

PIC16(L)F1847 Family Silicon Errata and Data Sheet Clarification

The PIC16(L)F1847 family devices that you have received conform functionally to the current Device Data Sheet (DS41453B), except for the anomalies described in this document.

The silicon issues discussed in the following pages are for silicon revisions with the Device and Revision IDs listed in [Table 1](#). The silicon issues are summarized in [Table 2](#).

The errata described in this document will be addressed in future revisions of the PIC16(L)F1847 silicon.

Note: This document summarizes all silicon errata issues from all revisions of silicon, previous as well as current. Only the issues indicated in the last column of [Table 2](#) apply to the current silicon revision (A2).

Data Sheet clarifications and corrections start on [page 6](#), following the discussion of silicon issues.

The silicon revision level can be identified using the current version of MPLAB® IDE and Microchip's programmers, debuggers, and emulation tools, which are available at the Microchip corporate web site (www.microchip.com).

For example, to identify the silicon revision level using MPLAB IDE in conjunction with MPLAB ICD 3 or PICKit™ 3:

1. Using the appropriate interface, connect the device to the MPLAB ICD 3 programmer/debugger or PICKit™ 3.
2. From the main menu in MPLAB IDE, select *Configure>Select Device*, and then select the target part number in the dialog box.
3. Select the MPLAB hardware tool (*Debugger>Select Tool*).
4. Perform a "Connect" operation to the device (*Debugger>Connect*). Depending on the development tool used, the part number and Device Revision ID value appear in the **Output** window.

Note: If you are unable to extract the silicon revision level, please contact your local Microchip sales office for assistance.

The DEVREV values for the various PIC16(L)F1847 silicon revisions are shown in [Table 1](#).

TABLE 1: SILICON DEVREV VALUES

| Part Number | DEVICE ID<13:0> ^{(1),(2)} | |
|-------------|------------------------------------|----------------------------------|
| | DEV<8:0> | Revision ID for Silicon Revision |
| | | A2 |
| PIC16F1847 | 01 0100 100 | 0 0010 |
| PIC16LF1847 | 01 0100 101 | 0 0010 |

- Note 1:** The Device ID is located in the configuration memory at address 8006h.
- Note 2:** Refer to the "PIC16(L)F1847/PIC12(L)F1840 Memory Programming Specification" (DS41439) for detailed information on Device and Revision IDs for your specific device.

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TABLE 2: SILICON ISSUE SUMMARY

| Module | Feature | Item Number | Issue Summary | Affected Revisions ⁽¹⁾ |
|---|-------------------------------------|-------------|--|-----------------------------------|
| | | | | A2 |
| Timer1 | Timer0 Gate Source | 1.1 | Toggle mode works improperly. | X |
| Timer1 | T1 Gate Toggle mode | 2.1 | T1 gate flip-flop does not clear. | X |
| Oscillator | HFINTOSC Ready/Stable bit | 3.1 | Bits remained set to '1' after initial trigger. | X |
| Oscillator | Clock Switching | 3.2 | Clock switching can cause a single corrupted instruction. | X |
| Oscillator | Oscillator Start-up Timer (OST) bit | 3.3 | OST bit remains set. | X |
| Enhanced Universal Synchronous Asynchronous Receiver (EUSART) | Auto-Baud Detect | 4.1 | Auto-Baud Detect may store incorrect count value in the SPBRG registers. | X |

Note 1: Only those issues indicated in the last column apply to the current silicon revision.

Silicon Errata Issues

Note: This document summarizes all silicon errata issues from all revisions of silicon, previous as well as current. Only the issues indicated by the shaded column in the following tables apply to the current silicon revision (**A2**).

1. Module: Timer1

1.1 Timer1 Gate Toggle Mode with Timer0 as Gate Source

Timer1 Gate Toggle mode provides unexpected results when Timer0 overflow is selected as the Timer1 gate source. We do not recommend using Timer0 overflow as the Timer1 gate source while in Timer1 Gate Toggle mode or when Toggle mode is used in conjunction with Timer1 Gate Single-Pulse mode.

Work around

None.

Affected Silicon Revisions

| | | | | | | | |
|-----------|--|--|--|--|--|--|--|
| A2 | | | | | | | |
| X | | | | | | | |

2. Module: Timer1

2.1 Timer1 Gate Toggle mode

When Timer1 Gate Toggle mode is enabled, it is possible to measure the full-cycle length of a Timer1 gate signal. To perform this function, the Timer1 gate source is routed through a flip-flop that changes state on every incrementing edge of the gate signal. Timer1 Gate Toggle mode is enabled by setting the T1GTM bit of the T1GCON register. When working properly, clearing either the T1GTM bit or the TMR1ON bit would also clear the output value of this flip-flop, and hold it clear. This is done in order to control which edge is being measured. The issue that exists is that clearing the TMR1ON bit does not clear the output value of the flip-flop and hold it clear.

Work around

Clear the T1GTM bit in the T1GCON register to clear and hold clear the output value of the flip-flop.

Affected Silicon Revisions

| | | | | | | | |
|-----------|--|--|--|--|--|--|--|
| A2 | | | | | | | |
| X | | | | | | | |

3. Module: Oscillator

3.1 OSCSTAT bits: HFIOFR and HFIOFS

When HFINTOSC is selected, the HFIOFR and HFIOFS bits will become set when the oscillator becomes ready and stable. Once these bits are set, they become “stuck”, indicating that HFINTOSC is always ready and stable. If the HFINTOSC is disabled, the bits fail to be cleared.

Work around

None.

Affected Silicon Revisions

| | | | | | | | |
|-----------|--|--|--|--|--|--|--|
| A2 | | | | | | | |
| X | | | | | | | |

3.2 Clock Switching

When switching clock sources between INTOSC clock source and an external clock source, one corrupted instruction may be executed after the switch occurs.

This issue does not affect Two-Speed Start-up or the Fail-Safe Clock Monitor operation.

Work around

When switching from an external oscillator clock source, first switch to 16 MHz HFINTOSC. Once running at 16 MHz HFINTOSC, configure IRCF to run at desired internal oscillator frequency.

When switching from an internal oscillator (INTOSC) to an external oscillator clock source, first switch to HFINTOSC High-Power mode (8 MHz or 16 MHz). Once running from HFINTOSC, switch to the external oscillator clock source.

Affected Silicon Revisions

| | | | | | | | |
|-----------|--|--|--|--|--|--|--|
| A2 | | | | | | | |
| X | | | | | | | |

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3.3 Oscillator Start-up Timer (OST) bit

During the Two-Speed Start-up sequence, the OST is enabled to count 1024 clock cycles. After the count is reached, the OSTS bit is set, the system clock is held low until the next falling edge of the external crystal (LP, XT or HS mode), before switching to the external clock source.

When an external oscillator is configured as the primary clock and Fail-Safe Clock mode is enabled (FCMEN = 1), any of the following conditions will result in the Oscillator Start-up Timer (OST) failing to restart:

- MCLR Reset
- Wake from Sleep
- Clock change from INTOSC to Primary Clock

This anomaly will manifest itself as a clock failure condition for external oscillators which take longer than the clock failure time-out period to start.

Work around

None.

Affected Silicon Revisions

| | | | | | | | | |
|----|--|--|--|--|--|--|--|--|
| A2 | | | | | | | | |
| X | | | | | | | | |

4. Module: Enhanced Universal Synchronous Asynchronous Receiver (EUSART)

4.1 Auto-Baud Detect

When using automatic baud detection (ABDEN), on occasion, an incorrect count value can be stored at the end of auto-baud detection in the SPBRGH:SPBRGL (SPBRG) registers. The SPBRG value may be off by several counts. This condition happens sporadically when the device clock frequency drifts to a frequency where the SPBRG value oscillates between two different values. The issue is present regardless of the baud rate Configuration bit settings.

Work around

When using auto-baud, it is a good practice to always verify the obtained value of SPBRG, to ensure it remains within the application specifications. Two recommended methods are shown below.

For additional auto-baud information, see Technical Brief TB3069, "Use of Auto-Baud for Reception of LIN Serial Communications Devices: Mid-Range and Enhanced Mid-Range".

EXAMPLE 1: METHOD 1 – EUSART AUTO-BAUD DETECT WORK AROUND

In firmware, define default, minimum and maximum auto-baud (SPBRG) values according to the application requirements.

For example, if the application runs at 9600 baud at 16 MHz then, the default SPBRG value would be (assuming 16-bit/Asynchronous mode) 0x67. The minimum and maximum allowed values can be calculated based on the application. In this example, a +/-5% tolerance is required, so tolerance is $0x67 * 5\% = 0x05$.

```
#define SPBRG_16BIT    *((*int)&SPBRG;           // define location for 16-bit SPBRG value

const int DEFAULT_BAUD = 0x0067;              // Default Auto-Baud value
const int TOL = 0x05;                          // Baud Rate % tolerance
const int MIN_BAUD = DEFAULT_BAUD - TOL;       // Minimum Auto-Baud Limit
const int MAX_BAUD = DEFAULT_BAUD + TOL;       // Maximum Auto-Baud Limit
.
.
.
ABDEN = 1;                                       // Start Auto-Baud
while (ABDEN);                                  // Wait until Auto-Baud completes

if((SPBRG_16BIT > MAX_BAUD) || (SPBRG_16BIT < MIN_BAUD))
{
    SPBRG_16BIT = DEFAULT_BAUD;                // Compare if value is within limits
                                                // if out of spec, use DEFAULT_BAUD
}
.
.
.
// if in spec, continue using the
// Auto-Baud value in SPBRG
```

EXAMPLE 2: METHOD 2 – EUSART AUTO-BAUD DETECT WORK AROUND

Similar to Method 1, define default, minimum and maximum auto-baud (SPBRG) values. In firmware, compute a running average of SPBRG. If the new SPBRG value falls outside the minimum or maximum limits, then use the current running average value (Average_Baud), otherwise use the auto-baud SPBRG value and calculate a new running average.

For example, if the application runs at 9600 baud at 16 MHz then, the default SPBRG value would be (assuming 16-bit/ Asynchronous mode) 0x67. The minimum and maximum allowed values can be calculated based on the application. In this example, a +/-5% tolerance is required, so tolerance is $0x67 * 5\% = 0x05$.

```
#define SPBRG_16BIT    *((*int)&SPBRG;                // define location for 16-bit SPBRG value

const int DEFAULT_BAUD = 0x0067;                    // Default Auto-Baud value
const int TOL = 0x05;                               // Baud Rate % tolerance
const int MIN_BAUD = DEFAULT_BAUD - TOL;           // Minimum Auto-Baud Limit
const int MAX_BAUD = DEFAULT_BAUD + TOL;           // Maximum Auto-Baud Limit

int Average_Baud;                                    // Define Average_Baud variable
int Integrator;                                     // Define Integrator variable
.
.
.
Average_Baud = DEFAULT_BAUD;                        // Set initial average Baud rate
Integrator = DEFAULT_BAUD*15;                       // The running 16 count average
.
.
.
ABDEN = 1;                                          // Start Auto-Baud
while (ABDEN);                                     // Wait until Auto-Baud completes

Integrator+ = SPBRG_16BIT;
Average_Baud = Integrator/16;
if((SPBRG_16BIT > MAX_BAUD)|| (SPBRG_16BIT < MIN_BAUD))
{
    SPBRG_16BIT = Average_Baud;                    // Check if value is within limits
                                                    // If out of spec, use previous average
}
else
{
    Integrator+ = SPBRG_16BIT;                      // If in spec, calculate the running
                                                    // average but continue using the
                                                    // Auto-Baud value in SPBRG
    Average_Baud = Integrator/16;
    Integrator- = Average_Baud;
}
.
.
.
```

Affected Silicon Revisions

| | | | | | | | | |
|----|--|--|--|--|--|--|--|--|
| A2 | | | | | | | | |
| X | | | | | | | | |

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Data Sheet Clarifications

The following typographic corrections and clarifications are to be noted for the latest version of the device data sheet (DS41453B):

| |
|---|
| Note: Corrections are shown in bold . Where possible, the original bold text formatting has been removed for clarity. |
|---|

1. Module: Oscillator

5.5 Fail-Safe Clock Monitor

5.5.3 FAIL-SAFE CONDITION CLEARING

The Fail-Safe condition is cleared after a Reset, executing a `SLEEP` instruction or changing the SCS bits of the OSCCON register. When the SCS bits are changed, the OST is restarted. While the OST is running, the device continues to operate from the INTOSC selected in OSCCON. When the OST times out, the Fail-Safe condition is cleared **after successfully switching to the external clock source. The OSFIF bit should be cleared prior to switching to the external clock source. If the Fail-Safe condition still exists, the OSFIF flag will again become set by hardware.**

APPENDIX A: DOCUMENT REVISION HISTORY

Rev A Document (05/2011)

Initial release of this document.

Rev B Document (02/2012)

Updated Table 1; Added Modules 3 and 4; Other minor corrections.

Data Sheet Clarifications: Added Module 1, Oscillator.

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NOTES:

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
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 Printed on recycled paper.

ISBN: 9781620760574

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