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## Mask Set Errata for Mask 1M72Y

### Introduction

This report applies to mask 1M72Y for these products:

- MC9S08AC128
- MC9S08AC96

The mask set is identified by a 5-character code consisting of a version number, a letter, two numerical digits, and a letter, for example 0J27F. All standard devices are marked with a mask set number and a date code.

Device markings indicate the week of manufacture and the mask set used. The date is coded as four numerical digits where the first two digits indicate the year and the last two digits indicate the work week. For instance, the date code "0301" indicates the first week of the year 2003.

Some MCU samples and devices are marked with an SC, PC, or XC prefix. An SC prefix denotes special/custom device. A PC prefix indicates a prototype device which has undergone basic testing only. An XC prefix denotes that the device is tested but is not fully characterized or qualified over the full range of normal manufacturing process variations. After full characterization and qualification, devices will be marked with the MC or SC prefix.

### SE183-NEG-INJCUR: Negative injection current

**Errata type:** Silicon

**Affects:** I/O

**Description:** A negative current applied to the PTG4 pin may cause excessive supply current ( $I_{DD}$ ) while the current pulled out of the pin is greater than 20 mA. This condition exists when the pin is pulled below ground by a strong injection current while configured as an input.

The high  $I_{DD}$  current is caused by a parasitic bipolar device close to the pin. This is not a latchup condition since the  $V_{DD}$  supply does not need to be switched off to remove the condition.

A transient pin current greater than -20 mA can momentarily trigger the high  $I_{DD}$  condition. The supply current will recover after the transient current decays.

**Workaround:** This condition requires a negative current that is many times greater than the maximum negative DC injection current specification of -0.2 mA per pin. Proper resistor selection to limit the injection current will prevent this condition when the pin is configured as an input.

## SE181-ICG-RST: ICG HGO = 1 long reset

**Errata type:** Silicon

**Affects:** ICG, Reset

**Description:** When the ICG (Internal Clock Generator) is configured in FBE (FLL bypassed external) mode and the HGO (high gain option) bit is set, an internally generated reset may cause a reset (low) pulse that is much longer than a typical 9  $\mu$ s to 20  $\mu$ s pulse width. The Reset low time can extend to many seconds at low temperatures ( $<0^{\circ}\text{C}$ ) if the oscillations on the EXTAL pin are attenuated due to series resistance or oscillator loading.

The ICG contains logic to switch from the external clock to an internal clock when Reset is asserted (low) in FBE mode. This switch requires 2 full clocks to operate properly. However, in FBE mode with HGO = 1, the external clock input signal (EXTAL) may not have sufficient voltage swing, particularly the low level, to properly clock the logic just after Reset is asserted.

**Workaround:** The best workaround is to use HGO = 0 if FBE mode is desired. Note that when HGO = 0 is selected, the series resistor (RS) must be 0  $\Omega$ . This workaround is effective because the oscillation levels at the EXTAL pin are sufficient to clock the internal logic when Reset is asserted.

An alternate workaround is to use HGO = 1 with RS = 0  $\Omega$  and crystal/resonator load components that guarantee that the EXTAL low level is below 0.5 V.

## SE157-ADC-INCORRECT-DATA: Boundary case may result in incorrect data being read in 10-bit modes

**Errata type:** Silicon

**Affects:** ADC

**Description:** In normal 10-bit operation of the ADC, the coherency mechanism will freeze the conversion data such that when the high byte of data is read, the low byte of data is frozen, ensuring that the high and low bytes represent result data from the same conversion.

In the errata case, there is a single-cycle (bus clock) window per conversion cycle when a high byte may be read on the same cycle that subsequent a conversion is completing. Although extremely rare due to the precise timing required, in this case, it is possible that the data transfer occurs, and the low byte read may be from the most recently completed conversion.

In systems where the ADC is running off the bus clock, and the data is read immediately upon completion of the conversion, the errata will not occur. Also, in single conversion mode, if the data is read prior to starting a new conversion, then the errata will not occur.

The errata does not impact 8-bit operation.

Introducing significant delay between the conversion completion and reading the data, while a following conversion is executing/pending, could increase the probability for the errata to occur. Nested interrupts, significant differences between the bus clock and the ADC clock, and not handling the result register reads consecutively, can increase the delay and therefore the probability of the errata occurring.

**Workaround:** Using the device in 8-bit mode will eliminate the possibility of the errata occurring.

Using the ADC in single conversion mode, and reading the data register prior to initiating a subsequent conversion will eliminate the possibility of the errata occurring.

Minimizing the delay between conversion complete and processing the data can minimize the risk of the errata occurring. Disabling interrupts on higher priority modules and avoiding nested interrupts can reduce possible contentions that may delay the time from completing a conversion and handling the data. Additionally, increasing the bus frequency when running the ADC off the asynchronous clock, may reduce the delay from conversion complete to handling of the data.

## **SE156-ADC-COCO: COCO bit may not get cleared when ADCSC1 is written to**

**Errata type:** Silicon

**Affects:** ADC

**Description:** If an ADC conversion is near completion when the ADC Status and Control 1 Register (ADCSC1) is written to (i.e., to change channels), it is possible for the conversion to complete, setting the COCO bit, before the write instruction is fully executed. In this scenario, the write may not clear the COCO bit, and the data in the ADC Result register (ADCR) will be that of the recently completed conversion.

If interrupts are enabled, then the interrupt vector will be taken immediately following the write to the ADCSC1 register.

**Workaround:** It is recommended when writing to the ADCSC1 to change channels or stop continuous conversion, that you write to the register twice. The first time should be to turn the ADC off and disable interrupts, and the second should be to select the mode/channel and re-enable the interrupts.

## **SE194-STOP3DCO: Stop3 Mode DCO Erratum**

**Errata type:** Silicon

**Affects:** ICG, stop3

**Description:** On some devices, during stop3 recovery in FEI, FEE, and SCM modes, the DCO clock can generate high frequency pulses that can cause the MCU to enter a code runaway condition due to excessive bus speed. This condition can occur when the Reduced Frequency Divider value (R) in the ICGC2 register is 1, 2, or 4. The Multiplication Factor value (N) in the ICGC2 register does not matter. Stop recovery by reset is not affected. Supply voltage is not a factor.

**Workaround:**

1. Select a value of R that is greater than or equal to 8 when choosing a system bus frequency. This divides the high frequency DCO clocks to within system specification.
2. Increase the R value to 8 by writing the ICGC2 register just before the stop instruction. Restore the R value by writing the ICGC2 register to its original value in the service routine of the interrupt that wakes the MCU from stop3 mode.

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