USB-C
VBUS
USB1_VBUS
USB1_ID
USB1_SS_SEL
USB1_DP
USB1_DN
USB1_TXP
USB1_TXN
USB1_RXP
USB1_RXN
TCPC_INT
I2C1_SDA
I2C1_SCL
EN_SNK
EN_SRC
usb-c.sch
Battery
VBUS
battery.sch
VBAT_REG
I2C1_SDA
I2C1_SCL
CHRG_INT
EN_SRC
EN_SNK
ONOFF
Power
VBAT_REG
5V_SOM
5V_P
3V3
3V3_P
1V8_P
22V4_P
2V8_P
LEDK
PWM
PWR_EN
power.sch
Boot Config
BOOT_CFG00 SAI1_RXD0(GPIO4_IO02)
BOOT_CFG01 SAI1_RXD1(GPIO4_IO03)
BOOT_CFG02 SAI1_RXD2(GPIO4_IO04) Alternate Functions:
BOOT_CFG03 SAI1_RXD3(GPIO4_IO05) CAPTOUCH_RST
BOOT_CFG04 SAI1_RXD4(GPIO4_IO06) SW_BACK
BOOT_CFG05 SAI1_RXD5(GPIO4_IO07) SAI6_TXDO
BOOT_CFG06 SAI1_RXD6(GPIO4_IO08) SAI6_TXFS/RXFS
BOOT_CFG07 SAI1_RXD7(GPIO4_IO09)
BOOT_CFG08 SAI1_TXD0(GPIO4_IO12)
BOOT_CFG09 SAI1_TXD1(GPIO4_IO13) SW_HOME
BOOT_CFG10 SAI1_TXD2(GPIO4_IO14)
BOOT_CFG11 SAI1_TXD3(GPIO4_IO15)
BOOT_CFG12 SAI1_TXD4(GPIO4_IO16) SAI6_TXC/RXC
BOOT_CFG13 SAI1_TXD5(GPIO4_IO17) SAI6_RXDO
BOOT_CFG14 SAI1_TXD6(GPIO4_IO18)
BOOT_CFG15 SAI1_TXD7(GPIO4_IO19)
BOOT_MODE0
BOOT_MODE1
boot.sch
WLAN+BT M.2
USB_WLAN_DP
USB_WLAN_DM
UART4_TXD
UART4_RXD
UART4_RTS
UART4_CTS
BT_HOST_WAKE
WIFI_DISABLE
BT_DISABLE
WIFI_CLK
WIFI_CMD
WIFI_DATA0
WIFI_DATA1
WIFI_DATA2
WIFI_DATA3
SD2_RST
WIFI_WAKE
I2C2_SDA
I2C2_SCL
SAI5_TX_BCLK
SAI5_TX_SYNC
SAI5_RXD
SAI5_TXD
wifi_bt_m2.sch
RTC
I2C1_SDA
I2C1_SCL
rtc.sch
UART Debug
UART1_TXD
UART1_RXD
uart.sch
JTAG
JTAG_TMS
JTAG_TCK
JTAG_TDO
JTAG_TDI
POR_B
JTAG_TRST
jtag.sch
uSD Card
CONN_SD2_DATA1
CONN_SD2_DATA0
CONN_SD2_CMD
CONN_SD2_DATA3
CONN_SD2_DATA2
CONN_SD2_CLK
CONN_SD2_CD_B
sd.sch
USB Hub + SDIO Bridge
USB2_DP
USB2_DN
USB2_ID
USB_WWAN_DP
USB_WWAN_DM
SMARTCARD_DP
SMARTCARD_DM
SDCD
uSD_CLK
uSD_CMD
uSD_DATA0
uSD_DATA1
uSD_DATA2
uSD_DATA3
SRST
usb_hub_sdio.sch
MIPI
DSI_DP0
DSI_DN0
DSI_DP1
DSI_DN1
DSI_DP2
DSI_DN2
DSI_DP3
DSI_DN3
DSI_CKP
DSI_CKN
LCD_RESET
LCD_LEDK
CAPTOUCH_INT GPIO3_IO25
CAPTOUCH_RST SAI1_RXD3(GPIO4_IO05)
CSI_P1_DP0
CSI_P1_DN0
CSI_P1_DP1
CSI_P1_DN1
DSI_P1_DP2
CSI_P1_DN2
CSI_P1_DP3
CSI_P1_DN3
CSI_P1_CKP
CSI_P1_CKN
I2C1_SDA
I2C1_SCL
mipi.sch
Ethernet
ENET_2V5
CLKO_25MHz
ENET_TXC
ENET_TD0
ENET_TD1
ENET_TD2
ENET_TD3
ENET_TX_CTL
ENET_RXC
ENET_RD0
ENET_RD1
ENET_RD2
ENET_RD3
ENET_RX_CTL
ENET_MDC
ENET_MDIO
ENET_RST
ENET_WoL
ENET_INT
ethernet.sch
HDMI
HDMI_AUXP
HDMI_AUXN
HDMI_CLKP
HDMI_CLKN
HDMI_TXP0
HDMI_TXN0
HDMI_TXP1
HDMI_TXN1
HDMI_TXP2
HDMI_TXN2
HDMI_DDC_SDA
HDMI_DDC_SCL
HDMI_CEC
HDMI_HPD
hdmi.sch
Buttons & LED
SW_BACK SAI1_RXD4(GPIO4_IO06)
SW_VOLDN BTN1
SW_VOLUP BTN2
SW_HOME SAI1_TXD1(GPIO4_IO13)
ONOFF
SYS_RST
GP_LED1 GPIO1_IO13
buttons_led.sch
Sensors
I2C1_SDA
I2C1_SCL
PROX_INT GPIO1_IO12 (was IR_CAP)
IMU_INT GPIO3_IO19 (was LED1)
sensors.sch
WWAN M.2
WoWWAN GPIO3_IO08
W_DISABLE1 WWAN_DISABLE GPIO3_IO04
RESET GPIO3_IO09
UART_TX/LED UART3_RXD
UART_RX/DPR UART3_TXD
USB_D+ USB_WWAN_DP
USB_D- USB_WWAN_DM
PCM_CLK/I2S_SCK SAI1_TXD4(GPIO4_IO16) SAI6_TXC/RXC
PCM_SYNC/I2S_FSC SAI1_RXD6(GPIO4_IO08) SAI6_TXFS/RXFS
PCM_IN/I2S_IN SAI1_RXD5(GPIO4_IO07) SAI6_TXD0
PCM_OUT/I2S_OUT SAI1_TXD5(GPIO4_IO17) SAI6_RXD0
wwan_m2.sch
SPI Flash
SCLK
MOSI
MISO
CS
flash.sch
Smart Card
SMARTCARD_DP
SMARTCARD_DM
smartcard.sch
Haptic Motor
HAPTIC GPIO5_IO04 (was PWM2)
haptic.sch
Audio
HP_DET GPIO3_IO20
MIC_SEL GPIO5_IO05 (was PWM1)
SAI2_RXD
SAI2_TXD
SAI2_TXFS
SAI2_TXC
SAI2_MCLK
I2C1_SDA
I2C1_SCL
audio.sch
TODO:
GNSS
MIPI CSI/DSI

Spare GPIO:
GPIO5_IO03 (was PWM3)

GPIO that can be swapped around:
GPIO1_IO12 (was IR_CAP)
GPIO3_IO20
GPIO3_IO25
GPIO3_IO19 (was LED1)
GPIO5_IO05 (was PWM1)
GPIO5_IO03 (was PWM3)

J101A
ENET_TXC
ENET_TD0
ENET_TD1
ENET_TD2
ENET_TD3
ENET_TX_CTL
ENET_RD0
ENET_RD1
ENET_RD2
ENET_RD3
CSI_P1_DP3
CSI_P1_DN3
ENET_RX_CTL
ENET_RXC
CSI_P1_DP1
CSI_P1_DN1
ENET_MDIO
ENET_MDC
DSI_P1_DP2
CSI_P1_DN2
SD2_RST
WIFI_DATA3
WIFI_DATA2
WIFI_DATA1
CSI_P1_DP0
CSI_P1_DN0
WIFI_DATA0
WIFI_WAKE
CSI_P1_CKP
CSI_P1_CKN
WIFI_CMD
uSD_CD_B
WIFI_CLK
TCPC_INT
WWAN_DISABLE
USB1_SS_SEL
BT_HOST_WAKE
LCD_RESET
IMX8M-SOM
GND GND

J101B
WIFI_DISABLE
GPIO3_IO09
GPIO3_IO08
PWR_FLAG 3V3_OUT
2V2 ENET_2V5
PWR_FLAG NVCC_SD2
DSI_DP2
DSI_DN2
DSI_DP0
DSI_DN0
DSI_CKN
DSI_CKP
DSI_DP1
DSI_DN1
DSI_DP3
DSI_DN3
5V_SOM
C101 22uF
C102 22uF
C103 100nF
C104 100nF
C105 22uF
C106 22uF
IMX8M-SOM
GND GND

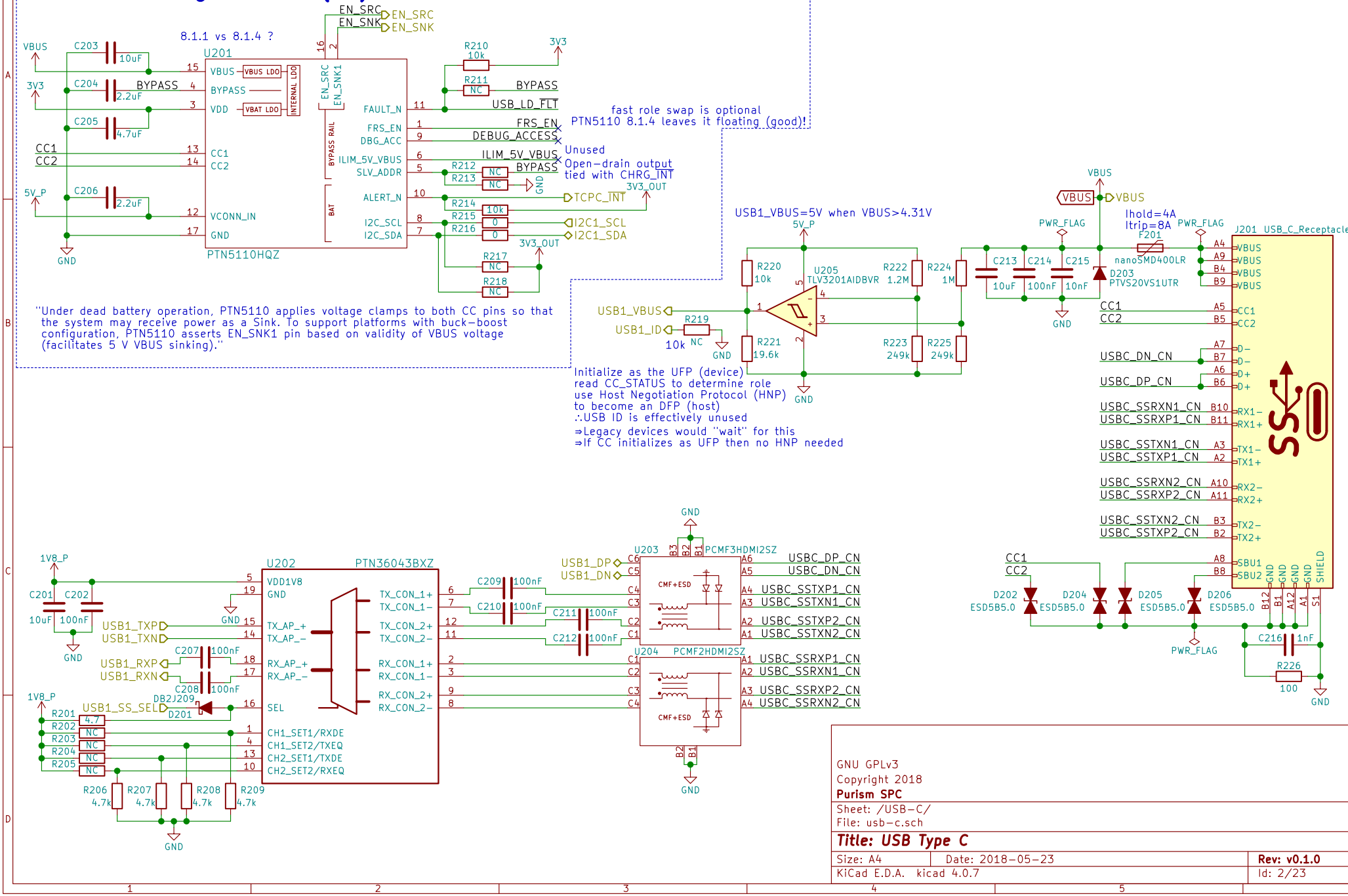
J101C
HDMI_CEC
BOOT_MODE0
BOOT_MODE1
JTAG_TDI
JTAG_TMS
JTAG_TRST
JTAG_TDO
JTAG_TCK
HDMI_HPD
HDMI_AUXN
HDMI_AUXP
HDMI_TXP1
HDMI_TXN1
HDMI_TXP0
HDMI_TXN0
J102 TEST_1P
DSI_BL_PWM
WDG
HDMI_DDC_SCL
HDMI_DDC_SDA
HDMI_TXP2
HDMI_TXN2
HDMI_CLKP
HDMI_CLKN
IMU_INT
SAI5_TX_BCLK
PWR_EN
SAI5_RXD
ENET_RST
ENET_WoL
SAI1_RXD1(GPIO4_IO03)
SAI5_TX_SYNC
ENET_INT
HP_DET
PROX_INT
CAPTOUCH_INT
SAI1_RXD0(GPIO4_IO02)
SAI5_TXD
CLKO_25MHz
GPIO1_IO13
SAI1_RXD4(GPIO4_IO06)
SAI2_TXC
SAI1_RXD3(GPIO4_IO05)
BTN1
SAI1_RXD2(GPIO4_IO04)
BTN2
SAI2_TXFS
SAI2_RXD
SAI2_MCLK
IMX8M-SOM
GND GND

J101D
SAI2_TXD
SAI1_RXD7(GPIO4_IO09)
I2C2_SCL
HAPTIC
SAI1_RXD5(GPIO4_IO07)
SAI1_TXD0(GPIO4_IO12)
ONOFF
I2C2_SDA
MIC_SEL
SAI1_TXD1(GPIO4_IO13)
SYS_RST
UART4_TXD
I2C1_SCL
I2C1_SDA
ECSPI1_SCLK
SAI1_TXD3(GPIO4_IO15)
SAI1_TXD4(GPIO4_IO16)
ECSPI1_SS0
SAI1_TXD7(GPIO4_IO19)
UART3_TXD
BT_DISABLE
SAI1_TXD5(GPIO4_IO17)
POR_B
UART4_RXD
UART1_RXD
SAI1_TXD2(GPIO4_IO14)
SAI1_TXD6(GPIO4_IO18)
ECSPI1_MISO
UART4_CTS
UART3_RXD
USB2_DN
USB2_DP
ECSPI1_MOSI
USB1_RXN
UART4_RTS
USB1_RXP
UART1_TXD
USB1_TXN
USB2_VBUS
USB2_ID
USB1_DN
USB1_VBUS
USB1_DP
USB1_ID
BTN2
IMX8M-SOM
GND GND

3V3_OUT
R106 10k
R101 2.2k
R102 2.2k
R105 10k
5V_P
R103 10k
R104 19.6k
GND

Purism SPC
Sheet: /
File: dvk-mx8m-bsb.sch
Title: DVK-MX8M-BSB
Size: A2 | Date: 2018-05-23 | Rev: v0.1.0
KiCad E.D.A. kicad 4.0.7 | Id: 1/23

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



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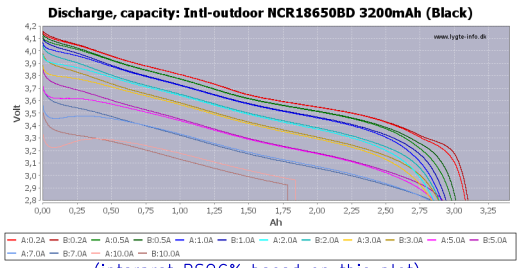
Purism SPC

Sheet: /USB-C/		
File: usb-c.sch		
Title: USB Type C		
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 2/23

Battery Charge Controller



(interpret RSOC% based on this plot)

use AUTO_DPDM_EN
to auto-detect IINLIM

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

U301 BQ25896

I(Lsat)=7A

3.5~4.25V

~110uF

Default LOW:
adapter source

Open-drain output
tied with TCPC_INT

If enough I/O is available then
separate CHRG_INT & TCPC_INT

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)

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

VBAT(DPL)=2.15~2.5V

NCR18650B is recommended

VBAT(nom)=REG06[7:2]
VBAT(default_max_ovp)=(REG06[7:2]×1.005)×1.04=4.3982016V
REG06[7:2]=010111⇒VBAT(max_ovp)=4.3814784
BQ29705 provides 4.425V as OVP!!!

reference design: http://www.ti.com/lit/ug/sluuba2b/sluuba2b.pdf

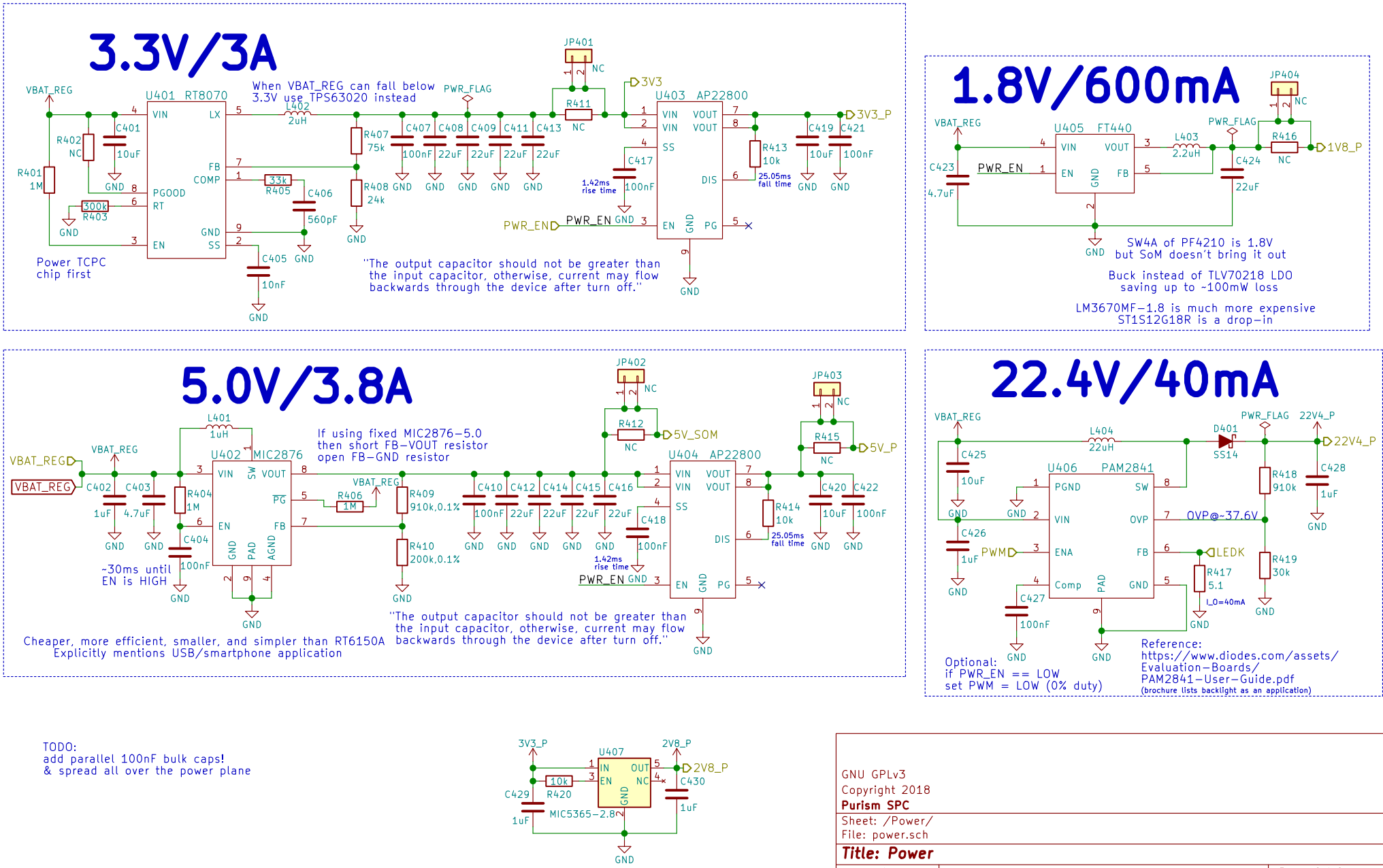
may want to include BQ29705 protection as in:
http://www.ti.com/lit/ug/tiducl1/tiducl1.pdf
schematic: http://www.ti.com/lit/df/tidrp70/tidrp70.pdf
(PTC may be good enough)

TODO:
Keystone 1042 footprint???

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

Sheet: /Battery/		
File: battery.sch		
Title: Battery		
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 3/23


3.3V/3A
VBAT_REG
U401 RT8070
When VBAT_REG can fall below 3.3V use TPS63020 instead
PWR_FLAG
JP401
NC
3V3
U403 AP22800
3V3_P
L402
2uH
R411
NC
R407
75k
R408
24k
R405
33k
C406
560pF
C405
10nF
R401
1M
R402
NC
R403
300k
C401
10uF
C407
100nF
C408
22uF
C409
22uF
C411
22uF
C413
22uF
C417
100nF
1.42ms rise time
R413
10k
25.05ms fall time
C419
10uF
C421
100nF
PWR_EN
Power TCPC chip first
"The output capacitor should not be greater than the input capacitor, otherwise, current may flow backwards through the device after turn off."
1.8V/600mA
JP404
U405 FT440
L403
2.2uH
R416
NC
1V8_P
C423
4.7uF
C424
22uF
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
5.0V/3.8A
JP402
JP403
L401
1uH
U402 MIC2876
If using fixed MIC2876-5.0 then short FB-VOUT resistor open FB-GND resistor
R412
5V_SOM
R415
5V_P
U404 AP22800
R404
1M
C402
1uF
C403
4.7uF
C404
100nF
R406
1M
R409
910k,0.1%
R410
200k,0.1%
C410
100nF
C412
22uF
C414
22uF
C415
22uF
C416
22uF
C418
100nF
R414
10k
C420
10uF
C422
100nF
~30ms until EN is HIGH
Cheaper, more efficient, smaller, and simpler than RT6150A
Explicitly mentions USB/smartphone application
"The output capacitor should not be greater than the input capacitor, otherwise, current may flow backwards through the device after turn off."
22.4V/40mA
L404
22uH
D401
SS14
22V4_P
U406 PAM2841
C425
10uF
C426
1uF
C427
100nF
R418
910k
C428
1uF
R419
30k
R417
5.1
I_O=40mA
OVP@~37.6V
PWM
LEDK
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)
TODO:
add parallel 100nF bulk caps!
& spread all over the power plane
U407
MIC5365-2.8
2V8_P
R420
10k
C429
1uF
C430
1uF
GND
GNU GPLv3
Copyright 2018
Purism SPC
Sheet: /Power/
File: power.sch
Title: Power
Size: A4
Date: 2018-05-23
Rev: v0.1.0
KiCad E.D.A. kicad 4.0.7
Id: 4/23

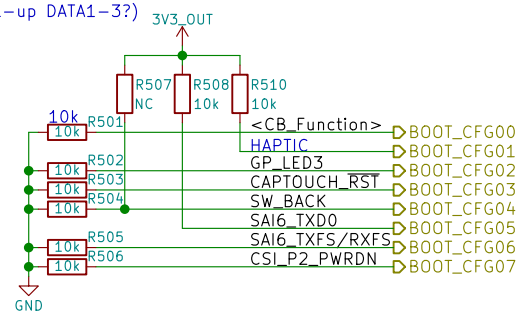
Only eMMC

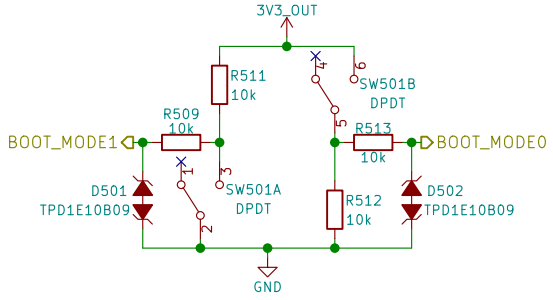
BOOT_CFG[14:12]	Boot device
001	SD/eSD
010	MMC/eMMC
011	NAND

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_CFG04:
0 – 1-bit SD bus
1 – 4-bit SD bus
(pull-up DATA1-3?)

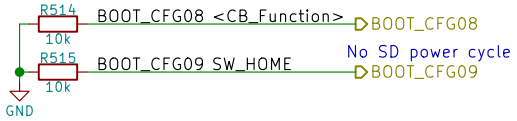
BOOT_CFG05:
1 – 8-bit eMMC bus
0 – 1-bit eMMC bus

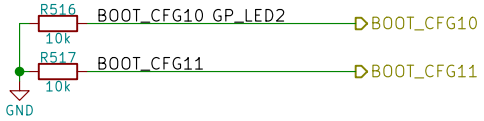


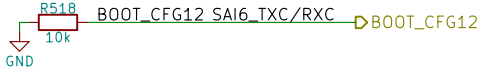


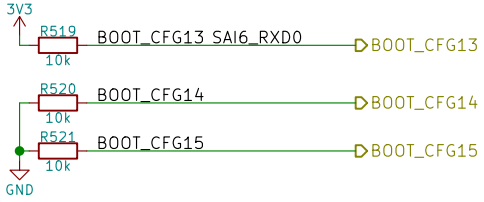
2->1: eMMC
2->3: USB (Serial Downloader)

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





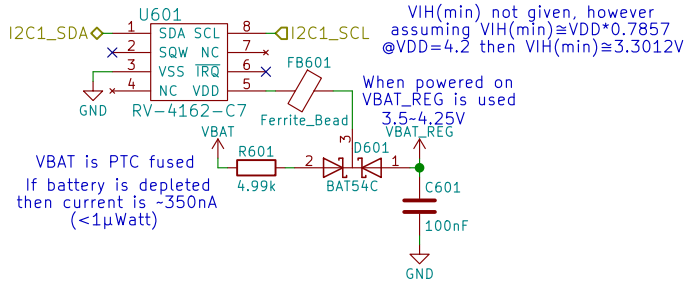




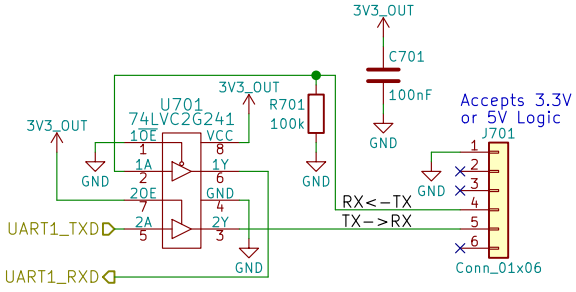
Sheet: /Boot Config/
File: boot.sch

Title: Boot Configuration

Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 5/23



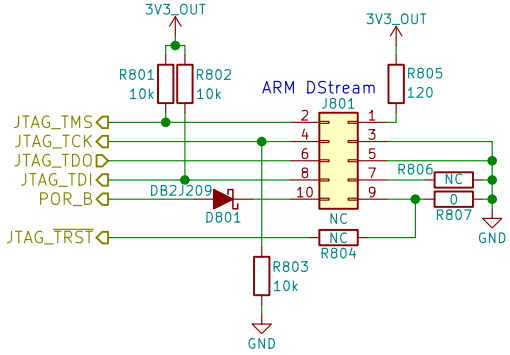
Sheet: /RTC/		
File: rtc.sch		
Title: RTC		
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 6/23



Sheet: /UART Debug/
File: uart.sch

Title: UART Debug

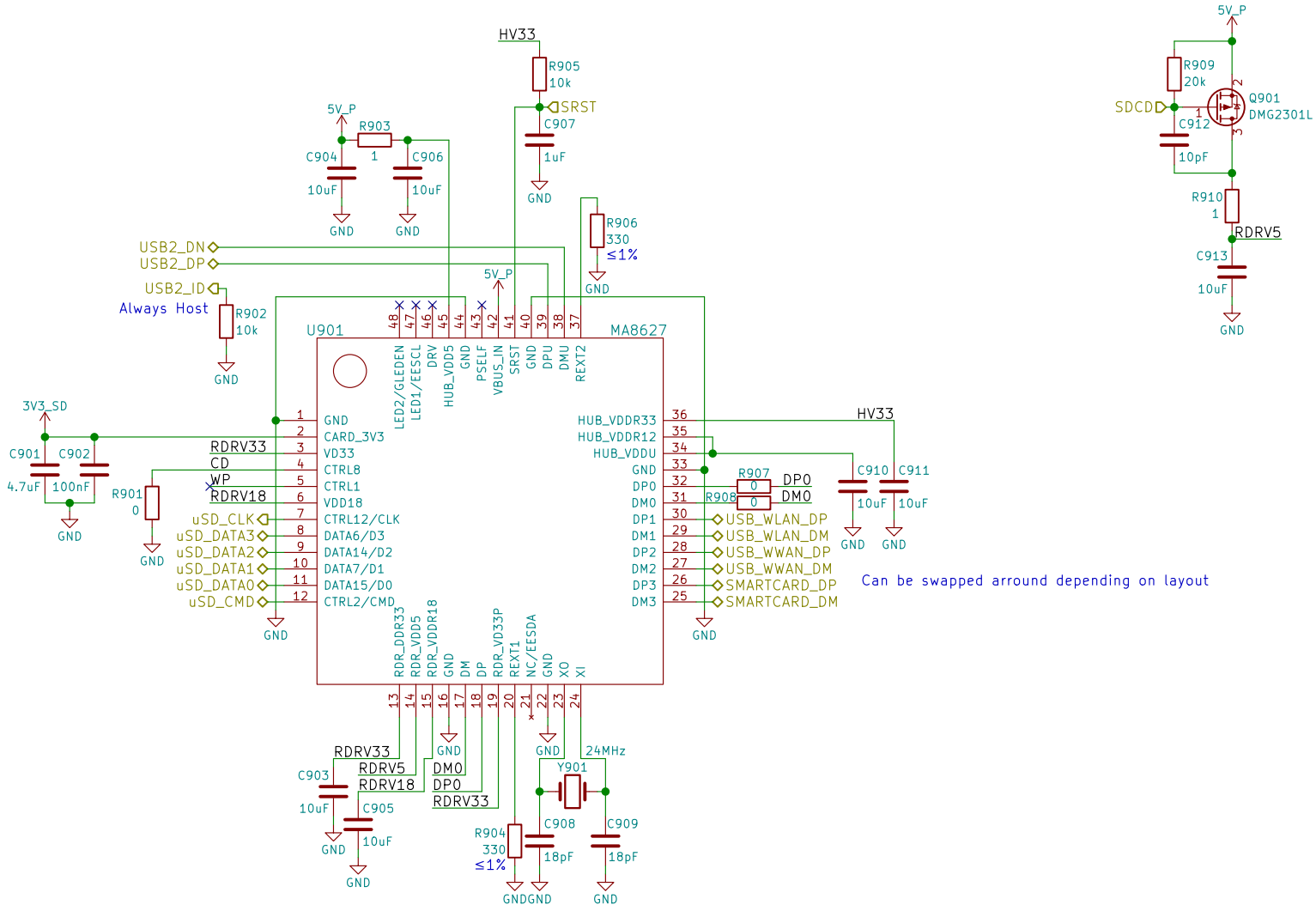
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 7/23



Sheet: /JTAG/
File: jtag.sch

Title: JTAG

Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 8/23



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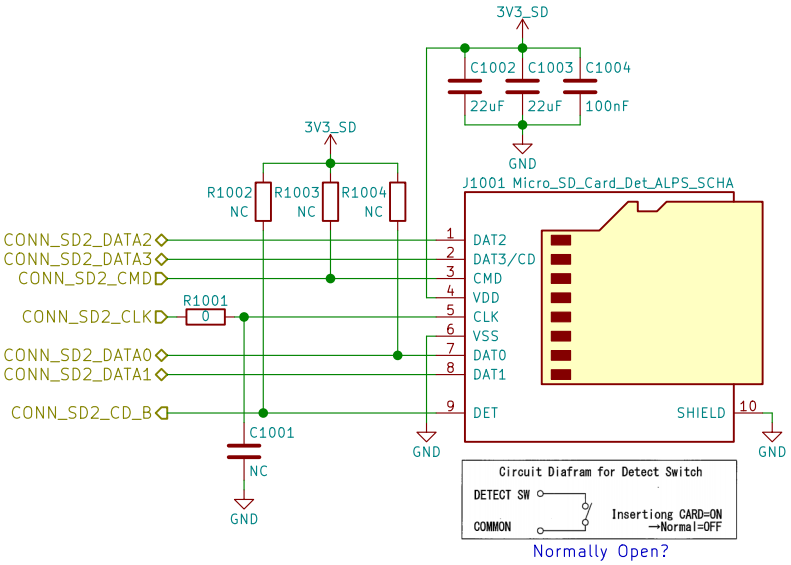
Purism SPC

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

Title:

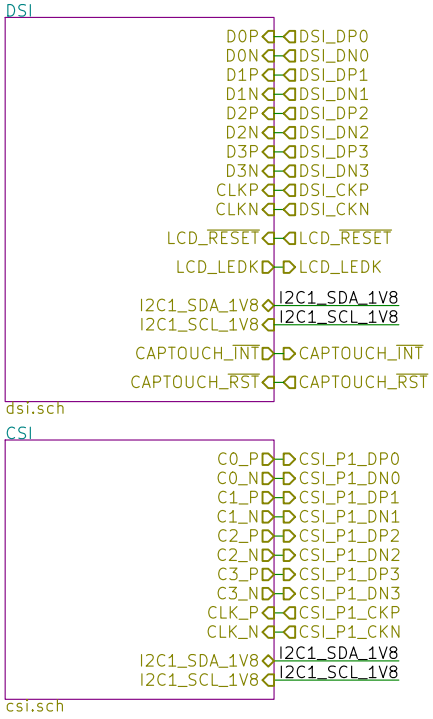
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 9/23

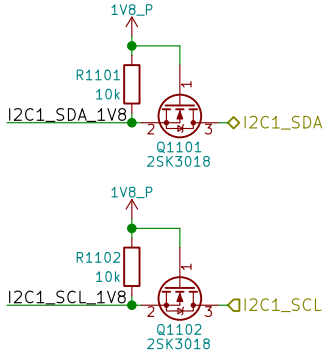


Sheet: /uSD Card/
File: sd.sch

Title: uSD Card

Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 10/23

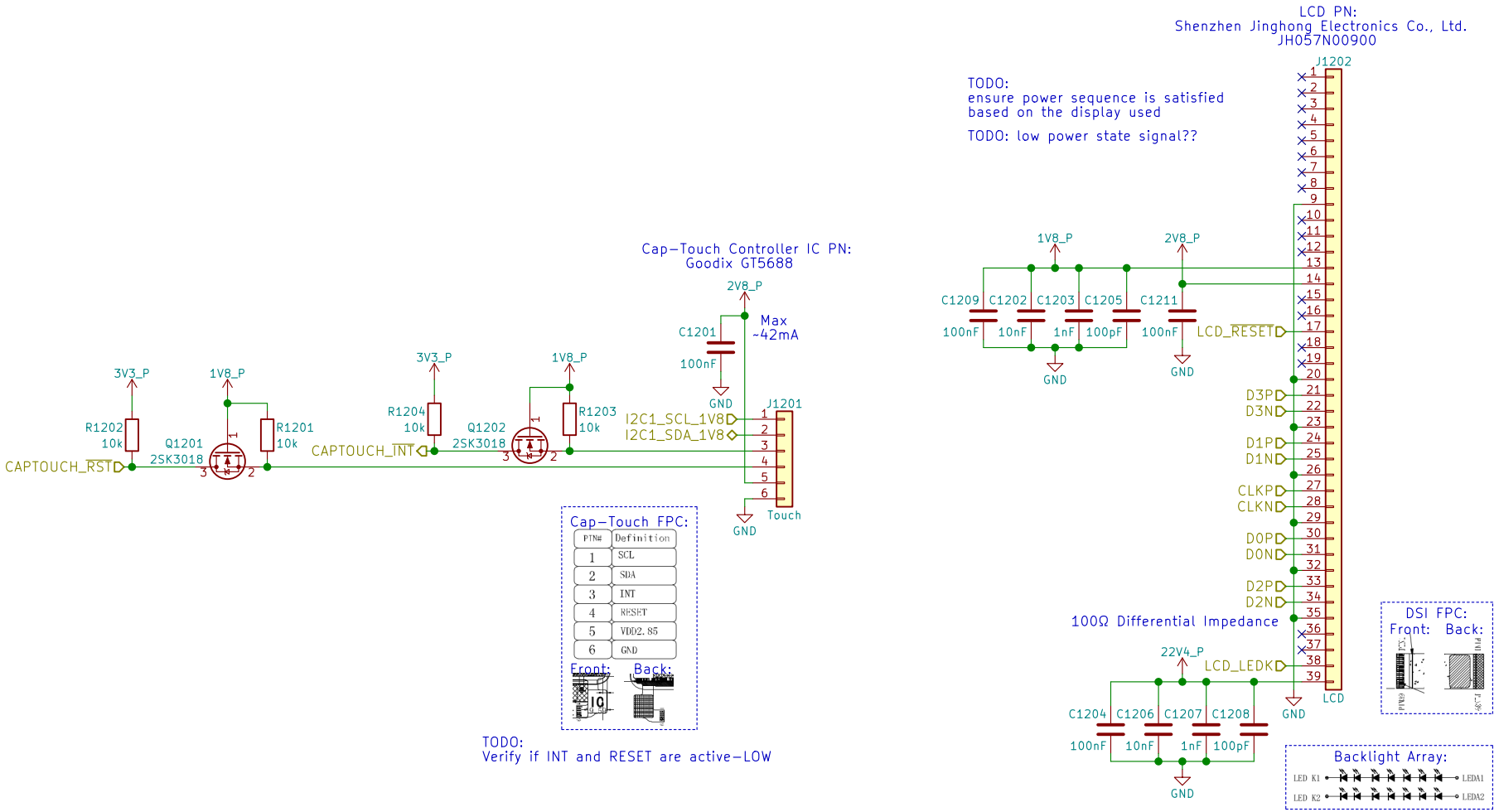




Sheet: /MIPI/
File: mipi.sch

Title:

Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 11/23



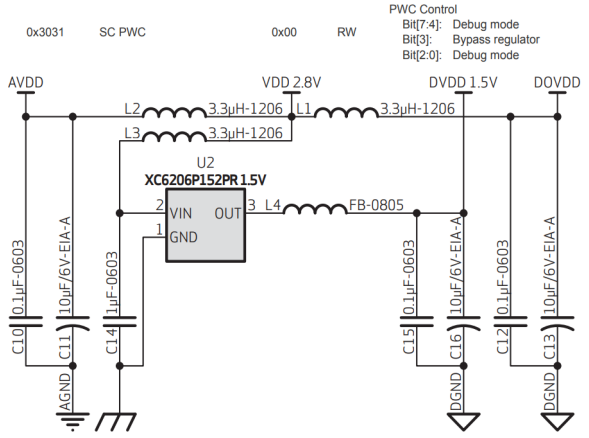
GNU GPLv3
Copyright 2018
Purism SPC

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

Title: MIPI DSI

Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 12/23

Using Internal DVDD 1.5V Regulator:



2.7 POWER UP SEQUENCE

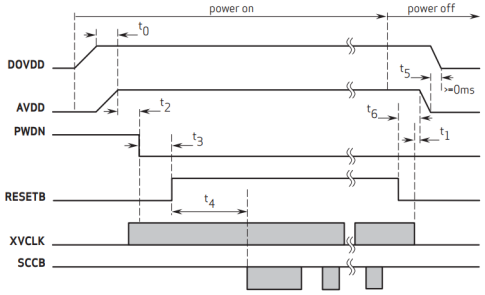
Based on the system power configuration (1.8V or 2.8V for I/O power, using external DVDD or internal DVDD, requiring access to the I2C during power up period or not), the power up sequence will differ. If 1.8V is used for I/O power, using the internal DVDD is preferred. If 2.8V is used for I/O power, 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 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
$t_0 \geq 0$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

S640_DS_2_2

C0_P
C0_N
C1_P
C1_N
C2_P
C2_N
C3_P
C3_N
CLK_P
CLK_N

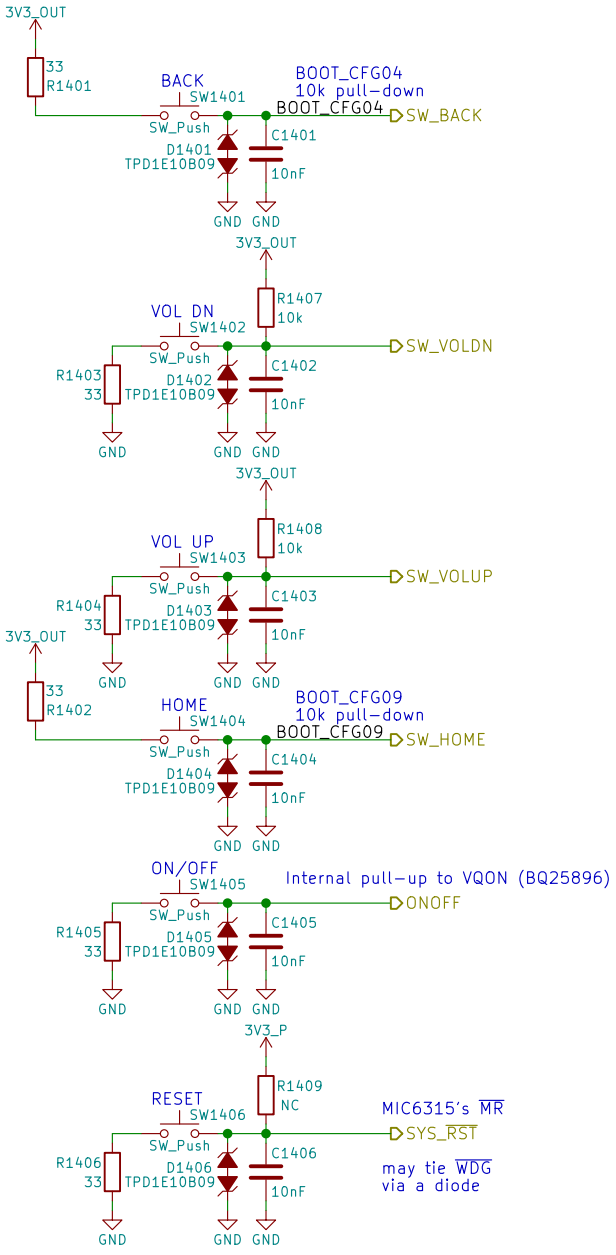
I2C1_SDA_1V8
I2C1_SCL_1V8

Purism SPC

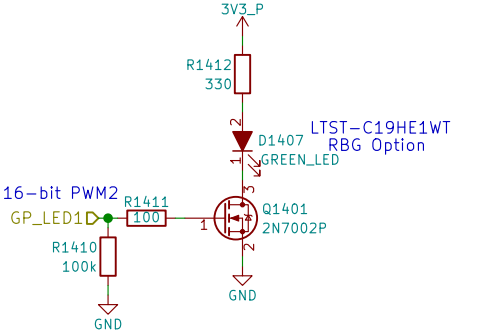
Sheet: /MIPI/CSI/
File: csi.sch

Title:

Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 13/23



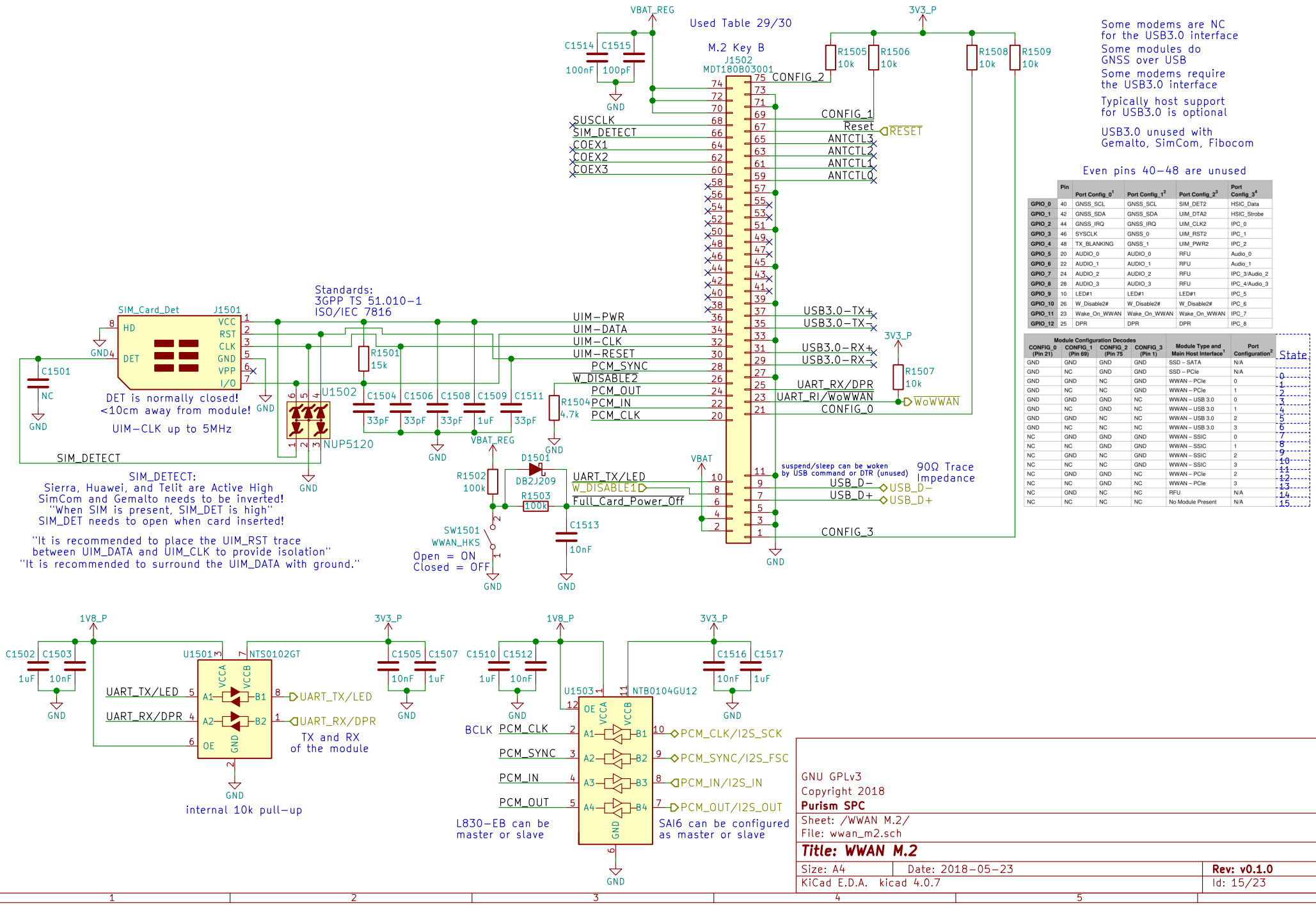
Use PWM2_PWMSAR to set the compare value (duty cycle)
Use PWM2_PWMCR[15:4] to set the PRESCALER (frequency)
Use PWM2_PWMPR to set the top of the counter (frequency)



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

Title: Buttons & LED

Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 14/23



	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

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

Title: WWAN M.2

Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 15/23

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

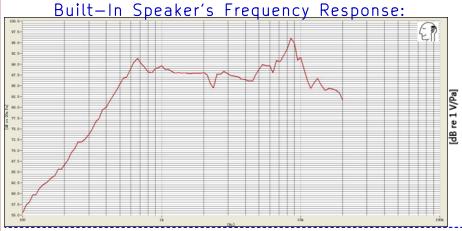
U1601 SGTL5000
Mute via MUTE_LO=1
may use lineout left channel for pseudo-earpiece speaker
U1602 PAM8301
LS1601 AS01608MS-SP9
DLW21SN900SQ2L
FL1601
FL1602
J1601
SMD Equivalent: SJ-43515RS-SMT-TR
SJ-43515TS
CTIA/AHJ
Microphone
Ground
Audio (Right)
Audio (Left)
Pin 5 (tip switch) is NC, open when inserted
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
Z(hp)≥16Ω
<3.3µA

SW Mute Mic:
MUTE_ADC=1
U1603 FSA6157L6X
MIC_SEL
SW1601A SW_DPST_x2
TODO: DPST with camera!
Ext-Mic enabled
MIC_SEL=LOW
Int-Mic enabled
MIC_SEL=LOW
MK1601 CMC-6022
Add TVS next to int-mic? (OpenMoko does this)

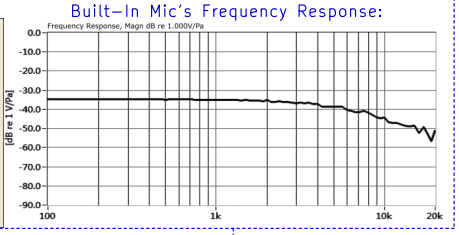
−37dB=14.1254mV/Pa
∴ mic produces 14.1254mVrms when exposed to a 1kHz tone of 94dB-SPL at the capsule (or 19.98mV amplitude)

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

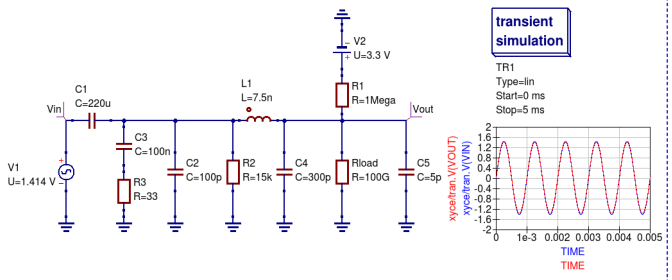
Built-In Speaker's Frequency Response:



Built-In Mic's Frequency Response:



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



LCR Measurements:

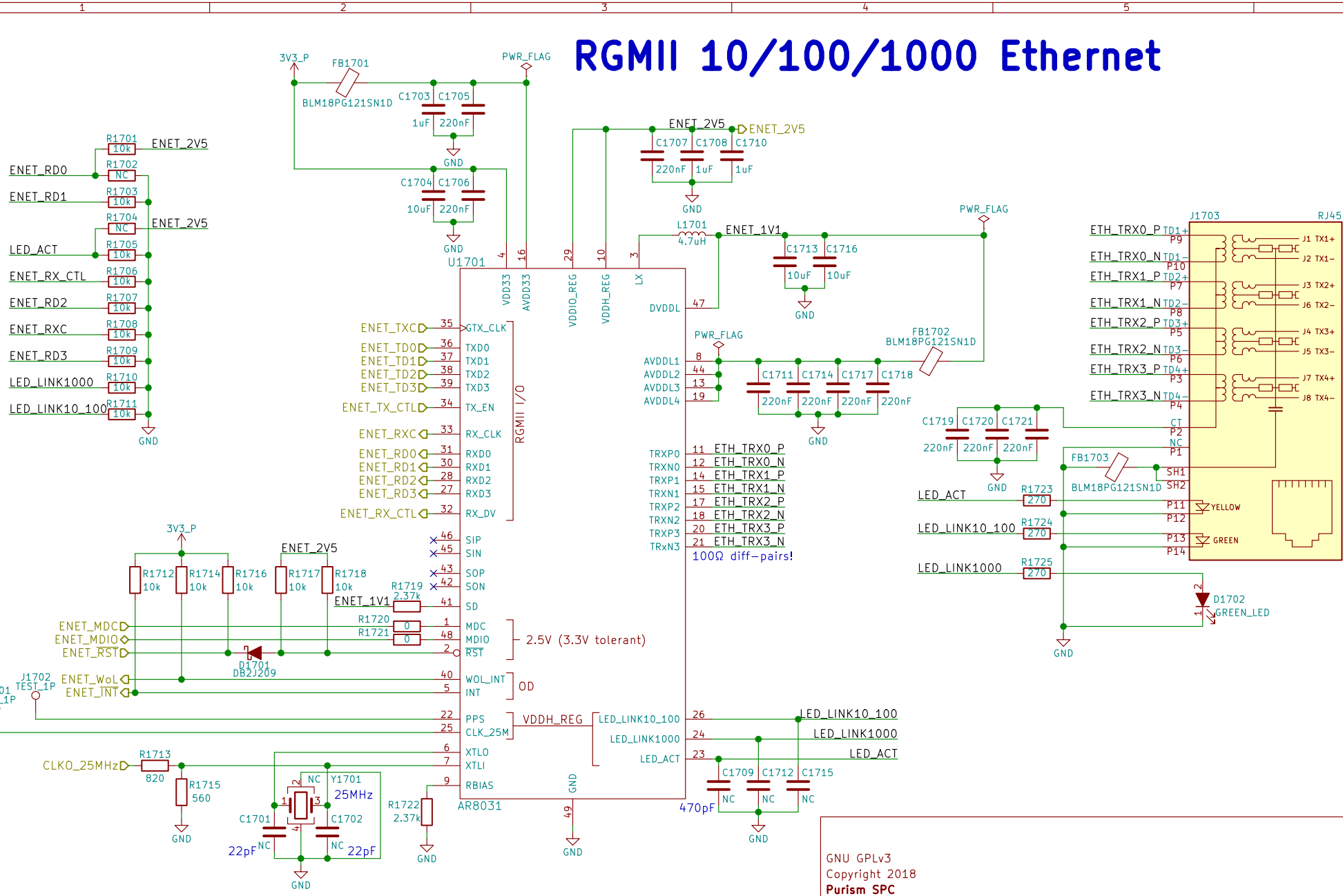
Earbud Microphone: @1kHz	Headset Speaker: @1kHz	Earbud Speaker: @1kHz
Ls = 3.844mH	Ls = 244.4uH	Ls = 25.2uH
Lp = 15.757H	Lp = 141.99mH	Lp = 311.0mH
Cs = 6.583uF	Cs = 103.6uF	Cs = 1.0mF
Cp = 1612.8pF	Cp = 178.77nF	Cp = 81.95nF
Rs = 1.5465kOhms	Rs = 36.860hms	Rs = 17.0300hms
Rp = 1.5478kOhms	Rp = 36.860hms	Rp = 17.0340hms
θ = −0.8deg	θ = −2.3deg	θ = 0.5deg

Purism SPC

Sheet: /Audio/
File: audio.sch

Title: Audio

Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 16/23


RGMII 10/100/1000 Ethernet
3V3_P
FB1701
BLM18PG121SN1D
PWR_FLAG
C1703 C1705
1uF 220nF
C1704 C1706
10uF 220nF
GND
ENET_2V5
C1707 C1708 C1710
220nF 1uF 1uF
L1701
4.7uH
ENET_1V1
C1713 C1716
10uF 10uF
FB1702
BLM18PG121SN1D
C1711 C1714 C1717 C1718
220nF 220nF 220nF 220nF
U1701
AR8031
VDD33
AVDD33
VDDIO_REG
VDDH_REG
LX
DVDDL
AVDDL1
AVDDL2
AVDDL3
AVDDL4
RGMII I/O
GTX_CLK
TXD0
TXD1
TXD2
TXD3
TX_EN
RX_CLK
RXD0
RXD1
RXD2
RXD3
RX_DV
ENET_TXC
ENET_TD0
ENET_TD1
ENET_TD2
ENET_TD3
ENET_TX_CTL
ENET_RXC
ENET_RD0
ENET_RD1
ENET_RD2
ENET_RD3
ENET_RX_CTL
TRXP0
TRXN0
TRXP1
TRXN1
TRXP2
TRXN2
TRXP3
TRXN3
ETH_TRX0_P
ETH_TRX0_N
ETH_TRX1_P
ETH_TRX1_N
ETH_TRX2_P
ETH_TRX2_N
ETH_TRX3_P
ETH_TRX3_N
100Ω diff-pairs!
SIP
SIN
SOP
SON
SD
MDC
MDIO
RST
2.5V (3.3V tolerant)
WOL_INT
INT
OD
PPS
CLK_25M
XTLO
XTLI
RBIAS
R1719 2.37k
R1720 0
R1721 0
R1722 2.37k
R1723 270
R1724 270
R1725 270
LED_ACT
LED_LINK10_100
LED_LINK1000
VDDH_REG
470pF
C1709 C1712 C1715
NC NC NC
R1701 10k ENET_2V5
R1702 NC ENET_RD0
R1703 10k ENET_RD1
R1704 NC ENET_2V5
R1705 10k LED_ACT
R1706 10k ENET_RX_CTL
R1707 10k ENET_RD2
R1708 10k ENET_RXC
R1709 10k ENET_RD3
R1710 10k LED_LINK1000
R1711 10k LED_LINK10_100
R1712 10k
R1714 10k
R1716 10k
R1717 10k
R1718 10k
D1701
DB2J209
J1701
TEST_1P
J1702
TEST_1P
ENET_WoL
ENET_INT
ENET_MDC
ENET_MDIO
ENET_RST
CLKO_25MHz
R1713 820
R1715 560
Y1701
25MHz
C1701 22pF NC
C1702 NC 22pF
J1703
RJ45
ETH_TRX0_P TD1+ P9 J1 TX1+
ETH_TRX0_N TD1- P10 J2 TX1-
ETH_TRX1_P TD2+ P7 J3 TX2+
ETH_TRX1_N TD2- P8 J6 TX2-
ETH_TRX2_P TD3+ P5 J4 TX3+
ETH_TRX2_N TD3- P6 J5 TX3-
ETH_TRX3_P TD4+ P3 J7 TX4+
ETH_TRX3_N TD4- P4 J8 TX4-
CT P2
NC P1
SH1
SH2
P11
P12
P13
P14
YELLOW
GREEN
C1719 C1720 C1721
220nF 220nF 220nF
FB1703
BLM18PG121SN1D
D1702
GREEN_LED
GND
GNU GPLv3
Copyright 2018
Purism SPC
Sheet: /Ethernet/
File: ethernet.sch
Title: Ethernet
Size: A4
Date: 2018-05-23
Rev: v0.1.0
KiCad E.D.A. kicad 4.0.7
Id: 17/23

Module: Table 23
Socket: Table 46

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 for USB!

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

VIH=2.31V

SoC's IN/OUT

SoC's RX
Module's TX

SoC's TX
Module's RX

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

Note:
Dual 2-input AND much more
available and cheaper than NOR

TODO:
Pin 54 on RS9116 is USB_VBUS Sink!!!

RS9116 SUSCLK
is a GPIO (unused)

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

internal 10k pull-up

RX, TX, RTS, CTS
of the SoC

configure as slave

IN, OUT
of the SoC

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

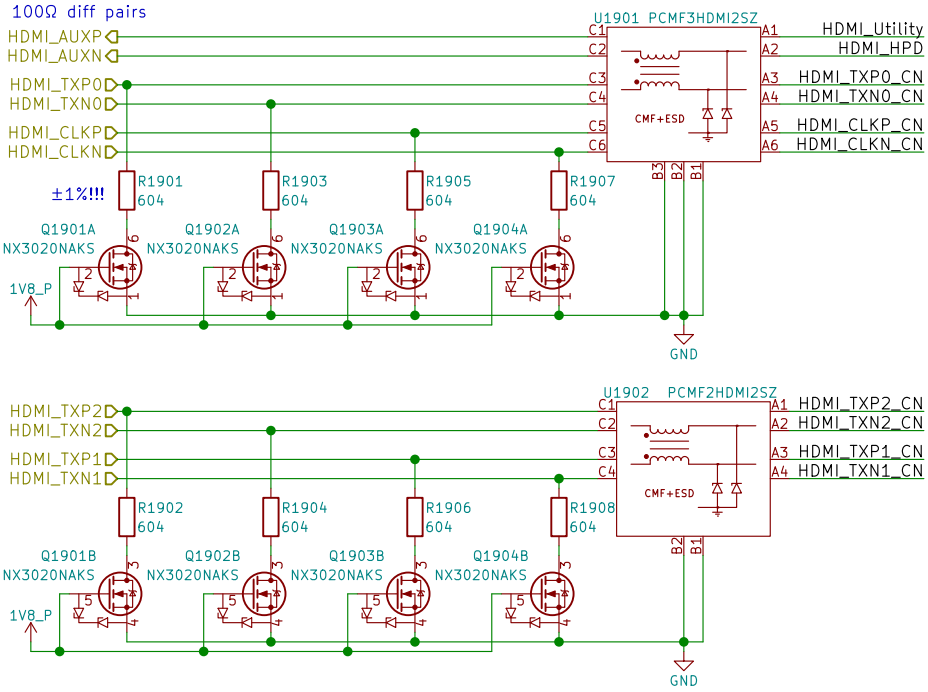
Title: WLAN+BT M.2

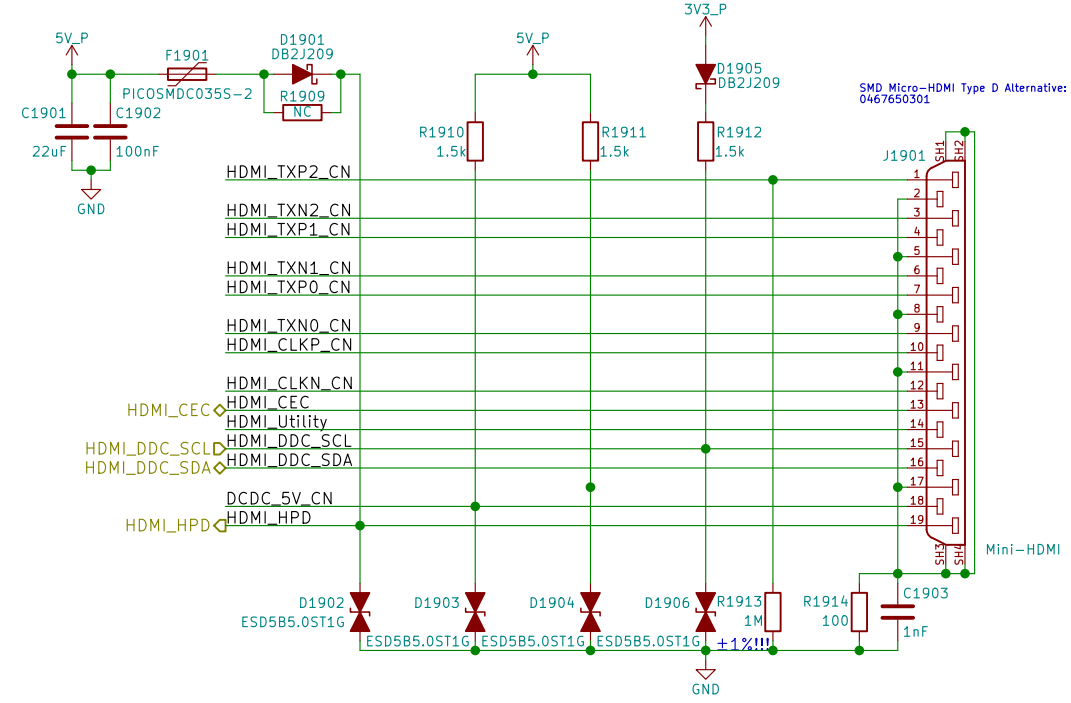
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 18/23

HD3SS460 can be used for DP over USB-C

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

100Ω diff pairs



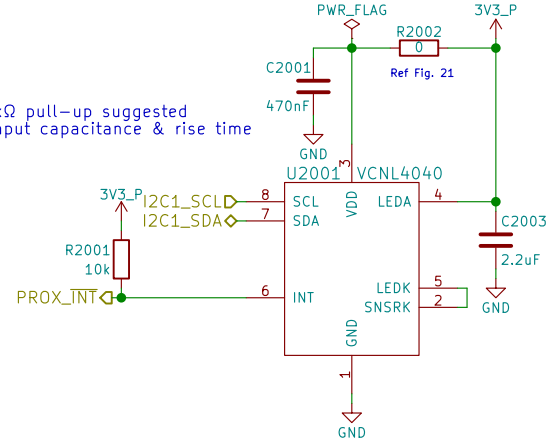


Sheet: /HDMI/
File: hdmi.sch

Title: HDMI

Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 19/23

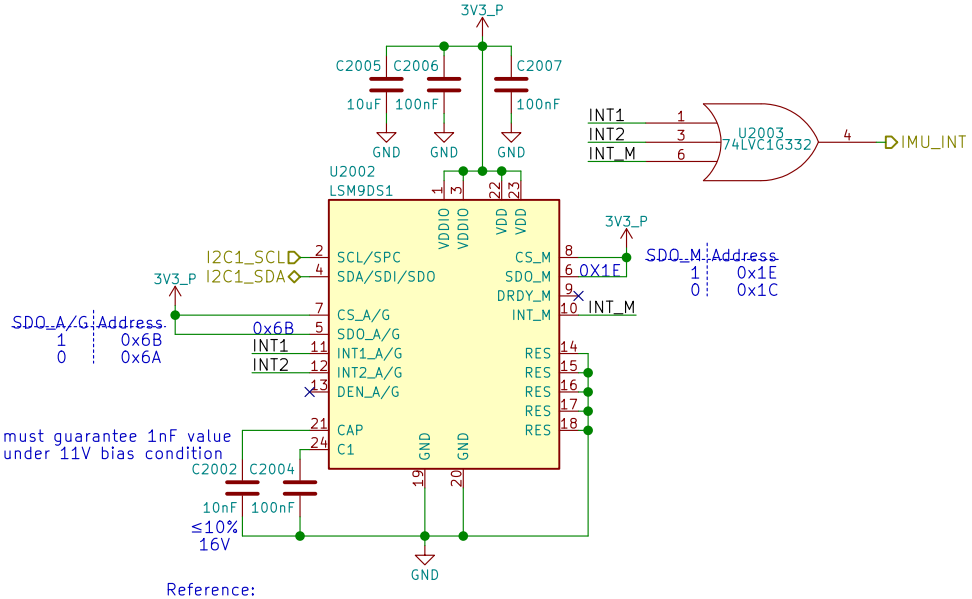
Proximity & Ambient Light



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

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

9-Axis IMU



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

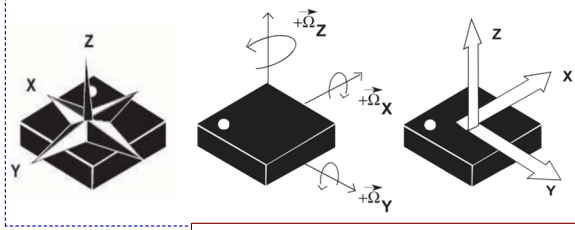


Table 19. Accelerometer and gyroscope SAD+Read/Write patterns

Command	SAD[6:1]	SAD[0] = SA0	R/W	SAD+R/W
Read	110101	0	1	11010101 (D5h)
Write	110101	0	0	11010100 (D4h)
Read	110101	1	1	11010111 (D7h)
Write	110101	1	0	11010110 (D6h)

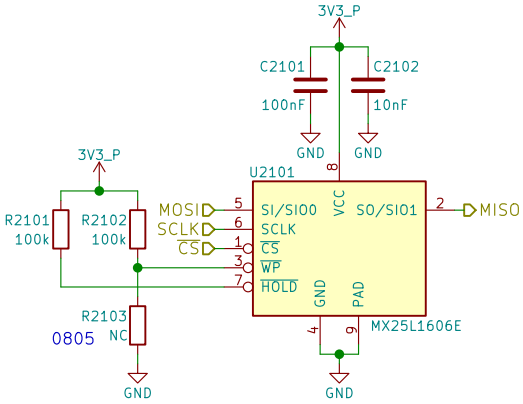
Table 20. Magnetic sensor SAD+Read/Write patterns

Command	SAD[6:2]	SAD[1] = SDO/SA1	SAD[0]	R/W	SAD+R/W
Read	00111	0	0	1	00111001 (39h)
Write	00111	0	0	0	00111000 (38h)
Read	00111	1	0	1	00111101 (3Dh)
Write	00111	1	0	0	00111100 (3Ch)

Sheet: /Sensors/
File: sensors.sch

Title: Sensors

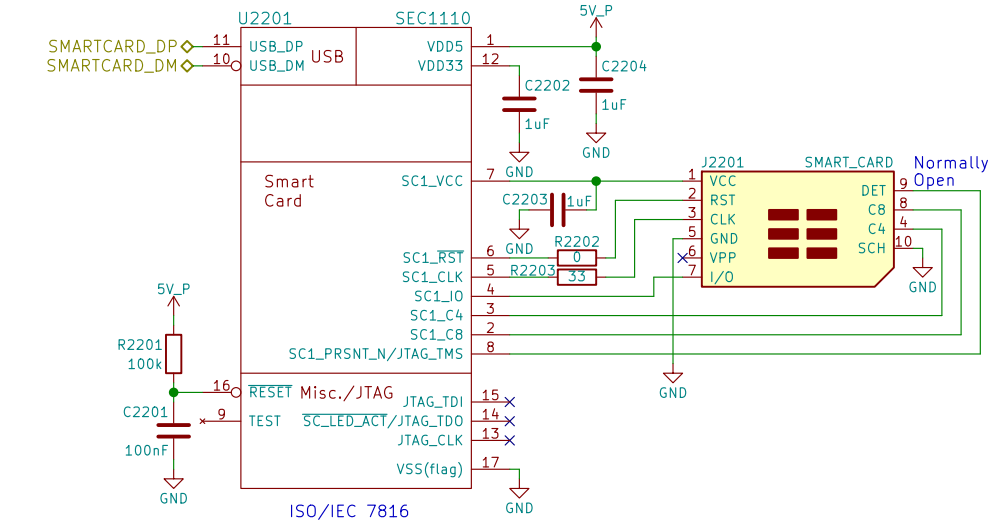
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 20/23



Sheet: /SPI Flash/
File: flash.sch

Title: SPI NOR Flash

Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 21/23



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

Sheet: /Smart Card/
File: smartcard.sch

Title: Smart Card

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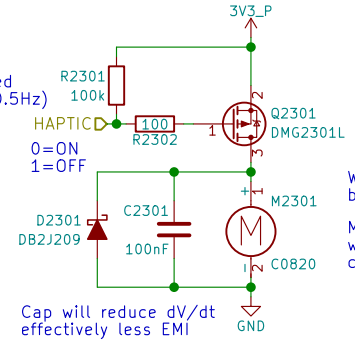
PWM pins occupied:
GPIO1_IO01 – LCD Backlight
GPIO1_IO13 – LED
GPIO1_IO14 – Ethernet (CLKO_25MHz)
GPIO1_IO15 – CSI (CLKO2)

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 JST
connector installed (by request)!

Cap will reduce dV/dt
effectively less EMI

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

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

Sheet: /Haptic Motor/
File: haptic.sch

Title: Haptic/Vibration Motor

Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 23/23