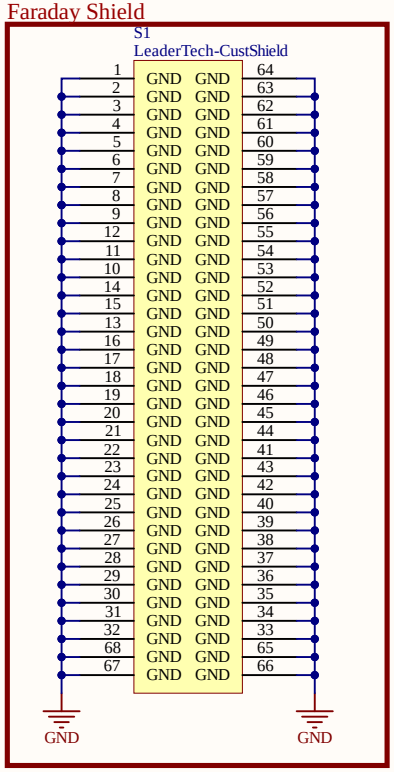
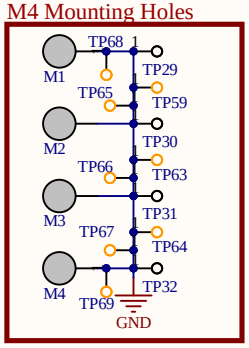
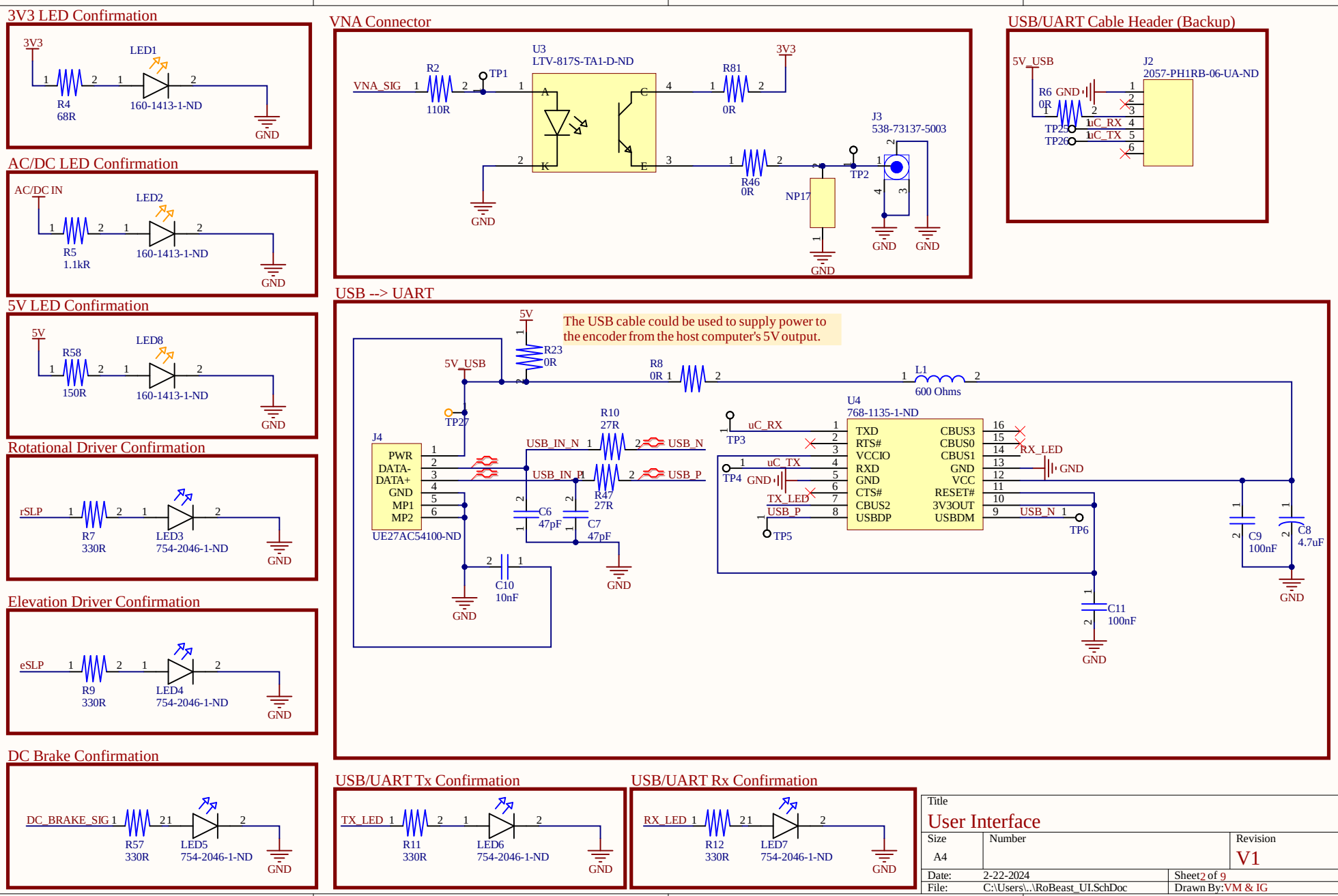
Faraday Shield



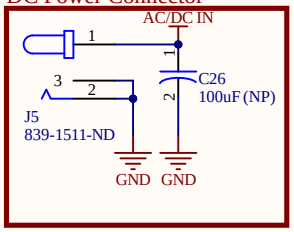
M4 Mounting Holes



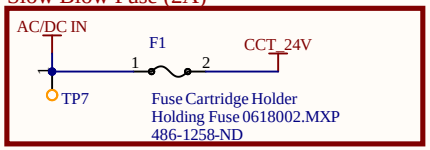
Title: Connectors & Shield		
Size: A4	Number:	Revision: V1
Date: 2-22-2024	Sheet 1 of 9	
File: C:\Users\..\RoBeast_Mounting_Shield.SchDoc	Drawn By: VM & IG	


3V3 LED Confirmation
3V3
LED1
R4
68R
160-1413-1-ND
GND
AC/DC LED Confirmation
AC/DC IN
LED2
R5
1.1kR
160-1413-1-ND
GND
5V LED Confirmation
5V
LED8
R58
150R
160-1413-1-ND
GND
Rotational Driver Confirmation
rSLP
R7
330R
LED3
754-2046-1-ND
GND
Elevation Driver Confirmation
eSLP
R9
330R
LED4
754-2046-1-ND
GND
DC Brake Confirmation
DC_BRAKE_SIG
R57
330R
LED5
754-2046-1-ND
GND
VNA Connector
VNA_SIG
R2
110R
TP1
U3
LTV-817S-TA1-D-ND
3V3
R81
0R
R46
0R
J3
538-73137-5003
TP2
NP17
GND
USB/UART Cable Header (Backup)
5V_USB
J2
2057-PH1RB-06-UA-ND
R6
0R
GND
TP25
TP26
uC_RX
uC_TX
USB --> UART
The USB cable could be used to supply power to the encoder from the host computer's 5V output.
5V
R23
0R
5V_USB
TP27
R8
0R
L1
600 Ohms
J4
PWR
DATA-
DATA+
GND
MP1
MP2
UE27AC54100-ND
USB_IN_N
USB_IN_P
R10
27R
R47
27R
USB_N
USB_P
C6
47pF
C7
47pF
C10
10nF
U4
768-1135-1-ND
TXD
RTS#
VCCIO
RXD
GND
CTS#
CBUS2
USBDP
CBUS3
CBUS0
CBUS1
GND
VCC
RESET#
3V3OUT
USBDM
RX_LED
TX_LED
TP3
TP4
TP5
TP6
C9
100nF
C8
4.7uF
C11
100nF
USB/UART Tx Confirmation
TX_LED
R11
330R
LED6
754-2046-1-ND
GND
USB/UART Rx Confirmation
RX_LED
R12
330R
LED7
754-2046-1-ND
GND
Title
User Interface
Size
A4
Number
Revision
V1
Date:
2-22-2024
Sheet 2 of 9
File:
C:\Users\..\RoBeast_UI.SchDoc
Drawn By: VM & IG

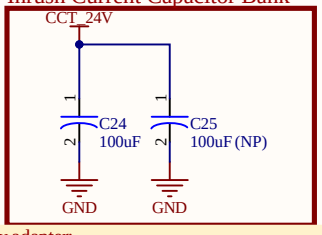
DC Power Connector



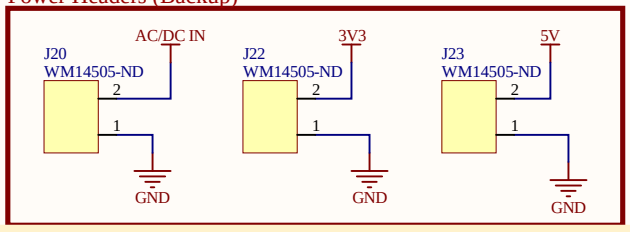
Slow Blow Fuse (2A)



Inrush Current Capacitor Bank

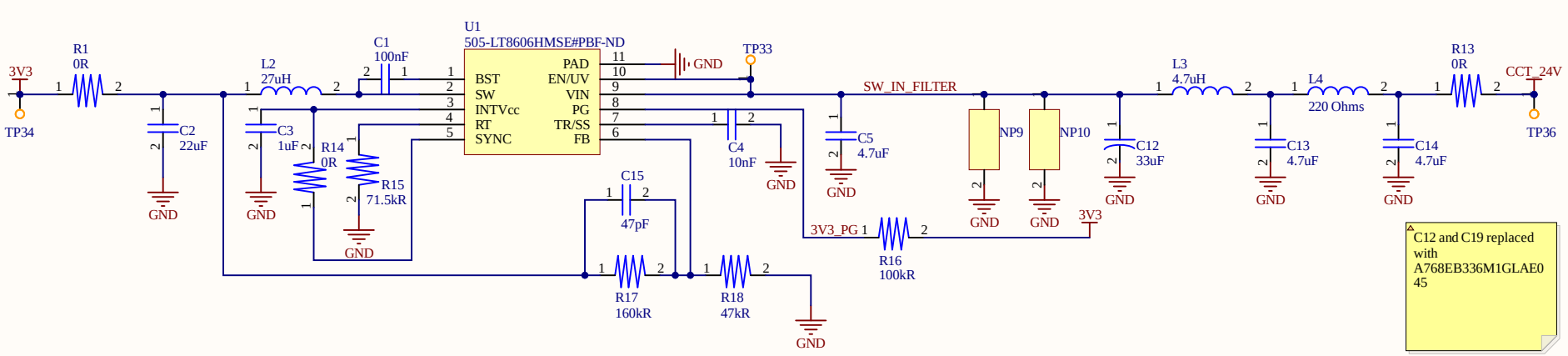


Power Headers (Backup)

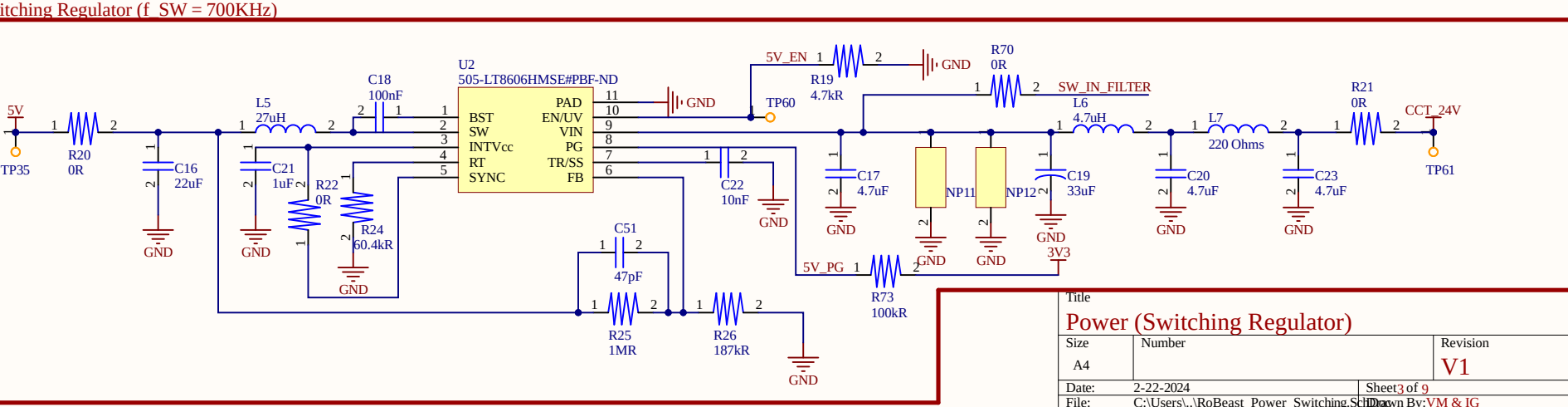


Compatible with following power supply adapter:
https://www.amazon.ca/UORLEN-24V-2-5A-Logitech-Silhouette/dp/B0B77CBSTW/ref=asc_df_B0B77CBSTW/?tag=googleshopc0c-20&linkCode=df0&hvadid=578938610390&hvpos=&hvnetw=g&hvrand=15266282696536227734&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1002057&hvtargid=pla-1929838423599&psc=1&mcid=fe1e2a77a4a83ddca3018a9fba854ebd

3V3 Switching Regulator (f_SW = 600KHz)

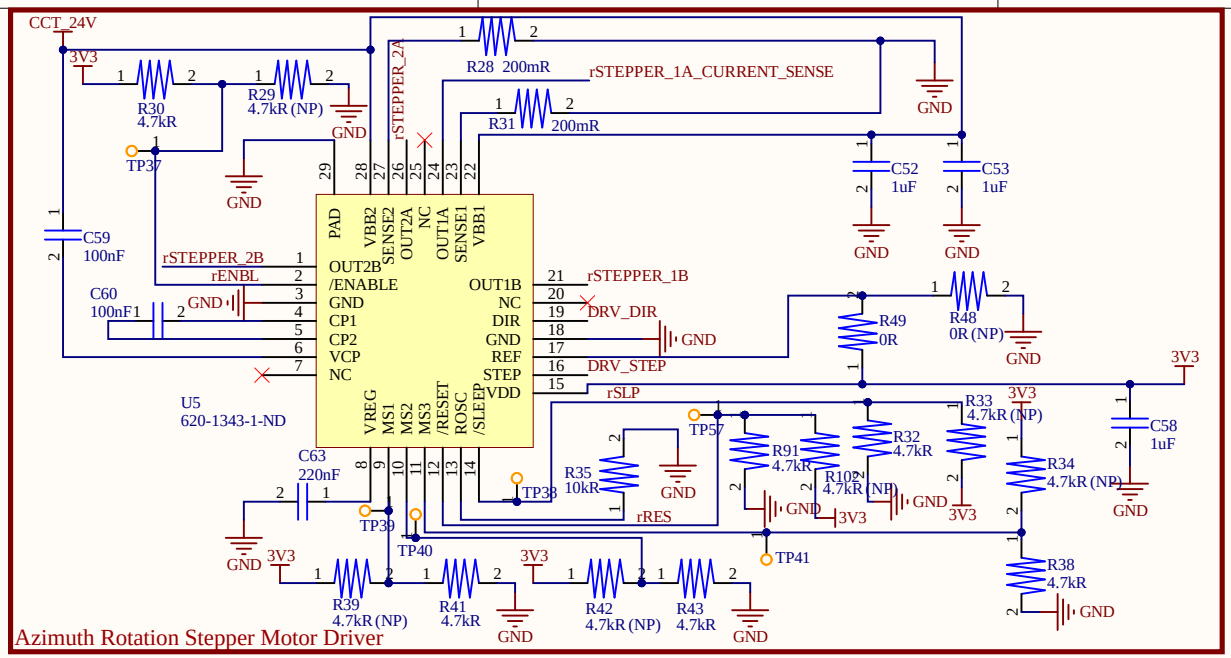


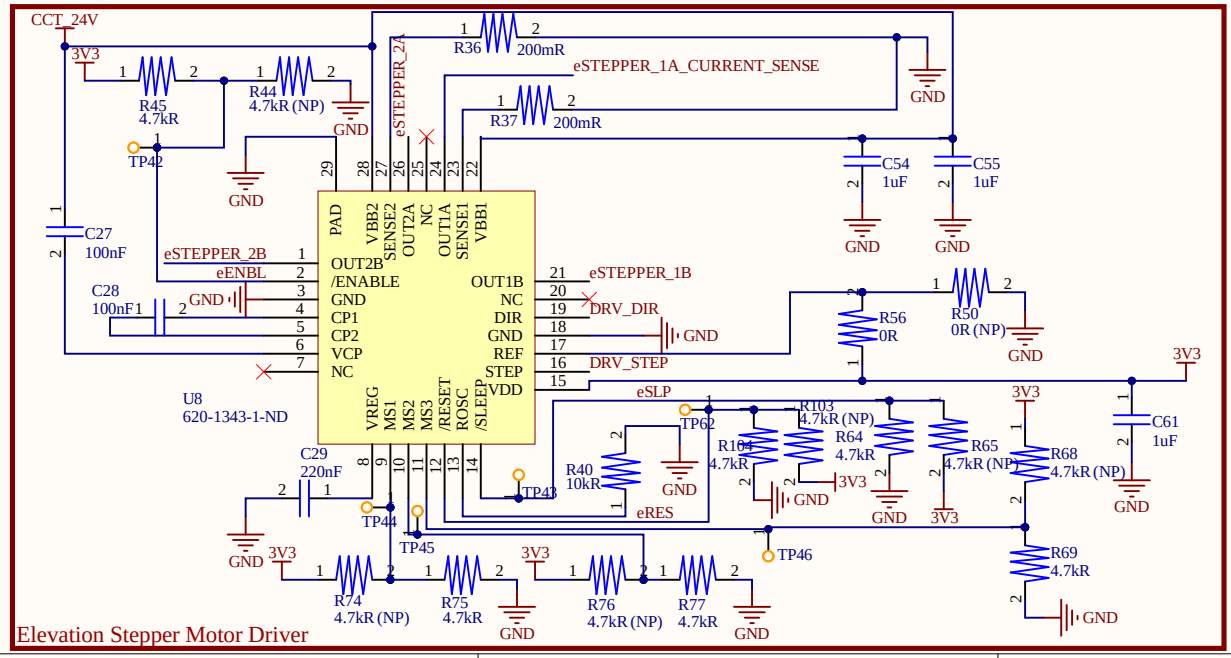
5V Switching Regulator (f_SW = 700KHz)

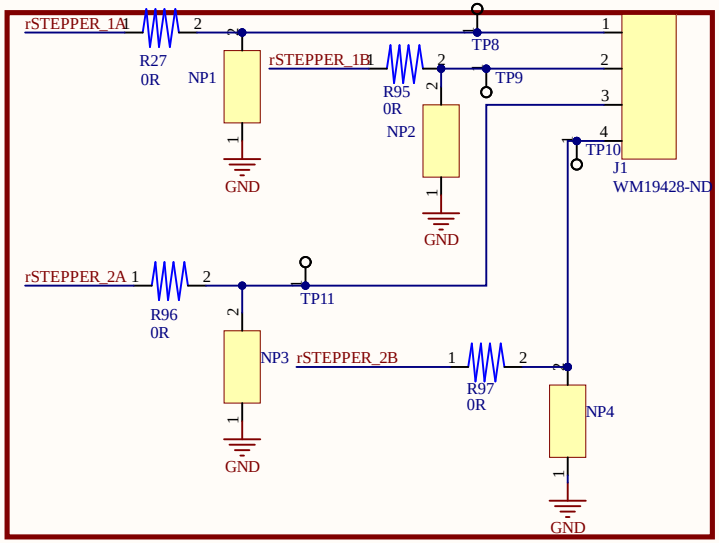


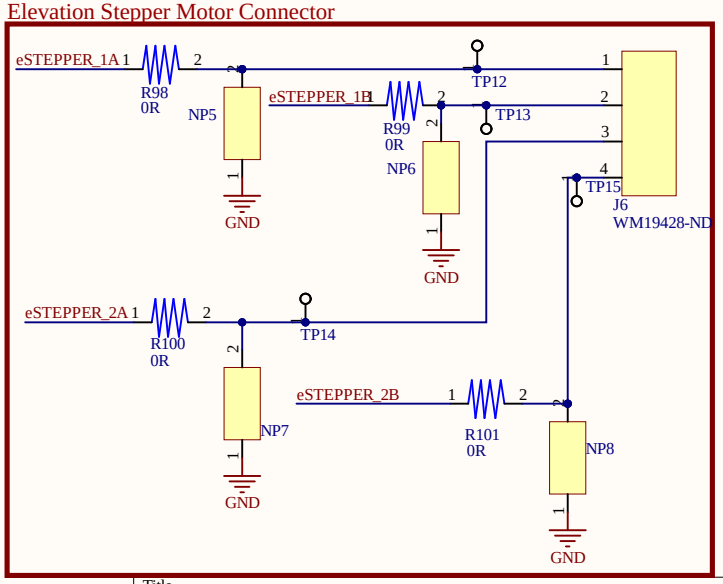
Title
Power (Switching Regulator)

Size	Number	Revision
A4		V1
Date: 2-22-2024		Sheet 3 of 9
File: C:\Users\..\RoBeast_Power_Switching.SchDoc		Drawn By: VM & IG







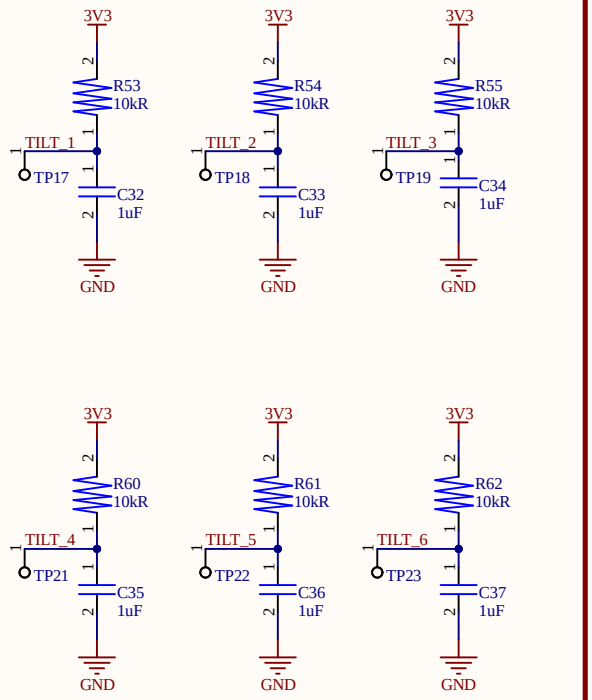


Title

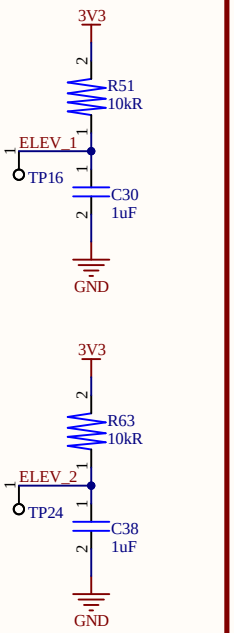
Stepper Motor Drivers

Size	Number	Revision
A4		V1
Date: 2-22-2024		Sheet4 of 9
File: C:\Users\..\RoBeast_Driver.SchDoc		Drawn By:VM & IG

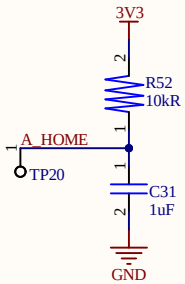
Tilt Debouncing (x6)



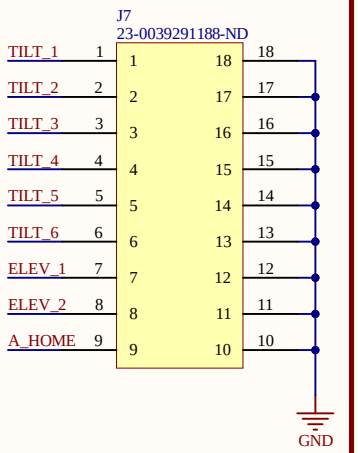
Elevation Debouncing (x2)



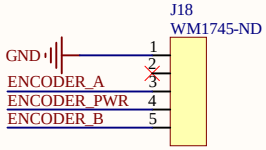
Azimuth Debouncing



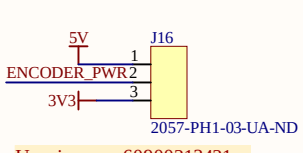
Limit Switch Header



Encoder



Encoder Power Control



Uses jumper: 60900213421

Limit switches - SAJ25YXWHL147SDTSEQ: https://www.digikey.ca/en/products/detail/te-connectivity-alcoswitch-switches/SAJ25YXWHL147SDTSEQ/11312233

The common (COM) and normally open (NO) pins will be used for all limit switches

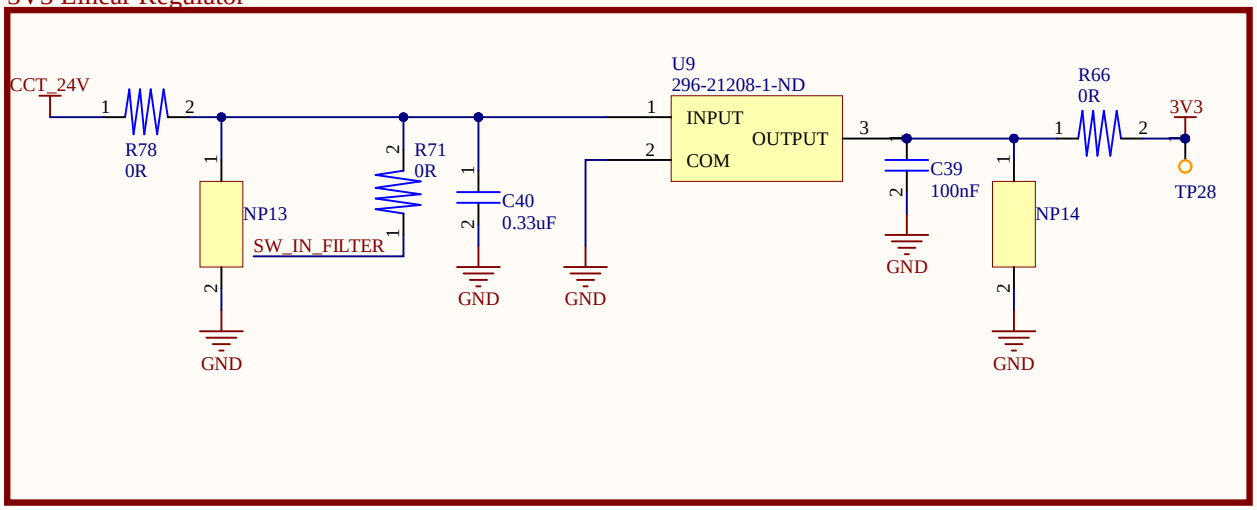
Molex Connector - 39291188: https://www.digikey.ca/en/products/detail/molex/0039291188/356046

Receptacle Housing Connection - 5016461800: https://www.digikey.ca/en/products/detail/molex/5016461800/1787763

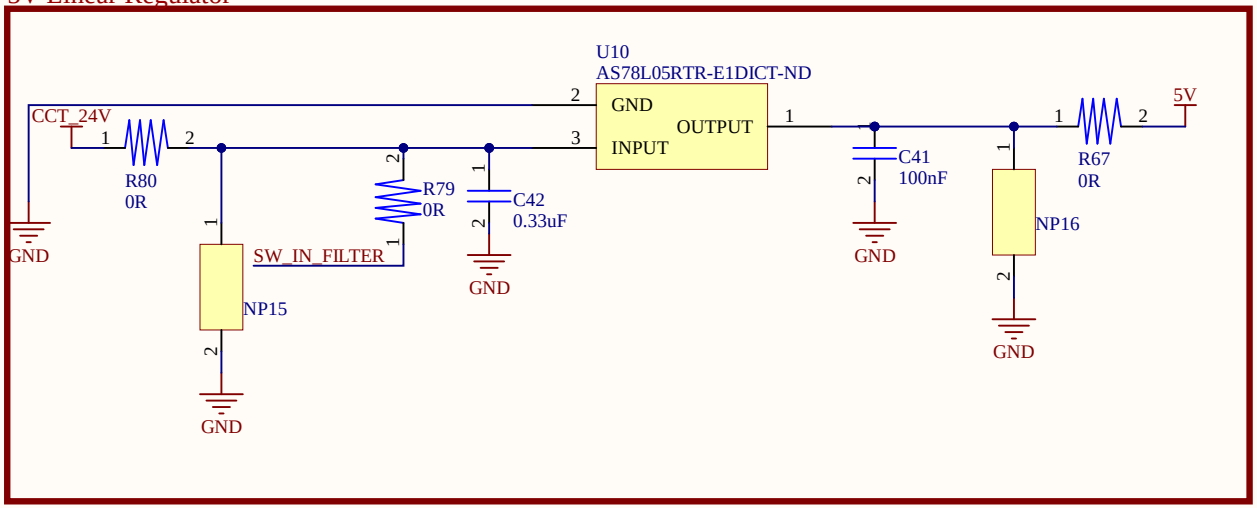
AWG 16 Crimp: 0039000077 - https://www.digikey.ca/en/products/detail/molex/0039000077/1643440

Title: Positional Feedback		
Size: A4	Number:	Revision: V1
Date: 2-22-2024		Sheet 5 of 9
File: C:\Users\..\RoBeast_Positional_Feedback.SchDoc		Drawn By: VM & IG

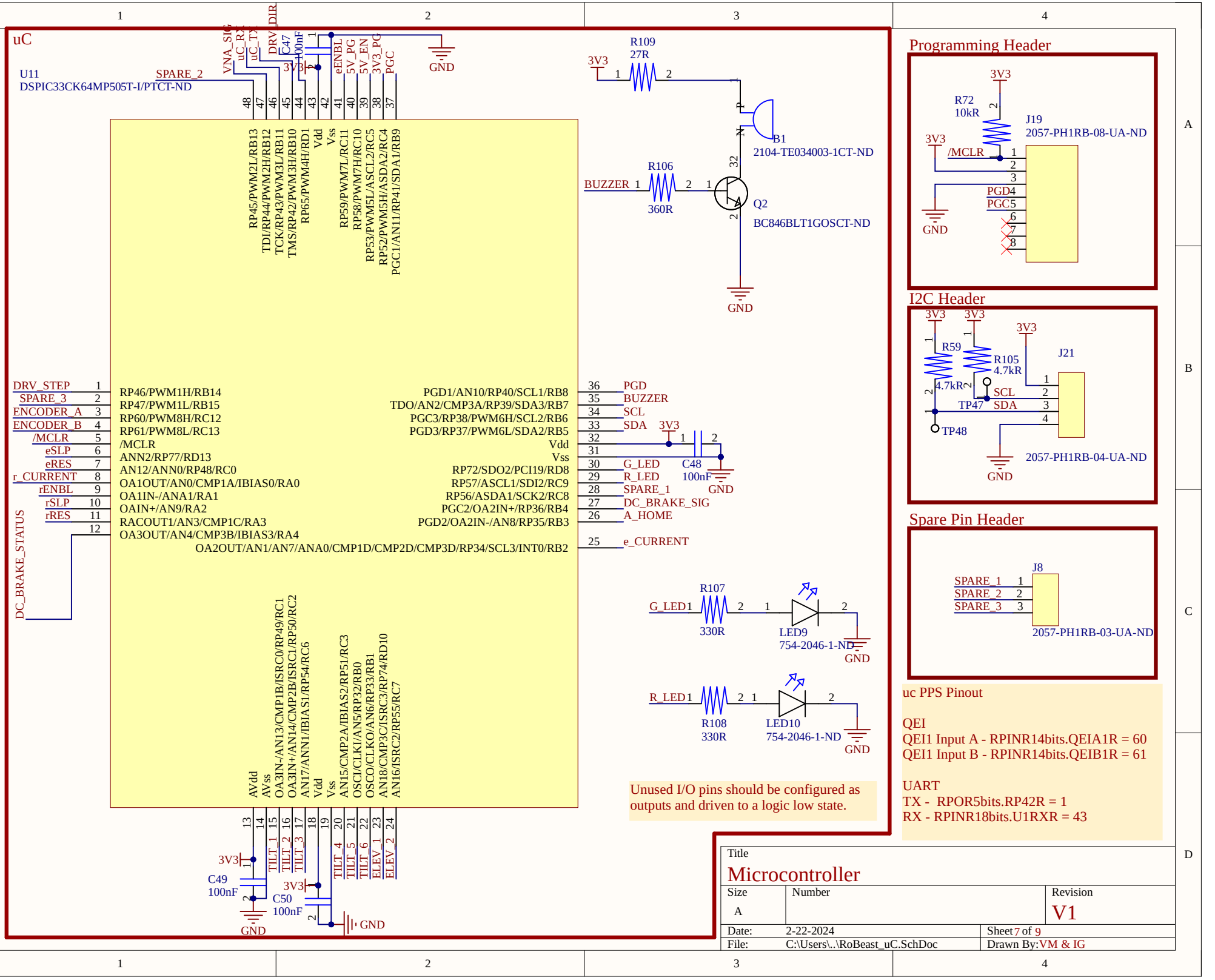
3V3 Linear Regulator



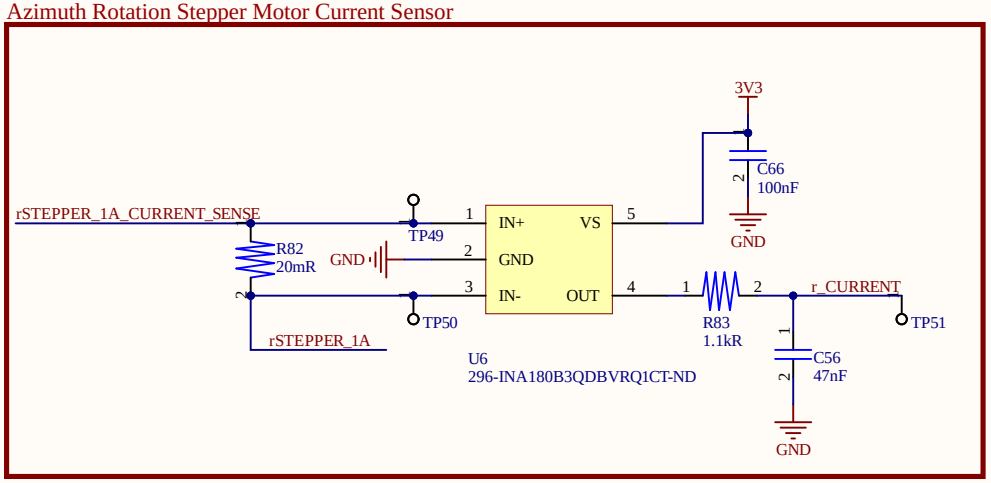
5V Linear Regulator



Title: Power (Linear Regulator)		
Size: A	Number:	Revision: V1
Date: 2-22-2024	Sheet 6 of 9	
File: C:\Users\..\RoBeast_Power_Linear.SchDoc	Drawn By: VM & IG	


uC
U11
DSPIC33CK64MP505T-I/PTCT-ND
SPARE_2
VNA_SIG
uC_RX
uC_TX
DRV_DIR
C47
100nF
3V3
eENBL
5V_PG
5V_EN
3V3_PG
PGC
GND
RP45/PWM2L/RB13
TDI/RP44/PWM2H/RB12
TCK/RP43/PWM3L/RB11
TMS/RP42/PWM3H/RB10
RP65/PWM4H/RD1
Vdd
Vss
RP59/PWM7L/RC11
RP58/PWM7H/RC10
RP53/PWM5L/ASCL2/RC5
RP52/PWM5H/ASDA2/RC4
PGC1/AN11/RP41/SDA1/RB9
DRV_STEP 1
SPARE_3 2
ENCODER_A 3
ENCODER_B 4
/MCLR 5
eSLP 6
eRES 7
r_CURRENT 8
rENBL 9
rSLP 10
rRES 11
12
DC_BRAKE_STATUS
RP46/PWM1H/RB14
RP47/PWM1L/RB15
RP60/PWM8H/RC12
RP61/PWM8L/RC13
/MCLR
ANN2/RP77/RD13
AN12/ANN0/RP48/RC0
OA1OUT/AN0/CMP1A/IBIAS0/RA0
OA1IN-/ANA1/RA1
OAIN+/AN9/RA2
RACOUT1/AN3/CMP1C/RA3
OA3OUT/AN4/CMP3B/IBIAS3/RA4
OA2OUT/AN1/AN7/ANA0/CMP1D/CMP2D/CMP3D/RP34/SCL3/INT0/RB2
PGD1/AN10/RP40/SCL1/RB8
TDO/AN2/CMP3A/RP39/SDA3/RB7
PGC3/RP38/PWM6H/SCL2/RB6
PGD3/RP37/PWM6L/SDA2/RB5
Vdd
Vss
RP72/SDO2/PCI19/RD8
RP57/ASCL1/SDI2/RC9
RP56/ASDA1/SCK2/RC8
PGC2/OA2IN+/RP36/RB4
PGD2/OA2IN-/AN8/RP35/RB3
36 PGD
35 BUZZER
34 SCL
33 SDA
32
31
30 G_LED
29 R_LED
28 SPARE_1
27 DC_BRAKE_SIG
26 A_HOME
25 e_CURRENT
AVdd
AVss
OA3IN-/AN13/CMP1B/ISRC0/RP49/RC1
OA3IN+/AN14/CMP2B/ISRC1/RP50/RC2
AN17/ANN1/IBIAS1/RP54/RC6
Vdd
Vss
AN15/CMP2A/IBIAS2/RP51/RC3
OSCI/CLKI/AN5/RP32/RB0
OSCO/CLKO/AN6/RP33/RB1
AN18/CMP3C/ISRC3/RP74/RD10
AN16/ISRC2/RP55/RC7
13 14 15 16 17 18 19 20 21 22 23 24
TILT_1
TILT_2
TILT_3
TILT_4
TILT_5
TILT_6
ELEV_1
ELEV_2
3V3
C49
100nF
C50
100nF
GND
R109
27R
B1
2104-TE034003-1CT-ND
R106
360R
BUZZER
Q2
BC846BLT1GOSCT-ND
C48
100nF
R107
330R
G_LED1
LED9
754-2046-1-ND
R108
330R
R_LED1
LED10
754-2046-1-ND
Unused I/O pins should be configured as outputs and driven to a logic low state.
Programming Header
R72
10kR
J19
2057-PH1RB-08-UA-ND
/MCLR
PGD
PGC
I2C Header
R59
4.7kR
R105
4.7kR
J21
SCL
SDA
TP47
TP48
2057-PH1RB-04-UA-ND
Spare Pin Header
J8
SPARE_1
SPARE_2
SPARE_3
2057-PH1RB-03-UA-ND
uc PPS Pinout
QEI
QEI1 Input A - RPINR14bits.QEIA1R = 60
QEI1 Input B - RPINR14bits.QEIB1R = 61
UART
TX - RPOR5bits.RP42R = 1
RX - RPINR18bits.U1RXR = 43
Title
Microcontroller
Size
A
Number
Revision
V1
Date: 2-22-2024
Sheet 7 of 9
File: C:\Users\..\RoBeast_uC.SchDoc
Drawn By: VM & IG

Azimuth Rotation Stepper Motor Current Sensor



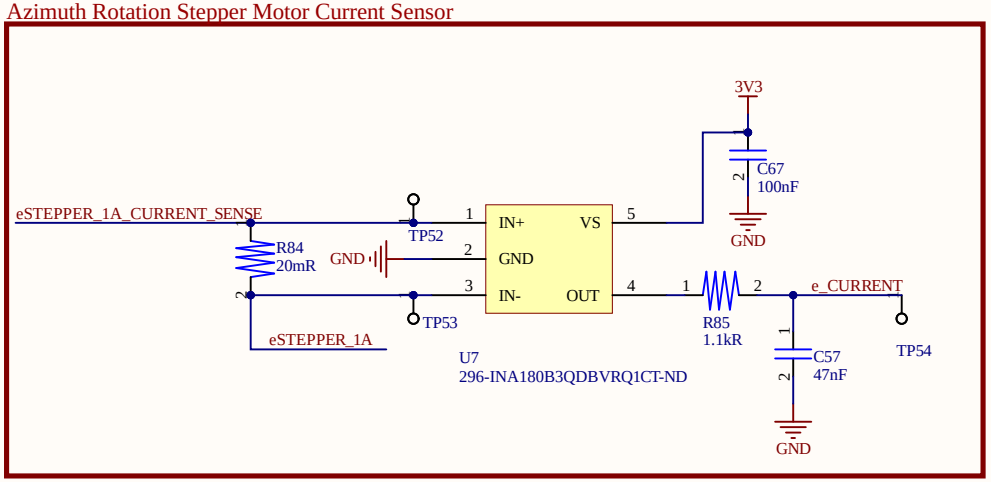
OUT:
V_sense*Gain = V_sense*20V/V

V_sense = I_1A * R_sense
V_sense = I_1A * 0.1

Error in measurement: 1.05%

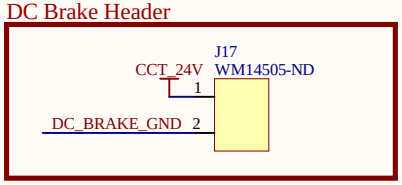
Maximum sampling rate due to anti aliasing filter at the output: 3kHz

Azimuth Rotation Stepper Motor Current Sensor

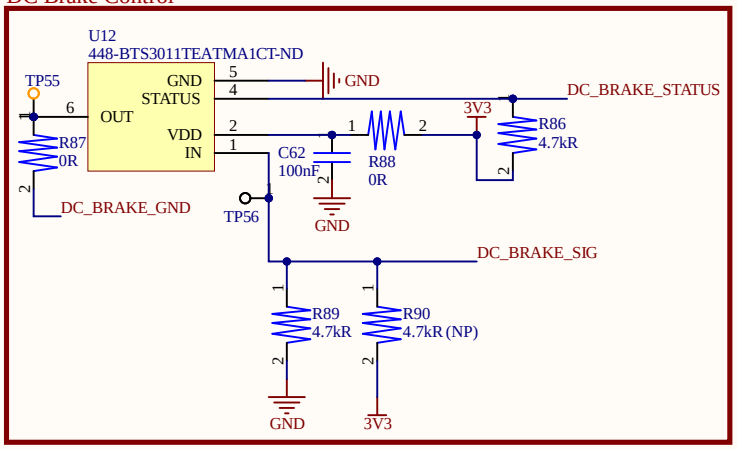


Title: Current Sense		
Size: A4	Number:	Revision: V1
Date: 2-22-2024	Sheet 8 of 9	
File: C:\Users\..\RoBeast_Current_Sense.SchDoc	Drawn By: VM & IG	

DC Brake Header

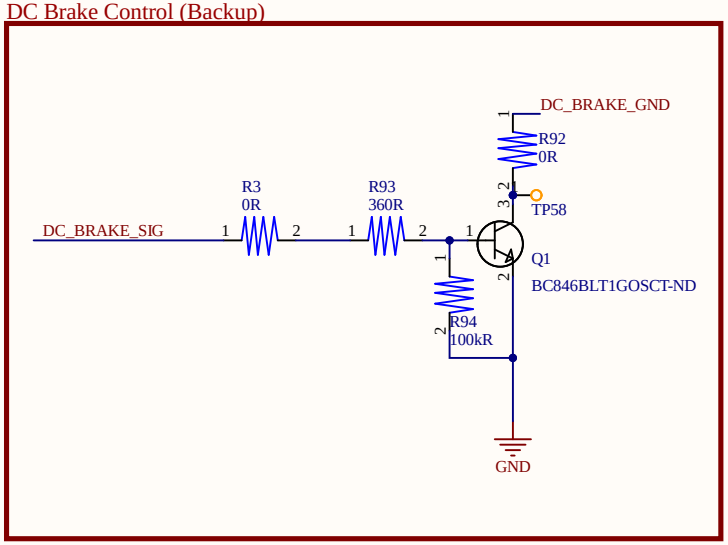


DC Brake Control



Regarding Power Rail Switch:
In case of a thermal shutdown (fault), an internal MOSFET connected to the STATUS pin, pulls its voltage down
to GND, providing a “low” level signal to the microcontroller. To reset the latch fault signal of the BTS3011TE, the STATUS pin has to be pulled up to 5 V (recommended VDD).
Resetting the fault signal will not reset the current limitation trigger signal. To do so, the INPUT pin has to be
set in logic “low” at the same time the STATUS pin is set “high”.

DC Brake Control (Backup)



As the inductance of the chosen DC brake is unknwon, a backup high side control has been implemented in the even that the power rail switch is not able to withstand the flyback voltage/current from the inductive DC brake.

DC Electromagnetic Brake:
https://www.omc-stepperonline.com/dc-electromagnetic-brake-24v-0-25nm-35-4oz-in-for-nema-17-stepper-motor-swb-01

After elevation changes, the elevation stepper motor will have to be disabled by disabling its stepper motor driver, and then the DC brake must be enabled.

The DC brake also serves the purpose of preventing the elevating rails from falling down in the event of an emergency stop that may occur during the elevation change/sweep.

Molex Connector - 768250002:
https://www.digikey.ca/en/products/detail/molex/0768250002/5639611

Receptacle Housing Connection - 1700010102:
https://www.digikey.ca/en/products/detail/molex/1700010102/4515221

AWG 12 Crimp: 768230322 -
https://www.molex.com/en-us/products/part-detail/768230322

Title: DC Brake		
Size: A4	Number:	Revision: V1
Date: 2-22-2024		Sheet 9 of 9
File: C:\Users\..\RoBeast_DC_Brake.SchDoc		Drawn By: VM & IG