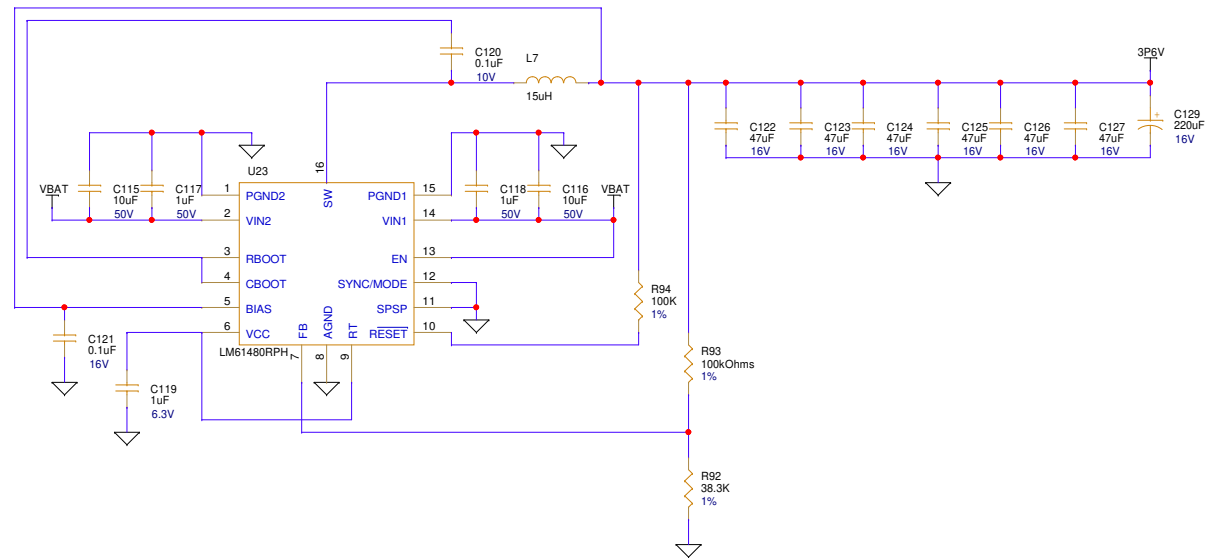
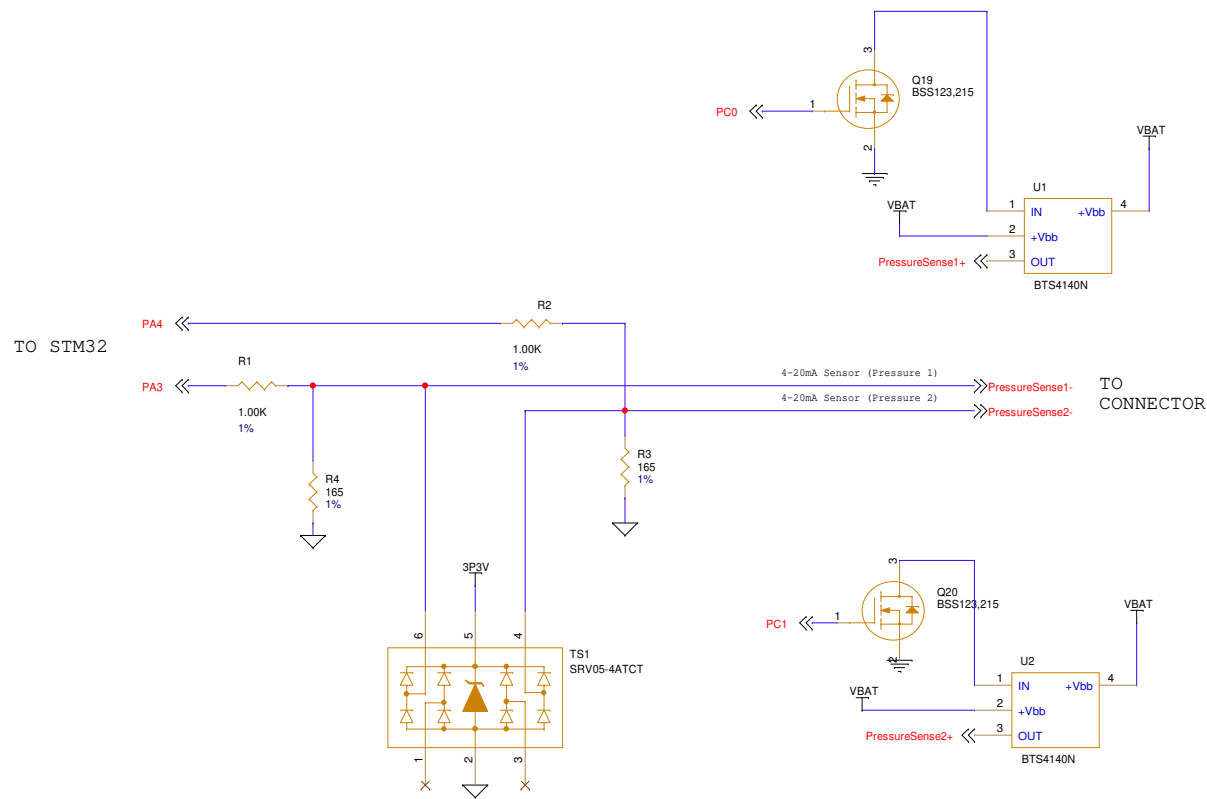


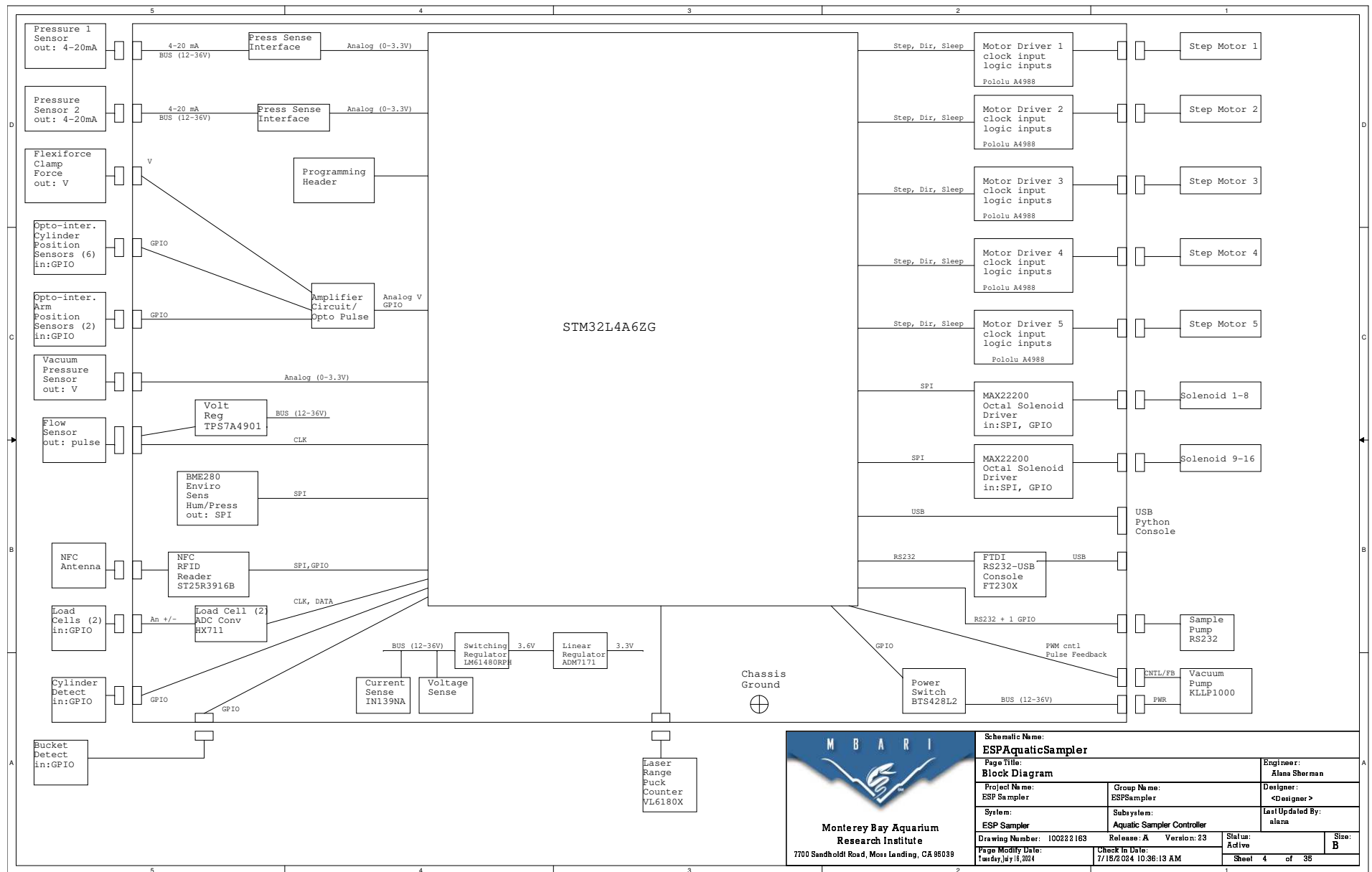
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Page Title: 3P3V Linear Regulator			Engineer: Alana Sherman	
Project Name: ESP Sampler	Group Name: ESPSampler		Designer: <Designer>	
System: ESP Sampler	Subsystem: Aquatic Sampler Controller		Last Updated By: alana	
Drawing Number: 100222163	Release: A	Version: 23	Status: Active	Size: A
Page Modify Date: Tuesday, July 16, 2024	Check In Date: 7/15/2024 10:36:13 AM		Sheet 1 of 35	



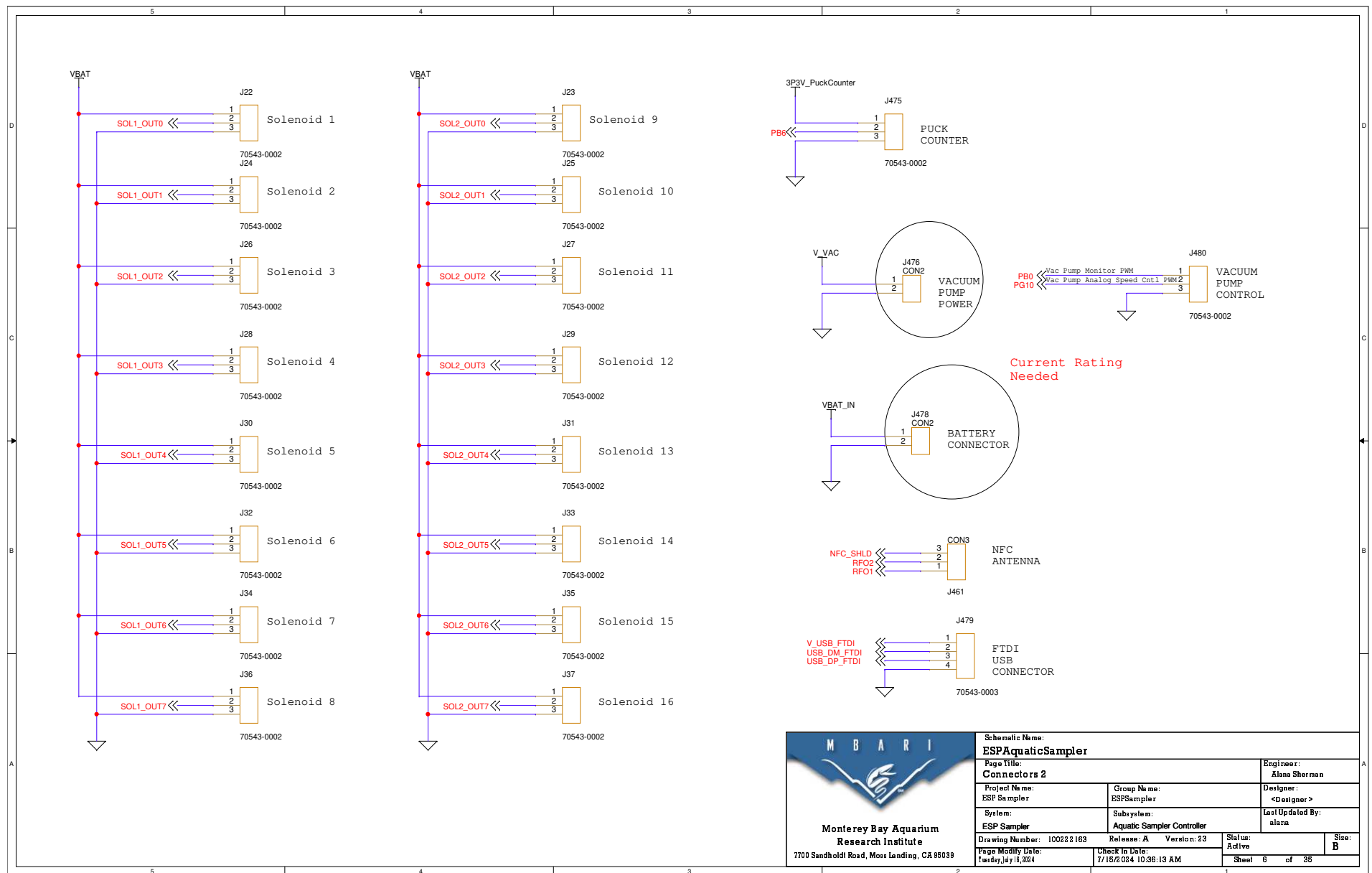
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Page Title: 3P6V Converter		Engineer: Alana Sherman	
Project Name: ESP Sampler	Group Name: ESPSampler	Designer: <Designer>	
System: ESP Sampler	Subsystem: Aquatic Sampler Controller	Last Updated By: alana	
Drawing Number: 100228163	Release: A	Version: 23	Status: Active
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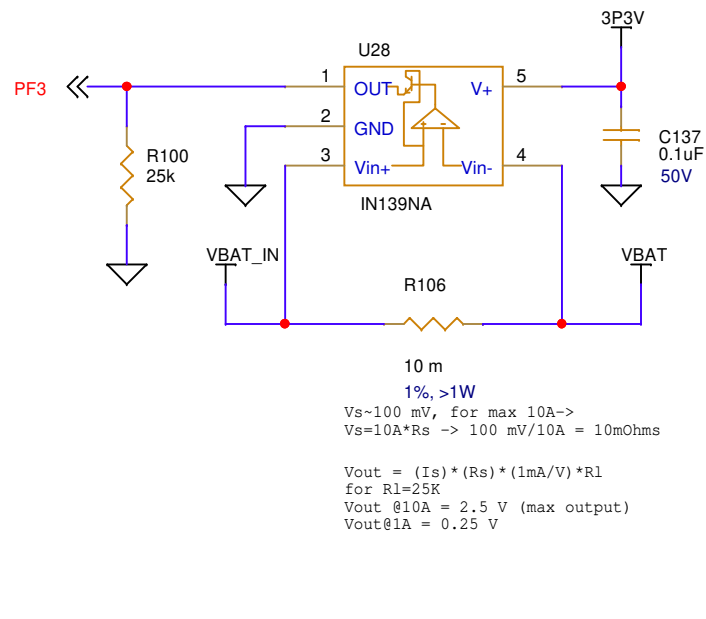


 Monterey Bay Aquarium Research Institute 7700 Sandholdt Road, Moss Landing, CA 95039		Schematic Name: ESPAquaticSampler	
		Page Title: 4-20mA Pressure Sens Interface	
		Project Name: ESP Sampler	Engineer: Alana Sherman
		Group Name: ESPSampler	Designer: <Designer >
System: ESP Sampler		Subsystem: Aquatic Sampler Controller	Last Updated By: alana
Drawing Number: 100222163	Release: A	Version: 23	Status: Active
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		Sheet	3 of 36

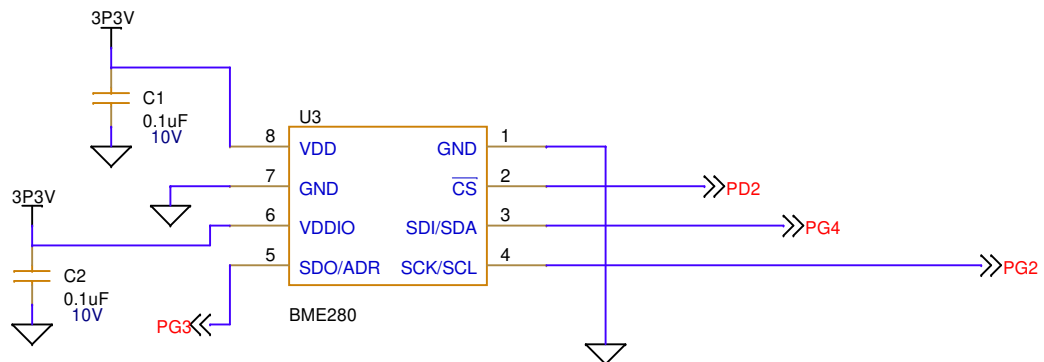


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Page Title: Block Diagram	Engineer: Alana Sherman		
Project Name: ESP Sampler	Group Name: ESPSampler	Designer: <Designer>	
System: ESP Sampler	Subsystem: Aquatic Sampler Controller	Last Updated By: alana	
Drawing Number: 100222163	Release: A	Version: 23	Status: Active
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		Sheet 4 of 36	

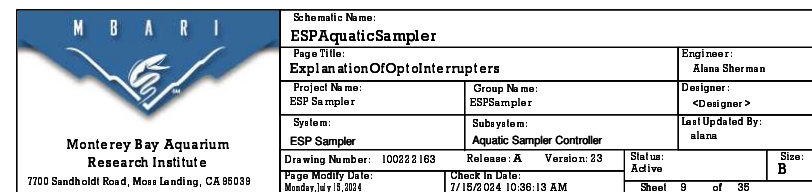


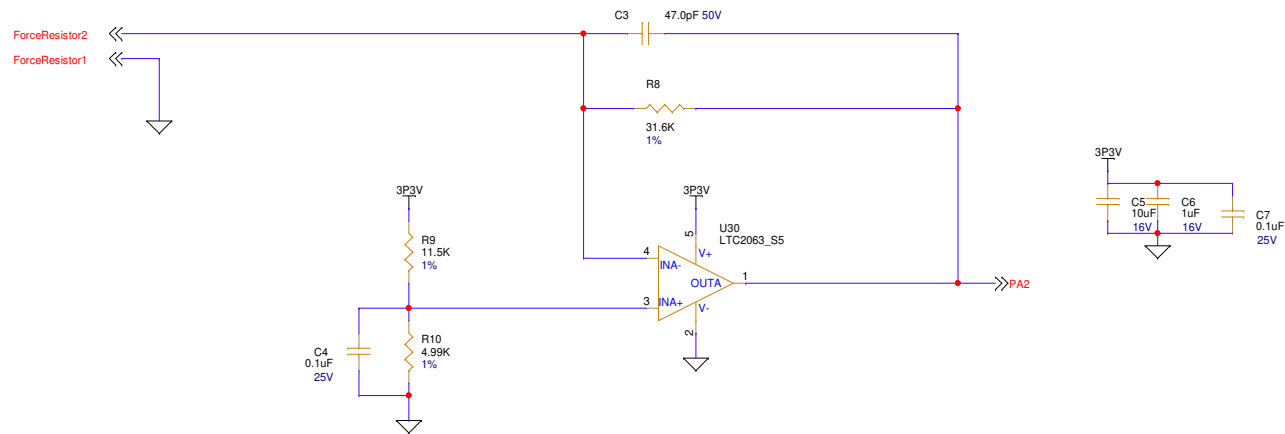


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Page Title: Current_Volt_Monitor			Engineer: Alana Sherman
Project Name: ESP Sampler	Group Name: ESPSampler		Designer: <Designer>
System: ESP Sampler	Subsystem: Aquatic Sampler Controller		Last Updated By: alana
Drawing Number: 100222163		Release: A Version: 23	Status: Active
Page Modify Date: Tuesday, July 16, 2024		Check In Date: 7/15/2024 10:36:13 AM	Size: A
			Sheet 7 of 35



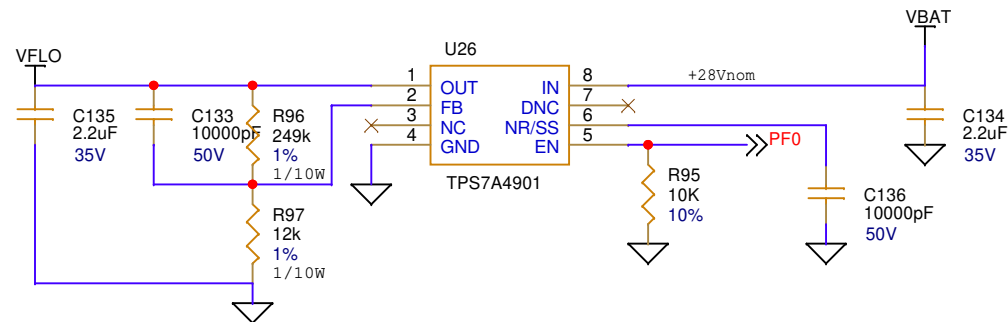
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Project Name: ESP Sampler	Group Name: ESPSampler		Designer: <Designer>	
System: ESP Sampler	Subsystem: Aquatic Sampler Controller		Last Updated By: alana	
Drawing Number: 100222163	Release: A	Version: 23	Status: Active	Size: A
Page Modify Date: Tuesday, July 16, 2024	Check In Date: 7/15/2024 10:36:13 AM		Sheet 8 of 35	





Schematic Name: ESPAquaticSampler			
Page Title: FLEXIFORCE			Engineer: Alana Sherman
Project Name: ESP Sampler	Group Name: ESPSampler	Designer: <Designer>	
System: ESP Sampler	Subsystem: Aquatic Sampler Controller	Last Updated By: alana	
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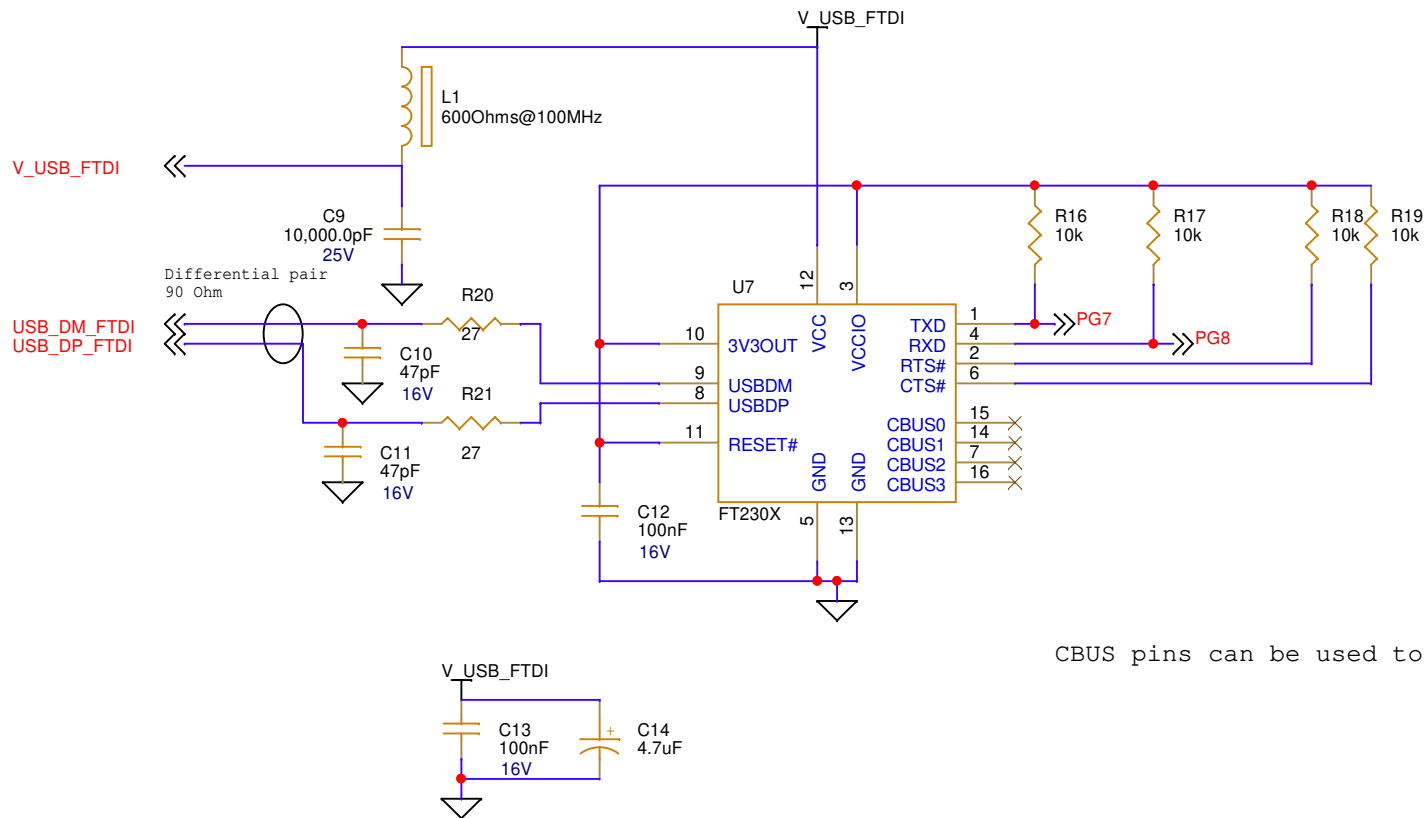
THIS IS A 36V PART!!!



VFLO= 24V for Vbus > 24.3V
VFLO= Vbus - .3 for Vbus < 24.3V



Schematic Name: ESPAquaticSampler				
Page Title: FlowSensorLinearRegulator			Engineer: Alana Sherman	
Project Name: ESP Sampler		Group Name: ESPSampler		Designer: <Designer>
System: ESP Sampler		Subsystem: Aquatic Sampler Controller		Last Updated By: alana
Drawing Number: 100222163		Release: A		Version: 23
Page Modify Date: Tuesday, July 16, 2024		Check In Date: 7/15/2024 10:36:13 AM		Status: Active
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CBUS pins can be used to drive tx,rx LEDs



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Schematic Name:
ESPAquaticSampler

Page Title:
FTDI USB Console

Project Name:
ESP Sampler

System:
ESP Sampler

Drawing Number: 100222163

Page Modify Date:
Tuesday, July 16, 2024

Group Name:
ESPSampler

Subsystem:
Aquatic Sampler Controller

Release: A Version: 23

Check In Date:
7/15/2024 10:36:13 AM

Engineer:
Alana Sherman

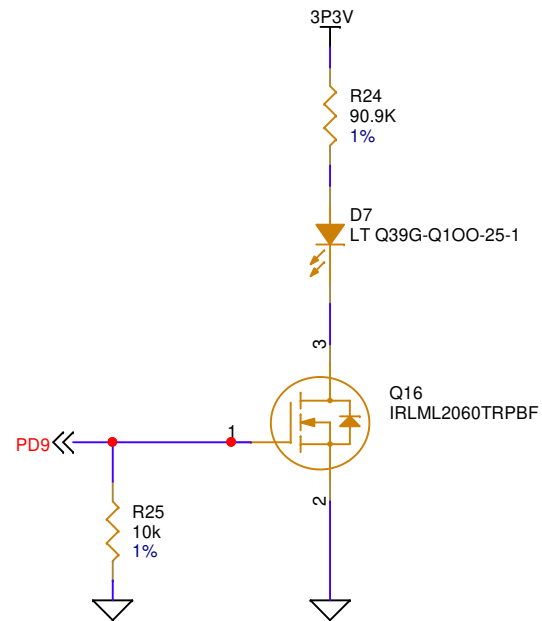
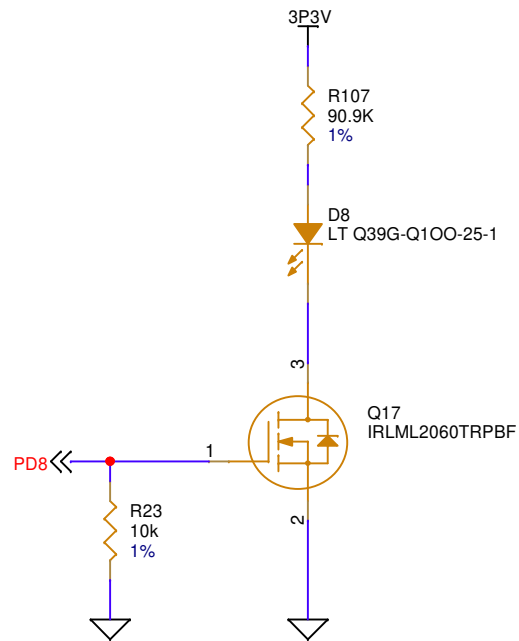
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Last Updated By:
alana

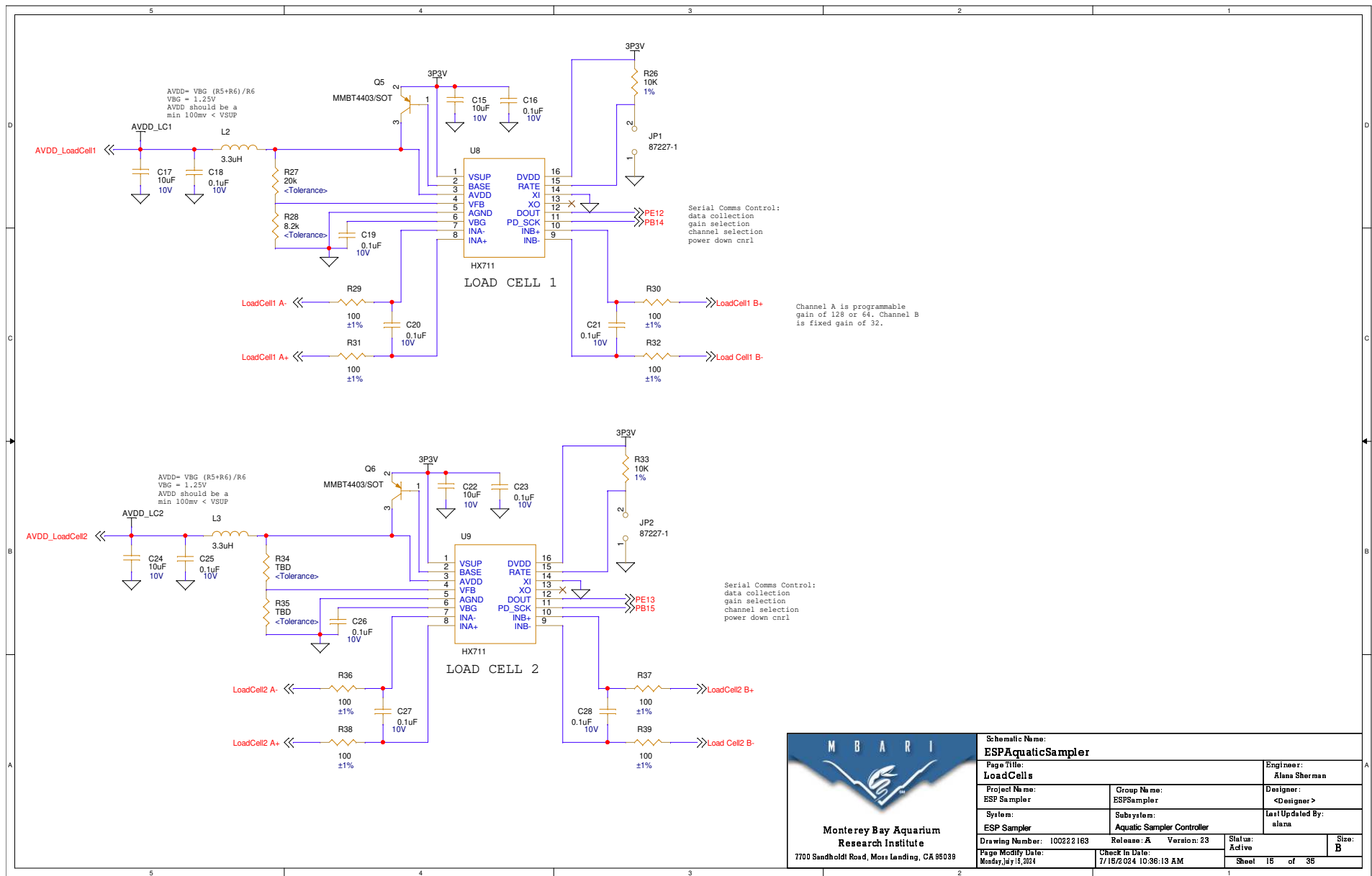
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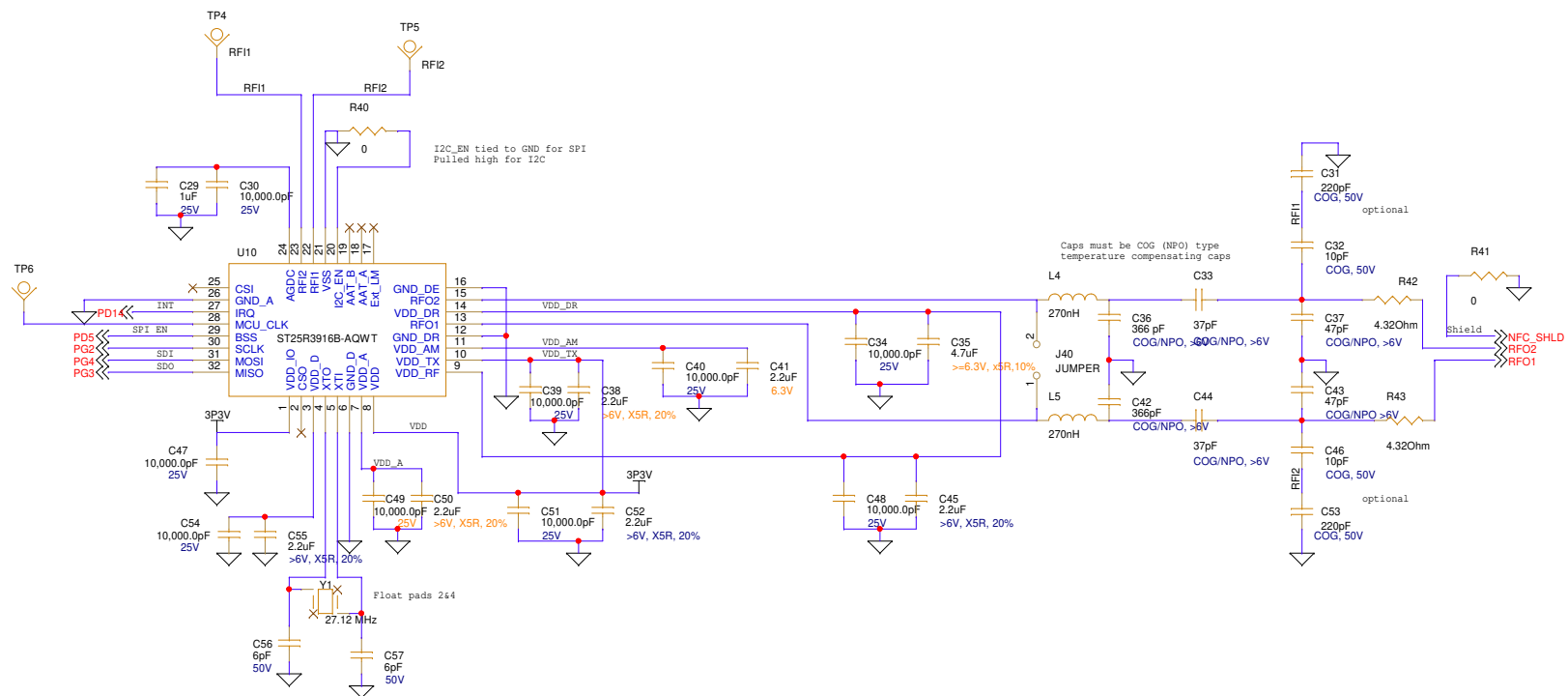
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Schematic Name: ESPAquaticSampler				
Page Title: LED Indicators			Engineer: Alana Sherman	
Project Name: ESP Sampler	Group Name: ESPSampler		Designer: <Designer>	
System: ESP Sampler	Subsystem: Aquatic Sampler Controller		Last Updated By: alana	
Drawing Number: 100222163	Release: A	Version: 23	Status: Active	Size: A
Page Modify Date: Monday, July 15, 2024	Check In Date: 7/15/2024 10:36:13 AM		Sheet 14 of 35	



 Monterey Bay Aquarium Research Institute 7700 Sandholdt Road, Moss Landing, CA 95039		Schematic Name: ESPAquaticSampler	
		Page Title: LoadCells	Engineer: Alana Sherman
Project Name: ESP Sampler	Group Name: ESPSampler	Designer: <Designer>	
System: ESP Sampler	Subsystem: Aquatic Sampler Controller	Last Updated By: alana	
Drawing Number: 100222163	Release: A	Version: 23	Status: Active
Page Modify Date: Monday, July 15, 2024	Check in Date: 7/15/2024 10:36:13 AM	Sheet 16 of 36	
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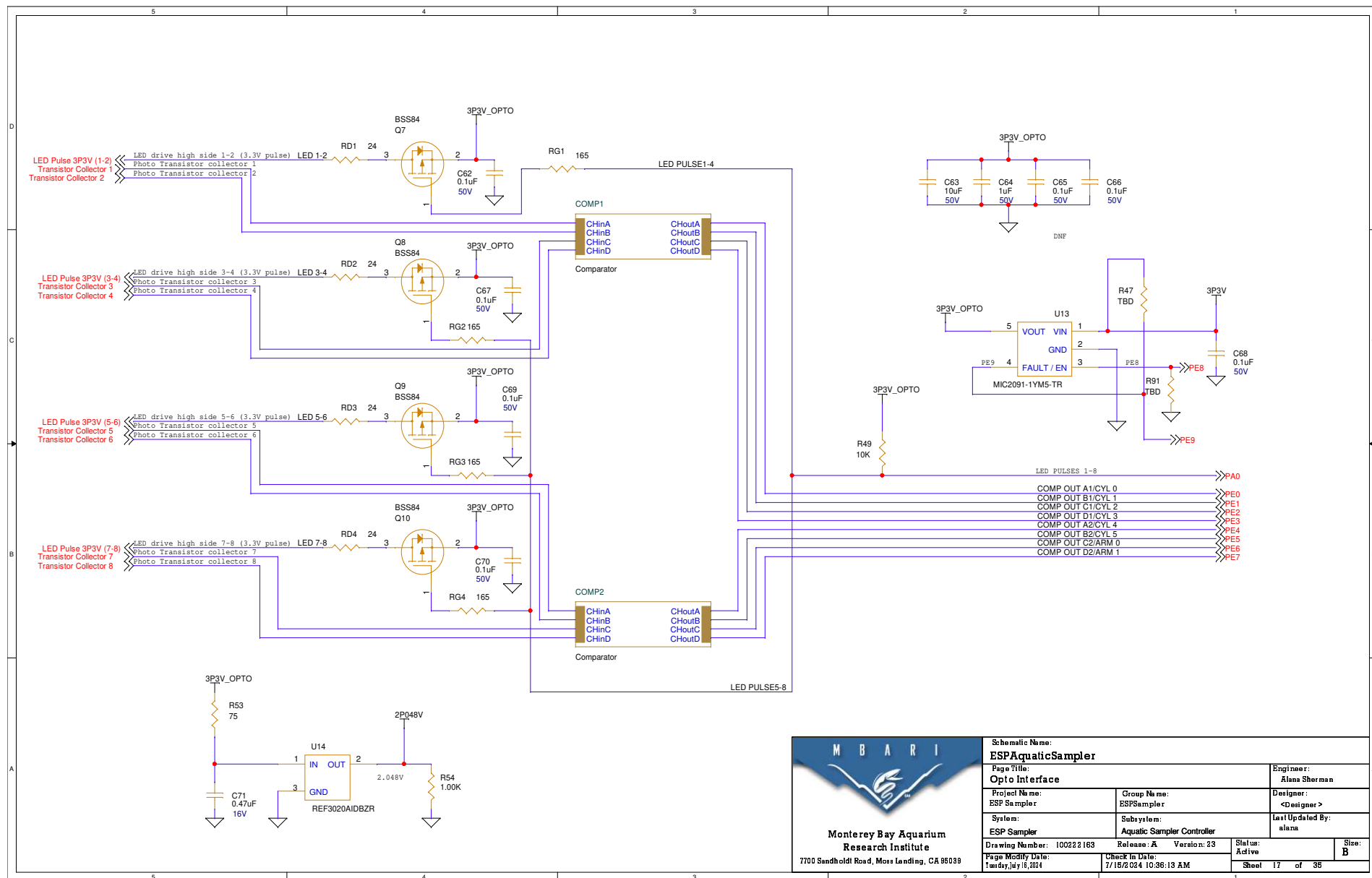


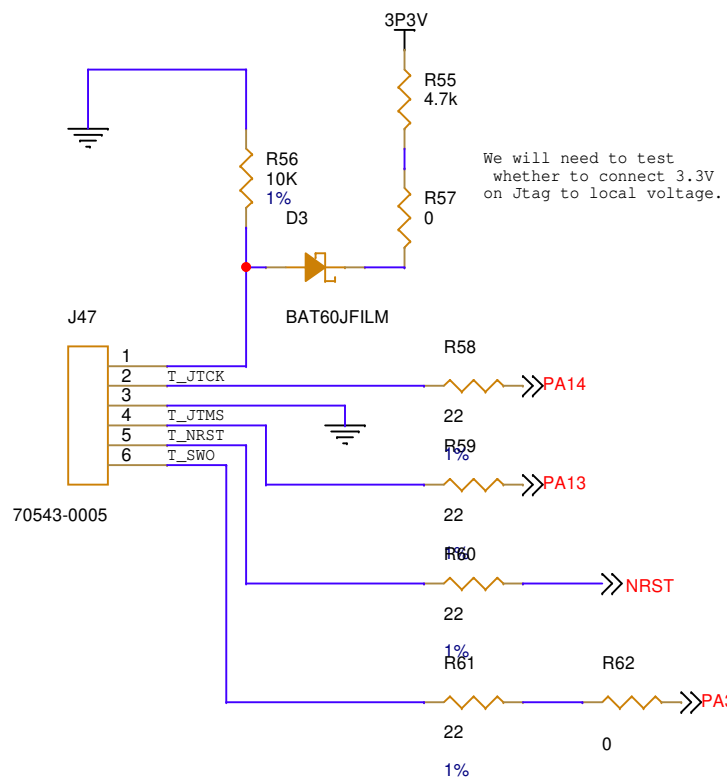
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		Project Name: ESP Sampler	Group Name: ESPSampler
		System: ESP Sampler	Subsystem: Aquatic Sampler Controller
Drawing Number: 100222163		Release: A	Version: 23
Page Modify Date: Monday, July 15, 2024		Check in Date: 7/15/2024 10:38:13 AM	
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Engineer:
Alana Sherman

Designer:
<Designer>

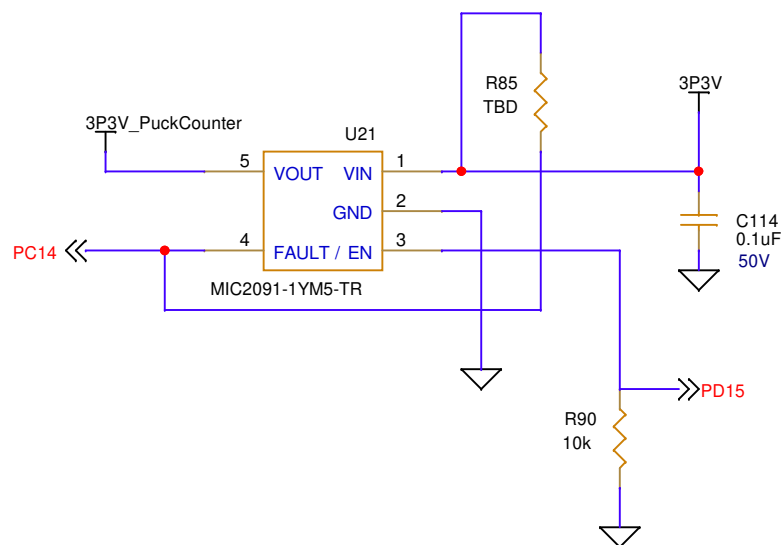
Last Updated By:
alana



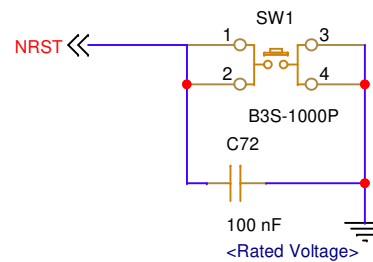


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Page Title: Programming Header			Engineer: Alana Sherman	
Project Name: ESP Sampler		Group Name: ESPSampler		Designer: <Designer>
System: ESP Sampler		Subsystem: Aquatic Sampler Controller		Last Updated By: alana
Drawing Number: 100222163		Release: A		Version: 23
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				Size: A
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There is a 50mA version of this part



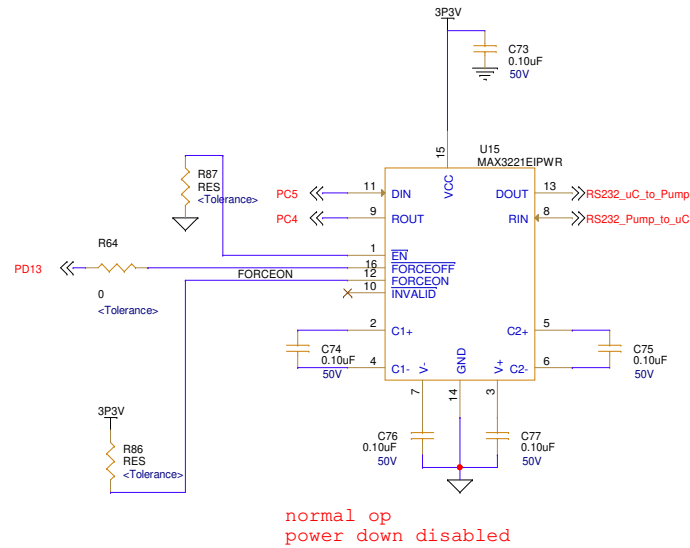
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Page Title: Puck Counter Interface			Engineer: Alana Sherman		
Project Name: ESP Sampler	Group Name: ESPSampler		Designer: <Designer>		
System: ESP Sampler	Subsystem: Aquatic Sampler Controller		Last Updated By: alana		
Drawing Number: 100222163		Release: A	Version: 23	Status: Active	Size: A
Page Modify Date: Monday, July 15, 2024		Check In Date: 7/15/2024 10:36:13 AM		Sheet 19 of 35	



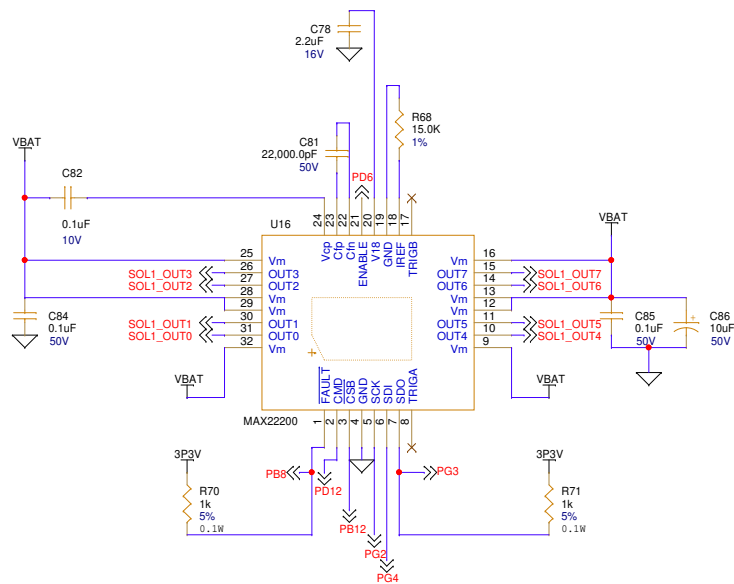


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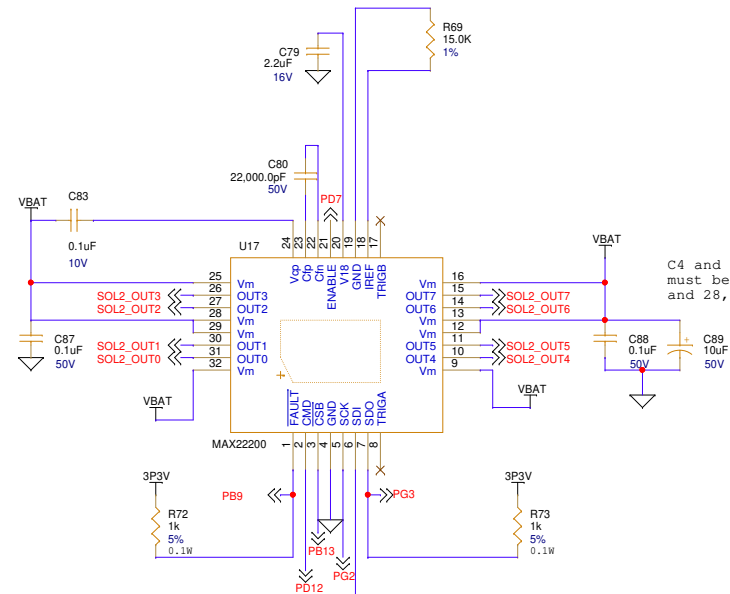
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Page Title: Reset Button			Engineer: Alana Sherman	
Project Name: ESP Sampler		Group Name: ESPSampler		Designer: <Designer>
System: ESP Sampler		Subsystem: Aquatic Sampler Controller		Last Updated By: alana
Drawing Number: 100222163	Release: A	Version: 23	Status: Active	Size: A
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Schematic Name: ESPAquaticSampler			
Page Title: Sample Pump Comms		Engineer: Alana Sherman	
Project Name: ESP Sampler	Group Name: ESP Sampler	Designer: <Designer>	
System: ESP Sampler	Subsystem: Aquatic Sampler Controller	Last Updated By: alana	
Drawing Number: 100222163	Release: A	Version: 23	Status: Active
Page Modify Date: Tuesday, July 16, 2024	Check in Date: 7/16/2024 10:38:13 AM		Size: B
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Solenoids 1-8



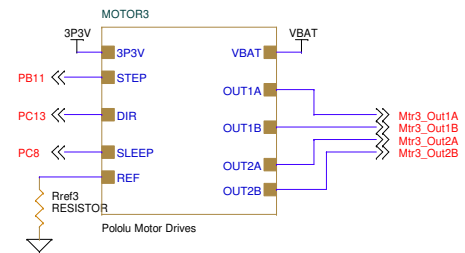
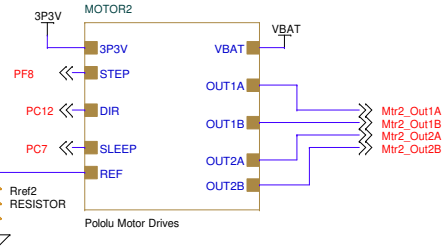
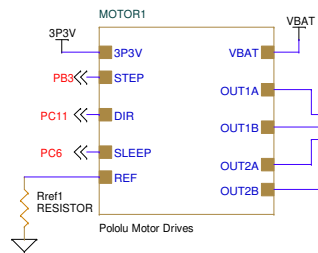
Solenoids 9-16

IRef Circuit ground must be kept short and ground should be connected to ground pin

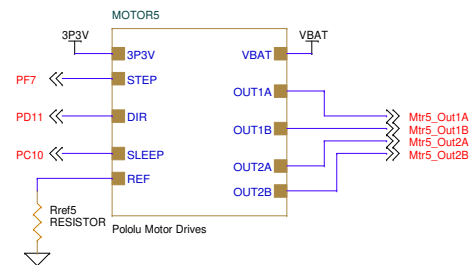
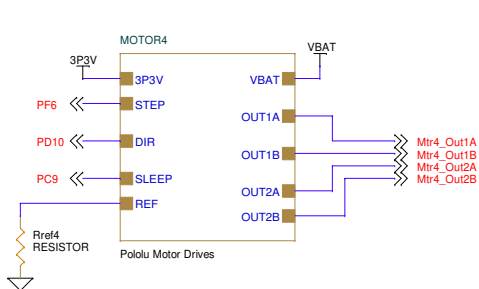
C4 and C5 (0.1 uF bypass caps) must be near pins 12, 13 and 28,29 respectively



Schematic Name: ESPAquaticSampler			
Page Title: Solenoid Drivers		Engineer: Alana Sherman	
Project Name: ESP Sampler	Group Name: ESPSampler		Designer: <Designer>
System: ESP Sampler	Subsystem: Aquatic Sampler Controller		Last Updated By: alana
Drawing Number: 100222163	Release: A	Version: 23	Status: Active
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bring another port out for VREF
attach resistor to set current to pin



Another way to set the current limit is to calculate the reference voltage that corresponds to your desired current limit and then adjust the current limit potentiometer until you measure that voltage on the **VREF** pin. The VREF pin voltage is accessible on a via that is circled on the bottom silkscreen of the circuit board. The current limit, I_{MAX} , relates to the reference voltage as follows:

$$I_{MAX} = \frac{V_{REF}}{8 \cdot R_{CS}}$$

or, rearranged to solve for VREF:

$$V_{REF} = 8 \cdot I_{MAX} \cdot R_{CS}$$

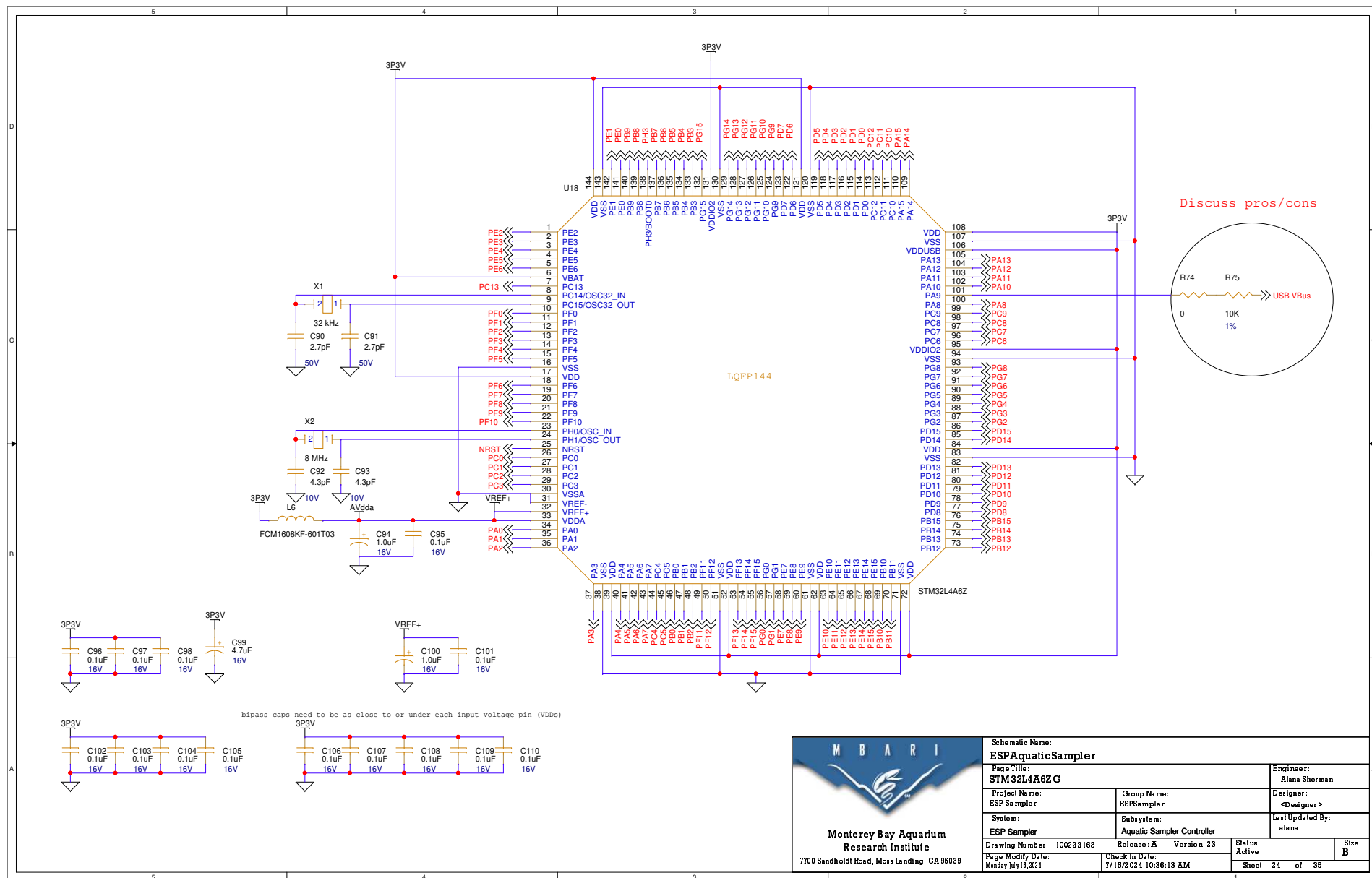
R_{CS} is the current sense resistance, and all units manufactured since 2017 have **0.068 Ω** current sense resistors (units made prior to this had green 0.050 Ω sense resistors). So, for example, if you want to set the current limit to 1 A, you would set VREF to 540 mV. Doing this ensures that even though the current through each coil changes from step to step, the magnitude of the current vector in the stepper motor stays constant at 1 A.

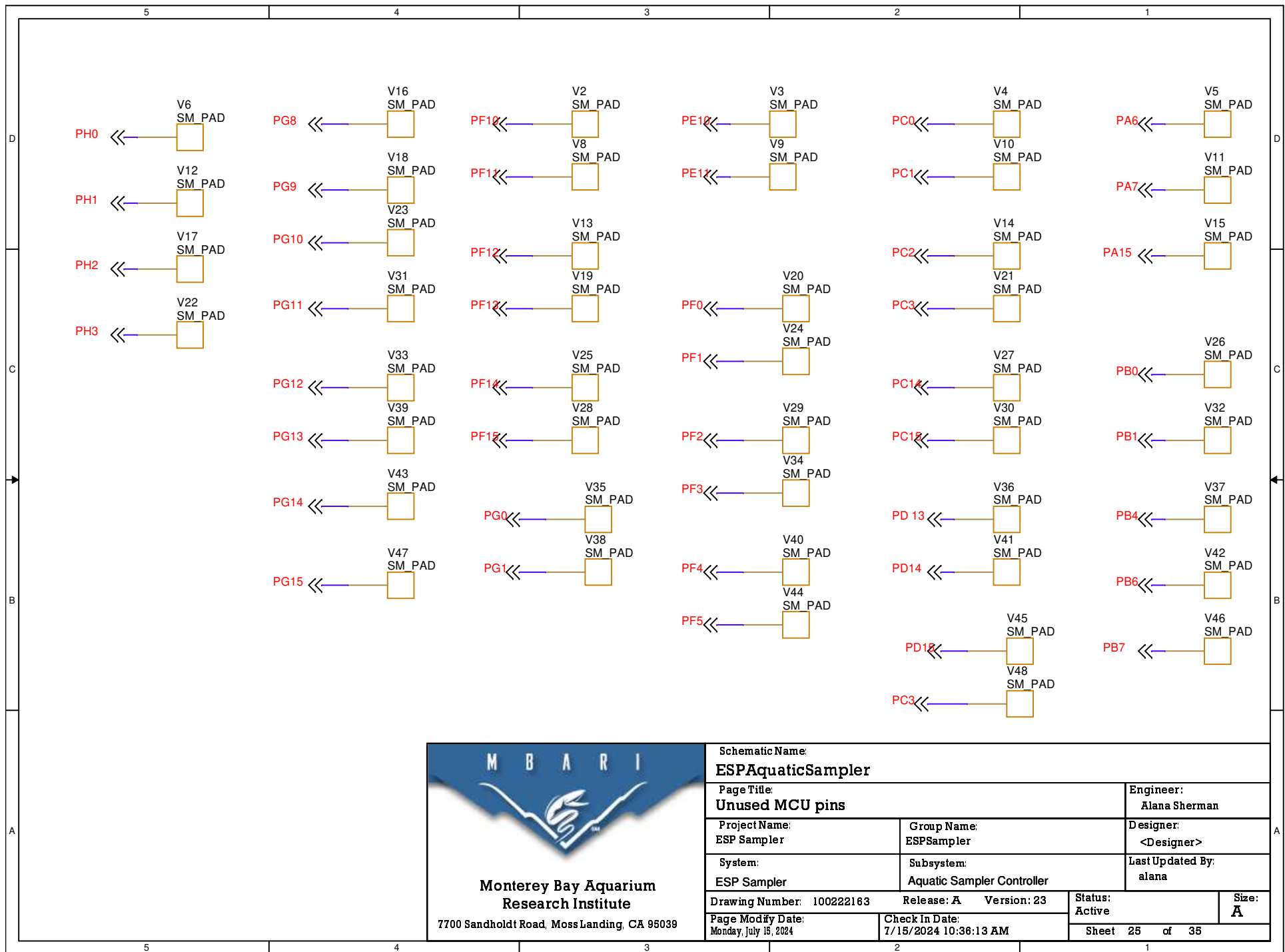
$$\sqrt{I_{COIL1}^2 + I_{COIL2}^2} = I_{MAX} = 1A$$

If you instead want the current through each coil to be 1 A in full-step mode, you would need to set the current limit to be 40% higher, or 1.4 A, since the coils are limited to approximately 70% of the set current limit in full-step mode (the equation above shows why this is the case). This can be accomplished by setting VREF to 770 mV.

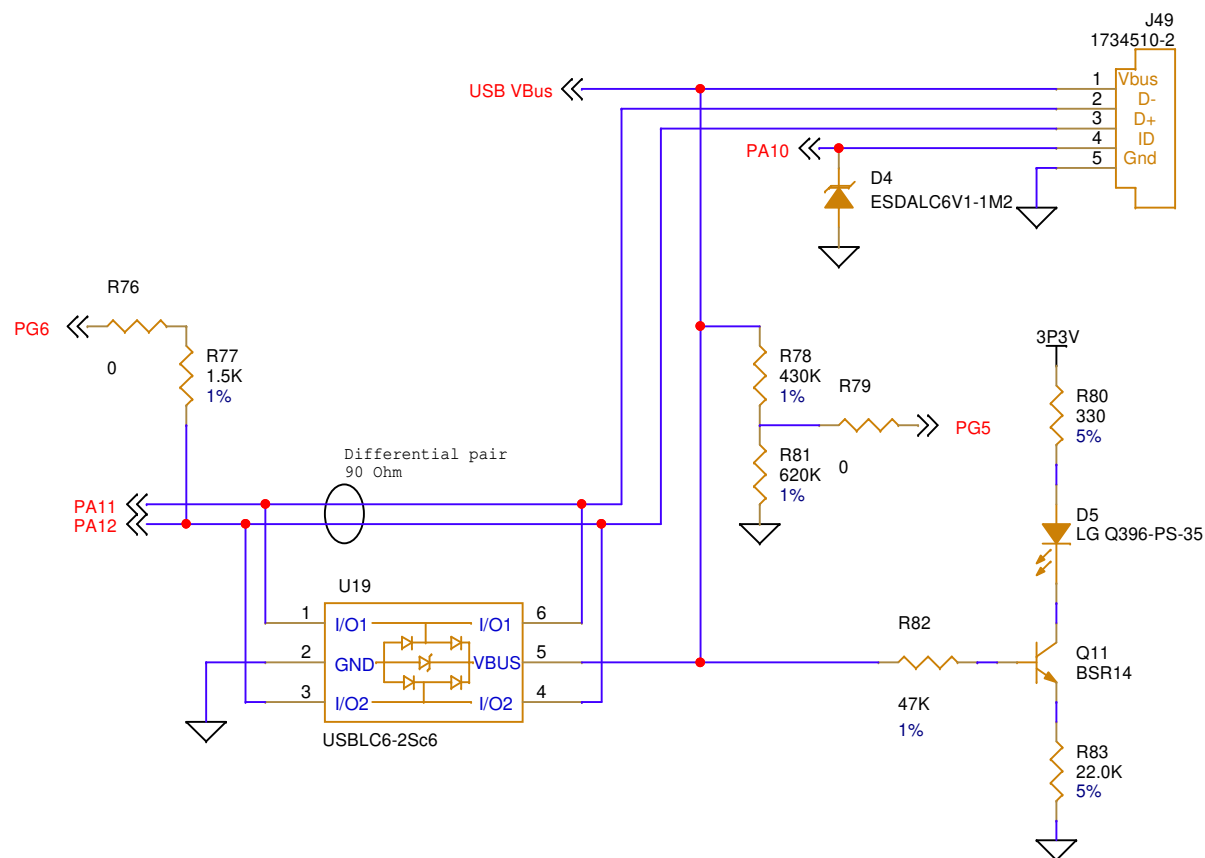


Schematic Name: ESPAquaticSampler			
Page Title: Stepper Motor Drives		Engineer: Alana Sherman	
Project Name: ESP Sampler	Group Name: ESPSampler		Designer: <Designer>
System: ESP Sampler	Subsystem: Aquatic Sampler Controller		Last Updated By: alana
Drawing Number: 100222163	Release: A	Version: 23	Status: Active
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Schematic Name: ESPAquaticSampler				
Page Title: Unused MCU pins			Engineer: Alana Sherman	
Project Name: ESP Sampler		Group Name: ESPSampler		Designer: <Designer>
System: ESP Sampler		Subsystem: Aquatic Sampler Controller		Last Updated By: alana
Drawing Number: 100222163		Release: A Version: 23		Status: Active
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Schematic Name:
ESPAquaticSampler

Page Title:
USB Python Console

Project Name:
ESP Sampler

System:

ESP Sampler

Group Name:
ESPSampler

Subsystem:

Aquatic Sampler Controller

Engineer:
Alana Sherman

Designer:

<Designer>
alana

Drawing Number: 100222163

Release: A

Version: 23

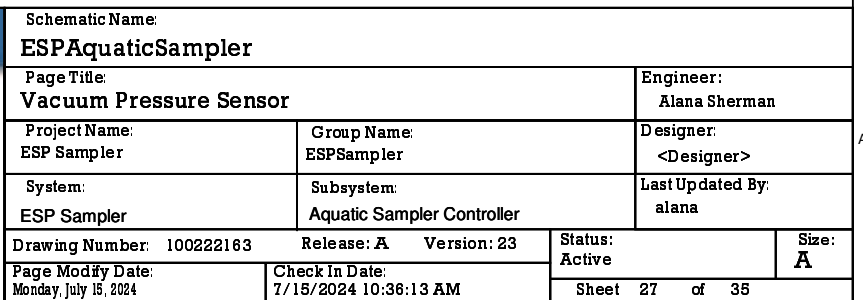
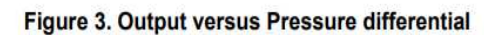
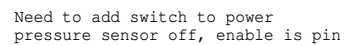
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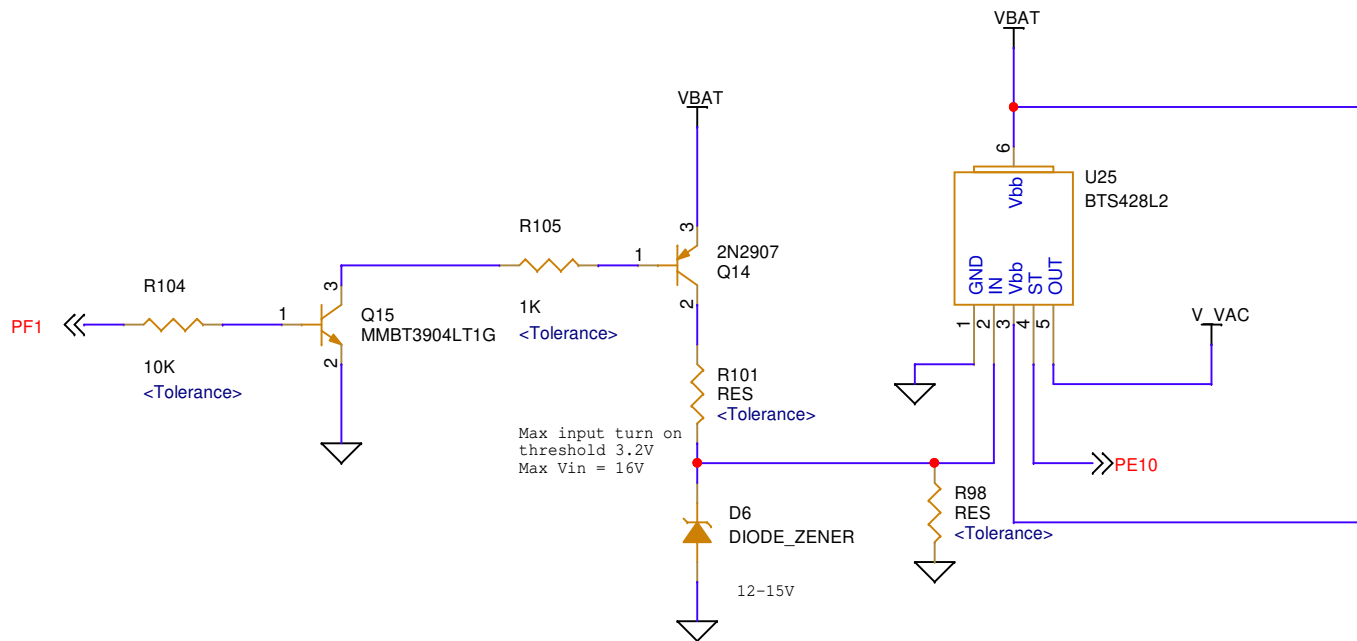
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Monday, July 15, 2024

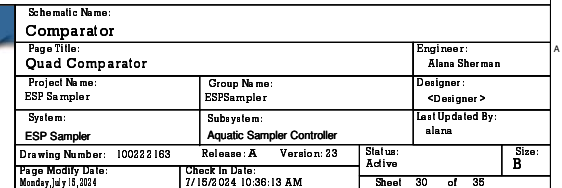
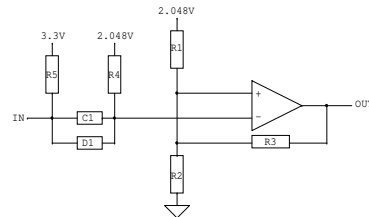
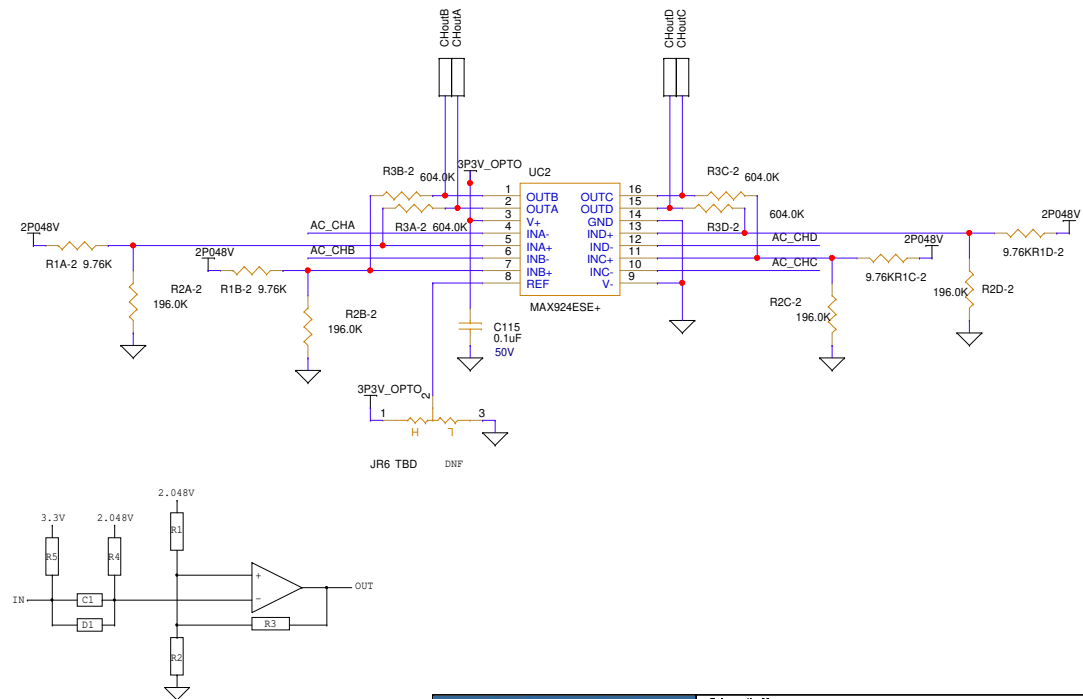
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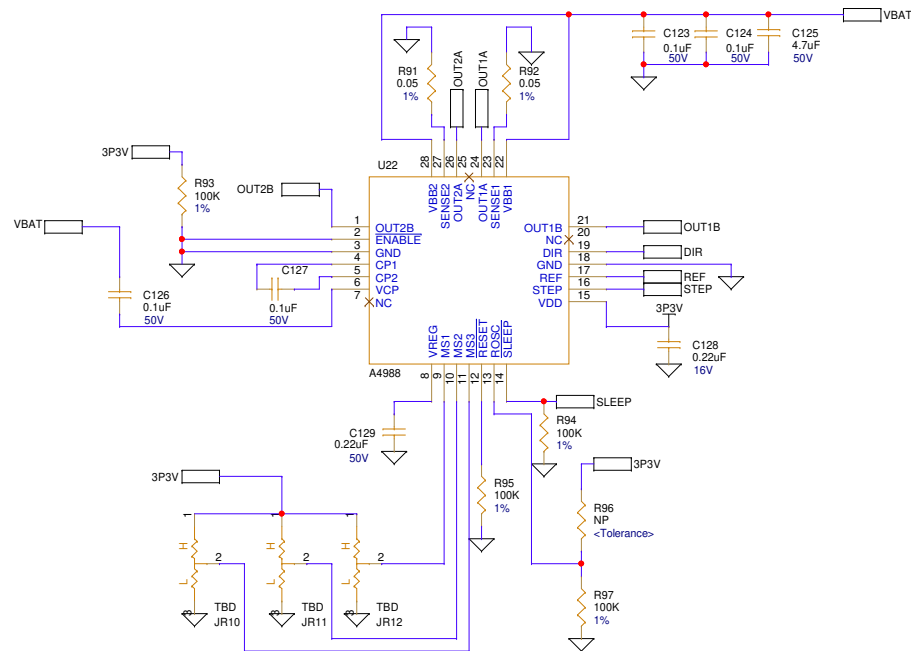


Schematic Name: ESPAquaticSampler				
Page Title: Vacuum Pump Pwr Switch			Engineer: Alana Sherman	
Project Name: ESP Sampler	Group Name: ESPSampler		Designer: <Designer>	
System: ESP Sampler	Subsystem: Aquatic Sampler Controller		Last Updated By: alana	
Drawing Number:	100222163	Release:	A	Version: 23
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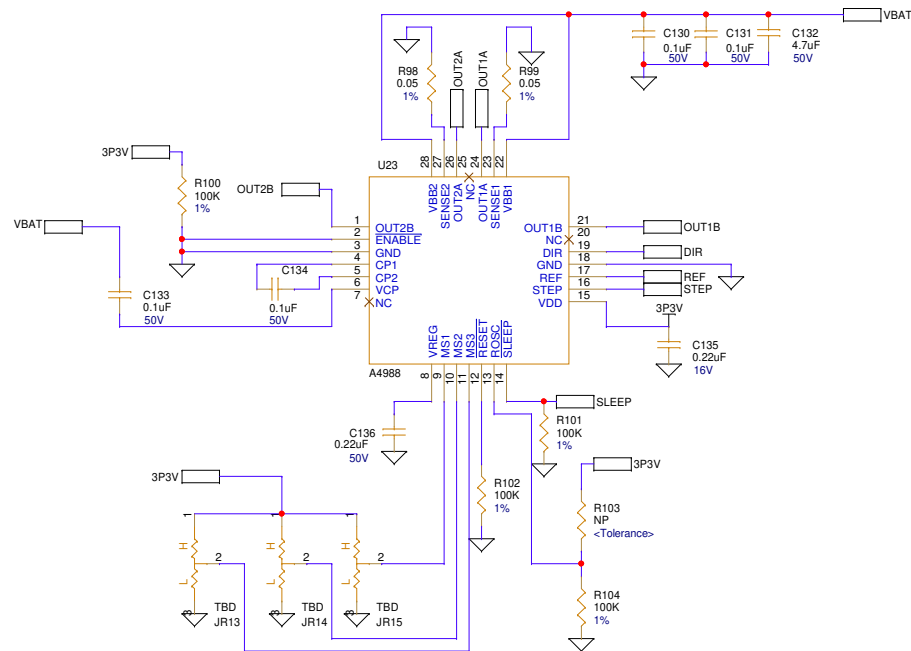




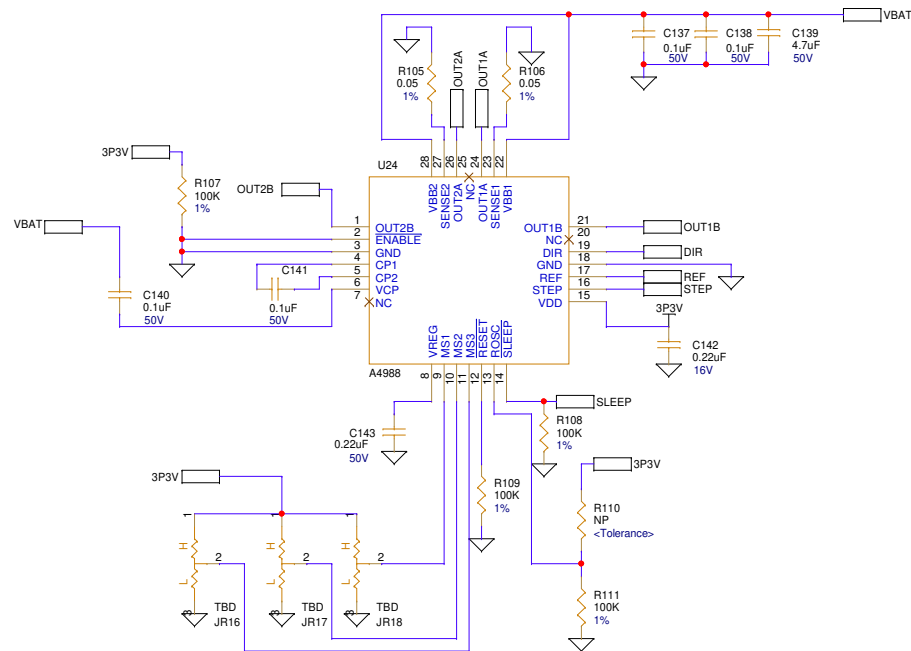
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Page Title: Pololu A4988			Engineer: Alana Sherman
Project Name: ESP Sampler	Group Name: ESPSampler		Designer: <Designer>
System: ESP Sampler	Subsystem: Aquatic Sampler Controller	Last Updated by: alana	
Drawing Number: 100222.163		Release: A Version: 23	Status: Active
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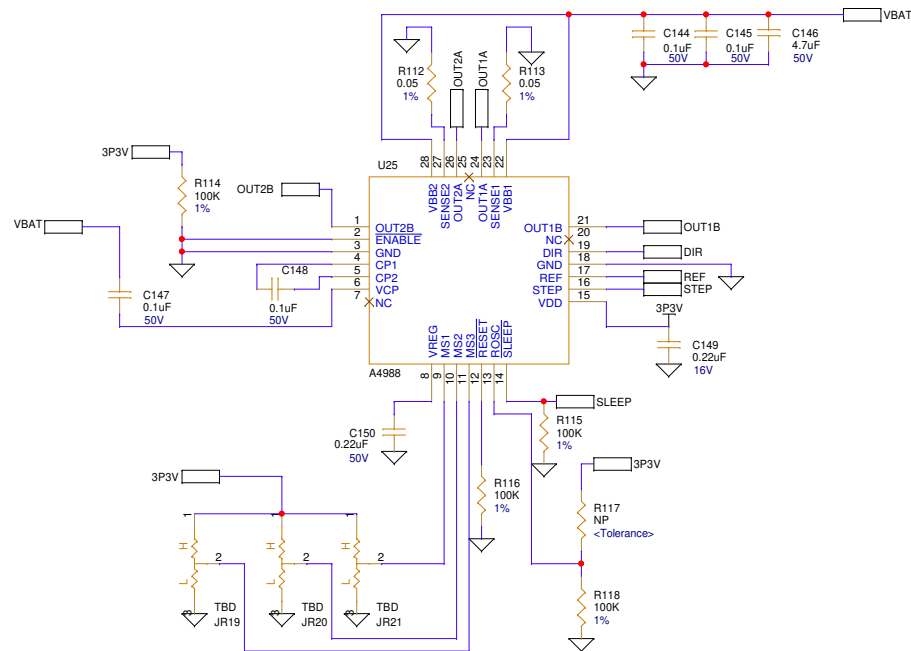
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Project Name: ESP Sampler	Group Name: ESPSampler	Designer: <Designer>	
System: ESP Sampler	Subsystem: Aquatic Sampler Controller	Last Updated By: alana	
Drawing Number: 100222163	Release: A	Version: 23	Status: Active
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 Monterey Bay Aquarium Research Institute 7700 Sandholdt Road, Moss Landing, CA 95039		Schematic Name: Pololu Motor Drives	
		Page Title: Pololu A4988	Engineer: Alana Sherman
Project Name: ESP Sampler	Group Name: ESPSampler	Designer: <Designer>	
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Drawing Number: 100222163	Release: A	Version: 23	Status: Active
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 Monterey Bay Aquarium Research Institute 7700 Sandholdt Road, Moss Landing, CA 95039				Schematic Name: Pololu Motor Drives			
				Page Title: Pololu A4988		Engineer: Alana Sherman	
Project Name: ESP Sampler		Group Name: ESPSampler		Designer: <Designer>		Last Updated By: alana	
System: ESP Sampler		Subsystem: Aquatic Sampler Controller		Status: Active		Size: B	
Drawing Number: 100222163		Release: A		Version: 23		Sheet 34 of 36	
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 Monterey Bay Aquarium Research Institute 7700 Sandholdt Road, Moss Landing, CA 95039		Schematic Name: Pololu Motor Drives	
		Page Title: Pololu A4988	Engineer: Alana Sherman
		Project Name: ESP Sampler	Group Name: ESP Sampler
		System: ESP Sampler	Subsystem: Aquatic Sampler Controller
Drawing Number: 100222163		Release: A	Version: 23
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		Status: Active	Size: B
		Sheet 35 of 35	