Silicon Errata
Contents

1 Introduction .......................................................................................................................... 5
  1.1 Device and Development Support Tool Nomenclature .................................................. 5
  1.2 Revision Identification ................................................................................................. 6

2 Silicon Revision 1.2 Usage Notes and Known Design Exceptions to Functional
   Specifications ......................................................................................................................... 8
  2.1 Usage Notes for Silicon Revision 1.2 ............................................................................. 8
        2.1.1 ARM ROM Boot - Default MAC Address Enhancement for EMAC Boot Mode .......... 8
        2.1.2 Reading the DEVREV Register (0x1c400028) ...................................................... 8
        2.1.3 Peripherals: Electrostatic Discharge (ESD) Sensitivity Classification .................. 8
  2.2 Silicon Revision 1.2 Known Design Exceptions to Functional Specifications .............. 8

3 Silicon Revision 1.1 Usage Notes and Known Design Exceptions to Functional
   Specifications ....................................................................................................................... 19
  3.1 Usage Notes for Silicon Revision 1.1 .......................................................................... 19
  3.2 Silicon Revision 1.1 Known Design Exceptions to Functional Specifications ............ 19

Appendix A Revision History ................................................................................................ 23
List of Figures

1 Example 1, Device Markings for TMS320DM365 (ZCE) .............................................................. 6
2 Example 2, Device Markings for TMS320DM365 (ZCE) .............................................................. 6
3 MB Pair Pipeline Slot Example .......................................................................................... 12

List of Tables

1 Device Silicon Revisions ................................................................................................... 7
2 Silicon Revision 1.2 Advisory List......................................................................................... 8
3 Format of MB-mode for Spatial Intra Prediction................................................................. 14
4 Q/IQ Information ................................................................................................................ 15
5 Silicon Revision 1.1 Advisory List ....................................................................................... 19
6 Revision History .................................................................................................................. 23
1 Introduction

This document describes the known exceptions to the functional specifications for the TMS320DM365 Digital Media System-on-Chip (DMSoC). The updates are applicable to the ZCE package.

For additional information, see the TMS320DM365 Digital Media System-on-Chip Data Manual (literature number SPRS457).

The advisory numbers in this document may not be sequential. Some advisory numbers may be moved to the next revision and others may have been removed and documented in the user's guide. When items are moved or deleted, the remaining numbers remain the same and are not resequenced.

This document also contains Usage Notes. Usage Notes highlight and describe particular situations where the device's behavior may not match presumed or documented behavior. This may include behaviors that affect device performance or functional correctness. These notes will be incorporated into future documentation updates for the device (such as the device-specific data sheet), and the behaviors they describe will not be altered in future silicon revisions.

1.1 Device and Development Support Tool Nomenclature

To designate the stages in the product development cycle, TI assigns prefixes to the part numbers of all DSP devices and support tools. Each DSP commercial family member has one of three prefixes: TMX, TMP, or TMS (e.g., TMS320DM365). Texas Instruments recommends two of three possible prefix designators for its support tools: TMDX and TMDS. These prefixes represent evolutionary stages of product development from engineering prototypes (TMX/TMDX) through fully qualified production devices/tools (TMS/TMDS).

Device development evolutionary flow:

**TMX**
Experimental device that is not necessarily representative of the final device's electrical specifications

**TMP**
Final silicon die that conforms to the device's electrical specifications but has not completed quality and reliability verification

**TMS**
Fully-qualified production device

Support tool development evolutionary flow:

**TMDX**
Development support product that has not yet completed Texas Instruments internal qualification testing

**TMDS**
Fully-qualified development support product

TMX and TMP devices and TMDX development support tools are shipped against the following disclaimer:

“Developmental product is intended for internal evaluation purposes.”

TMS devices and TMDS development support tools have been characterized fully, and the quality and reliability of the device have been demonstrated fully. TI's standard warranty applies.

Predictions show that prototype devices (TMX or TMP) have a greater failure rate than the standard production devices. Texas Instruments recommends that these devices not be used in any production system because their expected end use failure rate still is undefined. Only qualified production devices are to be used.
1.2 Revision Identification

Figure 1 and Figure 2 provide examples of device markings. The device revision can be determined by the symbols marked on the top of the package. Some prototype devices may have markings different from those illustrated.

Figure 1. Example 1, Device Markings for TMS320DM365 (ZCE)

Figure 2. Example 2, Device Markings for TMS320DM365 (ZCE)

NOTES:
(A) "#" denotes an alphanumeric character. "x" denotes an alpha character only.
Silicon revision is identified by a code on the chip as shown in Figure 1 and Figure 2. Table 1 lists the silicon revisions associated with each device revision code for the device.

<table>
<thead>
<tr>
<th>Device Revision Code (on above package symbol ‘x’)</th>
<th>SILICON REVISION</th>
<th>COMMENTS (part number association)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>1.1</td>
<td>TMX320DM365AZCE</td>
</tr>
<tr>
<td>B</td>
<td>1.2</td>
<td>TMX320DM365BZCE</td>
</tr>
<tr>
<td>TMS</td>
<td>(blank)</td>
<td></td>
</tr>
</tbody>
</table>
2 Silicon Revision 1.2 Usage Notes and Known Design Exceptions to Functional Specifications

2.1 Usage Notes for Silicon Revision 1.2

Usage Notes highlight and describe particular situations where the device’s behavior may not match presumed or documented behavior. This may include behaviors that affect device performance or functional correctness. These notes will be incorporated into future documentation updates for the device (such as the device-specific data sheet), and the behaviors they describe will not be altered in future silicon revisions.

2.1.1 ARM ROM Boot - Default MAC Address Enhancement for EMAC Boot Mode

Silicon Revision 1.2 supports an enhancement to the ARM ROM Boot-EMAC mode. In the case no magic number is found in the EEPROM, the EMAC boot mode will use a default MAC address. This feature was not present on Silicon Revision 1.1. For more details, see the TMS320DM36x DMSoC ARM Subsystem Reference Guide (literature number SPRUFG5).

2.1.2 Reading the DEVREV Register (0x1c400028)

On DM365 Silicon Revision 1.2, the Device ID register value equals 0x8B83E02F. On DM365 Silicon Revision 1.1, the Device ID register value equals 0x0B83E02F.

2.1.3 Peripherals: Electrostatic Discharge (ESD) Sensitivity Classification

JESD22-C101D, Field-induced Charged-Device Model Test method for Electrostatic-Discharge-Withstand Thresholds of Microelectronic Components: Testing results demonstrated that the device’s charged-device model (CDM) sensitivity classification is class II (200V to 500V). No work around required.

2.2 Silicon Revision 1.2 Known Design Exceptions to Functional Specifications

Table 2. Silicon Revision 1.2 Advisory List

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advisory 1.2.1 — The Buffer Logic of VPSS is Not Reset by System Reset Pin</td>
<td>9</td>
</tr>
<tr>
<td>Advisory 1.2.2 — VIL on 3.3-V LVCMOS Input Buffers</td>
<td>11</td>
</tr>
<tr>
<td>Advisory 1.2.3 — HDVICP—H.264 Encode/Decode: Intra 16 x 16 Plane MB Values ≥ 512 are Incorrect</td>
<td>12</td>
</tr>
<tr>
<td>Advisory 1.2.4 — Bootloader: RBL Code 4bit ECC Mode Limitation</td>
<td>16</td>
</tr>
<tr>
<td>Advisory 1.2.5 — USB Communication Stops During Temperature Swing</td>
<td>18</td>
</tr>
</tbody>
</table>
Advisory 1.2.1 — The Buffer Logic of VPSS is Not Reset by System Reset Pin

Revision(s) Affected: 1.2 and earlier

Details:
At Power-on Reset, the Buffer Logic module, which is a DMA interface logic between the system DMA bus and the VPSS modules, is not getting reset by the system reset pin (RESET) logic. As a result, the VPSS DMA transfers through the Buffer Logic will not occur.

Workaround:
A workaround for this issue is to apply Sync Reset via the Power and Sleep Controller module to the VPSS module followed by a system reset. This software workaround code must be implemented before PLL, DDR, and System Initialization.

The code workaround below flows as follows:
Initially, a Power-on reset or Warm reset is detected using the RSTYPE register of PLLC1, and then a sync reset to the VPSS is applied. After doing this, a system reset is generated using the System Watchdog timer. The next time the RSTYPE is read by the code (after the system reset and code re-runs), its value would then be 4, which indicates that a maximum system reset has occurred. The code will then proceed with the PLL, DDR, and system initialization functions.

In the event that a Watchdog Reset is ever executed in the code by either the Linux 'reboot' command or a regular system Watchdog reset occurs the Bold code on below workaround example has been added to address this situation.

Sample code for the software workaround is shown below:

```c
#define RSTYPE (*((volatile unsigned int *)0x01C400E4)
#define VPSS_CLK_CTRL (*((volatile unsigned int *)0x01C40044)
#define SYSTEM_RESET_EN (*((volatile unsigned int *)0x01C21C08)
#define SYSTEM_RESET_TRIGGER (*((volatile unsigned int *)0x01C21C0C)
#define MDSTAT_VPSS (*((volatile unsigned int *)0x01C418BC)
#define MDCTL_VPSS (*((volatile unsigned int *)0x01C41ABE)
#define PTCMD (*((volatile unsigned int *)0x01C41120)
#define PTSTAT (*((volatile unsigned int *)0x01C41128)
#define TMPBUF *(unsigned int *)(0x17ff8)
#define TMPSTATUS *(unsigned int *)(0x17ff0)
#define FLAG_PORRST 0x00000001
#define FLAG_WDTRST 0x00000002
#define FLAG_FLGON 0x00000004
#define FLAG_FLGOFF 0x00000010

void VPSSSyncReset(void);
void WDT_RESET();
void WDT_FLAG_ON();
void main()
{
    volatile unsigned int s;
    if (RSTYPE & 3) // Execute on power on reset or warm reset
    {
        VPSS_CLK_CTRL = 0x80; // VPSS_CLKCMD = 1:1
        VPSSSyncReset(); // VPSS sync reset
        *TMPBUF = 0;
        *TMPSTATUS |= FLAG_PORRST;
        SYSTEM_RESET_EN = 0x00020000; // Watchdog timer enable for system reset
        SYSTEM_RESET_TRIGGER = 0x00020002; // Watchdog timer trigger for system reset
        while(1);
    }
    if(*TMPBUF == 0x591b3ed7) // Execute on Watchdog Reset situation
    {
        *TMPBUF = 0;
        *TMPSTATUS |= FLAG_PORRST;
        *TMPSTATUS |= FLAG_FLGOFF;
    }
}
```

In the event that a Watchdog Reset is ever executed in the code by either the Linux 'reboot' command or a regular system Watchdog reset occurs the Bold code on below workaround example has been added to address this situation.

The code workaround below flows as follows:
Initially, a Power-on reset or Warm reset is detected using the RSTYPE register of PLLC1, and then a sync reset to the VPSS is applied. After doing this, a system reset is generated using the System Watchdog timer. The next time the RSTYPE is read by the code (after the system reset and code re-runs), its value would then be 4, which indicates that a maximum system reset has occurred. The code will then proceed with the PLL, DDR, and system initialization functions.

In the event that a Watchdog Reset is ever executed in the code by either the Linux 'reboot' command or a regular system Watchdog reset occurs the **Bold** code on below workaround example has been added to address this situation.

Sample code for the software workaround is shown below:

```c
#define RSTYPE (*((volatile unsigned int *)0x01C400E4)
#define VPSS_CLK_CTRL (*((volatile unsigned int *)0x01C40044)
#define SYSTEM_RESET_EN (*((volatile unsigned int *)0x01C21C08)
#define SYSTEM_RESET_TRIGGER (*((volatile unsigned int *)0x01C21C0C)
#define MDSTAT_VPSS (*((volatile unsigned int *)0x01C418BC)
#define MDCTL_VPSS (*((volatile unsigned int *)0x01C41ABE)
#define PTCMD (*((volatile unsigned int *)0x01C41120)
#define PTSTAT (*((volatile unsigned int *)0x01C41128)
#define TMPBUF *(unsigned int *)(0x17ff8)
#define TMPSTATUS *(unsigned int *)(0x17ff0)
#define FLAG_PORRST 0x00000001
#define FLAG_WDTRST 0x00000002
#define FLAG_FLGON 0x00000004
#define FLAG_FLGOFF 0x00000010

void VPSSSyncReset(void);
void WDT_RESET();
void WDT_FLAG_ON();
void main()
{
    volatile unsigned int s;
    if (RSTYPE & 3) // Execute on power on reset or warm reset
    {
        VPSS_CLK_CTRL = 0x80; // VPSS_CLKCMD = 1:1
        VPSSSyncReset(); // VPSS sync reset
        *TMPBUF = 0;
        *TMPSTATUS |= FLAG_PORRST;
        SYSTEM_RESET_EN = 0x00020000; // Watchdog timer enable for system reset
        SYSTEM_RESET_TRIGGER = 0x00020002; // Watchdog timer trigger for system reset
        while(1);
    }
    if(*TMPBUF == 0x591b3ed7) // Execute on Watchdog Reset situation
    {
        *TMPBUF = 0;
        *TMPSTATUS |= FLAG_PORRST;
        *TMPSTATUS |= FLAG_FLGOFF;
    }
}
```
for (s=0; s < 0x100; s++) {}
VPSS_CLK_CTRL = 0x80; // VPSS_CLKCMD = 1:1
VPSSSyncReset(); // VPSS sync reset
SYSTEM_RESET_EN = 0x00020000; // Watchdog timer enable for system reset
SYSTEM_RESET_TRIGGER = 0x00020002; // Watchdog timer trigger for system reset
while(1);
} // PLL,DDR Initialization and remaining code
WDT_FLAG_ON();

void VPSSSyncReset()
{
  unsigned int PdNum=0;
  MDCTL_VPSS = (((MDCTL_VPSS) & 0xffffffe0 ) | 0x00000001);
  PTCMD = (1 << PdNum);
  while(! (((PTSTAT >> PdNum) & 0x00000001)==0));
  while(!((MDSTAT_VPSS & 0x0000001F)==0x1));
}

void WDT_FLAG_ON()
{
  SYSTEM->VPSS_CLKCTL &= 0xffffffff; // VPSS_CLKMD 1:2
  *TMPBUF = 0x591b3ed7;
  *TMPSTATUS |= FLAG_FLGON;
}
Advisory 1.2.2  

---

V\text{IL} on 3.3-V LVCMOS Input Buffers

Revision(s) Affected: 1.2 and earlier

Details: The input buffers on the device have shown a timing sensitivity to the logic-low input voltage that can cause changes to the AC input timings. Due to this issue, input voltages must be driven below 0.2V on all 3.3V LVCMOS input signals or 3.3V LVCMOS IO signals used as inputs. Some device signals are dedicated 3.3V and some signals can be configured as either 1.8V or 3.3V.

This issue applies to any input signal operated at 3.3V.

LVCMOS inputs operated at 1.8V are not affected.

The DDR2/MDDR memory interface is not affected.

Workaround: Although there is no specific workaround, the following recommendations can be used to help prevent this issue:

- Minimize loads as much as possible, especially DC loads that could cause the V\text{IL} to rise. **Point-to-point (single-load) connections are unlikely to be affected.**
- Falling edges should transition as rapidly as possible (so the signal passes through the 0.2V point as early as possible). Heavily loaded nodes resulting in degraded fall times may require drivers to provide rapid input edges to the DM365.
Advisory 1.2.3 — HDVICP—H.264 Encode/Decode: Intra 16 x 16 Plane MB Values ≥ 512 are Incorrect

Revision(s) Affected: 1.2 and earlier

Details:
During the calculation of the intra prediction block, pixel values can reach 512 or higher. However, the computation engine has precision only enough to hold values equal to 511 or less.

This issue can occur only when all the following conditions are met:
- H.264 Encode or Decode
- Intra_16x16_Plane mode MB
- Luma blocks only; it does not affect Chroma blocks
- If the prediction block generated using the Intra_16x16_Plane mode has a pixel value of 512 or higher

The Artifacts by this advisory are:
- In Encode, an incorrect (but legal) bitstream will be generated, and a mismatch will happen between the Encoder and Decoder resulting in significant quality degradation.
- In Decode, the reconstructed macroblock will be incorrect.
- If the following MBs are intra referring to this MB, the error is propagated spatially within the picture.
- If the following pictures refer to this MB, the error is propagated temporally to the following pictures.

This advisory is content dependent. Typically, generating Intra Prediction Values ≥ 512 is rare but can occur; therefore, the suggested workarounds below should be used. A potential exception could be for a closed-system decoder where the user can ensure that the encoder does not use Intra_16x16_Plane mode.

Workaround(s):

Encode
Turn off the Intra_16x16_plane mode evaluation by HDVICP IPE. Typically, the quality degradation for removing this mode is relatively small.

Decode
During a MB pipeline slot, a CALC is done, a workaround by CPU, and CALC again with corrected intra prediction macroblock (see Figure 3).

![Figure 3. MB Pair Pipeline Slot Example](image-url)
If the MB is of intra 16x16 plane mode, perform the following steps:

1. Let CALC run.
2. Wait for CALC to complete
3. After CALC completes, switch BFSW for iprdbuf : CALC → DMA
4. Check and correct Intra Prediction (for more details, see the Check and Correct Intra Prediction section below)
5. Switch BFSW for iprdbuf : DMA → CALC
6. Switch BFSW for calcmbuf : CALC → DMA
7. Set up CALC commands with intra mode for IQ/IT and inter mode for prediction (for more details, see the Set up CALC Commands with Intra mode for IQ/IT and Inter Mode for Prediction section below)
8. If MBAFF, retrigger DMA for upper row data
9. Switch BFSW for calcmbuf : DMA → CALC
10. Switch BFSW for reconbuf : LPF → DMA
11. Read left reconstructed column
12. Switch BFSW for reconbuf : DMA → LPF
13. Switch BFSW for calcmbuf : CALC → DMA
14. Set back left reconstructed column
15. Switch BFSW for calcmbuf : DMA → CALC
16. Re-run CALC
17. Wait for CALC to complete

**Check and Correct Intra Prediction**

Read Pred[0,0], Pred[15,0], Pred[0,15], Pred[15,15], Pred[7,7] and Pred[7,8] (or Pred[8,7]) from iprdbuf

/* This workaround uses the fact that 1D slope is constant on a Plane. */

// right top pixel is wrong
if ((Pred[15,0] == 0x00) && Pred[0,15] < Pred[7,8] (or Pred[8,7])) {
  Pred[15,0] = 0xFF;
}
// left bottom pixel is wrong
else if ((Pred[0,15] == 0x00) && Pred[15,0] < Pred[7,8] (or Pred[8,7])) {
  Pred[0,15] = 0xFF;
}
// right bottom pixels are wrong
else if ((Pred[15,15] == 0x00) && Pred[0,0] < Pred[7,7]) {
  Pred[15,15] = 0xFF
if (Pred[11,15] == 0x00) Pred[11,15] = 0xFF;
if (Pred[12,14] == 0x00) Pred[12,14] = 0xFF;
if (Pred[12,15] == 0x00) Pred[12,15] = 0xFF;
if (Pred[13,13] == 0x00) Pred[13,13] = 0xFF;
if (Pred[13,14] == 0x00) Pred[13,14] = 0xFF;
if (Pred[13,15] == 0x00) Pred[13,15] = 0xFF;
if (Pred[14,12] == 0x00) Pred[14,12] = 0xFF;
if (Pred[14,13] == 0x00) Pred[14,13] = 0xFF;
if (Pred[14,14] == 0x00) Pred[14,14] = 0xFF;
if (Pred[14,15] == 0x00) Pred[14,15] = 0xFF;
if (Pred[15,11] == 0x00) Pred[15,11] = 0xFF;
if (Pred[15,12] == 0x00) Pred[15,12] = 0xFF;
if (Pred[15,13] == 0x00) Pred[15,13] = 0xFF;
if (Pred[15,14] == 0x00) Pred[15,14] = 0xFF;
}

**Set up CALC Commands With Intra Mode for IQ/IT and Inter mode for Prediction**

To do the 2nd run, set CALC commands per Table 3 and Table 4. MB mode and Q/IQ information will need to be modified.
Table 3. Format of MB-mode for Spatial Intra Prediction

<table>
<thead>
<tr>
<th>MB-MODE</th>
<th>BIT NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>TQ Bypass-mode</td>
<td></td>
</tr>
<tr>
<td>30:28</td>
<td>Reserved.</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Chroma DC-Transform (2x2)</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Luma DC-Transform (4x4)</td>
<td></td>
</tr>
<tr>
<td>25:24</td>
<td>Scaling-timing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[00] : Do not use Scaling-function.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[01] : Scaling per Luma/Chroma.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[01] : Scaling per Block.</td>
<td></td>
</tr>
<tr>
<td>23:20</td>
<td>Reserved.</td>
<td></td>
</tr>
<tr>
<td>19:18</td>
<td>Transform size of Block [5]</td>
<td></td>
</tr>
<tr>
<td>17:16</td>
<td>Transform size of Block [4]</td>
<td></td>
</tr>
<tr>
<td>15:14</td>
<td>Transform size of Block [3]</td>
<td></td>
</tr>
<tr>
<td>13:12</td>
<td>Transform size of Block [2]</td>
<td></td>
</tr>
<tr>
<td>11:10</td>
<td>Transform size of Block [11]</td>
<td></td>
</tr>
<tr>
<td>9:8</td>
<td>Transform size of Block [0]</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Reserved.</td>
<td></td>
</tr>
<tr>
<td>6:4</td>
<td>Chroma Block-mode</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[000] : Reserved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[001] : Intra 8x8 , [010] : Reserved.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Reserved.</td>
<td></td>
</tr>
<tr>
<td>2:0</td>
<td>Luma Block-mode</td>
<td></td>
</tr>
</tbody>
</table>

For Table 4, set Inter shift-scale value = Intra shift-scale value.
### Table 4. Q/IQ Information

<table>
<thead>
<tr>
<th>ADDRESS OFFSET</th>
<th>BIT NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x08</td>
<td>63:24</td>
<td>Reserved.</td>
</tr>
<tr>
<td></td>
<td>23:16</td>
<td>Shift-scale for IQ Intra-DC-Y</td>
</tr>
<tr>
<td></td>
<td>15:8</td>
<td>Shift-scale for IQ Inter-DC-Y</td>
</tr>
<tr>
<td></td>
<td>7:0</td>
<td>Shift-scale for IQ AC-Y</td>
</tr>
<tr>
<td>0x10</td>
<td>63:56</td>
<td>Reserved.</td>
</tr>
<tr>
<td></td>
<td>55:48</td>
<td>Shift-scale for IQ Intra-DC-Cr</td>
</tr>
<tr>
<td></td>
<td>47:40</td>
<td>Shift-scale for IQ Inter-DC-Cr</td>
</tr>
<tr>
<td></td>
<td>39:32</td>
<td>Shift-scale for IQ AC-Cr</td>
</tr>
<tr>
<td></td>
<td>31:24</td>
<td>Reserved.</td>
</tr>
<tr>
<td></td>
<td>23:16</td>
<td>Shift-scale for IQ Intra-DC-Cb</td>
</tr>
<tr>
<td></td>
<td>15:8</td>
<td>Shift-scale for IQ Inter-DC-Cb</td>
</tr>
<tr>
<td></td>
<td>7:0</td>
<td>Shift-scale for IQ AC-Cb</td>
</tr>
<tr>
<td>0x18</td>
<td>63:24</td>
<td>Reserved.</td>
</tr>
<tr>
<td></td>
<td>23:16</td>
<td>Shift-scale for Q Intra-DC-Y</td>
</tr>
<tr>
<td></td>
<td>15:8</td>
<td>Shift-scale for Q Inter-DC-Y</td>
</tr>
<tr>
<td></td>
<td>7:0</td>
<td>Shift-scale for Q AC-Y</td>
</tr>
<tr>
<td>0x20</td>
<td>63:56</td>
<td>Reserved.</td>
</tr>
<tr>
<td></td>
<td>55:48</td>
<td>Shift-scale for Q Intra-DC-Cr</td>
</tr>
<tr>
<td></td>
<td>47:40</td>
<td>Shift-scale for Q Inter-DC-Cr</td>
</tr>
<tr>
<td></td>
<td>39:32</td>
<td>Shift-scale for Q AC-Cr</td>
</tr>
<tr>
<td></td>
<td>31:24</td>
<td>Reserved.</td>
</tr>
<tr>
<td></td>
<td>23:16</td>
<td>Shift-scale for Q Intra-DC-Cb</td>
</tr>
<tr>
<td></td>
<td>15:8</td>
<td>Shift-scale for Q Inter-DC-Cb</td>
</tr>
<tr>
<td></td>
<td>7:0</td>
<td>Shift-scale for Q AC-Cb</td>
</tr>
<tr>
<td>0x28</td>
<td>63:32</td>
<td>Round coefficient [1]</td>
</tr>
<tr>
<td></td>
<td>31:0</td>
<td>Round coefficient [0]</td>
</tr>
</tbody>
</table>
Advisory 1.2.4 — Bootloader: RBL Code 4bit ECC Mode Limitation

Revision(s) Affected

1.2 and earlier

Details

There is an issue with ROM NAND 4bit ECC mode.

The NAND code in the ROM should read 512-byte data chunks from NAND, and the AEMIF ECC hardware has the capability to correct up to 4 bit errors per 512 bytes of data. However, when 5 or more ECC errors are detected for a certain chunk of 512 bytes of data, existing TI software components (UBL, U-Boot and kernel) and the RBL will not read the NANDERRADD1/NANDERRADD2 registers. As a result, the 4BITECC_ADD_CALC_START bit in NANDFCR register is not cleared.

If there are any ECC errors in the ensuing chunks of 512 bytes of data, no ECC corrections will take place. The software workaround for this is that when the NAND driver detects 5 bit errors, the driver will perform a dummy read of the NANDERRVAL1 register or NANDERRADD1 register. This clears the 4BITECC_ADD_CALC_START (bit 13 of NANDFCR register). Doing this ensures ECC error correction takes place even after encountering 5-bit errors for the ensuing chunks of 512 bytes of data. There is no workaround for this issue in the RBL. This is expected to be rectified when TI comes up with new revisions of the device.

TI uses a 2 stage boot loader; the RBL loads a UBL into IRAM which then loads the U-Boot to DDR.

This bug exists in the RBL. This means that if the NAND driver in the RBL encounters 5-bit errors, ECC correction will stop. The UBL, which is the first software component in the bootup sequence, will do a dummy read of the NANDERRADD1 register after setting up the AEMIF as shown below (#1 of FIXES IN TI SOFTWARE COMPONENTS) . If this is not done, UBL will not be able to correct any errors due to the RBL bug. This will occur if the RBL encounters 5-bit errors.

A dummy read of the NANDERRADD1 register will take place even after the NAND driver encounters no bit errors although experiments performed did show that such a dummy read was not required.

The issue is more likely to be seen in NAND devices that require 4-bit ECC.

Even though there might be ECC errors in the UBL image, it is possible to load a UBL with errors in the UBL image. Random boot failures can occur as a result, or if boot appears to succeed, it is also possible to see system stability issues due to possible corrupted system configuration values (e.g., PLL multiplier, PSC domains).

This is a limitation in the RBL. This is not a limitation in the ECC hardware that is a feature of the Asynchronous EMIF (AEMIF) peripheral. Therefore any software outside of the RBL, such as the UBL and NAND driver in the U-Boot and kernel, can use the ECC hardware to implement NAND error correction and detection.

This limitation has no impact on any of the other boot modes: MMC/SD boot mode, AEMIF (OneNAND/NOR), USB, SPI, EMAC, UHPI or UART boot modes.

FIXES IN TI SOFTWARE COMPONENTS

1. Mitigation of RBL BUG in UBL

The UBL code is modified to include the sequence of code mentioned below. The following is done in the “device.c” file that is part of the UBL projects for DM365.

```c
// AEMIF Setup
if (status == E_PASS) status |= DEVICE_EMIFInit();

temp = AEMIF->NANDERRADD1
```

This ensures that 4BITECC_ADD_CALC_START is “low” thereby ensuring that the UBL can perform ECC correction if it encounters bit errors.

2. Software Fix in NAND writer and UBL

The NAND writer and UBL both use the same NAND driver and are built from the
same source. The NAND driver for both the NAND writer and UBL has been modified according to the above explanation. Code excerpt from the NAND driver is shown below. The required sequence has been marked in bold.

```c
if ((corrState == 1) || (corrState > 3))
{
    temp = AEMIF->NANDERRADD1;
    return E_FAIL;
}
else if (corrState == 0)
{
    temp = AEMIF->NANDERRADD1;
    return E_PASS;
}
```

3. Software Fix in U-Boot and kernel
TI makes sure that the NAND driver code in both the U-Boot and kernel are exactly the same. The following is an excerpt from the kernel NAND driver that is part of LSP 2.10 and later versions.

```c
If (iserror == ECC_STATE_NO_ERR) {
    val = __raw_readl(info->emifregs + NANDERRVAL1);
    return 0;
}
else if (iserror == ECC_STATE_TOO_MANY_ERRS) {
    val = __raw_readl(info->emifregs + NANDERRVAL1);
    printk(KERN_ERR "%s Too many errors to be corrected!\n", __func__);
    return -1;
}
```

In the kernel and U-boot the NANDERRVAL1 register is read, but in the UBL and NAND writer the NANDERRADD1 register is read. Doing a dummy read of any of these registers has exactly the same effect of clearing the 4BITECC_ADD_CALC_START in the NANDFCR register.

**NOTE:** All TI Software releases for DM365 SOC’s (including the PSP 3.01 releases) have been updated with the above software fixes. TI has patches for DM365 SOCs in addition to the official LSP 2.10 and later releases.

Workaround(s)
Other Workaround(s) to mitigate RBL issue:

- A workaround for this issue would be to use a different ROM boot mode, such as MMC/SD, AEMIF (OneNAND/NOR), USB, SPI, EMAC, UHPI or UART to load a secondary boot loader that can correctly access the NAND and load the remaining system software from the NAND device.
- Another recommendation would be to replace the current 4-bit ECC NAND device with a NAND device that uses less than 4-bit ECC. By employing the 4-bit ECC in the ROM we automatically cover any ECC requirements less than or equal to 4-bits (including 1-bit).
Advisory 1.2.5 — USB Communication Stops During Temperature Swing

Revision(s) Affected: 1.2 and earlier

Details: The USB PHY internal PLL can drift significantly over large transitions in temperature, especially when the Tc temperature is outside the 0c to 65c range. The observed failure is that the PHY is no longer able to communicate with the MUSB controller causing all USB data transfer to stop.

Workaround: When the issue happens, you can recover from it by resetting the USB PHY. This will force the USB PHY to reinitialize and re-calibrate its PLL.

The USB PHY can be reset as shown below:

```c
#define USB_PHY_CTRL *((volatile unsigned int *)0x01C40034)
#define USBPHY_PHYPDWN 0x1

Void phy_reset(void)
{
    /* Power down the USB PHY */
    USB_PHY_CTRL |= USBPHY_PHYPDWN;

    /* Wait a little */
    mdelay(1);

    /* Power up the USB PHY */
    USB_PHY_CTRL &= ~USBPHY_PHYPDWN;
}
```

For additional information, see the TMS320DM36x DMSoC ARM Subsystem Reference Guide (literature number SPRUFG5) Section 9.12.14 USB PHY Control (USB_PHY_CTRL) Register.

In order to invoke the recovery mechanism (i.e. resetting the USB PHY) we need to figure out when the issue is present. One way to implement this is to look for the absence of MUSB interrupts over a 2 to 5 seconds interval. This can be done from user space by monitoring this value: `[cat /proc/interrupts |grep musb_hdrc | awk '{print $2}'`.

When this counter does not change for a 2 to 5 seconds period you can assume the condition is present and issue the PHY reset mechanism (described above).
3 Silicon Revision 1.1 Usage Notes and Known Design Exceptions to Functional Specifications

3.1 Usage Notes for Silicon Revision 1.1

Silicon revision 1.1 applicable usage notes have been found on a later silicon revision. For more details, see Section 2.1, Usage Notes for Silicon Revision 1.2.

3.2 Silicon Revision 1.1 Known Design Exceptions to Functional Specifications

Table 5. Silicon Revision 1.1 Advisory List

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advisory 1.1.1 — UART Boot Mode</td>
<td>20</td>
</tr>
<tr>
<td>Advisory 1.1.2 — MMCSD Boot Mode</td>
<td>20</td>
</tr>
<tr>
<td>Advisory 1.1.3 — Limitation of the User-defined Multiplier Values in the Boot Mode Which Uses PLL</td>
<td>21</td>
</tr>
<tr>
<td>Advisory 1.1.4 — USB Boot Mode</td>
<td>21</td>
</tr>
<tr>
<td>Advisory 1.1.5 — EMAC Boot Mode</td>
<td>21</td>
</tr>
</tbody>
</table>

Some silicon revision 1.1 applicable advisories have been found on a later silicon revision. For more details, see Section 2.2, Silicon Revision 1.2 Known Design Exceptions to Functional Specifications.
Advisory 1.1.1 — UART Boot Mode

Revision(s) Affected
1.1 (not present on silicon revision 1.2)

Details
The OSM_SEL (Over-Sampling Mode Select) bit in the UART0 MDR (Mode Definition Register) should be set to 0. The current boot ROM code sets it to 1.

OSM_SEL = 0: 16x over sampling => Divisor value = clk/(16*baud_rate)
OSM_SEL = 1: 13x over sampling => Divisor value = clk/(13*baud_rate)

The choice of divisor value for UART is affected by OSM_SEL for a particular baud_rate.

Workaround(s)
To workaround this issue, use higher baud rate code. The desired baud rate of 115200 should be increased to 16/13 times (i.e., ~141800).

Advisory 1.1.2 — MMCSD Boot Mode

Revision(s) Affected
1.1 (not present on silicon revision 1.2)

Details
The divider value in MMCSD Boot ROM code is smaller than required, leading to some MMC/SD cards getting stuck in identification. For the 24MHz input clock instance, the SD_CLK clock is calculated as:

\[ SD_{CLK} = \frac{24 \text{ MHz}}{2 \times (2 \times (SD_{DIV}+1))}. \]

The divider (SD_DIV) value is chosen accordingly so that SD_CLK lies between 150 kHz and 400 kHz. In the MMCSD Boot ROM code the divider value was incorrectly chosen to a lower value leading the SD_CLK of the order of 1 MHz. The issue is fixed in the next boot ROM release.

There are several SD cards that can still be detected. Once detected, the booting sequence will work smoothly. The cards that have worked are:

1. Various SanDisk cards of sizes 32 MB, 512 MB, 1 GB, 2 GB
2. SDHC cards such as HP 4 GB
3. Canon 32 MB SD cards

Workaround(s)
To workaround this issue, use the above SD cards for booting purposes.
Advisory 1.1.3  
**Limitation of the User-defined Multiplier Values in the Boot Mode Which Uses PLL**

**Revision(s) Affected:** 1.1 (not present on silicon revision 1.2)

**Details:** The ROM boot loader cannot perform PLL multiplier programming correctly. The user cannot set its own multiplier values using PLL; therefore, the UBL descriptors should not use PLL boot options for a boot mode. This affects the following Boot modes of operation:
- NAND Boot Mode
- EMAC Boot Mode

**Workaround:** There is no workaround for this problem.

Advisory 1.1.4  
**USB Boot Mode**

**Revision(s) Affected:** 1.1 (not present on silicon revision 1.2)

**Details:** The PLL clock is not enabled for ARM9 in the boot ROM code for the USB boot mode. The PHYCLKFREQ in USBPHY_CTL register must be set to 2. The effect of this problem is that USB boot mode will not work.

**Workaround:** There is no workaround for this problem.

Advisory 1.1.5  
**EMAC Boot Mode**

**Revision(s) Affected:** 1.1 (not present on silicon revision 1.2)

**Details:** The I2C driver used for reading I2C EEPROM in EMAC boot mode goes into an indeterminate state once EMAC descriptor is read from the EEPROM. This I2C driver problem does not affect EMAC booting operation.

**Workaround:** The UBL downloaded via EMAC boot mode should perform a Synchronous Reset of the I2C module.
Appendix A Revision History

Table 6 highlights the technical changes to SPRZ294D to make it a E revision.

Table 6. Revision History

<table>
<thead>
<tr>
<th>SEE</th>
<th>ADDITIONS/CHANGES/DELETIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 2.2</td>
<td>Added the following Advisory:</td>
</tr>
<tr>
<td></td>
<td>• USB Communication Stops During Temperature Swing</td>
</tr>
</tbody>
</table>
## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are neither designed nor intended for use in life support systems or critical safety applications where a failure of the TI product would reasonably be expected to cause severe personal injury or death. Buyers acknowledge and agree that they are solely responsible for all legal and regulatory requirements concerning their products and any use of TI products in such safety-critical applications. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements. TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications. TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use. TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

<table>
<thead>
<tr>
<th>Products</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio</td>
<td>Communications and Telecom</td>
</tr>
<tr>
<td>Amplifiers</td>
<td>Computers and Peripherals</td>
</tr>
<tr>
<td>Data Converters</td>
<td>Consumer Electronics</td>
</tr>
<tr>
<td>DLP® Products</td>
<td>Energy and Lighting</td>
</tr>
<tr>
<td>DSP</td>
<td>Industrial</td>
</tr>
<tr>
<td>Clocks and Timers</td>
<td>Medical</td>
</tr>
<tr>
<td>Interface</td>
<td>Security</td>
</tr>
<tr>
<td>Logic</td>
<td>Space, Avionics and Defense</td>
</tr>
<tr>
<td>Power Mgmt</td>
<td>Transportation and Automotive</td>
</tr>
<tr>
<td>Microcontrollers</td>
<td>Video and Imaging</td>
</tr>
<tr>
<td>RFID</td>
<td>Wireless</td>
</tr>
<tr>
<td>RF/IF and ZigBee® Solutions</td>
<td><a href="http://www.ti.com/lprf">www.ti.com/lprf</a></td>
</tr>
</tbody>
</table>