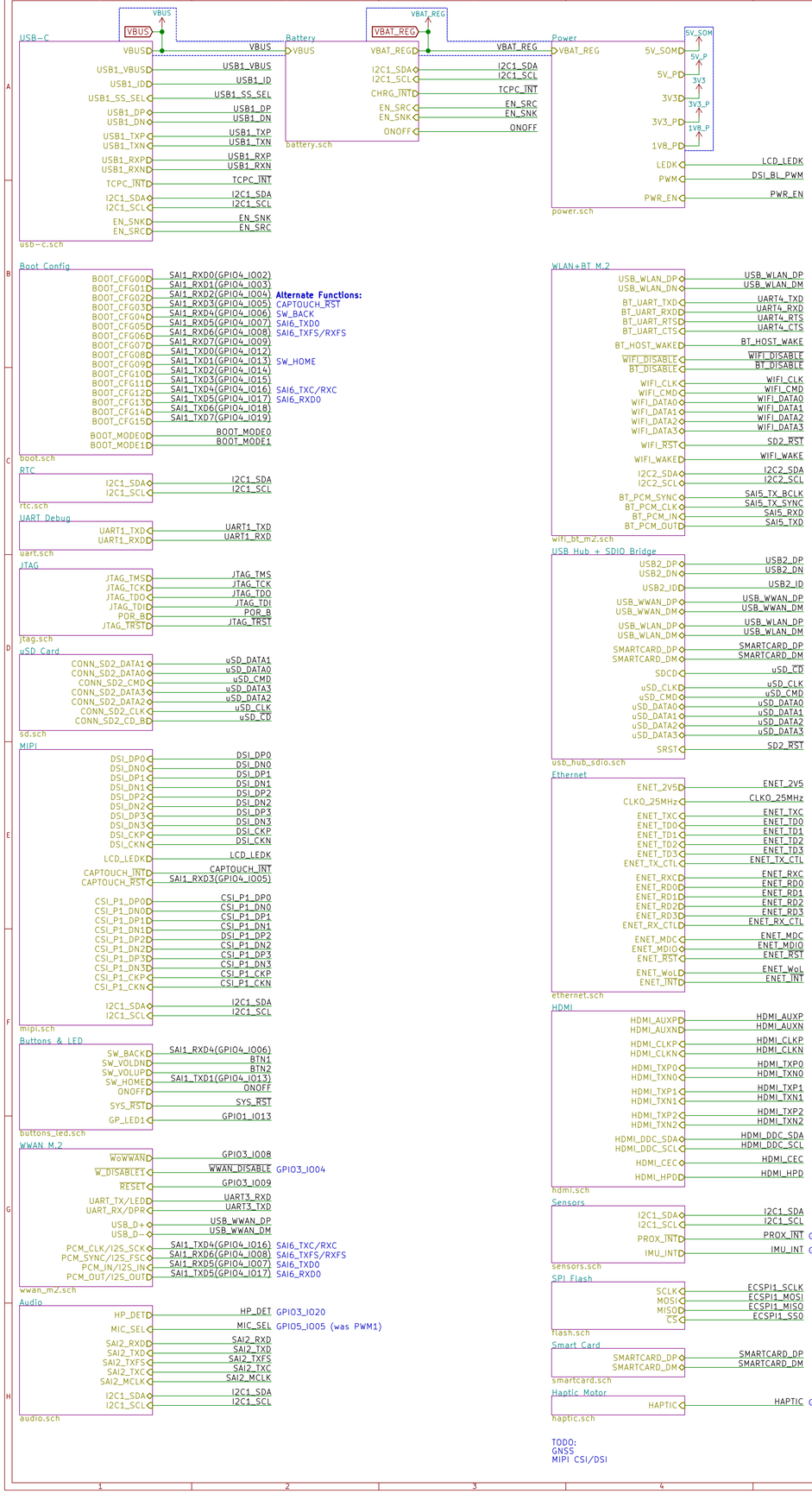
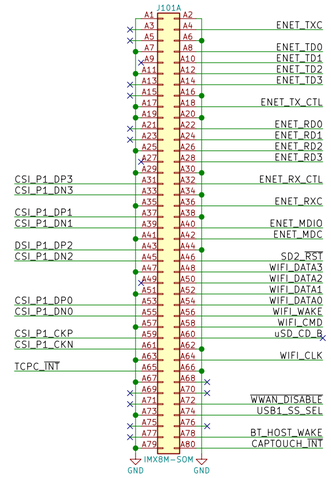
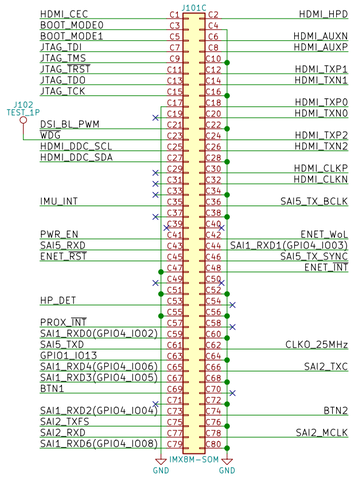
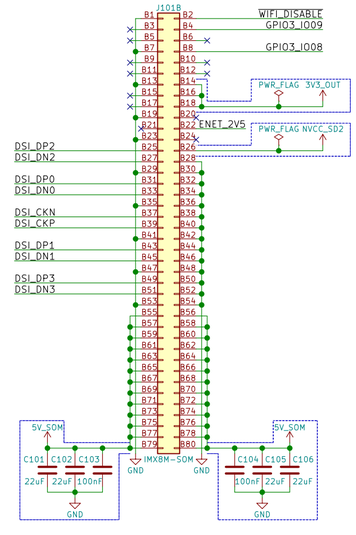


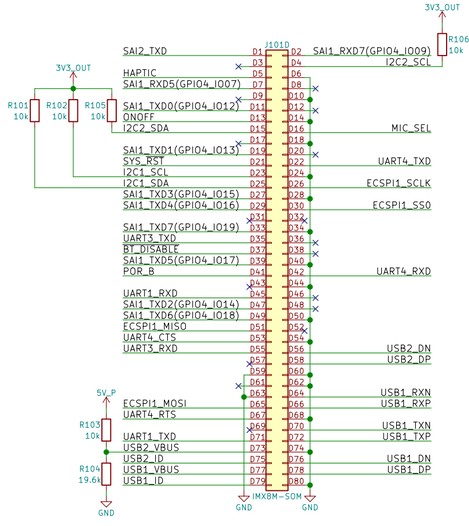
Spare GPIO:
GPIO5_IO03 (was PWM3)
GPIO3_IO25

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)









TODO:
GNSS
MIPI CSI/DSI

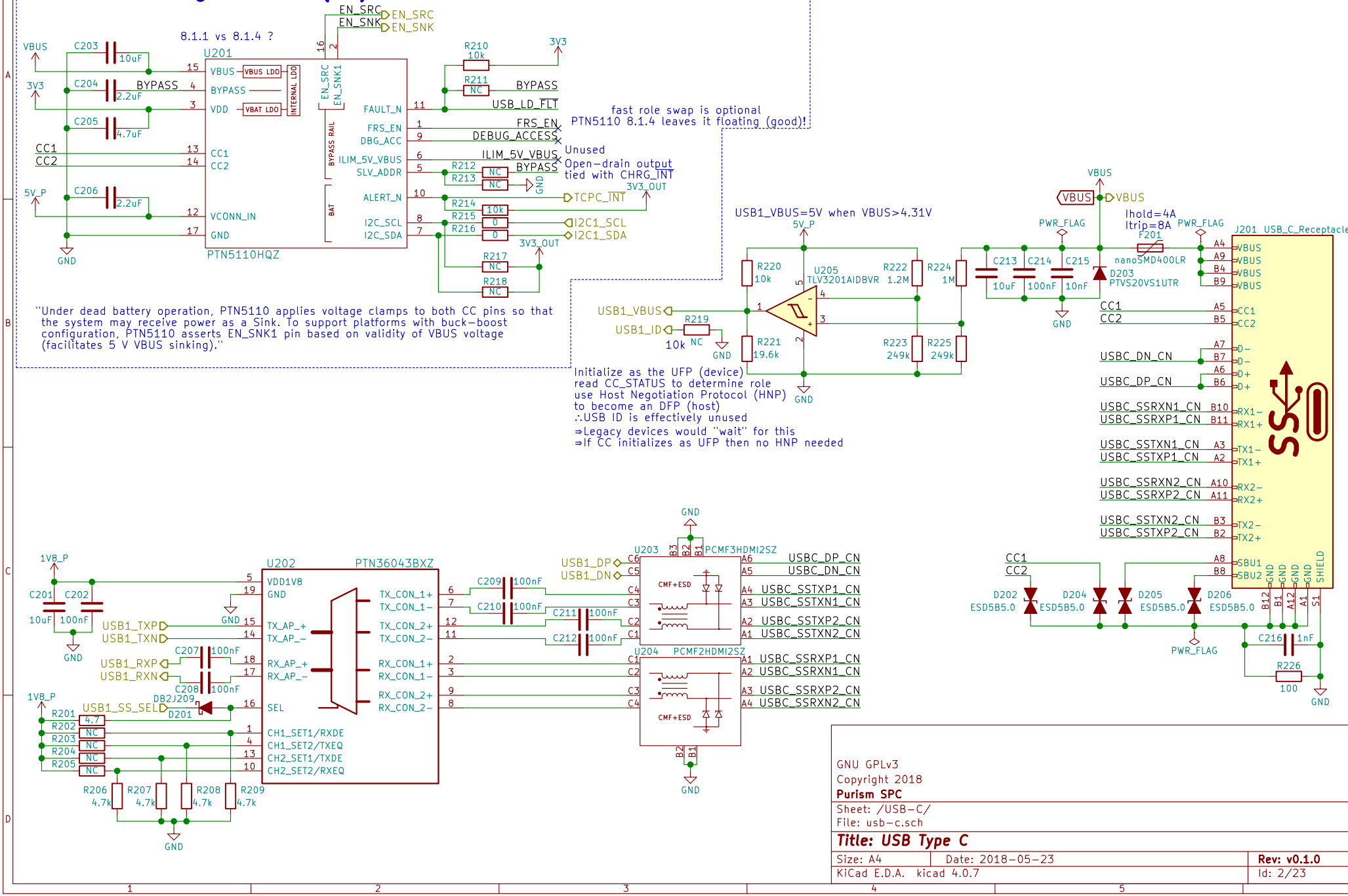
Purism SPC

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

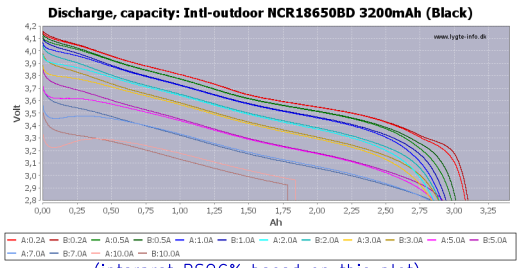
USB-C Config Channel (CC) and PD Role Controller



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

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

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???

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)

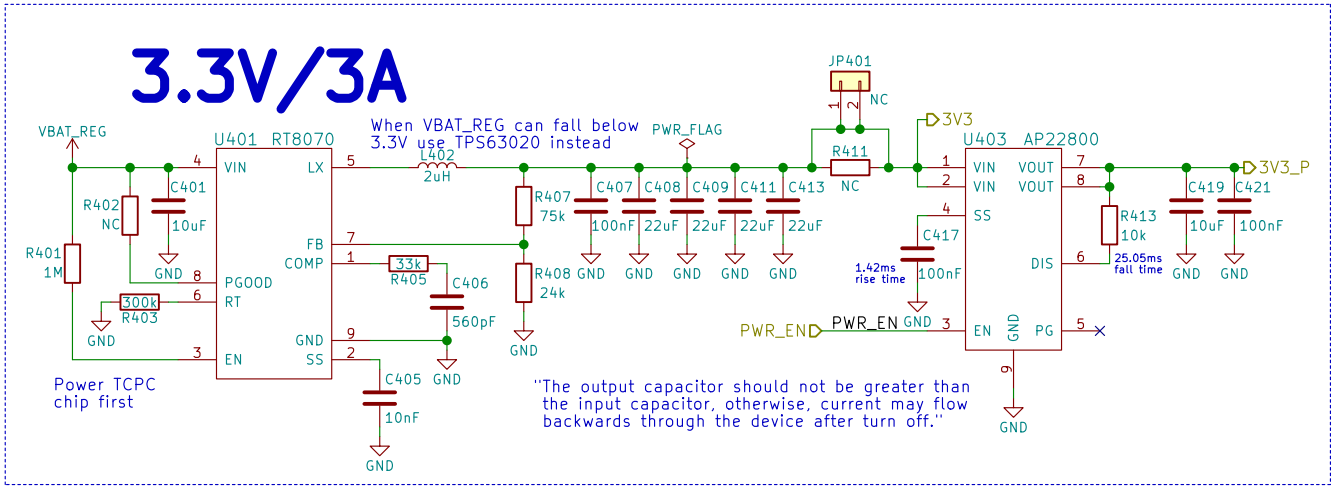
BC1.2 is not mandated by PD spec
ICO used to determine max current
Also negotiated from CC pins (I2C)

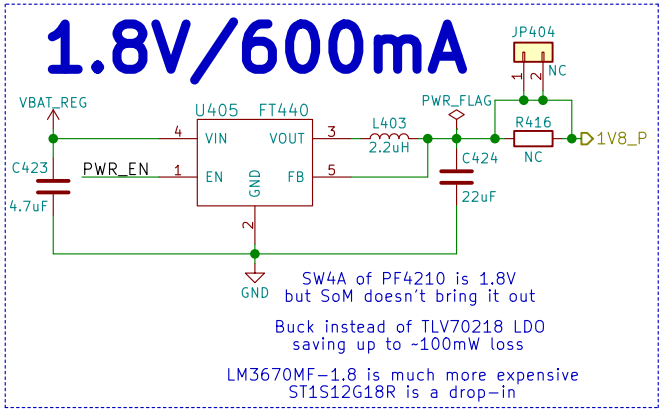
Battery holder gives ~1mm clearance underneath the battery
Thermistor is 1.1±0.15mm thick, should fit fine with stack-up

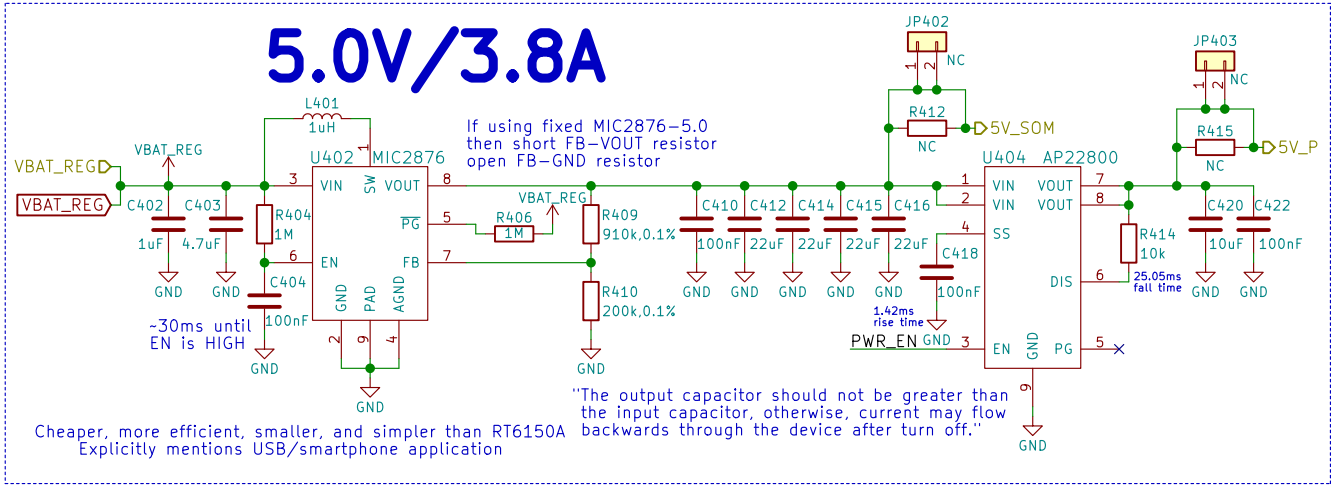
Battery holder seems to fit up to ~68.88mm long batteries
need to test 18650 protected cells which are ~69.35mm long

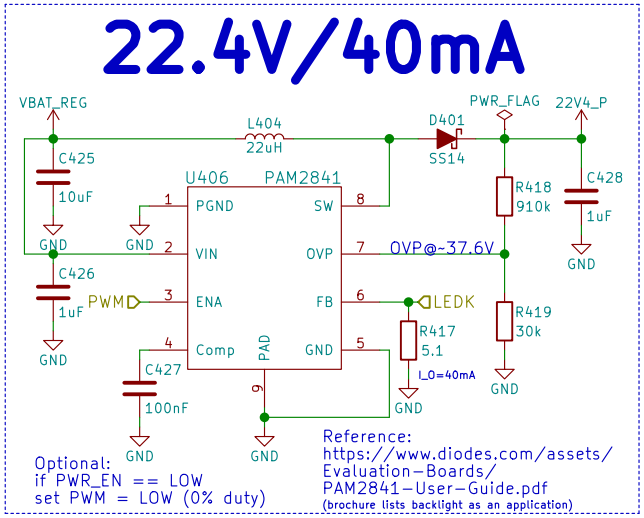
VBAT(DPL)=2.15~2.5V

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









TODO:
add parallel 100nF bulk caps!
& spread all over the power plane

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

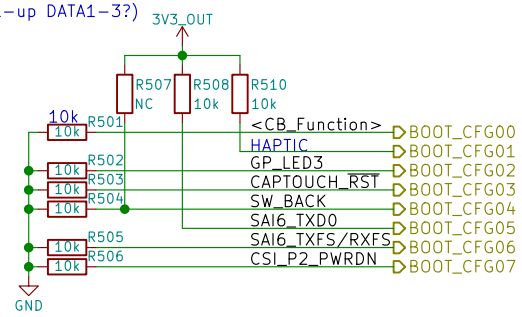
Only eMMC

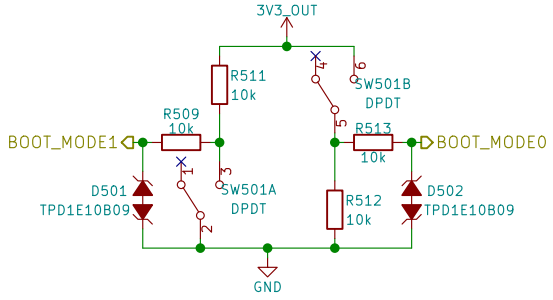
BOOT_CFG[14:12]	Boot device
001	SD/eSD
010	MMC/eMMC
011	NAND

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?)

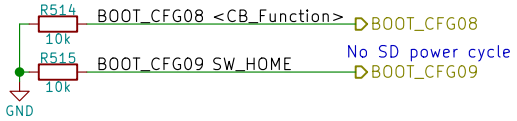
BOOT_CFG05:
1 – 8-bit eMMC bus
0 – 1-bit eMMC bus

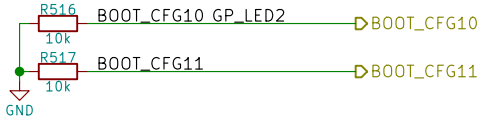


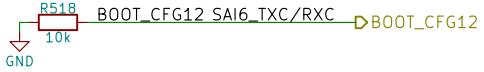


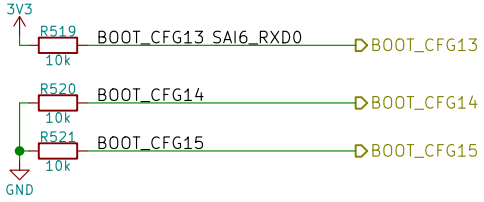
2->1: eMMC
2->3: USB (Serial Downloader)

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





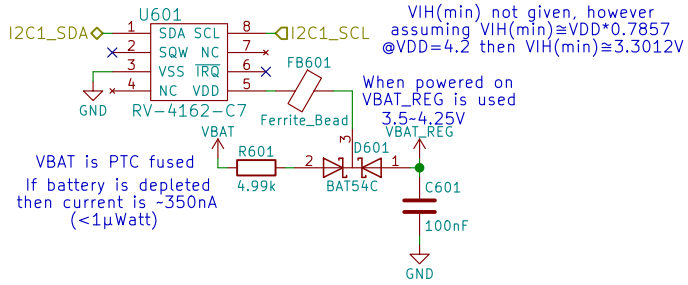




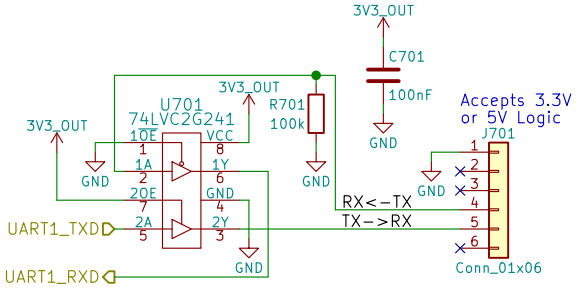
Sheet: /Boot Config/
File: boot.sch

Title: Boot Configuration

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



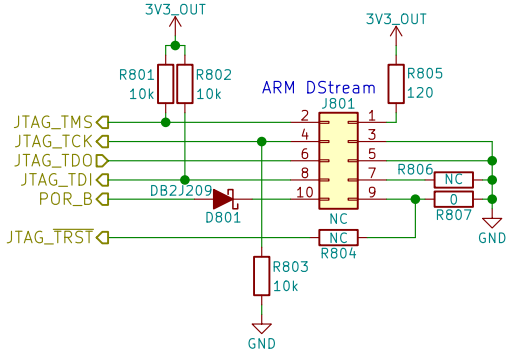
Sheet: /RTC/		
File: rtc.sch		
Title: RTC		
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 6/23



Sheet: /UART Debug/
File: uart.sch

Title: UART Debug

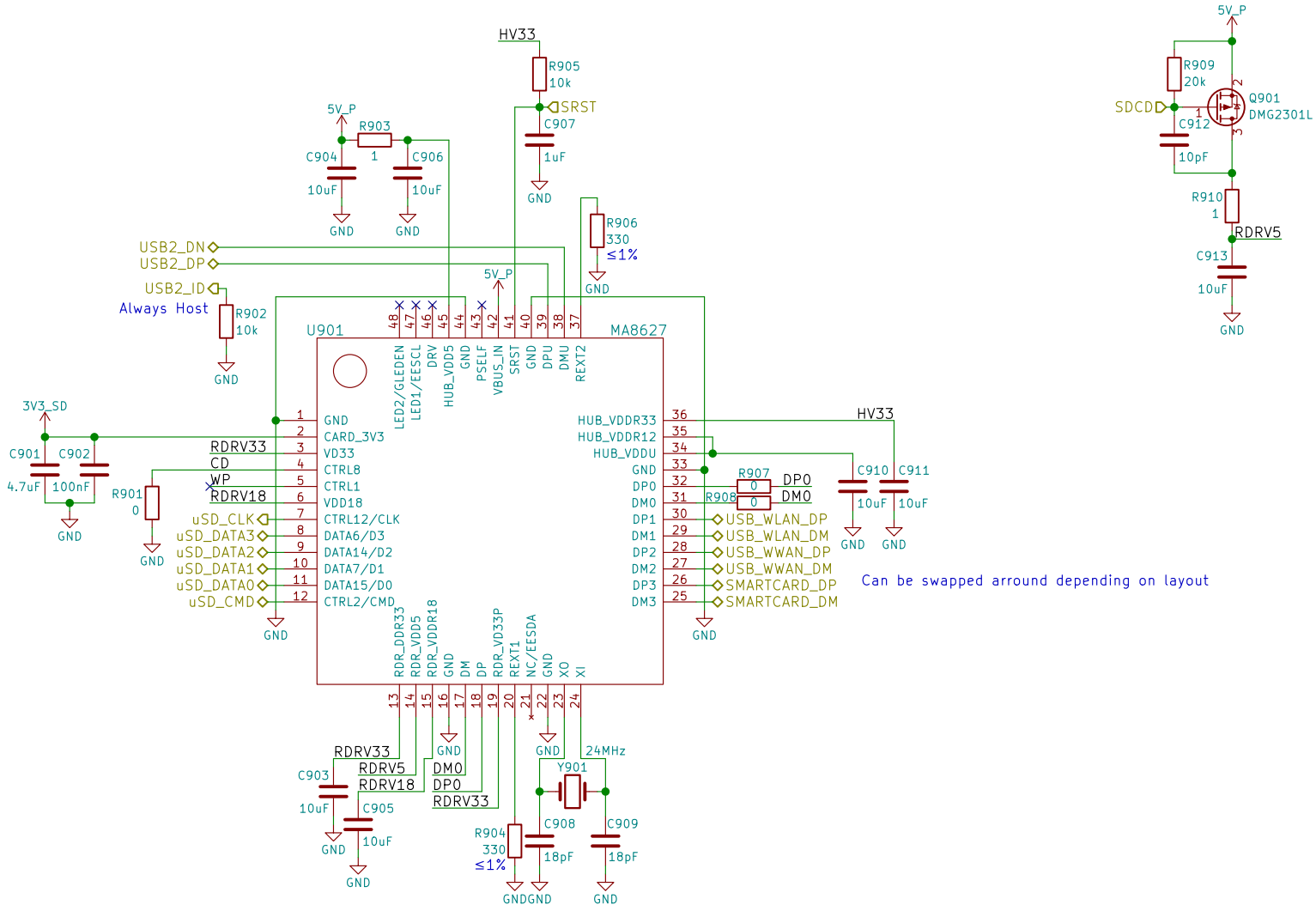
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 7/23



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

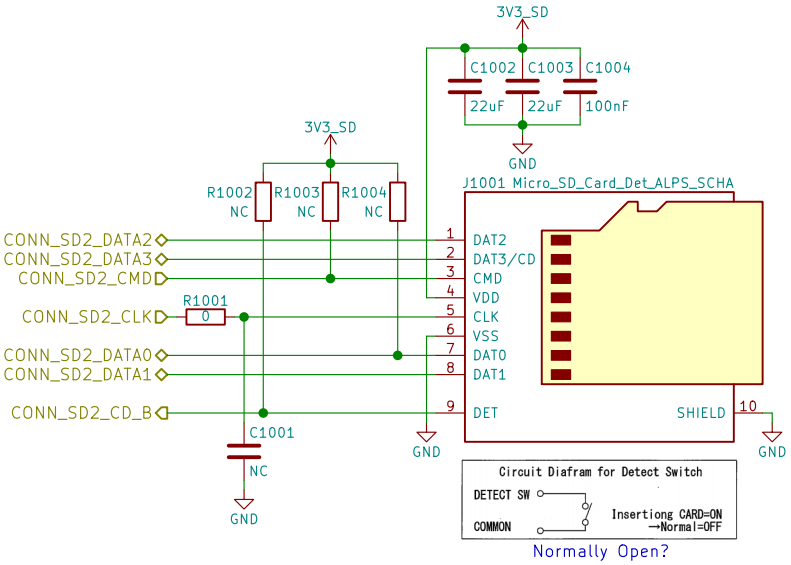


GNU GPLv3
Copyright 2018
Purism SPC

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

Title:

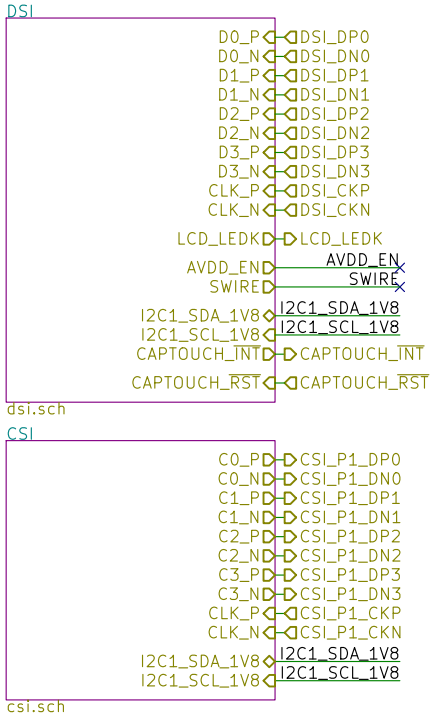
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 9/23

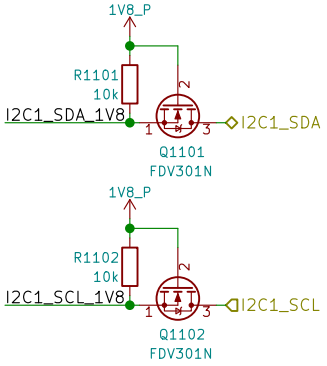


Sheet: /uSD Card/
File: sd.sch

Title: uSD Card

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



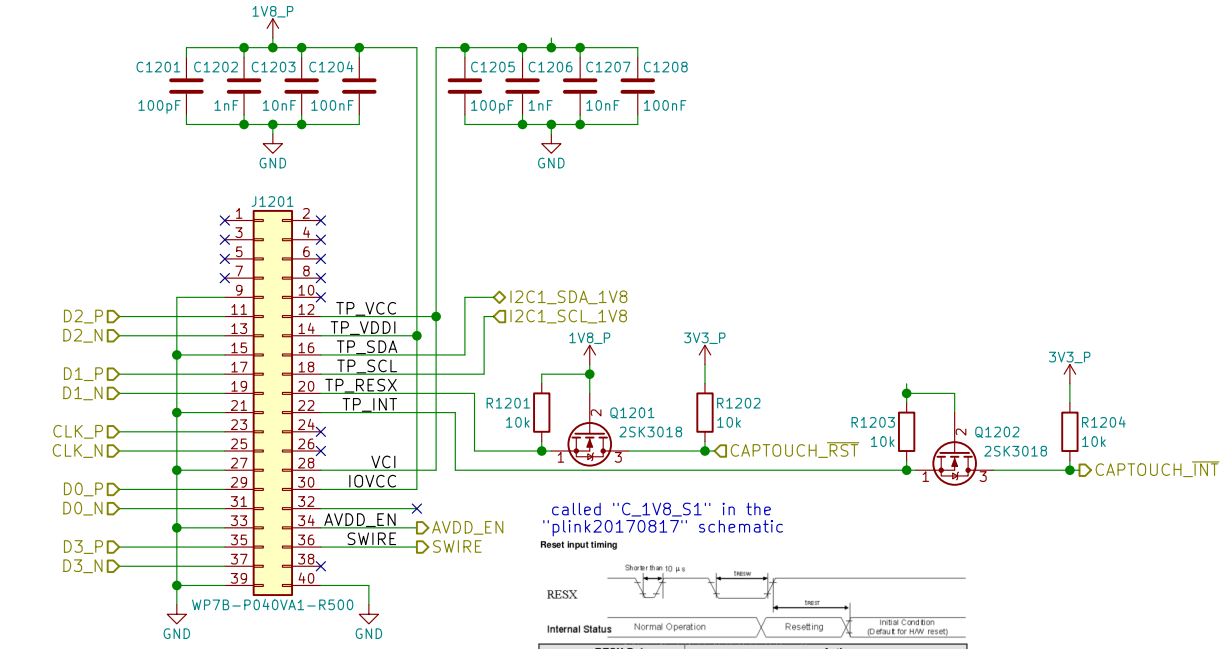


Sheet: /MIPI/
File: mipi.sch

Title:

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

TODO:
ensure power sequence is satisfied
based on the display used



called "C_1V8_S1" in the
"plink20170817" schematic

RESX Puise	Action
Shorter than 5µs	Invalid Reset
Longer than 10µs	Valid Reset
Between 5µs and 10µs	Reset Initialization Precedure

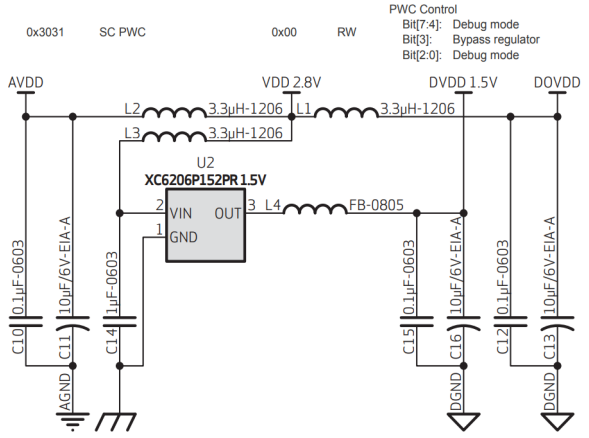
TODO: low power state signal?? LCD_LEDK

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

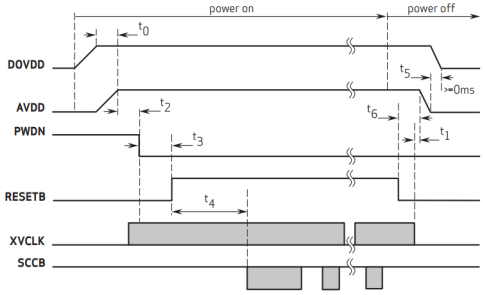
Based on the system power configuration (1.8V or 2.8V for I/O power, using external DVDD or internal DVDD, requiring access to the I2C during power up period or not), the power up sequence will differ. If 1.8V is used for I/O power, using the internal DVDD is preferred. If 2.8V is used for I/O power,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

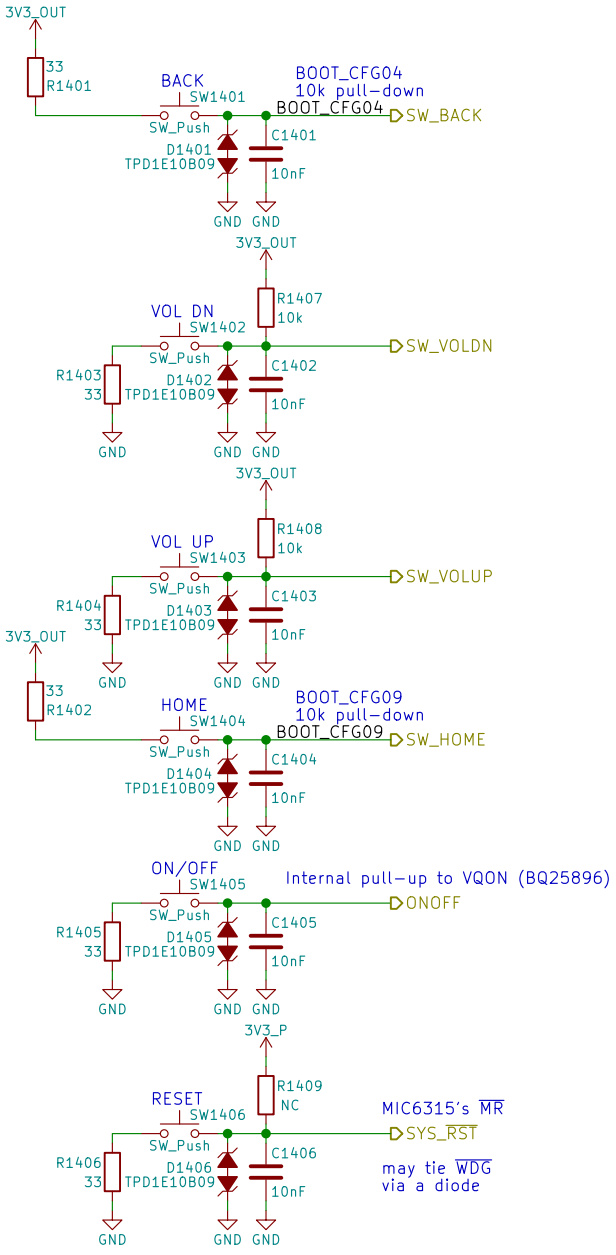
I2C1_SDA_1V8
I2C1_SCL_1V8

Purism SPC

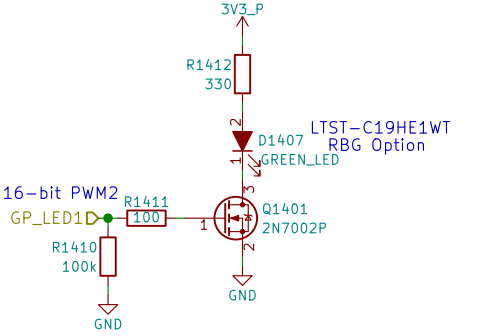
Sheet: /MIPI/CSI/
File: csi.sch

Title:

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



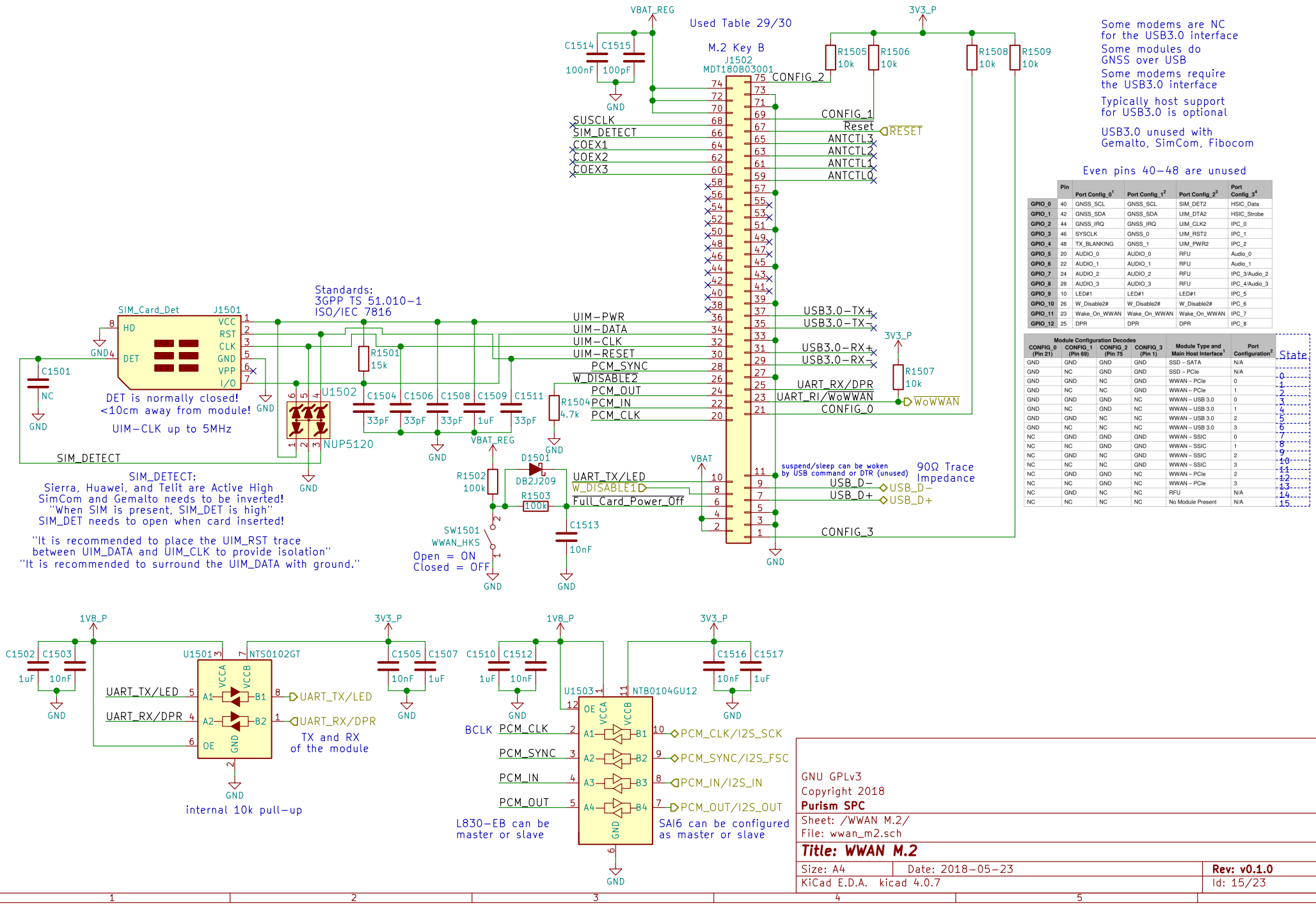
Use PWM2_PWMSAR to set the compare value (duty cycle)
Use PWM2_PWMCR[15:4] to set the PRESCALER (frequency)
Use PWM2_PWMPR to set the top of the counter (frequency)



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

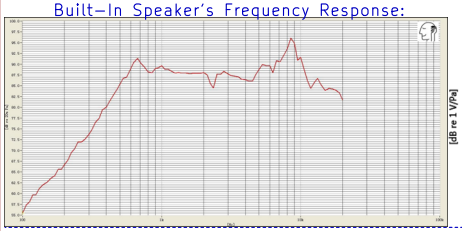
U1601 SGTL5000
Mute via MUTE_LO=1
may use lineout left channel for pseudo-earpiece speaker
U1602 PAM8301
LS1601 AS01608MS-SP9
DLW21SN900SQ2L
FL1601
FL1602
J1601
SMD Equivalent: SJ-43515RS-SMT-TR
SJ-43515TS
CTIA/AHJ
Microphone
Ground
Audio (Right)
Audio (Left)
Pin 5 (tip switch) is NC, open when inserted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

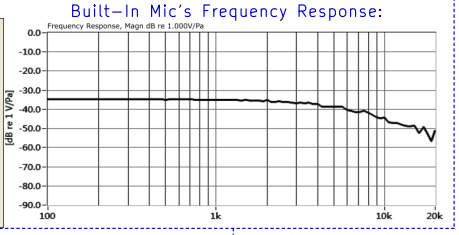
−37dB=14.1254mV/Pa
∴ mic produces 14.1254mVrms when exposed to a 1kHz tone of 94dB-SPL at the capsule (or 19.98mV amplitude)

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

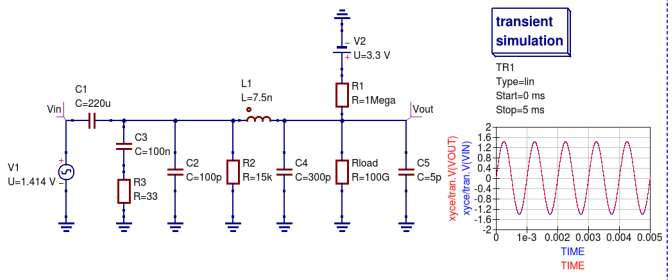
Built-In Speaker's Frequency Response:



Built-In Mic's Frequency Response:



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



LCR Measurements:

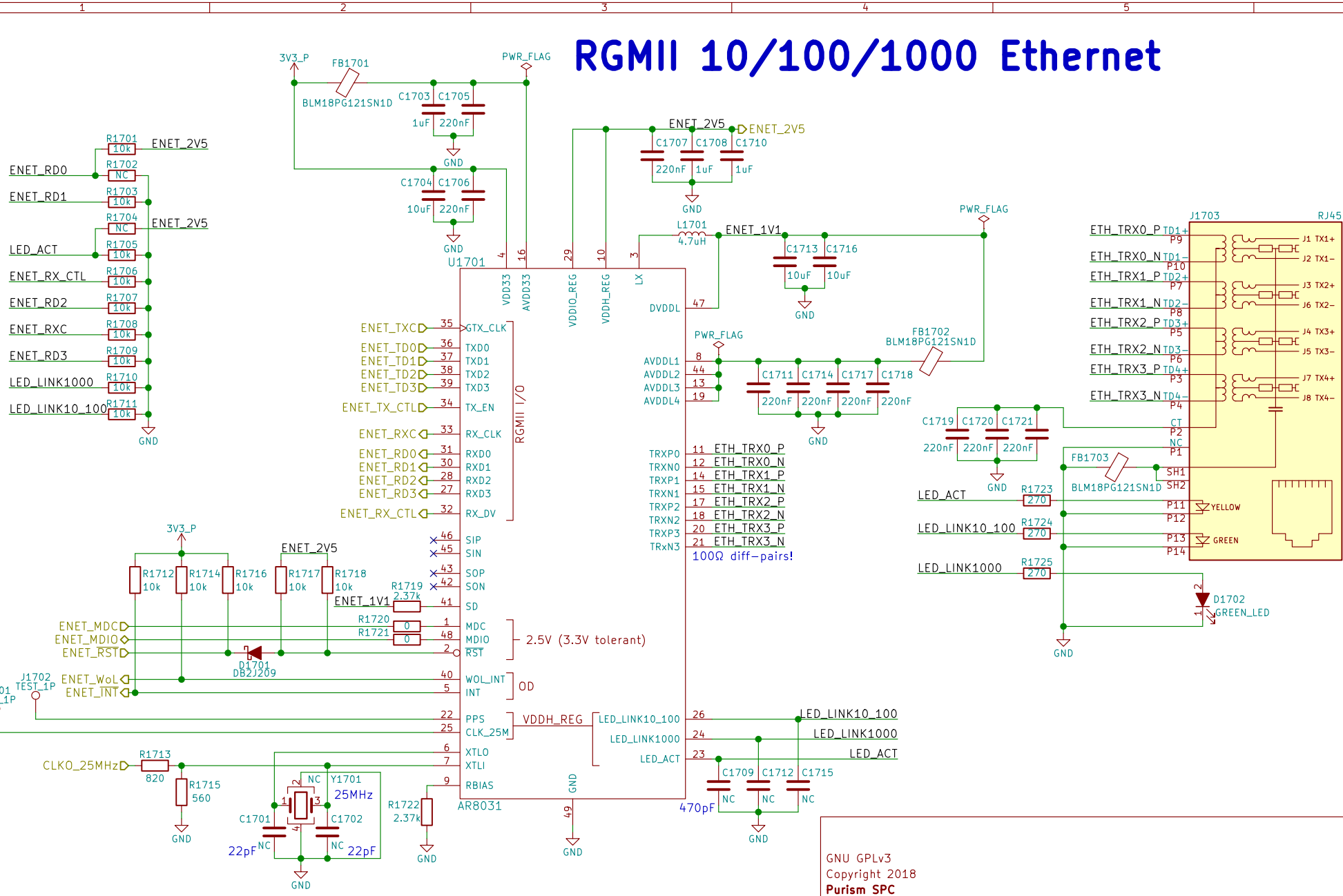
Earbud Microphone: @1kHz	Headset Speaker: @1kHz	Earbud Speaker: @1kHz
Ls = 3.844mH	Ls = 244.4uH	Ls = 25.2uH
Lp = 15.757H	Lp = 141.99mH	Lp = 311.0mH
Cs = 6.583uF	Cs = 103.6uF	Cs = 1.0mF
Cp = 1612.8pF	Cp = 178.77nF	Cp = 81.95nF
Rs = 1.5465kOhms	Rs = 36.860hms	Rs = 17.0300hms
Rp = 1.5478kOhms	Rp = 36.860hms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



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)

Open = ON
Closed = OFF

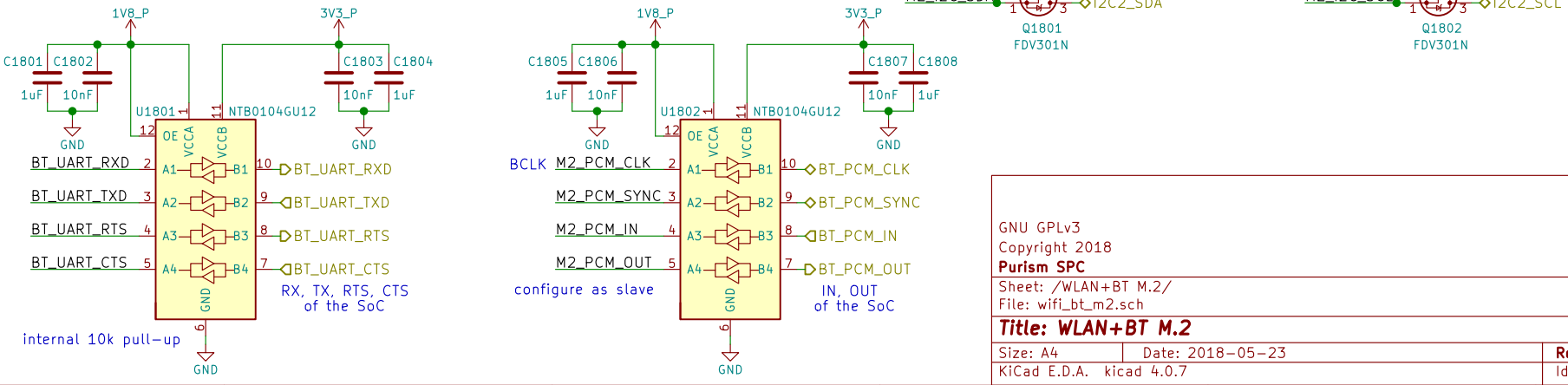
RS9116 is an I2C master
⇒its SCL is an output
(ok bc only device on I2C2)

internal 10k pull-up

RX, TX, RTS, CTS
of the SoC

configure as slave

IN, OUT
of the SoC

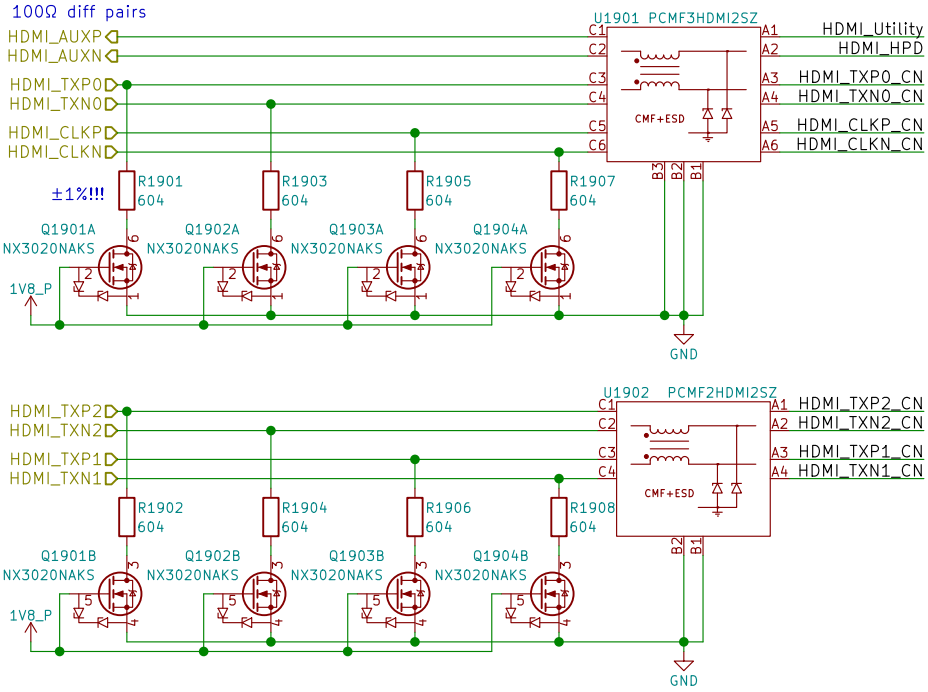


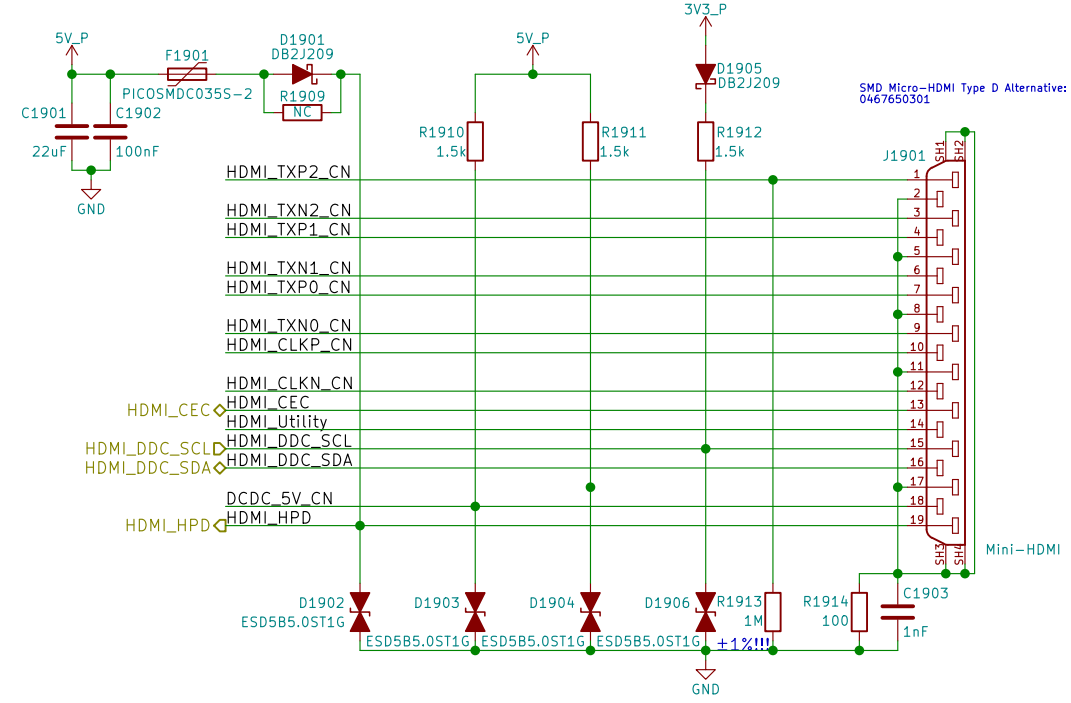
Sheet: /WLAN+BT M.2/		
File: wifi_bt_m2.sch		
Title: WLAN+BT M.2		
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 18/23

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



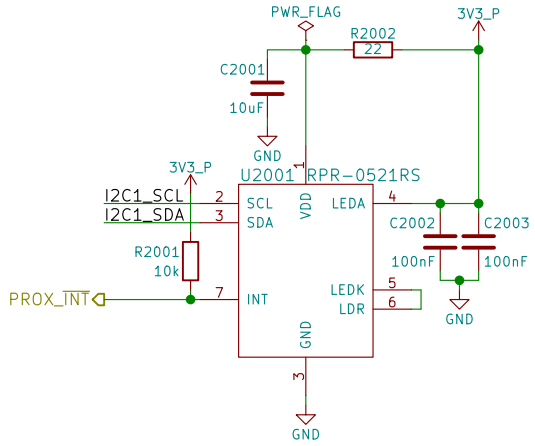


Sheet: /HDMI/
File: hdmi.sch

Title: HDMI

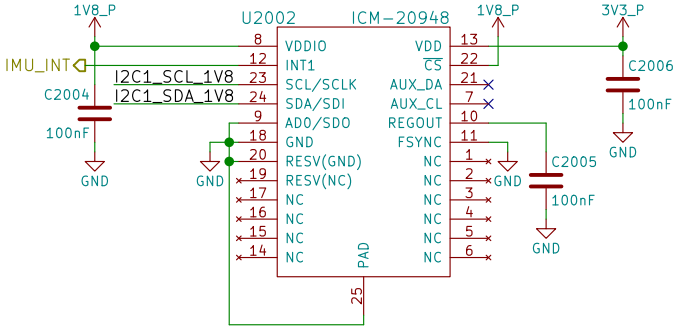
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 19/23

Proximity & Ambient Light



Reference:
http://www.rohm.com/web/global/sensor-shield-support/ps-als-sensor

9-Axis IMU



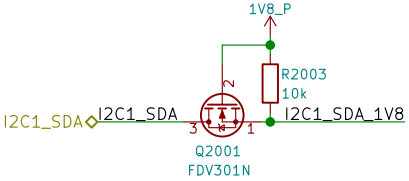
Reference:
https://store.invensense.com/datasheets/invensense/AN-IVS-0001EVB-00%20v1%202.pdf

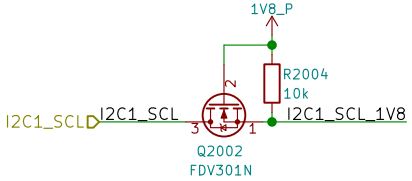
AD0 sets the slave address's LSB (110100X)

INT1_ACTL sets if IMU_INT
is active-high or active-low

"FSYNC - Connect to GND if unused"

I2C's VIH=1.8V





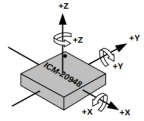


Figure 12. Orientation of Axes of Sensitivity and Polarity of Rotation

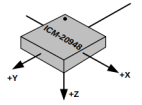
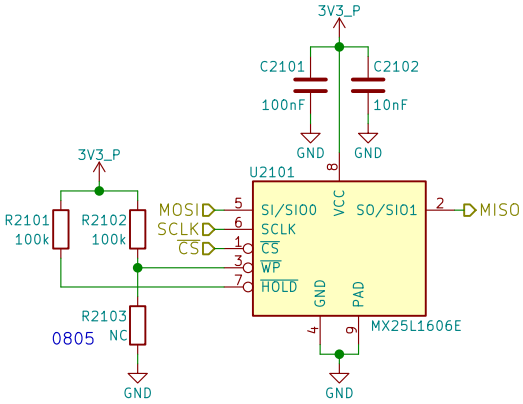


Figure 13. Orientation of Axes of Sensitivity for Magnetometer

Sheet: /Sensors/
File: sensors.sch

Title: Sensors

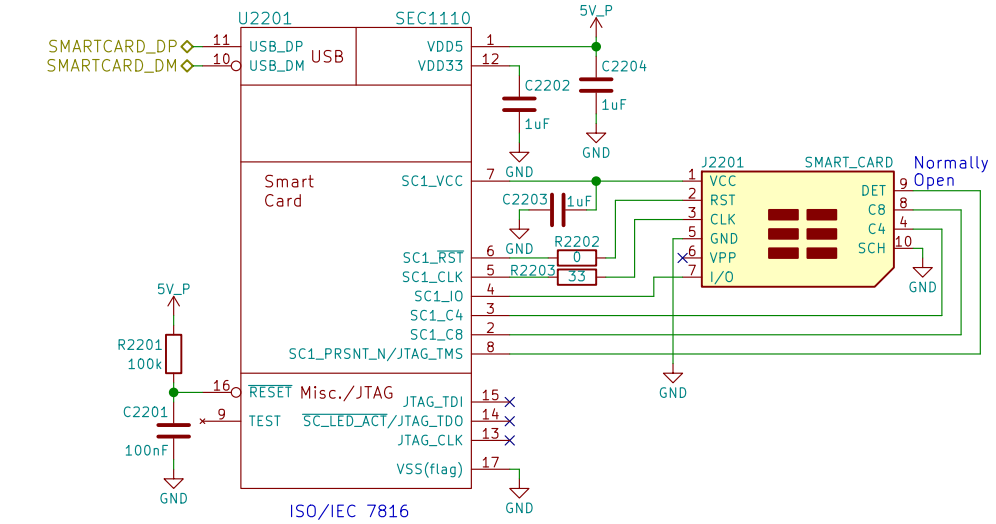
Size: A4	Date: 2018-05-23	**Rev: v0.1.0**
KiCad E.D.A. kicad 4.0.7		Id: 20/23



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

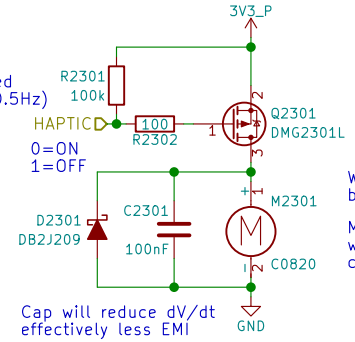
Title: Smart Card

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 – DSI (DSI_BL_PWM??)
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