Product Change Notification / SYST-09NPOV152

## Date:

11-Feb-2021

## Product Category:

8-bit Microcontrollers

## PCN Type:

Document Change

## Notification Subject:

ERRATA - PIC16(L)F18856/18876 Family Silicon Errata and Data Sheet Clarification

## Affected CPNs:

SYST-09NPOV152_Affected_CPN_02112021.pdf
SYST-09NPOV152_Affected_CPN_02112021.csv

## Notification Text:

SYST-09NPOV152

Microchip has released a new Product Documents for the PIC16(L)F18856/18876 Family Silicon Errata and Data Sheet Clarification of devices. If you are using one of these devices please read the document located at PIC16(L)F18856/ 18876 Family Silicon Errata and Data Sheet Clarification.

**Notification Status:** Final

**Description of Change:** 1) Added Module 1.3 (ADC Offset Error).

**Impacts to Data Sheet:** None

**Reason for Change:** To Improve Productivity

**Change Implementation Status:** Complete

**Date Document Changes Effective:** 11 Feb 2021

**NOTE:** Please be advised that this is a change to the document only the product has not been changed.

**Markings to Distinguish Revised from Unrevised Devices:** N/A

## Attachments:

PIC16(L)F18856/ 18876 Family Silicon Errata and Data Sheet Clarification

Please contact your local Microchip sales office with questions or concerns regarding this notification.

**Terms and Conditions:**

If you wish to receive Microchip PCNs via email please register for our PCN email service at our PCN home page select register then fill in the required fields. You will find instructions about registering for Microchips PCN email service in the PCN FAQ section.

If you wish to change your PCN profile, including opt out, please go to the PCN home page select login and sign into your myMicrochip account. Select a profile option from the left navigation bar and make the applicable selections.

Affected Catalog Part Numbers (CPN)

PIC16F18856-E/ML
PIC16F18856-E/MLVAO
PIC16F18856-E/MV
PIC16F18856-E/SO
PIC16F18856-E/SP
PIC16F18856-E/SS
PIC16F18856-E/STX
PIC16F18856-E/STXVAO
PIC16F18856-I/ML
PIC16F18856-I/MLVAO
PIC16F18856-I/MV
PIC16F18856-I/SO
PIC16F18856-I/SP
PIC16F18856-I/SS
PIC16F18856-I/SSVAO
PIC16F18856-I/STX
PIC16F18856T-E/MLVAO
PIC16F18856T-E/MV
PIC16F18856T-E/SS
PIC16F18856T-E/SS021
PIC16F18856T-E/SSV03
PIC16F18856T-E/SSVAO
PIC16F18856T-E/STXVAO
PIC16F18856T-I/ML
PIC16F18856T-I/MLC01
PIC16F18856T-I/MLVAO
PIC16F18856T-I/MV
PIC16F18856T-I/SO
PIC16F18856T-I/SS
PIC16F18856T-I/SSV01
PIC16F18856T-I/SSVAO
PIC16F18856T-I/STX
PIC16F18856T-I/STXJUUL
PIC16F18876-E/ML
PIC16F18876-E/MV
PIC16F18876-E/P
PIC16F18876-E/PT
PIC16F18876-I/ML
PIC16F18876-I/MV
PIC16F18876-I/P
PIC16F18876-I/PT
PIC16F18876T-E/PT
PIC16F18876T-E/PTVAO
PIC16F18876T-I/ML
PIC16F18876T-I/MV
PIC16F18876T-I/MVC02

PIC16F18876T-I/MVV02
PIC16F18876T-I/MVVAO
PIC16F18876T-I/PT
PIC16F18876T-I/PTV04
PIC16LF18856-E/ML
PIC16LF18856-E/MV
PIC16LF18856-E/SO
PIC16LF18856-E/SP
PIC16LF18856-E/SS
PIC16LF18856-E/STX
PIC16LF18856-I/ML
PIC16LF18856-I/MLVAO
PIC16LF18856-I/MV
PIC16LF18856-I/SO
PIC16LF18856-I/SP
PIC16LF18856-I/SS
PIC16LF18856-I/STX
PIC16LF18856T-E/MV
PIC16LF18856T-I/ML
PIC16LF18856T-I/MLV05
PIC16LF18856T-I/MLVAO
PIC16LF18856T-I/MV
PIC16LF18856T-I/SO
PIC16LF18856T-I/SS
PIC16LF18856T-I/STX
PIC16LF18876-E/ML
PIC16LF18876-E/MV
PIC16LF18876-E/P
PIC16LF18876-E/PT
PIC16LF18876-I/ML
PIC16LF18876-I/MV
PIC16LF18876-I/P
PIC16LF18876-I/PT
PIC16LF18876T-I/ML
PIC16LF18876T-I/MV
PIC16LF18876T-I/PT

# PIC16(L)F18856/18876 Family Silicon Errata and Data Sheet Clarification

The PIC16(L)F18856/18876 family devices that you have received conform functionally to the current Device Data Sheet (DS40001824**E**), 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)F18856/18876 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 **(A5)**.

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. 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)F18856/18876 silicon revisions are shown in Table 1.

**TABLE 1: SILICON DEVREV VALUES**

| Part Number | Device ID(1) | Revision ID (Silicon Revision)(2) | | |
|---|---|---|---|---|
| | | A2 | A3 | A5 |
| PIC16F18856 | 3070h | 2002h | 2003h | 2005h |
| PIC16LF18856 | 3072h | 2002h | 2003h | 2005h |
| PIC16F18876 | 3071h | 2002h | 2003h | 2005h |
| PIC16LF18876 | 3073h | 2002h | 2003h | 2005h |

**Note 1:** The Revision ID and Device ID are located in the Configuration memory at addresses 8005h and 8006h, respectively.

**2:** Refer to the *"PIC16(L)F188XX Memory Programming Specification"* (DS40001753) for detailed information on Device and Revision IDs for your specific device.

**TABLE 2: SILICON ISSUE SUMMARY**

| Module | Feature | Item No. | Issue Summary | Affected Revision(1) | | |
|---|---|---|---|---|---|---|
| | | | | A2 | A3 | A5 |
| Analog-to-Digital Converter with Computation (ADC2) | ADC Conversion | 1.1 | When using ADCRC as the ADC$^2$ clock source, there is a delay of one instruction cycle to set the ADGO bit. | X | | |
| Analog-to-Digital Converter with Computation (ADC2) | Positive Voltage Reference | 1.2 | Using the FVR as the ADC positive voltage reference can cause missing codes. | X | X | X |
| Analog-to-Digital Converter with Computation (ADC2) | ADC Offset Error | 1.3 | ADC Offset Error specification changed. | X | X | X |
| Nonvolatile Memory Control | NVMREG Access | 2.1 | Self-writes on LF devices below 2.2V at -40°C may not work. | X | | |
| EEPROM | Indirect Read | 3.1 | Indirect read of EEPROM with FSR returns unexpected value. | X | | |
| ECCP | Compare Mode | 4.1 | Toggle mode may output multiple pulses when the source clock has a prescaler other than 1:1. | X | | |
| MSSP | I$^2$C Communication | 5.1 | Acknowledge failure on LF devices only. | X | | |
| Electrical Specifications | Fixed Voltage Reference (FVR) Accuracy | 6.1 | Fixed Voltage Reference (FVR) output tolerance may be higher than specified at temperatures below -20°C. | X | | |
| Secondary Oscillator (Sosc) | Low-Power Mode | 7.1 | SOSC may not properly operate in Low-Power mode at low temperatures. | X | | |
| Comparators | Offset Voltage | 8.1 | Comparator input offset value is higher than specified. | X | X | 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: Analog-to-Digital Converter with Computation (ADC$^2$)

#### 1.1 ADC Conversion

When using ADCRC as the clock source for ADC$^2$, there is a delay of one instruction cycle between the user setting the ADGO bit and being able to read it set. This can lead to a false conversion complete scenario (i.e., ADGO being cleared), depending if the user code has a bit clear test (BTFSC) instruction on the ADGO bit, immediately after setting the ADGO bit. See the code example below.

e.g.

```
BSF ADCON0, ADGO      ; Start conversion
BTFSC ADCON0, ADGO    ; Is conversion done?
GOTO $-1              ; No, test again
```

BTFSC will pass the very first time in this situation.

**Work around**

Add a NOP instruction after setting the ADGO bit and before testing the bit for completion of conversion. See the code example below.

e.g.

```
BSF ADCON0, ADGO      ; Start conversion
NOP
BTFSC ADCON0, ADGO    ; Is conversion done?
GOTO $-1              ; No, test again
```

**Affected Silicon Revisions**

| A2 | A3 | A5 | | | | | |
|---|---|---|---|---|---|---|---|
| X | | | | | | | |

#### 1.2 Positive Voltage Reference

Using the FVR as the positive voltage reference for the ADC can cause an increase in missing codes.

**Work around**

Increase the bit conversion time (TAD) to 8 us or higher.

**Affected Silicon Revisions**

| A2 | A3 | A5 | | | | | |
|---|---|---|---|---|---|---|---|
| X | X | X | | | | | |

#### 1.3 ADC Offset Error

The table containing the Offset Error specification (AD04: EOFF) for the Digital-to-Analog Converter is modified. The updated value for Offset Error specification is +/-3.0 LSb.

**Work around**

None.

**Affected Silicon Revisions**

| A2 | A3 | A5 | | | | | |
|---|---|---|---|---|---|---|---|
| X | X | X | | | | | |

### 2. Module: Nonvolatile Memory Control

#### 2.1 NVMREG Access

When performing self-writes through NVMREG access on PIC16LF18857/18877 devices with VDD below 2.2V at a temperature of -40°C, the writes may not work. This applies to both PFM and EEPROM writes.

**Work around**

None.

**Affected Silicon Revisions**

| A2 | A3 | A5 | | | | | |
|---|---|---|---|---|---|---|---|
| X | | | | | | | |

### 3. Module: EEPROM

#### 3.1 Indirect Read

Performing FSR reads of Data EEPROM addresses other than the lowest address (FSR = 7000h) will return unexpected values.

**Work around**

Set NVMADRH:L to the desired address (F000h through F0FFh) and retrieve the EEPROM value from the NVMDATL register by setting the NVMREGS and RD bits in the NVMCON1 register.

**Affected Silicon Revisions**

| A2 | A3 | A5 | | | | | |
|---|---|---|---|---|---|---|---|
| X | | | | | | | |

## 4. Module: ECCP

### 4.1 Compare Mode

The ECCP Compare Toggle modes (CCPxCON<3:0> bits = 0010 or 0001) output multiple pulses instead of a single toggle pulse when its source clock has a prescaler other than 1:1.

**Work around**

Use CCP Compare mode with pulse output (CCPxCON<3:0> bits = 1011) to clock a CLC configured as a JK flip-flop in Toggle mode.

**Affected Silicon Revisions**

| A2 | A3 | A5 | | | | | |
|---|---|---|---|---|---|---|---|
| X | | | | | | | |

## 5. Module: MSSP

### 5.1 $I^2C$ Communication

When using the MSSP to perform $I^2C$ communication on LF devices and the voltage for VDD is above 3V, the Acknowledge signal (ACK) does not always occur after the second address byte is received, as expected. This issue exhibits itself when the MSSP is configured either for 7-bit or 10-bit addressing and in either Host or Client mode.

The issue occurs more frequently when using 10-bit addressing in Client mode and the lower address bits (A7-A0) are transmitted by the host on the SDA line.

**Work around**

Do not exceed 3V on VDD when using an LF device in this manner.

**Affected Silicon Revisions**

| A2 | A3 | A5 | | | | | |
|---|---|---|---|---|---|---|---|
| X | | | | | | | |

## 6. Module: Electrical Specifications

### 6.1 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**

| A2 | A3 | A5 | | | | | |
|---|---|---|---|---|---|---|---|
| X | | | | | | | |

## 7. Module: Secondary Oscillator (SOSC)

### 7.1 Low-Power Mode

While operating the device at low temperatures and using the SOSC in Low-Power mode (OSCCON3<6> = 0), the SOSC might fail to operate as expected.

**Work around**

If SOSC functionality is required at low temperatures, configure the SOSC for high-power operation (OSCCON3<6> = 1).

**Affected Silicon Revisions**

| A2 | A3 | A5 | | | | | |
|---|---|---|---|---|---|---|---|
| X | | | | | | | |

## 8. Module: Comparators

### 8.1 Offset Voltage

The maximum value of the input offset voltage for the comparators is increasing from ±30 mV to ±60 mV.

The parameter in the data sheet is CM01, also known as VIOFF.

**Work around**

None.

**Affected Silicon Revisions**

| A2 | A3 | A5 | | | | | |
|---|---|---|---|---|---|---|---|
| X | X | X | | | | | |

## Data Sheet Clarifications

The following typographic corrections and clarifications are to be noted for the latest version of the device data sheet (DS40001824**E**):

| | |
|---|---|
| **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 F Document (2/2021)

Added Module 1.3 (ADC Offset Error).

## Rev E Document (10/2020)

Added silicon revision A5.

## Rev D Document (3/2020)

Added Module 8 (Comparators).

## Rev C Document (2/2018)

Added Module 7 (Secondary Oscillator) and a row in Table 2.

## Rev B Document (4/2017)

Added Modules 1.2 (PVR), 5 (MSSP) and 6 (Electrical Specifications).

**Data Sheet Clarifications:**

Removed all modules, data sheet updated.

## Rev A Document (8/2016)

Initial release of this document.

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

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods being used in attempts to breach the code protection features of the Microchip devices. We believe that these methods require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Attempts to breach these code protection features, most likely, cannot be accomplished without violating Microchip's intellectual property rights.
- Microchip is willing to work with any customer who is concerned about the integrity of its code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is "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.



*For information regarding Microchip's Quality Management Systems, please visit www.microchip.com/quality.*

**Trademarks**



ISBN: 978-1-5224-7570-5

# 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

**Australia - Sydney**
Tel: 61-2-9868-6733

**China - Beijing**
Tel: 86-10-8569-7000

**China - Chengdu**
Tel: 86-28-8665-5511

**China - Chongqing**
Tel: 86-23-8980-9588

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

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

**China - Hangzhou**
Tel: 86-571-8792-8115

**China - Hong Kong SAR**
Tel: 852-2943-5100

**China - Nanjing**
Tel: 86-25-8473-2460

**China - Qingdao**
Tel: 86-532-8502-7355

**China - Shanghai**
Tel: 86-21-3326-8000

**China - Shenyang**
Tel: 86-24-2334-2829

**China - Shenzhen**
Tel: 86-755-8864-2200

**China - Suzhou**
Tel: 86-186-6233-1526

**China - Wuhan**
Tel: 86-27-5980-5300

**China - Xian**
Tel: 86-29-8833-7252

**China - Xiamen**
Tel: 86-592-2388138

**China - Zhuhai**
Tel: 86-756-3210040

## ASIA/PACIFIC

**India - Bangalore**
Tel: 91-80-3090-4444

**India - New Delhi**
Tel: 91-11-4160-8631

**India - Pune**
Tel: 91-20-4121-0141

**Japan - Osaka**
Tel: 81-6-6152-7160

**Japan - Tokyo**
Tel: 81-3-6880- 3770

**Korea - Daegu**
Tel: 82-53-744-4301

**Korea - Seoul**
Tel: 82-2-554-7200

**Malaysia - Kuala Lumpur**
Tel: 60-3-7651-7906

**Malaysia - Penang**
Tel: 60-4-227-8870

**Philippines - Manila**
Tel: 63-2-634-9065

**Singapore**
Tel: 65-6334-8870

**Taiwan - Hsin Chu**
Tel: 886-3-577-8366

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

**Taiwan - Taipei**
Tel: 886-2-2508-8600

**Thailand - Bangkok**
Tel: 66-2-694-1351

**Vietnam - Ho Chi Minh**
Tel: 84-28-5448-2100

## EUROPE

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

**Denmark - Copenhagen**
Tel: 45-4485-5910
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

**Germany - Garching**
Tel: 49-8931-9700

**Germany - Haan**
Tel: 49-2129-3766400

**Germany - Heilbronn**
Tel: 49-7131-72400

**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: 47-7288-4388

**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