Analog Circuit Reliability for Low Earth Orbit Space Applications

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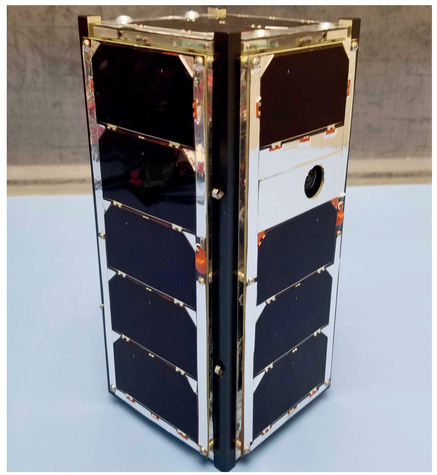
Acknowledgements
- Dr. Laforge, P.Eng
- Doug Wagner, P.Eng
- Dr. Chen, P.Eng
- Jin Jiang

1. Background

- Design a payload for RADSAT-SK2, in collaboration with CUBICS and The University of Saskatchewan Space Team
- A CubeSat is a miniature satellite
- Capable of housing 10x10cm Printed Circuit Boards (PCBs)



CubeSat from the RADSAT-SK1 Project

2. Objectives

- Build PCB capable of evaluating Integrated Circuits (ICs) reliability in low Earth orbit
- Provide PCB with 3.3V sinewave and -5V supply using the onboard 5V supply
- Conform to weight, size and power restrictions with respect to the CubeSat
- Communication between the microcontroller, on board computer (OBC) and the micro SD card
- Perform IC testing sequence within 15% error in results vs. expected results

3. Discussion

Procedure

Board Development:

- Design and implement prototype circuits on breadboards
- Test breadboard circuits integration with the whole system
- Develop baseline test results for further comparison
- Reconstruct system circuitry on PCB and reiterate tests

Testing Criteria:

- Non-Volatile Storage
- Sinewave generation
- Circuit readability from microcontroller configuration
- Op Amp (AD844) - Output gain
- Opto-Isolator (FOD814) - Current Transfer Ratio (CTR)
- Voltage Reference (REF192) - Voltage output

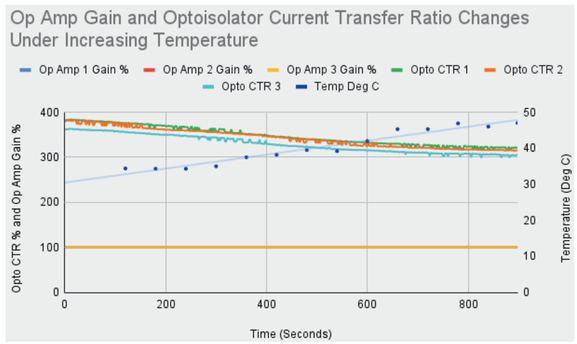
Analysis

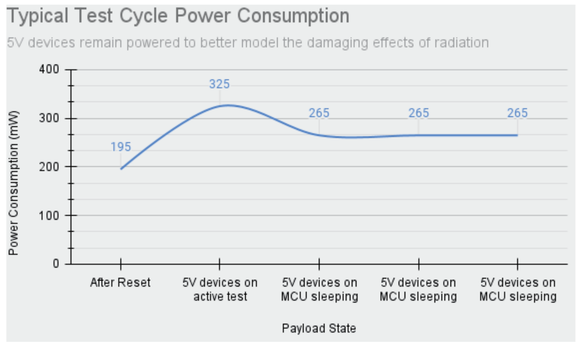
Temperature Testing:

- Temperatures ranged from 0°C to 50°C
- Results concluded that the CTR of FOD814 has an inverse relationship with temperature change
- AD844 and REF192 were relatively unaffected by changes in temperature

Power Results:

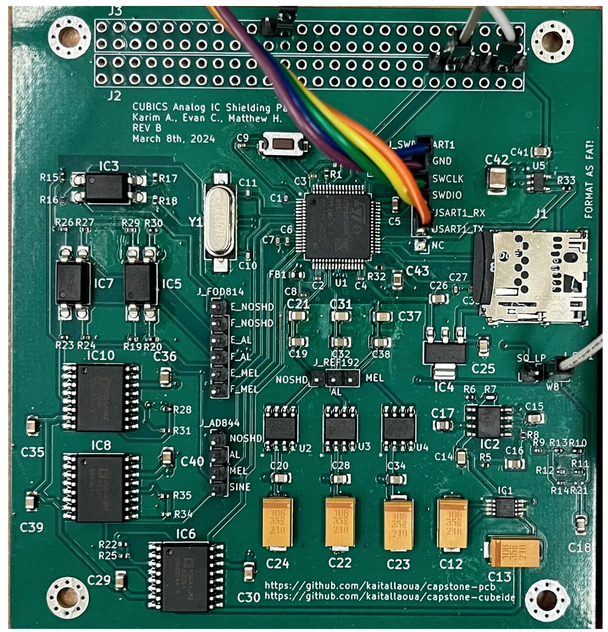
- Initial power budget of 1.75W peak, 1.25W continuous
- Peak power of 325mW
- Typical standby 265mW
- Emergency Low Power mode 50mW





4. Future Considerations

- Full shielding adaptations with temperature and radiation testing.
- Communication between OBC and microcontroller
- Test additional ICs
- Adding on-board temperature sensor
- Improve sine wave generation
- Use alternative non-volitile storage



PCB payload Rev. B

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RADSAT SK2