

# ADC Accuracy

## Regarding Errata S56F8013E, Item 13

### 1 Introduction

This engineering bulletin provides information on errata item 13 of Freescale Errata document S56F8013E.

The resolution for the errata item is advanced and the target schedule for the updated part is announced.

### 2 Errata Item 13 Summary

#### 2.1 Scope of Errata Item 13

This errata applies to S56F8013 devices of Revision A2, identified by a date code 0704 or greater. These devices have the 1M59B mask set. Their part number is S56F8013MFA00E.

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## 2.2 Description of Errata item 13

The ADC may not maintain accuracy of conversions if operated for extended periods of time, at certain voltages below nominal voltage, and at certain elevated ambient temperatures.

## 2.3 Impact

The conversion result is sporadically zero or the maximum value of 0xffff.

## 2.4 Workaround

To workaround this, there are two options:

- If operating the device at ambient temperatures greater than 105°C, maintain the VDDA and VREF inputs at a minimum of 3.2 V. Otherwise, maintain the VDDA and VREF inputs at a minimum of 3.1 V.
- If the values 0 and 0xffff are not expected in the application due to biasing of the circuit and timing allows, these values may be discarded when obtained and the ADC used to sample the value again.

## 3 Mask Revision Schedule for 2M59B

It is anticipated that parts built with mask 2M59B will retire the errata item 13 upon characterization completion. Parts based on mask set 2M59B for the S56F8013 are available for sampling now. Characterization of parts built with this mask was completed in December, 2007. This part may be ordered as S56F8013W2MFAE/R.

## 4 Justification for Mask Change from 1M59B to 2M59B

From testing and micro-probing the ADC on 1M59B mask set, the failing parts rail to VDDA or VSSA due to:

- Lowering the reference voltage,  $V_{rh}$ , with respect to VDDA in the external reference mode
- Lowering VDDA in the internal reference mode.

High temperature also makes the problem worse. This problem is related to the offset of the dynamic comparator circuit used. The comparator can be sensitive to biasing and device mismatches. This comparator receives four inputs:

- $V_{inplus}$
- $V_{inminus}$
- $V_H$
- $V_L$

It compares the value of  $(v_{inplus} - v_{inminus})$  to the value of  $(V_H - V_L)$ .

If  $v_{inplus}$  and  $v_{inminus}$  are centered around a DC voltage different than the center between  $V_H$  and  $V_L$ , this causes the comparator to have an offset. Also, mismatches between the input devices cause another offset.

## 5 Summary of Change from Mask 1M59B to 2M59B

The change reduced the voltage differential (VH-VL) from (VDDA divided by 6) to (VDDA divided by 8) to increase the margin on the analog voltage reference, V<sub>rh</sub>. It modified the internal voltage differential between VH and VL from 550mV to 450mV. This change is caused by an RPO layer change to resistor values and is accomplished on just one mask layer.

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