Revision History:

Date:	Revision:	Comments:
02-MAR-2023	A	Initial Revision A

Additional Notes:

Team Members:
Abishek Kannan
Ben Nowotny
Paul Pak
Sushanth Rao

Important Notes about this Schematic:

Notes in these schematics are shown in this Note object format.

Revision History and Table of Contents

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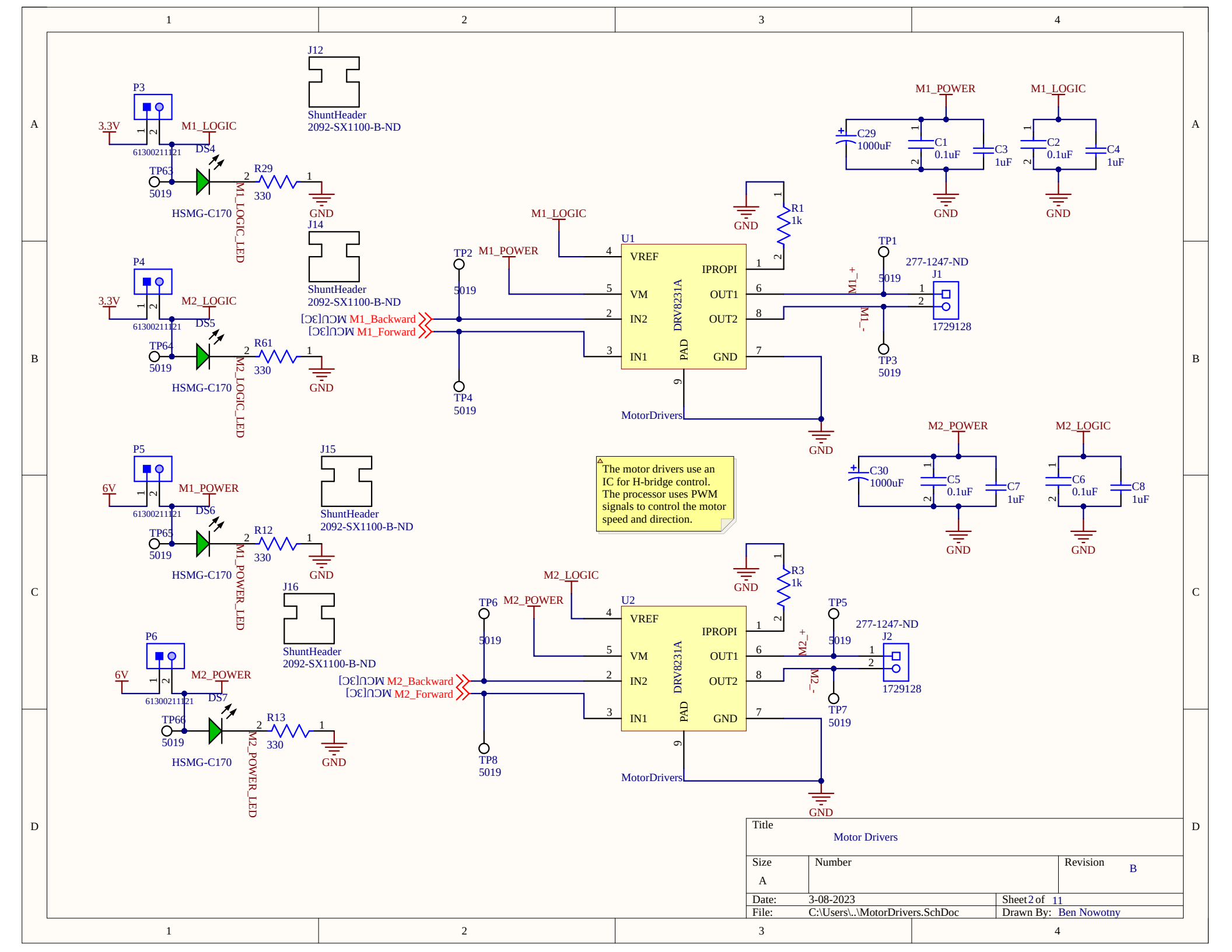
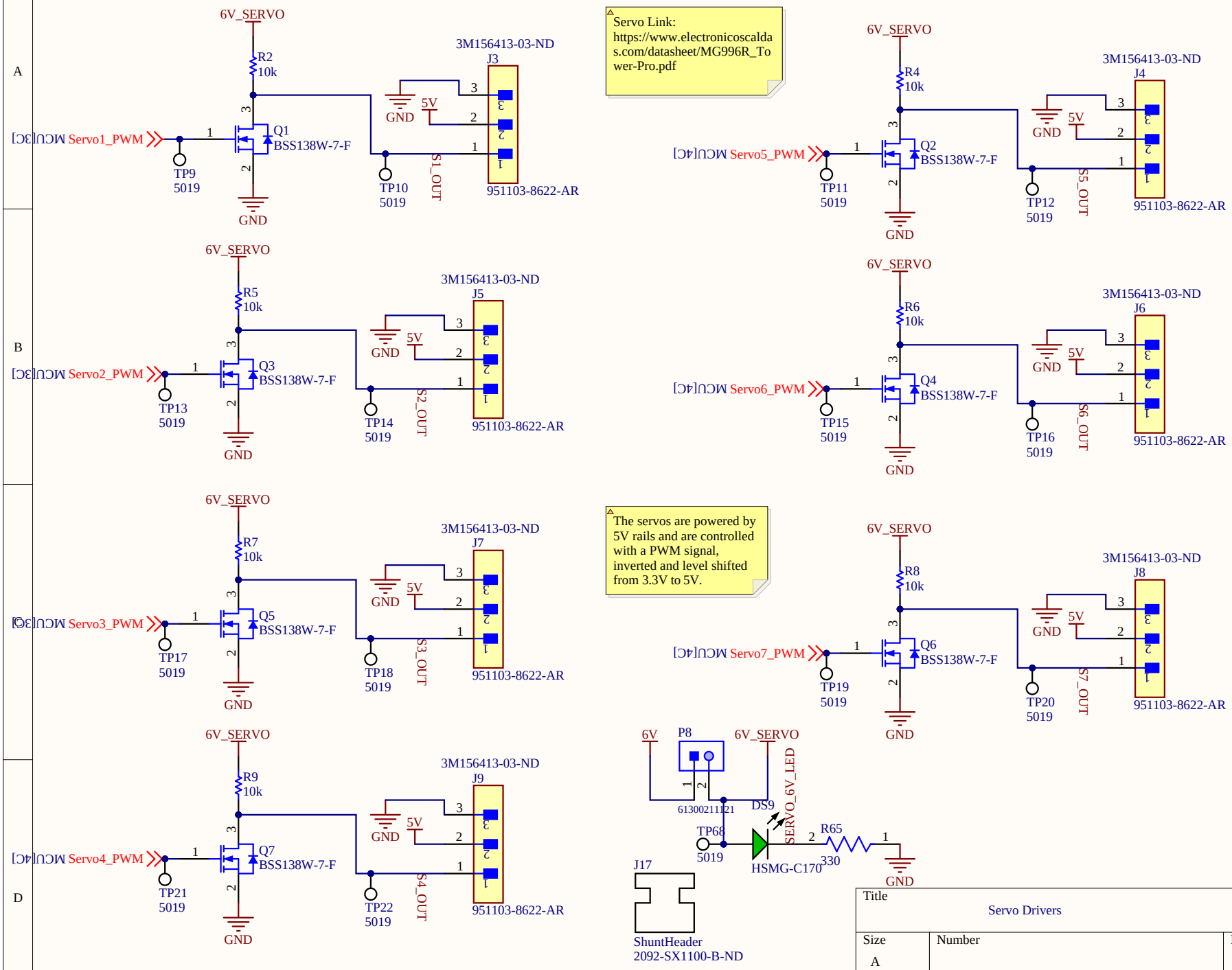
REVISION HISTORY
REV A: Initial Release
REV B: Updating based on instructor feedback

Title: Table of Contents		
Size: A	Number:	Revision: B
Date: 3-08-2023	Sheet 1 of 11	
File: C:\Users\..\00-Revision_History_and_Contents.SchDoc	Drawn By: DumptruckUltra	


P3
3.3V
M1_LOGIC
61300211121
DS4
TP63
5019
HSMG-C170
R29
330
M1_LOGIC_LED
GND
J12
ShuntHeader
2092-SX1100-B-ND
P4
3.3V
M2_LOGIC
61300211121
DS5
TP64
5019
HSMG-C170
R61
330
M2_LOGIC_LED
GND
J14
ShuntHeader
2092-SX1100-B-ND
P5
6V
M1_POWER
61300211121
DS6
TP65
5019
HSMG-C170
R12
330
M1_POWER_LED
GND
J15
ShuntHeader
2092-SX1100-B-ND
P6
6V
M2_POWER
61300211121
DS7
TP66
5019
HSMG-C170
R13
330
M2_POWER_LED
GND
J16
ShuntHeader
2092-SX1100-B-ND
M1_POWER
C29
1000uF
C1
0.1uF
C3
1uF
GND
M1_LOGIC
C2
0.1uF
C4
1uF
GND
M1_LOGIC
R1
1k
GND
TP2
5019
M1_POWER
U1
VREF
IPROPI
VM
OUT1
IN2
OUT2
IN1
PAD
GND
DRV8231A
4
5
2
3
1
6
8
7
9
M1_Backward
M1_Forward
TP4
5019
MotorDrivers
GND
TP1
5019
277-1247-ND
J1
1729128
M1_+
M1_-
TP3
5019
M2_POWER
C30
1000uF
C5
0.1uF
C7
1uF
GND
M2_LOGIC
C6
0.1uF
C8
1uF
GND
The motor drivers use an IC for H-bridge control. The processor uses PWM signals to control the motor speed and direction.
M2_LOGIC
R3
1k
GND
TP6
5019
M2_POWER
U2
VREF
IPROPI
VM
OUT1
IN2
OUT2
IN1
PAD
GND
DRV8231A
4
5
2
3
1
6
8
7
9
M2_Backward
M2_Forward
TP8
5019
MotorDrivers
GND
TP5
5019
277-1247-ND
J2
1729128
M2_+
M2_-
TP7
5019
Title
Motor Drivers
Size
A
Number
Revision
B
Date:
3-08-2023
Sheet 2 of 11
File:
C:\Users\..\MotorDrivers.SchDoc
Drawn By:
Ben Nowotny


6V_SERVO
R2
10k
Q1
BSS138W-7-F
Servo1_PWM
MCU[3C]
TP9
5019
GND
TP10
5019
S1_OUT
3M156413-03-ND
J3
951103-8622-AR
5V
Servo Link:
https://www.electronicoscaldas.com/datasheet/MG996R_Tower-Pro.pdf
R4
10k
Q2
BSS138W-7-F
Servo5_PWM
MCU[4C]
TP11
5019
TP12
5019
S5_OUT
J4
R5
10k
Q3
BSS138W-7-F
Servo2_PWM
TP13
5019
TP14
5019
S2_OUT
J5
R6
10k
Q4
BSS138W-7-F
Servo6_PWM
TP15
5019
TP16
5019
S6_OUT
J6
The servos are powered by 5V rails and are controlled with a PWM signal, inverted and level shifted from 3.3V to 5V.
R7
10k
Q5
BSS138W-7-F
Servo3_PWM
TP17
5019
TP18
5019
S3_OUT
J7
R8
10k
Q6
BSS138W-7-F
Servo7_PWM
TP19
5019
TP20
5019
S7_OUT
J8
R9
10k
Q7
BSS138W-7-F
Servo4_PWM
TP21
5019
TP22
5019
S4_OUT
J9
6V
P8
61300211121
DS9
SERVO_6V_LED
TP68
5019
HSMG-C170
R65
330
J17
ShuntHeader
2092-SX1100-B-ND
Title
Servo Drivers
Size
A
Number
Revision
B
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Sheet 3of 11
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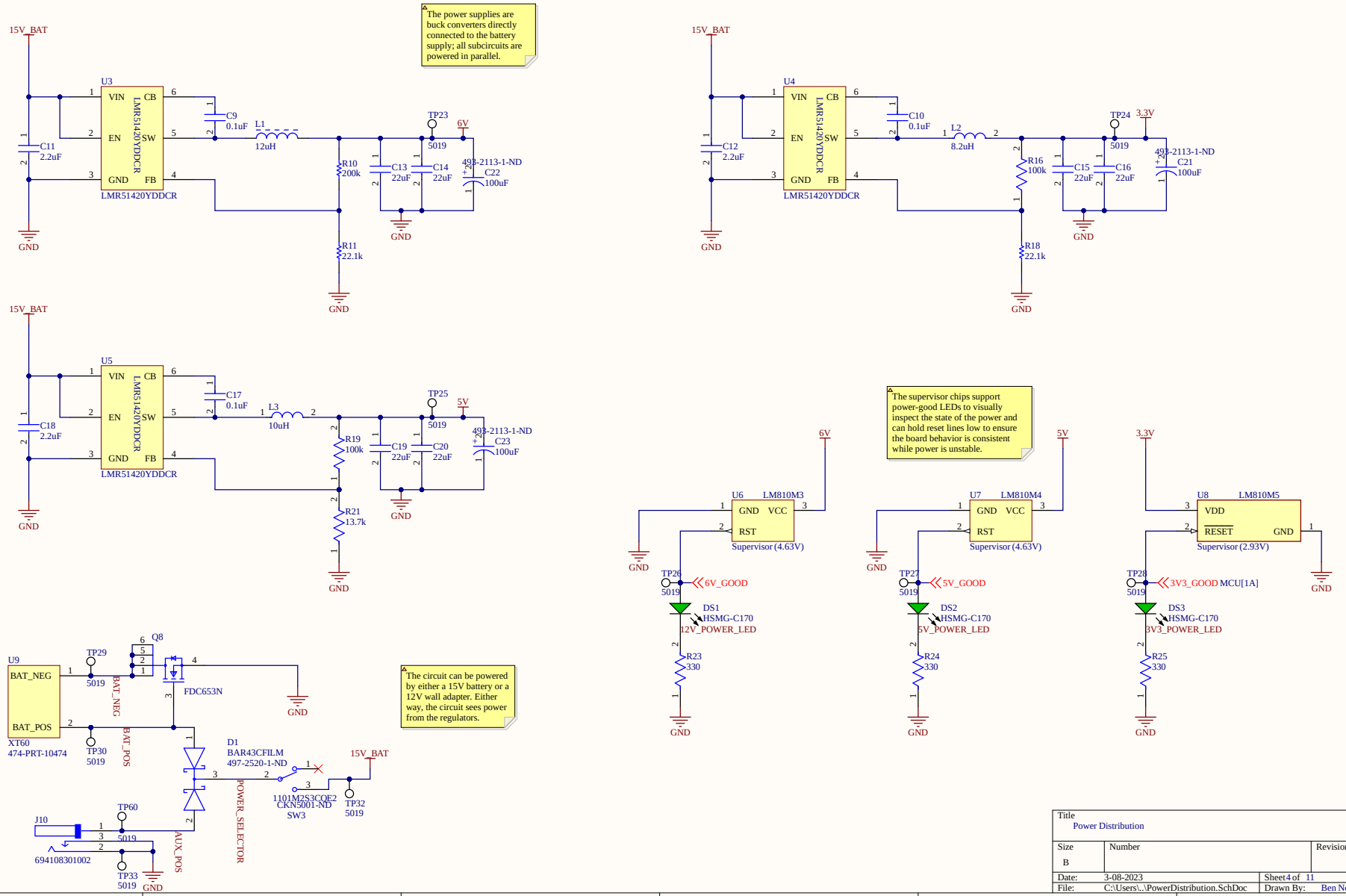
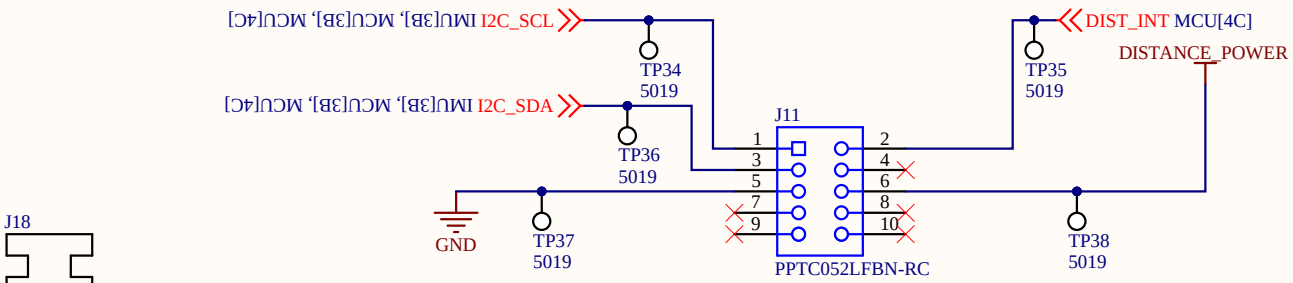
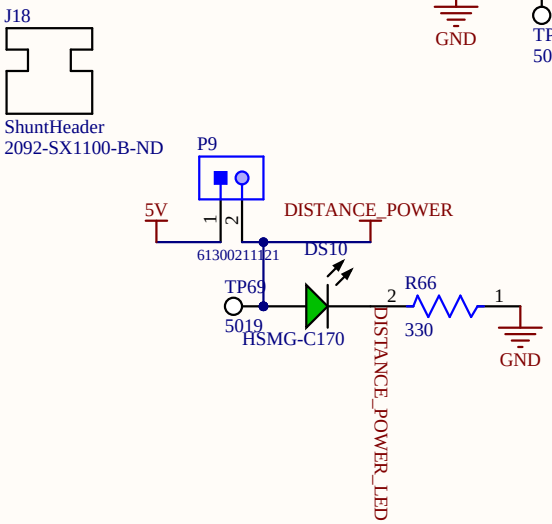
C:\Users\..\ServoDrivers.SchDoc
Drawn By:
Ben Nowotny


The power supplies are buck converters directly connected to the battery supply; all subcircuits are powered in parallel.
15V_BAT
U3
LMR51420YDDCR
C11 2.2uF
C9 0.1uF
L1 12uH
R10 200k
R11 22.1k
C13 22uF
C14 22uF
C22 100uF
493-2113-1-ND
TP23 5019
6V
GND
U4
C12 2.2uF
C10 0.1uF
L2 8.2uH
R16 100k
R18 22.1k
C15 22uF
C16 22uF
C21 100uF
TP24 5019
3.3V
U5
C18 2.2uF
C17 0.1uF
L3 10uH
R19 100k
R21 13.7k
C19 22uF
C20 22uF
C23 100uF
TP25 5019
5V
The supervisor chips support power-good LEDs to visually inspect the state of the power and can hold reset lines low to ensure the board behavior is consistent while power is unstable.
U6 LM810M3
GND VCC RST
Supervisor (4.63V)
TP26 5019
6V_GOOD
DS1 HSMG-C170
12V_POWER_LED
R23 330
U7 LM810M4
Supervisor (4.63V)
TP27 5019
5V_GOOD
DS2 HSMG-C170
5V_POWER_LED
R24 330
U8 LM810M5
VDD RESET GND
Supervisor (2.93V)
TP28 5019
3V3_GOOD
MCU[1A]
DS3 HSMG-C170
3V3_POWER_LED
R25 330
U9
BAT_NEG
BAT_POS
XT60
474-PRT-10474
TP29 5019
TP30 5019
Q8
FDC653N
D1
BAR43CFILM
497-2520-1-ND
1101M2S3CQE2
CKN5001-ND
SW3
TP32 5019
TP60 5019
TP33 5019
J10
694108301002
AUX_POS
POWER_SELECTOR
The circuit can be powered by either a 15V battery or a 12V wall adapter. Either way, the circuit sees power from the regulators.
Title
Power Distribution
Size B
Number
Revision B
Date: 3-08-2023
Sheet 4 of 11
File: C:\Users\..\PowerDistribution.SchDoc
Drawn By: Ben Nowotny

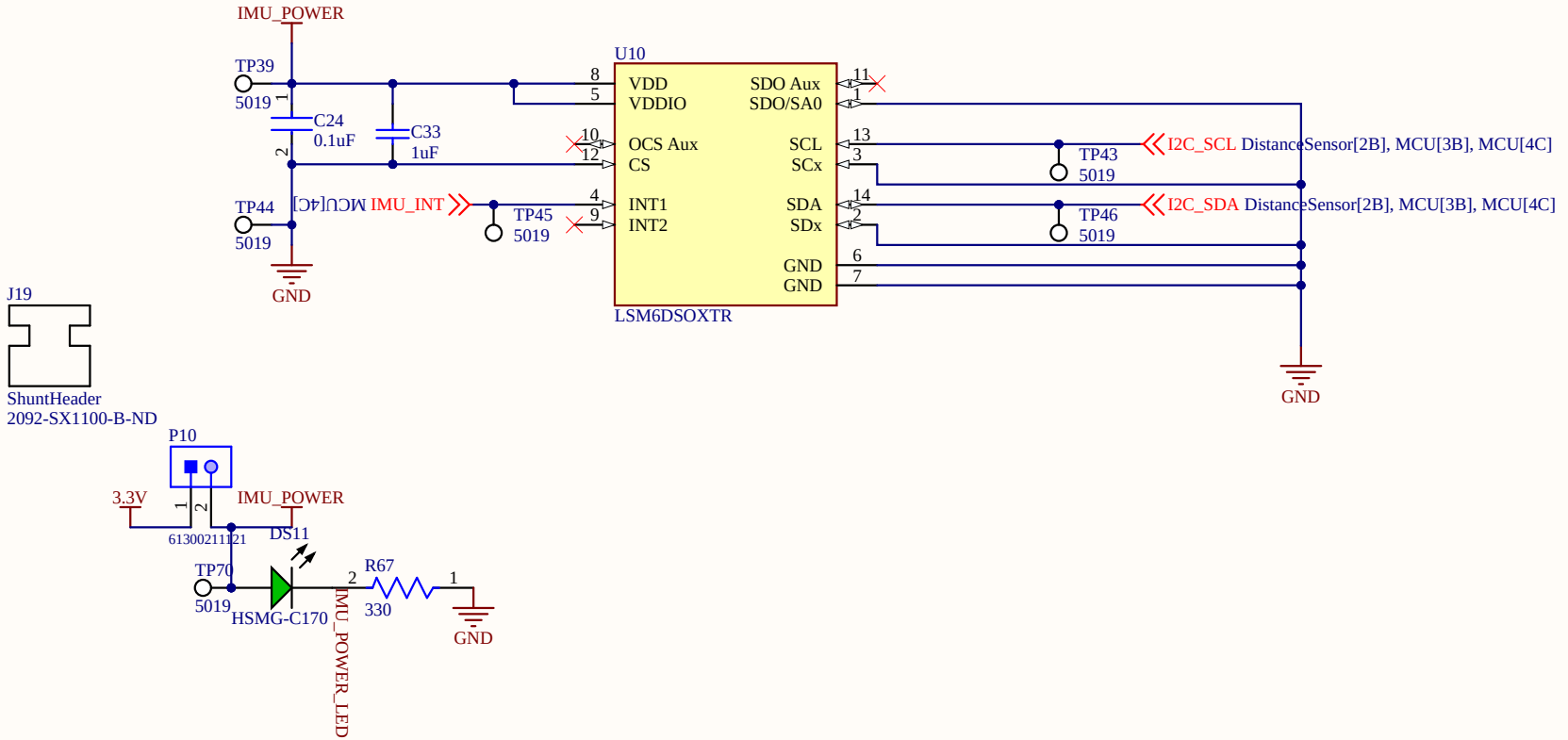
Header for VL53L1X-SATEL distance sensor breakout board. Sensor is connected off the board and features a built in power regulator when 5V is applied.

Distance sensor communicates with the MCU via I2C and an interrupt signal

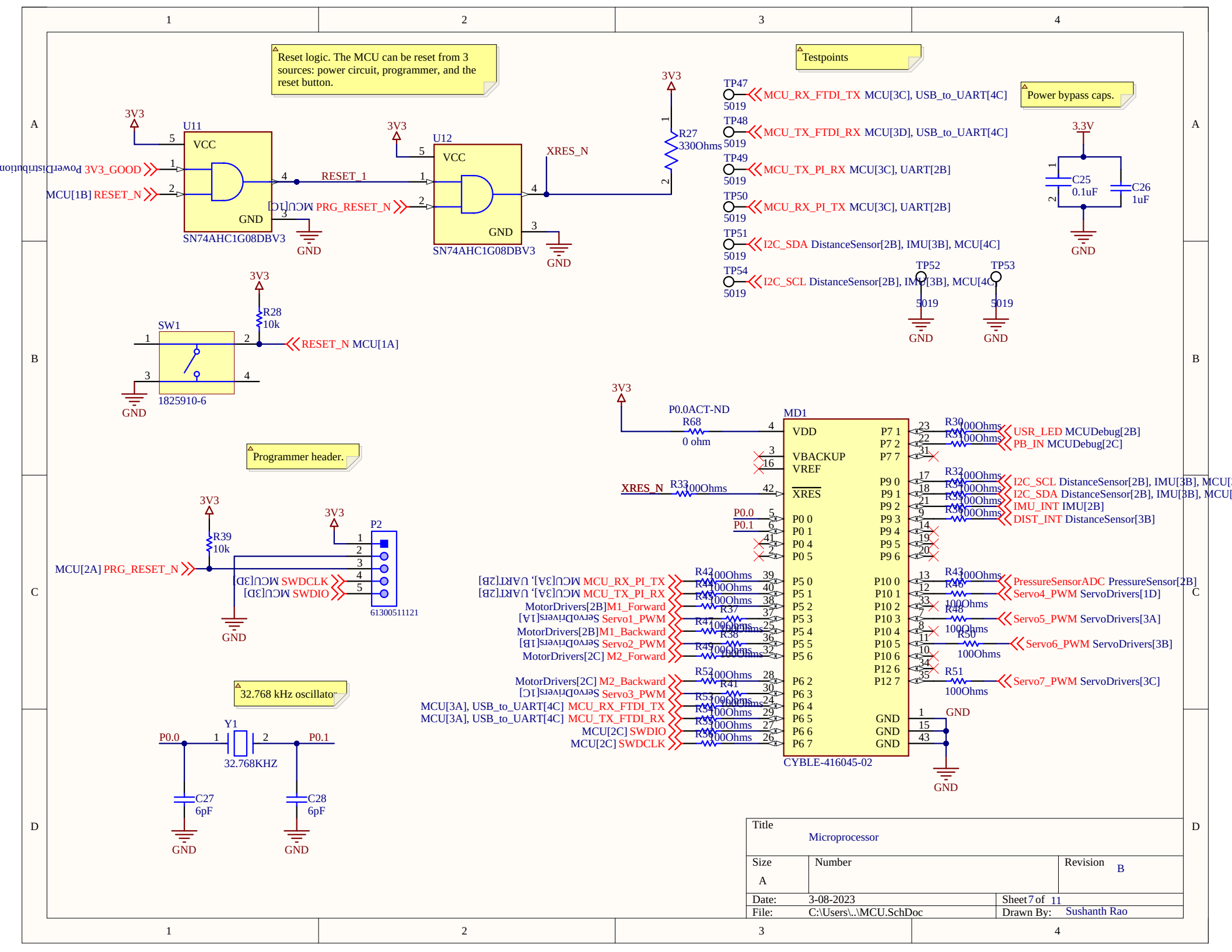


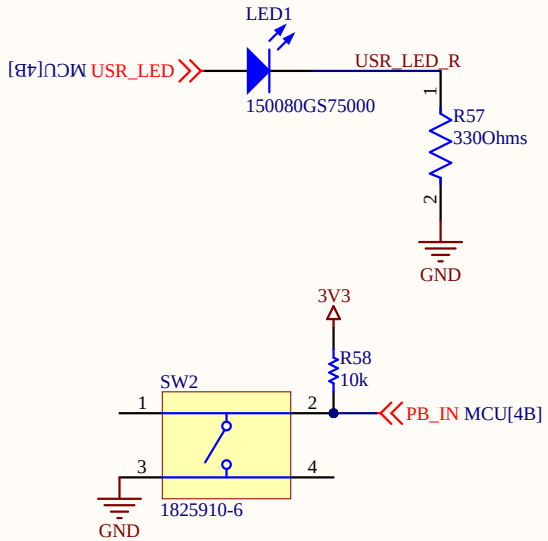


Title	Distance Sensor Breakout		
Size A	Number	Revision	B
Date:	3-08-2023	Sheet 5 of 11	
File:	C:\Users\..\DistanceSensor.SchDoc	Drawn By:	Abishek Kannan



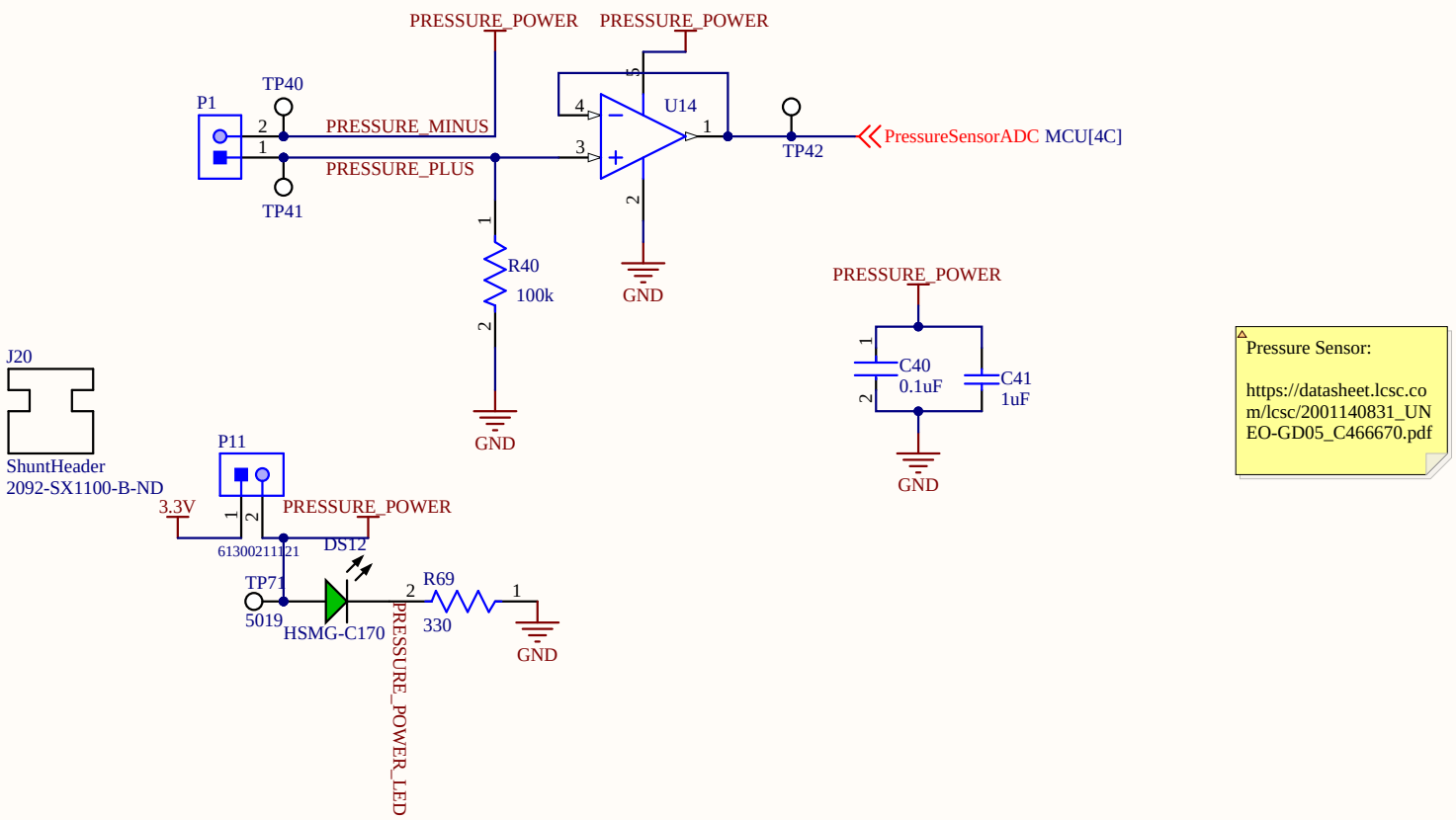
Title	IMU		
Size: A	Number:	Revision: B	
Date: 3-08-2023		Sheet 6 of 11	
File: C:\Users\..\IMU.SchDoc		Drawn By: Abishek Kannan	


Reset logic. The MCU can be reset from 3 sources: power circuit, programmer, and the reset button.
Testpoints
Power bypass caps.
Programmer header.
32.768 kHz oscillator
U11
U12
SN74AHC1G08DBV3
VCC
GND
3V3
3V3_GOOD
MCU[1B] RESET_N
RESET_1
MCU[1C] PRG_RESET_N
XRES_N
R27
330Ohms
TP47
TP48
TP49
TP50
TP51
TP54
TP52
TP53
5019
MCU_RX_FTDI_TX MCU[3C], USB_to_UART[4C]
MCU_TX_FTDI_RX MCU[3D], USB_to_UART[4C]
MCU_TX_PI_RX MCU[3C], UART[2B]
MCU_RX_PI_TX MCU[3C], UART[2B]
I2C_SDA DistanceSensor[2B], IMU[3B], MCU[4C]
I2C_SCL DistanceSensor[2B], IMU[3B], MCU[4C]
3.3V
C25
0.1uF
C26
1uF
SW1
R28
10k
RESET_N MCU[1A]
1825910-6
R39
10k
MCU[2A] PRG_RESET_N
MCU[3D] SWDCLK
MCU[3D] SWDIO
P2
61300511121
Y1
32.768KHZ
P0.0
P0.1
C27
6pF
C28
6pF
MD1
CYBLE-416045-02
P0.0ACT-ND
R68
0 ohm
VDD
VBACKUP
VREF
XRES
P0 0
P0 1
P0 4
P0 5
P9 0
P9 1
P9 2
P9 3
P9 4
P9 5
P9 6
P7 1
P7 2
P7 7
P10 0
P10 1
P10 2
P10 3
P10 4
P10 5
P10 6
P12 6
P12 7
P5 0
P5 1
P5 2
P5 3
P5 4
P5 5
P5 6
P6 2
P6 3
P6 4
P6 5
P6 6
P6 7
100Ohms
USR_LED MCUDebug[2B]
PB_IN MCUDebug[2C]
I2C_SCL DistanceSensor[2B], IMU[3B], MCU[
I2C_SDA DistanceSensor[2B], IMU[3B], MCU[
IMU_INT IMU[2B]
DIST_INT DistanceSensor[3B]
MCU_RX_PI_TX MCU[3A], UART[2B]
MCU_TX_PI_RX MCU[3A], UART[2B]
MotorDrivers[2B]M1_Forward
ServoDrivers[1A] Servo1_PWM
MotorDrivers[2B]M1_Backward
ServoDrivers[1B] Servo2_PWM
MotorDrivers[2C] M2_Forward
MotorDrivers[2C] M2_Backward
ServoDrivers[1C] Servo3_PWM
MCU[3A], USB_to_UART[4C] MCU_RX_FTDI_TX
MCU[3A], USB_to_UART[4C] MCU_TX_FTDI_RX
MCU[2C] SWDIO
MCU[2C] SWDCLK
PressureSensorADC PressureSensor[2B]
Servo4_PWM ServoDrivers[1D]
Servo5_PWM ServoDrivers[3A]
Servo6_PWM ServoDrivers[3B]
Servo7_PWM ServoDrivers[3C]
Title
Microprocessor
Size
A
Number
Revision
B
Date:
3-08-2023
Sheet 7 of 11
File:
C:\Users\..\MCU.SchDoc
Drawn By:
Sushanth Rao

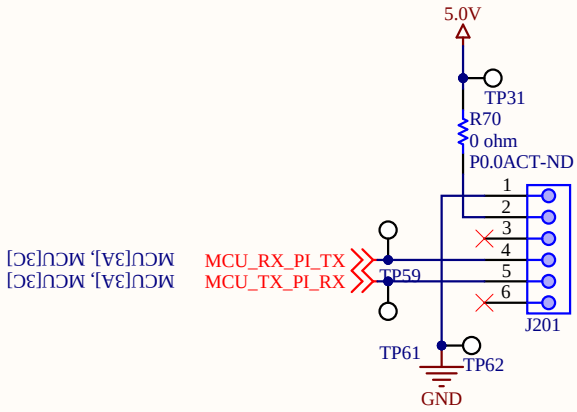


These components serve to help debug the processor and work with GPIO pins without other complicated hardware. During normal operation, the button can be unpopulated.

Title: Microprocessor Debug		
Size: A	Number:	Revision: A
Date: 3-08-2023		Sheet 8 of 11
File: C:\Users\..\MCUDebug.SchDoc		Drawn By: Sushanth Rao

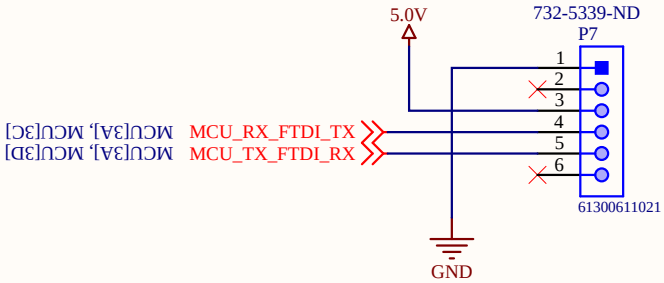


Title	Pressure Sensor	
Size: A	Number:	Revision: B
Date: 3-08-2023		Sheet 9 of 11
File: C:\Users\..\PressureSensor.SchDoc		Drawn By: Paul Pak



This is the 6 Position Header connector between the UART and the microprocessor. We label Pins 4 and 5 as our transmit and receive pins, connect two pins to ground and 5.0V, and disable the other two pins since the UART is only used to communicate with the Raspberry Pi.

Title: Pi UART		
Size: A	Number:	Revision: A
Date: 3-08-2023		Sheet 10 of 11
File: C:\Users\..\UART.SchDoc		Drawn By: Paul Pak



This USB to UART circuit is for debugging purposes. We can use the processor to send and receive test data during the development process. This circuit can be unpowered during normal operation.

Title: USB to UART - DEBUG		
Size: A	Number:	Revision: B
Date: 3-08-2023		Sheet 1 of 11
File: C:\Users\..\USB_to_UART.SchDoc		Drawn By: Sushanth Rao