

BM70 PICtail^{тм}/PICtail Plus Evaluation Board (EVB) User's Guide

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

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

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

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION. INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

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

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

Trademarks

The Microchip name and logo, the Microchip logo, AnyRate, AVR, AVR logo, AVR Freaks, BeaconThings, BitCloud, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, Heldo, JukeBlox, KEELoQ, KEELoQ logo, Kleer, LANCheck, LINK MD, maXStylus, maXTouch, MediaLB, megaAVR, MOST, MOST logo, MPLAB, OptoLyzer, PIC, picoPower, PICSTART, PIC32 logo, Prochip Designer, QTouch, RightTouch, SAM-BA, SpyNIC, SST, SST Logo, SuperFlash, tinyAVR, UNI/O, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

ClockWorks, The Embedded Control Solutions Company, EtherSynch, Hyper Speed Control, HyperLight Load, IntelliMOS, mTouch, Precision Edge, and Quiet-Wire are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, BodyCom, chipKIT, chipKIT logo, CodeGuard, CryptoAuthentication, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, JitterBlocker, KleerNet, KleerNet logo, Mindi, MiWi, motorBench, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PureSilicon, QMatrix, RightTouch logo, REAL ICE, Ripple Blocker, SAM-ICE, Serial Quad I/O, SMART-I.S., SQI, SuperSwitcher, SuperSwitcher II, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

 $\textcircled{\mbox{\sc op}}$ 2015-2018, Microchip Technology Incorporated, All Rights Reserved.

ISBN: 978-1-5224-2605-9



BM70 PICTAIL ™/PICTAIL PLUS EVB USER'S GUIDE

Table of Contents

Chapter 1. Introduction	
1.1 Kit Contents	11
1.2 BM70 EVB Features	11
Chapter 2. Hardware	
2.1 Hardware Features	15
Chapter 3. Getting Started	
3.1 Requirements	19
3.2 Configuring UI Parameters	20
3.3 BLE Connection to Smartphone	28
3.4 BLEDK3 Auto Pattern and Manual Pattern Tools	33
3.5 Application Firmware Information	33
Chapter 4. Flash Programming Procedure	
4.1 Flash Programming Procedure	35
Chapter 5. USB-to-UART Converter and Host DUT	
5.1 Connecting UART to BM70 EVB DUT	43
5.2 Connecting UART to Host Microcontroller DUT	44
Appendix A. Schematics	
A.1 Reference Schematics	45

NOTES:



BM70 PICTAIL ™/PICTAIL PLUS EVB USER'S GUIDE

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 "DSXXXXXXA", where "XXXXXXX" 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 is useful to know before using the BM70 PICtail [™]/PICtail Plus 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 BM70 PICtail [™]/PICtail Plus EVB (also referred as "BM70 EVB"), 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 BM70 EVB and its features.
- Chapter 2. "Hardware" provides hardware details of the BM70 EVB.
- Chapter 3. "Getting Started" provides information about various steps involved to update the User Interface (UI) parameters and to set up a connection between the BM70 EVB and a smartphone using the Bluetooth® Low Energy (BLE) link.
- Chapter 4. "Flash Programming Procedure" describes various steps involved in downloading the Flash code on the BM70 EVB.
- Chapter 5. "USB-to-UART Converter and Host DUT" describes the use of the USB- to-UART converter circuit, available on the host Device Under Test (DUT).
- Appendix A. "Schematics" provides the BM70 EVB reference schematics.

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Italic characters	Referenced books	MPLAB 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	<u>File > Save</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></f1></enter>
Plain Courier New	Sample source code	#define START
	Filenames	autoexec.bat
	File paths	c:\mcc18\h
	Keywords	_asm, _endasm, static
	Command-line options	-0pa+, -0pa-
	Bit values	0, 1
	Constants	0xFF, `A'
Italic Courier New	A variable argument	<pre>file.o, where file can be any valid filename</pre>
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	<pre>var_name [, var_name]</pre>
	Represents code supplied by user	<pre>void main (void) { }</pre>
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. Note 1: This is a note used in a table.

RECOMMENDED READING

This user's guide describes how to use the BM70 EVB. 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 the BM70 module. The reference information found in this data sheet includes:

- · 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
- Business of Microchip Product selector and ordering guides, latest Microchip press releases, listings of seminars and events; and listings of Microchip sales offices, distributors and factory representatives

DEVELOPMENT SYSTEMS CUSTOMER CHANGE NOTIFICATION SERVICE

Microchip's customer notification service helps keep customers current on Microchip products. Subscribers will receive email notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

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

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

Revision C (May 2016)

This revision includes the following updates:

- Updated Chapter 3. "Getting Started"
- Updated Chapter 4. "Flash Programming Procedure"
- Updated Chapter 5. "USB-to-UART Converter and Host DUT"
- Updated Appendix A. "Schematics"

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

Revision D (January 2018)

This revision includes the following updates:

• Updated Appendix A. "Schematics"

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

NOTES:



BM70 PICTAIL[™]/PICTAIL PLUS EVB USER'S GUIDE

Chapter 1. Introduction

Thank you for purchasing a Microchip Technology BM70 PICtail[™]/PICtail Plus Evaluation Board (EVB). This document provides detailed information about the BM70 EVB.

The BM70 EVB is designed to evaluate and demonstrate the capabilities of the Microchip BM70 BLE module.

This chapter includes the following topics:

1.1 "Kit Contents"

1.2 "BM70 EVB Features"

The BM70 EVB can be evaluated using various tools which are listed on the product page of the Microchip worldwide web site: http://www.microchip.com/bm-70-pictail.

1.1 KIT CONTENTS

The BM70 EVB kit contains these items:

- One BM70 EVB, which contains the BM70BLES1FC2 module
- One micro-USB cable

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 BM70 EVB FEATURES

The following are key features of the BM70 EVB:

- Option to switch power source between the Coin Cell battery, USB, and PICtail interface
- The UART interface to connect to an external MCU
- Connection and test interface between the BM70 module and Host Emulator tool on the PC (with UART commands)
- · Ability to update the firmware using the micro-USB port
- Switch between Application mode and Test mode
- LED, push button, I²C and SPI interface

Representation of the layout of the BM70 EVB is illustrated in Figure 1-1 and Figure 1-2. The top view of the board includes the following key features as indicated in Figure 1-1.

- 1. The BM70BLES1FC2 module
- 2. Power switch button (SW6)
- 3. SPI interface (J4)
- 4. USB GPIO interface (JP10)
- 5. USB-to-UART interface (J3)
- 6. LED
- 7. Power source connector (J1)
- 8. Reset button (SW5)
- 9. Test buttons (Push-low)
- 10. VBAT header pins (J10)
- 11. Test button header (J7)
- 12. I²C interface (JP12, JP13)
- 13. DIP switch (SW7)
- 14. LEDs and corresponding header pins (JP5)
- 15. GND header pins (J2)
- 16. PICtail interface (J8)

FIGURE 1-1: BM70 EVB (TOP VIEW)



Figure 1-2 illustrates the bottom view of the BM70 EVB with the following key components:

- 1. USB-to-UART converter. The switch SW8 is the USB Reset button
- 2. Module pads
- 3. Coin Cell battery holder

For additional information on these features, refer to Chapter 2. "Hardware".

FIGURE 1-2: BM70 EVB (BOTTOM VIEW)



NOTES:



BM70 PICTAIL™/PICTAIL PLUS EVB USER'S GUIDE

Chapter 2. Hardware

This chapter describes the hardware features of the BM70 EVB. The BM70 EVB provides many options for connecting and communicating with other peripheral devices and power sources as illustrated in Figure 2-1.



FIGURE 2-1: BM70 EVB BLOCK DIAGRAM

2.1 HARDWARE FEATURES

The following sections provide the details of each component in the BM70 EVB. For their locations on the board, refer to Figure 1-1 and Figure 1-2.

2.1.1 Power Supply

There are three ways to supply power to theBM70 EVB:

- Coin Cell battery (socket SK1 for CR2032 battery)
- USB
- PICtail socket connection

2.1.2 USB connectivity

The BM70 EVB provides micro-USB cable connectivity.

2.1.3 Switches

Push button switches provide the following functionality:

- SW1, SW2, SW3 and SW4 Test buttons, available for evaluation and are connected to the corresponding header pins
- SW5 Reset button, connects to the Reset pin(pin 21) of the module
- SW6 Power switch button, includes Push-High and Push-Low header
- SW7 DIP switch to switch between Application and Test modes
- SW8 USB Reset button

2.1.4 LEDs

The functionality of the six LEDs are as follows:

- LED1 Connected to the P0_2 pin(pin 30) of the BM70 module, which provides the module status
- LED2, LED3, LED4 and LED5 Configurable test LEDs for diagnostics. These LEDs have header connections which can be connected for testing
- LED6 USB connection indicator. This LED will turn ON when USB 5V input is connected

2.1.5 Jumpers

There are 12 jumpers (J1, J2, J3, J4, J5, J10, JP6, JP7, JP8, JP10, JP12 and JP13) available on the BM70 EVB. Table 2-1 through Table 2-12 provide the details of the pins and signals that are associated with the jumpers.

Part Number	Pin	Signal	Description
J1	1	PIC_3V3	Power source from PICtail 3.3V, enabled by pin 2 in the jumper bank J1
	2	VBAT	BM70 power source input
	3	USB_3V3	Power source from USB enabled by pin 4 on the jumper bank J1. The power input is sent to 3.3V LDO to provide the module with a 3.3V input
	4	VBAT	BM70 power source input
	5	BAT	Power source from Coin Cell Battery, enabled by pin 6 on the jumper bank J1
	6	VBAT	BM70 power source input

TABLE 2-1:POWER SOURCE OPTION CONNECTOR

TABLE 2-2: GROUND TEST CONNECTOR

Part Number	Pin	Signal	Description
J2	1 to 8	GND	Ground test pins

Part Number	Pin	Signal	Description
J3	1	RTS	MCP2200 RTS pin
	2	P0_0	BM70 GPIO P0_0 (Pin 15) Configured as CTS and connected to J3 pin1 by the jumper
	3	CTS	MCP2200 CTS pin
	4	P3_6	BM70 GPIO P3_6 (pin 17) Configured as RTS and connected to J3 pin 3 by the jumper
	5	ТΧ	MCP2200 RX pin
	6	HCI_TXD	BM70 HCI_TXD (pin 23) Connected to J3 pin 5 by the jumper
	7	RX	MCP2200 TX pin
	8	HCI_RXD	BM70 HCI_RXD (pin 22) Connected to J3 pin 7 by the jumper

TABLE 2-3: USB TO UART INTERFACE U10

TABLE 2-4: SERIAL FLASH INTERFACE

Part Number	Pin	Signal	Description
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	Description
J10	1 to 8	VBAT	VBAT test pins

TABLE 2-6:CONNECTOR J10

Part Number	Pin	Signal	Description
JP10	1 to 8	GP0 to GP7	MCP2200 GPIOs

TABLE 2-7:CONNECTOR JP12

Part Number	Pin	Signal	Description
JP12	1	VBAT	VBAT test pin
	2	3V3_I ² C	$3V3$ voltage of I^2C interface, short to $V\textsc{Bat}$ for voltage supply

Note: The jumper JP12 must be connected as a default jumper.

BM70 PICtail[™]/PICtail Plus EVB User's Guide

TABLE 2-8: CONNECTOR JP13

	-		
Part Number	Pin	Signal	Description
JP13	1	nRST	I ² C (device) Reset pin, wire connect to the configured GPIO Reset pin
	2	NC	No connect

TABLE 2-9: CONNECTOR J5

Part Number	Pin	Signal	Description
J5	1 to 4	LED2 to LED5	Test LED interface (Pull-Low enable), wire connect to test the GPIO pin

TABLE 2-10:CONNECTOR JP6

Part Number	Pin	Signal	Description
JP6	1	Push-High	Latching switch SW6, Push-High test pin, wire connect to test GPIO
	2	Push-Low	Latching switch SW6, Push-Low test pin, wire connect to test GPIO

TABLE 2-11:CONNECTOR JP7

Part Number	Pin	Signal	Description
JP7	1 to 4	SW1 to SW4	Push-Low test buttons, wire connect to test GPIO

TABLE 2-12:CONNECTOR JP8

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



BM70 PICTAIL™/PICTAIL PLUS EVB USER'S GUIDE

Chapter 3. Getting Started

This chapter describes how to update UI parameters and set up the connection between the BM70 EVB and a smartphone using the BLE link.

This chapter includes the following topics:

- 3.1 "Requirements"
- 3.2 "Configuring UI Parameters"
- 3.3 "BLE Connection to Smartphone"
- 3.4 "BLEDK3 Auto Pattern and Manual Pattern Tools"
- 3.5 "Application Firmware Information"

3.1 REQUIREMENTS

The following hardware and software are required for getting started with the BM70 EVB.

3.1.1 Hardware Requirements

- One BM70 EVB
- · Any one of these Bluetooth-enabled smartphones:
 - iPhone[®] 4S or later version (it must support BLE)
 - Android[™] device running on Android 4.3 or later version
- One Windows[®] host PC with USB port
- One micro-USB cable

3.1.2 Software Requirements

Users can download the latest firmware and corresponding tools for the following applications, which are available for download from the Microchip web site: www.microchip.com/bm-70-pictail.

- Firmware update tool, isupdate.v4.0.0.207.rar
- BLEDK3 Flash code, BT5505_BLEDK3_v103_c1457.rar
- BLEDK3 UI tool, IS187x_102_BLEDK3_UI v100.123.rar
- mBIoT Utility app, available at App Store for iPhone and at Google Play™ store for Android

3.2 CONFIGURING UI PARAMETERS

The UI configuration tool enables the user to change the BM70 EVB parameters, such as device name, UART settings, BLE connection settings, and adding or editing the GATT service table.

To update UI parameters, perform these actions:

- 1. Double-click the IS187x_102_BLEDK3_UI_Configuration_Tool.exe to open the BLEDK3 UI configuration tool on the PC. The UI Configuration tool window is displayed.
- 2. Click Load, see Figure 3-1. The Loading Option window is displayed.
 - **Note:** Download and install the UI configuration tool, which is available for download from the Microchip web site: www.microchip.com/bm-70-pictail. In this demonstration, the *IS187x_102_BLEDK3_UI_Configuration_Tool v100.123* tool is used. This UI tool version corresponds to the firmware version of the "BLEDK3 v1.03".

FIGURE 3-1: BLEDK3 UI CONFIGURATION TOOL WINDOW

Version & D	evice	
Version:	IS1870SF_102A	-
Device	BLEDK3	-
Source:	Factory UI	-
	Edit	
ave	Export Load	Write

3. In the Loading Option window, click **Load Text File** to load UI parameters, see Figure 3-2.



FIGURE 3-2: LOADING OPTION WINDOW

4. From the Open dialog, select the default UI parameter text file (provided with the UI tool) and then click **Open**, see Figure 3-3.

FIGURE 3-3: OPEN DIALOG BOX

★ Favorites	Name	Date modified	Туре	Size
🧮 Desktop	BM70_BLEDK3_UI_100.123_default	9/21/2015 4:36 PM	Text Document	36
Downloads 🗐 Recent Places	BM71_BLEDK3_UI_100.123_default	9/21/2015 4:36 PM	Text Document	36
 ☐ Libraries ☐ Documents J Music ☐ Pictures ☐ Subversion ☑ Videon 				
Videos				

5. From the UI Configuration Tool window, select UI parameters, and then click **Edit**, see Figure 3-4.

-Version & [Device		
Version:	IS1870SF_	102A	-
Device	BLEDK3		<u>_</u>
Source:	Factory UI		~
-		Edit	\triangleright
Save	Export	Load	Write

FIGURE 3-4: UI CONFIGURATION TOOL WINDOW

6. From the Main Feature window, click **BLEDK** and then click **OK**, see Figure 3-5.

FIGURE 3-5: MAIN FEATURE WINDOW

Feature			
	BLEDK	C Beacon	
	🗆 BeaconThings		
	Cancel	OK	1

7. The UI Configuration Tool dialog has various tabs to configure UI parameters. Click the **System Setup** tab, and in the **Name fragment** box, type BM70_BLE (or any user-defined name), see Figure 3-6.

Note:	Click Help button to	get the information	related to UI	parameters.
	-	5		

FIGURE 3-6: CONFIGURING UI PARAMETERS - SYSTEM SETUP

Device Information			
			Help
Name Fragment	BM70_BLE	[32 c	haracters]
Uart Setting			
HCI Baud Rate Index	0x03 : 115200	-	Help
H/W Flow Control	Disable	•	
Check Rx Data Interval	0x 00		
	(unit: 0.625ms)	total : 0.000 ms	
UART RX_IND	Enable	-	
Operation Mode Setting			
Operation Pattern	Auto Pattern	-	Help
Configure Mode Timeout	0x 00		
	(0:Disable Configure Mode,	unit: 640ms) total : 0 r	ns
Standby Mode Setting			
D	0		11.1

8. Click the **LE Mode Setup** tab, and under the Advertising Data Setting section, select **Device Name** to advertise the device name, see Figure 3-7.

stem Setup System Setup2 mode Con	P	An Service Table LED Serup Deacon Serup
LE Fast Advertising Timeout	0x	03
		(0x00:Disable, 0x01~0xFF, Unit:10.24s) total : 30.72 s
Power On LE Reduced Power Advertising	0x	09
Imeout		Total: 92.16 s
Disconnection LE Reduced Power	0x	09
Advertising limeout		Total: 92.16 s
RF Tx Power Setting		
Advertising Prefered Power Level		0 dBm
Connected Prefered Power Level		0 dBm
- Advertising Data Setting		
Advertising Data Length	0x	13 (Max: 31) Help
🔽 Device Name		Complete Length: 8
	0x	BM70_BLE
	0x	
Manufacture Data	0x	
		C Append Address

FIGURE 3-7: ADVERTISING DATA SETTING

9. Click Finish. The UI Configuration Tool window is displayed, see Figure 3-8.

FIGURE 3-8:	UI CONFIGURATION TOOL WINDOW

	└ Version & D	evice			
	Version:	IS1870SF_102A		-	
	Device	BLEDK3		-	
	Source:	Factory UI		-	
			Edit		
-	Save	Export	Load	Write	7

- 10. From the UI Configuration Tool window, perform any one of these actions:
 - Click Save to save the selected UI parameters as <code>.txt</code> or <code>.hex</code> files (for mass production)
 - Click **Export** to export the UI log .txt file. The log file contains the parameters and setup values
 - Click Write to download UI parameters to Flash
- 11. To write UI parameters on the BM70 module, perform these actions:
 - a) Set the switch SW7 in the ON position (Test mode), see Figure 3-9.

FIGURE 3-9: SW7 IN TEST MODE

	SH7
ON.	ON
OFF	1

b) Ensure that the jumpers, J1, JP8 and J3, on the BM70 EVB are connected, as shown in Figure 3-10.



FIGURE 3-10: JUMPER AND BM70 EVB CONNECTION DETAILS

c) Connect the USB port (P1) of the BM70 EVB to a PC using the micro-USB cable, see Figure 3-11.



FIGURE 3-11: UI CONFIGURATION SETUP

- d) On connection, LED1 (blue) and LED6 (red) on the BM70 EVB will turn ON.
- e) Go to the UI Configuration Tool window, and click **Write** to download UI parameters on the BM70 module, see Figure 3-8.

f) The Read/Write Flash window is displayed. Select the values for **COM Port** and **Baudrate**, and then click **Write**, see Figure 3-12.



FIGURE 3-12: READ/WRITE FLASH

g) A message box will appear displaying the message "Write Flash Finish". Click **OK** to download UI parameters, see Figure 3-13.

FIGURE 3-13: MESSAGE BOX

Write Flash Finish	
	ок

3.3 BLE CONNECTION TO SMARTPHONE

Perform the following actions to establish a BLE connection between the BM70 EVB and a smartphone. An iPhone with iOS9.2.1 is used for this demonstration.

1. Set the switch SW7 to the OFF position (Application mode) on the BM70 EVB, see Figure 3-14.



2. Connect the BM70 EVB to a PC using the micro-USB cable, see Figure 3-15. Press the Reset button (SW5) to reset the BM70 EVB. On connection, LED6 (red) will turn ON and LED1 (blue) blinks once at an interval.

FIGURE 3-15: POWER ON BM70 EVB



3. Download the mBIOT app from the App Store and enable the Bluetooth settings on the iPhone, see Figure 3-16.

●●●●● 中華電信 4G Settings	14:03 \$ 83 Bluetooth	∞ ■>		
Bluetooth		0		
Now discoverable	as "Charles'iPhone+".			
MY DEVICES				
BLE-SPPTX	Not Connected	(i)		
BluePort	Not Connected	(1)	m	1BIOT utility app
BM70_BLE	Not Connected	(1)		mBloT
SYNC	Not Connected	i		
OTHER DEVICES	0			
3SPK_SLA1				
DIO_CHANG-N	IB			
FY17_Alpha_2_	MAS			

FIGURE 3-16: ENABLING BLUETOOTH AND MBIOT APPLICATION

FIGURE 3-17:

•••••• 46 13:48	* 86% ■) CHIP 1.1	
BM70 BLE UART	BM78 BLE UART	
AUDIO WIDGET		

4. Tap mBIOT app and then tap to open the BM70 BLE UART, see Figure 3-17.

SELECT BM70 BLE UART

5. A list of discoverable devices will be displayed. Tap on BM70_BLE to connect, see Figure 3-18.

FIGURE 3-18: **DISCOVERED DEVICES VIEW**

40	13:50	3 86%
K Back	MICROCHIP	AutoTest
CONNECTED	DEVICE:	
DISCOVERED	DEVICES:	
BLESDK01		
BM70_BLE	Click!	
LE_Dual_EK	τŪ	
LE_FY17_Al	pha_2_MAS	
LE_Dual_SP	к	
DEVICE RECO	DRD:	
BLE-CLS1	9-8084E481F146	Delete
101071_DI E		
BM70 BLE UART 1.1, libr	Scanning rary 1.4, Jan 29 2016	2014 Prove
Refresh C	ancel UUID Set	ting

6. Under **Connected Device**, tap **BM70_BLE connected** to get the device information, see Figure 3-19

••••0	4G	13:50	\$ 86% 💻
< Back	2	MICROCHIP	AutoTest
CONNECT	ED DEV	/ICE:	
BM70_BI connected	LEC	lick!	Disconnect
DISCOVER		/ICES:	
BLESDK	01		
LE_Dual_	_EKU		
LE_FY17_	_Alpha	_2_MAS	
LE_Dual_	_SPK		
DEVICE RE	ECORD:		
BLE-CLS	51 17-D9E9-B084E4	481F146	Delete
101071_0			~ · ·
BM70 BLE UART 1.	Sc 1.1, library 1.4	anning I, Jan 29 2016	$\hat{\eta}_{1}\hat{q}$
Refresh	Cance	ป	

FIGURE 3-19: CONNECTED DEVICE VIEW

- 7. Tap **Device Info** to check the device information, see Figure 3-20.
- FIGURE 3-20: DEVICE INFORMATION



FIGURE 3-21:	DEVICE INFORMATION	
	HICROCHIP	7 \$ 86% ■)
	Manufacture Name: ISSC	1
	Model Number: BM70	
	Serial Number: 0000	
	Hardware Revision: 5505 102_BLDK3	
	Firmware Revision: 010300	
	Software Revison: 0000	
	System ID: <0000000 0000000>	
	Specific UUID1:	
	Specific UUID2:	
	[Regulatory Certification Data List] 0000000001000000 Count: 0x0000 Len: 0x0000	

8. The device information will be displayed, see Figure 3-21.

9. The BLE link is established between the BM70 EVB and an iPhone, see Figure 3-22.

FIGURE 3-22: BLE LINK CONNECTION



3.4 BLEDK3 AUTO PATTERN AND MANUAL PATTERN TOOLS

The BLEDK3 firmware, written on the BM70 module, has two distinct modes, Auto Pattern and Manual Pattern. Both these modes use their own state machines. The BM70 module can be operated in both the modes by setting the value in the EEPROM. By default, the BM70 module is in Auto Pattern mode.

3.4.1 Auto Pattern Mode

In Auto Pattern mode, the state machine automates most of the Bluetooth related operations, such as advertising and Transparent UART service. The Transparent UART service is primarily used to connect the module to a peer device and to create a data pipe with the peer device through the Transparent UART mode with minimal instructions from the host MCU.

To evaluate and test the BM70 module in Auto Pattern mode, download and install the Auto Pattern tool (Windows-based GUI emulation tool), which is available for download on the Microchip web site. This tool implements the communication protocol and provides a fast and easy way to test the functions with the available options in the Auto Pattern mode.

3.4.2 Manual Pattern Mode

The Manual Pattern mode provides a full control of the BM70 module to the user and the module operates only based on the commands from the user or host MCU. The Manual Pattern tool also allows the Transparent UART mode; however, there is a small difference in the protocol used in this mode in comparison to the Auto Pattern mode.

To evaluate and test the BM70 module in Manual Pattern mode, download and install the Manual Pattern tool (Windows-based GUI emulation tool), which is available for download on the Microchip web site. This tool implements the communication protocol and provides a fast and easy way to test the functions with the available options in the Manual Pattern mode.

Note: For more information on Auto Pattern and Manual Pattern tools, refer to the *"IS187x_BM7x BLEDK3 Application Note"*, which is available on the Microchip web site: www.microchip. com/bm-70-pictail.

3.5 APPLICATION FIRMWARE INFORMATION

The BLEDK3 firmware application is the default application on the BM70 EVB. This application provides the BLE UART Transparent, BLE GATT-based transceiver, Beacon and BeaconThings functionality.

For additional information on the BLEDK3 application functionality, refer to the *"IS187x_BM7x BLEDK3 Application Note"*, which is available on the Microchip web site: www.microchip.com/bm-70-pictail.

NOTES:



BM70 PICTAIL™/PICTAIL PLUS EVB USER'S GUIDE

Chapter 4. Flash Programming Procedure

This chapter describes the process of downloading the firmware to the BM70 module.

4.1 FLASH PROGRAMMING PROCEDURE

Flash programming is required to update a newer or specific version of the firmware. Perform the following actions for Flash programming:

1. Set the switch SW7 in the ON position (Test mode), see Figure 4-1.

FIGURE 4-1: SW7 IN TEST MODE



- 2. Ensure that the jumpers, J1, JP8 and J3, on the BM70 EVB are connected, as illustrated in Figure 3-10.
- Connect the BM70 EVB to a PC using the micro-USB cable, see Figure 4-2. On connection, LED6 (red) and LED1 (blue) will turn on. Press the Reset button (SW5) to reset the BM70 module.

FIGURE 4-2: FLASH PROGRAMMING SETUP



- 4. Download and install the isupdate.exe file, which is available for download from the Microchip web site: www.microchip.com/bm-70-pictail.
- 5. Double-click the isupdate.exe file to open the firmware update tool on the PC.
- 6. Click **Connect** after setting these parameters.
 - Port
 - Baud Rate: 115200
 - Memory type/subtype: Flash/Embedded Flash
 - Address: 0000

On successful connection, "Port connect -> Port Number" message will be displayed, see Figure 4-3.

FIGURE 4-3: FIRMWARE UPDATE TOOL WINDOW - PORT CONNECT

		memory			<i></i>
port COM28	baudrate 115200	type/subtype flash	/ Embedd 👻 addr	ess 0000	Disconnect
=lash Update/[ump				
Images Prepa	re: Load all images			 Browse 	PSRAM run
				Update	Verify
Images			bank num	Browse	Dump
-lash/EEPRom	MCU/AHB Access				
Address	Length(Hex)	Data(Hex)		Read	Write

7. If the connection is failed, "Connect failed" message will be displayed. Verify the parameters and try connecting it again, see Figure 4-4.

Access Port port COM28 🔻	baudrate 115200	▼ memory type/subtype flash	✓ / Embedd ✓	address	0000	Connect
Flash Update/Dum	ιp					
Images Prepare:	Load all images			-	Browse	PSRAM run
					Update	Verify
Images			- bank num	-	Browse	Dump
Flash/EEPRom/MC	U/AHB Access					
Address					Deed	
onnect faile	d	Data(Hex)			Read) write

FIGURE 4-4: FIRMWARE UPDATE TOOL WINDOW

8. Click **Browse** to display four Flash code files (.hex) downloaded from the Microchip web site.



10. In the Firmware Update tool window, click **Update**, see Figure 4-6.

ccess Port				
port COM55	- baudrate 115200 -	memory type/subtype flash + / Embedc +	address 0000	Disconnect
lach Lindate (Di		(personal)		
mages Bank 0	: D:\Project\Bluetooth SPP\BT!	5505\5505MP_102\System Test\MP Tool\Flash8	SUIV + Browse	PSRAM run
			Lindate	Verify
mages		- bank num	Province	
			browse	
lash/EEPRom/N	ICU/AHB Access			
ddress	Length(Hex)	Data(Hex)	Read	Write
tase flash tart Write	Memory Bank 0 Now	irch, 05, 10:51:32 Elapse time : Cime : March, 05, 10:51:32 Elapse	: 0.024 second e time : 0.117 s	second

FIGURE 4-6: FIRMWARE UPDATE

11. The Firmware Update tool will start writing the Flash codes. Wait until the message "End of Write Memory!" with the elapse time is displayed, see Figure 4-7.

nest COMES	- haudeate (urace	memory factory	فاقع المحادث	0000	Disconnect
port	* baudrate 115200 *	type/subtype hash /	Embedc - add	ress 0000	Disconnect
Flash Update/D	ump				
Images Prepar	e: Load all images			Browse	PSRAM run
				Update	Verify
Images		-	bank num	Browse	Dump
Flash/EEPRom/	ICU/AHB Access				
Address	Length(Hex)	Data(Hex)		Read	Write
Start erase Frase Flash Start Write Start Write Start Write Start Write	Flash NowTime : M success! NowTime : M Memory Bank 0 Now Memory Bank 1 Now Memory Bank 2 Now Memory Bank 3 Now Memory! Elapse ti	arch, 05, 10:51:32 Elaj arch, 05, 10:51:32 Elaj Time : March, 05, 10:51 Time : March, 05, 10:51 Time : March, 05, 10:51 Time : March, 05, 10:51 me : 18.526 second	ose time : 0. ose time : 0. 32 Elapse ti: 37 Elapse ti: 41 Elapse ti: 44 Elapse ti:	000 second 024 second me : 0.117 se me : 4.619 se me : 8.455 se me : 12.345 s	cond cond cond econd

FIGURE 4-7: FIRMWARE UPDATE FINISH

- 12. To verify the firmware version, enter the following parameters under the Flash/EEPROM/MCU/AHB Access section, and then click **Read**, see Figure 4-8:
 - Address: "100e"
 - Length (Hex): "02"

FIGURE 4-8: ENTERING PARAMETERS

Access Port				202200					
port COM2	28 🔻 ba	audrate 1152	00 type/s	subtype flash	-/	Embedd 👻	address	0000	Disconnect
Flash Update	:/Dump								
images Pre	pare: Load	d all images					•	Browse	PSRAM run
								Update	Verify
Images					•	bank num	•	Browse	Dump
Elash/EEPRo	m/MCLI/AF								
ddraee	100e	Length(Hev)	02	Data(Hex)				Read	Write
iddi C33		cengui(nex)		Data(iex)			l		
		00120							

13. The Data (Hex) box will display the value "01 03" along with the related log information, see Figure 4-9.

Flash Update/Dump Images Prepare: Load all images ▼ Browse PSRAM run Update Verify images ▼ bank num ▼ Browse Dump Flash/EEPRom/MCU/AHB Access kddress 100e Length(Hex) 02 Data(Hex) 01 03 Read Write ort connect -> COM28 ead E2PROM :	port COM28 Vort	115200 - tvr	memory e/subtype flash 👻	/ Embedd 👻 addr	ess 0000	Disconnect
Images Prepare: Load all images	Flash Update/Dump					
Update Verify Images value Imag	Images Prepare: Load all image	S			Browse	PSRAM run
Images value bank num value Browse Dump Flash/EEPRom/MCU/AHB Access Address 100e Length(Hex) 02 Data(Hex) 0103 Read Write Nort connect -> COM28 Lead E2PROM :					Update	Verify
Flash/EEPRom/MCU/AHB Access Address 100e Length(Hex) 02 Data(Hex) 0103 Read Write Port connect -> COM28 Wead E2PROM :	Images			- bank num	Browse	Dump
	Address 100e Length() ort connect -> COM28 ead E2PROM :	lex) U2	Data(Hex) 0103		Read	Write

FIGURE 4-9: DATA (HEX) VALUE

14. After completing the firmware update, reboot the BM70 EVB using the Reset button (SW5).



BM70 PICTAIL™/PICTAIL PLUS EVB USER'S GUIDE

Chapter 5. USB-to-UART Converter and Host DUT

This chapter describes the use of the USB-to-UART converter circuit which is available on the BM70 EVB. The UART interface of the BM70 module on the BM70 EVB can be connected to the user DUT. The DUT can be a customer board with a host microcontroller or another BM70 EVB.

5.1 CONNECTING UART TO BM70 EVB DUT

The BM70 EVB has a MCP2200 IC acting as a USB-to-UART converter that connects the BM70 module to the micro-USB port. The BM70 EVB also has a range of header pins that connect to the UART I/O pins of the BM70 module. This gives the flexibility to connect the USB-to-UART converter on the BM70 EVB to another BM70 DUT, or connect the BM70 EVB test pins directly to another host microcontroller DUT.

Figure 5-1 illustrates how to connect the USB-to-UART converter on the BM70 EVB to the user BM70 DUT. The pins, HCI_TXD, HCI_RXD, P2_0, VBAT, GPIO and GND, are connected to the DUT. The user can connect a micro-USB cable to a PC and perform the emulation tool functions, such as firmware or UI update. The P2_0 pin is connected to the switch SW7 to switch between Application and Test modes.



FIGURE 5-1: UART CONNECTION TO BM70 EVB DUT

5.2 CONNECTING UART TO HOST MICROCONTROLLER DUT

Figure 5-2 illustrates how to connect a user microcontroller DUT to a BM70 EVB to perform the emulation tool function. The pins, HCI_TXD, HCI_RXD, P2_0, VBAT, RESET, GPIO, and GND, are connected to the DUT. In this connection, the microcontroller can communicate with the BM70 EVB through the HCI UART interface by a defined command set. The P2_0 pin is controlled by the MCU to switch between Application and Test modes.



FIGURE 5-2: UART CONNECTION TO HOST MICROCONTROLLER DUT



BM70 PICTAIL™/PICTAIL PLUS EVB USER'S GUIDE

Appendix A. Schematics

A.1 REFERENCE SCHEMATICS





FIGURE A-2: BM70 EVB SCHEMATICS

NOTES:



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

Tel: 63-2-634-9065

Singapore Tel: 65-6334-8870

Taiwan - Hsin Chu

Taiwan - Kaohsiung

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

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

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

EUROPE

Austria - Wels

Tel: 43-7242-2244-39

Tel: 45-4450-2828

Fax: 45-4485-2829

Tel: 358-9-4520-820

Tel: 33-1-69-53-63-20

Fax: 33-1-69-30-90-79

Germany - Garching

Tel: 49-2129-3766400

Germany - Heilbronn

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

Italy - Milan

Italy - Padova

Tel: 972-9-744-7705

Tel: 39-0331-742611

Fax: 39-0331-466781

Tel: 39-049-7625286

Netherlands - Drunen

Tel: 49-7131-67-3636

Tel: 49-8931-9700

Germany - Haan

Finland - Espoo

France - Paris

Fax: 43-7242-2244-393

Denmark - Copenhagen

Norway - Trondheim Tel: 47-7289-7561

Poland - Warsaw Tel: 48-22-3325737

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

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

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

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

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

Philippines - Manila

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

Tel: 886-3-577-8366

Tel: 886-7-213-7830