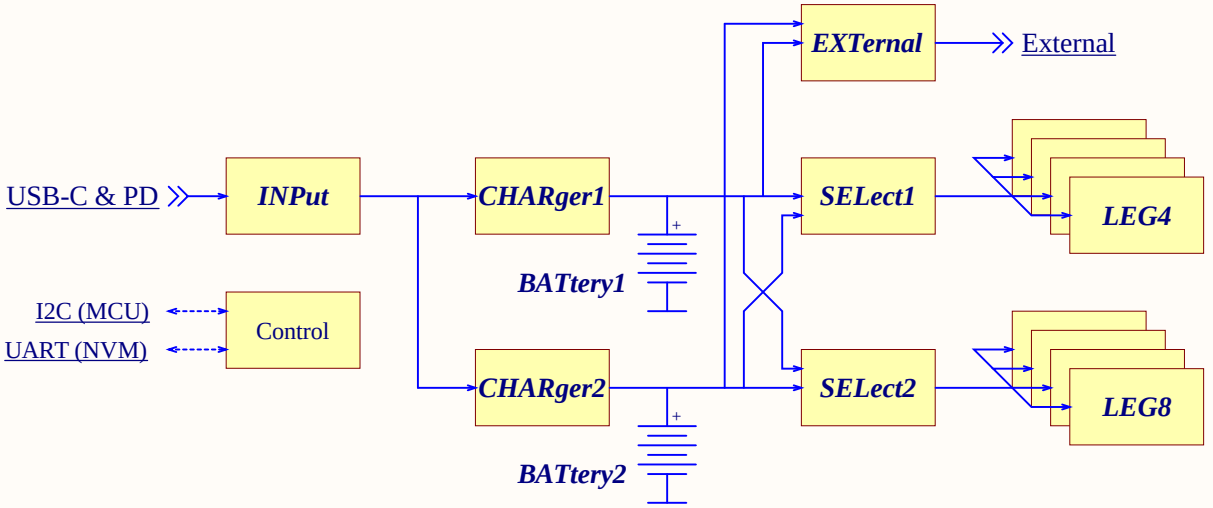
ASH Power

Variant: [No Variations]

Table of content

Text



Introduction

Text

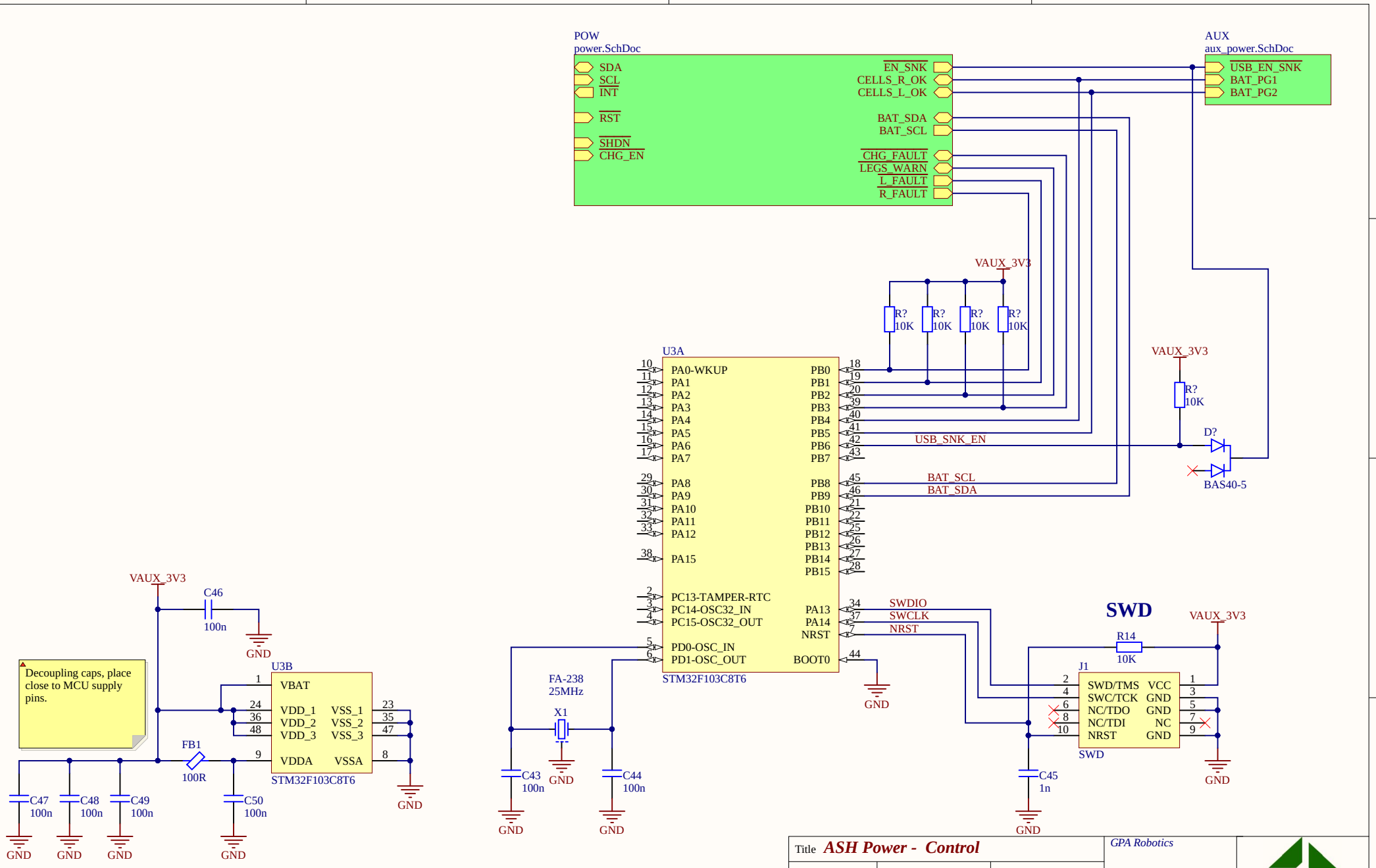
Specifications

Text

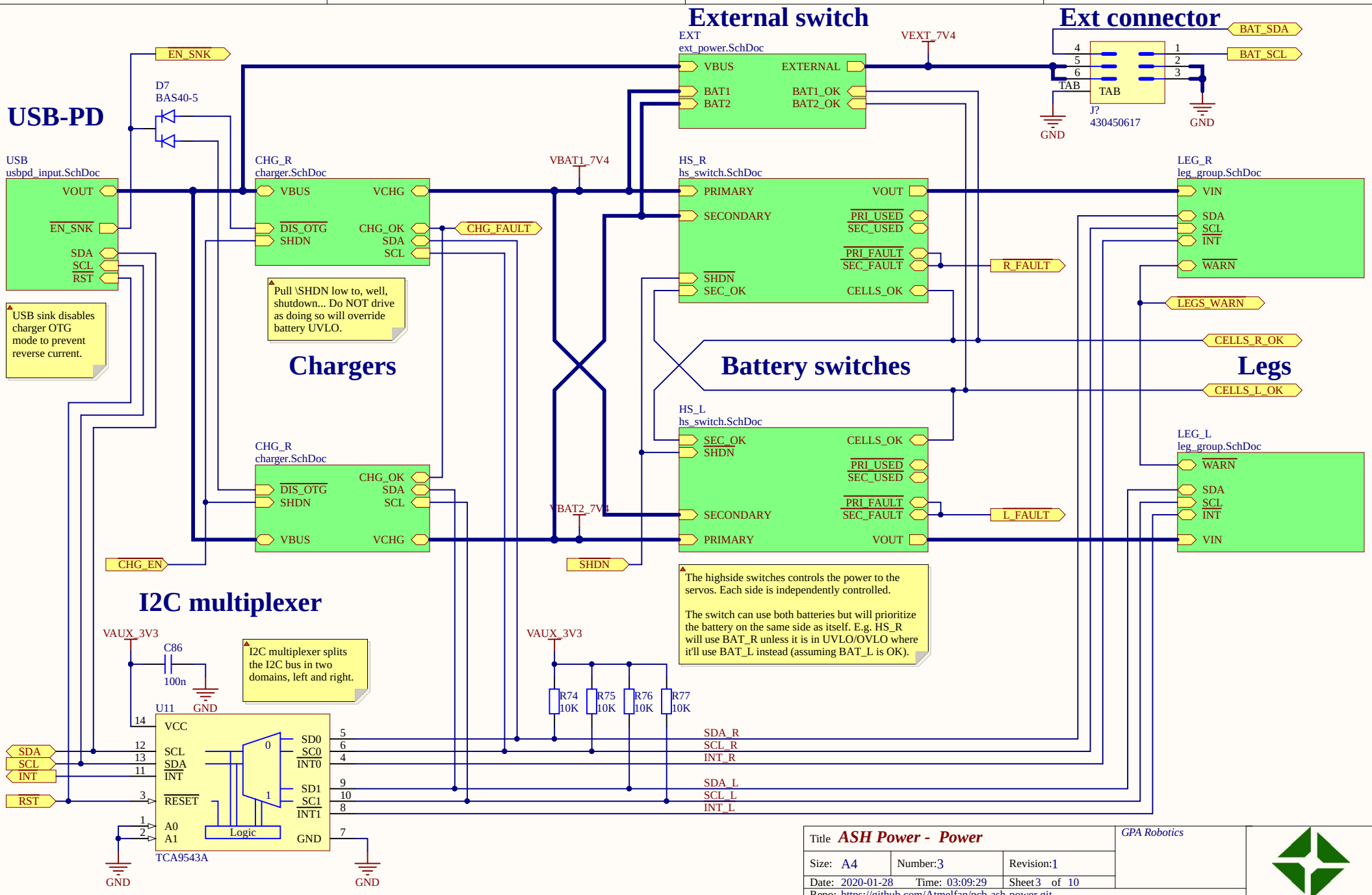
External connector

1 - SCL
2 - GND
3 - GND
4 - SDA
5 - VS
6 - VS

Title	*ASH Power - Cover*		*GPA Robotics*
Size: A4	Number:1	Revision:1	
Date: 2020-01-28	Time: 03:09:29	Sheet 1 of 10	
Repo: https://github.com/Atmelfan/pcb-ash-power.git			



Title	***ASH Power - Control***		*GPA Robotics*
Size: A4	Number:2	Revision:1	
Date: 2020-01-28	Time: 03:09:29	Sheet 2 of 10	
Repo: https://github.com/Atmelfan/pcb-ash-power.git			


External switch
Ext connector
USB-PD
Chargers
Battery switches
Legs
I2C multiplexer
EXT
ext_power.Schdoc
VBUS
EXTERNAL
BAT1
BAT2
BAT1_OK
BAT2_OK
VEXT_7V4
BAT_SDA
BAT_SCL
TAB
J?
430450617
GND
EN_SNK
D7
BAS40-5
USB
usbpd_input.SchDoc
VOUT
EN_SNK
SDA
SCL
RST
CHG_R
charger.SchDoc
VBUS
VCHG
DIS_OTG
SHDN
CHG_OK
SDA
SCL
CHG_FAULT
VBAT1_7V4
HS_R
hs_switch.SchDoc
PRIMARY
SECONDARY
VOUT
PRI_USED
SEC_USED
PRI_FAULT
SEC_FAULT
SHDN
SEC_OK
CELLS_OK
R_FAULT
LEG_R
leg_group.SchDoc
VIN
SDA
SCL
INT
WARN
LEGS_WARN
CELLS_R_OK
CELLS_L_OK
HS_L
hs_switch.SchDoc
L_FAULT
LEG_L
leg_group.SchDoc
VBAT2_7V4
CHG_EN
SHDN
USB sink disables charger OTG mode to prevent reverse current.
Pull \SHDN low to, well, shutdown... Do NOT drive as doing so will override battery UVLO.
The highside switches controls the power to the servos. Each side is independently controlled.
The switch can use both batteries but will prioritize the battery on the same side as itself. E.g. HS_R will use BAT_R unless it is in UVLO/OVLO where it'll use BAT_L instead (assuming BAT_L is OK).
I2C multiplexer splits the I2C bus in two domains, left and right.
VAUX_3V3
C86
100n
U11
VCC
SCL
SDA
INT
RESET
A0
A1
SD0
SC0
INT0
SD1
SC1
INT1
Logic
TCA9543A
R74
R75
R76
R77
10K
SDA_R
SCL_R
INT_R
SDA_L
SCL_L
INT_L
Title ASH Power - Power
GPA Robotics
Size: A4
Number:3
Revision:1
Date: 2020-01-28
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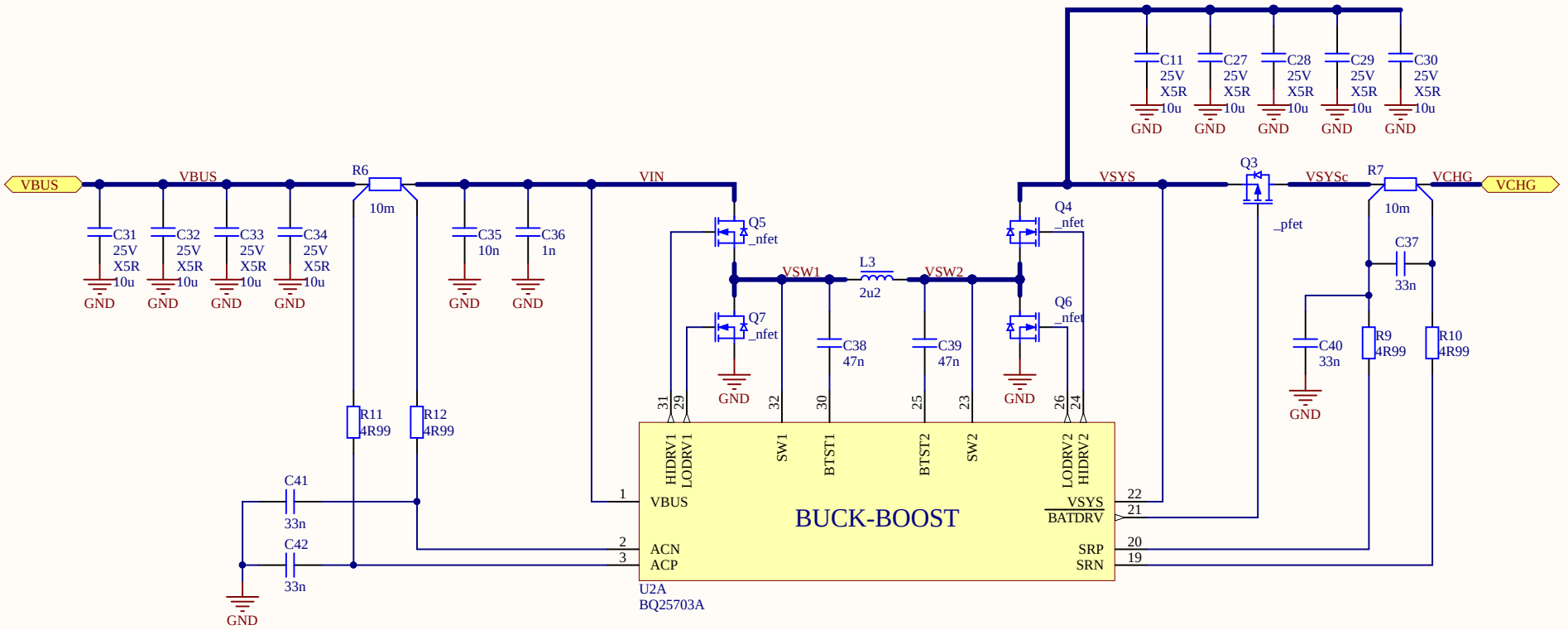
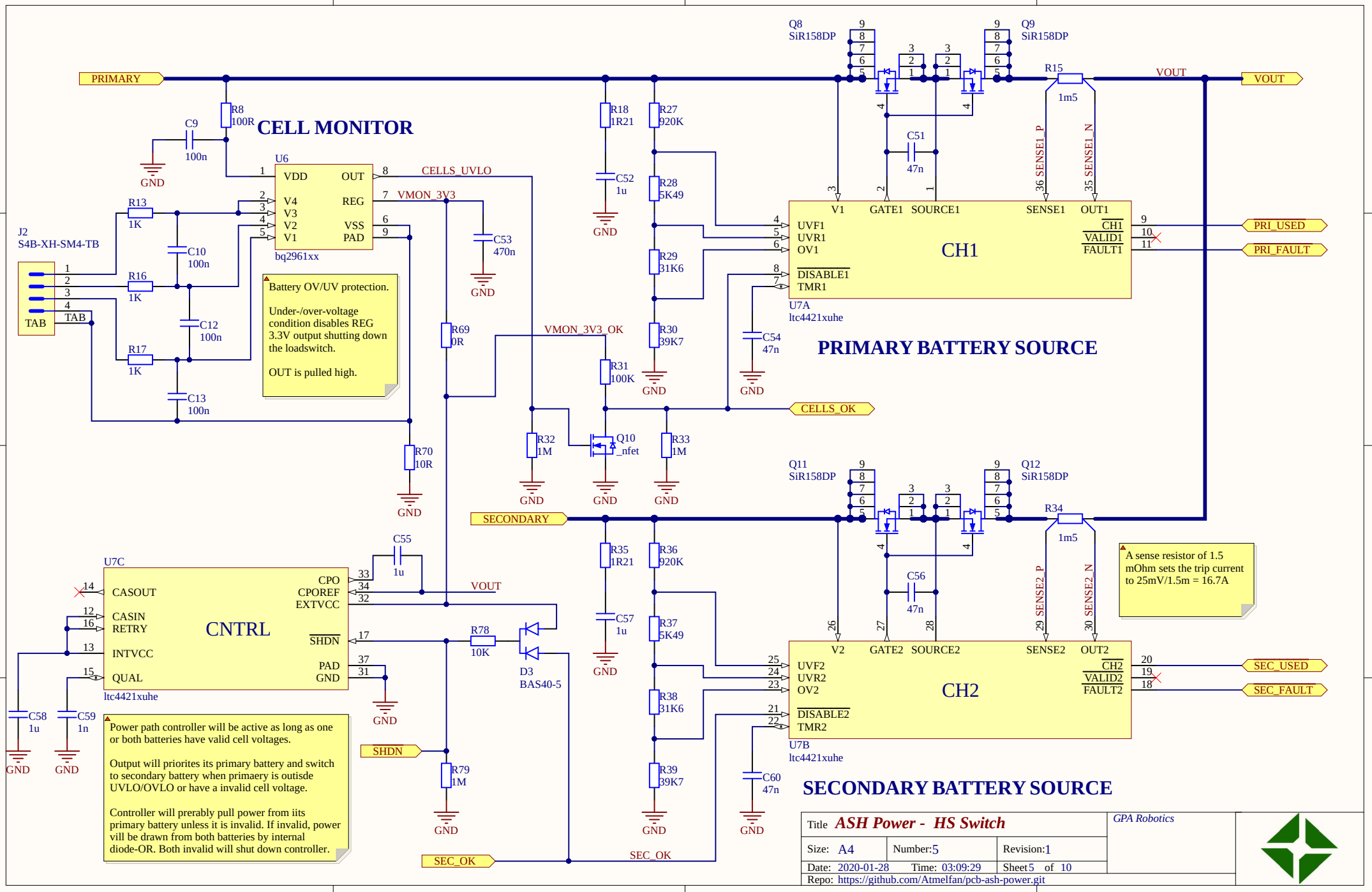
Repo: https://github.com/Atmelfan/pcb-ash-power.git


VBUS
VBUS
R6
10m
VIN
C31 25V X5R 10u
C32 25V X5R 10u
C33 25V X5R 10u
C34 25V X5R 10u
C35 10n
C36 1n
GND
Q5 _nfet
Q7 _nfet
VSW1
L3
2u2
VSW2
Q4 _nfet
Q6 _nfet
C38 47n
C39 47n
C11 25V X5R 10u
C27 25V X5R 10u
C28 25V X5R 10u
C29 25V X5R 10u
C30 25V X5R 10u
VSYS
Q3
_pfet
VSYSc
R7
10m
VCHG
VCHG
C37 33n
C40 33n
R9 4R99
R10 4R99
R11 4R99
R12 4R99
C41 33n
C42 33n
HIDRV1
LODRV1
SW1
BTST1
BTST2
SW2
LODRV2
HIDRV2
VBUS
ACN
ACP
VSYS
BATDRV
SRP
SRN
BUCK-BOOST
U2A
BQ25703A
REGN
C78 100n
U2B
R62 10K
SDA
SCL
COMP1
COMP2
REGN
PSYS
PGND
PAD
VDDA
SDA
SCL
COMP1
COMP2
REGN
PSYS
PGND
PAD
CELL_BATPRESZ
ILIM_HIZ
EN_OTG
CHRG_OK
PROCHOT
IADPT
IBAT
CMPOUT
CMPIN
CTRL
bq25703a
R24 10K
R25 10K
R26 10K
SET_VOLTAGE
SET_CURRENT
DIS_OTG
CHG_OK
IADPT
IBAT
R63 10K
R64 10K
Q19 _nfet
SHDN
R40 1M
R65 10K
R66 10K
R67 10K
R68 10K
C81 100n
C82 100n
C83 100n
C84 100n
C85 100n
C79 100n
C80 100n
Title ASH Power - Charger
GPA Robotics
Size: A4
Number:4
Revision:1
Date: 2020-01-28
Time: 03:09:29
Sheet 4 of 10
Repo: https://github.com/Atmelfan/pcb-ash-power.git


CELL MONITOR
PRIMARY BATTERY SOURCE
SECONDARY BATTERY SOURCE
PRIMARY
SECONDARY
VOUT
U6
bq2961xx
VDD
OUT
V4
REG
V3
VSS
V2
PAD
V1
CELLS_UVLO
VMON_3V3
VMON_3V3_OK
CELLS_OK
SHDN
SEC_OK
J2
S4B-XH-SM4-TB
TAB
R8 100R
C9 100n
R13 1K
R16 1K
R17 1K
C10 100n
C12 100n
C13 100n
R18 1R21
R27 920K
R28 5K49
R29 31K6
R30 39K7
C52 1u
C53 470n
R69 0R
R31 100K
R32 1M
R33 1M
R70 10R
Q10 _nfet
C54 47n
Q8 SiR158DP
Q9 SiR158DP
R15 1m5
C51 47n
CH1
UVF1
UVR1
OV1
DISABLE1
TMR1
V1
GATE1
SOURCE1
SENSE1
OUT1
CH1
VALID1
FAULT1
U7A
ltc4421xuhe
PRI_USED
PRI_FAULT
36 SENSE1_P
35 SENSE1_N
Battery OV/UV protection.
Under-/over-voltage condition disables REG 3.3V output shutting down the loadswitch.
OUT is pulled high.
U7C
CNTRL
CASOUT
CASIN
RETRY
INTVCC
QUAL
CPO
CPOREF
EXTVCC
SHDN
PAD
GND
ltc4421xuhe
C55 1u
R78 10K
D3 BAS40-5
R79 1M
C58 1u
C59 1n
Power path controller will be active as long as one or both batteries have valid cell voltages.
Output will priorites its primary battery and switch to secondary battery when primaery is outisde UVLO/OVLO or have a invalid cell voltage.
Controller will prerably pull power from iits primary battery unless it is invalid. If invalid, power vill be drawn from both batteries by internal diode-OR. Both invalid will shut down controller.
Q11 SiR158DP
Q12 SiR158DP
R34 1m5
C56 47n
CH2
UVF2
UVR2
OV2
DISABLE2
TMR2
V2
GATE2
SOURCE2
SENSE2
OUT2
CH2
VALID2
FAULT2
U7B
ltc4421xuhe
SEC_USED
SEC_FAULT
29 SENSE2_P
30 SENSE2_N
R35 1R21
R36 920K
R37 5K49
R38 31K6
R39 39K7
C57 1u
C60 47n
A sense resistor of 1.5 mOhm sets the trip current to 25mV/1.5m = 16.7A
Title ASH Power - HS Switch
GPA Robotics
Size: A4
Number:5
Revision:1
Date: 2020-01-28
Time: 03:09:29
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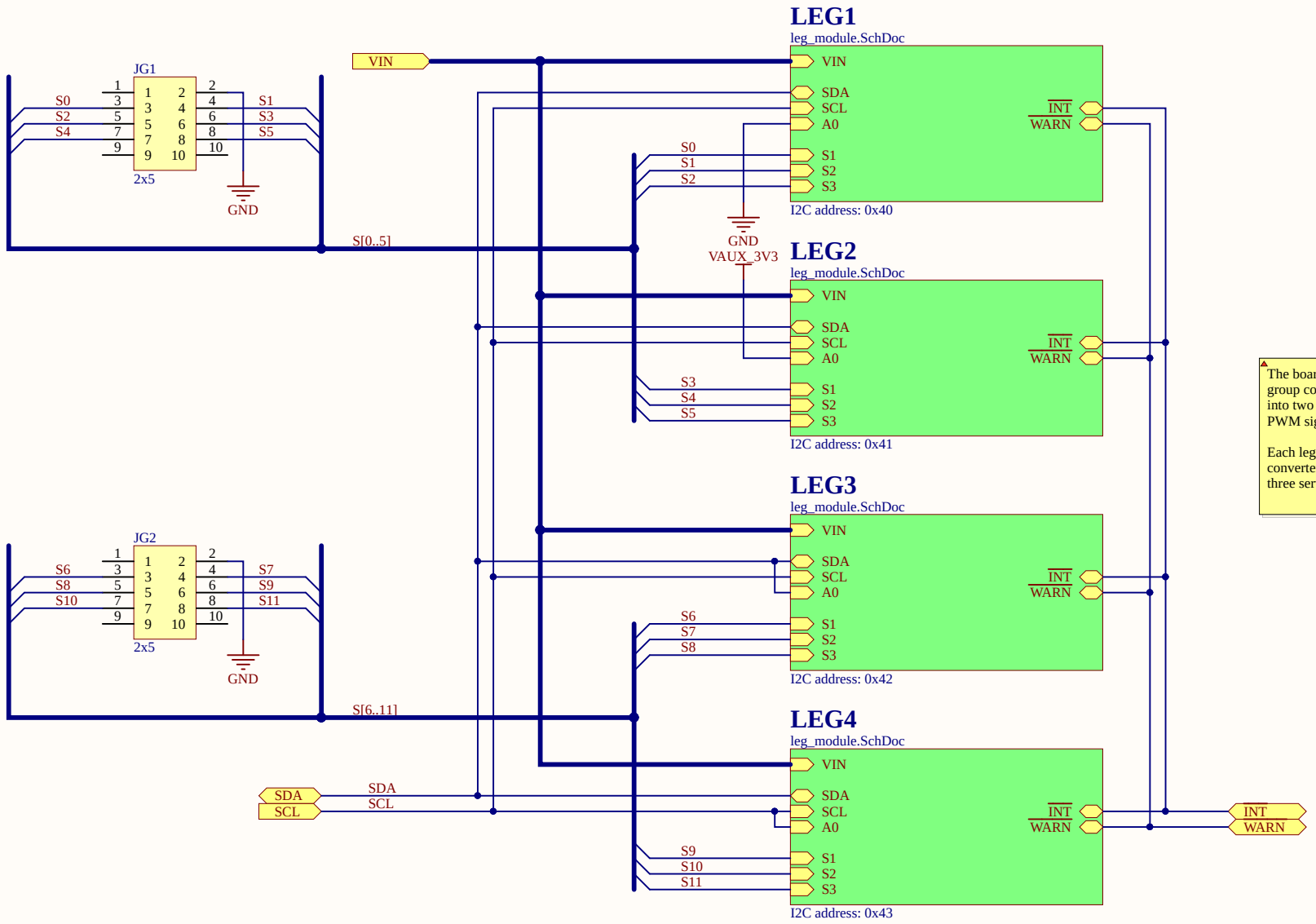
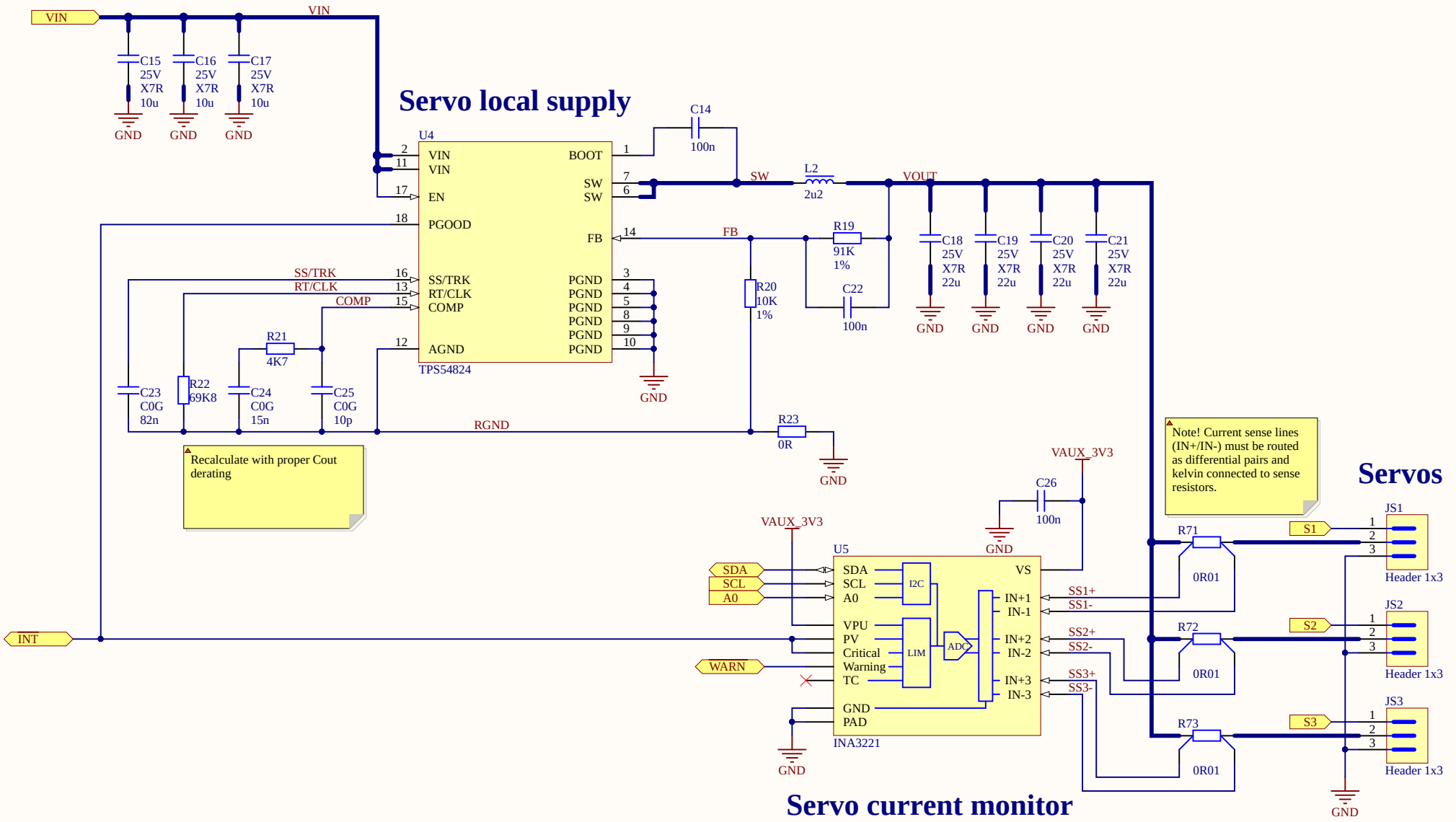
Repo: https://github.com/Atmelfan/pcb-ash-power.git



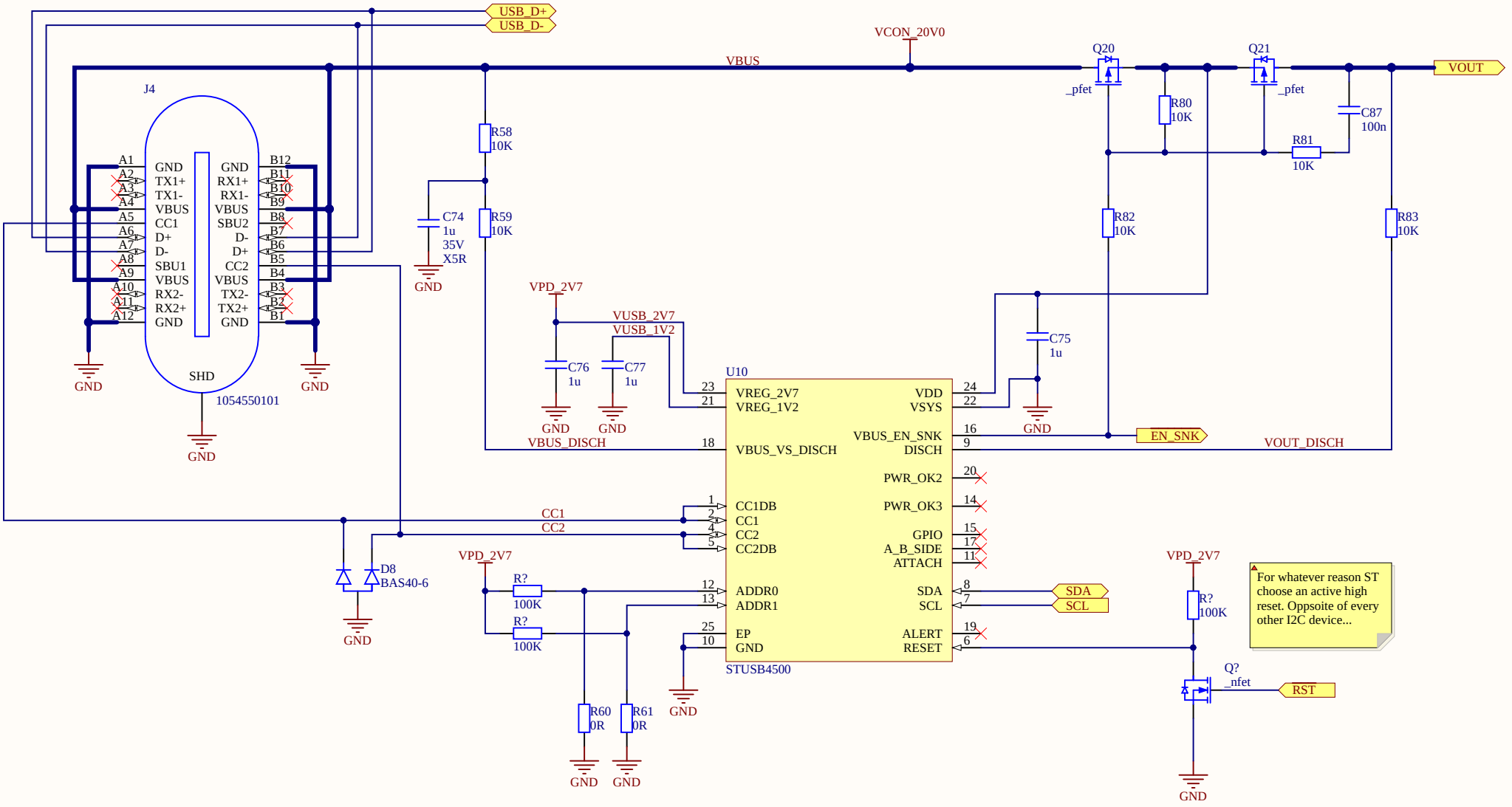
The board has two leg groups, right and left. Each group consists of four legs which is further divided into two pairs, front and back. Each pair has a input PWM signal connector (JG1 and JG2).

Each leg has its own independent step-down converter and power monitor (for each of the legs three servos).

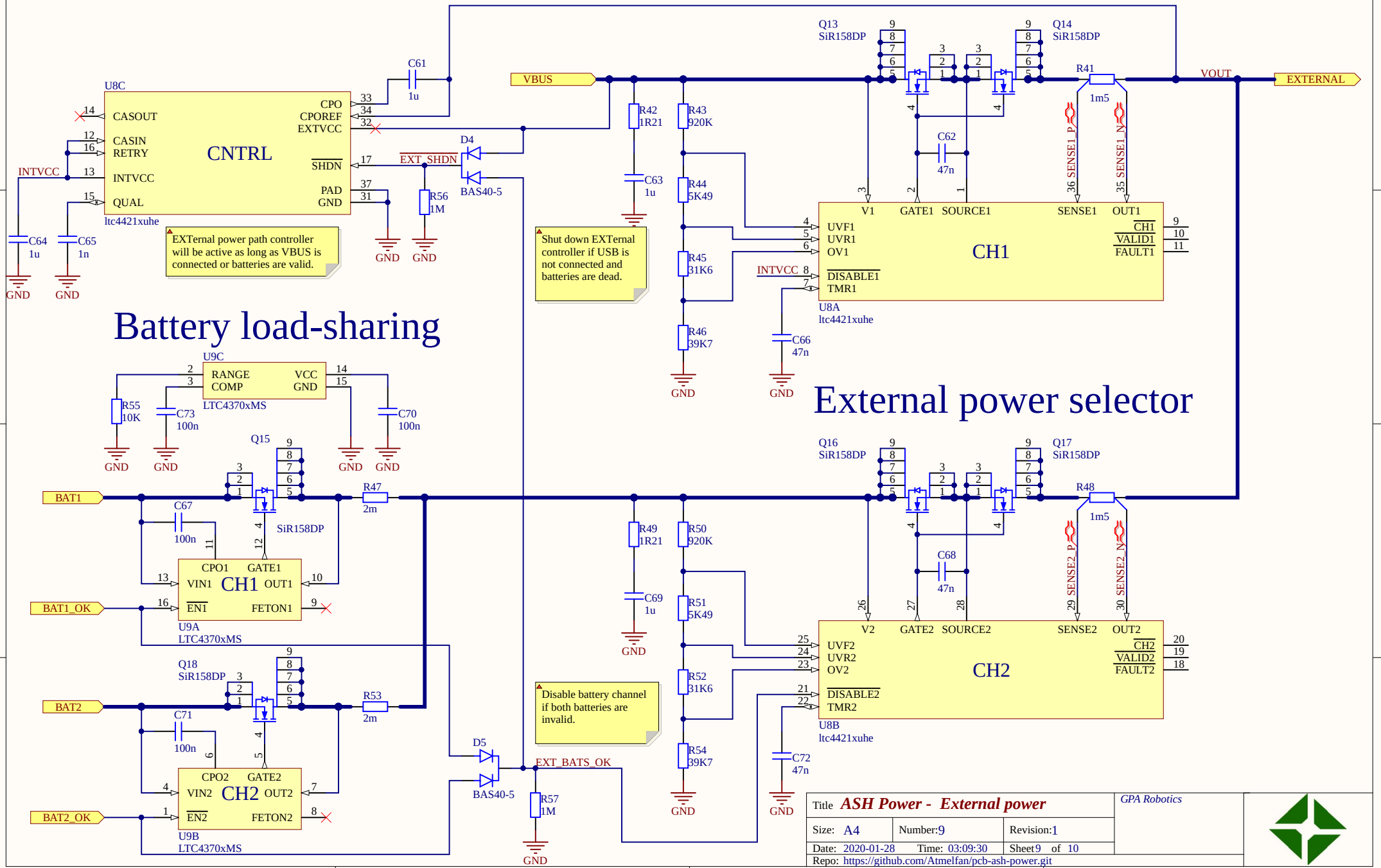
Title	***ASH Power - Leg group***		*GPA Robotics*
Size: A4	Number:6	Revision:1	
Date: 2020-01-28	Time: 03:09:30	Sheet 6 of 10	
Repo: https://github.com/Atmelfan/pcb-ash-power.git			



Title	***ASH Power - Leg module***		*GPA Robotics*
Size: A4	Number:7	Revision:1	
Date: 2020-01-28	Time: 03:09:30	Sheet 7 of 10	
Repo: https://github.com/Atmelfan/pcb-ash-power.git			



Title		
Size A4	Number	Revision
Date: 2020-01-28		Sheet of
File: C:\Users\..\usbpd_input.SchDoc		Drawn By:


Battery load-sharing
External power selector
U8C
CNTRL
ltc4421xuhe
CASOUT
CASIN
RETRY
INTVCC
QUAL
CPO
CPOREF
EXTVCC
SHDN
PAD
GND
EXTernal power path controller will be active as long as VBUS is connected or batteries are valid.
Shut down EXTernal controller if USB is not connected and batteries are dead.
Disable battery channel if both batteries are invalid.
VBUS
VOUT
EXTERNAL
EXT_SHDN
EXT_BATS_OK
BAT1
BAT2
BAT1_OK
BAT2_OK
Q13 SiR158DP
Q14 SiR158DP
Q15 SiR158DP
Q16 SiR158DP
Q17 SiR158DP
Q18 SiR158DP
U8A
ltc4421xuhe
CH1
V1
GATE1
SOURCE1
SENSE1
OUT1
UVF1
UVR1
OV1
DISABLE1
TMR1
CH1
VALID1
FAULT1
U8B
ltc4421xuhe
CH2
V2
GATE2
SOURCE2
SENSE2
OUT2
UVF2
UVR2
OV2
DISABLE2
TMR2
CH2
VALID2
FAULT2
U9A
LTC4370xMS
U9B
LTC4370xMS
U9C
LTC4370xMS
RANGE
COMP
VCC
GND
CPO1
GATE1
VIN1
CH1
OUT1
EN1
FETON1
CPO2
GATE2
VIN2
CH2
OUT2
EN2
FETON2
R41 1m5
R42 1R21
R43 920K
R44 5K49
R45 31K6
R46 39K7
R47 2m
R48 1m5
R49 1R21
R50 920K
R51 5K49
R52 31K6
R53 2m
R54 39K7
R55 10K
R56 1M
R57 1M
R70 100n
C61 1u
C62 47n
C63 1u
C64 1u
C65 1n
C66 47n
C67 100n
C68 47n
C69 1u
C71 100n
C72 47n
C73 100n
D4 BAS40-5
D5 BAS40-5
SENSE1_P
SENSE1_N
SENSE2_P
SENSE2_N
INTVCC
GND
Title ASH Power - External power
Size: A4
Number:9
Revision:1
Date: 2020-01-28
Time: 03:09:30
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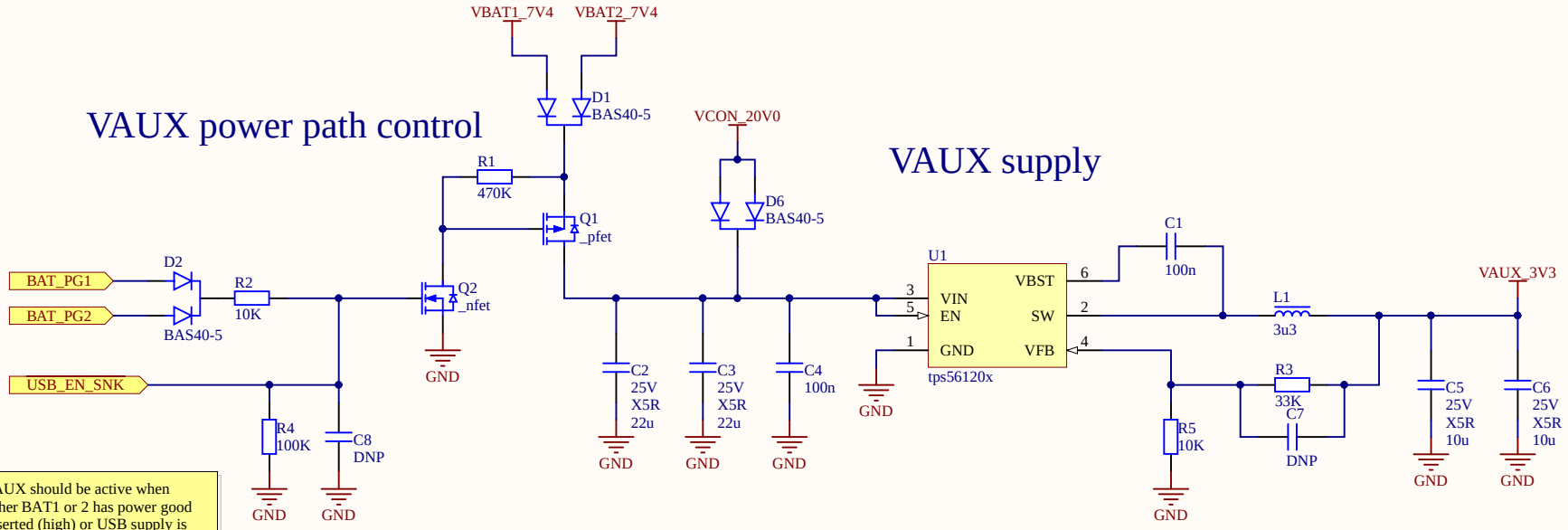
Repo: https://github.com/Atmelfan/pcb-ash-power.git
GPA Robotics

VAUX supplies the control circuitry of the power board.



VAUX should be active when either BAT1 or 2 has power good asserted (high) or USB supply is available.

If USB supply is available (5-20V) batteries should not be used for VAUX (even if VBATn > VBUS).

Title	***ASH Power - AUX supply***		*GPA Robotics*
Size: A4	Number:10	Revision:1	
Date: 2020-01-28	Time: 03:09:30	Sheet 10 of 10	
Repo: https://github.com/Atmelfan/pcb-ash-power.git			