Single Event Transient Test Report
LMH6702 Operational Amplifier

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1. Introduction

This test had two goals. One was to measure the cross section for single event transients (SETs). The second was to capture the transients and measure their amplitudes and widths. The test was done at LBNL in September 2006.

2. Device Information

The LMH6702 is a 1.7 GHz ultra-low distortion wideband operational amplifier manufactured by National Semiconductor. One part was tested. There is no date/lot code information on the package.

3. Test Setup

Figure 1 shows the configuration used for testing. This configuration had been used successfully during total dose testing and was substituted for one suggested by Jeff Jaso because the part went into oscillation when powered up. Therefore, the test results pertain to the particular test configuration used and care should be exercised in extrapolating these results to other test configurations.

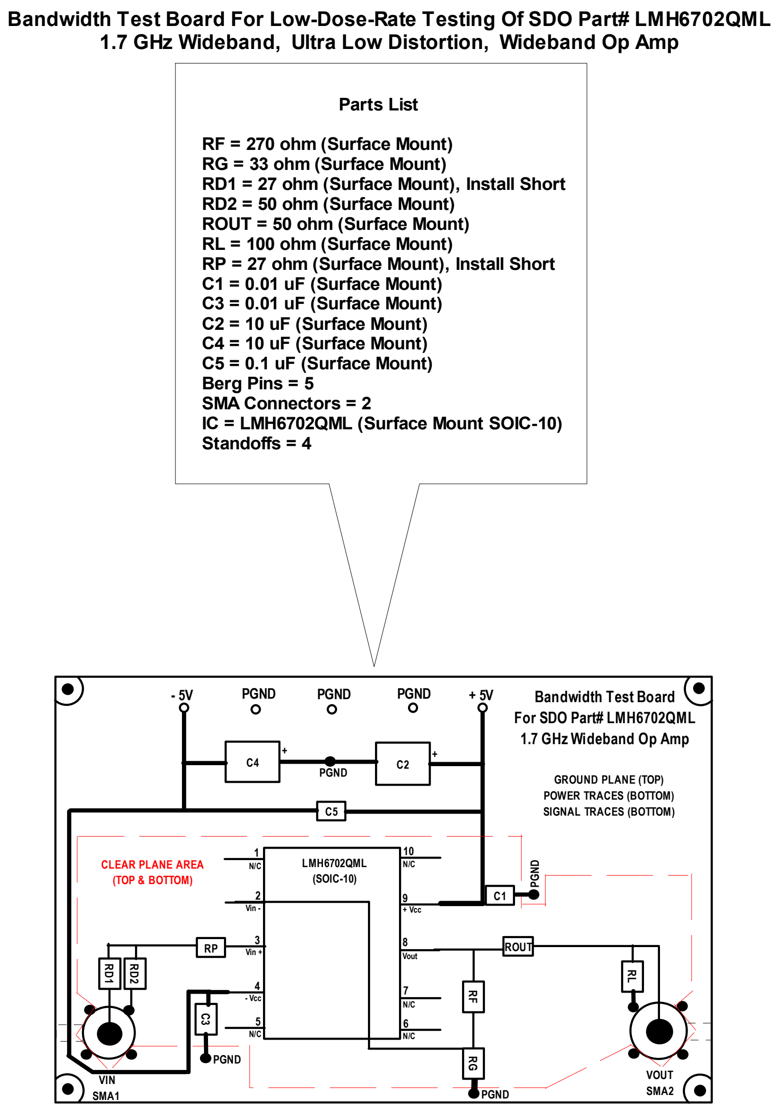

Fig. 1. Test setup used for SET testing of the LMH6702.

An oscilloscope was attached to the output. The trigger level was set at 100 mV above and below the DC output voltage. The output voltage was set at 3.8 V. All transients captured by the oscilloscope were transferred to a computer where they were stored for later analysis.

4. Ion Beam Information

The parts were tested at the 88" cyclotron at Lawrence Berkeley Laboratory. Table I shows the ions used for testing. The flux was kept sufficiently low to prevent the transients from overlapping and to allow sufficient time for each transient to be transferred from the oscilloscope to the computer with a small probability that a transient would occur during the transfer time. Additional values of LET were obtained by rotating the device by 45 degrees.

Table I
Ions used for Testing at LBL

Ion (10 MeV/amu)	**LET ($MeV.cm^2/mg$)**
Cu	21.33
Kr	31.28
Xe	58.72

5. Results

Figure 2 shows the SET cross section as a function of effective ion LET. The data points are fit with a Weibull curve in order to be able to calculate the SET rate. Using the Petersen figure of merit approach (Rate=$500 \cdot \sigma_{sat}/LET_0^2$) error rate for geosynchronous orbit is 1 transient every 150 years. (σ_{sat}= $8x10^{-6}$ and LET_0 = 15 $MeV.cm^2/mg$).

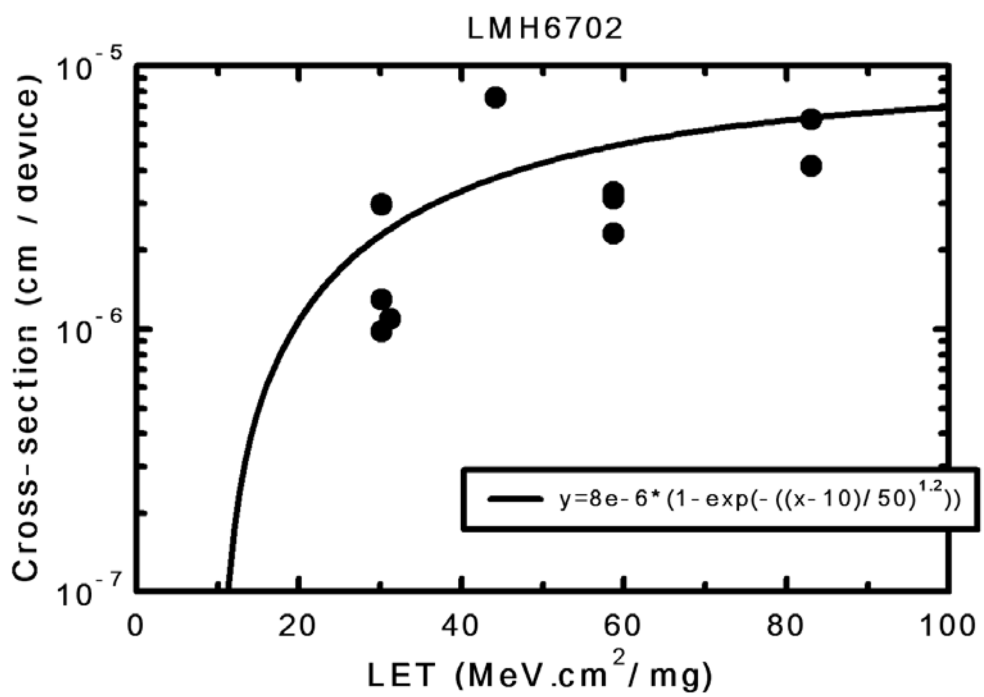

Fig. 2. Single Event Transient Cross Section as a Function of Effective Ion LET for the LMH6702. The Weibull curve is a fit to the data for a worst-case situation. All the transients with amplitudes greater than 100 mV were counted.

The amplitudes and widths of all the transients were measured using software. A plot was made for each LET that included the amplitudes and widths of each curve in order to obtain a graphical picture of the transient "phase space." The figures show that at each LET there is a wide distribution of transient shapes. Furthermore, in general, the transients last for a longer time at higher LETs. Only two transients had positive amplitudes and they were for LET=83.04 MeV.cm^2/mg.

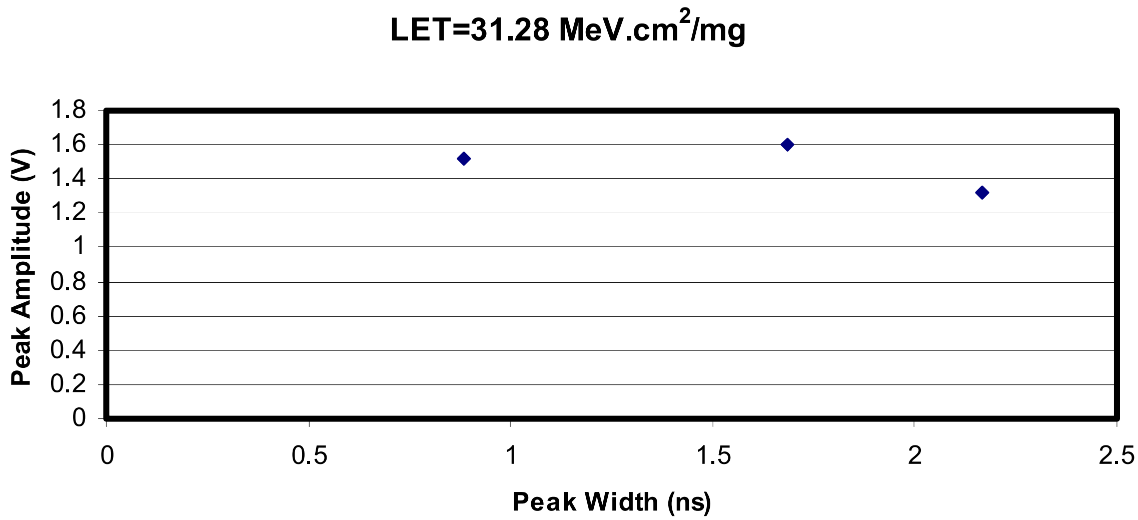

Fig 3: Amplitude (V) vs Peak Width for LET=31.28 MeV•cm^2/mg.

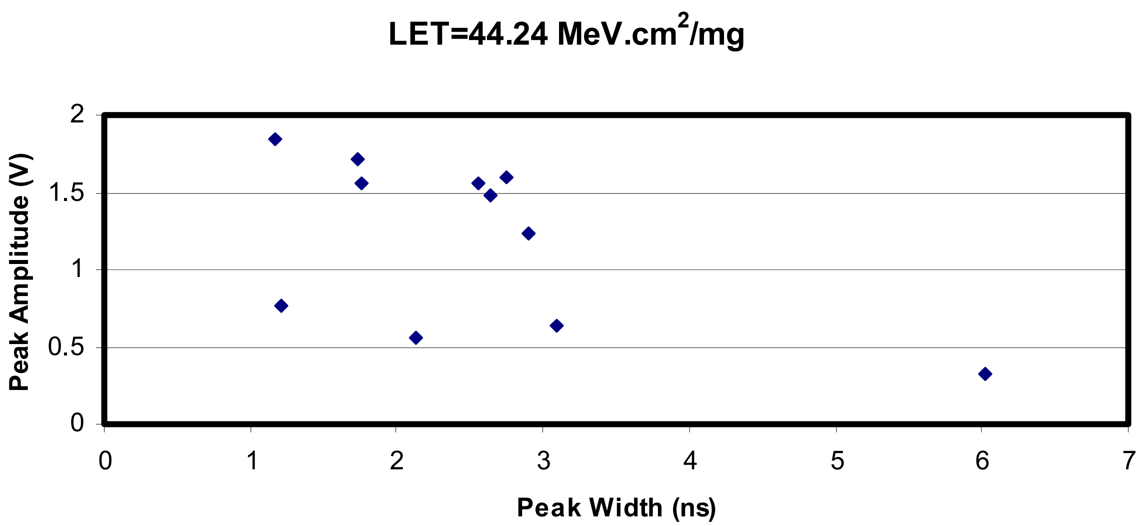

Fig 4: Amplitude (V) vs Peak Width for LET=44.24 MeV•cm^2/mg.

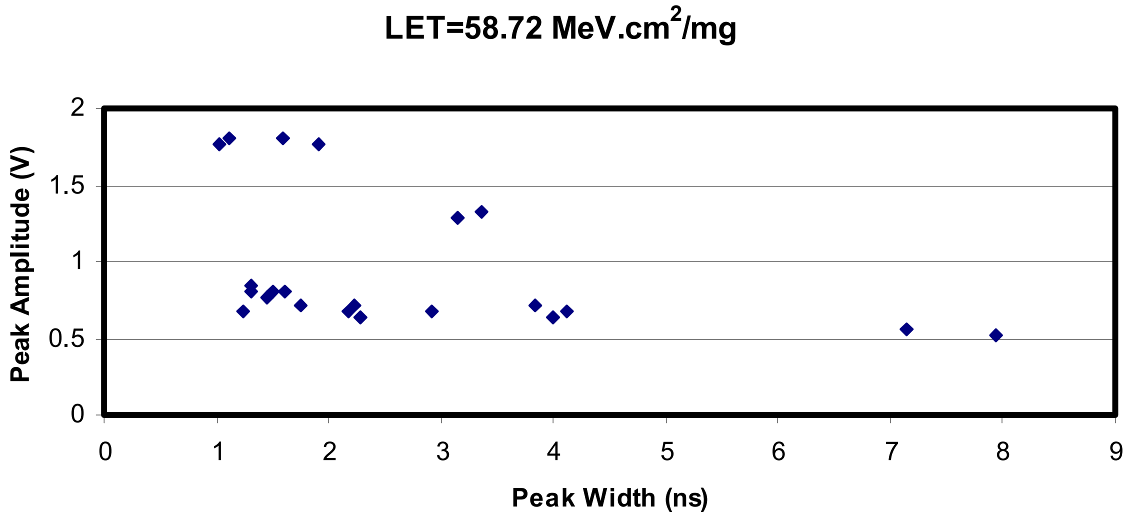

Fig 5: Amplitude (V) vs Peak Width for LET=58.72 MeV•cm^2/mg.

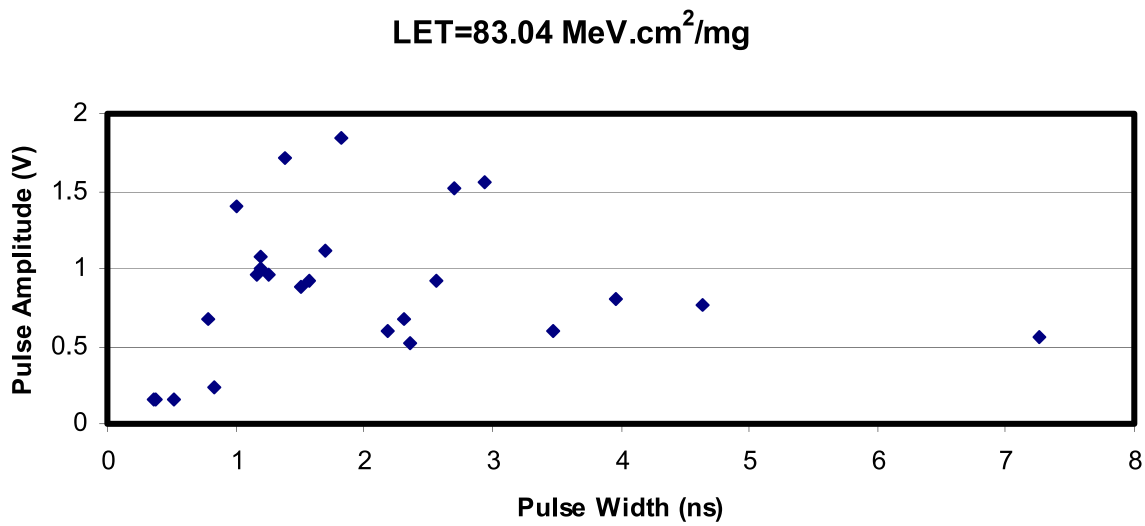

Fig 6: Amplitude (V) vs Peak Width for LET=83.04 MeV•cm^2/mg.

6. Conclusions

The transients generated in the LMH6702 were generally of short duration (<10ns). The maximum amplitude was around 1.6 V for ions with the lowest LETs and around 2 V for ions with the highest LETs. At lower LETs, the amplitudes and widths would have been even smaller, but no measurements were done at LETs below 30 MeV.cm^2/mg. The rate calculated for geosynchronous orbit is small – about one transient every 150 years.