

Heavy Ion Transients in Operational Amplifier of Type LM124, RH1014 and OP27

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ESA/ESTEC Contract 11407/95/NL/MV, CCN-5, COO-5/II •



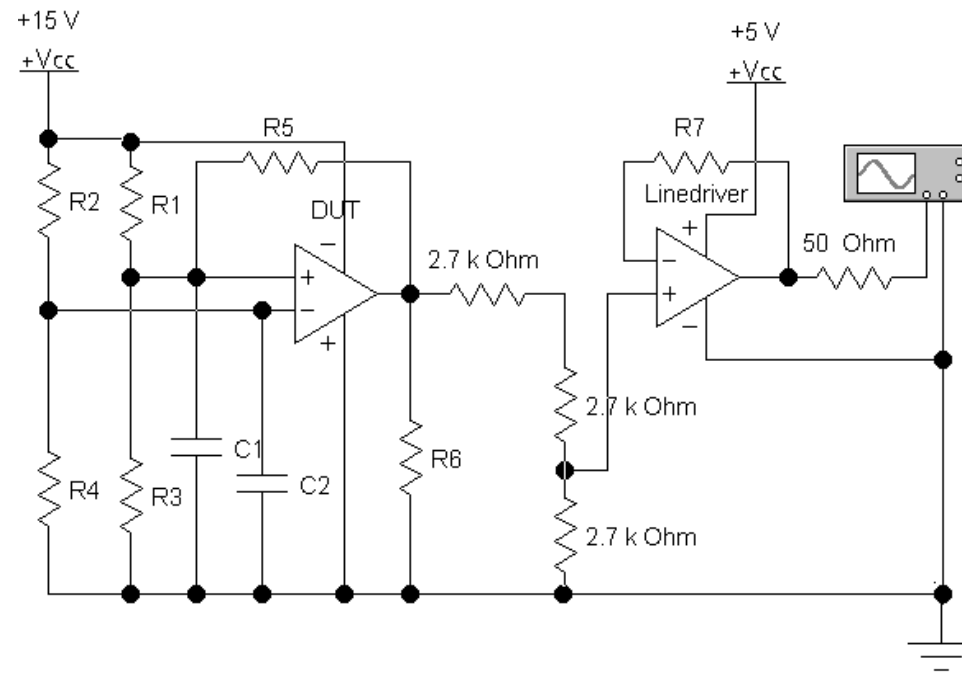
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Tested OP Amplifiers

- LM124 National Semiconductor
- RH1014 Linear Technology
- LM124 Texas Instruments
- OP27 Analog Devices



Bias conditions



Input bias

? $V_{in}(V)$

0.2

5

$V_{+}(V)$

2.70

7.43

$V_{-}(V)$

2.50

2.50

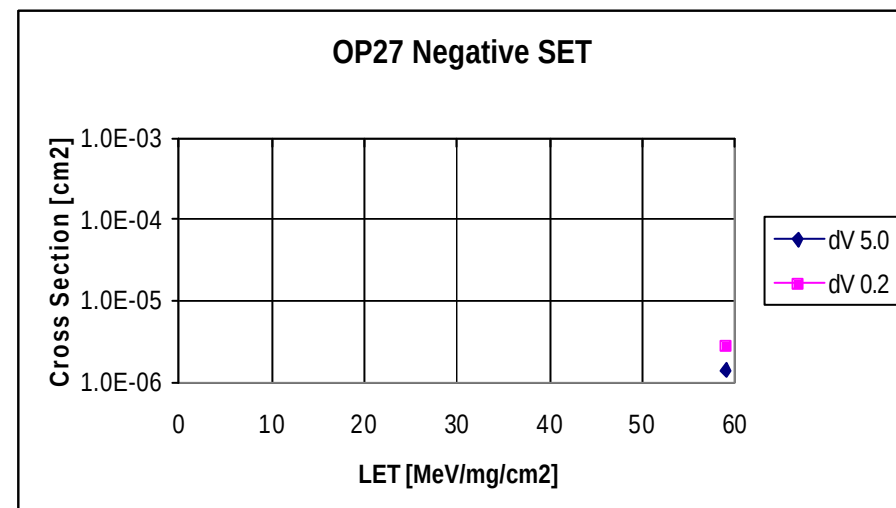
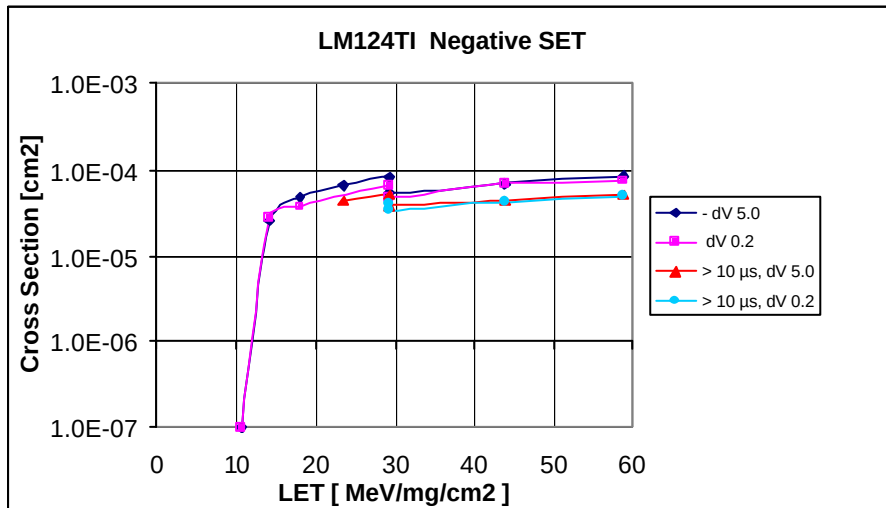
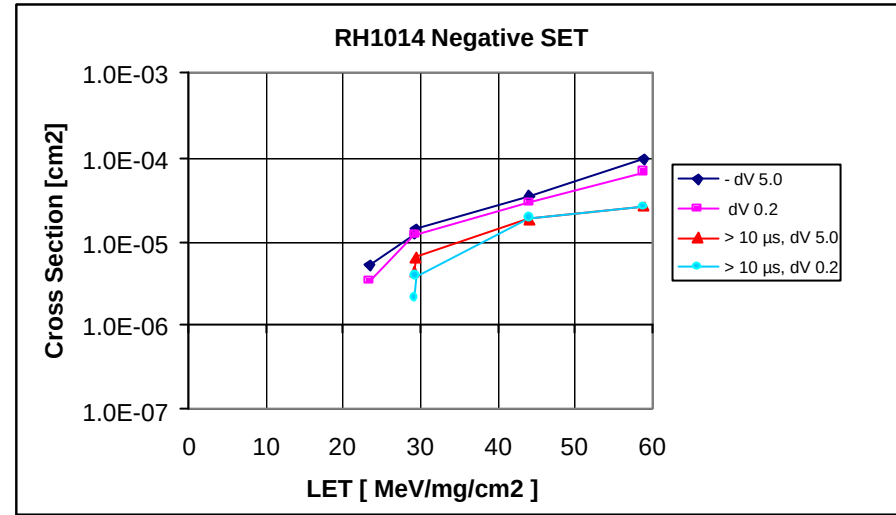
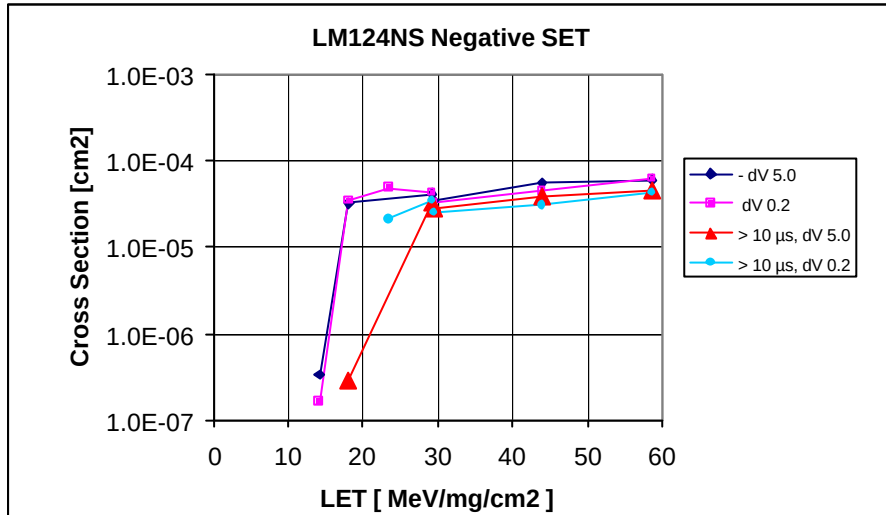
$V_{out}(V)$

12

12

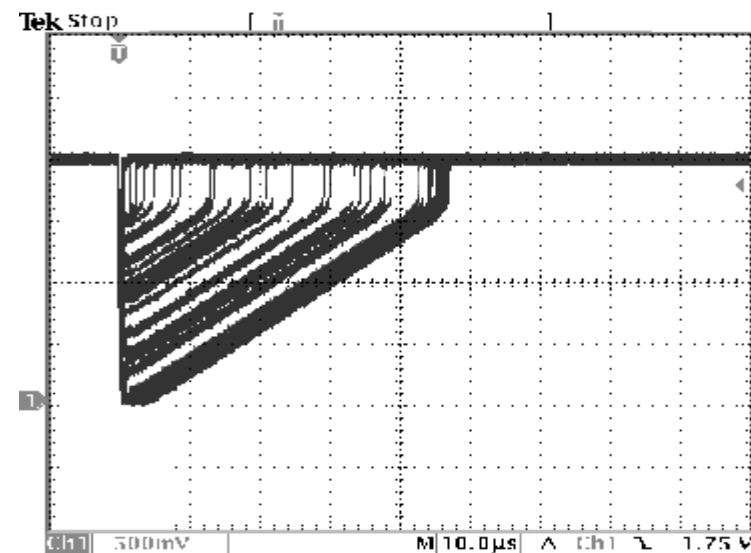
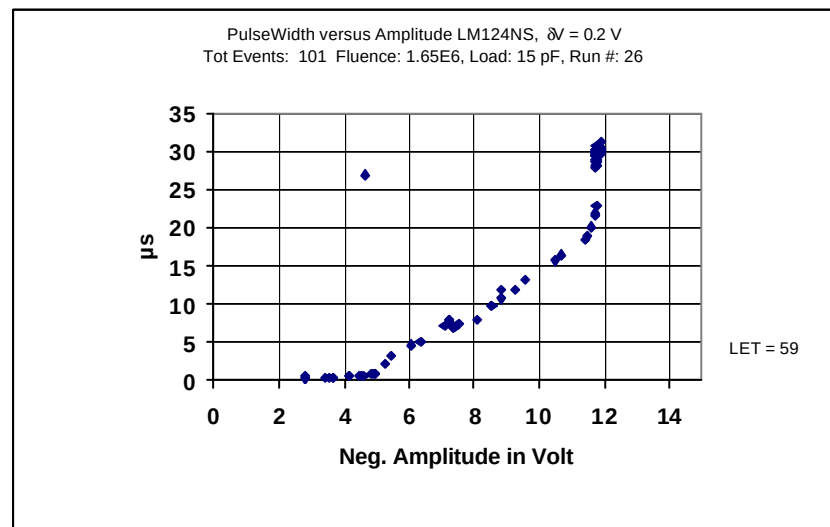
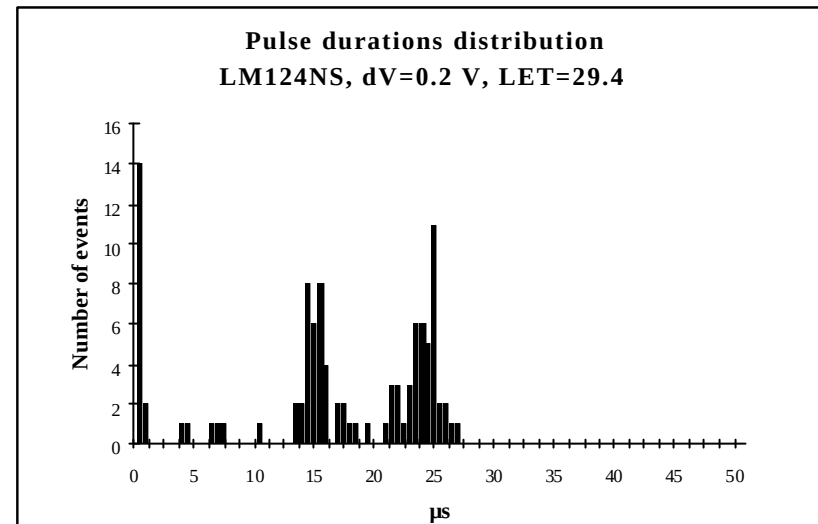


Cross Sections



LM124NS

(TI similar)

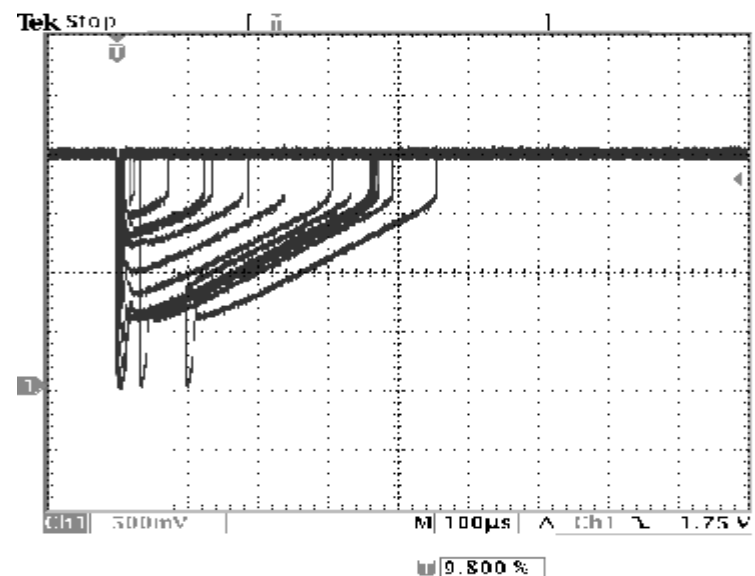
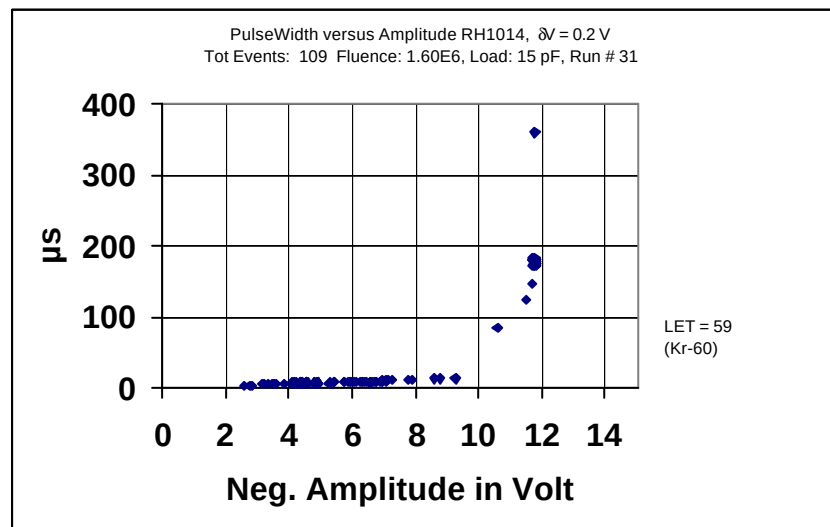
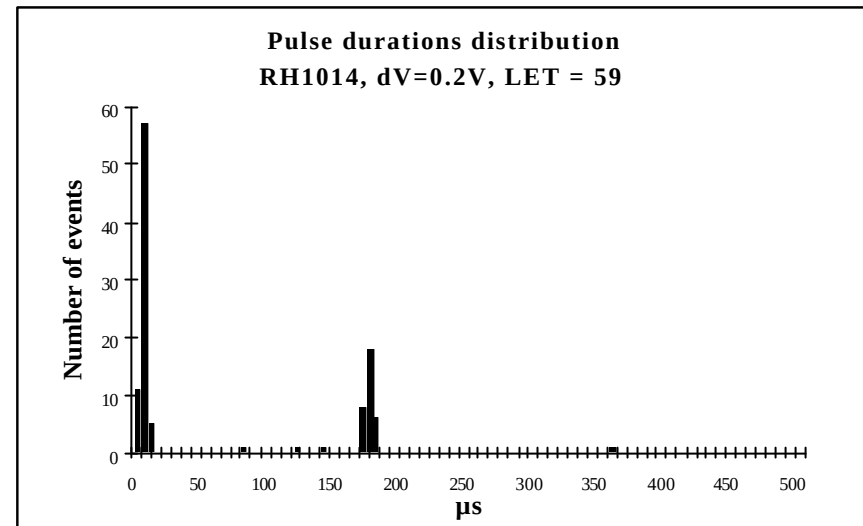


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RH1014



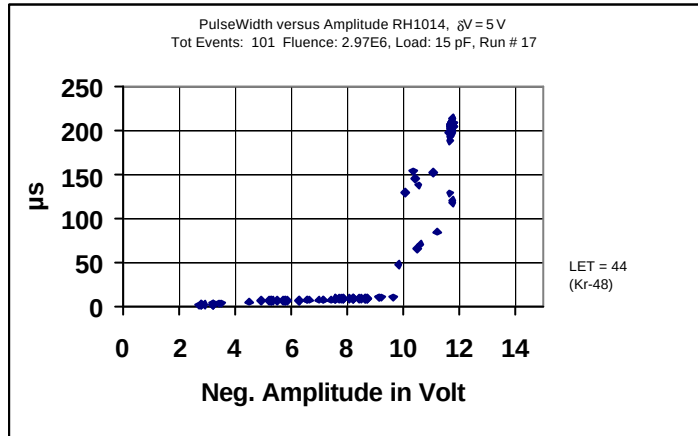
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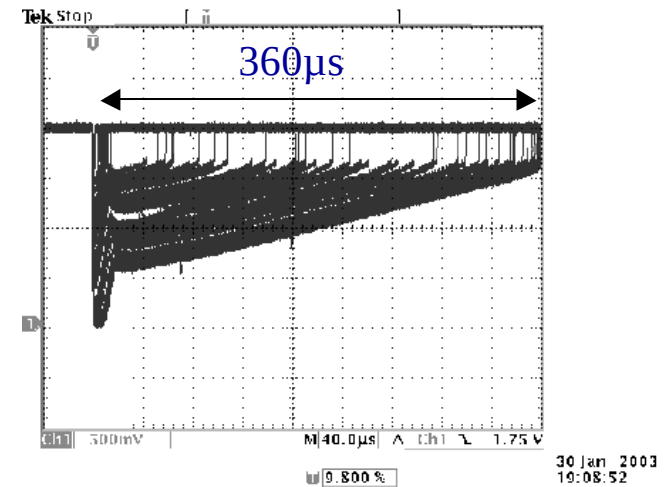
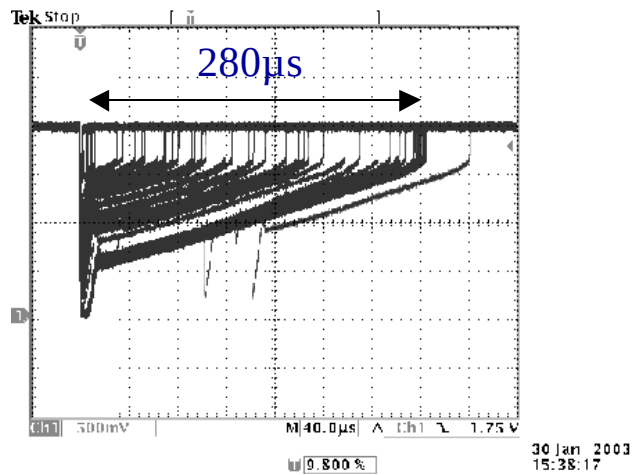
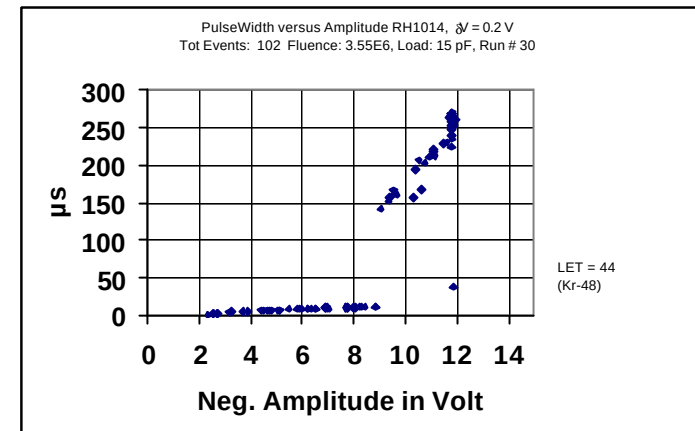
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RH1014

? $V_{in} = 5\text{ V}$

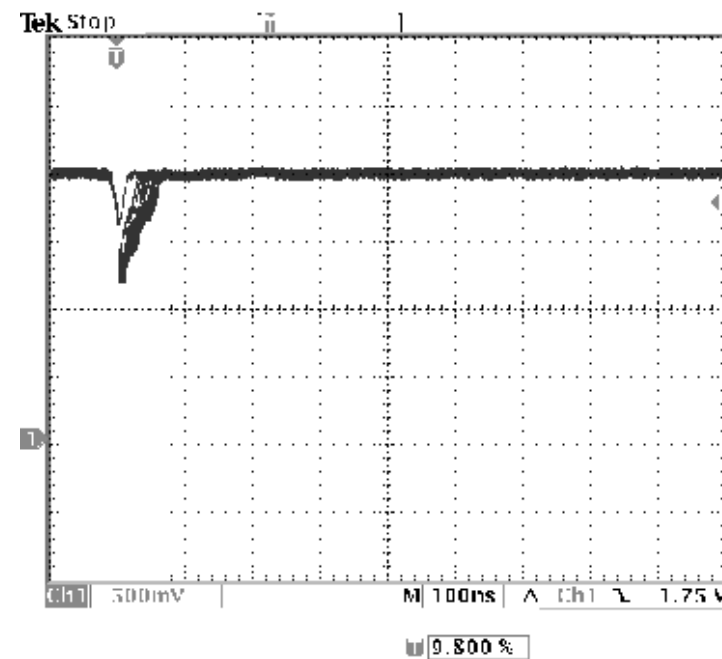
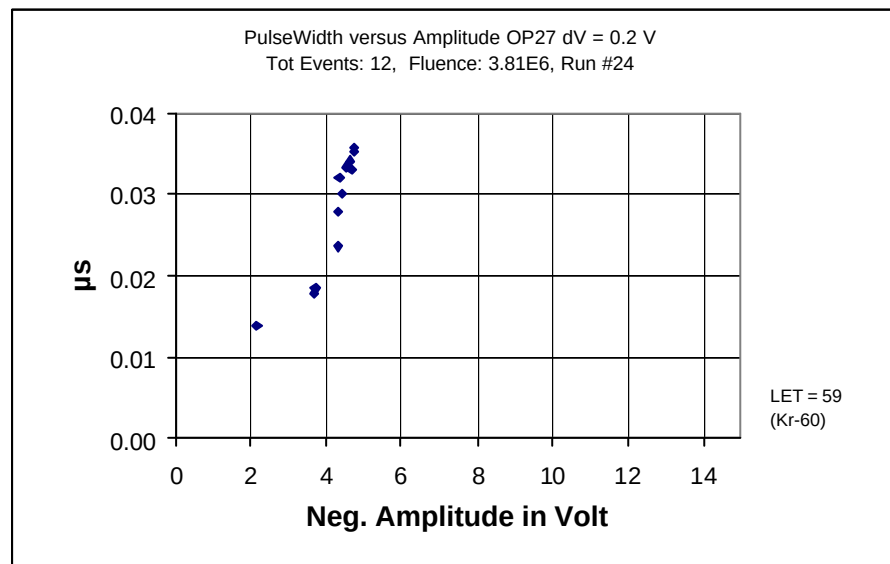


? $V_{in} = 0.2\text{ V}$



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OP27

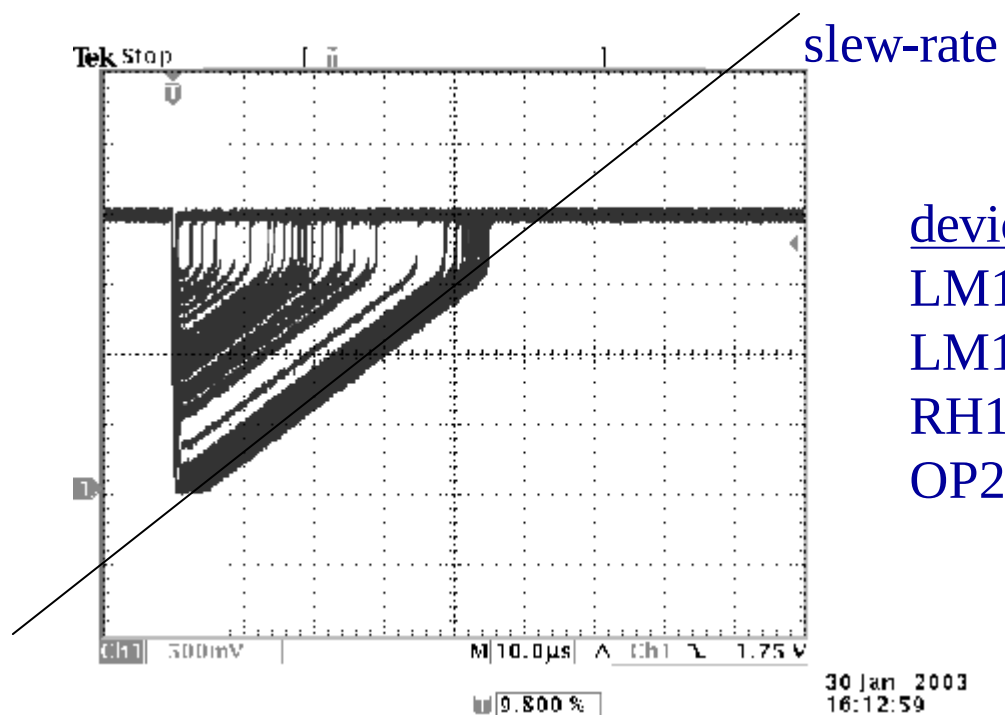


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The dependence on the slew-rate



device	SR1	SR2	SR, spec.
LM124NS	0.23	0.22	0.5
LM124TI	0.40	0.40	0.5
RH1014	0.024	-----	0.2
OP27	5.0	2.5	2.8

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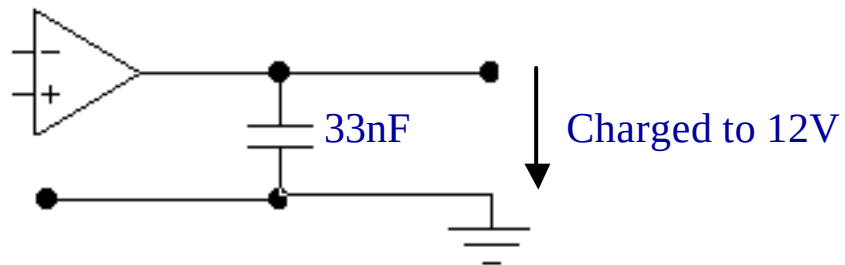


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One way to avoid SET!

With a load of 33nF and for LET = 69MeV/mg/cm²
no SET's were observed

LM124NS



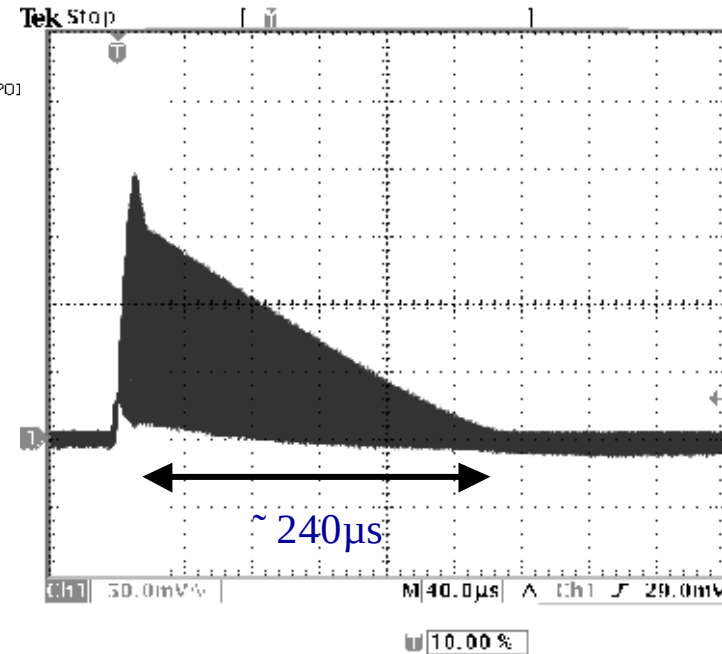
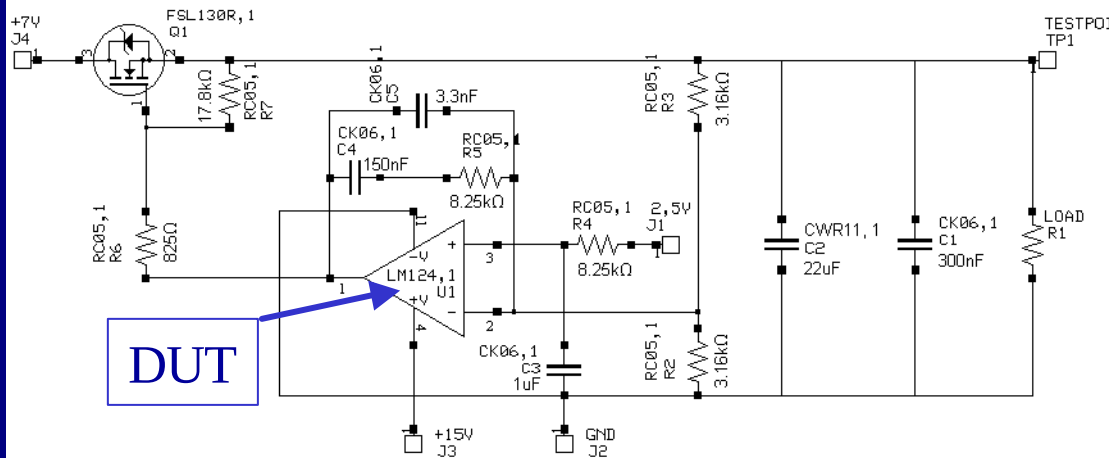
With a sink value of 15mA
of the OP-amp



discharge time of 26μs



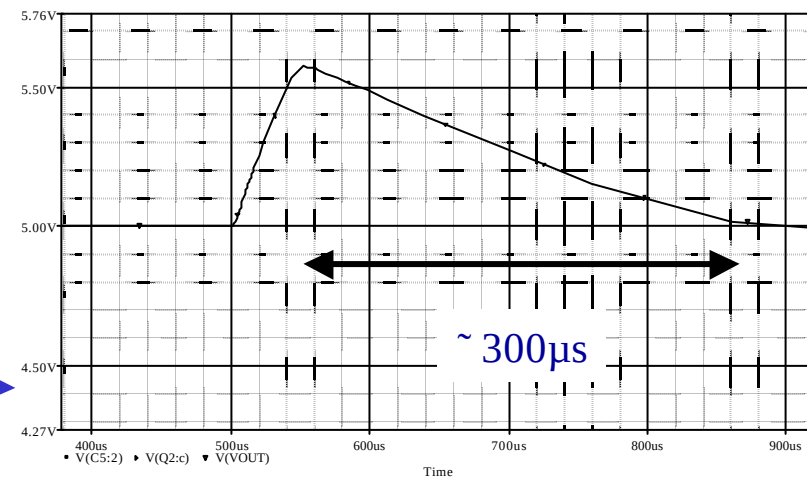
LM124 in a 5 voltage regulator application



$R1=1150$, $C=22\mu F$? $RC=2.5ms$?
0 negative events

Upcharged to 5.5V ? a discharge to 5V will take $\sim 240\mu s$

P-Spice simulation



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