



Goddard Space Flight Center

GSFC NASA ADVISORY

1. Advisory Number
NA-GSFC-2006-01

2. Subject
Destructive Physical Analyses (DPAs) on Field Programmable Gate Arrays (FPGAs) and Non-Volatile Memory Devices, Failure Reports, and Lessons Learned.

3. Manufacturer
N/A

4. Manufacturer CAGE Code
N/A

5. Federal Stock Code
N/A

6. Part/Material/Process Number
All

7. Lot Date Code/Batch Code/Serial Number
All

8. Controlling Spec/Document Number
N/A

9. References

Summary of Recent EEPROM Failures: http://klabs.org/richcontent/old_news/old_news_12
NA-GSFC-2005-04 Application of Hitachi 1-Mbit Die Based EEPROM Technology to Space Applications.
NA-GSFC-2005-01 Actel SX-A, RTSX-S, and RTSX-SU FPGAs in Mission and Safety-Critical Systems.
NA-GSFC-2004-08 Testing of Actel SX-A and RTSX-S Programming Algorithms.
NA-GSFC-2004-06 Actel RTSX-S and SX-A Programmed Antifuses.
NA-GSFC-2004-04 TRST* and the IEEE JTAG 1149.1 Interface.
NA-GSFC-2003-02 Application Note on Grounding the MODE Pin in Actel Field Programmable Gate Arrays.
Better Mechanisms Needed for Sharing Lessons Learned:
http://klabs.org/DEI/lessons_learned/GAO_Report/gao_lessons_learned_d02195.pdf

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11. Problem Description and Details:

Space flight parts usage is traditionally of relatively low volume when compared with commercial and industrial applications. In both FPGA and EEPROM device applications, the realization of past parts issues was delayed, since the failure rate was low enough that individual organizations did not realize the significance of each failure. Failures in non-flight parts are not always treated with the same rigor as failures in flight qualified devices. Learning about failure modes in non-flight parts (particularly for new technologies) is important in order to implement corrective actions at the earliest time.

Additionally, proprietary and stove-piped information barriers, along with a cultural resistance to discussing failures, prevent the user community from pooling their data collectively, observing trends, and "connecting the dots." All together, this had led to delays in manufacturers improving their parts, processes, and software.

After appropriate editing for purposes of protecting confidentiality, the DPAs/Failure Reports along with trending analyses, will be placed on either of the following two FPGA Reliability/EEPROM Reliability web pages:
http://klabs.org/richcontent/fpga_content/pages/notes/fpga_reliability.htm
http://klabs.org/richcontent/MemoryContent/mem_pages/mem_reliability.htm

Trend analyses will be performed and based on trends, manufacturers will be requested to improve device reliability.

12. Action Recommended:

NASA GSFC kindly requests other NASA programs and projects to share with the Advisory Technical Point of Contact (see block 13) all DPA and Failure Reports on FPGAs and non-volatile memory devices, from both flight and engineering model usage along with lessons learned that can benefit the community. Non-NASA organizations may also send in their reports. Note that prior to dissemination on the NASA Office of Logic Design web site, appropriate care (i.e. deleting items such as contractor names) will be taken.

13. Technical Point of Contact

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January 12, 2006

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16. Released by: (Signature)
Original signed by
GSFC NASA Advisory Coordinator

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17. Date Released
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