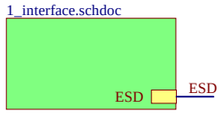
Rev	Description	Date	Author
0.1	- Initial release - Update beacon radio output - General updates for compliance with the SpaceLab hardware development standards	28-Aug-2020	Andre M. P. Mattos

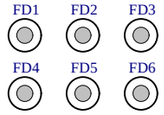
Revision History

PCB

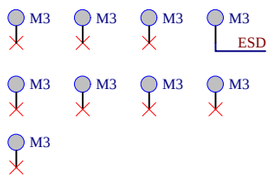
1_interface.schdoc



FIDUTIALS



MECHANICAL HOLES



PCB Elements

EPS2 Hardware:

- Drawn by: André M. P. Mattos (updates from FloripaSat-I EPS)
- Based on FloripaSat-I OBDH designed by: Sara V. Martinez
- Reviewers: Kleber Gouveia and Yan C. Azeredo
- Support: Gabriel M. Marcelino

Project Contributions

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EPS2 Hardware
Based on the FloripaSat-I EPS

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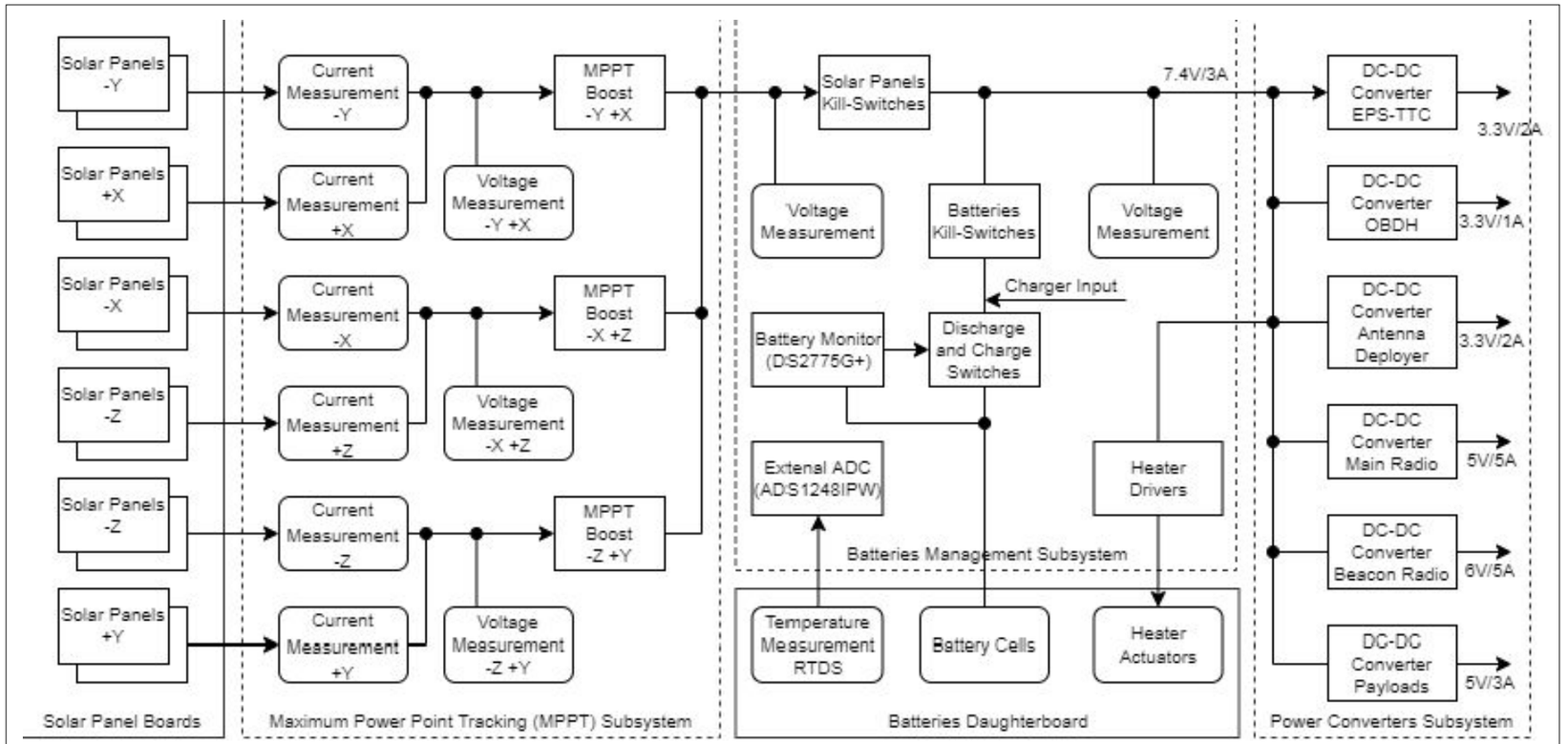
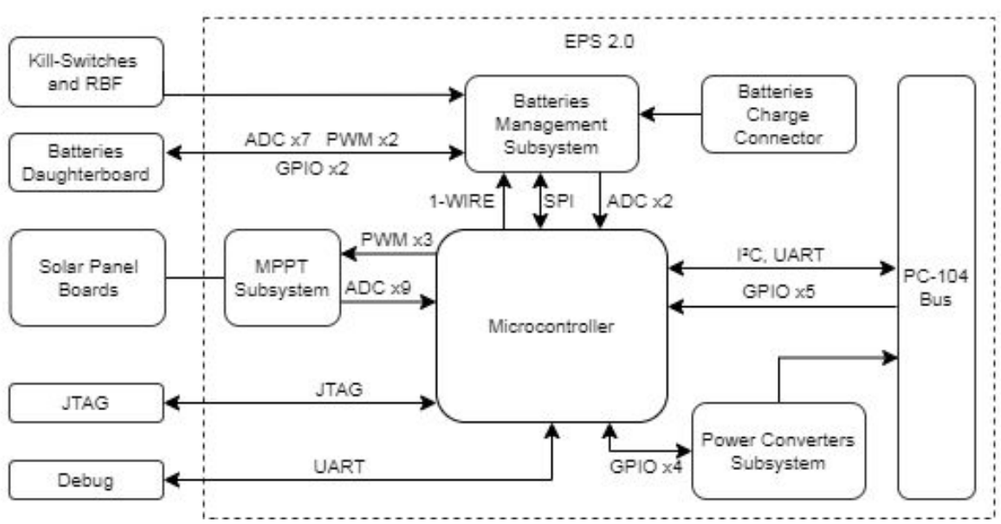
Project Information

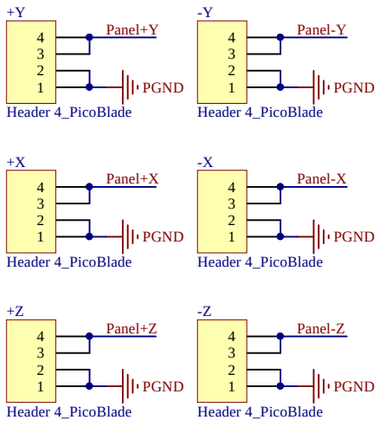




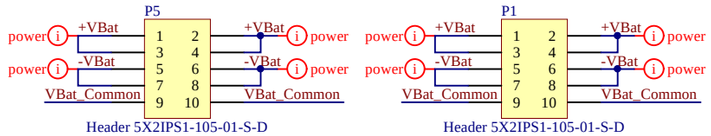
Block Diagram

SpaceLab - Federal University of Santa Catarina			
Project: *eps2_project.prjpcb / [No Variations]*			
Title: *Block diagram*			
Designed by: *Andre M. P. Mattos*			
Date: 31/08/2020	Version: *v0.1*	Sheet *1* of *11*	Size: A3

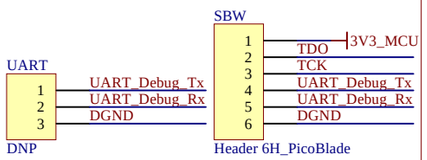
SOLAR PANNELS POWER INTERFACES



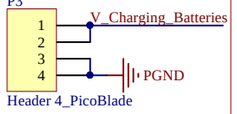
BATTERY BOARD POWER INTERFACES



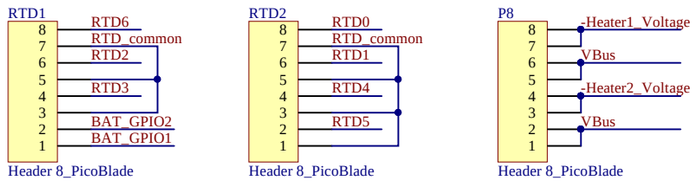
DEBUG AND PROGRAMMING INTERFACES



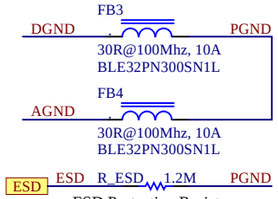
CHARGING BATTERIES CONNECTOR



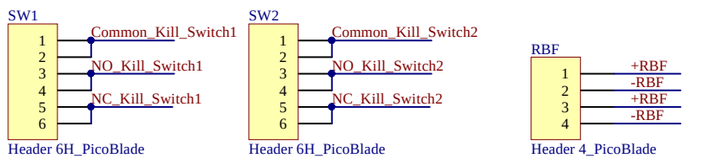
BATTERY BOARD SENSORS AND CONTROL INTERFACES



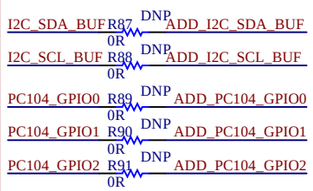
GROUNDING



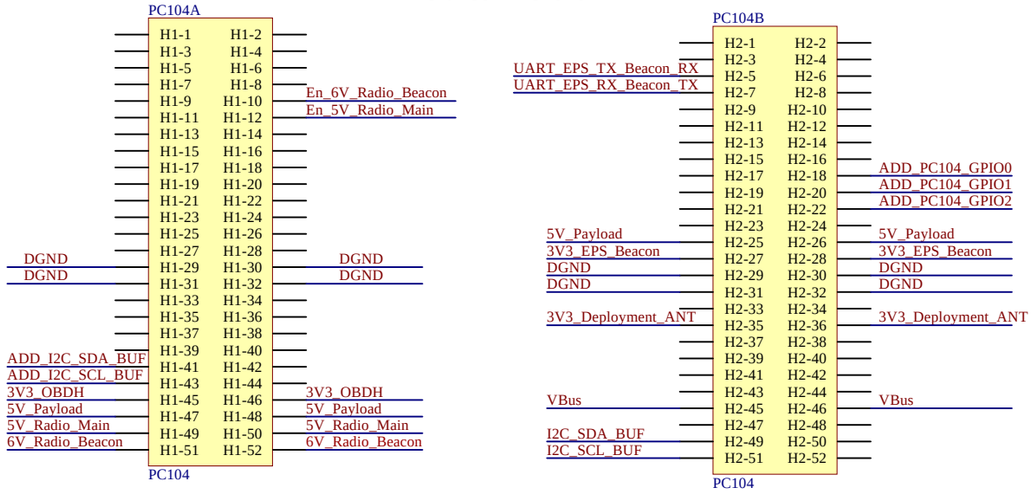
EXTERNAL SWITCHES INTERFACES



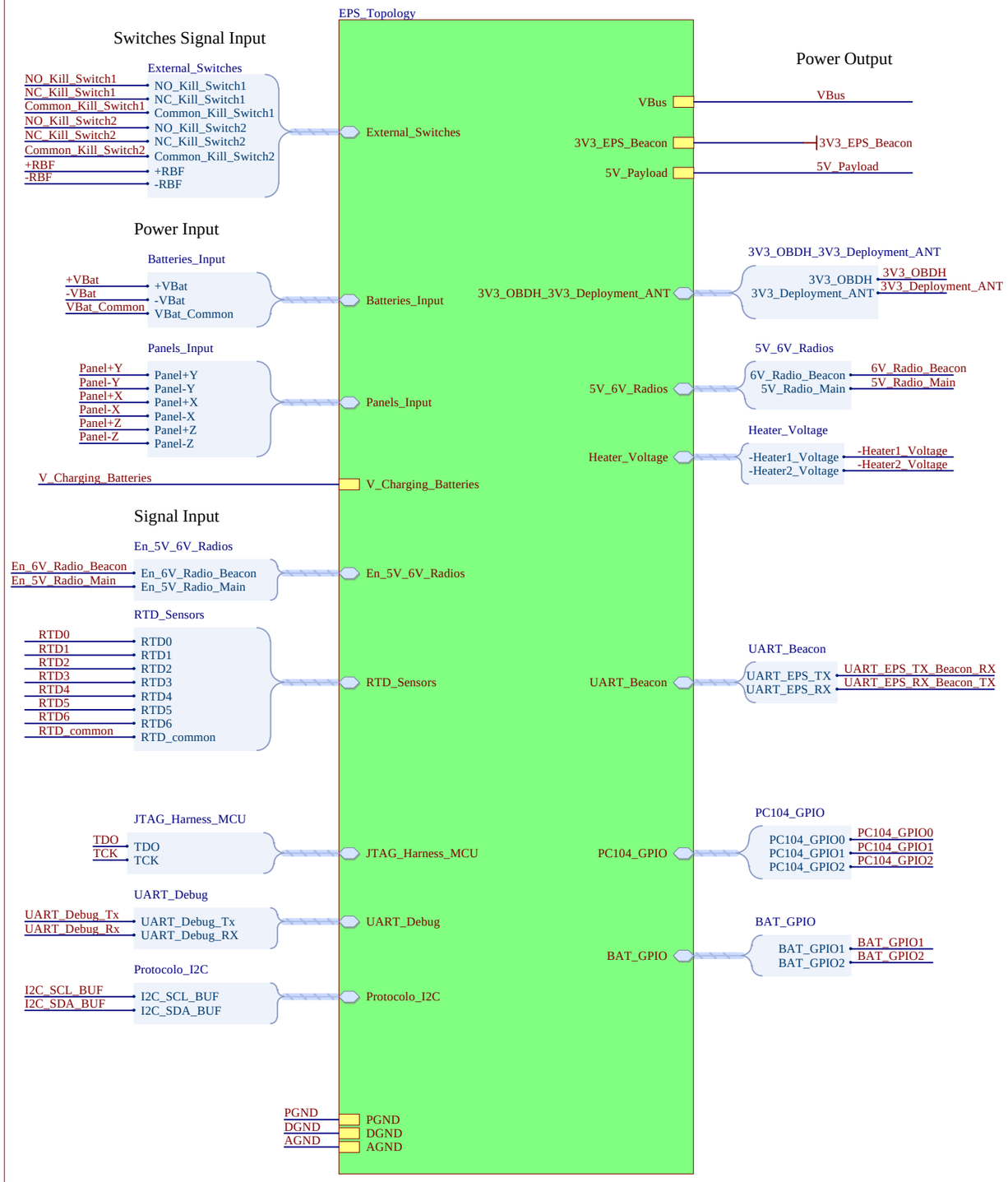
ADDITIONAL INTERFACES



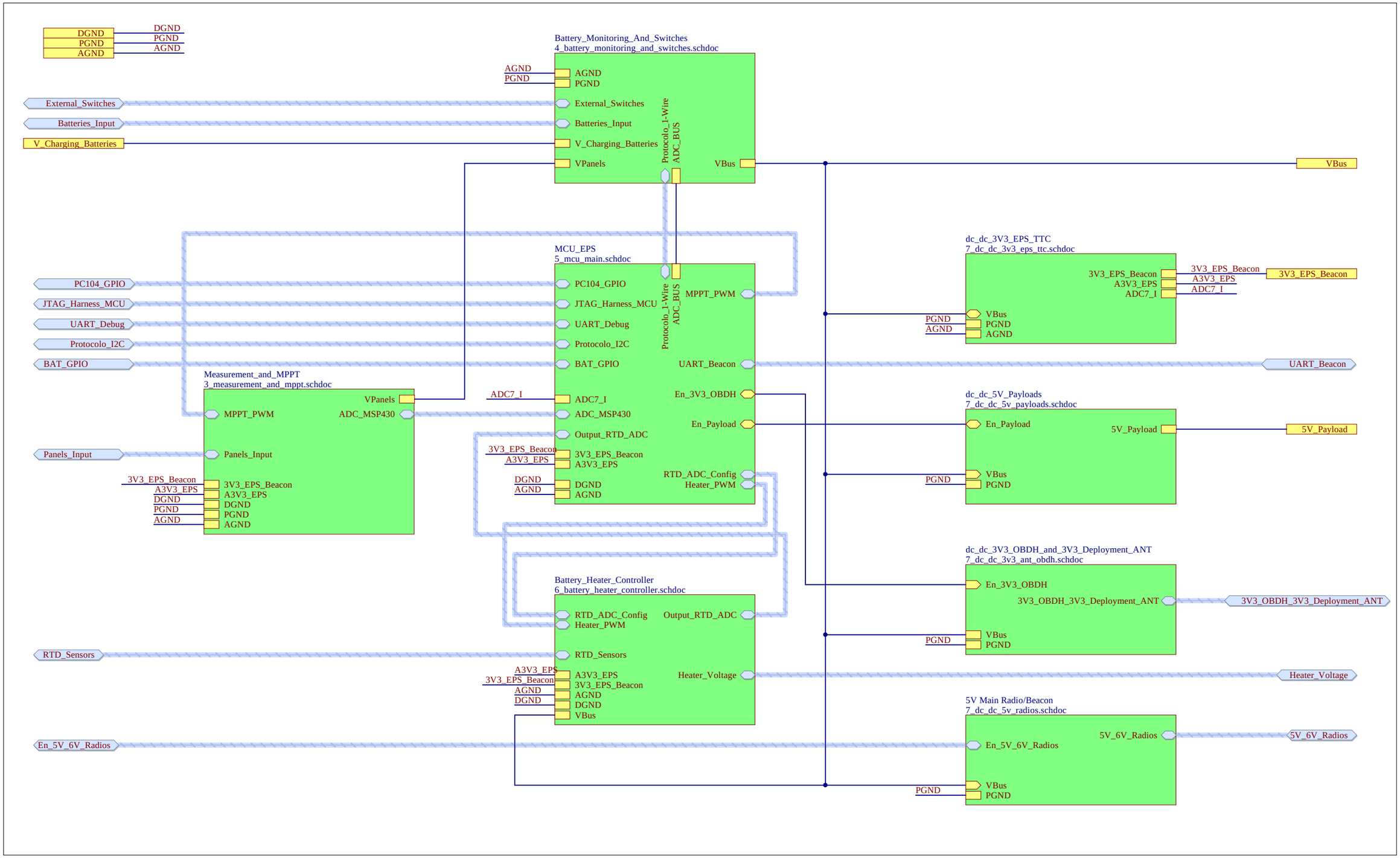
PC104 CONNECTORS



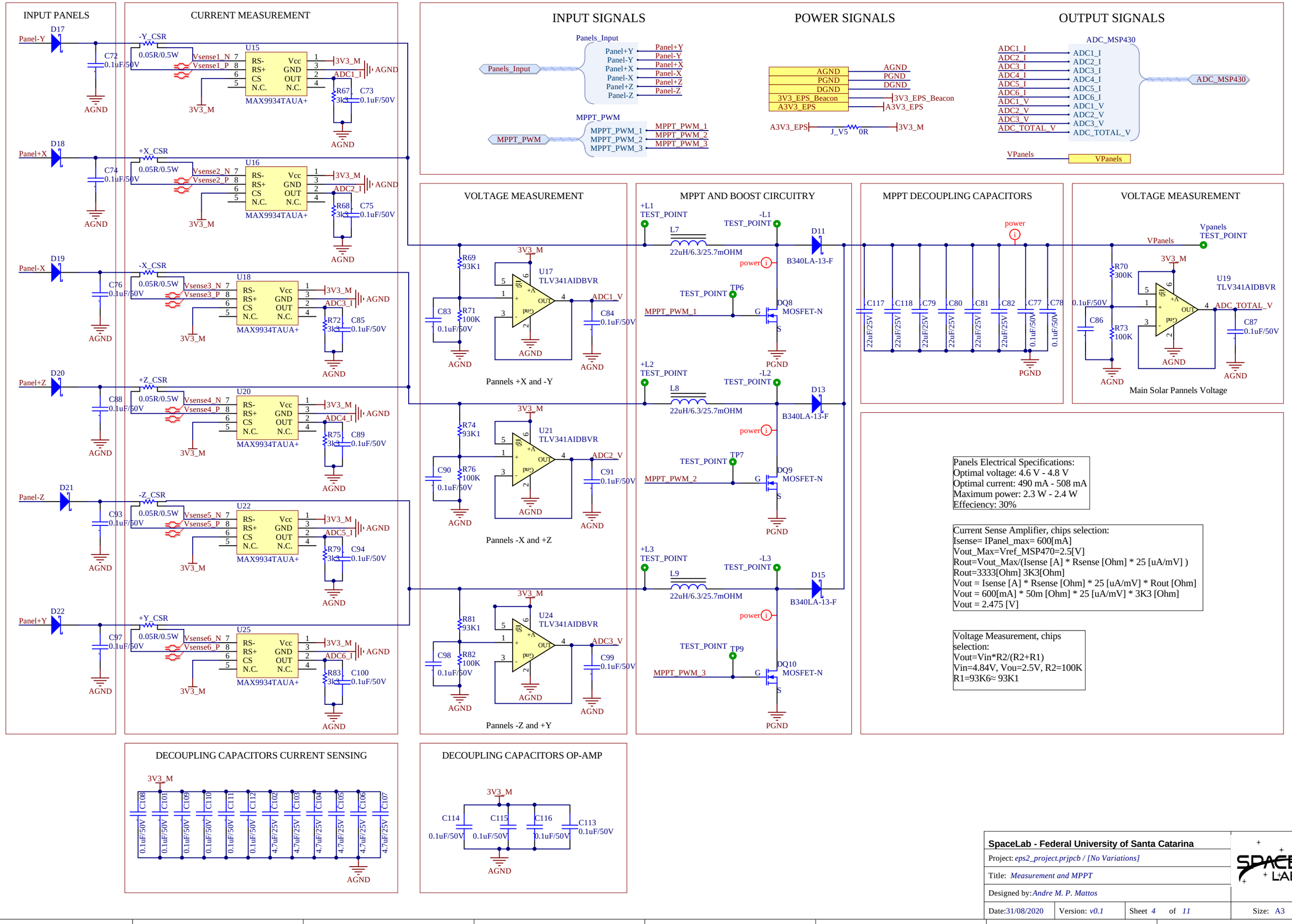
ELECTRICAL POWER SYSTEM TOPOLOGY INTERFACES



SpaceLab - Federal University of Santa Catarina	
Project: *eps2_project.prjpcb / [No Variations]*	
Title: *EPS Interface*	
Designed by: *Andre M. P. Mattos*	
Date: 31/08/2020	Version: *v0.1* | Sheet *2* of *11* | Size: A3

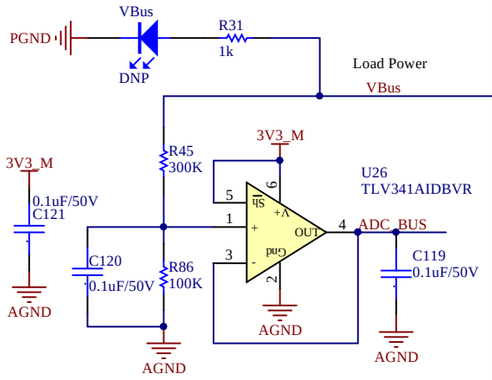


SpaceLab - Federal University of Santa Catarina			
Project: *eps2_project.prjpcb / [No Variations]*			
Title: *EPS Topology*			
Designed by: *Andre M. P. Mattos*			
Date: 31/08/2020	Version: *v0.1*	Sheet *3* of *11*	Size: A3



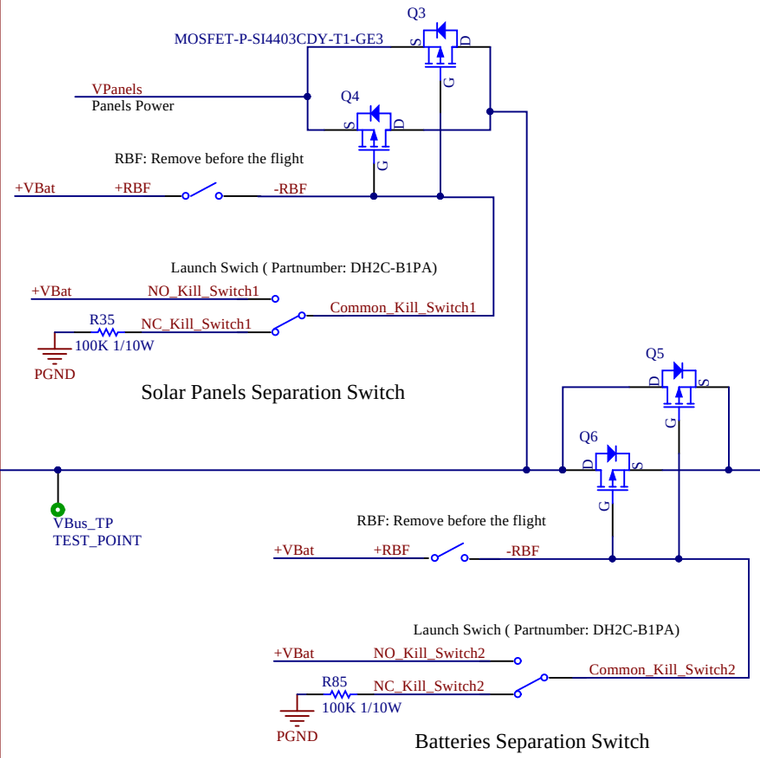
SpaceLab - Federal University of Santa Catarina	
Project: *eps2_project.prjpcb / [No Variations]*	
Title: *Measurement and MPPT*	
Designed by: *Andre M. P. Mattos*	
Date: 31/08/2020	Version: *v0.1* · Sheet *4* of *11* · Size: A3

VOLTAGE MEASUREMENT



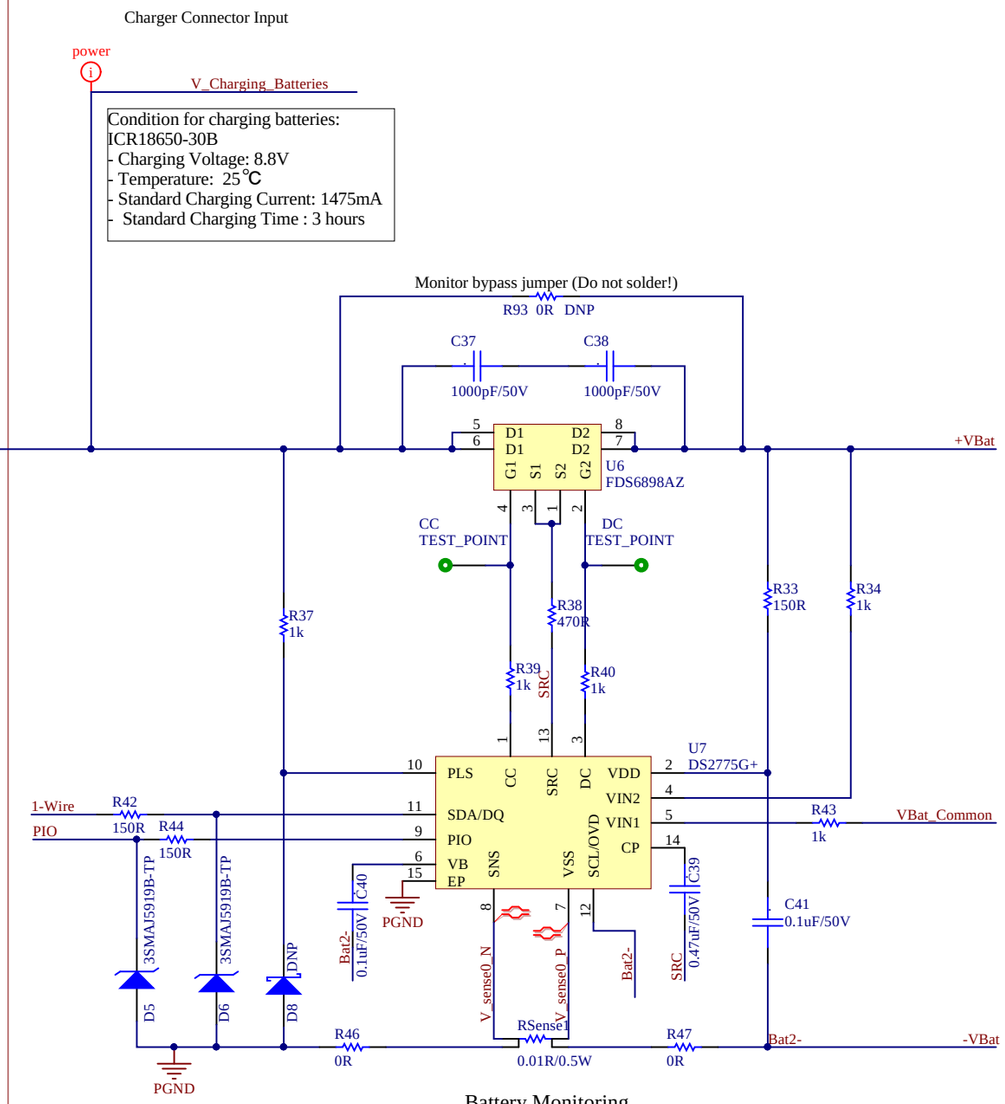
Bus Voltage Measurement, chips selection:
Vout=Vin*R2/(R2+R1)
Vin=10V, Vou=2.5V, R2=100K
R1=300K

SEPARATION SWITCHES



RBF	Switch(NC)	Switch(NO)	MOSFET	EPS POWER
1	X	X	OPEN	Cut-off
0	1	0	CLOSE	ON
0	0	1	OPEN	Cut-off (launch moment)

BATTERY MONITOR CIRCUITRY



Battery Monitoring

Rsenser for battery monitoring:
(Datasheet : DS2775, pag 17)
Rsense=10mOhms (LVK12R010DER)
Current Range: ± 5.12A
ACR Resolution = 625µAh
ACR Range = ±40.96Ah

External_Switches
NO_Kill_Switch1
NC_Kill_Switch1
Common_Kill_Switch1
NO_Kill_Switch2
NC_Kill_Switch2
Common_Kill_Switch2
+RBF
-RBF

Batteries_Input
+VBat
-VBat
VBat_Common

AGND
PGND
V_Charging_Batteries
VPanels

VBus
VBus

Bidirectional

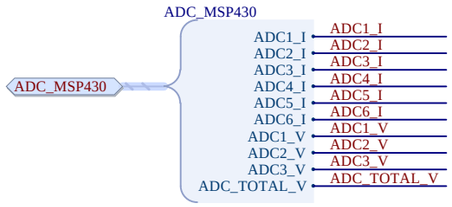
Protocolo_1-Wire
1-Wire
PIO

ADC_BUS
ADC_BUS

SpaceLab - Federal University of Santa Catarina			
Project: *eps2_project.prjpcb / [No Variations]*			
Title: *Batteries Monitor and Power Switches*			
Designed by: *Andre M. P. Mattos*			
Date: 31/08/2020	Version: *v0.1*	Sheet *5* of *11*	Size: A3

MICROCONTROLLER CIRCUITRY (MCU)

ADC_MSP430

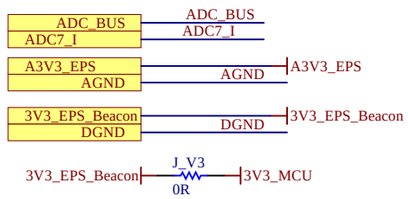


Output_RTD_ADC

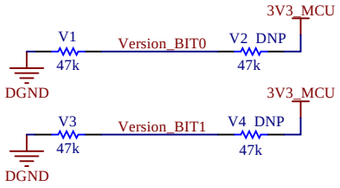
JTAG_Harness_MCU

PC104_GPIO

BAT_GPIO

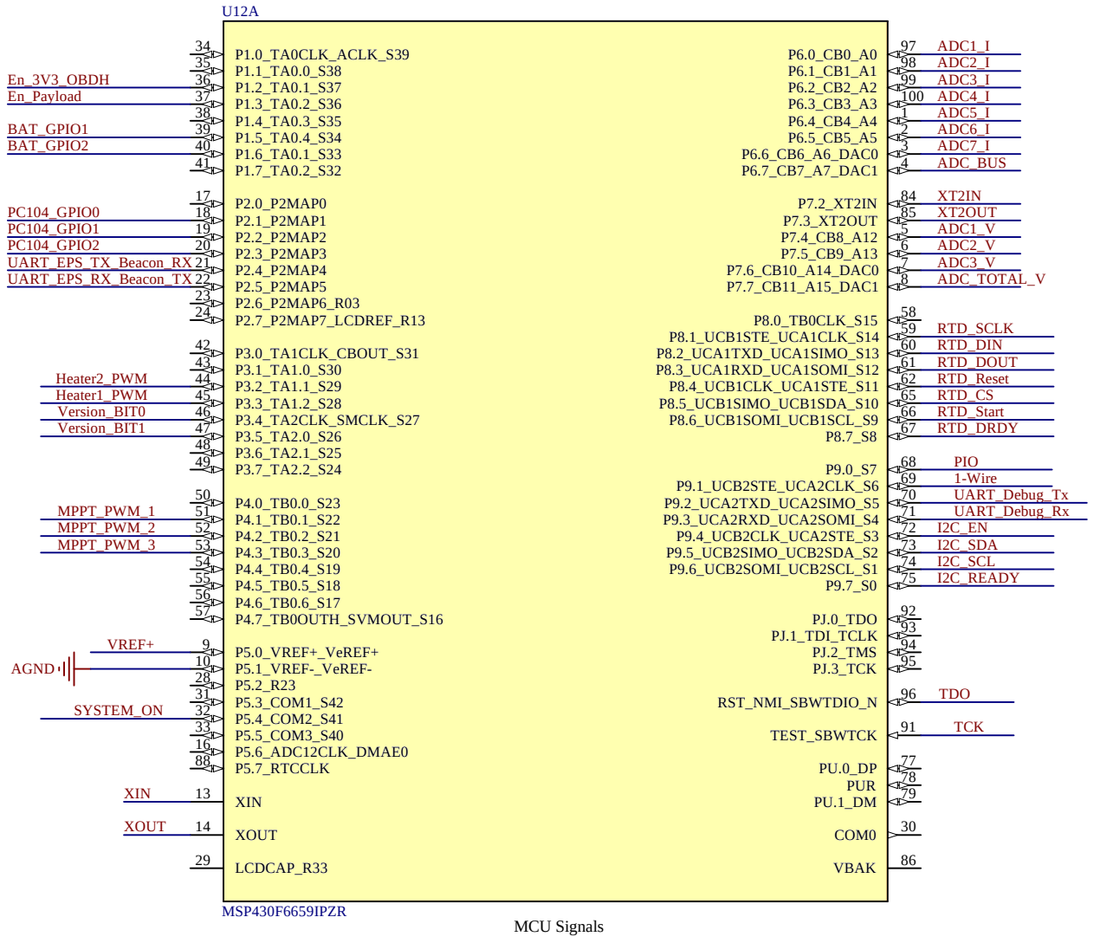


VERSIONING RESISTORS

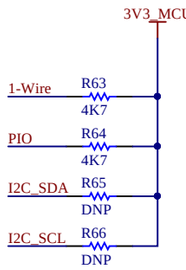


Configuration for version v0.1

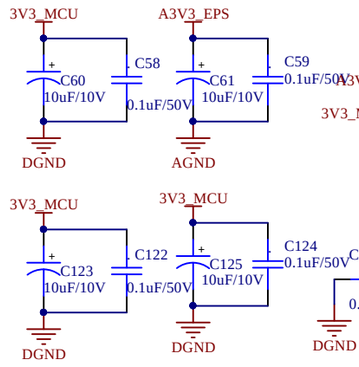
MCU Signals



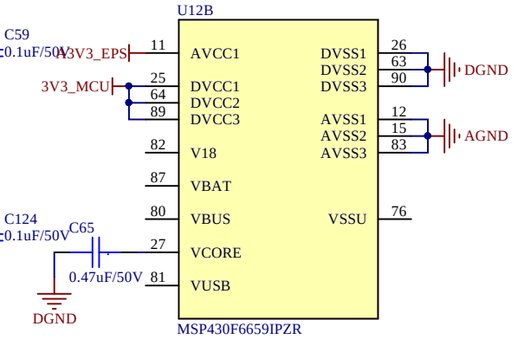
Pullup Resistors



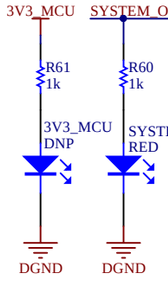
MCU Decoupling Capacitors



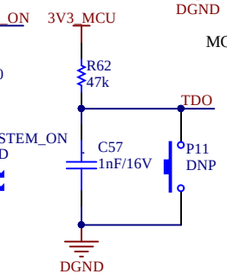
MCU Power



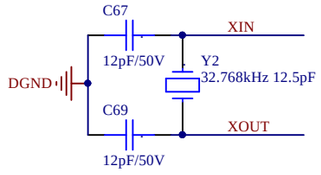
System LEDs



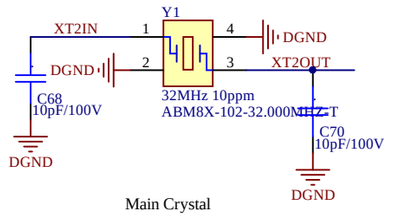
Reset and JTAG pullup



Auxiliary Crystal

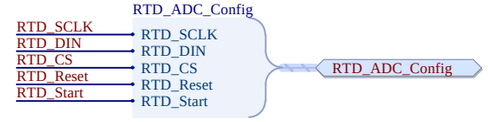


Main Crystal



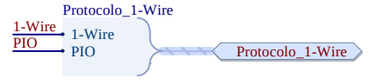
MPPT_PWM

RTD_ADC_Config

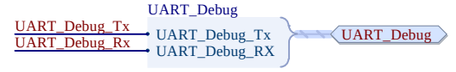


Harness

Protocolo_1-Wire

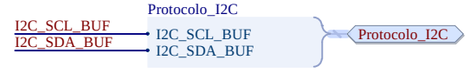


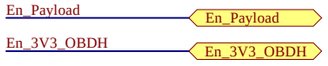
UART_Debug



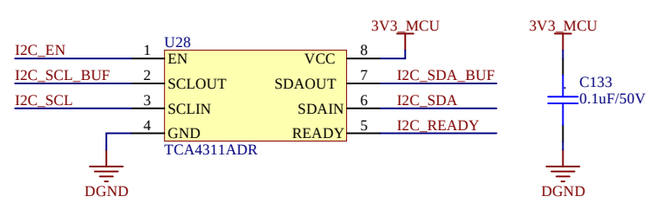
UART_Beacon

Protocolo_I2C

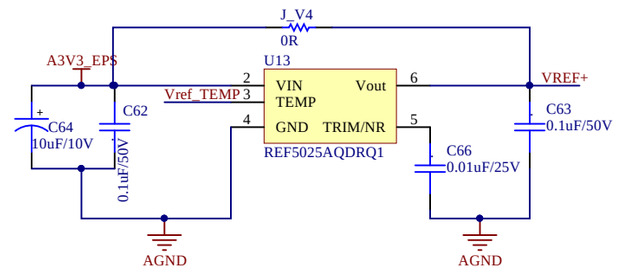




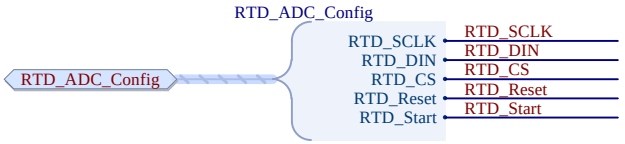
I2C BUFFER CIRCUIT

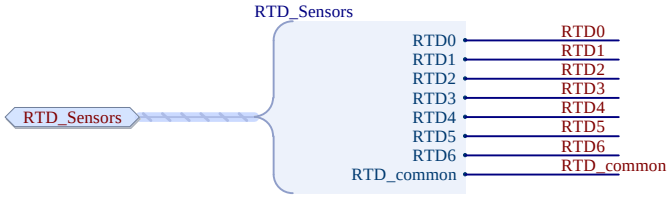


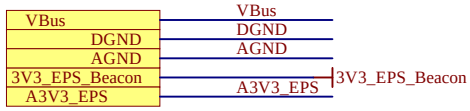
VOLTAGE REFERENCE CIRCUIT

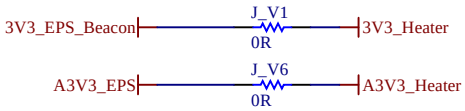


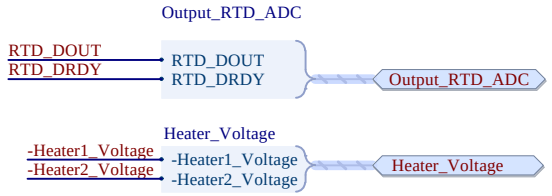
SpaceLab - Federal University of Santa Catarina			
Project: *eps2_project.prjpcb / [No Variations]*			
Title: *EPS MCU Main*			
Designed by: *Andre M. P. Mattos*			
Date: 31/08/2020	Version: *v0.1*	Sheet *6* of *11*	Size: A3



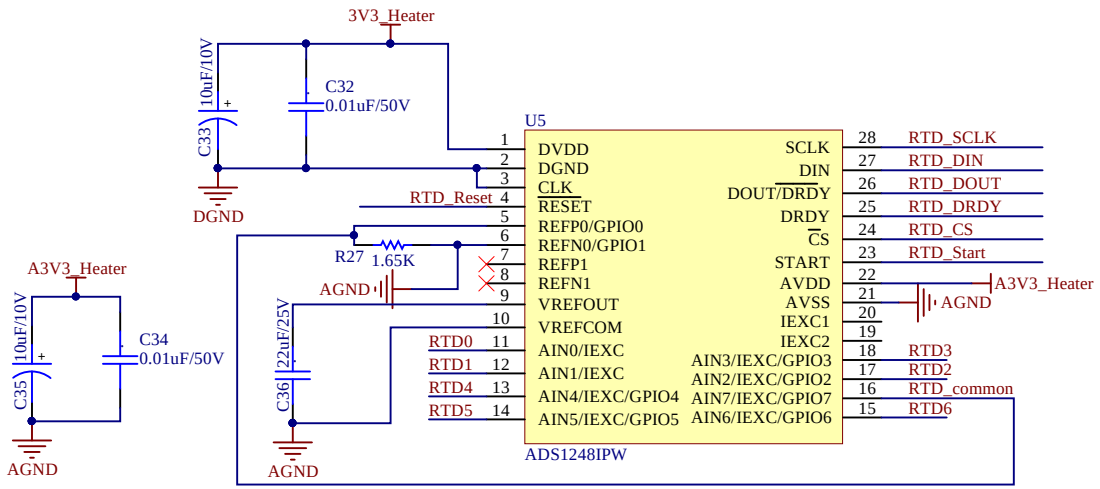








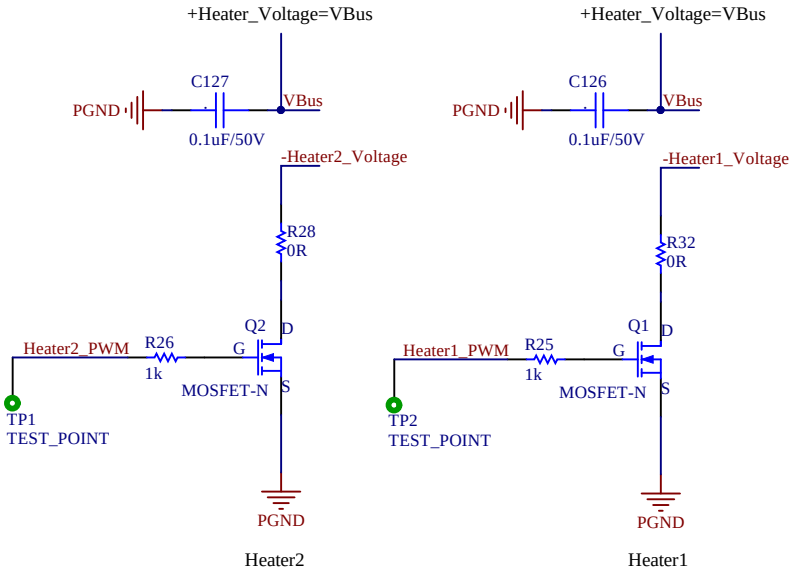
HEATERS SENSORS (RTD)



Decoupling capacitors

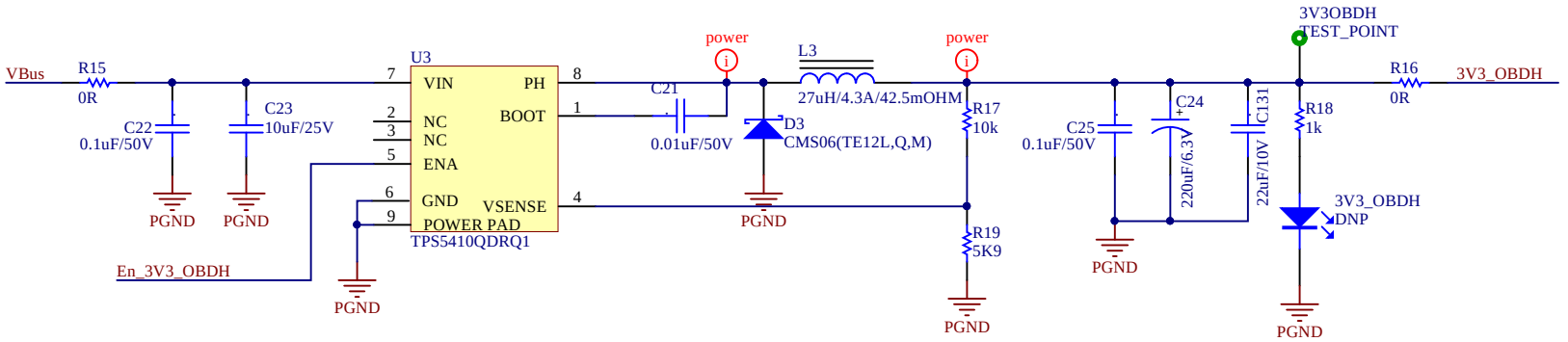
Analog-to-Digital Converter (for temperature acquisition through external thermocouples)

HEATERS ACTUATORS (PWM)



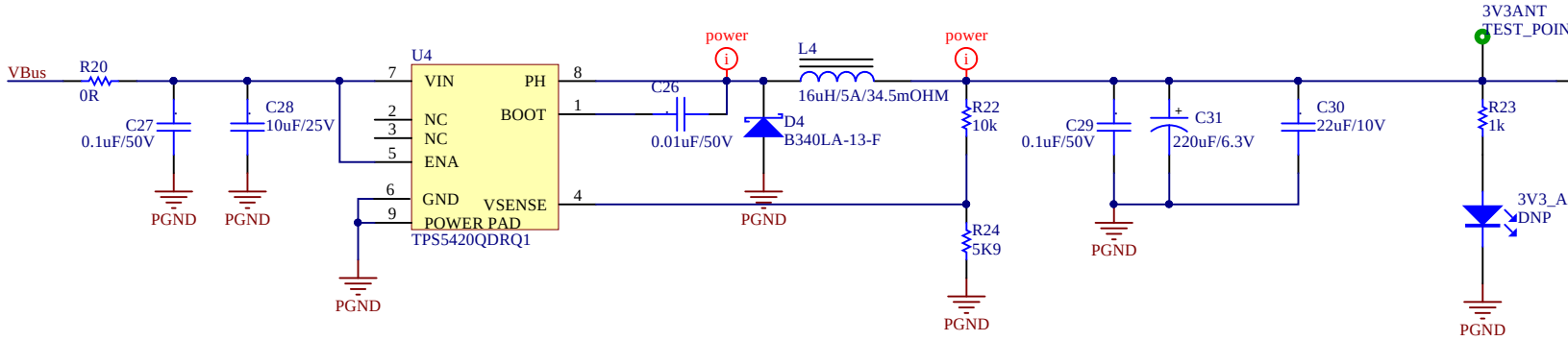
SpaceLab - Federal University of Santa Catarina			
Project: *eps2_project.prjpcb / [No Variations]*			
Title: *Batteries Heater Controller*			
Designed by: *Andre M. P. Mattos*			
Date: 31/08/2020	Version: *v0.1*	Sheet *7* of *11*	Size: A4

OBDH STEP-DOWN CONVERTER 3V3/1A



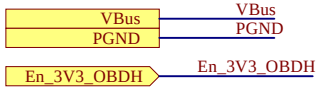
OBDH Digital dc/dc converter 3V3/1A.
Enable from EPS.
Configuration:
VinMin = 6.5V
VinMax = 15.0V
Vout = 3.3V
Iout = 1A
Pd = 0.58W

ANTENNA DEPLOYER STEP-DOWN CONVERTER 3V3/2A



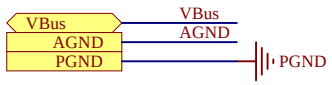
Deployment Antenna Step-Down Converter 3V3/2A.
Configuration:
VinMin =5.5V
VinMax = 15.0V
Vout =3.3V
Iout = 2A
Total Pd =1.08W

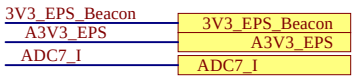
Input



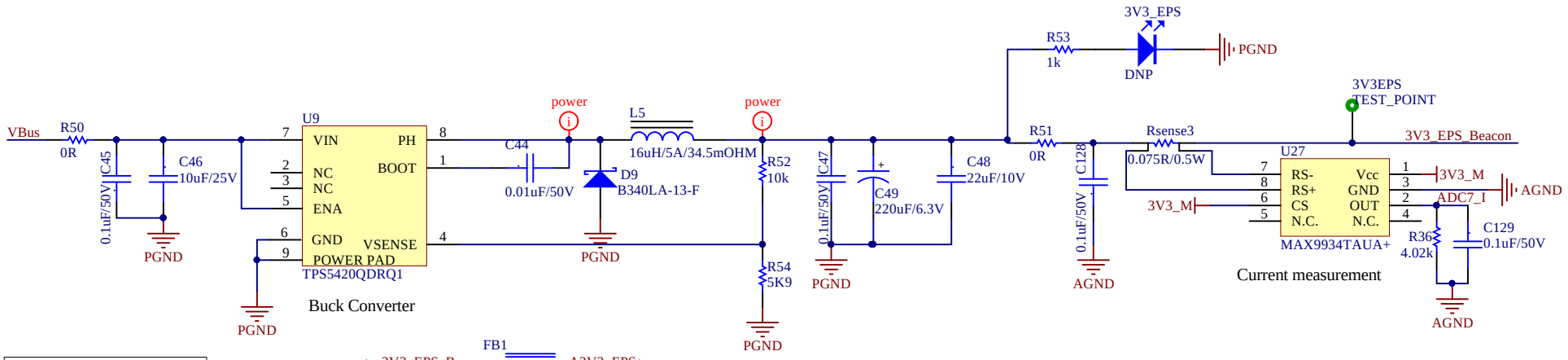
Output

SpaceLab - Federal University of Santa Catarina			
Project: *eps2_project.prjpcb / [No Variations]*			
Title: *OBDH Step-Down 3V3/1A/2A*			
Designed by: *Andre M. P. Mattos*			
Date: 31/08/2020	Version: *v0.1*	Sheet *8* of *11*	Size: A4

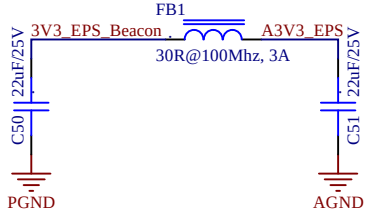




EPS/BEACON STEP-DOWN CONVERTER 3V3/2A

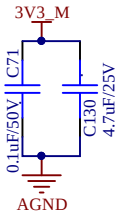


Beacon/EPS Digital dc/dc converter 3V3/2A:
Configuration:
VinMin =5.5V
VinMax = 15V
Vout = 3.3V
Iout = 2A
Footprint = 81.0 mm2
Total Pd = 1.21W



High frequency noise reduction ferrite bread

Current Sense Amplifier, chips selection:
I_EPS_Beacon=300[mA]
Vout_Max=Vref_MSP470=2.5[V]
Rout=Vout_Max/(Isense [A] * Rsense [Ohm] * 25 [uA/mV])
Rout=4065[Ohm] 4.02 k[Ohm]
Vout = Isense [A] * Rsense [Ohm] * 25 [uA/mV] * Rout [Ohm]
Vout = 300[mA] * 82m [Ohm] * 25 [uA/mV] * 4.02 k [Ohm]
Vout = 2.4723 [V]



SpaceLab - Federal University of Santa Catarina			
Project: *eps2_project.prjpcb / [No Variations]*			
Title: *EPS/BCM Step-Down Converter*			
Designed by: *Andre M. P. Mattos*			
Date: 31/08/2020	Version: *v0.1*	Sheet *9* of *11*	Size: A4

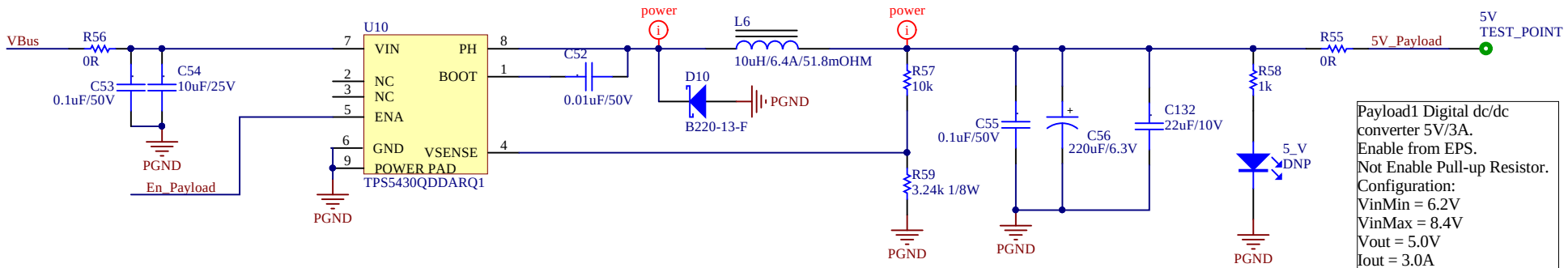
Input

VBus
PGND
En_Payload

Output

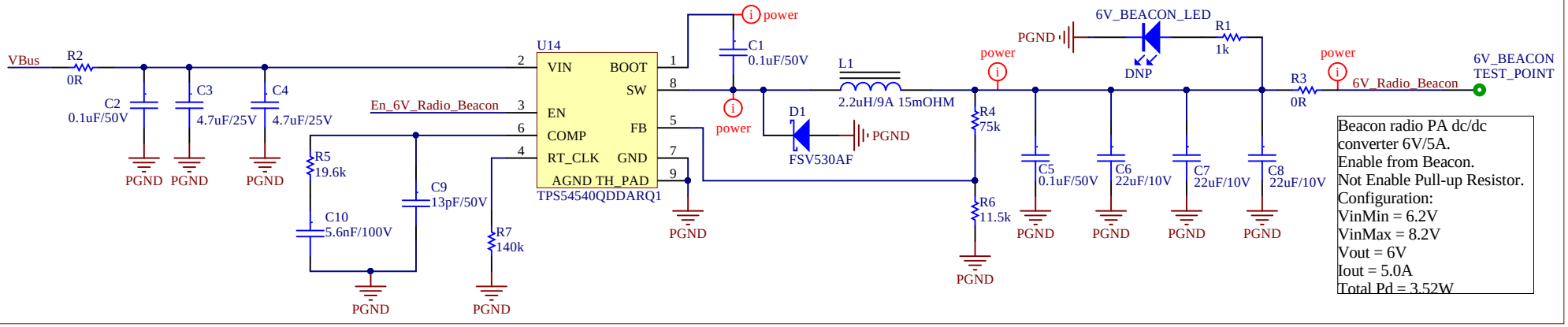
5V_Payload

PAYLOAD STEP-DOWN CONVERTER 5V/3A

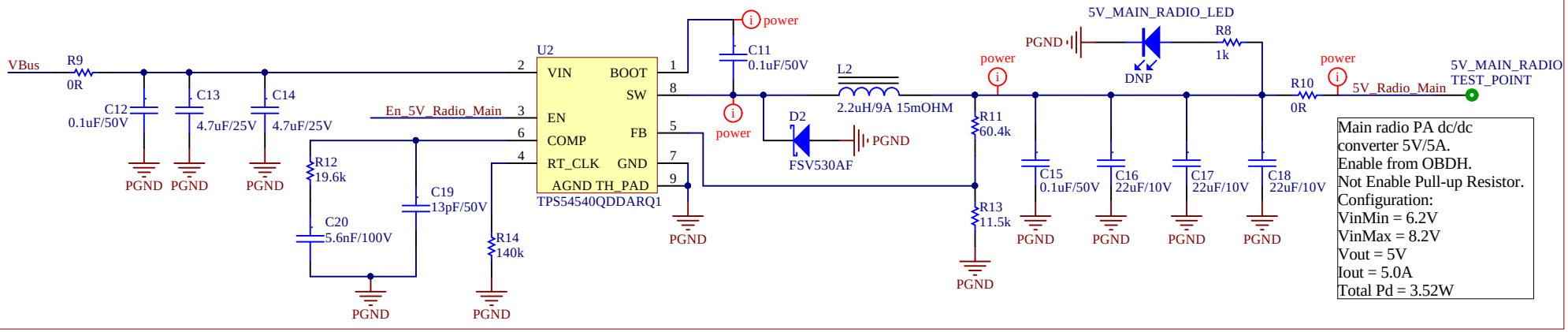


SpaceLab - Federal University of Santa Catarina			
Project: *eps2_project.prjpcb / [No Variations]*			
Title: *Payloads Step-Down Converters 5V/3A*			
Designed by: *Andre M. P. Mattos*			
Date: 31/08/2020	Version: *v0.1*	Sheet *10* of *11*	Size: A4

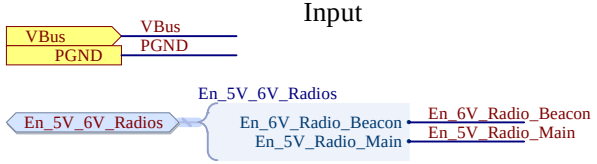
BEACON RADIO STEP-DOWN CONVERTER 6V/5A



MAIN RADIO STEP-DOWN CONVERTER 5V/5A



Input



Output

SpaceLab - Federal University of Santa Catarina			
Project: *eps2_project.prjpcb / [No Variations]*			
Title: *Radios Step-Down Converters 5V/3A*			
Designed by: *Andre M. P. Mattos*			
Date: 31/08/2020	Version: *	Sheet *11* of *11*	Size: A4