

Heavy Ion Transients in 2.5V Voltage References

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Heavy ion and 252-Cf tests of 4 types of 2.5V Voltage Ref. of type 1009

- LT1009 Linear Technologies
- RH1009 Linear Technologies
- IS1009 Intersil
- REF43 Analog Devices

TABLE 2
Heavy ions used in the present investigation

Element	LET value [MeV·cm ² /mg]
15 N	3
40 Ar	14
78 Kr	34
131 Xe	56

 **Saab Ericsson Space**

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TITLE

**Heavy Ion Transients in 2.5 Volt Precision
Voltage Referens of Type 1009**

EUROPEAN SPACE AGENCY
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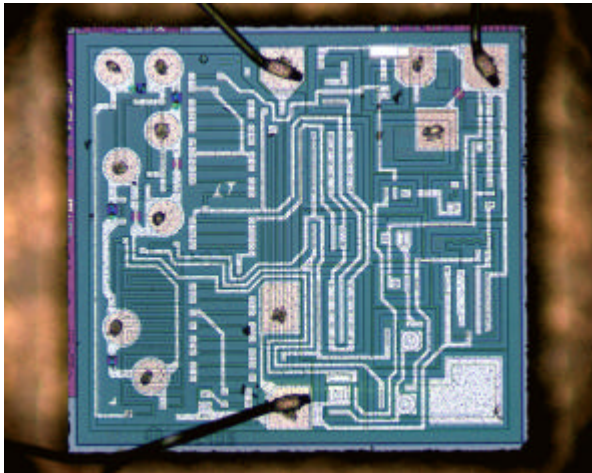


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Test Samples

Precision trimmed 2.5 V shunt regulator, manufactured in bipolar technology,

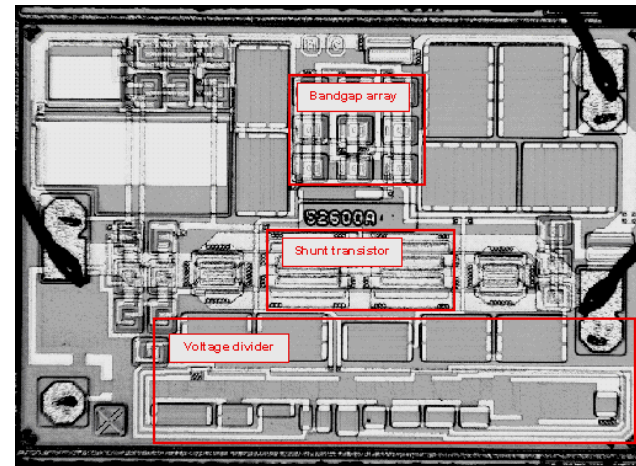
LT1009 (RH1009)



with conventional diode isolation of the different elements.

Chip size 1.36 mm × 1.23 mm.

IS1009RH



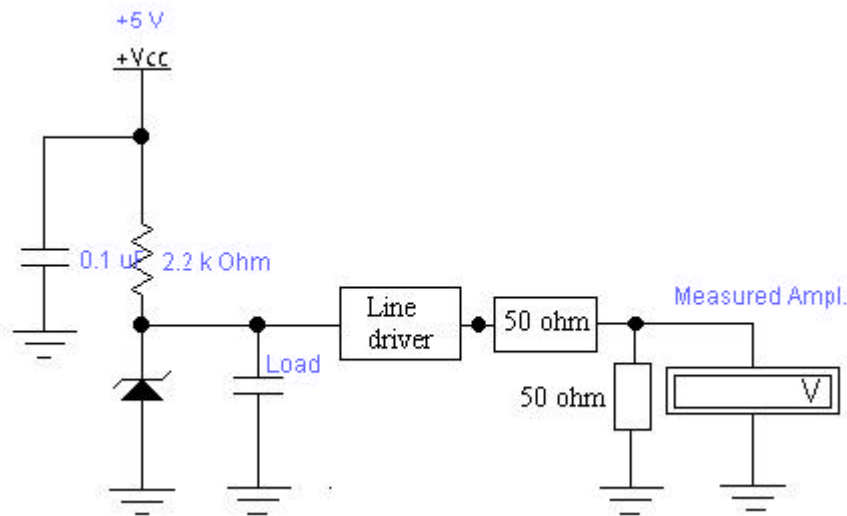
with dielectric isolation of the different elements. Each element has its own tub, and both npn and pnp transistors are vertical.

Chip size is 1.8 mm × 1.3 mm.



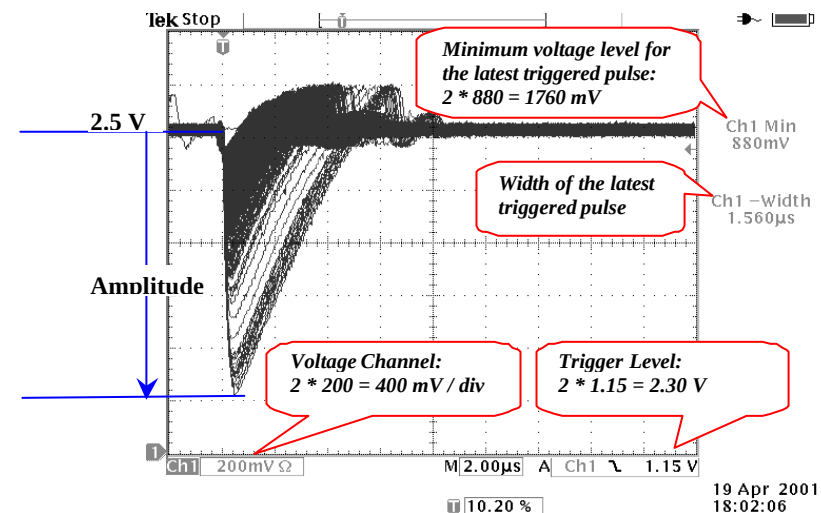
Test Set-up and Measuring Techniques

Width and Amplitude of each Transient pulse were recorded



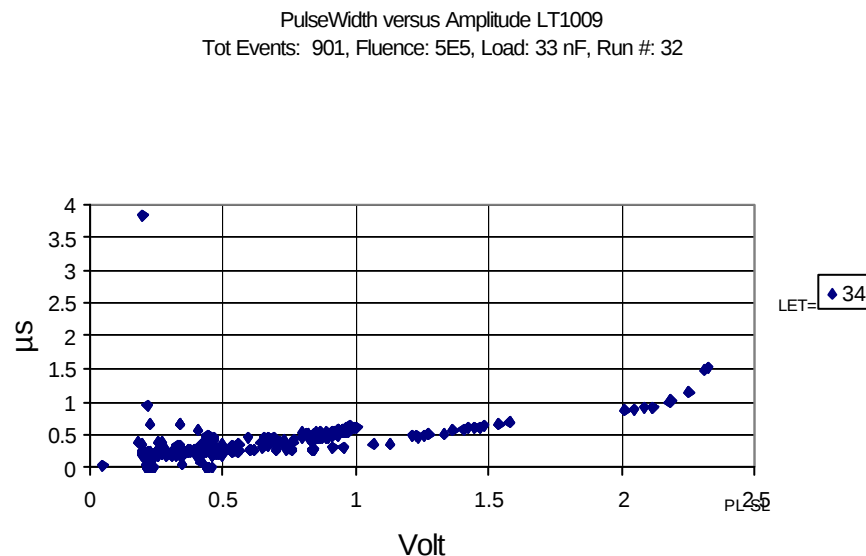
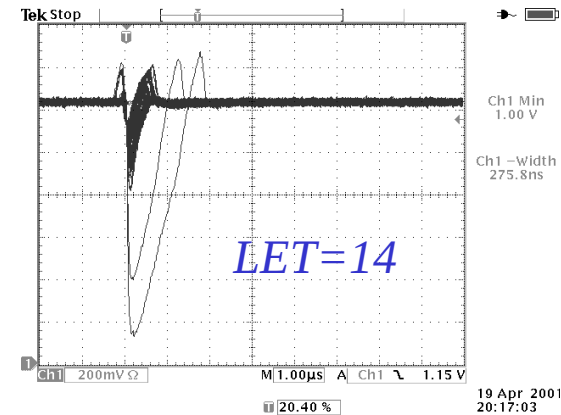
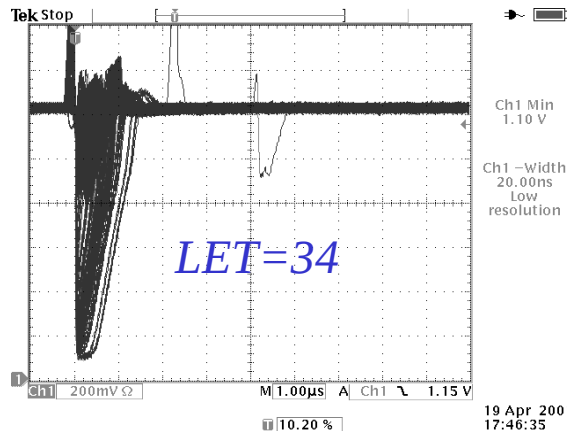
*Schematic drawing of test set-up.
Amplitude measured by Tektronix
TDS3054, 500 MHz, 5GS/s).
The load capacitance were varied for
values 15 pF, 3 nF, 30 nF, 100 nF, 1 mF.*

Definition of the amplitude of the SET pulse. An impedance match is connected after the linedriver, therefore the measured amplitude will be half of the output from the zener diode.



Scatter Diagram “Pulse Width vs Amplitude”

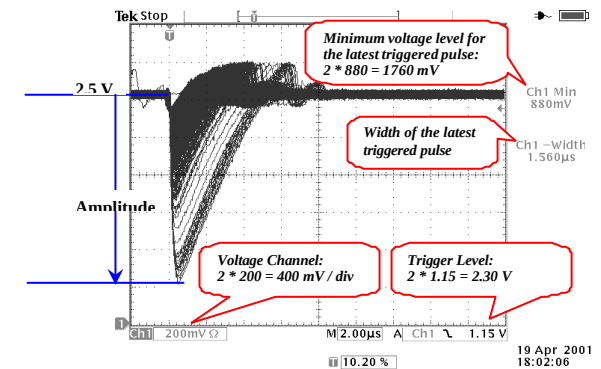
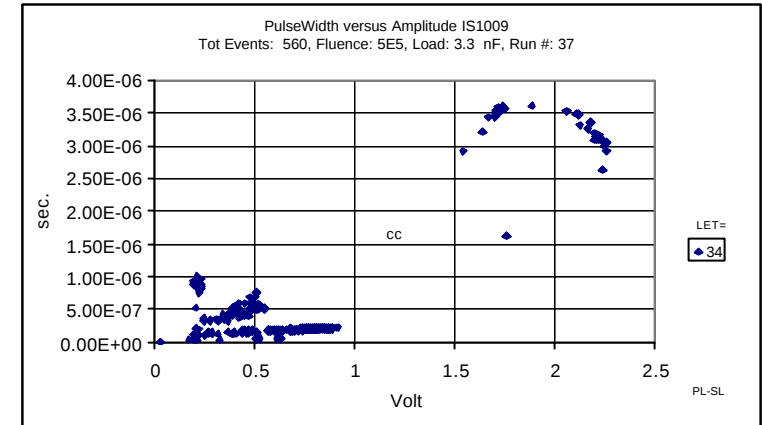
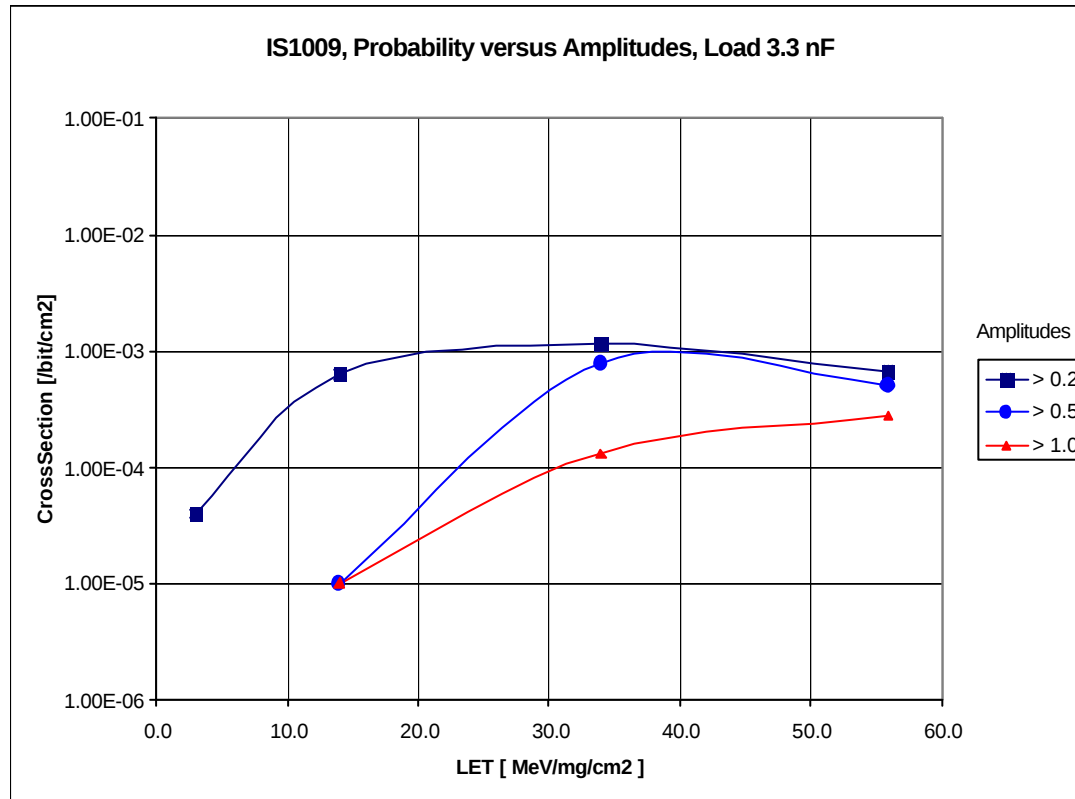
Oscilloscope picture, $\text{load}=33 \text{ nF}$, LT1009



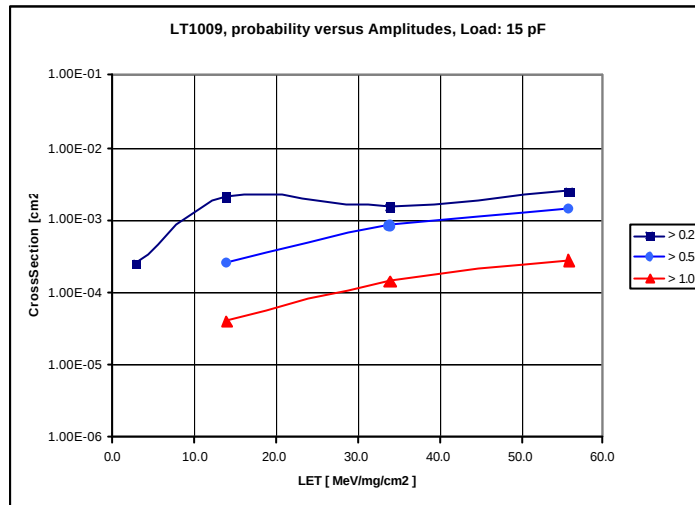
Scatter diagram showing pulse width in μs versus amplitude in Volt.



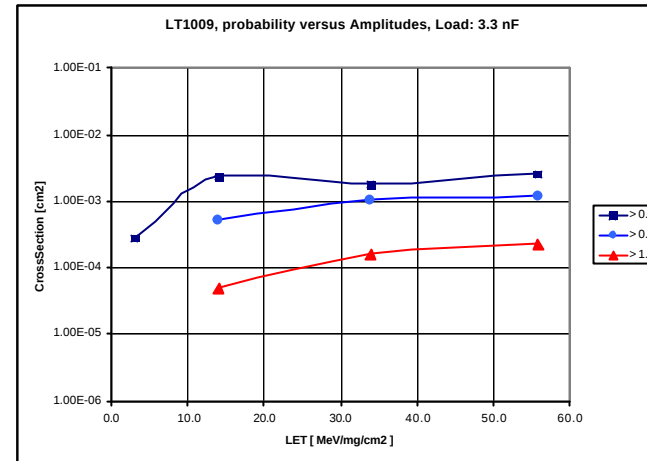
Cross Section vs LET and Pulse Amplitude



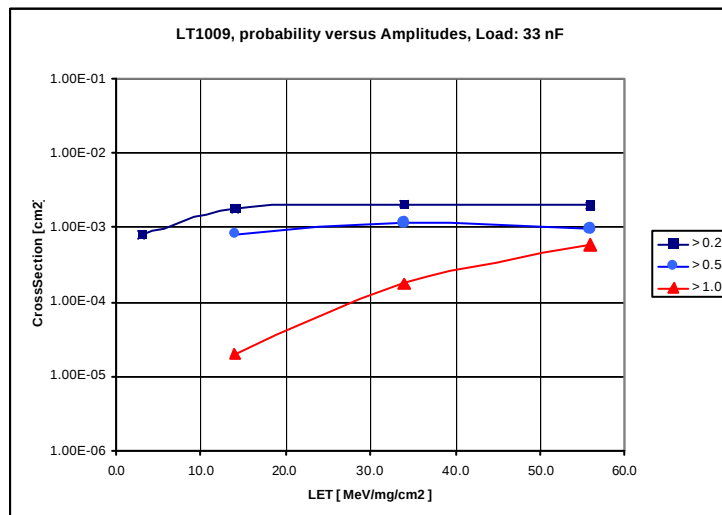
Cross Section vs LET and Amplitude for LT1009



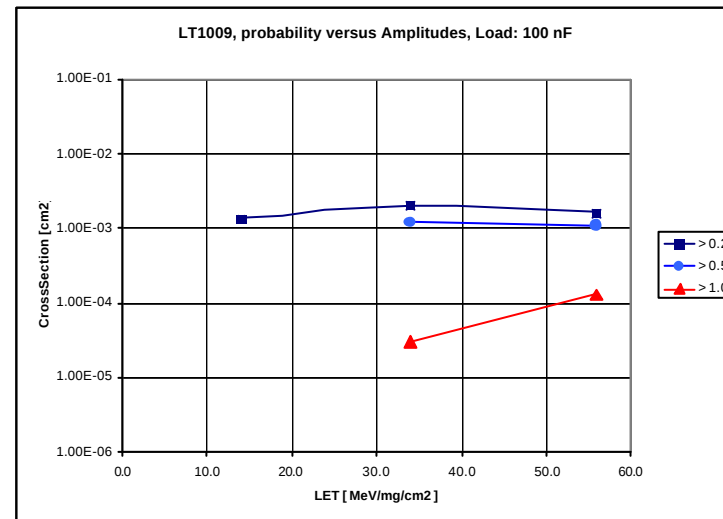
Load 15 pF: LT1009



Load 3.3 nF: LT1009



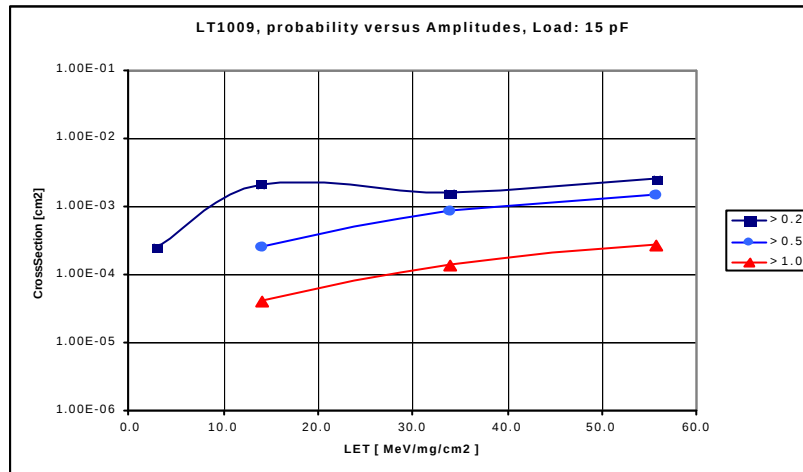
Load 33 nF: LT1009



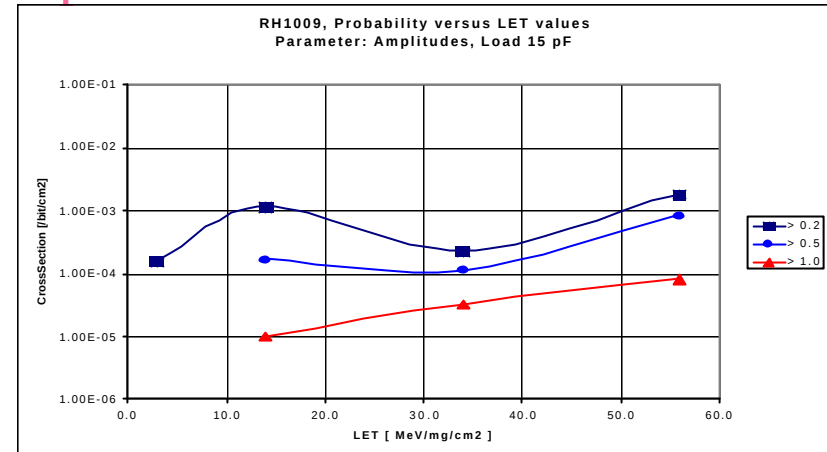
Load 100 nF: LT1009



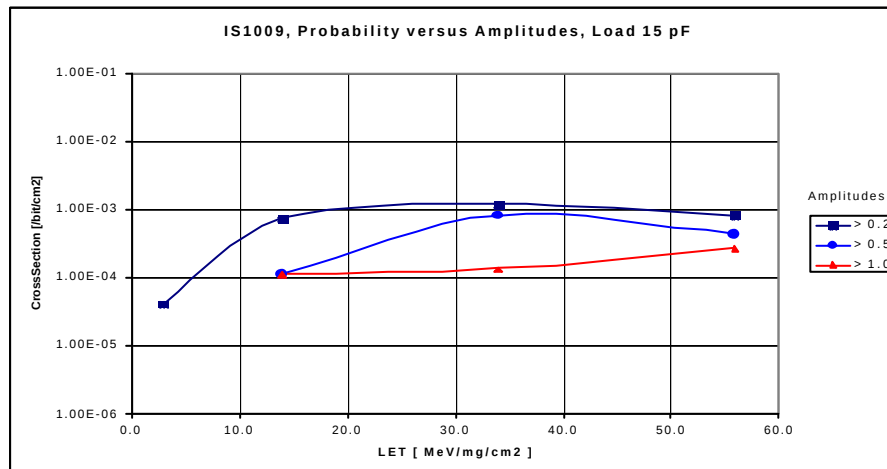
Cross Section vs LET and Amplitude for All devices



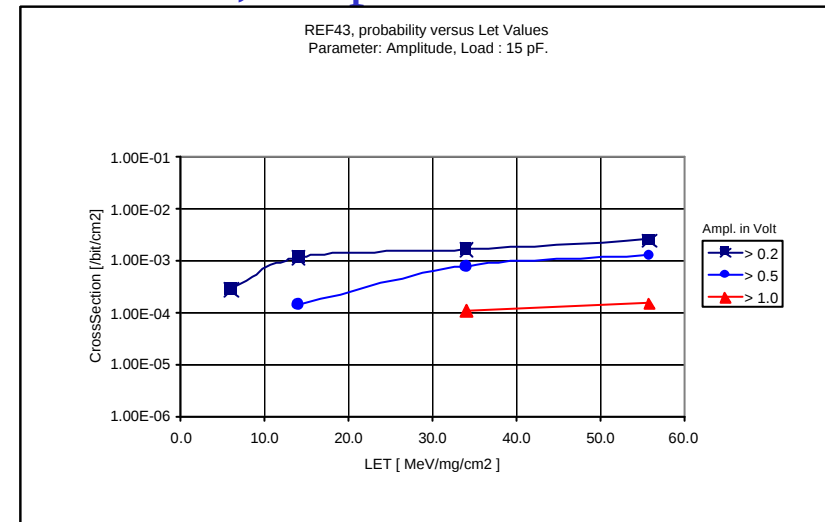
LT1009, 15 pF



RH1009, 15 pF



IS1009, 15 pF

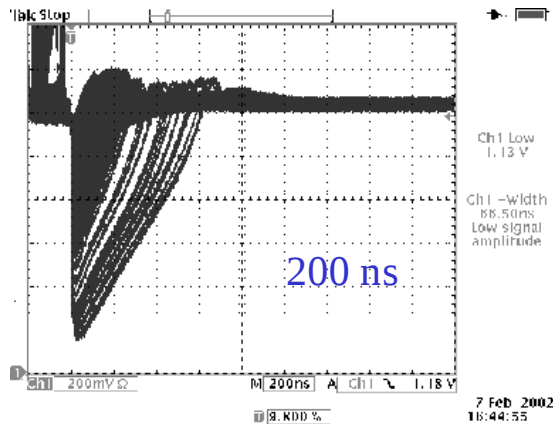


REF43, 15 pF

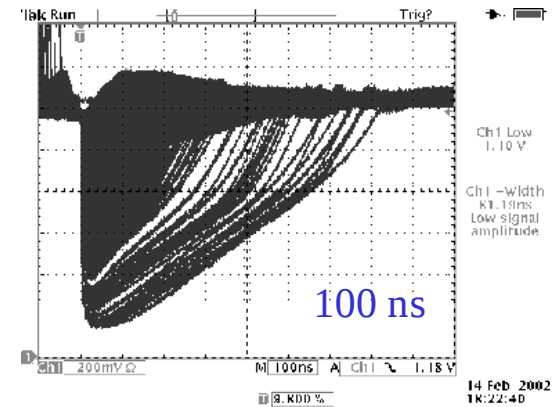


Comparison of Negative Transient Pulses, 252-Cf

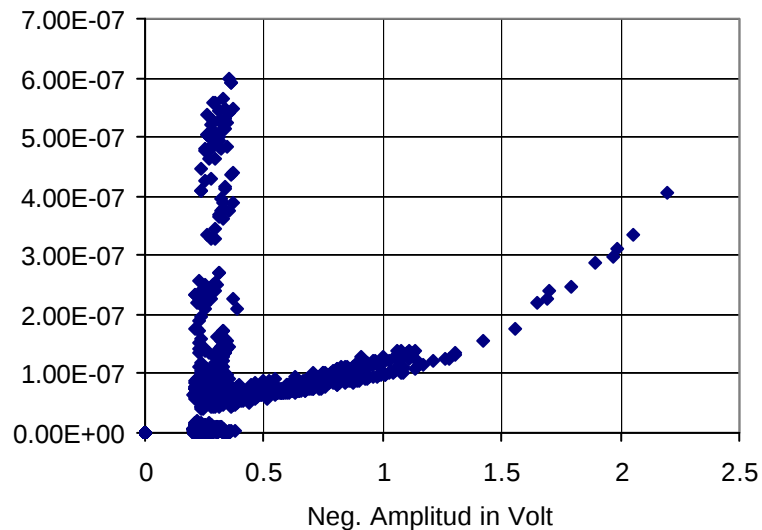
LT1009, 15pF



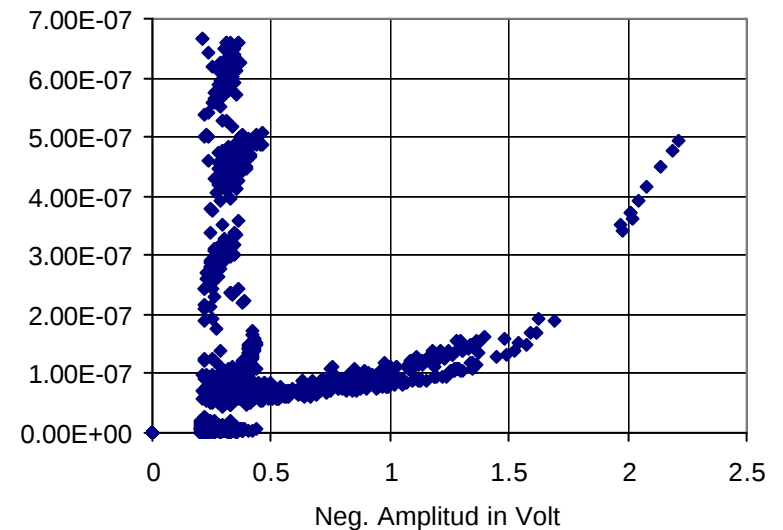
RH1009, 15pF



Seconds LT1009, 15 pF, 1332 min, 4001 events, (3.00ev./min)

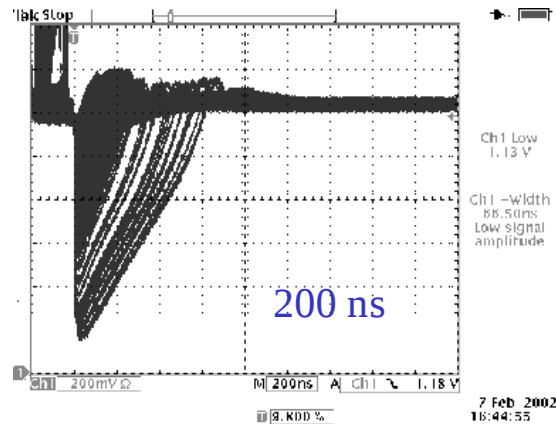


Seconds RH1009, 15 pF, 1511 min, 9099 events, (6.02 ev./min)

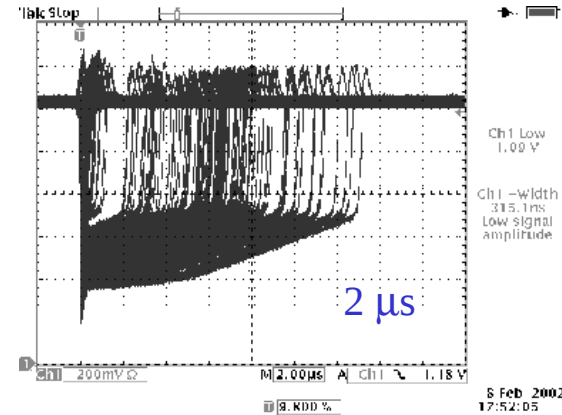


Comparison of Negative Transient Pulses, 252-Cf

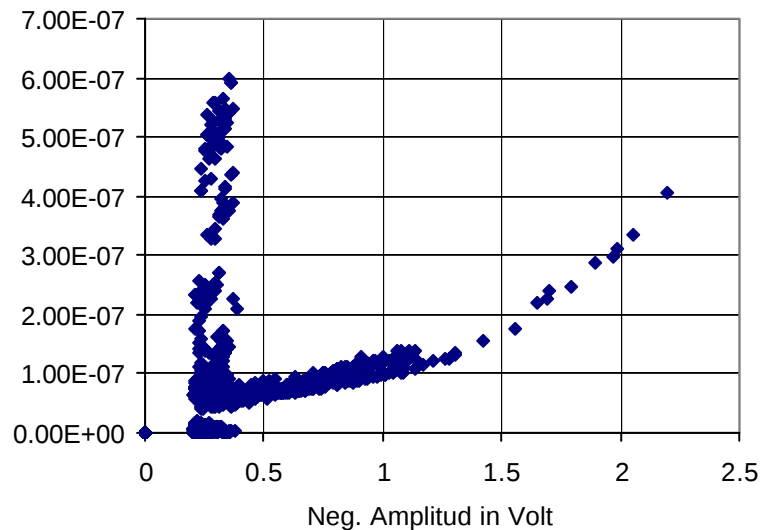
LT1009, 15pF



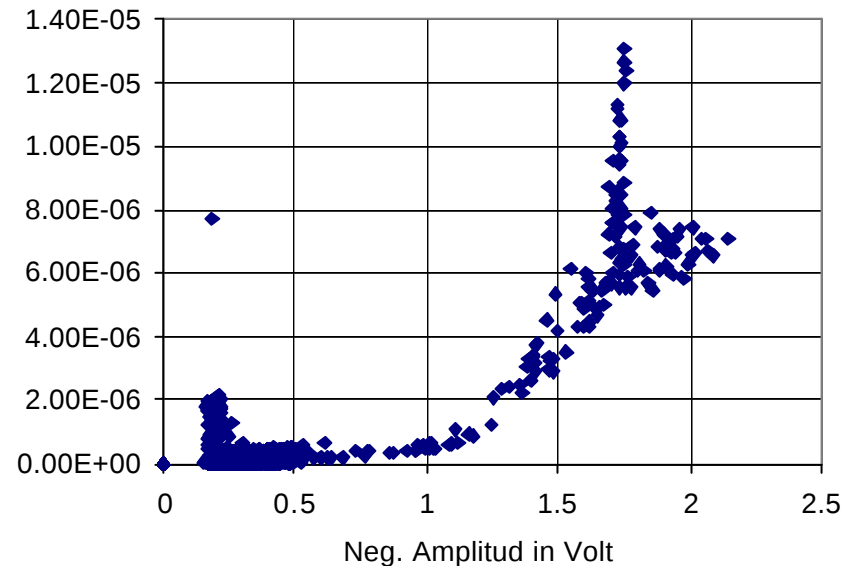
IS1009, 15pF



Seconds LT1009, 15 pF, 1332 min, 4001 events, (3.00ev./min)

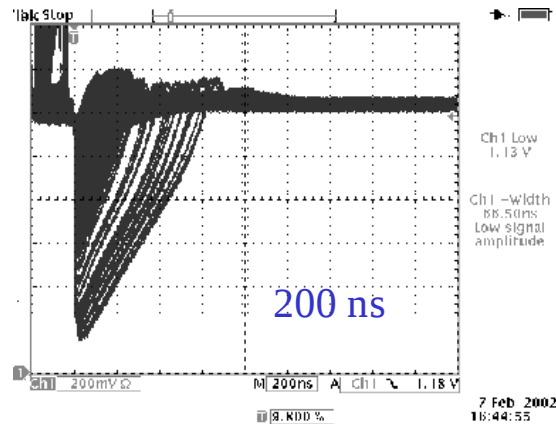


Seconds IS1009, 15 pF, 1556 min, 1900 events, (1.22 ev/min)

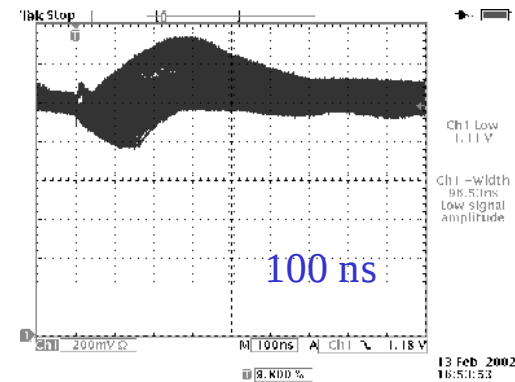


Comparison of Negative Transient Pulses, 252-Cf

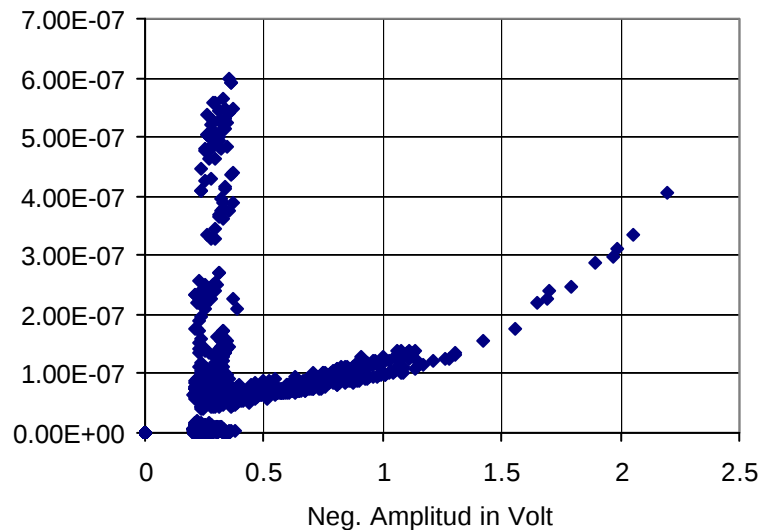
LT1009, 15pF



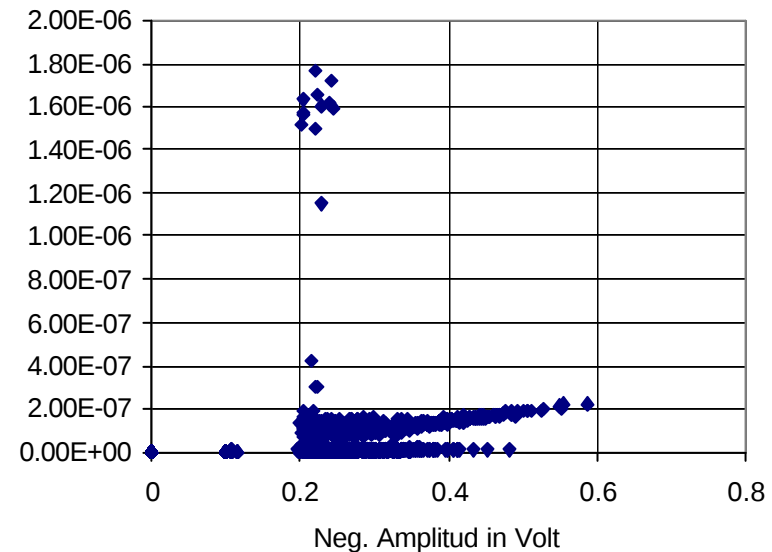
REF43, 15pF



Seconds LT1009, 15 pF, 1332 min, 4001 events, (3.00ev./min)

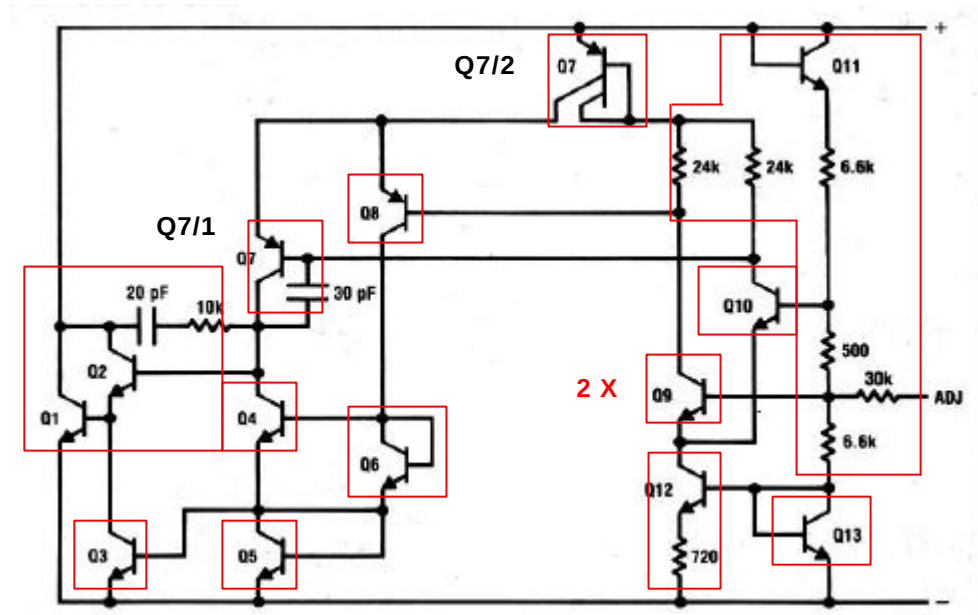
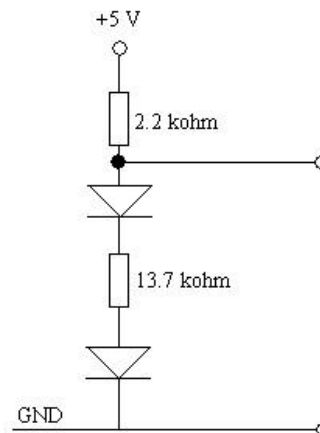
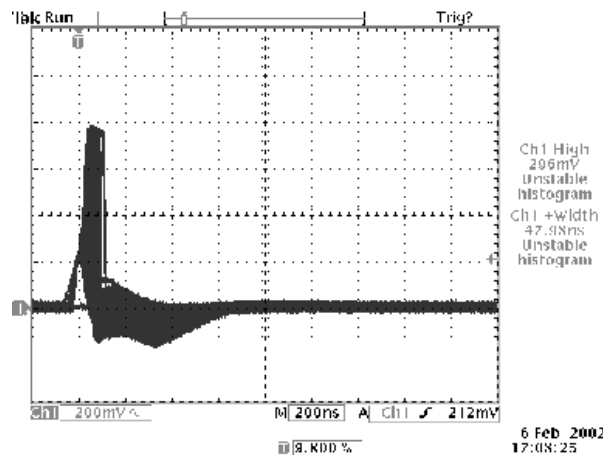
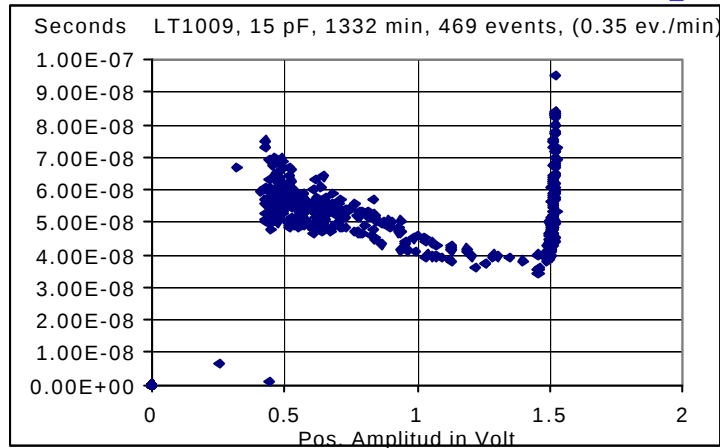


Seconds REF43, 15 pF, 1440 min, 2171 events, (1.51 ev./min)



Comparison of Positive Transient Pulses, 252-Cf

LT1009, RH1009, 15pF

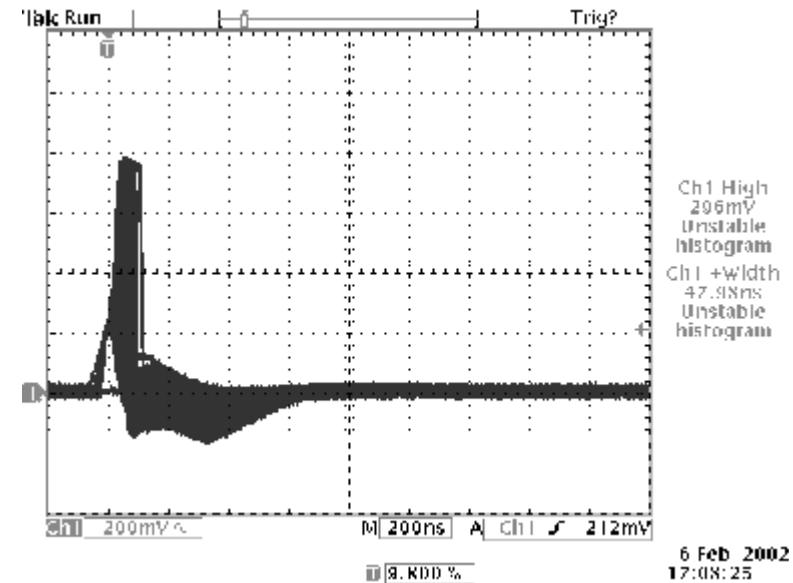
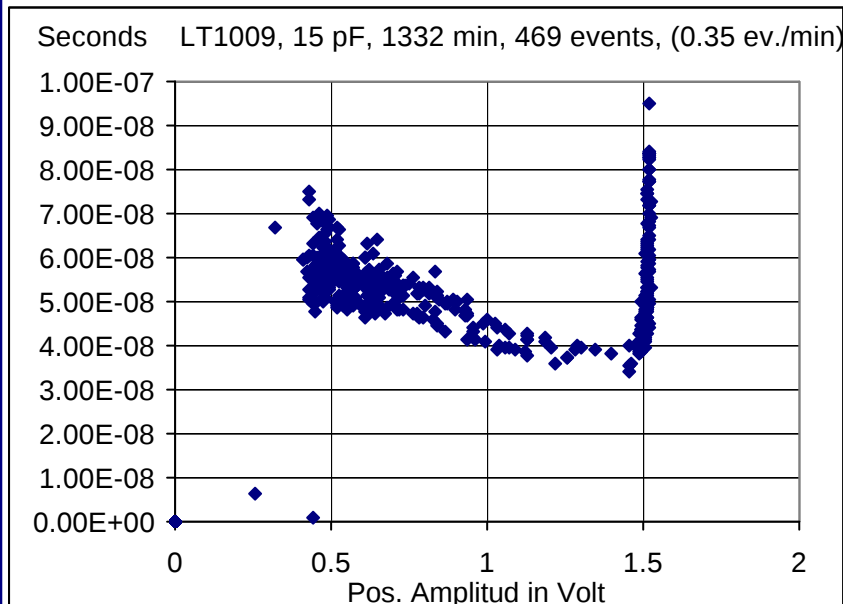


Worst case positive transient occurs when the shunt-transistor Q1 is cut off, giving a transient height of:

$$V_{IN} - ((I_{BIAS} + I_{LOAD}) \cdot R) \approx 4 \text{ V}$$

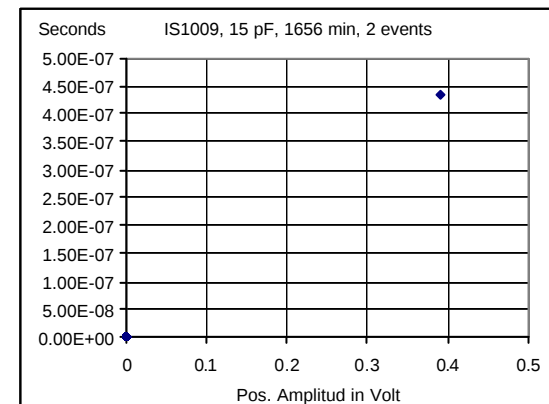

Comparison of Positive Transient Pulses, 252-Cf

LT1009, RH1009, 15pF



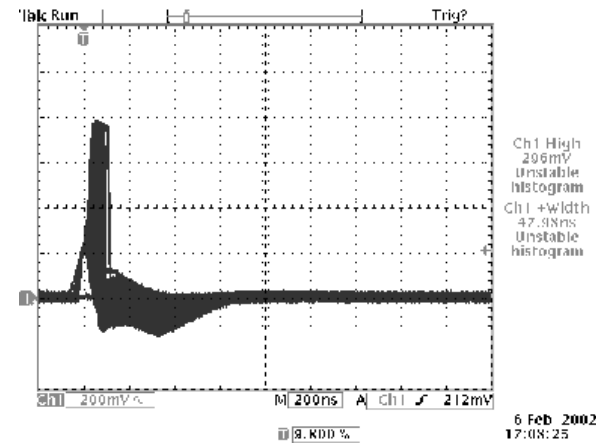
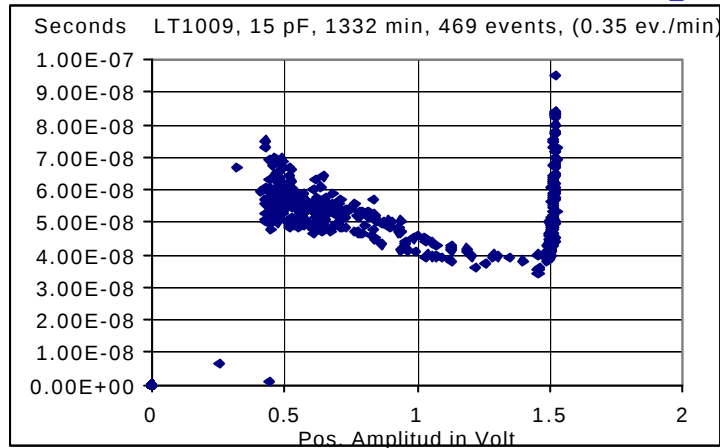
6 Feb 2002
17:08:25

IS1009, 15pF

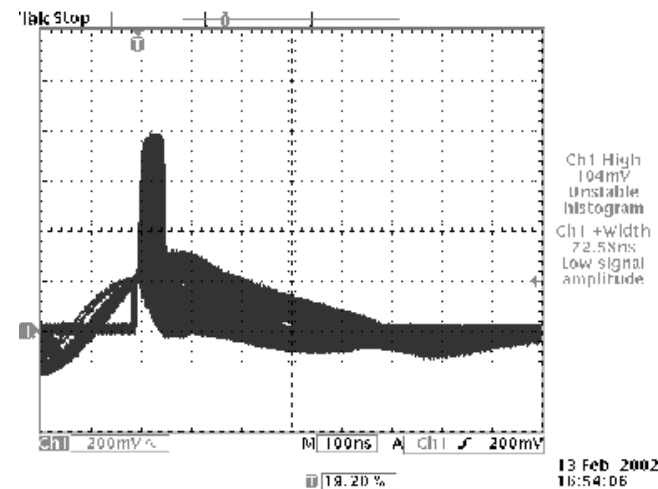
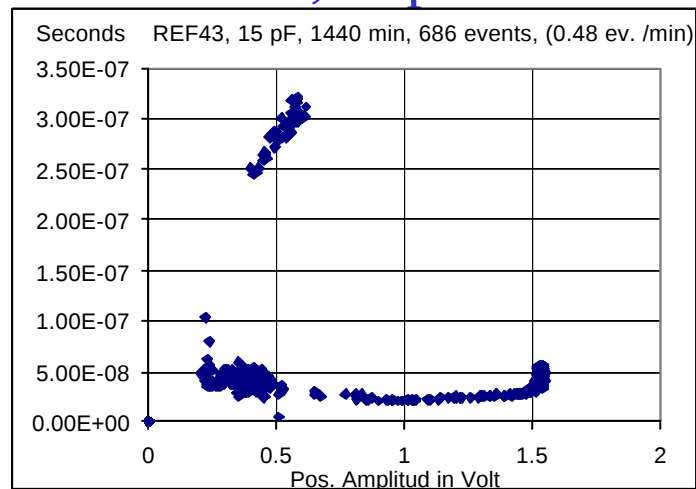


Comparison of Positive Transient Pulses, 252-Cf

LT1009, RH1009, 15pF



REF43, 15pF



Conclusions

- Heavy Ion Transient Cross Sections About the Same for the Four Device Types
- Amplitudes for Negative pulses about the Same for All Types
- Positive Transients Very Short (200 ns)
- Large Differences in Pulse Widths (1 -to-15 μ s)

