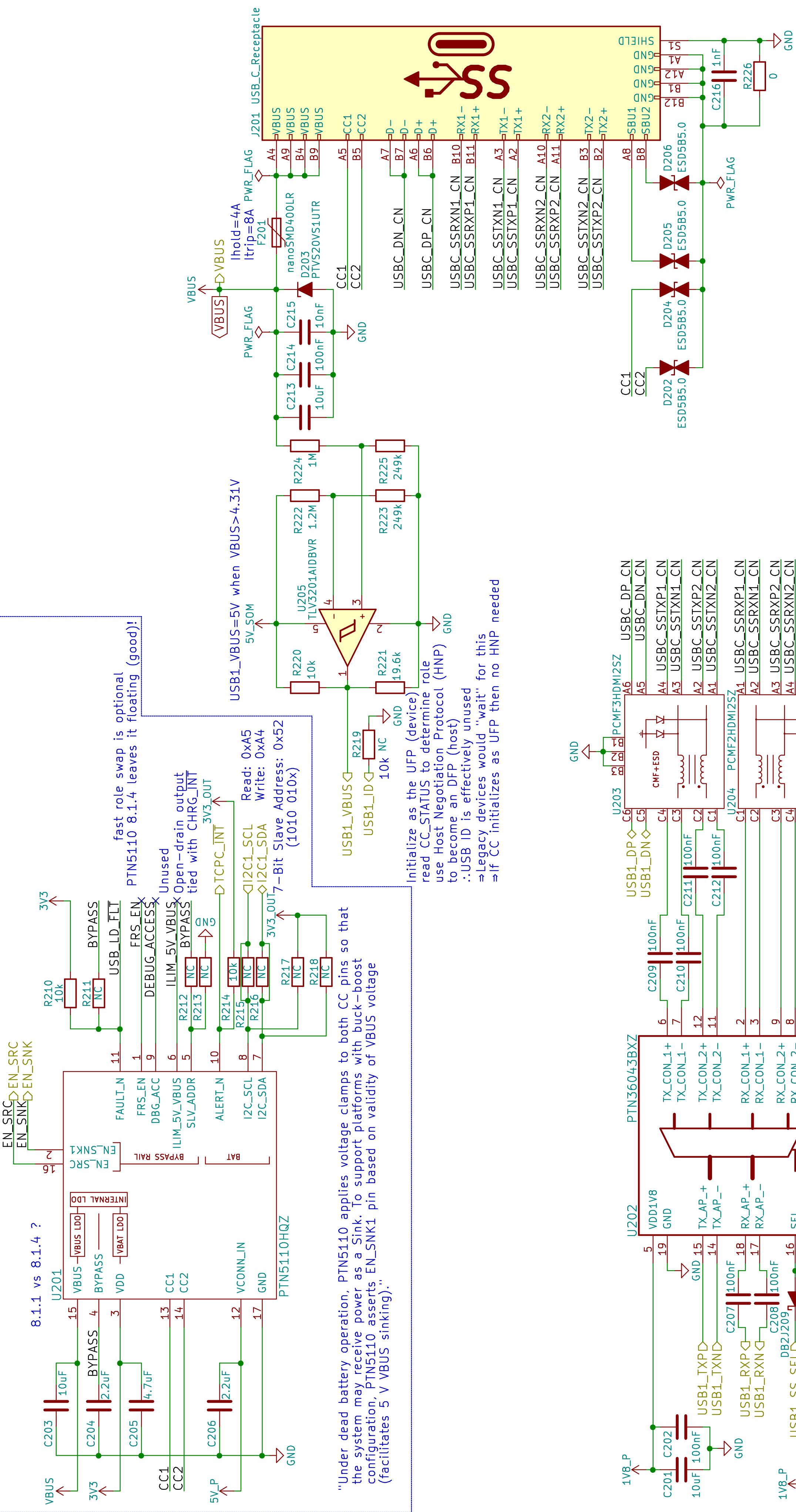




# USB-C TCPC – Config Channel (CC) and PD Role Controller



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

**Title: Librem5 development kit**

Size: A4

Date: 2018-06-07

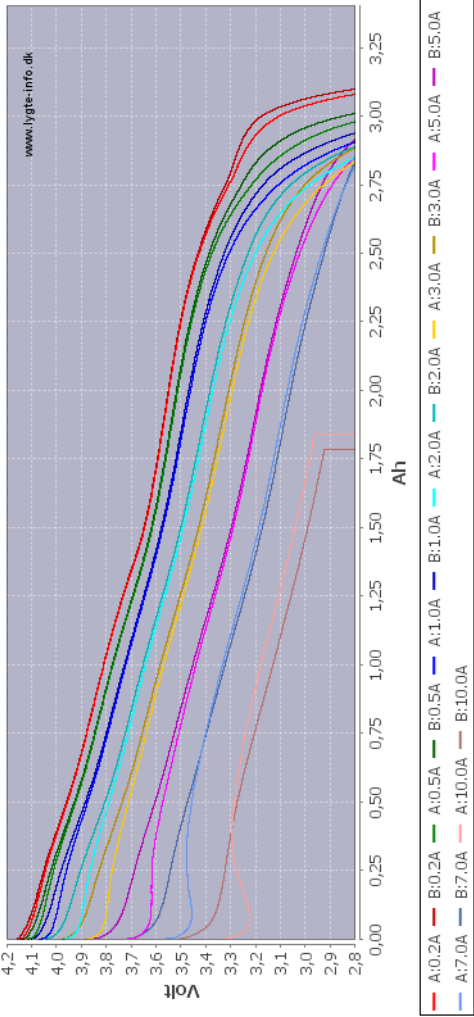
KiCad E.D.A. kicad 4.0.7+dfsg1-1

Rev: v0.1.0

Id: 2/24



Discharge, capacity: Intl-outdoor NCR18650BD 3200mAh (Black)



(interpret RSOC% based on this plot)

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

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

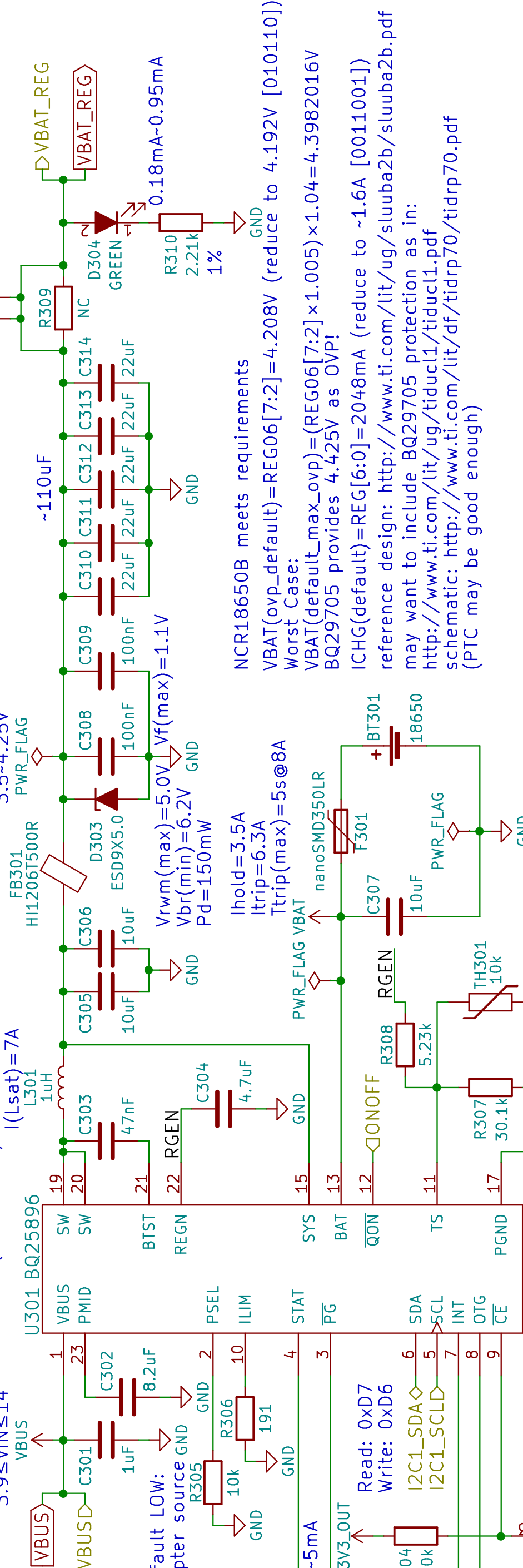
Reading PTN5110HQ's CC\_STATUS and POWER\_STATUS registers will tell TCPM (i.MX8M) when to set EN\_HiZ Also, reading PTN5110HQ's CC\_STATUS and POWER\_STATUS registers will tell TCPM (i.MX8M) when to set OTG\_CONFIG=1 (this will also happen when PTN5110HQ sets EN\_SRC HIGH)

# Battery Charge Controller

use AUTO\_DPDM\_LEN to auto-detect INLIM

1.658≤ILIM≤2.063  
ILIM(nom)≈1.859A  
3.9≤VIN≤14

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



NCR18650B meets requirements

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 [00111001])

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)

VBAT(DPL)=2.15-2.5V

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

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Sheet: /Battery/

File: battery.sch

Title: Librem5 development kit

Size: A4

Date: 2018-06-07

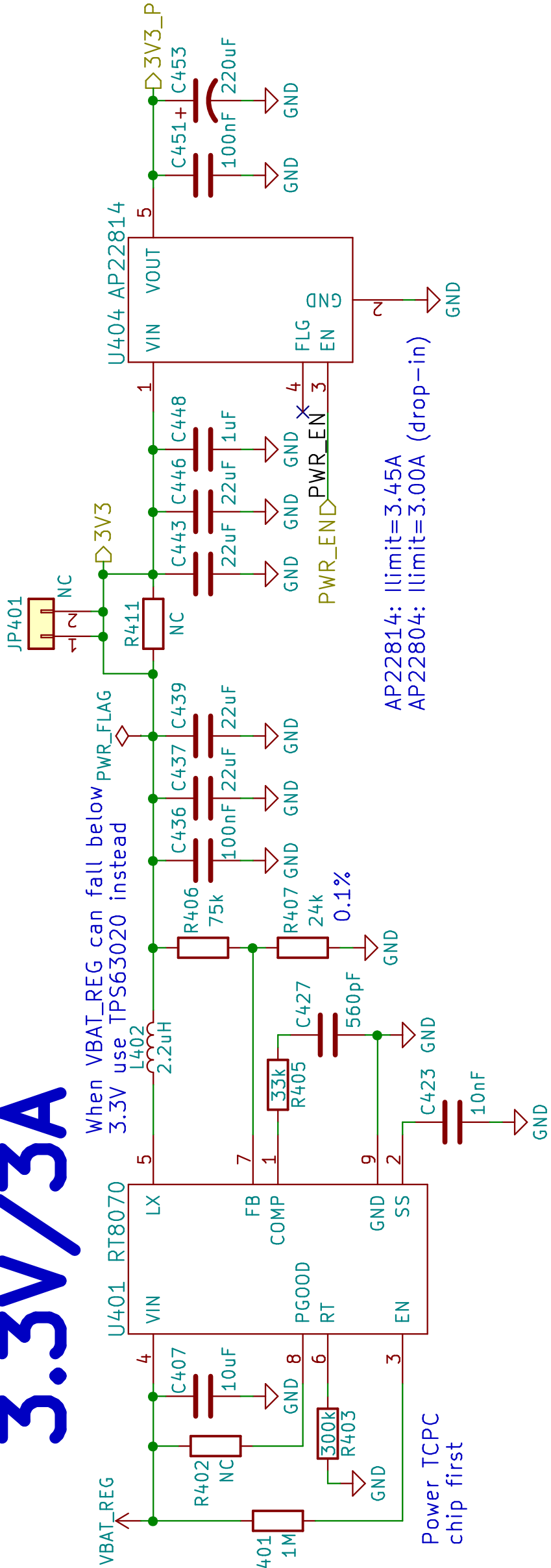
KiCad E.D.A. kicad 4.0.7+dfsg1-1

Rev: v0.1.0

Id: 3/24

# 3.3V/3A

When VBAT\_REG can fall below 3.3V use TPS63020 instead

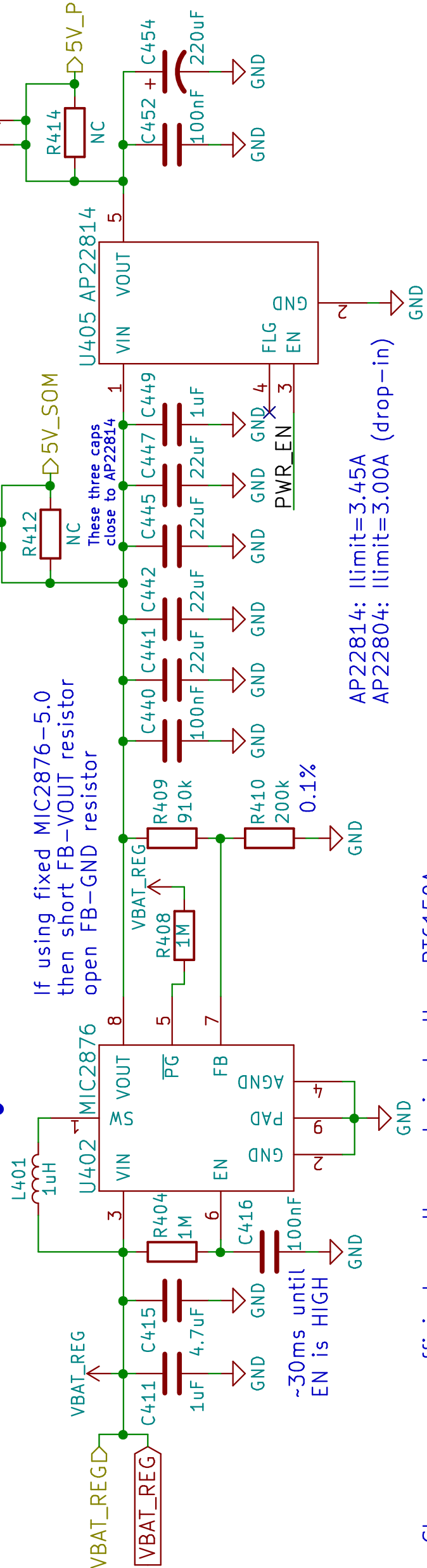


Power TCPC chip first

AP22814: Ilimit=3.45A  
AP22804: Ilimit=3.00A (drop-in)

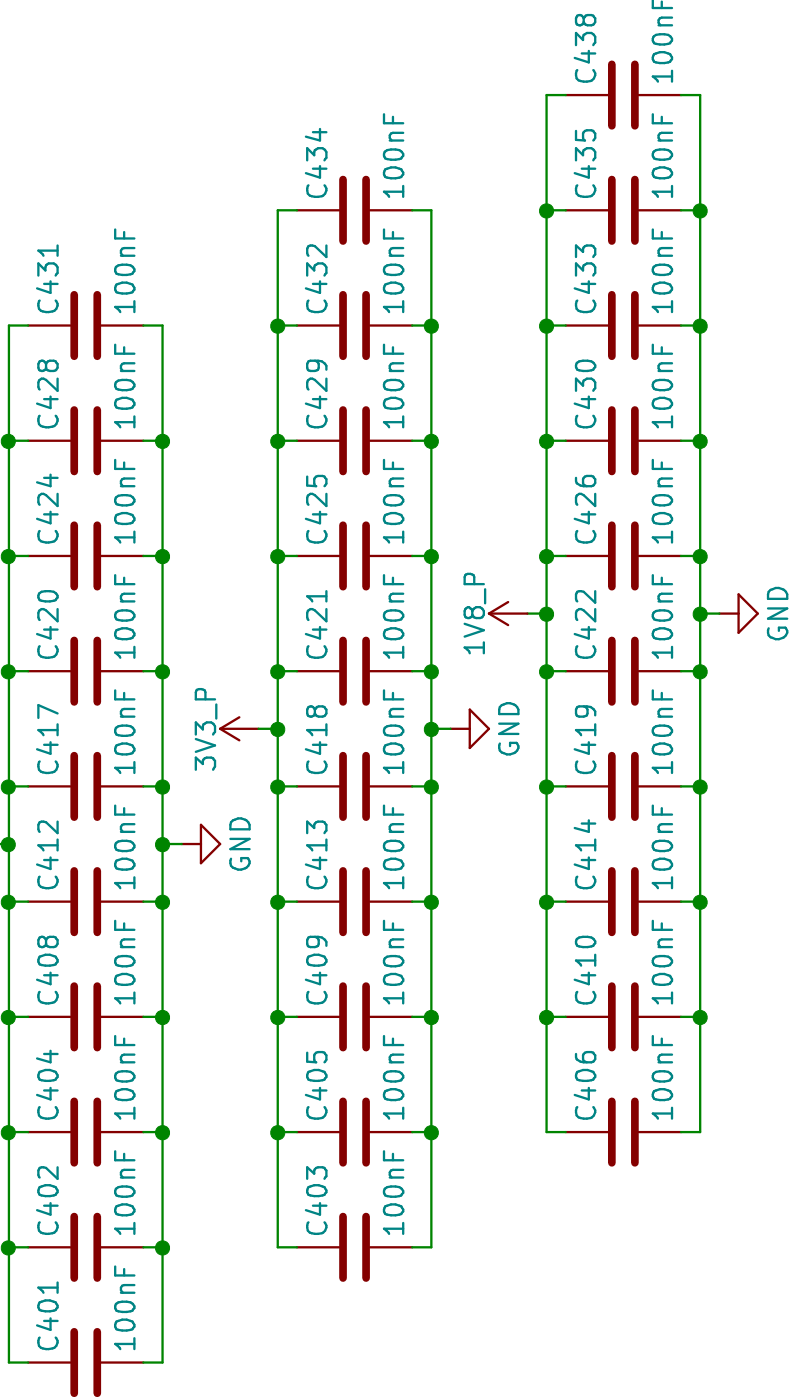
# 5.0V/3.8A

If using fixed MIC2876-5.0 then short FB-VOUT resistor open FB-GND resistor

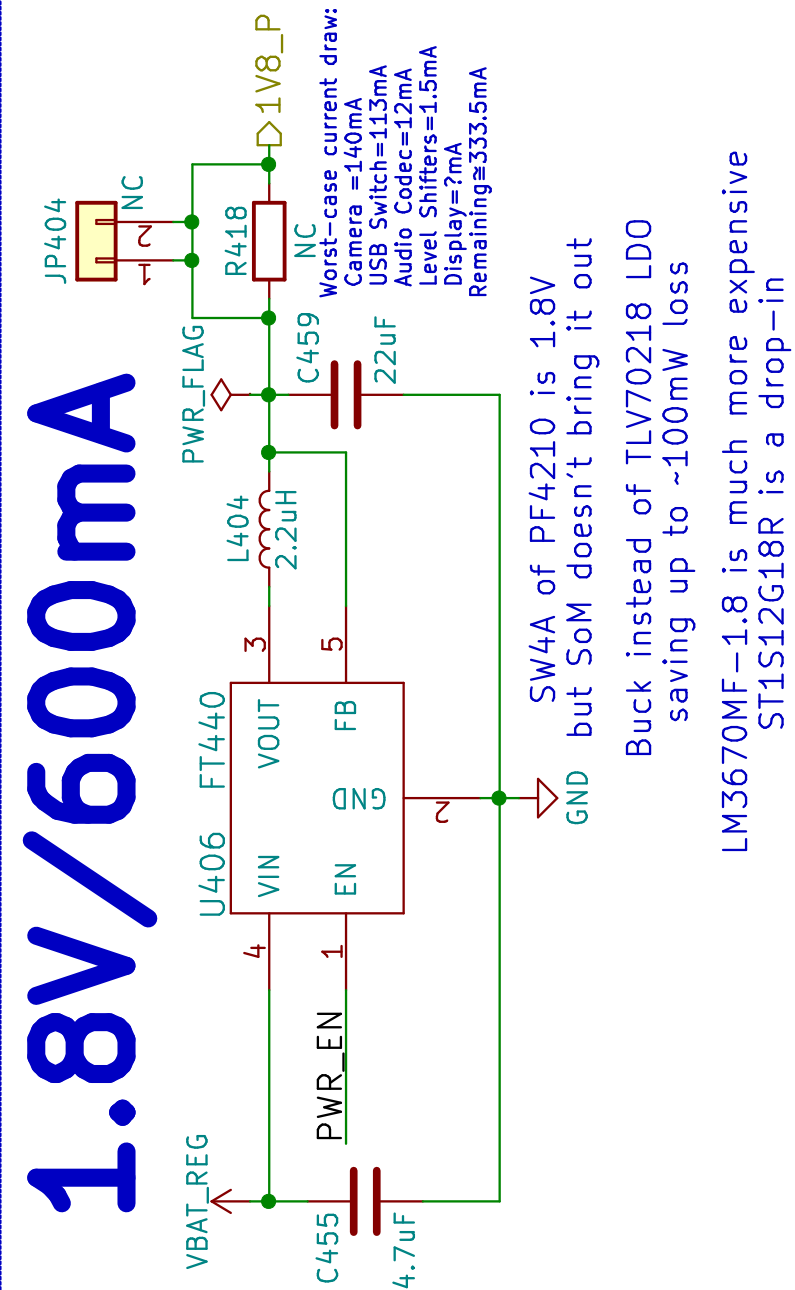


Cheaper, more efficient, smaller, and simpler than RT6150A  
Explicitly mentions USB/smartphone application

5V\_P Spread all the decoupling/stitching capacitors all over the power plane

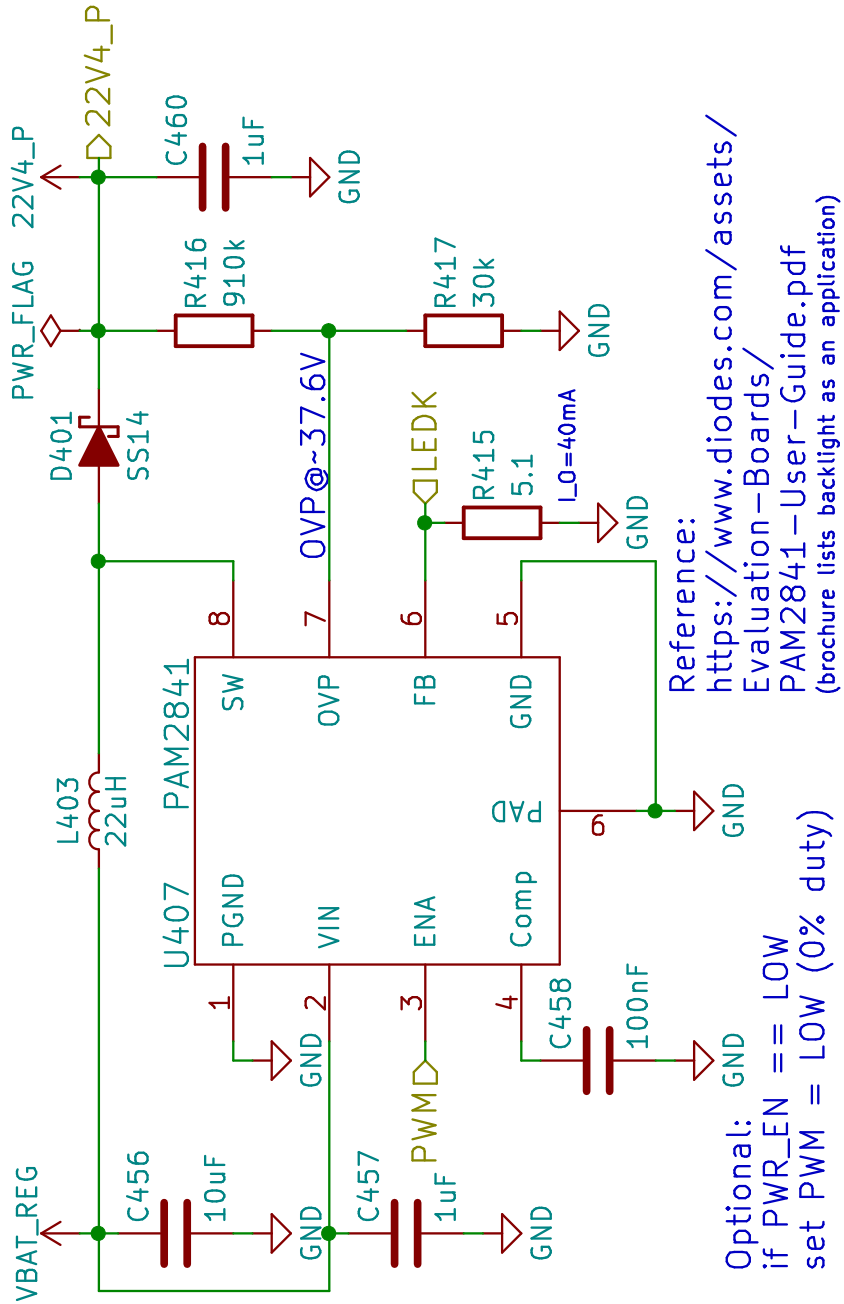


# 1.8V/600mA



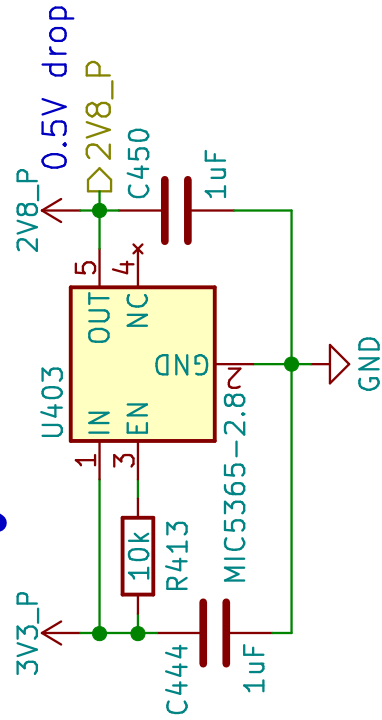
SW4A of PF4210 is 1.8V but SoM doesn't bring it out  
Buck instead of TLV70218 LDO saving up to ~100mW loss  
LM3670MF-1.8 is much more expensive  
ST1S12G18R is a drop-in

# 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



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Sheet: /Power/  
File: power.sch

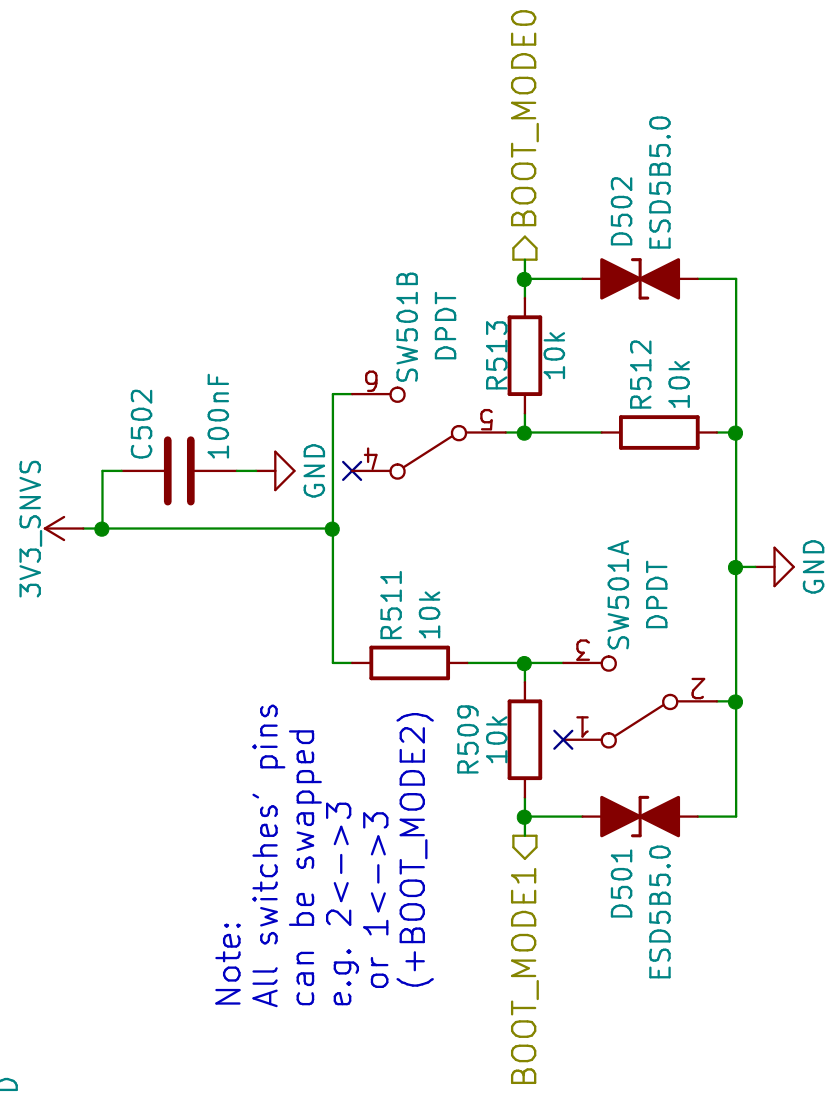
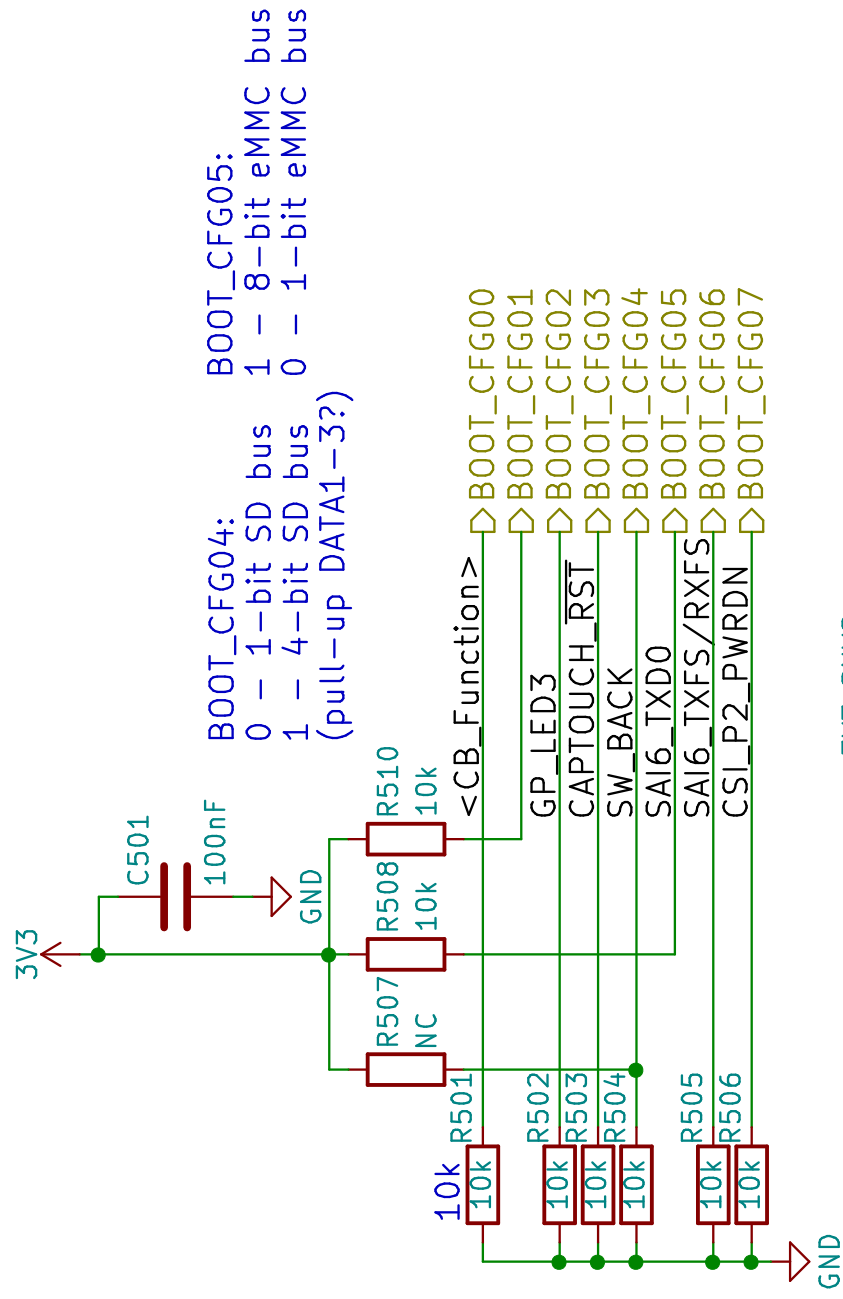
Title: Librem5 development kit

Size: A4 Date: 2018-06-07

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Rev: v0.1.0

Id: 4/24

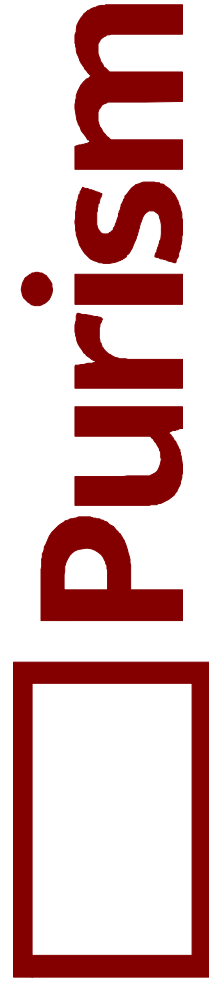
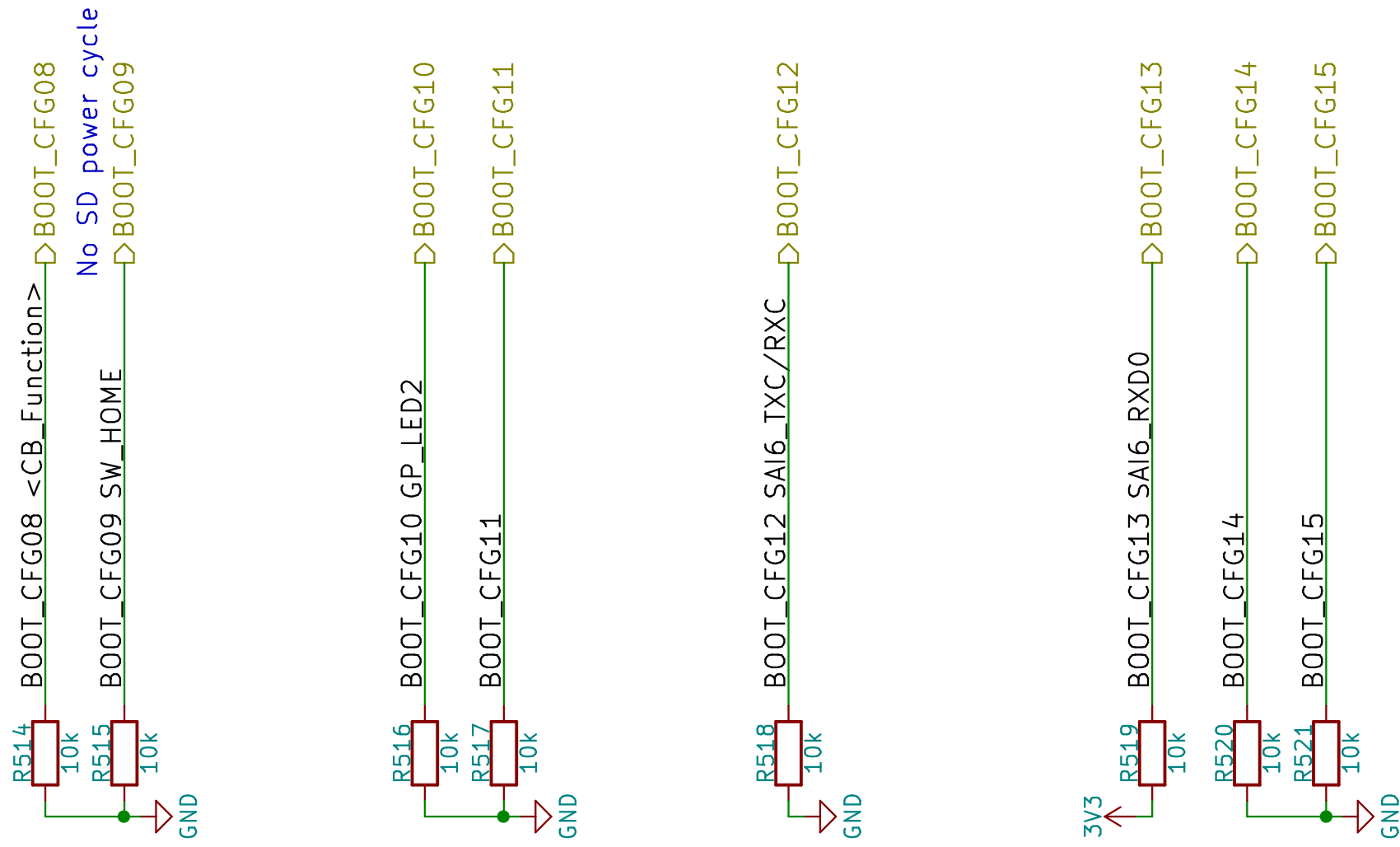


BOOT_MODE[1:0]	Boot Type
00	Boot From Fuses
01	Serial Downloader
10	Internal Boot
11	Reserved

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



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Sheet: /Boot Config/

File: boot.sch

# Title: Libre5 development kit

Size: A4	Date: 2018-06-07
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Rev: v0.1.0

Id: 5/24













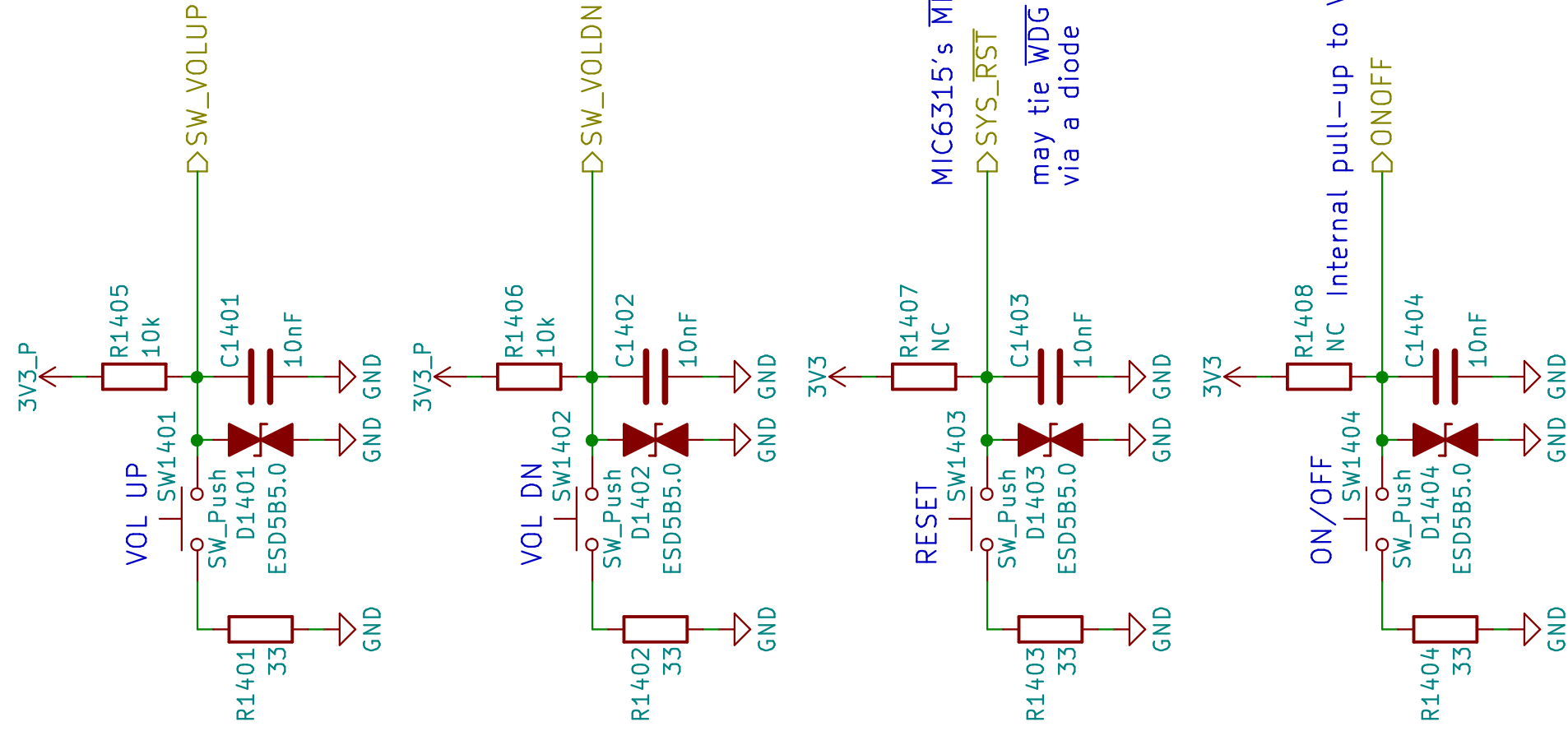




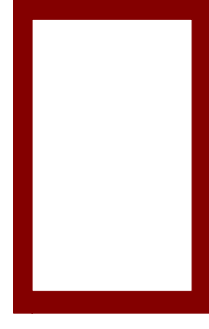
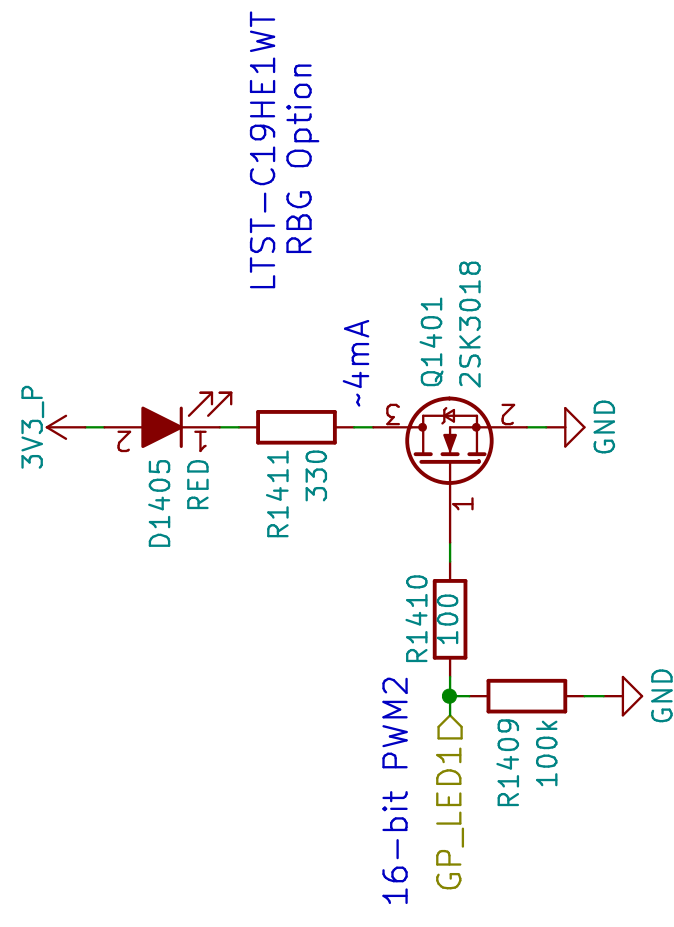








- Use PWM2\_PWMSAR to set the compare value (duty cycle)
- Use PWM2\_PWMCR[15:4] to set the PRESCALER (frequency)
- Use PWM2\_PWMPR to set the top of the counter (frequency)



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Sheet: /Buttons &amp; LED/

File: buttons\_led.sch

**Title: Librem5 development kit**

Size: A4

Date: 2018-06-07

Rev: v0.1.0

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Id: 14/24

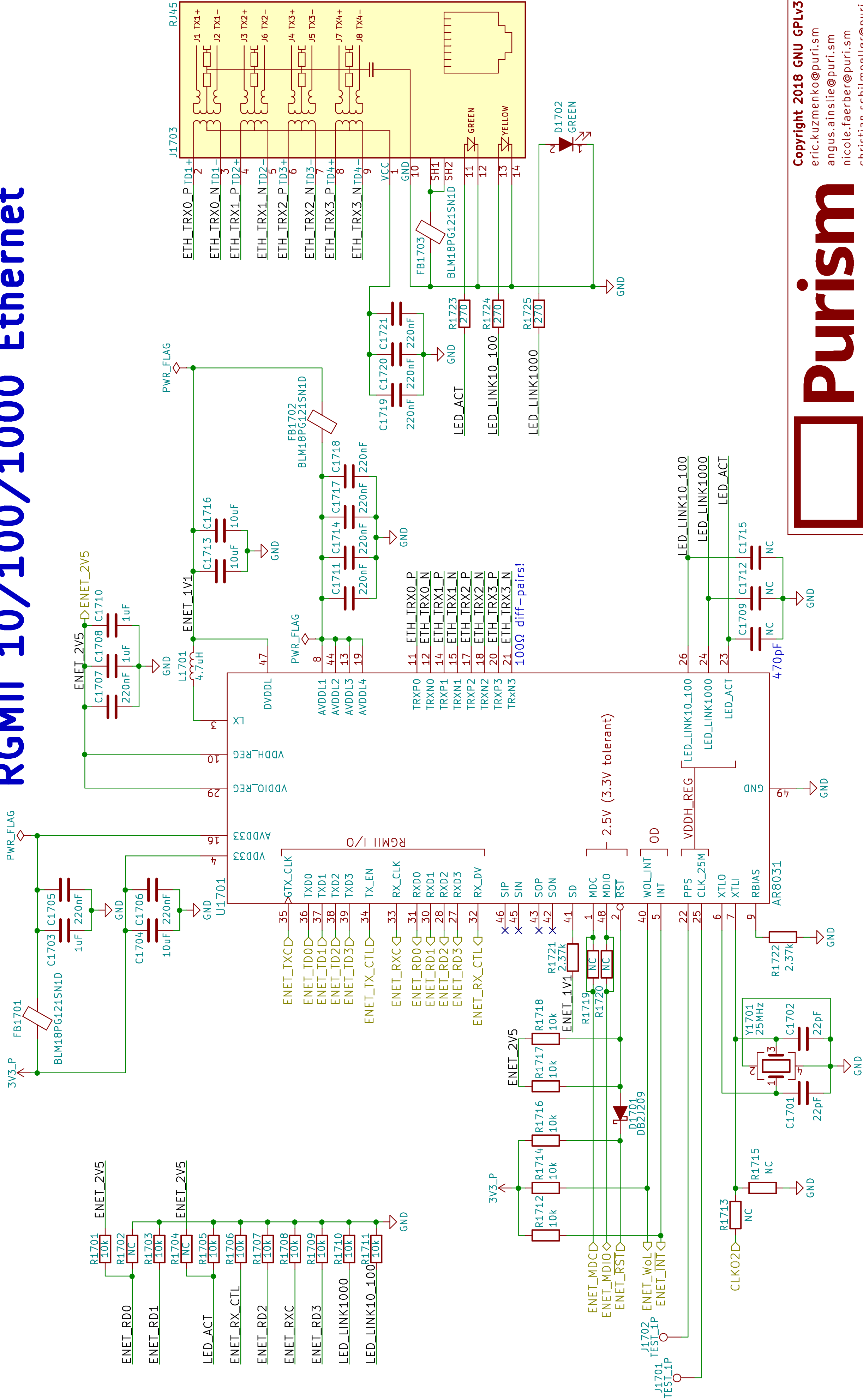




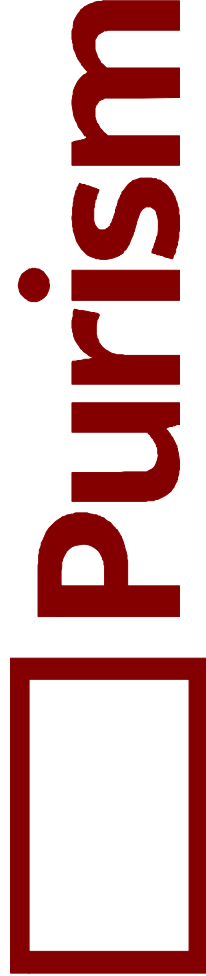




# RGMI 10/100/1000 Ethernet



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Sheet: /Ethernet/  
File: ethernet.sch

Title: Librem5 development kit

Size: A4 Date: 2018-06-07  
KiCad E.D.A. kicad 4.0.7+dfsg1-1

Rev: v0.1.0  
Id: 17/24















# Purism

# Title: Librem5 development kit

Size: A4
Date: 2018-06-07

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