# Preliminary Heavy ion Single Event Effects test of ADC 16 bits LTC1605 from Linear Technology. Test Report

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# 1 Introduction

This report gives preliminary heavy ion SEE test data on the 16 bits ADC LTC1605 from Linear Technologies. The main objective of this test was to check the Single Event Latch-up (SEL) sensitivity and get an idea of the Single Event Upset (SEU) sensitivity with a simplified test set-up. This work has performed in the frame of the NGST project.

# 2 Tested Device

The tested device is described in Table 1.

| | |
|---|---|
| **Type** | LTC1605CSW |
| **Function** | 16 bits, 100 ksps, A/D converter |
| **Package** | 28 pin SSOP |
| **Technology** | CMOS |
| **Date code** | 9914K |
| **Package marking** | 9914K<br>LTC1605AISW<br>J83241 |

Table 1: description of the tested device.

# 3 Test description

## *3.1 Irradiation facility*

The tests have been performed at TEXAS A&M in Ocotber 2001 with a 15 MeV/u Xenon beam. Irradiation has been performed in Air. The distance of Air between the beam output and the Device Under Test is about 5mm. The LET and range values given in Table 2 are the LET and ranges on the device after 5mm of Air and the 25.4 µm Aramica window. The higher LET value has been obtained with a degrader.

| **Ion** | **Energy (MeV/u)** | **Range (µm)** | **LET (MeVcm$^2$/mg)** |
|---|---|---|---|
| Xe | 15 | ~ 57 | 60 |
| Xe | 15 | ~100 | 53.6 |

Table 2: Ions used at TEXAS A&M.

## *3.2 Test set-up*

The part has been tested with the LTC1605 evaluation board. The digital signal is converted back to an analog signal with the 16 bits DAC AD768 evaluation board.
The input signal is a 2 Vpp 1kHz sinewave. The sampling clock is 100 kHz (maximum sampling clock), it is internally provided by the evaluation board. The output sinewave signal is monitored with an oscilloscope. As soon as the DUT output goes under (or above) a given trigger level set at 100 mV, a SEU is counted. SEU frames are stored on a PC. With this set-up, only the 6 Most Significant Bits are tested.

The device power supply current is monitored during the irradiation. The SEL detection threshold has been initially set at 100 mA (average power supply current of the evaluation board is about 65 mA).

# 4 Test Results

The tests results are shown in Table 3. The part has shown a very high SEL sensitivity down to a LET of 53.6 MeVcm2/mg and it was not possible to perform any SEU testing.

| Run# | dut# | LET (MeVcm$^2$/mg) | SEL detection threshold (mA) | Flux (#/cm$^2$-s) | Fluence (#/cm$^2$) | SEL | SEL current (mA) |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 60 | 100 | 5.4E+04 | 3.16E+04 | 1 | ~300 |
| 2 | 1 | 60 | 100 | 500 | Window latch | 1 | ~300 |
| 3 | 1 | 60 | 200 | 500 | Window latch | 1 | ~300 |
| 4 | 1 | 60 | 500 | 500 | Window latch | 0 | |
| 5 | 1 | 60 | 500 | 500 | Window latch | 0 | |
| 6 | 1 | 60 | 500 | 500 | Window latch | 0 | |
| 7 | 1 | 60 | 500 | 500 | Window latch | 0 | |
| 8 | 1 | 60 | 500 | 500 | Window latch | 0 | |
| 9 | 1 | 60 | 500 | 500 | Window latch | 0 | |
| 10 | 1 | 53.6 | 100 | 500 | Window latch | 1 | ~300 |

Table 3: Test results.

As soon as the beam is turned on the part latches. While the device is latched the part is not functional. The device always recovered its functionality and a normal power supply current after a power cycle.

On runs 4 to 9 the Latch-up detection threshold has been set to 500 mA in order to maintain the latch-up condition and look at the latch-up current. The latch-up current is about 300 mA and stays at this value when it is maintained. On runs 7, 8 and 9 the latch-up current has been maintained for 30, 60 and 300 seconds respectively without destructive effect. Each time the part recovered functionality after a power cycle.

# 5 Conclusions

These preliminary tests show that the device is highly sensitive to SEL down to a LET of about 54 MeVcm$^2$/mg. The latched condition gives a high power supply current of about 300 mA that is not destructive. The part is not functional when it is latched but recovers functionality after a power cycle.

Further characterization is needed in order to estimate the latch-up rate in the NGST environment.

Use of this part will require a Single Event Latch-up protection circuitry.