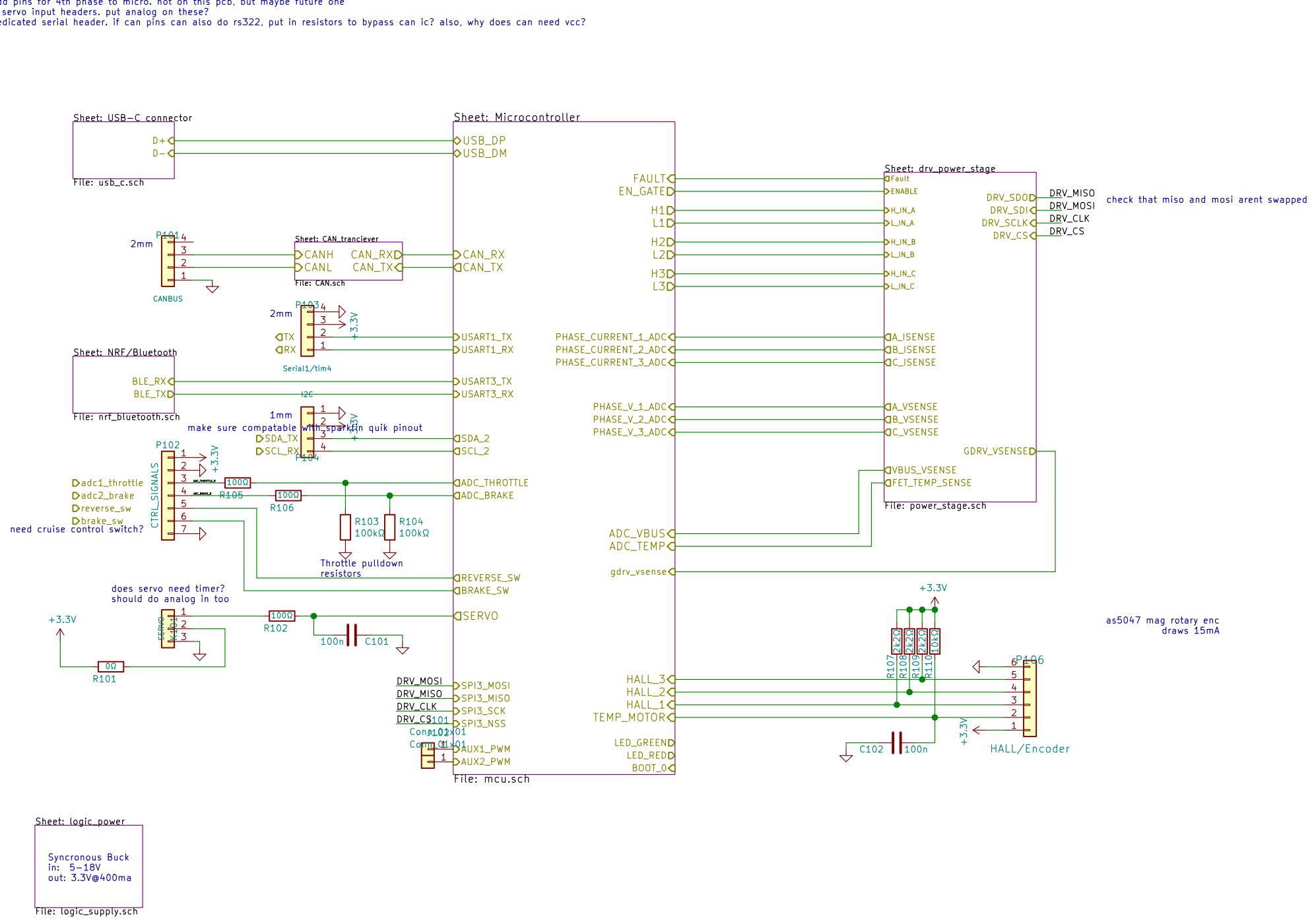
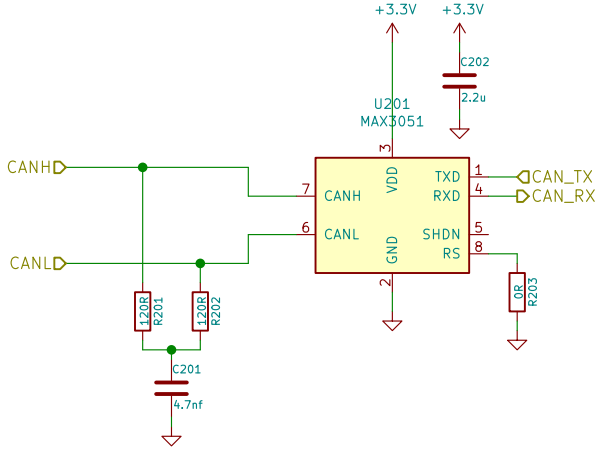
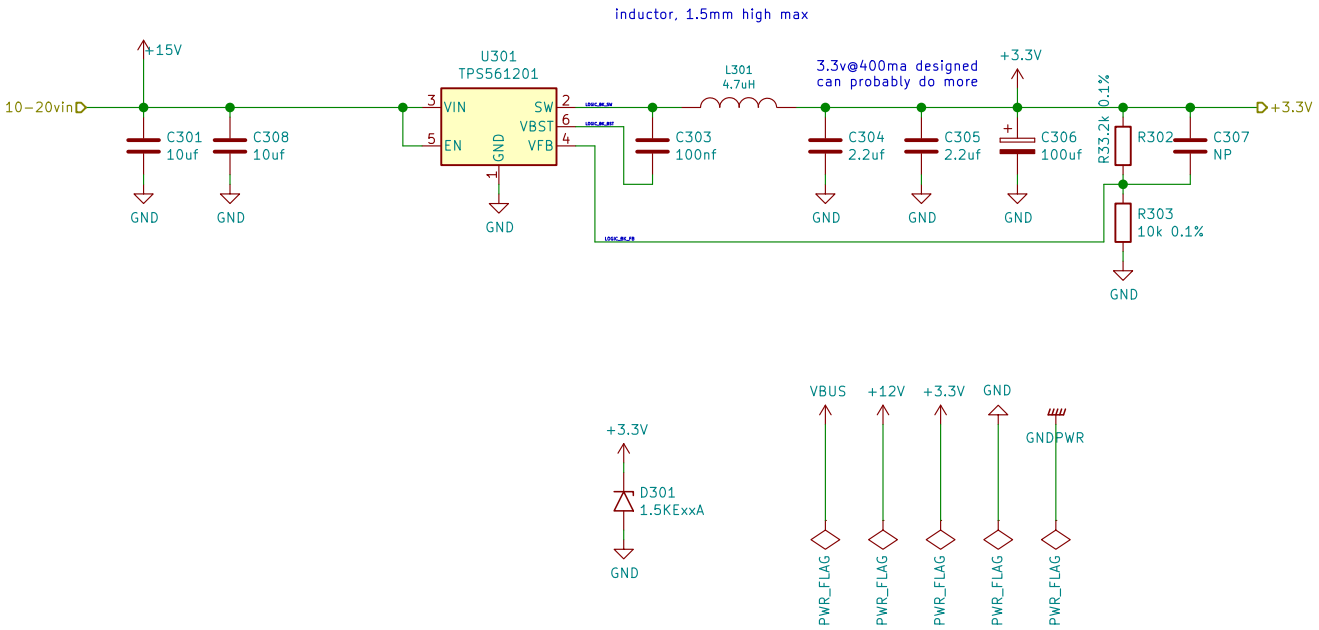

add pins for 4th phase to micro. not on this pcb, but maybe future one
2 servo input headers. put analog on these?
dedicated serial header. if can pins can also do rs322, put in resistors to bypass can ic? also, why does can need vcc?
Sheet: USB-C connector
D+
D-
File: usb_c.sch
Sheet: Microcontroller
USB_DP
USB_DM
Sheet: drv_power_stage
FAULT
EN_GATE
H1
L1
H2
L2
H3
L3
DRV_SDO
DRV_SDI
DRV_SCLK
DRV_CS
DRV_MISO
DRV_MOSI
DRV_CLK
DRV_CS
check that miso and mosi arent swapped
P101
2mm
CANBUS
Sheet: CAN_tranciever
CANH
CANL
CAN_RX
CAN_TX
File: CAN.sch
CAN_RX
CAN_TX
P103
2mm
+3.3V
TX
RX
Serial1/tim4
USART1_TX
USART1_RX
Sheet: NRF/Bluetooth
BLE_RX
BLE_TX
File: nrf_bluetooth.sch
USART3_TX
USART3_RX
1mm
I2C
make sure compatable with sparkfun quik pinout
SDA_TX
SCL_RX
P104
SDA_2
SCL_2
PHASE_CURRENT_1_ADC
PHASE_CURRENT_2_ADC
PHASE_CURRENT_3_ADC
A_ISENSE
B_ISENSE
C_ISENSE
PHASE_V_1_ADC
PHASE_V_2_ADC
PHASE_V_3_ADC
A_VSENSE
B_VSENSE
C_VSENSE
GDRV_VSENSE
VBUS_VSENSE
FET_TEMP_SENSE
P102
CTRL_SIGNALS
+3.3V
adc1_throttle
adc2_brake
reverse_sw
brake_sw
need cruise control switch?
100Ω
R105
R106
ADC_THROTTLE
ADC_BRAKE
R103
100kΩ
R104
100kΩ
Throttle pulldown resistors
ADC_VBUS
ADC_TEMP
gdrv_vsense
REVERSE_SW
BRAKE_SW
does servo need timer?
should do analog in too
+3.3V
SERVO
100Ω
R102
100n
C101
0Ω
R101
DRV_MOSI
DRV_MISO
DRV_CLK
DRV_CS
SPI3_MOSI
SPI3_MISO
SPI3_SCK
SPI3_NSS
Conn_01x01
Conn_01x01
AUX1_PWM
AUX2_PWM
HALL_3
HALL_2
HALL_1
TEMP_MOTOR
LED_GREEN
LED_RED
BOOT_0
+3.3V
2k2Ω
2k2Ω
2k2Ω
10kΩ
R107
R108
R109
R110
P106
C102
100n
+3.3V
HALL/Encoder
as5047 mag rotary enc
draws 15mA
File: mcu.sch
Sheet: logic_power
Syncronous Buck
in: 5-18V
out: 3.3V@400ma
File: logic_supply.sch

5v supply can trancievers are much more robust and cheaper
(have higher transient tolerance on can lines)

but really want to avoid extra 5v rail.

footprint also compatable with TI tcan332




inductor, 1.5mm high max
+15V
10-20vin
C301
10uf
C308
10uf
GND
GND
U301
TPS561201
VIN
EN
GND
SW
VBST
VFB
3
5
1
2
6
4
GND
C303
100nf
L301
4.7uH
3.3v@400ma designed
can probably do more
C304
2.2uf
C305
2.2uf
C306
100uf
GND
GND
GND
+3.3V
R33.2k 0.1%
R302
C307
NP
R303
10k 0.1%
GND
+3.3V
+3.3V
D301
1.5KExxA
GND
VBUS
+12V
+3.3V
GND
GNDPWR
PWR_FLAG
PWR_FLAG
PWR_FLAG
PWR_FLAG
PWR_FLAG

can i use micro internal pullups for this?

+3.3V

R402
10kΩ

Fault

ENABLE

H_IN_A

L_IN_A

H_IN_B

L_IN_B

H_IN_C

L_IN_C

+3.3V

why is this r needed?

R401
1kOhm

DRV_SDO

DRV_SDI

DRV_SCLK

DRV_CS

GND

+3.3V +3.3VA

Net-Tie_2
NT403

Net-Tie_2
NT401

GNDA GND

Net-Tie_2
NT402

GNDD GNDPWR

make agnd plane that runs
under all analog current signals
also kelvin connect 3.3v ref at mcu

A_ISENSE

B_ISENSE

C_ISENSE

+3.3VA

3.3_IREF

C406
2.2uF

GNDA

can this be changed to
100nf to reduce bom #?

C407
0.047uF

+15V

C401
10uF

C403
0.1uF

GNDD GNDD

C408
1uF

vgls

C409
1uF

dvdd

GND

GNDPWR

+BATT

C425
4.7uF
100V

C404
0.1uF

GNDD GNDD

batt_pwr_ctl

R403
560kΩ

BK_VCC

C405
1uF

GNDD

GNDD

U401
DRV8353RSRGZT

28	FAULT_N	VCP	7
33	ENABLE	VDRAIN	6
34	INHA		
35	INLA		
36	INHB	GHA	8
37	INLB	SHA	9
38	INHC	GLA	10
39	INLC	SPA	11
29	MODE_SDO	SNA	12
30	IDRIVE_SDI		
31	VDS_SCLK		
32	NC_SCS_N		
41	DGND	GHB	17
25	SOA	SHB	16
24	SOB	GLB	15
23	SOC	SPB	14
26	VREF	SNB	13
27	AGND	GHC	18
4	CPH	SHC	19
3	CPL	GLC	20
5	VM	SPC	21
2	VGLS	SNC	22
1	DVDD		
43	VIN	BST	45
47	RT_SD	SW	42
44	VCC	DFB	
49	PAD	FB	48
1	PGND	RCL	46

buck vin stby ic =120ua

LM5008A buck

+BATT

NT404
Net-Tie_2

vdrain must be kelvin connected to mosfet drain for
proper shoothrough overcurrent detection

C411
1uF

vdrain

vdrain stby ic < 40ua

BK_BST_C

C410
0.1uF

BK_SW

L401
470uH

BK_VOUT_RIPP

D401
DFLS1100-7

R407
57.6kΩ

C415
3nf

C412
10nf

15v_FB

GDRV_VSENSE

R404
200kΩ

buck_rcl

GNDD

diode footprint needs to be updated. can likely be put on bottonm of pcb

R405
10kΩ

R406
909Ω

GND

C413
10uF

C402
10uF

C416
10uf, 25v

+15V

fb at 2.5 v

Sheet: power_phase_A
H_GATE
H_SWITCH
L_GATE
PR_SENSE
NR_SENSE
PHASE_OUT
File: power_phase.sch

PHASE_A

J403
A

Sheet: power_phase_B
H_GATE
H_SWITCH
L_GATE
PR_SENSE
NR_SENSE
PHASE_OUT
File: power_phase.sch

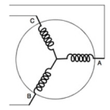
PHASE_B

J404
B

Sheet: power_phase_C
H_GATE
H_SWITCH
L_GATE
PR_SENSE
NR_SENSE
PHASE_OUT
File: power_phase.sch

PHASE_C

J405
C



+BATT

C417
56uF

C419
56uF

C421
56uF

extra through hole caps to allow
smd or pth cap placement

GNDPWR

+BATT

C414
560uF

C418
20uF
80v

C420
20uF
80v

C422
20uF
80v

J401
+Vbat

J402
Gnd

batt vin pads spaced for
xt60 or 12-8awg wires

GNDPWR

try out a single alu solid polymer cap?

R408
47kΩ

R409
2.2kΩ

A_VSENSE

R410
47kΩ

R411
2.2kΩ

B_VSENSE

R412
47kΩ

R413
2.2kΩ

C_VSENSE

+BATT

R414
47kΩ

R415
2.2kΩ

VBUS_VSENSE

check v divider max voltage.

3.3v out = 73.8vin max. reasonable w 75v fets

16s*4.2v = 67.2v (16s abs max input, recommend 14s)

+3.3V

R416
10kΩ

C423
100n

R417
NTC 10kΩ

FET_TEMP_SENSE

place near low side fets

The temp resistor ladder
is flipped from the vesc official hw
because I do not want my 3.3v rail
anywhere near 48+v
will need to invert adc reading

jp perminantly enables power.
power switch will not work

+BATT

JP401
pwr_ctl_byp

R418
1M

R419
500k

Q401
Q_PNP_BCE

batt_pwr_ctl

J406
Conn_01x03

switch

R420
100

GNDD

+15V

possibly change c502 to 2x 0603
or same as hv filter cap (1.0-2.2uf) 1206 package
and place on top if 1206

MK401
Mounting_Hole

MK402
Mounting_Hole

MK403
Mounting_Hole

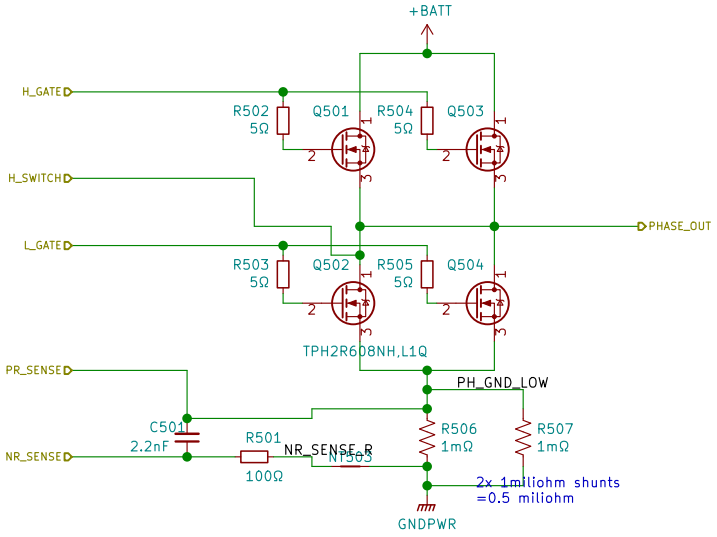
MK404
Mounting_Hole

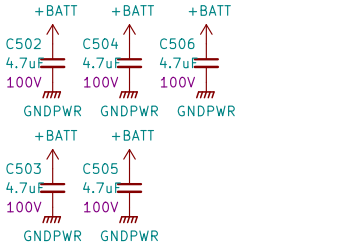
MK405
Mounting_Hole

MK406
Mounting_Hole

Mosfet replacements:
TPW1R306PL, 60v, 1.29 mΩ, top cool
TPH2R608NH, 75v, 2.60mΩ, bottom cool
TPW2R508NH, 75v, 2.50 mΩ, top cool
TPW4R50ANH, 100v, 3.7 mΩ, top cool

Gain: (recalcualte)
0.00015 * 20v/v = 3mv/A
+−1.6v / 0.003 = 533A
see google spreadsheet





place caps as close to fets as possible.
can be replaced with 2.2uf caps if needed

kelvin connect shb_x to bottom fet drain to try out fet r current sense.
put i sense filter resistor on snc_x to be able to disconnect it and connecto to fet as well.

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TPH2R608NH, 75v, 2.60mΩ, bottom cool
TPW2R508NH, 75v, 2.50 mΩ, top cool
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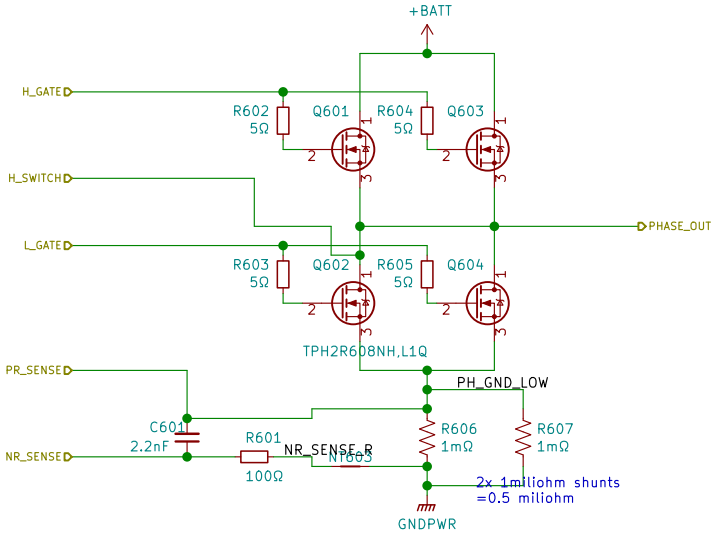

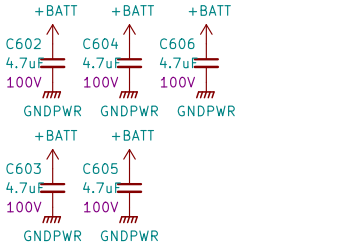

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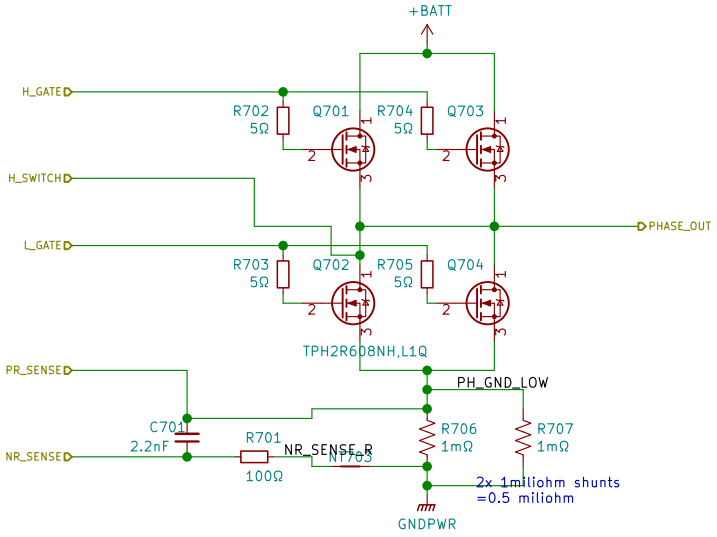
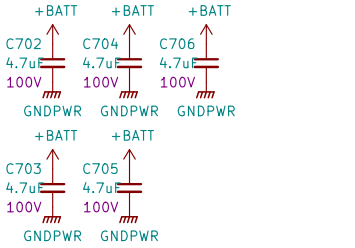
see google spreadsheet

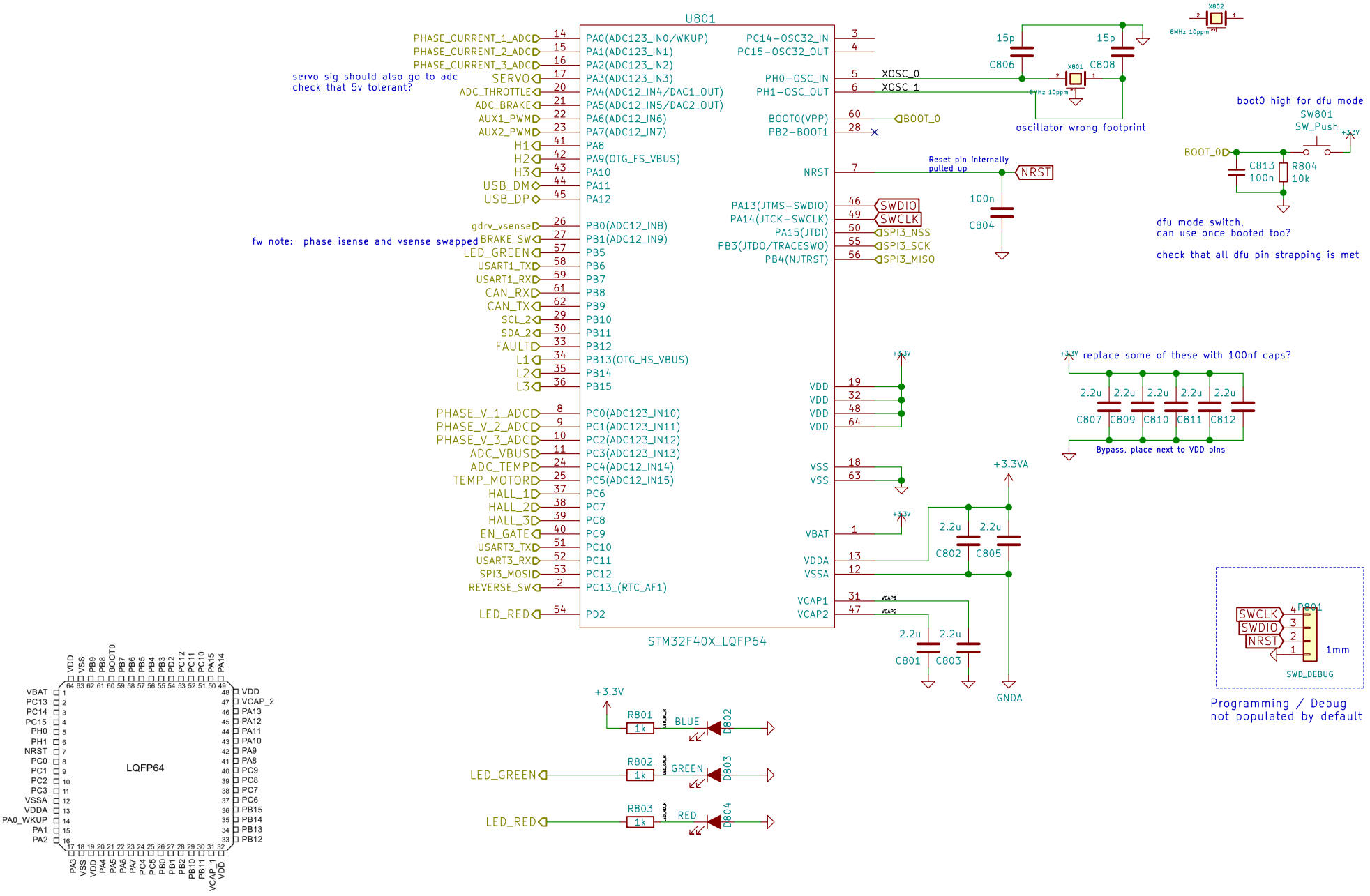




place caps as close to fets as possible.
can be replaced with 2.2uf caps if needed

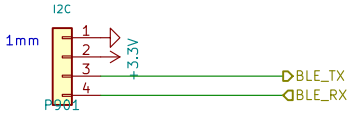
kelvin connect shb_x to bottom fet drain to try out fet r current sense.
put i sense filter resistor on snc_x to be able to disconnect it and connecto to fet as well.

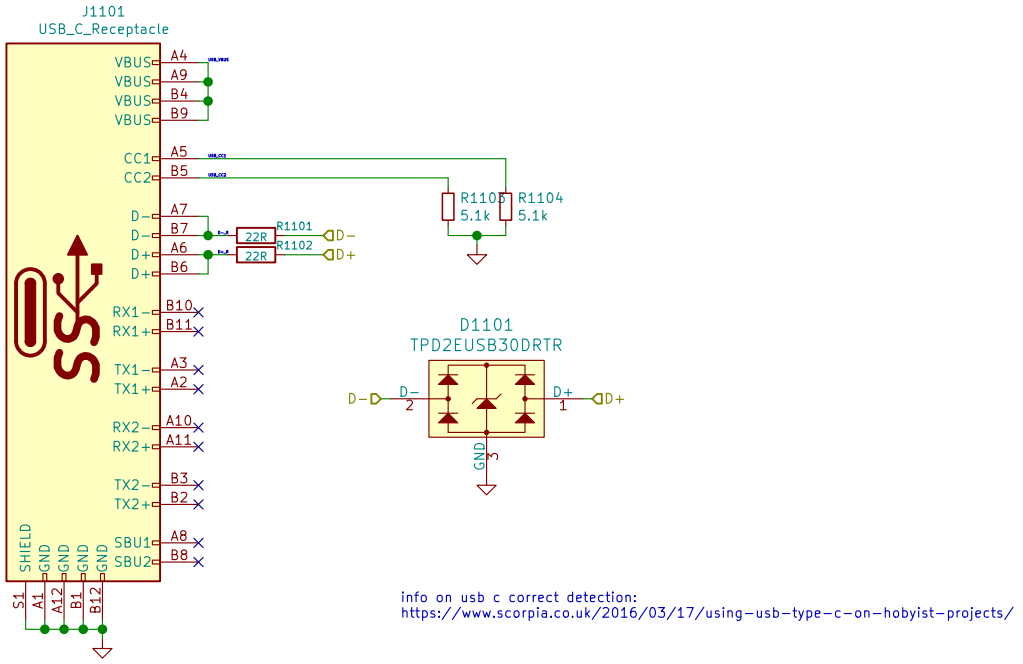
draws 50-100ma from 3.3v
1.4mm tall, fets are 1 mm



bluetooth module won't fit on this design

http://www.wireless-tag.com/wireless_module/BLE/WT51822-S4AT.html
or




J1101
USB_C_Receptacle
VBUS
VBUS
VBUS
VBUS
A4
A9
B4
B9
CC1
CC2
A5
B5
R1103
5.1k
R1104
5.1k
D−
D−
D+
D+
A7
B7
A6
B6
22R
22R
R1101
R1102
D−
D+
RX1−
RX1+
B10
B11
TX1−
TX1+
A3
A2
RX2−
RX2+
A10
A11
TX2−
TX2+
B3
B2
SBU1
SBU2
A8
B8
SHIELD
GND
GND
GND
GND
S1
A1
A12
B1
B12
D1101
TPD2EUSB30DRTR
D−
D−
2
D+
1
D+
GND
3
info on usb c correct detection:
https://www.scorpia.co.uk/2016/03/17/using-usb-type-c-on-hobyist-projects/