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BM70 EVB User's Guide

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Object of Declaration
BM70 EVB Development Kit

EU Declaration of Conformity

Manufacturer: Microchip Technology Inc.
2355 W. Chandler Blvd.
Chandler, Arizona, 85224-6199
USA

This declaration of conformity is issued by the manufacturer.

The development/evaluation tool is designed to be used for research and development in a laboratory environment. This development/evaluation tool is not a Finished Appliance, nor is it intended for incorporation into Finished Appliances that are made commercially available as single functional units to end users under EU EMC Directive 2004/108/EC and as supported by the European Commission's Guide for the EMC Directive 2004/108/EC (8th February 2010).

This development/evaluation tool complies with EU RoHS2 Directive 2011/65/EU.

This development/evaluation tool, when incorporating wireless and radio-telecom functionality, is in compliance with the essential requirement and other relevant provisions of the R&TTE Directive 1999/5/EC and the FCC rules as stated in the declaration of conformity provided in the module datasheet and the module product page available at www.microchip.com.

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Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA


Derek Carlson
VP Development Tools

12-Sep-14
Date

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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 web site (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 BM70BLES1FC2 Evaluation Board (EVB). Items discussed in this chapter include:

- [Document Layout](#)
- [Conventions Used in this Guide](#)
- [Recommended Reading](#)
- [The Microchip Web Site](#)
- [Development Systems Customer Change Notification Service](#)
- [Customer Support](#)
- [Document Revision History](#)

DOCUMENT LAYOUT

This document describes how to use the BM70BLES1FC2 Evaluation Board (EVB), (also referred to as “Evaluation kit”) as a development tool to emulate and debug firmware on a target board. This user's guide is composed of the following chapters:

- **Chapter 1. “Introduction”** provides an overview of the BM70BLES1FC2 EVB and its features.
- **Chapter 2. “Hardware”** provides hardware details of the BM70BLES1FC2 EVB.
- **Chapter 3. “Flash Programming Procedure”** provides information about various steps involved in downloading the Flash code of the BM70BLES1FC2 EVB.
- **Chapter 4. “UI Configuration and Download”** describes UI settings and UI table download procedures of the BM70BLES1FC2 EVB.
- **Chapter 5. “UART Command Tool Environment Setting”** provides information about the Auto Pattern Test and Manual Test tools of the BM70BLES1FC2 EVB.
- **Appendix A. “Reference Schematics”** provides information about the EVB circuits of the BM70 BLES1FC2 EVB.

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CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Italic characters	Referenced books	<i>MPLAB IDE User's Guide</i>
	Emphasized text	...is the <i>only</i> 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	<u><i>File > Save</i></u>
Bold characters	A dialog button	Click OK
	A tab	Click the Power tab
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
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'
<i>Italic Courier New</i>	A variable argument	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets []	Optional arguments	mcc18 [options] <i>file</i> [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) { ... }
Notes	A Note presents information that we want to re-emphasize, either to help you avoid a common pitfall or to make you aware of operating differences between some device family members. A Note can be in a box, or when used in a table or figure, it is located at the bottom of the table or figure.	Note: This is a standard note box.
		CAUTION
		This is a caution note.
Notes		Note 1: This is a note used in a table.

RECOMMENDED READING

This user's guide describes how to use the Evaluation kit. The following Microchip document is available and recommended as supplemental reference resources.

BM70/BM71 Data Sheet (DS60001372)

Refer to this document for detailed information on BM70 devices. Reference information found in this data sheet includes:

- BM70 Module features and pin configurations
- Electrical Specifications
- Reference Circuits

THE MICROCHIP WEB SITE

Microchip provides online support via our web site at: <http://www.microchip.com>. This web site makes files and information easily available to customers. Accessible by most Internet browsers, the web site 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 listings
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To register, access the Microchip web site 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 and other language tools
- **Emulators** – The latest information on the Microchip in-circuit emulator, MPLAB REAL ICE™
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debugger, MPLAB ICD 3
- **MPLAB X IDE** – The latest information on Microchip MPLAB X IDE, the Windows® Integrated Development Environment for development systems tools
- **Programmers** – The latest information on Microchip programmers including the PICkit™ 3 development programmer

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 web site at: <http://support.microchip.com>.

DOCUMENT REVISION HISTORY

Revision A (October 2015)

This is the initial released version of this document.

Revision B (October 2015)

This revision includes the following updates:

- Added [Figure 2-1](#), [Table 2-1](#) through [Table 2-10](#)
- Updated [Figure A-1](#), [Figure 3-4](#).

Minor updates to text and formatting were incorporated throughout the document.

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NOTES:

Chapter 1. Introduction

Thank you for purchasing a BM70BLES1FC2 Evaluation Kit. This document describes a detailed information about the Microchip Technology BM70BLES1FC2 Evaluation Board (EVB).

The BM70BLES1FC2 EVB is designed to emulate the functions of the Microchip BM70 BLE module. It also enables the customer to evaluate and demonstrate the capabilities of the Microchip BM70 BLE module.

This chapter includes the following topics:

1.1 “Kit Contents”

1.2 “BM70BLES1FC2 Functionality”

1.3 “BM70 BLES1FC2 Components”

1.4 “USB to UART Converter DUT”

The BM70BLES1FC2 EVB includes an integrated configuration and programming interface for plug-and-play capability. It also provides an integrated test environment for all functions supported in the BM70BLES1FC2 EVB.

1.1 KIT CONTENTS

The Evaluation kit contains the following items:

- A BM70BLES1FC2 module
- A BM70BLES1FC2 Evaluation Board

Note: If you are missing any part of the kit, contact a Microchip sales office for assistance. A list of Microchip offices for sales and service is provided on the back page of this document.

1.2 BM70BLES1FC2 FUNCTIONALITY

The following are key features of the BM70BLES1FC2 Evaluation Board.

- Optional power source between USB, button cell battery and PICTail™ interface
- Connection interface between module UART and MCU Evaluation board
- Connection and test interface between the BM70 module and PC Tool (UART Command Tool)
- Update Flash code or UI table using the USB port (micro-USB)
- Modes configuration for Application mode or Test mode
- LED, push button, I²C and serial Flash test interface

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1.3 BM70 BLES1FC2 COMPONENTS

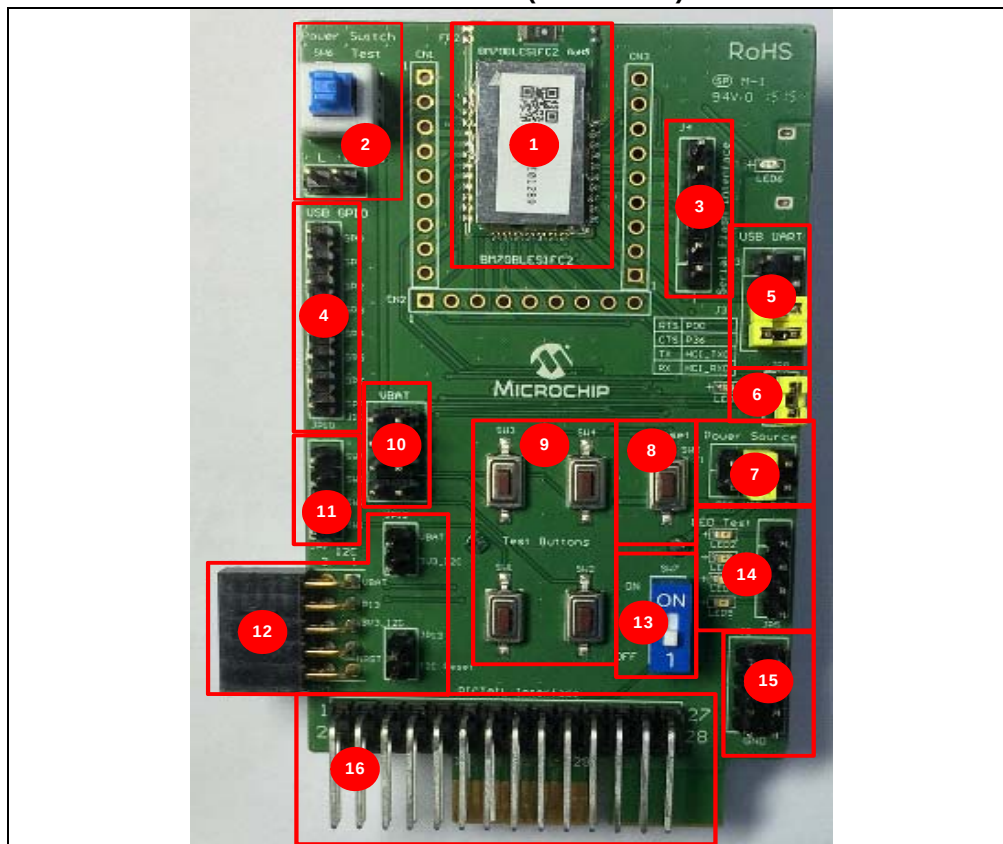
Representations of the layout of the BM70BLES1FC2 Evaluation Board are shown in [Figure 1-1](#) and [Figure 1-2](#)

The top assembly of the board includes these key components, as indicated in [Figure 1-1](#):

1. BM70BLES1FC2 Module.
2. Power Switch Test Button.
3. Serial Flash Interface.
4. USB GPIO interface.
5. USB UART interface.
6. Default LED display.
7. Power Source Connector (Jumper J1).
8. Reset Button.
9. Test buttons (Push-Low).
10. VBAT connector.
11. Test buttons connector (Jumper J7).
12. I²C Interface.
13. DIP Switch SW7.
14. LED test interface.
15. GND test pads.
16. PICtail Interface.

For details on these features, refer to the [Chapter 2. "Hardware Description"](#).

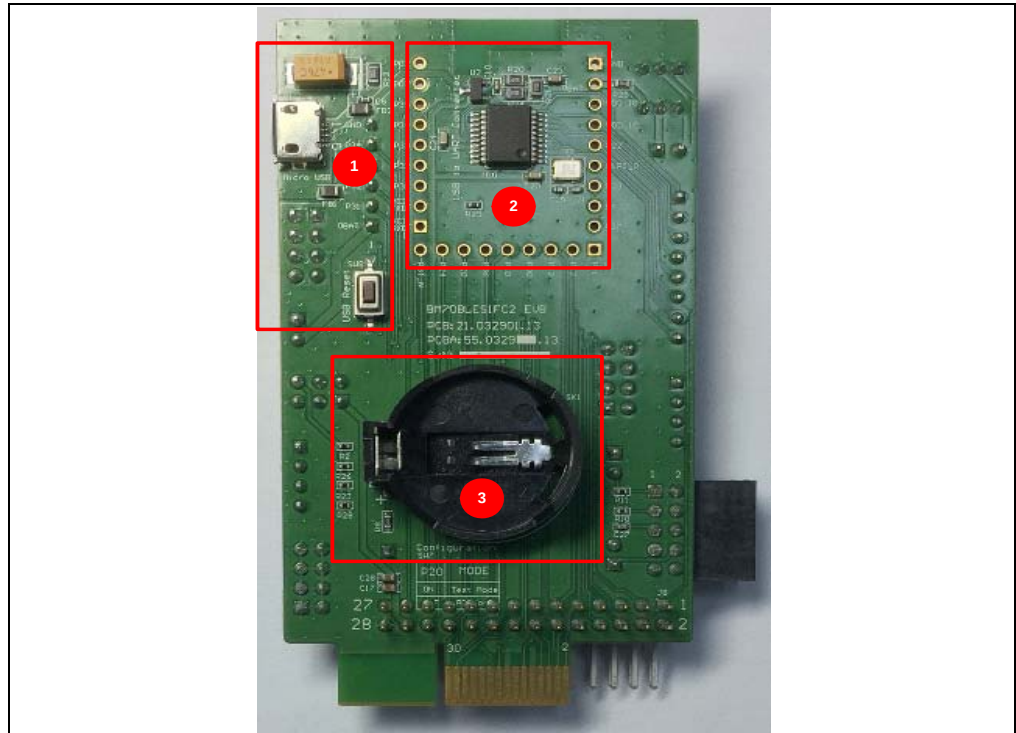
FIGURE 1-1: BM70BLES1FC2 EVB (TOP VIEW)



The bottom assembly of the board includes these key components, as indicated in [Figure 1-2](#):

1. USB to UART converter. Switch SW8 is the USB Reset button.
2. Module pads.
3. Provision for coin cell battery.

FIGURE 1-2: BM70BLES1FC2 EVB (BOTTOM VIEW)

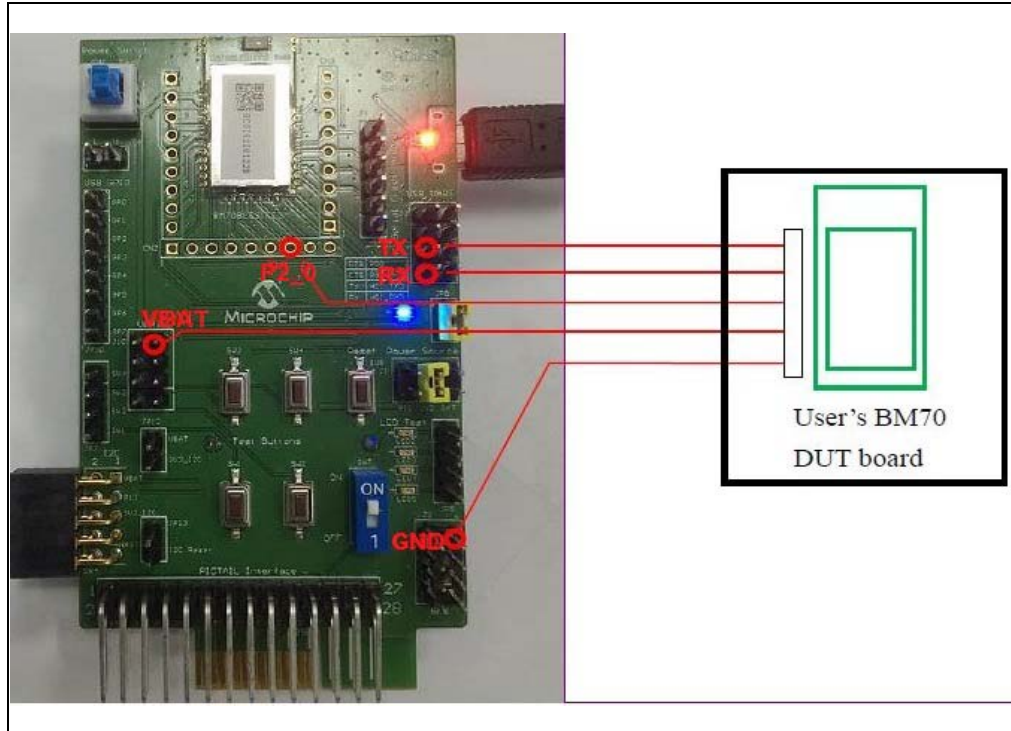


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1.4 USB TO UART CONVERTER DUT

The USB to UART converter circuit can be used independently to connect to the BM70BLES1FC2 Device Under Test (DUT) board by connecting the UART configuration interface, see [Figure 1-3](#). The VBAT, P2_0, Tx, Rx and GND can be connected to the BM70 DUT board for emulation. The user need to configure the BM70BLES1FC2 EVB to Test mode and then connect the USB cable to the PC to power-up the test connection.

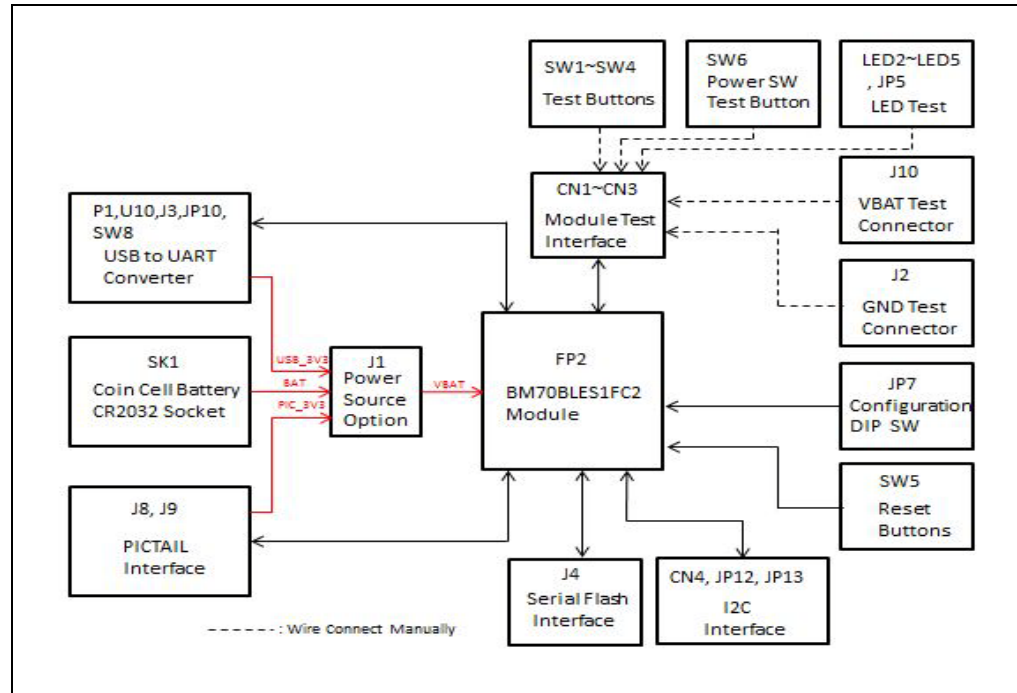
FIGURE 1-3: USB TO UART CONVERTER CONNECTED TO DUT



Chapter 2. Hardware

The BM70BLES1FC2 board includes a range of peripheral features, see [Figure 2-1](#). This chapter describes the hardware features of the BM70BLES1FC2 board.

FIGURE 2-1: BM70 EVB BLOCK DIAGRAM



2.1 HARDWARE FEATURES

The following key features of the BM70 BLES1FC2 board are provided in the order given in [1.3 “BM70 BLES1FC2 Components”](#). Refer to [Figure 1-1](#) and [Figure 1-2](#) for their locations on the board.

2.1.1 Power Supply

There are three ways to supply power to the board:

- Button Cell Battery (SK1)
- USB_3V3
- PICTail 3V3

2.1.2 USB connectivity

The BM70 EVB provides micro-USB cable connectivity.

2.1.3 Switches

Push-button switches provide the following functionalities:

- SW1, SW2, SW3 and SW4 – Test buttons.
- SW5 – Reset button
- SW6 – Power switch test button, which includes Push-High and Push-Low header J6
- SW7 – DIP switch
- SW8 – USB Reset button

2.1.4 LEDs

The six LEDs, LED1 through LED6, are connected to the BM70BLES1FC2 board.

- LED1 – Default LED, connected to P0_2
- LED2, LED3, LED4, and LED5 – Test LEDs
- LED6 – USB connection indicator. This LED will turn ON when USB 5V input is connected.

2.1.5 Jumpers

The following 12 jumpers are available on the BM70BLES1FC2 board. [Table 2-1](#) through [Table 2-12](#) provide the pin and signal details of the jumpers.

TABLE 2-1: POWER SOURCE OPTION CONNECTOR

Part Number	Pin	Signal	Description
J1	1	PIC_3V3	Power Source from PICtail™ 3.3V, enabled by jumper connection to J1 pin 2
	2	VBAT	BM70 Power source input
	3	USB_3V3	Power Source from USB 5V ~ 3.3V LDO output enables by jumper connection to J1 pin 4
	4	VBAT	BM70 Power source input
	5	BAT	Power source from Coin-Cell Battery enabled by connection to J1 pin 6
	6	VBAT	BM70 Power source input

TABLE 2-2: GROUND TEST CONNECTOR

Part Number	Pin	Signal	Remarks
J2	1	GND	Ground Test Pin
	2	GND	Ground Test Pin
	3	GND	Ground Test Pin
	4	GND	Ground Test Pin
	5	GND	Ground Test Pin
	6	GND	Ground Test Pin
	7	GND	Ground Test Pin
	8	GND	Ground Test Pin

TABLE 2-3: USB UART INTERFACE U10

Part Number	Pin	Signal	Remarks
J3	1	RTS	U10MCP2200RTS pin
	2	P0_0	BM70 GPIO P0_0 (Pin 15) Configured as CTS and connected to J3 pin1 by jumper
	3	CTS	U10MCP2200 CTS pin
	4	P3_6	BM70 GPIO P3_6 (Pin 17) Configured as RTS and connected to J3 pin 3 by jumper
	5	Tx	U10MCP2200 Rx pin
	6	HCI_TXD	BM70 HCI_TXD (Pin 23) Connected to J3 pin 5 by jumper
	7	Rx	U10MCP2200 Tx pin
	8	HCI_RXD	BM70 HCI_RXD (Pin 22) Connected to J3 pin 7 by jumper

TABLE 2-4: SERIAL FLASH INTERFACE

Part Number	Pin	Signal	Remark
J4	1	VBAT	BM70 Power Source input
	2	P3_1	Configured as SPI_NCS
	3	P3_2	Configured as SPI_MISO
	4	P3_3	Configured as SPI_MOSI
	5	P3_4	Configured as SPI_SCLK
	6	GND	Ground Pin

TABLE 2-5: VBAT TEST CONNECTOR

Part Number	Pin	Signal	Remark
J10	1	VBAT	VBAT Test Pin
	2	VBAT	VBAT Test Pin
	3	VBAT	VBAT Test Pin
	4	VBAT	VBAT Test Pin
	5	VBAT	VBAT Test Pin
	6	VBAT	VBAT Test Pin
	7	VBAT	VBAT Test Pin
	8	VBAT	VBAT Test Pin

TABLE 2-6: JUMPER CONNECTOR J10

Part Number	Pin	Signal	Remark
JP10	1 to 8	GP0 to GP7	USB GPIO Interface

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TABLE 2-7: JUMPER CONNECTOR JP12

Part Number	Pin	Signal	Remark
JP12	1	VBAT	VBAT Test Pin
	2	3V3_I ² C	3V3 voltage of I ² C interface, short to VBAT for voltage supply

TABLE 2-8: JUMPER CONNECTOR JP13

Part Number	Pin	Signal	Remark
JP13	1	nRST	I ² C reset pin, wire connect to configured GPIO Reset pin
	2	NC	No Connect

TABLE 2-9: JUMPER CONNECTOR J5

Part Number	Pin	Signal	Remark
J5	1 to 4	LED2 to LED5	Test LED interface (PullLow enable), wire connect to test the GPIO pin

TABLE 2-10: JUMPER CONNECTOR JP6

Part Number	Pin	Signal	Remark
JP6	1	PushHigh	Latching switch SW6 PushHigh test pin, wire connect to test GPIO
	2	PushLow	Latching switch SW6 PushLow test pin, wire connect to test GPIO

TABLE 2-11: JUMPER CONNECTOR JP7

Part Number	Pin	Signal	Remark
JP7	1 to 4	SW1 to SW4	PushLow test buttons, Wire connect to test GPIO

TABLE 2-12: JUMPER CONNECTOR JP8

Part Number	Pin	Signal	Remark
JP8	1	LED	Connected to status LED (LED1)
	2	VBAT	Power Source of LED1, short to JP8 pin1 to enable status LED function

Chapter 3. Flash Programming Procedure

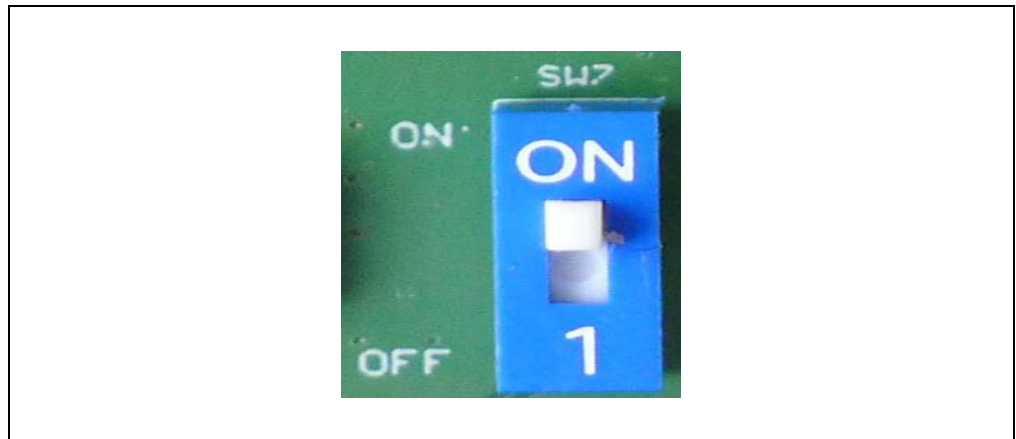
This chapter describes the Flash programming procedure using the BM70 EVB.

3.1 FLASH PROGRAMMING

To perform Flash programming, follow these steps:

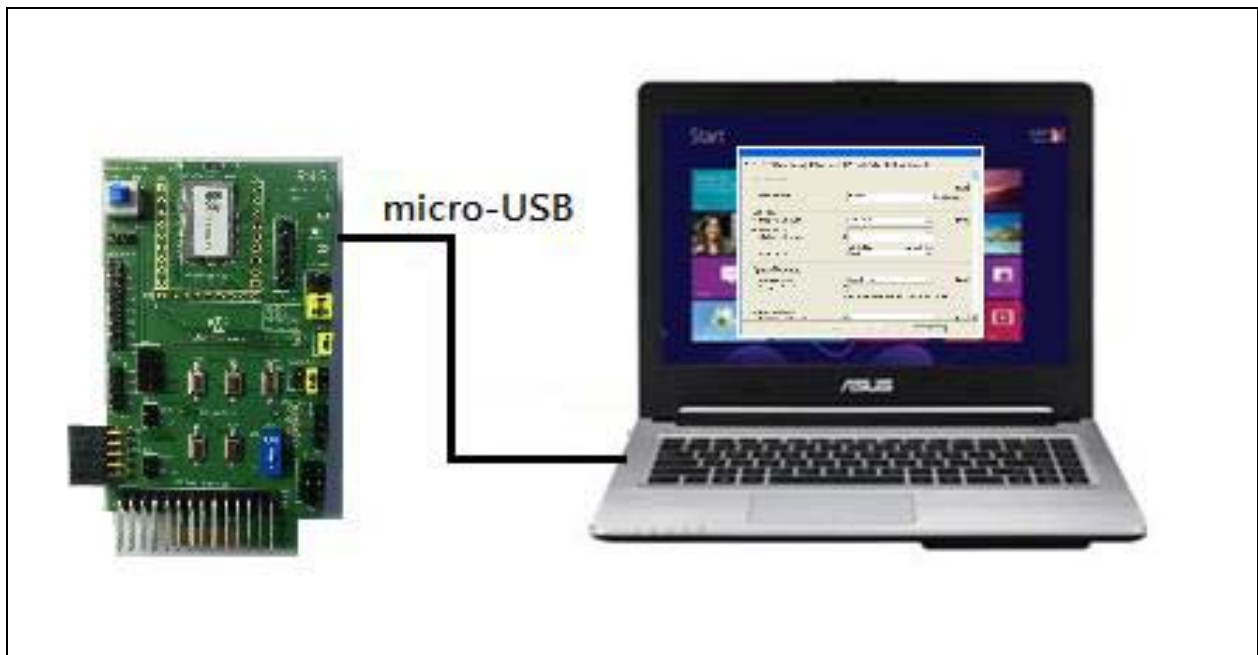
1. Set the switch SW7 to ON (Test Mode).

FIGURE 3-1: SW7 IN TEST MODE



2. Connect the BM70 EVB to a PC using the micro-USB cable.

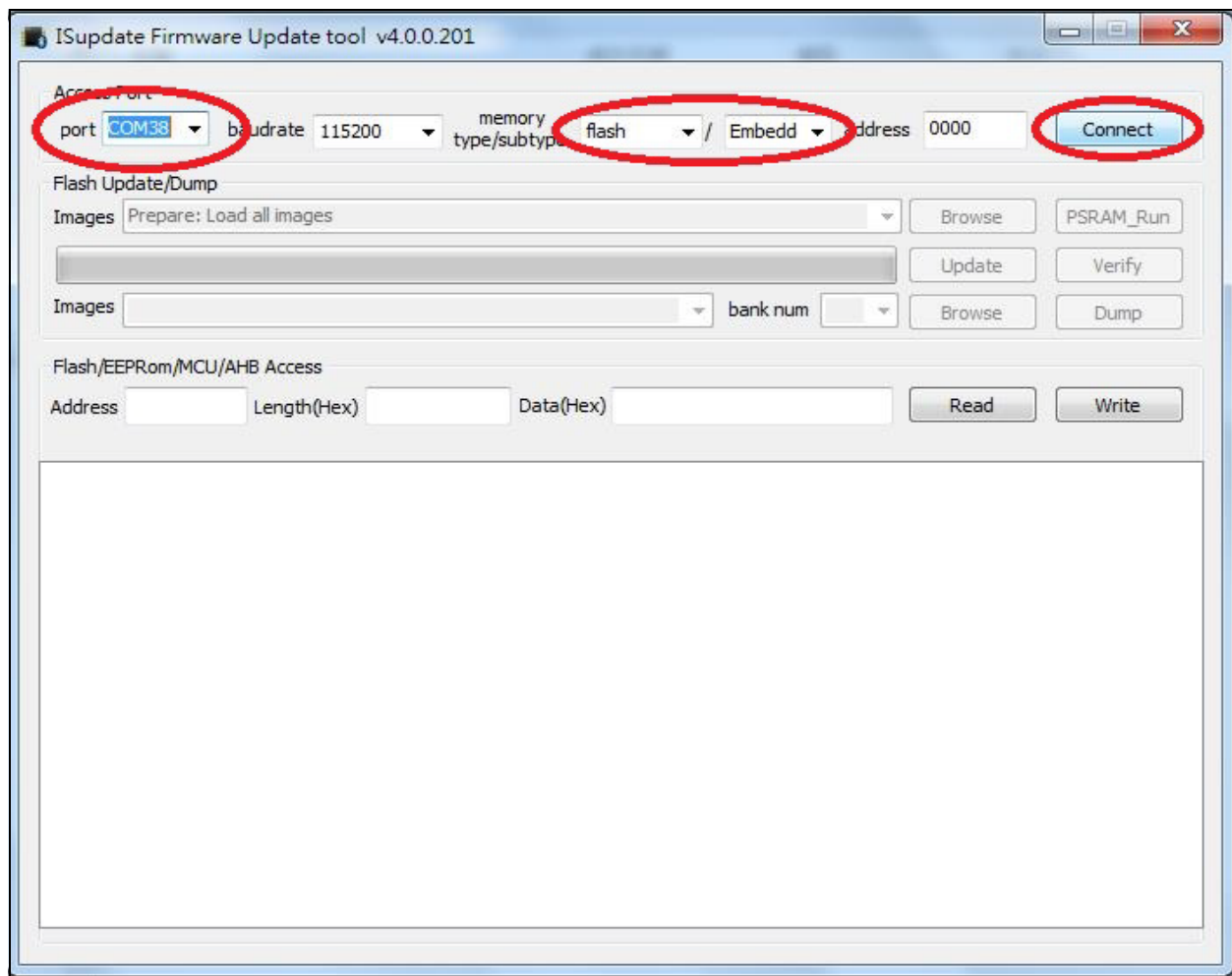
FIGURE 3-2: FLASH PROGRAMMING SETUP



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3. From the ISupdate.exe firmware update tool select the port, baud rate, memory, and address. The ISupdate.exe is available for download from the Microchip web site at <http://www.microchip.com/bm-70-pictail>.
4. Click **Connect**.

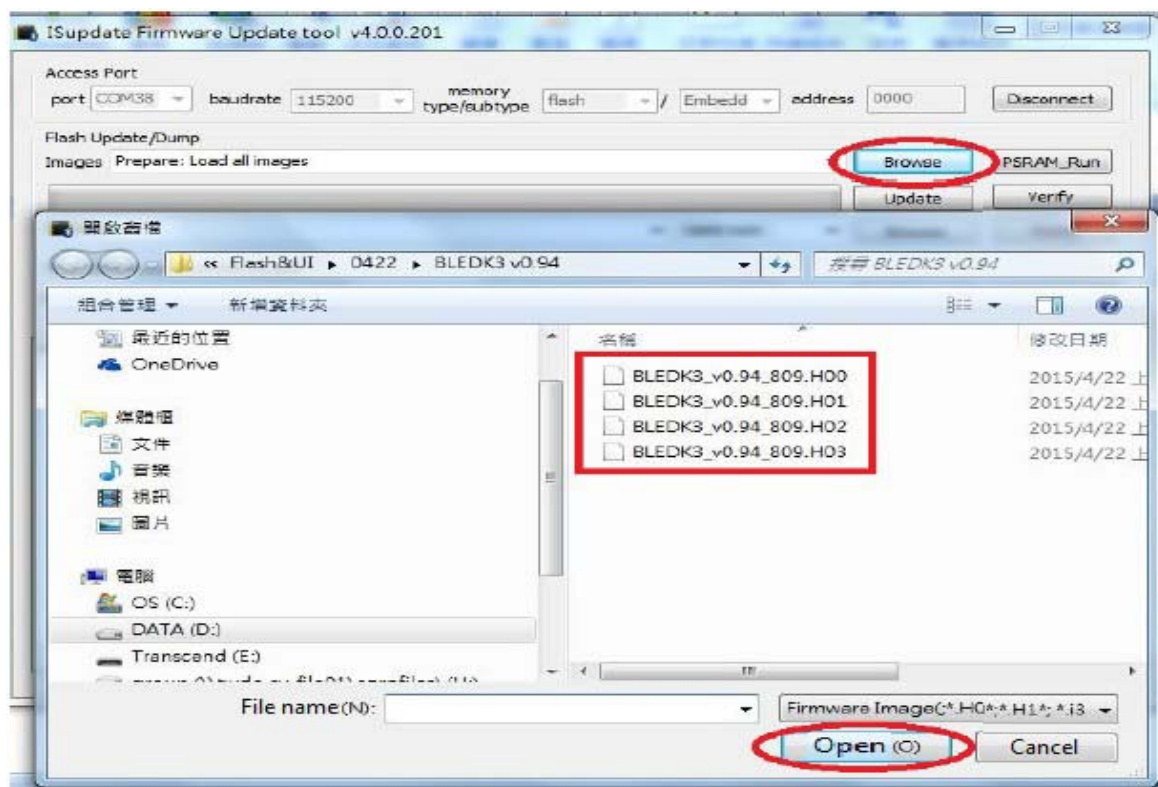
FIGURE 3-3: FIRMWARE UPDATE TOOL



Flash Programming Procedure

5. Click **Browse**. An Open window is displayed.
6. Select the Flash code file, and click **Open**.

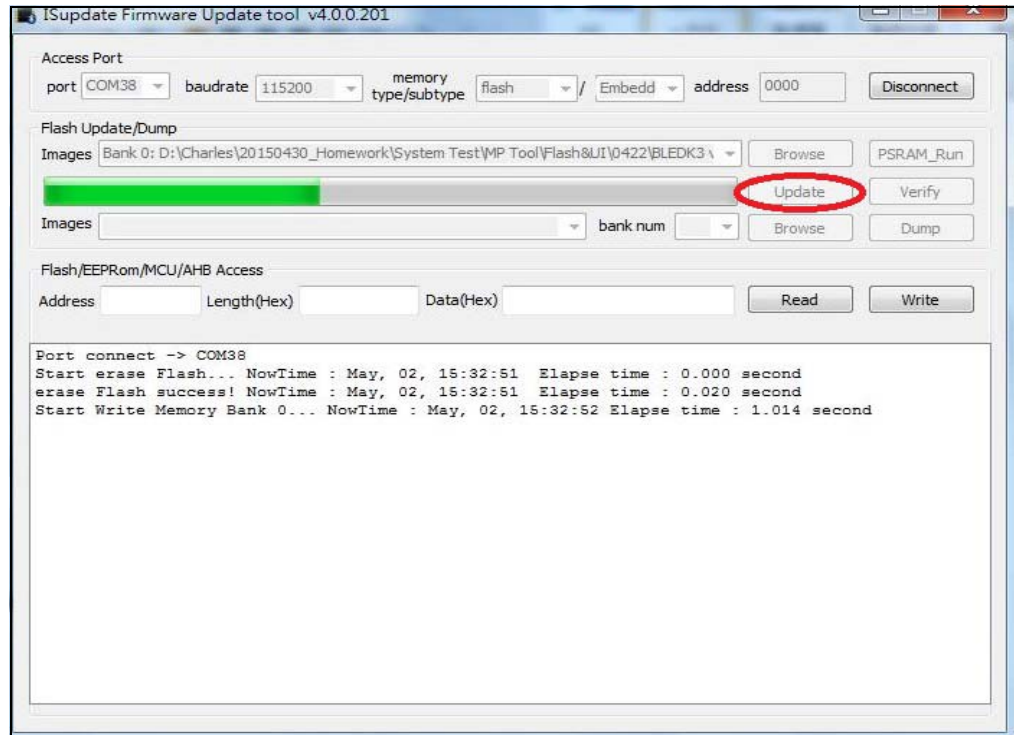
FIGURE 3-4: SELECTING THE FIRMWARE IMAGE



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7. From the `isupdate.exe` firmware update tool, click **Update**.

FIGURE 3-5: FIRMWARE UPDATE



8. The `isupdate.exe` firmware update tool will start downloading the selected Flash code.
9. Once the firmware update process is completed, reboot the BM70 EVB.

Chapter 4. UI Configuration and Download

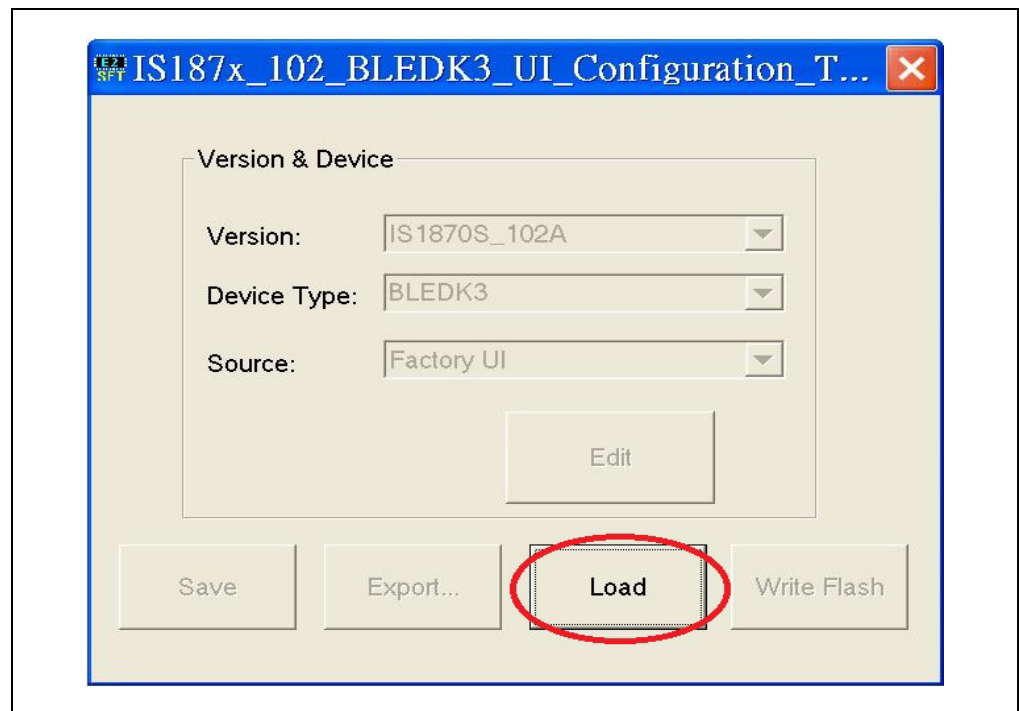
This chapter describes how to configure and download UI parameters using the UI configuration tools. Users must download the Flash codes before updating the UI parameters.

4.1 UI CONFIGURATION

To set up UI configuration, perform these actions:

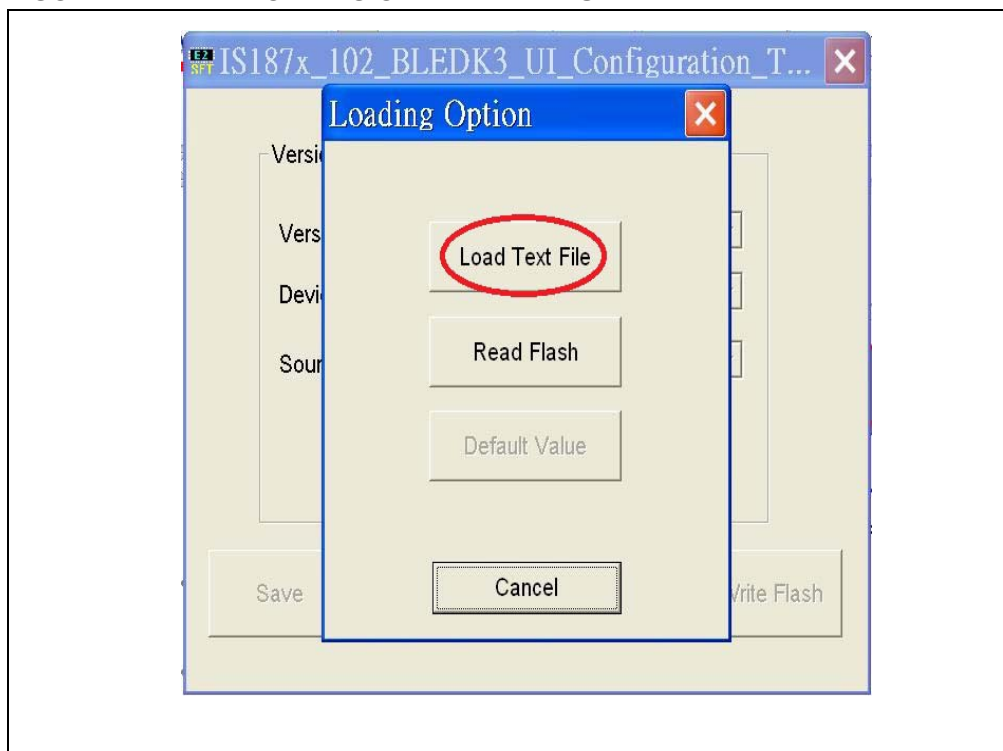
1. From the UI tool, click **Load**. For demo purpose BLEDK3 UI configuration tool is used.

FIGURE 4-1: BLEDK3 UI CONFIGURATION TOOL



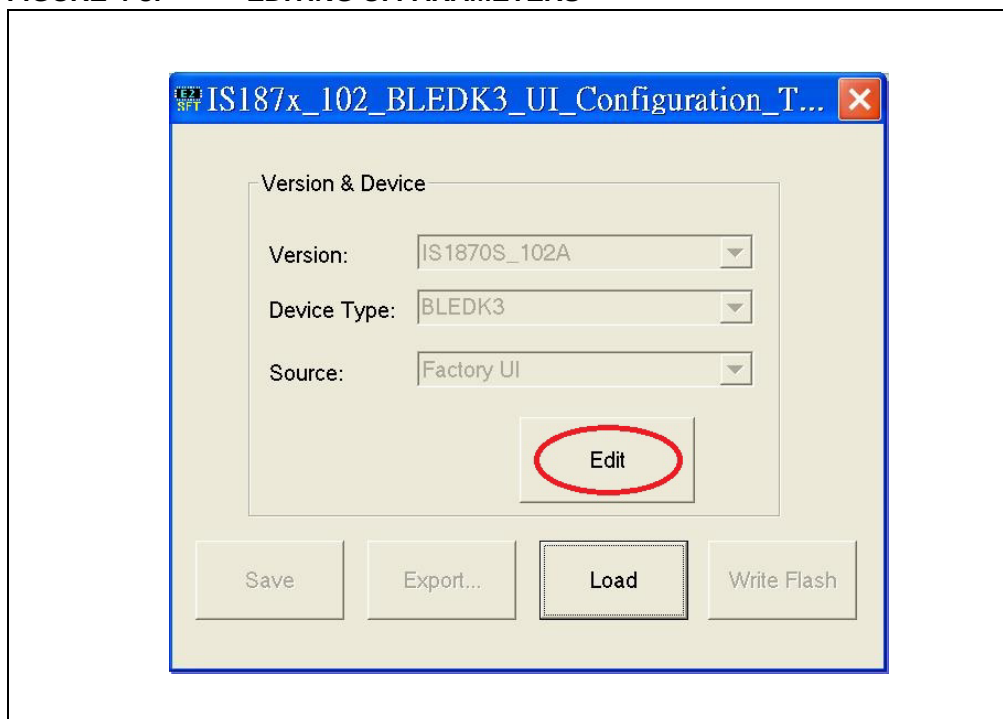
2. From the Loading Option, click **Load Text File** to load UI parameters.

FIGURE 4-2: LOADING UI PARAMETERS



3. Verify UI parameters and click **Edit**.

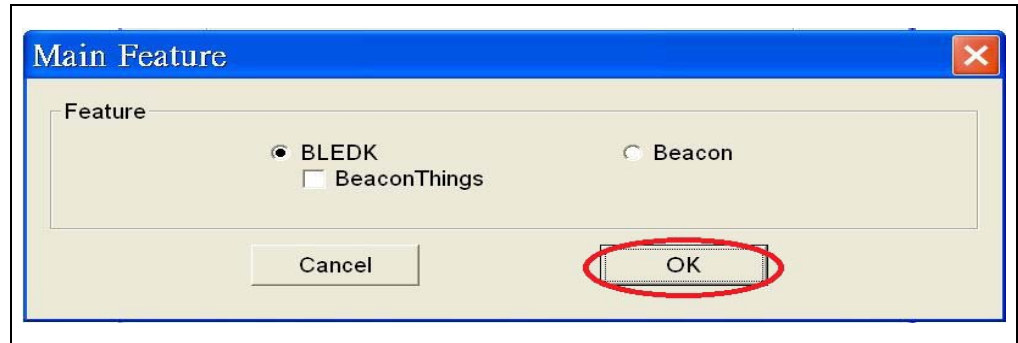
FIGURE 4-3: EDITING UI PARAMETERS



UI Configuration and Download

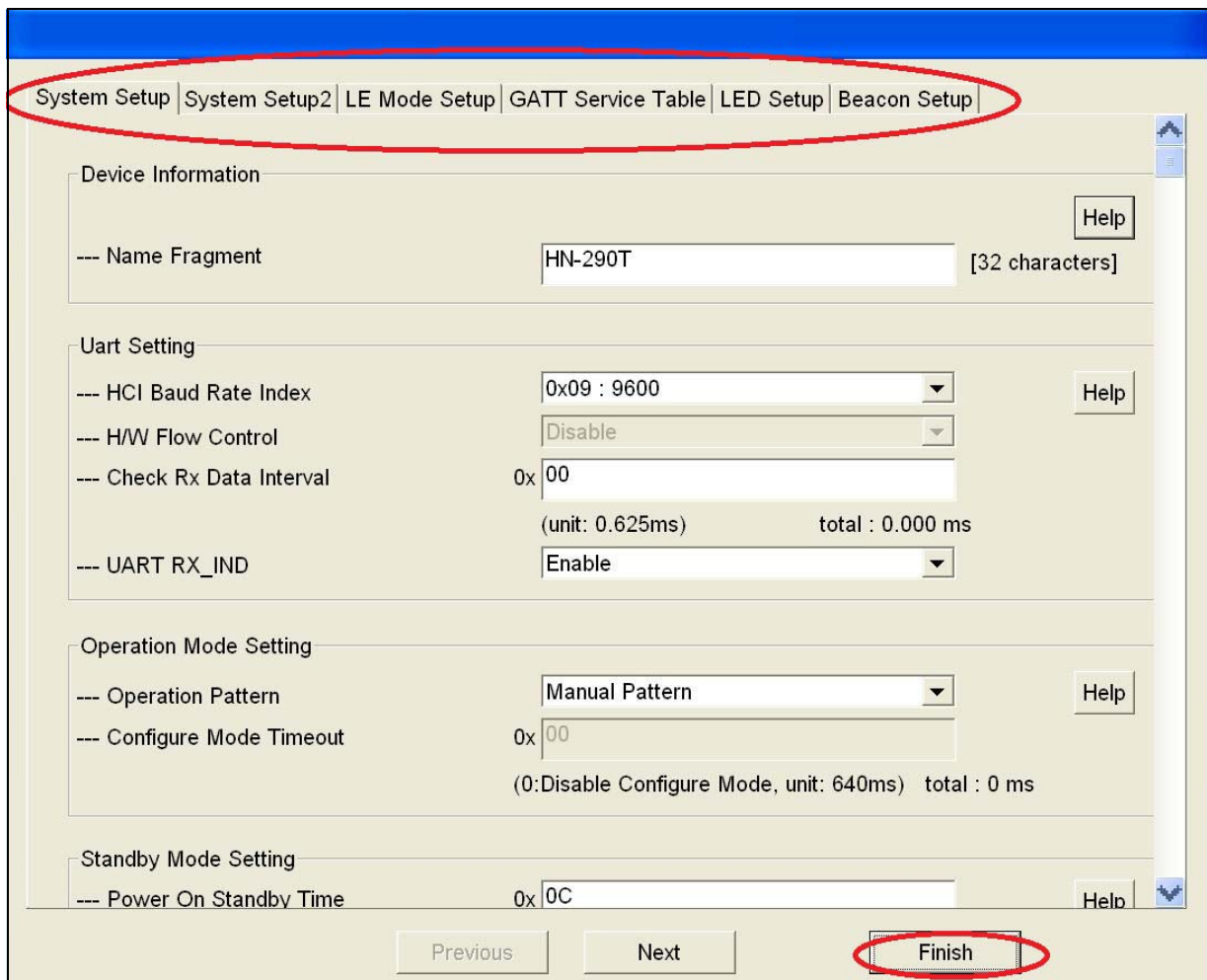
- From the Main Feature window, select the feature and click **OK**.

FIGURE 4-4: SELECTING MAIN FEATURE



- Click **Help** to display complete Device Information.

FIGURE 4-5: CONFIGURE UI PARAMETERS

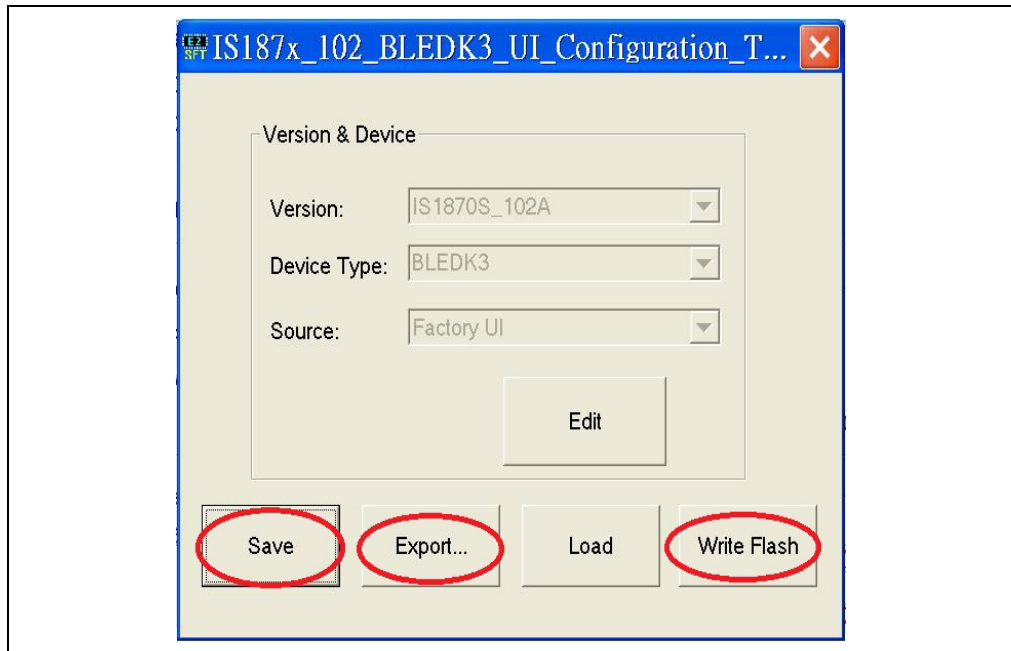


- Select required information and then click **Finish**. Firmware UI Configuration window will be displayed.

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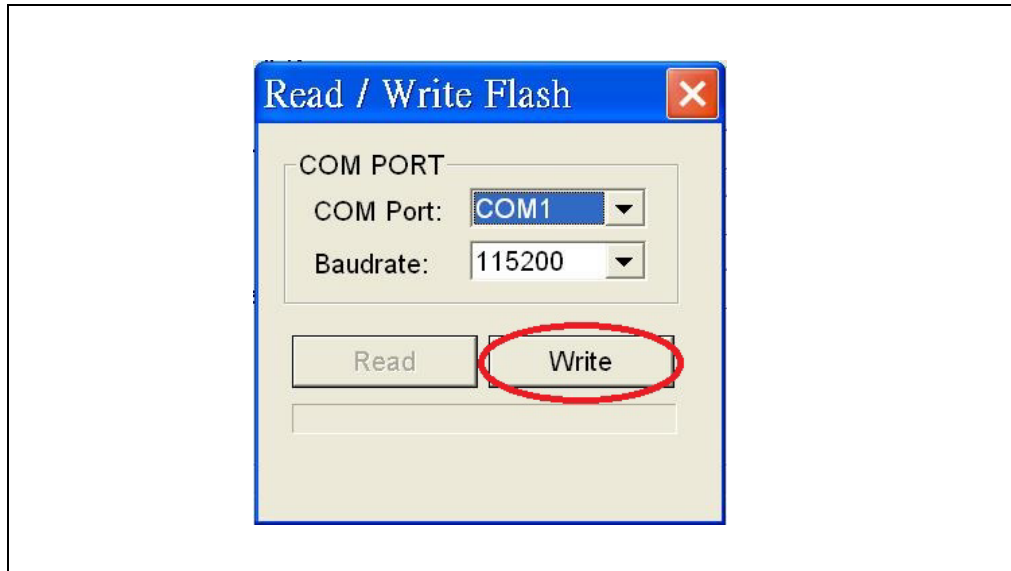
7. From the UI configuration window, users can perform any one these actions:
 - Click **Save** to save the selected UI parameters as .txt and .hex files for mass production.
 - Click **Export** to export the UI log .txt file.
 - Click **Write Flash** to download UI parameters to Flash.

FIGURE 4-6: SELECT VERSION AND DEVICE



8. Click **Write Flash**, the Read/Write Flash window will be displayed.

FIGURE 4-7: DOWNLOAD UI PARAMETERS



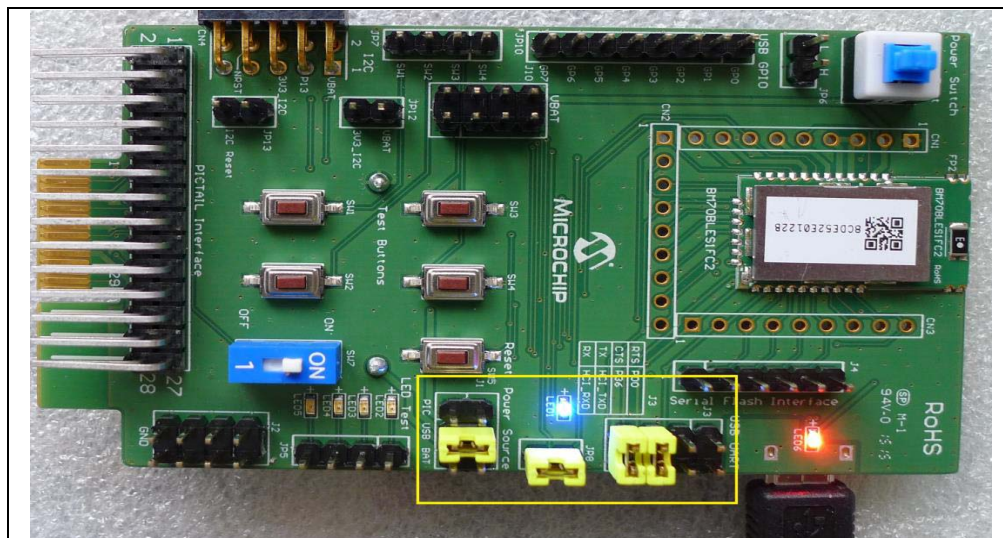
9. Click **Write** to download UI parameters to Flash.

4.2 DOWNLOADING UI PARAMETERS

To download UI parameters, perform the following actions:

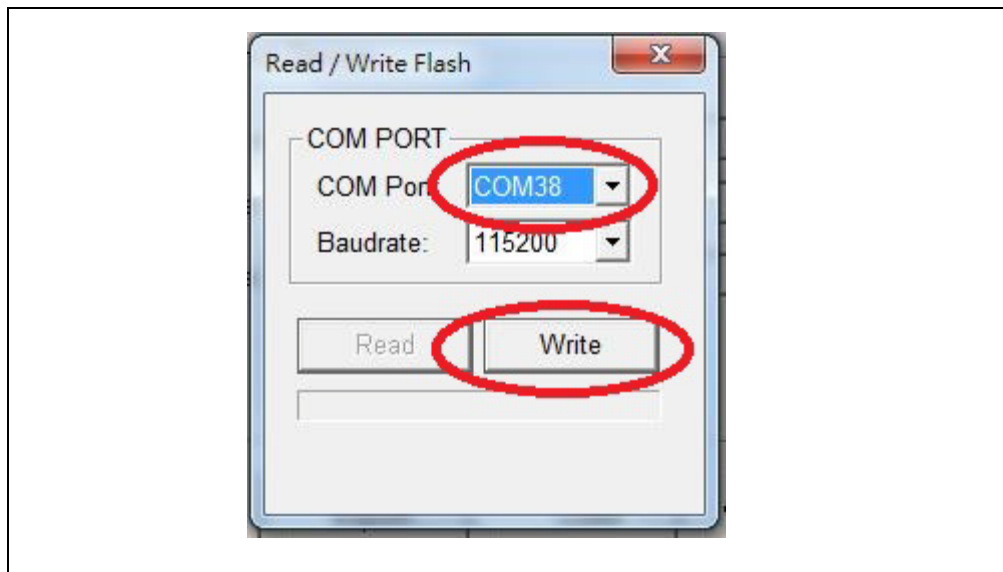
1. Set the switch SW7 to ON (Test mode), see [Figure 3-1](#).
2. Connect the BM70 EVB board to a PC using the micro-USB cable, see [Figure 3-2](#).
3. Ensure that the jumpers on the J1, J8 and J3 are connected. Connect the USB port of the EVB P1 and PC using the micro-USB cable.
4. On connection, the LED1 (blue) on the BM70 EVB board will start glowing.

FIGURE 4-8: JUMPER CONNECTION



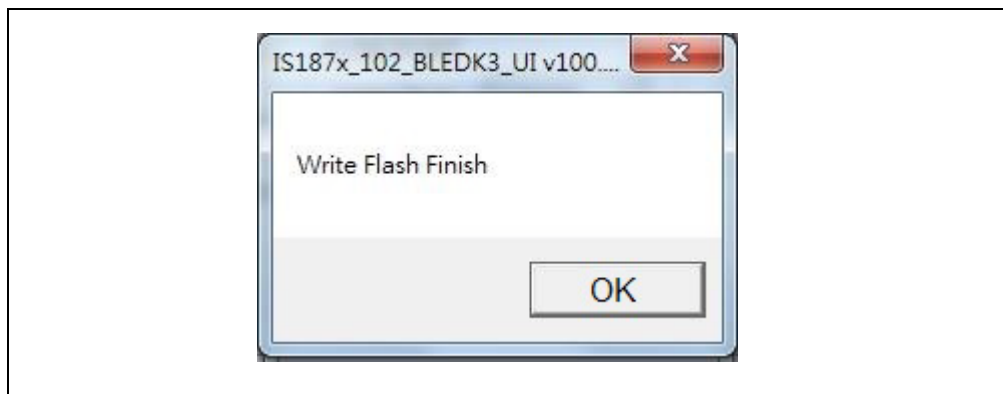
5. To download the edited UI parameters from the Read/Write Flash window, choose the COM port and baud rate values, and then click **Write**.

FIGURE 4-9: READ/WRITE PAGE



6. On completion, the Write Flash window is displayed.
7. Click **OK** to download UI parameters.

FIGURE 4-10: WRITE FLASH FINISH WINDOW



Chapter 5. UART Command Tool Environment Setting

This chapter describes how to set up the UART command tool environment using the BLEDK3 Auto Pattern Test Tool and BLEDK3 Manual Test Tool.

The following topics included in this chapter:

[Section 5.1 “Auto-Pattern Test Tool SET UP”](#)

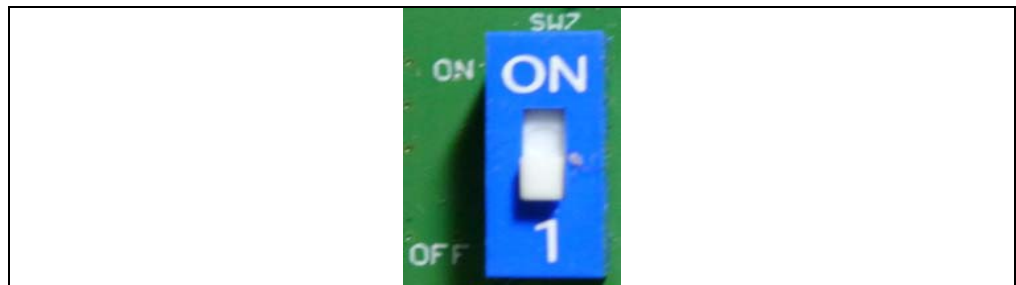
[Section 5.2 “Manual Test Tool”](#)

5.1 AUTO-PATTERN TEST TOOL SET UP

To set up the Auto Pattern Test Tool, perform the following actions:

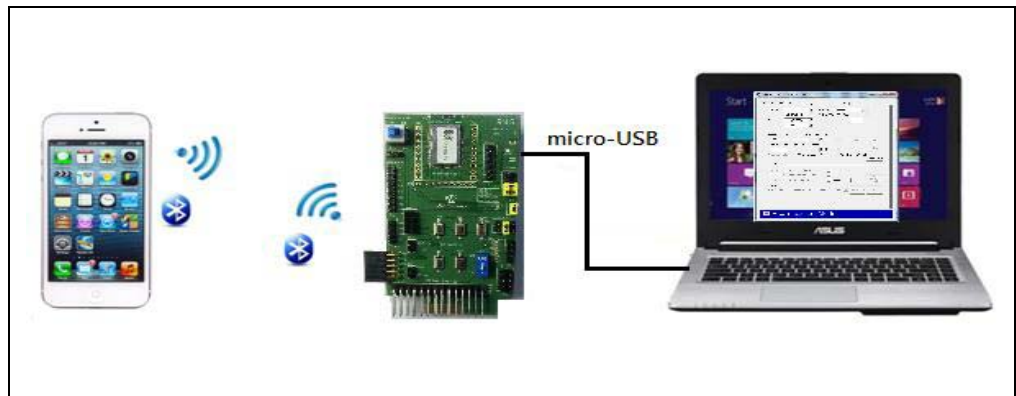
1. Set the switch SW7 to OFF (Application mode).

FIGURE 5-1: SW7 IS OFF: APPLICATION MODE



2. Connect the BM70 EVB to a PC using the micro-USB cable and make a connection to the BLEDK3 application using a smart phone.

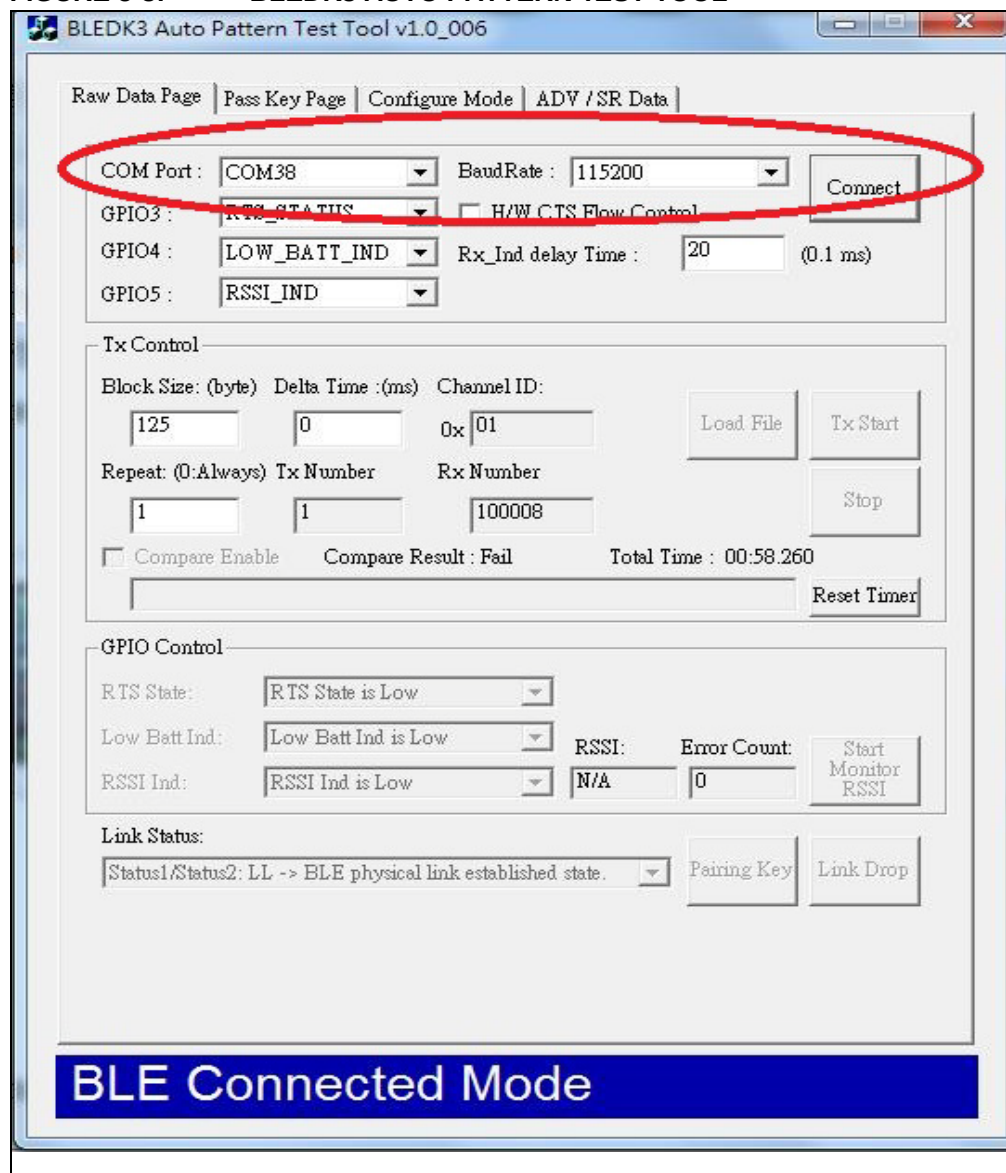
FIGURE 5-2: AUTO-PATTERN TEST SETUP



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3. Open the Auto Pattern Test Tool in the PC.
4. Set up the COM Port and Baud Rate by selecting the appropriate values, and then click **Connect** to establish the connection with the device.

FIGURE 5-3: BLEDK3 AUTO PATTERN TEST TOOL



5. The Auto Pattern Test functions are performed by the tool to control the BM70 module. Refer to the "BM70 BLEDK3 Application Note" for additional information.

UART Command Tool Environment Setting

5.2 MANUAL TEST TOOL

To set up the Manual Test Tool, perform the following actions:

1. Set the switch SW7 to OFF (Application mode), see [Figure 5-1](#).
2. Connect the BM70 Evaluation board to a PC using the micro-USB cable, and make a connection to the BLEDK3 application using a smart phone, see [Figure 5-2](#).
3. Set up the COM Port and Baud Rate, and then click **Connect** to establish the connection with the device.

FIGURE 5-4: BLEDK3 MANUAL PATTERN TEST TOOL

BLEDK3 Manual Test Tool v0.26

COM Port: COM38 Baudrate: 115200 Connect

Parity Bit: None Stop Bit: 1

GPIO Ctrl: No Use

Write

Opcode: Write Data: Length: 0 Write Data

Continuous Send

Load Script Count Times: Repeat Round Times: Continuous Send

Configure Status

BT Status:

Log View: Clear

ADV / SR Data GATT Client GATT Server SMP Local GATT Table DIO

Common GAP Pass Key Page Transparent Remote GATT Table

Common Command

Opcode: 0x01: Read Local Information Send

Parameter 1: 0x Unit:

Parameter 2: 0x Unit:

Parameter 3: 0x Unit:

Parameter 4: 0x Unit:

Local Information

Version: 0x

Bluetooth Address: 0x

Read Information

Device Name:

Pairing Mode:

ADC Value: 0x (ADC Value)

Paired Device List

Device Index	Priority	Device Address

4. Perform the Manual Test Tool functions to control the BM70 module. Refer to the "BM70 BLEDK3 Application Note" for additional information.

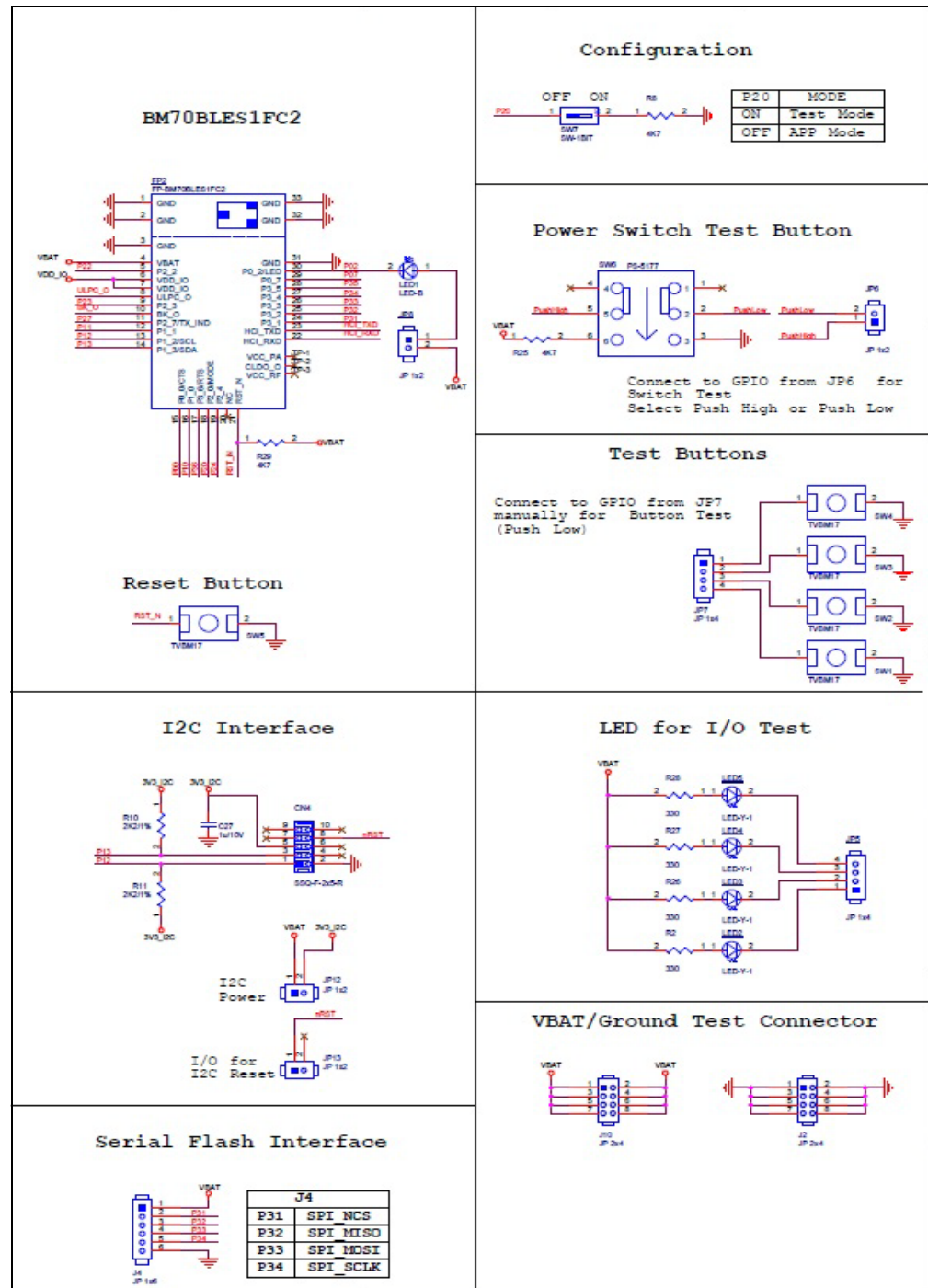
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NOTES:

Appendix A. Schematics

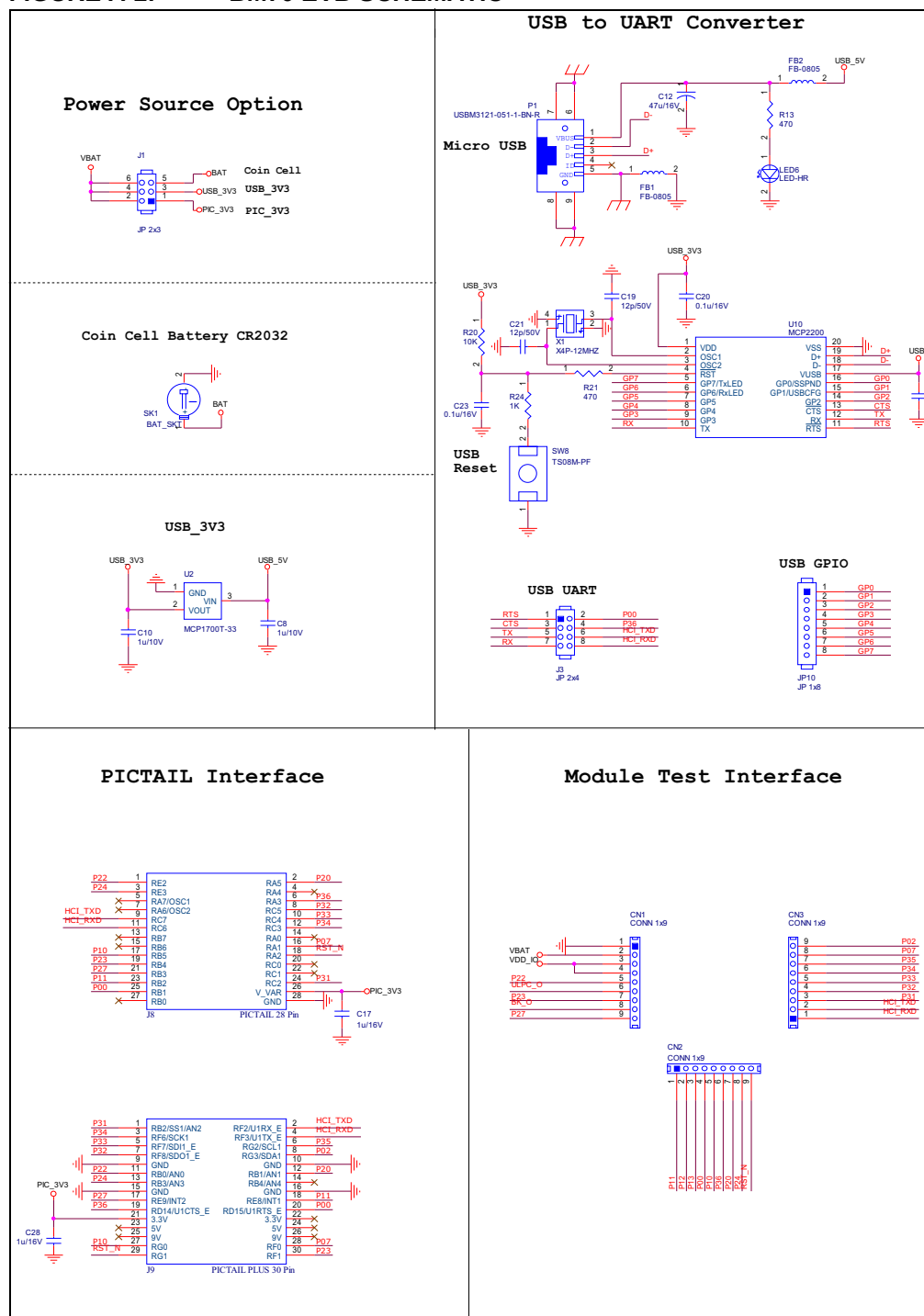
A.1 BLOCK DIAGRAM

FIGURE A-1: BM70 EVB SCHEMATICS



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FIGURE A-2: BM70 EVB SCHEMATIC



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