6736e2d4c98851a2282275/arch/arm/boot/dts/imx6qdl-mtp.dtsi#L351

| | |
|---|---|
| <div> <div>RTC</div> <div>  <div>Purism</div> </div> </div> <div> <p>Copyright 2018 GNU GPLv3</p> <p>Sheet: /RTC/ File: rtc.sch</p> </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>Size: A4</div> <div>Date: 2018-06-18</div> </div> | <div> <div>Rev: v0.1.0</div> <div>Id: 6/24</div> </div> |

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

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christian.schilmoeller@puri.sm

Rev: v0.1.0
Id: 7/24

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

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christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 8/24

[illegible]

 Purism

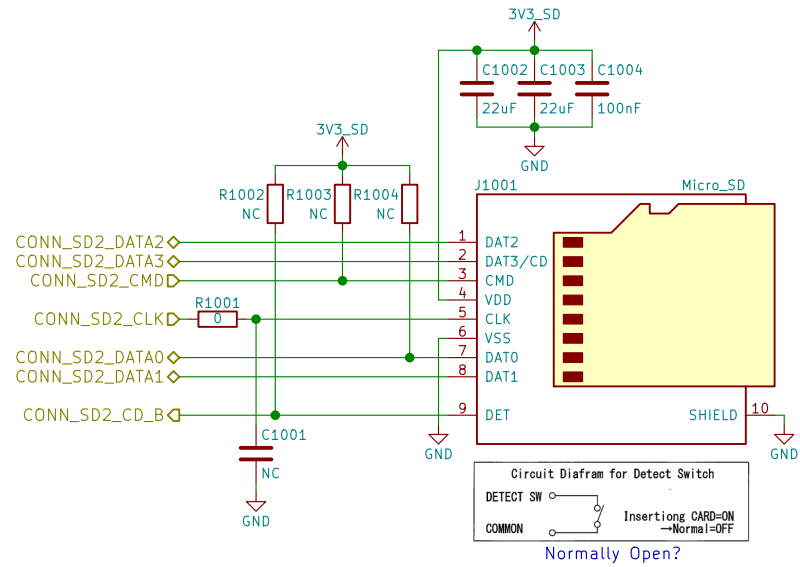
Sheet: /USB Hub + SDIO Bridge/
File: usb_hub_sdio.sch

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

christian.schilmoeller@puri.sm

Id: 9/24

μSD



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 |
|--------------|-------------|

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

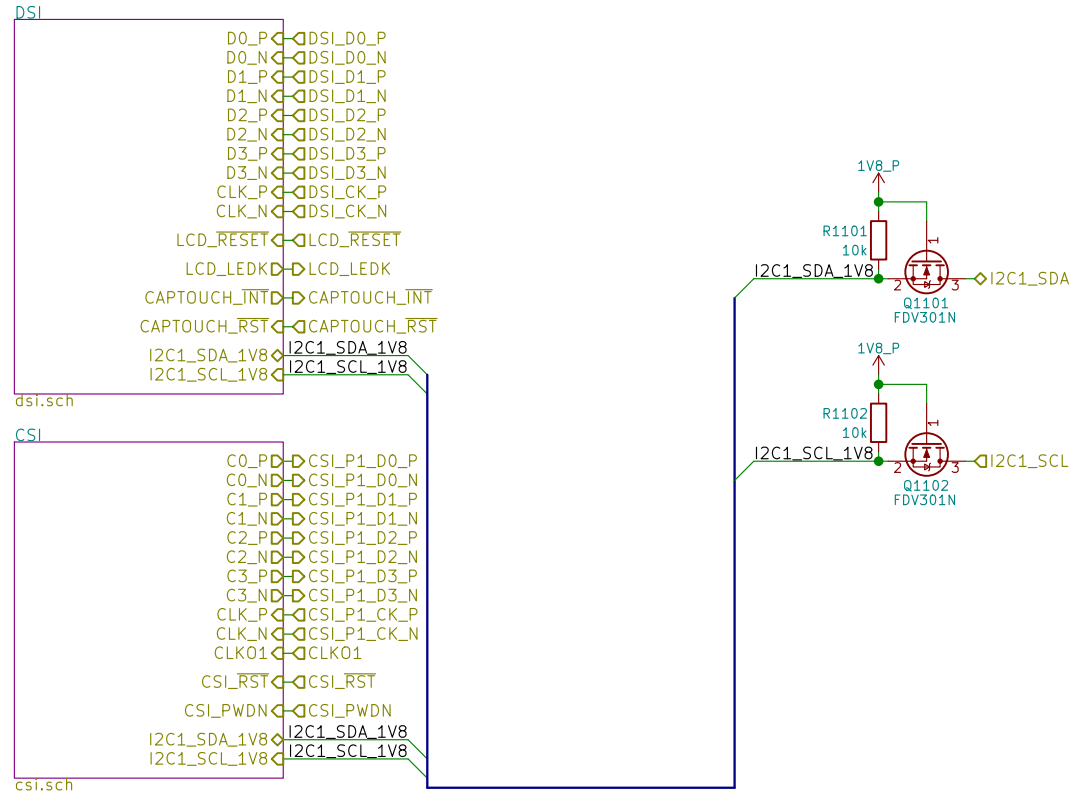
nicole.faerber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 10/24

MIPI



MIPI



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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

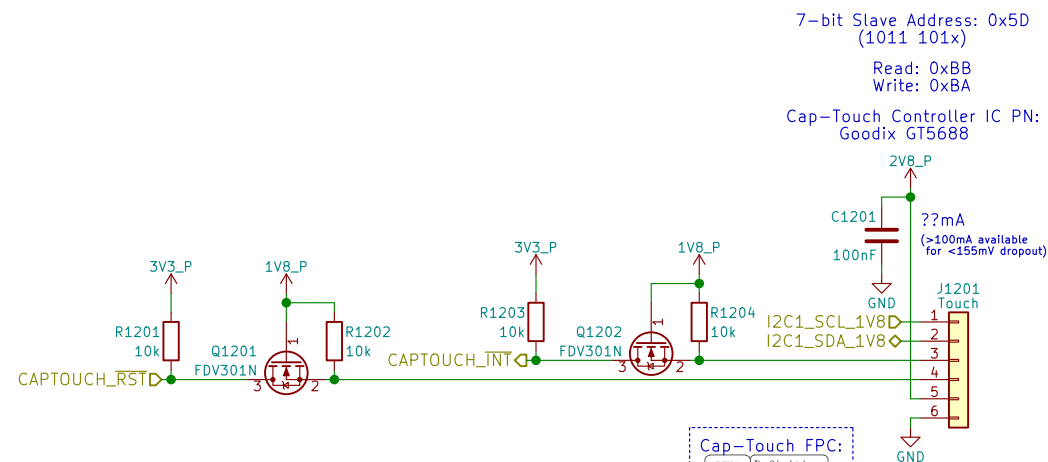
christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 11/24

Display & Touch Controller

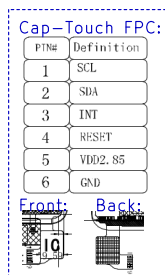
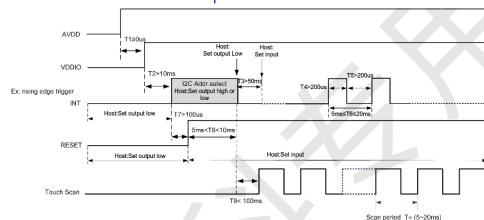
LCD PN:
Shenzhen Jinghong Electronics Co., Ltd.
JH057N00900



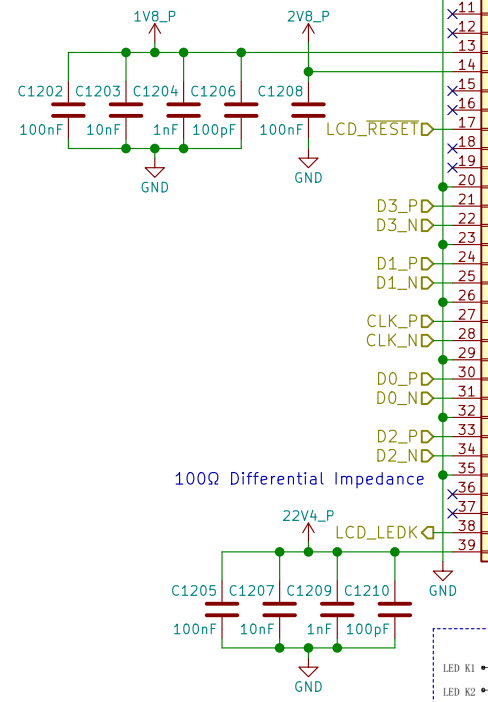
The upper 7 bits are the address,
and bit 0 is used to select read or write.
GT5688 has two slave device addresses to choose from:

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

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



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



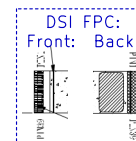
Display_JH057N00900

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
KiCad E.D.A. kicad 4.0.7

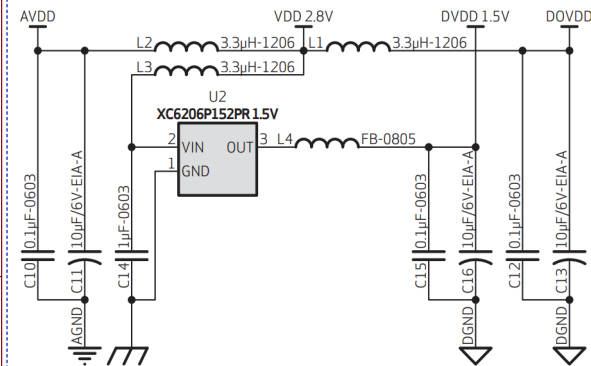
Date: 2018-06-18

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

Rev: v0.1.0
Id: 12/24

Camera

Using Internal DVDD 1.5V Regulator:



2.7 POWER UP SEQUENCE

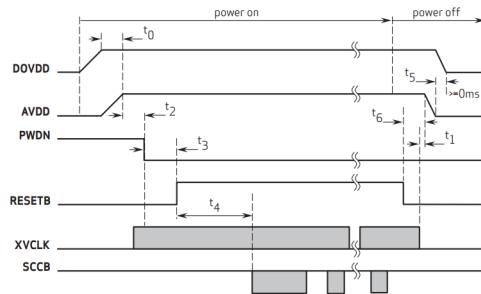
Based on the system power configuration (1.8V or 2.8V for I/O power, using external DVDD or internal DVDD, requiring access to the I2C during power up period or not), the power up sequence will differ. If 1.8V is used for I/O power, using the internal DVDD is preferred. If 2.8V is used for I/O power, due to a high voltage drop at the internal DVDD regulator, there is a potential heat issue. Hence, for a 2.8V power system, OmniVision recommends using an external DVDD source. Due to the higher power down current when using an external DVDD source, OmniVision strongly recommends cutting off all powers, including the external DVDD, when the sensor is not in use in the case of 2.8V I/O and external DVDD.

2.7.1 POWER UP WITH INTERNAL DVDD

For powering up with the internal DVDD and I2C access during the power ON period, the following conditions must occur:

1. when DOVDD and AVDD are turned ON, make sure DOVDD becomes stable before AVDD becomes stable
2. PWDN is active high with an asynchronous design (does not need clock)
3. PWDN pin tied to digital ground if it is not controlled.
4. if PWDN pin is controlled as below, for PWDN to go low, power must first become stable (AVDD to PWDN ≥ 5 ms)
5. RESETB is active low with an asynchronous design
6. master clock XVCLK should provide at least 1 ms before host accesses the sensor's registers
7. host can access I2C bus (if shared) during entire period. 20ms after RESETB goes high, host can access the sensor's registers to initialize sensor

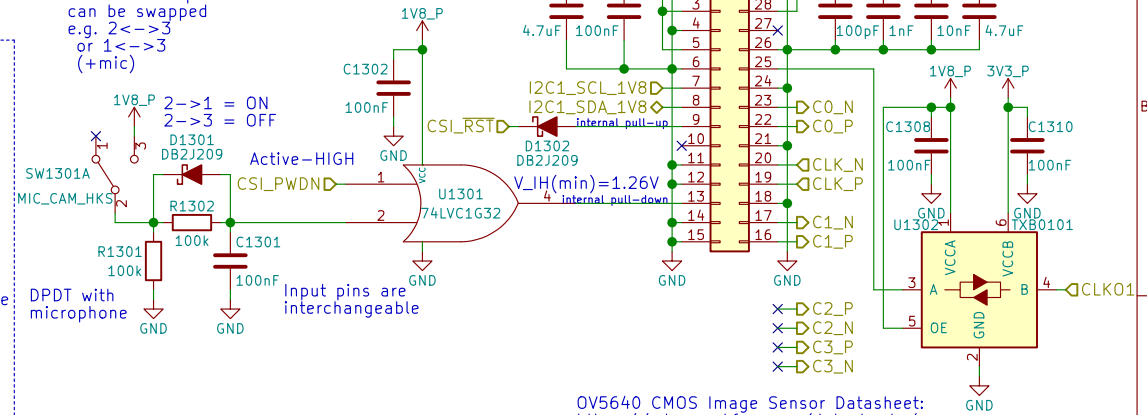
figure 2-3 power up timing with internal DVDD



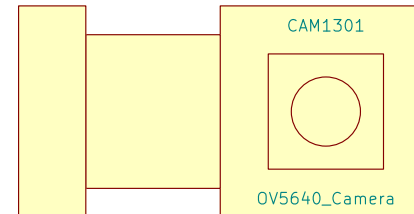
note $t_0 \geq 0$ ms, delay from DOVDD stable to AVDD stable, it is recommended to power up AVDD shortly after DOVDD has been powered up
 $t_1 \geq 0$ ms, delay from XVCLK off to AVDD off
 $t_2 \geq 5$ ms, delay from AVDD stable to sensor power up stable, PWDN can be pulled low after this point, XVCLK can be turned on after power on
 $t_3 \geq 1$ ms, delay from sensor power up stable to RESETB pull up
 $t_4 \geq 20$ ms, delay from RESETB pull high to SCCB initialization
 $t_5 \geq 0$ ms, delay from AVDD off to DOVDD off
 $t_6 \geq 0$ ms, delay from RESETB pull low to AVDD off

5640_05_2.2

Note:
All switches' pins
can be swapped
e.g. 2 \leftrightarrow 1 = ON
or 1 \leftrightarrow 3 = OFF
(+mic)



OV5640 CMOS Image Sensor Datasheet:
https://cdn.sparkfun.com/datasheets/Sensors/LightImaging/OV5640_datasheet.pdf



MIPI CSI

Purism

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Sheet: /MIPI/CSI/
 File: csi.sch

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

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

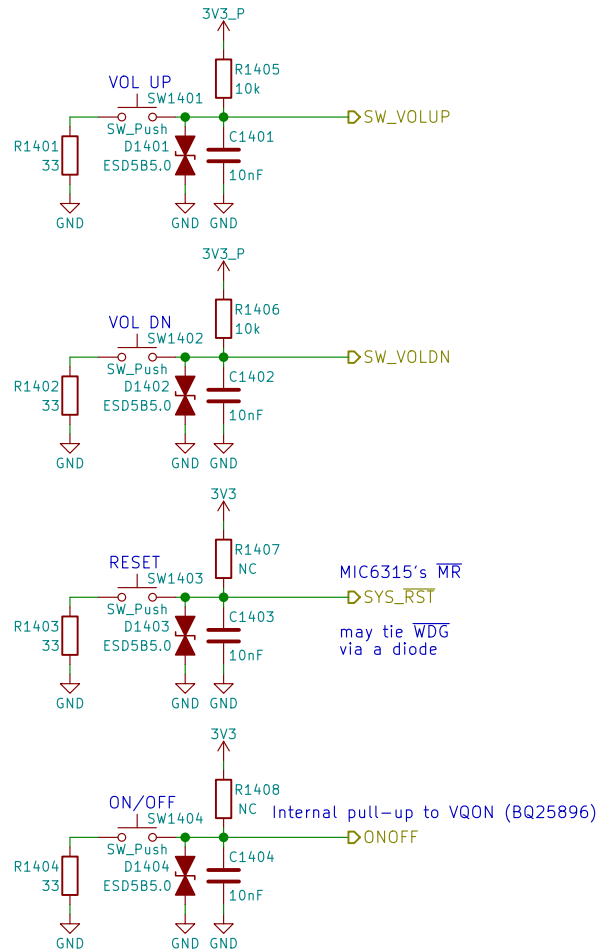
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

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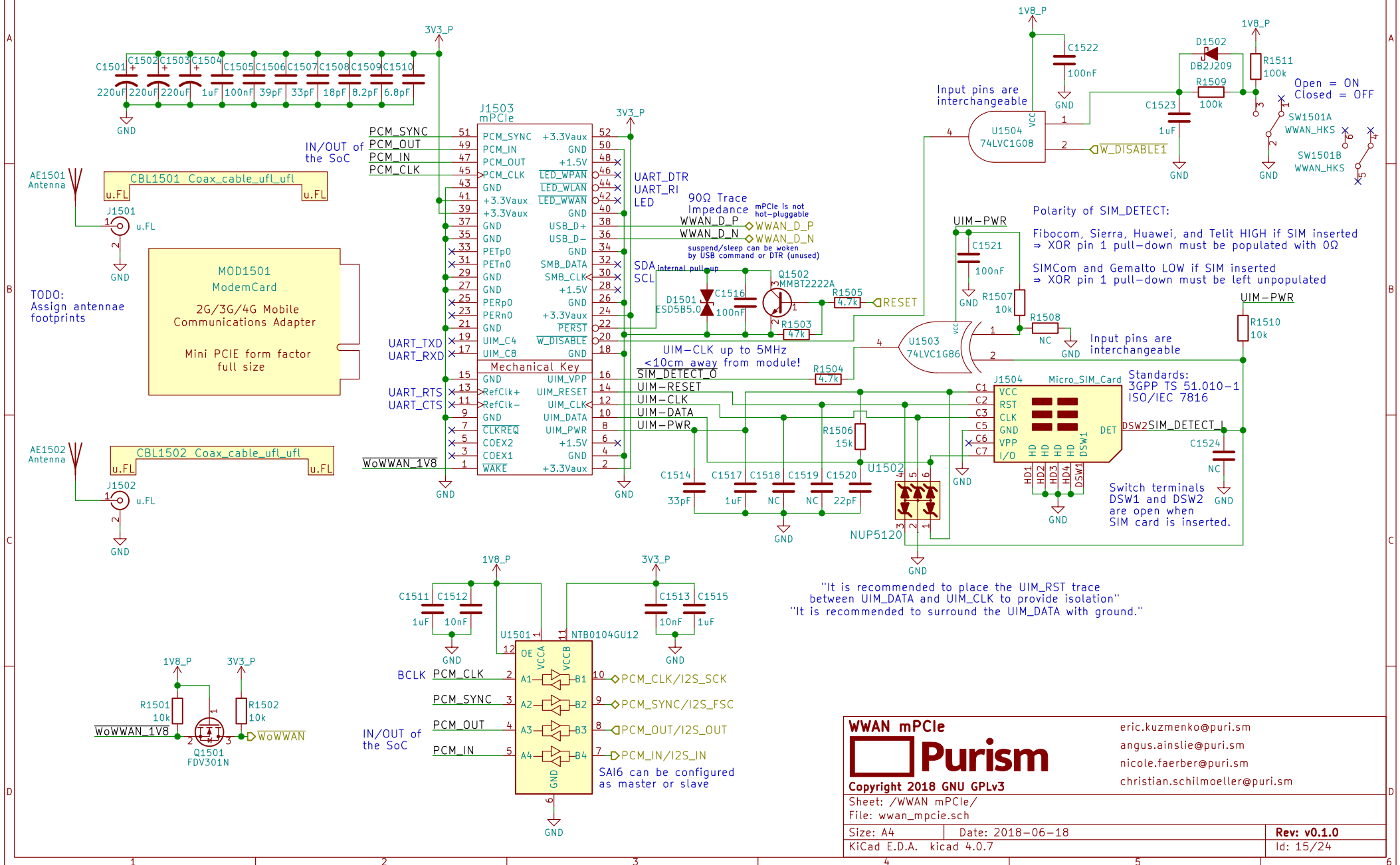
Sheet: /Buttons & LED/
File: buttons_led.sch

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

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

Rev: v0.1.0
Id: 14/24

WWAN mPCle



WWAN mPCle

Purism

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Sheet: /WWAN mPCle/
File: wwan_mpcie.sch

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

eric.kuzmenko@puri.sm

angus.ainstie@puri.sm

nicole.ferber@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

GND

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)

FB1606

BLM18KG601SZ1D

GND

C1612

100nF

GND

C1614

100pF

GND

C1615

100nF

GND

C1616

220pF

GND

C1617

220pF

GND

C1618

100pF

GND

C1619

1uF

GND

C1620

100nF

FB1607

BLM18KG601SZ1D

GND

C1612

100nF

GND

C1614

100pF

GND

C1615

100nF

GND

C1616

220pF

GND

C1617

220pF

GND

C1618

100pF

GND

C1619

1uF

GND

C1620

100nF

FB1606

BLM18KG601SZ1D

GND

C1612

100nF

GND

C1614

100pF

GND

C1615

100nF

GND

C1616

220pF

GND

C1617

220pF

GND

C1618

100pF

GND

C1619

1uF

GND

C1620

100nF

FB1607

BLM18KG601SZ1D

GND

C1612

100nF

GND

C1614

100pF

GND

C1615

100nF

GND

C1616

220pF

GND

C1617

220pF

GND

C1618

100pF

GND

C1619

1uF

GND

C1620

100nF

FB1606

BLM18KG601SZ1D

GND

C1612

100nF

GND

C1614

100pF

GND

C1615

100nF

GND

C1616

220pF

GND

C1617

220pF

GND

C1618

100pF

GND

C1619

1uF

GND

C1620

100nF

FB1607

BLM18KG601SZ1D

GND

C1612

100nF

GND

C1614

100pF

GND

C1615

100nF

GND

C1616

220pF

GND

C1617

220pF

GND

C1618

100pF

GND

C1619

1uF

GND

C1620

100nF

FB1606

BLM18KG601SZ1D

GND

C1612

100nF

GND

C1614

100pF

GND

C1615

100nF

GND

C1616

220pF

GND

C1617

220pF

GND

C1618

100pF

GND

C1619

1uF

GND

C1620

100nF

FB1607

BLM18KG601SZ1D

GND

C1612

100nF

GND

C1614

100pF

GND

C1615

100nF

GND

C1616

220pF

GND

C1617

220pF

GND

C1618

100pF

GND

C1619

1uF

GND

C1620

100nF

FB1606

BLM18KG601SZ1D

GND

C1612

100nF

GND

C1614

100pF

GND

C1615

100nF

GND

C1616

220pF

GND

C1617

220pF

GND

C1618

100pF

GND

C1619

1uF

GND

C1620

100nF

FB1607

BLM18KG601SZ1D

GND

C1612

100nF

GND

C1614

100pF

GND

C1615

100nF

GND

C1616

220pF

GND

C1617

220pF

GND

C1618

100pF

[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

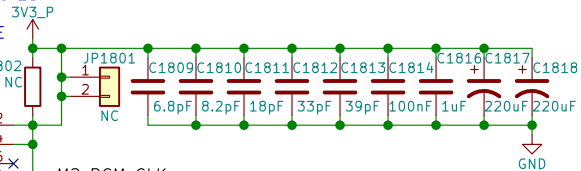
RS9116 NC:
RTS, CTS, BT_HOST_WAKE

RS9116 datasheet says
no WIFI_WAKE
but the schematic has it

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

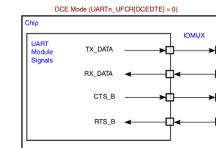
Socket: Table 46
Module: Table 23

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

AE1801
FR05-S1-NO-1-004

CBL1801 Coax_cable_ufl_ufl



AE1802
FR05-S1-NO-1-004

CBL1802 Coax_cable_ufl_ufl



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

R1804 10k
Q1801 FDV301N

M2_I2C_SDA
M2_I2C_SCL

1V8_P
3V3_P

R1806 10k
Q1802 FDV301N

1V8_P
3V3_P

R1807 100k

SW1801A
WLAN_HKS

SW1801B
WLAN_HKS

Leave BT_DISABLE
LOW for RS9116

Input pins are
interchangeable

1V8_P
3V3_P

R1805 100k

1V8_P
3V3_P

R1806 10k

1V8_P
3V3_P

R1807 100k

1V8_P
3V3_P

R1808 100k

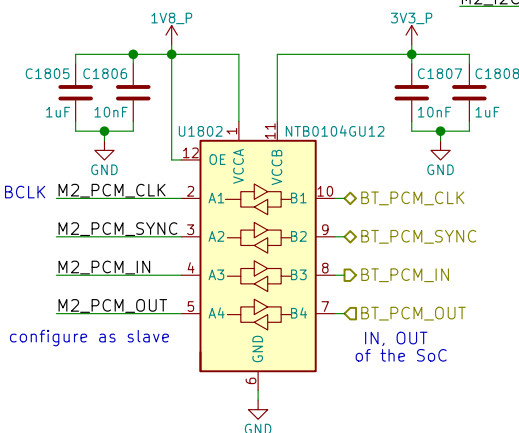
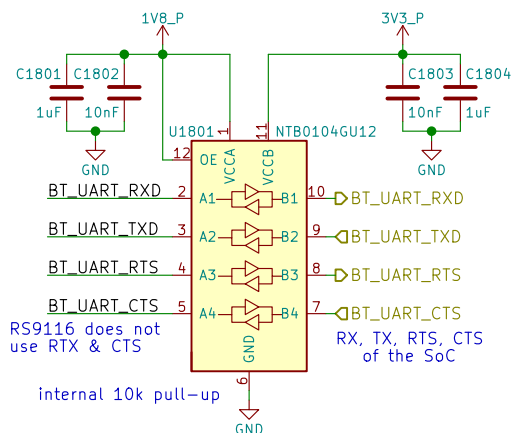
1V8_P
3V3_P

R1809 100k

1V8_P
3V3_P

R1810 100k

1V8_P
3V3_P



WLAN+BT M.2

Purism

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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

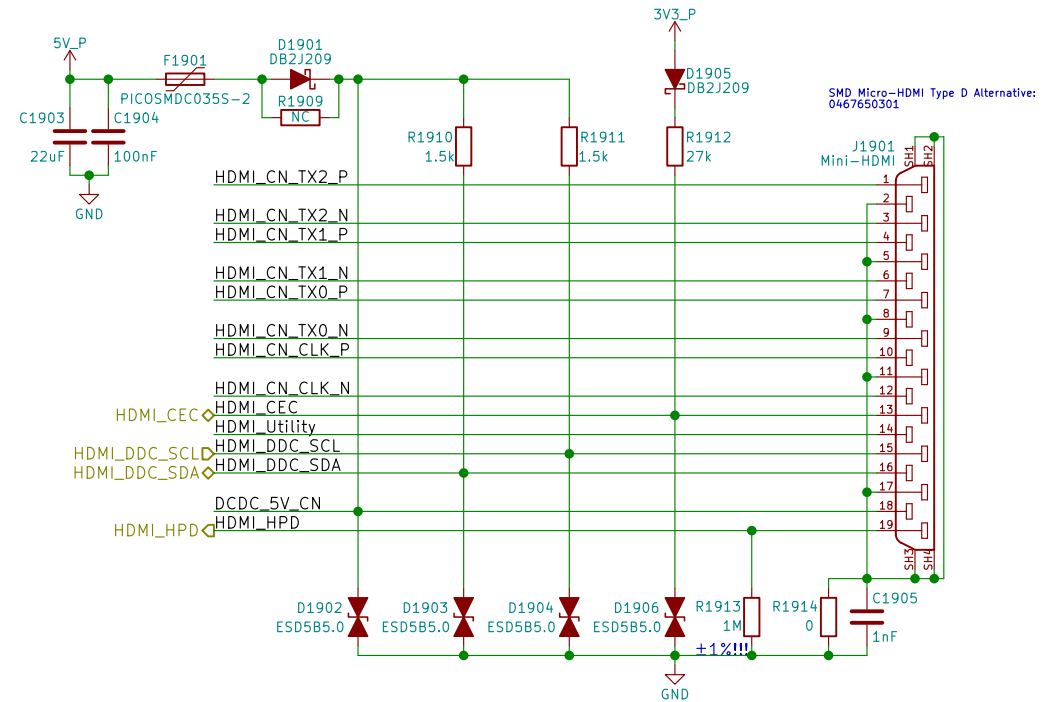
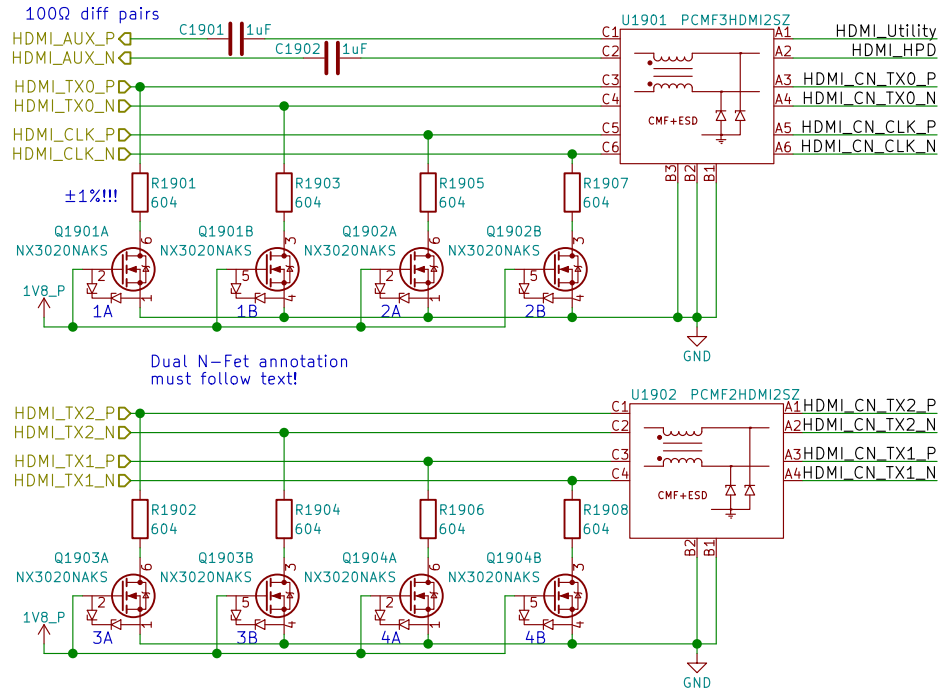
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christian.schilmoeller@puri.sm

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 Date: 2018-06-18
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Rev: v0.1.0
Id: 19/24

A

B



C

D

B



C



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]

| | | |
|---|---|---|
| <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.faeber@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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Sheet: /GNSS/

File: gnss.sch

Size: A4

Date: 2018-06-18

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Rev: v0.1.0

Id: 23/24

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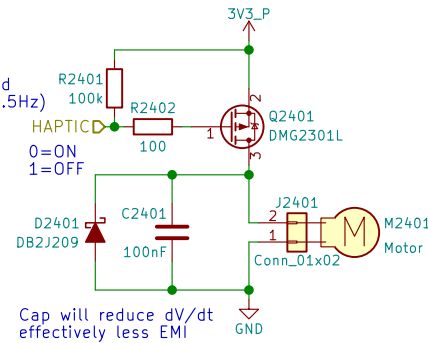
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Haptic Motor

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



Cap will reduce dV/dt
 effectively less EMI

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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 File: haptic.sch

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Size: A4 Date: 2018-06-18

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Rev: v0.1.0

Id: 24/24