AM1804 Bumped Wafer Silicon Errata

1. Introduction

This document describes silicon errata for die and wafers that have been gold bumped by Ambiq Micro that do not contain a redistribution layer (RDL). There is currently only a single gold bumped die part number for this version of the die: AM1804. This part will behave as an AM1805 device, but will have the specification limitations and differences/deviations from the AM18x5 datasheet specifications as described in the errata details below. The AM18x5 datasheet can be downloaded from the Ambiq Micro website here:

http://ambiqmicro.com/sites/default/files/am18x5_data_sheet_ds0003v1p2.pdf

2. Errata Details

Ambiq Micro's current gold bumping process exposes the wafer to elevated temperatures which may degrade the internal NVM data retention. This could potentially result in loss of tuning and device configuration information, which is stored in the NVM. Because of this, gold bumped wafers currently being shipped by Ambiq Micro will not be factory tuned and instead require fixed tuning parameters to be written to the device as described in the application impact section below. These wafers will perform similar to normal factory tuned wafers, but have the following electrical specifications and limitations, which are different from those specified in the current AM08XX and AM18XX datasheets:

1. The operating temperature range is limited to -10 °C to 60 °C.
2. No autocalibration or RC mode is supported without performing a reverse autocalibration step to tune the analog RC frequency (see application impact section below).
3. The typical XT mode current at VCC = 3.0 V will range from 60 nA – 80 nA, with the average current being 70 nA.
4. The part number will read as 1800. The part number can be read from address 0x28 (part number upper register) and 0x29 (part number lower register).
5. There is no VBAT pin or VBAT pin function support. The VBAT pin must be connected to VSS.

In addition, a specific register initialization sequence is required. Please see the application impact section below.

3. Application Impact

In order to guarantee correct AM1800 device operation, the following register initialization sequence must be executed to set specific values into the analog tuning parameter registers whenever a power-on-reset occurs.

1. Write 0x9D to address 0x1F
2. Write 0xD1 to address 0x22
3. Write 0x9D to address 0x1F
4. Write 0x60 to address 0x23
5. Write 0x9D to address 0x1F
6. Write 0x01 to address 0x24
7. Write 0x9D to address 0x1F
8. Write 0x0B to address 0x25

In order to operate in autocalibration or RC modes, the following reverse autocalibration algorithm must be executed to tune the analog RC oscillator to 122 Hz. This algorithm must be executed after the above initialization sequence whenever a power-on-reset occurs.

1. Write 0x00 to address 0x15
2. Write 0x00 to address 0x16

3. Clear the OF bit by writing a 0 to bit 1 at address 0x1D (oscillator status register). Use a read/modify write sequence to not disturb the other bits in the register.
4. Write a value of 0x28 to address 0x13 (SQW register)
5. Write a value of 0xA1 to address 0x1F (Configuration key register)
6. Write a value of 0x00 to address 0x1C (Oscillator control)
7. Write a value of 0xA1 to address 0x1F (Configuration key register)
8. Write a value of 0x20 to address 0x1C (Oscillator control)
9. Wait for at least 300 ms.
10. Write a value of 0xA1 to address 0x1F (Configuration key register)
11. Write a value of 0x00 to address 0x1C (Oscillator control)
12. Read the values of register addresses 0x15 (Calibration RC Upper) and 0x16 (Calibration RC Lower). Register address 0x15 contains the upper 8 bits of the 16 bit CALRC value. Register address 0x16 contains the lower 8 bits of the 16 bit CALRC value. For example, if address 0x15 reads a value of 0x6 and address 0x16 reads a value of 0xB0, the CALRC value = 0x6B0 = 1712 decimal.
13. Calculate the IGENAD decimal value. IGENAD value = ((122 – (262144 / CALRC)) / 1.2) + 32, where CALRC is the decimal value from step 12 above. The IGENAD value needs to be an integer value between 0 and 63, so the floating point value will need to be rounded up or down to give the integer value. If the IGENAD value is less than 0, make the IGENAD value 0. If the IGENAD value is greater than 63, make the IGENAD value 63.
14. Write a value of 0x9D to address 0x1F (Configuration key register)
15. Write the IGENAD value (integer decimal value calculated from step 13 above) to bits 5:0 at address 0x23 (RC analog calibration register). Use a read/modify write sequence to not disturb the other bits in the register.
16. The RC oscillator analog calibration is complete.

4. Errata Expiration

This silicon errata applies indefinitely unless otherwise notified by Ambiq Micro.

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Document Revision History

Rev #	Description
1.0	Initial version
1.1	Updated introduction, errata details, and errata expiration sections of the document

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