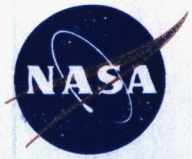

Single Event Transients in Low Voltage Dropout (LVDO) Voltage Regulators

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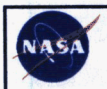
J. Karsh[2], S. Pursley[2],I. Kleyner[2], R. Katz[2],
S. Pursley[2]

[1] MEI Technologies
[2] NASA - GSFC

To be presented by Christian Poivey at the 2006 Single Event Effects Symposium (SEESYM), April 10, 2006 to April 12, 2006 in Long Beach, CA.

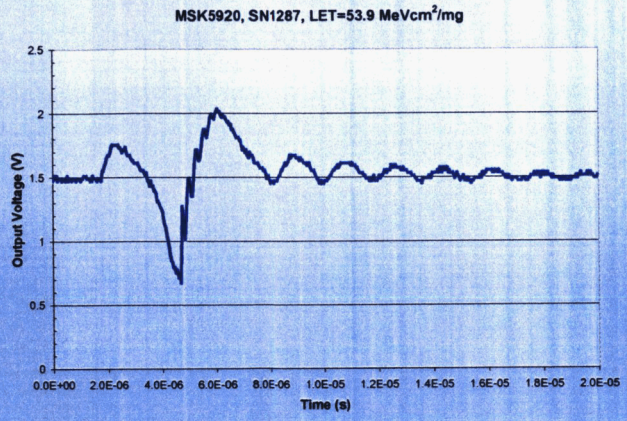


Outline

- Background – Introduction
- Summary of recent test results
  - RHLP4913
  - MSK5900
- Conclusion

Background

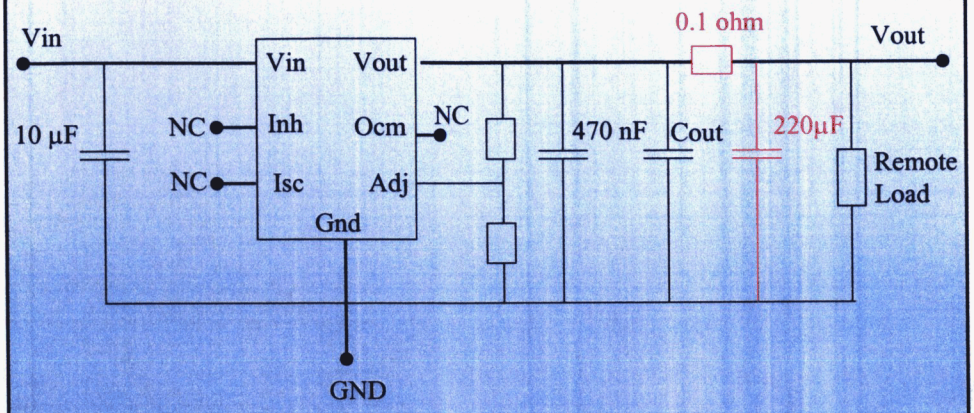
- Voltage regulators are sensitive to heavy ion induced Single Event Transients
  - SET amplitude is small (<1V) because of large output capacitors used in typical applications



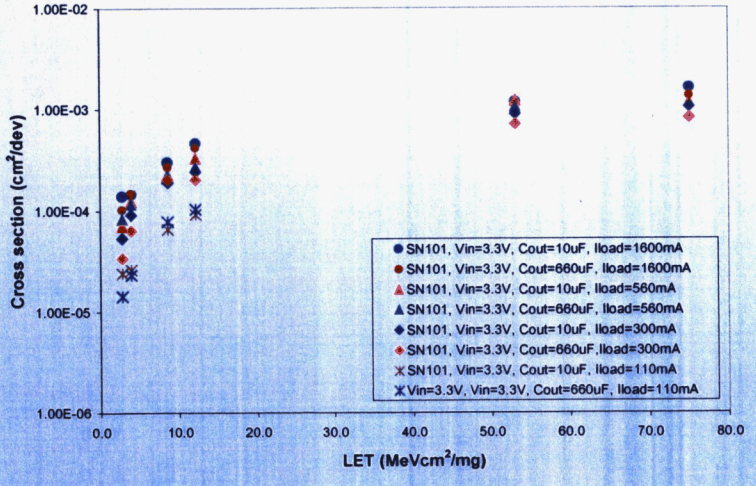
Background

- SET in voltage regulators are a concern for low voltage applications (< 5V)
  - Overvoltages may cause destructive conditions
  - Undervoltages may cause functional interrupts
- SET in voltage regulators are critical for FPGA RTAX
  - DC core absolute max rating = 1.6V
  - 1.5V core supply voltage recommended operating conditions: 1.425V min, 1.575V max

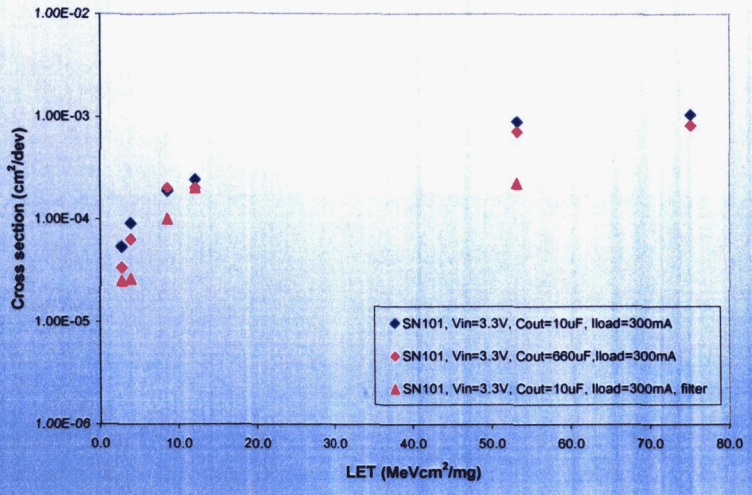
Summary of test results, RHLP4913 from STM, Bias condition



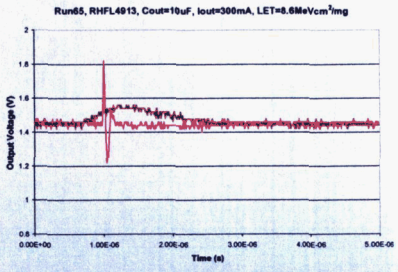
RHLP4913 from STM SET cross section curves - Effect of load

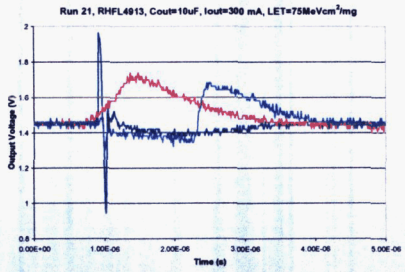


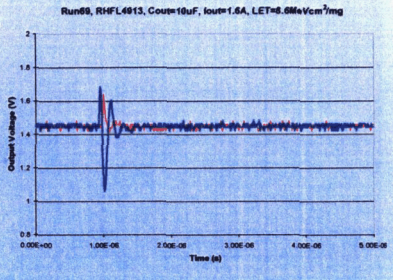
RHLP4913 from STM SET cross section curves - Effect of filter

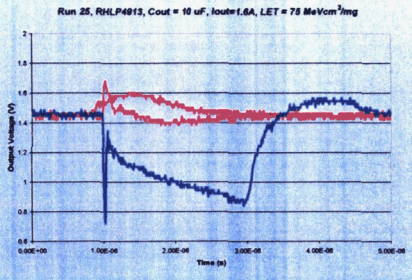


RHLP4913 from STM, Typical SETs, Cout=10μF, no filter

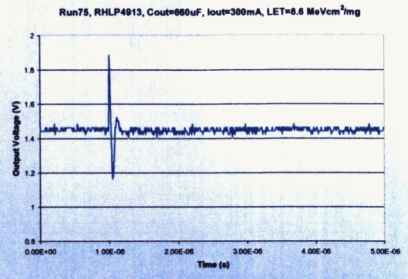


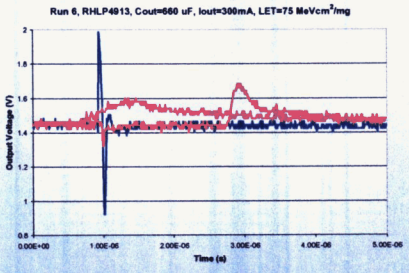


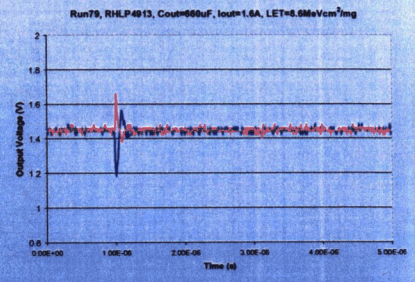


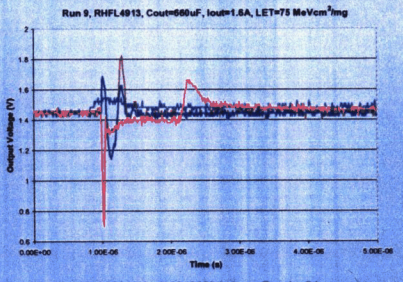


RHLP4913 from STM, Typical SETs, Cout=660μF, no filter

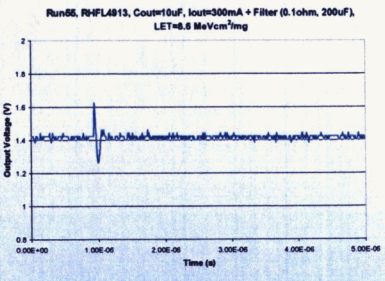


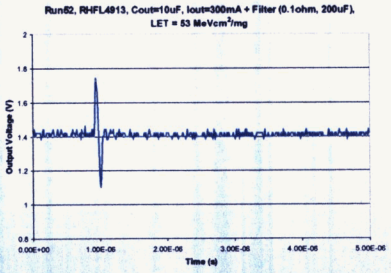


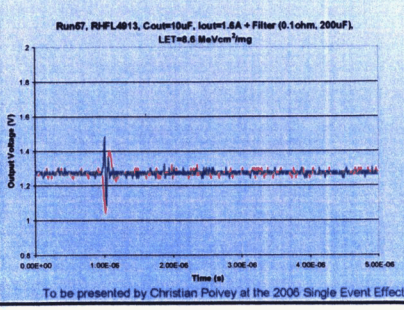




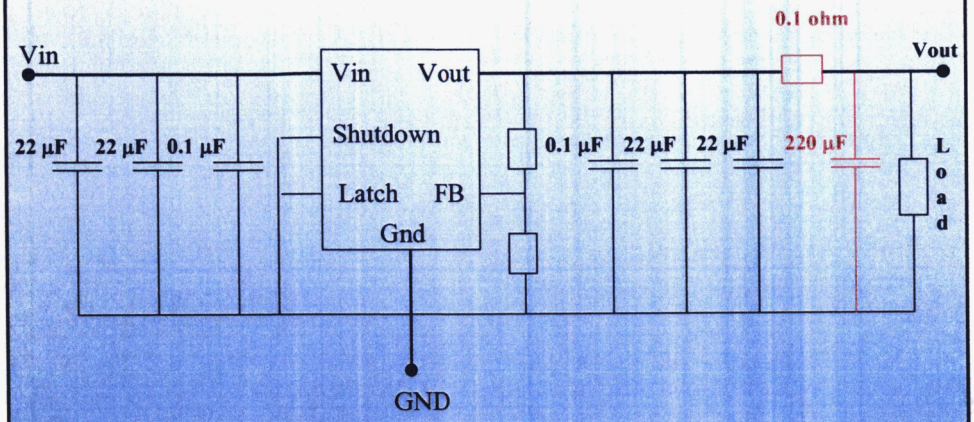
RHLP4913 from STM, Typical SETs, Cout=10μF, with filter



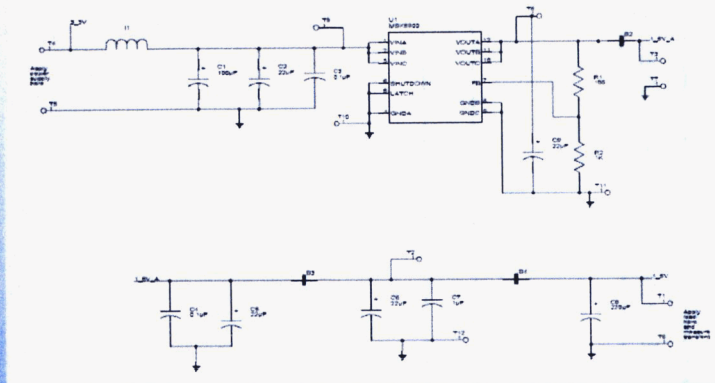




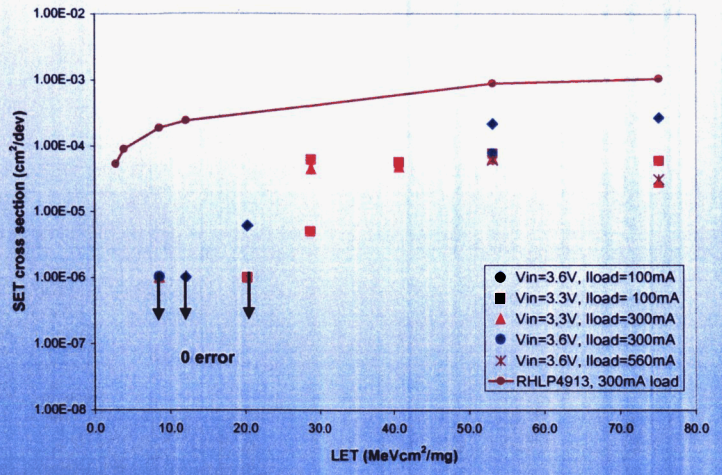
Summary of test results, MSK5900 from MS Kennedy, Bias condition 1



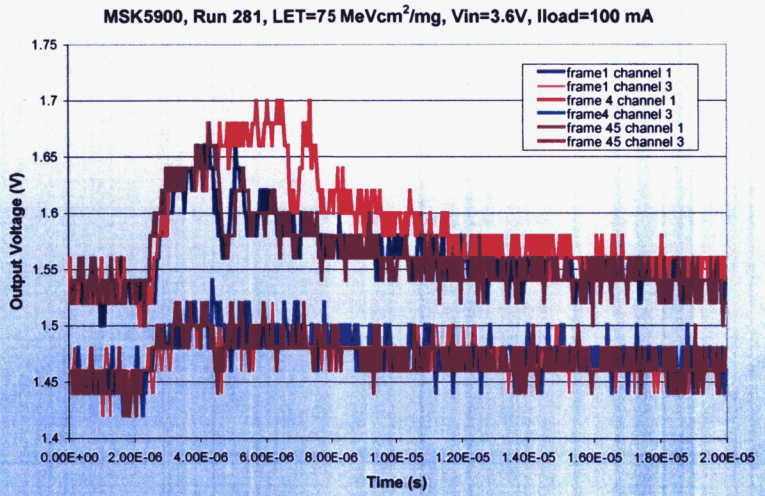
Summary of test results, MSK5900 from MS Kennedy, Bias condition 2



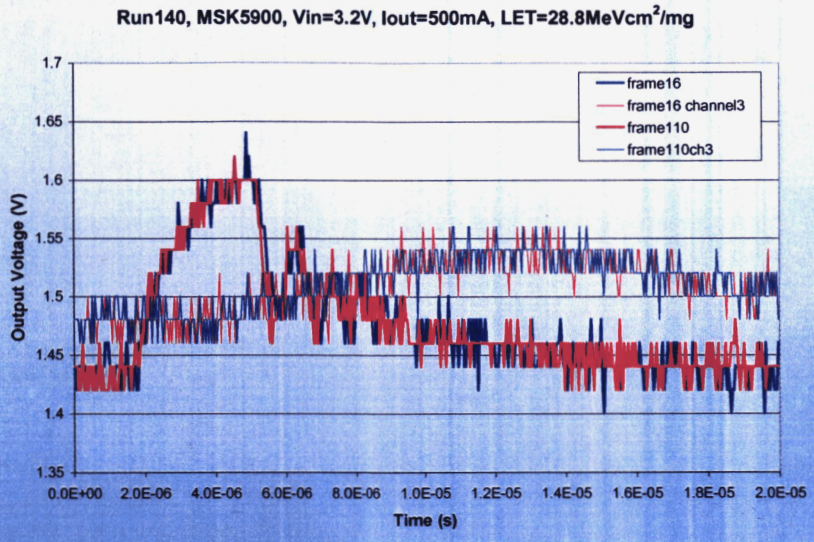
MSK5900, SET cross section curves



MSK5900, Typical SETs, RC filter



MSK5900, Typical SETs, ferrite based filter



Conclusion

- SET sensitivity changes significantly from type to type
- Worst case bias is different from type to type
- Adding up output capacitors is not always effective
- Filtering does not remove all SETs
- Filtering methods without resistor elements proved to be effective