

Errata
MSP430FR2100 Microcontroller



ABSTRACT

This document describes the known exceptions to the functional specifications (advisories).

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1 Functional Advisories

Advisories that affect the device's operation, function, or parametrics.

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

Errata Number	Rev B
ADC50	✓
ADC63	✓
CPU46	✓
CS13	✓
CS14	✓
PMM32	✓
RTC15	✓
TB25	✓
USCI42	✓
USCI47	✓
USCI50	✓

2 Preprogrammed Software Advisories

Advisories that affect factory-programmed software.

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

The device does not have any errata for this category.

3 Debug Only Advisories

Advisories that affect only debug operation.

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

Errata Number	Rev B
EEM23	✓

4 Fixed by Compiler Advisories

Advisories that are resolved by compiler workaround. Refer to each advisory for the IDE and compiler versions with a workaround.

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

Errata Number	Rev B
CPU21	✓
CPU22	✓
CPU40	✓

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 Nomenclature, Package Symbolization, and Revision Identification

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.

5.1 Device Nomenclature

To designate the stages in the product development cycle, TI assigns prefixes to the part numbers of all MSP MCU devices. Each MSP MCU commercial family member has one of two prefixes: MSP or XMS. These prefixes represent evolutionary stages of product development from engineering prototypes (XMS) through fully qualified production devices (MSP).

XMS – Experimental device that is not necessarily representative of the final device's electrical specifications

MSP – Fully qualified production device

Support tool naming prefixes:

X: Development-support product that has not yet completed Texas Instruments internal qualification testing.

null: Fully-qualified development-support product.

XMS devices and X development-support tools are shipped against the following disclaimer:

"Developmental product is intended for internal evaluation purposes."

MSP devices 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 (XMS) have a greater failure rate than the standard production devices. TI 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.

TI device nomenclature also includes a suffix with the device family name. This suffix indicates the temperature range, package type, and distribution format.

5.2 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

5.3 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.

6 Advisory Descriptions

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.

OR

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

CPU 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.

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. --silicon_errata=CPU21
MSP430 GNU Compiler (MSP430-GCC)	MSP430-GCC 4.9 build 167 or later	

CPU22

CPU Module

Category

Compiler-Fixed

CPU22

CPU Module

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. --silicon_errata=CPU22
MSP430 GNU Compiler (MSP430-GCC)	MSP430-GCC 4.9 build 167 or later	

CPU40

CPU 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.

CPU40 (continued) **CPU Module**

IDE/Compiler	Version Number	Notes
IAR Embedded Workbench	IAR EW430 v5.51 or later	For the command line version add the following information Compiler: --hw_workaround=CPU40 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. --silicon_errata=CPU40
MSP430 GNU Compiler (MSP430-GCC)	Not affected	

CPU46**CPU 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 (SFRIE1.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.

CPU46 (continued) **CPU Module**

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

CS14 (continued)	CS Module
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	<ol style="list-style-type: none"> 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: <ul style="list-style-type: none"> - 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	<p>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:</p> <p>Condition1:</p> <p>The following three events happen at the same time:</p> <ol style="list-style-type: none"> 1) The device transitions from AM to LPM3/4 (e.g. during ISR exits or Status Register modifications), <p>AND</p> <ol style="list-style-type: none"> 2) An interrupt is requested (e.g. GPIO interrupt),

PMM32 (continued) *PMM Module*

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 CapTlvate (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
}
```

PMM32 (continued) *PMM Module*

```
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.

TB25 *TB Module*

Category

Functional

Function

In up mode, TBxCCRn value is immediately transferred to TBxCLn when TBxCCTLn.CLLD bits are set or 0x01 or 0x10

Description

IF Timer B is configured for Up mode,
AND
the compare latch load event (TBxCCTLn.CLLD bits) setting is configured to update TBxCCRn when TBxR reaches 0,
THEN
TBxCCRn will update immediately instead of the described condition.

This is contrary to the user guide description of TBxCCTLn.CLLD = 0x01 or 0x10 modes.

Workaround

If user needs to update TBxCCRn value when TBxR counts to 0 in Timer B up mode:

1. Set TBxCCTLn.CLLD = 0x00
2. Enable the Timer B interrupt (TBIE) in TBxCTL
3. Update TBxCCRn value within interrupt routine.

Timer B Interrupt would need to be serviced in a timely manner to mitigate disruption or unintended timer output if an output mode is used.

USCI42 *USCI Module*

Category

Functional

USCI42 (continued) ***USCI Module***

Function UART asserts UCTXCPITIFG after each byte in multi-byte transmission

Description UCTXCPITIFG 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.

USCI47 ***USCI Module***

Category Functional

Function eUSCI SPI slave with clock phase UCCKPH = 1

Description The eUSCI SPI operates incorrectly under the following conditions:

1. The eUSCI_A or eUSCI_B module is configured as a SPI slave with clock phase mode UCCKPH = 1

AND

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.

If both of the above conditions are satisfied, then the following will occur:
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).
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).

Workaround Use clock phase mode UCCKPH = 0 for MSP SPI slave if allowed by the application.

OR

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).

OR

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.

USCI50 ***USCI Module***

Category Functional

Function Data may not be transmitted correctly from the eUSCI when operating in SPI 4-pin master mode with UCSTEM = 0

Description 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

USCI50 (continued) *USCI Module*

eUSCI is used with UCSTEM = 1 (STE pin used to output an enable signal), data is transmitted correctly.

Workaround

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.

7 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from July 14, 2021 to August 27, 2021

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• TB25 was added to the errata documentation.....	6
• TB25 Description was updated.....	12
• TB25 Workaround was updated.....	12

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