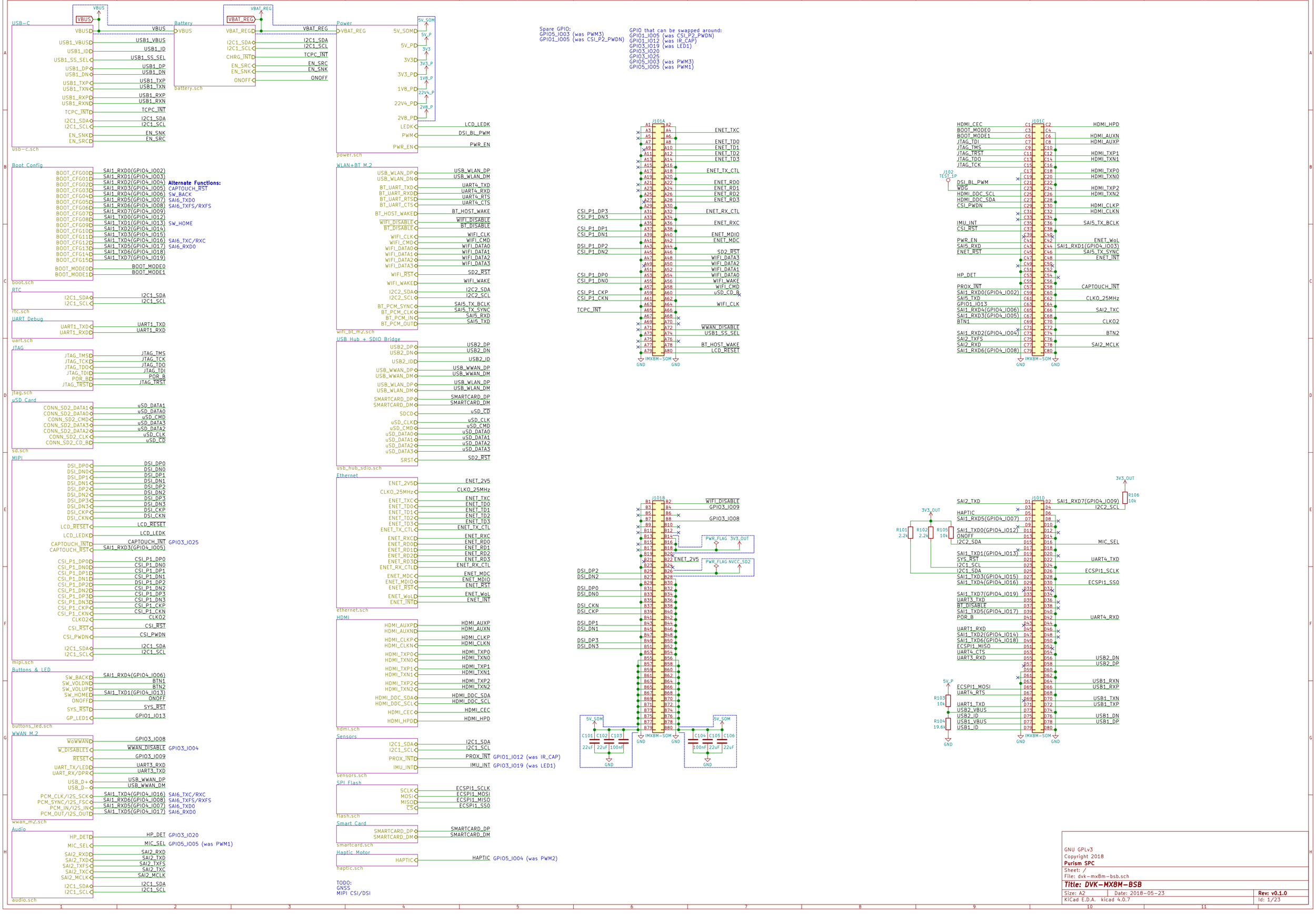
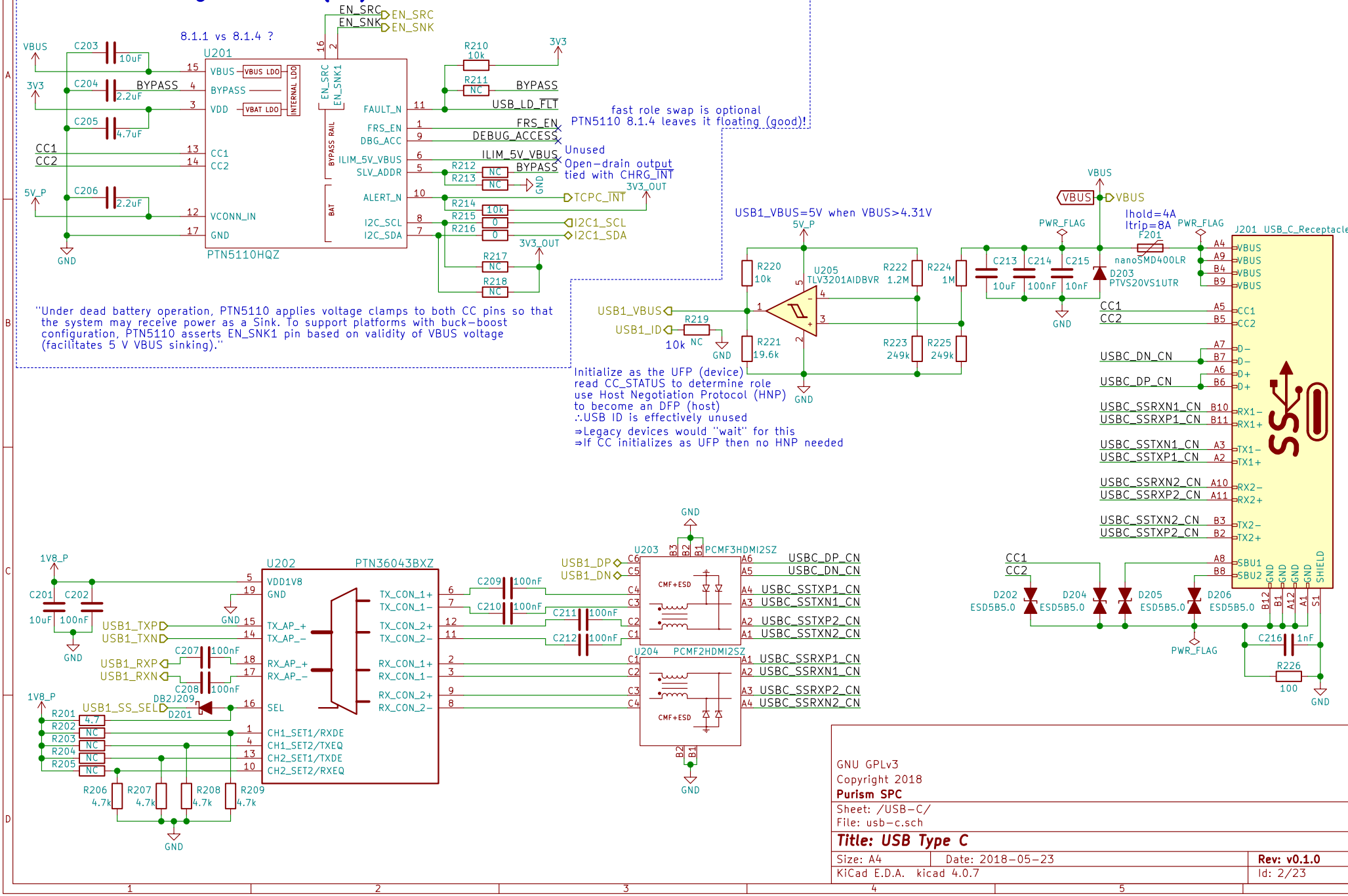

USB-C
VBUS
USB1_VBUS
USB1_ID
USB1_SS_SEL
USB1_DP
USB1_DN
USB1_TXP
USB1_TXN
USB1_RXP
USB1_RXN
TCPC_INT
I2C1_SDA
I2C1_SCL
EN_SNK
EN_SRC
usb-c.sch
Battery
VBUS
battery.sch
VBAT_REG
I2C1_SDA
I2C1_SCL
TCPC_INT
EN_SRC
EN_SNK
ONOFF
Power
VBAT_REG
5V_SOM
5V_P
3V3
3V3_P
1V8_P
22V4_P
2V8_P
LEDK
PWM
PWR_EN
power.sch
LCD_LEDK
DSI_BL_PWM
PWR_EN
Spare GPIO:
GPIO5_IO03 (was PWM3)
GPIO1_IO05 (was CSI_P2_PWDN)
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_IO05 (was PWM1)
J101A
ENET_TXC
ENET_TD0
ENET_TD1
ENET_TD2
ENET_TD3
ENET_TX_CTL
ENET_RD0
ENET_RD1
ENET_RD2
ENET_RD3
ENET_RX_CTL
ENET_RXC
ENET_MDIO
ENET_MDC
SD2_RST
WIFI_DATA3
WIFI_DATA2
WIFI_DATA1
WIFI_DATA0
WIFI_CLK
uSD_CD_B
WWAN_DISABLE
USB1_SS_SEL
BT_HOST_WAKE
LCD_RESET
CSI_P1_DP3
CSI_P1_DN3
CSI_P1_DP1
CSI_P1_DN1
DSI_P1_DP2
CSI_P1_DN2
CSI_P1_DP0
CSI_P1_DN0
CSI_P1_CKP
CSI_P1_CKN
TCPC_INT
IMX8M-SOM
GND
J101C
HDMI_CEC
BOOT_MODE0
BOOT_MODE1
JTAG_TDI
JTAG_TMS
JTAG_TRST
JTAG_TDO
JTAG_TCK
J102
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
GPIO1_IO13
SAI1_RXD4(GPIO4_IO06)
SAI1_RXD3(GPIO4_IO05)
BTN1
SAI1_RXD2(GPIO4_IO04)
SAI2_TXFS
SAI2_RXD
SAI1_RXD6(GPIO4_IO08)
HDMI_HPD
HDMI_AUXN
HDMI_AUXP
HDMI_TXN2
HDMI_TXP2
HDMI_TXN1
HDMI_TXP1
HDMI_TXN0
HDMI_TXP0
HDMI_CLKN
HDMI_CLKP
SAI5_TX_BCLK
SAI5_TX_SYNC
ENET_INT
CAPTOUCH_INT
CLKO_25MHz
SAI2_TXC
USB2_DN
USB2_DP
USB1_RXN
USB1_RXP
USB1_TXN
USB1_TXP
USB1_DN
USB1_DP
CLKO2
SAI2_MCLK
Boot Config
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
SW_BACK
SAI6_TXD0
SAI6_TXFS/RXFS
SW_HOME
SAI6_TXC/RXC
SAI6_RXD0
BOOT_MODE0
BOOT_MODE1
boot.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
uSD_DATA1
uSD_DATA0
uSD_CMD
uSD_DATA3
uSD_DATA2
uSD_CLK
uSD_CD
sd.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
CAPTOUCH_RST
GPIO3_IO25
CSI_P1_DP0
CSI_P1_DN0
CSI_P1_DP1
CSI_P1_DN1
CSI_P1_DP2
CSI_P1_DN2
CSI_P1_DP3
CSI_P1_DN3
CSI_P1_CKP
CSI_P1_CKN
CLKO2
CSI_RST
CSI_PWDN
I2C1_SDA
I2C1_SCL
mipi.sch
Buttons & LED
SW_BACK
SW_VOLDN
SW_VOLUP
SW_HOME
ONOFF
SYS_RST
GP_LED1
SAI1_RXD4(GPIO4_IO06)
BTN1
BTN2
SAI1_TXD1(GPIO4_IO13)
ONOFF
SYS_RST
GPIO1_IO13
buttons_led.sch
WWAN_M.2
WoWWAN
W_DISABLE1
RESET
UART_TX/LED
UART_RX/DPR
USB_D+
USB_D-
PCM_CLK/I2S_SCK
PCM_SYNC/I2S_FSC
PCM_IN/I2S_IN
PCM_OUT/I2S_OUT
GPIO3_IO08
WWAN_DISABLE
GPIO3_IO04
GPIO3_IO09
UART3_RXD
UART3_TXD
USB_WWAN_DP
USB_WWAN_DM
SAI1_TXD4(GPIO4_IO16)
SAI1_RXD6(GPIO4_IO08)
SAI1_RXD5(GPIO4_IO07)
SAI1_TXD5(GPIO4_IO17)
SAI6_TXC/RXC
SAI6_TXFS/RXFS
SAI6_TXD0
SAI6_RXD0
wwan_m2.sch
Audio
HP_DET
MIC_SEL
SAI2_RXD
SAI2_TXD
SAI2_TXFS
SAI2_TXC
SAI2_MCLK
GPIO3_IO20
GPIO5_IO05 (was PWM1)
audio.sch
WLAN+BT M.2
USB_WLAN_DP
USB_WLAN_DM
BT_UART_TXD
BT_UART_RXD
BT_UART_RTS
BT_UART_CTS
BT_HOST_WAKE
WIFI_DISABLE
BT_DISABLE
WIFI_CLK
WIFI_CMD
WIFI_DATA0
WIFI_DATA1
WIFI_DATA2
WIFI_DATA3
WIFI_RST
WIFI_WAKE
I2C2_SDA
I2C2_SCL
BT_PCM_SYNC
BT_PCM_CLK
BT_PCM_IN
BT_PCM_OUT
UART4_TXD
UART4_RXD
UART4_RTS
UART4_CTS
SAI5_TX_BCLK
SAI5_TX_SYNC
SAI5_RXD
SAI5_TXD
wifi_bt_m2.sch
USB Hub + SDIO Bridge
USB2_DP
USB2_DN
USB2_ID
USB_WWAN_DP
USB_WWAN_DM
USB_WLAN_DP
USB_WLAN_DM
SMARTCARD_DP
SMARTCARD_DM
SDCD
uSD_CD
uSD_CLK
uSD_CMD
uSD_DATA0
uSD_DATA1
uSD_DATA2
uSD_DATA3
SRST
SD2_RST
usb_hub_sdio.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
Sensors
I2C1_SDA
I2C1_SCL
PROX_INT
IMU_INT
GPIO1_IO12 (was IR_CAP)
GPIO3_IO19 (was LED1)
sensors.sch
SPI Flash
SCLK
MOSI
MISO
CS
ECSPI1_SCLK
ECSPI1_MOSI
ECSPI1_MISO
ECSPI1_SS0
flash.sch
Smart Card
SMARTCARD_DP
SMARTCARD_DM
smartcard.sch
Haptic Motor
HAPTIC
haptic.sch
J101B
WIFI_DISABLE
GPIO3_IO09
GPIO3_IO08
PWR_FLAG_3V3_OUT
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
C102
C103
22uF
22uF
100nF
C104
C105
C106
100nF
22uF
22uF
3V3_OUT
R101
2.2k
R102
2.2k
R105
10k
R106
10k
5V_P
R103
10k
R104
19.6k
SAI2_TXD
HAPTIC
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_MISO
UART4_CTS
UART3_RXD
ECSPI1_MOSI
UART4_RTS
UART1_TXD
USB2_VBUS
USB2_ID
USB1_VBUS
USB1_ID
MIC_SEL
UART4_TXD
ECSPI1_SCLK
ECSPI1_SS0
UART4_RXD
USB2_DN
USB2_DP
USB1_RXN
USB1_RXP
USB1_TXN
USB1_TXP
USB1_DN
USB1_DP
TODO:
GNSS
MIPI CSI/DSI
GNU GPLv3
Copyright 2018
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

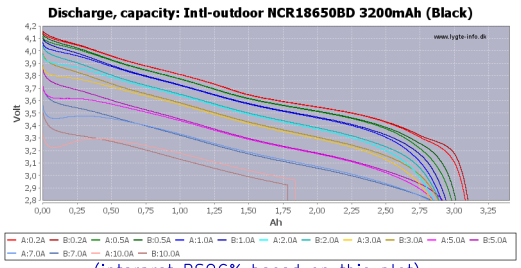
USB-C Config Channel (CC) and PD Role Controller



GNU GPLv3
Copyright 2018
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

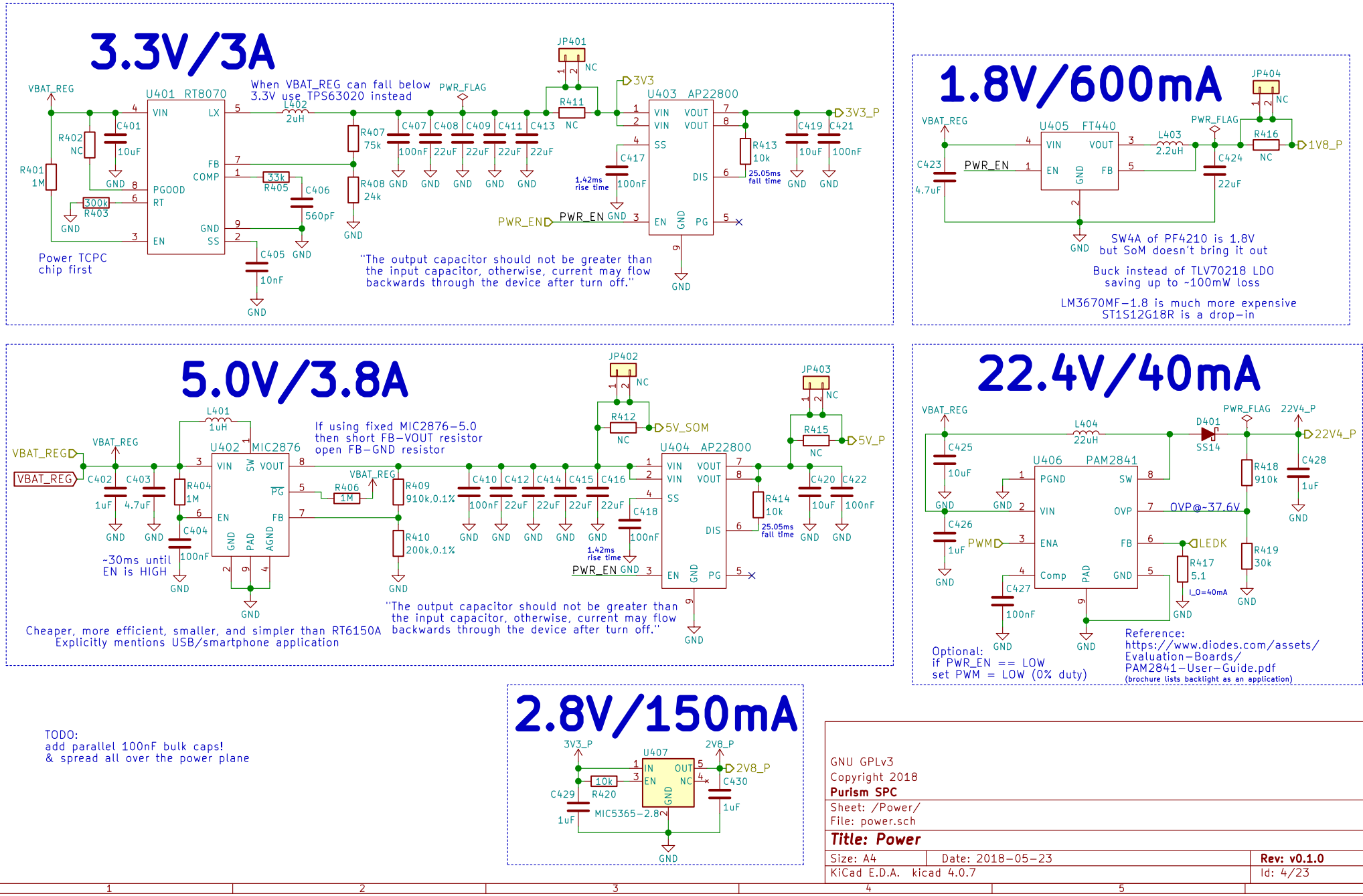
may want to include BQ29705 protection as in:
http://www.ti.com/lit/ug/tiducl1/tiducl1.pdf
schematic: http://www.ti.com/lit/df/tidrp70/tidrp70.pdf
(PTC may be good enough)

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
When VBAT_REG can fall below 3.3V use TPS63020 instead
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
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
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
"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
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
TODO:
add parallel 100nF bulk caps!
& spread all over the power plane
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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

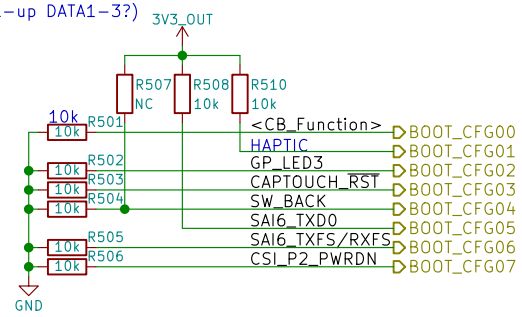
Only eMMC

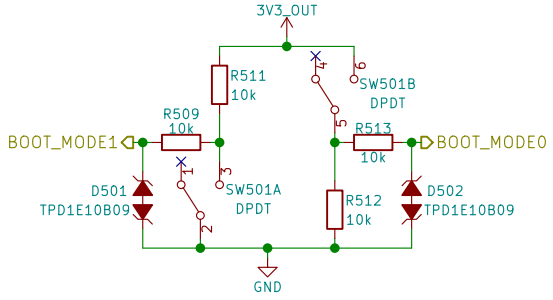
BOOT_CFG[14:12]	Boot device
001	SD/eSD
010	MMC/eMMC
011	NAND

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?)

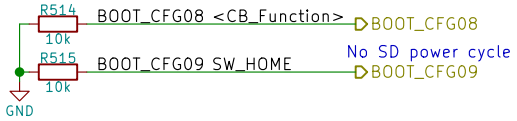
BOOT_CFG05:
1 – 8-bit eMMC bus
0 – 1-bit eMMC bus

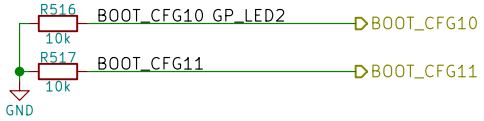


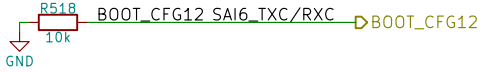


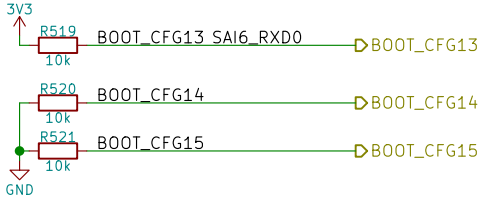
2->1: eMMC
2->3: USB (Serial Downloader)

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





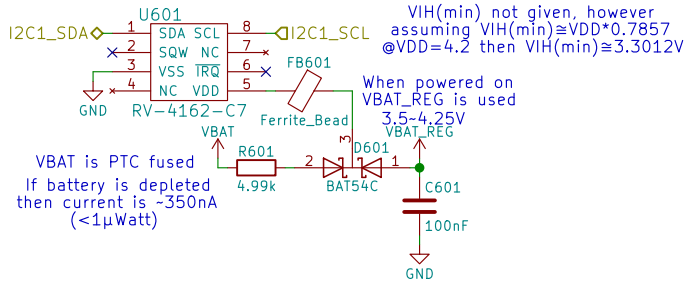




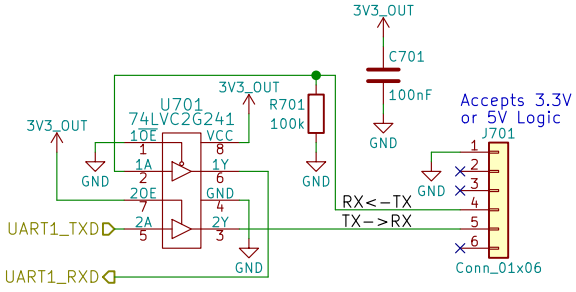
Sheet: /Boot Config/
File: boot.sch

Title: Boot Configuration

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



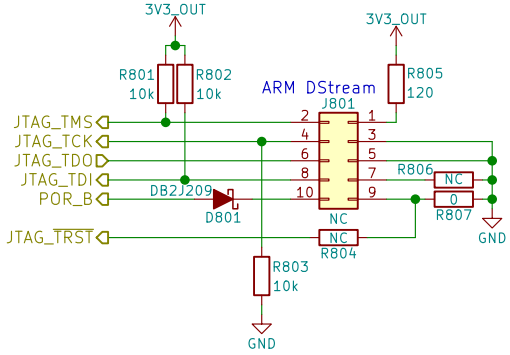
Sheet: /RTC/		
File: rtc.sch		
Title: RTC		
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 6/23



Sheet: /UART Debug/
File: uart.sch

Title: UART Debug

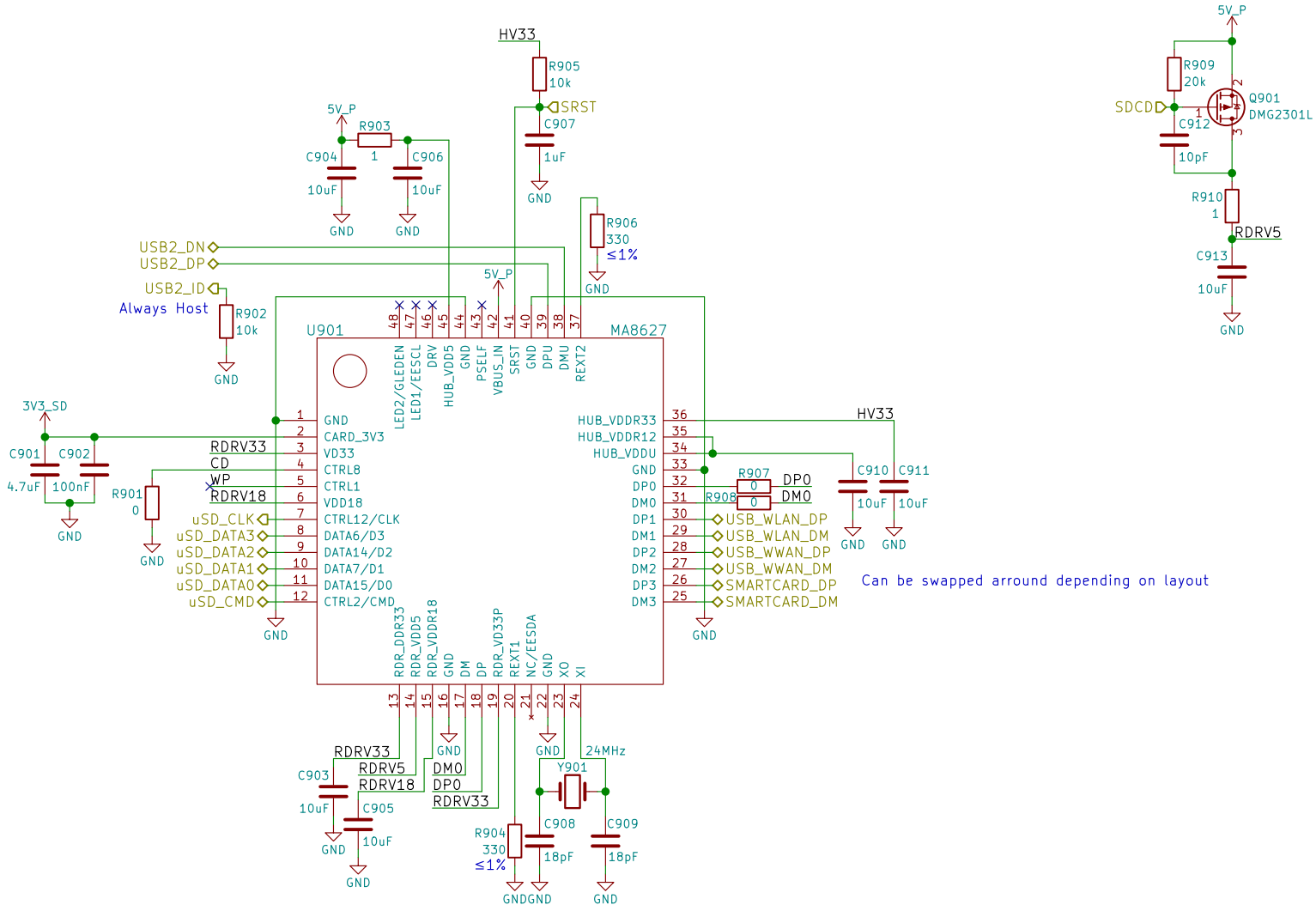
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 7/23



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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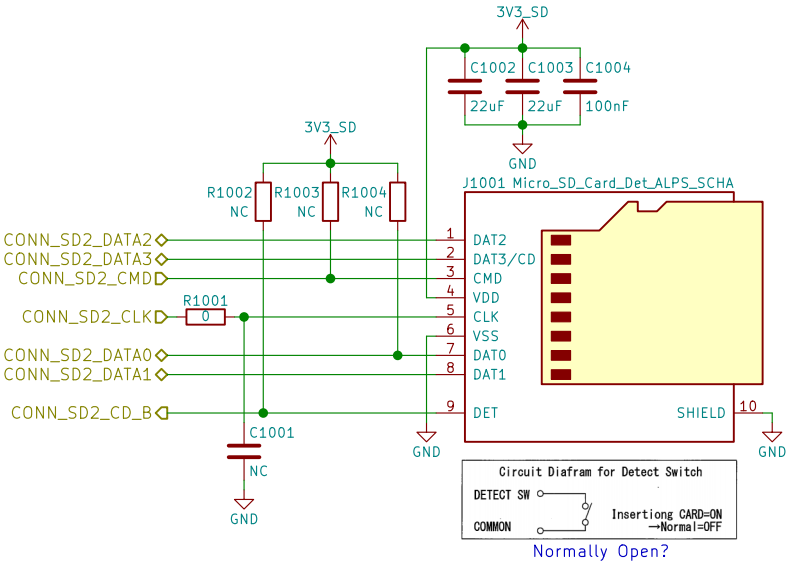
Purism SPC

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

Title:

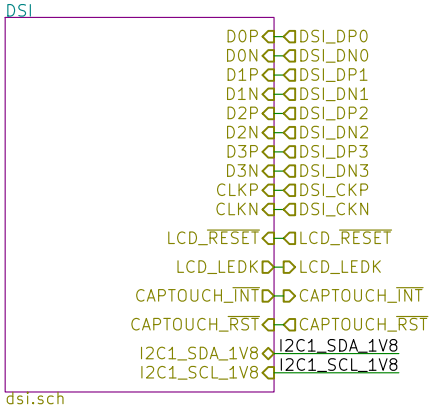
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 9/23

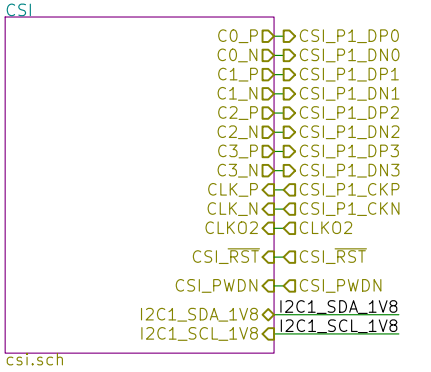


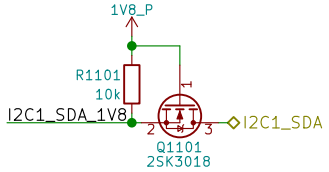
Sheet: /uSD Card/
File: sd.sch

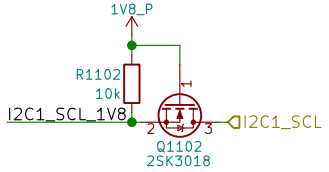
Title: uSD Card

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





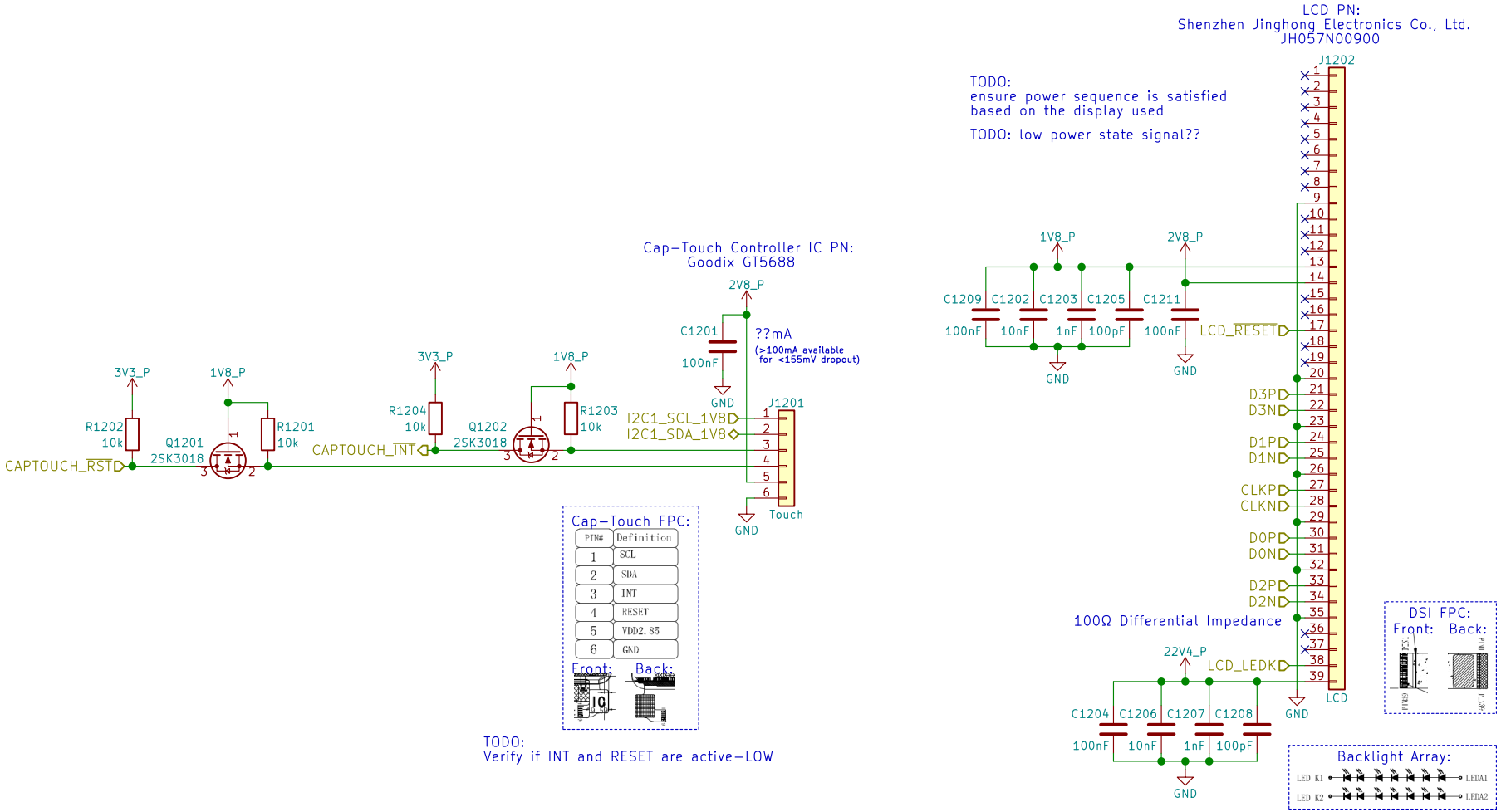




Sheet: /MIPI/
File: mipi.sch

Title:

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



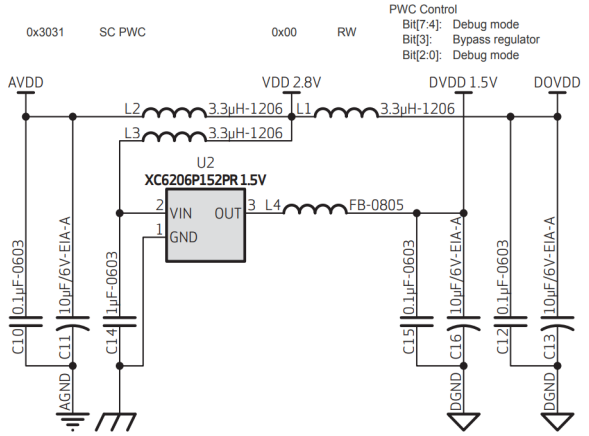
GNU GPLv3
Copyright 2018
Purism SPC

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

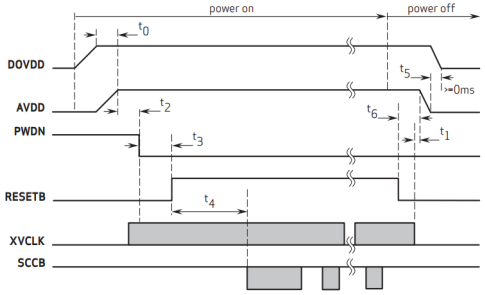
Based on the system power configuration (1.8V or 2.8V for I/O power, using external DVDD or internal DVDD, requiring access to the I2C during power up period or not), the power up sequence will differ. If 1.8V is used for I/O power, using the internal DVDD is preferred. If 2.8V is used for I/O power,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

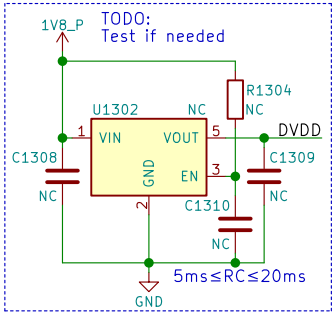
1. when DOVDD and AVDD are turned ON, make sure DOVDD becomes stable before AVDD becomes stable
2. PWDN is active high with an asynchronized design (does not need clock)
3. PWDN pin tied to digital ground if it is not controlled.
4. if PWDN pin is controlled as below, for PWDN to go low, power must first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

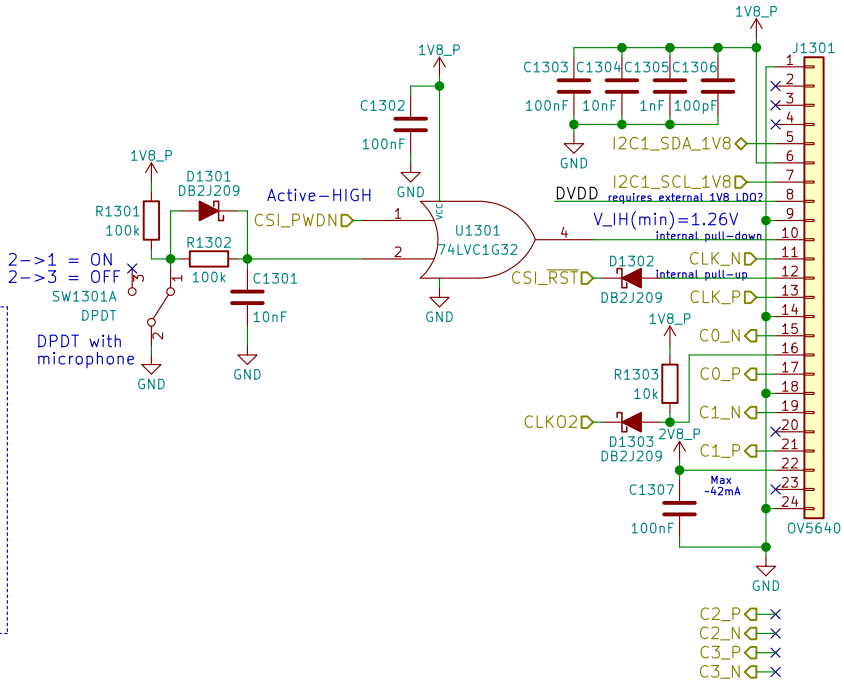
figure 2-3 power up timing with internal DVDD



note
t_0 ≥ 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



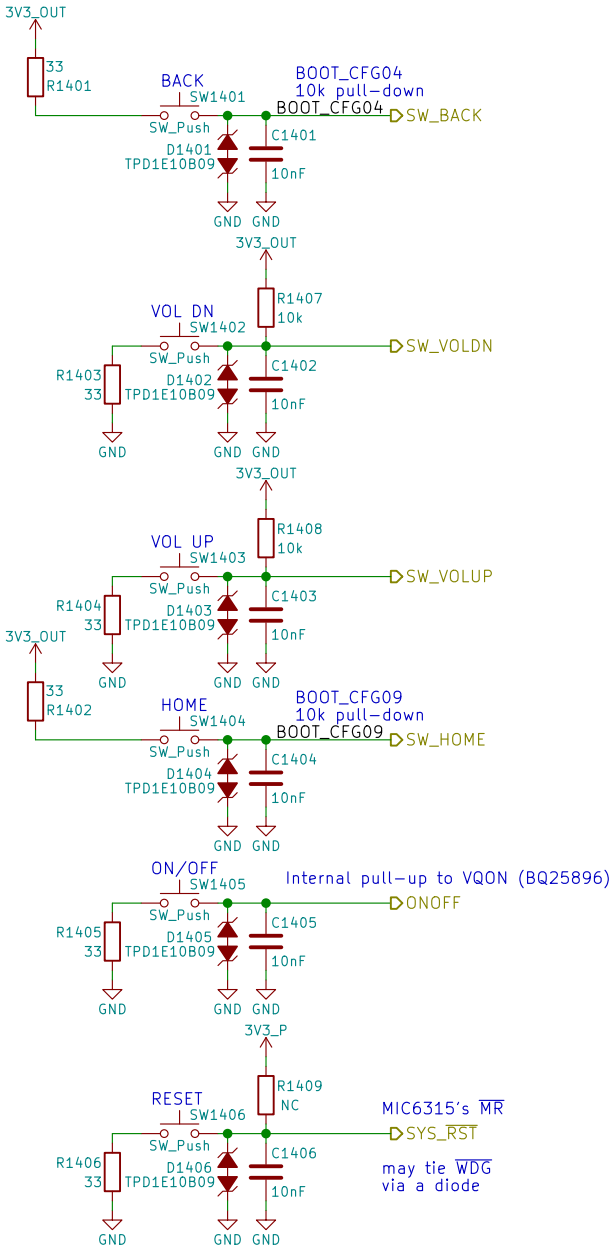


OV5640 CMOS Image Sensor Datasheet:
https://cdn.sparkfun.com/datasheets/Sensors/LightImaging/OV5640_datasheet.pdf

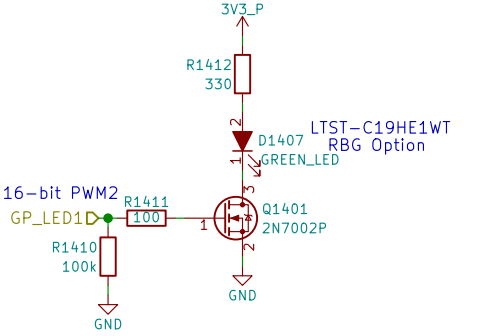
Sheet: /MIPI/CSI/
File: csi.sch

Title:

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



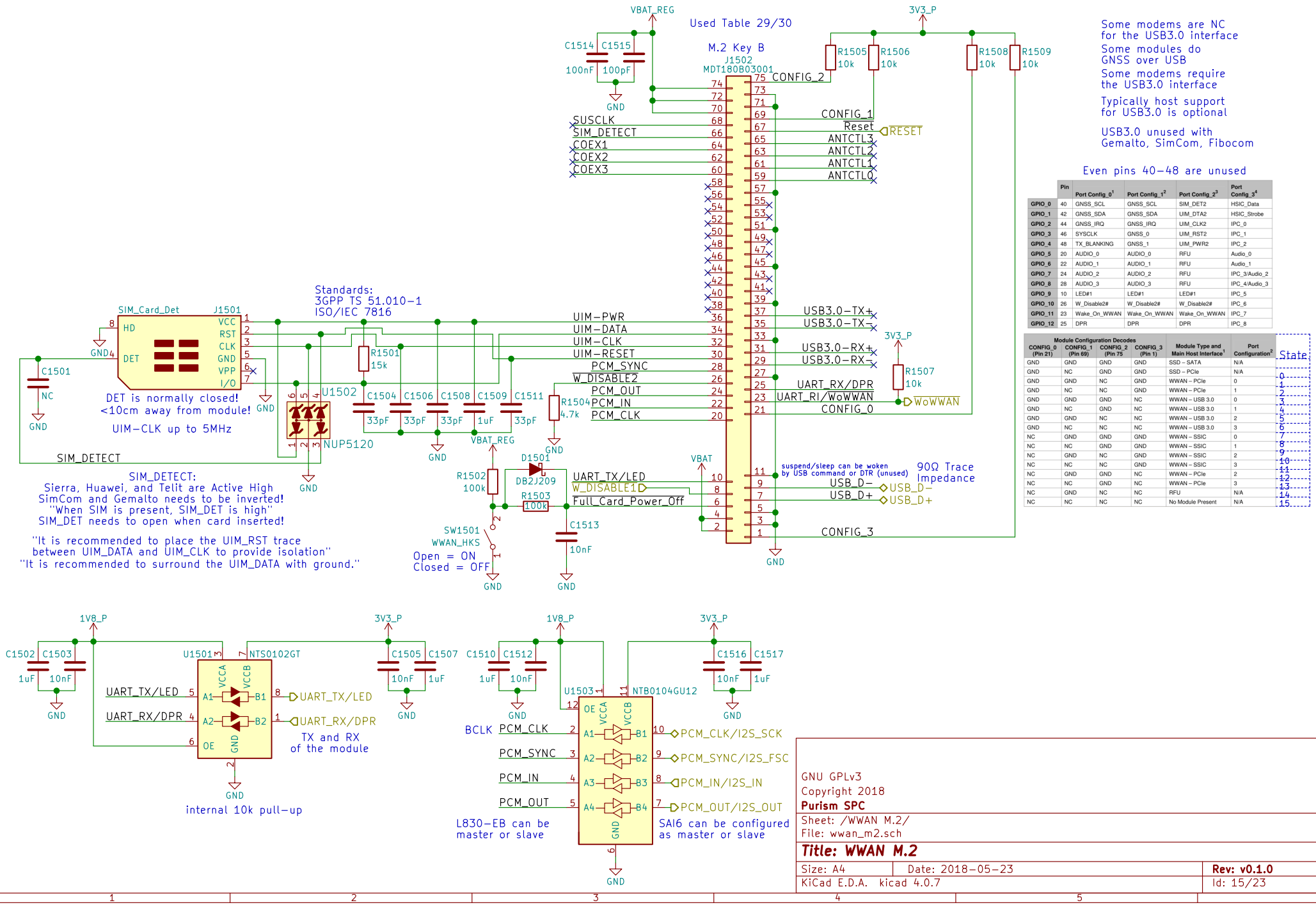
Use PWM2_PWMSAR to set the compare value (duty cycle)
Use PWM2_PWMCR[15:4] to set the PRESCALER (frequency)
Use PWM2_PWMPR to set the top of the counter (frequency)



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

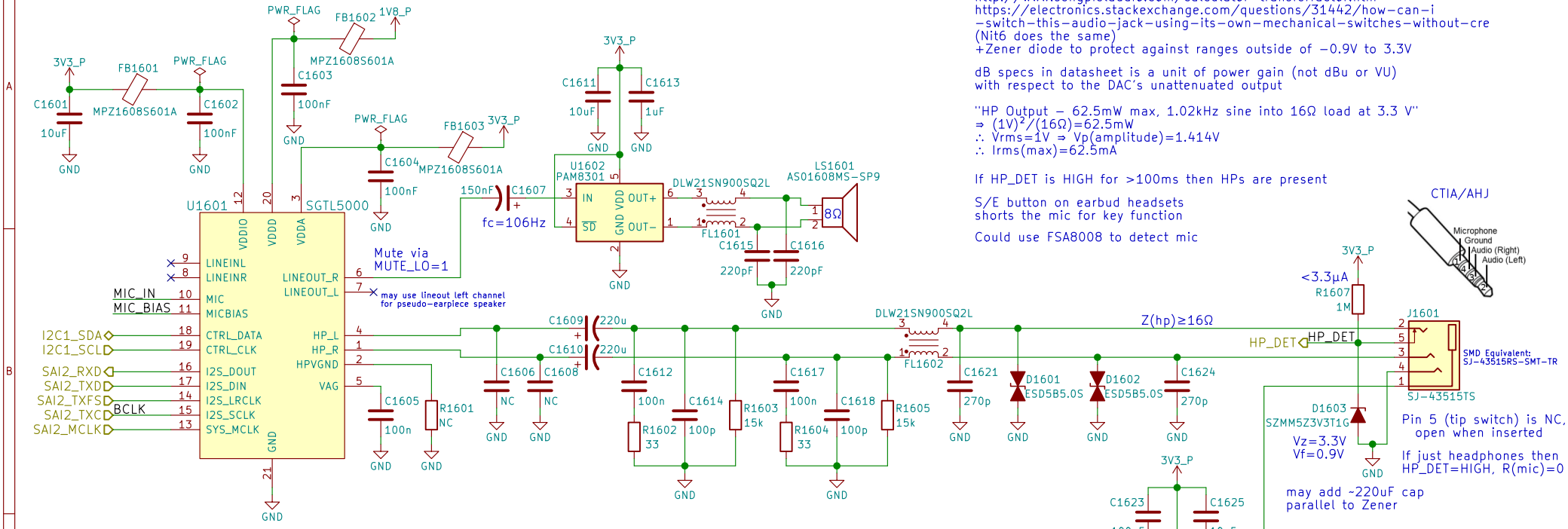
dB specs in datasheet is a unit of power gain (not dBu or VU)
with respect to the DAC's unattenuated output

"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

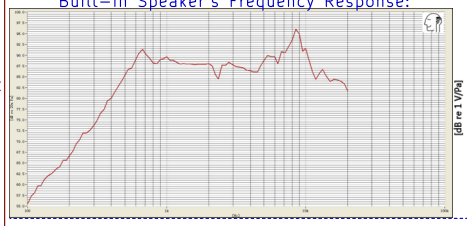
If HP_DET is HIGH for >100ms then HPs are present

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

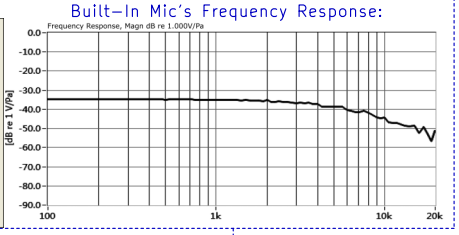
Could use FSA8008 to detect mic



Built-In Speaker's Frequency Response:



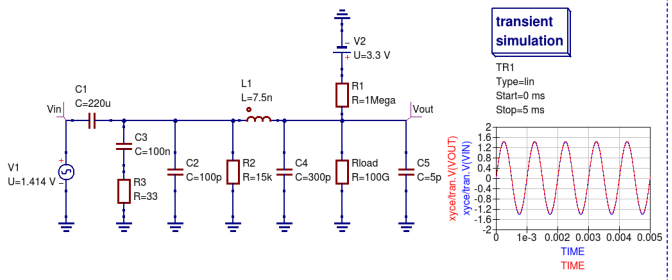
Built-In Mic's Frequency Response:



−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:



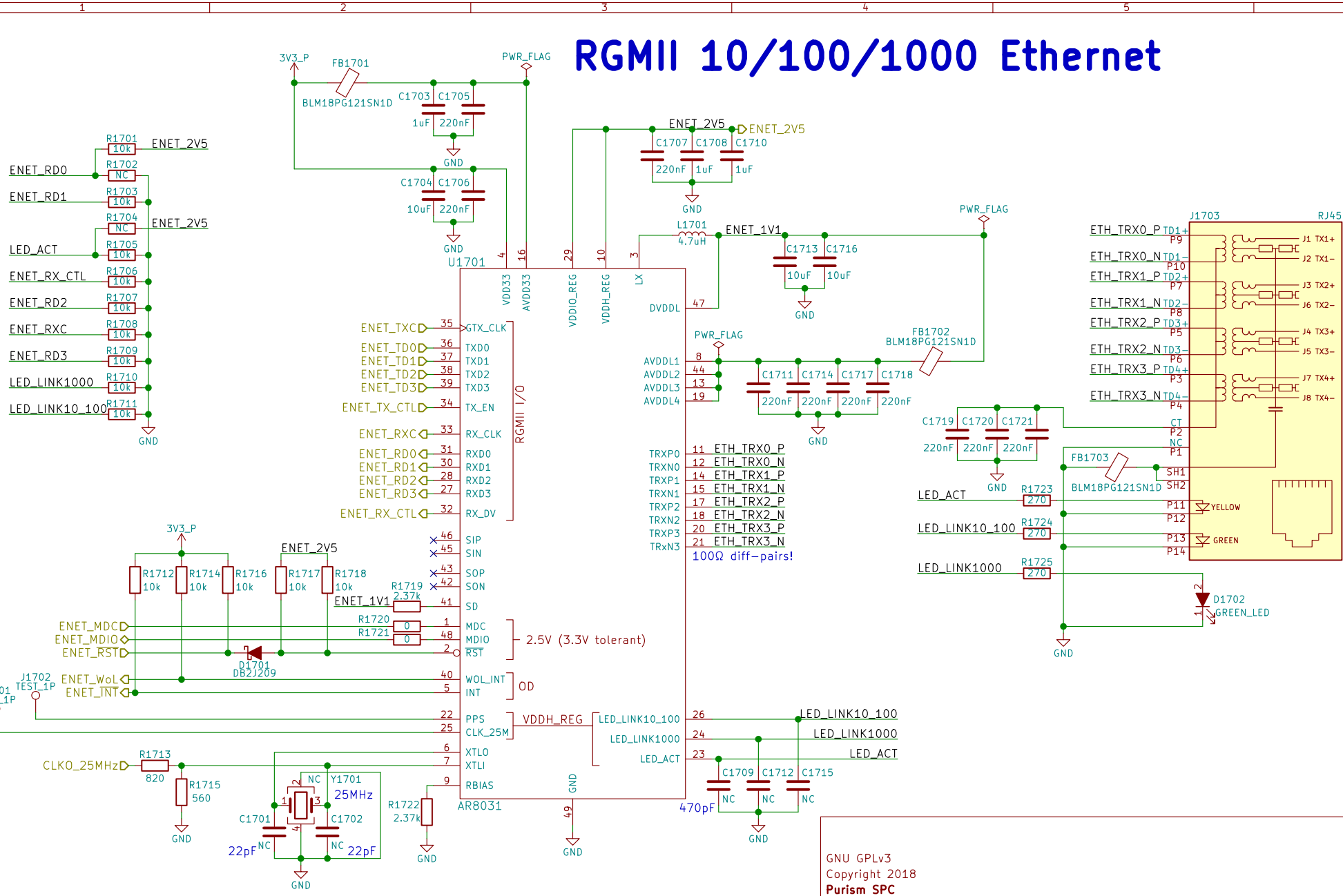
LCR Measurements:

Earbud Microphone:	Headset Speaker:	Earbud Speaker:
@1kHz	@1kHz	@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

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

RS9116 NC:
RTS, CTS, BT_HOST_WAKE

RS9116 datasheet says
no WIFI_WAKE
but the schematic has it

Module: Table 23
Socket: Table 46

RedPine RS9116 MB0
Requires 5V on
Pin 54 for USB!

3V3_P
R1802 NC
JP1801
NC

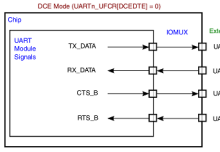
J1801
USB_WLAN_DP
USB_WLAN_DN
WIFI_CLK
WIFI_CMD
WIFI_DATA0
WIFI_DATA1
WIFI_DATA2
WIFI_DATA3
WIFI_WAKE
M2_PCM_CLK
M2_PCM_SYNC
M2_PCM_IN
M2_PCM_OUT
SoC's IN/OUT
BT_HOST_WAKE
BT_UART_RXD
SoC's RX
Module's TX
SoC's TX
Module's RX
BT_UART_TXD
BT_UART_RTS
BT_UART_CTS
i.MX8M in DCE mode (POR state)
has CTS output, RTS input
M.2_Key_E
GND

1V8_P
R1801 100k
D1801 DB2J209
WIFI_RST
VIH=2.31V
D1802 DB2J209
W_DISABLE1

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

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

3V3_P
C1810 100nF
GND

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

RS9116 SUSCLK
is a GPIO (unused)
SUSCLK
R1803 10k

U1803A 74AUP2G08
BT_DISABLE
U1803B 74AUP2G08
WIFI_DISABLE

D1803 DB2J209
R1807 100k
R1805 100k
C1809 10nF
SW1801 WWAN_HKS
Open = ON
Closed = OFF

W_DISABLE2
W_DISABLE1
M2_I2C_SDA
M2_I2C_SCL

1V8_P
R1804 10k
M2_I2C_SDA
Q1801 2SK3018
I2C2_SDA

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

R1806 10k
M2_I2C_SCL
Q1802 2SK3018
I2C2_SCL

1V8_P
3V3_P
C1801 1uF
C1802 10nF
C1803 10nF
C1804 1uF
U1801 NTB0104GU12
OE
VCCA
VCCB
GND
BT_UART_RXD
BT_UART_TXD
BT_UART_RTS
BT_UART_CTS
A1 A2 A3 A4
B1 B2 B3 B4
BT_UART_RXD
BT_UART_TXD
BT_UART_RTS
BT_UART_CTS
RX, TX, RTS, CTS
of the SoC
internal 10k pull-up

C1805 1uF
C1806 10nF
C1807 10nF
C1808 1uF
U1802 NTB0104GU12
BCLK
M2_PCM_CLK
M2_PCM_SYNC
M2_PCM_IN
M2_PCM_OUT
BT_PCM_CLK
BT_PCM_SYNC
BT_PCM_IN
BT_PCM_OUT
configure as slave
IN, OUT
of the SoC

GNU GPLv3
Copyright 2018
Purism SPC

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

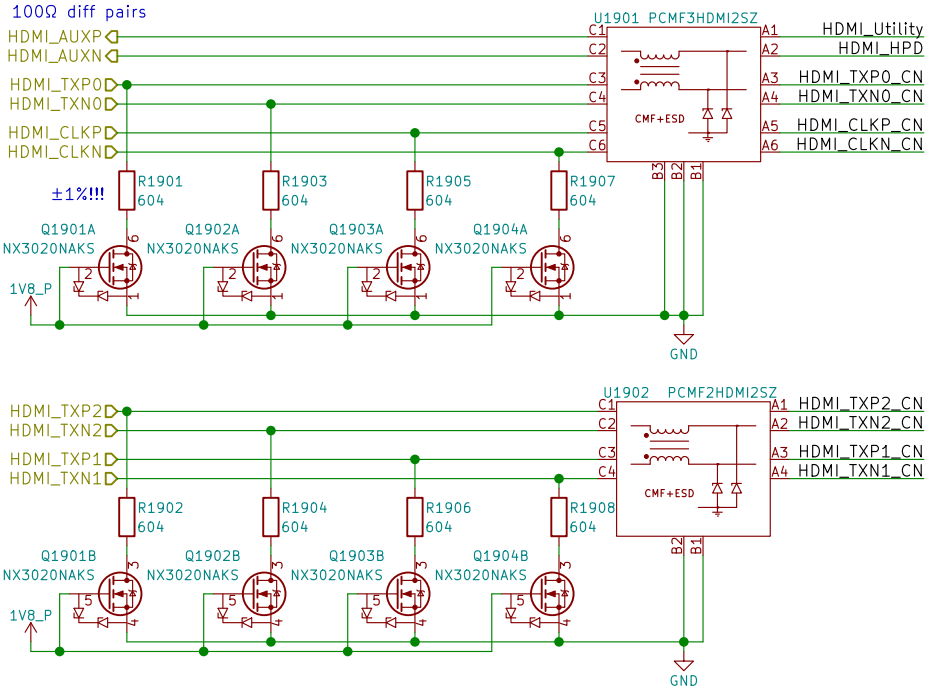
Title: WLAN+BT M.2

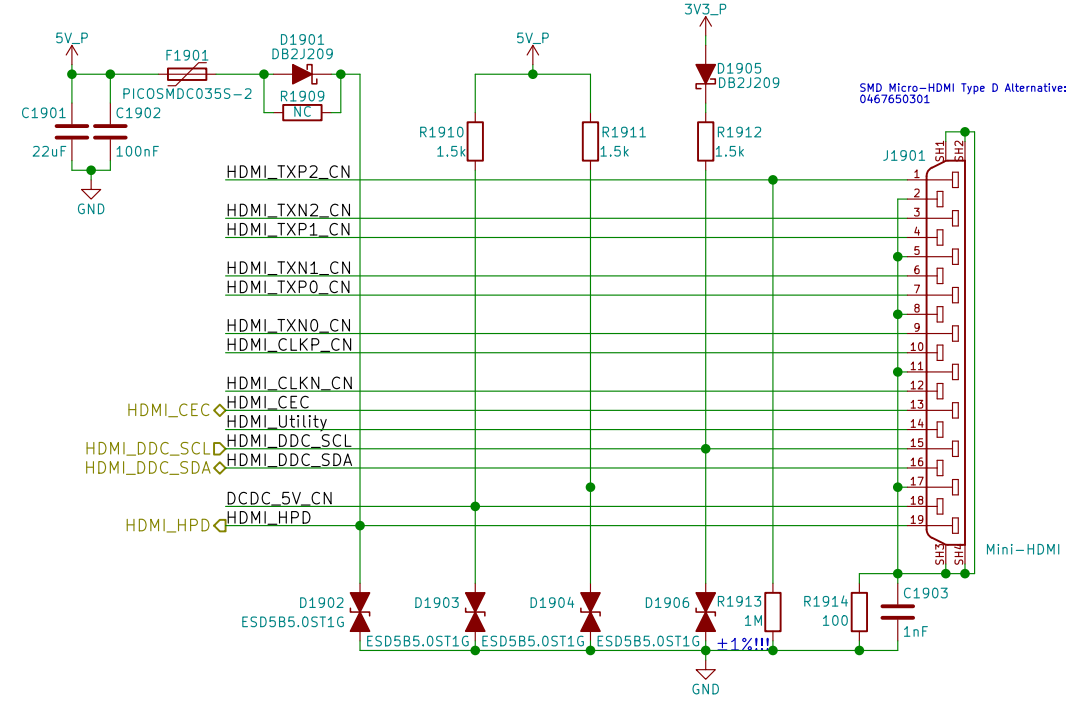
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 18/23

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



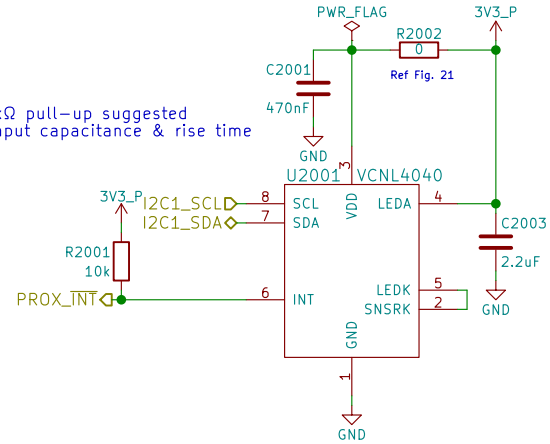


Sheet: /HDMI/
File: hdmi.sch

Title: HDMI

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

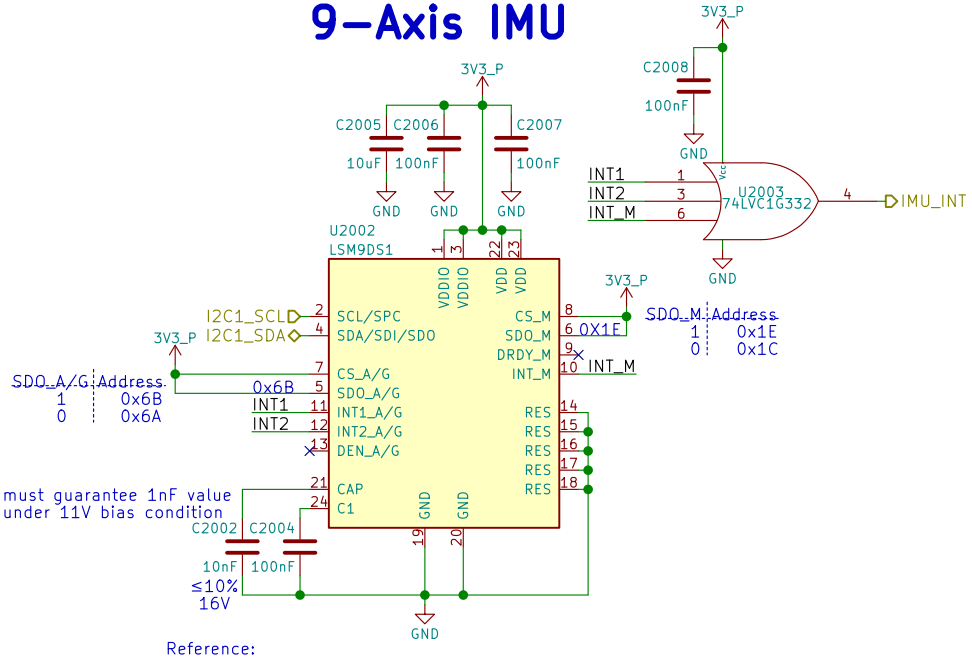
Proximity & Ambient Light



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

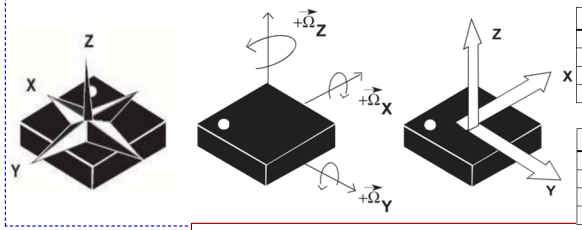


Table 19. Accelerometer and gyroscope SAD+Read/Write patterns

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)

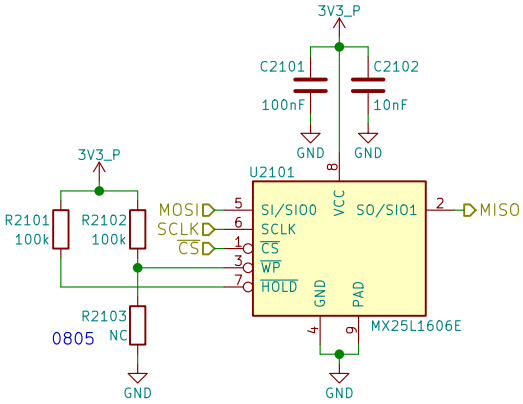
Table 20. Magnetic sensor SAD+Read/Write patterns

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

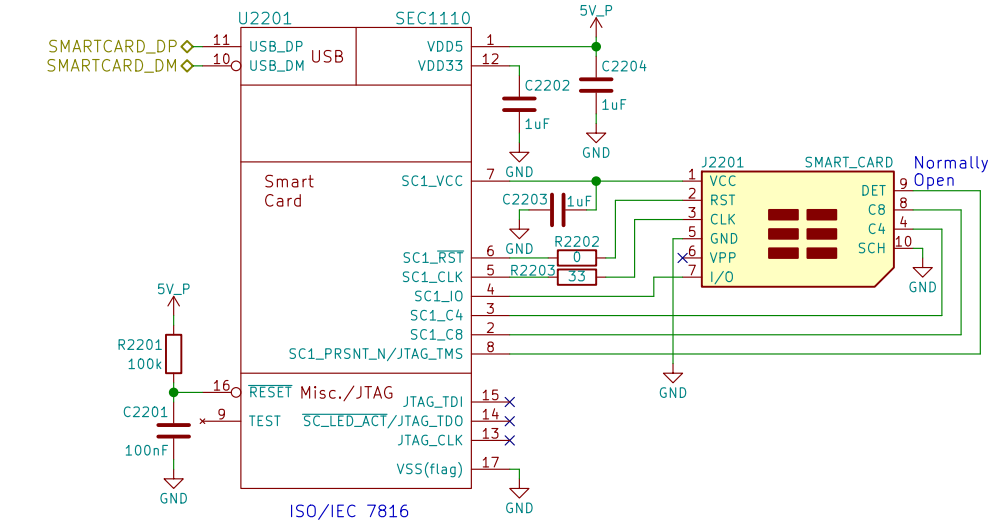
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 20/23



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

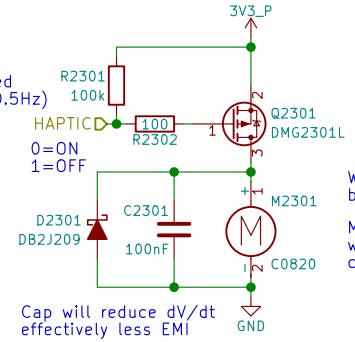
Title: Smart Card

Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 22/23

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