

# MSP430F1491 Device Erratasheet

NOTE: Silicon Revisions AA, AB, and AD use BSL version 1.61. For specific information on this version of the BSL and its proper usage, see the MSP430 Memory Programming User's Guide ([SLAU265](#)).

## 1 Functional Errata Revision History

Errata impacting device's operation, function or parametrics.

✓ The check mark indicates that the issue is present in the specified revision.

| Errata Number         | Rev AE | Rev AD | Rev AB | Rev AA | Rev S | Rev Q | Rev O | Rev N | Rev M | Rev L |
|-----------------------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|
| <a href="#">BCL5</a>  | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">MPY2</a>  | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">PORT3</a> | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">RES3</a>  | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">RES4</a>  | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">TA12</a>  | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">TA16</a>  | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">TA21</a>  | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">TAB22</a> | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">TB1</a>   | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">TB2</a>   | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">TB3</a>   | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">TB4</a>   | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">TB14</a>  | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">TB16</a>  | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">TB24</a>  | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">US13</a>  | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">US14</a>  | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">US15</a>  | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">WDG2</a>  | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |

## 2 Preprogrammed Software Errata Revision History

Errata impacting pre-programmed software into the silicon by Texas Instruments.

✓ The check mark indicates that the issue is present in the specified revision.

| Errata Number        | Rev AE | Rev AD | Rev AB | Rev AA | Rev S | Rev Q | Rev O | Rev N | Rev M | Rev L |
|----------------------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|
| <a href="#">BSL3</a> | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">BSL4</a> | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |
| <a href="#">BSL5</a> | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |

### 3 Debug only Errata Revision History

Errata only impacting debug operation.

✓ The check mark indicates that the issue is present in the specified revision.

| Errata Number         | Rev AE | Rev AD | Rev AB | Rev AA | Rev S | Rev Q | Rev O | Rev N | Rev M | Rev L |
|-----------------------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|
| <a href="#">EEM20</a> | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |

### 4 Fixed by Compiler Errata Revision History

Errata completely resolved by compiler workaround. Refer to specific erratum for IDE and compiler versions with workaround.

✓ The check mark indicates that the issue is present in the specified revision.

| Errata Number        | Rev AE | Rev AD | Rev AB | Rev AA | Rev S | Rev Q | Rev O | Rev N | Rev M | Rev L |
|----------------------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|
| <a href="#">CPU4</a> | ✓      | ✓      | ✓      | ✓      | ✓     | ✓     | ✓     | ✓     | ✓     | ✓     |

Refer to the following MSP430 compiler documentation for more details about the CPU bugs workarounds.

#### TI MSP430 Compiler Tools (Code Composer Studio IDE)

- [MSP430 Optimizing C/C++ Compiler](#): Check the --silicon\_errata option
- [MSP430 Assembly Language Tools](#)

#### MSP430 GNU Compiler (MSP430-GCC)

- [MSP430 GCC Options](#): Check -msilicon-errata= and -msilicon-errata-warn= options
- [MSP430 GCC User's Guide](#)


#### IAR Embedded Workbench

- [IAR workarounds for msp430 hardware issues](#)

## 5 Package Markings

### PM64

#### LQFP (PM), 64 Pin

|  |  |
|--|--|
|  NNNNNNN <u>G4</u><br><br>M430Fxxxx<br>REV #<br>○ | # = Die revision<br>○ = Pin 1 location<br>N = Lot trace code |
|--|--|

### RTD64

#### QFN (RTD), 64 Pin

|  |  |
|--|--|
| ○<br>M430Fxxxx<br><br>TI NNN<br>NNNN #           | # = Die revision<br>○ = Pin 1 location<br>N = Lot trace code |
| ○<br>M430Fxxxx<br><br>TI NNN <u>G3</u><br>NNNN # | # = Die revision<br>○ = Pin 1 location<br>N = Lot trace code |

## 6 Detailed Bug Description

### **BCL5** *BCS Module*

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**Category** Functional

**Function** RSELx bit modifications can generate high frequency spikes on MCLK

**Description** When DIVMx = 00 or 01 the RSELx bits of the Basic Clock Module are incremented or decremented in steps of 2 or greater, the DCO output may momentarily generate high frequency spikes on MCLK, which may corrupt CPU operation. This is not an issue when DIVMx = 10 or 11.

**Workaround** Set DIVMx = 10 or 11 to divide the MCLK input prior to modifying RSELx. After the RSELx bits are configured as desired, the DIVMx setting can be changed back to the original selection.

### **BSL3** *BSL Module*

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**Category** Software in ROM

**Function** Receiving framesBug

**Description** Receiving frames with a checksum value equal to a legal address can change the content of this address or the bootstrap loader may stop operation.

**Workaround** Software workaround is available as part of BSLDEMO.exe, found as part of the BSL-SCRIPTER download on the page for [MSPBSL](#).

### **BSL4** *BSL Module*

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**Category** Software in ROM

**Function** Flash memory can not be programmed

**Description** The bootstrap loader software cannot program the flash memory.

**Workaround** Software workaround is available as part of BSLDEMO.exe, found as part of the BSL-SCRIPTER download on the page for [MSPBSL](#).

### **BSL5** *BSL Module*

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**Category** Software in ROM

**Function** BSL might not start if RST/NMI pin is configured as NMI input

**Description** If the RST/NMI pin is configured to NMI, the bootstrap loader may not be started. Unpredictable operations will result.

**Workaround** None

### **CPU4** *CPU Module*

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**Category** Compiler-Fixed

**Function** PUSH #4, PUSH #8CPU4 - Bug

**Description** The single operand instruction PUSH cannot use the internal constants (CG) 4 and 8. The other internal constants (0, 1, 2, -1) can be used. The number of clock cycles is different:

PUSH #CG uses address mode 00, requiring 3 cycles, 1 word instruction

PUSH #4/#8 uses address mode 11, requiring 5 cycles, 2 word instruction

**Workaround** Refer to the table below for compiler-specific fix implementation information.

| IDE/Compiler                                    | Version Number                    | Notes   |
|---|-----------------------------------|---|
| IAR Embedded Workbench                          | IAR EW430 v2.x until v6.20        | User is required to add the compiler flag option below.<br>--hw_workaround=CPU4 |
| IAR Embedded Workbench                          | IAR EW430 v6.20 or later          | Workaround is automatically enabled   |
| TI MSP430 Compiler Tools (Code Composer Studio) | v1.1 or later                     |   |
| MSP430 GNU Compiler (MSP430-GCC)                | MSP430-GCC 4.9 build 167 or later |   |

## **EEM20** *EEM Module*

**Category** Debug

**Function** Debugger might clear interrupt flags

**Description** During debugging read-sensitive interrupt flags might be cleared as soon as the debugger stops. This is valid in both single-stepping and free run modes.

**Workaround** None.

## **MPY2** *MPY Module*

**Category** Functional

**Function** Multiplier Result register corruption

**Description** Depending on the address of the write instruction, writing to the multiplier result registers (RESHI, RESLO, or SUMEXT) may corrupt the result registers. The address dependency varies between a 2-word and a 3-word instructions.

**Workaround** Ensure that a write instruction to an MPY result register (for example, mov.w #200, &RESHI) is not located at an address with the four least significant bits shown in Table 1:

Table 1. Sensitive Addresses for Write Access to MPY Result Registers MAB[3:0]

| RESLOW 013Ah |        | RESHI 013Ch |        | SUMEXT 013Eh |        |
|--------------|--------|-------------|--------|--------------|--------|
| 3 Word       | 2 Word | 3 Word      | 2 Word | 3 Word       | 2 Word |
| 2            | 4      | 2           | 4      | 2            | 4      |
| 6            | 8      | 4           | 6      | 6            | 8      |
| A            | C      | A           | C      | A            | C      |
| E            | 0      | C           | E      | -            | -      |

|                    |   |
|--------------------|---|
| <b>PORT3</b>       | <b><i>PORT Module</i></b>   |
| <b>Category</b>    | Functional  |
| <b>Function</b>    | Port interrupts can get lost  |
| <b>Description</b> | Port interrupts can get lost if they occur during CPU access of the P1IFG and P2IFG registers.  |
| <b>Workaround</b>  | None  |
| <b>RES3</b>        | <b><i>RESET Module</i></b>  |
| <b>Category</b>    | Functional  |
| <b>Function</b>    | Reset   |
| <b>Description</b> | When RST/NMI is held low during power up of VCC, some internal drivers are not reset correctly. This may result in a high Icc current until the internal power-on signal has generated one clock cycle to reset the internal drivers. This limits the time when the excess current can occur to the time the power-up circuit is active.  |
| <b>Workaround</b>  | None  |
| <b>RES4</b>        | <b><i>RESET Module</i></b>  |
| <b>Category</b>    | Functional  |
| <b>Function</b>    | No reset if external resistor exceeds certain value   |
| <b>Description</b> | No reset of the device is performed if the external pull down resistor on RST/NMI pin is above a certain limit. The limits are:<br>Vcc = 1.8V: maximum pull down resistor = 12 kohm<br>Vcc = 3.0V: maximum pull down resistor = 5 kohm<br>Vcc = 3.6V: maximum pull down resistor = 2.5 kohm<br>In addition, a higher current consumption occurs during high/low RST/NMI signal transition when using improper resistors.  |
| <b>Workaround</b>  | Use external pulldown resistors below the listed values or directly drive RST/NMI low to generate a reset.  |
| <b>TA12</b>        | <b><i>TIMER_A Module</i></b>  |
| <b>Category</b>    | Functional  |
| <b>Function</b>    | Interrupt is lost (slow ACLK)   |
| <b>Description</b> | Timer_A counter is running with slow clock (external TACLK or ACLK) compared to MCLK. The compare mode is selected for the capture/compare channel and the CCRx register is incremented by one with the occurring compare interrupt (if TAR = CCRx). Due to the fast MCLK the CCRx register increment (CCRx = CCRx+1) happens before the Timer_A counter has incremented again. Therefore the next compare interrupt should happen at once with the next Timer_A counter increment (if TAR = CCRx + 1). |

This interrupt gets lost.

**Workaround** Switch capture/compare mode to capture mode before the CCRx register increment. Switch back to compare mode afterwards.

**TA16** *TIMER\_A Module*

**Category** Functional

**Function** First increment of TAR erroneous when IDx > 00

**Description** The first increment of TAR after any timer clear event (POR/TACLr) happens immediately following the first positive edge of the selected clock source (INCLK, SMCLK, ACLK or TACLK). This is independent of the clock input divider settings (ID0, ID1). All following TAR increments are performed correctly with the selected IDx settings.

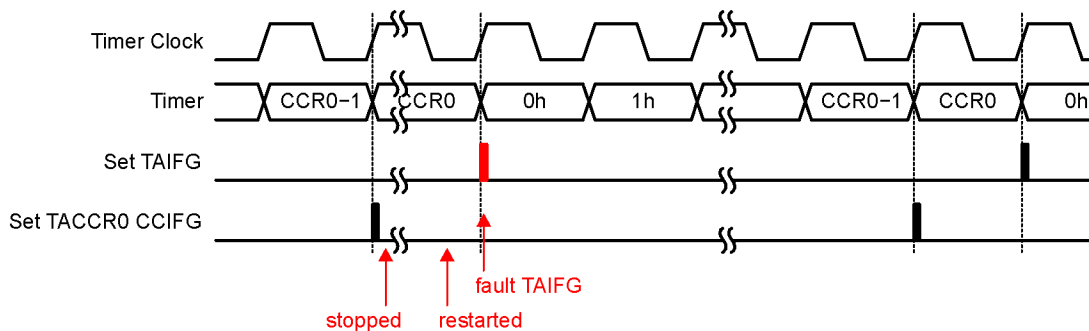
**Workaround** None

**TA21** *TIMER\_A Module*

**Category** Functional

**Function** TAIFG Flag is erroneously set after Timer A restarts in Up Mode

**Description** In Up Mode, the TAIFG flag should only be set when the timer counts from TACCR0 to zero. However, if the Timer A is stopped at TAR = TACCR0, then cleared (TAR=0) by setting the TACLr bit, and finally restarted in Up Mode, the next rising edge of the TACLK will erroneously set the TAIFG flag.



**Workaround** None.

**TAB22** *TIMER\_A/TIMER\_B Module*

**Category** Functional

**Function** Timer\_A/Timer\_B register modification after Watchdog Timer PUC

**Description** Unwanted modification of the Timer\_A/Timer\_B registers TACTL/TBCTL and TAIV/TBIV can occur when a PUC is generated by the Watchdog Timer(WDT) in Watchdog mode and any Timer\_A/Timer\_B counter register TACCRx/TBCCRx is incremented/decremented (Timer\_A/Timer\_B does not need to be running).

**Workaround** Initialize TACTL/TBCTL register after the reset occurs using a MOV instruction (BIS/BIC

may not fully initialize the register). TAIV/TBIV is automatically cleared following this initialization.

Example code:

```
MOV.W #VAL, &TACTL
```

or

```
MOV.W #VAL, &TBCTL
```

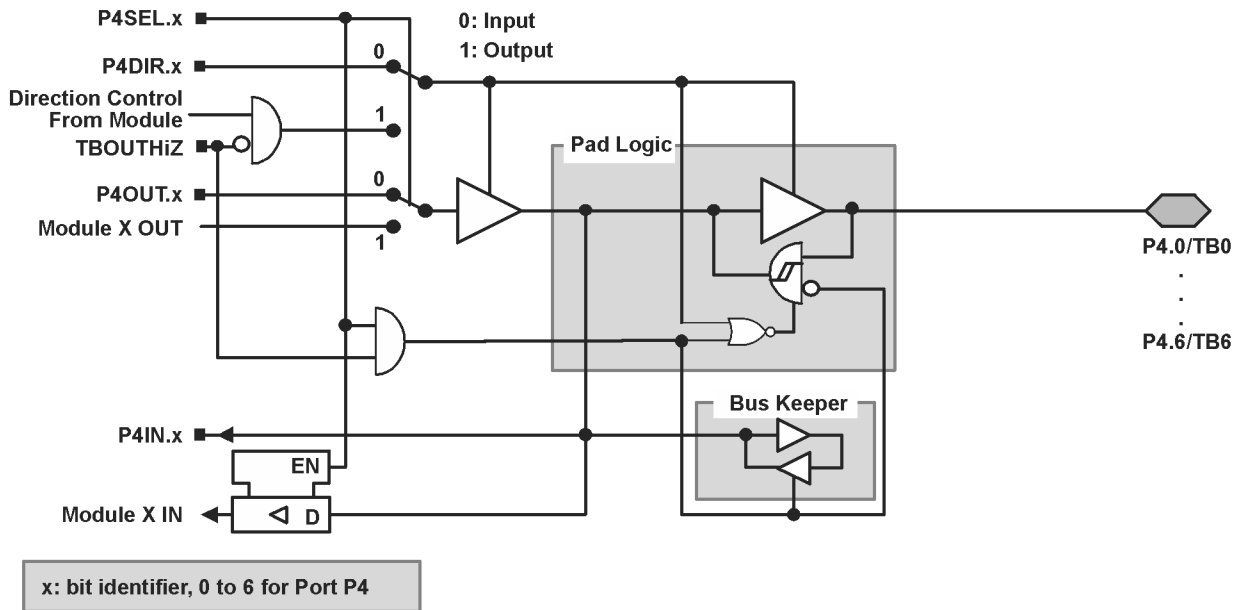
Where, VAL=0, if Timer is not used in application otherwise, user defined per desired function.

|                    |   |
|--------------------|---|
| <b>TB1</b>         | <b><i>TIMER_B Module</i></b>  |
| <b>Category</b>    | Functional  |
| <b>Function</b>    | "Equal mode" when grouping compare latches  |
| <b>Description</b> | The "equal mode" for loading the compare latches (CLLD = 3) cannot be used when compare latches are grouped (TBCLGRP > 0).  |
| <b>Workaround</b>  | None  |
| <b>TB2</b>         | <b><i>TIMER_B Module</i></b>  |
| <b>Category</b>    | Functional  |
| <b>Function</b>    | Interrupt is lost (slow ACLK)   |
| <b>Description</b> | <p>Timer_B counter is running with slow clock (external TBCLK or ACLK) compared to MCLK. The compare mode is selected for the capture/compare channel and the CCRx register is incremented by 1 with the occurring compare interrupt (if TBR = CCRx).</p> <p>Due to the fast MCLK, the CCRx register increment (CCRx = CCRx + 1) happens before the Timer_B counter has incremented again. Therefore, the next compare interrupt should happen at once with the next Timer_B counter increment (if TBR = CCRx + 1). This interrupt is lost.</p>   |
| <b>Workaround</b>  | Switch capture/compare mode to capture mode before the CCRx register increment. Switch back to compare mode afterward.  |
| <b>TB3</b>         | <b><i>TIMER_B Module</i></b>  |
| <b>Category</b>    | Functional  |
| <b>Function</b>    | Port is switched to 3-state independent of selected function  |
| <b>Description</b> | <p>Incorrect 3-state function of Ports P4.0/TB0 through P4.6/TB6 (TBoutHiZ control). If TBoutHiZ is set to high, all ports P4.0/TB0 through P4.6/TB6 are set to 3-state, independent of the P4SEL.x control signals. This means a port P4.x is switched to 3-state with TBoutHiZ, even if it is not selected for Timer_B function. In addition, the ports P4.0/TB0 through P4.6/TB6 are switched to 3-state with TBoutHiZ, even if the port direction (direction control from module) is set to input. This is in accordance with the specification description but, nevertheless, is an unexpected behavior.</p> |
| <b>Workaround</b>  | No workaround.  |



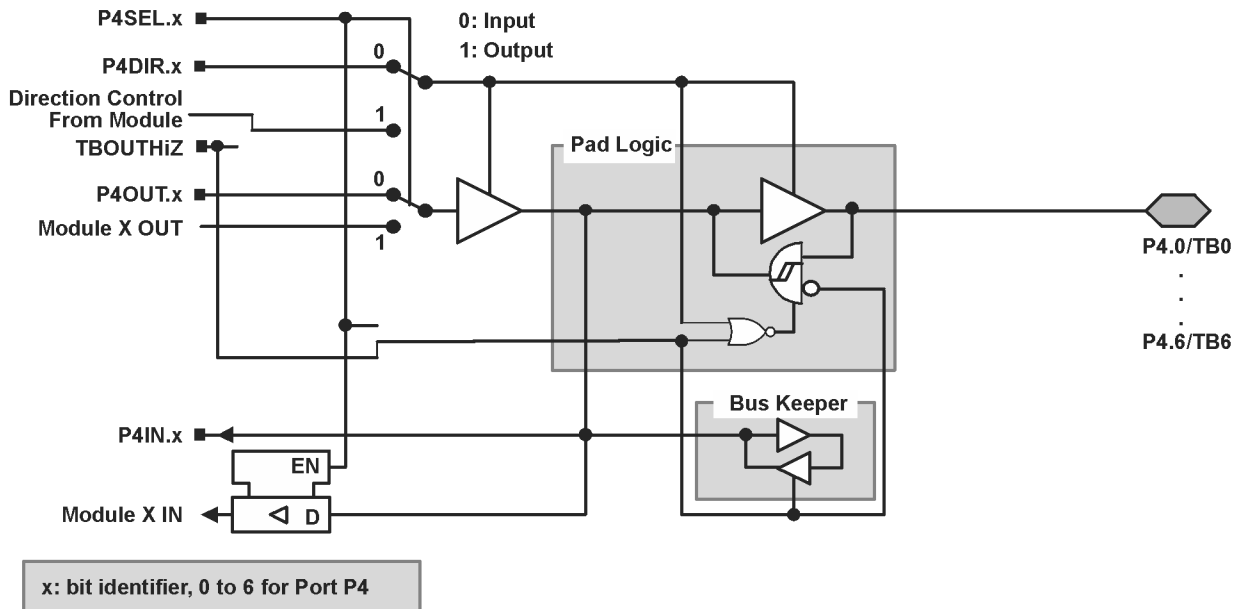
Port function as specified

port P4, P4.0 to P4.6, input/output with Schmitt-trigger



Port Realization With TB3 Bug

port P4, P4.0 to P4.6, input/output with Schmitt-trigger



**TB4** *TIMER\_B Module*

**Category** Functional

**Function** Group function

**Description** If the shadow registers are organized in groups (SHR = 1, 2, or 3), one shadow register

is not loaded correctly. This happens when the last CCRx register within a group is loaded at exactly the same time that the timer counter reaches the event for loading the shadow registers (TBR = 0 or TBR = CCR0).

**Workaround** Ensure that all CCRx registers within a group are loaded before the shadow register load event occurs.

## **TB14** *TIMER\_B Module*

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**Category** Functional

**Function** PWM output

**Description** The PWM output unit may behave erroneously if the condition for changing the PWM output (EQUx or EQU0) and the condition for loading the shadow register TBCLx happen at the same time. Depending on the load condition for the shadow registers (CLLD bits in TBCCTLx), there are four possible error conditions:

1. Change CCRx register from any value to CCRx = 0 (for example, sequence for CCRx = 4 3 2 0 0 0)
2. Change CCRx register from CCRx = 0 to any value (for example, sequence for CCRx = 0 0 0 2 3 4)
3. Change CCRx register from any value to current SHD0 (CCR0) value (for example, sequence for CCRx = 4 2 5 SHD0 3 8)
4. Change CCRx register from current SHD0 (CCR0) value to any value (for example, sequence for CCRx = 4 2 SHD0 5 3 8)

**Workaround** No general workaround available.

## **TB16** *TIMER\_B Module*

---

**Category** Functional

**Function** First increment of TBR erroneous when IDx > 00

**Description** The first increment of TBR after any timer clear event (POR/TBCLR) happens immediately following the first positive edge of the selected clock source (INCLK, SMCLK, ACLK, or TBCLK). This is independent of the clock input divider settings (ID0, ID1). All following TBR increments are performed correctly with the selected IDx settings.

**Workaround** None

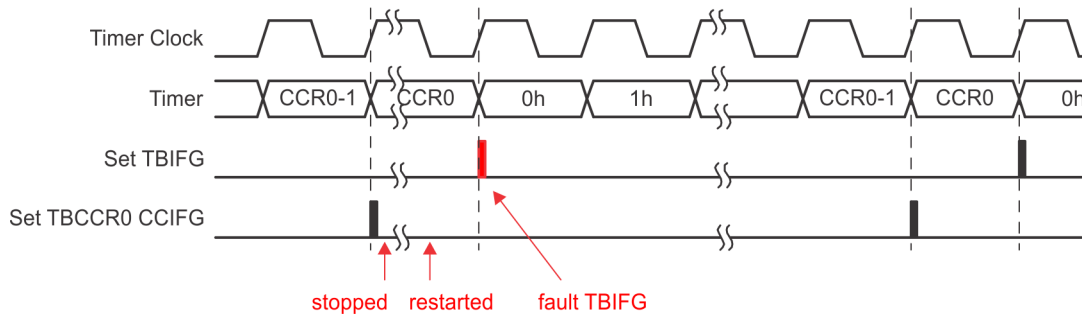
## **TB24** *TIMER\_B Module*

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**Category** Functional

**Function** TBIFG Flag is erroneously set after Timer B restarts in Up Mode

**Description** In Up Mode, the TBIFG flag should only be set when the timer resets from TBCCR0 to zero. However, if the Timer B is stopped at TBR = TBCCR0, then cleared (TBR=0) by setting the TBCLR bit, and finally restarted in Up Mode, the next rising edge of the TBCLK will erroneously set the TBIFG flag.



**Workaround** None.

**US13** ***USART Module***

**Category** Functional

**Function** Unpredictable program execution

**Description** USART interrupts requested by URXS can result in unpredictable program execution if this request is not served within two bit times of the received data.

**Workaround** Ensure that the interrupt service routine is entered within two bit times of the received data.

**US14** ***USART Module***

**Category** Functional

**Function** Start edge of received characters may be ignored

**Description** When using the USART in UART mode with UxBR0 = 0x03 and UxBR1 = 0x00, the start edge of received characters may be ignored due to internal timing conflicts within the UART state machine. This condition does not apply when UxBR0 is > 0x03.

**Workaround** None

**US15** ***USART Module***

**Category** Functional

**Function** UART receive with two stop bits

**Description** USART hardware does not detect a missing second stop bit when SPB = 1. The Framing Error Flag (FE) will not be set under this condition and erroneous data reception may occur.

**Workaround** None (Configure USART for a single stop bit, SPB = 0)

**WDG2** ***WDT Module***

**Category** Functional

|                    |   |
|--------------------|---|
| <b>Function</b>    | Incorrectly accessing a flash control register  |
| <b>Description</b> | If a key violation is caused by incorrectly accessing a flash control register, the watchdog interrupt flag is set in addition to the expected PUC. |
| <b>Workaround</b>  | None  |

## 7 Document Revision History

Changes from family erratasheet to device specific erratasheet.

1. Errata ADC25 was removed
2. Errata MPY2 was added
3. Package PAG64 was removed

Changes from device specific erratasheet to document Revision A.

1. Errata EEM20 was added to the errata documentation.

Changes from document Revision A to Revision B.

1. Errata TA21 was added to the errata documentation.

Changes from document Revision B to Revision C.

1. Errata TB24 was added to the errata documentation.

Changes from document Revision C to Revision D.

1. Package Markings section was updated.

Changes from document Revision D to Revision E.

1. TA21 Description was updated.

Changes from document Revision E to Revision F.

1. Function for CPU4 was updated.
2. Workaround for CPU4 was updated.

Changes from document Revision F to Revision G.

1. Workaround for BSL4 was updated.
2. Function for BSL3 was updated.
3. Workaround for BSL3 was updated.

Changes from document Revision G to Revision H.

1. Erratasheet format update.
2. Added errata category field to "Detailed bug description" section

Changes from document Revision H to Revision I.

1. Description for TB24 was updated.

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