DM160237

Serial Memory I^2C Evaluation Kit User's Guide

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.
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DM160237 SERIAL MEMORY I²C EVALUATION KIT USER'S GUIDE

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Preface

NOTICE TO CUSTOMERS

All documentation becomes dated and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our website (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXXXXA", where "XXXXXXXX" is the document number and "A" is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® X IDE online help. Select the Help menu and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the DM160237 Serial Memory I²C Evaluation Kit. Items discussed in this chapter include:

- Document Layout
- Conventions Used in This Guide
- Recommended Reading
- The Microchip Website
- Customer Support
- Revision History

DOCUMENT LAYOUT

This document describes how to use the DM160237 Serial Memory I²C Evaluation Kit as a tool to demonstrate the best-in-class features, functionality and low-power operation of Microchip's I²C Serial EEPROM devices.
The document is organized as follows:

- **Chapter 1. "Product Overview"**
- **Chapter 2. "Installation and Operation"**
- **Chapter 3. "Graphical User Interface (GUI)"**
- **Chapter 4. "USB Base Board Firmware Update"**
- **Chapter 5. "Troubleshooting Guide"**
- **Appendix A. "Schematics"**
- **Appendix B. "Bill of Materials (BOM)"**

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*MPLAB® X IDE User's Guide*
	Emphasized text	...is the *only* compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, Italic text with right angle bracket	A menu path	*File>Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	`#define START`
	Filenames	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
	Constants	`0xFF, 'A'`
Italic Courier New	A variable argument	*`file`*`.o`, where *`file`* can be any valid filename
Square brackets [ ]	Optional arguments	`mcc18 [options]` *`file`* `[options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`
	Represents code supplied by user	`void main (void) { ... }`

RECOMMENDED READING

This user's guide describes how to use the DM160237 Serial Memory I²C Evaluation Kit. The following documents are available and recommended as supplemental reference resources.

- **Serial Memory I²C Quick Start Guide – "*Serial Memory I²C Evaluation Kit Quick Start Guide*" (DS20005844)** – This quick start guide provides a brief overview on the DM160237 Evaluation Kit's functionalities, features and capabilities.

THE MICROCHIP WEBSITE

Microchip provides online support via our website at www.microchip.com. This website is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the website contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

DEVELOPMENT SYSTEMS CUSTOMER CHANGE NOTIFICATION SERVICE

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To register, access the Microchip website at www.microchip.com, click on Customer Change Notification and follow the registration instructions.

The Development Systems product group categories are:

- **Compilers** – The latest information on Microchip C compilers, assemblers, linkers and other language tools. These include all MPLAB C compilers; all MPLAB assemblers (including MPASM™ assembler); all MPLAB linkers (including MPLINK™ object linker); and all MPLAB librarians (including MPLIB™ object librarian).
- **Emulators** – The latest information on Microchip in-circuit emulators.This includes the MPLAB REAL ICE™ and MPLAB ICE 2000 in-circuit emulators.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debuggers. This includes MPLAB ICD 3 in-circuit debuggers and PICkit™ 3 debug express.

- **MPLAB IDE** – The latest information on Microchip MPLAB X IDE, the Windows® Integrated Development Environment for development systems tools. This list is focused on the MPLAB X IDE, MPLAB X IDE Project Manager, MPLAB Editor and MPLAB SIM simulator, as well as general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include production programmers such as MPLAB REAL ICE in-circuit emulator, MPLAB ICD 3 in-circuit debugger and MPLAB PM3 device programmers. Also included are nonproduction development programmers such as PICSTART® Plus and PICkit 2 and 3.

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the website at:

http://www.microchip.com/support.

REVISION HISTORY

Revision A (02/2021)

- Initial release of this document.

Chapter 1. Product Overview

1.1 INTRODUCTION

Microchip Technology's DM160237 Serial Memory I²C Evaluation Kit allows the user to read, write and verify Microchip's Serial EEPROM devices using the I²C bus protocol.

This chapter introduces the DM160237 Serial Memory I²C Evaluation Kit and provides an overview of its features. Topics covered include:

- DM160237 Evaluation Kit Overview
- DM160237 Evaluation Kit Contents
- Operational Requirements

1.2 DM160237 EVALUATION KIT OVERVIEW

The Serial Memory I²C Evaluation Kit (DM160237) is an easy-to-use interactive user tool that demonstrates the best-in-class features, functionality and low-power operation of Microchip I²C Serial EEPROM devices. The included Graphical User Interface (GUI) makes it easy for engineers and developers to configure and evaluate I²C Serial EEPROMs, shortening the overall development time needed to bring new designs from prototype to production.

1.3 EVALUATION KIT CONTENTS

The Serial Memory I²C Evaluation Kit includes the following:

- I²C Socket Board (02-10727) (Figure 1-1)
- USB Base Board (02-10682) (Figure 1-2)
- Various loose Microchip I²C Serial EEPROM devices
- Important Information Sheet

FIGURE 1-1: I²C SOCKET BOARD (02-10727)

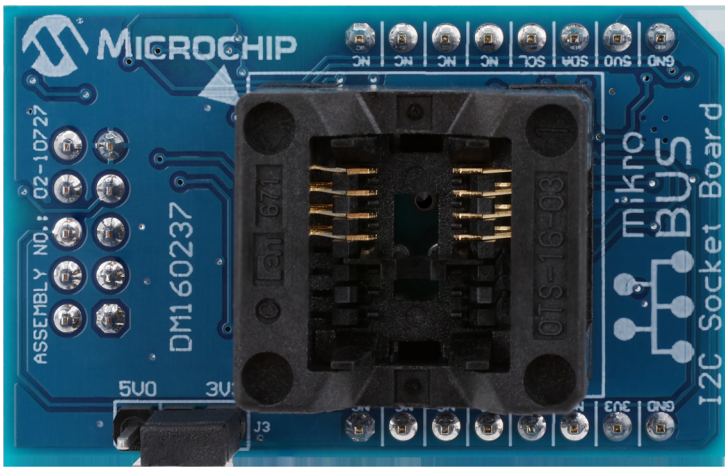
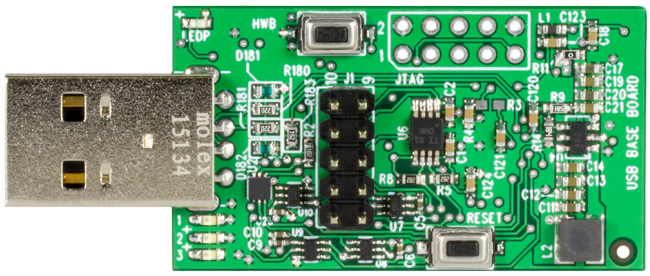


FIGURE 1-2: USB BASE BOARD (02-10682)



The I²C Socket Board also includes mikroBUS™ headers that allow the user to further develop applications by using the Socket Board with Microchip's extensive Development Tool offering. The VCC for the mikroBUS™ operation can be selected by the user by changing jumper on header J3 to select either 3.3V or 5.0V.

Note: By default the board is shipped with 3.3V selected by jumper installed in header J3 as shown in Figure 1-1.

1.4 OPERATIONAL REQUIREMENTS

For the Serial Memory I²C Evaluation Kit to function properly, the following hardware and software requirements must be met:

- PC compatible system
- An available USB port on PC
- At least 25.3 MB of free disk space
- Windows® 7 or higher operating systems(1)

Note 1: Testing has been performed on a 64-bit Windows® 10 operating system.

Chapter 2. Installation and Operation

2.1 INTRODUCTION

Setup for the Serial Memory I²C Evaluation Kit is straightforward. To start, the I²C Graphical User Interface (GUI) will need to be downloaded and installed on the user's PC. Note that the USB Base Board driver is also installed during the GUI installation process. Once installed, the user should perform a simple hardware setup sequence. Once completed, simply plug in the USB Base Board to an available USB port on the user's PC and launch the I²C GUI.

WARNING

Read the DM160237 Serial Memory I²C Evaluation Kit User's Guide (this document) fully before proceeding to evaluation kit setup.

2.2 INSTALLING THE GRAPHICAL USER INTERFACE (GUI)

The following steps are needed to successfully install the GUI software:

Note: If an earlier version of the DM160237 I²C Evaluation Kit GUI was previously installed, it is recommended to uninstall the previous version before installing the new version. This will ensure robust GUI operation.

1. Go to http://www.microchip.com/DM160237 to download the GUI software.
2. Navigate to *Documentation and Software* and select the *DM160237 I²C Evaluation Kit GUI* software.
3. Download and open the setup file:
   `DM160237_x.x.x_setup.exe`, where `x.x.x` indicates the GUI version.
4. If the Open File – Security Warning pops up, press the **Run** button.

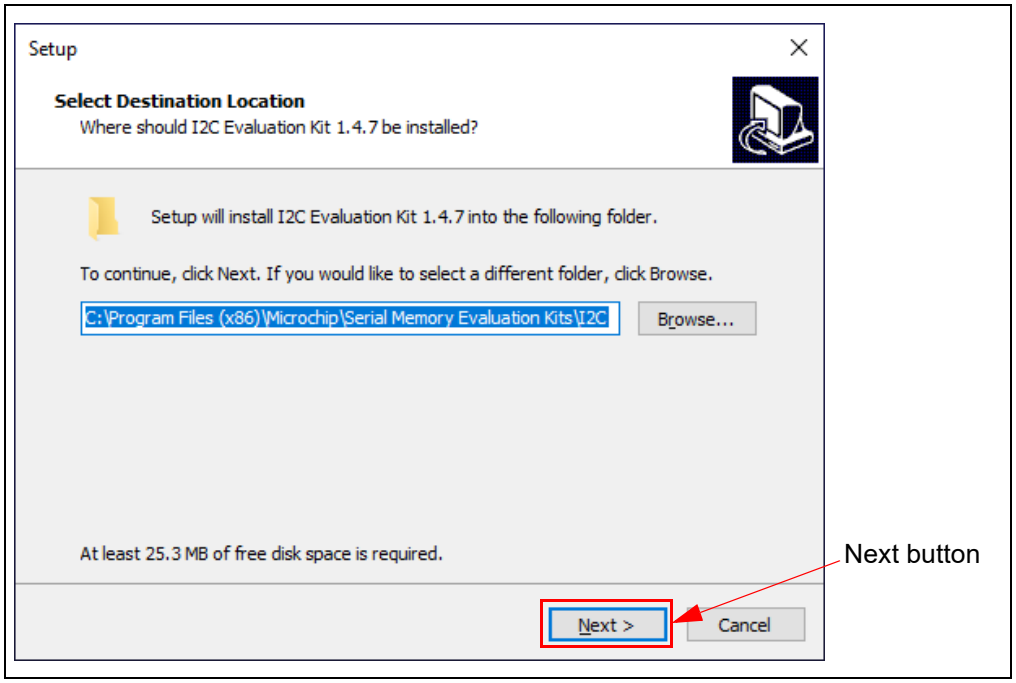
Note: If prompted, allow the program to make changes to your PC.

5. Select the Installation Destination Location from the GUI. Press the **Next** button when ready (Figure 2-1). The default Destination Location is:

   `C:\Program Files (x86)\Microchip\Serial Memory Evaluation Kits\I2C`

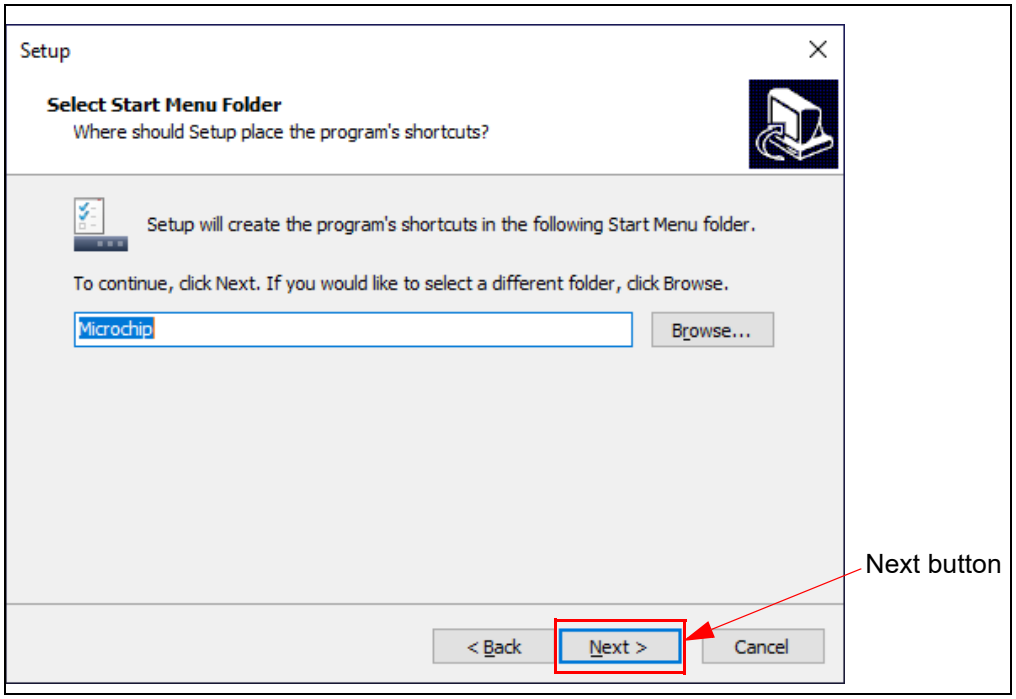
Note: When referring to location of files on the user's PC, this document is assuming that the default installation was used when the GUI was installed. If the default installation is not used, it is the user's responsibility to determine the reference file location.

FIGURE 2-1: GUI INSTALLATION LOCATION



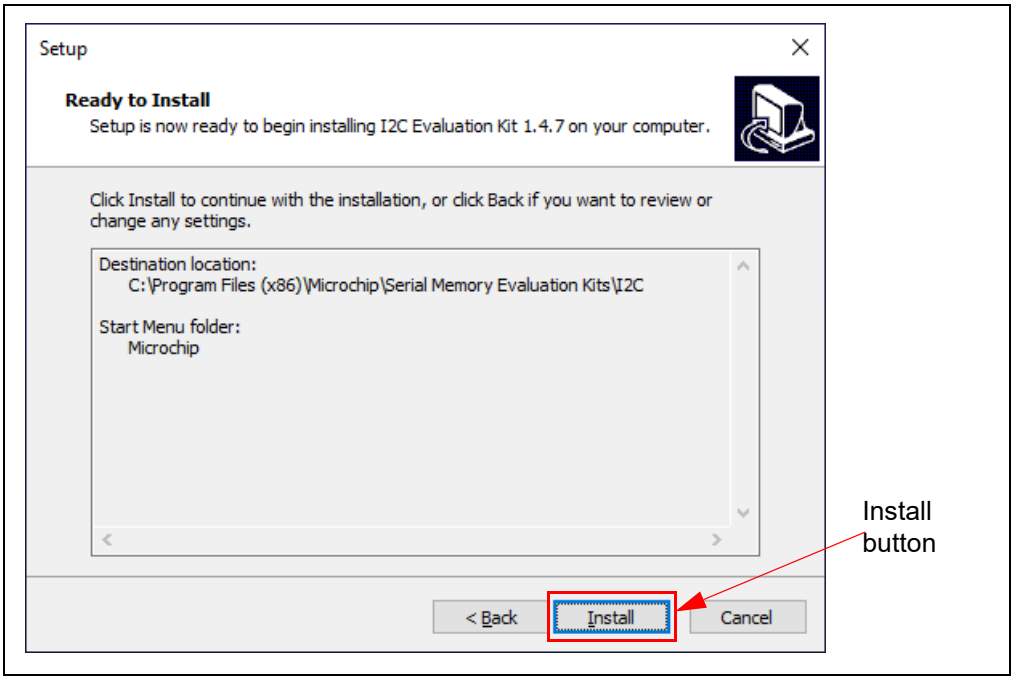
6. The next step is to select the Start Menu folder. By default, the setup will create a Start Menu folder named *Microchip* (if one is not already present on the user's PC). Press the **Next** button when ready to continue (Figure 2-2).

FIGURE 2-2: GUI START MENU FOLDER



7. Once the Destination location and the Start Menu folder have been selected, the setup will prompt the user if they are ready to install the software. Press the **Install** button when ready (Figure 2-3) and, once complete, the installation will then install the FLIP software.

FIGURE 2-3: GUI READY TO INSTALL



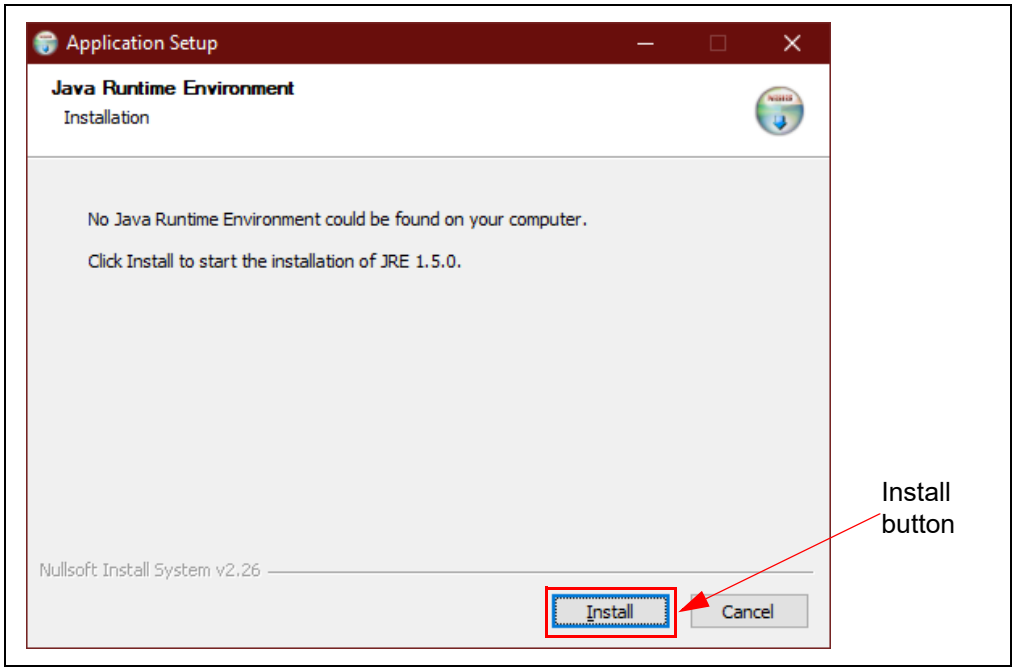
2.3 FLEXIBLE IN-SYSTEM PROGRAMMING (FLIP) SOFTWARE

The Microchip Technology Serial Memory Evaluation Kits have a built-in ability to update the USB Base Board using a sequence of steps, along with using the Atmel FLexible In-system Programming (FLIP) software.
The following steps are needed to successfully install the FLIP Software Utility:

1. If Java Runtime is already installed or a newer version is already installed, the setup will automatically start and you may skip to Step 7. If no Java Runtime or an older version is present on the user's PC, when prompted, press the **Install** button to start the Java Runtime installation.

Note: If prompted, allow the program to make changes to your PC.

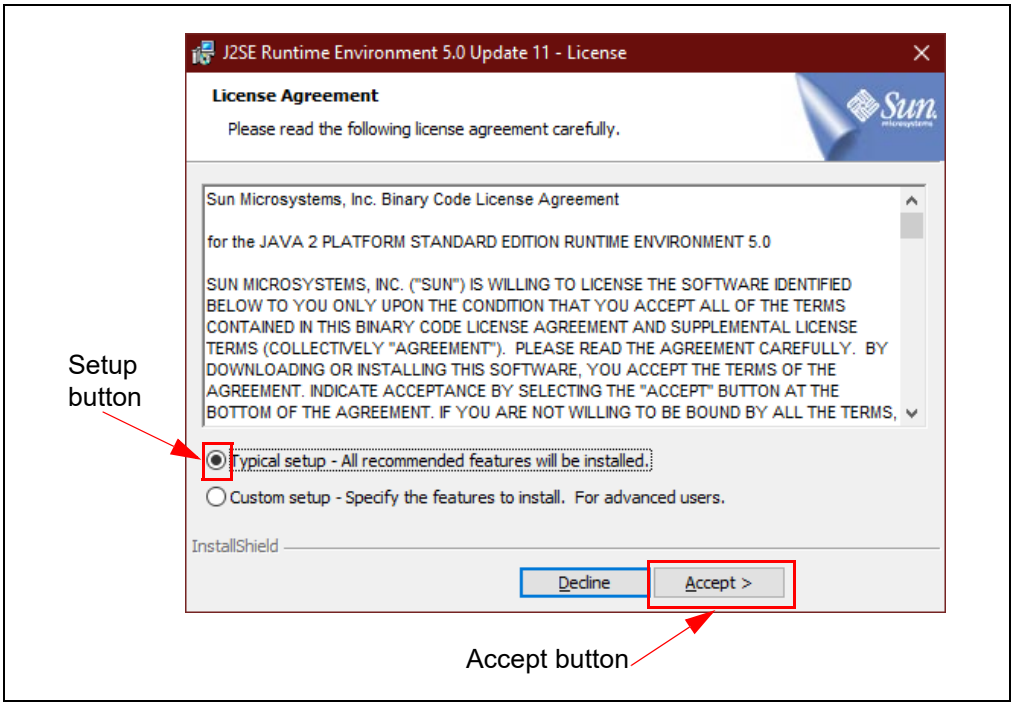
FIGURE 2-4: JAVA RUNTIME ENVIRONMENT SETUP



2. Allow the program to setup the Java Runtime. When prompted, select "Typical setup" and press the **Accept** button to accept the License Agreement.

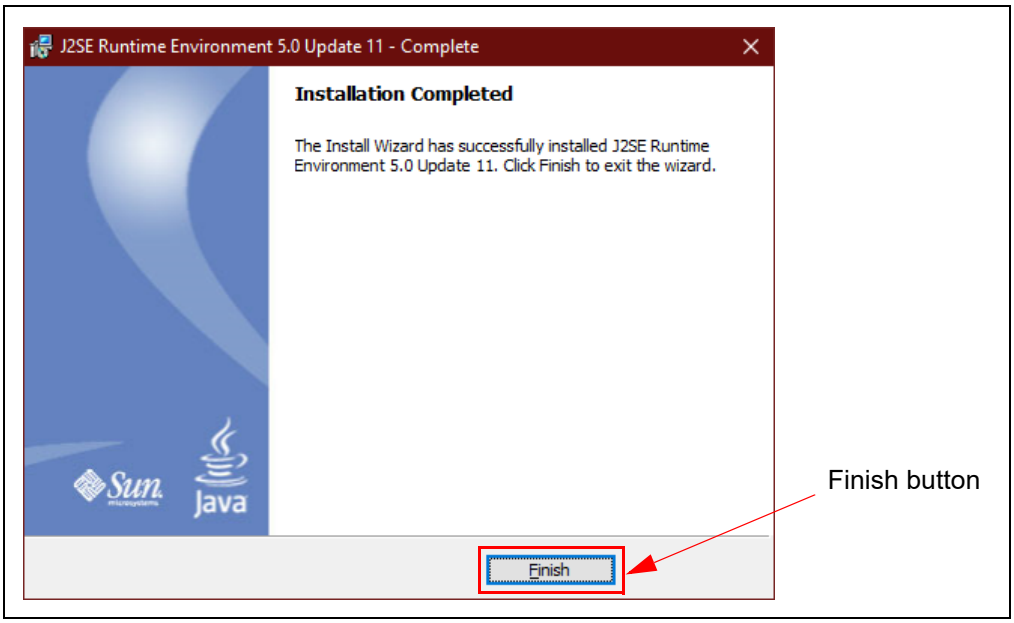
Note: For this example, the "Typical setup" was used. If the user selects a "*Custom setup*", it is the user's responsibility to ensure the FLIP Software Utility is installed correctly.

FIGURE 2-5: JAVA RUNTIME TYPICAL SETUP



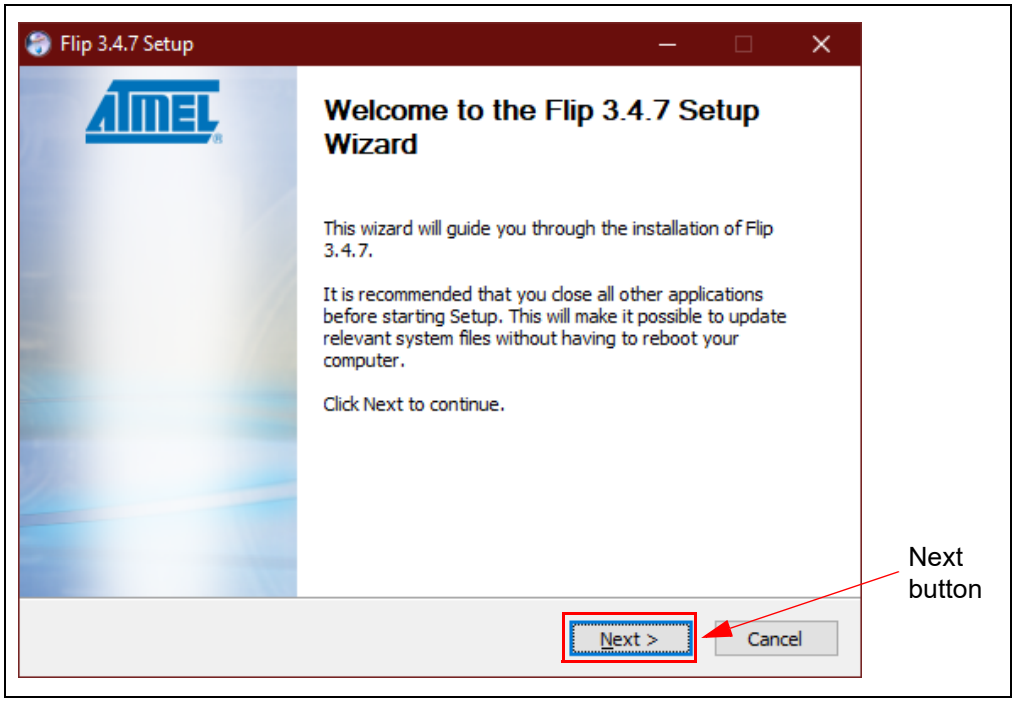
3. Let the program setup the Java Runtime. A progress or status bar is included to show the overall progress of the installation. Once completed, press the **Finish** button to complete the Java Runtime installation.

FIGURE 2-6: JAVA RUNTIME COMPLETION



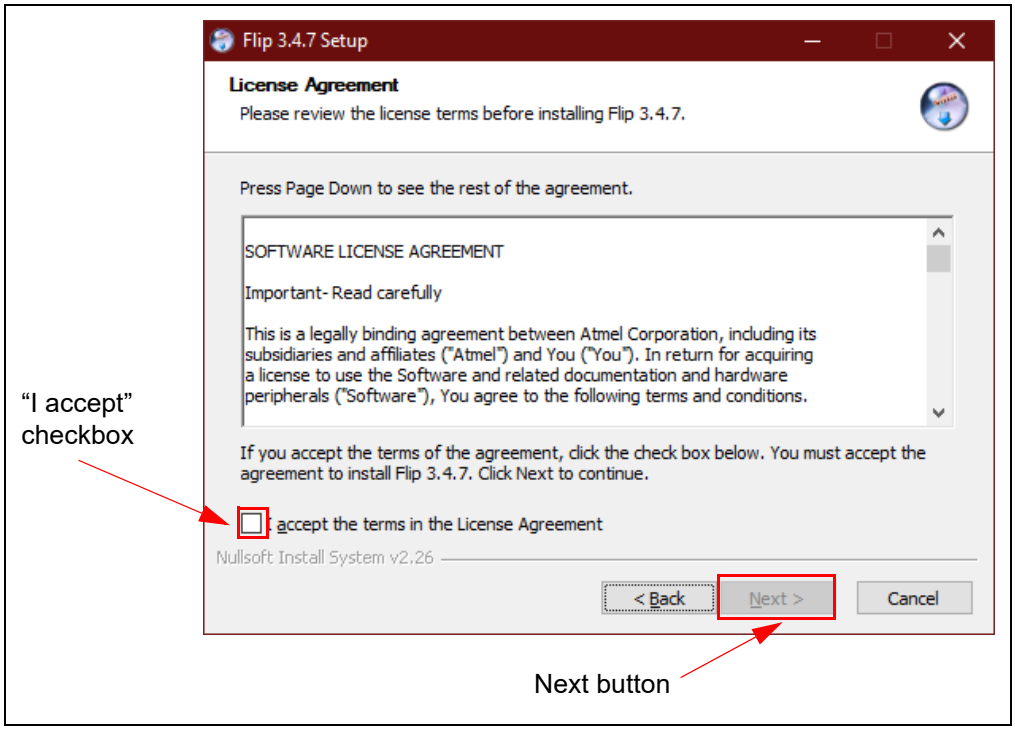
4. Once the Java Runtime is installed, the FLIP 3.4.7 Setup Wizard is automatically started. Once ready, click the **Next** button to continue.

FIGURE 2-7: FLIP SETUP WIZARD



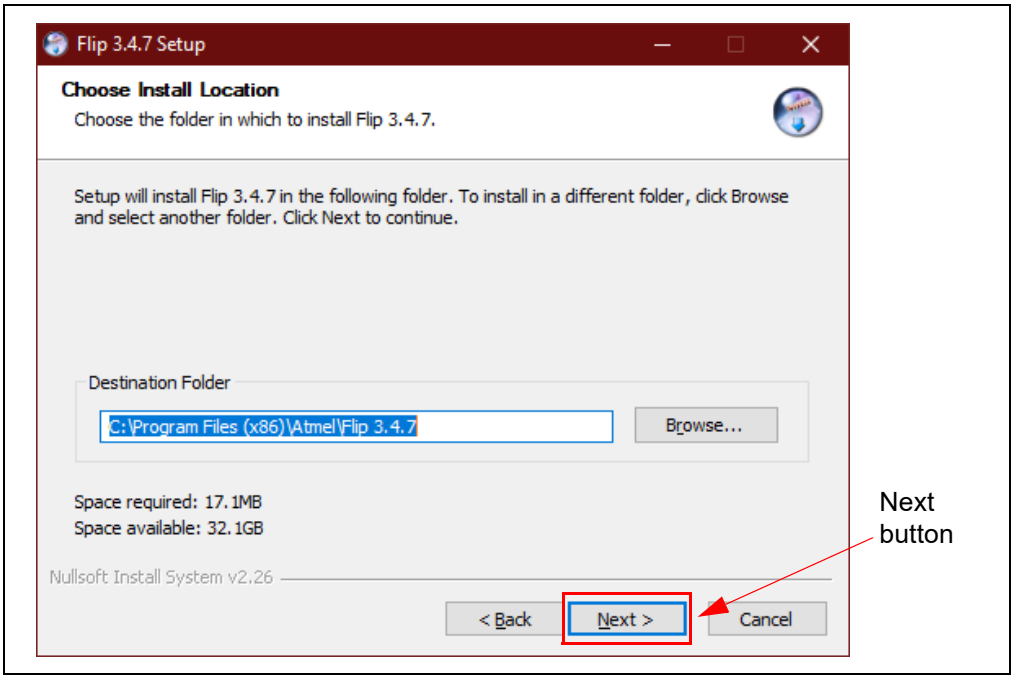
5. Read the License Agreement. When finished, accept the terms in the License Agreement by checking the box and press the **Next** button to continue.

FIGURE 2-8: FLIP LICENSE AGREEMENT



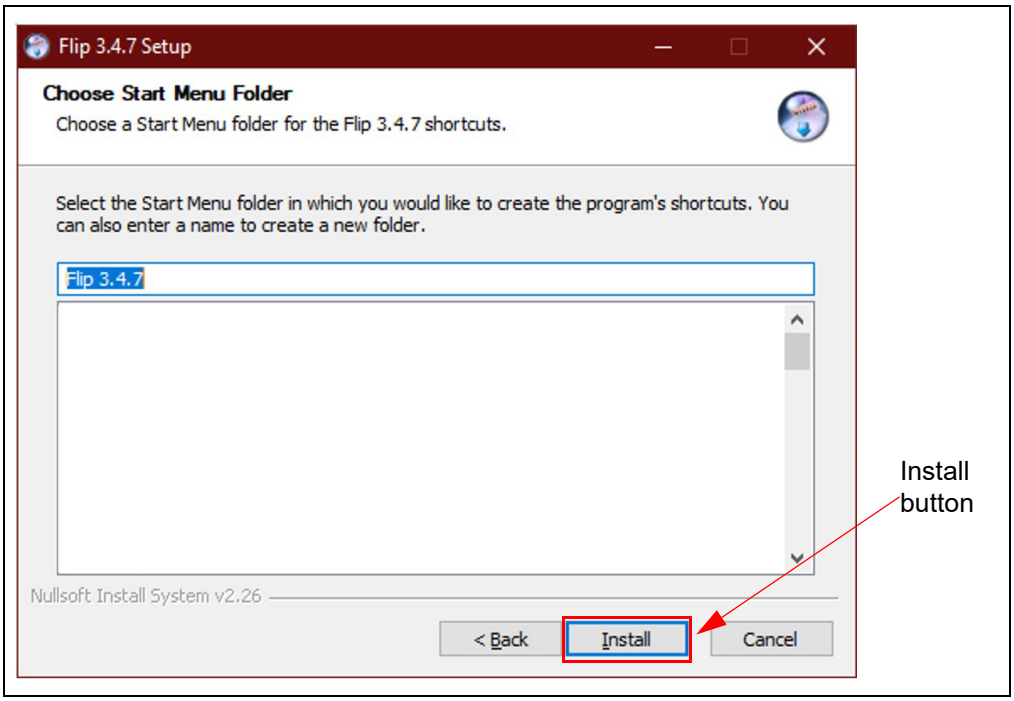
6. Next, select the installation location. The default installation location is set to `C:\Program Files (x86)\Atmel\Flip 3.4.7` (3.4.7 indicates the version). It is recommended that the default installation location is used. Once the installation location has been selected, press the **Next** button.

FIGURE 2-9: FLIP INSTALLATION LOCATION



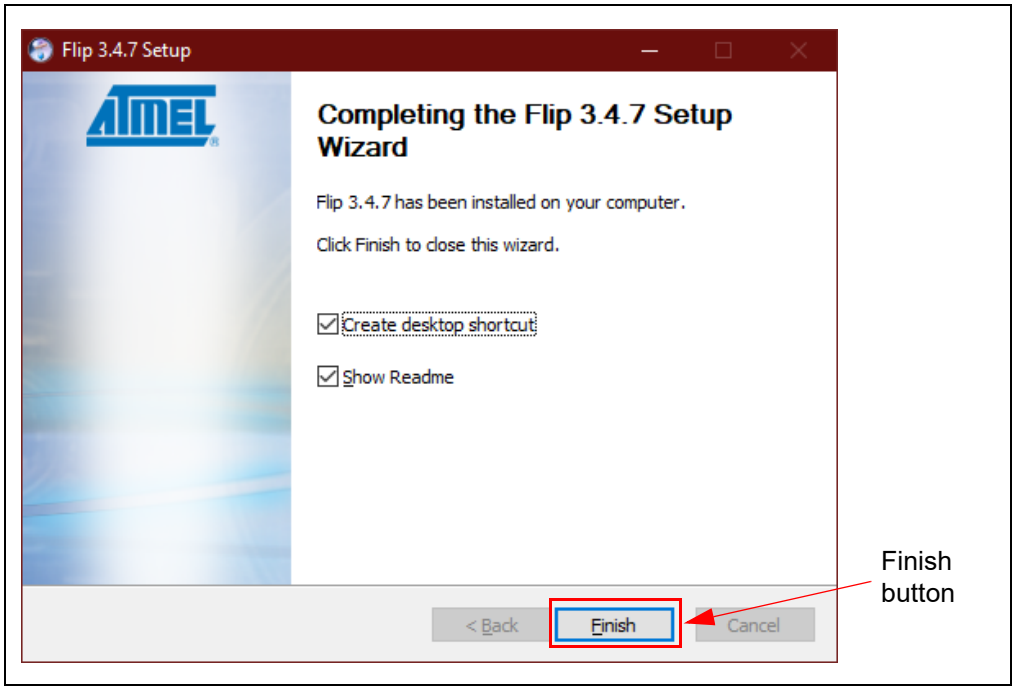
7. Choose a Start Menu folder. By default, the Start Menu folder is set to *Flip 3.4.7*, where 3.4.7 indicates the FLIP version. It is recommended that the default Start Menu folder is used. Once ready, press the **Install** button to continue.

FIGURE 2-10: FLIP START MENU FOLDER



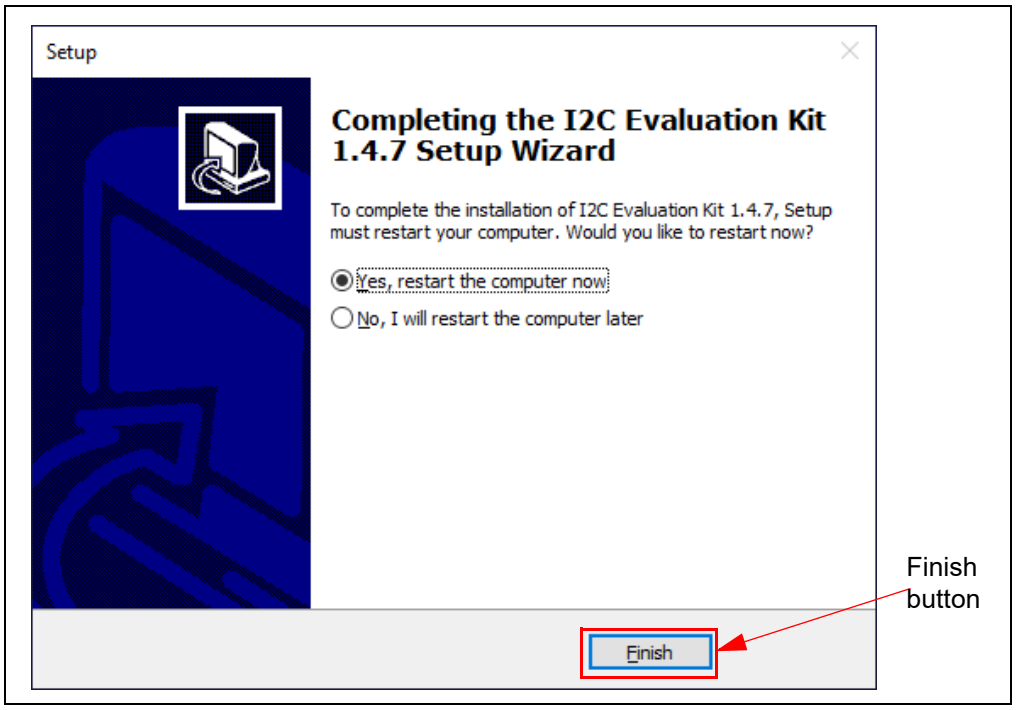
8. Let the program setup the FLIP Software Utility. A progress or status bar is included to show the overall progress of the installation. Click the **Next** button during the installation progress, if prompted. Once completed, press the **Finish** button to complete the FLIP Software Utility installation.

FIGURE 2-11: FLIP SOFTWARE UTILITY COMPLETE



9. Let the program setup the I²C GUI. A progress or status bar is included to show the overall progress of the installation. Once completed, press the **Finish** button to complete the I²C GUI installation and restart the computer (Figure 2-12).

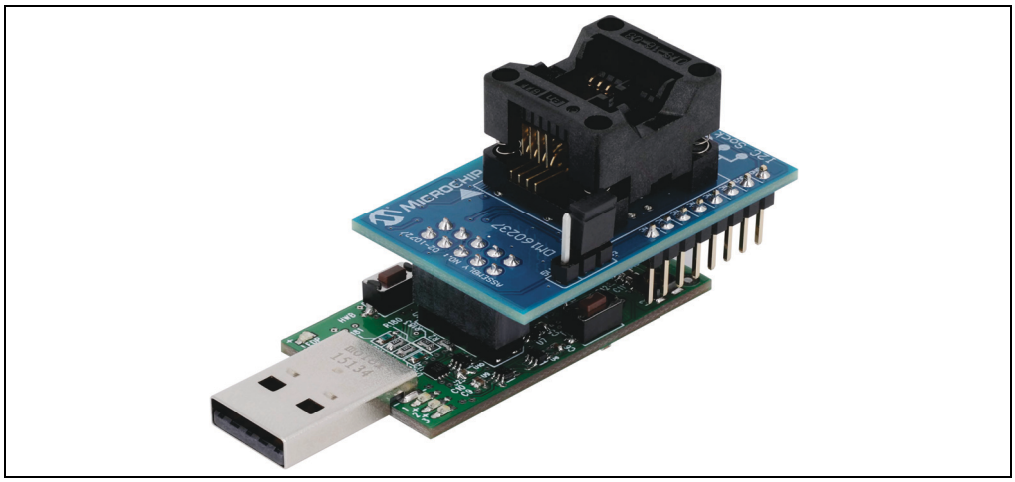
FIGURE 2-12: GUI INSTALLATION COMPLETE



2.4 EVALUATION KIT SETUP PROCEDURE

In order to start using the evaluation kit, simply plug the I²C Socket Board into the USB Base Board using the H1 and J1 headers. See Figure 2-13 for illustration.

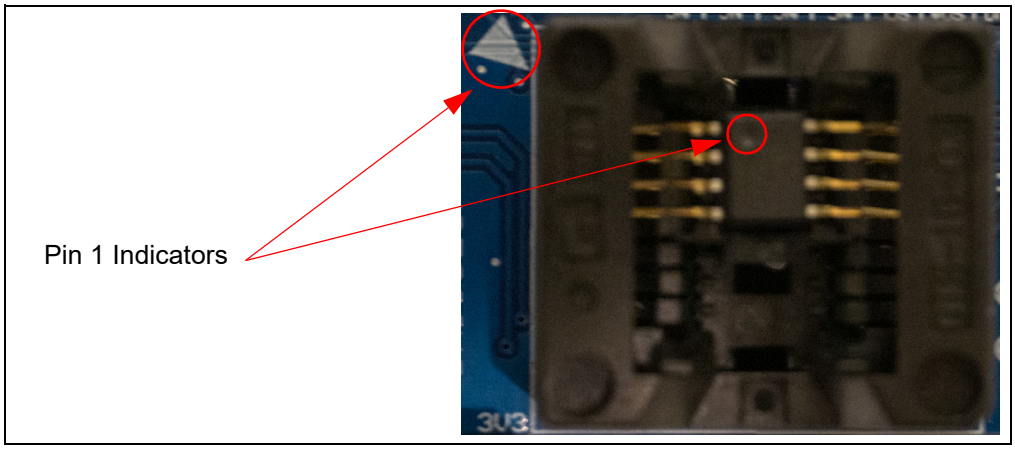
FIGURE 2-13: USB BASE BOARD AND I²C SOCKET BOARD



Once both boards are connected, verify that there is a device correctly installed in the SOIC socket on the I²C Socket Board, making sure to note that the Pin 1 indicator on the PCB matches the Pin 1 indicator on the I²C device. To ensure robust GUI and hardware operation, it is recommended that when installing a device, the USB Base Board be disconnected from the user's PC. Figure 2-14 illustrates an I²C device that is properly seated in the SOIC socket and highlights the pin 1 indicator on the PCB.

Note: Due to the small size of the 8-lead SOIC package, it is recommended to use tweezers in order to properly install the device into the I²C Socket Board socket.

FIGURE 2-14: I²C DEVICE IN SOIC SOCKET



Once a device is installed in the SOIC socket, the user can then plug the USB Base Board into one of their computer's USB ports. Once the USB Base Board enumerates on the user's PC, open the GUI by selecting either the desktop icon (I²C GUI) or navigating to the Start Menu folder that was created when the DM160237 I²C Evaluation Kit GUI software was installed.

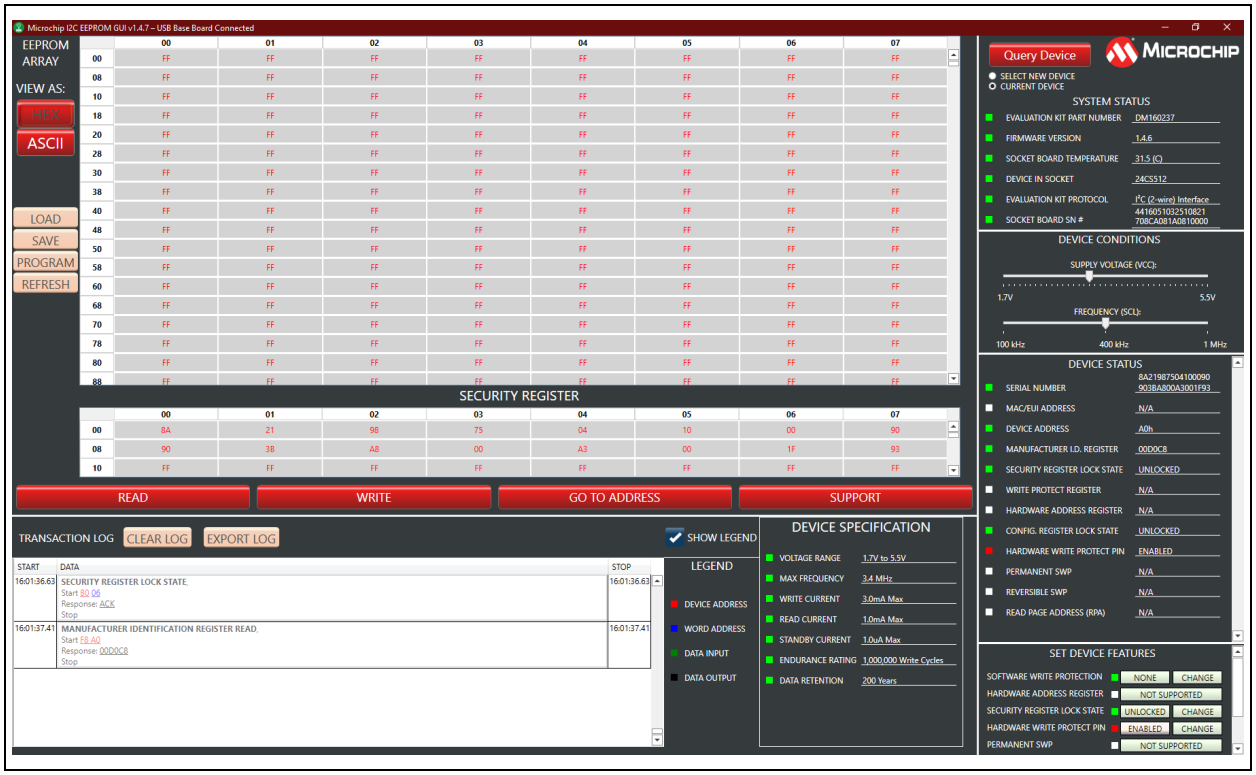
Chapter 3. Graphical User Interface (GUI)

3.1 INTRODUCTION

The Serial Memory I²C Evaluation Kit includes a Graphical User Interface (GUI) which is used as an interface between the user's PC and the evaluation kit hardware. The GUI allows the user to easily interact with the I²C Serial EEPROM using built-in read and write features. The GUI also highlights the value-added features of the installed supported device. In the subsequent sections, the GUI features and functions are explained in detail to help the user to interact with the installed I²C Serial EEPROM.

The GUI detects the USB Base Board firmware version and determines whether it is compatible with that GUI version. If the GUI determines the USB Base Board firmware is incompatible, the GUI will try to update the firmware using a sequence of on-screen steps. Alternatively, this process can be done manually by the user if he or she chooses. Refer to the **Chapter 4. "USB Base Board Firmware Update"** for details on the firmware update process. If the GUI version is earlier than the USB Base Board, download the latest version of the GUI (refer to **Section 2.2 "Installing the Graphical User Interface (GUI)"** for additional information).

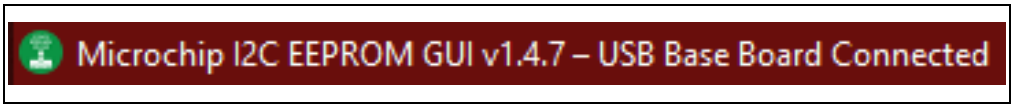
FIGURE 3-1: GRAPHICAL USER INTERFACE



3.2 MAIN TITLE BAR

The title bar displays the GUI version and the USB Base Board connection status. Figure 3-2, shown below, illustrates a GUI version of 1.4.7.

FIGURE 3-2: TITLE BAR



3.3 QUERY DEVICE

The GUI will perform an auto-query when the GUI is launched or when the USB Base Board is initially connected to the PC. Afterwards, the user can initiate a device query at any time with the **QUERY DEVICE** button (Figure 3-3). There are two different queries that the user can perform, "SELECT NEW DEVICE" or "CURRENT DEVICE". The difference between the two is the SELECT NEW DEVICE Query will allow the user to select a new device. The Device Query determines the client address of the installed device by sending all eight possible client address combinations until the device acknowledges. Querying the device will populate or repopulate the GUI with the content read from the installed device.

FIGURE 3-3: QUERY DEVICE

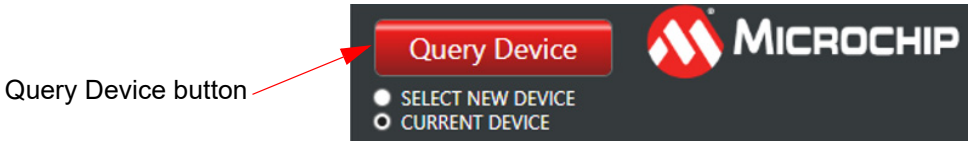
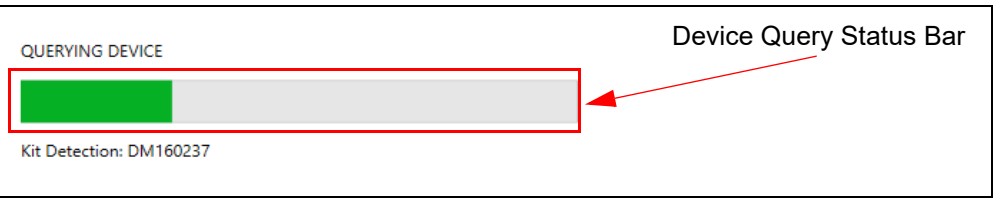


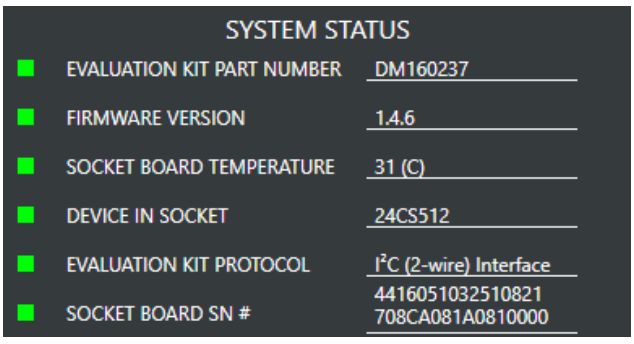
FIGURE 3-4: DEVICE QUERY PROGRESS BAR



3.4 SYSTEM STATUS

The System Status pane is populated with information related to the evaluation kit hardware. These include the "EVALUATION KIT PART NUMBER", "FIRMWARE REVISION", "SOCKET BOARD TEMPERATURE," the installed supported device or "DEVICE IN SOCKET", the "EVALUATION KIT PROTOCOL" and the "SOCKET BOARD SN #" (serial number).

FIGURE 3-5: SYSTEM STATUS PANE



3.4.1 Evaluation Kit Part Number

This displays the evaluation kit part number, DM160237.

3.4.2 Firmware Revision

This is the version of the firmware programmed in the USB Base Board.

3.4.3 Socket Board Temperature

This is the temperature of the socket board (in degrees Celsius) by reading the temperature from the AT30TSE752A located on the I²C Socket Board. Note that the temperature is only read during a Device Query (see **Section 3.3 "Query Device"**) and the value is not continuously updated.

3.4.4 Device in Socket

The GUI identifies the installed supported device that was selected by user.

3.4.5 Evaluation Kit Protocol

Identifies the communication protocol used by the evaluation kit's socket board.

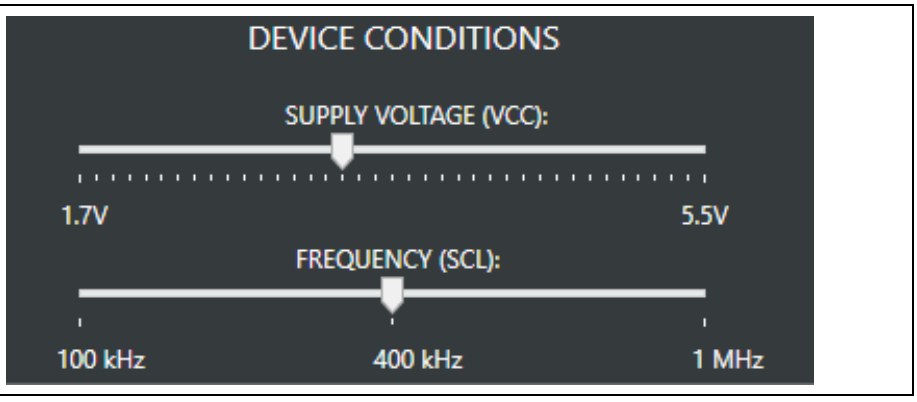
3.4.6 Socket Board SN

The I²C Socket Board serial number is retrieved from the AT24CS02 serialized Serial EEPROM located on the I²C Socket Board. Every I²C Socket Board will have its own unique serial number.

3.5 DEVICE CONDITIONS

The Device Conditions pane (Figure 3-6) allows the user to set the supply voltage to the I²C Socket Board and the communication speed or frequency of the I²C (two-wire) protocol.

FIGURE 3-6: DEVICE CONDITIONS PANE



3.5.1 Supply Voltage Slider

The voltage slider provides the ability to change the supply voltage, in 100 mV increments, to the I²C Socket Board, including the installed device VCC voltage. The user can change the VCC by either clicking along the slider or dragging the indicator to the desired VCC. The upper and lower limits of the VCC are determined by the installed device specification. Because the supply voltage is common between every device on the I²C Socket Board, a test point is included to measure VCC. Whenever the GUI is initially started or a Device Query is performed, the voltage slider will default to 3.3V to ensure the installed supported device has sufficient VCC to communicate.

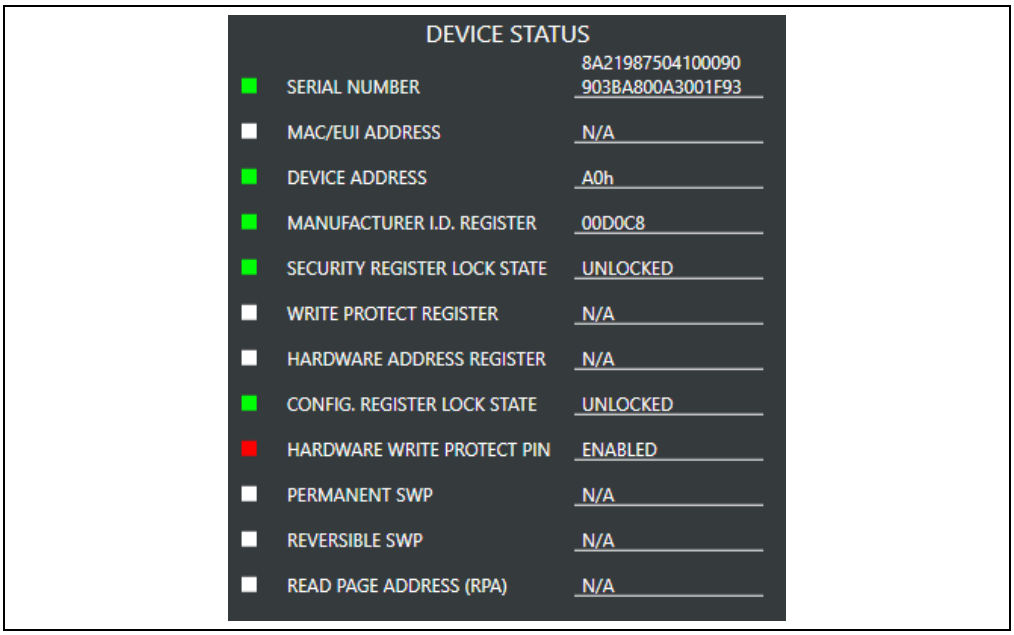
3.5.2 Frequency Slider

The frequency slider provides the ability to change the frequency communication speed between the host controller (USB Base Board) and the installed device. The user can change the SCL speed by either clicking along the slider or dragging the indicator to the desired frequency. The upper frequency limit of the communication speed slider is determined by the installed device specification. Whenever the GUI is initially started or a Device Query is performed, the frequency slider will default to 400 kHz to ensure the installed supported device is able to communicate with the host controller.

3.6 DEVICE STATUS

The Device Status pane shows various Serial EEPROM device features. Note that not all features are present on all supported devices. If the supported device offers such a feature, the box on the left side of the pane will be green or red. If it isn't offered, it will be gray (Figure 3-7).

FIGURE 3-7: DEVICE STATUS PANE



3.6.1 128-Bit Serial Number

Displays the serial number read from the installed supported device. The serial number is displayed in hexadecimal and will be shown in two rows of eight bytes.

3.6.2 MAC/EUI Address

Displays the MAC/EUI read from the installed supported device. The MAC/EUI is displayed in hexadecimal.

3.6.3 Device Address

Displays the device client address or device address byte that the installed device acknowledged during the Device Query. If the device has device address inputs (A_2, A_1 and A_0 pins), these are set to GND or logic '0' on the I²C Socket Board. The device address is displayed in hexadecimal with the R/W bit set to '0'.

3.6.4 Manufacturer I.D. Register

Reports the content of the installed device's Manufacturer ID register. The data is displayed in hexadecimal.

3.6.5 Security Register Lock State

Displays the lock state of the Security register. If the register is not locked, UNLOCKED is displayed. If the register is locked, LOCKED is displayed.

3.6.6 Write Protect Register

Displays the protection level programmed into the Write-Protect register. The protection level can be NONE, UPPER 1/4, UPPER 1/2, UPPER 3/4 or ENTIRE.

3.6.7 Hardware Address Register

Displays the current programmed hardware address (A2, A1 and A0) bits programmed to the Hardware Address register. The data is displayed in hexadecimal.

3.6.8 Config. Register Lock State

Displays the lock state of the Configuration register. If the register is not locked, UNLOCKED is displayed. If the register is locked, LOCKED is displayed.

3.6.9 Hardware Write Protect Pin

Displays the current state of the hardware write protect pin. If set to VCC, ENABLED is displayed. If set to GND, DISABLED is displayed.

3.6.10 Permanent SWP

Displays the lock state of the Permanent Software Write Protection. If the register is not locked, DISABLED is displayed. If the register is locked, LOCKED is displayed.

3.6.11 Reversible SWP

Displays the lock state of the Reversible Software Write Protection. If the register is not locked, DISABLED is displayed. If the register is locked, LOCKED is displayed.

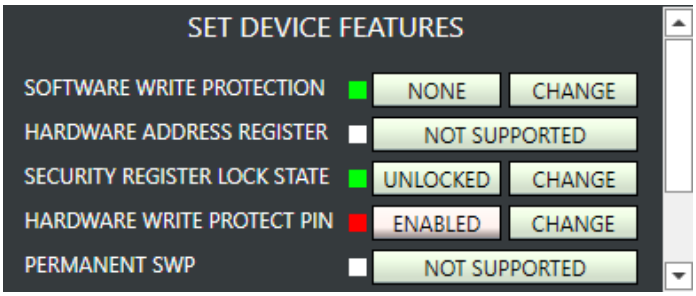
3.6.12 Read Page Address (RPA)

Displays the current state of the Set Page Address register. The text displayed is either SPA: (0) for first-half of array or SPA: (1) for second-half of array.

3.7 SET DEVICE FEATURES

The Set Device Features pane (Figure 3-8) allows the user to modify the various device features for the supported device. These include "SOFTWARE WRITE PROTECTION", "HARDWARE ADDRESS REGISTER", "SECURITY REGISTER LOCK STATE", "HARDWARE WRITE PROTECT PIN", "PERMANENT SWP", "REVERSIBLE SWP" and "SET PAGE ADDRESS (SPA)". To change the state, press the left button and modify the state. Once the state is set, press the **CHANGE** button and the state will be updated based of the new state.

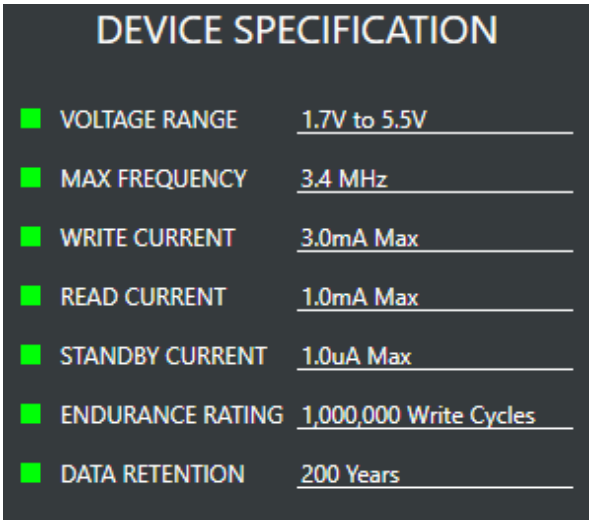
FIGURE 3-8: SET DEVICE FEATURES PANE



3.8 DEVICE SPECIFICATION

The Device Specification pane (Figure 3-9) displays key device parameters that can be found in the installed device's data sheet. These parameters include "VOLTAGE RANGE", "MAX FREQUENCY", "WRITE CURRENT", "READ CURRENT", "STANDBY CURRENT", "ENDURANCE RATING" and "DATA RETENTION".

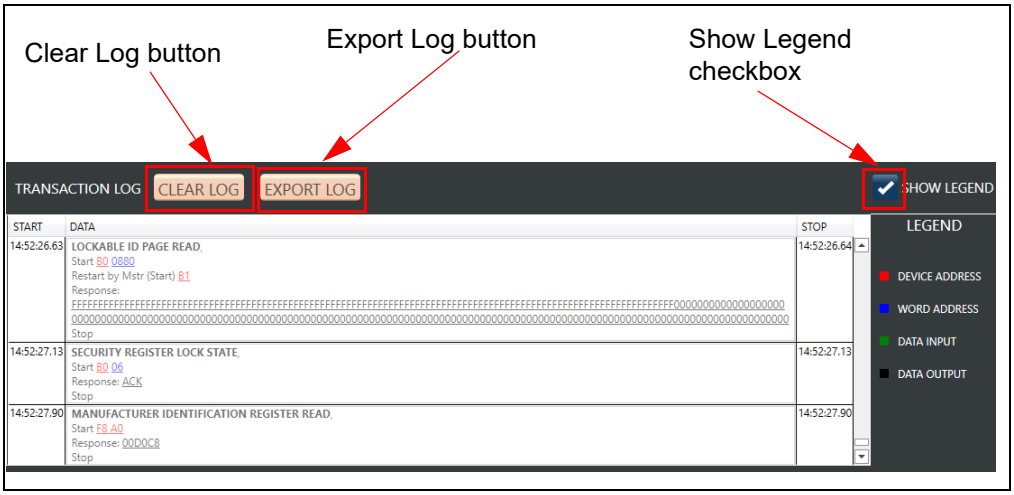
FIGURE 3-9: DEVICE SPECIFICATION PANE



3.9 TRANSACTION LOG

The Transaction Log records all I²C communication with the installed device as well as highlights the communication protocol according to the legend. The Transaction Log reports the data on the I²C bus in hexadecimal. The Transaction Log can be used in conjunction with an oscilloscope connected to the SCL, SDA and GND test points to help the user decode the captured protocol.

FIGURE 3-10: TRANSACTION LOG



3.9.1 Clear Log

The **CLEAR LOG** button clears the Transaction Log. The Clear Log function is helpful when the user wants to look at a specific type(s) or group(s) of I²C protocol.

3.9.2 Export Log

The **EXPORT LOG** button exports the Transaction Log in HTML format. The exported Transaction Log can be used as a reference without having to resend protocol to the installed device.

3.9.3 Legend

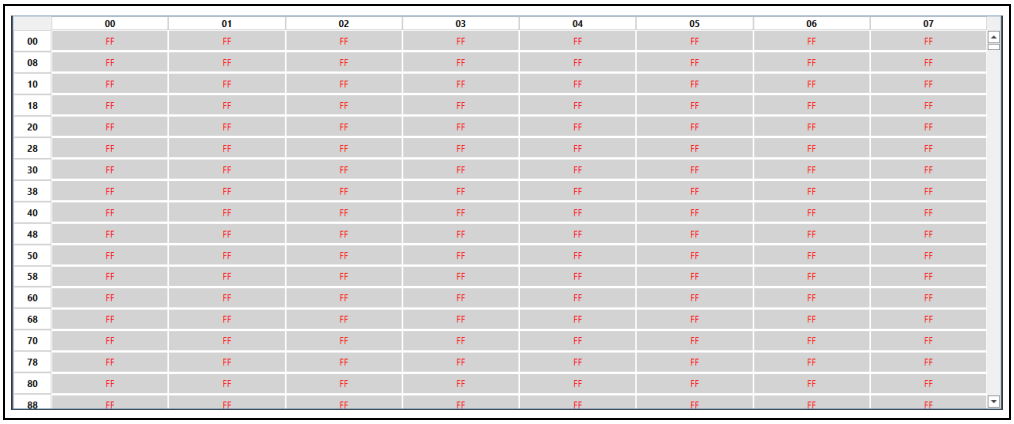
The Transaction Log legend highlights the different data bytes in the I²C protocol that is being sent/received; the device address byte is shown in *red*, the word address byte is shown in *blue*, data input byte(s) is shown in *green* and data output byte(s) or the response is shown in *black*. The Show Legend function can either show or hide the Transaction Log legend.

3.10 GUI MEMORY ARRAY

The GUI memory array is initially populated with the data read from the installed Serial EEPROM. The data of the GUI memory array is organized in 8-byte rows, left to right and in ascending order. The GUI memory array will always be displayed in 8-byte row lengths, regardless of the installed device's page size. The GUI memory array data can be modified by the user by using various GUI features that are outlined later in the subsequent sections.

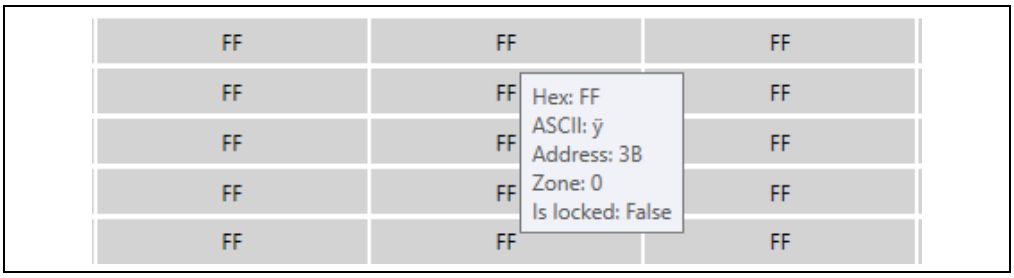
The GUI memory array features memory cell font coloring that is used to highlight the different state of that memory cell or cells. *Black* font indicates that the cell or cells have not been locked and the user can write to that word address or range of word addresses. *Red* font indicates that cell or cells are write-protected. *Yellow* font indicates that the memory array cell or cells have been changed in the internal GUI buffer and have not been written to the Serial EEPROM (see **Section 3.11.5 "PROGRAM"** for additional information).

FIGURE 3-11: MEMORY ARRAY



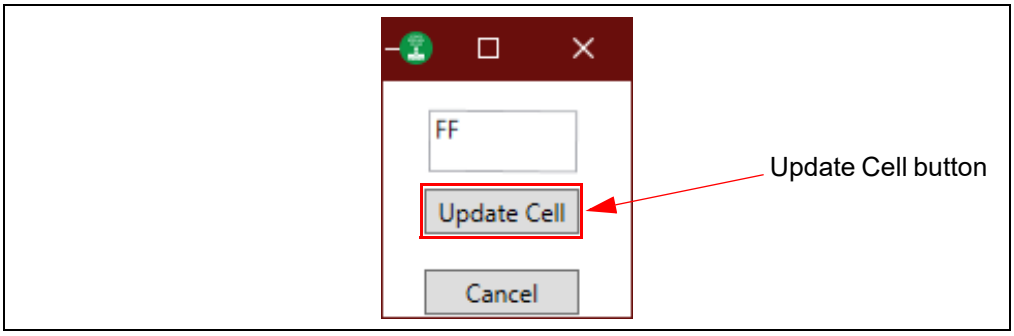
When the user hovers the mouse cursor over the GUI memory array, a pop-up appears to show the data in *HEX*, data in *ASCII*, *Address*, *Zone: #* and Zone Protection state (*Is locked*:) of that particular memory cell. This is illustrated in Figure 3-12.

FIGURE 3-12: ARRAY HOVER



The user can change the content of a cell by double clicking a word address or memory cell in the GUI memory array. In order to change the content of a cell, the user should update the value, followed by pressing the **Update Cell** button. Once the cell is updated, the cell font will become *yellow*. This indicates to the user that they must program the device using the Program Feature (see **Section 3.11.5 "PROGRAM"** for additional information).

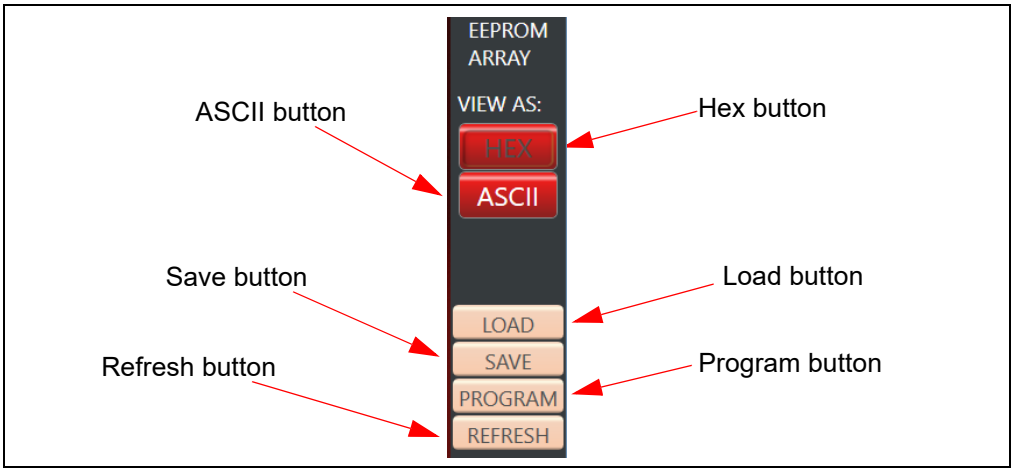
FIGURE 3-13: ARRAY UPDATE CELL



3.11 ARRAY ACTIONS

Array actions allow the user to manipulate the GUI memory array in terms of how the data is displayed (HEX or ASCII) and also allow the user to save the GUI memory array or load a previous array.

FIGURE 3-14: ARRAY ACTIONS



3.11.1 HEX

The **HEX** button displays the GUI memory array in hexadecimal (HEX) format.

3.11.2 ASCII

The **ASCII** button displays the GUI memory array in American Standard Code for Information Interchange (ASCII) format.

3.11.3 LOAD

The **LOAD** button gives the user the option to load a previously saved GUI memory array (either HEX (.hex) or TEXT (.txt) file). The file, once loaded, will be used to populate the internal GUI buffer. Once the file is loaded in the GUI array buffer, the user must program the installed device using the **PROGRAM** button in order to write the data to the installed device (see **Section 3.11.5 "PROGRAM"** for additional information).

Note:	The loaded file must follow a specific format. In order to determine the correct file format, it is recommended to save a GUI memory array as a reference (see **Section 3.11.4 "SAVE"** for additional information) and refer to that file when formatting the data.

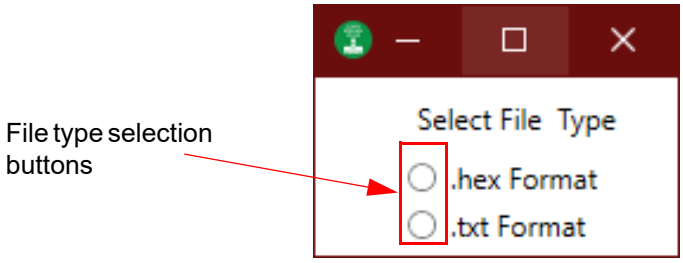
FIGURE 3-15: LOAD

3.11.4 SAVE

The **SAVE** button gives the user the ability to save the current state of the internal GUI buffer. The GUI memory array can be saved as either a HEX (.hex) file or TEXT (.txt) file based on the user preference. Once a file type is selected, a file explorer will pop up, prompting the user to specify the file directory and name of the file.

Note: When using the Save feature, the software will create the data for the saved file based on the internal GUI buffer and not on the actual data from the Serial EEPROM.

FIGURE 3-16: SAVE



3.11.5 PROGRAM

The Program feature can be used to write the GUI array buffer to the installed Serial EEPROM memory array. When the **PROGRAM** button is pressed, the current internal GUI buffer will be written to the Serial EEPROM memory. The Program feature must be used when a cell is updated (*yellow* shaded), or when a file (.hex or .txt) is loaded. If the Program feature is not used, the data in the internal GUI buffer will not be written to the installed Serial EEPROM.

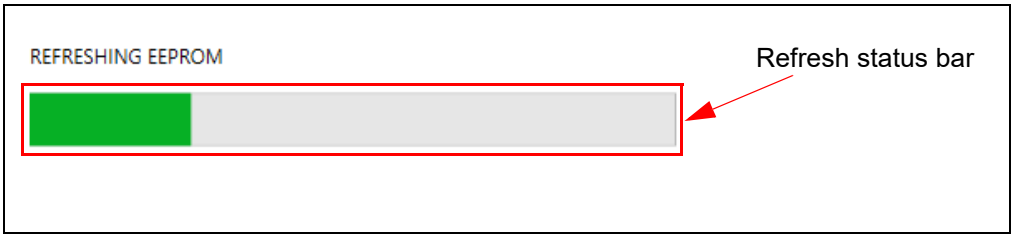
When the Program feature is used to program the Serial EEPROM memory array, that entire memory region will be written with the current data in the internal GUI buffer rather than only the changed values. If a specific data byte or bytes are to be programmed, it is recommended to use the Write feature by pressing the **WRITE** button (see **Section 3.13.2 "Write"** for additional information).

3.11.6 REFRESH

The **REFRESH** button reads the Serial EEPROM memory array and Security register of the installed device and then populates the GUI memory array and Security register with that data. If there is data in the internal GUI buffer (*yellow*-shaded cell) when the Refresh feature is used, that data will be replaced with the data read from the Serial EEPROM. After the completion of any write operation to the Serial EERPOM, the GUI will automatically update the GUI memory array and Security register using the Refresh feature.

Note: If a new device is installed while leaving the USB Base Board connected to the user's PC, it is recommended to use the Device Query feature instead of the Refresh feature to ensure robust GUI operation.

FIGURE 3-17: REFRESH

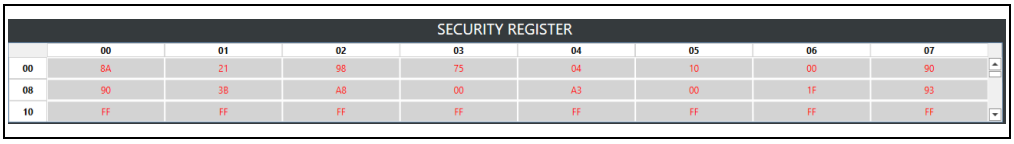


3.12 SECURITY REGISTER

The Security register consists of two regions (size based on the selected supported device) with a factory-programmed unique serial number in the lower 16 bytes (address 00h to 0Fh) in the first section and a user-programmable lockable identification page in the second section. The *red* font cells indicate they are locked and cannot be modified by the user; *black* font cells indicate that the cell or cells are unlocked and can be modified by the user. The entire Security register can be locked by using the SET DEVICE FEATURES pane (see **Section 3.7 "Set Device Features"**).

Note: Once the Security register has been locked, it cannot be unlocked and will permanently set to ROM (Read-Only Memory).

FIGURE 3-18: SECURITY REGISTER



3.13 ARRAY BUTTONS

The array buttons, which are located below the GUI Security register, allow the user to perform read and write operations to the Serial EEPROM, navigate to specific word addresses in the GUI memory array and also provides various support functions.

FIGURE 3-19: ARRAY BUTTONS

3.13.1 Read

The Read feature allows the user to read the entire Serial EEPROM memory array, a specific word address or a range of word addresses, the Security register, the serial number, MAC/EUI and/or the Manufacturer ID register. When the **READ** button is pressed, a pop-up window appears, allowing the user to enter details related to the read operation to be performed.

Note: The Read feature will not update the GUI memory array or GUI Security register. To update the internal GUI buffer, use the Refresh feature by pressing the **REFRESH** button (see the **Section 3.11.6 "REFRESH"** for additional information).

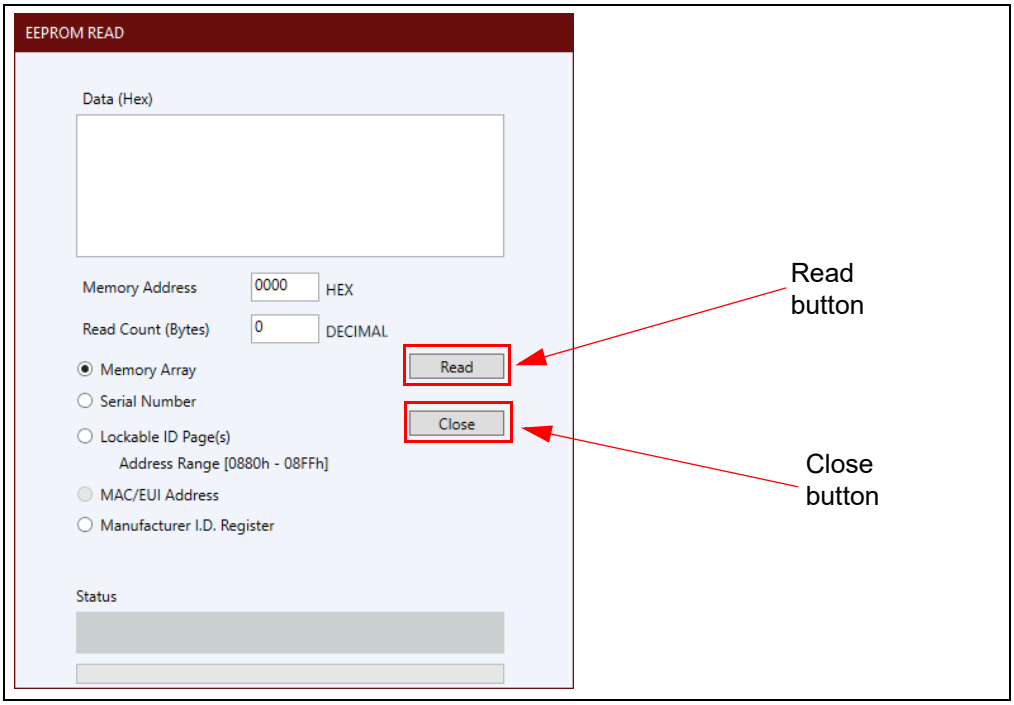
The user can input a starting word address using the Memory Address field that the read operation will start at (in hexadecimal) and the Read Count or the amount of bytes to be read. The user can then select what read operation is to be performed.

Once all the input data has been filled, press the **READ** button to start the read operation. A status message is included at the bottom of the window to notify the user that the read operation is complete by displaying "*Successful*".

> **Note:** If the user performs a read operation to the Security register, reads the serial number, MAC/EUI or the Manufacturer I.D. register, the GUI will automatically populate the starting memory address for the user starting at the first byte of the region, depending on which is selected. The user may be able to change the starting address, but the GUI will limit the word address to the boundary of that region.

Once the read operation is complete, the data will be displayed in hexadecimal in the "Data (Hex)" field. The user can perform as many read operations as preferred from this window. For each new read operation, the "Data (Hex)" field will be re-written using the data read from the current read operation being performed. Once all read operations are completed, the user can close the window by pressing the **Close** button.

FIGURE 3-20: READ OPERATION



3.13.2 Write

The Write feature allows the user to write the entire Serial EEPROM memory array, a specific word address or a range of word addresses and the writable portion of the Security register (Lockable ID Page). When the **WRITE** button is pressed, a pop-up window appears, allowing the user to enter details related to the write operation to be performed.

The user inputs the data that is to be written in the "Data" field (in hexadecimal) or the user can fill the "Data" field with a single-byte data pattern by setting the "Value" and the "Count (Bytes)" found at the top of the window. Once these fields have been populated, press the **Fill Array** button and the data will be populated. The user can also clear the "Data" field by pressing the **Clear Array** button.

Once data has been input, the user then selects the starting word address using the "Memory Address (Hex)" field that the write operation will start at (in hexadecimal). The "Count (Decimal)" or the number of bytes to be written is filled automatically based on the amount of data bytes in the "Data" field. The user can also select whether the write operation will occur in the Serial EEPROM memory array ("Memory Array") or the Security register ("Lockable ID Page").

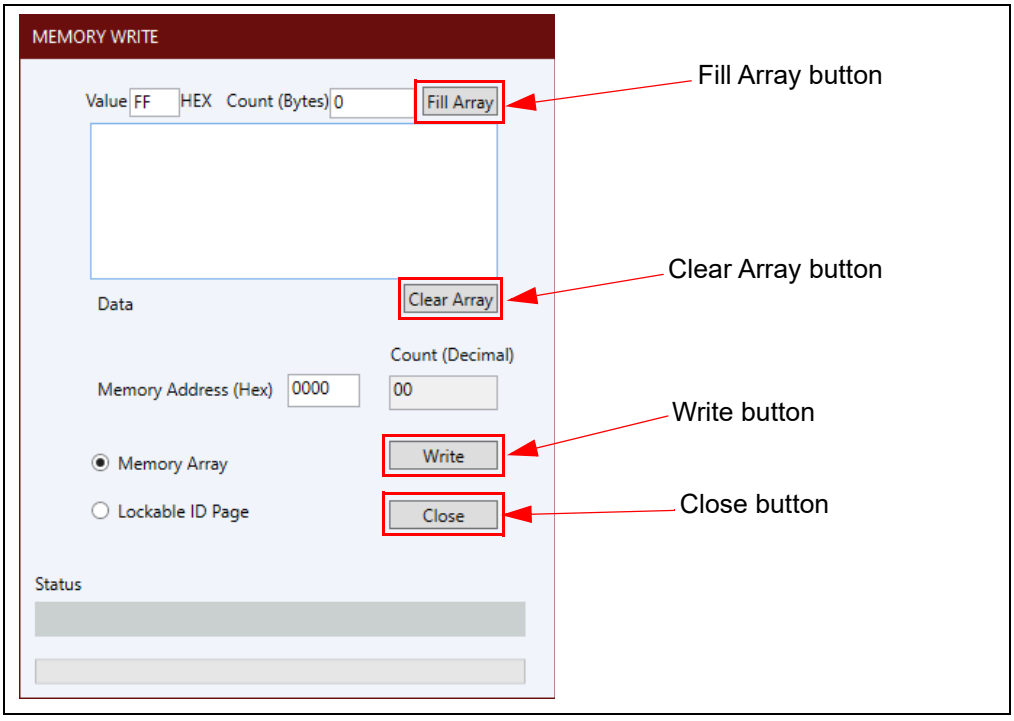
Note: If the user performs a write operation to the Security register, the GUI will automatically populate the memory address for the user stating at the first byte of the Lockable ID Page of the Security register. The user can change the starting word address of the write operation, but the GUI limits the word address to the Lockable ID Page of the Security register.

The GUI limits write operations to the physical device boundary of that region.The write operation will be aborted if the address boundary of that particular memory region is exceeded. Once all the input data has been input, press the **Write** button to start the write operation. A status message is included at the bottom of the window to notify the user that the write operation is complete by displaying "*Successful*".

Note: Due to the construction of the Serial EEPROM devices, the write operation is limited to the page size or boundary of the installed device. If the "Data" field exceeds the page boundary of the installed device, the GUI will automatically parse the data into the correct page size and perform multiple write operations until the entire "Data" field has been written to the Serial EEPROM.

Once the write operation is complete, the user can close the window by pressing the **Close** button or continue with another write operation. Once the **Close** button is pressed, a progress bar for the Refresh feature is displayed and the entire GUI memory array and Security register are read and the GUI buffer is updated with the new data.

FIGURE 3-21: WRITE OPERATION

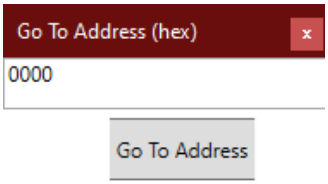


3.13.3 Go To Address

The Go To Address feature allows the user to jump to a specific word address in the GUI memory array. Once the **Go To Address** button is pressed, the memory address that was input will be highlighted in a black box in the GUI memory array.

Note:	The Go To Address feature does not work for the GUI Security register and only works for addresses within the GUI memory array.

FIGURE 3-22: GO TO ADDRESS

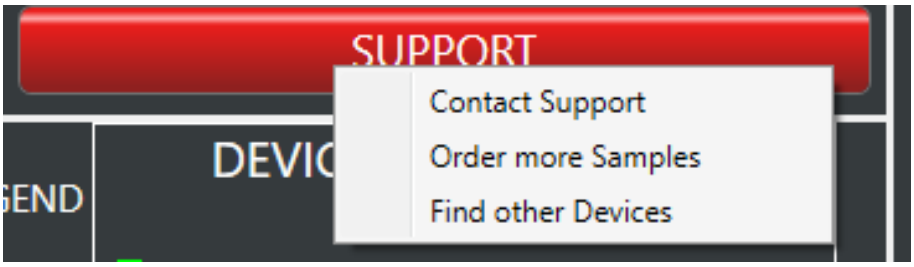


3.13.4 Support

The **SUPPORT** button provides a hyperlink to various support pages. The support feature allows the user to select between three support classes:

- "Contact Support" which directs the user to the Microchip support portal
- "Order more Samples" which directs the use to MicrochipDIRECT
- "Find other Devices" which directs the user to Microchip Serial EEPROM memory page

FIGURE 3-23: SUPPORT



Chapter 4. USB Base Board Firmware Update

4.1 INTRODUCTION

The Microchip Technology Serial Memory Evaluation kit has a built-in ability to update the USB Base Board using a sequence of steps outlined by GUI or using the Atmel **FL**exible **I**n-system **P**rogramming (FLIP) software.

> **Note:** Both USB Base Board firmware update modes use Atmel FLIP software and, therefore, it must be installed on the user's PC in order to perform either firmware update process.

4.2 USING THE GUI TO UPDATE THE FIRMWARE

If the GUI detects the firmware needs to be updated, it will prompt the user to update the firmware using a sequence of steps outlined on the screen. Please follow the steps on the screen and the firmware will be updated. Note that once the USB Base Board firmware has been updated, it is recommended that the customer disconnect the USB Base Board from the PC and reconnect (as specified by the GUI) before restarting the GUI.

> **Note:** The USB Base Board must be reset or disconnected after the firmware update in order to complete the process.

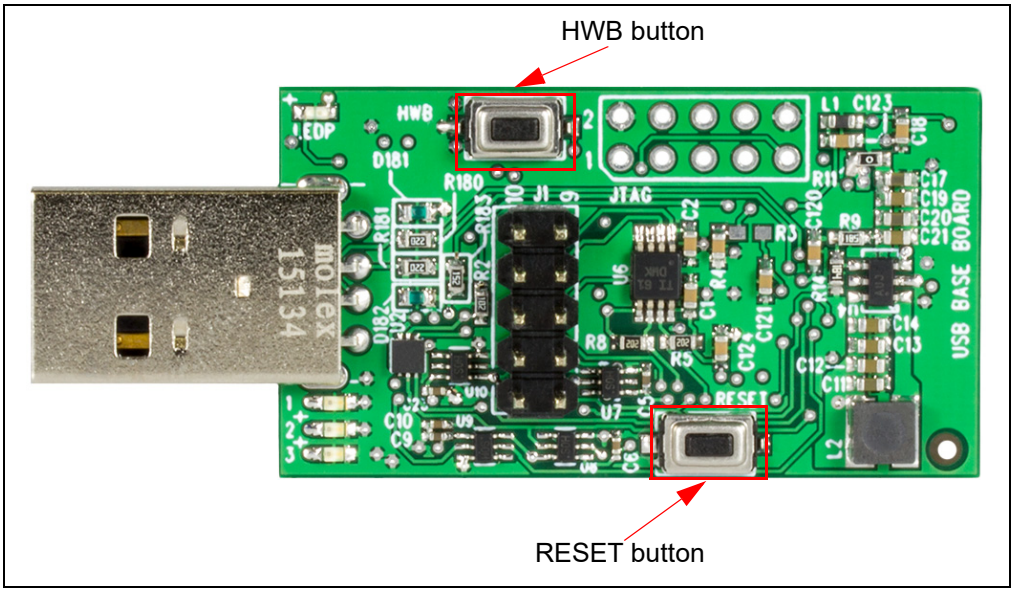
4.3 USING THE FLIP SOFTWARE TO UPDATE THE FIRMWARE

If the user chooses to update the firmware using the more manual FLIP software process, first plug in the USB Base Board into a USB port without the I²C Socket Board connected. The PC will recognize the USB Base Board as "I2C Evaluation Kit" in the PC's Devices and Printers window from the Control Panel, if there is firmware already loaded in the USB Base Board (Figure 4-1). Note that the COM port numeration may change based on the user's PC.

FIGURE 4-1: I2C EVALUATION KIT COM PORT

Once the USB Base Board is plugged in and recognized by the PC, the user should enable DFU mode on the USB Base Board. DFU mode is enabled by a specific sequence of **HWB** and **RESET** buttons. Refer to Figure 4-2 for locations of the **HWB** and **RESET** buttons.

FIGURE 4-2: USB BASE BOARD BUTTONS



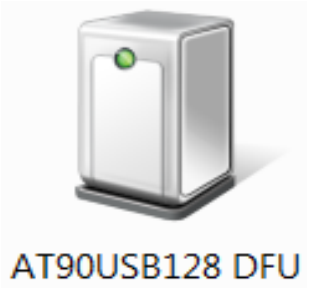
Once the **HWB** and **RESET** buttons have been located, use the specific press and hold sequence shown below to enable DFU mode on the USB Base Board:

- Press and hold the **HWB** button
- Press and release the **RESET** button
- Release the **HWB** button

Note:	Once DFU mode is enabled on the USB Base Board, the rest of the firmware update process must be completed in order to ensure robust USB Base Board operation.

Once the USB Base Board has DFU mode enabled, allow the PC to relearn the USB Base Board as "AT90USB128 DFU" (Figure 4-3). If the PC does not automatically recognize the USB Base Board as stated above and shown below, it is recommended to unplug the USB Base Board from the PC and restart the procedure.

FIGURE 4-3: AT90USB128 DFU COM PORT

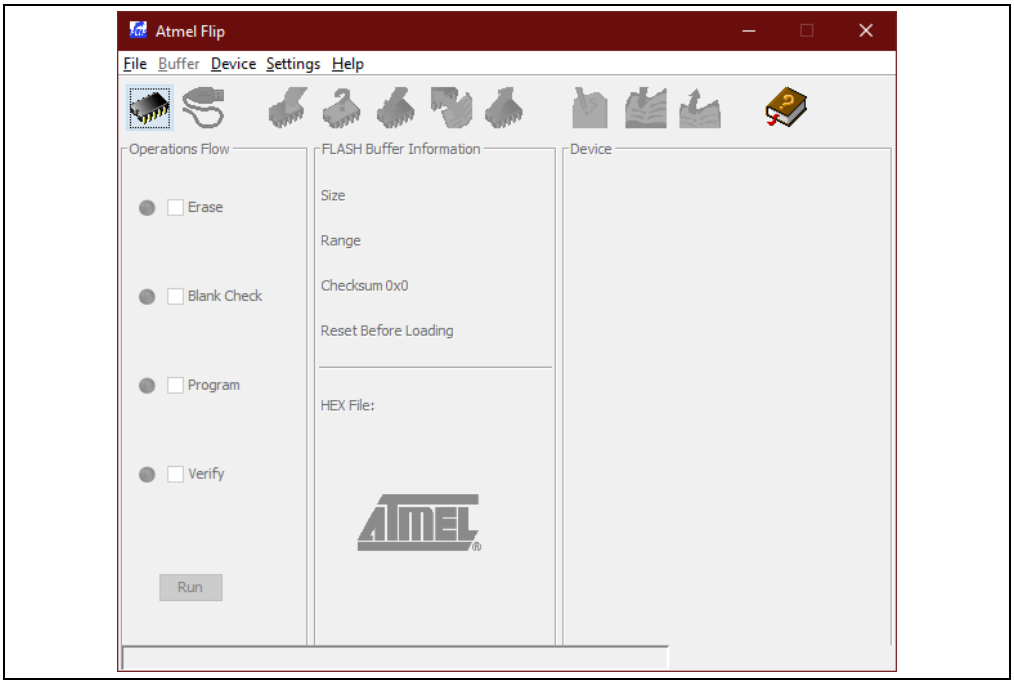


4.4 FLIP SOFTWARE UTILITY

Once the USB Base Board has DFU mode enabled and the COM port is relearned by the PC, perform the following sequence using the FLIP Software Utility to update the USB Base Board firmware:

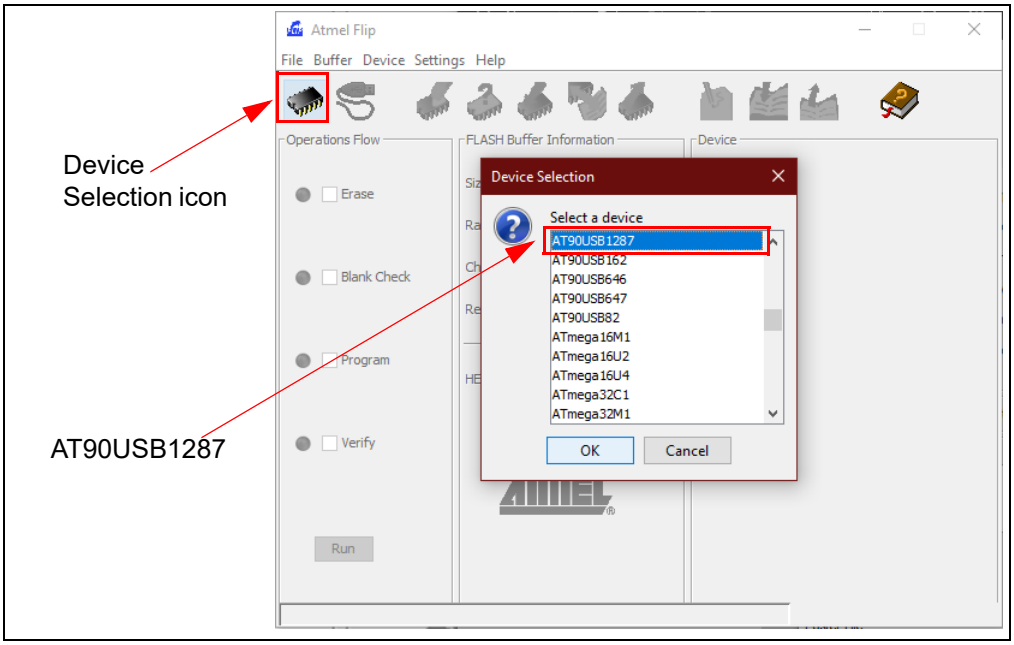
1. Open the FLIP Software Utility (Figure 4-4) by either selecting the desktop icon (if created) or selecting "Flip 3.4.7" (3.4.7 indicates the version) from the Start Menu folder.

FIGURE 4-4: FLIP SOFTWARE UTILITY



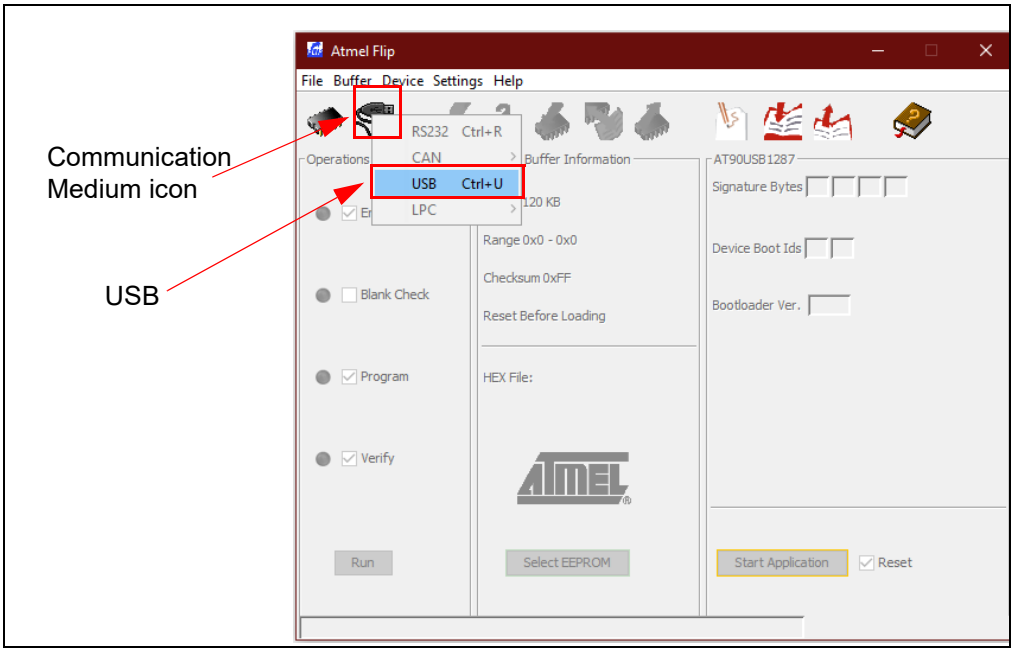
2. After opening the FLIP Software Utility, navigate to the Device Selection icon as shown below. Select the "AT90USB1287" as the device and press the **OK** button.

FIGURE 4-5: DEVICE SELECTION



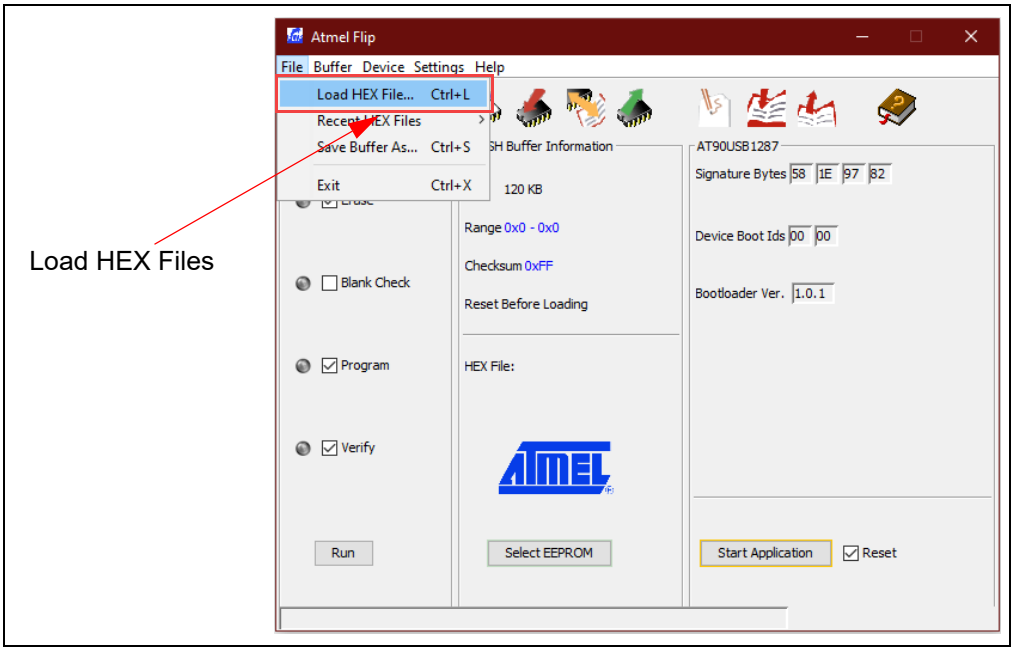
3. Once the target device has been selected, click on the Communication Medium icon as shown below and select "USB". Once "USB" is selected, an additional dialog box is displayed. Press the **Open** button to continue.

FIGURE 4-6: COMMUNICATION MEDIUM SELECTION



4. Once the communication between the PC and the AT90USB1287 (USB Base Board microcontroller) has been established, navigate to File and select "Load HEX Files" as shown in Figure 4-7.

FIGURE 4-7: LOAD FILE

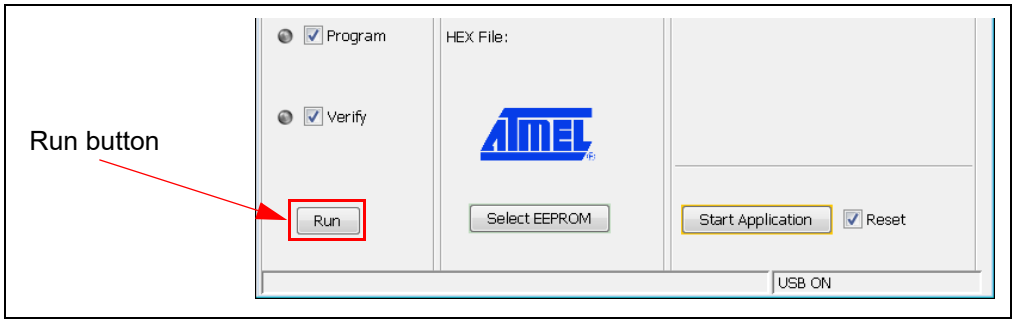


5. Proceed to load the I²C firmware by navigating to the firmware found at:
   `C:\Program Files (x86)\Microchip\Serial Memory Evaluation Kits\I²C\Firmware`

> **Note:** If the default installation was not used when the DM160237 I²C GUI was installed, it is the user's responsibility to determine the I²C firmware file location.

6. Once the HEX file has been loaded into the FLIP Software Utility, press the **Run** button to program the new firmware to the AT90USB1287 as shown in Figure 4-8. A progress or status bar is included to show the overall progress of the hex image program.

FIGURE 4-8: RUN FLIP SOFTWARE

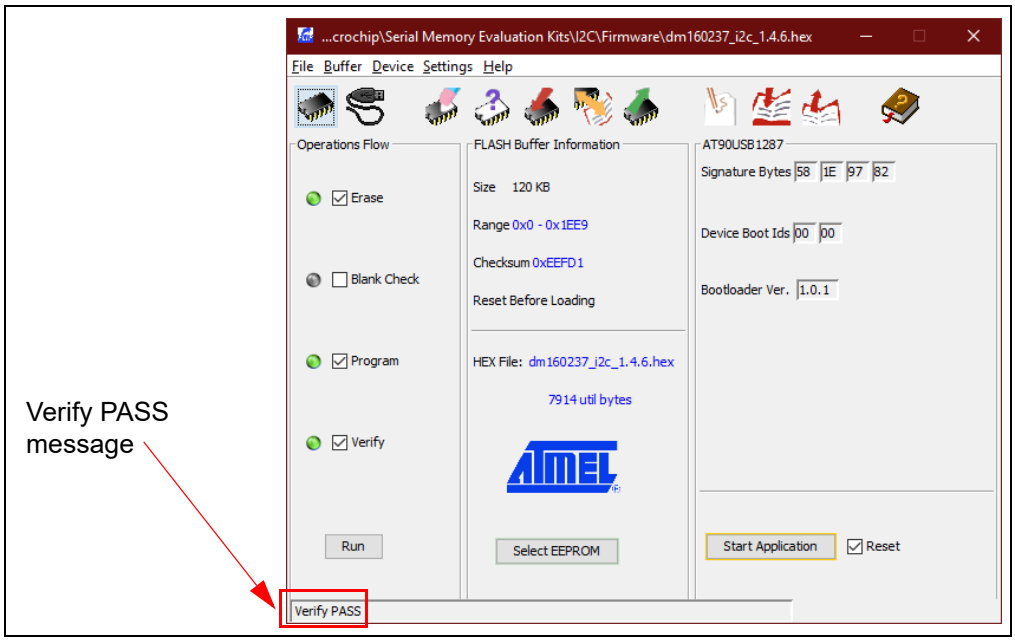


7. If the "Verified Pass" is reported in the FLIP Software Utility (see Figure 4-9), close the FLIP Software Utility and remove the USB Base Board from the PC. The USB Base Board Firmware Update procedure is complete.

> **Note:** If the USB Base Board was updated successfully, the PC will recognize the USB Base Board as "I2C Evaluation Kit" (see Figure 4-1).

If the "Verified Pass" is not shown, or any other error is displayed, it is recommended to unplug the USB Base Board from the PC and restart the entire firmware update procedure.

FIGURE 4-9: FLIP SOFTWARE COMPLETE



Chapter 5. Troubleshooting Guide

ISSUE: **USB BASE BOARD IS NOT RECOGNIZED BY THE USER'S PC**

SOLUTION:

The USB Base Board driver is not installed or not installed properly. Download and install the USB Base Board driver using the procedure outlined in **Section 2.2 "Installing the Graphical User Interface (GUI)"**.

The USB Base Board firmware was not programmed properly or has become corrupted. Perform the USB Base Board Firmware Update procedure outlined in **Chapter 4. "USB Base Board Firmware Update"**.

If the problem persists, contact your local Sales representative for additional support or create a support ticket at www.microchip.com/support.

ISSUE: **GUI STATES THE USER MUST PERFORM A FIRMWARE UPDATE TO THE USB BASE BOARD**

SOLUTION:

Perform the USB Base Board Firmware Update procedure outlined in **Chapter 4. "USB Base Board Firmware Update"**.

If the problem persists, contact your local Sales representative for additional support or create a support ticket at www.microchip.com/support.

ISSUE: **GUI STATES THERE IS NO DEVICE INSTALLED IN THE I²C SOCKET BOARD**

SOLUTION:

Close the GUI and remove the USB Base Board from the PC. Verify that the I²C Socket Board and the USB Base Board are connected properly. Verify that the device is installed correctly in the SOIC socket on the I²C Socket Board and that the pin 1 indicators match. Refer to **Section 2.4 "Evaluation Kit Setup Procedure"** for additional information. Make sure the device is completely sitting in the socket. Plug the I²C Socket Board into the USB Base Board and restart the GUI.

If the problem persists, contact your local Sales representative for additional support or create a support ticket at www.microchip.com/support.

Appendix A. Schematics

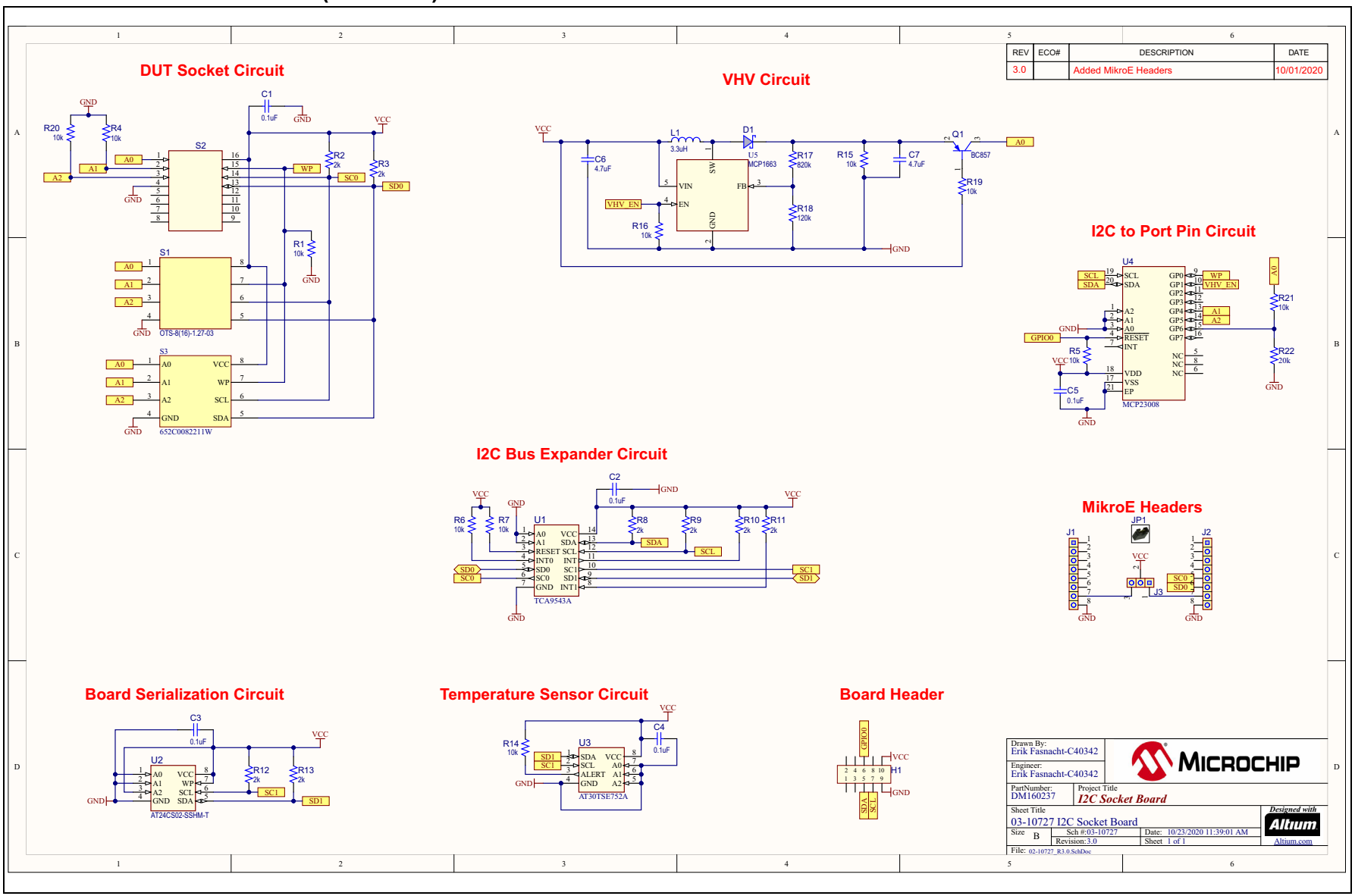
A.1 INTRODUCTION

This appendix contains the following schematics for the DM160237 Serial Memory I²C Evaluation Kit:

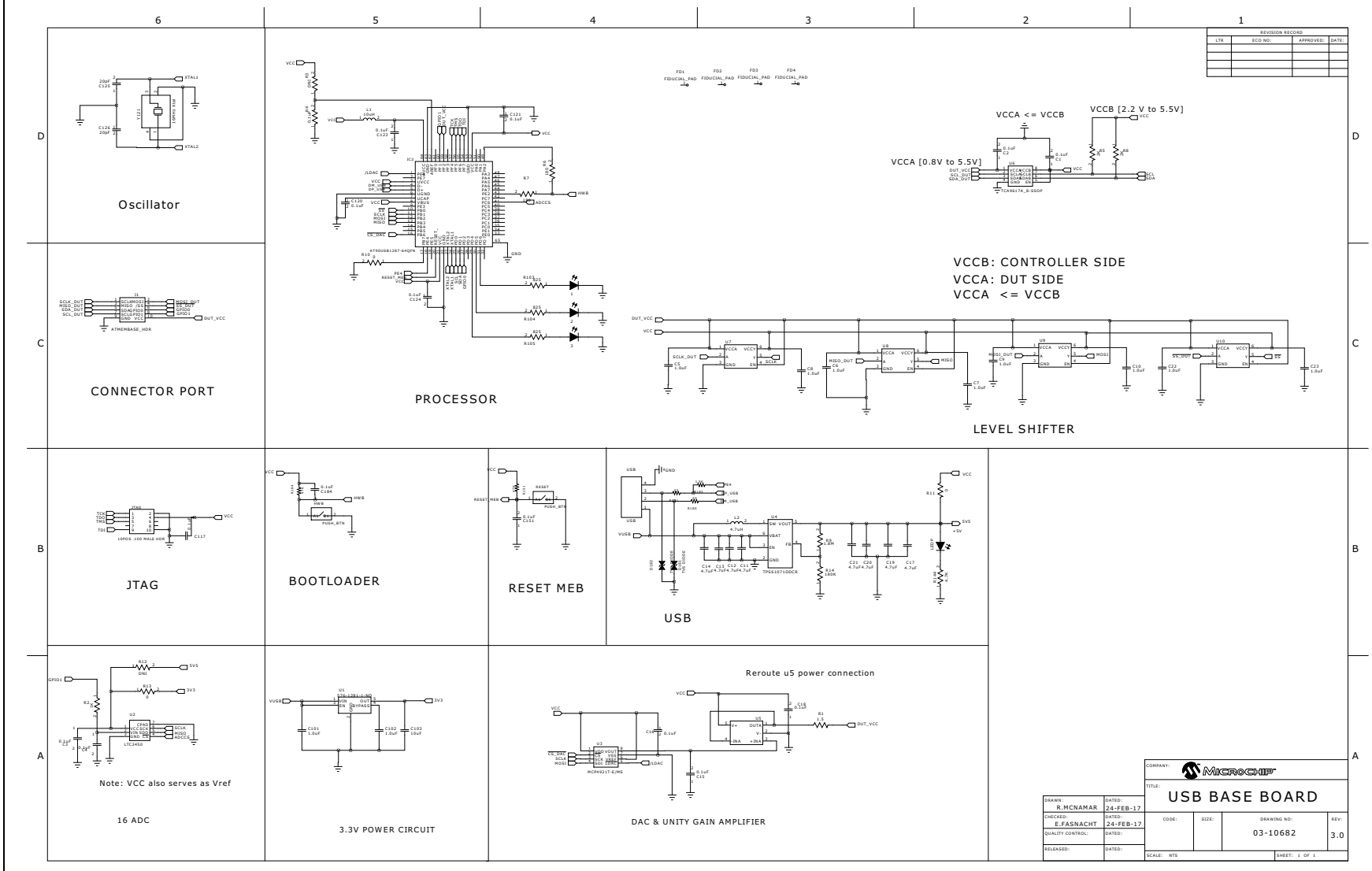
- I²C Socket Board (02-10727)
- USB Base Board (02-10682)

Note: Electronic versions of the I²C Socket Board and USB Base Board schematics can be downloaded from http://www.microchip.com/DM160237 under "Documentation and Software".

A.2 I²C SOCKET BOARD (02-10727)



A.3 USB BASE BOARD (02-10682)



Appendix B. Bill of Materials (BOM)

TABLE B-1: I²C SOCKET BOARD (02-10727)(1)

Qty	Reference	Description	Manufacturer	Part Number
5	C1, C2, C3, C4, C5	Ceramic Capacitor, 0.1 µF, 10V, 10% X7R SMD 0603	Kemet	C0603C104K8RACTU
2	C6, C7	Ceramic Capacitor, 4.7 µF, 16V, 10% X5R SMD 0603	TDK Corporation	C1608X5R1C475K080AC
1	D1	Diode Schottky 620 mV 1A, 20V SMD SOD-523	NXP Semiconductors	PMEG2010AEB, 115
2	J1, J2	Connector Header Through Hole 8 position 0.100" (2.54 mm)	Würth Elektronik	61300811121
1	J3	Connector Header Through Hole 3 position 0.100" (2.54 mm)	Molex	0901200123
1	H1	Receptacle Connector, 100", 10 positions Dual Gold	Samtec Inc.	SSW-105-01-F-D
1	L1	Inductor 3.3 µH 10% SMD 0603	Abracon LLC	AIML-0603-3R3K-T
1	PCB	Printed Circuit Board – DM160237 I²C Socket Board	Microchip Technology Inc.	**01-10727**
1	Q1	Transistor BJT PNP 45V 100 mA 200 mW SOT23-3	NXP Semiconductors	BC857C, 215
8	R2, R3, R8, R9, R10, R11, R12, R13	Resistor TKF, 2 kOhms, 1%, 1/10W, 0603	Panasonic	ERJ-3EKF2001V
11	R1, R4, R5, R6, R7, R14, R15, R16, R19, R20, R21	Resistor SMD, 10 kOhms, 5%, 1/10W, 0603	Panasonic	ERJ-3GEYJ103V
1	R17	Resistor SMD, 820 kOhms, 1%, 1/10W, 0603	Yageo Corporation	RC0603FR-07820KL
1	R18	Resistor SMD, 120 kOhms, 1%, 1/10W, 0603	Panasonic	ERJ-3EKF1203V
1	R22	Resistor SMD, 20 kOhms, 5%, 1/10W, 0603	Panasonic	ERJ-3GEYJ203V
1	S1	8-Lead SOIC Socket	Enplas	OTS-8(16)-1.27-03
1	U1	IC Switcher Dual W/Reset TSSOP-14	Texas Instruments	TCA9543APWR
1	U2	Atmel 2 Kb Serialized Two-Wire Device SOIC-8	Microchip Technology Inc.	**AT24CS02-SSHM-T**
1	U3	Atmel 2 Kb Digital Temperature Sensor SOIC-8	Microchip Technology Inc.	**AT30TSE752A-SS8M-T**
1	U4	IC Interface GPIO-Port Expand I²C 8-Port QFN-20	Microchip Technology Inc.	**MCP23008T-E/ML**
1	U5	Microchip Analog Switcher Boost 32V SOT23-5	Microchip Technology Inc.	**MCP1663T-E/OT**

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

TABLE B-2: USB BASE BOARD (02-10682)[1]

Qty	Reference	Description	Manufacturer	Part Number
3	1, 2, 3	LED RED CLEAR 0603 SMD	Lite-On® Technology Corporation	LTST-C191KRKT
15	C1, C2, C3, C4, C15, C16, C18, C117, C120, C121, C123, C124, C151, C184, R4	Ceramic capacitor, 0.1 µF, 50V Y5V 0603	Yageo Corporation	CC0603ZRY5V9BB104
10	C5, C6, C7, C8, C9, C10, C22, C23, C101, C102	Ceramic capacitor, 1 µF, 6.3V X5R 0402	Taiyo Yuden Co., Ltd.	JMK105BJ105KV-F
8	C11, C12, C13, C14, C17, C19, C20, C21	Ceramic capacitor, 4.7 µF, 6.3V X5R 0603	Taiyo Yuden Co., Ltd.	JMK107BJ475KA-T
1	C103	Ceramic capacitor, 10 µF, 6.3V X5R 0603	Taiyo Yuden Co., Ltd.	JMK107BJ106MA-T
2	C125, C126	Ceramic capacitor, 20 pF, 250V C0G/NP0 0603	Johanson Technology, Inc.	251R14S200GV4T
2	D181, D182	TVS Diode, 24VWM 150VC 0603	Littelfuse® Inc.	PGB1010603MR
2	HWB, RESET	Tactile switch SPST-NO 0.05A 12V	Apem, Inc.	ADTSM31NV
1	IC2	IC 8-bit MCU, 128 KB, Flash 64QFN	Microchip Technology Inc.	**AT90USB1287-MU**
1	J1	Connector – Header, 100" Dual STR, 10 positions	Sullins Connector Solutions	PRPC005DAAN-RC
3	JTAG, R12, R3	**DO NOT POPULATE**		
1	L1	Fixed inductor, 10 µH, 50 mA, 900 MOHM SMD	Murata Electronics North America, Inc.	LQM18FN100M00D
1	L2	Fixed inductor, 4.7 µH, 1.2A 105 MOHM	Wurth Electronics Inc.	744031004
1	LEDP	LED Blue Diffused, 0603 SMD	Osram Opto Semiconductors GmbH	LB Q39G-L2OO-35-1
1	PCB	Printed Circuit Board – DM160237 USB Base Board	Microchip Technology Inc.	**01-10682**
1	R1	Resistor SMD 1.5 Ohm, 5%, 1/10W 0603	Yageo Corporation	RC0603JR-071R5L
1	R2	Resistor SMD 1K Ohm, 5%, 1/10W 0603	Yageo Corporation	RC0603JR-071KL
2	R5, R8	Resistor SMD 2K Ohm, 5%, 1/10W 0603	Yageo Corporation	RC0603JR-072KL
2	R6, R7	Resistor SMD 180 Ohm, 5%, 1/10W 0603	Yageo Corporation	RC0603JR-07180RL
1	R9	Resistor SMD 499K Ohm, 1%, 1/10W 0603	Yageo Corporation	RC0603FR-07499KL
2	R10, R11	Resistor SMD 0.0 Ohm Jumper, 1/10W 0603	Yageo Corporation	RC0603JR-070RL

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

TABLE B-2: USB BASE BOARD (02-10682)[1] (CONTINUED)

Qty	Reference	Description	Manufacturer	Part Number
1	R13	Resistor SMD 0.0 Ohm Jumper, 1/16W 0402	Yageo Corporation	RC0402JR-070RL
1	R14	Resistor SMD 143K Ohm, 1%, 1/10W 0603	Yageo Corporation	RC0603FR-07143KL
3	R103, R104, R105	Resistor SMD 825 Ohm,1%, 1/10W 0603	Yageo Corporation	RC0603FR-07825RL
1	R144	Resistor SMD 4.7K Ohm, 5%, 1/10W 0603	Yageo Corporation	RC0603JR-074K7L
2	R151, R184	Resistor SMD 47K Ohm, 1%, 1/10W 0603	Yageo Corporation	RC0603FR-0747KL
2	R180, R181	Resistor SMD 22 Ohm, 5%, 1/10W 0603	Yageo Corporation	RC0603JR-0722RL
1	R183	Resistor SMD 1.5K Ohm, 5%, 1/10W 0603	Yageo Corporation	RC0603JR-071K5L
1	U1	Linear Regulator IC 3.3V, 0.5A, SOT23-5	Microchip Technology Inc.	**MIC5219-3.3YM5-TR**
1	U2	IC ADC 16-bit Sigma-Delta 6-DFN	Linear Technology Corporation	LTC2450CDC#TRMPBF
1	U3	IC DAC 12BIT SNGL W/SPI 8-MSOP	Microchip Technology Inc.	**MCP4921T-E/MS**
1	U4	Boost regulator adjustable IC 0.65A SYNC SOT23	Microchip Technology Inc.	**MCP16251T-I/CH**
1	U5	IC OPAMP GP 3 MHz RRO SOT23-5	Analog Devices, Inc.	AD8531ARTZ-REEL7
1	U6	IC V-Level XLATR FM+ I2C 8-VSSOP	Texas Instruments	TCA9617ADGKR
4	U7, U8, U9, U10	Translator bidirectional SGL LL SC70-6	Analog Devices Inc.	ADG3301BKSZ-REEL7
1	USB	Plug connector USB, 4 positions, right angle PCB	Molex® LLC	0480370001
1	Y121	Crystal 16.0000 MHz, 18 pF SMD	Abracon® LLC	ABM3B-16.000MHZ-B2-T

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

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