PIC16(L)F19155/56/75/76/85/86 Family Silicon Errata and Data Sheet Clarification

The PIC16(L)F19155/56/75/76/85/86 family devices that you have received conform functionally to the current Device Data Sheet (DS40001923**A**), 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)F19155/56/75/76/85/86 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 (**A1**).

Data Sheet clarifications and corrections start on page 5, 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 website (www.microchip.com).

For example, to identify the silicon revision level using MPLAB IDE in conjunction with a hardware debugger:

1. Using the appropriate interface, connect the device to the hardware debugger.
2. Open an MPLAB IDE project.
3. Configure the MPLAB IDE project for the appropriate device and hardware debugger.
4. Based on the version of MPLAB IDE you are using, do one of the following:
   a) For MPLAB IDE 8, select *Programmer > Reconnect*.
   b) For MPLAB X IDE, select *Window > Dashboard* and click the **Refresh Debug Tool Status** icon ( ).
5. 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)F19155/56/75/76/85/86 silicon revisions are shown in Table 1.

TABLE 1: SILICON DEVREV VALUES

Part Number	Device ID(1)	Revision ID for Silicon Revision(2)
		A1
PIC16F19155	3096h	2001h
PIC16LF19155	3097h	2001h
PIC16F19156	3098h	2001h
PIC16LF19156	3099h	2001h
PIC16F19175	309Ah	2001h
PIC16LF19175	309Bh	2001h
PIC16F19176	309Ch	2001h
PIC16LF19176	309Dh	2001h
PIC16F19185	30BAh	2001h
PIC16LF19185	30BBh	2001h
PIC16F19186	30BCh	2001h
PIC16LF19186	30BDh	2001h

Note 1: The Device and Revision IDs is located at the respective addresses 8006h and 8005h of configuration memory space.

2: Refer to the *"PIC16(L)F191XX Memory Programming Specification"* (DS40001880) for detailed information on Device and Revision IDs for your specific device.

TABLE 2: SILICON ISSUE SUMMARY

Module	Feature	Item Number	Summary	Affected Revisions
				A1
Analog-to-Digital Converter with Computation (ADC^2)	ADC^2 with Fixed Voltage Reference (FVR)	1.1	Using the FVR as the ADC positive voltage reference can cause missing codes.	X
	ADC^2 with Guard Ring Outputs	1.2	The Guard Ring Output feature is not implemented.	X
Reset and V_{BAT}	V_{BAT} with ULPBOR	2.1	Higher current with ULPBOR active.	X
Liquid Crystal Display (LCD) Controller	Internal VLCD3 Measurement	3.1	Non stable readings.	X
Comparator (CMP)	C2 Low-Power Clocked Comparator	4.1	Unstable output.	X
Electrical Specifications	SMBus V_{IL} Level	5.1	The maximum V_{IL} level changes when V_{DD} is below 4.0V.	X
	Program Flash Memory (PFM) Endurance	5.2	The PFM endurance is lower than specified.	X
	Fixed Voltage Reference (FVR) Accuracy	5.3	Fixed Voltage Reference (FVR) output tolerance may be higher than specified at temperatures below -20°C.	X

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 (**A1**).

1. Module: Analog-to-Digital Converter with Computation (ADC^2)

1.1 ADC^2 with Fixed Voltage Reference (FVR)

Using the FVR as the positive voltage reference (V_{REF}+) for the ADC, can cause an increase in missing codes.

Work around

Method 1: Increase the bit conversion time, known as TAD, to 8 µs or higher.

Method 2: Use V_{DD} as the positive voltage reference to the ADC.

Affected Silicon Revisions

A1							
X							

1.2 ADC^2 with Guard Ring Outputs

The two guard ring drive outputs ADGRDA and ADGRDB are not implemented on these devices.

Work around

None.

Affected Silicon Revisions

A1							
X							

2. Module: Reset and V_{BAT}

2.1 V_{BAT} with ULPBOR

In order to avoid high I_{BAT} currents of 10 µA or greater, when utilizing V_{BAT} to provide battery back-up the ULPBOR should not be activated. When the part is used in this fashion, V_{DD} should also be either off (0 volts) or >1.5V.

Work around

Do not use V_{BAT} along with ULPBOR.

Affected Silicon Revisions

A1							
X							

3. Module: Liquid Crystal Display (LCD) Controller

3.1 Internal VLCD3 Measurement

The ¼ scale tap point provided on the LP Resistor Ladder for use together with the ADC does not provide stable readings to support monitoring of the LCD pump output level.

Work around

Measure the VLCD3 via an external ADC.

Affected Silicon Revisions

A1							
X							

4. Module: Comparator (CMP)

4.1 C2 Low-Power Clocked Comparator

The output of the Low-Power Clocked Comparator (CMP2) is unstable and is not recommended for use.

Work around

None.

Affected Silicon Revisions

A1							
X							

5. Module: Electrical Specifications

5.1 SMBus VIL Level

When the VDD voltage level supplied to the device is 4.0V and above, the maximum SMBus voltage level for the VIL parameter is 0.8V. When VDD drops below 4.0V, the maximum SMBus voltage level for VIL drops to 0.7V.

Work around

None.

Affected Silicon Revisions

A1							
X							

5.2 Program Flash Memory Endurance

The minimum value for the Program Flash Memory (PFM) endurance specification, called out as parameter number MEM30 in the data sheet, is 1K cycles.

Work around

None.

Affected Silicon Revisions

A1							
X							

5.3 Fixed Voltage Reference (FVR) Accuracy

At temperatures below -20°C, the output voltage for the FVR may be greater than the levels specified in the data sheet. This will apply to all three gain amplifier settings (1X, 2X, 4X). The affected parameter numbers found in the data sheet are: FVR01 (1X gain setting), FVR02 (2X gain setting), and FVR03 (4X gain setting).

Work around

At temperatures above -20°C, the stated tolerances in the data sheet remain in effect. Operate the FVR only at temperatures above -20°C.

Affected Silicon Revisions

A1							
X							

Data Sheet Clarifications

The following typographic corrections and clarifications are to be noted for the latest version of the device data sheet (DS40001923**A**):

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

None.

APPENDIX A: DOCUMENT REVISION HISTORY

Rev A Document (06/2017)

Initial release of this document; issued for revision A1. Includes silicon issues 1.1 (ADC^2), 2.1 (V_{BAT}), 3.1 (LCD), 4.1 (CMP), Electrical Specifications: 5.1 SMBus, 5.2 Program Flash Memory, and 5.3 FVR.

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.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
═ ISO/TS 16949 ═

Trademarks

ISBN: 978-1-5224-1849-8

Worldwide Sales and Service

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
http://www.microchip.com/support
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Austin, TX
Tel: 512-257-3370

Boston
Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Novi, MI
Tel: 248-848-4000

Houston, TX
Tel: 281-894-5983

Indianapolis
Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453
Tel: 317-536-2380

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608
Tel: 951-273-7800

Raleigh, NC
Tel: 919-844-7510

New York, NY
Tel: 631-435-6000

San Jose, CA
Tel: 408-735-9110
Tel: 408-436-4270

Canada - Toronto
Tel: 905-695-1980
Fax: 905-695-2078

ASIA/PACIFIC

Asia Pacific Office
Suites 3707-14, 37th Floor
Tower 6, The Gateway
Harbour City, Kowloon

Hong Kong
Tel: 852-2943-5100
Fax: 852-2401-3431

Australia - Sydney
Tel: 61-2-9868-6733
Fax: 61-2-9868-6755

China - Beijing
Tel: 86-10-8569-7000
Fax: 86-10-8528-2104

China - Chengdu
Tel: 86-28-8665-5511
Fax: 86-28-8665-7889

China - Chongqing
Tel: 86-23-8980-9588
Fax: 86-23-8980-9500

China - Dongguan
Tel: 86-769-8702-9880

China - Guangzhou
Tel: 86-20-8755-8029

China - Hangzhou
Tel: 86-571-8792-8115
Fax: 86-571-8792-8116

China - Hong Kong SAR
Tel: 852-2943-5100
Fax: 852-2401-3431

China - Nanjing
Tel: 86-25-8473-2460
Fax: 86-25-8473-2470

China - Qingdao
Tel: 86-532-8502-7355
Fax: 86-532-8502-7205

China - Shanghai
Tel: 86-21-3326-8000
Fax: 86-21-3326-8021

China - Shenyang
Tel: 86-24-2334-2829
Fax: 86-24-2334-2393

China - Shenzhen
Tel: 86-755-8864-2200
Fax: 86-755-8203-1760

China - Wuhan
Tel: 86-27-5980-5300
Fax: 86-27-5980-5118

China - Xian
Tel: 86-29-8833-7252
Fax: 86-29-8833-7256

ASIA/PACIFIC

China - Xiamen
Tel: 86-592-2388138
Fax: 86-592-2388130

China - Zhuhai
Tel: 86-756-3210040
Fax: 86-756-3210049

India - Bangalore
Tel: 91-80-3090-4444
Fax: 91-80-3090-4123

India - New Delhi
Tel: 91-11-4160-8631
Fax: 91-11-4160-8632

India - Pune
Tel: 91-20-3019-1500

Japan - Osaka
Tel: 81-6-6152-7160
Fax: 81-6-6152-9310

Japan - Tokyo
Tel: 81-3-6880- 3770
Fax: 81-3-6880-3771

Korea - Daegu
Tel: 82-53-744-4301
Fax: 82-53-744-4302

Korea - Seoul
Tel: 82-2-554-7200
Fax: 82-2-558-5932 or
82-2-558-5934

Malaysia - Kuala Lumpur
Tel: 60-3-6201-9857
Fax: 60-3-6201-9859

Malaysia - Penang
Tel: 60-4-227-8870
Fax: 60-4-227-4068

Philippines - Manila
Tel: 63-2-634-9065
Fax: 63-2-634-9069

Singapore
Tel: 65-6334-8870
Fax: 65-6334-8850

Taiwan - Hsin Chu
Tel: 886-3-5778-366
Fax: 886-3-5770-955

Taiwan - Kaohsiung
Tel: 886-7-213-7830

Taiwan - Taipei
Tel: 886-2-2508-8600
Fax: 886-2-2508-0102

Thailand - Bangkok
Tel: 66-2-694-1351
Fax: 66-2-694-1350

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4450-2828
Fax: 45-4485-2829

Finland - Espoo
Tel: 358-9-4520-820

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

France - Saint Cloud
Tel: 33-1-30-60-70-00

Germany - Garching
Tel: 49-8931-9700

Germany - Haan
Tel: 49-2129-3766400

Germany - Heilbronn
Tel: 49-7131-67-3636

Germany - Karlsruhe
Tel: 49-721-625370

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Germany - Rosenheim
Tel: 49-8031-354-560

Israel - Ra'anana
Tel: 972-9-744-7705

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Italy - Padova
Tel: 39-049-7625286

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Norway - Trondheim
Tel: 47-7289-7561

Poland - Warsaw
Tel: 48-22-3325737

Romania - Bucharest
Tel: 40-21-407-87-50

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

Sweden - Gothenberg
Tel: 46-31-704-60-40

Sweden - Stockholm
Tel: 46-8-5090-4654

UK - Wokingham
Tel: 44-118-921-5800
Fax: 44-118-921-5820