Jet Propulsion Laboratory
California Institute of Technology

JPL

Overview of Testing and Debugging of the ISAAC iBoard (Instrument ShAred Artifact for Computing)

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Outline

- My Background
- Overview of iBoard
- Visual Inspection Procedure/Results
- Continuity Testing Procedure/Results
- Power Testing Procedure/Results
- Functionality Testing Procedure/Results
- Summary of Work
- Acknowledgement

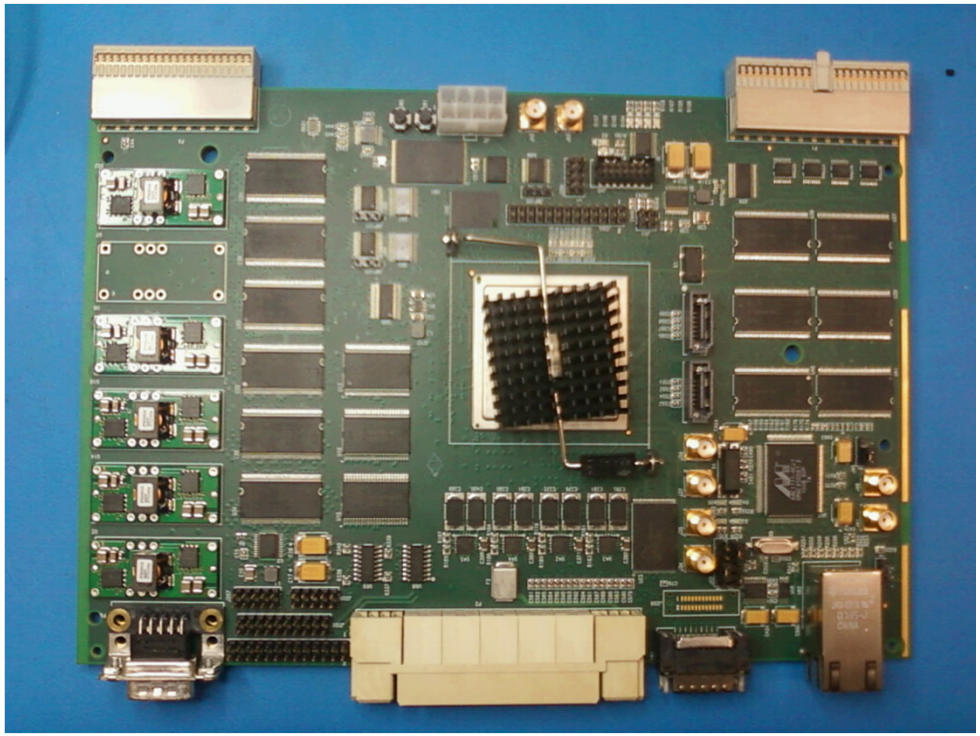
My Background

Carson Umsted

- California State Polytechnic University-Pomona (Cal Poly Pomona)
- 4th Year Electrical Engineering Undergraduate Student
- Research Apprenticeship Intern at JPL
- Section 345 - Flight System Avionics

ISAAC Technology Overview

- The ISAAC iBoard has one Virtex-5 fx130t -1 FPGA
- Very adaptable board with many interfaces and components that can suit many different needs



ISAAC iBoard

Visual Inspection

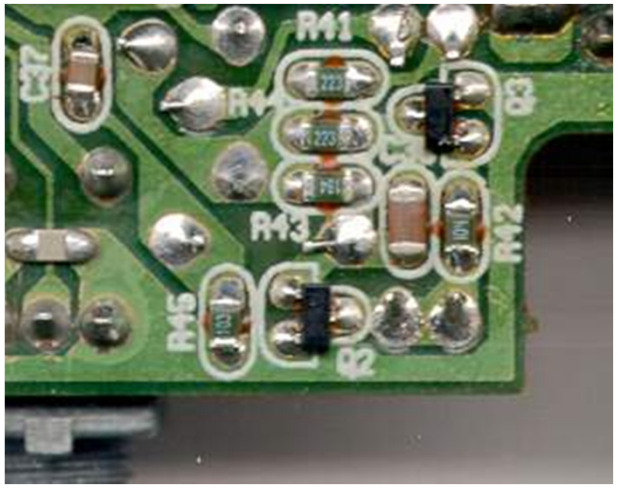
- Before performing any test on the board, it is important to first look at the board closely to ensure that there are no obvious issues
- Checking of proper polarized capacitors orientation
- Checking secure attachment of connectors and other components
- Verification of proper LED orientation
- Ensure that there are no obvious solder bridges

Continuity Testing

- To ensure that the board was safe to be powered, it was necessary to check for shorts between both a power supply to ground and to the output of other power supplies
- If there is a short, there is a potential for catastrophic damage to the board components due to overheating and overcurrent
- There were many problems found during this phase of testing

Continuity Testing

- Most boards exhibited multiple shorts to both ground and other voltage outputs.
- The cause was determined to be solder bridging on 0402 package capacitors.
- The footprint was made slightly too close together for the assembly machine to properly solder the parts, resulting in a short.



This representative photo shows the small scale parts that were being worked with.

Continuity Testing

- To fix these issues, use of a microscope was essential to see the bridge
- In some cases, the bridge was under the part, making it very difficult to find without removing the part
- Removal of bridged components and subsequent wicking of solder was necessary to resolve the shorts
- Once all shorts were removed, proper replacement by hand was necessary for the board to meet its required specifications

Power Testing

- Once all previous tests have passed, verification of proper voltages is necessary prior to programming the FPGA
- There were issues found with some of the early boards where there were flaky connections because of the wrong packaged part for the footprint on the board
- Issue was resolved by heating up the solder and drawing it into the via and instructing the assembler to use the proper part for future boards

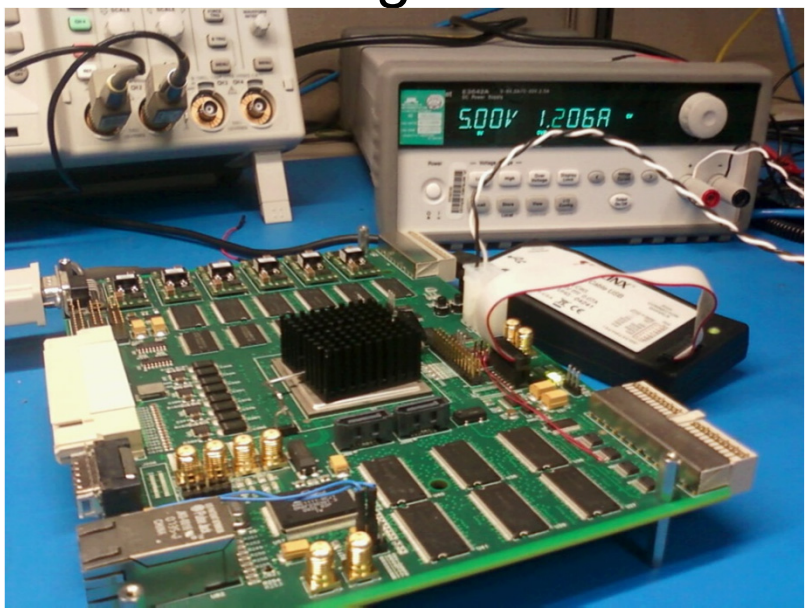
Functionality Testing

- Using previously developed builds targeted for the iBoard's features, we programmed the FPGA to ensure that they were working
- Overall, the boards performed well, but when failures occurred, verification of individual signals was necessary
- Some problems were shorts between some data lines and others attributed to some flaky solder connections

Summary

- The new iBoards are now functioning with all problems resolved.

- All components have been verified with the exception of NAND and NOR flash and SERDES using the XAUI connector



Fully Tested and Operational iBoard

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