EV12AQ600 Overdrive in Cold Sparing Conditions

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Document aim and comment

This document aims at describing the input of the EV12AQ600 ADC in cold sparing conditions. Document such as the datasheet of the EV12AQ600 ADC has to read prior to this application note.

Introduction

EV12AQ600 ADC can be used as a cold spare in a system needing this mode of operation. In cold sparing, a voltage may be applied to an I/O such as the analog input of the ADC before and during power up of the device. When the ADC is powered off, the power supply must be clamped to ground and the voltage on the I/O must be within the specified recommended operating conditions, and must remain below the absolute maximum ratings. In addition to the information provided in the datasheet, this document brings more information about the conditions of operation in cold spare mode, applied to the analog inputs of the ADC.

Content

1. Conditions of cold-sparing operation

Signal characteristics on the analog input of the ADC are shown on Figure 1 where typical condition for cold sparing is when Vcca=GND=0V. In such condition, the ADC is in OFF mode. In this case, the input common mode (V_{ICM}) of the ADC is 0V.

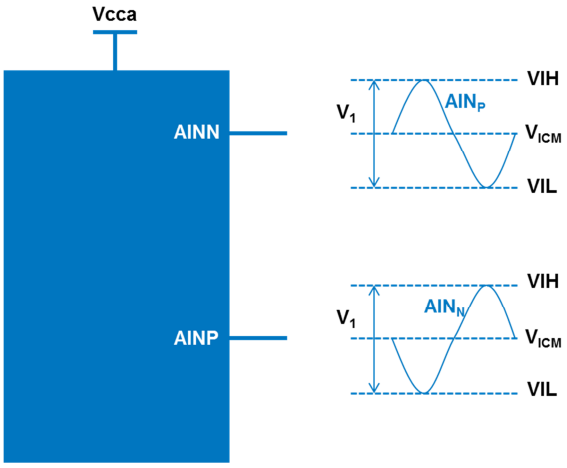

Figure 1 – Condition of cold sparing operation

Typical overdrive conditions at the input of the ADC are as follow:

- Input level of +8 dBFS or 2.5 Vppd.
- Signal type: continuous wave
- Maximum duration for the whole mission profile: 24h.
- Maximum temperature: Tj=125°C

2. Problematic

The problematic is then to determine the maximum differential voltage swing V_1 at the analog input of the ADC. According to EV12AQ600 datasheet, the maximum input voltage swing (single-ended) is AGND – 0.3V or differential |AINp - AINn| = 1.2 Vppd. This limitation comes from the ESD protection of the circuit in order that no current flows through the ESD diode. The equivalent electrical schematic of the input stage at the ESD level is presented in Figure 2.

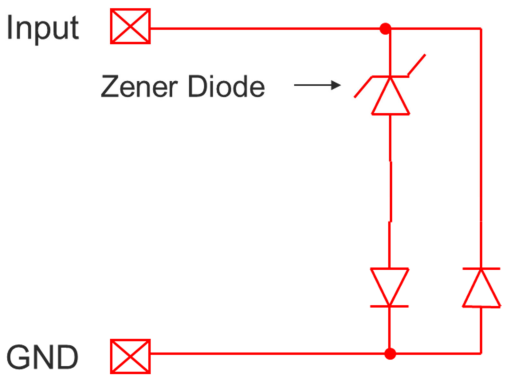

Figure 2 – Equivalent electrical schematic of ESD protection at input stage

But these conditions do not comply with the overdrive conditions of +8 dBFS at the analog input typically specified.

3. Analysis and Results

To overcome this limitation, a deeper analysis of current flow through the ESD diode is necessary in order to assess the reliability of the operation.

Figure 3 represents the input I/V characteristic curves (including ESD protection diodes) at Tj=27°C and Tj=125°C (cf. Figure 3). At Tj=125°C (worst case), the current flowing through the ESD diode is:

- -15.7 mA for Vin = -0.625 V
- 10.2 mA for Vin = 0.625 V

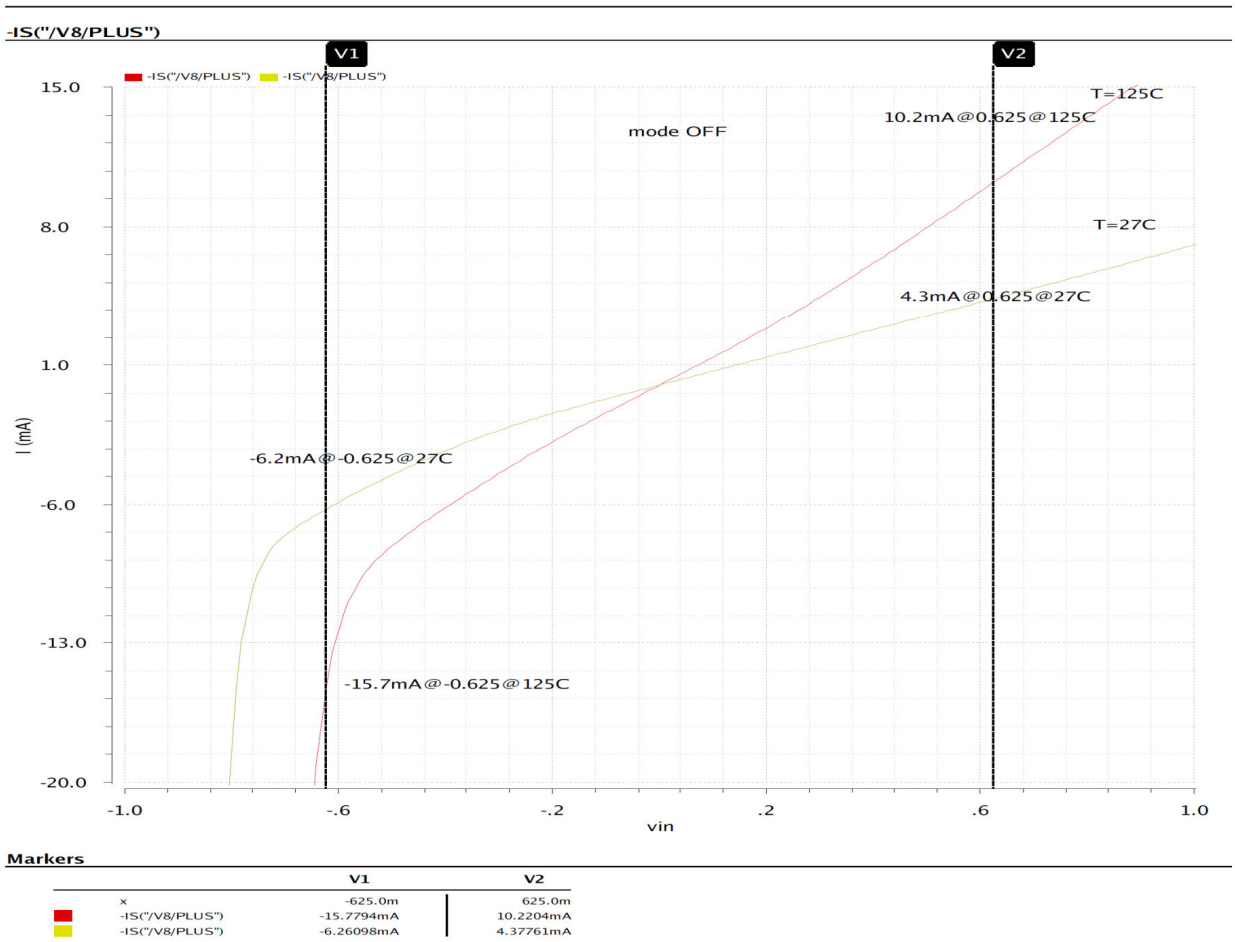

Figure 3 – ESD diode characteristic curves

In this worst case, the current flowing through the ESD diode is far below the allowed current through ESD protection. We assume that 20 years life time is guaranteed by a current of 25 mA at 125°C (0.1% defect).

With 25 mA current, for 24 hours, the life time is reduced by 0.0137%.

For more information, please contact: Hotline-BDC@teledyne-e2v.com.

Related documentation

EV12AQ600 Datasheet available on the Product Webpage (https://www.teledyne-e2v.com/products/semiconductors/adc/ev12aq600/)