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
CLK01
CSI_RST
CSI_PWDN

TCPC_INT

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
R101 2.2k
R102 2.2k

GPIO3_IO19 (was LED1)
IMU_INT

Sensors

IMU_INT
I2C1_SCL
I2C1_SDA
PROX_INT

sensors.sch

I2C1_SCL
I2C1_SDA

PROX_INT
GPIO1_IO12 (was IR_CAP)

I2C1_SCL
I2C1_SDA

RTC

I2C1_SCL
I2C1_SDA
IRQ

rtc.sch

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

Buttons & LED

SW_VOLDN
SW_VOLUP
ONOFF
SYS_RST
GP_LED1

BTN1
BTN2
ONOFF
SYS_RST
LED

buttons_led.sch

P1 — IMX8M-SOM1

P1.31 P1.33 P1.37 P1.39 P1.43 P1.45 P1.53 P1.55 P1.59 P1.61 P1.65
P1.04 P1.08 P1.10 P1.12 P1.14 P1.18 P1.22 P1.24 P1.26 P1.28 P1.32 P1.36 P1.40 P1.42
P1.46 P1.48 P1.50 P1.52 P1.54 P1.56 P1.58 P1.60 P1.64 P1.72 P1.74 P1.78 P1.80

SD2_RST
uSD_CD_B
WWAN_DISABLE
USB1_SS_SEL
LCD_RESET

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

SAI5_TX_BCLK
SAI5_TX_SYNC
SAI5_RXD
SAI5_TXD
WLAN_DP
WLAN_DN
UART4_TXD
UART4_RXD
UART4_RTS
UART4_CTS
WIFI_DISABLE
BT_DISABLE
I2C2_SDA
I2C2_SCL

wifi_bt_m2.sch

3V3_OUT
R103 10k
R104 10k
I2C2_SDA
I2C2_SCL

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
GND

P3 — IMX8M-SOM3

P3.01 P3.03 P3.05 P3.07 P3.09 P3.11 P3.13 P3.15 P3.21 P3.23 P3.25 P3.27 P3.29 P3.35 P3.37 P3.41 P3.43 P3.45 P3.53 P3.57 P3.59 P3.61 P3.63 P3.65 P3.67 P3.69 P3.73 P3.75 P3.77 P3.79
P3.02 P3.06 P3.08 P3.12 P3.14 P3.18 P3.20 P3.24 P3.26 P3.30 P3.32 P3.36 P3.42 P3.44 P3.46 P3.48 P3.58 P3.62 P3.66 P3.70 P3.74 P3.78

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

SAI5_TX_BCLK
ENET_WoL
SAI1_RXD1(GPIO4_IO03)
SAI5_TX_SYNC
ENET_INT
CHRG_INT
CLKO2
CLK01
BTN2
GPIO5_IO05 (was PWM1)

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

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

boot.sch

Audio

SAI2_TXC
SAI2_MCLK
MIC_SEL

HP_DET
SAI2_TXFS
SAI2_RXD
SAI2_TXD
I2C1_SDA
I2C1_SCL

audio.sch

HP_DET
GPIO3_IO20

WWAN M.2

WoWWAN
W_DISABLE1
RESET
DPR
PCM_CLK/I2S_SCK
PCM_SYNC/I2S_FSC
PCM_IN/I2S_IN
PCM_OUT/I2S_OUT

WoWWAN
GPIO3_IO08
WWAN_DISABLE
GPIO3_IO04
WWAN_RESET
GPIO3_IO09
DPR
GPIO5_IO03 (was PWM3)
SAI1_TXD4(GPIO4_IO16)
SAI6_TXC/RXC
SAI1_RXD6(GPIO4_IO08)
SAI6_TXFS/RXFS
SAI1_RXD5(GPIO4_IO07)
SAI6_TXD0
SAI1_TXD5(GPIO4_IO17)
SAI6_RXD0

wwan_m2.sch

SPI Flash

ECSPI1_MISO
ECSPI1_MOSI
MISO
MOSI
SCLK
CS

flash.sch

USB Hub + SDIO Bridge

WWAN_DP
WWAN_DN
WLAN_DP
WLAN_DN
USB2_ID
SRST
SDCD
uSD_CLK
uSD_CMD
uSD_DATA0
uSD_DATA1
uSD_DATA2
uSD_DATA3
USB2_DN
USB2_DP

SD2_RST

usb_hub_sdio.sch

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

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

Battery

VBUS
EN_SRC
EN_SNK
CHRG_INT
ONOFF

battery.sch

Power

VBAT_REG
LCD_LEDK
DSI_BL_PWM
PWR_EN
CHRG_INT
GPIO3_IO25
ONOFF

5V_SOM
5V_P
3V3
3V3_P
1V8_P
22V4_P
2V8_P

power.sch

P2 — IMX8M-SOM2

P2.25 P2.27 P2.31 P2.33 P2.37 P2.39 P2.43 P2.45 P2.49 P2.51
P2.02 P2.04 P2.08 P2.10

WIFI_DISABLE
WWAN_RESET
WoWWAN
CAPTOUCH_INT

NC: P1.03 P1.05 P1.09 P1.13 P1.15 P1.21 P1.23 P1.27 P1.49 P1.68 P1.69 P1.70 P1.71 P1.75 P1.77 P1.76 P2.03 P2.05 P2.06 P2.09 P2.11 P2.12 P2.15 P2.17 P2.20 P2.21 P2.26

GND: P1.01 P1.02 P1.06 P1.07 P1.11 P1.16 P1.17 P1.19 P1.20 P1.25 P1.29 P1.30 P1.34 P1.35 P1.38 P1.41 P1.44 P1.47 P1.51 P1.57 P1.62 P1.63 P1.66 P1.67 P1.73 P1.79
GND: P2.01 P2.07 P2.13 P2.19 P2.23 P2.29 P2.35 P2.41 P2.47 P2.53 P2.28 P2.30 P2.32 P2.34 P2.36 P2.38 P2.40 P2.42 P2.44 P2.46 P2.48 P2.50 P2.52 P2.54
GND: P3.04 P3.10 P3.17 P3.16 P3.22 P3.28 P3.34 P3.38 P3.47 P3.51 P3.52 P3.55 P3.56 P3.60 P3.64 P3.68 P3.72 P3.76 P3.80
GND: P4.06 P4.10 P4.14 P4.18 P4.24 P4.28 P4.34 P4.40 P4.44 P4.50 P4.54 P4.59 P4.60 P4.62 P4.63 P4.68 P4.74 P4.80

NC: P3.19 P3.31 P3.33 P3.39 P3.40 P3.49 P3.50 P3.54 P3.71 P4.09 P4.12 P4.17 P4.20 P4.31 P4.36 P4.32 P4.38 P4.43 P4.46 P4.48 P4.52 P4.57 P4.61 P4.69

PWM4

P4 — IMX8M-SOM4

P4.01 P4.03 P4.05 P4.07 P4.11 P4.13 P4.15 P4.19 P4.21 P4.23 P4.25 P4.27 P4.29 P4.33 P4.35 P4.37 P4.39 P4.41 P4.45 P4.47 P4.49 P4.51 P4.53 P4.55 P4.65 P4.67 P4.71 P4.73 P4.75 P4.77 P4.79
P4.02 P4.04 P4.08 P4.16 P4.22 P4.26 P4.30 P4.42 P4.56 P4.58 P4.64 P4.66 P4.70 P4.72 P4.76 P4.78

SAI2_TXD
DPR
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_TXD6(GPIO4_IO18)
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

I2C2_SCL
IRQ
UART4_TXD
UART4_RXD

UART Debug

UART1_RXD
UART1_TXD

uart.sch

GNSS

UART3_RXD
UART3_TXD

gnss.sch

Haptic Motor

HAPTIC

HAPTIC
GPIO5_IO04 (was PWM2)

haptic.sch

5V_P
R105 10k
R106 19.6k
GND

5V_SOM

C101 22uF
C102 22uF
C103 100nF
C104 100nF
C105 22uF
C106 22uF

3V3_OUT

C107 100nF

3V3_SNVS

C108 100nF

GND

P2 header

P2.80 P2.79 P2.78 P2.77 P2.76 P2.75 P2.74 P2.73 P2.72 P2.71 P2.70 P2.69 P2.68 P2.67 P2.66 P2.65 P2.64 P2.63 P2.62 P2.61 P2.60 P2.59 P2.58 P2.57 P2.56 P2.55

+5V Input

P3 header

P2.18 P2.16 P2.14

+3.3V Output

P4 header

P2.24

+3.3V Output

P2 header

P2.22

+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)

Spare GPIO:
GPIO1_IO05 (was CSI_P2_PWDN)
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
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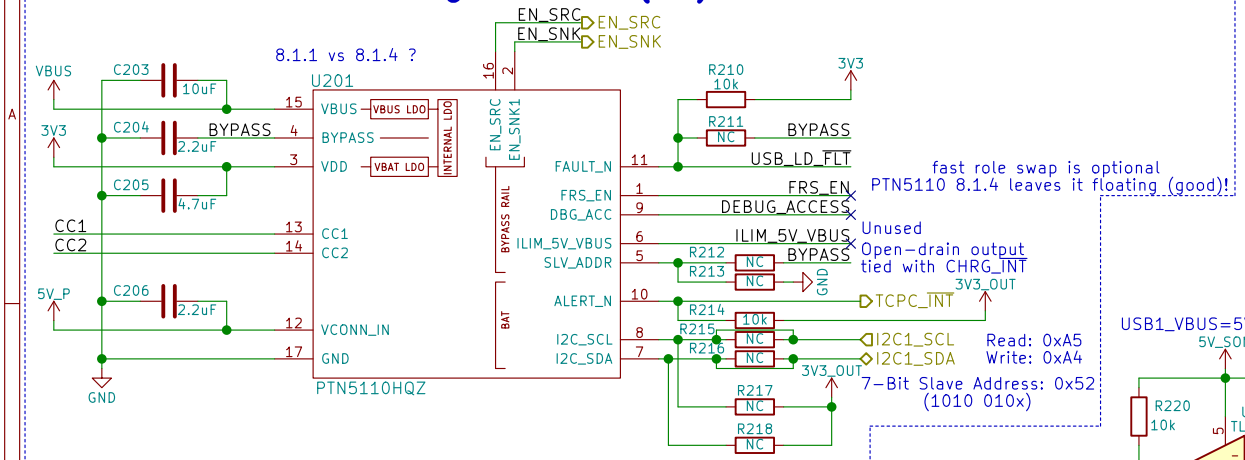
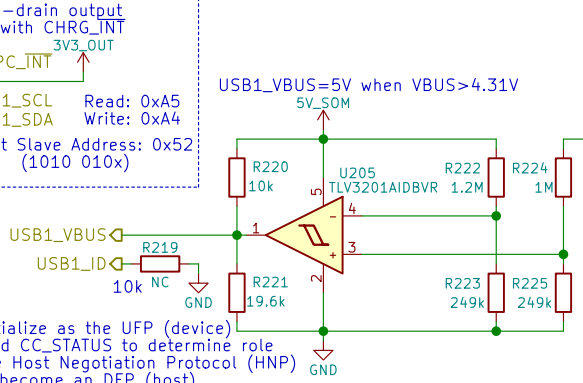
Sheet: /
File: dvk-mx8m-bsb.sch

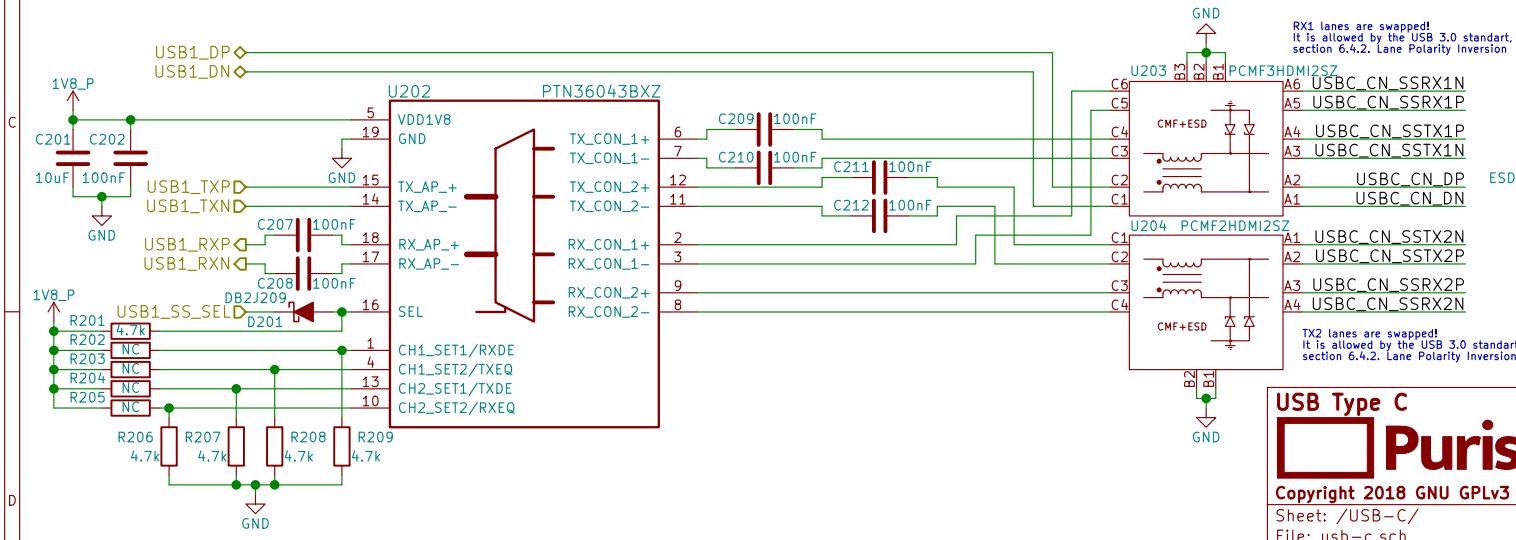
Size: A3	Date: 2018-06-12	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6		Id: 1/24

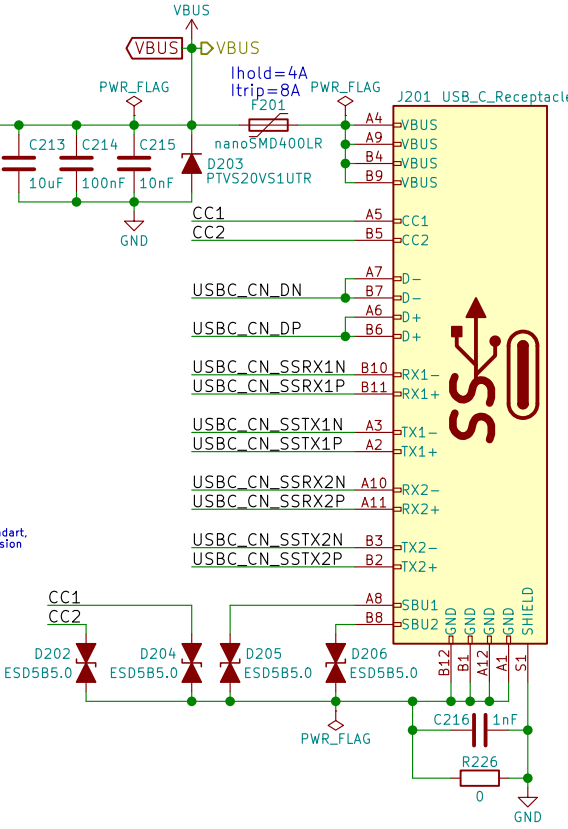
USB-C TCPC – Config Channel (CC) and PD Role Controller



"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 Type C

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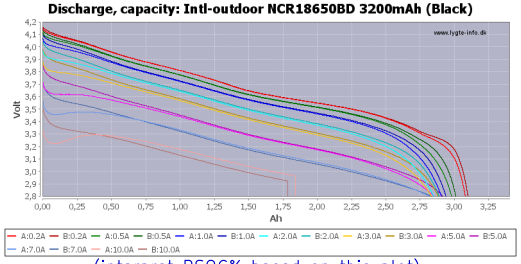
Sheet: /USB-C/		
File: usb-c.sch		
Size: A4	Date: 2018-06-13	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6		Id: 2/24

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

0.18mA~0.95mA

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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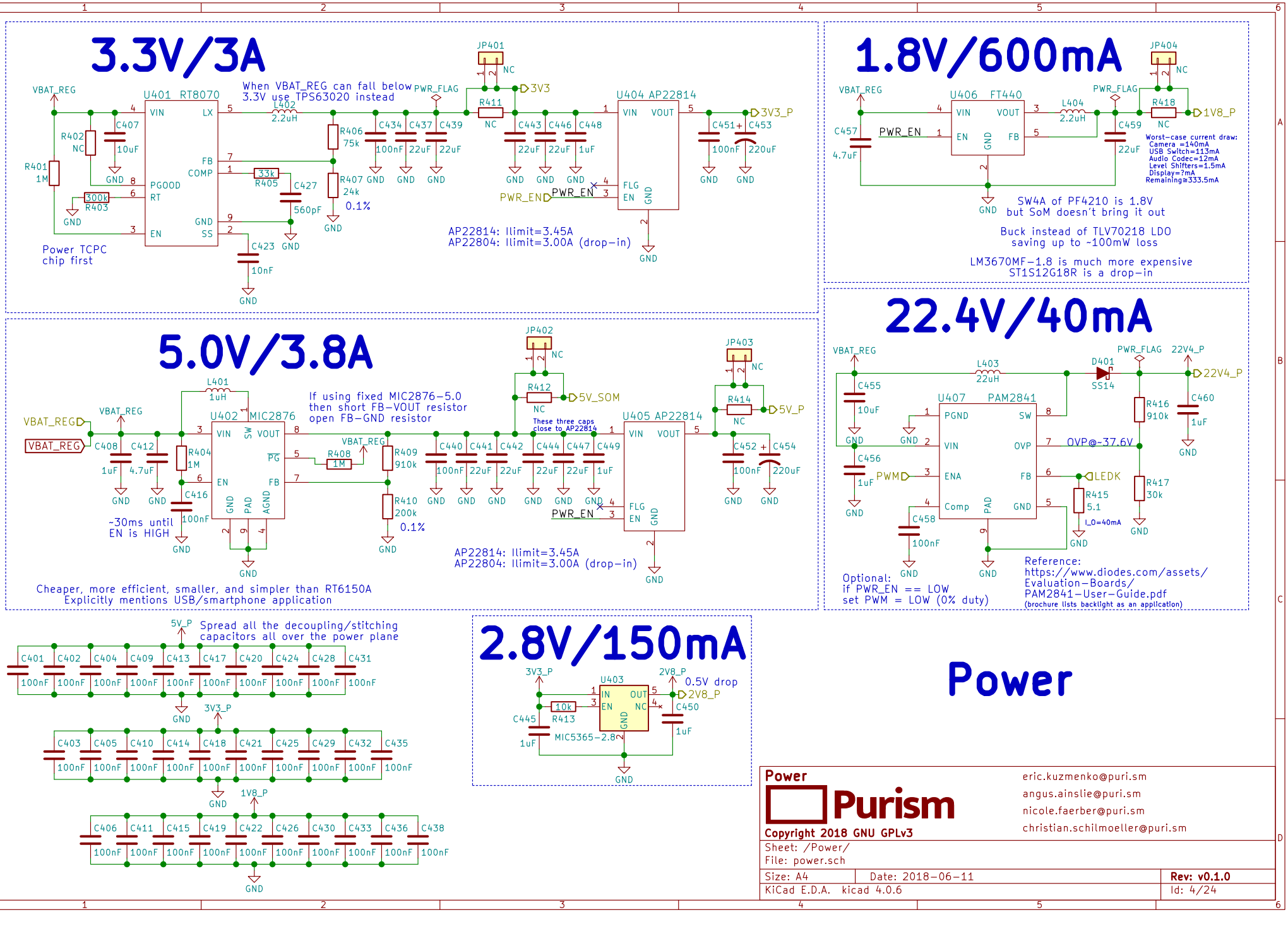
Sheet: /Battery/		
File: battery.sch		
Size: A4	Date: 2018-06-11	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6		Id: 3/24


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)
Spread all the decoupling/stitching capacitors all over the power plane
2.8V/150mA
0.5V drop
Power
Purism
Copyright 2018 GNU GPLv3
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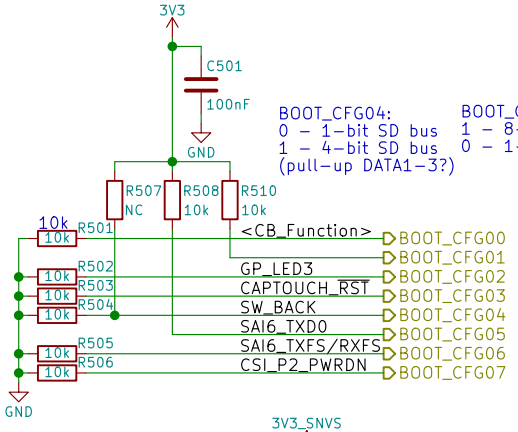
christian.schilmoeller@puri.sm
Sheet: /Power/
File: power.sch
Size: A4
Date: 2018-06-11
Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6
Id: 4/24

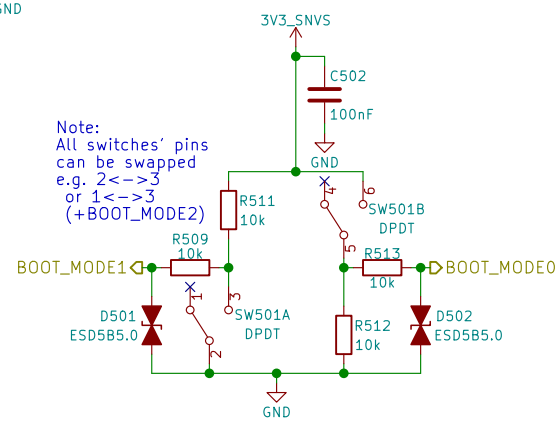
Boot Config

Only eMMC

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

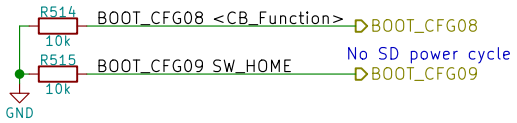
Fuse	Config	Definition	GPIO[1]	Shipped value	Settings
BOOT_CFG[11:10]	OEM	USDHC port selection	Yes	00	00 - USDHC-1
					01 - USDHC-2
					10 - USDHC-3
					else - reserved

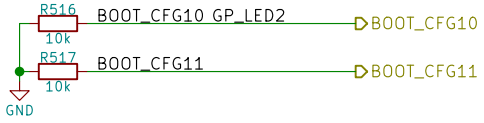


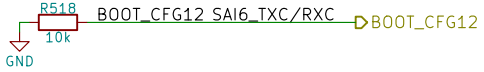


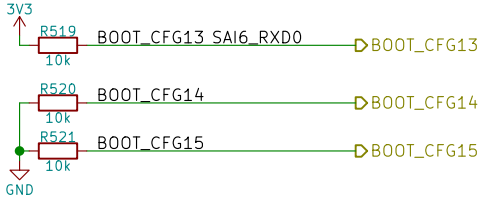
2–>1: eMMC
2–>3: USB (Serial Downloader)

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









Boot Configuration

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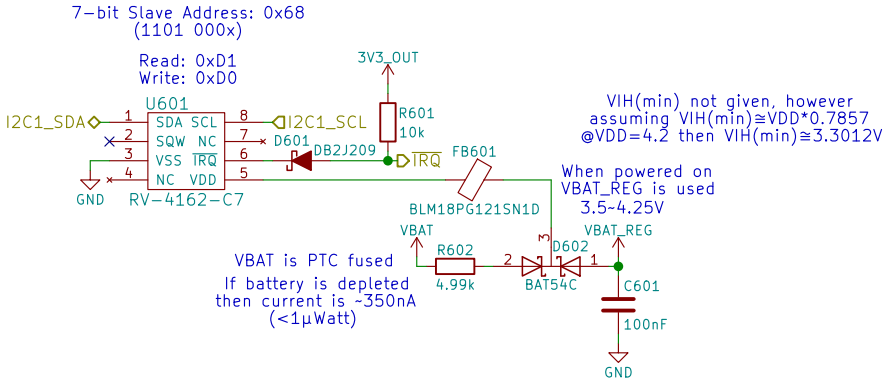
christian.schilmoeller@puri.sm

Sheet: /Boot Config/
File: boot.sch

Size: A4 | Date: 2018–06–11 | **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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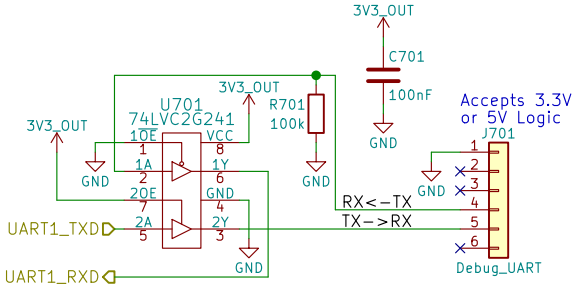
Sheet: /RTC/
File: rtc.sch

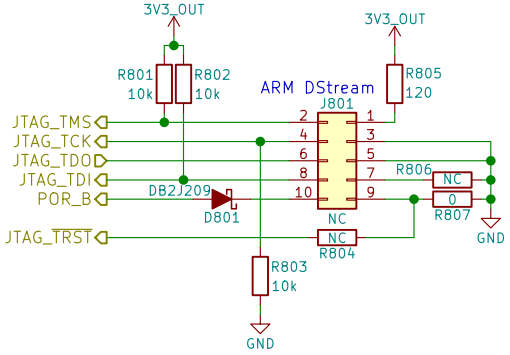
Size: A4 | Date: 2018-06-11 | **Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.6 | Id: 6/24

UART Debug



UART Debug	eric.kuzmenko@puri.sm	
Purism	angus.ainslie@puri.sm	
	nicole.faerber@puri.sm	
Copyright 2018 GNU GPLv3	christian.schilmoeller@puri.sm	
Sheet: /UART Debug/		
File: uart.sch		
Size: A4	Date: 2018-06-11	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.6		Id: 7/24

JTAG



JTAG

Purism

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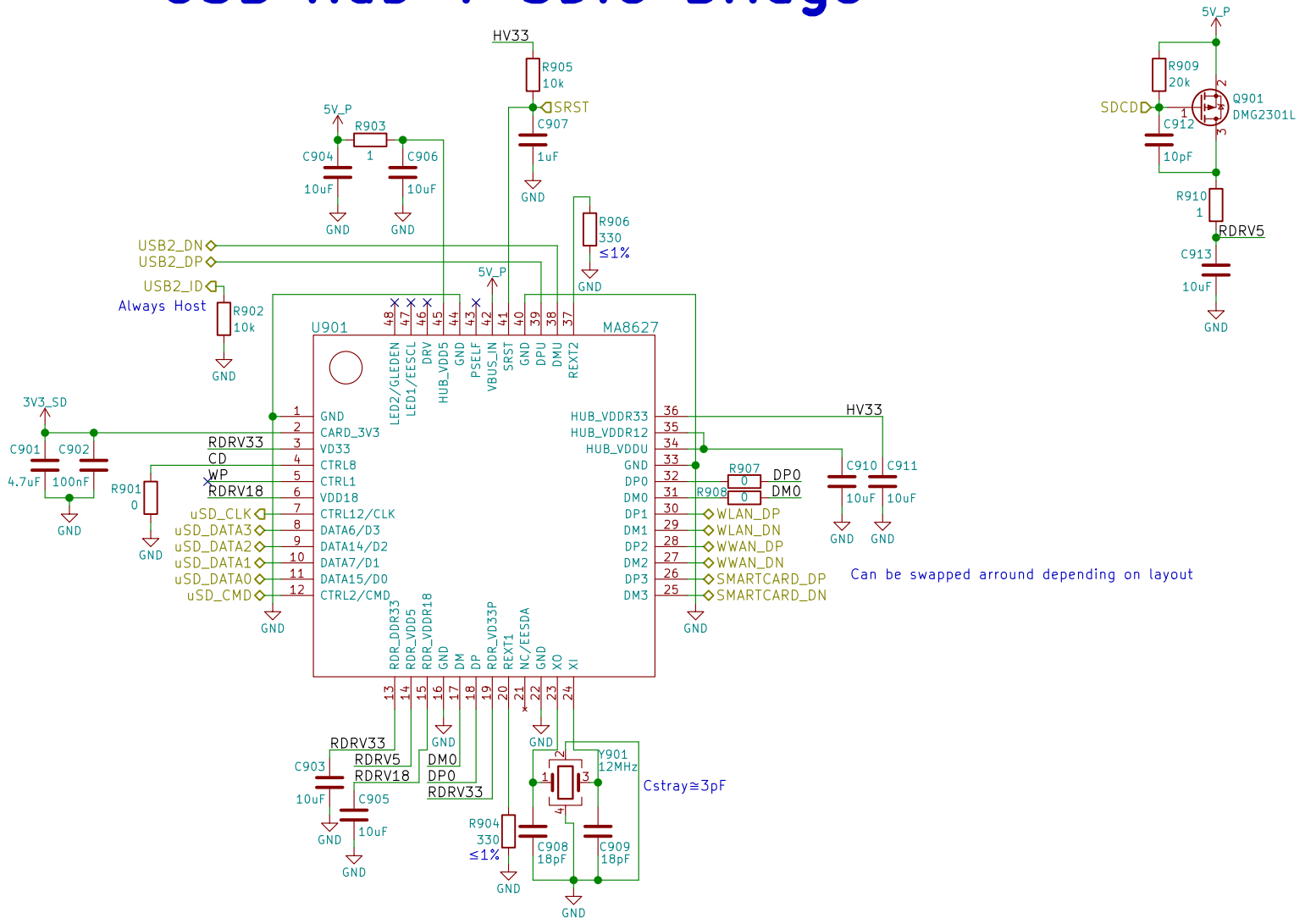
Sheet: /JTAG/
File: jtag.sch

Size: A4 | Date: 2018-06-11 | **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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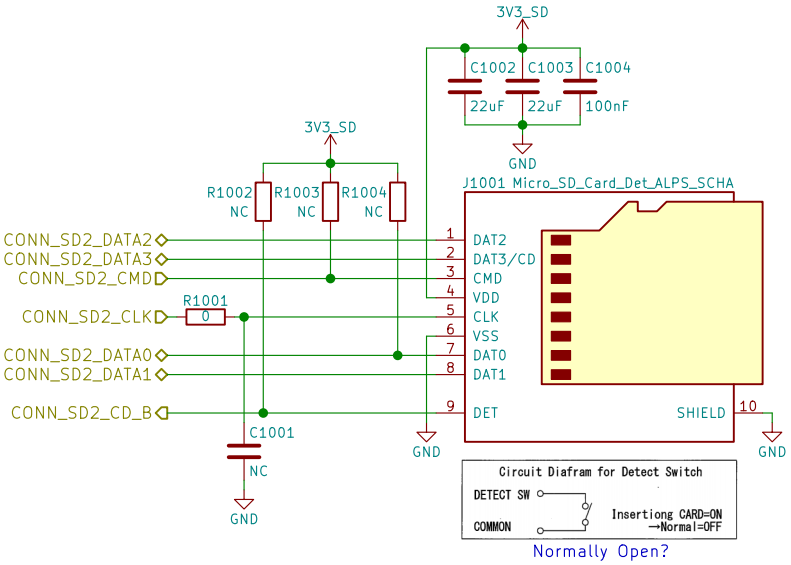
christian.schilmoeller@puri.sm

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

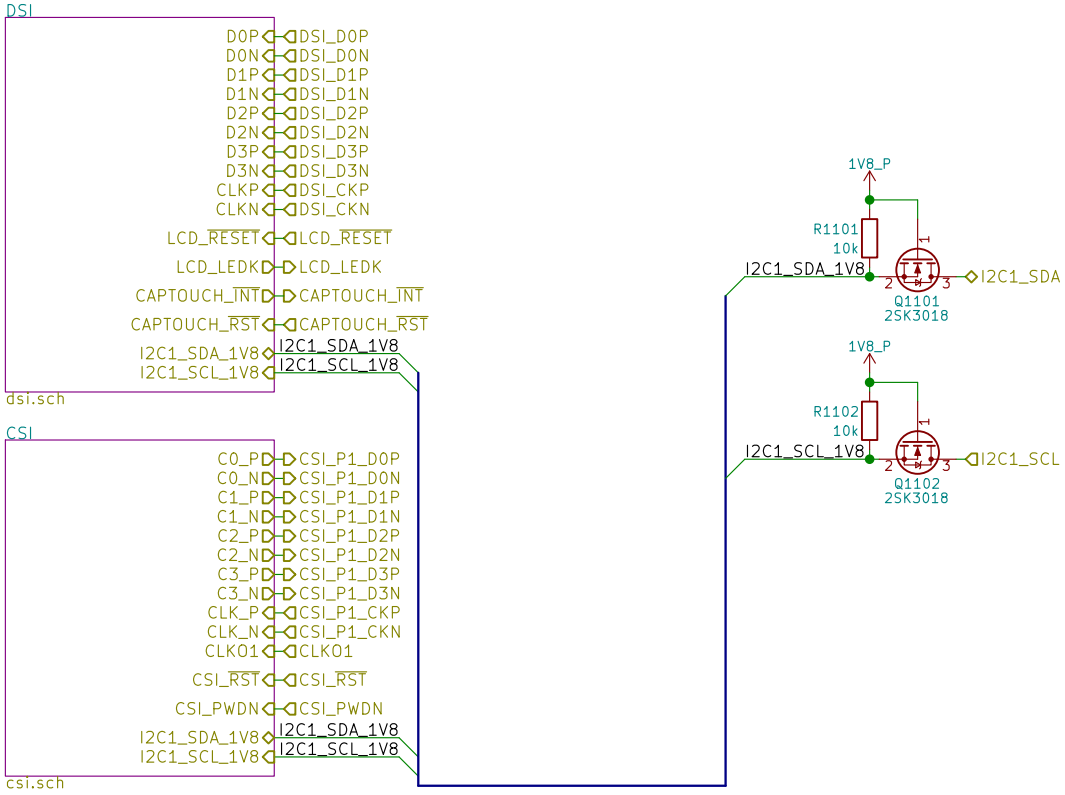
Size: A4	Date: 2018-06-11	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.6		Id: 9/24

µSD



uSD Card		eric.kuzmenko@puri.sm angus.ainslie@puri.sm nicole.faerber@puri.sm christian.schilmoeller@puri.sm
Purism		
Sheet: /uSD Card/ File: sd.sch		
Size: A4	Date: 2018-06-11	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.6		Id: 10/24

MIPI



MIPI		eric.kuzmenko@puri.sm angus.ainslie@puri.sm nicole.faerber@puri.sm christian.schilmoeller@puri.sm
Purism		
Sheet: /MIPI/ File: mipi.sch		
Size: A4	Date: 2018-06-11	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.6		Id: 11/24

Display & Touch Controller

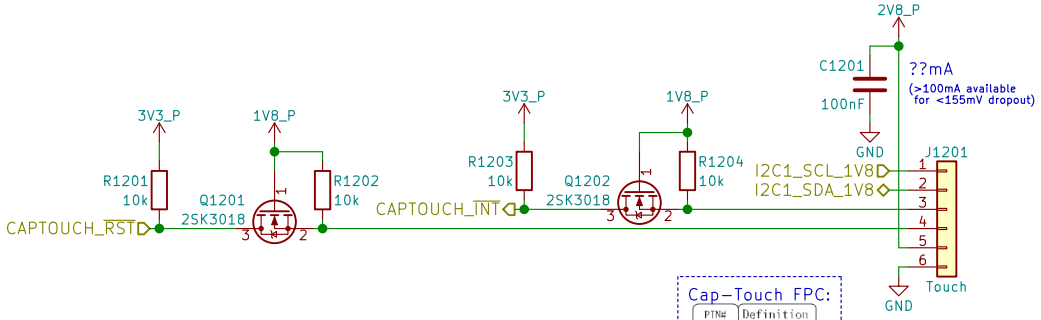
LCD PN:
Shenzhen Jinghong Electronics Co., Ltd.
JH057N00900

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



Cap-Touch FPC:

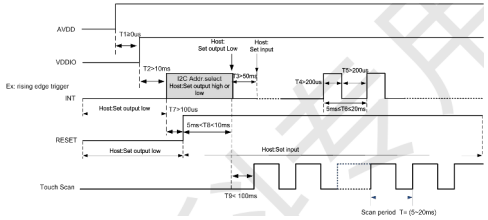
PIN#	Definition
1	SCL
2	SDA
3	INT
4	RESET
5	VDD2.85
6	GND

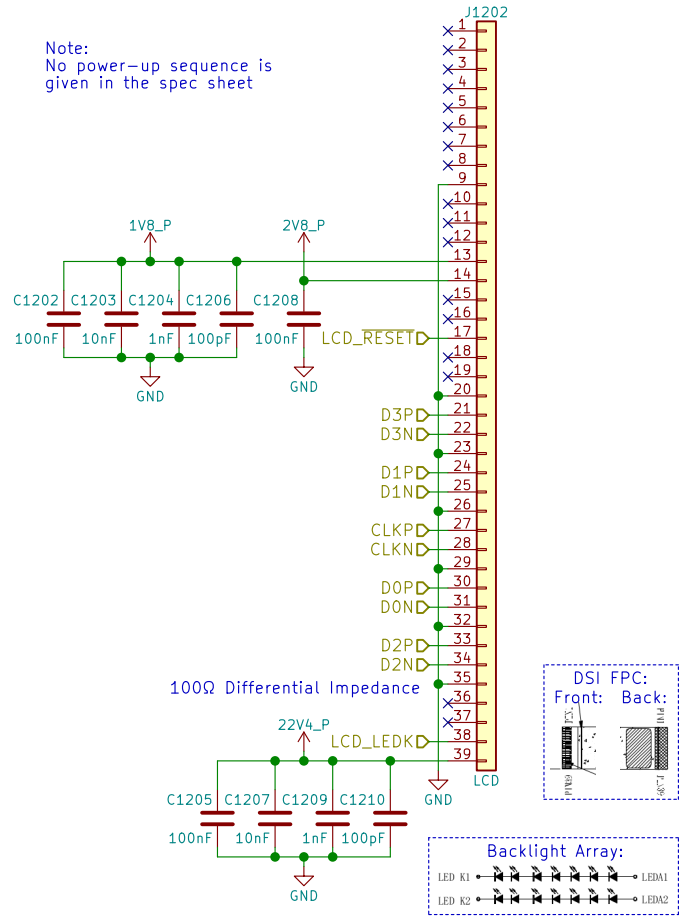
Front: Back:

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:





DSI FPC:
Front: Back:

Backlight Array:

MIPI DSI

Purism

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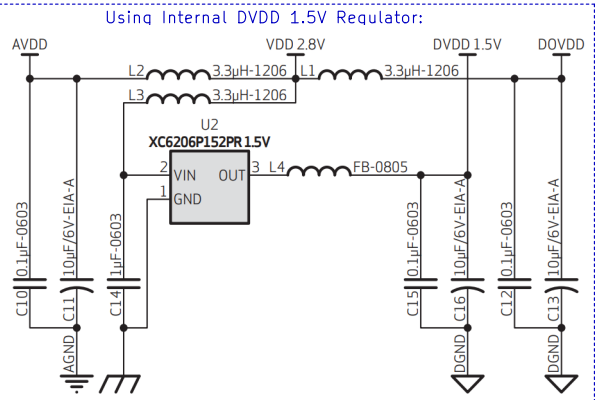
christian.schilmoeller@puri.sm

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

Size: A4 | Date: 2018-06-11 | **Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.6 | Id: 12/24

Camera



2.7 POWER UP SEQUENCE

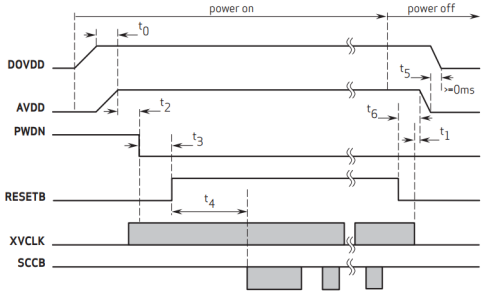
Based on the system power configuration (1.8V or 2.8V for I/O power, using external DVDD or internal DVDD, requiring access to the I2C during power up period or not), the power up sequence will differ. If 1.8V is used for I/O power, using the internal DVDD is preferred. If 2.8V is used for I/O power,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

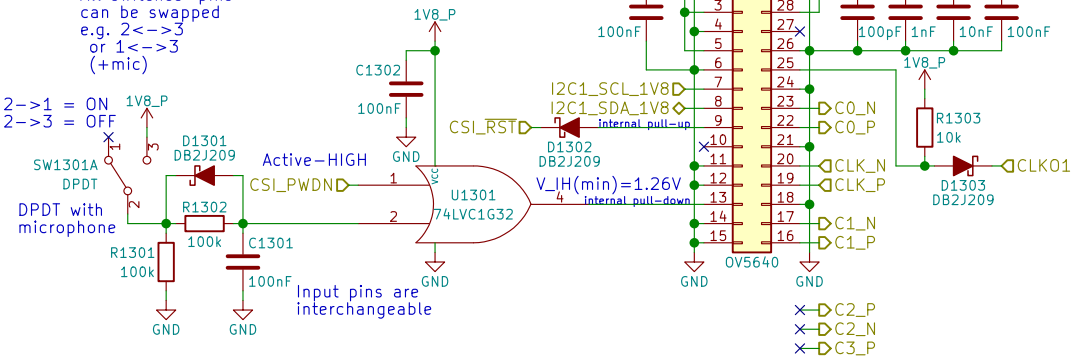
1. when DOVDD and AVDD are turned ON, make sure DOVDD becomes stable before AVDD becomes stable
2. PWDN is active high with an asynchronized design (does not need clock)
3. PWDN pin tied to digital ground if it is not controlled.
4. if PWDN pin is controlled as below, for PWDN to go low, power must first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



Camera PN:
Truly CO8725-B5SA-E

7-bit Slave Address: 0x78
(1111 000x)

Read: 0xF1
Write 0xF0

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

MIPI CSI

Purism

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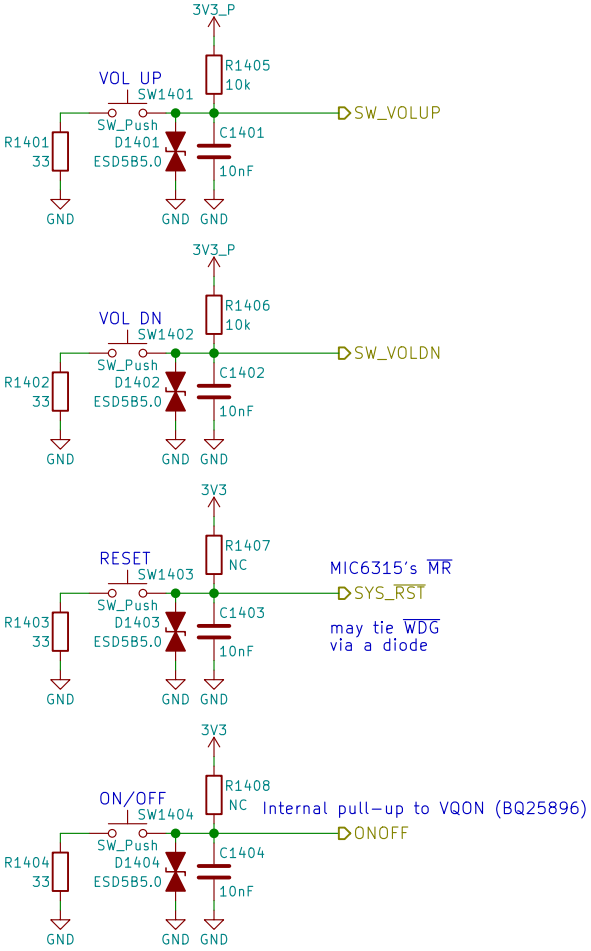
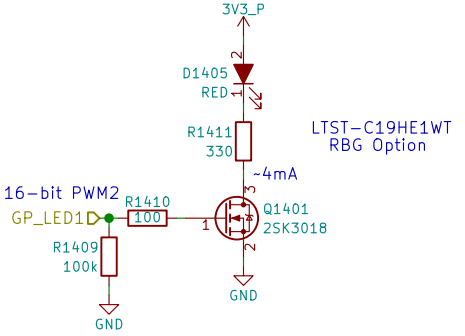
Sheet: /MIPI/CSI/
File: csi.sch

Size: A4	Date: 2018-06-11	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
Purism
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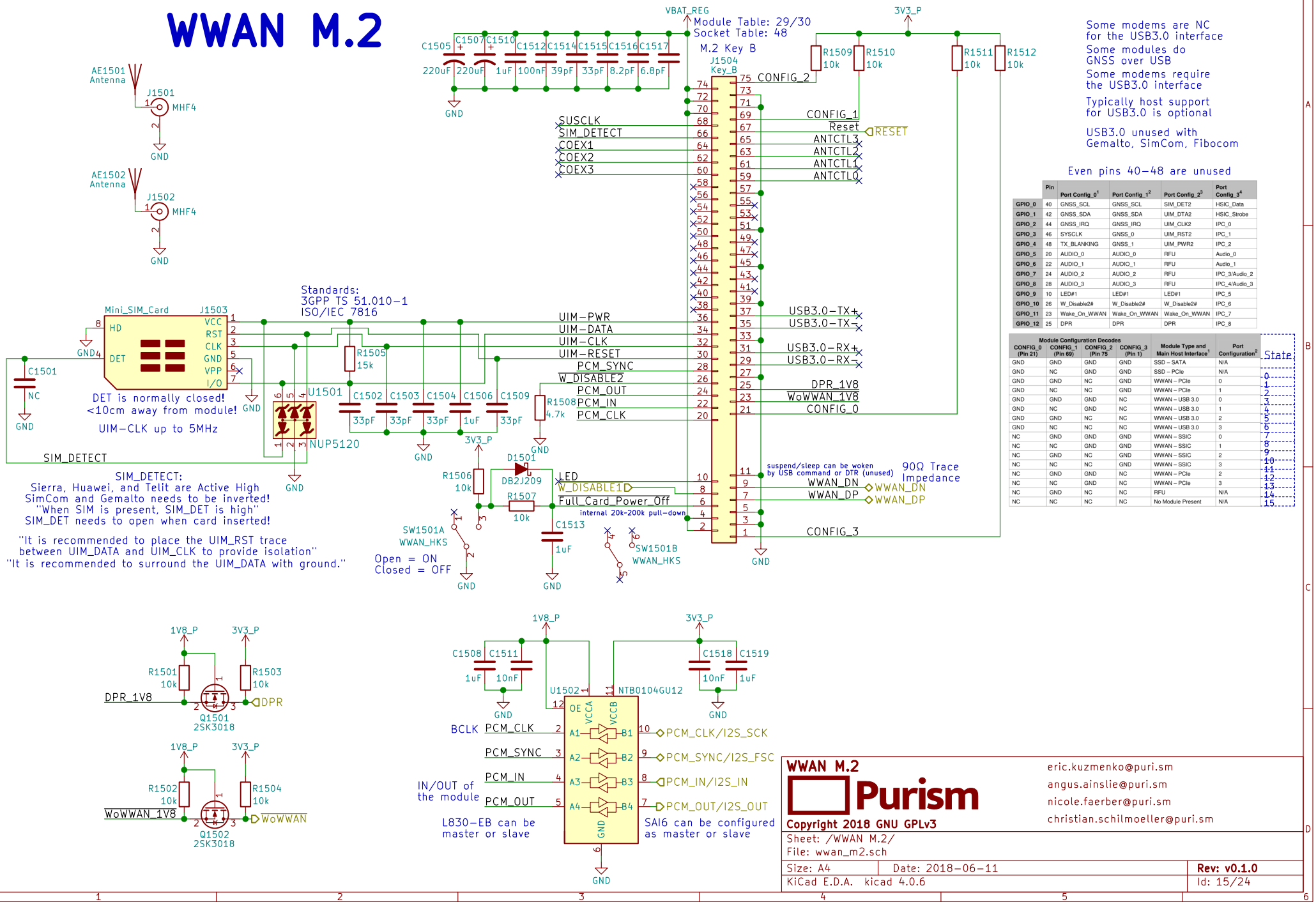
christian.schilmoeller@puri.sm

Sheet: /Buttons & LED/
File: buttons_led.sch
Size: A4 | Date: 2018-06-11 | Rev: v0.1.0
KiCad E.D.A. kicad 4.0.6 | Id: 14/24

WWAN M.2



	Pin	Port Config_0[1]	Port Config_1[2]	Port Config_2[3]	Port Config_3[4]
GPIO_0	40	GNSS_SCL	GNSS_SCL	SIM_DET2	HSIC_Data
GPIO_1	42	GNSS_SDA	GNSS_SDA	UIM_DTA2	HSIC_Strobe
GPIO_2	44	GNSS_IRQ	GNSS_IRQ	UIM_CLK2	IPC_0
GPIO_3	46	SYSCLK	GNSS_0	UIM_RST2	IPC_1
GPIO_4	48	TX_BLANKING	GNSS_1	UIM_PWR2	IPC_2
GPIO_5	20	AUDIO_0	AUDIO_0	RFU	Audio_0
GPIO_6	22	AUDIO_1	AUDIO_1	RFU	Audio_1
GPIO_7	24	AUDIO_2	AUDIO_2	RFU	IPC_3/Audio_2
GPIO_8	28	AUDIO_3	AUDIO_3	RFU	IPC_4/Audio_3
GPIO_9	10	LED#1	LED#1	LED#1	IPC_5
GPIO_10	26	W_Disable2#	W_Disable2#	W_Disable2#	IPC_6
GPIO_11	23	Wake_On_WWAN	Wake_On_WWAN	Wake_On_WWAN	IPC_7
GPIO_12	25	DPR	DPR	DPR	IPC_8

Module Configuration Decodes						State
CONFIG_0 (Pin 21)	CONFIG_1 (Pin 69)	CONFIG_2 (Pin 75)	CONFIG_3 (Pin 1)	Module Type and Main Host Interface[1]	Port Configuration[2]	
GND	GND	GND	GND	SSD – SATA	N/A	
GND	NC	GND	GND	SSD – PCIe	N/A	
GND	GND	NC	GND	WWAN – PCIe	0	0
GND	NC	NC	GND	WWAN – PCIe	1	1
GND	GND	GND	NC	WWAN – USB 3.0	0	2
GND	NC	GND	NC	WWAN – USB 3.0	1	3
GND	GND	NC	NC	WWAN – USB 3.0	2	4
GND	NC	NC	NC	WWAN – USB 3.0	3	5
NC	GND	GND	GND	WWAN – SSIC	0	6
NC	NC	GND	GND	WWAN – SSIC	1	7
NC	GND	NC	GND	WWAN – SSIC	2	8
NC	NC	NC	GND	WWAN – SSIC	3	9
NC	GND	GND	NC	WWAN – PCIe	2	10
NC	NC	GND	NC	WWAN – PCIe	3	11
NC	GND	NC	NC	RFU	N/A	12
NC	NC	NC	NC	No Module Present	N/A	13
						14
						15

WWAN M.2

Purism

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Sheet: /WWAN M.2/
File: wwan_m2.sch

Size: A4 | Date: 2018-06-11 | 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

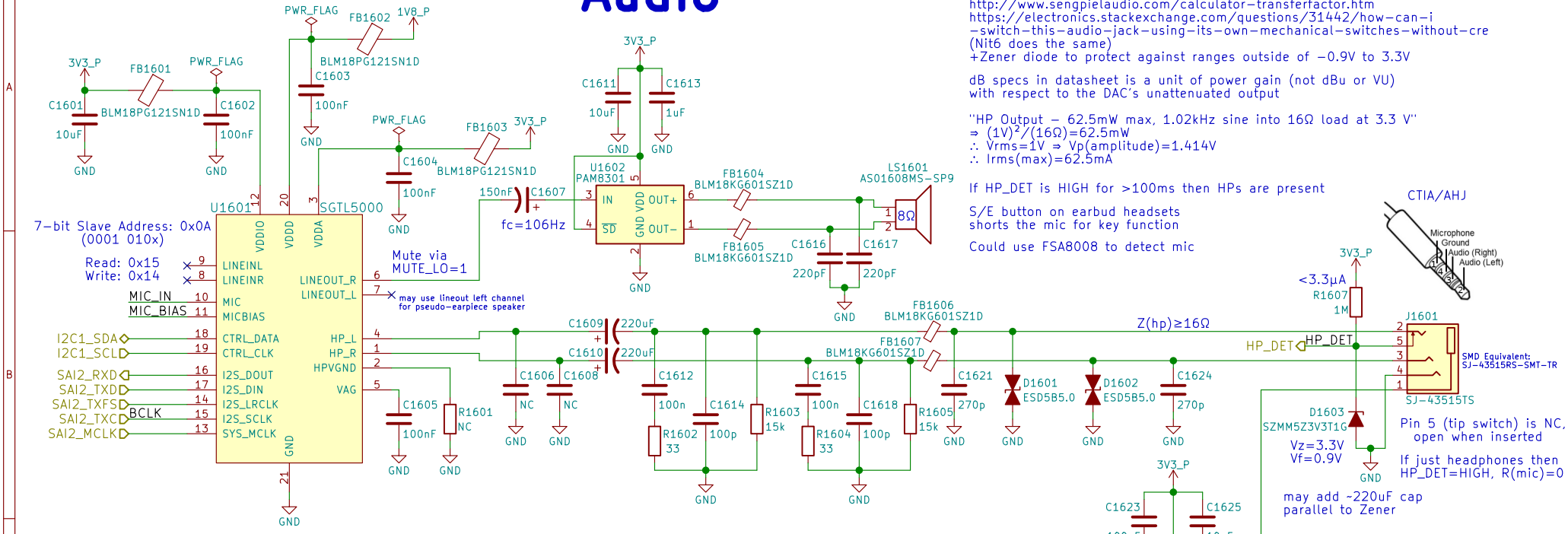
dB specs in datasheet is a unit of power gain (not dBu or VU)
with respect to the DAC's unattenuated output

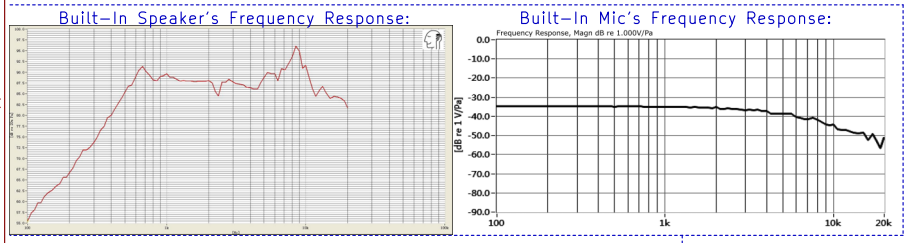
"HP Output - 62.5mW max, 1.02kHz sine into 16Ω load at 3.3 V"
⇒ $(1V)^2/(16Ω)=62.5mW$
∴ Vrms=1V ⇒ Vp(amplitude)=1.414V
∴ Irms(max)=62.5mA

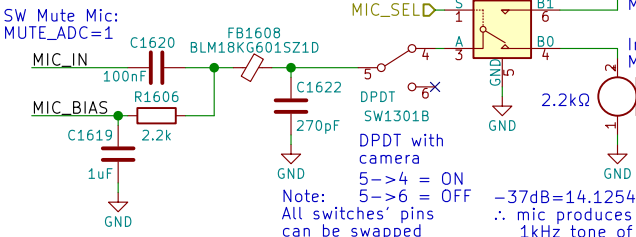
If HP_DET is HIGH for >100ms then HPs are present

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

Could use FSA8008 to detect mic



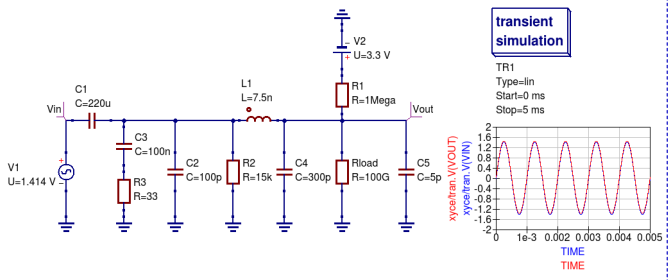




-37dB=14.1254mV/Pa
∴ mic produces 14.1254mVrms when exposed to a 1kHz tone of 94dB-SPL at the capsule (or 19.98mV amplitude)

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

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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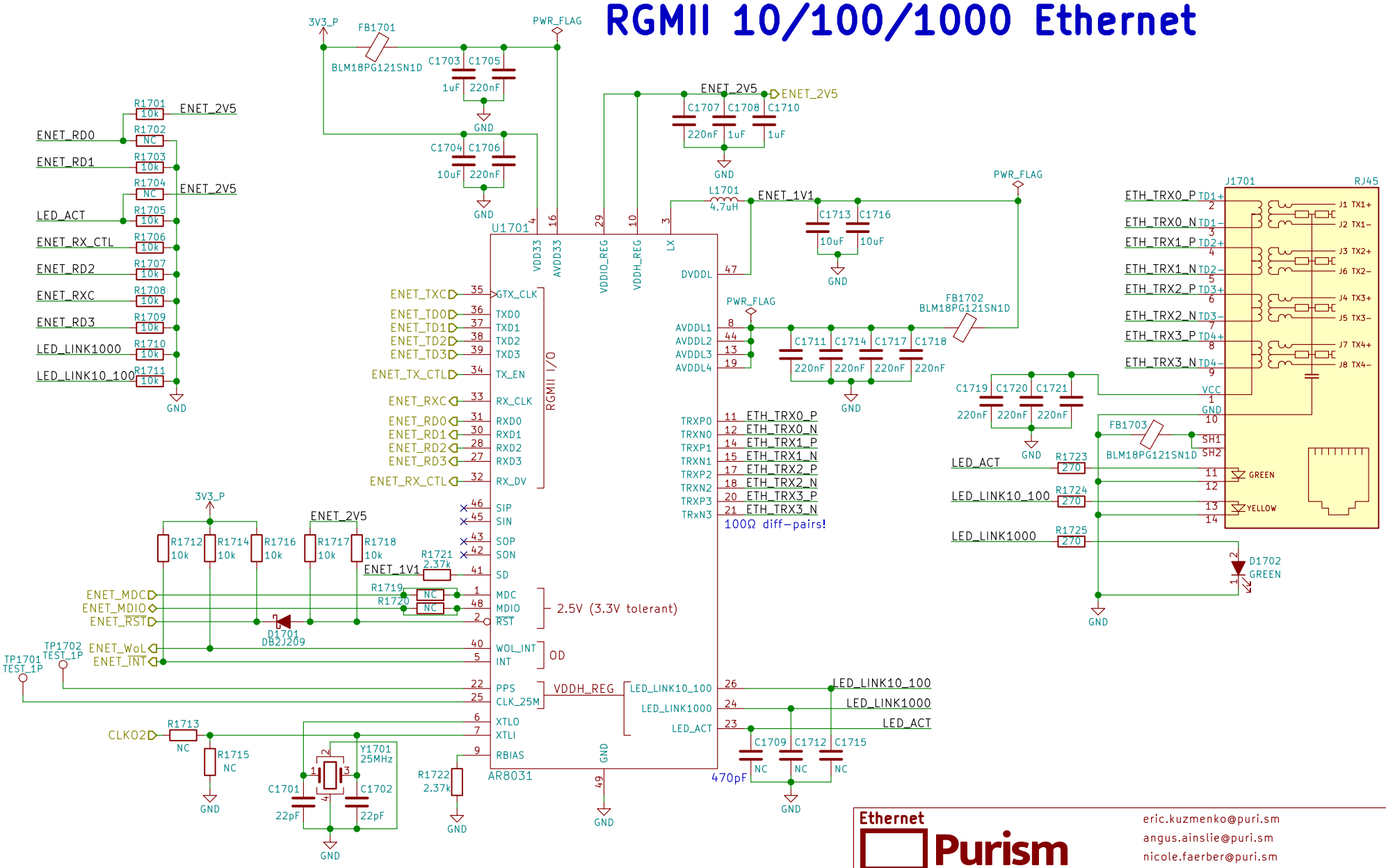
christian.schilmoeller@puri.sm

Sheet: /Audio/		
File: audio.sch		
Size: A4	Date: 2018-06-11	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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christian.schilmoeller@puri.sm

Sheet: /Ethernet/
File: ethernet.sch

Size: A4	Date: 2018-06-11	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

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

VIH=2.31V

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

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

Open = ON
Closed = OFF

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

RS9116 does not
use RTX & CTS

internal 10k pull-up

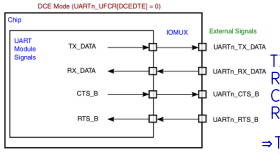
RX, TX, RTS, CTS
of the SoC

configure as slave

IN, OUT
of the SoC

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

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

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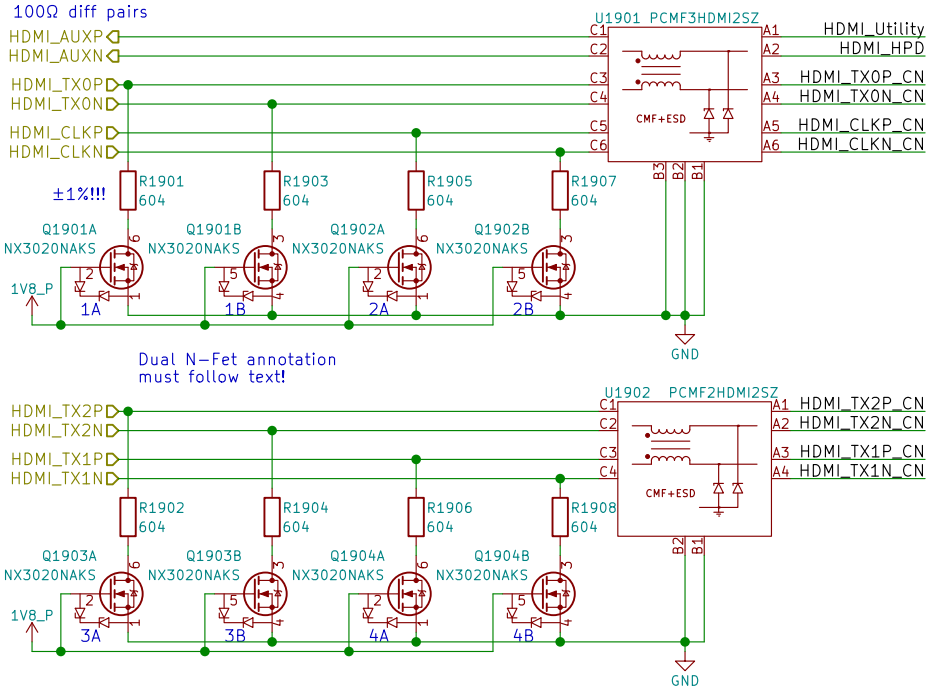
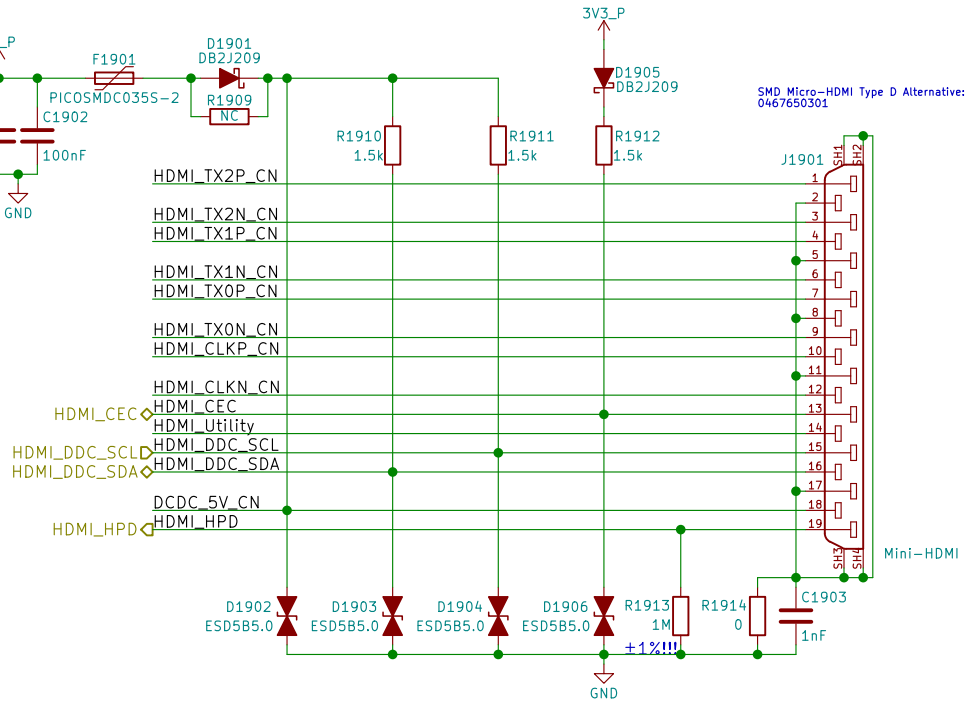
TUSB1046 can be used for DP over USB-C

HDMI

Layout Note:
May need swap some signals
due to micro-HDMI pinout diff
depending on pin location/routing





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Sheet: /HDMI/		
File: hdmi.sch		
Size: A4	Date: 2018-06-11	Rev: v0.1.0
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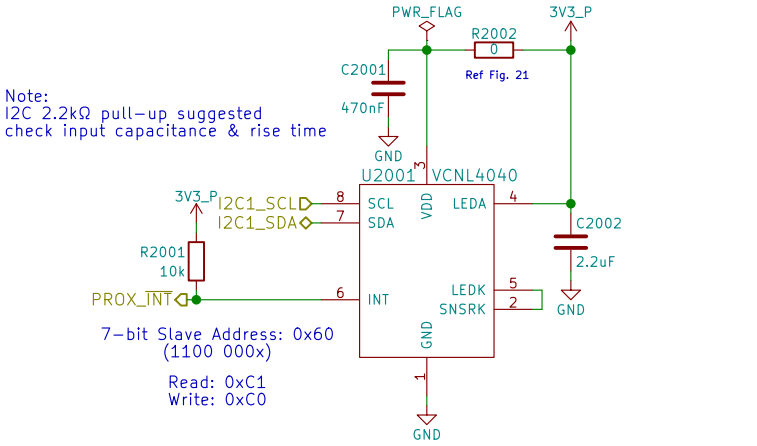
Sensors

Proximity & Ambient Light



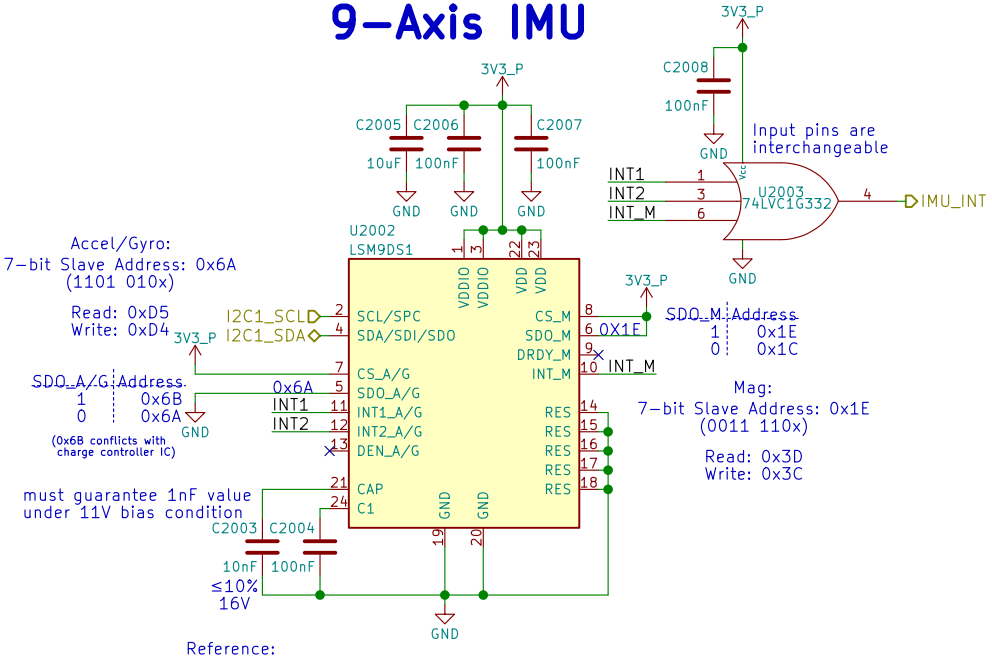
Note:
I2C 2.2kΩ pull-up suggested
check input capacitance & rise time

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
≤10%
16V

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

Read: 0x3D
Write: 0x3C

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

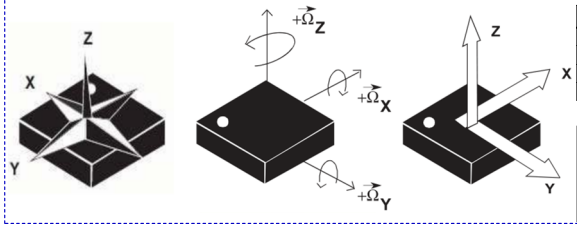


Table 19. Accelerometer and gyroscope SAD+Read/Write patterns

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

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File: sensors.sch

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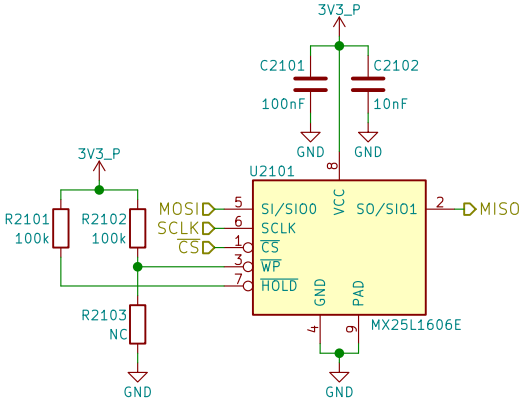
SPI NOR Flash



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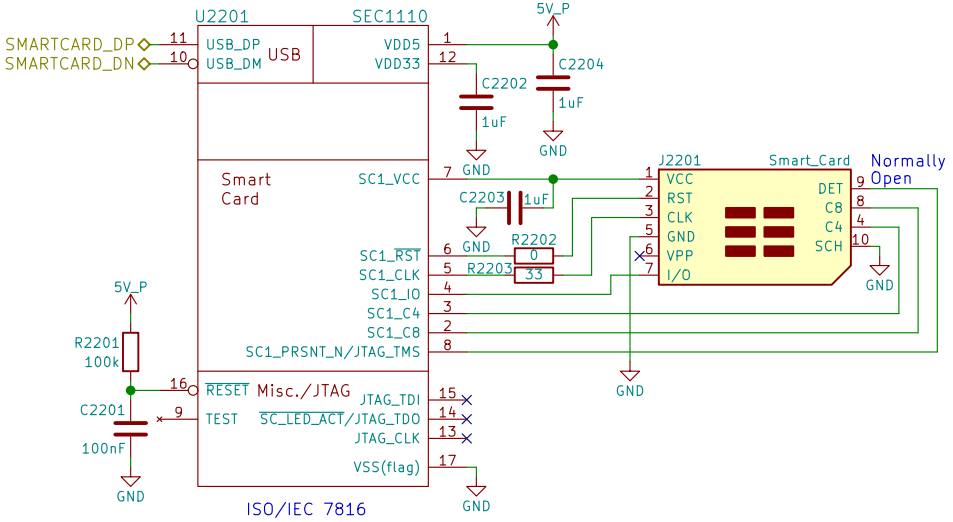
Smart Card



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

Smart Card

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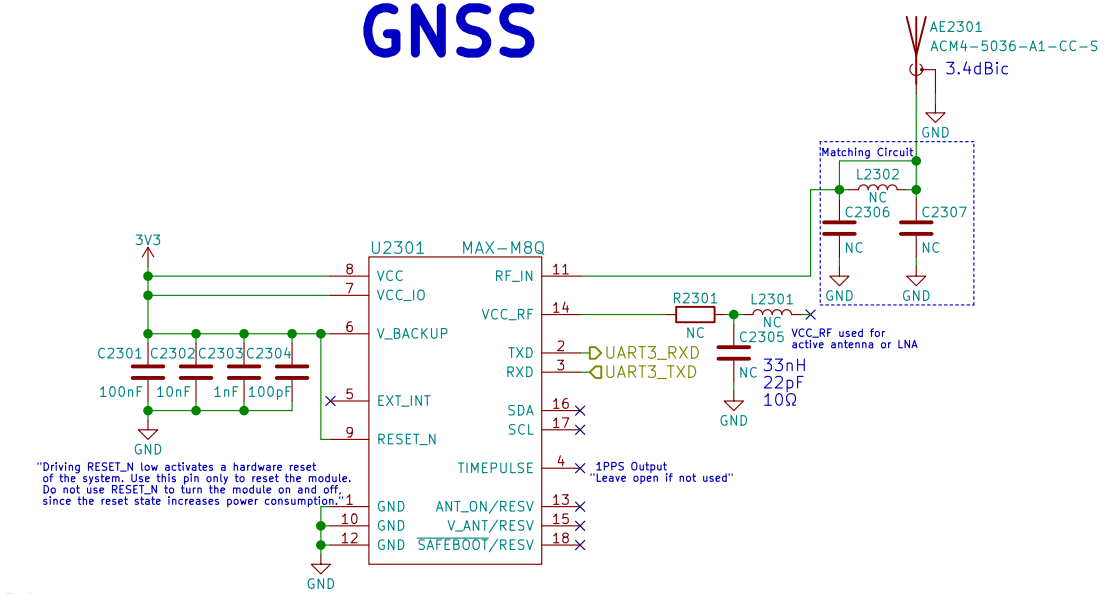
GNSS



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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File: gnss.sch

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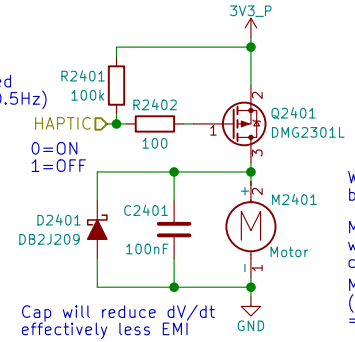
Haptic Motor

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

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