

Click | Here
V

1 This sheet: index

Sheet: Charger/OTG

2 Charger/OTG

File: charger.sch

Sheet: Battery

3 Battery

File: battery.sch

Sheet: Modem Power

4 Modem Power

File: modempwr.sch

Sheet: 3G/4G Modem

5 3G/4G Modem

File: modem.sch

Sheet: SIM cards and switch

6 SIM cards and switch

File: sims.sch

Sheet: Modem Antennas

7 Modem Antennas

File: ants.sch

Sheet: WLAN, Bluetooth, FM

8 WLAN, Bluetooth, FM

File: wlan.sch

Sheet: Sensors

9 Sensors

File: sensors.sch

Sheet: Audio Codec

10 Audio Codec

File: codec.sch

Sheet: Audio Headset, ECI

11 Audio Headset, ECI

File: jack.sch

Sheet: Misc

12 Misc

File: misc.sch

Click | Here
V

Sheet: RFID/NFC

13 RFID/NFC

File: nfc.sch

Sheet: Infrared

14 Infrared

File: ir.sch

Sheet: B2B LOWER-UPPER

15 B2B LOWER-UPPER

File: b2b.sch

Sheet: Hackerbus

16 Hackerbus

File: hb.sch

Sheet: uSD Breakout Board

17 uSD Breakout Board

File: bob.sch

Sheet: Keypad and buttons

18 Keypad and buttons

File: keys.sch

Sheet: Display

19 Display

File: display.sch

Sheet: Cameras

20 Cameras

File: cams.sch

Sheet: LEDs

21 LEDs

File: leds.sch

Click | Here
V

Sheet: Adaptation (v2 only)

22 Adaptation (v2 only)

File: v2.sch

Sheet: BB-xM Adapter (CPU)

23 BB-xM Adapter (CPU)

File: bbcpu.sch

Sheet: BB-xM Adapter (DISP)

24 BB-xM Adapter (DISP)

File: bbdisp.sch

Sheet: BB-xM Adapter (CAM)

25 BB-xM Adapter (CAM)

File: bbcam.sch

Circuits that exist in the v2 prototype only
and that will not be part of the final design.

Unless indicated otherwise, resistors have a tolerance of 1%,
or better. If the nominal value specified in the schematics is
only available with lower tolerance, use that.

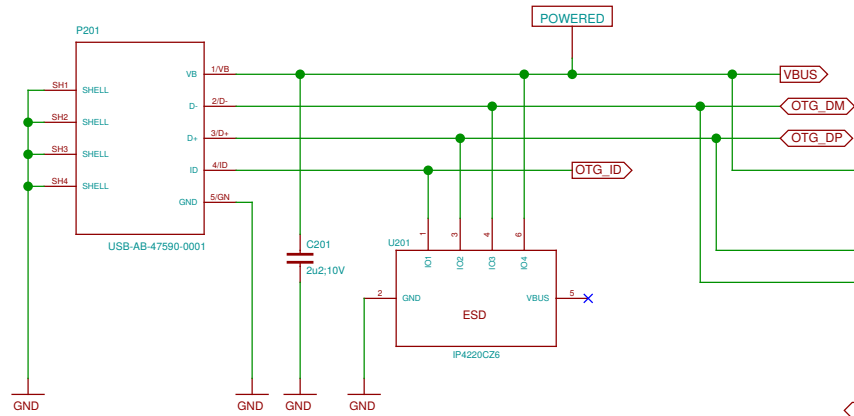
Unless indicated otherwise, all capacitors should be X5R or X6S,
or better (X7R, NP0, etc.)
If no voltage is specified, use >= 6.3 V.

Note regarding I2C addresses:
Addresses in the schematics are provided for convenience.
The authoritative source is
<https://neo900.org/git/misc/tree/i2c>

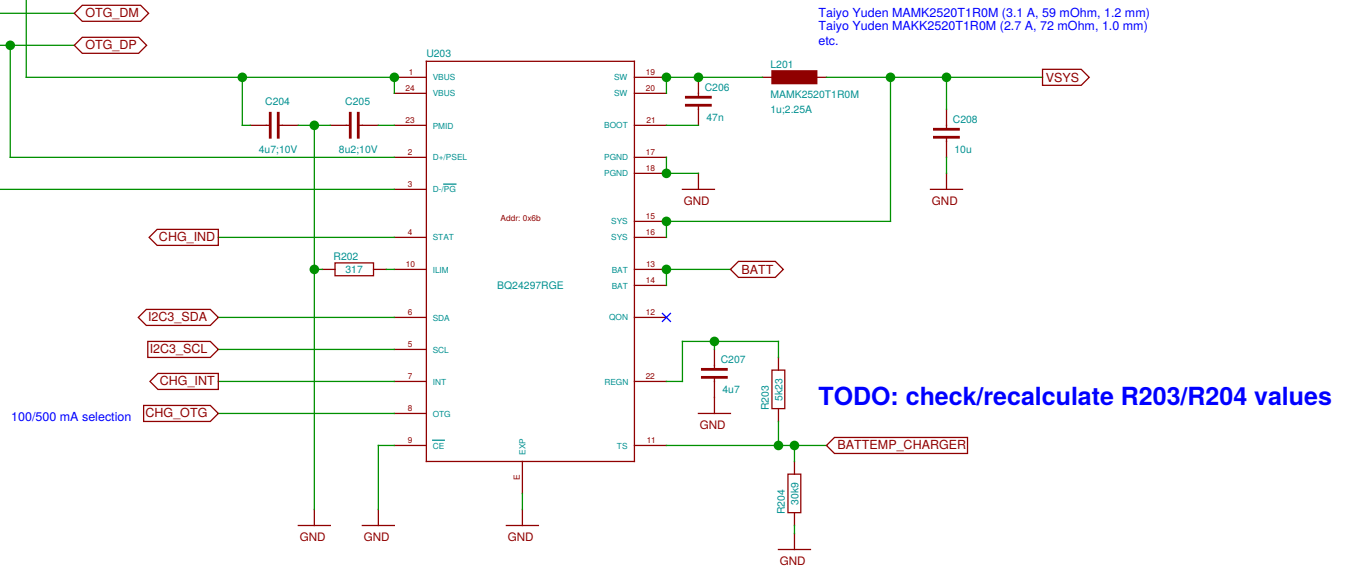
Signals that exist on both LOWER and UPPER (and maybe also BOB)
have a _U suffix on UPPER. No suffix is needed to distinguish
between LOWER and BOB because all BOB components are on
the same sheet and wires connecting them use sheet-local labels.

Sheet: /	
File: neo900.sch	
Title: Neo900	
Size: A3	Date: 2017-04-01 23:46:19
Plotted by: eeshow 50dc19d 20170404-04:55Z	Rev: /
Id: 1/25	

USB OTG connector

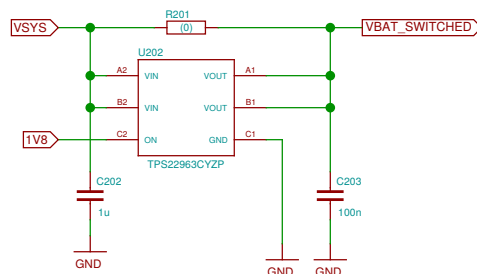


Battery charger with USB OTG

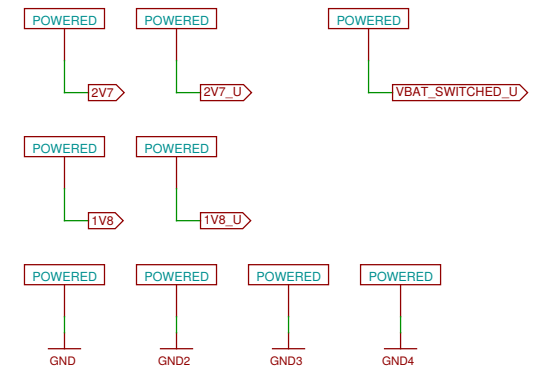


Power distribution and sequencing

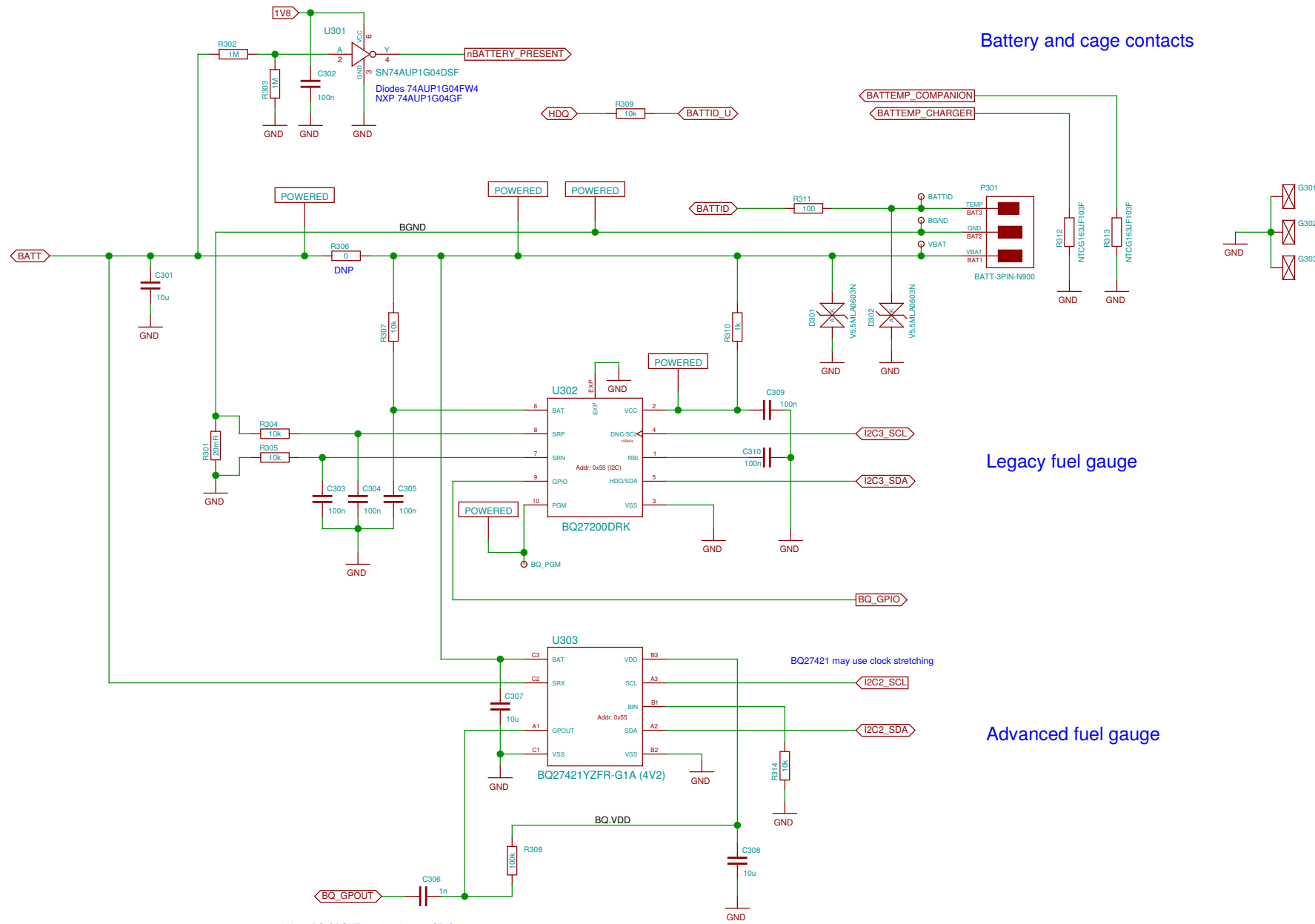
Most high-current consumers are on VBAT_SWITCHED. 1V8 signals that the regulators on UPPER are operational.



KiCad bureaucracy



Sheet: /Charger/OTG/ File: charger.sch		Board: LOWER
Title: Charger/OTG		
Size: A3	Date: 2017-04-03 23:52:36	Rev:
Plotted by eeshow 5dc19d 20170404-04:55Z		Id: 2/25



Battery and cage contacts

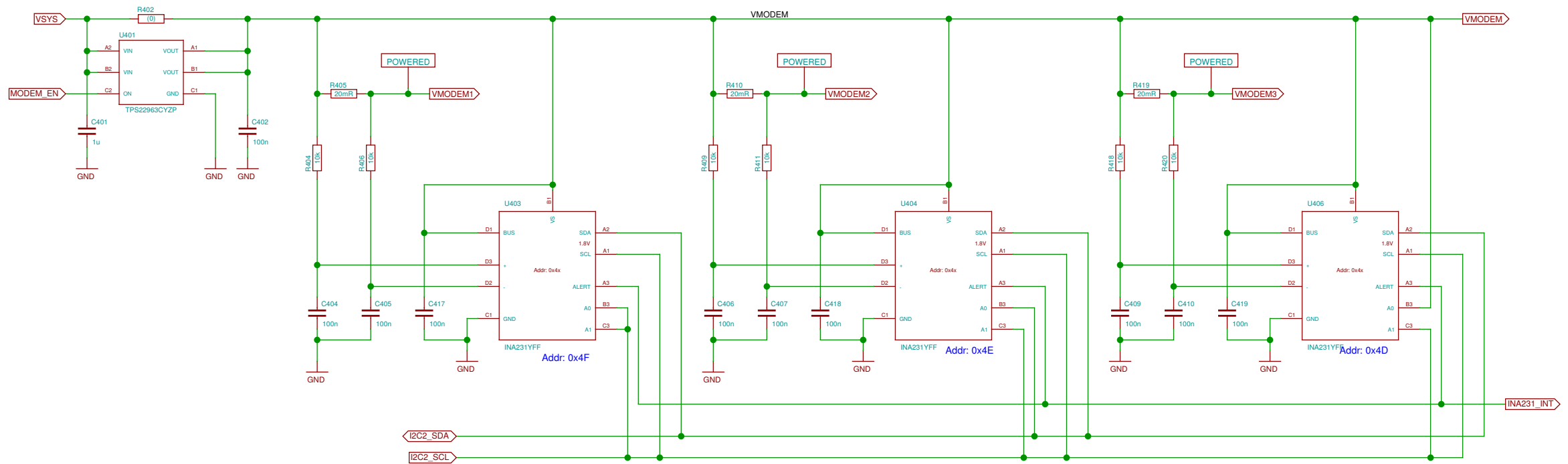
Legacy fuel gauge

Advanced fuel gauge

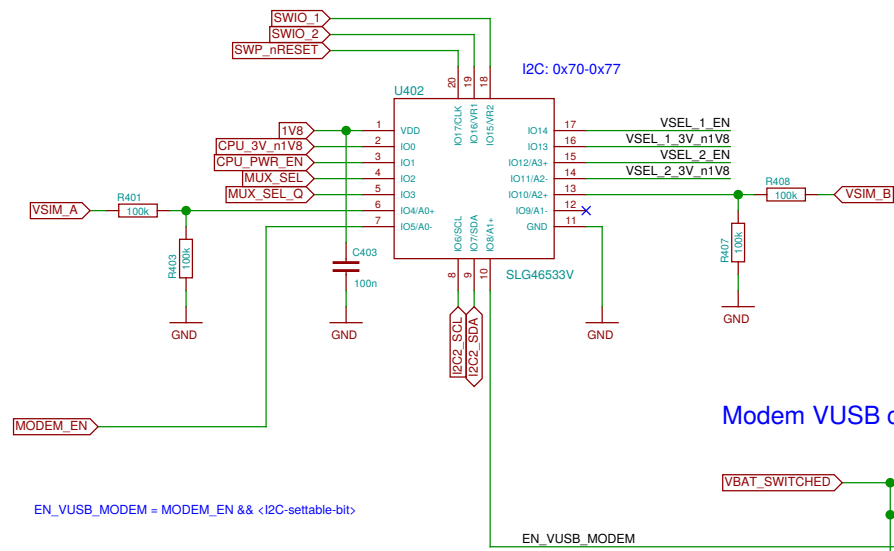
Note: BQ.GPOUT needs pull-up at GPIO.

Sheet: /Battery/ File: battery.sch		Board: LOWER
Title: Battery		
Size: A3	Date: 2017-04-01 23:46:19	Rev:
Plotted by eeshow Sdc19d 20170404-04:55Z		Id: 3/25

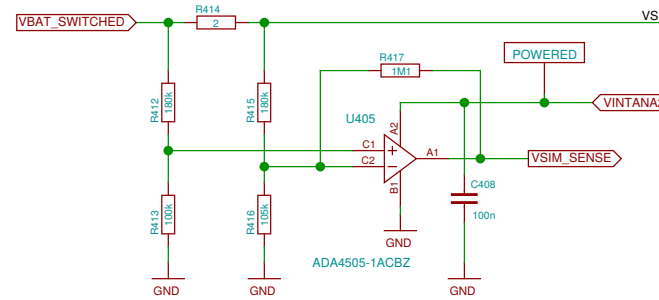
Modem current monitor



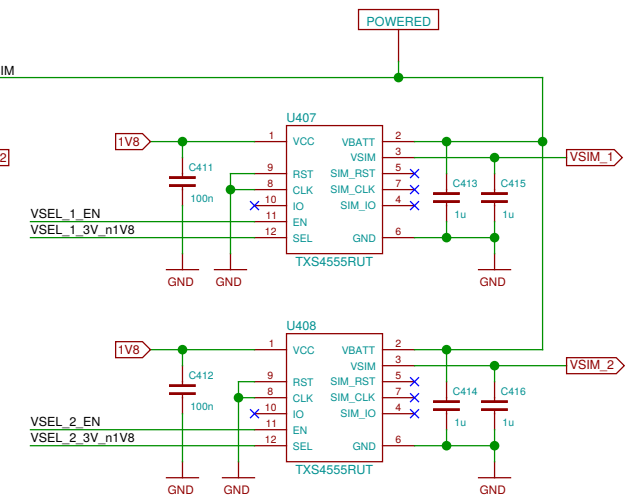
SIM power selection



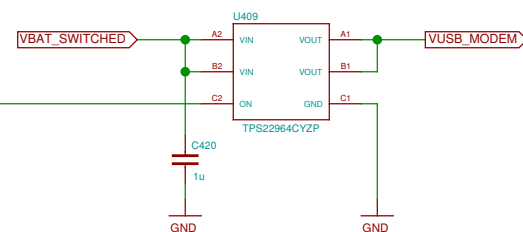
SIM current sensing



SIM power supply



Modem VUSB control (experimental)

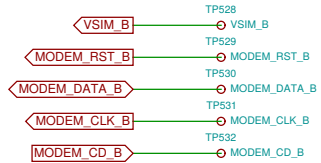


EN_VUSB_MODEM = MODEM_EN && <I2C-settable-bit>

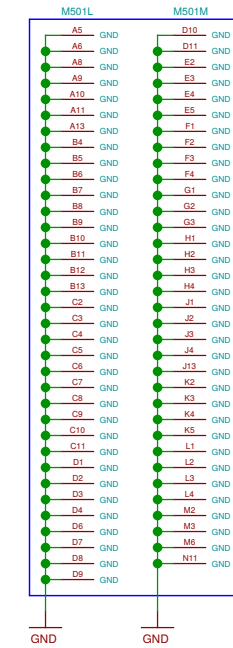
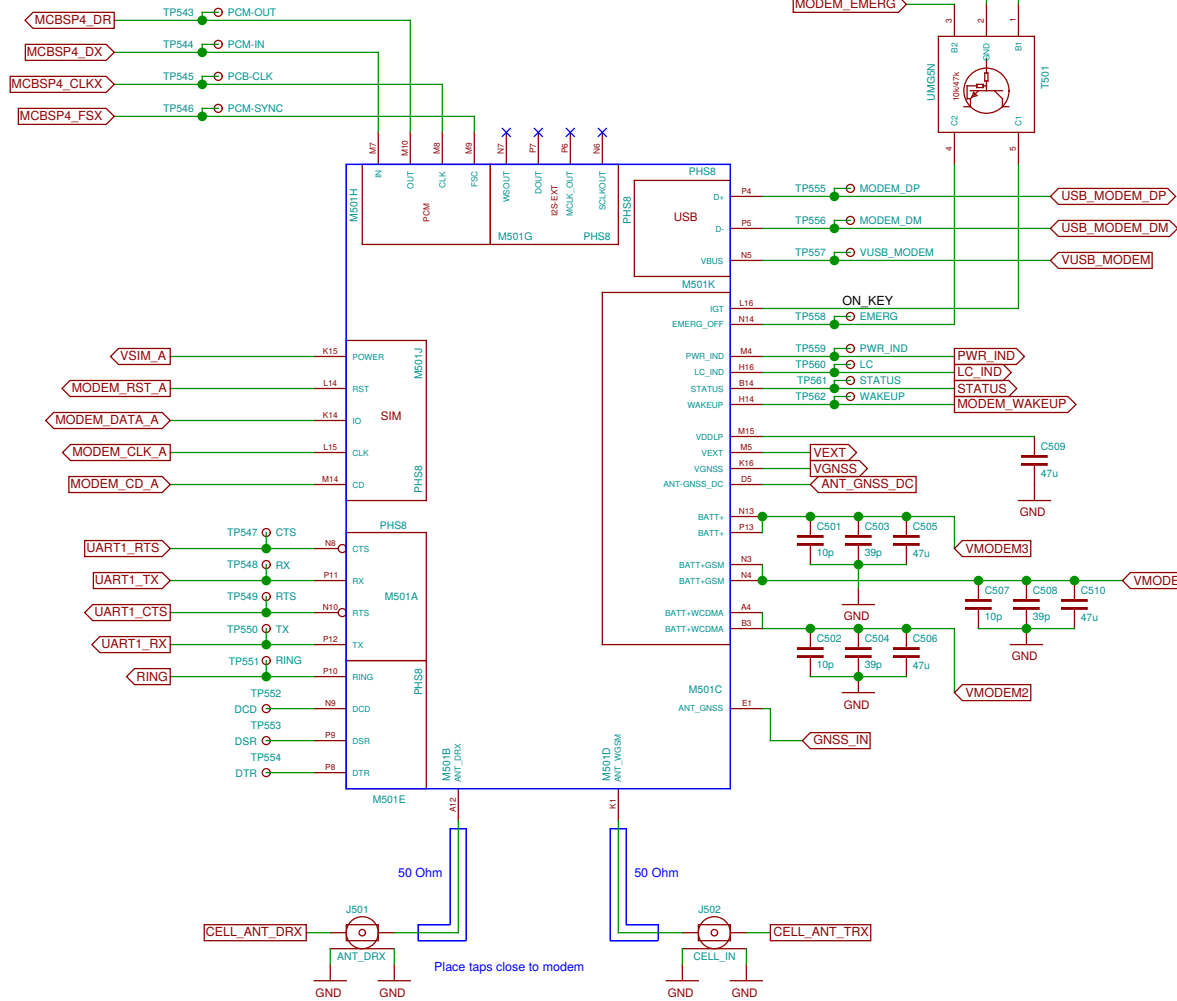
EN_VUSB_MODEM

Sheet: /Modem Power/ File: modempwr.sch		Board: LOWER
Title: Modem Power		
Size: A3	Date: 2017-04-01 23:46:19	Rev: 4/25
Plotted by eeshow 5dc19d 20170404-04:55Z		

SIM B bus



Modem (module)



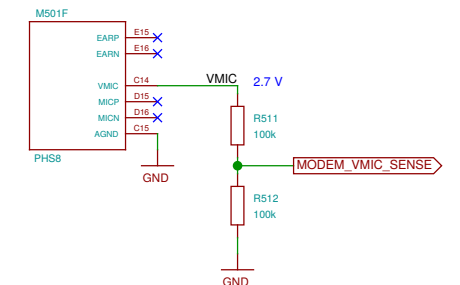
17+10+10 = 37 test points. PCB space permitting, to be arranged in a 6 x 6 + 1 grid with 1.0 mm pitch. This patch field is to be placed adjacent to the SIM B bus test points.

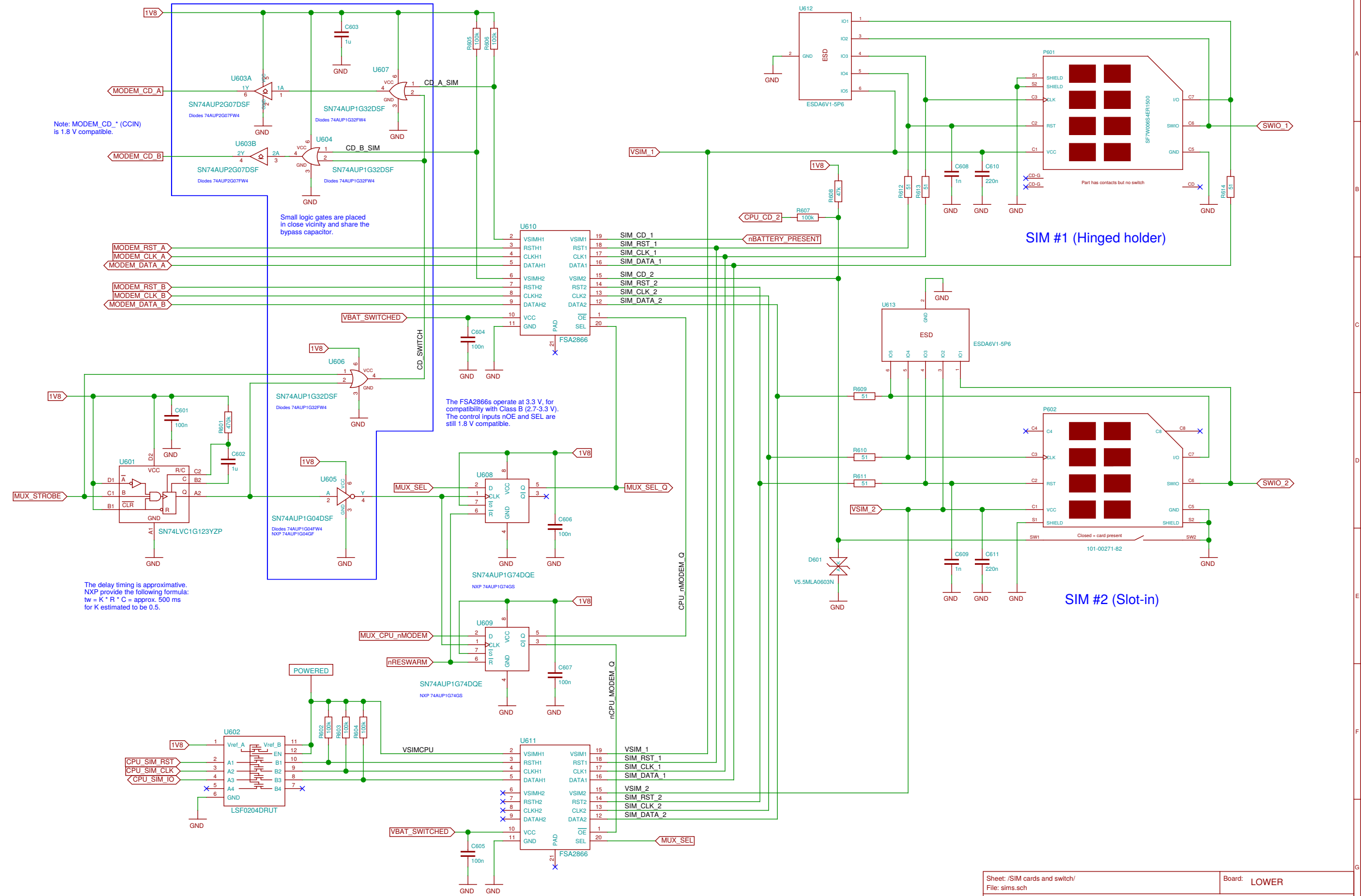
Pads that are DNU in PHS8 and PLS8.

Pads that are DNU in PHS8 but have a GPIO or ADC function assigned to them in PLS8.

Pads RFU (GND) in PHS8 and RFU (DNU) in PLS8. The resistors indicate cuttable traces.

Anti-eavesdropping





Note: MODEM_CD_* (CCIN) is 1.8 V compatible.

Small logic gates are placed in close vicinity and share the bypass capacitor.

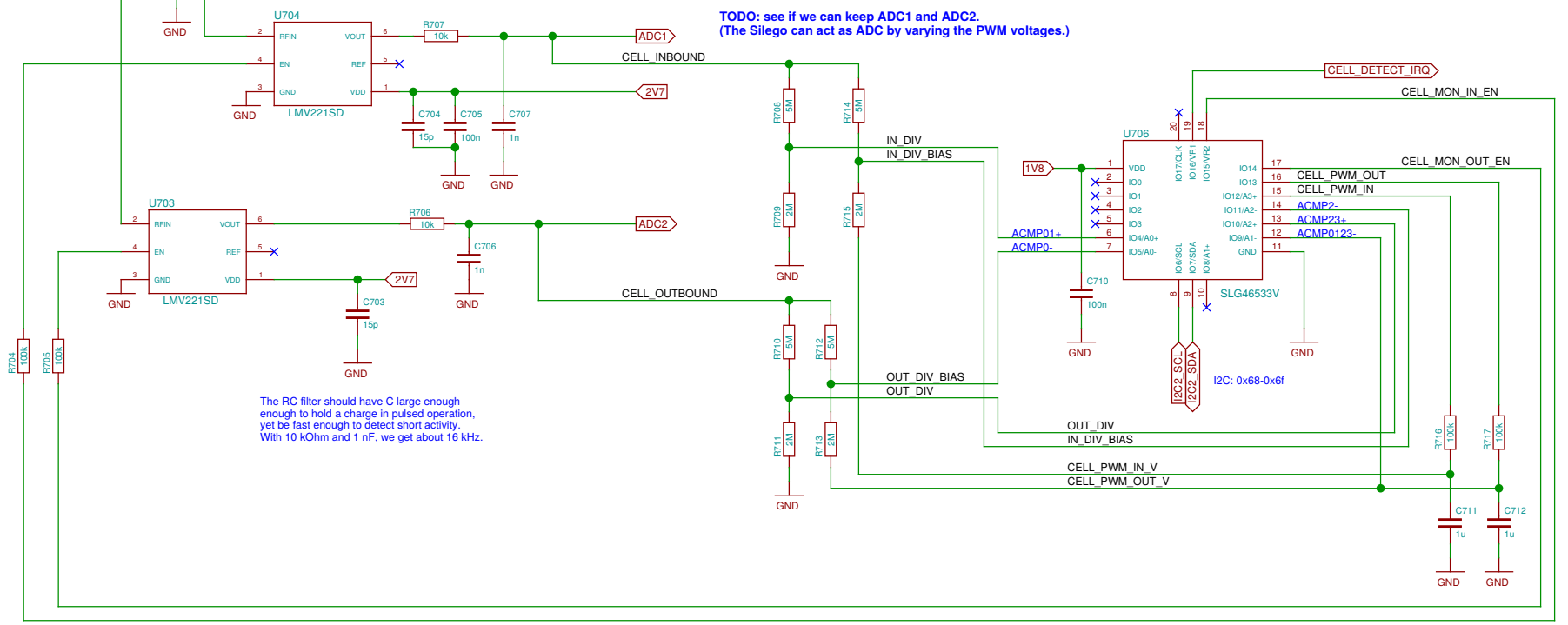
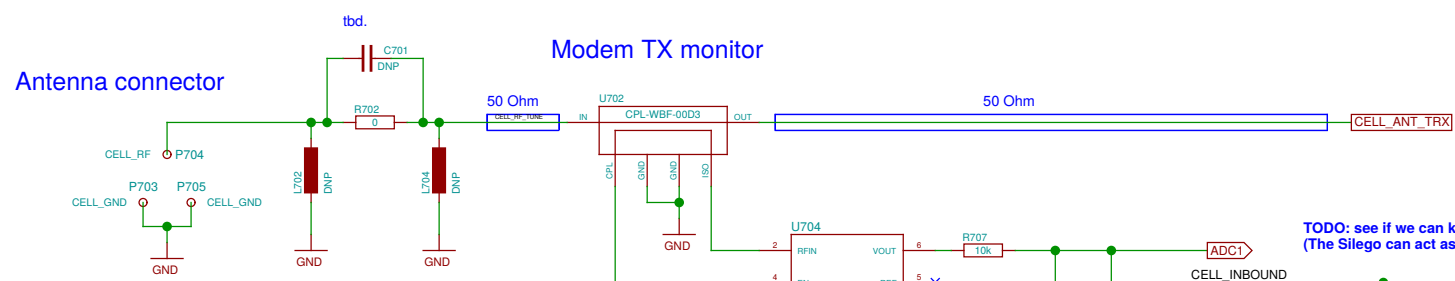
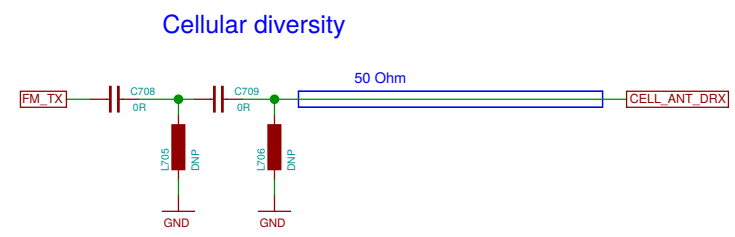
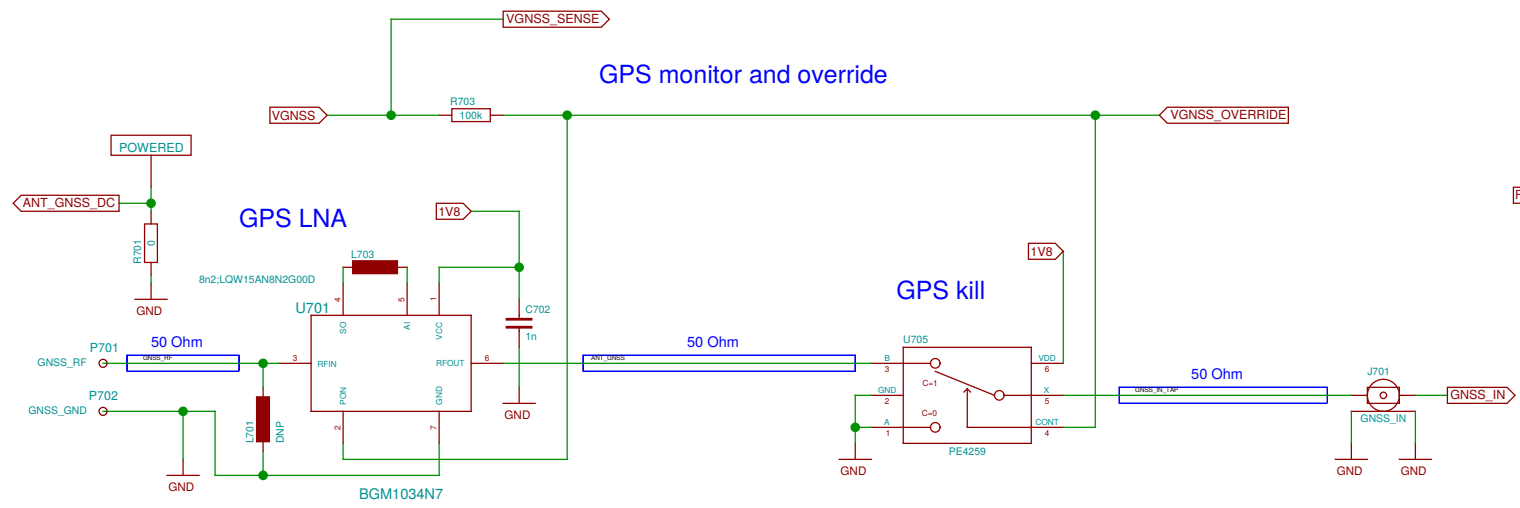
The FSA2866s operate at 3.3 V, for compatibility with Class B (2.7-3.3 V). The control inputs nOE and SEL are still 1.8 V compatible.

The delay timing is approximative. NXP provide the following formula: $t_w = K * R * C = \text{approx. } 500 \text{ ms}$ for K estimated to be 0.5.

SIM #1 (Hinged holder)

SIM #2 (Slot-in)

Sheet: /SIM cards and switch/ File: sims.sch		Board: LOWER
Title: SIM cards and switch		
Size: A3	Date: 2017-04-01 23:46:19	Rev: 6/25
Plotted by eeshow 5dc19d 20170404-04:55Z		



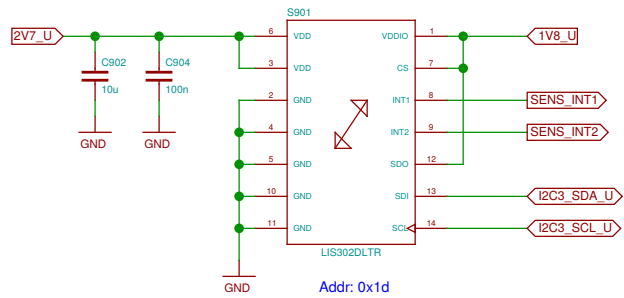
The RC filter should have C large enough enough to hold a charge in pulsed operation, yet be fast enough to detect short activity. With 10 kOhm and 1 nF, we get about 16 kHz.

TODO: see if we can keep ADC1 and ADC2. (The Silago can act as ADC by varying the PWM voltages.)

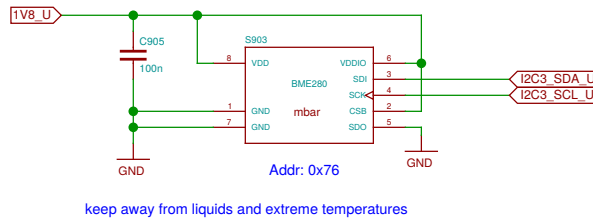
Sheet: /Modem Antennas/ File: ants.sch	Board: LOWER
Title: Modem Antennas	
Size: A3	Date: 2017-04-01 23:46:19
Plotted by eeshow 5dc19d 20170404-04:55Z	Rev: Id: 7/25

!!! UPPER !!!

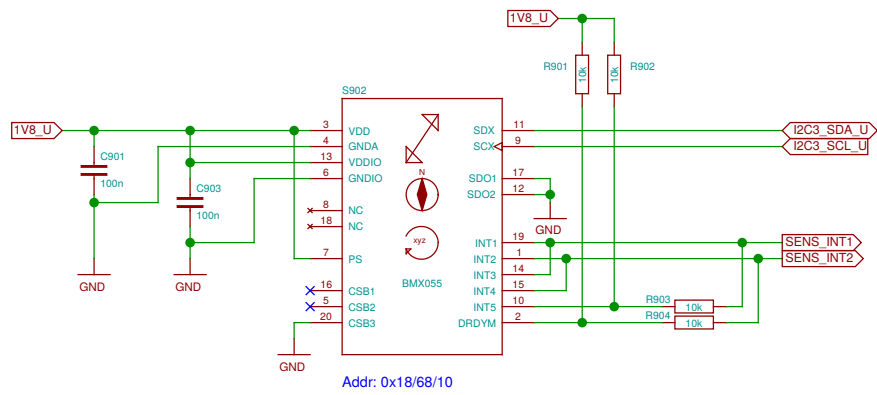
Acceleration (legacy)



Pressure, humidity

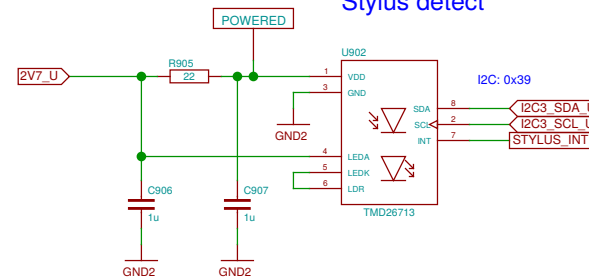


9-axis (acceleration, gyroscope, magnetometer)

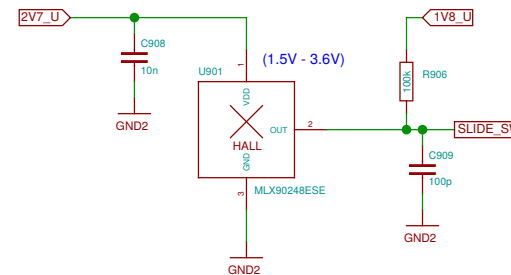


Keep away from magnets, metal,
high current traces.

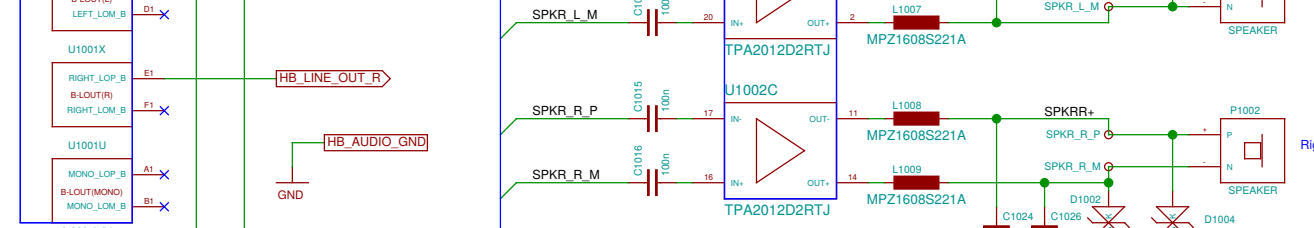
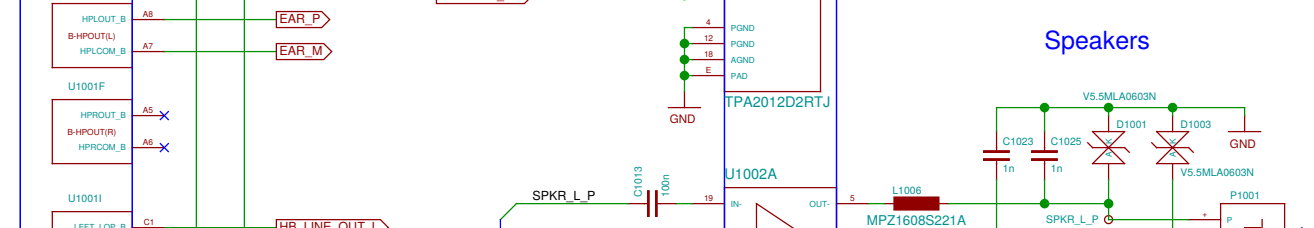
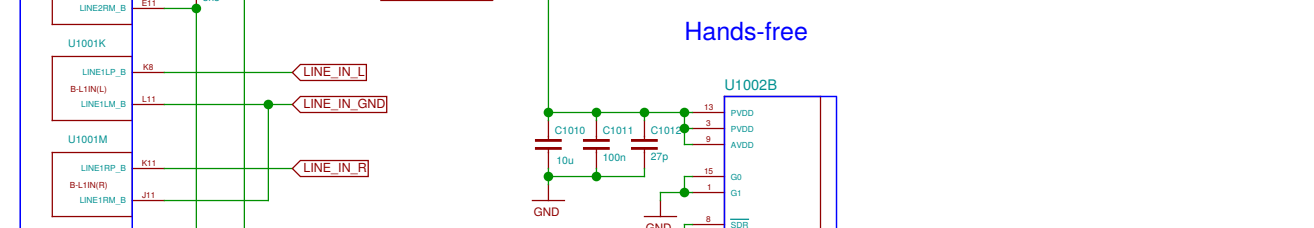
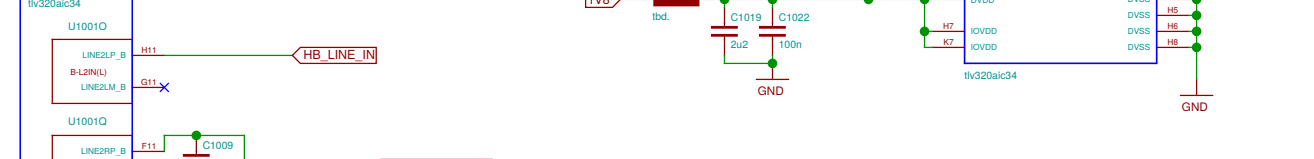
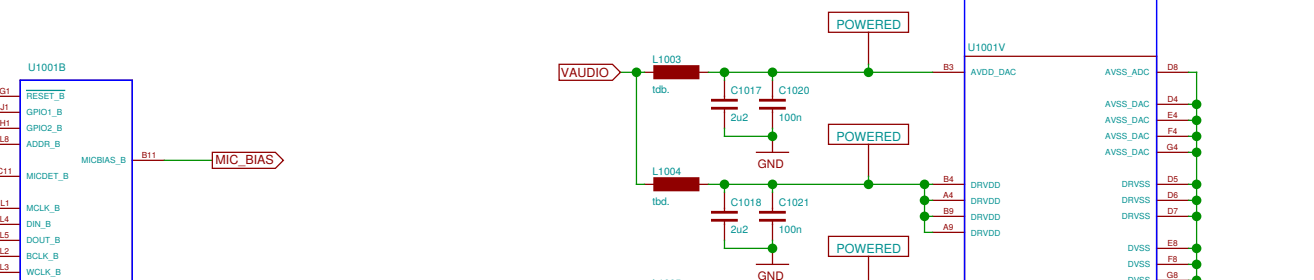
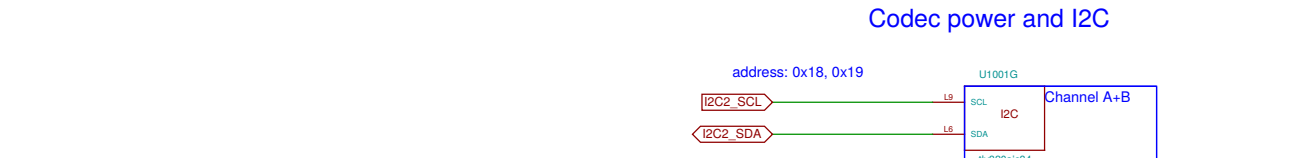
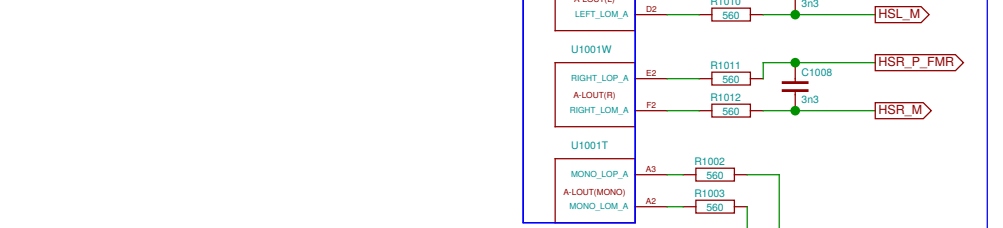
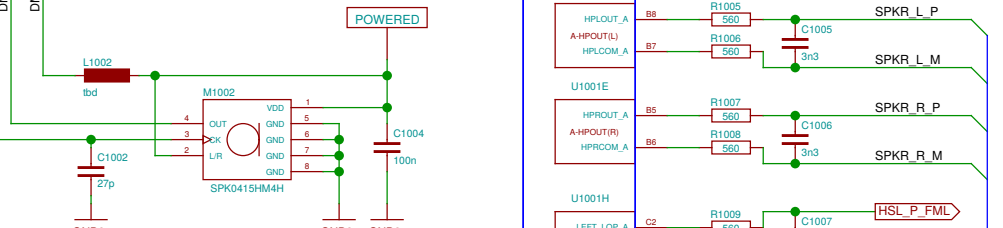
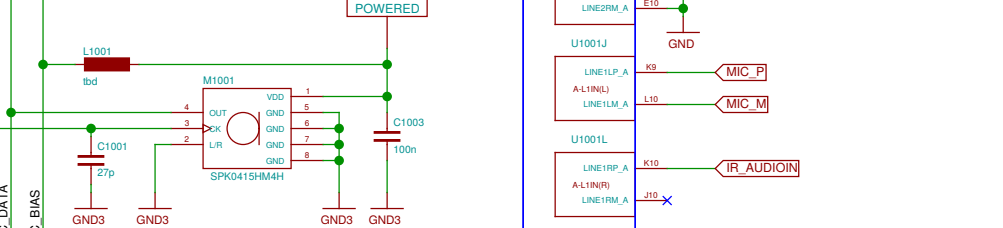
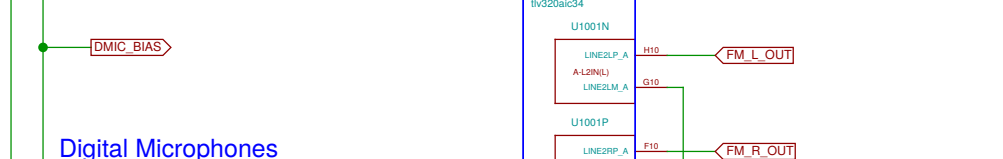
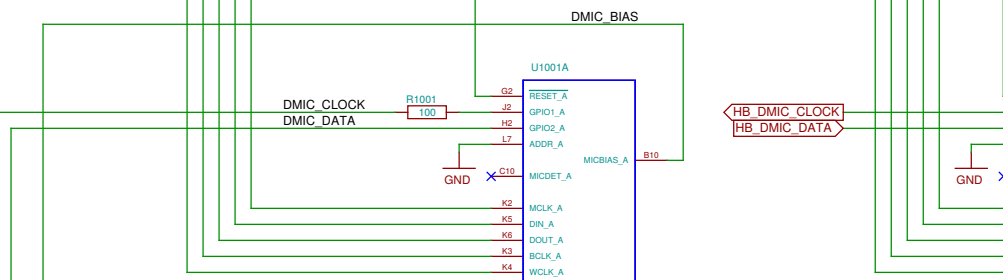
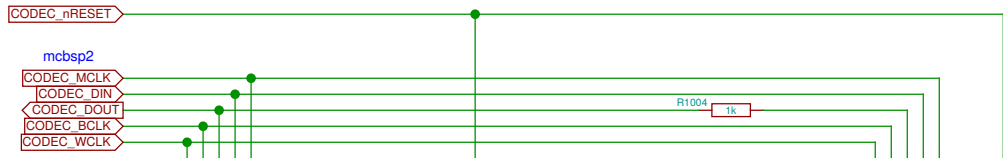
Stylus detect



Slide sensor



Sheet: /Sensors/ File: sensors.sch	Board: UPPER
Title: Sensors	
Size: A3	Date: 2017-04-01 23:46:19
Plotted by eeshow 5dc19d 20170404-04:55Z	
Rev:	Id: 9/25



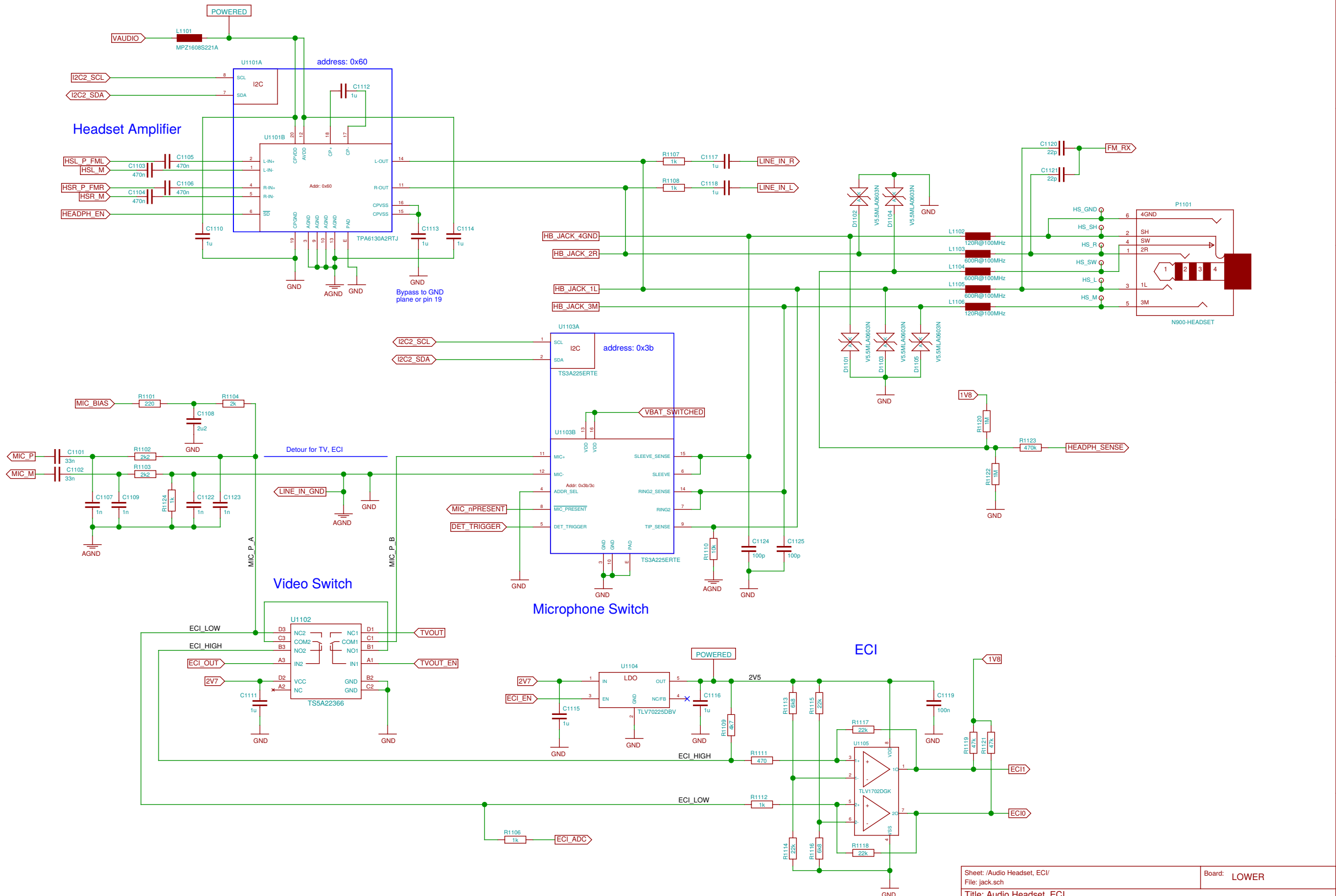
Codec

Codec power and I2C

Hands-free

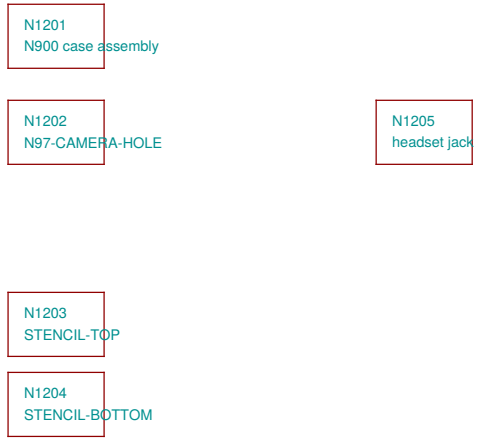
Speakers

Sheet: /Audio Codec/	Board: LOWER
File: codec.sch	
Title: Audio Codec	
Size: A3	Date: 2017-04-01 23:46:19
Plotted by: eeshow	Id: 10/25

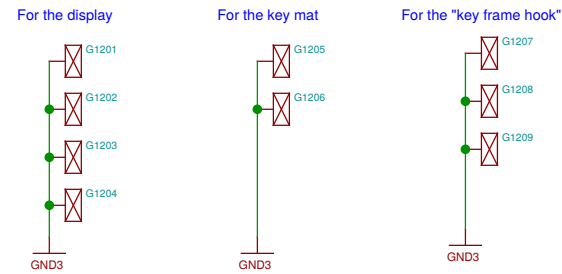


Sheet: /Audio Headset, ECI/ File: jack.sch		Board: LOWER
Title: Audio Headset, ECI		
Size: A3	Date: 2017-04-01 23:46:19	Rev:
Plotted by eeshow 5dc19d 20170404-04:55Z		Id: 11/25

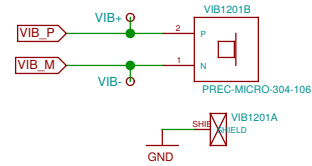
No-Solder Components



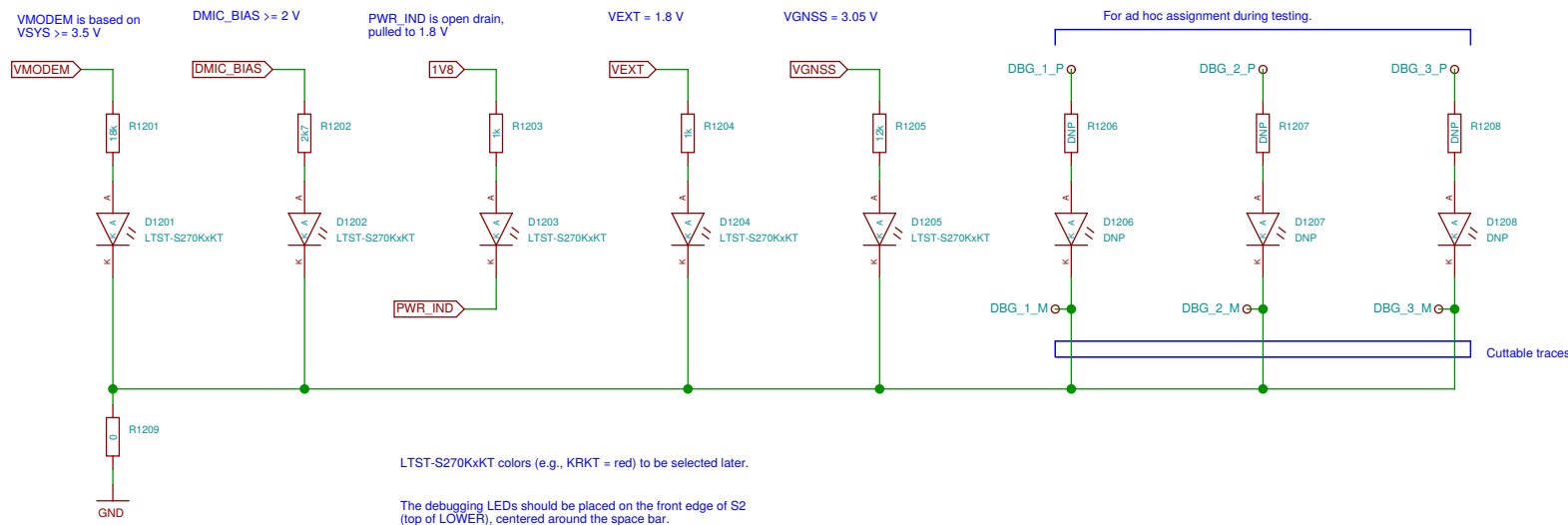
Shield Contacts on UPPER



Vibramotor



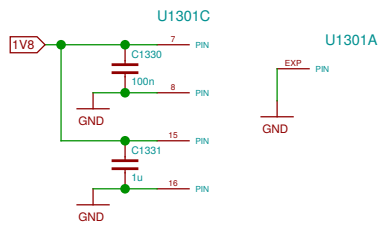
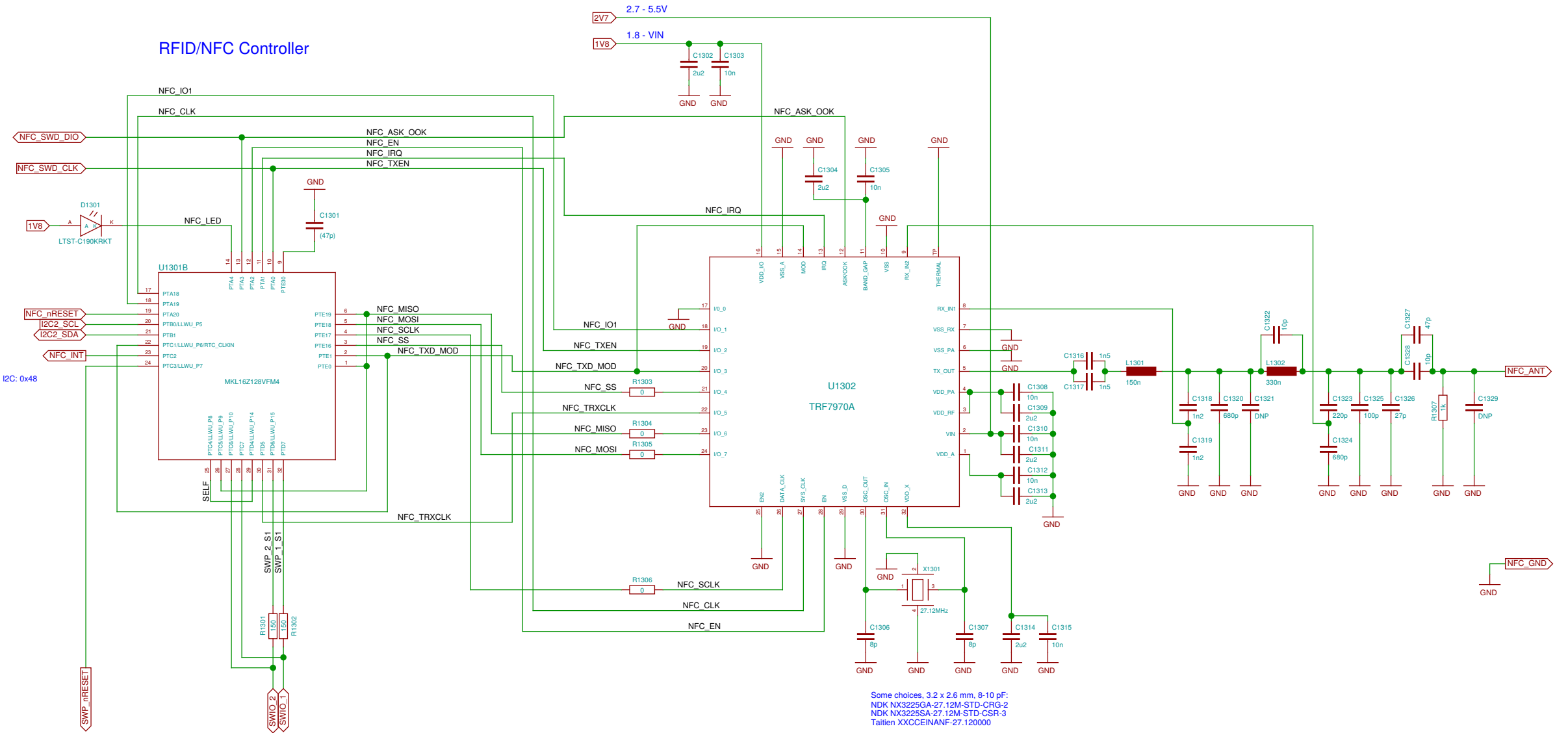
Hardware scrutiny LEDs



Sheet: /Misc/ File: misc.sch		Board: LOWER
Title: Misc		
Size: A3	Date: 2017-04-01 23:46:19	Rev:
Plotted by eeshow 5dc19d 20170404-04:55Z		Id: 12/25

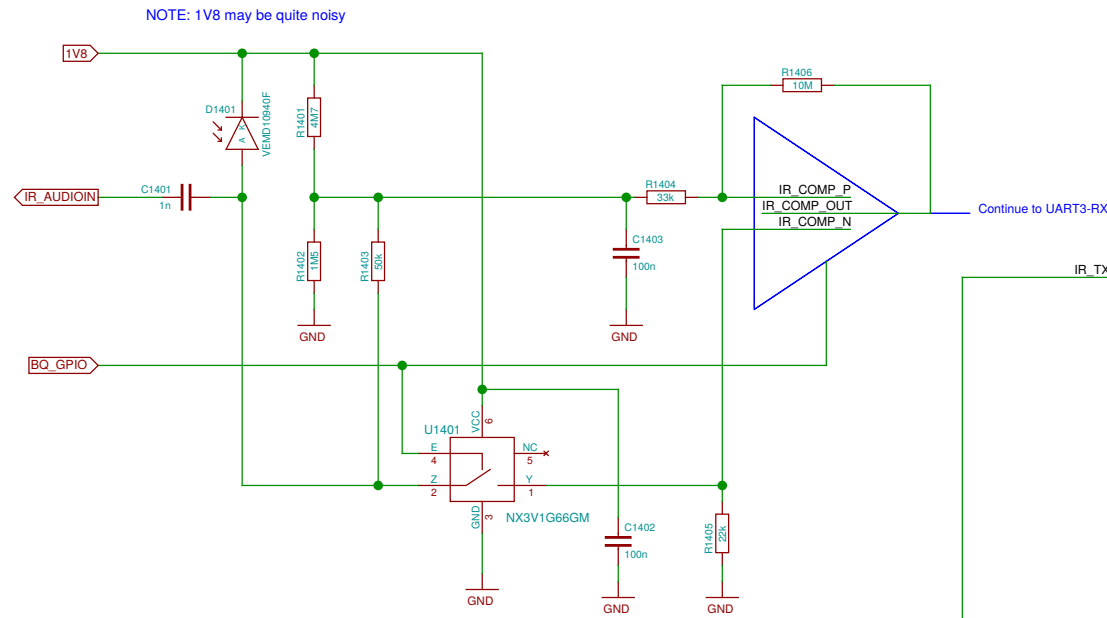
RFID/NFC Transceiver

RFID/NFC Controller

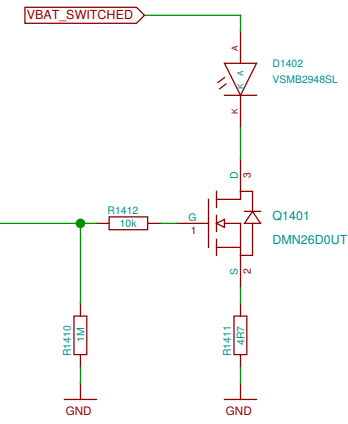


Sheet: /RFID/NFC/ File: nfc.sch		Board: LOWER
Title: RFID/NFC		
Size: A3	Date: 2017-04-01 23:46:19	Rev:
Plotted by eeshow 5dc19d 20170404-04:55Z		Id: 13/25

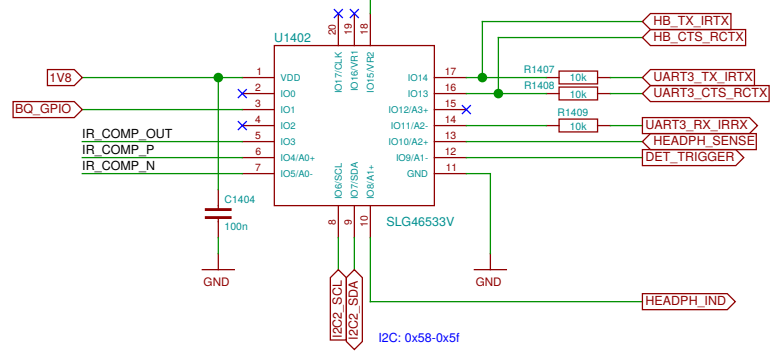
IR receiver



IR transmitter



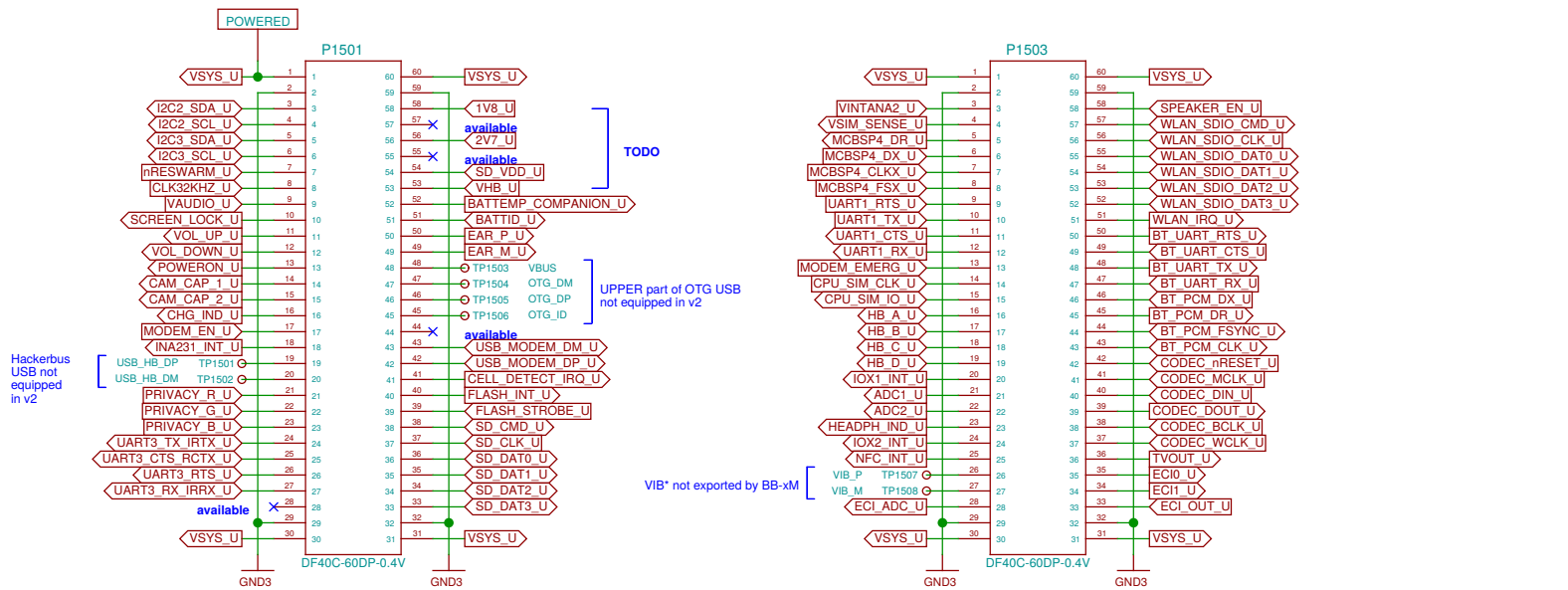
IR send/receive logic



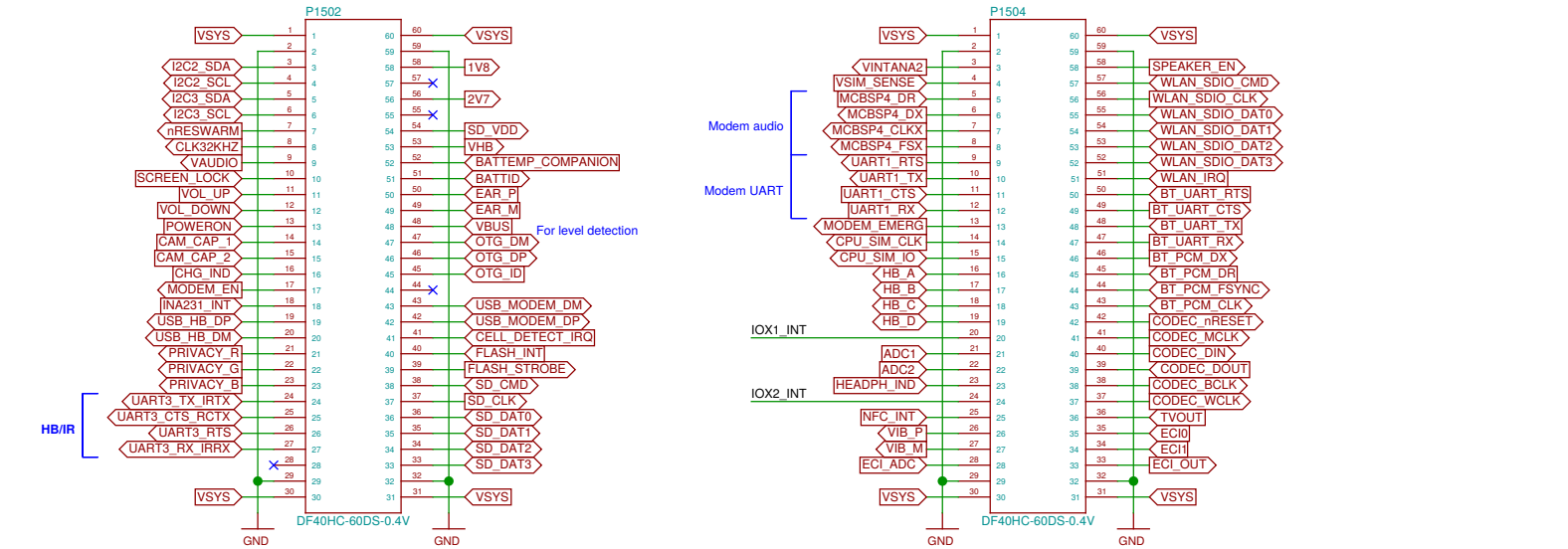
Sheet: /Infrared/		Board: LOWER	
File: ir.sch			
Title: Infrared			
Size: A3	Date: 2017-04-01 23:46:19	Rev:	
Plotted by eeshow 5dc19d 20170404-04:55Z		Id: 14/25	

This is just the collection of signals we have.

Assignment can still change, e.g., to improve layout.

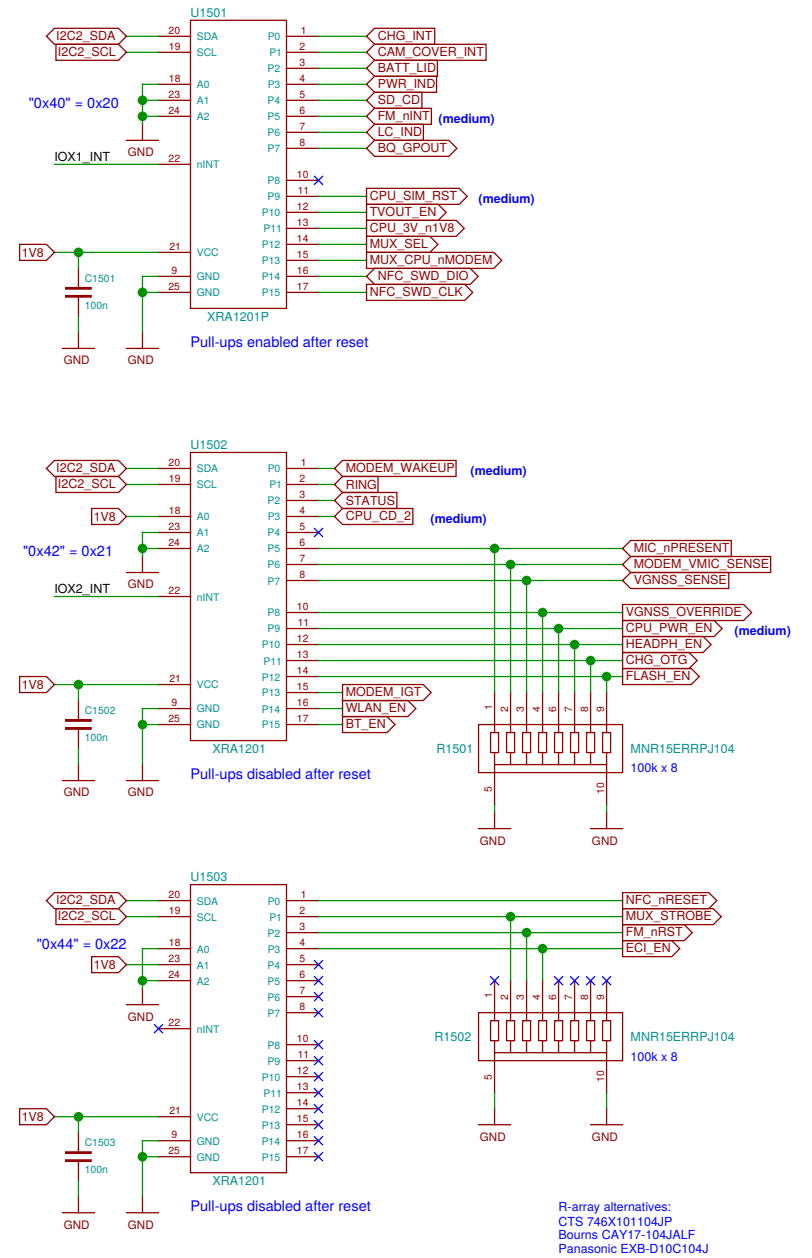


UPPER
LOWER



Current rating per contact: 0.3 A

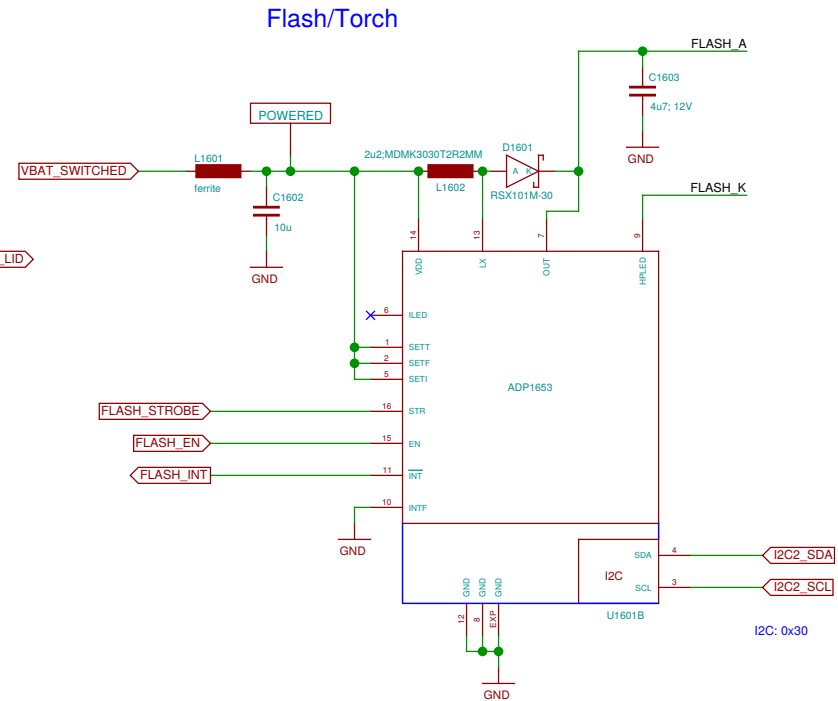
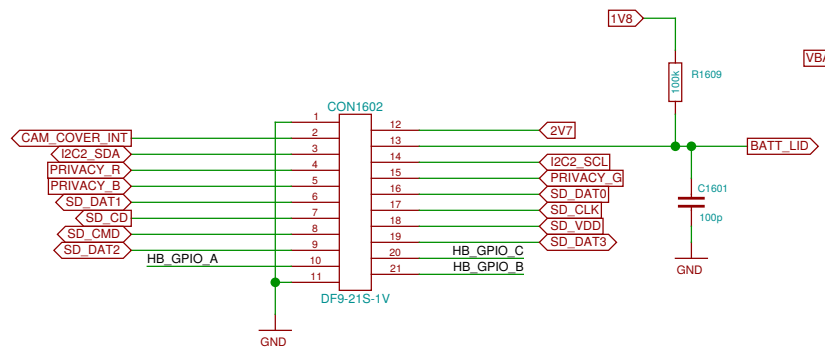
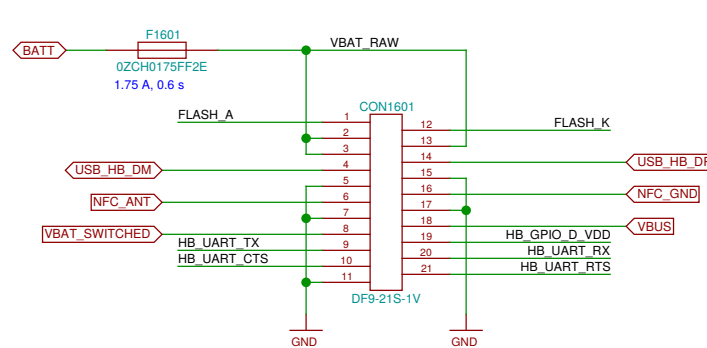
IO expanders (on LOWER)



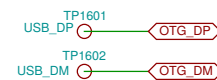
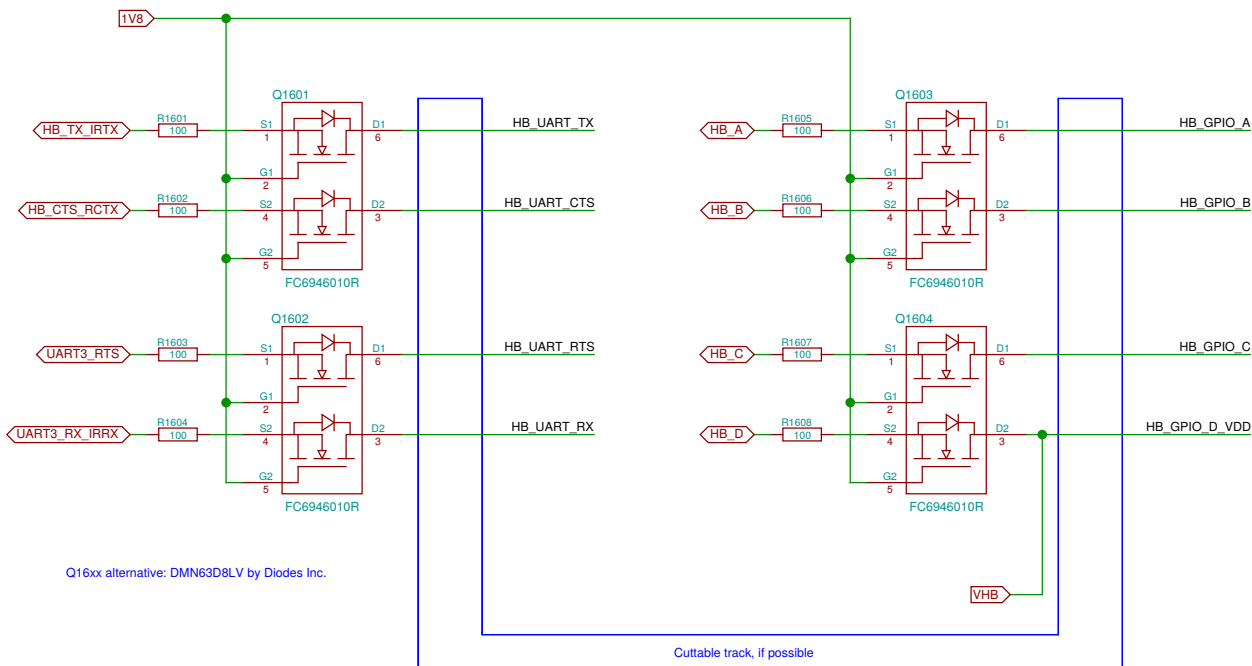
Sheet: /B2B LOWER-UPPER/ File: b2b.sch	Board: LOWER/UPPER
Title: B2B LOWER-UPPER	
Size: A3	Date: 2017-04-01 23:46:19
Plotted by eeshow 5dc19d 20170404-04:55Z	Rev: Id: 15/25

LOWER-BOB Interconnect (LOWER side)

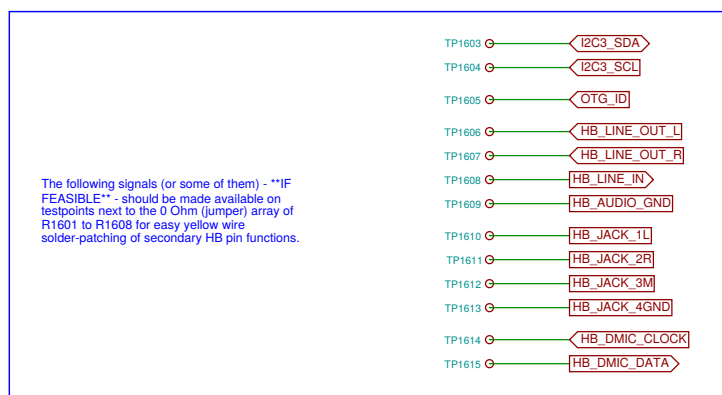
Defined in the Hackerbus specification, <http://neo900.org/stuff/papers/hb.pdf>



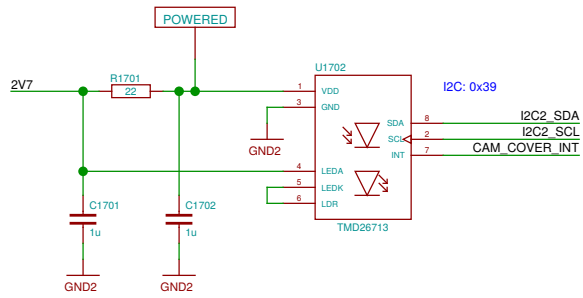
Level shifters for Hackerbus GPIO and UART



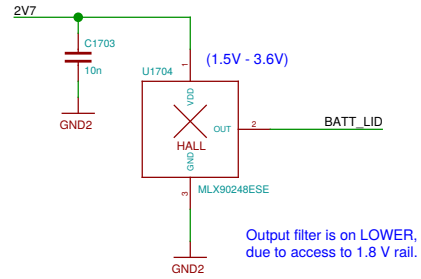
Patch field



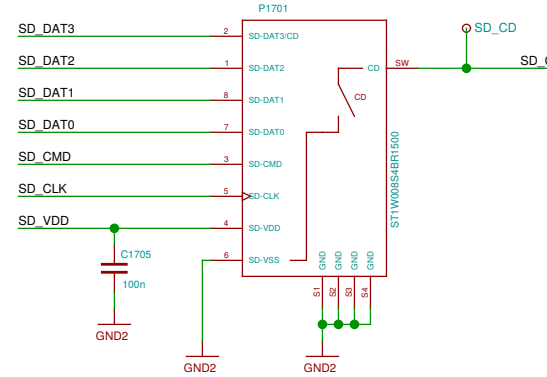
Camera Cover detect



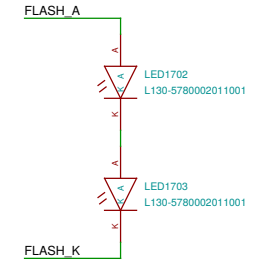
Battery Cover detect



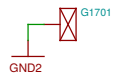
Memory card holder



Camera flash

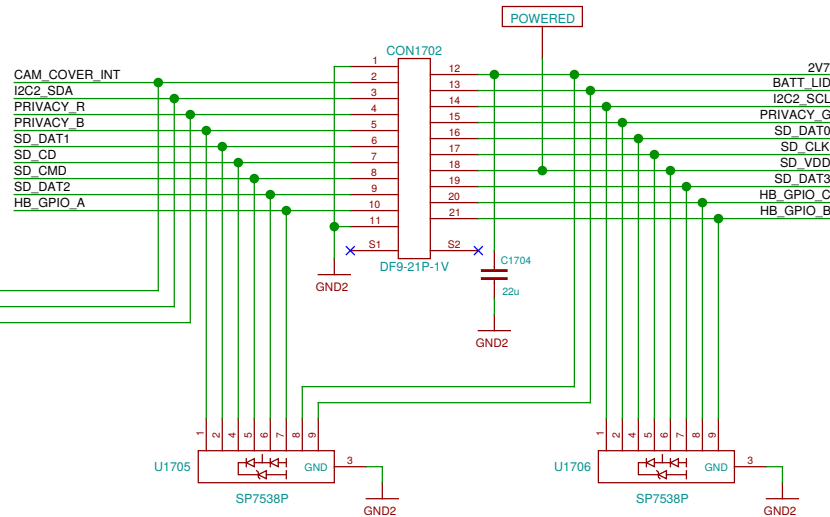
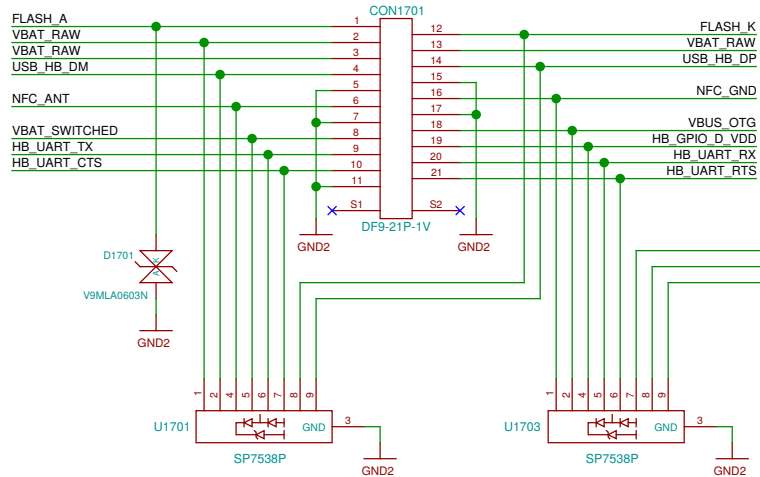


Camera lens plate

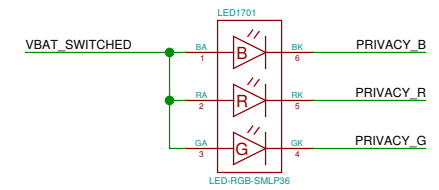


LOWER-BOB Interconnect (BOB side)

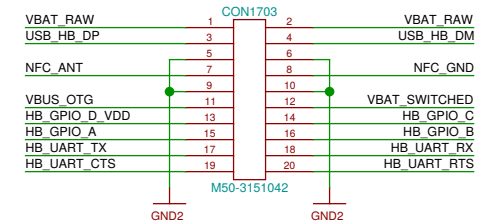
Defined in the Hackbus specification, <http://neo900.org/stuff/papers/hb.pdf>



Privacy LED



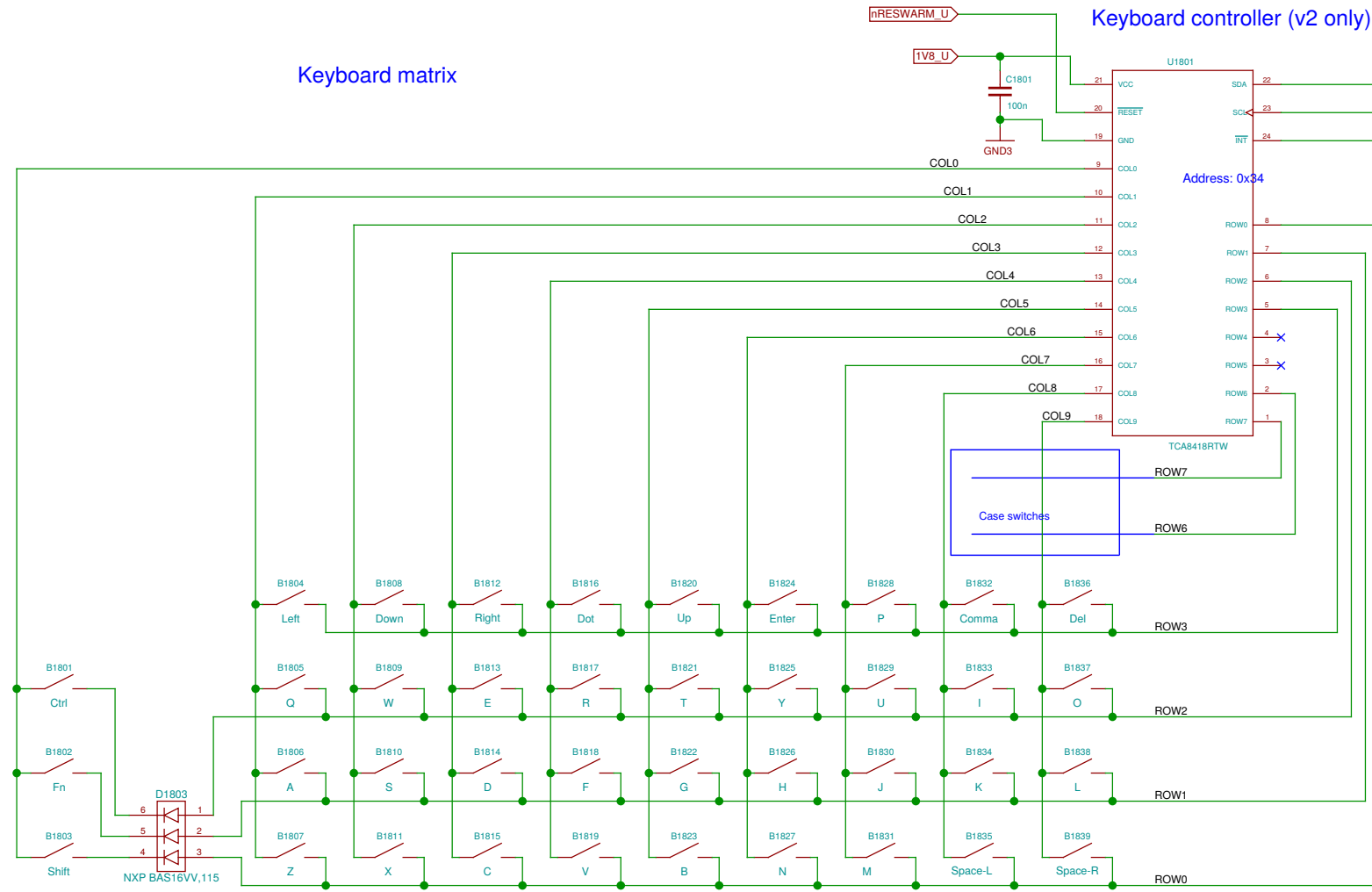
Hackbus



**ESD pin assignment is only indicative.
Actual assignment to be defined by layout.**

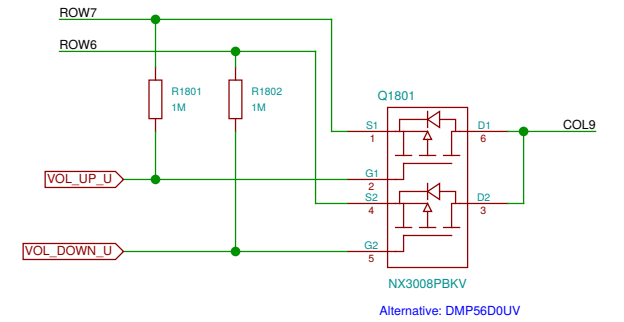
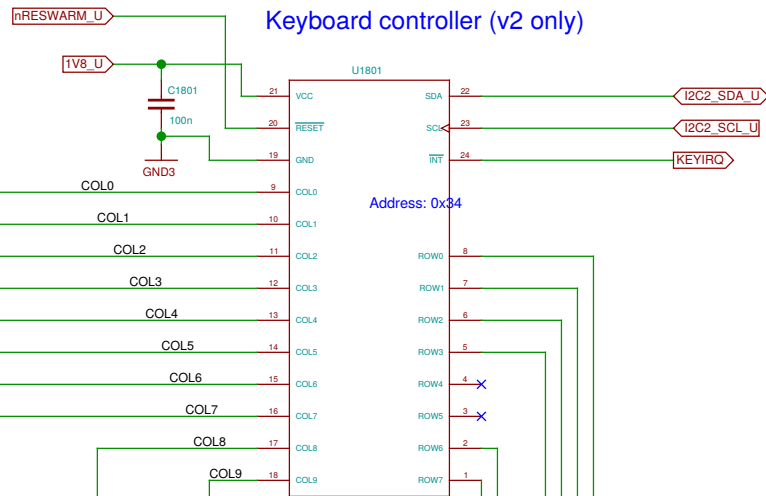
Sheet: /uSD Breakout Board/ File: bob.sch		Board: BOB
Title: uSD Breakout Board		
Size: A3	Date: 2017-04-01 23:46:19	Rev:
Plotted by eeshow 5dc19d 20170404-04:55Z		Id: 17/25

Keyboard matrix



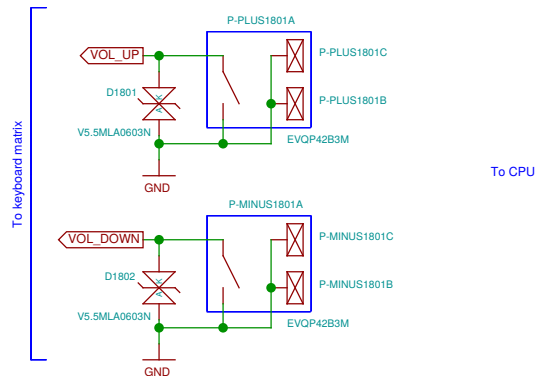
Alternative: Diodes Inc. BAS16VV-7
Warning: Diodes Inc. have cathodes on pin 1 side, NXP anodes !

Keyboard controller (v2 only)

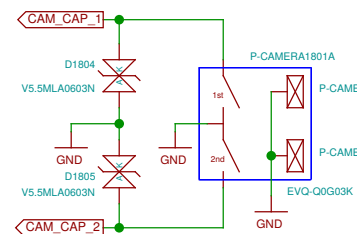


UPPER
LOWER

Volume

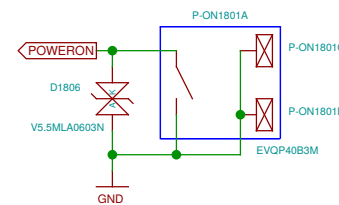


Camera trigger

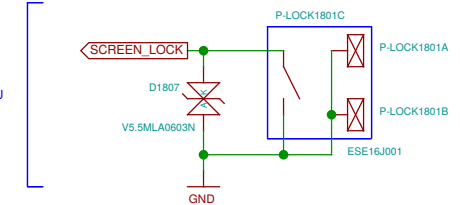


To companion chip

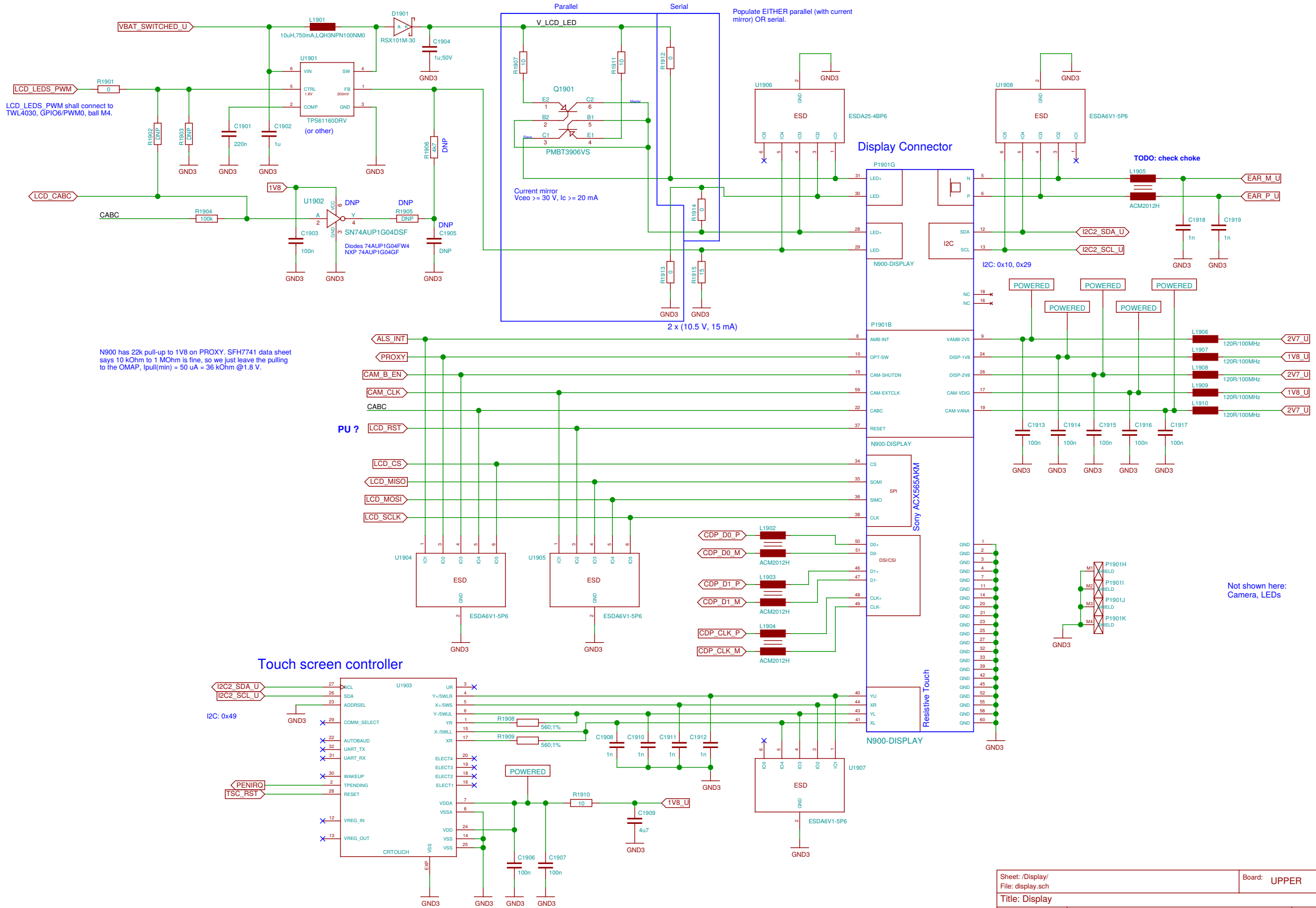
On-off



Lock switch



Sheet: /Keypad and buttons/ File: keys.sch		Board: LOWER/UPPER
Title: Keypad and buttons		
Size: A3	Date: 2017-04-01 23:46:19	Rev:
Plotted by eeshow 5dc19d 20170404-04:55Z		Id: 18/25



LCD_LEDS_PWM shall connect to TWL4030, GPIO6/PWM0, ball M4.

N900 has 22k pull-up to 1V8 on PROXY. SFH7741 data sheet says 10 kOhm to 1 MOhm is fine, so we just leave the pulling to the OMAP. I_{pull}(min) = 50 uA = 36 kOhm @ 1.8 V.

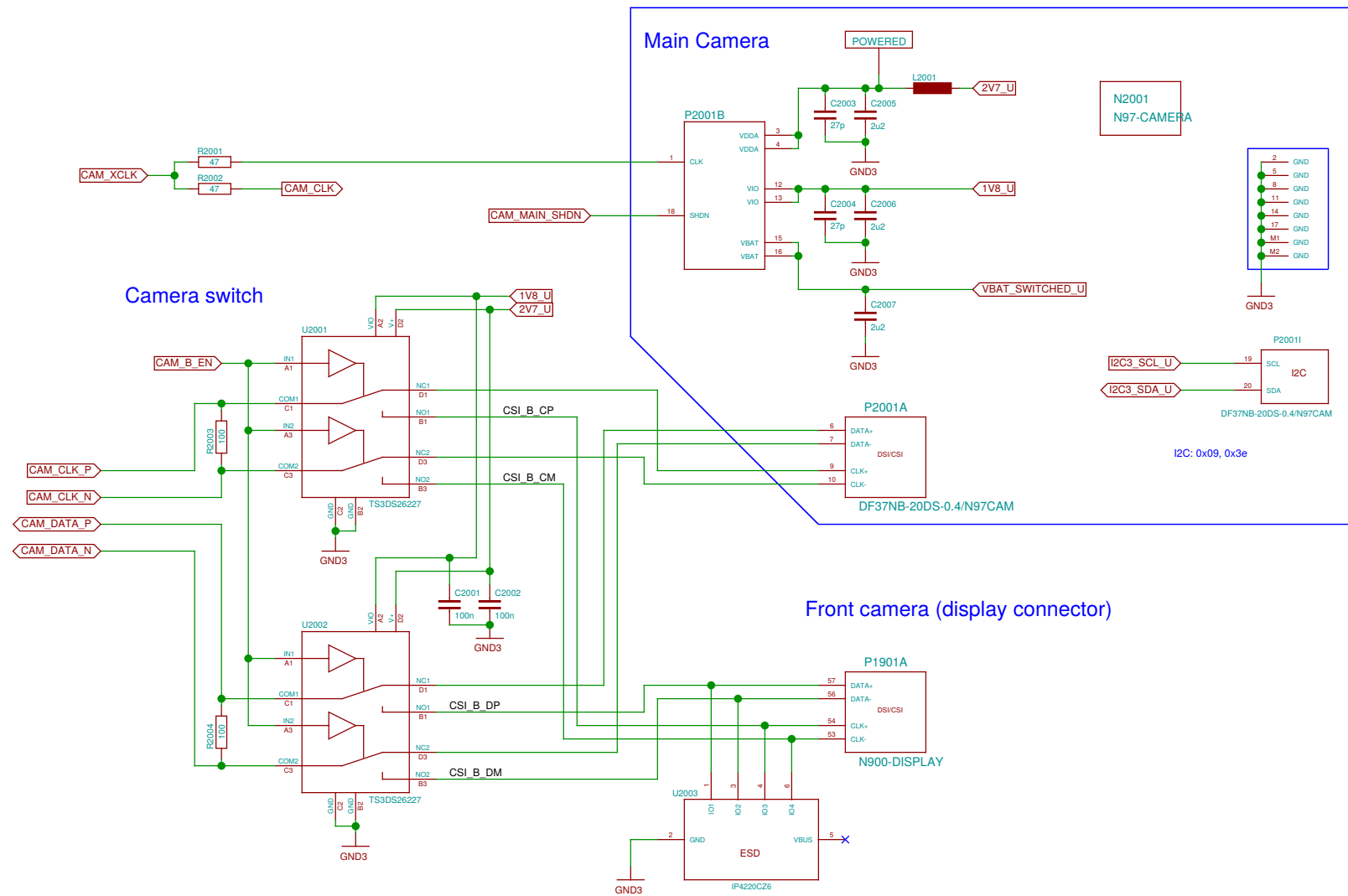
Current mirror V_{ceo} >= 30 V, I_c >= 20 mA

Populate EITHER parallel (with current mirror) OR serial.

TODO: check choke

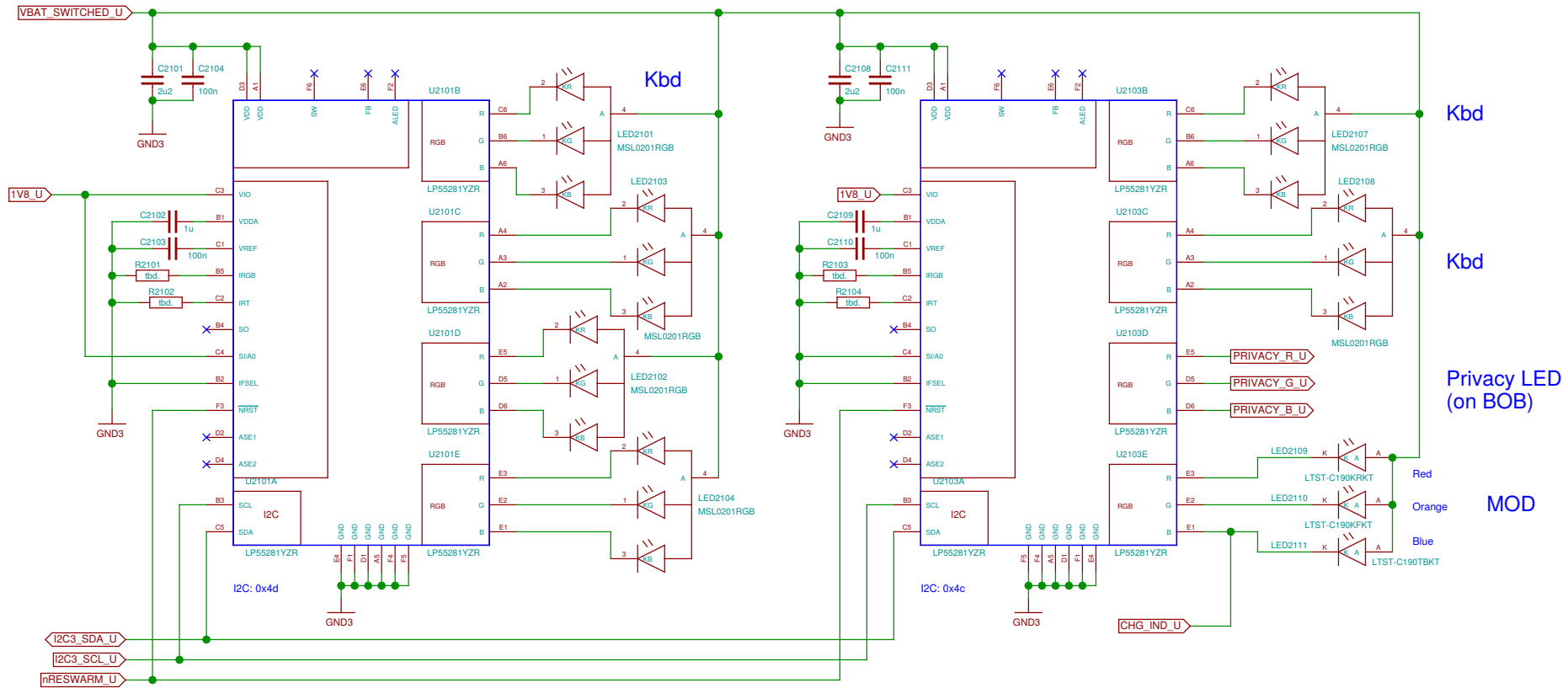
Not shown here: Camera, LEDs

Sheet: /Display/ File: display.sch		Board: UPPER
Title: Display		
Size: A3	Date: 2017-04-01 23:46:19	Rev:
Plotted by eeshow 5dc19d 20170404-04:55Z		Id: 19/25

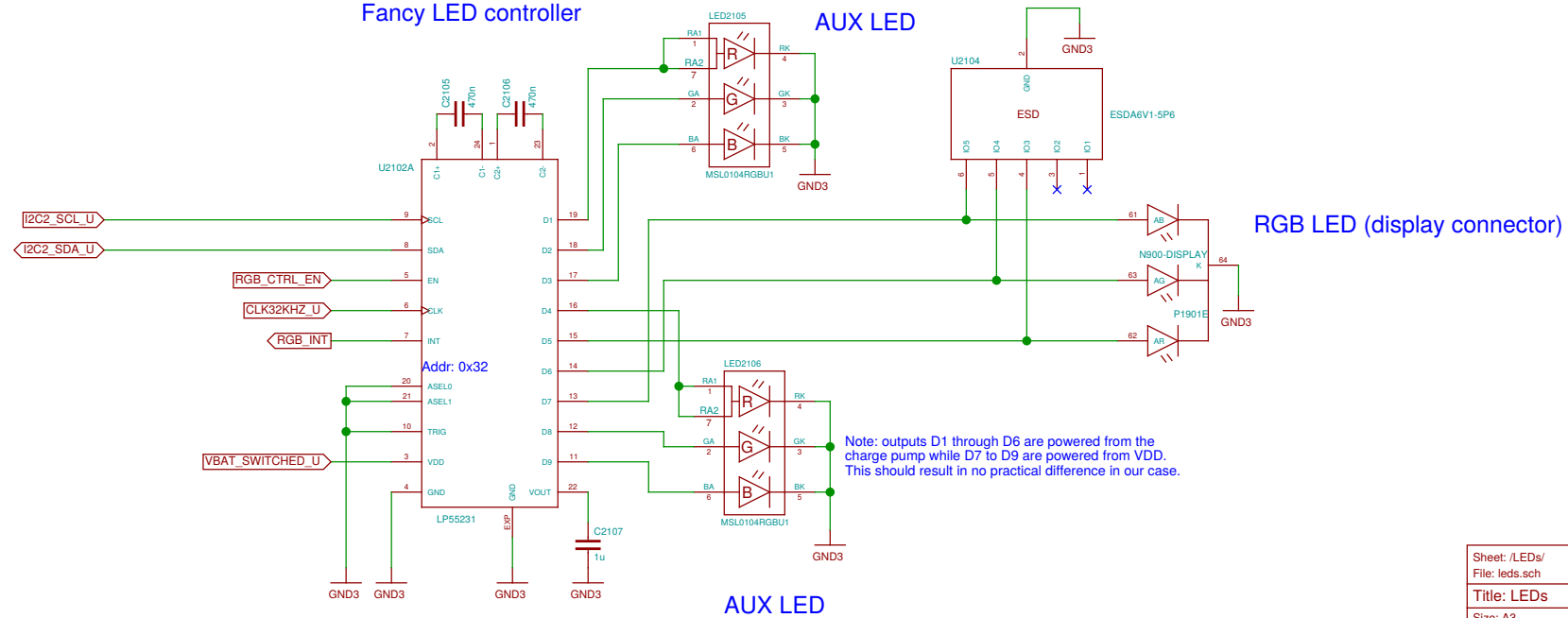


Sheet: /Cameras/ File: cams.sch		Board: UPPER
Title: Cameras		
Size: A3	Date: 2017-04-01 23:46:19	Rev:
Plotted by eeshow 5dc19d 20170404-04:55Z		Id: 20/25

Basic LED controllers

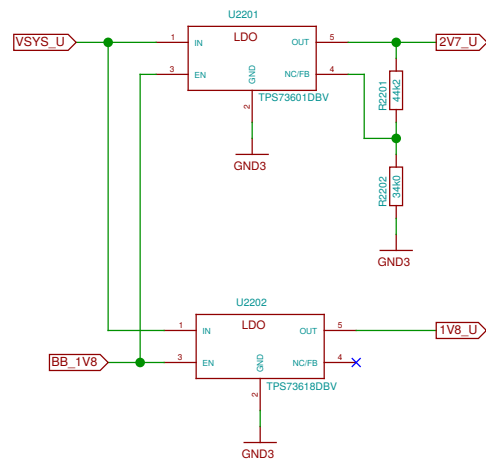


Fancy LED controller



Sheet: /LEDs/ File: leds.sch		Board: UPPER
Title: LEDs		
Size: A3	Date: 2017-04-01 23:46:19	Rev:
Plotted by eeshow 5dc19d 20170404-04:55Z		Id: 21/25

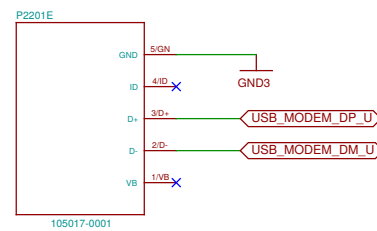
simple capless 400mA LDO for TPS65950 substitute
(only for prototype)



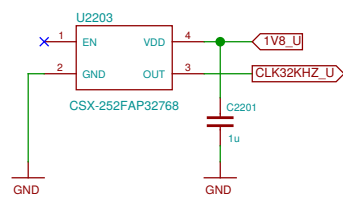
TODO: use REGEN ?

Modem USB

connect to BB
by some Micro-USB cable

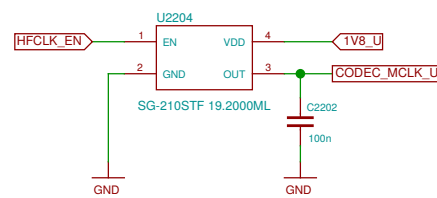


32 kHz clock



Alternative: OYKTGLJANF-0.032768

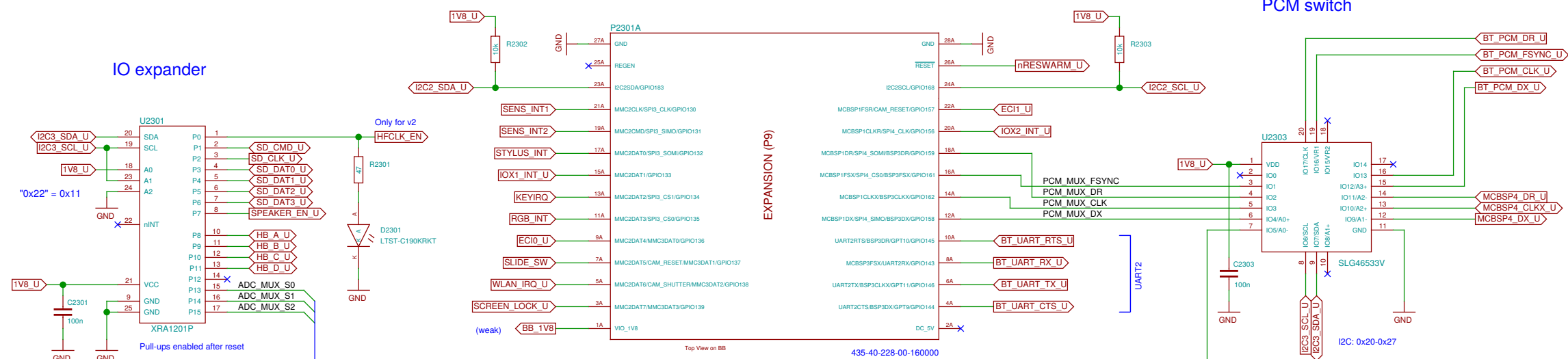
19.2 MHz clock



Alternative: KC2520B19.2000C1GE00

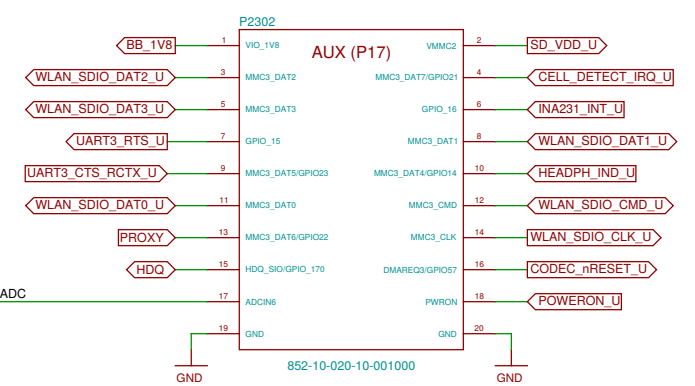
Sheet: /Adaptation (v2 only)/		Board: UPPER
File: v2.sch		
Title: Adaptation (v2 only)		
Size: A3	Date: 2017-04-01 23:46:19	Rev:
Plotted by eeshow 5dc19d 20170404-04:55Z		Id: 22/25

BB-xM Main Expansion Header (P9, 7.24)



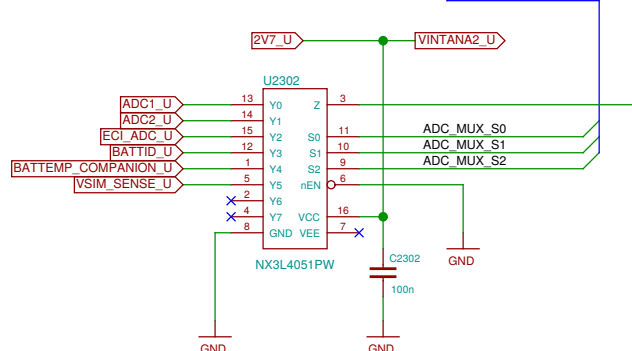
Same part, as "breakaway" strip (72 positions):
435-40-272-00-160000

Auxiliary Expansion Header (P17, 7.26)



Same part, as "breakaway" strip (100 positions):
852-10-100-10-001000

ADC multiplexer

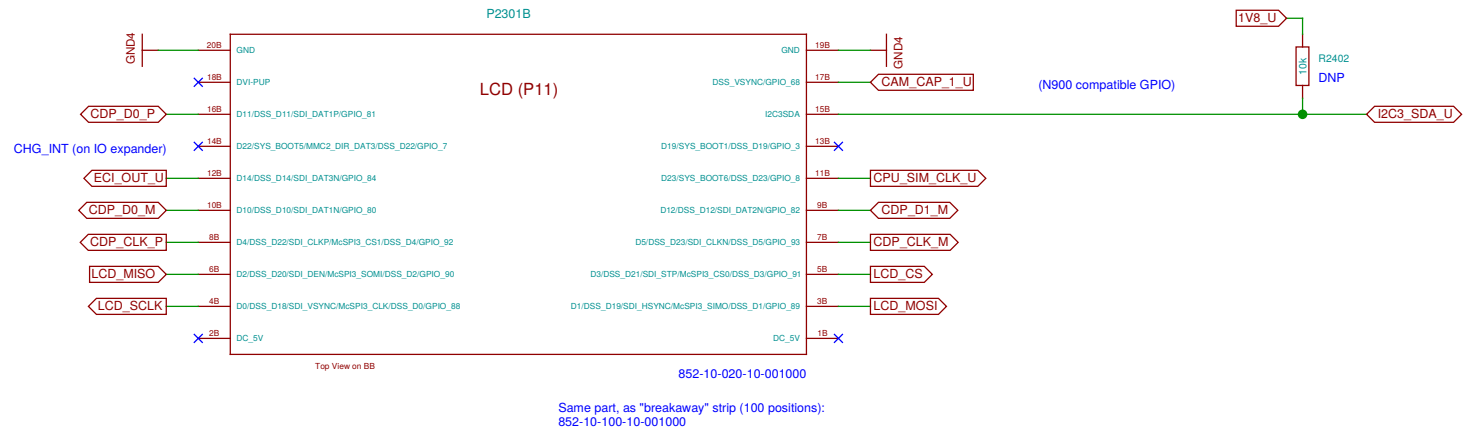


No UART3_RTS on BB-xM, using GPIO
No UART3_CTS on BB-xM, using GPIO

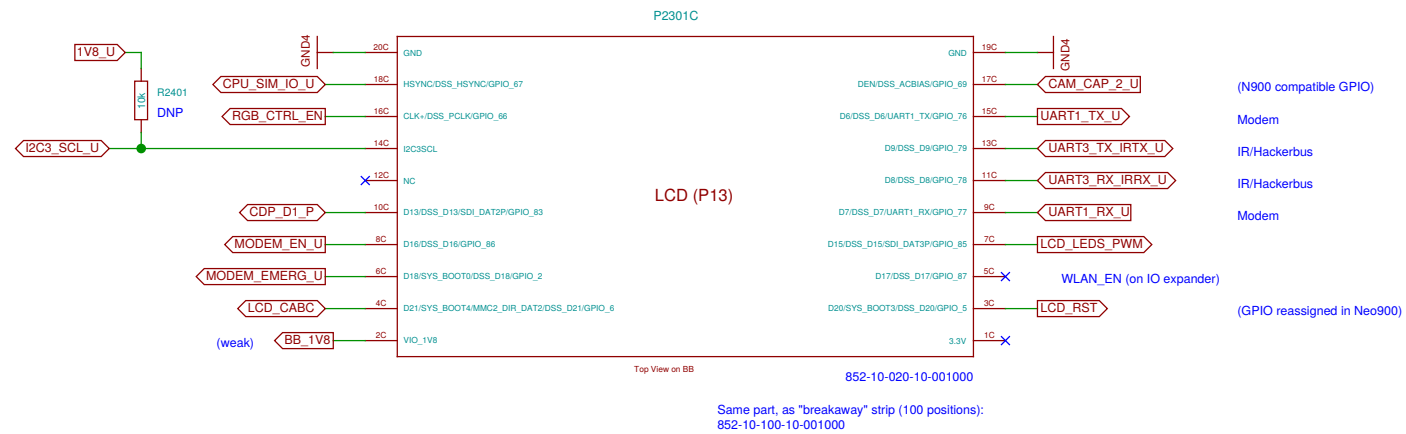
FM_nINT (on IO expander)

Sheet: /BB-xM Adapter (CPU)/		Board: UPPER
File: bbcpu.sch		
Title: BB-xM Adapter (CPU)		
Size: A3	Date: 2017-04-01 23:46:19	Rev:
Plotted by eeshow 5dc19d 20170404-04:55Z		Id: 23/25

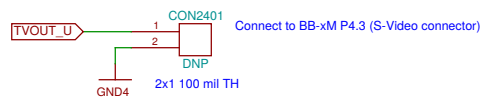
P11 (7.25)



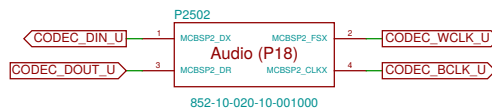
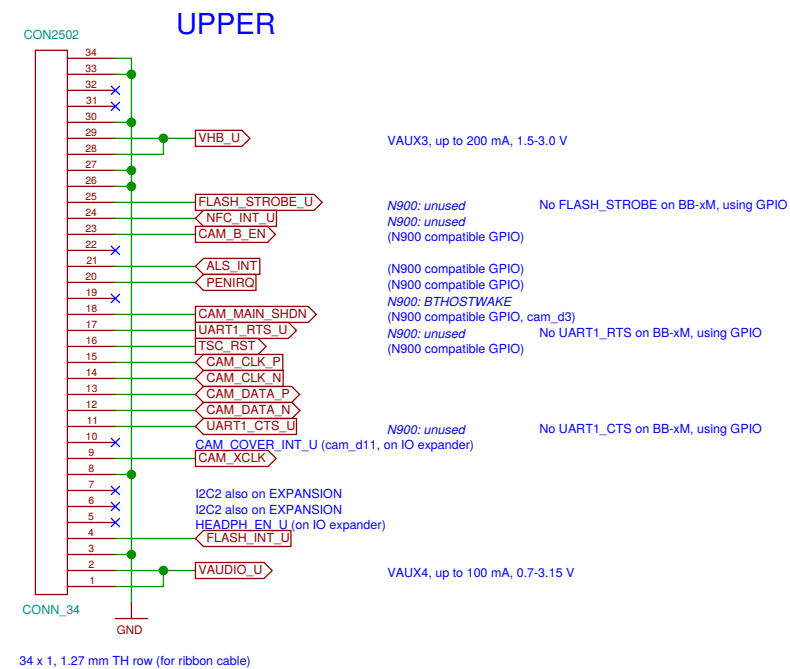
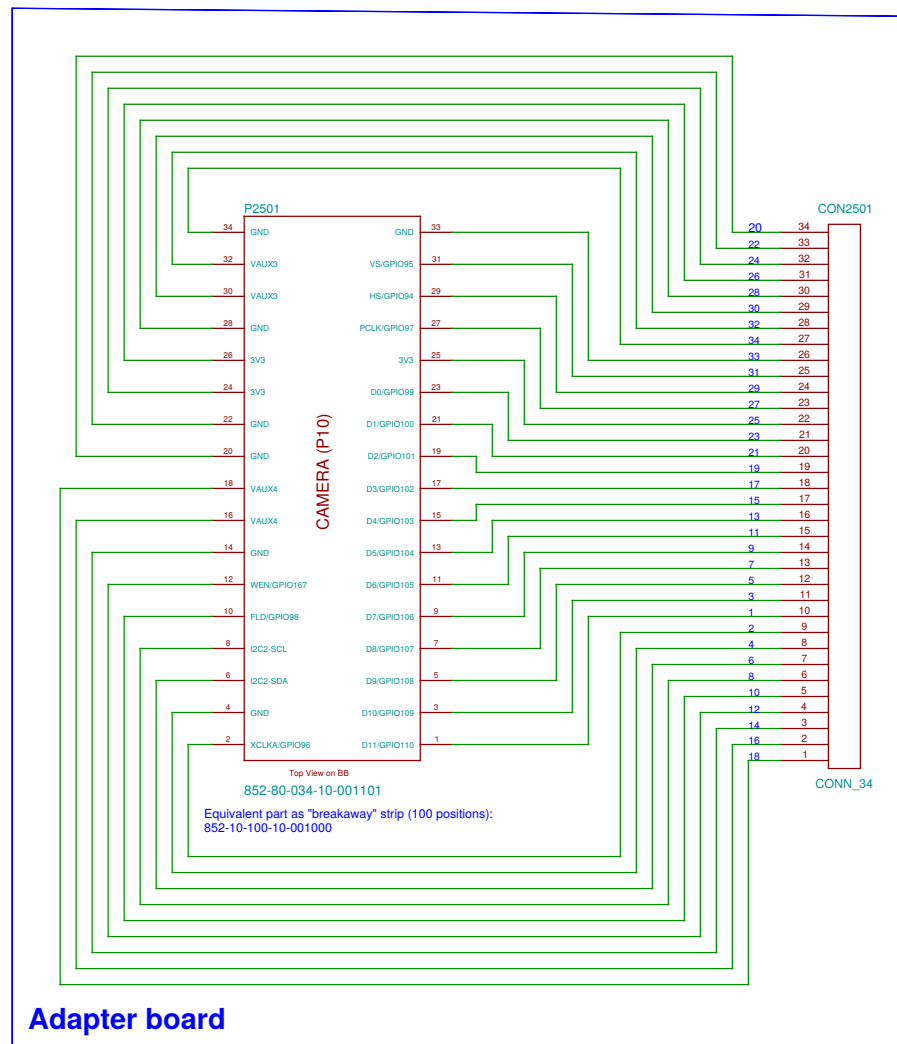
P13 (7.25)



P4 (7.19)



Processor Camera Port Interface (P10, 7.20.3)



This part is a "breakaway" strip (20 positions) and needs to be customized (cut) before assembly.
Alternatively, 852-10-100-10-001000 (100 positions) could be used.