

## MSP430FR2110 Device Erratasheet

The revision of the device can be identified by the revision letter on the [Package Markings](#) or by the [HW\\_ID](#) located inside the TLV structure of the device

### 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 B |
|------------------------|-------|
| <a href="#">ADC50</a>  | ✓     |
| <a href="#">ADC63</a>  | ✓     |
| <a href="#">CPU46</a>  | ✓     |
| <a href="#">CS13</a>   | ✓     |
| <a href="#">CS14</a>   | ✓     |
| <a href="#">PMM32</a>  | ✓     |
| <a href="#">RTC15</a>  | ✓     |
| <a href="#">USCI42</a> | ✓     |
| <a href="#">USCI47</a> | ✓     |
| <a href="#">USCI50</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.

The device doesn't have Software in ROM errata.

### 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 B |
|-----------------------|-------|
| <a href="#">EEM23</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 B |
|-----------------------|-------|
| <a href="#">CPU21</a> | ✓     |
| <a href="#">CPU22</a> | ✓     |
| <a href="#">CPU40</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

### PW16

#### TSSOP (PW), 16 Pin



# = Die revision  
○ = Pin 1 location  
N = Lot trace code

### RLL24

#### QFN (RLL), 24 pins



# = Die revision  
○ = Pin 1 location  
N = Lot trace code

## 6 Memory-Mapped Hardware Revision (TLV Structure)

| Die Revision | TLV Hardware Revision |
|--------------|-----------------------|
| Rev B        | 11h                   |

Further guidance on how to locate the TLV structure and read out the HW\_ID can be found in the device User's Guide.

## 7 Detailed Bug Description

### ADC50

#### ADC Module

|             |                                                                                                                                                                    |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Category    | Functional                                                                                                                                                         |
| Function    | Erroneous ADC conversion result for internal temperature sensor in LPM3 mode                                                                                       |
| Description | When ACLK is used as ADC clock source and device is in LPM3 mode while sampling the on-chip temperature sensor, the ADC may generate erroneous conversion results. |
| Workaround  | 1) Use SMCLK or MODCLK as the ADC clock source. A 100us sampling time is required if triggering ADC conversion from LPM3.<br>OR<br>2) Use LPM0 or Active Mode.     |

### ADC63

#### ADC Module

|             |                                                                                    |
|-------------|------------------------------------------------------------------------------------|
| Category    | Functional                                                                         |
| Function    | ADCHI/ADCLO may be reset unexpectedly when ADCCTL2 high byte is written byte-wise  |
| Description | ADCHI/ADCLO may be reset unexpectedly when ADCCTL2 high byte is written byte-wise. |
| Workaround  | Write to ADCCTL2 high byte in word-wise method.                                    |

### CPU21

#### CPUXv2 Module

|             |                                                                                                                                                                                         |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Category    | Compiler-Fixed                                                                                                                                                                          |
| Function    | Using POPM instruction on Status register may result in device hang up                                                                                                                  |
| Description | When an active interrupt service request is pending and the POPM instruction is used to set the Status Register (SR) and initiate entry into a low power mode , the device may hang up. |
| Workaround  | None. It is recommended not to use POPM instruction on the Status Register.<br>Refer to the table below for compiler-specific fix implementation information.                           |

| IDE/Compiler                                    | Version Number                    | Notes                                                                                          |
|-------------------------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------|
| IAR Embedded Workbench                          | Not affected                      |                                                                                                |
| TI MSP430 Compiler Tools (Code Composer Studio) | v4.0.x or later                   | User is required to add the compiler or assembler flag option below.<br>--silicon_errata=CPU21 |
| MSP430 GNU Compiler (MSP430-GCC)                | MSP430-GCC 4.9 build 167 or later |                                                                                                |

### CPU22

#### CPUXv2 Module

|          |                                                                                                         |
|----------|---------------------------------------------------------------------------------------------------------|
| Category | Compiler-Fixed                                                                                          |
| Function | Indirect addressing mode with the Program Counter as the source register may produce unexpected results |

**Description** When using the indirect addressing mode in an instruction with the Program Counter (PC) as the source operand, the instruction that follows immediately does not get executed.

For example in the code below, the ADD instruction does not get executed.

```
mov @PC, R7
add #1h, R4
```

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

| IDE/Compiler                                    | Version Number                    | Notes                                                                                          |
|-------------------------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------|
| IAR Embedded Workbench                          | Not affected                      |                                                                                                |
| TI MSP430 Compiler Tools (Code Composer Studio) | v4.0.x or later                   | User is required to add the compiler or assembler flag option below.<br>--silicon_errata=CPU22 |
| MSP430 GNU Compiler (MSP430-GCC)                | MSP430-GCC 4.9 build 167 or later |                                                                                                |

## CPU40

### CPUXv2 Module

**Category** Compiler-Fixed

**Function** PC is corrupted when executing jump/conditional jump instruction that is followed by instruction with PC as destination register or a data section

**Description** If the value at the memory location immediately following a jump/conditional jump instruction is 0X40h or 0X50h (where X = don't care), which could either be an instruction opcode (for instructions like RRCM, RRAM, RLAM, RRUM) with PC as destination register or a data section (const data in flash memory or data variable in RAM), then the PC value is auto-incremented by 2 after the jump instruction is executed; therefore, branching to a wrong address location in code and leading to wrong program execution.

For example, a conditional jump instruction followed by data section (0140h).

```
@0x8012 Loop DEC.W R6
@0x8014 DEC.W R7
@0x8016 JNZ Loop
@0x8018 Value1 DW 0140h
```

**Workaround** In assembly, insert a NOP between the jump/conditional jump instruction and program code with instruction that contains PC as destination register or the data section.

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

| IDE/Compiler                                    | Version Number           | Notes                                                                                                          |
|-------------------------------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------|
| IAR Embedded Workbench                          | IAR EW430 v5.51 or later | For the command line version add the following information<br>Compiler: --hw_workaround=CPU40<br>Assembler:-v1 |
| TI MSP430 Compiler Tools (Code Composer Studio) | v4.0.x or later          | User is required to add the compiler or assembler flag option below.<br>--silicon_errata=CPU40                 |
| MSP430 GNU Compiler (MSP430-GCC)                | Not affected             |                                                                                                                |

**CPU46**
**CPUXv2 Module**
**Category**

Functional

**Function**

POPM performs unexpected memory access and can cause VMAIFG to be set

**Description**

When the POPM assembly instruction is executed, the last Stack Pointer increment is followed by an unintended read access to the memory. If this read access is performed on vacant memory, the VMAIFG will be set and can trigger the corresponding interrupt (SFR1E1.VMAIE) if it is enabled. This issue occurs if the POPM assembly instruction is performed up to the top of the STACK.

**Workaround**

If the user is utilizing C, they will not be impacted by this issue. All TI/IAR/GCC pre-built libraries are not impacted by this bug. To ensure that POPM is never executed up to the memory border of the STACK when using assembly it is recommended to either

1. Initialize the SP to

a. TOP of STACK - 4 bytes if POPM.A is used

b. TOP of STACK - 2 bytes if POPM.W is used

OR

2. Use the POPM instruction for all but the last restore operation. For the the last restore operation use the POP assembly instruction instead.

For instance, instead of using:

```
POPM.W #5, R13
```

Use:

```
POPM.W #4, R12
```

```
POP.W R13
```

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

| IDE/Compiler                                    | Version Number | Notes                                                                                                                                |
|-------------------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------|
| IAR Embedded Workbench                          | Not affected   | C code is not impacted by this bug. User using POPM instruction in assembler is required to implement the above workaround manually. |
| TI MSP430 Compiler Tools (Code Composer Studio) | Not affected   | C code is not impacted by this bug. User using POPM instruction in assembler is required to implement the above workaround manually. |
| MSP430 GNU Compiler (MSP430-GCC)                | Not affected   | C code is not impacted by this bug. User using POPM instruction in assembler is required to implement the above workaround manually. |

**CS13**
**CS Module**
**Category**

Functional

**Function**

Device may enter lockup state during transition from AM to LPM3/4 if DCO frequency is above 2 MHz.

**Description**

The device might enter lockup state if DCO frequency is above 2 MHz and two events

happen at the same time:

- 1) The device transitions from AM to LPM3/4 (e.g. during ISR exits or Status Register modifications)
- 2) An interrupt is requested (e.g. GPIO interrupt).

This condition can be recovered by BOR/Power cycle.

#### Workaround

1. Use DCOCLK at 2MHz or lower.

OR

2. Use LPM0/x.5 instead of LPM3/4.

OR

3. Use external high-frequency crystal if it is available on the device.

OR

4. Set DCOCLK to 2MHz or lower before entering LPM3/4, then restore DCOCLK after wake-up. Note using peripherals using clocks derived from DCOCLK might be affected during this interval.

### CS14

#### CS Module

#### Category

Functional

#### Function

TLV values for 16MHz calibration are shifted beyond datasheet error limits

#### Description

During setting DCO frequency to 16MHz, 16MHz DCO tap settings value inside of TLV is used as the CSCTL0 setting. In this case after FLL locked, DCO 16MHz frequency can shift outside of datasheet specification of +/- 1% at 25C for a maximum time of 60ms. After the maximum time of 60ms, DCO frequency error will settle back to DCO FLL lock frequency of 16 MHz +/- 1% at 25C specified in device data sheet

#### Workaround

1. After setting the DCO frequency to 16MHz, set a 300us delay in software, then poll the FLL locked status bits in CSCTL7 Register. Once the FLL is locked, the DCO frequency will match the device data sheet specifications.

OR

2. During first power on of MCU:

- set DCO frequency to 16MHz,
- set a 300us delay in software,
- poll FLL locked status bits in CSCTL7 until FLL lock
- store DCO tap settings by reading CSCTL0 register value and write to FRAM

The stored DCO tap settings can then be loaded into CSCTL0 when setting the DCO to 16MHz in order to reduce FLL lock duration. This value will be used in lieu of TLV values.

### EEM23

#### EEM Module

#### Category

Debug

#### Function

EEM triggers incorrectly when modules using wait states are enabled

#### Description

When modules using wait states (USB, MPY, CRC and FRAM controller in manual mode) are enabled, the EEM may trigger incorrectly. This can lead to an incorrect profile

counter value or cause issues with the EEMs data watch point, state storage, and breakpoint functionality.

**Workaround**

None.

---

**NOTE:** This erratum affects debug mode only.

---

**PMM32**
***PMM Module***


---

**Category**

Functional

**Function**

Device may enter lockup state or execute unintentional code during transition from AM to LPM3/4

**Description**

The device might enter lockup state or start executing unintentional code resulting in unpredictable behavior depending on the contents of the address location- if any of the two conditions below occurs:

Condition1:

The following three events happen at the same time:

1) The device transitions from AM to LPM3/4 (e.g. during ISR exits or Status Register modifications),

AND

2) An interrupt is requested (e.g. GPIO interrupt),

AND

3) MODCLK is requested (e.g. triggered by ADC) or removed (e.g. end of ADC conversion).

Modules which can trigger MODCLK clock requests/removals are ADC, eUSCI and CapTivate (if exist).

If clock events are started by the CPU (e.g. eUSCI during SPI master transmission), they can not occur at the same time as the power mode transition and thus should not be affected. The device should only be affected when the clock event is asynchronous to the power mode transition.

The device can recover from this lockup condition by a PUC/BOR/Power cycle (e.g. enable Watchdog to trigger PUC).

Condition2:

The following events happen at the same time:

1) The device transitions from AM to LPM3/4 (e.g. during ISR exits or Status Register modifications),

AND

2) An interrupt is requested (e.g. GPIO interrupt),

AND

3) Neither MODCLK nor SMCLK are running (e.g. requested by a peripheral),

AND

4) SMCLK is configured with a different frequency than MCLK.

The device can recover from this lockup condition by a BOR/Power cycle.



**Workaround**

1. Use LPM0/1/x.5 instead of LPM3/4.

OR

2. Place the FRAM in INACTIVE mode before any entry to LPM3/4 by clearing the FRPWR bit and FRLPMPWR bit (if exist) in the GCCTL0 register. This must be performed from RAM as shown below:

// define a function in RAM

```
#pragma CODE_SECTION(enterLpModeFromRAM, ".TI.ramfunc")
```

```
void enterLpModeFromRAM(unsigned short lowPowerMode);
```

//call this function before any entry to LPM3/4

```
void enterLpModeFromRAM(unsigned short lowPowerMode)
```

```
{
```

```
FRCTL0 = FRCTLPW;
```

```
GCCTL0 &= ~(FRPWR+FRLPMPWR); //clear FRPWR and FRLPMPWR
```

```
FRCTL0_H = 0; //re-lock FRCTL
```

```
__bis_SR_register(lowPowerMode);
```

```
}
```

**RTC15**
***RTC Module***
**Category**

Functional

**Function**

RTC Counter stops operating if RTC Counter clock source is changed from XT1CLK to another source while XT1CLK is stopped

**Description**

If XT1CLK is used as the clock source for the RTC Counter and XT1CLK stops (e.g. oscillator fault), if the RTC Counter clock source is changed by user software (e.g. in the clock fault handling ISR) from XT1CLK to a different clock source while XT1CLK is stopped the RTC Counter hangs. In this hang state, the RTC Counter stops operating and cannot be restarted without a device reset via the hardware RST pin, a power-cycle of the device, or recovery of XT1CLK oscillation.

**Workaround**

To change the RTC Counter clock source due to an oscillator fault, in the ISR for handling the OFIFG fault, use this software sequence:

1) Change the RTC Counter clock source away from XT1CLK normally

2) Reconfigure the XIN pin as a GPIO output, then toggle the GPIO twice with at least 2 rising or falling edges.

At this point the RTC Counter will be able to resume operation.

**USCI42**
***eUSCI Module***
**Category**

Functional

**Function**

UART asserts UCTXCPITIFG after each byte in multi-byte transmission

**Description**

UCTXCPTIFG flag is triggered at the last stop bit of every UART byte transmission, independently of an empty buffer, when transmitting multiple byte sequences via UART. The erroneous UART behavior occurs with and without DMA transfer.

**Workaround**

None.

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>USCI47</b>      | <b>eUSCI Module</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Category</b>    | Functional                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Function</b>    | eUSCI SPI slave with clock phase UCCKPH = 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>The eUSCI SPI operates incorrectly under the following conditions:</p> <ol style="list-style-type: none"> <li>1. The eUSCI_A or eUSCI_B module is configured as a SPI slave with clock phase mode UCCKPH = 1</li> </ol> <p>AND</p> <ol style="list-style-type: none"> <li>2. The SPI clock pin is not at the appropriate idle level (low for UCCKPL = 0, high for UCCKPL = 1) when the UCSWRST bit in the UCxxCTLW0 register is cleared.</li> </ol> <p>If both of the above conditions are satisfied, then the following will occur:</p> <p>eUSCI_A: the SPI will not be able to receive a byte (UCAxRXBUF will not be filled and UCRXIFG will not be set) and SPI slave output data will be wrong (first bit will be missed and data will be shifted).</p> <p>eUSCI_B: the SPI receives data correctly but the SPI slave output data will be wrong (first byte will be duplicated or replaced by second byte).</p> |
| <b>Workaround</b>  | <p>Use clock phase mode UCCKPH = 0 for MSP SPI slave if allowed by the application.</p> <p>OR</p> <p>The SPI master must set the clock pin at the appropriate idle level (low for UCCKPL = 0, high for UCCKPL = 1) before SPI slave is reset (UCSWRST bit is cleared).</p> <p>OR</p> <p>For eUSCI_A: to detect communication failure condition where UCRXIFG is not set, check both UCRXIFG and UCTXIFG. If UCTXIFG is set twice but UCRXIFG is not set, reset the MSP SPI slave by setting and then clearing the UCSWRST bit, and inform the SPI master to resend the data.</p>                                                                                                                                                                                                                                                                                                                                       |
| <b>USCI50</b>      | <b>eUSCI Module</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Category</b>    | Functional                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Function</b>    | Data may not be transmitted correctly from the eUSCI when operating in SPI 4-pin master mode with UCSTEM = 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>When the eUSCI is used in SPI 4-pin master mode with UCSTEM = 0 (STE pin used as an input to prevent conflicts with other SPI masters), data that is moved into UCxTXBUF while the UCxSTE input is in the inactive state may not be transmitted correctly. If the eUSCI is used with UCSTEM = 1 (STE pin used to output an enable signal), data is transmitted correctly.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Workaround</b>  | <p>When using the STE pin in conflict prevention mode (UCSTEM = 0), only move data into UCxTXBUF when UCxSTE is in the active state. If an active transfer is aborted by UCxSTE transitioning to the master-inactive state, the data must be rewritten into UCxTXBUF to be transferred when UCxSTE transitions back to the master-active state.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## 8 Document Revision History

Changes from device specific erratasheet to document Revision A.

1. CPU21 was added to the errata documentation.
2. USCI45 was added to the errata documentation.
3. CPU22 was added to the errata documentation.
4. Workaround for CPU40 was updated.
5. Workaround for CPU46 was updated.

Changes from document Revision A to Revision B.

1. TLV Hardware Revision section was added to the documentation.
2. Workaround for CPU46 was updated.

Changes from document Revision B to Revision C.

1. USCI45 was removed from the errata documentation.
2. USCI47 was added to the errata documentation.

Changes from document Revision C to Revision D.

1. Function for USCI47 was updated.
2. Description for USCI47 was updated.
3. Workaround for USCI47 was updated.

Changes from document Revision D to Revision E.

1. Workaround for USCI47 was updated.

Changes from document Revision E to Revision F.

1. RTC15 was added to the errata documentation.

Changes from document Revision F to Revision G.

1. USCI50 was added to the errata documentation.

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. Workaround for CPU40 was updated.

Changes from document Revision I to Revision J.

1. CS13 was added to the errata documentation.

Changes from document Revision J to Revision K.

1. PMM32 was added to the errata documentation.

Changes from document Revision K to Revision L.

1. CPU47 was added to the errata documentation.

Changes from document Revision L to Revision M.

1. CPU47 was removed from the errata documentation.

Changes from document Revision M to Revision N.

1. CS14 was added to the errata documentation.

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to TI's Terms of Sale ([www.ti.com/legal/termsofsale.html](http://www.ti.com/legal/termsofsale.html)) or other applicable terms available either on [ti.com](http://ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2020, Texas Instruments Incorporated