Best Design Award, 2023

Team 5: Space Motor

Diego Corona, Peter Crary, Nick Palladino, Seifallah Nabil Abdelhamid Ahmed Ibrahim
Client: Infineon Technologies

Abstract

Our project is a brushless DC motor controller that demonstrates radiation-hardened power semiconductor devices. The controller's power components are Infineon MOSFETs and gate drivers, and it can be programmed using the VESC Project's VESC Tool. Customizable features include commutation method (e.g., trapezoidal and sinusoidal), feedback method (e.g., back-EMF, hall-effect sensors, and encoders), input and output voltage and current limits (for protection and torque control), board and motor temperature monitoring, and more. The VESC Tool can also be used to monitor in real time the motor speed, board and motor current and temperature, and log both input and phase currents for efficiency testing. We built a system that demonstrates three of our motor controllers in a space application. The system is a self-contained 15-cubic centimeter cube with reaction wheels mounted on three of its faces, that can balance on an edge and its vertex. It uses the reaction wheels and an accelerometer and gyroscope sensor to orient and balance itself. The 3D-printed body of the cube and its cost-optimized motor controllers make it the ideal system for demonstrating power devices at conferences and trade shows. One motor and controller can be used to demonstrate device efficiency, while the balancing cube is an application demonstration.