

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

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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**
 - RHL4913
 - MSK5900
- **Conclusion**

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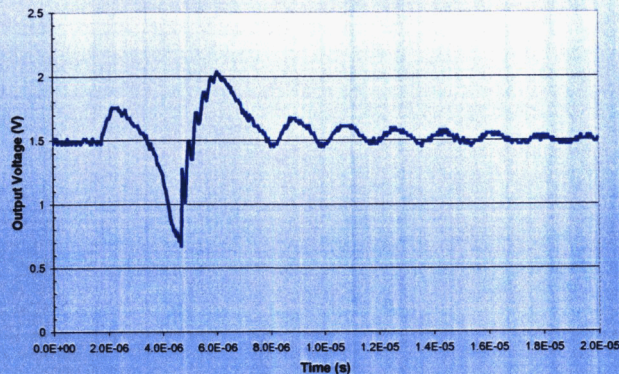
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Background

- **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

MSK5920, SN1287, LET=53.9 MeVcm²/mg



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Background

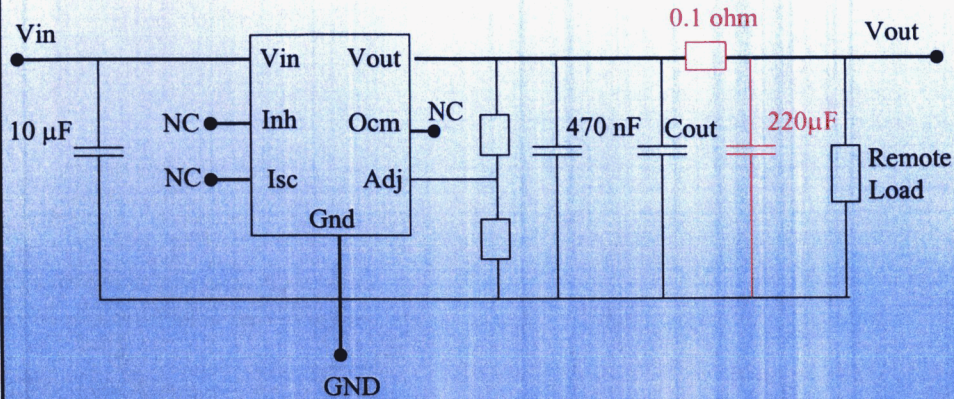
- **SET in voltage regulators are a concern for low voltage applications (< 5V)**
 - Overvoltages may cause destructive conditions
 - Undervoltages may cause functional interrupts
- **SET in voltage regulators are critical for FPGA RTAX**
 - DC core absolute max rating = 1.6V
 - 1.5V core supply voltage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

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Summary of test results, RHL4913 from STM, Bias condition

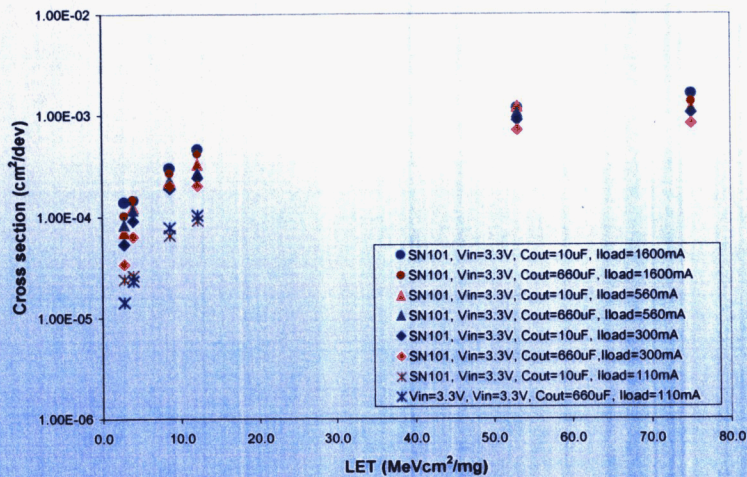


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RHL4913 from STM SET cross section curves - Effect of load

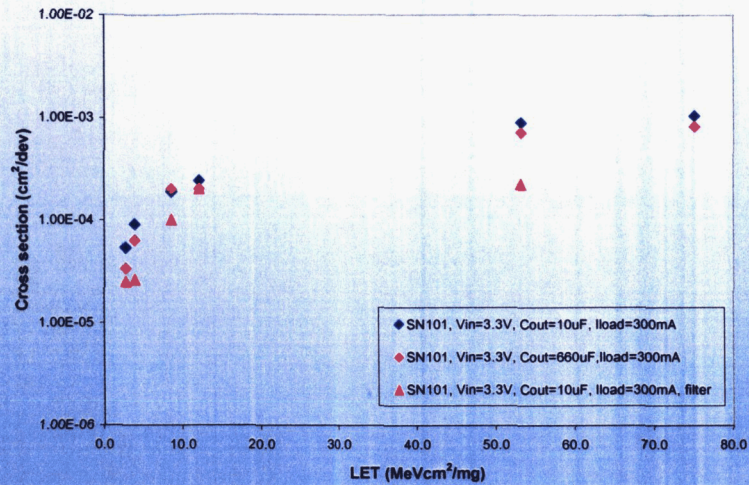


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RHLP4913 from STM SET cross section curves - Effect of filter

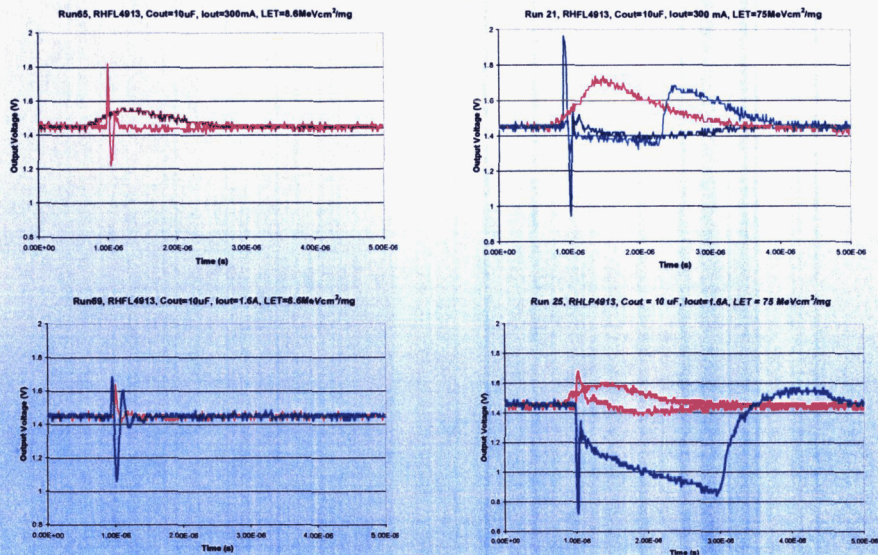


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RHLP4913 from STM, Typical SETs, Cout=10µF, no filter

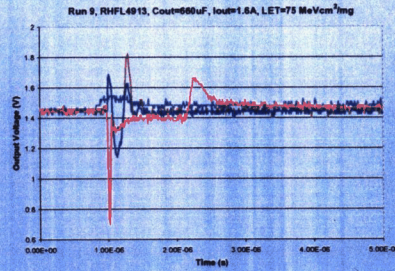
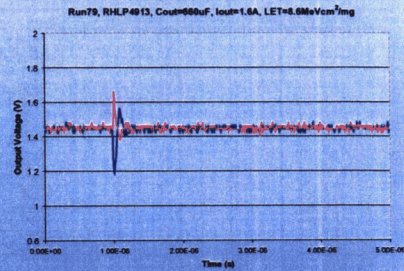
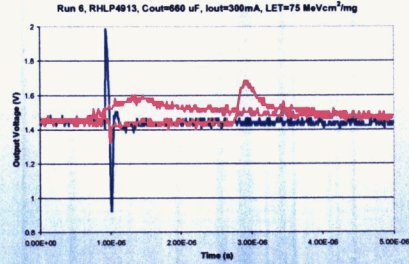
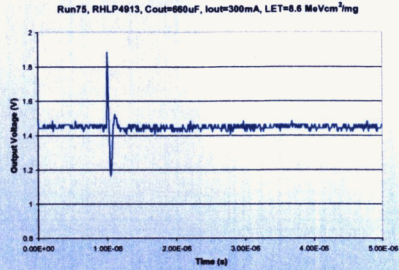


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RHLP4913 from STM, Typical SETs, Cout=660 μ F, no filter

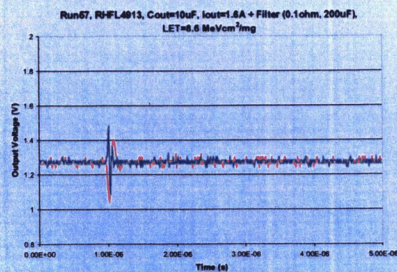
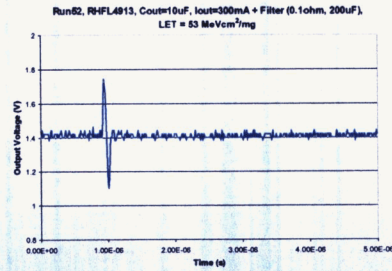
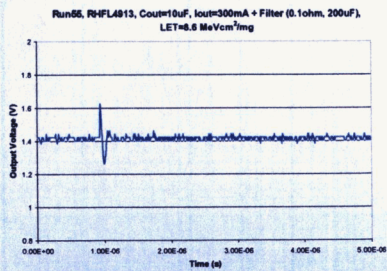


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RHLP4913 from STM, Typical SETs, Cout=10 μ F, with filter

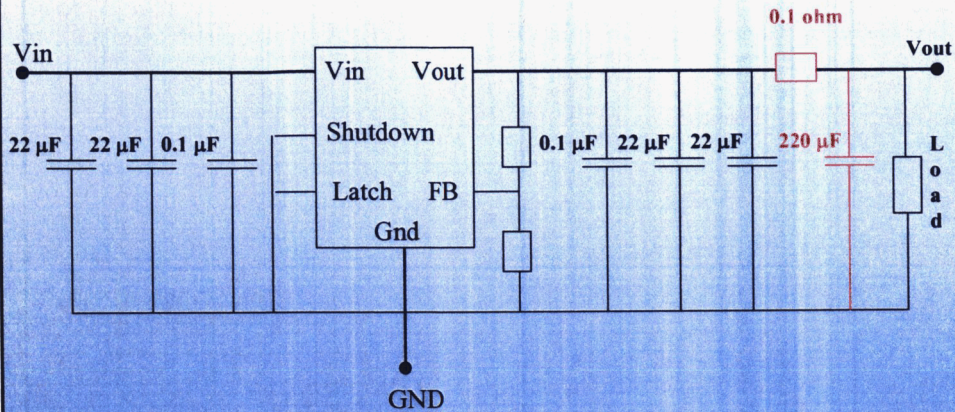


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Summary of test results, MSK5900 from MS Kennedy, Bias condition 1

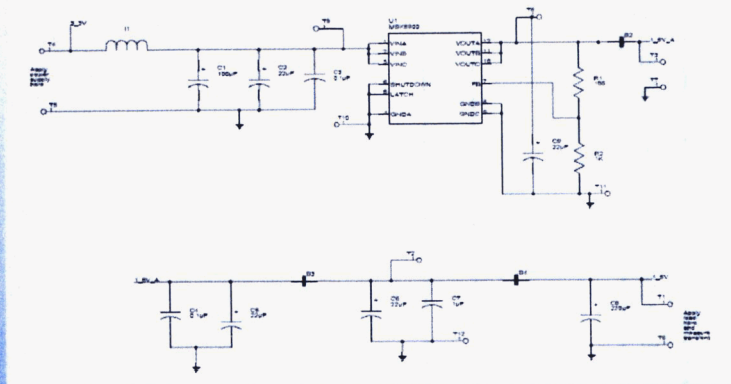


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Summary of test results, MSK5900 from MS Kennedy, Bias condition 2

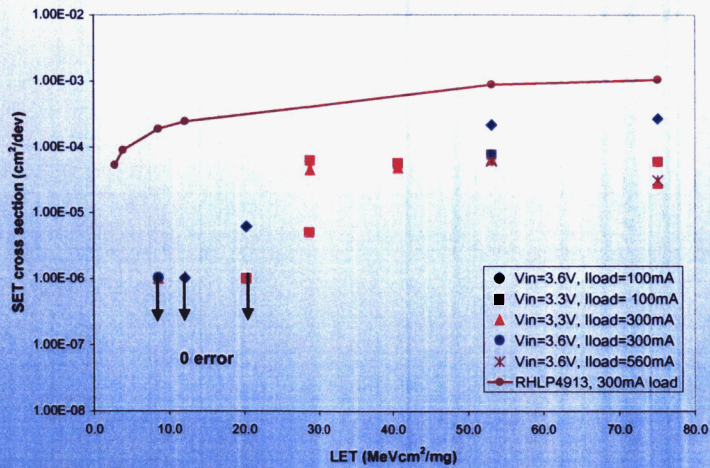


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MSK5900, SET cross section curves

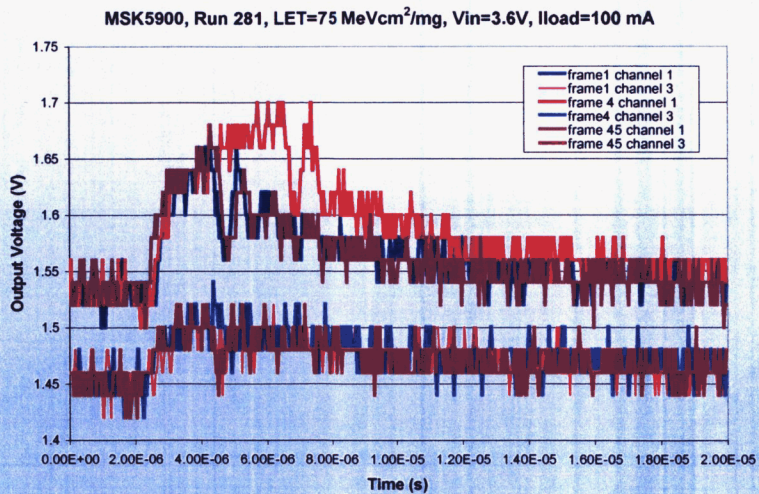


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MSK5900, Typical SETs, RC filter



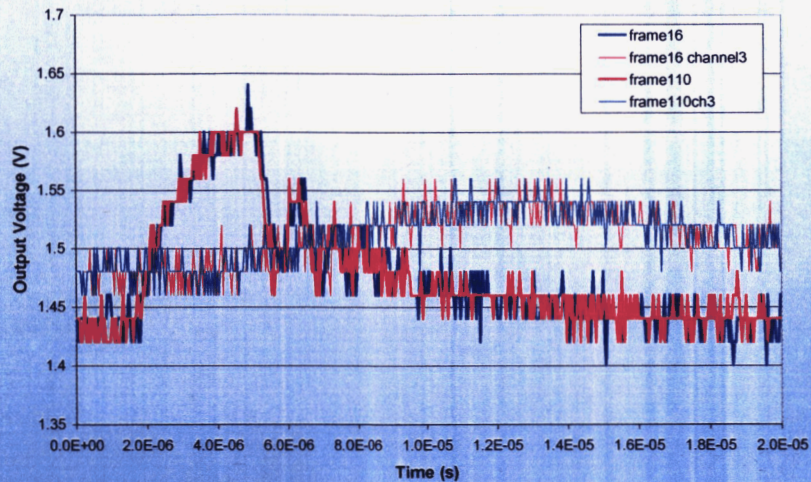
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MSK5900, Typical SETs, ferrite based filter

Run140, MSK5900, Vin=3.2V, Iout=500mA, LET=28.8MeVcm²/mg



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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

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