Conference Paper

Methods and Results of Radiation Tests of a Digital-to-Analog Converter LTC1257

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Abstract

The methods and results of radiation tests of a digital-to-analog converter (DAC) LTC1257 is observed in this article.

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1. Introduction

The experimental data obtained on the measurement of transmission characteristics integrated 12-bit DAC LTC1257 at different stages of irradiation can be useful in the analysis of radiation degradation DAC of this type.

2. Materials and Methods

The method for measuring parameters of DAC is described as follows. The schematic circuit diagram for measuring the electrical parameters of an integrated 12-bit DAC LTC1257 manufactured by Linear Technology during radiation tests is shown in Figure 1.

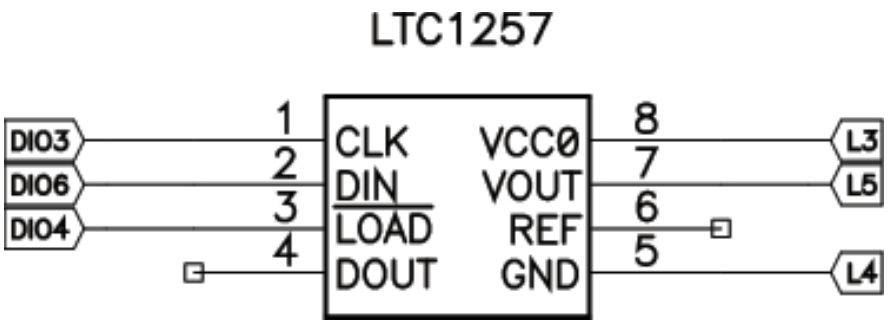

Figure 1: The schematic circuit diagram for measuring electrical parameters of LTC1257 during radiation tests.

During measurements, the codes from ob0000000000000 to ob1111111111111 are fed sequentially to the DAC, and it is measured appropriate to each of this code voltages. The measured time of total transfer characteristic of LTC1257 is 10 min.

3. Results

The irradiation of microcircuits of integrated DACs LTC1257 is conducted in passive electrical mode. The irradiation was performed in five steps. Every step continued for 20 min. The intensity of the radiation was 8.5 R/s. Since electrical parameters of integrated circuits (ICs) depend on operation temperature, the devices [1, 2] for temperature control and monitoring are usually used during radiation test experiments. In our case, we didn't use the devices because the temperature dependence of electrical parameters for our devices under test is not significant. Dependence of voltage deviation is calculated by an ideal DAC characteristic of the measured output voltage. The dependence before irradiation and after each step is presented in Figure 2.

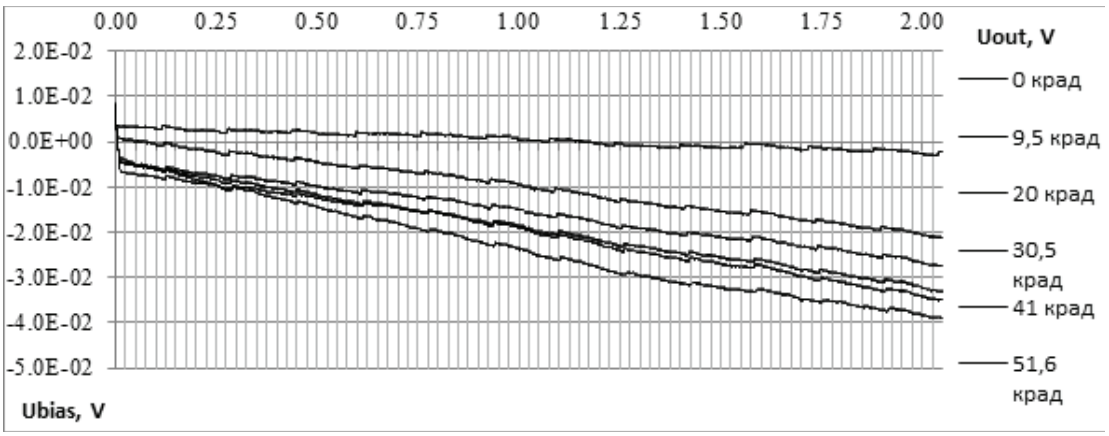

Figure 2: The dependence of the voltage deviation calculated from the ideal characteristic of the DAC from the measured output voltage.

Figure 3 shows dose dependences of the output voltage bias for four fixed code values.

The obtained data allow to conclude that the parametric failure of the DAC LTC1257 is observed at a dose level 27krad (Si).

4. Conclusion

The result of radiation testing of integrated 12-bit digital-to-analog converter LTC1257 was found that DAC with an absorbed total dose 26 krad (Si), a parametric failure occurs with respect to the input offset voltage. The functional failures are not identified.

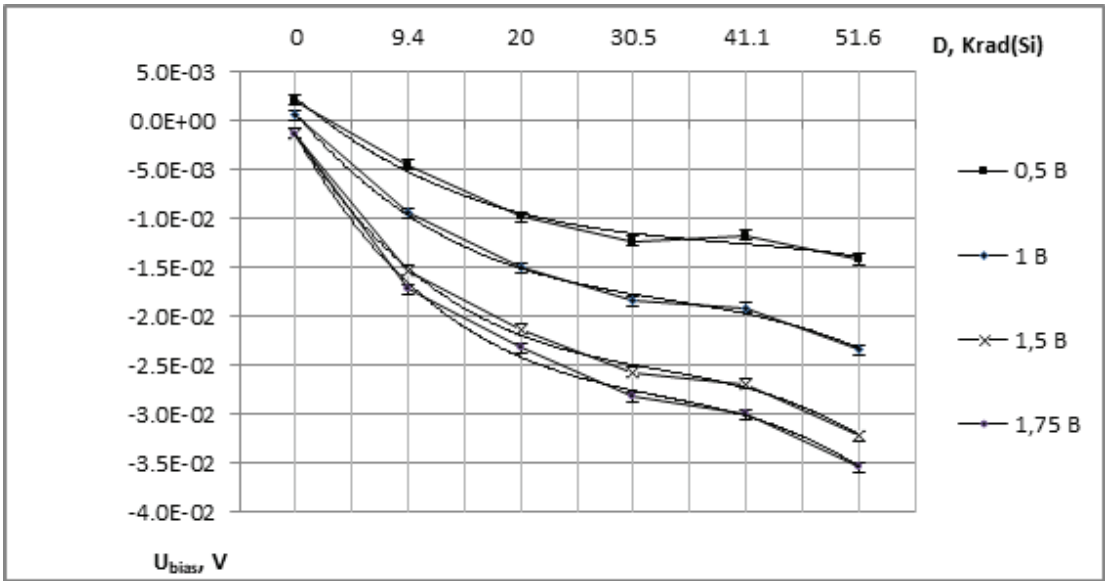

Figure 3: The dose dependences of the output voltage bias for four fixed code values.

In addition, an additional circuit investigation is required based on the analysis of the circuit architecture of the converter using circuit simulation techniques, to identify the causes of the obtained results.

References

[1] Bakerenkov, A. S., Belyakov, V. V., Kozyukov, A. E., et al. Temperature control system for the study of single event effects in integrated circuits using a cyclotron accelerator. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*.

[2] Anashin, V. S., Kozyukov, A. E., Emeliyanov, V. V., et al. Equipment and test results of the electronic components to SEE in the temperature. *IEEE Radiation Effects Data Workshop*, 6353725.