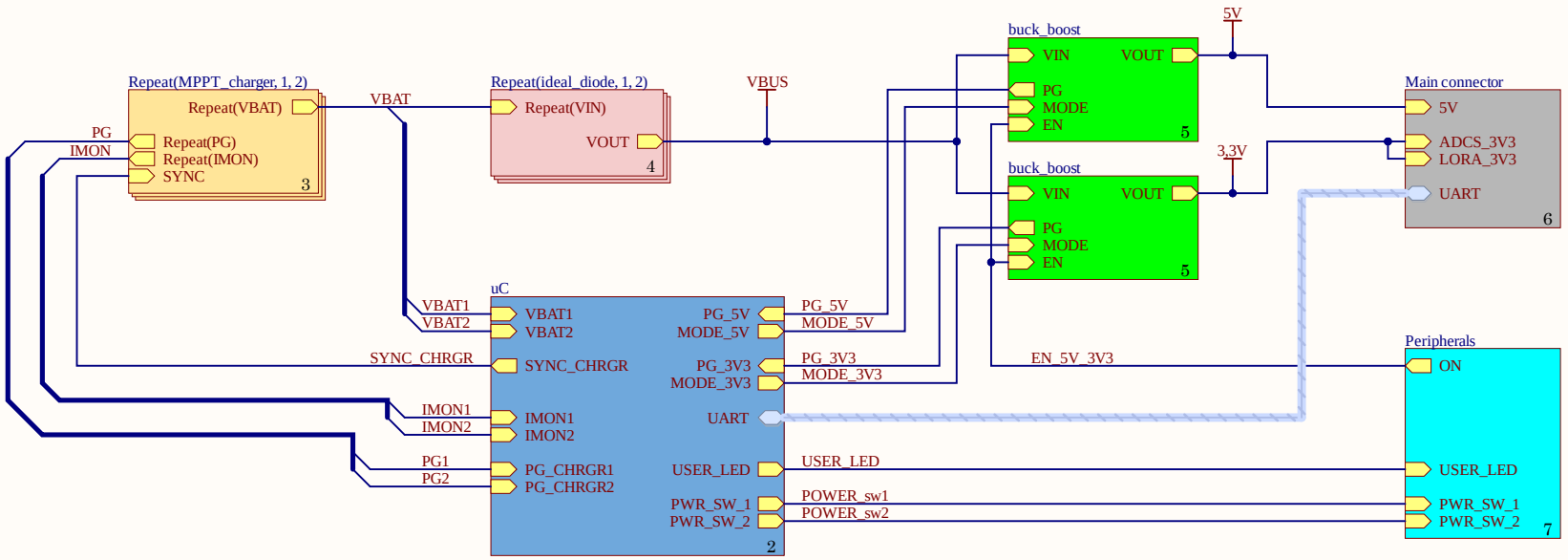
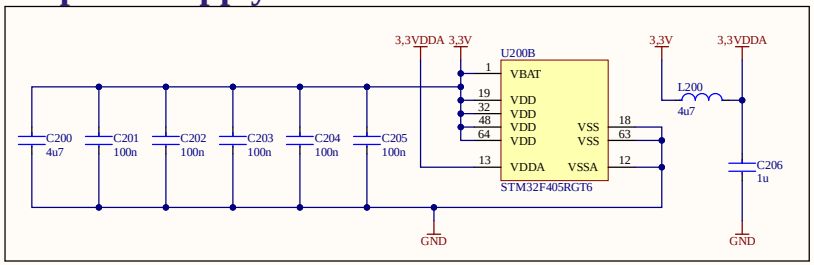
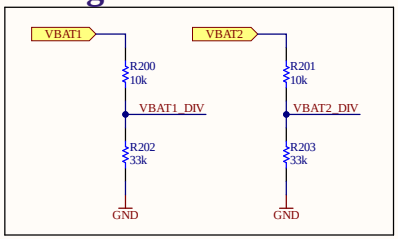


Title	Electrical Power System	
Size: A4	Number:	Revision: 0.1
Date: 10/27/2024		Sheet of EPS_board
File: D:\tmp\CubeSat-EPS\pcb\EPS.SchDoc		Drawn By: Dominik Pluta

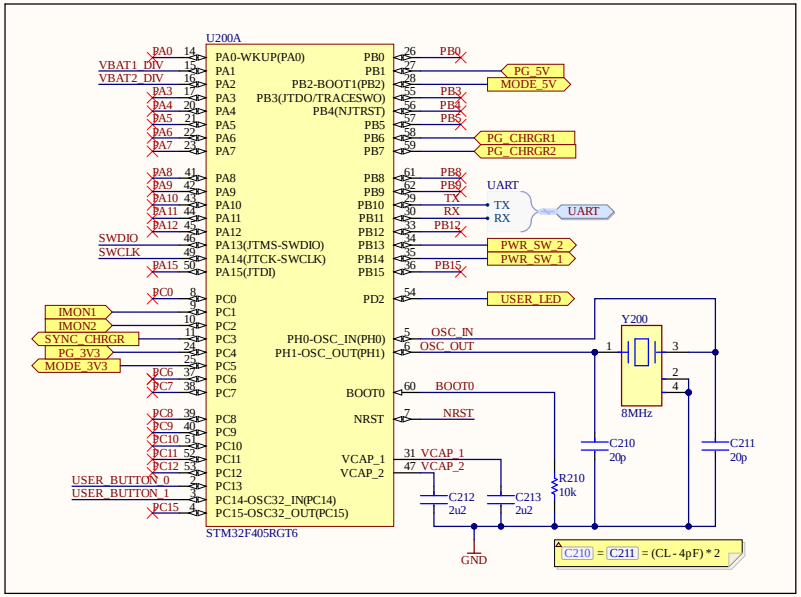
uC power supply



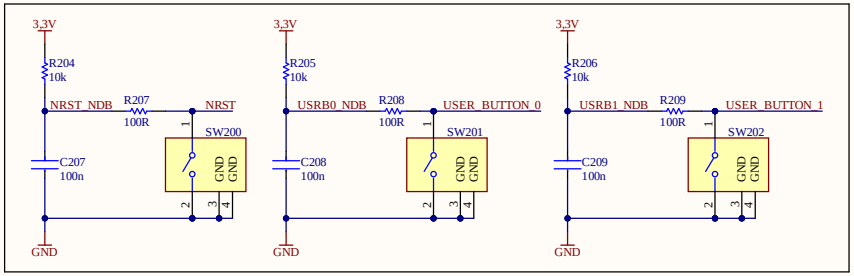
Voltage divider



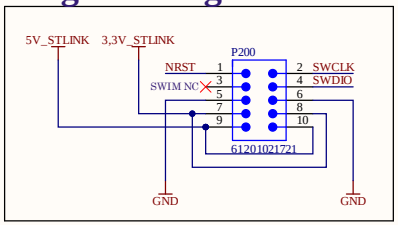
uC



Reset & user buttons



Programming connector



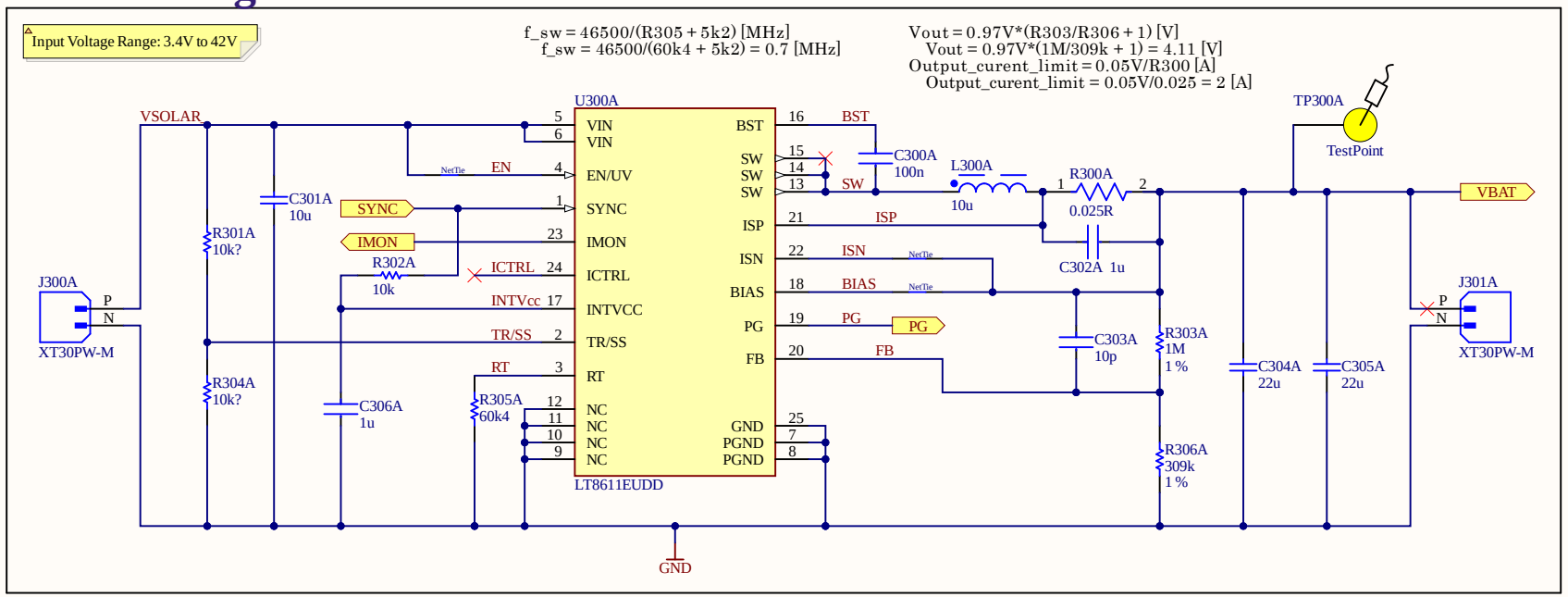
Title: Microcontroller		
Size: A3	Number:	Revision: 0.1
Date: 10/27/2024		Sheet of: EPS_board
File: D:\tmp\CubeSat-EPS\pcb\uC.SchDoc		Drawn By: Dominik Pluta

SYNC (Pin 1): External Clock Synchronization Input. Ground this pin for low ripple Burst Mode operation at low output loads. Tie to a clock source for synchronization to an external frequency. Apply a DC voltage of 3V or higher or tie to INTVCC for pulse-skipping mode. When in pulseskipping mode, the IQ will increase to several hundred µA. When SYNC is DC high or synchronized, frequency foldback will be disabled. Do not float this pin.

IMON (Pin 23): Proportional-to-Current Monitor Output. This pin sources a voltage 20 times the voltage between the ISP and ISN pins such that:
VIMON = 20 • (VISP-VISN).

TO DO:
- calculate R301, R304
-choose specific RC components

MPPT charger 4.1V 2A



https://www.analog.com/en/resources/technical-articles/high-efficiency-solar-mppt-battery-charger-using-lt8611-and-ad5245.html

Title	MPPT CC CV charger		
Size	Number		Revision
A4			0.1
Date:	10/27/2024	Sheet of	EPS_board
File:	D:\tmp\..\MPPT_charger.SchDoc	Drawn By:	Dominik Pluta

TO DO:
- calculate R301, R304
-choose specific RC components

SYNC (Pin 1): External Clock Synchronization Input. Ground this pin for low ripple Burst Mode operation at low output loads. Tie to a clock source for synchronization to an external frequency. Apply a DC voltage of 3V or higher or tie to INTVCC for pulse-skipping mode. When in pulseskipping mode, the IQ will increase to several hundred µA. When SYNC is DC high or synchronized, frequency foldback will be disabled. Do not float this pin.

IMON (Pin 23): Proportional-to-Current Monitor Output. This pin sources a voltage 20 times the voltage between the ISP and ISN pins such that:
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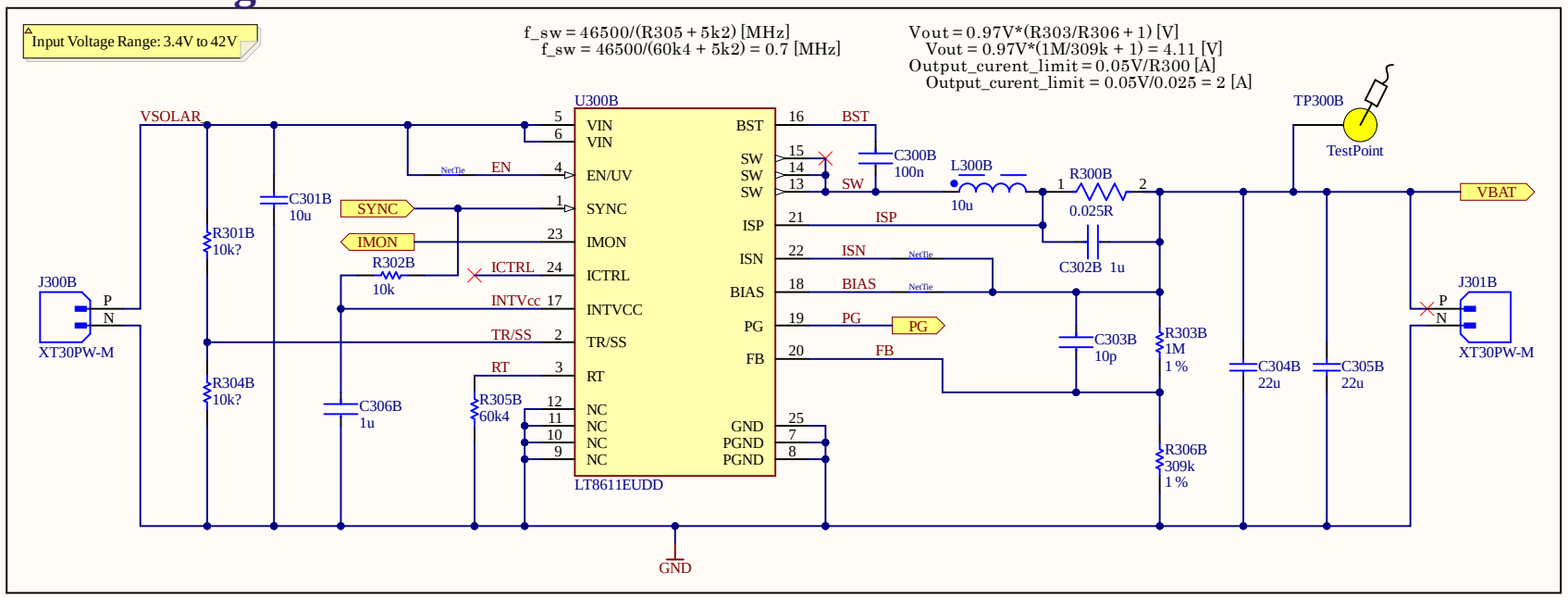
MPPT charger 4.1V 2A



https://www.analog.com/en/resources/technical-articles/high-efficiency-solar-mppt-battery-charger-using-lt8611-and-ad5245.html

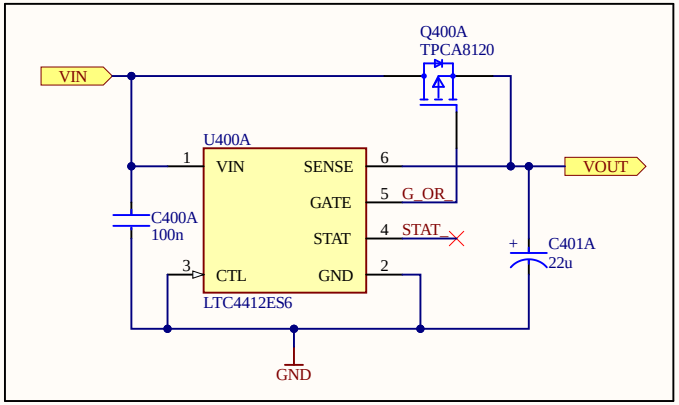
Title	MPPT CC CV charger	
Size: A4	Number:	Revision: 0.1
Date: 10/27/2024		Sheet of EPS_board
File: D:\tmp\..\MPPT_charger.SchDoc		Drawn By: Dominik Pluta

MOSFET Selection

If the MOSFET is grossly undersized, it can enter the saturation region and a large VDS may result. However, the drain-source diode of the MOSFET, if forward biased, will limit VDS. A large VDS, combined with the load current, will likely result in excessively high MOSFET power dissipation. Keep in mind that the LTC4412 will regulate the forward voltage drop across the primary MOSFET at 20mV if RDS(ON) is low enough. The required RDS(ON) can be calculated by dividing 0.02V by the load current in amps.

max_Rds(on) = 0.02V/5A = 4mΩ

Ideal diode 5A



The LTC®4412 controls an external P-channel MOSFET to create a near ideal diode function for power switchover or load sharing. This permits highly efficient OR'ing of multiple power sources.
When conducting, the voltage drop across the MOSFET is typically 20mV.

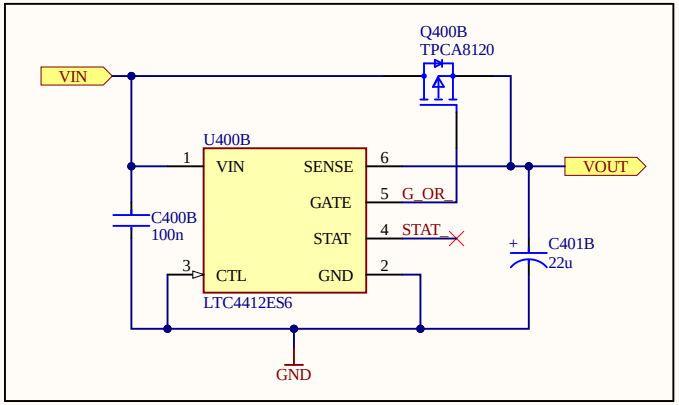
Title	Ideal diode		
Size: A4	Number:	Revision: 0.1	
Date: 10/27/2024		Sheet of EPS_board	
File: D:\tmp\..\ideal_diode.SchDoc		Drawn By: Dominik Pluta	

MOSFET Selection

If the MOSFET is grossly undersized, it can enter the saturation region and a large VDS may result. However, the drain-source diode of the MOSFET, if forward biased, will limit VDS. A large VDS, combined with the load current, will likely result in excessively high MOSFET power dissipation. Keep in mind that the LTC4412 will regulate the forward voltage drop across the primary MOSFET at 20mV if RDS(ON) is low enough. The required RDS(ON) can be calculated by dividing 0.02V by the load current in amps.

max_Rds(on) = 0.02V/5A = 4mΩ

Ideal diode 5A



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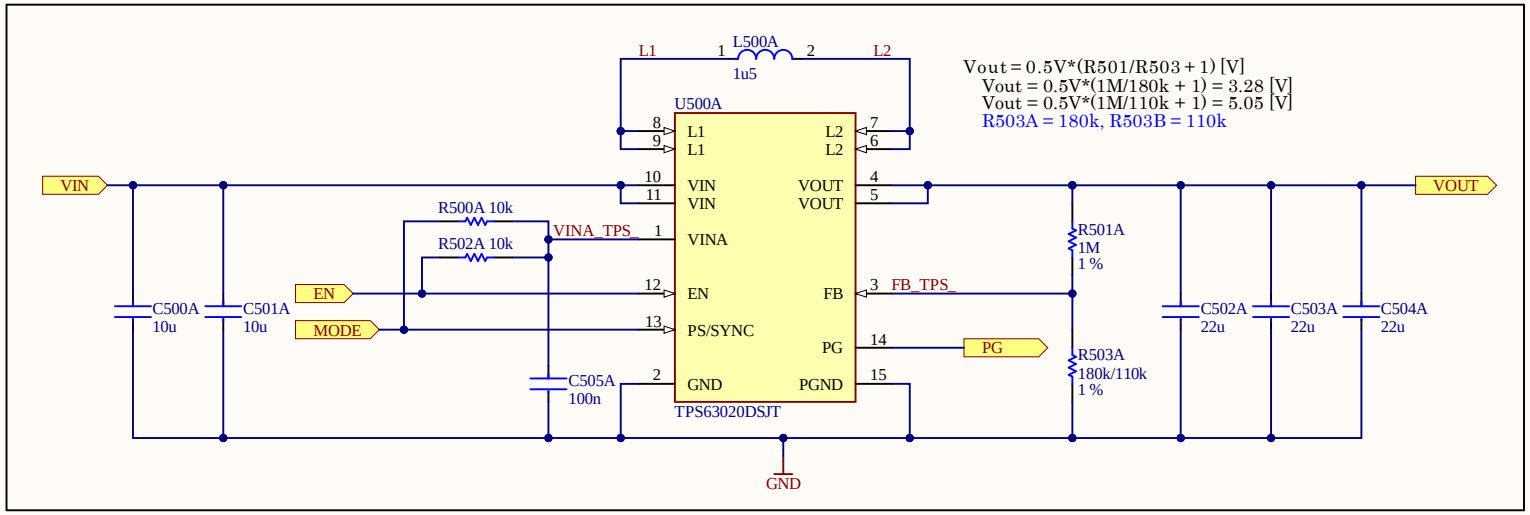
When conducting, the voltage drop across the MOSFET is typically 20mV.

Title	Ideal diode		
Size: A4	Number:	Revision: 0.1	
Date: 10/27/2024		Sheet of EPS_board	
File: D:\tmp\..\ideal_diode.SchDoc		Drawn By: Dominik Pluta	

PS/SYNC (Pin 13): can be used to select different operation modes. Power save mode is used to improve efficiency at light load. To enable power-save, PS/SYNC must be set low. If PS/SYNC is set low then power save mode is entered when the average inductor current gets lower then about 100 mA. At this point the converter operates with reduced switching frequency and with a minimum quiescent current to maintain high efficiency.

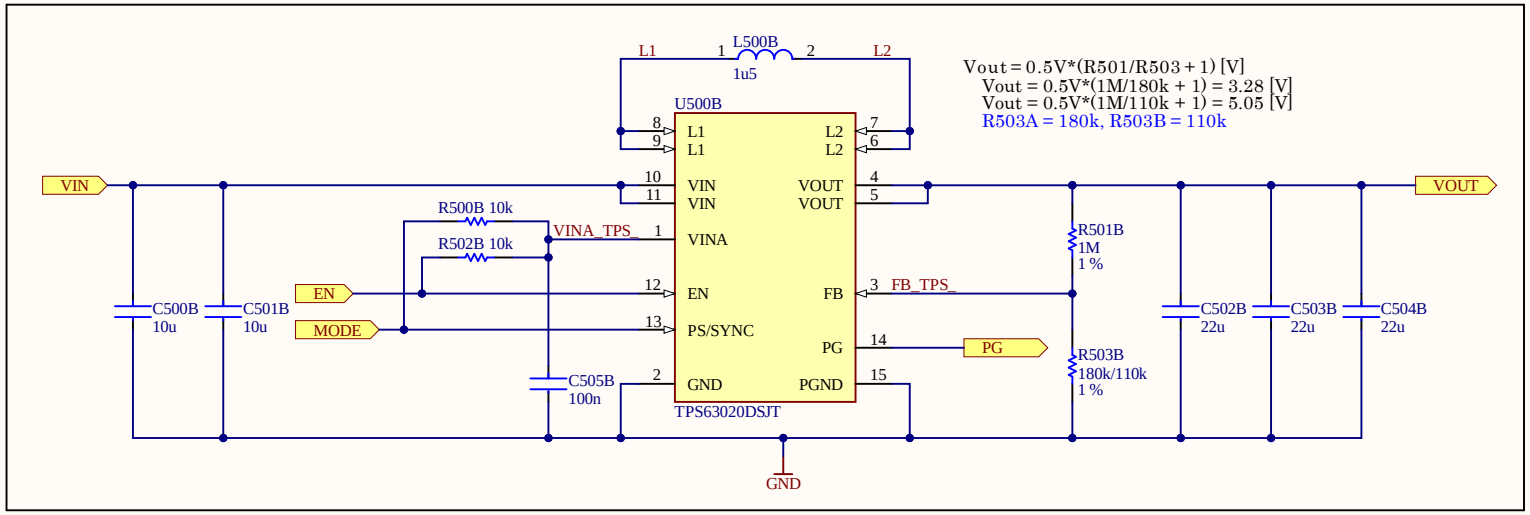
Buck-Boost converter



Title	Buck-Boost Converter		
Size: A4	Number:		Revision: 0.1
Date: 10/27/2024		Sheet of EPS_board	
File: D:\tmp\..\buck_boost.SchDoc		Drawn By: Dominik Pluta	

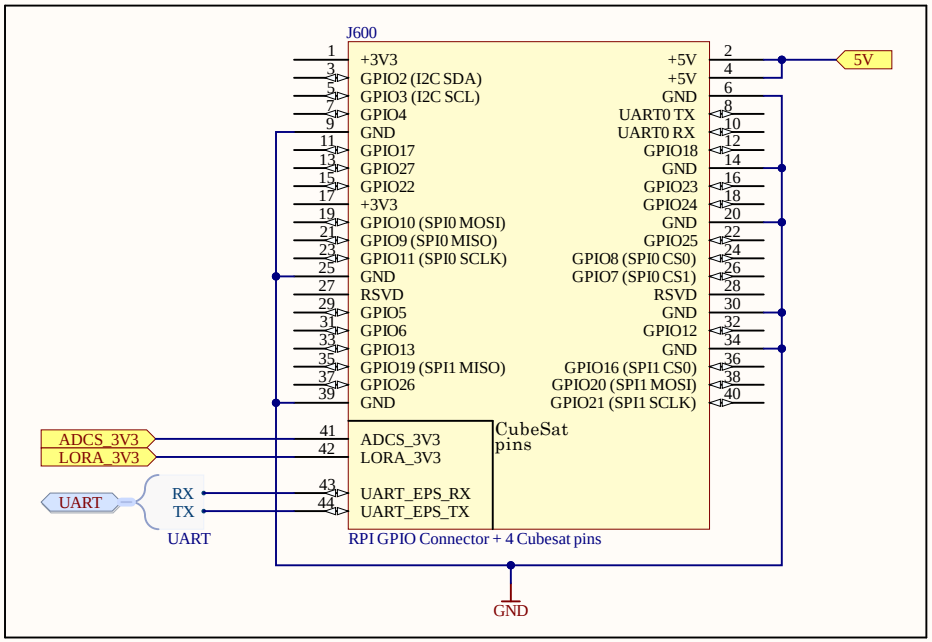
PS/SYNC (Pin 13): can be used to select different operation modes. Power save mode is used to improve efficiency at light load. To enable power-save, PS/SYNC must be set low. If PS/SYNC is set low then power save mode is entered when the average inductor current gets lower then about 100 mA. At this point the converter operates with reduced switching frequency and with a minimum quiescent current to maintain high efficiency.

Buck-Boost converter



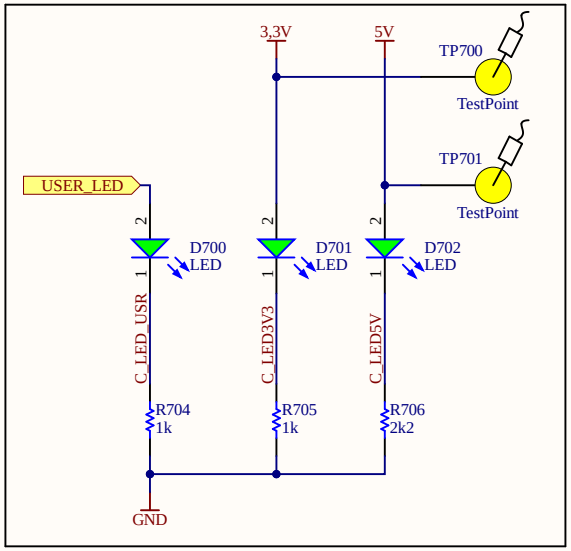
Title	Buck-Boost Converter		
Size: A4	Number:		Revision: 0.1
Date: 10/27/2024		Sheet of EPS_board	
File: D:\tmp\..\buck_boost.SchDoc		Drawn By: Dominik Pluta	

Board-to-board connector

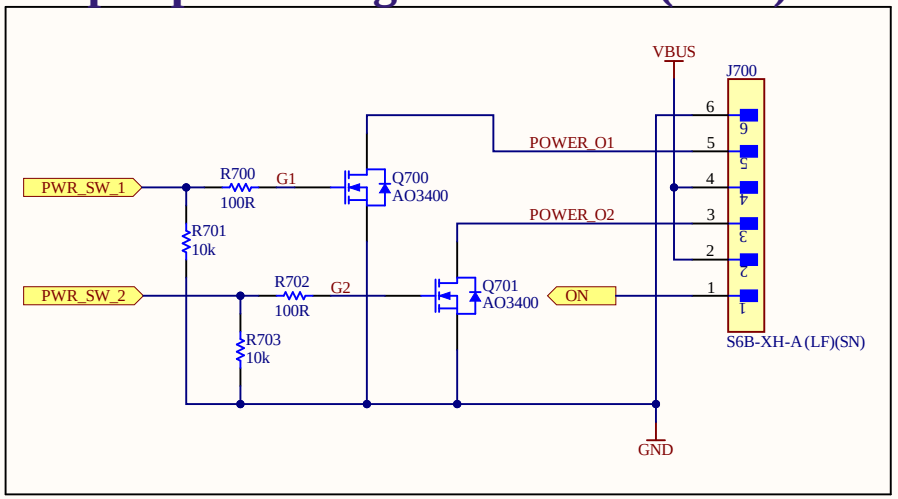


Title	Board-to-board connector		
Size: A4	Number:		Revision: 0.1
Date: 10/27/2024		Sheet of EPS_board	
File: D:\tmp\..\main_connector.SchDoc		Drawn By: Dominik Pluta	

LEDs

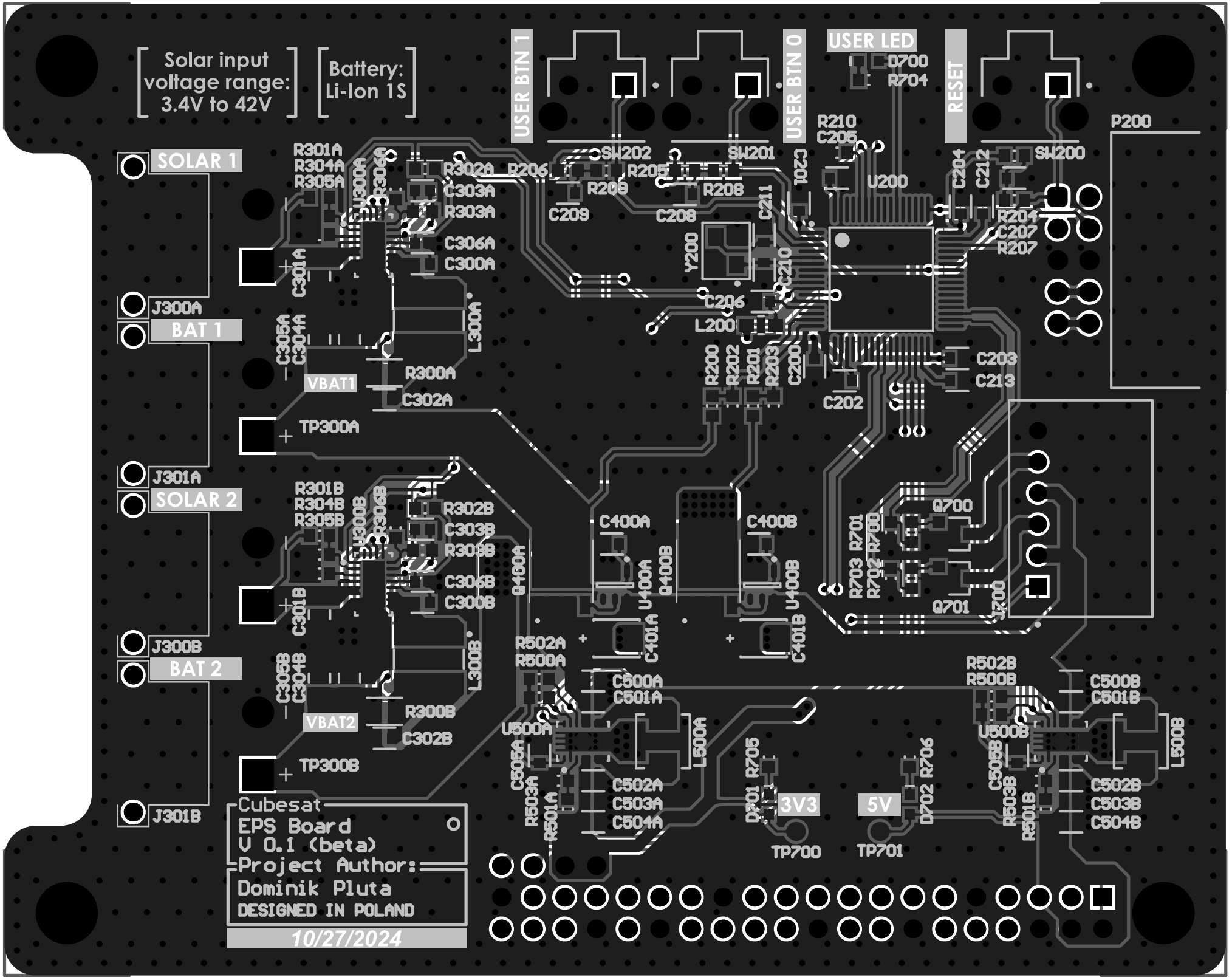


Output power stage and on/off (RBF)



Short pins 1 and 6 to power off the cubesat

Title: LEDs, connector		
Size: A4	Number:	Revision: 0.1
Date: 10/27/2024		Sheet of EPS_board
File: D:\tmp\..\peripherals.SchDoc		Drawn By: Dominik Pluta


Solar input voltage range: 3.4V to 42V
Battery: Li-Ion 1S
USER BTN 1
USER BTN 0
USER LED
RESET
SOLAR 1
J300A
BAT 1
J301A
SOLAR 2
J300B
BAT 2
J301B
VBAT1
VBAT2
TP300A
TP300B
TP700
TP701
3V3
5V
P200
SW200
SW201
SW202
U200
Y200
L200
Q700
Q701
U400A
U400B
U500A
U500B
Cubesat
EPS Board
V 0.1 (beta)
Project Author:
Dominik Pluta
DESIGNED IN POLAND
10/27/2024

Board Stack Report