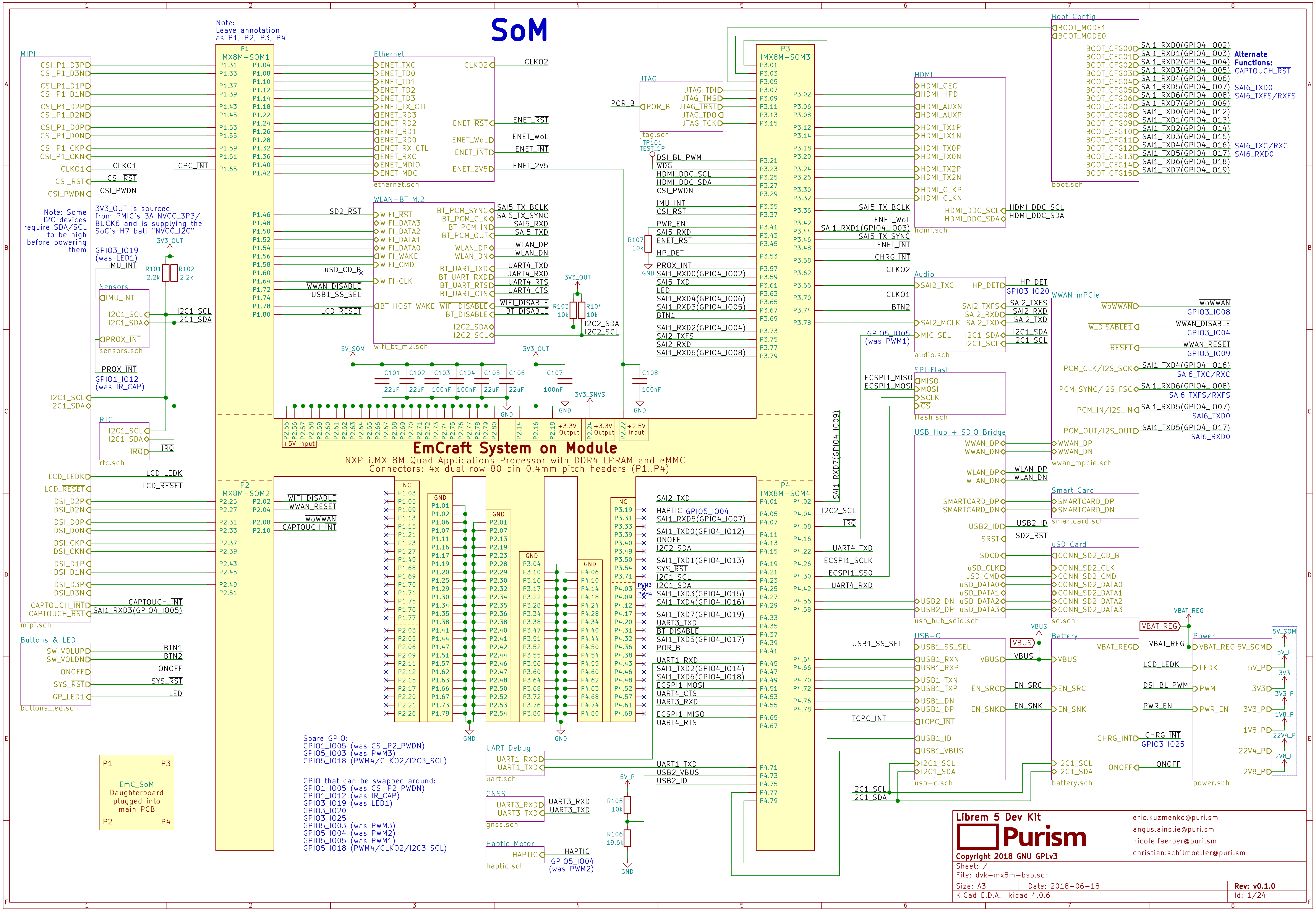
SoM
Note:
Leave annotation
as P1, P2, P3, P4
MIPI
CSI_P1_D3P
CSI_P1_D3N
CSI_P1_D1P
CSI_P1_D1N
CSI_P1_D2P
CSI_P1_D2N
CSI_P1_D0P
CSI_P1_D0N
CSI_P1_CKP
CSI_P1_CKN
CLKO1
CSI_RST
CSI_PWDN
LCD_LEDK
LCD_RESET
DSI_D2P
DSI_D2N
DSI_D0P
DSI_D0N
DSI_CKP
DSI_CKN
DSI_D1P
DSI_D1N
DSI_D3P
DSI_D3N
CAPTOUCH_INT
CAPTOUCH_RST
mipi.sch
TCPC_INT
SAI1_RXD3(GPIO4_IO05)
Note: Some I2C devices require SDA/SCL to be high before powering them
3V3_OUT is sourced from PMIC's 3A NVCC_3P3/BUCK6 and is supplying the SoC's H7 ball "NVCC_I2C"
3V3_OUT
GPIO3_IO19
(was LED1)
IMU_INT
R101
2.2k
R102
2.2k
Sensors
IMU_INT
I2C1_SCL
I2C1_SDA
PROX_INT
sensors.sch
PROX_INT
GPIO1_IO12
(was IR_CAP)
RTC
I2C1_SCL
I2C1_SDA
IRQ
rtc.sch
Buttons & LED
SW_VOLUP
SW_VOLDN
ONOFF
SYS_RST
GP_LED1
buttons_led.sch
BTN1
BTN2
LED
P1
IMX8M-SOM1
P2
IMX8M-SOM2
P3
IMX8M-SOM3
P4
IMX8M-SOM4
Ethernet
ENET_TXC
ENET_TD0
ENET_TD1
ENET_TD2
ENET_TD3
ENET_TX_CTL
ENET_RD3
ENET_RD2
ENET_RD1
ENET_RD0
ENET_RX_CTL
ENET_RXC
ENET_MDIO
ENET_MDC
CLKO2
ENET_RST
ENET_WoL
ENET_INT
ENET_2V5
ethernet.sch
WLAN+BT M.2
WIFI_RST
WIFI_DATA3
WIFI_DATA2
WIFI_DATA1
WIFI_DATA0
WIFI_WAKE
WIFI_CMD
WIFI_CLK
BT_HOST_WAKE
BT_PCM_SYNC
BT_PCM_CLK
BT_PCM_IN
BT_PCM_OUT
WLAN_DP
WLAN_DN
BT_UART_TXD
BT_UART_RXD
BT_UART_RTS
BT_UART_CTS
WIFI_DISABLE
BT_DISABLE
I2C2_SDA
I2C2_SCL
wifi_bt_m2.sch
SD2_RST
uSD_CD_B
WWAN_DISABLE
USB1_SS_SEL
LCD_RESET
SAI5_TX_BCLK
SAI5_TX_SYNC
SAI5_RXD
SAI5_TXD
UART4_TXD
UART4_RXD
UART4_RTS
UART4_CTS
R103
10k
R104
10k
5V_SOM
C101 22uF
C102 22uF
C103 100nF
C104 100nF
C105 22uF
C106 22uF
C107 100nF
C108 100nF
GND
3V3_SNVS
+5V Input
+3.3V Output
+3.3V Output
+2.5V Input
EmCraft System on Module
NXP i.MX 8M Quad Applications Processor with DDR4 LPRAM and eMMC
Connectors: 4x dual row 80 pin 0.4mm pitch headers (P1..P4)
JTAG
POR_B
JTAG_TDI
JTAG_TMS
JTAG_TRST
JTAG_TDO
JTAG_TCK
jtag.sch
TP101
TEST_1P
DSI_BL_PWM
WDG
HDMI_DDC_SCL
HDMI_DDC_SDA
CSI_PWDN
IMU_INT
CSI_RST
PWR_EN
SAI5_RXD
ENET_RST
HP_DET
PROX_INT
SAI1_RXD0(GPIO4_IO02)
SAI5_TXD
LED
SAI1_RXD4(GPIO4_IO06)
SAI1_RXD3(GPIO4_IO05)
BTN1
SAI1_RXD2(GPIO4_IO04)
SAI2_TXFS
SAI2_RXD
SAI1_RXD6(GPIO4_IO08)
R107
10k
SAI1_RXD1(GPIO4_IO03)
CHRG_INT
CLKO1
BTN2
HDMI
HDMI_CEC
HDMI_HPD
HDMI_AUXN
HDMI_AUXP
HDMI_TX1P
HDMI_TX1N
HDMI_TX0P
HDMI_TX0N
HDMI_TX2P
HDMI_TX2N
HDMI_CLKP
HDMI_CLKN
HDMI_DDC_SCL
HDMI_DDC_SDA
hdmi.sch
Boot Config
BOOT_MODE1
BOOT_MODE0
BOOT_CFG00
BOOT_CFG01
BOOT_CFG02
BOOT_CFG03
BOOT_CFG04
BOOT_CFG05
BOOT_CFG06
BOOT_CFG07
BOOT_CFG08
BOOT_CFG09
BOOT_CFG10
BOOT_CFG11
BOOT_CFG12
BOOT_CFG13
BOOT_CFG14
BOOT_CFG15
boot.sch
SAI1_RXD0(GPIO4_IO02)
SAI1_RXD1(GPIO4_IO03)
SAI1_RXD2(GPIO4_IO04)
SAI1_RXD3(GPIO4_IO05)
SAI1_RXD4(GPIO4_IO06)
SAI1_RXD5(GPIO4_IO07)
SAI1_RXD6(GPIO4_IO08)
SAI1_RXD7(GPIO4_IO09)
SAI1_TXD0(GPIO4_IO12)
SAI1_TXD1(GPIO4_IO13)
SAI1_TXD2(GPIO4_IO14)
SAI1_TXD3(GPIO4_IO15)
SAI1_TXD4(GPIO4_IO16)
SAI1_TXD5(GPIO4_IO17)
SAI1_TXD6(GPIO4_IO18)
SAI1_TXD7(GPIO4_IO19)
Alternate Functions:
CAPTOUCH_RST
SAI6_TXD0
SAI6_TXFS/RXFS
SAI6_TXC/RXC
SAI6_RXD0
Audio
SAI2_TXC
SAI2_MCLK
MIC_SEL
HP_DET
SAI2_TXFS
SAI2_RXD
SAI2_TXD
I2C1_SDA
I2C1_SCL
audio.sch
GPIO3_IO20
GPIO5_IO05
(was PWM1)
WWAN mPCIe
WoWWAN
W_DISABLE1
RESET
PCM_CLK/I2S_SCK
PCM_SYNC/I2S_FSC
PCM_IN/I2S_IN
PCM_OUT/I2S_OUT
WWAN_DP
WWAN_DN
wwan_mpcie.sch
GPIO3_IO08
WWAN_DISABLE
GPIO3_IO04
WWAN_RESET
GPIO3_IO09
SPI Flash
MISO
MOSI
SCLK
CS
flash.sch
ECSPI1_MISO
ECSPI1_MOSI
USB Hub + SDIO Bridge
WWAN_DP
WWAN_DN
WLAN_DP
WLAN_DN
SMARTCARD_DP
SMARTCARD_DN
USB2_ID
SRST
SDCD
uSD_CLK
uSD_CMD
uSD_DATA0
uSD_DATA1
uSD_DATA2
uSD_DATA3
USB2_DN
USB2_DP
usb_hub_sdio.sch
SD2_RST
Smart Card
SMARTCARD_DP
SMARTCARD_DN
smartcard.sch
uSD Card
CONN_SD2_CD_B
CONN_SD2_CLK
CONN_SD2_CMD
CONN_SD2_DATA0
CONN_SD2_DATA1
CONN_SD2_DATA2
CONN_SD2_DATA3
sd.sch
SAI1_RXD7(GPIO4_IO09)
I2C2_SCL
IRQ
UART4_TXD
ECSPI1_SCLK
ECSPI1_SS0
UART4_RXD
SAI2_TXD
HAPTIC GPIO5_IO04
SAI1_RXD5(GPIO4_IO07)
SAI1_TXD0(GPIO4_IO12)
ONOFF
I2C2_SDA
SAI1_TXD1(GPIO4_IO13)
SYS_RST
I2C1_SCL
I2C1_SDA
SAI1_TXD3(GPIO4_IO15)
SAI1_TXD4(GPIO4_IO16)
SAI1_TXD7(GPIO4_IO19)
UART3_TXD
BT_DISABLE
SAI1_TXD5(GPIO4_IO17)
POR_B
UART1_RXD
SAI1_TXD2(GPIO4_IO14)
SAI1_TXD6(GPIO4_IO18)
ECSPI1_MOSI
UART4_CTS
UART3_RXD
ECSPI1_MISO
UART4_RTS
UART1_TXD
USB2_VBUS
USB2_ID
PWM3
PWM4
WIFI_DISABLE
WWAN_RESET
WoWWAN
CAPTOUCH_INT
NC
GND
USB-C
USB1_SS_SEL
USB1_RXN
USB1_RXP
USB1_TXN
USB1_TXP
USB1_DN
USB1_DP
TCPC_INT
USB1_ID
USB1_VBUS
I2C1_SCL
I2C1_SDA
VBUS
EN_SRC
EN_SNK
usb-c.sch
VBUS
Battery
VBUS
EN_SRC
EN_SNK
VBAT_REG
CHRG_INT
ONOFF
I2C1_SCL
I2C1_SDA
battery.sch
GPIO3_IO25
VBAT_REG
Power
VBAT_REG
LEDK
PWM
PWR_EN
5V_SOM
5V_P
3V3
3V3_P
1V8_P
22V4_P
2V8_P
power.sch
LCD_LEDK
DSI_BL_PWM
UART Debug
UART1_RXD
UART1_TXD
uart.sch
GNSS
UART3_RXD
UART3_TXD
gnss.sch
Haptic Motor
HAPTIC
haptic.sch
GPIO5_IO04
(was PWM2)
5V_P
R105
10k
R106
19.6k
P1 P3
EmC_SoM
Daughterboard
plugged into
main PCB
P2 P4
Spare GPIO:
GPIO1_IO05 (was CSI_P2_PWDN)
GPIO5_IO03 (was PWM3)
GPIO5_IO18 (PWM4/CLKO2/I2C3_SCL)
GPIO that can be swapped around:
GPIO1_IO05 (was CSI_P2_PWDN)
GPIO1_IO12 (was IR_CAP)
GPIO3_IO19 (was LED1)
GPIO3_IO20
GPIO3_IO25
GPIO5_IO03 (was PWM3)
GPIO5_IO04 (was PWM2)
GPIO5_IO05 (was PWM1)
GPIO5_IO18 (PWM4/CLKO2/I2C3_SCL)
Librem 5 Dev Kit
Purism
Copyright 2018 GNU GPLv3
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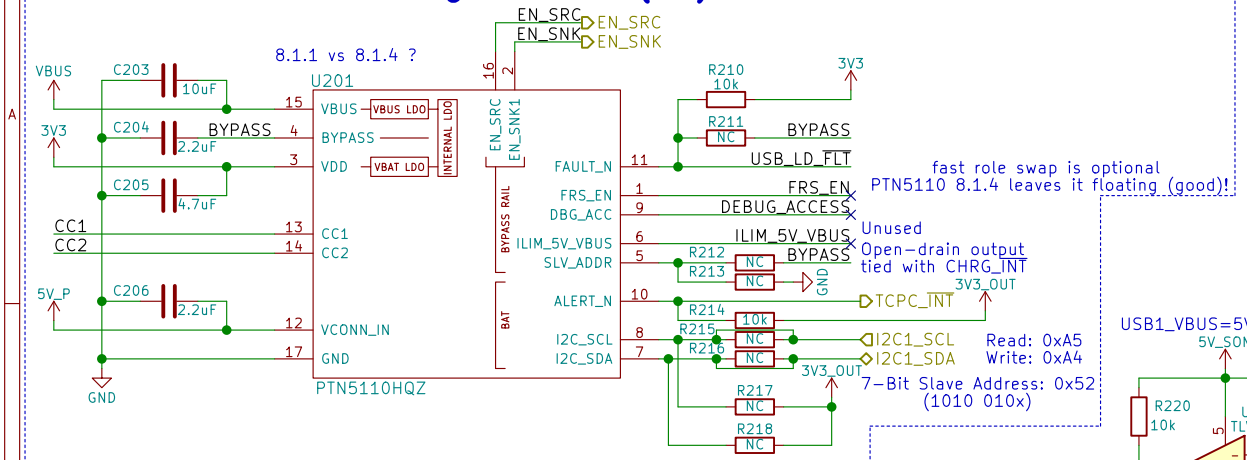
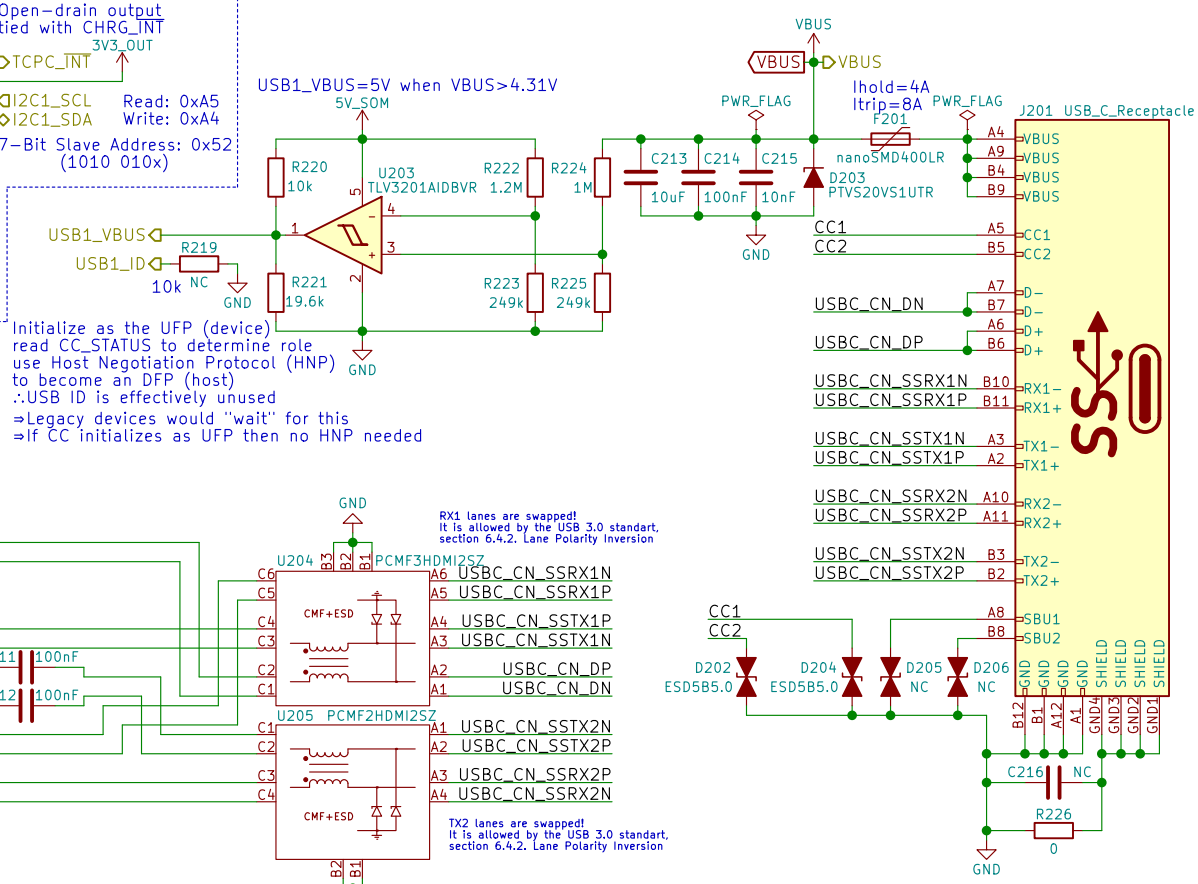
christian.schilmoeller@puri.sm
Sheet: /
File: dvk-mx8m-bsb.sch
Size: A3
Date: 2018-06-18
Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6
Id: 1/24

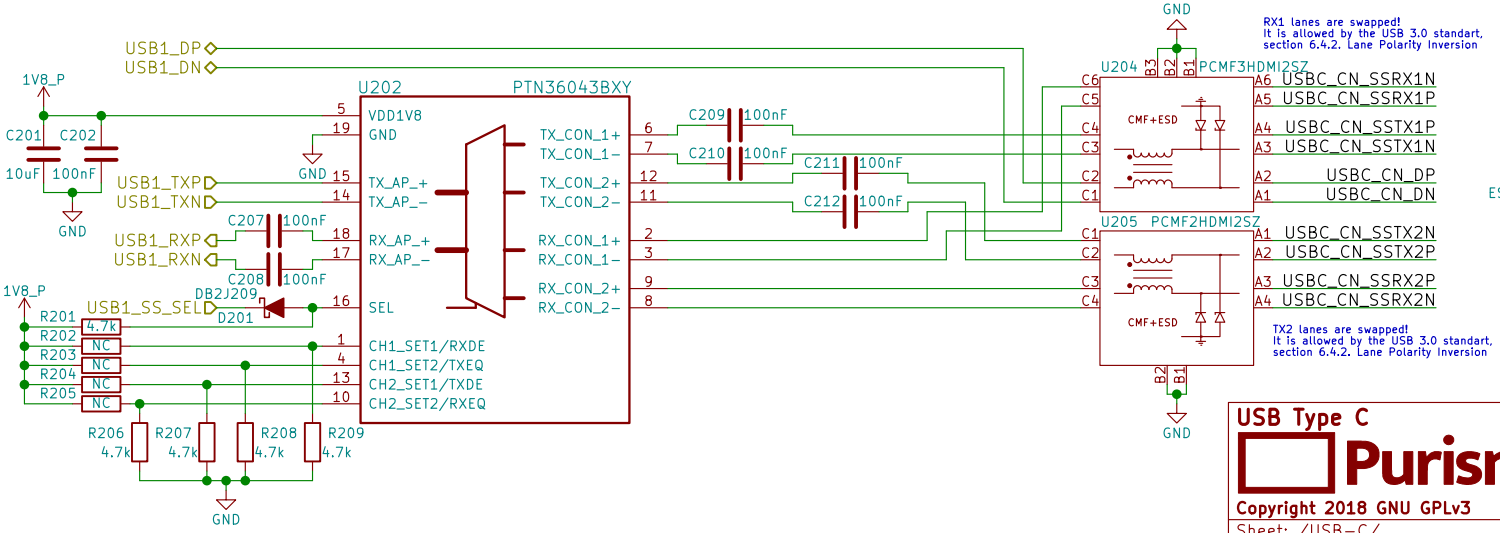
USB-C TCPC – Config Channel (CC) and PD Role Controller



"Under dead battery operation, PTN5110 applies voltage clamps to both CC pins so that the system may receive power as a Sink. To support platforms with buck-boost configuration, PTN5110 asserts EN_SNK1 pin based on validity of VBUS voltage (facilitates 5 V VBUS sinking)."

USB-C





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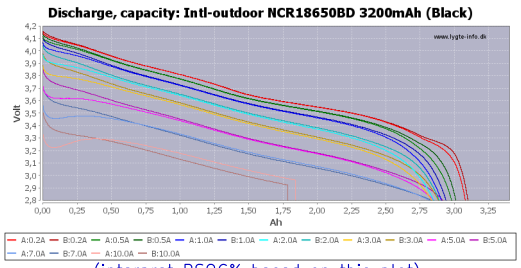
Sheet: /USB-C/		
File: usb-c.sch		
Size: A4	Date: 2018-06-18	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.6		Id: 2/24

Battery Charge Controller



(interpret RSOC% based on this plot)

Drawing ~333.33mA, or consuming <1.2W, should give close to 10 hours going from 100% to 0% charge

use AUTO_DPDM_EN to auto-detect IINLIM

1.658≤ILIM≤2.063
ILIM(nom)≅1.859A
3.9≤VIN≤14

7-bit Slave Address: 0x6B (1101 011x)

U301 BQ25896

I(Lsat)=7A

Default LOW: adapter source

sink current ~5mA

Read: 0xD7
Write: 0xD6

Ihold=3.5A
Itrip=6.3A
Ttrip(max)=5s@8A

Vrwm(max)=5.0V
Vbr(min)=6.2V
Pd=150mW
Vf(max)=1.1V

VBAT(DPL)=2.15~2.5V

0.4mA~2.4mA

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/tiducl1/tiducl1.pdf
schematic: http://www.ti.com/lit/df/tidrp70/tidrp70.pdf
(PTC may be good enough)

This disables charging
but maybe not VBUS->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 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

Purism

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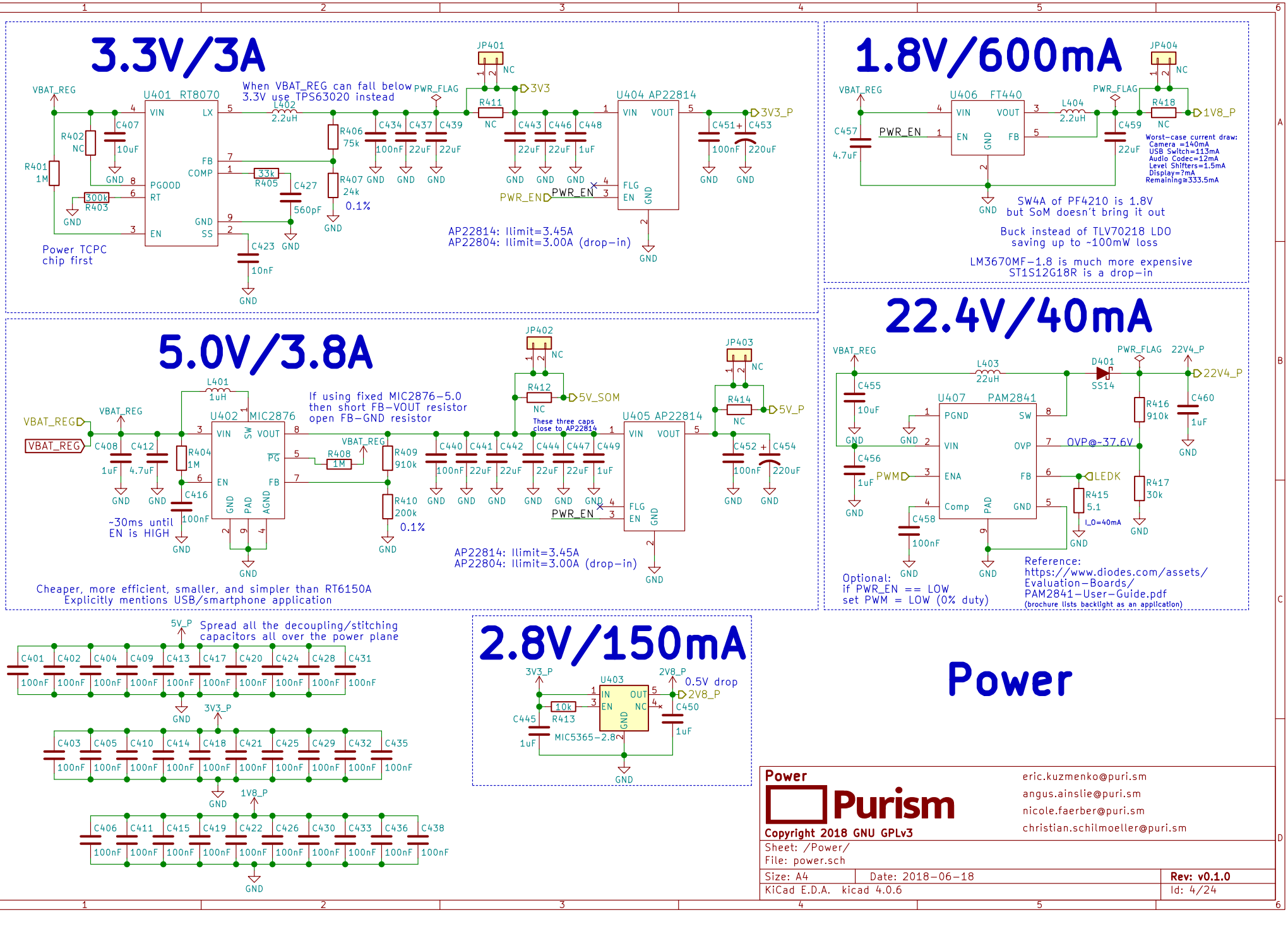
Sheet: /Battery/
File: battery.sch

Size: A4 | Date: 2018-06-18 | Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6 | Id: 3/24


3.3V/3A
When VBAT_REG can fall below 3.3V use TPS63020 instead
Power TCPC chip first
AP22814: Ilimit=3.45A
AP22804: Ilimit=3.00A (drop-in)
1.8V/600mA
SW4A of PF4210 is 1.8V but SoM doesn't bring it out
Buck instead of TLV70218 LDO saving up to ~100mW loss
LM3670MF-1.8 is much more expensive
ST1S12G18R is a drop-in
Worst-case current draw:
Camera =140mA
USB Switch=113mA
Audio Codec=12mA
Level Shifters=1.5mA
Display=7mA
Remaining≥333.5mA
5.0V/3.8A
If using fixed MIC2876-5.0 then short FB-VOUT resistor open FB-GND resistor
~30ms until EN is HIGH
Cheaper, more efficient, smaller, and simpler than RT6150A
Explicitly mentions USB/smartphone application
AP22814: Ilimit=3.45A
AP22804: Ilimit=3.00A (drop-in)
22.4V/40mA
Optional: if PWR_EN == LOW set PWM = LOW (0% duty)
Reference: https://www.diodes.com/assets/Evaluation-Boards/PAM2841-User-Guide.pdf
(brochure lists backlight as an application)
2.8V/150mA
0.5V drop
Spread all the decoupling/stitching capacitors all over the power plane
Power
Purism
Copyright 2018 GNU GPLv3
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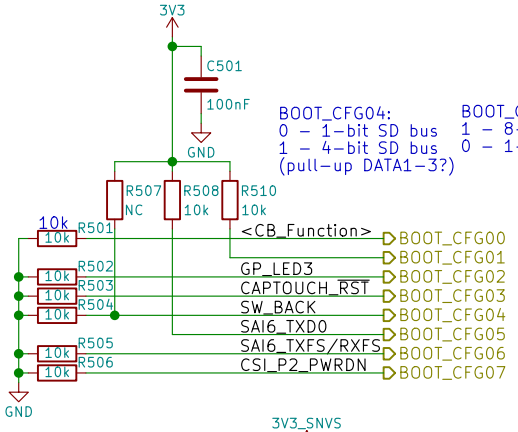
christian.schilmoeller@puri.sm
Sheet: /Power/
File: power.sch
Size: A4
Date: 2018-06-18
Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6
Id: 4/24

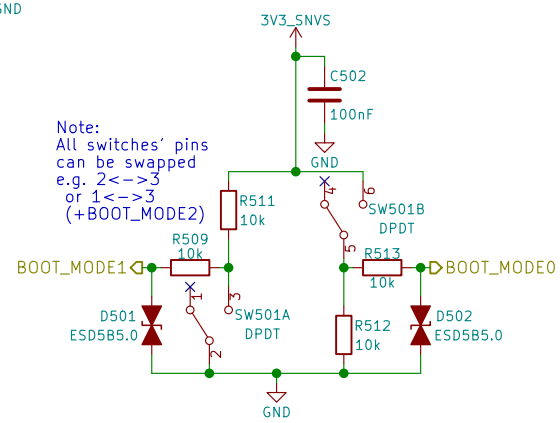
Boot Config

Only eMMC

BOOT_CFG[14:12]	Boot device
001	SD/eSD
010	MMC/eMMC
011	NAND

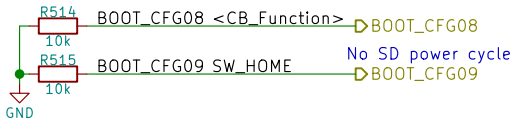
Fuse	Config	Definition	GPIO[1]	Shipped value	Settings
BOOT_CFG[11:10]	OEM	USDHC port selection	Yes	00	00 - USDHC-1
					01 - USDHC-2
					10 - USDHC-3
					else - reserved

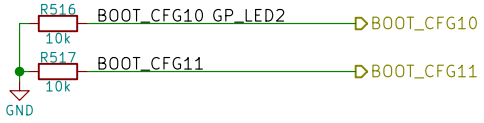


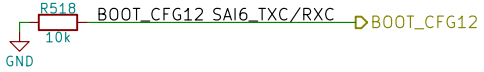


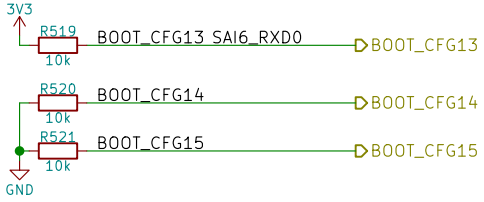
2–>1: eMMC
2–>3: USB (Serial Downloader)

BOOT_MODE[1:0]	Boot Type
00	Boot From Fuses
01	Serial Downloader
10	Internal Boot
11	Reserved









Boot Configuration

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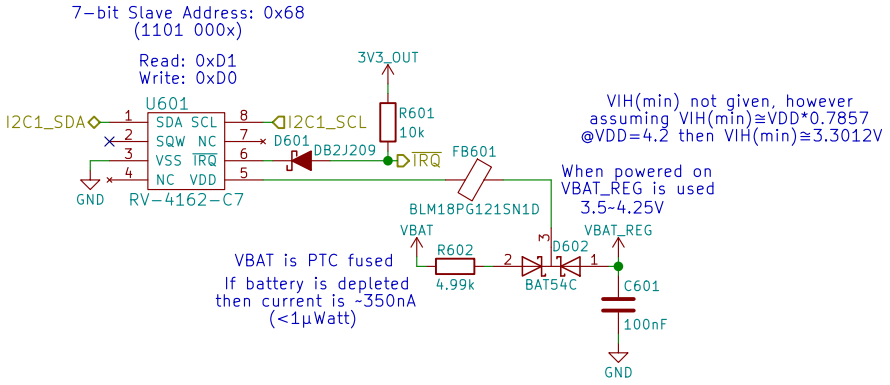
Sheet: /Boot Config/
File: boot.sch

Size: A4 | Date: 2018–06–18 | **Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.6 | Id: 5/24

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

Purism

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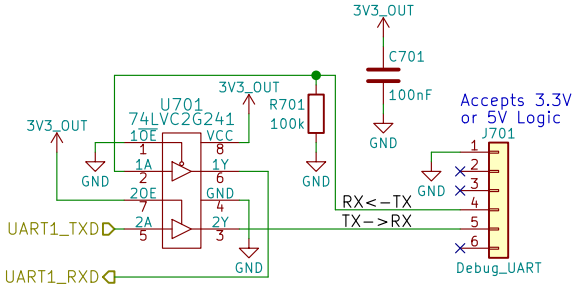
Sheet: /RTC/
File: rtc.sch

Size: A4 | Date: 2018-06-18 | **Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.6 | Id: 6/24

UART Debug



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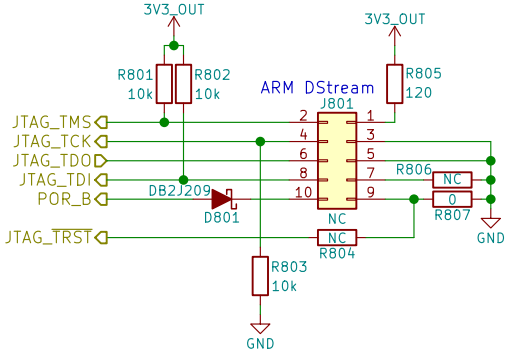
	nicole.faerber@puri.sm	
Copyright 2018 GNU GPLv3	christian.schilmoeller@puri.sm	
Sheet: /UART Debug/		
File: uart.sch		
Size: A4	Date: 2018-06-18	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.6		Id: 7/24

JTAG



JTAG

Purism

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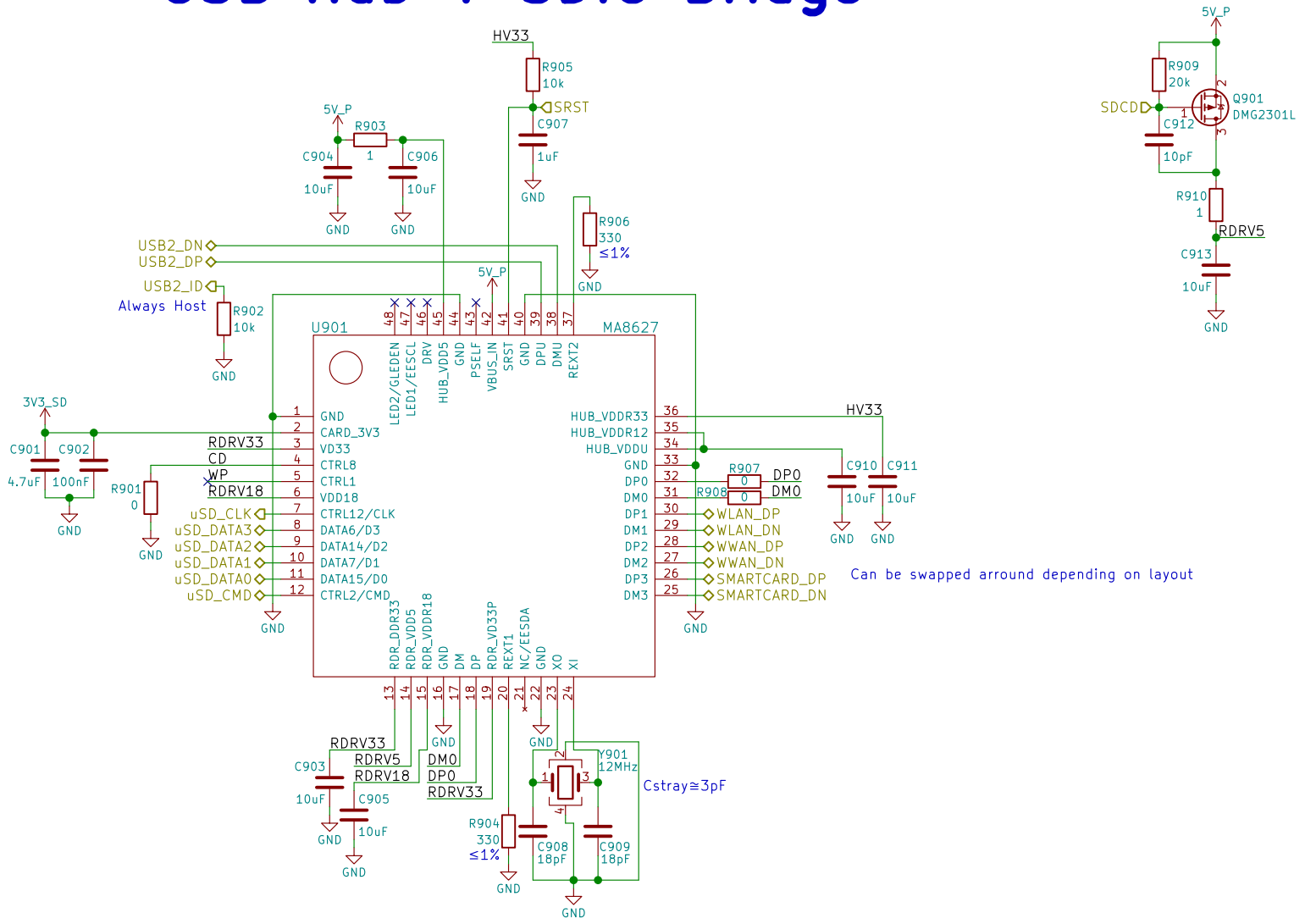
Sheet: /JTAG/
File: jtag.sch

Size: A4	Date: 2018-06-18	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6		Id: 8/24

USB Hub + SDIO Bridge



USB Hub + SDIO Bridge

Purism

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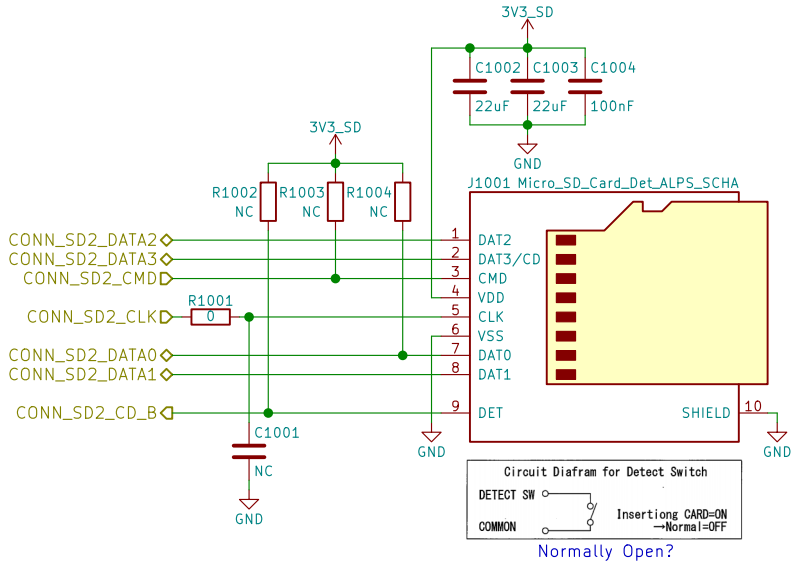
christian.schilmoeller@puri.sm

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

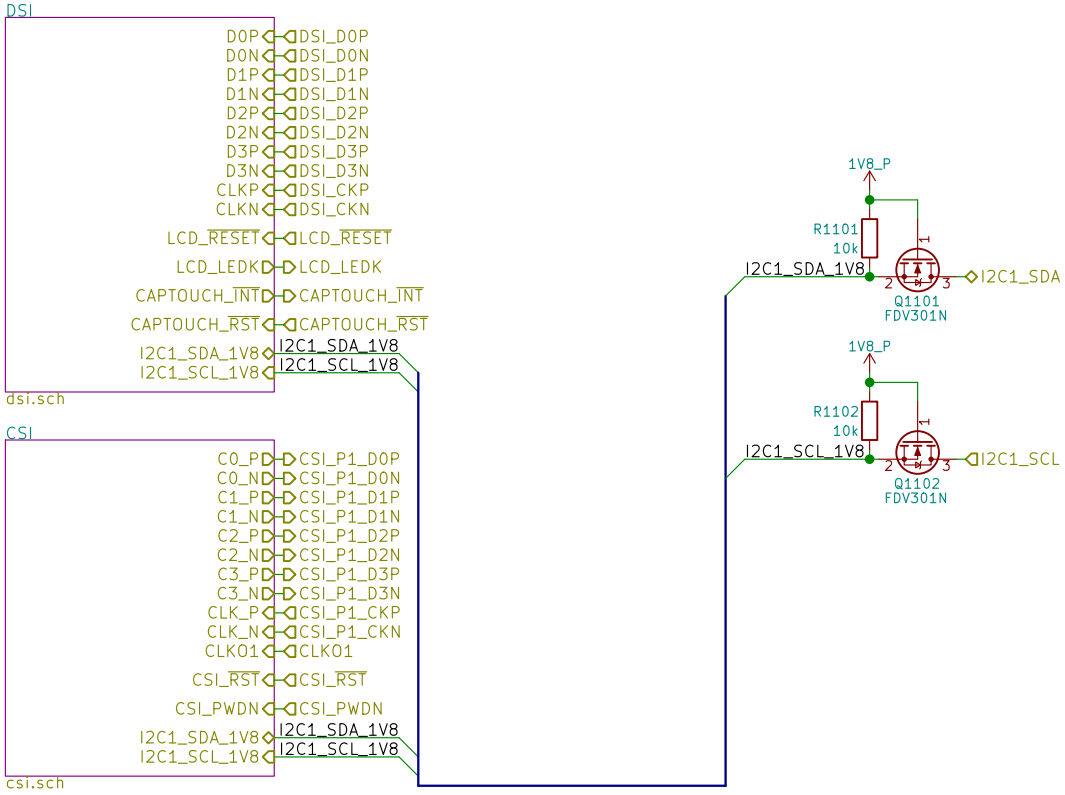
Size: A4	Date: 2018-06-18	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6		Id: 9/24

µSD



uSD Card	eric.kuzmenko@puri.sm angus.ainslie@puri.sm nicole.faerber@puri.sm christian.schilmoeller@puri.sm
Purism	
Copyright 2018 GNU GPLv3	
Sheet: /uSD Card/ File: sd.sch	
Size: A4 | Date: 2018-06-18	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6	Id: 10/24

MIPI



MIPI

Purism

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christian.schilmoeller@puri.sm

Sheet: /MIPI/
File: mipi.sch

Size: A4	Date: 2018-06-18	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6		Id: 11/24

Display & Touch Controller

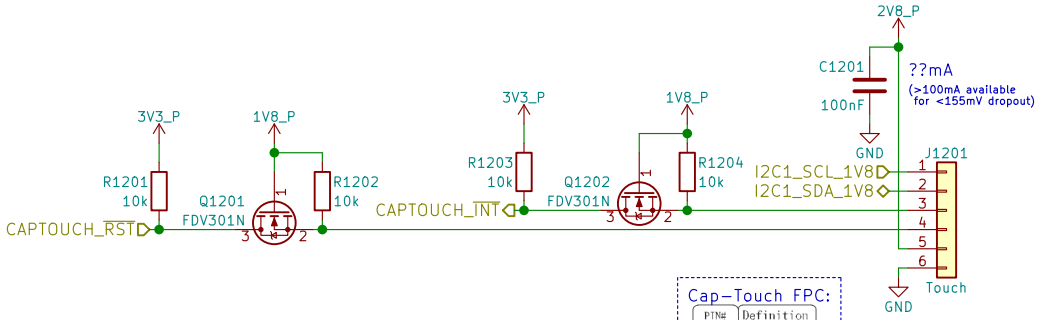
LCD PN:
Shenzhen Jinghong Electronics Co., Ltd.
JH057N00900

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

7-bit Slave Address: 0x5D
(1011 101x)

Read: 0xBB
Write: 0xBA

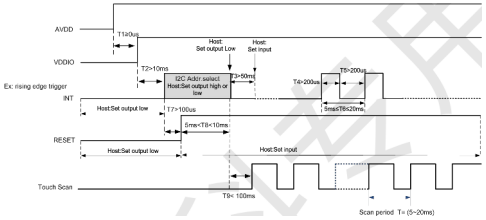
Cap-Touch Controller IC PN:
Goodix GT5688



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

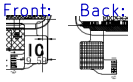
Every time you power on or reset, you need to use the INT pin to set the I2C address:

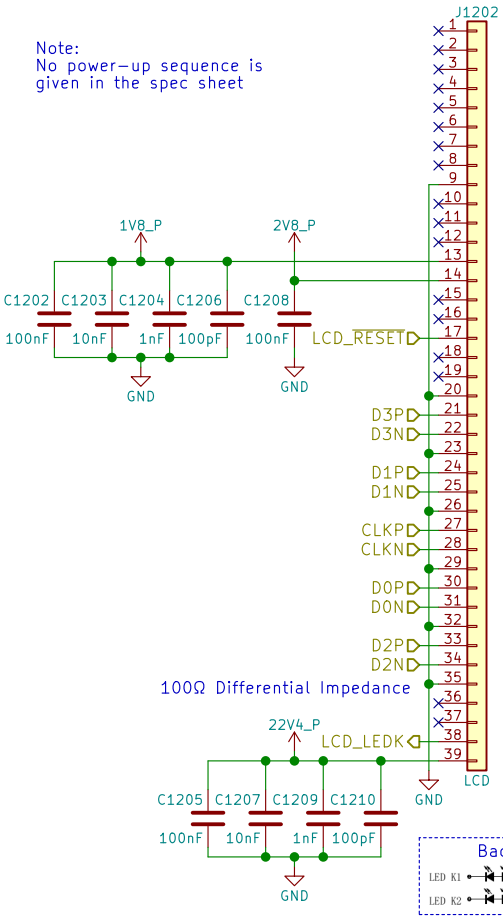


Cap-Touch FPC:

PIN#	Definition
1	SCL
2	SDA
3	INT
4	RESET
5	VDD2.85
6	GND

Front: Back:





Display_JH057N00900

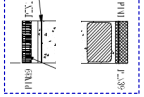
DISP1201

5,7 "
RGB
720 x 1440
pixels

FPC6
Touch

FPC39
Display +
Backlight

DSI FPC:
Front: Back:



Backlight Array:

MIPI DSI

Purism

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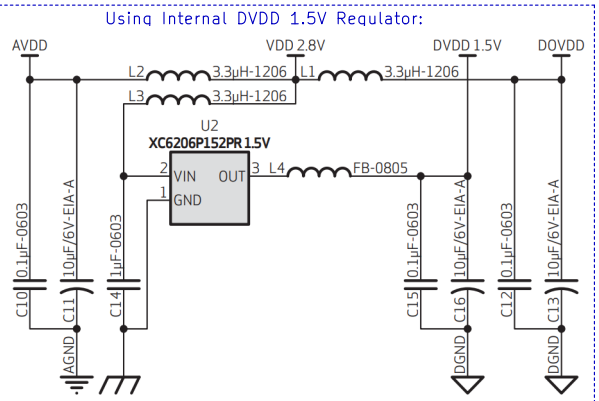
Sheet: /MIPI/DSI/
File: dsi.sch

Size: A4	Date: 2018-06-18	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6		Id: 12/24

Camera

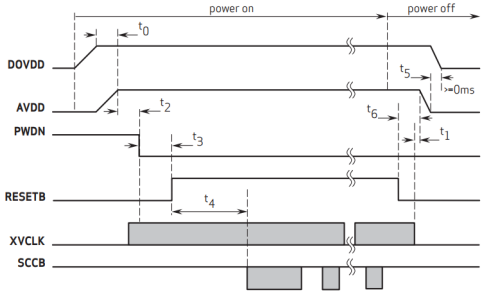


2.7 POWER UP SEQUENCE
Based on the system power configuration (1.8V or 2.8V for I/O power, using external DVDD or internal DVDD, requiring access to the I2C during power up period or not), the power up sequence will differ. If 1.8V is used for I/O power, using the internal DVDD is preferred. If 2.8V 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:

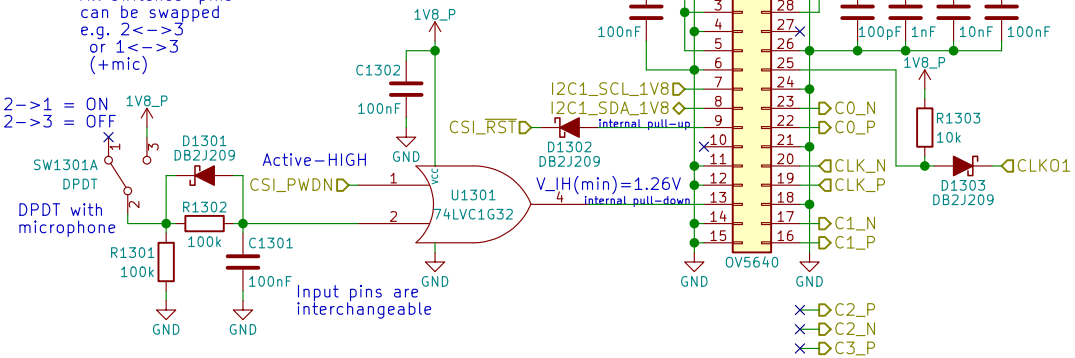
1. when DOVDD and AVDD are turned ON, make sure DOVDD becomes stable before AVDD becomes stable
2. PWDN is active high with an asynchronized design (does not need clock)
3. PWDN pin tied to digital ground if it is not controlled.
4. if PWDN pin is controlled as below, for PWDN to go low, power must first become stable (AVDD to PWDN ≥ 5 ms)
5. RESETB is active low with an asynchronized 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

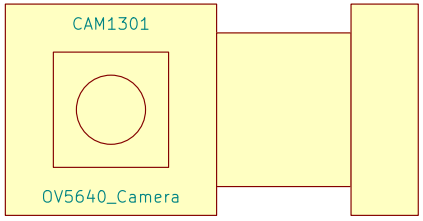


note
t_0 ≥ 0ms, delay from DOVDD stable to AVDD stable, it is recommended to power up AVDD shortly after DOVDD has been powered up
t_1 ≥ 0ms, delay from XVCLK off to AVDD off
t_2 ≥ 5ms, delay from AVDD stable to sensor power up stable, PWDN can be pulled low after this point, XVCLK can be turned on after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

S640_DS_2_2



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



MIPI CSI

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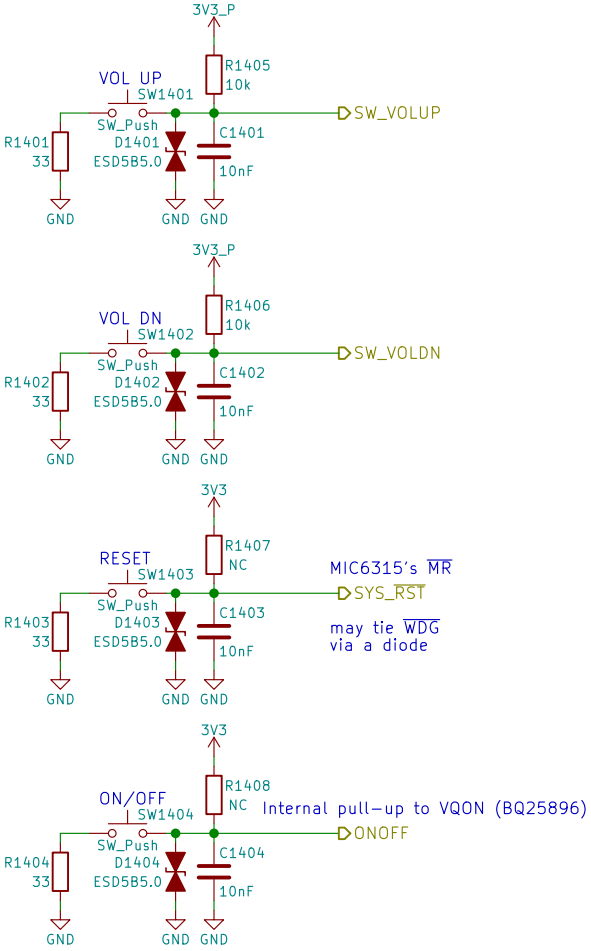
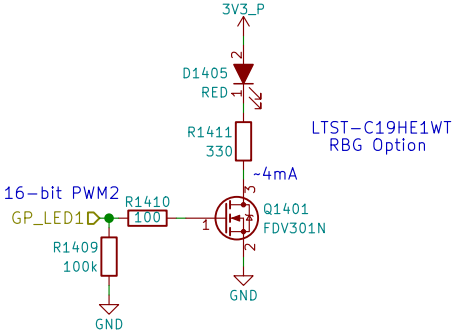
Sheet: /MIPI/CSI/
File: csi.sch

Size: A4 | Date: 2018-06-18 | Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6 | 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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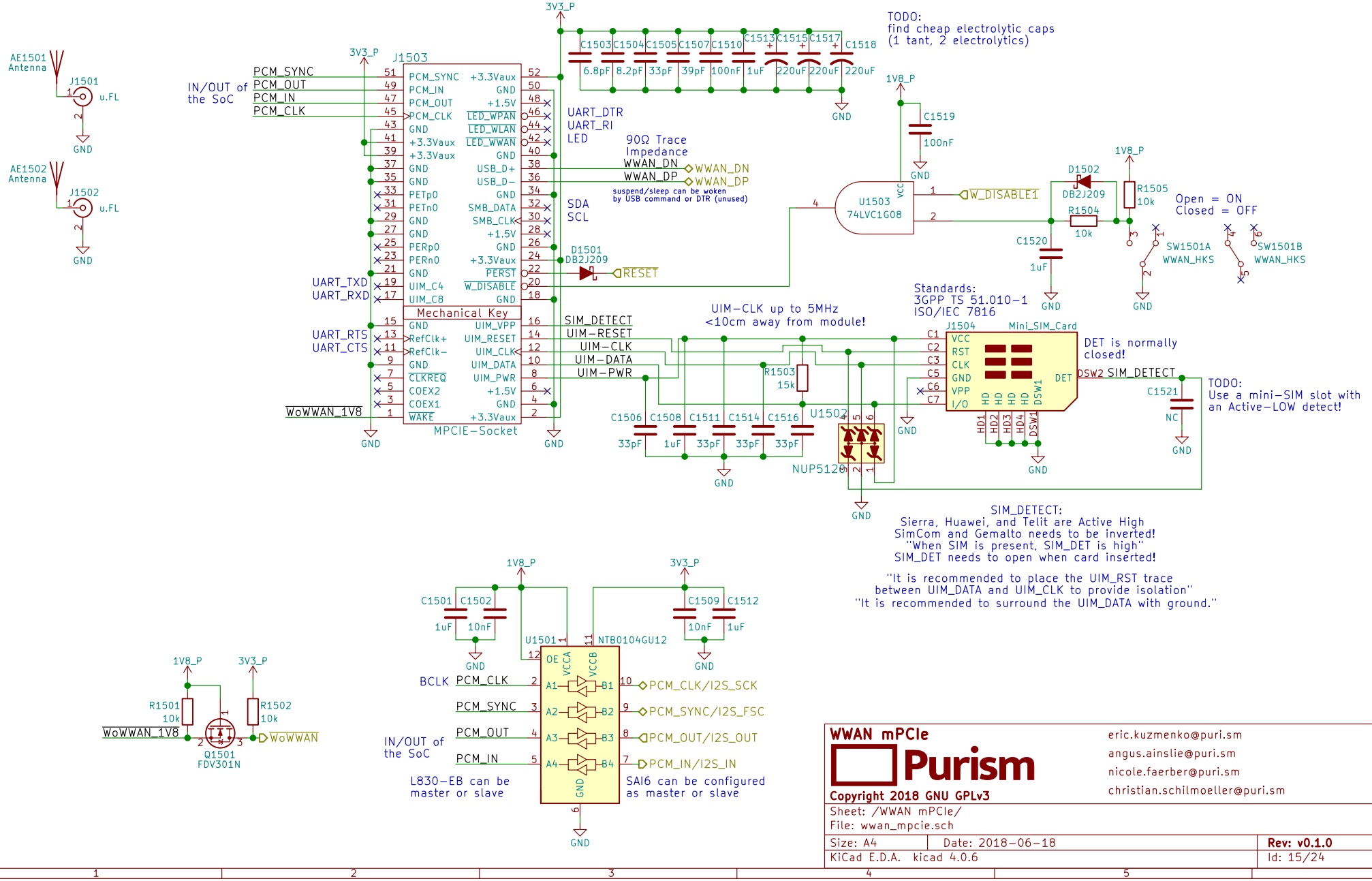
Sheet: /Buttons & LED/
File: buttons_led.sch

Size: A4	Date: 2018-06-18	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.6		Id: 14/24

WWAN mPCIe



WWAN mPCIe

Purism

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Sheet: /WWAN mPCIe/		
File: wwan_mpcie.sch		
Size: A4	Date: 2018−06−18	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.6		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"
⇒ $(1V)^2/(16Ω)=62.5mW$
∴ Vrms=1V ⇒ Vp(amplitude)=1.414V
∴ Irms(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

U1601 SGTL5000

7-bit Slave Address: 0x0A
(0001 010x)
Read: 0x15
Write: 0x14

Mute via MUTE_LO=1

may use lineout left channel for pseudo-earpiece speaker

U1602 PAM8301

LS1601 AS01608MS-SP9

fc=106Hz

CTIA/AHJ
Microphone
Ground
Audio (Right)
Audio (Left)

<3.3µA

Z(hp)≥16Ω

SMD Equivalent: 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

D1603 SZMM5Z3V3T1G
Vz=3.3V
Vf=0.9V

may add ~220uF cap parallel to Zener

U1603 FSA6157L6X

Ext-Mic enabled
MIC_SEL=LOW

Int-Mic enabled
MIC_SEL=LOW

MK1601 CMC-6022

Add TVS next to int-mic?
(OpenMoko does this)

SW Mute Mic:
MUTE_ADC=1

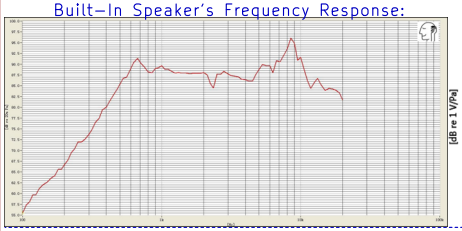
DPDT SW1301B

DPDT with camera
5->4 = ON
Note: 5->6 = OFF
All switches' pins can be swapped
e.g. 5<->4
or 5<->6
(+camera)

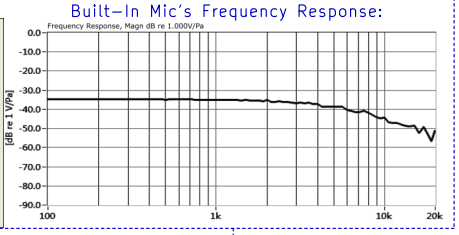
-37dB=14.1254mV/Pa
∴ mic produces 14.1254mVrms when exposed to a 1kHz tone of 94dB-SPL at the capsule (or 19.98mV amplitude)

⇒ 40dB gain would produce ~2V amplitude (4Vpp, clipping)
30dB gain would produce ~0.632V amplitude (1.264Vpp)
38.33dB gain would yield 3.3Vpp

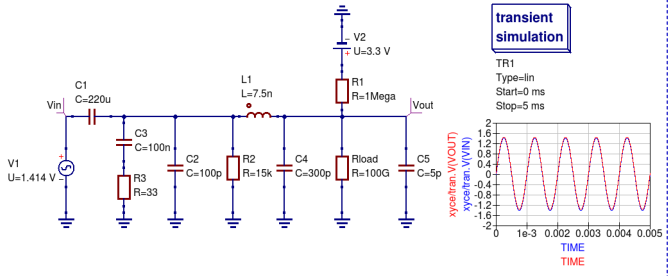
Built-In Speaker's Frequency Response:



Built-In Mic's Frequency Response:



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



LCR Measurements:

Earbud Microphone: @1kHz	Headset Speaker: @1kHz	Earbud Speaker: @1kHz
Ls = 3.844mH	Ls = 244.4uH	Ls = 25.2uH
Lp = 15.757H	Lp = 141.99mH	Lp = 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 = 17.0300hms
Rp = 1.5478kOhms	Rp = 36.860hms	Rp = 17.0340hms
θ = -0.8deg	θ = -2.3deg	θ = 0.5deg

Audio

Purism

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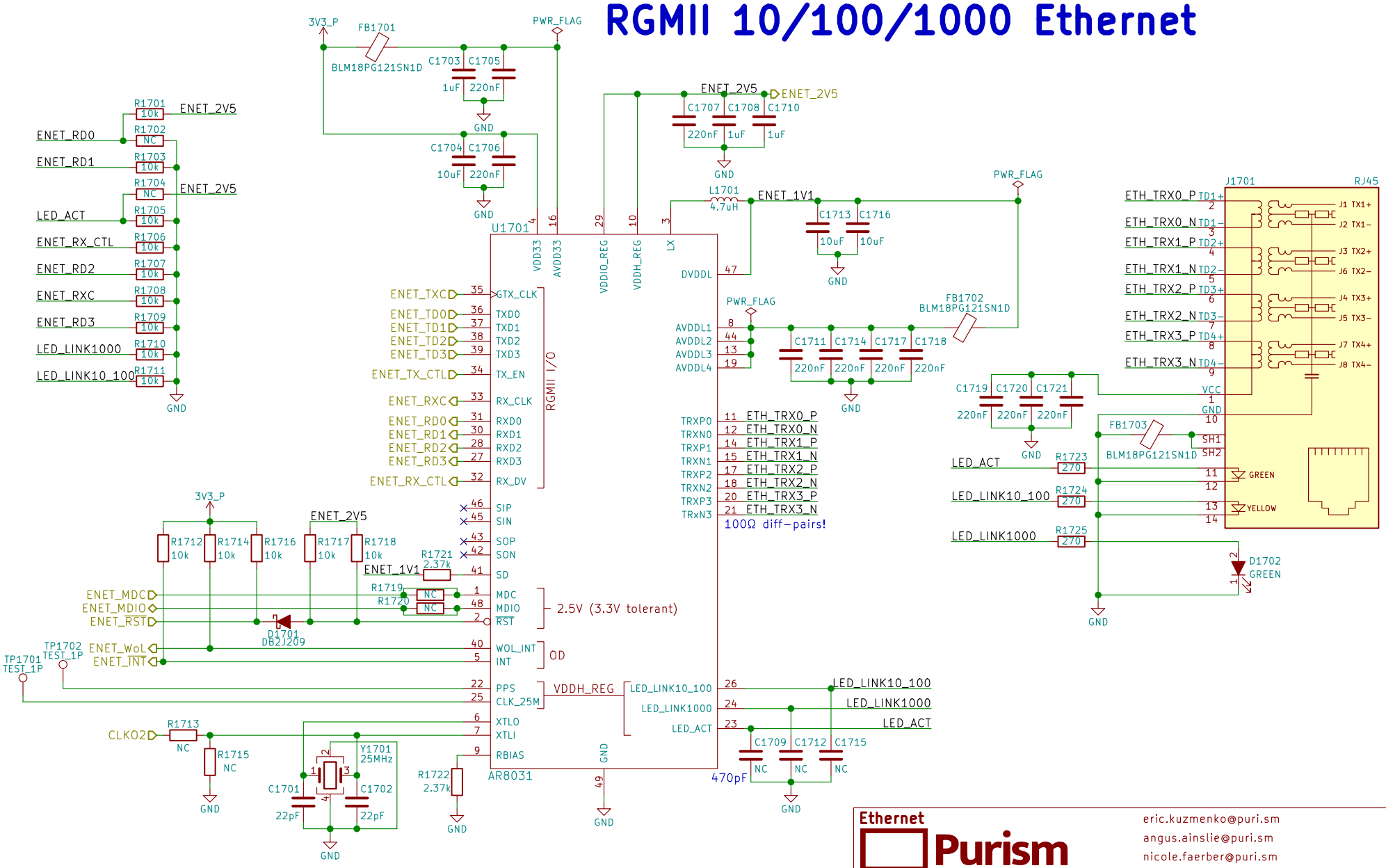
Sheet: /Audio/
File: audio.sch

Size: A4 | Date: 2018-06-18 | **Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.6 | Id: 16/24

RGMII 10/100/1000 Ethernet



Ethernet

Purism

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Sheet: /Ethernet/
File: ethernet.sch

Size: A4	Date: 2018-06-18	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6		Id: 17/24

WLAN+BT M.2

Module: Table 23
Socket: Table 46

M.2 Key E

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

SoC's IN/OUT

SoC's RX
Module's TX

SoC's TX
Module's RX

VIH=2.31V

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

i.MX8M in DCE mode (POR state)
has CTS output, RTS input

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

Pin 54 on RS9116 is
USB_VBUS Sink

RS9116 SUSCLK
is a GPIO (unused)

Leave BT_DISABLE
LOW for RS9116

Input pins are
interchangeable

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

SW1801A
WLAN_HKS

SW1801B
WLAN_HKS

Open = ON
Closed = OFF

RS9116 is an I2C master
⇒its SCL is an output
(ok bc only device on I2C2)

MOD1801
WifiBTCard

WiFi + Bluetooth

M.2 Form Factor
Key ID "E"
width: 22 mm
length: 30 mm

RS9116 does not
use RTX & CTS

internal 10k pull-up

RX, TX, RTS, CTS
of the SoC

configure as slave

IN, OUT
of the SoC

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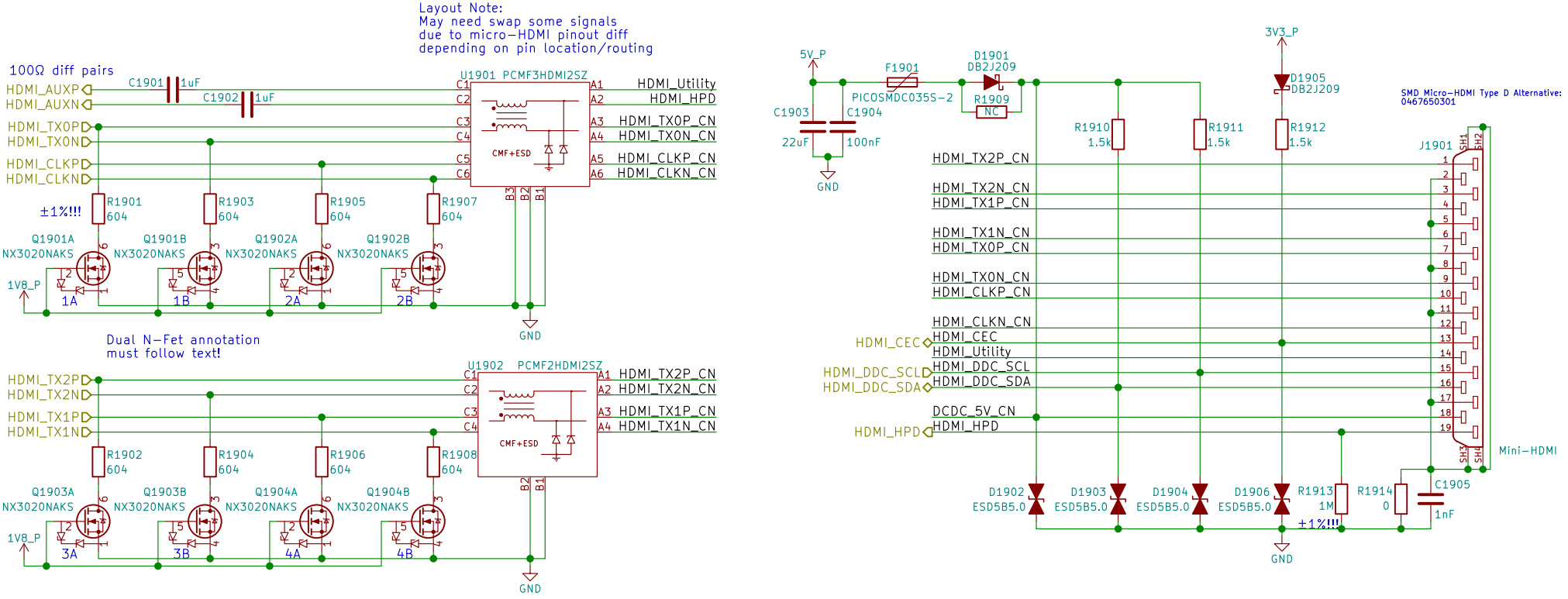
christian.schilmoeller@puri.sm

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

Size: A4 | Date: 2018-06-18 | Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6 | Id: 18/24

TUSB1046 can be used for DP over USB-C

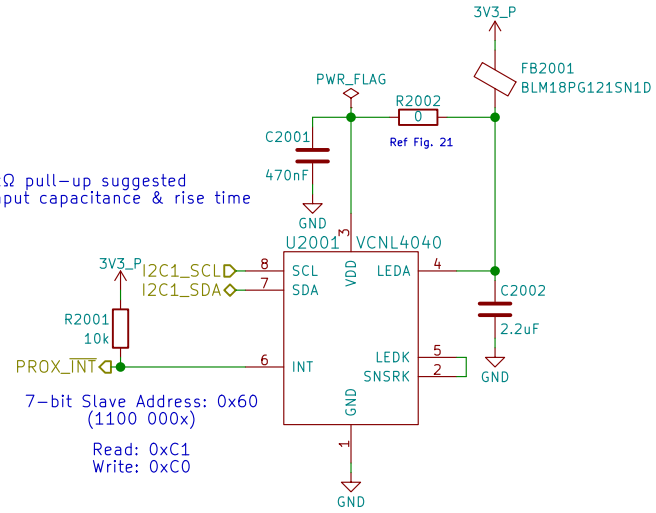
HDMI



HDMI		eric.kuzmenko@puri.sm angus.ainslie@puri.sm nicole.faerber@puri.sm christian.schilmoeller@puri.sm
Purism		
Copyright 2018 GNU GPLv3		
Sheet: /HDMI/ File: hdmi.sch		
Size: A4	Date: 2018-06-18	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6		Id: 19/24

Sensors

Proximity & Ambient Light



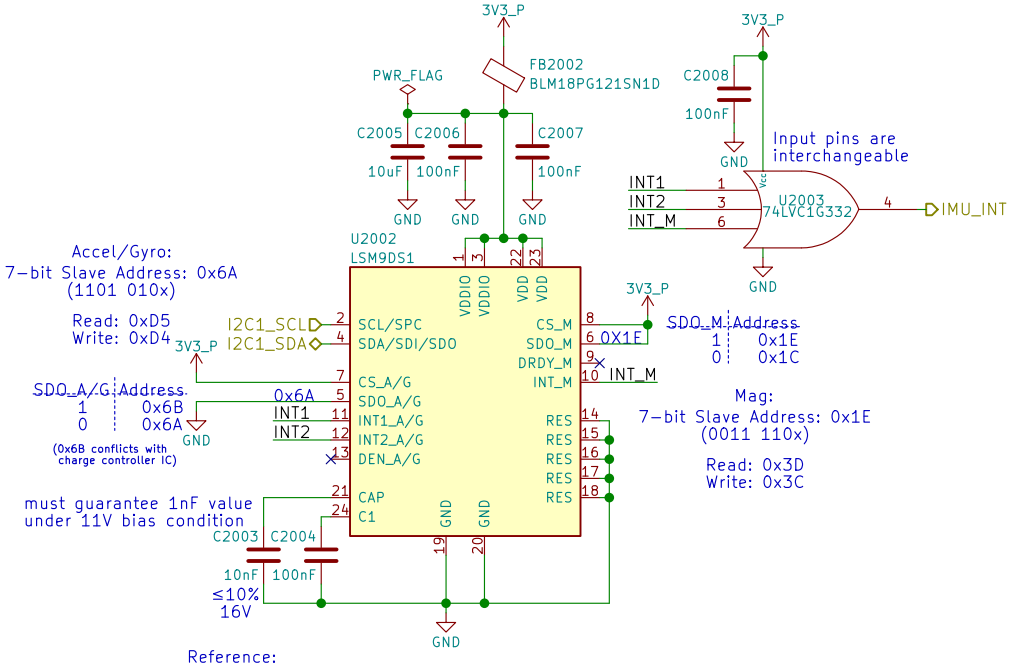
Note:
I2C 2.2kΩ pull-up suggested
check input capacitance & rise time

7-bit Slave Address: 0x60
(1100 000x)

Read: 0xC1
Write: 0xC0

Reference:
https://www.vishay.com/docs/84307/designingvcnl4040.pdf
http://www.vishay.com/docs/84931/vcnl4040sensorboardfiles.pdf

9-Axis IMU



Accel/Gyro:
7-bit Slave Address: 0x6A
(1101 010x)

Read: 0xD5
Write: 0xD4

must guarantee 1nF value
under 11V bias condition

Mag:
7-bit Slave Address: 0x1E
(0011 110x)

Read: 0x3D
Write: 0x3C

Reference:
http://www.st.com/en/evaluation-tools/steval-mki159v1.html

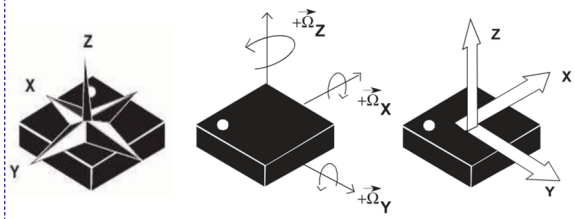


Table 19. Accelerometer and gyroscope SAD+Read/Write patterns

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

Purism

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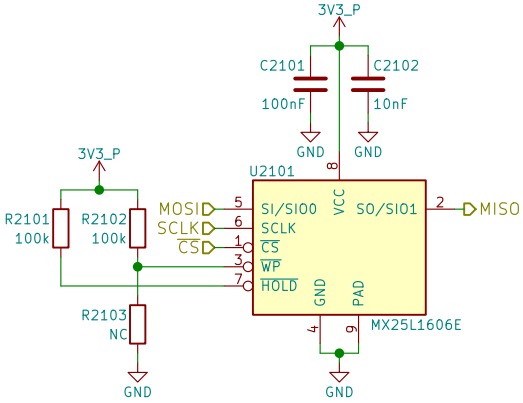
Sheet: /Sensors/
File: sensors.sch

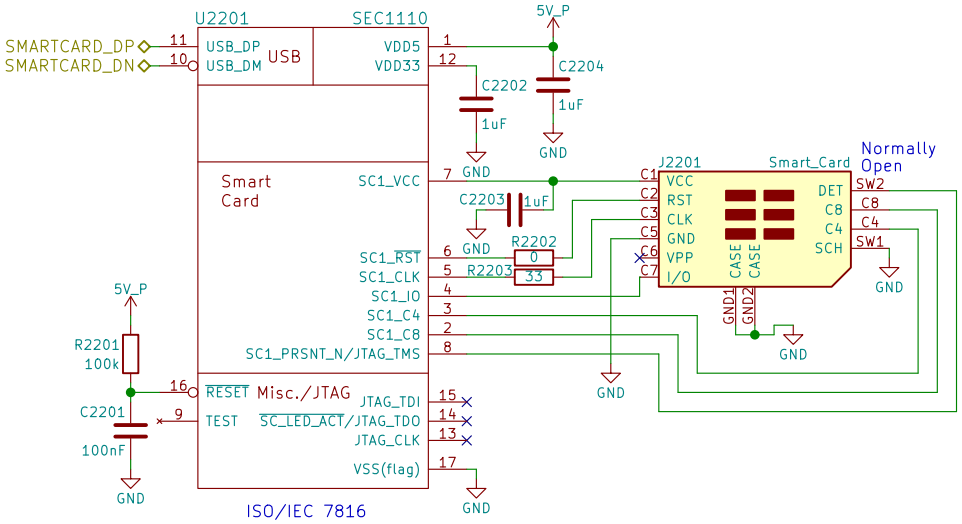
Size: A4 | Date: 2018-06-18 | Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6 | Id: 20/24

SPI NOR Flash



SPI NOR Flash		eric.kuzmenko@puri.sm angus.ainslie@puri.sm nicole.faerber@puri.sm christian.schilmoeller@puri.sm
Purism		
Copyright 2018 GNU GPLv3		
Sheet: /SPI Flash/ File: flash.sch		
Size: A4	Date: 2018-06-18	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6		Id: 21/24

Smart Card



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

Smart Card

Purism

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Sheet: /Smart Card/
File: smartcard.sch

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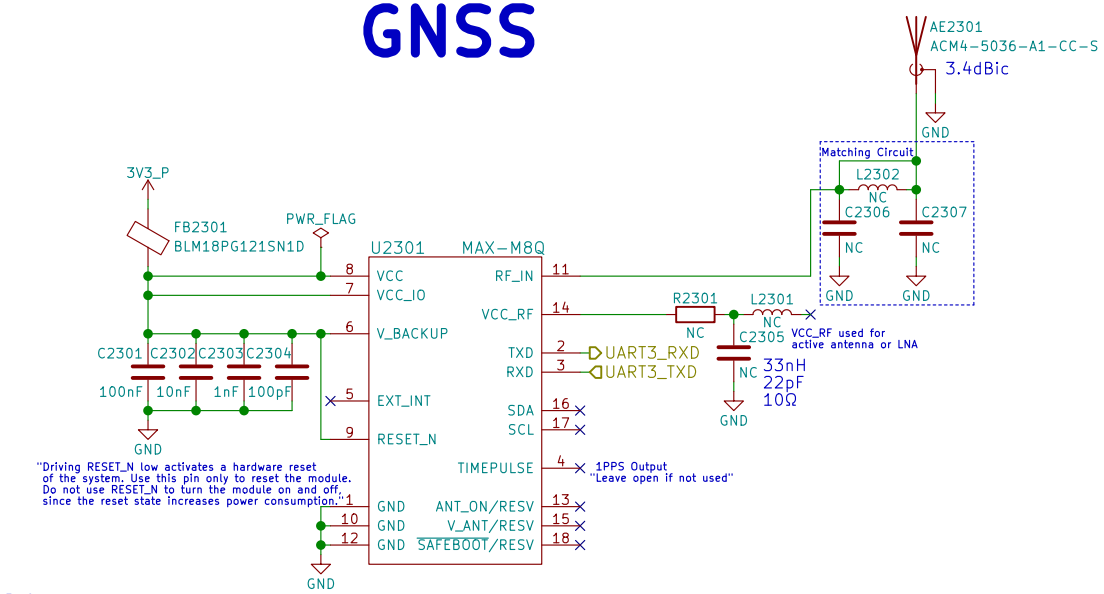
GNSS



References:
https://www.u-blox.com/sites/default/files/MAX-M8_HardwareIntegrationManual_%28UBX-13004876%29.pdf
https://www.u-blox.com/sites/default/files/MAX-8-M8-FW3_HardwareIntegrationManual_%28UBX-15030059%29.pdf

GNSS

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Sheet: /GNSS/
File: gnss.sch

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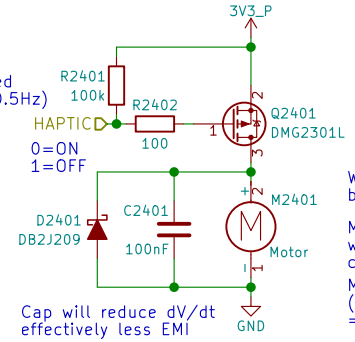
Haptic Motor

PWM pins occupied:
GPIO1_IO01 – LCD Backlight
GPIO1_IO13 – LED
GPIO1_IO14 – Ethernet (CLKO_25MHz)
GPIO1_IO15 – 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
(not connected to either pin)
⇒ could connect housing to GND

Cap will reduce dV/dt
effectively less EMI

Cheaper Motor Connector:
https://lcsc.com/product-detail/1-25T-Connectors_1-25T-1-2AW_C10832.html

Motor Source:
https://www.alibaba.com/product-detail/Coin-motor-vibration-dc-motor
cellphone_1994583657.html?spm=a2700.8443308.0.0.5aa13e5f1wxHgs

Motor Datasheet:
https://cloud.puri.sm/s/z8JR6DJ4KrJYzoW

Motor PN:
BY0820Z021L20

Haptic/Vibration Motor

Purism

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File: haptic.sch

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