

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

8.1.1 vs 8.1.4 ?

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

fast role swap is optional
PTN5110 8.1.4 leaves it floating..(good)!

Unused
Open-drain output tied with CHRG_INT
3V3_OUT

Read: 0xA5
Write: 0xA4
7-Bit Slave Address: 0x52 (1010 010x)

Initialize as the UFP (device)
read CC_STATUS to determine role
use Host Negotiation Protocol (HNP)
to become an DFP (host)
∴ USB ID is effectively unused
⇒ Legacy devices would "wait" for this
⇒ If CC initializes as UFP then no HNP needed

USB1_VBUS=5V when VBUS>4.31V

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Purism SPC
Sheet: /USB-C/
File: usb-c.sch

Title: USB Type C

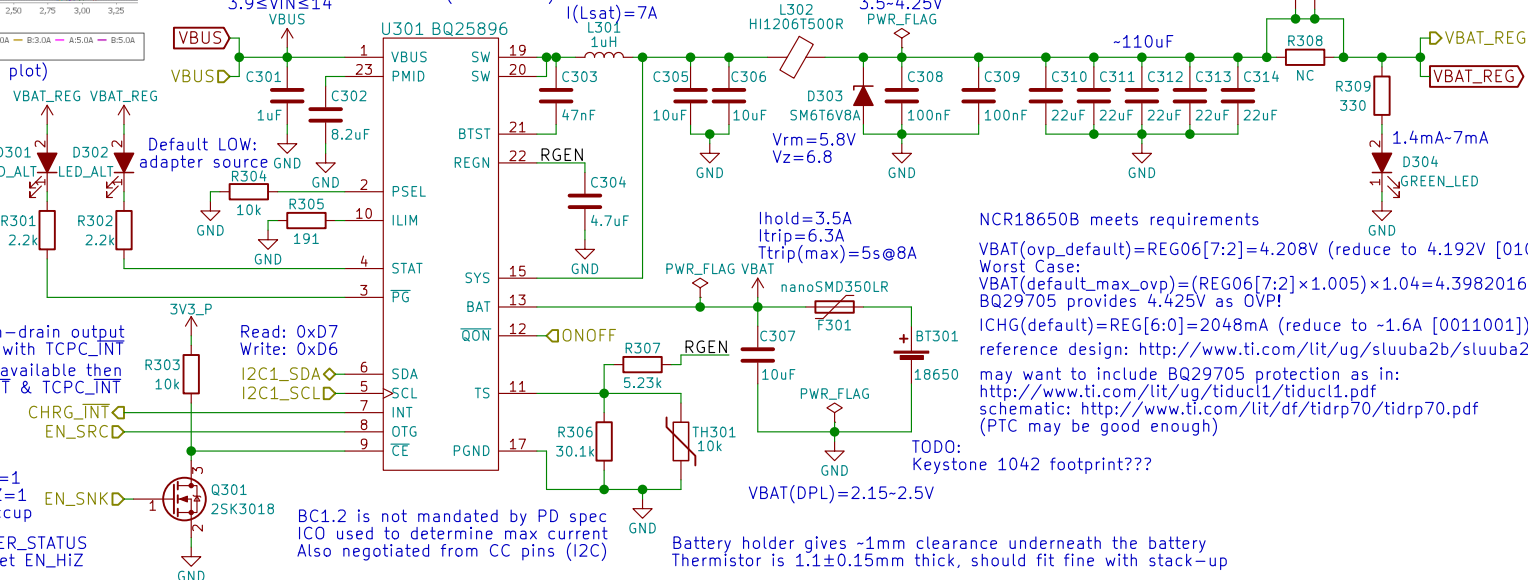
Size: A4 Date: 2018-05-31
KiCad E.D.A. kicad 4.0.7

Rev: v0.1.0
Id: 2/24

Rev: v0.1.0
Id: 2/24



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

$$\begin{aligned} 1.658 \leq I_{LIM} \leq 2.063 \\ I_{LIM(nom)} \cong 1.859A \\ 3.9 \leq V_{IN} \leq 14 \end{aligned}$$
$$I(L_{sat}) = 7A$$


VBAT(ovp_default)=REG06[7:2]=4.208V (reduce to 4.192V [010110])
Worst Case:
VBAT(default_max_ovp)=(REG06[7:2]×1.005)×1.04=4.3982016V
BQ29705 provides 4.425V as OVP!
ICHG(default)=REG[6:0]=2048mA (reduce to -1.6A [0011001])
reference design: <http://www.ti.com/lit/ug/sluuba2b/sluuba2b.pdf>
may want to include BQ29705 protection as in:
<http://www.ti.com/lit/ug/tiduc11/tiduc11.pdf>
schematic: <http://www.ti.com/lit/df/tidrp70/tidrp70.pdf>
(PTC may be good enough)

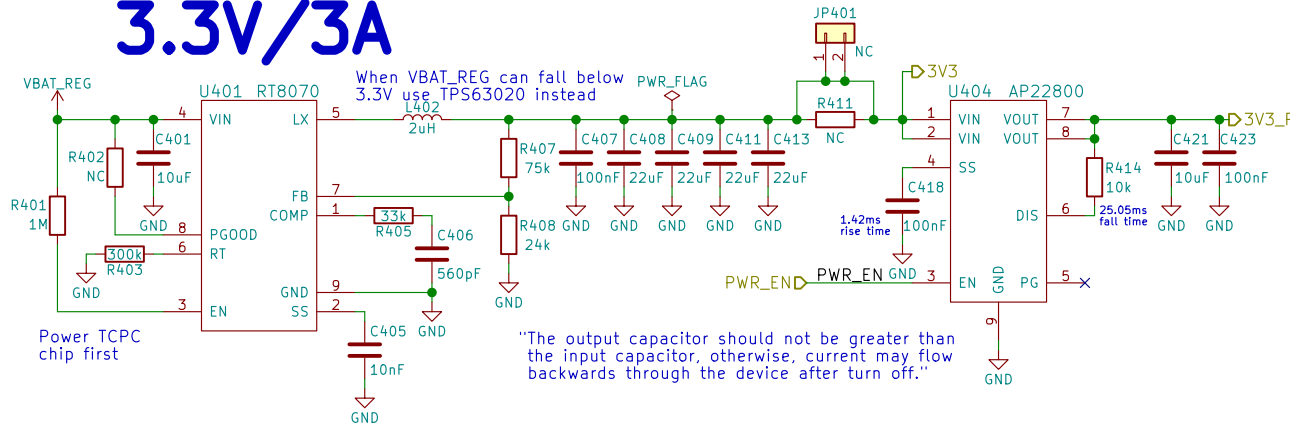
TODO:
Keystone 1042 footprint???

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

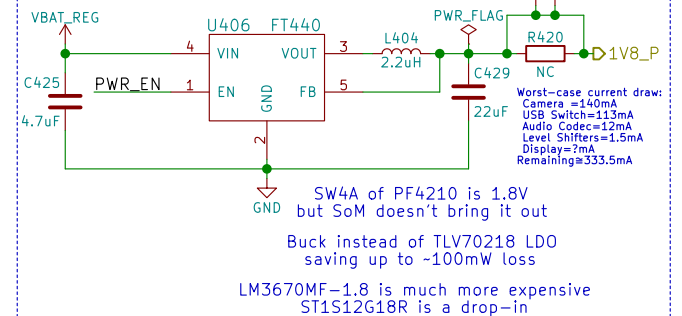
Battery holder seems to fit up to ~68.88mm long batteries
need to test 18650 protected cells which are ~69.35mm long

Id: 3/24

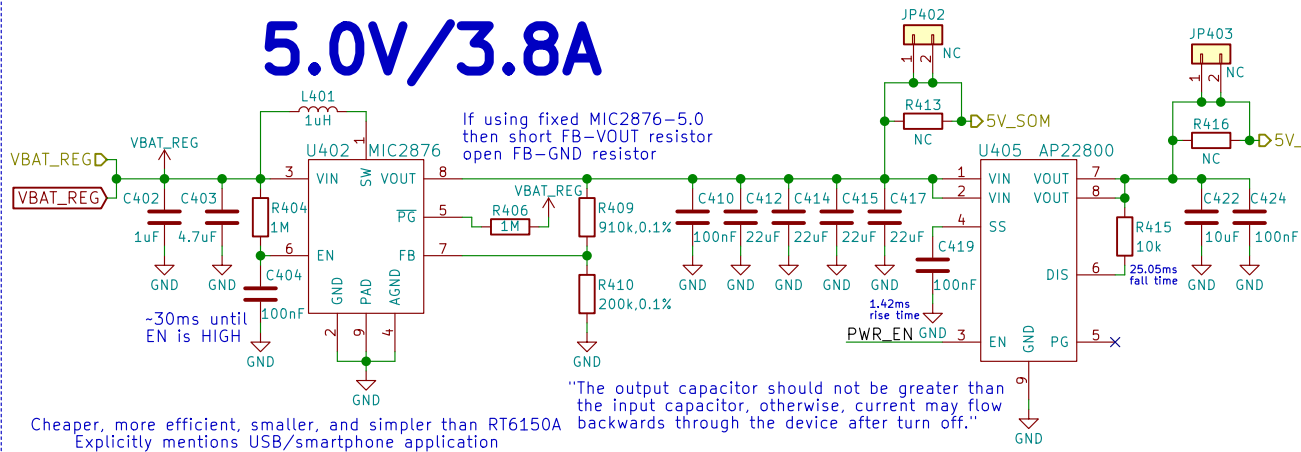
3.3V/3A



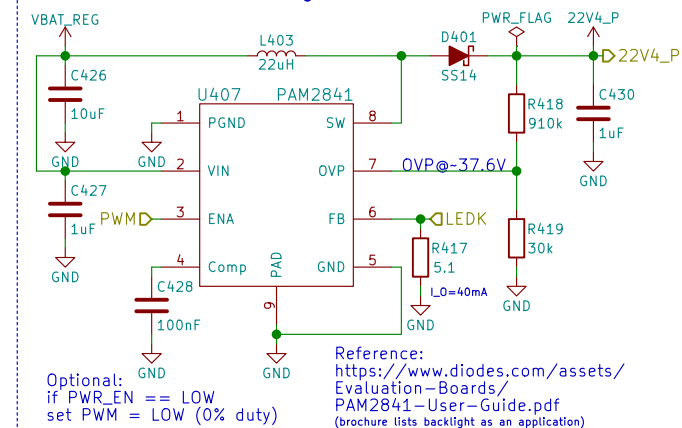
1.8V/600mA



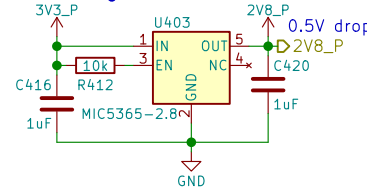
5.0V/3.8A



22.4V/40mA



2.8V/150mA



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

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Sheet: /Power/
File: power.sch

Title: Power

Size: A4 Date: 2018-05-31

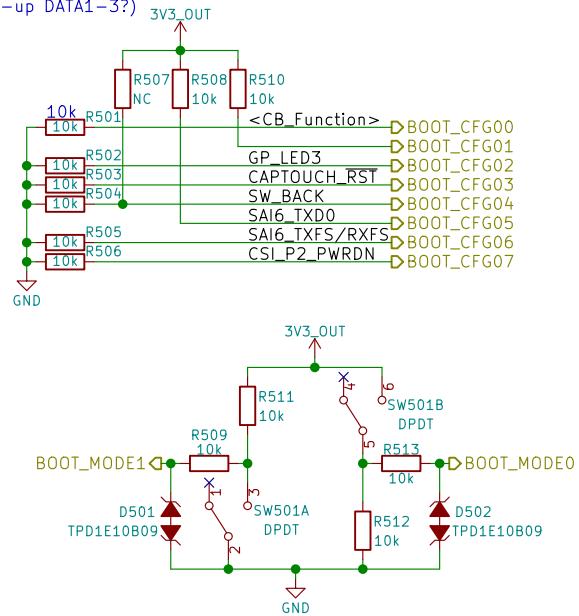
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Rev: v0.1.0

Id: 4/24

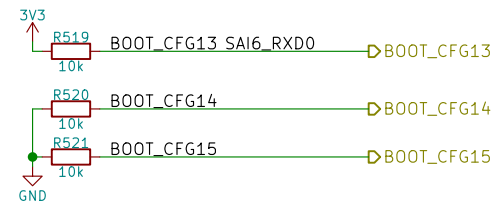
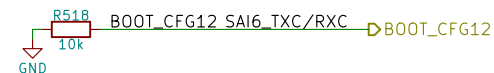
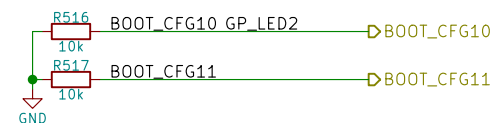
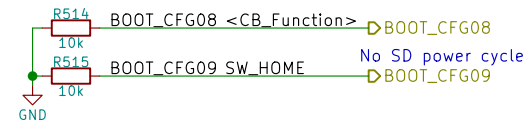
BOOT_CFG04: 0 - 1-bit SD bus
1 - 4-bit SD bus (pull-up DATA1-3?)

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

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



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Sheet: /Boot Config/
File: boot.sch

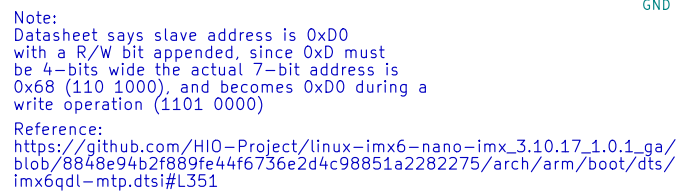
Title: Boot Configuration

Size: A4 Date: 2018-05-31

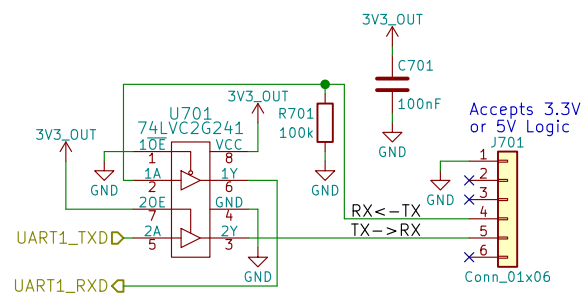
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Rev: v0.1.0

Id: 5/24



Id: 6/24



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Sheet: /UART Debug/
File: uart.sch

Title: UART Debug

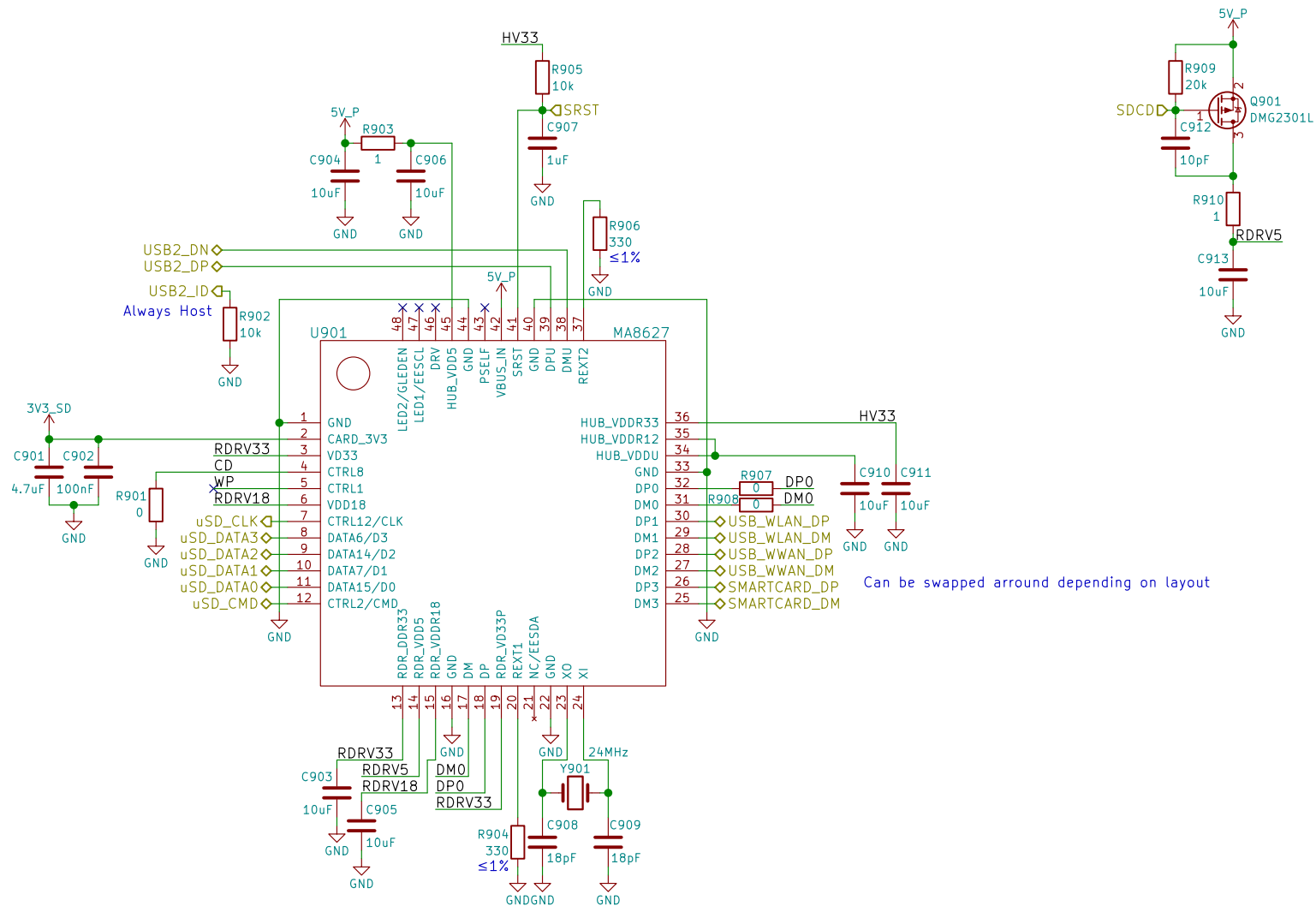
Size: A4 Date: 2018-05-31

KiCad E.D.A. kicad 4.0.7

Rev: v0.1.0

Id: 7/24

Id: 8/24



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Sheet: /USB Hub + SDIO Bridge/

File: usb_hub_sdio.sch

Title:

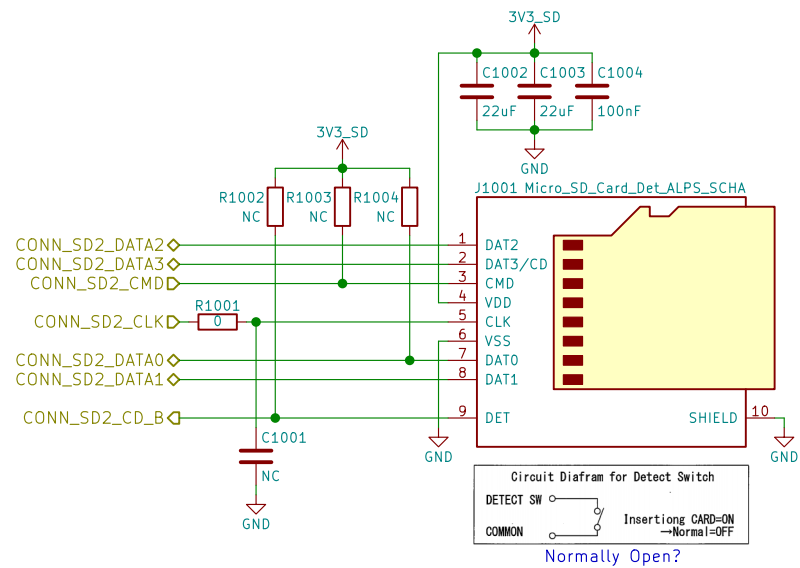
Size: A4

Date: 2018-05-31

Rev: v0.1.0

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Id: 9/24



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Sheet: /uSD Card/
File: sd.sch

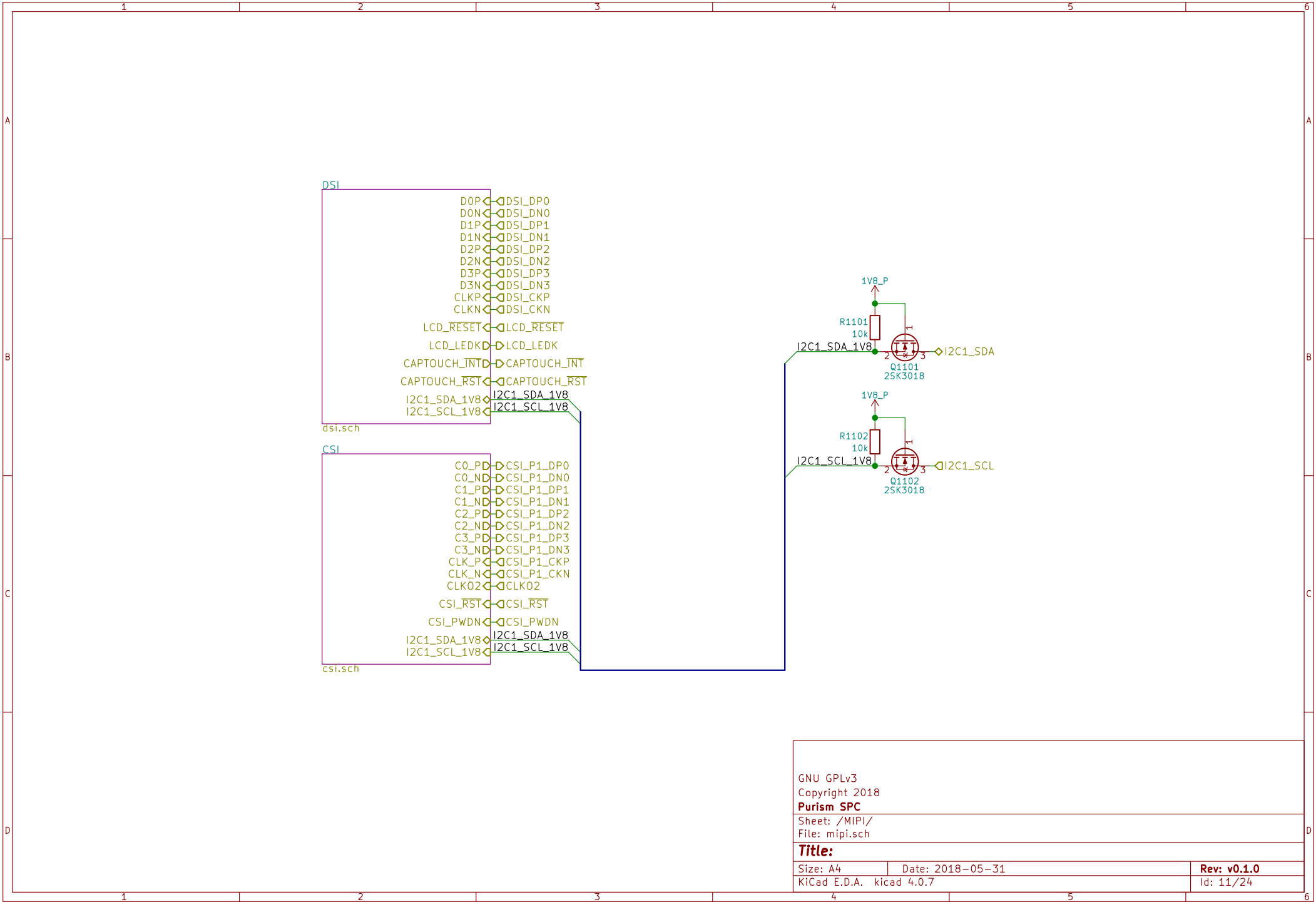
Title: uSD Card

Size: A4 Date: 2018-05-31

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Rev: v0.1.0

Id: 10/24



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Purism SPC

Sheet: /MIPI/
File: mipi.sch

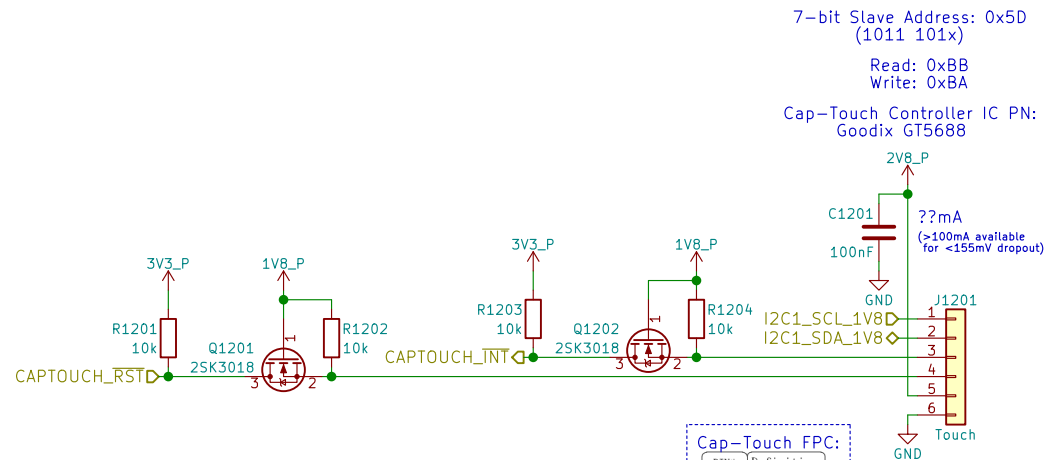
Title:

Size: A4 Date: 2018-05-31

KiCad E.D.A. kicad 4.0.7

Rev: v0.1.0

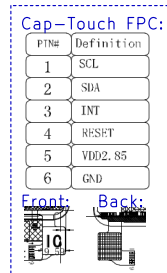
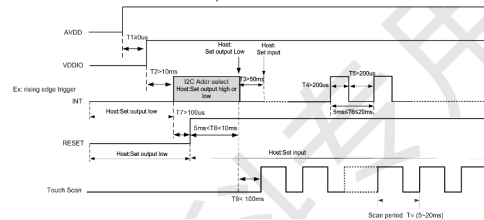
Id: 11/24



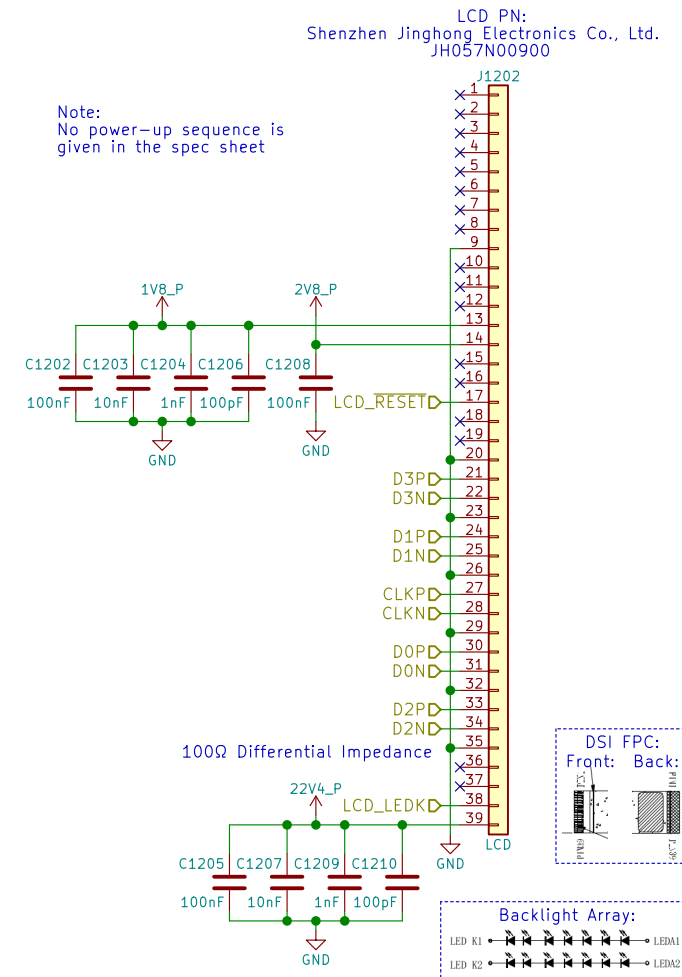
The upper 7 bits are the address,
and bit 0 is used to select read or write.
GT5688 has two slave device addresses to choose from:

7-bit Address	8-bit Write Address	8-bit Read Address
0x5D	0xBA	0xBB
0x14	0x28	0x29

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



TODO:
Verify if INT and RESET are active-LOW



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Sheet: /MIPI/DSI/

File: dsi.sch

Title: MIPI DSI

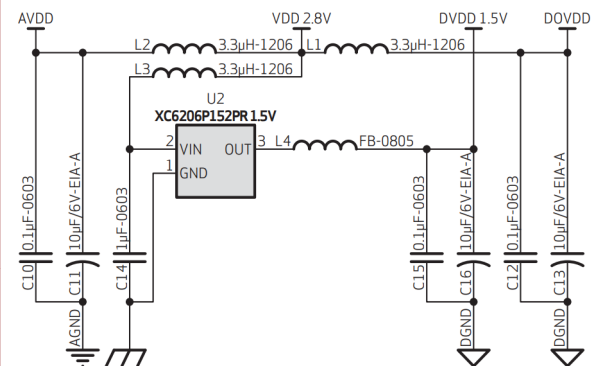
Size: A4 Date: 2018-05-31

KiCad E.D.A. kicad 4.0.7

Rev: v0.1.0

Id: 12/24

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:

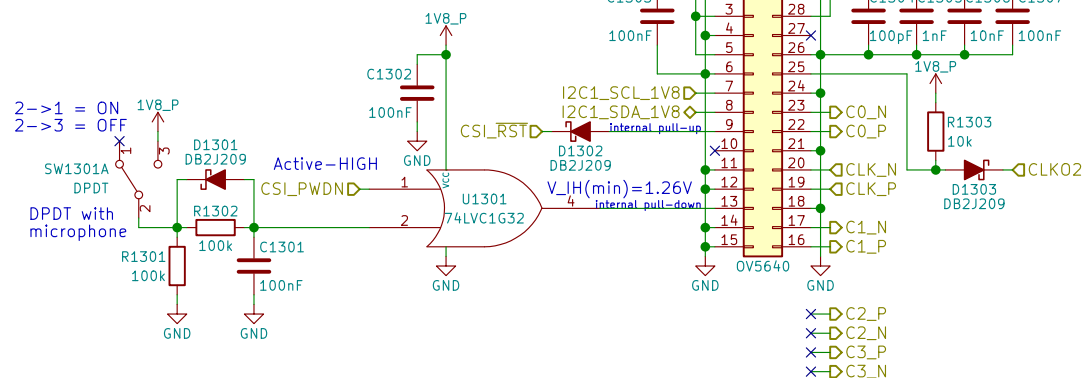
1. when DOVDD and AVDD are turned ON, make sure DOVDD becomes stable before AVDD becomes stable
2. PWDN is active high with an asynchronized design (does not need clock)
3. PWDN pin tied to digital ground if it is not controlled.
4. if PWDN pin is controlled as below, for PWDN to go low, power must first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

5640_05_2-2



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

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Sheet: /MIPI/CSI/

File: csi.sch

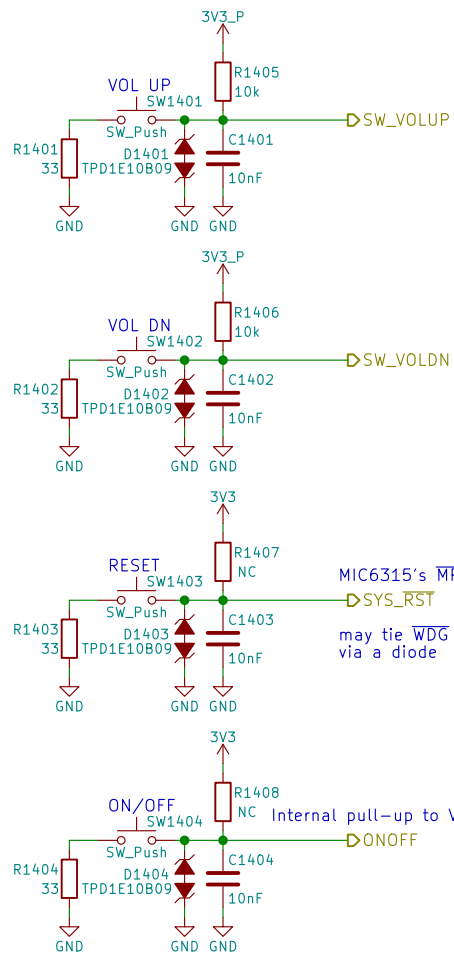
Title:

Size: A4 Date: 2018-05-31

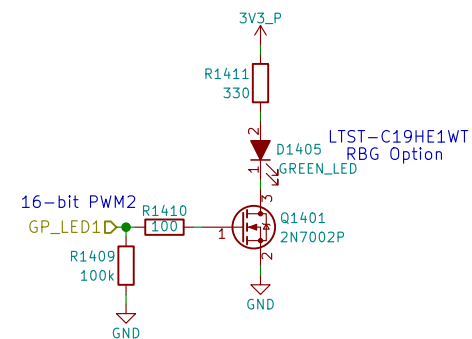
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Rev: v0.1.0

Id: 13/24



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)



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

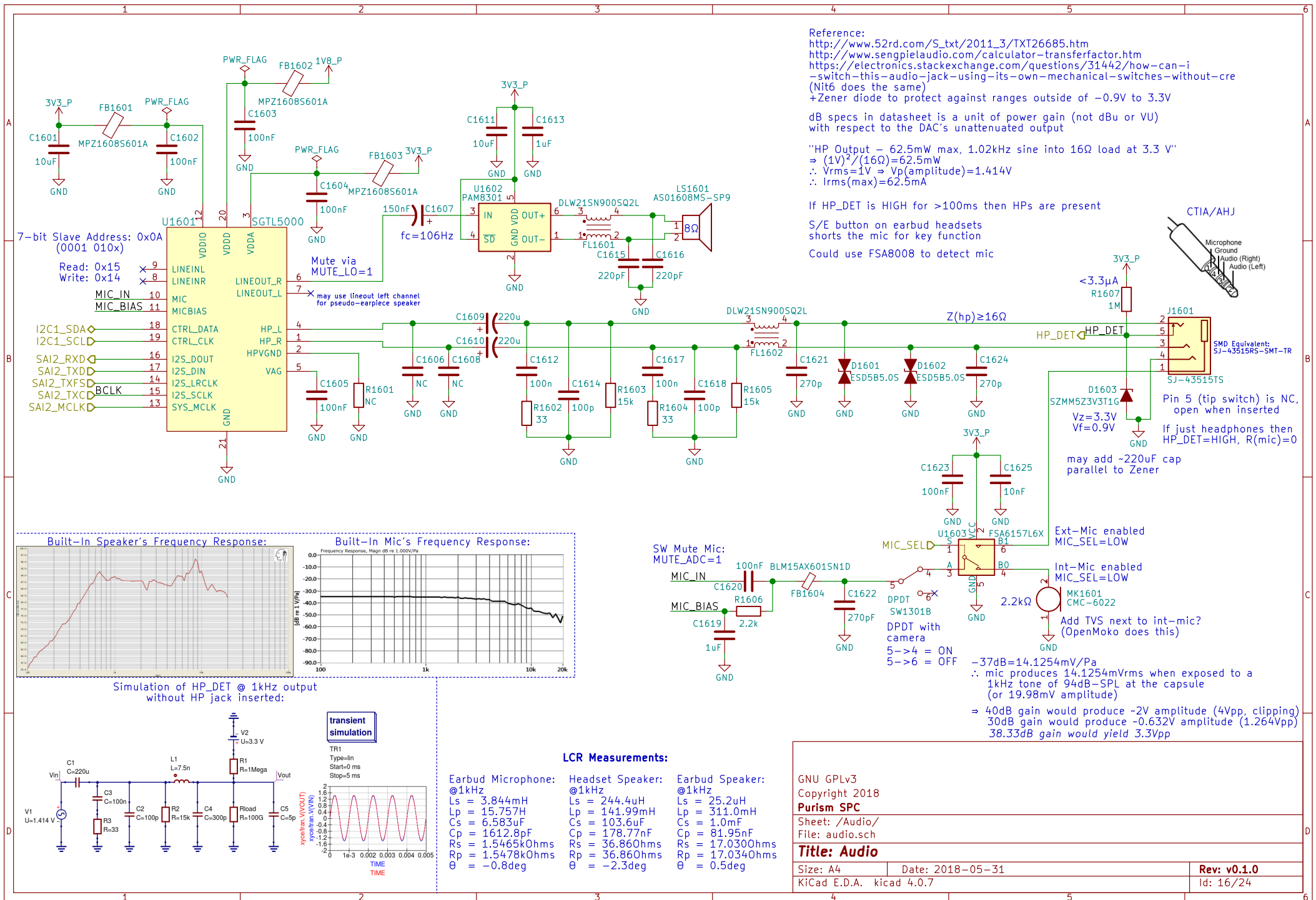
Title: Buttons & LED

Size: A4 Date: 2018-05-31

KiCad E.D.A. kicad 4.0.7

Rev: v0.1.0

Id: 14/24



RGMII 10/100/1000 Ethernet

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Purism SPC
Sheet: /Ethernet/
File: ethernet.sch

Title: Ethernet

Size: A4	Date: 2018-05-31	Rev: v0.1.0
KiCad E.D.A. kicad 4.0.7		Id: 17/24

Id: 17/24

RS9116 NC:
RTS, CTS, BT_HOST_WAKE

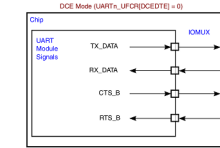
RS9116 datasheet says
no WIFI_WAKE
but the schematic has it

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

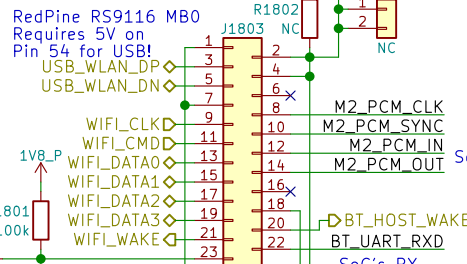
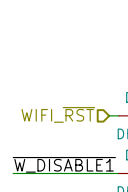
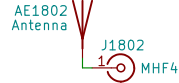
Module: Table 23
Socket: Table 46

6.2 M.2 Signal Directions
UARTn_UFCR[DCEDTE]=0 on POR



TX output
RX input
CTS output
RTS input

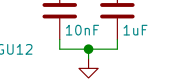
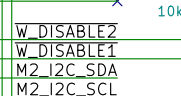
⇒ TX→RX
RX→TX
CTS→CTS
RTS→RTS



SoC's IN/OUT

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

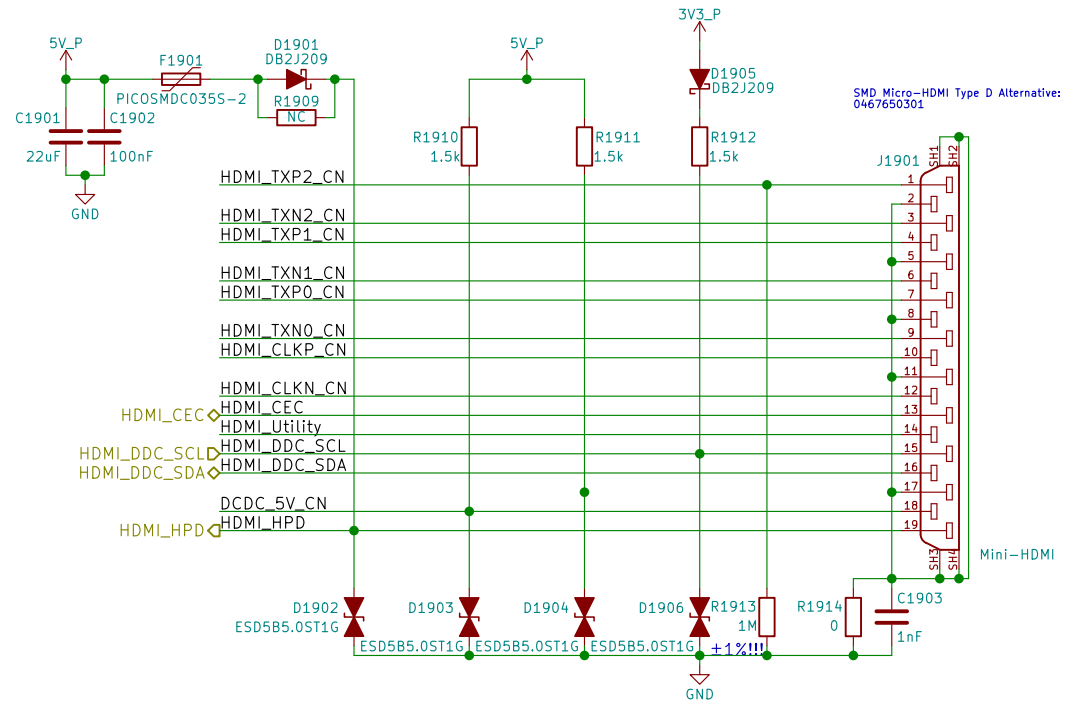
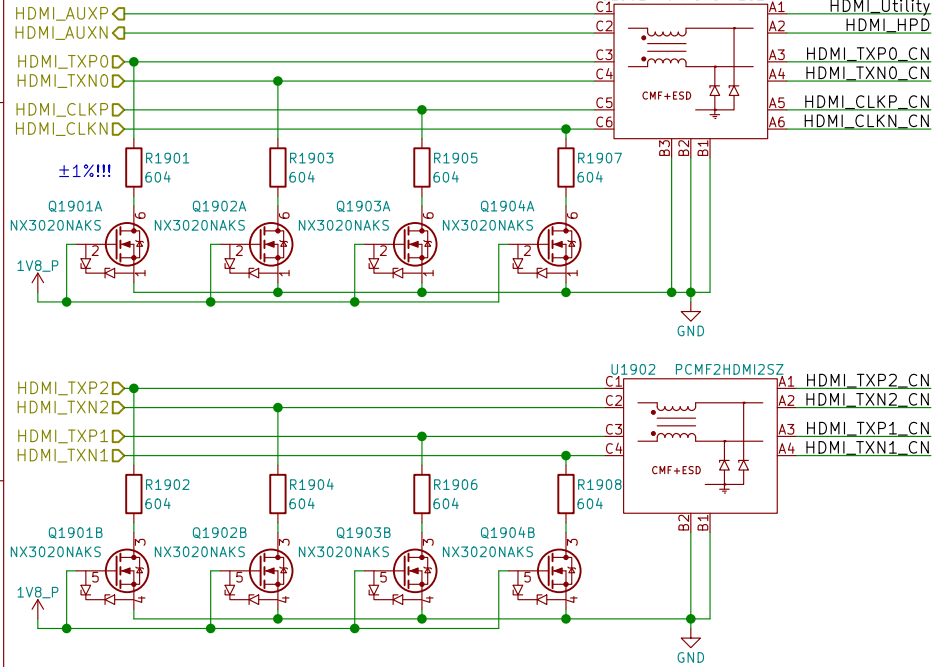
RS9116 SUSCLK
is a GPIO (unused)
SUSCLK



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



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Sheet: /HDMI/
File: hdmi.sch

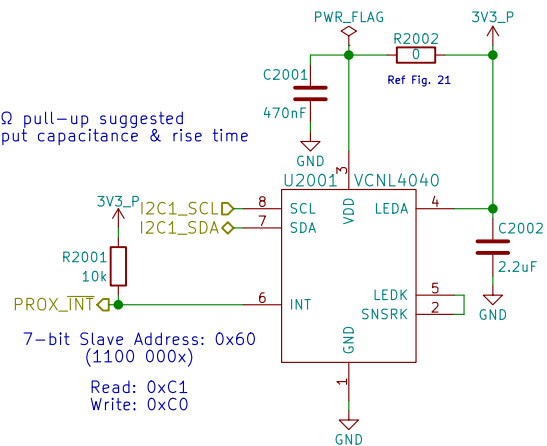
Title: HDMI

Size: A4 Date: 2018-05-31
KiCad E.D.A. kicad 4.0.7

Rev: v0.1.0
Id: 19/24

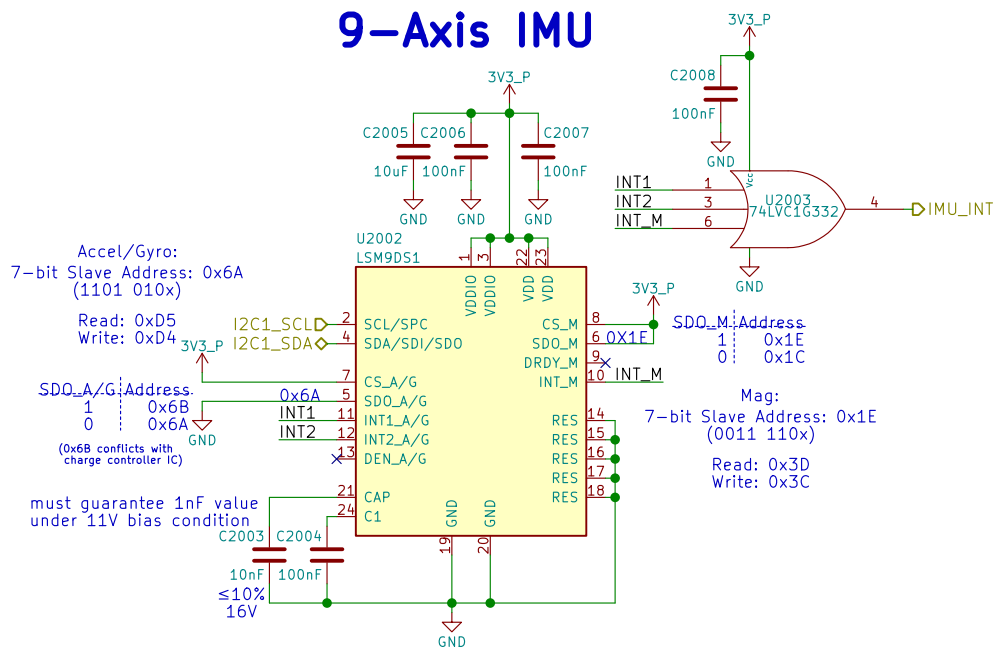
Proximity & Ambient Light

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



Reference:
<https://www.vishay.com/docs/84307/designingvnl4040.pdf>
<http://www.vishay.com/docs/84931/vcnl4040sensorboardfiles.pdf>

9-Axis IMU



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

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)

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)

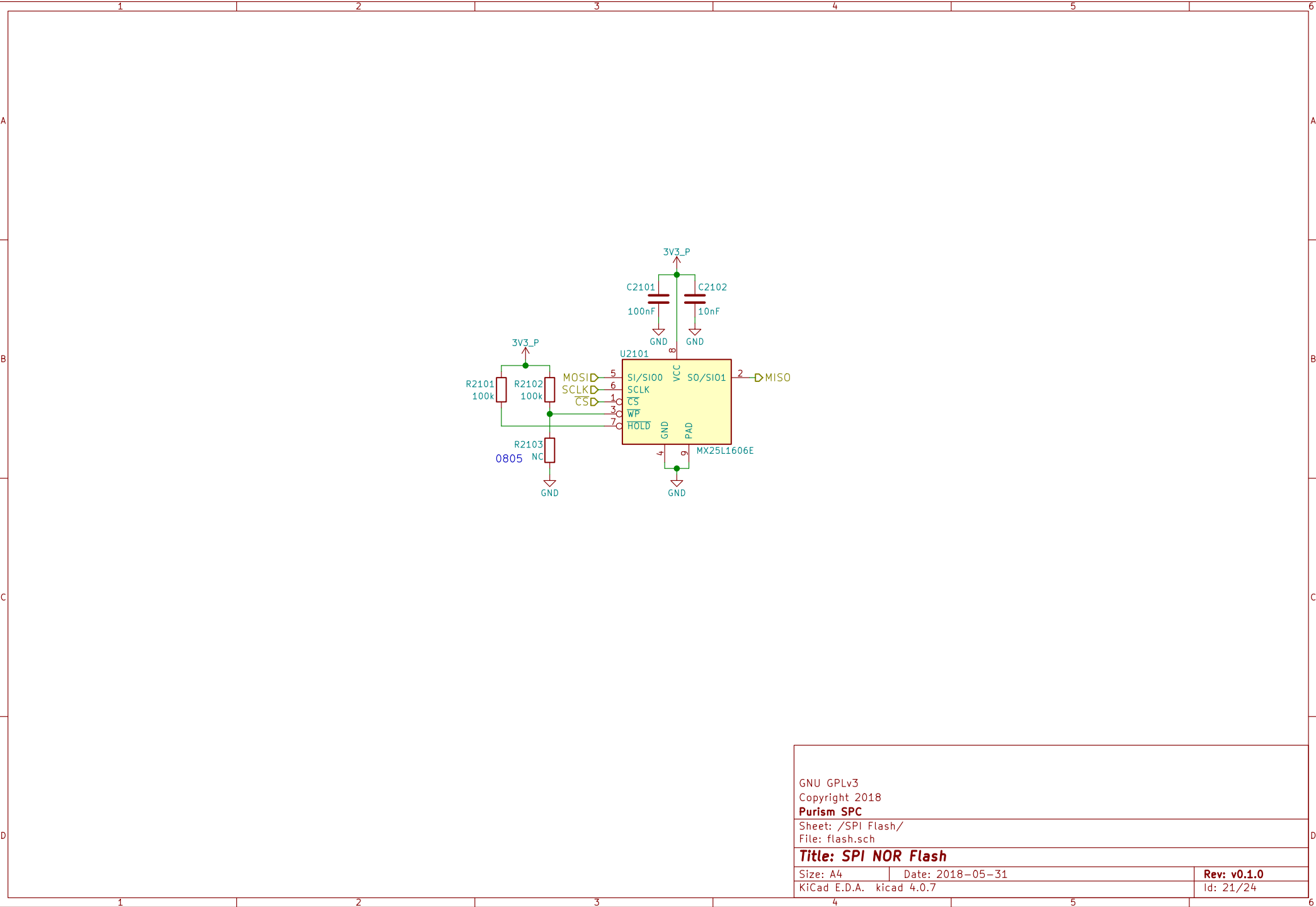
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Sheet: /Sensors/
File: sensors.sch

Title: Sensors

Size: A4 Date: 2018-05-31
KiCad E.D.A. kicad 4.0.7

Rev: v0.1.0
Id: 20/24



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Sheet: /SPI Flash/

File: flash.sch

Title: SPI NOR Flash

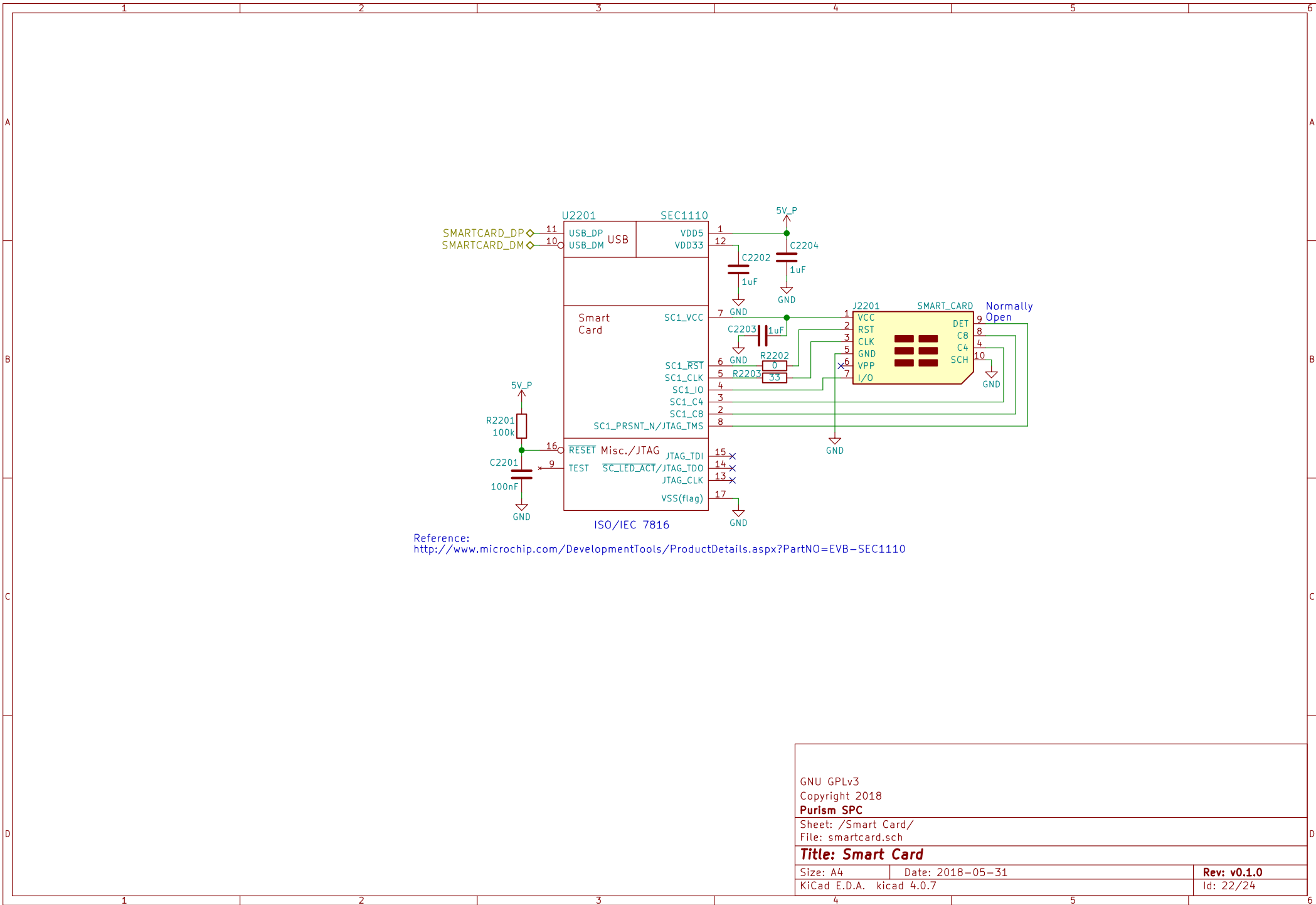
Size: A4

Date: 2018-05-31

Rev: v0.1.0

KiCad E.D.A. kicad 4.0.7

Id: 21/24



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Sheet: /Smart Card/

File: smartcard.sch

Title: Smart Card

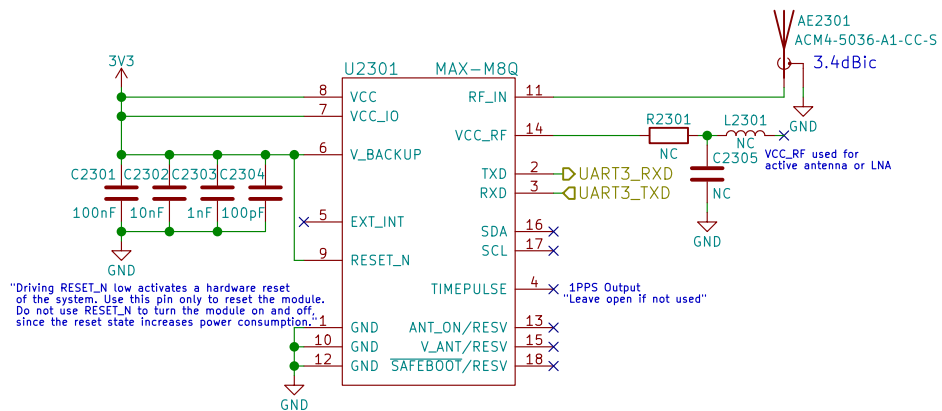
Size: A4

Date: 2018-05-31

Rev: v0.1.0

KiCad E.D.A. kicad 4.0.7

Id: 22/24



Reference:
https://www.u-blox.com/sites/default/files/MAX-8-M8-FW3_HardwareIntegrationManual_1503005929.pdf

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Sheet: /GNSS/
 File: gnss.sch

Title: GNSS

Size: A4 Date: 2018-05-31

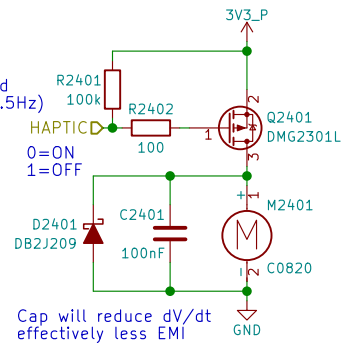
KiCad E.D.A. kicad 4.0.7

Rev: v0.1.0

Id: 23/24

PWM pins occupied:
 GPIO1_I001 - LCD Backlight
 GPIO1_I013 - LED
 GPIO1_I014 - Ethernet (CLKO_25MHz)
 GPIO1_I015 - CSI (CLKO2)

PWM needed?
 Only needs to be toggled
 ON 1 sec, OFF 1 sec (0.5Hz)
 Can MUX as either
 GPIO or PWM2
 swapping with LED



When the motor is off
 both terminals are at GND

Motor will have wire leads
 with a 2-pin Molex or Boom Precision
 connector installed (by request)!

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

Motor Source:
https://www.alibaba.com/product-detail/Coin-motor-vibration-dc-motor-cellphone_1994583657.html?spm=a2700.8443308.0.0.5aa13e5f1wxHgs
 Motor Datasheet:
<https://cloud.puri.sm/s/z8JR6DJ4KrJYzoW>

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Purism SPC

Sheet: /Haptic Motor/
 File: haptic.sch

Title: Haptic/Vibration Motor

Size: A4 Date: 2018-05-31

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Rev: v0.1.0

Id: 24/24