Problem Overview

Cal Poly’s Formula SAE club, Cal Poly Racing, needs a smaller, higher voltage rated DC-DC converter because their existing solution, the RSP-500-12, is only rated at 370 VDC, which is slightly 0.4 V more than the expected maximum operating voltage of 369.6 VDC. The purpose of the DC-DC converter is to use the "high-voltage" 316 V battery pack, which is used to drive the electric motor, to power all of the low voltage electronics during vehicle operation.

Requirements

- 200-400VDC input voltage range
- 12-15V adjustable output voltage
- 500W continuous output power rating
- Input/Output overcurrent/overvoltage/reverse voltage protection
- Isolated design
- Small, lightweight
- >90% Efficiency
- <5% Line and Load regulation

Solution

- LT3752-1/LT8311 Active Clamp Synchronous Forward Controllers
  - Active clamp reduces stress on switches and increases efficiency
  - Housekeeping supply improves efficiency and startup performance
  - Synchronous rectification for increased efficiency
  - Forced or discontinuous conduction mode for improved efficiency
  - Isolated topology
  - Balance between efficiency and number of switches
  - System input overvoltage, undervoltage, overcurrent protections

Design and Simulation

Implementation