



University of Victoria

# PCB Design, Assembly, and Manufacturing of a Power Distribution Board



ECE 499, Group 5

Kyle Jarvis (V00730008), Bryce Gammon (V00709534), Sean Schocat (V00925804), and Dai Tran (V00928014)

## Introduction

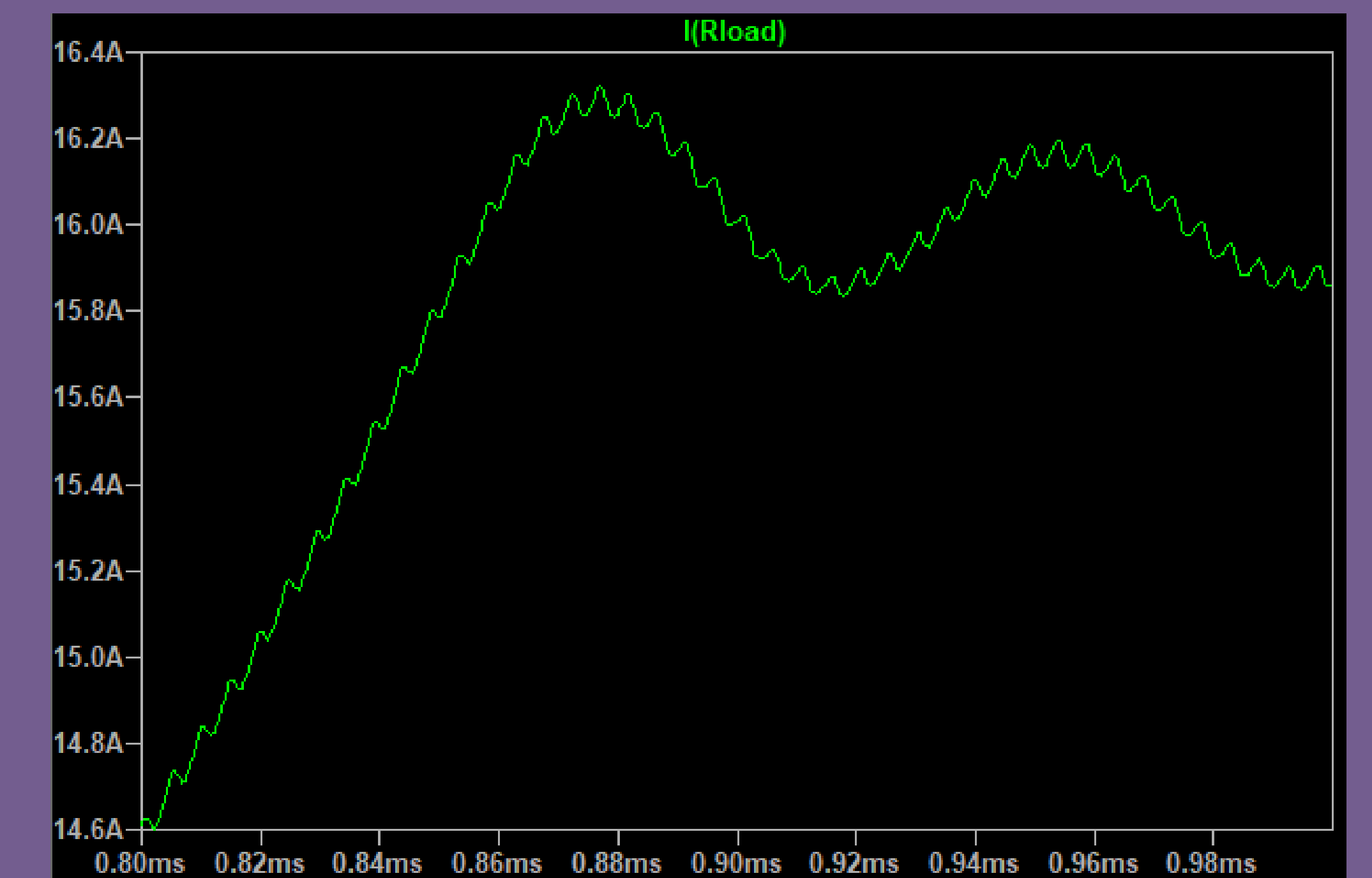
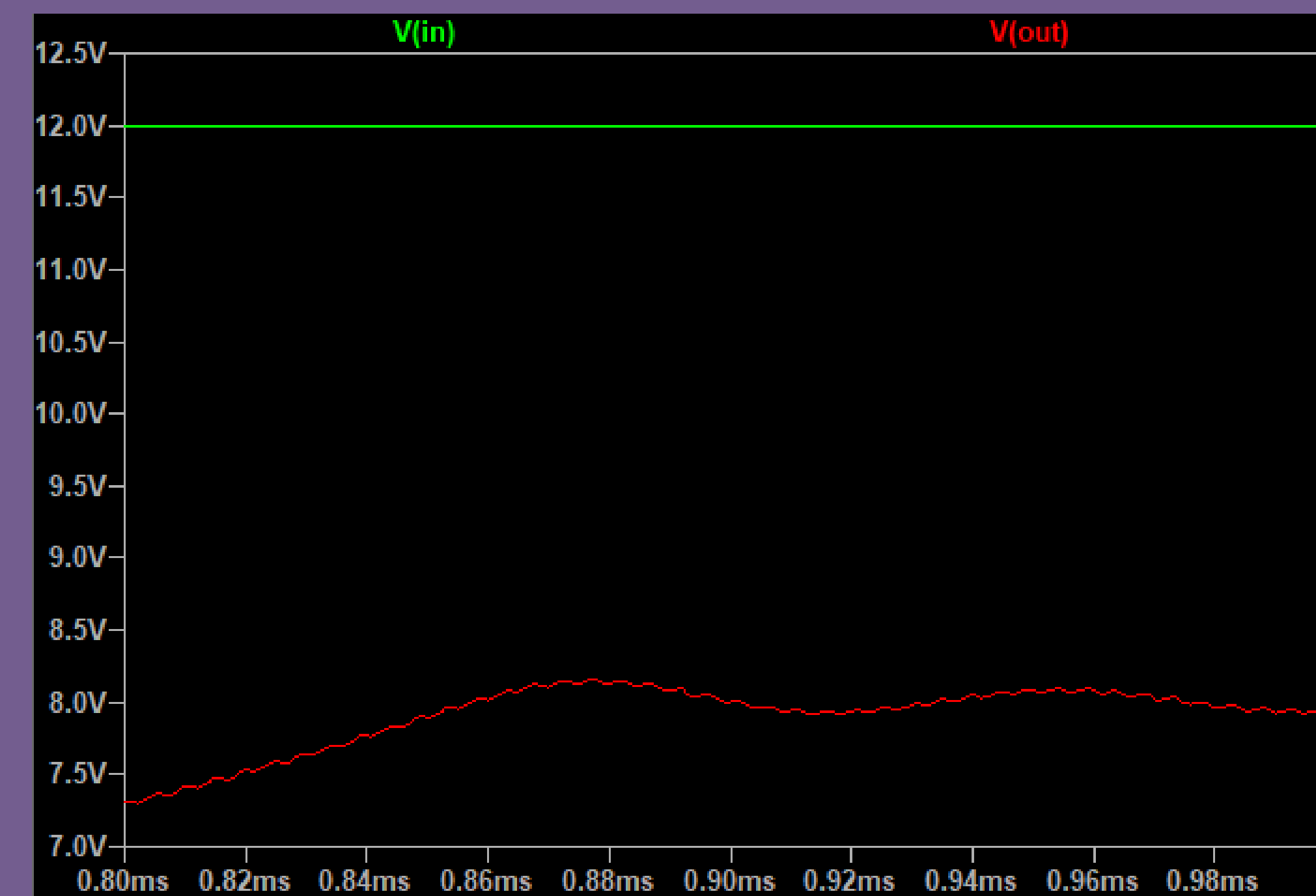
- UVic's Centre for Aerospace Research (CfAR) has an unmanned aircraft that uses a PDB to power its various systems
- This PDB takes a 12V input and has four converter circuits that generate 3.3V, 5V, 8V, and 24V outputs
- The current implementation of this PDB has limitations and issues CfAR would like to address
- Overall goal:** Design a modular PDB to replace the existing PDB system

## Methodology and Design

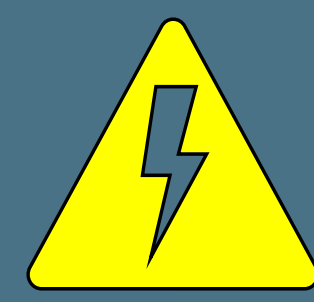
- A modular design achieves desired voltages while allowing additional PCBs in the future
- Allow any board to serve as the input, route from this board to the rest of the system
- Allow stacking of boards so subsets of the PDB system can be used as desired
- Reduce number of layers from four to two if possible to reduce costs
- Place components as close to ICs as possible to minimize trace length, signal noise, and allow for large ground planes
- Validate new 8V design with LTspice simulation

## Simulation Results

An LTspice simulation confirms that the 8V converter outputs 8V and 15A current with 12 V input



## Buck & Boost Conversion



### Buck Conversion

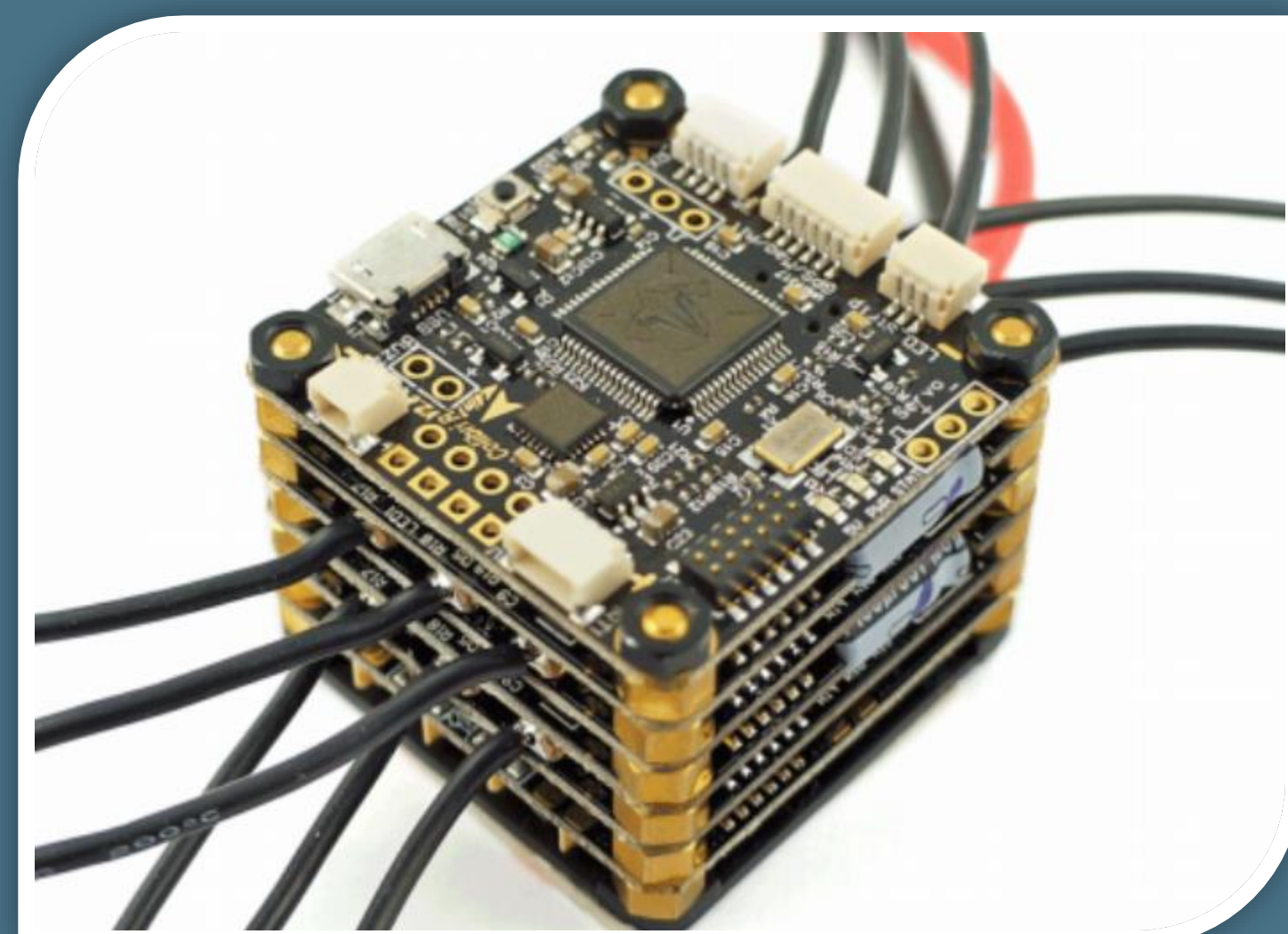
Chops high voltage to a lower average and creates a lower voltage output

### Boost Conversion

Rapidly switches an inductor to utilize its tendency to resist voltage change to pull a lower voltage to a higher voltage

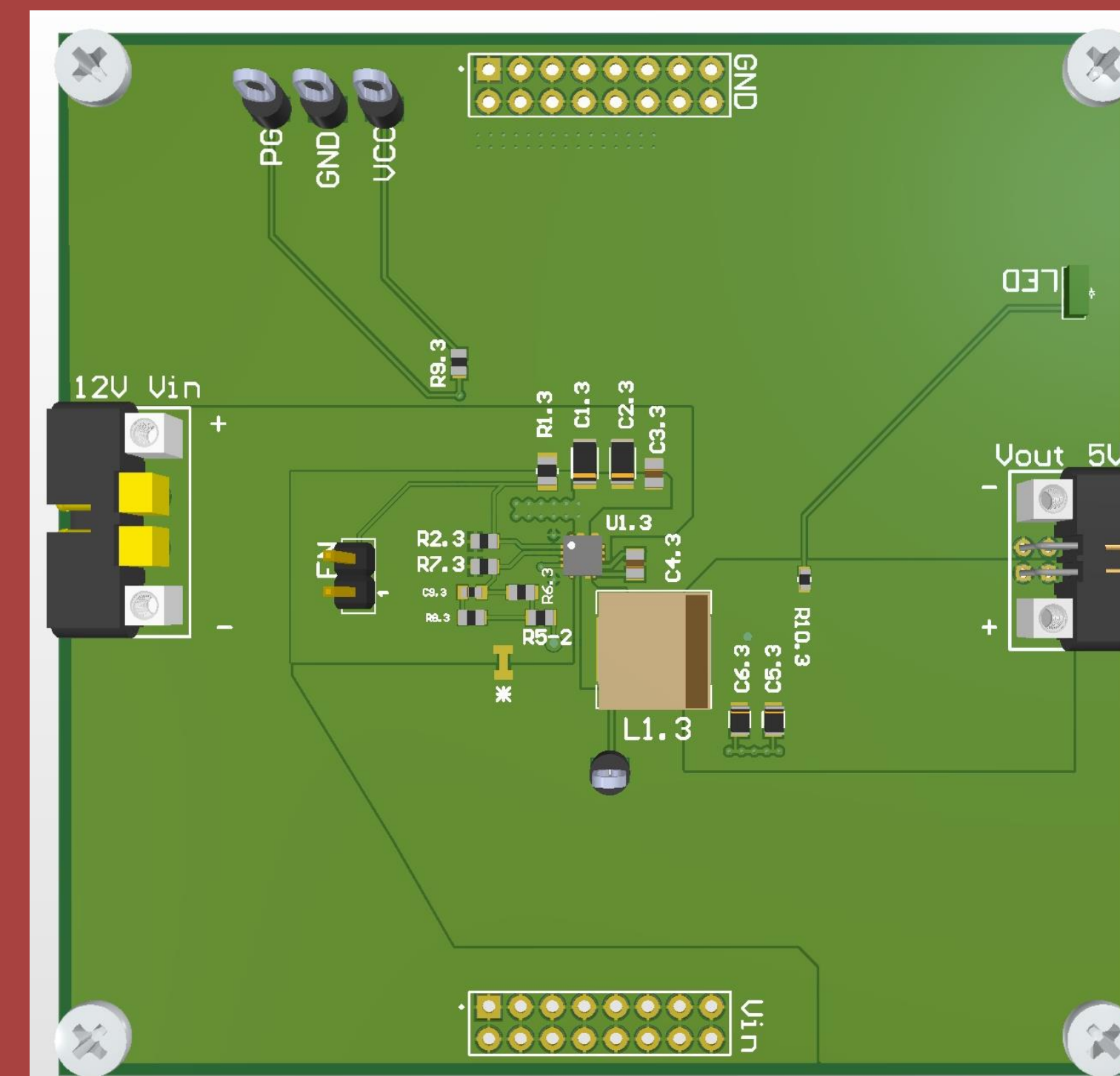
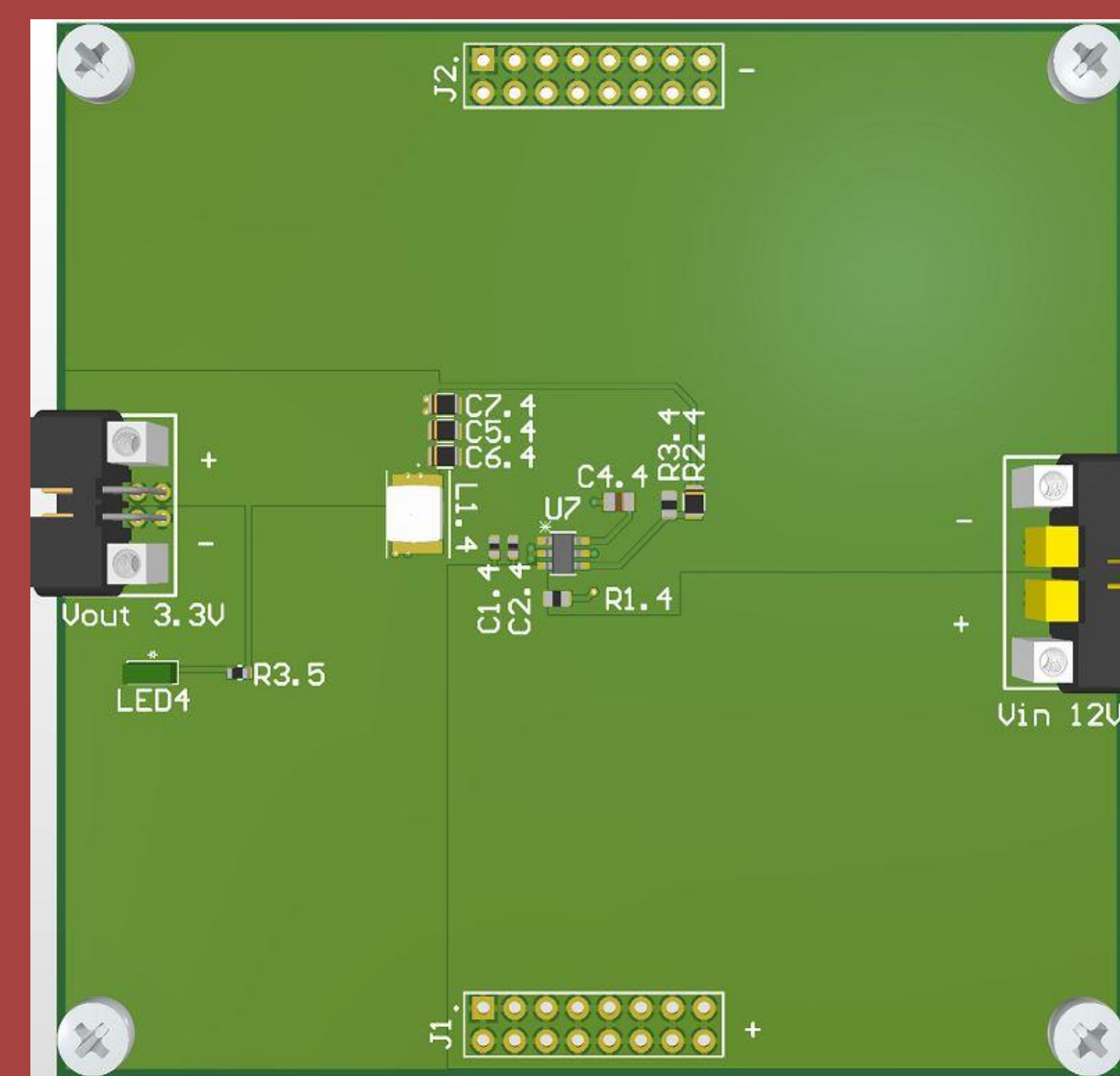
## Design Objectives

- Incorporate modularity by splitting the all-in-one PDB into several individual PCBs
- Minimize the cost of the design as much as possible
- Replace the ICs on the 8V and 24V converters and verify the new designs work
- Generate fabrication files for all four PCBs



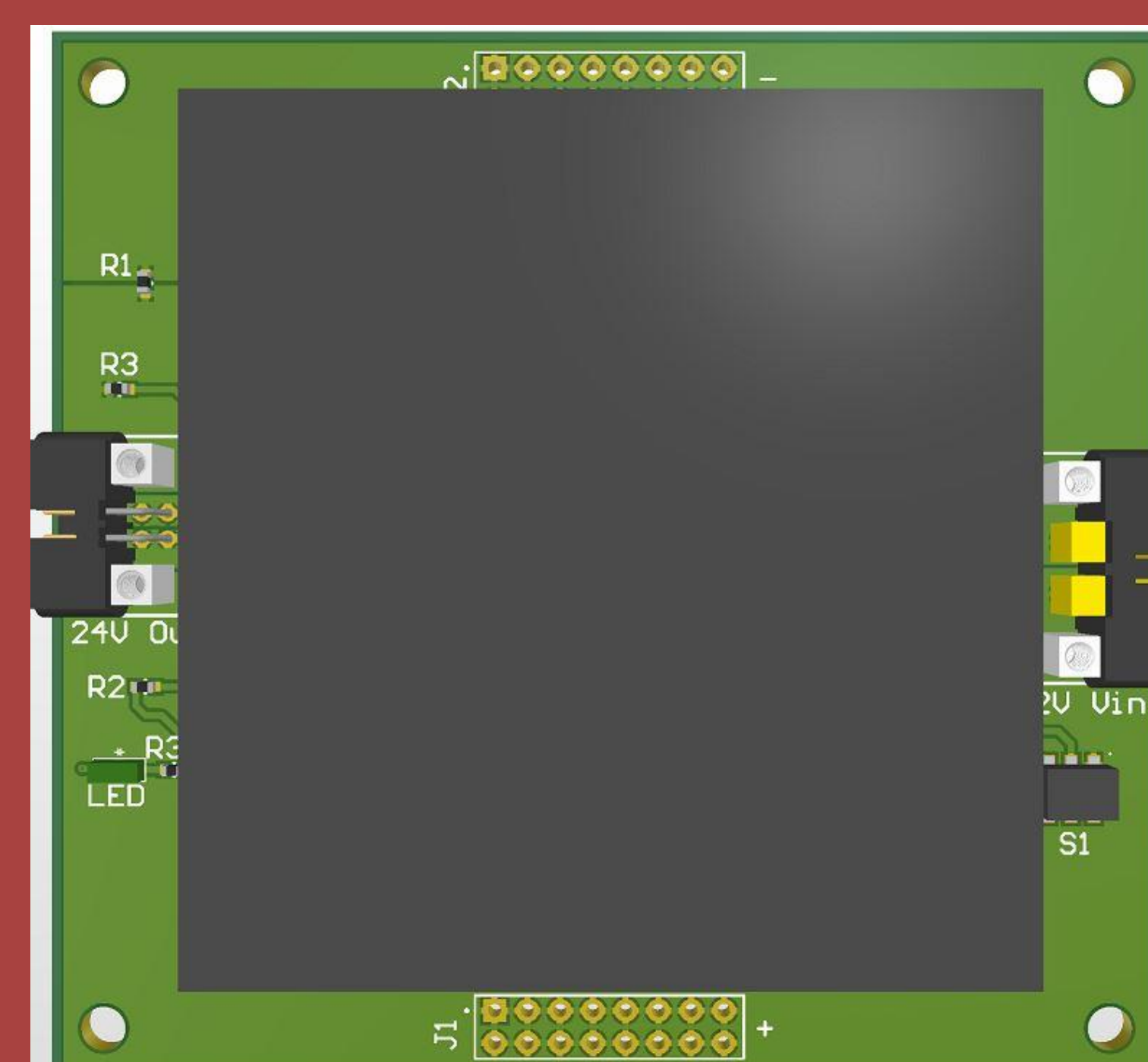
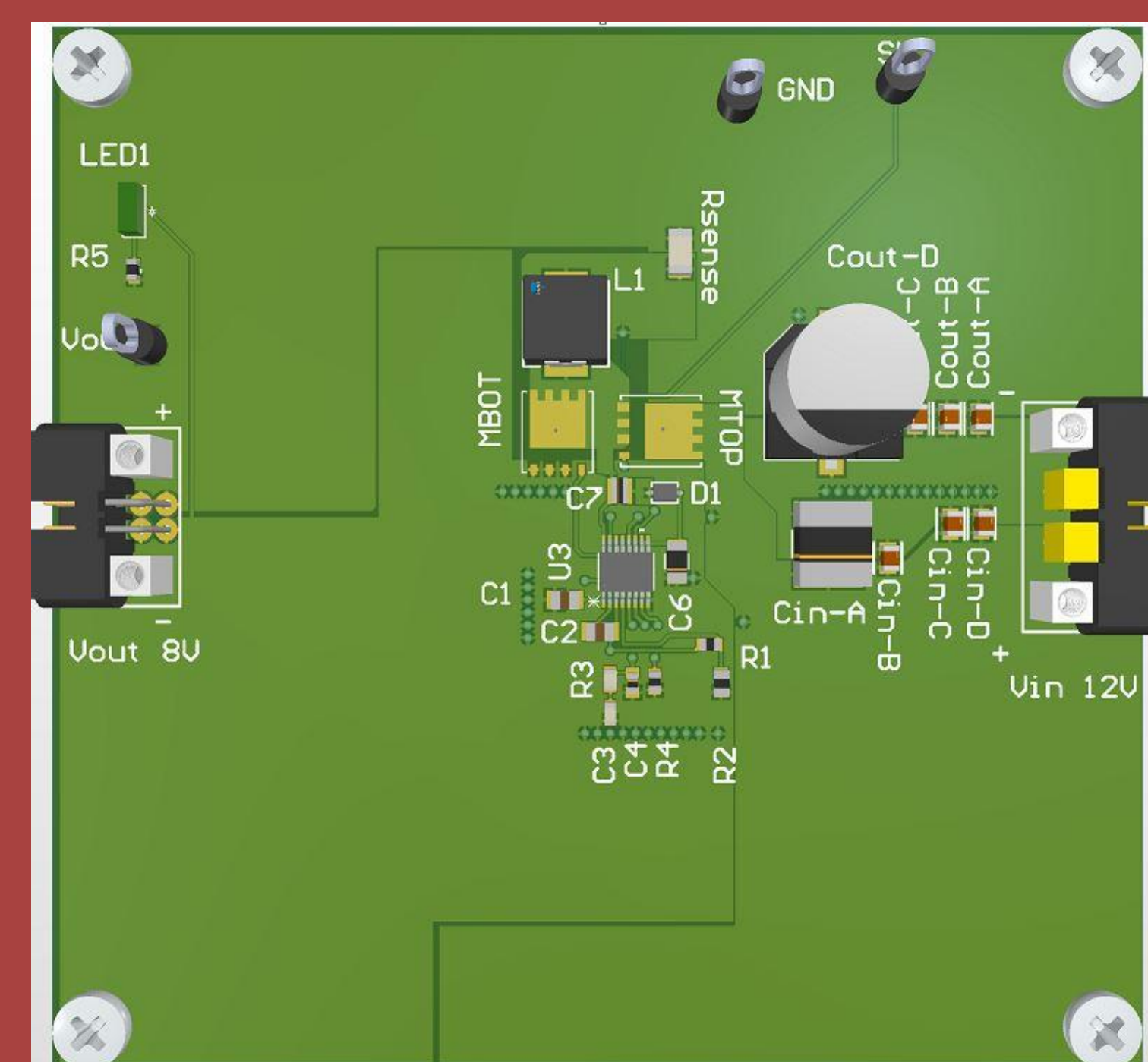
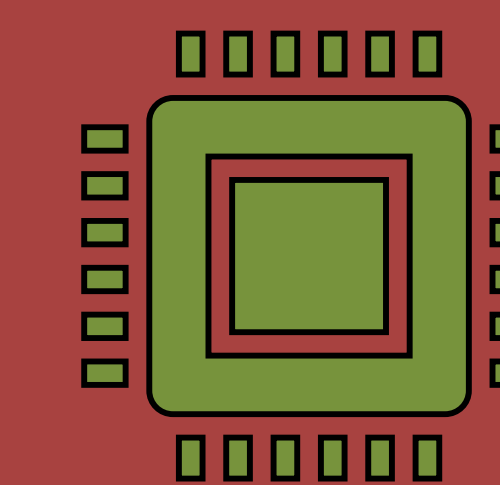
[1] Example of a stacked PCB system

## Results – Final PCB Designs



3.3V buck (left) and 5V buck (right) converters

- Working design that has been migrated to single PCB's
- Two-layer design



8V buck (left) and 24V boost (right) converters

- New design created for the 8V and validated through simulation
- 24V single unit converter used, reducing circuit overhead
- Two-layer design

## Conclusion

Our redesign addresses CfAR's needs and provides modularity while reducing overall costs.

## Future Work

- Add support for cooling (e.g. using fans)
- Add overvoltage protection and reverse polarity protection
- Reduce 3.3V and 5V board sizes

## References

[1] "Quad Questions," Quad Questions, 2020. [Online]. Available: <https://quadquestions.com/product/tbs-powercube/> [Accessed 27- Mar- 2021].

## Acknowledgements

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