Power Distribution System for a CubeSat

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February 27, 2023

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Contents

Objective

To design and implement a fully autonomous power generation, storage and distribution system for a CubeSat

System Architecture

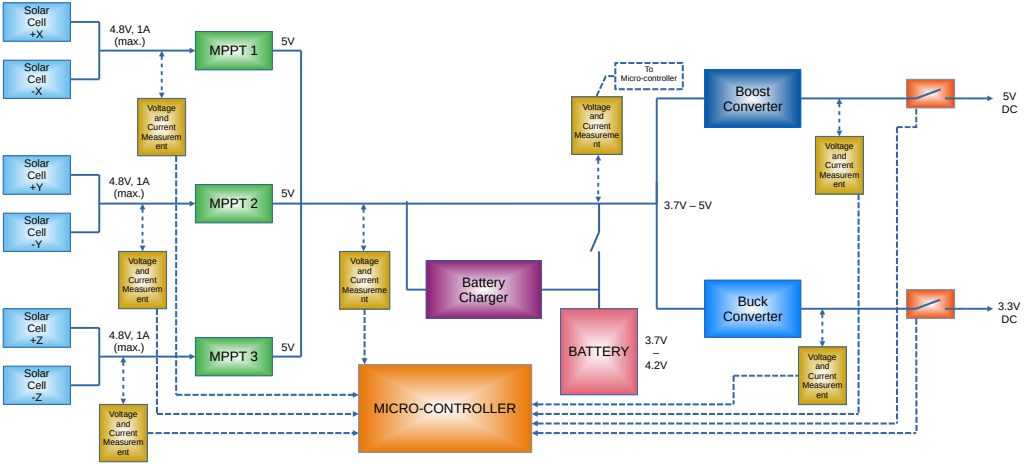

Figure 1: CubeSat EPS Architecture

Hardware Design - Buck and Boost Converters with Monitoring

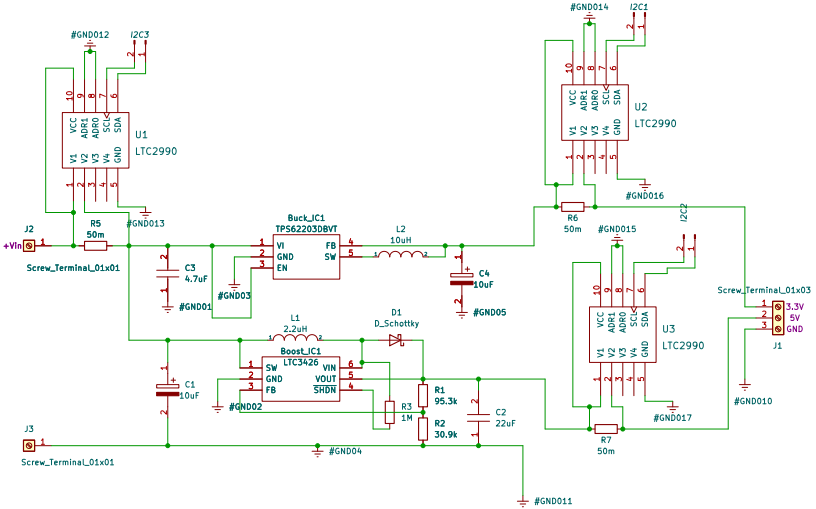

Figure 2: Circuit design of buck and boost converters with monitoring

Hardware Design - Buck and Boost Converters (Contd.)

Buck Converter:

- IC: TPS62203
- Input Voltage: 3.6 - 5V
- Output Voltage: 3.3V
- Switching Frequency: 1MHz
- Output Current: 300mA (max.)

Boost Converter:

- IC: LTC3426
- Input Voltage: 3.6 - 5V
- Output Voltage: 5V
- Switching Frequency: 1.2MHz
- Output Current: 500mA (max.)

All convertors operate in continuous conduction mode.

Hardware Design - Buck and Boost Converters with Monitoring (Contd.)

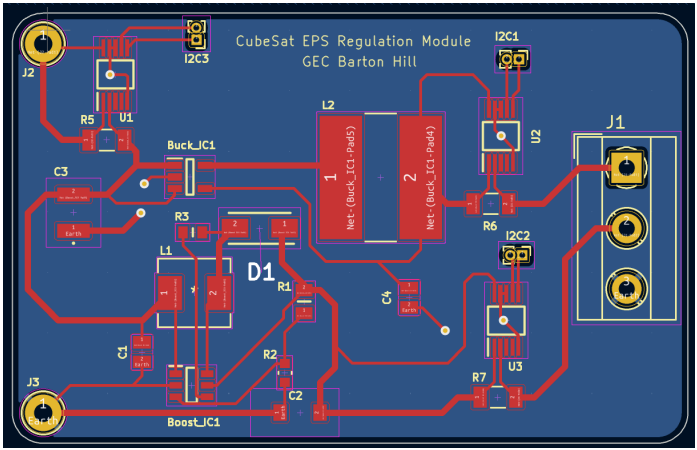

Figure 3: PCB Layout of buck and boost converters with monitoring

Hardware Design - Buck and Boost Converters with Monitoring (Contd.)

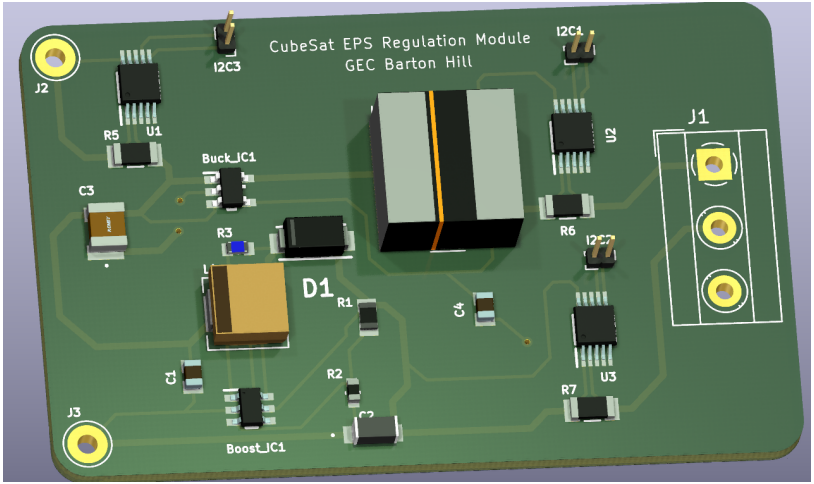

Figure 4: 3-D model of buck and boost converters with monitoring

Hardware Design - Voltage and Current monitoring IC

- IC: LTC 2990
- Quad input
- Voltage and Current Monitoring
- Communication via I2C serial interface

Hardware Design - Battery Charger

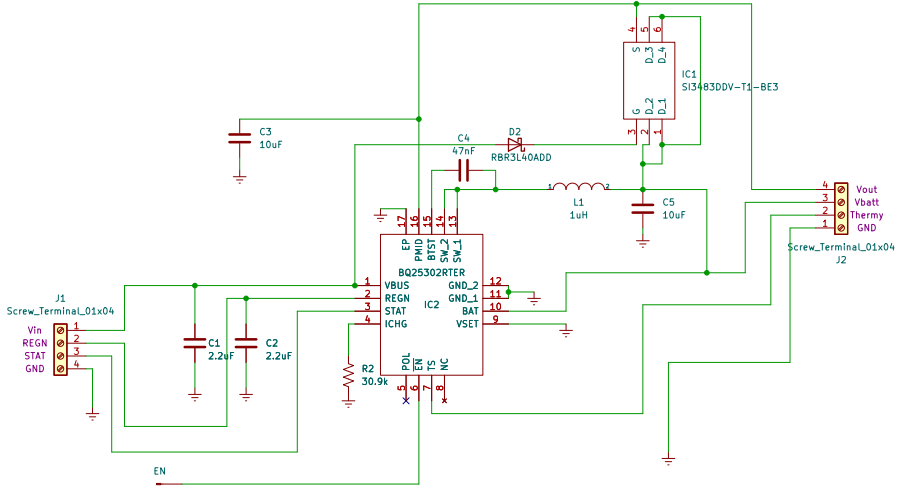

Figure 5: Circuit design of Battery Charger

Hardware Design - Battery Charger (Contd.)

Synchronous Buck Battery Charger:

- IC: BQ25302 (With External Power Path configuration)
- Input Voltage: 5V
- Output Voltage: 4.2V (max.)
- Switching Frequency: 1.2MHz
- Output Current: Limited to 1.2A
- Thermistor: Semitec 103AT-2 (10kΩ)
- Charging Temperature: Limited between 0 - 45 C

Hardware Design - Battery Charger (Contd.)

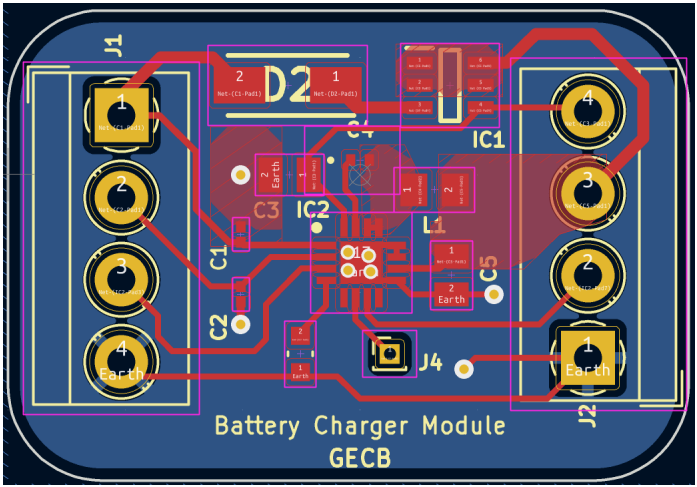

Figure 6: PCB Layout of Battery Charger

Hardware Design - Battery Charger (Contd.)

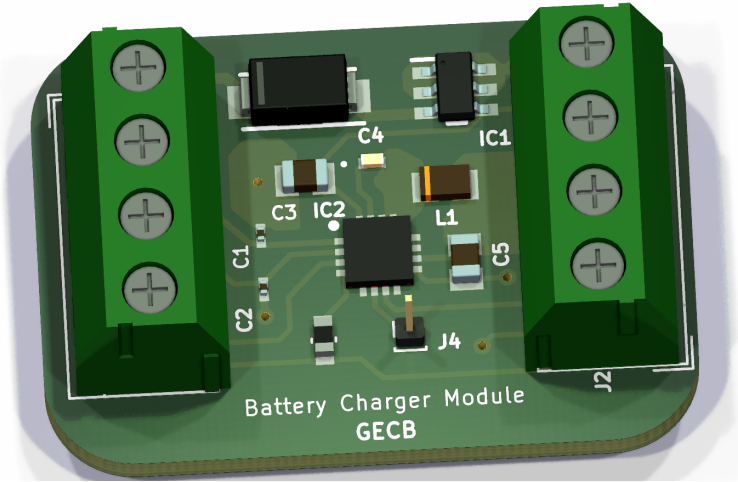

Figure 7: 3-D model of Battery Charger

Hardware Design - MPPT

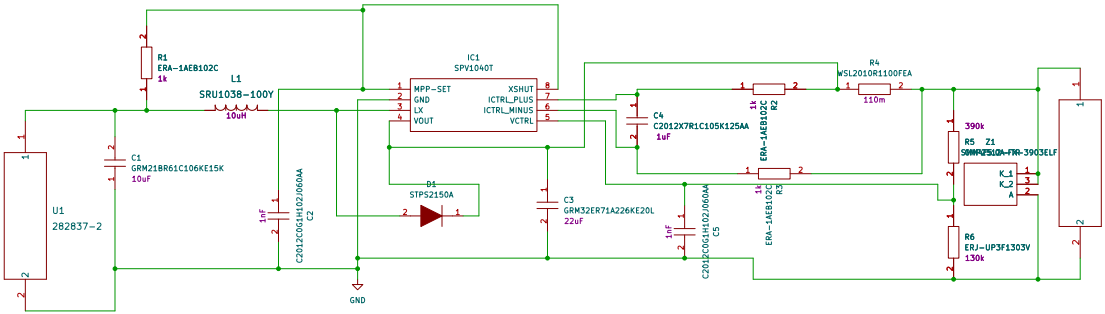

Figure 8: Circuit design of MPPT

Hardware Design - MPPT (Contd.)

- IC: SPV1040
- MPPT with Perturb and Observe algorithm
- Input Voltage: 0.3 - 5.5V
- Output Voltage: 5V
- Switching Frequency: 100kHz
- Inbuilt over-current, temperature protection
- Efficiency: 95%

Hardware Design - MPPT (Contd.)

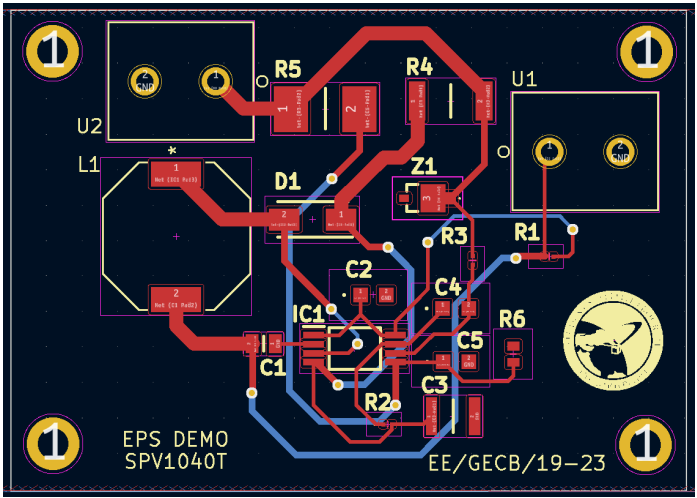

Figure 9: PCB Layout of MPPT

Hardware Design - MPPT (Contd.)

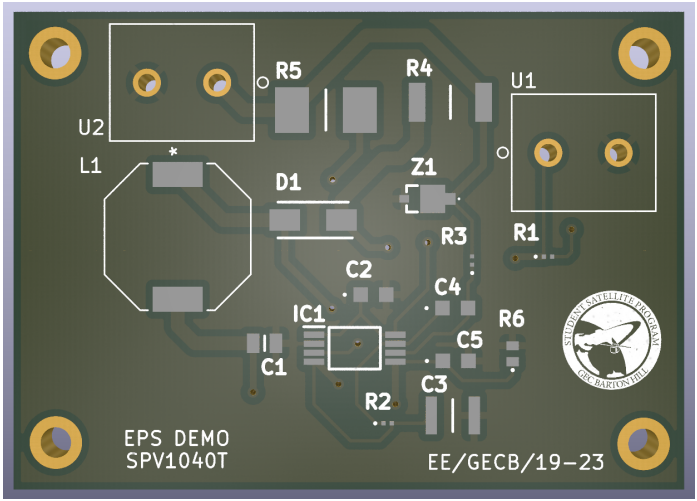

Figure 10: 3-D model of MPPT

Hardware Design - Protection

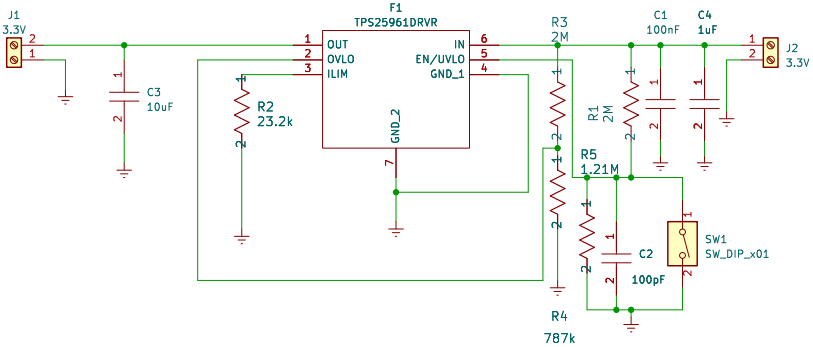

Figure 11: Circuit design for protection

Hardware Design - Protection (Contd.)

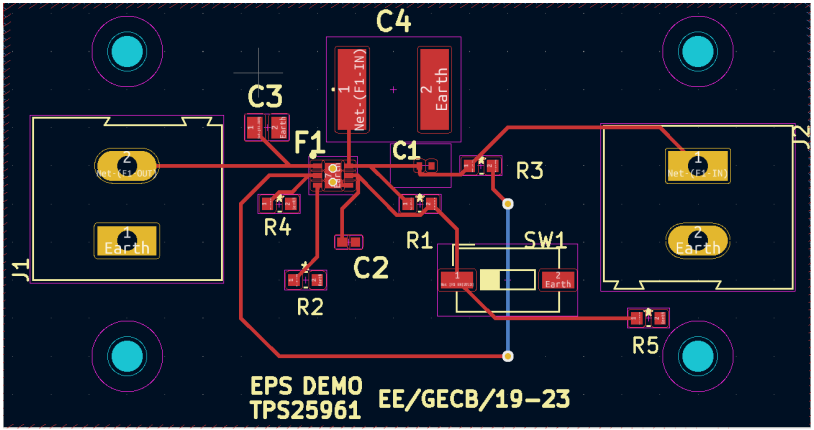

Figure 12: PCB Layout of protection circuit

Hardware Design - Protection (Contd.)

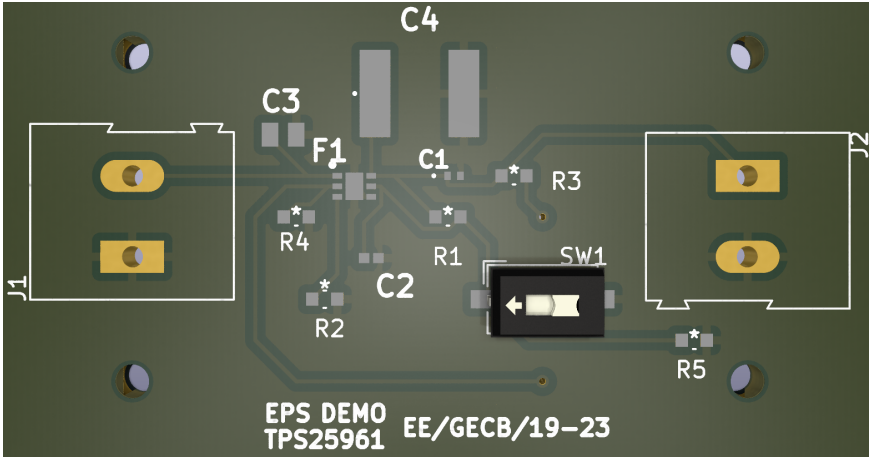

Figure 13: 3-D model of protection circuit

Project Timeline

Activity	Jan week 3-4	Feb week 1-2	Feb week 3-4	Mar week 1-2	Mar week 3-4	Apr week 1-2	Apr week 3-4	May week 1-3
PCB design and fabrication								
Component procurement								
Microcontroller programming								
Soldering								
Troubleshooting								
Report Writing								

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Thank You