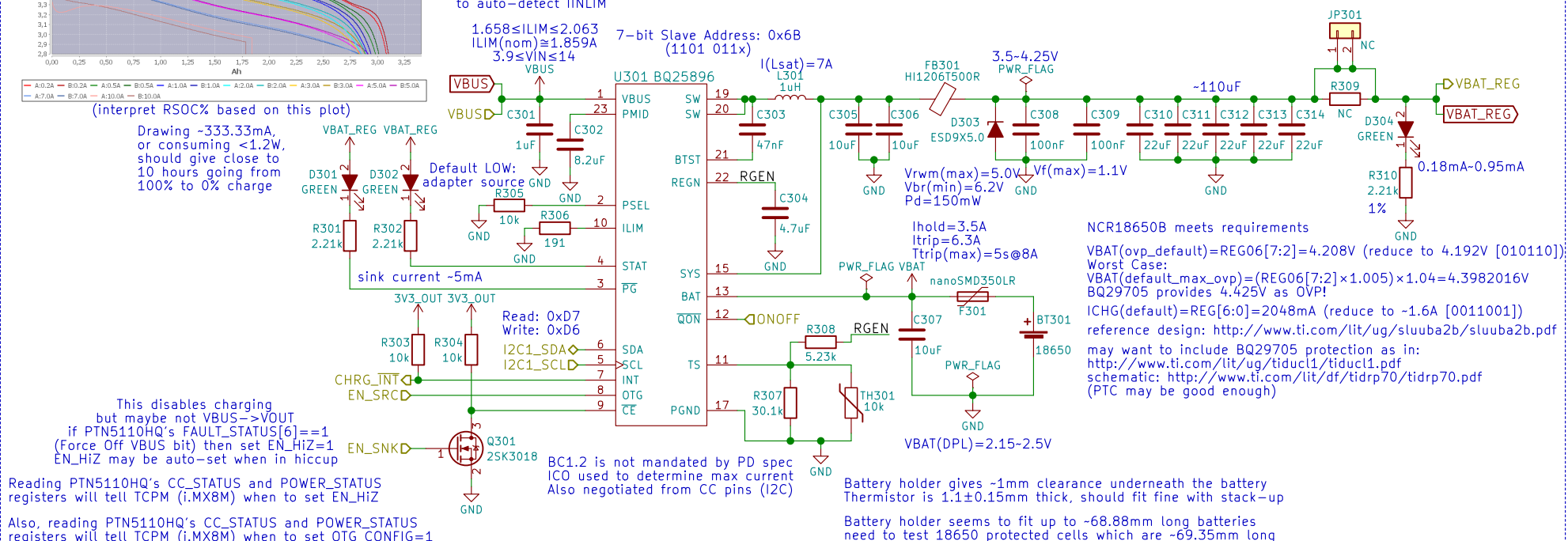


```
use AUTO_DPDM_EN
to auto-detect IINLIM
```

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

7-bit Slave Address: 0x6B  
(1101 011x)

# Battery Charge Controller



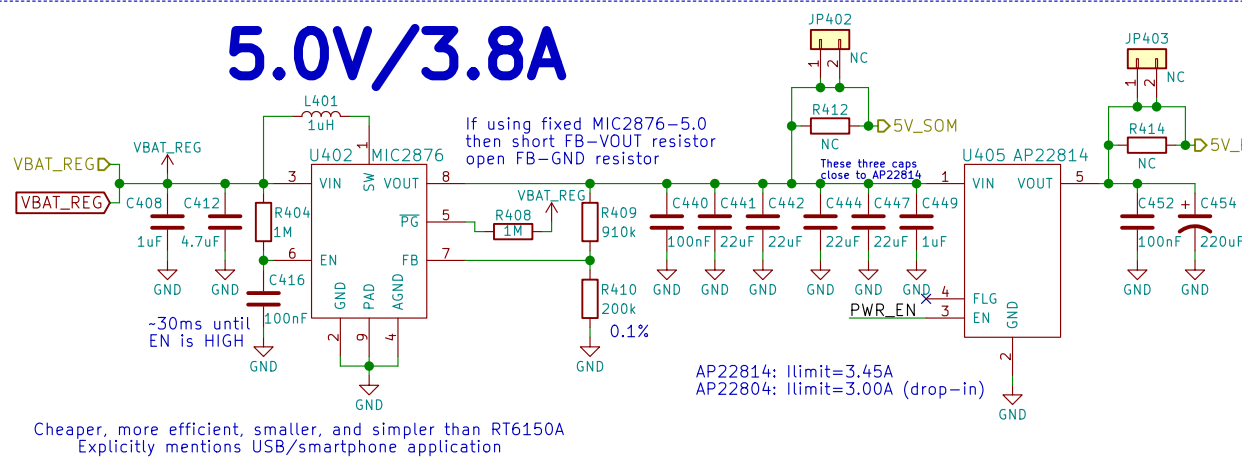
## 3.3V/3A



## 1.8V/600mA



## 5.0V/3.8A



## 22.4V/40mA



## 2.8V/150mA



## Power

Power

**Purism**

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Sheet: /Power/  
File: power.sch

Size: A4  
KiCad E.D.A. kicad 4.0.7

Date: 2018-06-11

Rev: v0.1.0

Id: 4/24

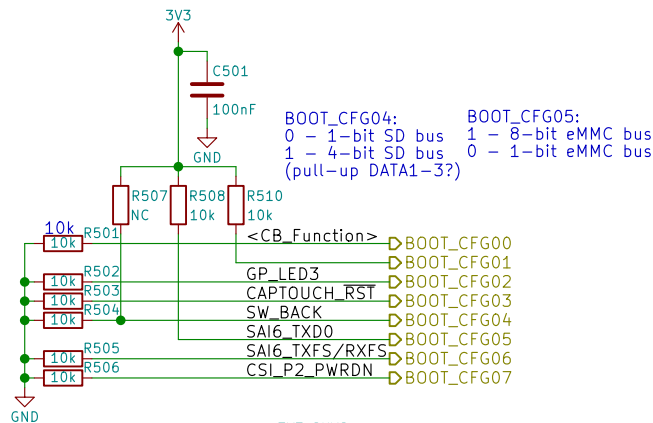
eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

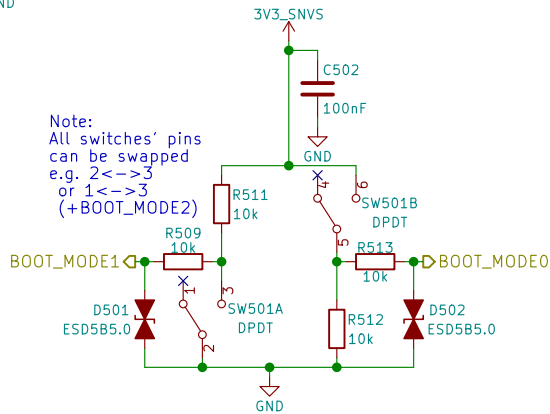
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

# Boot Config



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



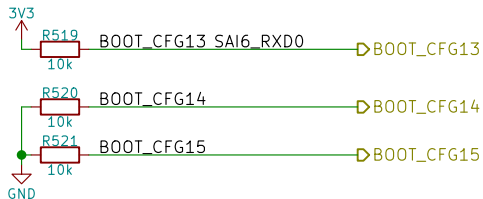
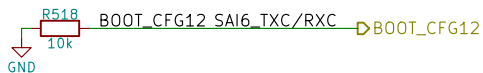
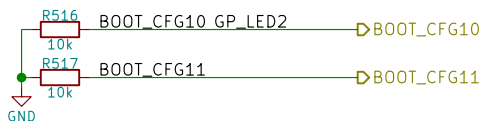
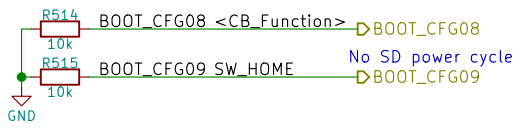
Note:  
All switches' pins  
can be swapped  
e.g. 2<->3  
or 1<->3  
(+BOOT\_MODE2)

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 <sup>1</sup>	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 Configuration

Purism

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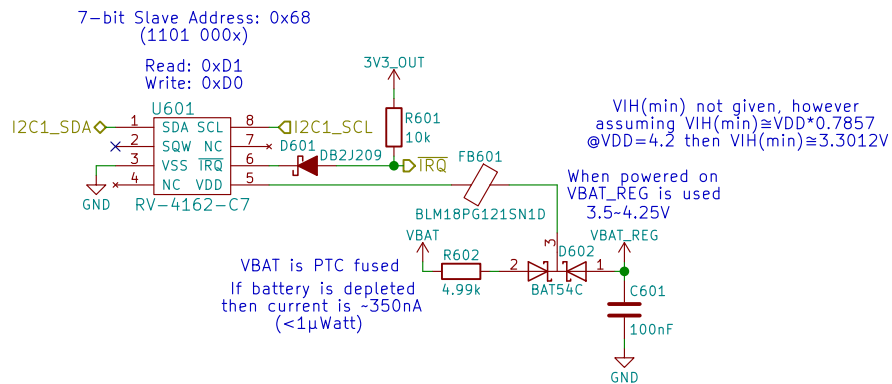
Sheet: /Boot Config/  
File: boot.sch

Size: A4  
KiCad E.D.A. kicad 4.0.7

eric.kuzmenko@puri.sm  
angus.ainstlie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 5/24

# Real-Time Clock



Note:  
Datasheet says slave address is 0xD0 with a R/W bit appended, since 0xD0 must be 4-bits wide the actual 7-bit address is 0x68 (110 1000), and becomes 0xD0 during a write operation (1101 0000)

Reference:  
[https://github.com/H10-Project/linux-imx6-nano-imx\\_3.10.17-1.0.1\\_ga/blob/8848e94b2f889fe44f6736e2d4c98851a2282275/arch/arm/boot/dts/linux6qdl-mtp.dtsi#L351](https://github.com/H10-Project/linux-imx6-nano-imx_3.10.17-1.0.1_ga/blob/8848e94b2f889fe44f6736e2d4c98851a2282275/arch/arm/boot/dts/linux6qdl-mtp.dtsi#L351)

RTC



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Sheet: /RTC/

File: rtc.sch

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

KiCad E.D.A.	kicad 4.0.7
--------------	-------------

eric.kuzmenko@puri.sm

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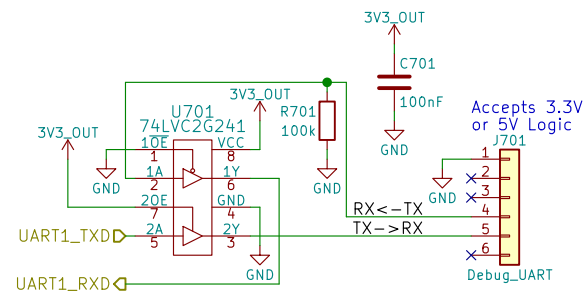
nicole.faerber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 6/24

# UART Debug



## UART Debug



Copyright 2018 GNU GPLv3

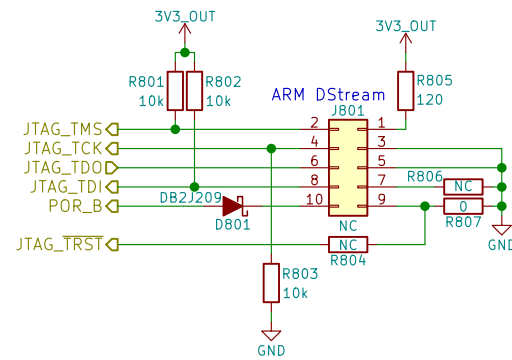
Sheet: /UART Debug/  
File: uart.sch

Size: A4 Date: 2018-06-11  
KiCad E.D.A. kicad 4.0.7

eric.kuzmenko@puri.sm  
angus.ainstlie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 7/24

# JTAG



JTAG



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Sheet: /JTAG/

File: jtag.sch

Size: A4 Date: 2018-06-11

KiCad E.D.A. kicad 4.0.7

eric.kuzmenko@puri.sm

angus.ainstlie@puri.sm

nicole.farber@puri.sm

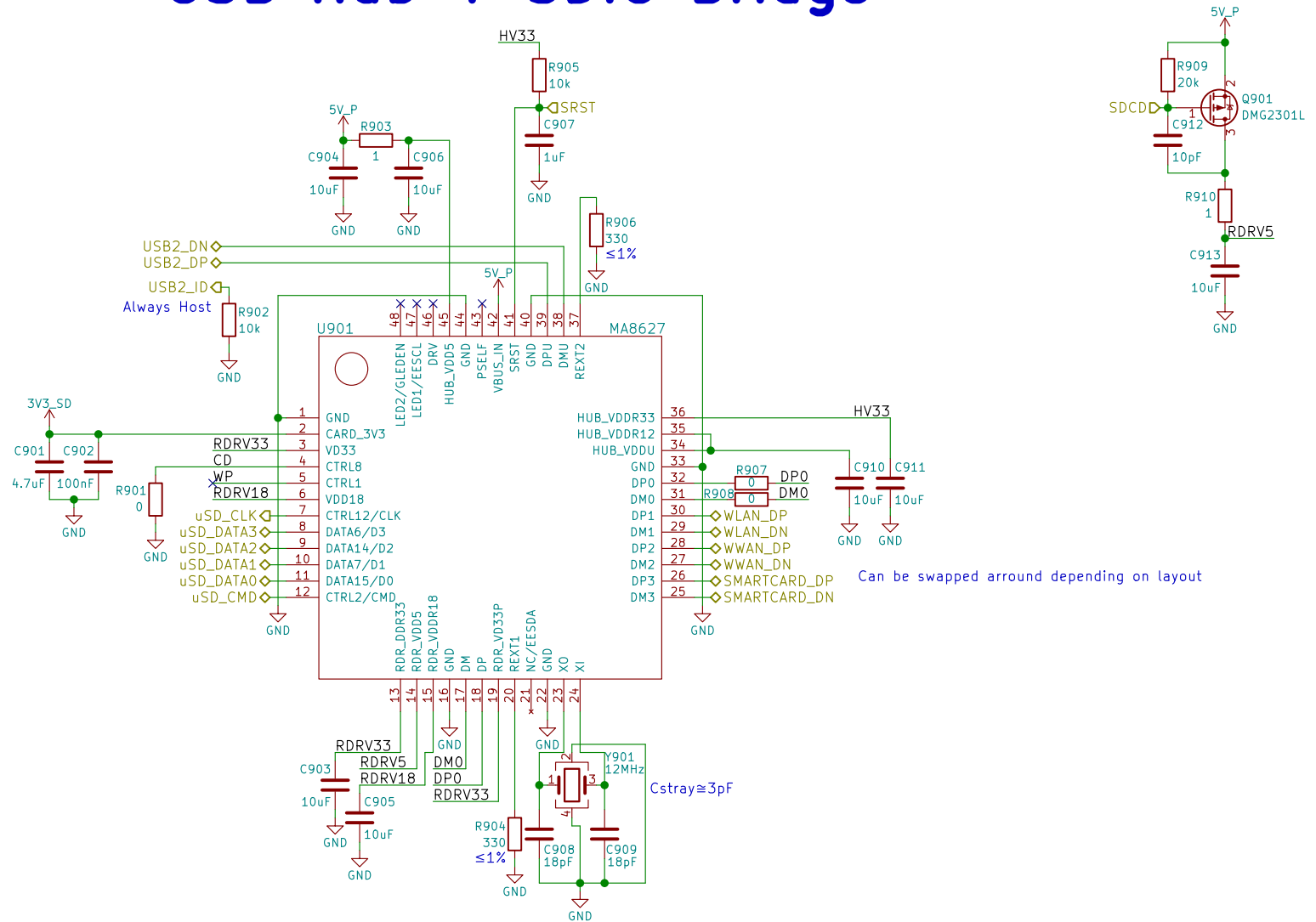
christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 8/24



## USB Hub + SDIO Bridge



## USB Hub + SDIO Bridge



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Sheet: /USB Hub + SDIO Bridge/

File: usb\_hub\_sdio.sch

Size: A4	Date: 2018-06-11
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Size: A1	Date: 7/20/2023
KiCad E.D.A.	kicad 4.0.7

eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

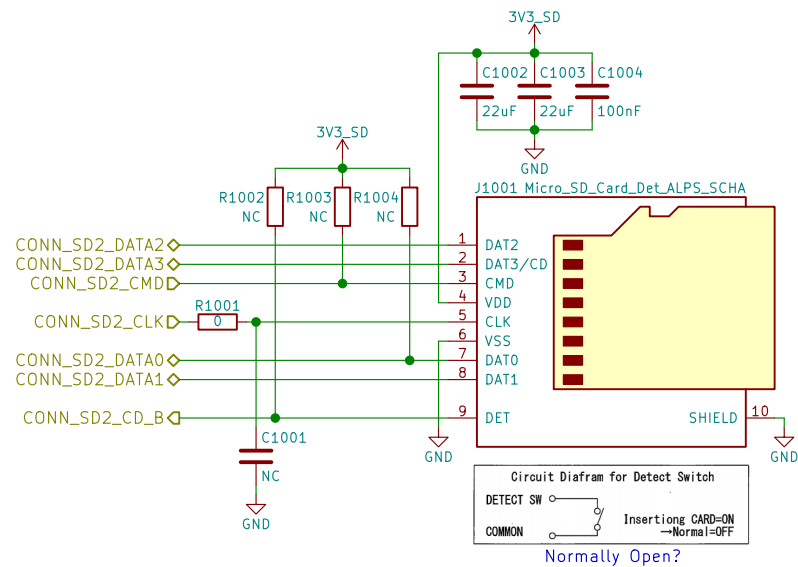
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 9/24

$\mu$ SD



uSD Card



## Purism

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Sheet: /uSD Card/

File: sd.sch

---

eric.kuzmenko@puri.sm

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christian.schilmoeller@puri.sm

Size: A4

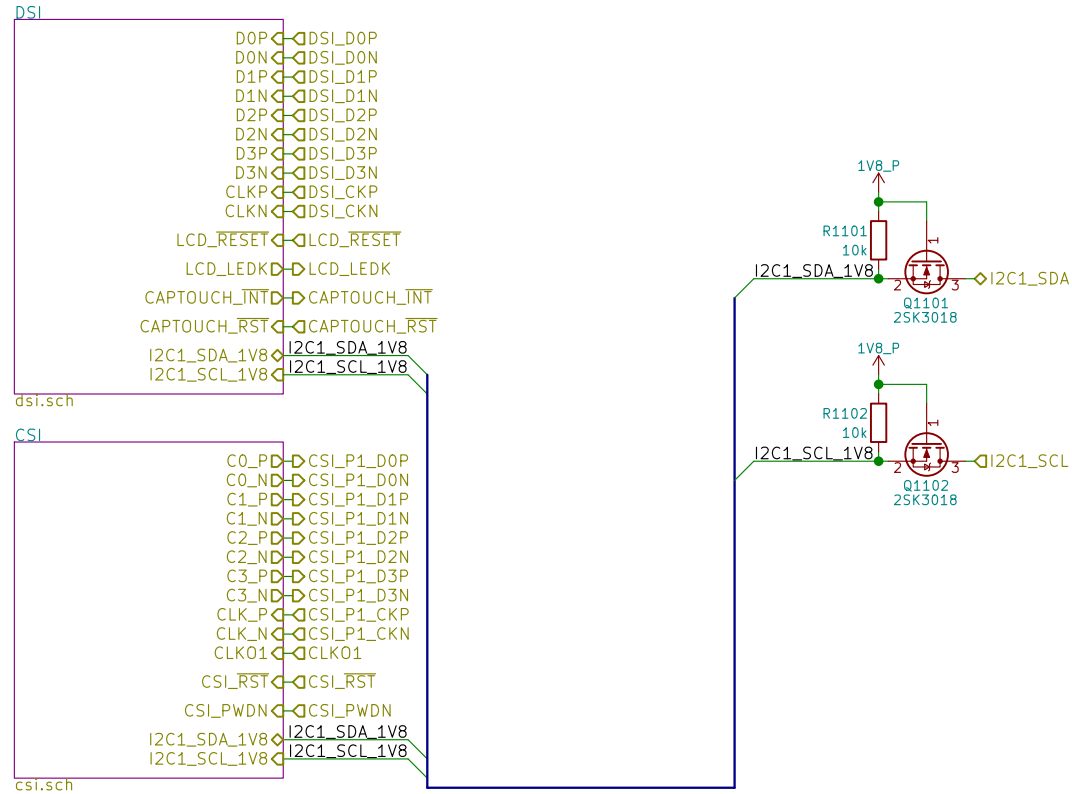
Date: 2018-06-11

Rev: v0.1.0

Size: A4	Date: 2025-01-27
KiCad E.D.A.	kicad 4.0.7

Id: 10/24

# MIPI



MIPI



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Sheet: /MIPI/  
File: mipi.sch

Size: A4 Date: 2018-06-11

KiCad E.D.A. kicad 4.0.7

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angus.ainstlie@puri.sm

nicole.farber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

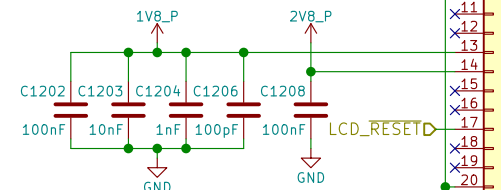
Id: 11/24

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

7-bit Slave Address: 0x5D  
(1011 101x)

Read: 0xBB  
Write: 0xBA


Cap-Touch Controller IC PN:  
Goodix GT5688




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:

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

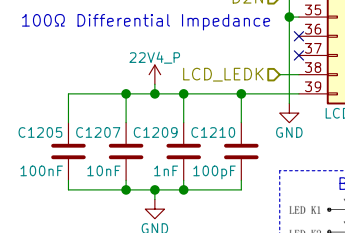
**Front:**



**Back:**



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



DSI FPC:  
Front: Back:

Backlight Array:



MIPI DSI



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Sheet: /MIPI/DSI/

File: dsi.sch

Size: A4

KiCad E.

4

Date: 2018-06-11

ad 4.0.7

---

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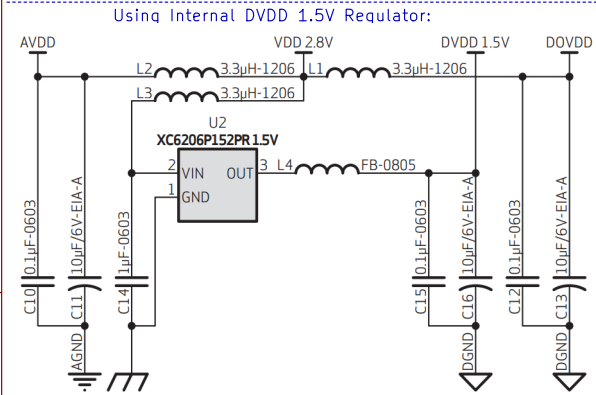
christian.schilmoeller@

---

Rev: v0.1.0

Id: 12/24

# Camera



## 2.7 POWER UP SEQUENCE

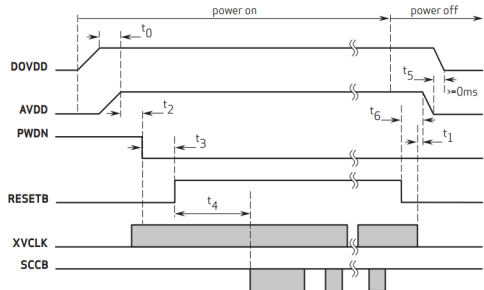
Based on the system power configuration (1.8V or 2.8V for I/O power, using external DVDD or internal DVDD, requiring access to the I2C during power up period or not), the power up sequence will differ. If 1.8V is used for I/O power, using the internal DVDD is preferred. If 2.8V is used for I/O power, due to a high voltage drop at the internal DVDD regulator, there is a potential heat issue. Hence, for a 2.8V power system, OmniVision recommends using an external DVDD source. Due to the higher power down current when using an external DVDD source, OmniVision strongly recommends cutting off all powers, including the external DVDD, when the sensor is not in use in the case of 2.8V I/O and external DVDD.

### 2.7.1 POWER UP WITH INTERNAL DVDD

For powering up with the internal DVDD and I2C access during the power ON period, the following conditions must occur:

1. when DOVDD and AVDD are turned ON, make sure DOVDD becomes stable before AVDD becomes stable
2. PWDN is active high with an asynchronous 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  $\geq 5$  ms)
5. RESETB is active low with an asynchronous 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**  $t_0 \geq 0\text{ms}$ , delay from DOVDD stable to AVDD stable, it is recommended to power up AVDD shortly after DOVDD has been powered up

$t_1 \geq 0\text{ms}$ , delay from XVCLK off to AVDD off

$t_2 \geq 5\text{ms}$ , 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

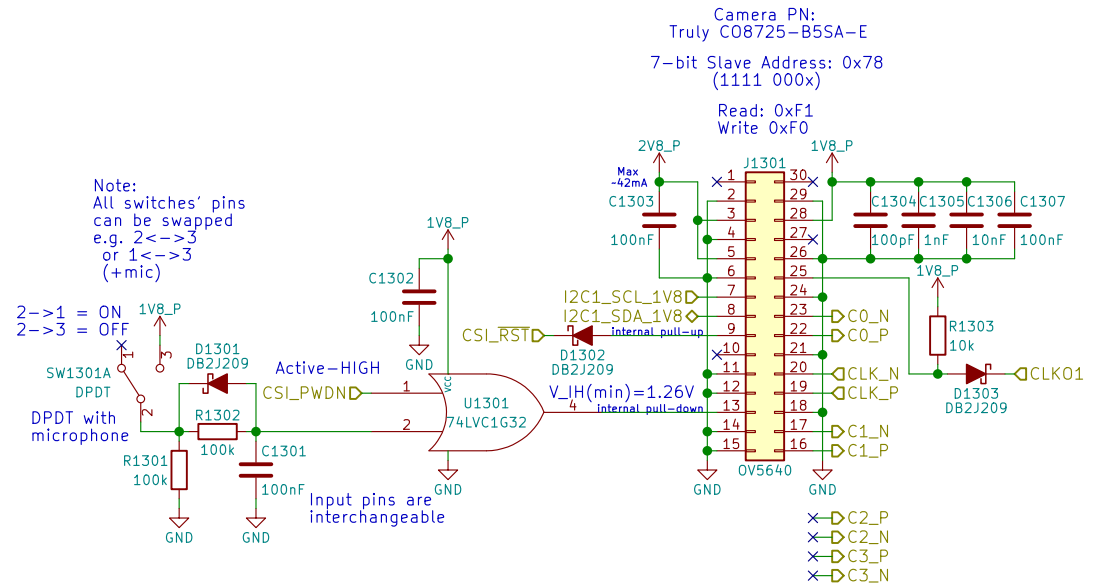
$t_3 \geq 1\text{ms}$ , delay from sensor power up stable to RESETB pull up

$t_4 \geq 20\text{ms}$ , delay from RESETB pull high to SCCB initialization

$t_5 \geq 0\text{ms}$ , delay from AVDD off to DOVDD off

$t_6 \geq 0\text{ms}$ , delay from RESETB pull low to AVDD off

5640 DS 2.2



OV5640 CMOS Image Sensor Datasheet:  
[https://cdn.sparkfun.com/datasheets/Sensors/LightImaging/OV5640\\_datasheet.pdf](https://cdn.sparkfun.com/datasheets/Sensors/LightImaging/OV5640_datasheet.pdf)



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Sheet: /MIPI/CSI/

File: csi.sch

Size: A4	Date: 2018-06-11
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Size: A4	Date:
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eric.kuzmenko@puri.sm

angus.ainslie@puri.sm

nicole.ferber@puri.sm

christian.schilmoeller@puri.sm

Rev: v0.1.0

Id: 13/24

A	
B	
C	
D	

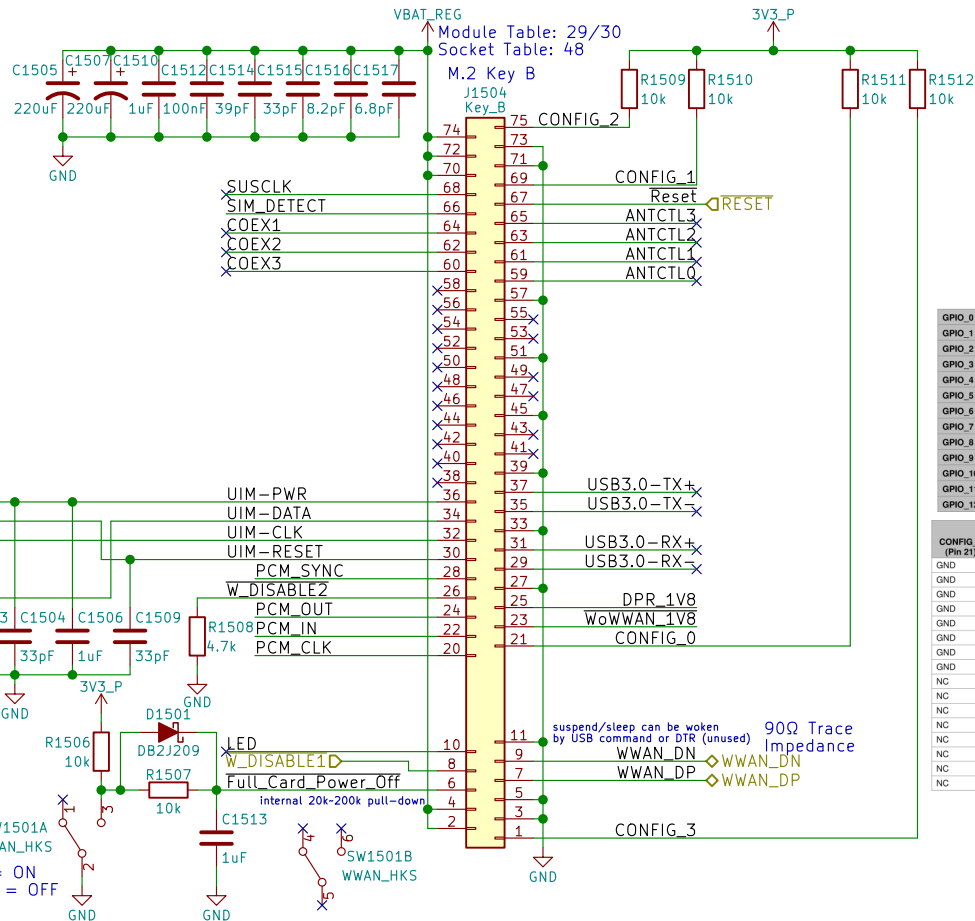
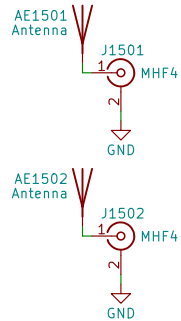


C



Rev: v0.1.0  
Id: 14/24

# WWAN M.2



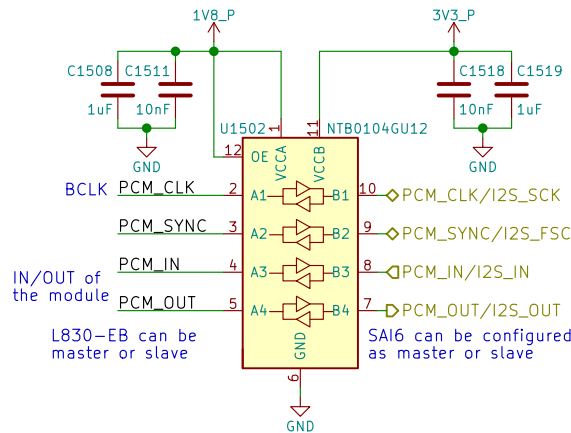
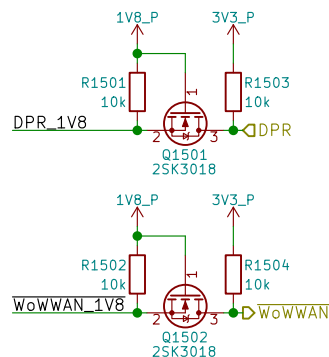
Standards:  
3GPP TS 51.010-1  
ISO/IEC 7816

DET is normally closed!  
<10cm away from module!  
UIM-CLK up to 5MHz

SIM\_DETECT:

Sierra, Huawei, and Telit are Active High  
SimCom and Gemalto needs to be inverted!  
"When SIM is present, SIM\_DET is high"  
SIM\_DET needs to open when card inserted!

"It is recommended to place the UIM\_RST trace  
between UIM\_DATA and UIM\_CLK to provide isolation"  
"It is recommended to surround the UIM\_DATA with ground."



Some modems are NC  
for the USB3.0 interface  
Some modules do  
GNSS over USB  
Some modems require  
the USB3.0 interface  
Typically host support  
for USB3.0 is optional  
USB3.0 unused with  
Gemalto, SimCom, Fibocom

Even pins 40-48 are unused

	Pin	Port Config_0 <sup>1</sup>	Port Config_1 <sup>2</sup>	Port Config_2 <sup>3</sup>	Port Config_3 <sup>4</sup>
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				Module Type and Main Host Interface <sup>1</sup>	Port Configuration <sup>2</sup>
CONFIG_0 (Pin 21)	CONFIG_1 (Pin 69)	CONFIG_2 (Pin 75)	CONFIG_3 (Pin 1)		
GND	GND	GND	GND	SSD - SATA	N/A
GND	NC	GND	GND	SSD - PCIe	N/A
GND	GND	NC	GND	WWAN - PCIe	0
GND	NC	NC	GND	WWAN - PCIe	1
GND	GND	GND	NC	WWAN - USB 3.0	2
GND	NC	GND	NC	WWAN - USB 3.0	3
GND	GND	NC	NC	WWAN - USB 3.0	4
GND	NC	NC	NC	WWAN - USB 3.0	5
NC	GND	GND	GND	WWAN - SSIC	6
NC	NC	GND	GND	WWAN - SSIC	7
NC	GND	NC	GND	WWAN - SSIC	8
NC	NC	NC	GND	WWAN - SSIC	9
NC	GND	NC	GND	WWAN - SSIC	10
NC	NC	GND	NC	WWAN - SSIC	11
NC	GND	GND	NC	WWAN - PCIe	12
NC	NC	GND	NC	WWAN - PCIe	13
NC	GND	NC	NC	RFU	N/A
NC	NC	NC	NC	No Module Present	N/A

WWAN M.2

**Purism**

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Sheet: /WWAN M.2/  
File: wwan\_m2.sch

Size: A4  
KiCad E.D.A. kicad 4.0.7

eric.kuzmenko@puri.sm  
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nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 15/24

# Audio

Reference:  
[http://www.52rd.com/S\\_txt/2011\\_3/TXT26685.htm](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"  
 $\Rightarrow (1V)^2 / (16\Omega) = 62.5mW$   
 $\therefore V_{rms} = 1V \Rightarrow V_p(\text{amplitude}) = 1.414V$   
 $\therefore I_{rms}(\text{max}) = 62.5mA$

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



$Z(\text{hp}) \geq 16\Omega$

HP\_DET  
 SMD Equivalents:  
 SJ-43515RS-SMT-TR  
 SJ-43515TS  
 Pin 5 (tip switch) is NC, open when inserted  
 If just headphones then HP\_DET=HIGH, R(mic)=0

may add ~220uF cap parallel to Zener

Ext-Mic enabled MIC\_SEL=LOW  
 Int-Mic enabled MIC\_SEL=LOW  
 Add TVS next to int-mic? (OpenMoko does this)  
 Note: 5->4 = ON  
 5->6 = OFF  
 All switches' pins can be swapped e.g. 5<->4 or 5<->6 (+camera)  
 $-37dB = 14.1254mV/Pa$   
 $\therefore \text{mic produces } 14.1254mV_{rms} \text{ when exposed to a } 1kHz \text{ tone of } 94dB-SPL \text{ at the capsule (or } 19.98mV \text{ amplitude)}$   
 $\Rightarrow 40dB \text{ gain would produce } -2V \text{ amplitude (4Vpp, clipping)}$   
 $30dB \text{ gain would produce } -0.632V \text{ amplitude (1.264Vpp)}$   
 $38.33dB \text{ gain would yield } 3.3V_{pp}$

## LCR Measurements:

Earbud Microphone: @1kHz  
 $L_s = 3.844mH$   
 $L_p = 15.757H$   
 $C_s = 6.583uF$   
 $C_p = 1612.8pF$   
 $R_s = 1.5465k\Omega$   
 $R_p = 1.5478k\Omega$   
 $\theta = -0.8deg$

Headset Speaker: @1kHz  
 $L_s = 244.4uH$   
 $L_p = 141.99mH$   
 $C_s = 103.6uF$   
 $C_p = 178.77nF$   
 $R_s = 36.860\Omega$   
 $R_p = 36.860\Omega$   
 $\theta = -2.3deg$

Earbud Speaker: @1kHz  
 $L_s = 25.2uH$   
 $L_p = 311.0mH$   
 $C_s = 1.0mF$   
 $C_p = 81.95nF$   
 $R_s = 17.0300\Omega$   
 $R_p = 17.0340\Omega$   
 $\theta = 0.5deg$

## Audio

**Purism**

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Sheet: /Audio/  
 File: audio.sch

Size: A4 Date: 2018-06-11

KiCad E.D.A. kicad 4.0.7

eric.kuzmenko@puri.sm

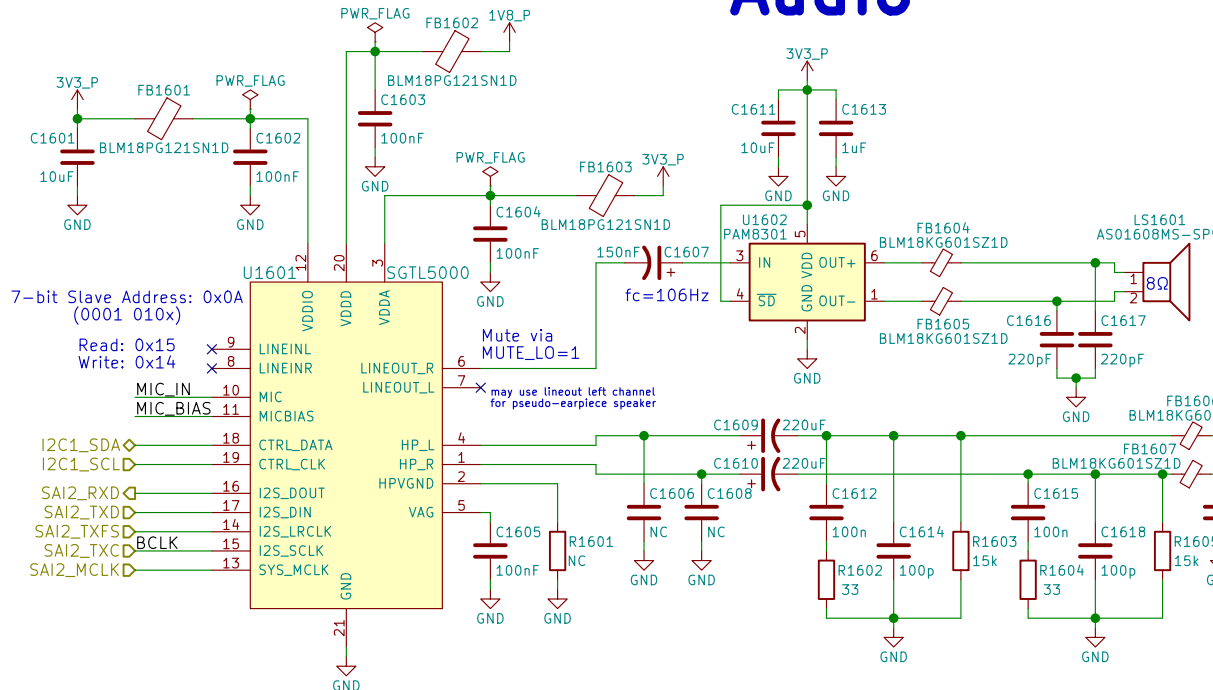
angus.ainslie@puri.sm

nicole.farber@puri.sm

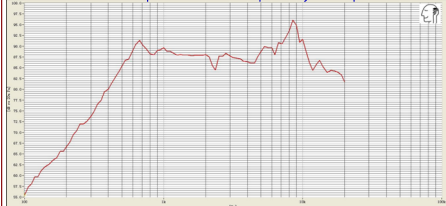
christian.schilmoeller@puri.sm

Rev: v0.1.0

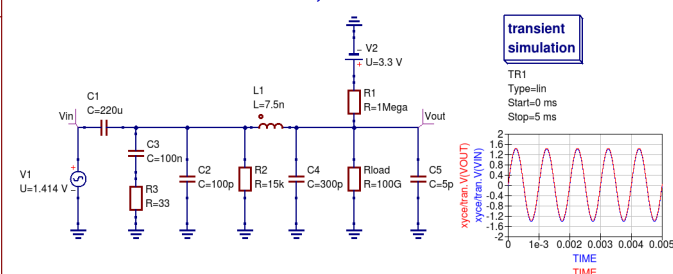
Id: 16/24



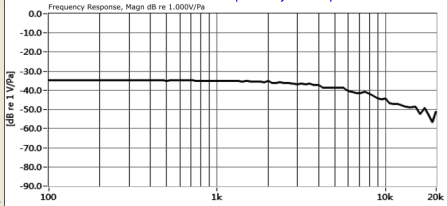
Built-In Speaker's Frequency Response:



Simulation of HP\_DET @ 1kHz output without HP jack inserted:



Built-In Mic's Frequency Response:





[illegible]

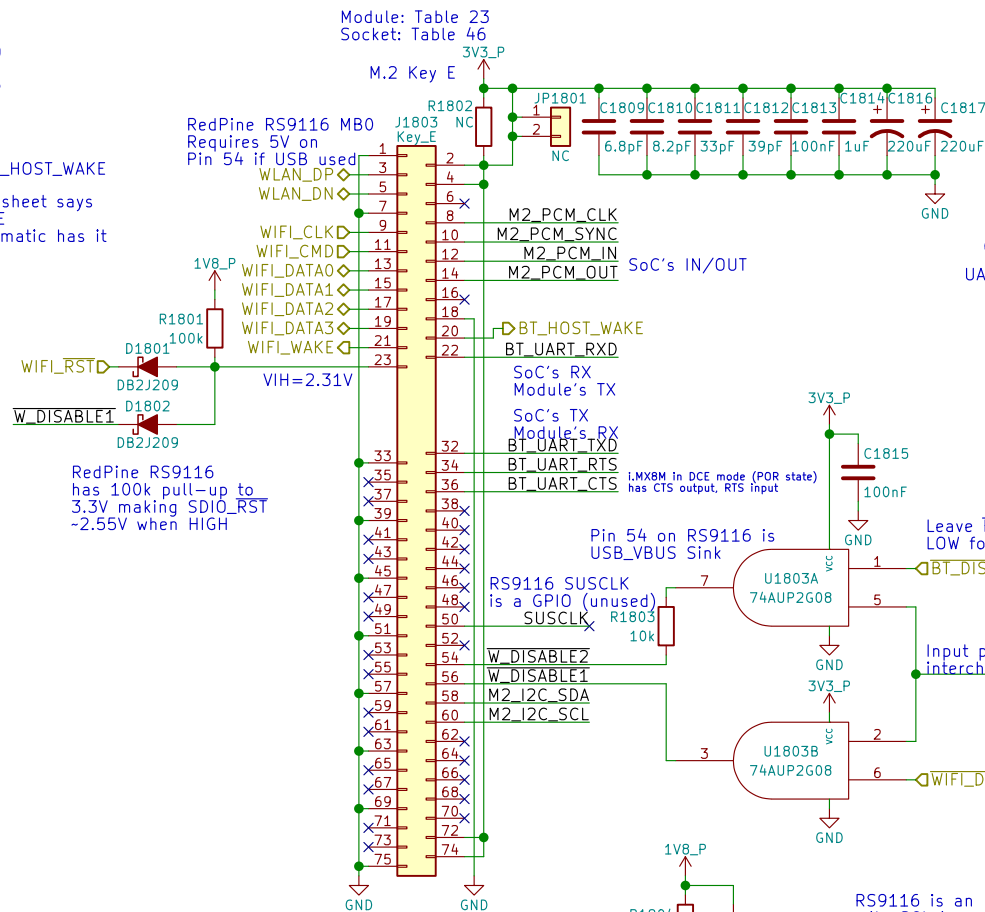
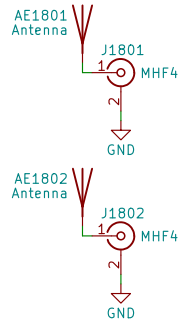
 Purism

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nicole.farber@puri.sm  
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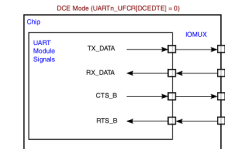
# WLAN+BT M.2

RS9116 NC:  
RTS, CTS, BT\_HOST\_WAKE

RS9116 datasheet says  
no WIFI\_WAKE  
but the schematic has it

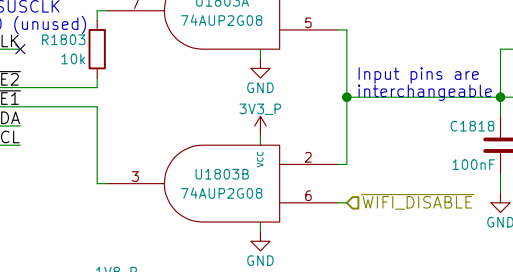


6.2 M.2 Signal Directions  
UARTn\_UFCR[DCEDTE]=0 on POR



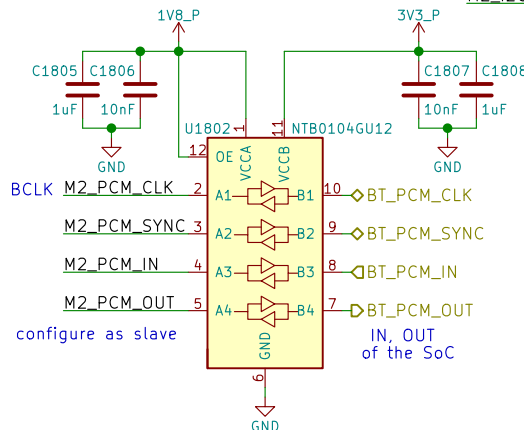
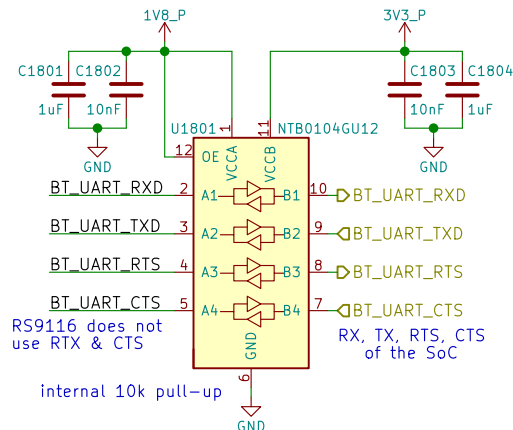
TX output  
RX input  
CTS output  
RTS input  
⇒ TX→RX  
RX→TX  
CTS→CTS  
RTS→RTS

Pin 54 on RS9116 is  
USB\_VBUS Sink  
Leave BT\_DISABLE  
LOW for RS9116



Note:  
All switches' pins  
can be swapped  
e.g. 2<->3  
or 1<->3  
Open = ON  
Closed = OFF

RS9116 is an I2C master  
⇒ its SCL is an output  
(ok bc only device on I2C2)  
M2\_I2C\_SDA  
M2\_I2C\_SCL



WLAN+BT M.2

**Purism**

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Sheet: /WLAN+BT M.2/  
File: wifi\_bt\_m2.sch

Size: A4  
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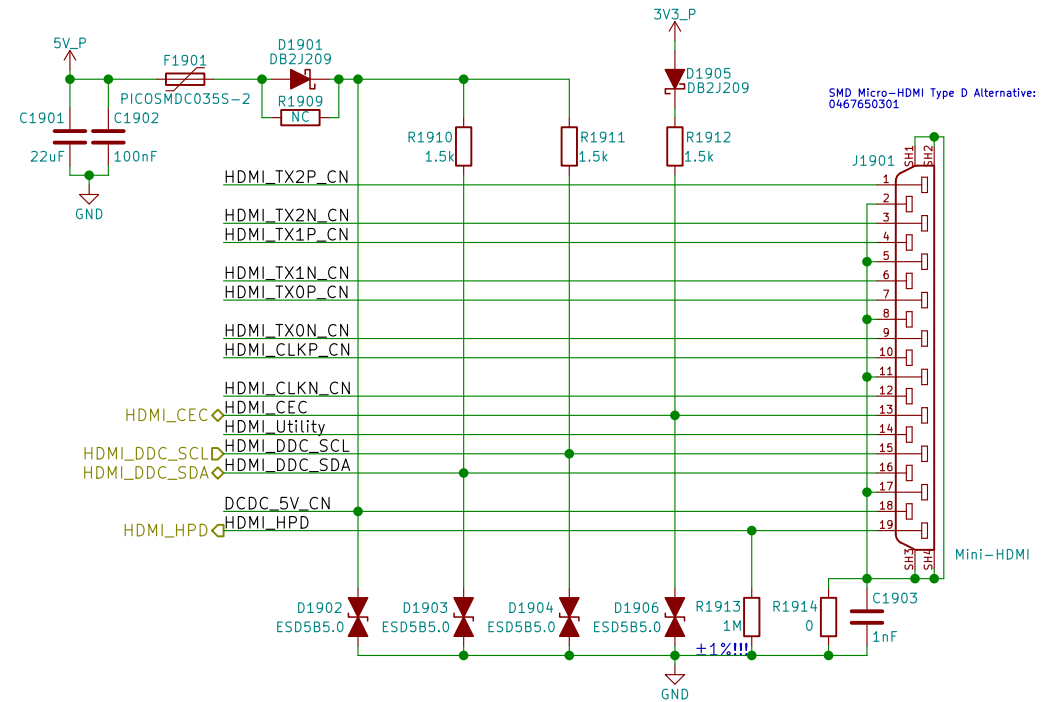
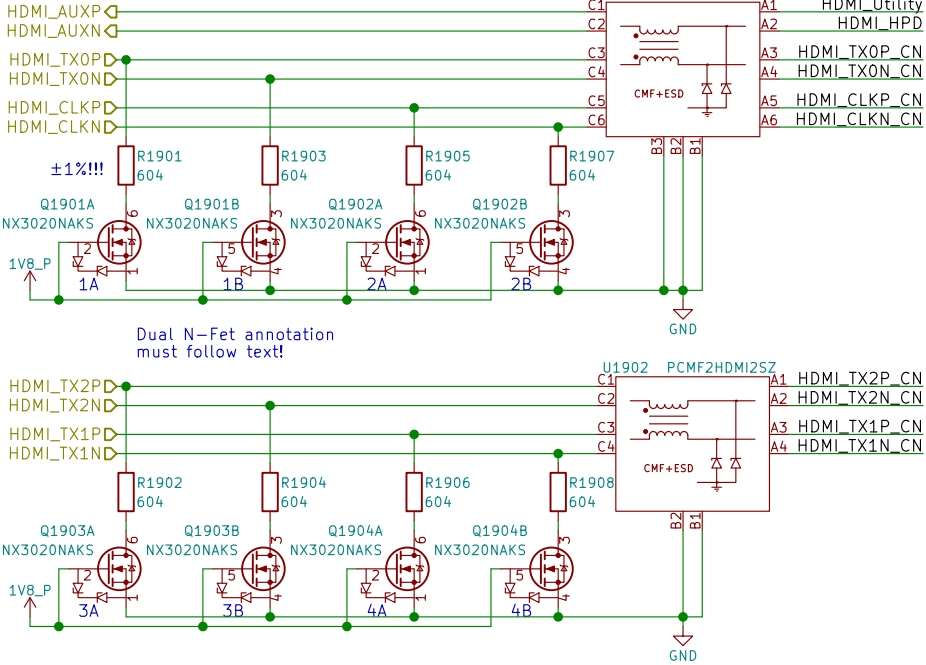
Rev: v0.1.0  
Id: 18/24

TUSB1046 can be used for DP over USB-C

# HDMI

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

100Ω diff pairs



HDMI



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Sheet: /HDMI/  
File: hdmi.sch

Size: A4 Date: 2018-06-11  
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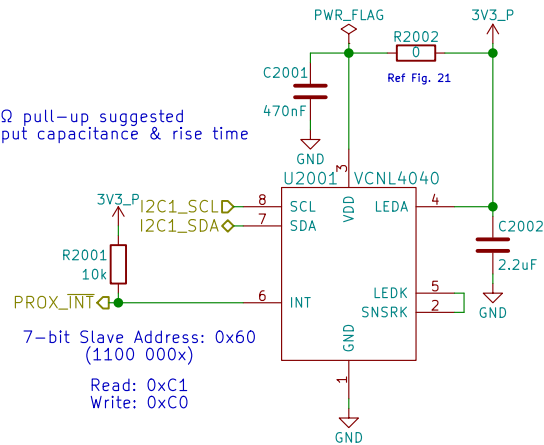
eric.kuzmenko@puri.sm  
angus.ainstie@puri.sm  
nicole.farber@puri.sm  
christian.schilmoeller@puri.sm

Rev: v0.1.0  
Id: 19/24

# Sensors

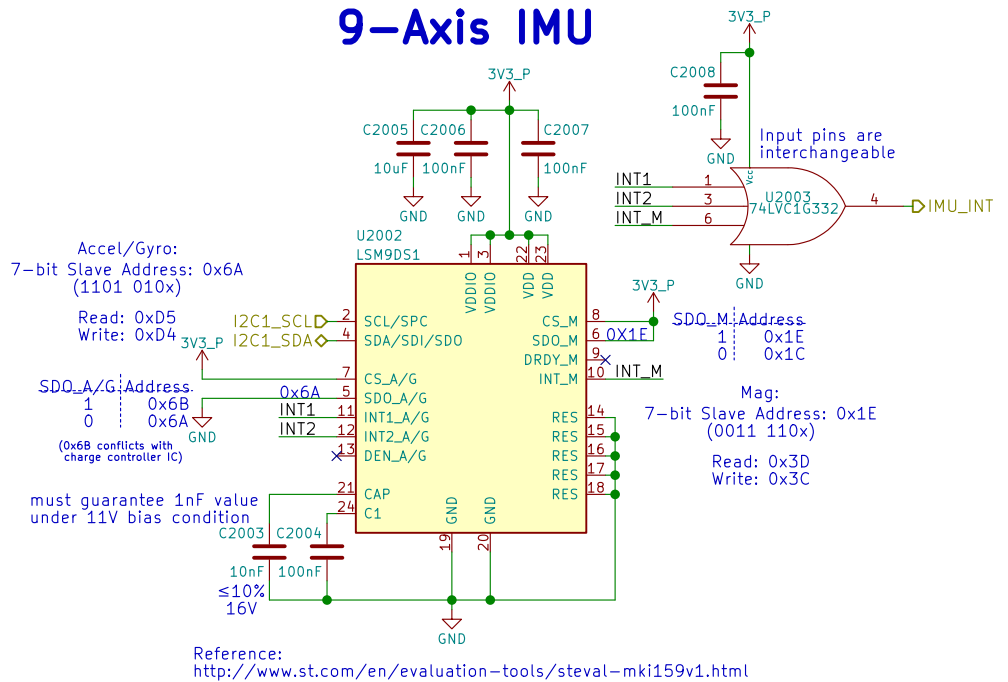
## Proximity & Ambient Light

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/vcni4040sensorboardfiles.pdf>

## 9-Axis IMU



**Table 19. Accelerometer and gyroscope SAD\*Read/Write patterns**

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

**Table 20. Magnetic sensor SAD\*Read/Write patterns**

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

### Sensors



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Sheet: /Sensors/  
File: sensors.sch

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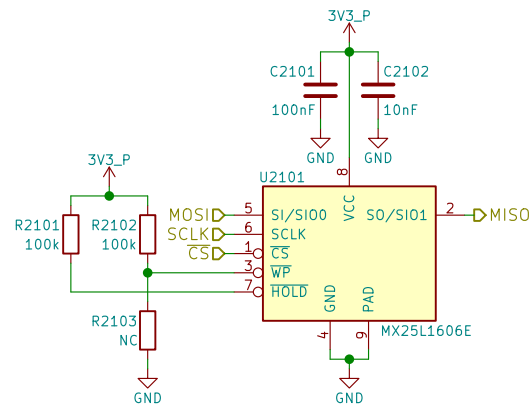
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# SPI NOR Flash



## SPI NOR Flash



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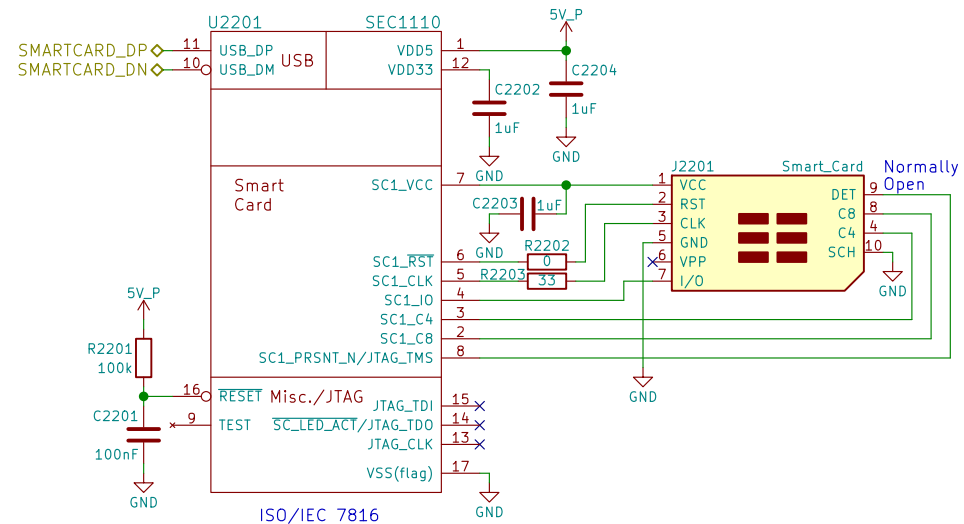
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Rev: v0.1.0

Id: 21/24

# Smart Card



## Smart Card



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Size: A4 Date: 2018-06-11

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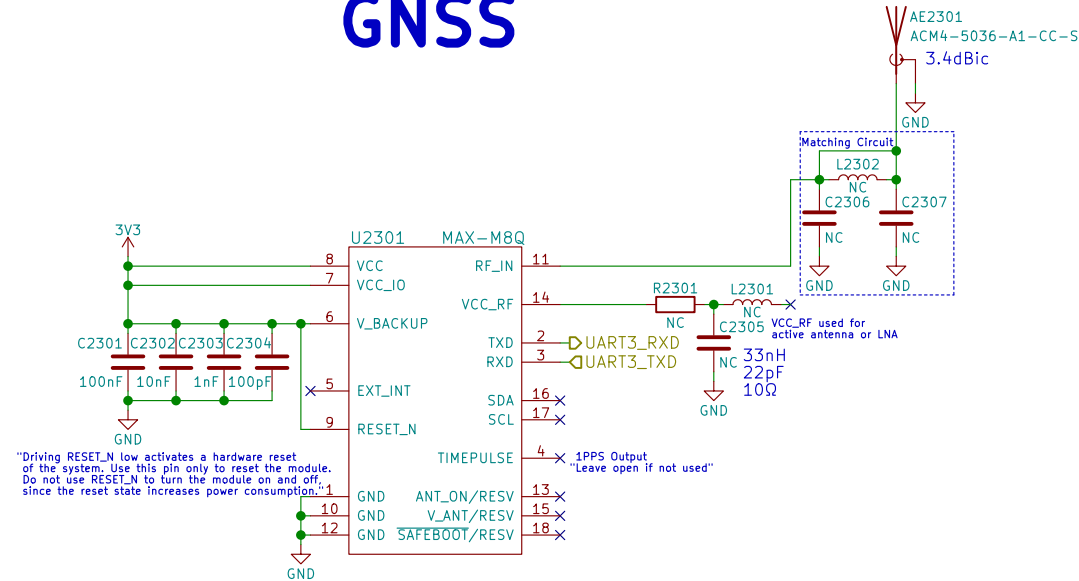
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Rev: v0.1.0

Id: 22/24

# GNSS



## References:

[https://www.u-blox.com/sites/default/files/MAX-M8\\_HardwareIntegrationManual\\_L%28UBX-13004876%29.pdf](https://www.u-blox.com/sites/default/files/MAX-M8_HardwareIntegrationManual_L%28UBX-13004876%29.pdf)  
[https://www.u-blox.com/sites/default/files/MAX-8-M8-FW3\\_HardwareIntegrationManual\\_L%28UBX-15030059%29.pdf](https://www.u-blox.com/sites/default/files/MAX-8-M8-FW3_HardwareIntegrationManual_L%28UBX-15030059%29.pdf)

GNSS



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Sheet: /GNSS/

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eric.kuzmenko@puri.sm

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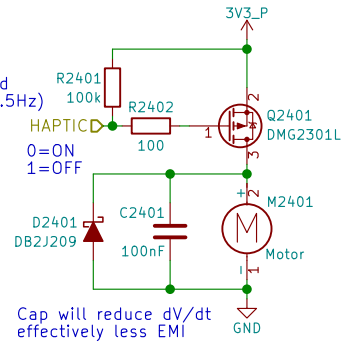
nicole.farber@puri.sm

christian.schilmoeller@puri.sm

# Haptic Motor

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)!  
 Metal housing is floating  
 (not connected to either pin)  
 => could connect housing to GND

Cheaper Motor Connector:  
[https://lcsc.com/product-detail/1-25T-Connectors\\_1-25T-1-2AW\\_C10832.html](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](https://www.alibaba.com/product-detail/Coin-motor-vibration-dc-motor-cellphone_1994583657.html?spm=a2700.8443308.0.0.5aa13e5f1wxHgs)

Motor Datasheet:  
<https://cloud.puri.sm/s/z8JR6DJ4KrJYzoW>

Motor PN:  
 BY0820Z021L20

Haptic/Vibration Motor



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Sheet: /Haptic Motor/  
 File: haptic.sch

Size: A4 Date: 2018-06-11

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Rev: v0.1.0

Id: 24/24