Conference Paper

The Methodology and Results of Radiation Tests of ADS 8320 Analog-to-Digital Converter

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Abstract

This article describes a technique ADC ADS8320 radiation tests, as well as circuitry measuring the transfer characteristic of the ADC and the results of tests conducted. It has been found that said ADCs did not show any parametric or functional failure when the absorbed doses to 50 krad (Si) at an intensity of irradiation of 8.5 F/sec passive electric mode.

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1. Introduction

Texas production of integrated inverter Instruments ADC ADS 8320 is the hexadecimal analog-to-digital converter Switched Capacitor.

The transfer characteristic of an ADC is the dependence of the output code on the voltage applied to the input. According to the transfer characteristic, a number of static parameters of the ADC can be determined: differential nonlinearity (DNL) and integral nonlinearity (INL), zero bias voltage.

Differential nonlinearity of the ADC transfer characteristic is the difference between the measured and the ideal quantization step values, expressed in scale units (LSB – last significant bit).

2. Materials and Methods

To measure the transmission characteristic circuit diagram, ADC subkey has been used, as shown in Figure 1.

The source voltage + 5.0V supplied by a line L1 to the input of the power integral ADC ADS8320, and from L2 of the line – to the input of the reference voltage. Second input signal fed from the second source through line L 3 through the divider resistors R. Code of transformations are read by DIO4 line connected to the SDO input (look

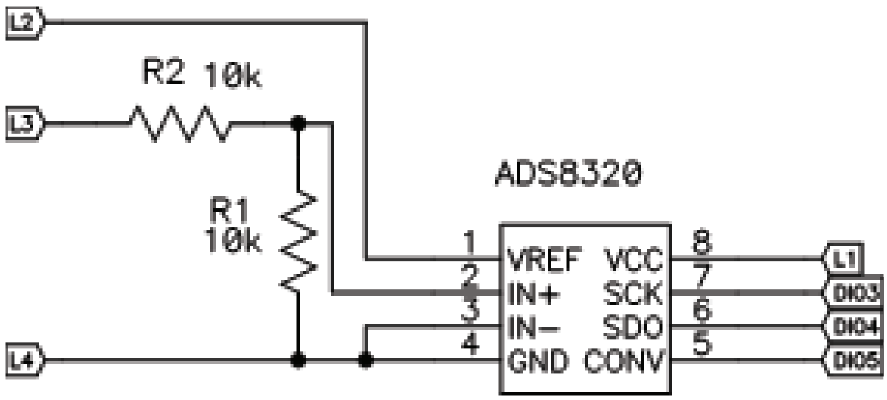

Figure 1: A circuit for measuring the transmission characteristic ADS 8320.

in the ADS8320 specification) chip. Running of conversion and timing are carried on lines DIO5 and DIO3, CONV is connected to the inputs and S C K, respectively. The measuring ground is fed via the L4 line to the GND and IN- inputs.

The voltage source is required for measuring the differential non-linearity, whose capacity exceeds the bit width n of the test transmitter m. The absolute error in measuring differential nonlinearity, in this case, is defined as:

$$\Delta\ DNL = 2^{m-n}. \tag{1}$$

Considering that the voltage sources of the measuring device implemented on the basis of hexadecimal DAC absolute precision reference voltage which has been increased by the method of calibration, and the range of output voltages sources $\pm$ 10V, the circuit (Figure 1) provides the ADC effective bit width n = 14. Thus, this technique allows measuring differential nonlinearity conversion with an accuracy of 4 LSB. A typical value of ADC differential non-linearity is $\pm$ 0.5 LSB. A typical value of INL ADS8320 is $\pm$ 3LSB. The measuring equipment allows to fix this parameter exceeded the limits of the specification.

3. Results

Irradiation of microcircuits of integrated ADCs ADS8320 was carried out in passive electric mode. Irradiation was carried out in five 20 min stages at an intensity of 8.5 P/s. Typically, tests are carried out using a thermal stabilization device, but in this case to use it was not necessary because the temperature dependence of the test equipment is rather weak [1, 2]. The dependence of the voltage deviation calculated by the ideal characteristic of the ADC of the input voltage is shown in Figure 2 to radiation and after each step.

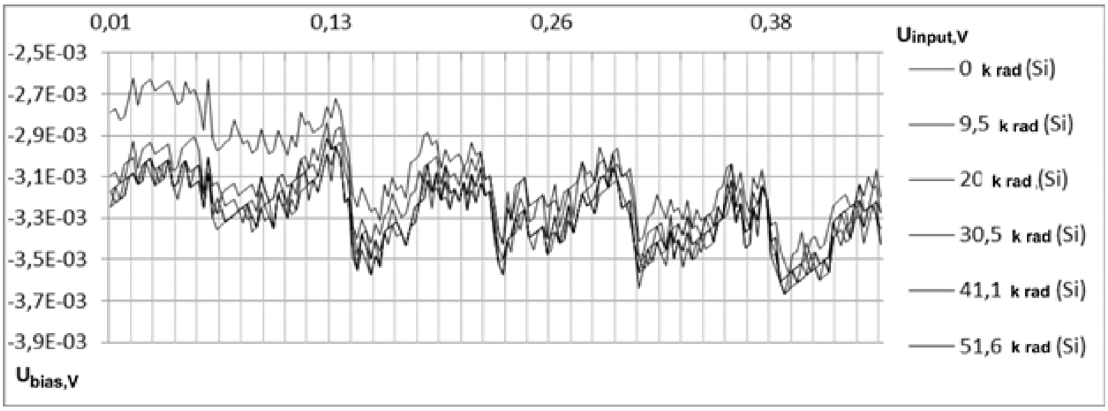

Figure 2: The dependence of the voltage deviation, calculated from the ideal characteristic of the ADC on the input voltage before irradiation and after each irradiation stage.

4. Discussion

The data obtained make it possible to conclude that the transfer characteristic of the ADC did not change up to a dose of 50 krad (Si). Thus, in the tests of either parametric or functional failure, the ADS8320 was not detected.

5. Conclusion

From the analysis of Integral hexadecimal ADC ADS 8320 radiation tests, it can be concluded that ADCs did not show any parametric or functional failure when the absorbed doses to 50 krad (Si) at an intensity of irradiation of 8.5 F/sec passive electric mode [3].

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