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EMI Filtered Switched Mode Power Supplies for Sounding Rocket Applications

Switch mode power supplies/power converters are specialized circuits that are in charge of efficiently converting electrical power and are vital components for NASA sounding rocket missions. However, many "space grade" converters on the market are expensive and have long lead times. This project explored the development of cheaper yet reliable custom power electronics that can withstand space conditions. A 28V to ± 28 V converter, 28V to 12V converter, and a low-dropout (LDO) regulator circuit to split the ± 28 V voltages into ± 18 V and ± 8 V were designed in support of the Black and Diffuse Aurora Science Surveyor (BADASS) sounding rocket mission, which aims to investigate the physics behind the optical variations within the aurora borealis. These power converters operate with 75%-80% nominal efficiency, provide galvanic isolation from input to output, feature on-board EMI filtering to prevent excessive interference, and use automotive grade commercial-off-the-shelf components all while achieving a small form factor of PC104 (3.550×3.775 inches). The LDO, aside from providing the extra voltage rails necessary, also incorporates additional passive filtering to further reduce noise on the ± 28 V lines. This combined hardware will be in charge of supplying power to the charge-coupled device (CCD) instrument responsible for measuring auroral particles, which is a novel idea and will be a technology demonstration on this sounding rocket experiment. This project supports both the Space Technology Mission Directorate and Science Mission Directorate NASA research priorities.