MICROCHIP

BM70/BM71

Bluetooth® 4.2 BLE Module

Features

- Bluetooth® Smart 4.2 BLE compliant
- 1.9V~3.6V operating range
- UART/ I2C/ SPI interface supported
- PWM supported(3-ch for BM70, 1-ch for BM71)
- Temperature range (-20℃~70℃)
- Main Crystal : 32MHz
- Temperature sensor supported
- 12 bits ADC supported for 6CH(BM70) /4CH(BM71) input ports and battery voltage detection
- Wake up by any GPIO
- Peak current: TX 13mA/RX 13mA with Buck,@ VBAT=3.0V
- RSSI Monitor

RF/Analog Features

- ISM Band 2.402 to 2.480 GHz operation
- Channels 0-39
- Rx Sensitivity: -90 dBm@ BLE, in typical
- Tx Power: +2 dBm, support class 2 power output
- RSSI monitor

Antenna

- Ceramic Chip Antenna (BM70BLES1FC2/BM71BLES1FC2)
- External Antenna Connection via RF pad (BM70BLE01FC2/BM71BLES1FC2)

FIGURE 1: (BM71 NA)

Description

The BM70/BM71 BLE module is designed for App-enabled accessories and IoT (Internet of Things) through Bluetooth® connectivity.

It is available in the 2.4GHz ISM band radio, compatible with Bluetooth Core Specification Version 4.2 to enhance the throughputs and security for IoT applications.

For improving user experiences for IoT applications, the patent and trademark for Beacon Things Technology is applied to let users can control automatically and receive data to cloud without open App through iPhone.

The module build-in Bluetooth® stacks to be embedded Bluetooth® LE solution, so developer can save time to finish their design without taking efforts to care Bluetooth® issue. In addition, it narrows down the module size and minimizes its cost. For portable and wearable applications, the product optimized power design to minimize current consumption to extend battery life.

Applications

- IoT/ IoE
- Payment/ Security
- Wearable devices
- Smart Home
- Smart Health
- Apple iBeacon
- Digital Sports
- Proximity/ Find Me

Table of Contents

TO OUR VALUED CUSTOMERS

It is our intention to provide our valued customers with the best documentation possible to ensure successful use of your Microchip products. To this end, we will continue to improve our publications to better suit your needs. Our publications will be refined and enhanced as new volumes and updates are introduced.

If you have any questions or comments regarding this publication, please contact the Marketing Communications Department via E-mail at **docerrors@microchip.com**. We welcome your feedback.

Most Current Data Sheet

To obtain the most up-to-date version of this data sheet, please register at our Worldwide Web site at:

http://www.microchip.com

You can determine the version of a data sheet by examining its literature number found on the bottom outside corner of any page. The last character of the literature number is the version number, (e.g., DS30000000A is version A of document DS30000000).

Errata

An errata sheet, describing minor operational differences from the data sheet and recommended workarounds, may exist for current devices. As device/documentation issues become known to us, we will publish an errata sheet. The errata will specify the revision of silicon and revision of document to which it applies.

To determine if an errata sheet exists for a particular device, please check with one of the following:

- Microchip's Worldwide Web site; **http://www.microchip.com**
- Your local Microchip sales office (see last page)

When contacting a sales office, please specify which device, revision of silicon and data sheet (include literature number) you are using.

Customer Notification System

Register on our web site at **www.microchip.com** to receive the most current information on all of our products.

Abbreviations List:

BLE: Bluetooth Low Energy
IOT: Internet of Things

1.0 PRODUCT OVERVIEW

BM70 and BM71 are embedded 2.4 GHz Bluetooth® Version 4.2 (BLE) modules. The chip inside incorporates Bluetooth stack, power management subsystem, 2.4 GHz transceiver, and RF power amplifier. With the module developers can add Bluetooth® functionality rapidly for any IoT devices.

The BM70 and BM71 provide cost and time to market savings as a self-contained module solution. The modules have been designed to provide developers with a simple Bluetooth® solution as below:

- Ease of integration and programming
- Vastly reduced development time
- Minimum system cost and highest quality for wireless module
- Interoperability with Apple iOS and Google Android OS
- Maximum value in a range of applications

In addition, BM70 and BM71 also provide the BeaconThings® Technology to improve user experiences for IoT applications:

- Auto Connection/Control
- Data to Cloud Easily

The BM70 and BM71 can independently maintain a low power wireless connection. Low power usage and flexible power management maximize the module's lifetime in battery operated devices. A wide operating temperature range allows use in indoor and outdoor environments.

BM71 is the small form factor for wearable, compact, surface mount module with castellated pads for easy and reliable host PCB mounting.

TABLE 1-1: BM70/BM71 MODULE FAMILY TYPES

Part Number	Antenna on Board	Shielding	Pin #	Dimension
BM70BLE01FC2	No (External)	No	28	12mm x 15mm
BM70BLES1FC2	Yes	Yes	33	12mm x 22mm
BM71BLE01FC2	No (External)	No	17	6mm x 8mm
BM71BLES1FC2	Yes	Yes	16	9mm x 11.5mm

1.1 Interface Description

The block diagram of BM70/BM71 is shown in Figure 1-1. Pin diagram is shown in Figure 1-2 and the pin descriptions are shown in Table 1-1. Test pads on button side of each module, which are used for production test, are listed in Table 1-2.

FIGURE 1-1: BM70/BM71 BLOCK DIAGRAM

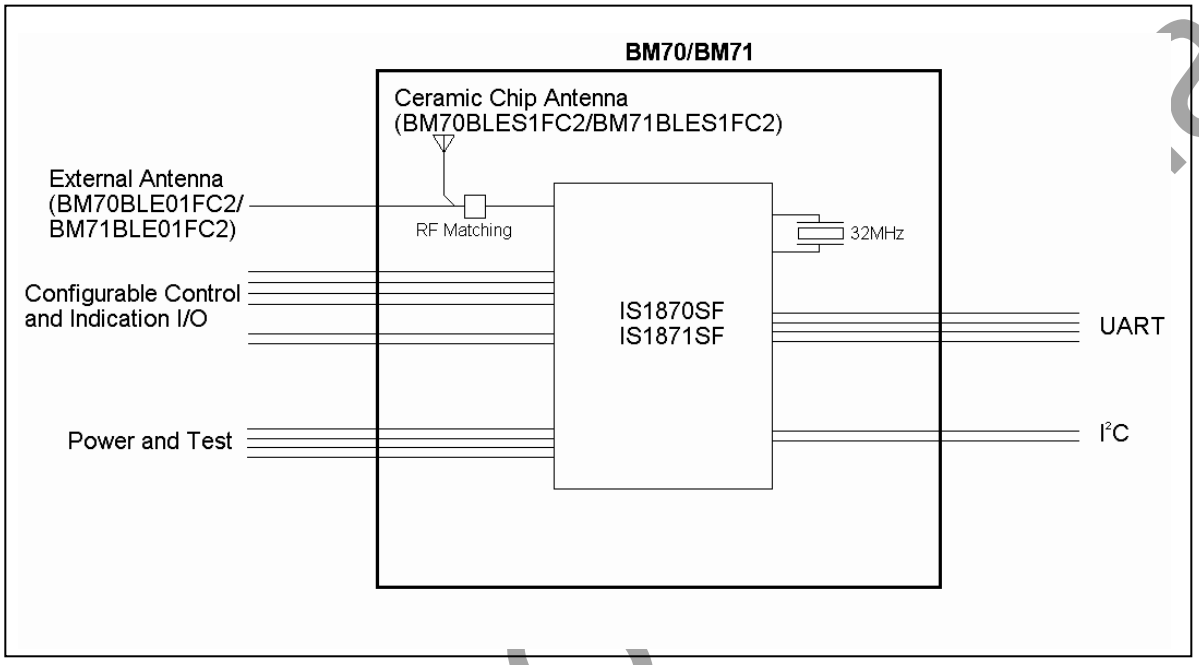


FIGURE 1-2: BM70/BM71 PIN DIAGRAM

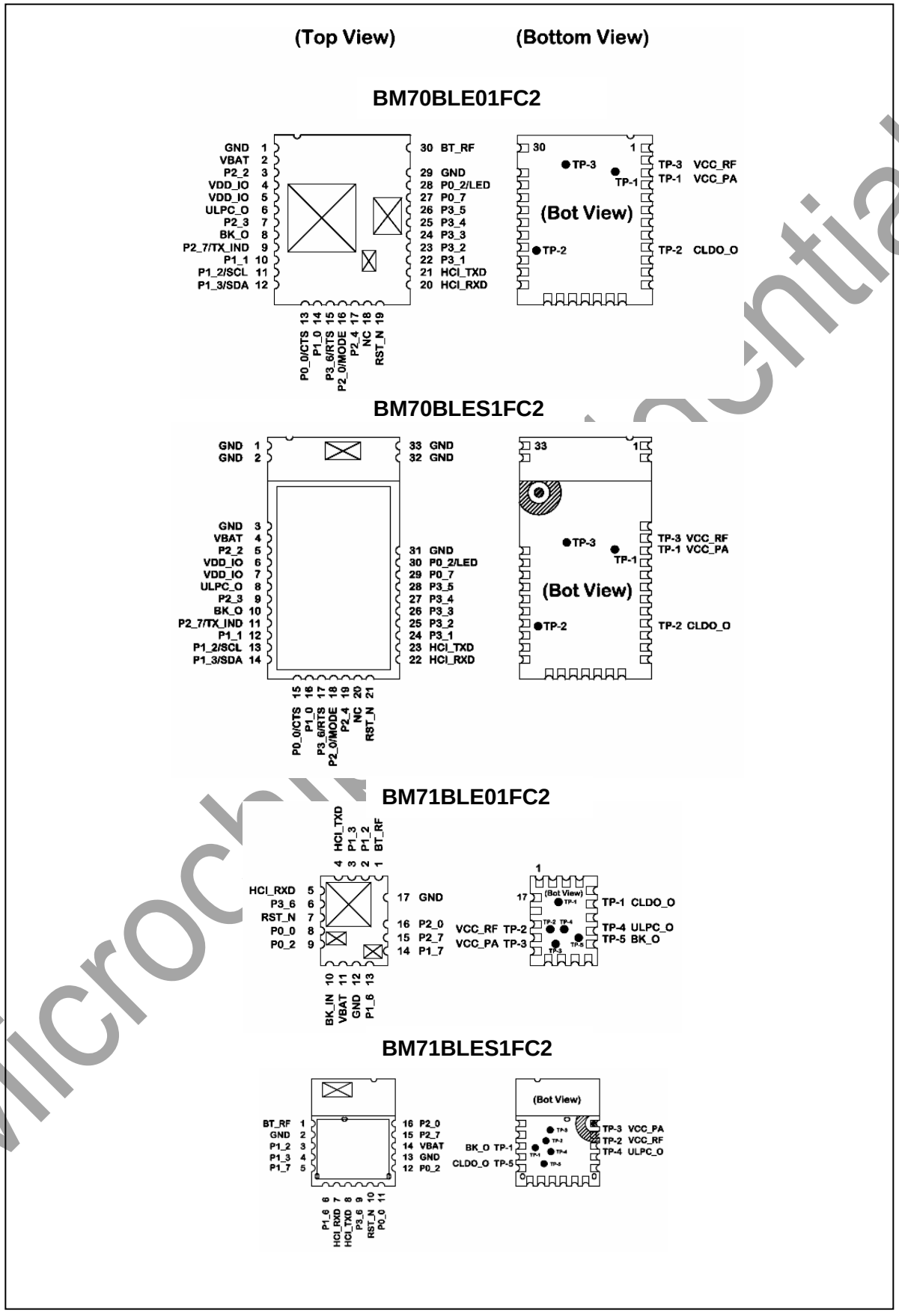


TABLE 1-1: PIN DESCRIPTION

BM70BLE01FC2	BM70BLES1FC2	BM71BLE01FC2	BM71BLES1FC2	Symbol	Type	Description
-- -	1	--	--	GND	Power	Ground reference
-- -	2	--	--	GND	Power	Ground reference
1	3	12	13	GND	Power	Ground reference
2	4	11	14	VBAT	Power	Battery input. Main positive supply input. Voltage Range: 1.9V~3.6V
		10	--	BK_IN	Power	Buck input. Main positive supply input. Connect to 10uF low ESR ceramic capacitor. Voltage Range: 1.9V~3.6V
3	5	--	--	P2_2	DIO	GPIO, default pull-high input PWM1
4	6	--	--	VDD_IO	Power	I/O positive supply. Ensure VDD_IO and MCU I/O voltage are compatible
5	7	--	--	VDD_IO	Power	I/O positive supply. Ensure VDD_IO and MCU I/O voltage are compatible
6	8	--	--	ULPC_O	Power	1.2V Programmable ULPC LDO Output for AON-logic and Retention Memory Supply
7	9	--	--	P2_3	DI	GPIO, default pull-high input PWM2
8	10	--	--	BK_O	Power	1.55V buck output
		13	6	P1_6	DIO AO	P1_6 External 32.768KHz Crystal Input: XI32K
		14	5	P1_7	DIO AI	P1_7 External 32.768KHz Crystal Output: XO32K
9	11	15	15	P2_7	DIO AI DO DO	GPIO, default pull-high input AD14 NCS2 : : 2nd SPI-Bus (Master mode) TX_IND
10	12	--	--	P1_1	DIO AI	GPIO, default pull-high input AD9
11	13	2	3	P1_2	DIO AI I/O	GPIO, default pull-high input AD10 I2C SCL.
12	14	3	4	P1_3	DIO AI DIO	GPIO, default pull-high input AD11 I2C SDA
13	15	8	11	P0_0	DIO AI DI	GPIO, default pull-high input AD0 UART flow-control CTS
14	16	--	--	P1_0	DIO AI	GPIO, default pull-high input AD8
15	17	6	9	P3_6	DIO DO DO	GPIO, default pull-high input PWM0 UART flow-control RTS
16	18	16	16	P2_0	DIO	System configuration, default pull-high input H → Application L → test mode.

17	19	--	--	P2_4	DIO	GPIO, default pull-high input
18	20	--	--	NC		No Connection
19	21	7	10	RST_N	DI	Module Reset(active low) (internal pull-
20	22	5	7	HCI_RXD	DI	HCI UART Data Input
21	23	4	8	HCI_TXD	DO	HCI UART Data Output
22	24	--	--	P3_1	DIO	GPIO, default pull-high input
23	25	--	--	P3_2	DIO DO	GPIO, default pull-high input SPI-Bus: MISO
24	26	--	--	P3_3	DIO DI	GPIO, default pull-high input SPI-Bus: MOSI
25	27	--	--	P3_4	DIO DO	GPIO, default pull-high input SPI-Bus: SCLK
26	28	--	--	P3_5	DIO AI	GPIO, default pull-high input LED1
27	29	--	--	P0_7	DIO	GPIO, default pull-high input
28	30	9	12	P0_2/LED	DIO AI	P02 AD2
29	31	17	2	GND	Power	Ground reference
--	32	--	--	GND	Power	Ground reference
30	--	1	1	BT_RF	AIO	External Antenna Connection (50 Ω)
--	33	--	--	GND	Power	Ground reference

Note 1: Pin type abbreviation: A = Analog, D = Digital, I = Input, O = Output.

Table 1-2 Test Points on Button Side

BM70BLE01FC2	BM70BLES1FC2	BM71BLE01FC2	BM71BLES1FC2	Symbol	Type	Description
TP-1	TP-1	TP-3	TP-3	VCC_PA	Power	1.55V RF PA LDO
TP-2	TP-2	TP-1	TP-5	CLDO_O	Power	1.2V CLDO Output
TP-3	TP-3	TP-2	TP-2	VCC_RF	Power	1.2V RF LDO Output
--	--	TP-4	TP-4	ULPC_O	Power	1.2V ULPC LDO Output
--	--	TP-5	TP-1	BK_O	Power	1.55V Buck Output

1.2 Configuring the BM70/BM71

Configuring the BM70/BM71 features and service table can be performed by using the "*Windows UI Configuration tool".* The detail information will be disclosed in the Application Note.

1.3 UART Interface

Figures 1-4 and 1-5 show Power and MCU interface examples

The BM70 UART pins TXD and RXD connect to the UART pins of the host MCU. It is highly recommended to use hardware flow control pins RTS and CTS. The BM70 hardware flow control is disabled by default and must be configured to enable. The UART Baud rate is configurable.

1.4 Control and Indication I/O Pins

I/O pins on BM70 are configurable control and indication I/O. Control signals are input to the BM70. Indication signals are output from the BM70. Table 1-3 shows configurable I/O pin assignment to control and indication signals example of BM70 BLEDK3 application. Note that for different BM70 application, the I/O assignment is different. The detail information will be disclosed in the related application note and configurable in the dedicated "UI Configuration Tool".

TABLE 1-3: CONFIGURATION AND INDICATION I/O ASSIGNMENTS FOR BM70 BLEDK3 APPLICATION

	N/C	LOW_BATTERY_IND	RSSI_IND	LINK_DROP	UART_RX_IND	PAIRING_KEY	RF_ACTIVE_IND	BLEDK_STATUS1_IND (*Note)	BLEDK_STATUS2_IND (*Note)
P10									Default
P31			Default						
P32				Default					
P33					Default				
P34						Default			
P07		Default							
P11								Default	
P22	Default								
P24	Default								
P35	Default								

*Note: Detail BLEDK status indication please see BLEDK3 release note.

For the BM70 BLEDK3 example, some I/O functions are fixed to dedicated function as listed in Table 1-4.

TABLE 1-4: FIX I/O ASSIGNMENTS FOR BM70 BLEDK3 APPLICATION

P36	UART_RTS
P00	UART_CTS
P27	TX_IND
P12	I2C/SCL
P13	I2C/SDA
P02	LED0
P31	SPI BUS/ NCS
P32	SPI BUS/ MISO
P33	SPI BUS/ MOSI
P34	SPI BUS/ SCLK

1.5 RESET (RST_N)

The Reset (RST_N) input pin resets the BM70/BM71 (active low pulse for at least 63 ns).

1.6 System Configuration

I/O pins P20 place the BM70 into operation modes as shown in Table1-5. P20 have internal pull-up.

TABLE 1-5: SYSTEM CONFIGURATION SETTINGS

P20	Operational Mode
High	Application Mode
Low	Test Mode (Write UI/Flash: Firmware Programming)

1.7 Power

Figure 1-4 shows an example power scheme using a 3.3 volt low-dropout (LDO) regulator supplying 3.3 volts to both the BM70/BM71 (BAT_IN and VDD_IO) and MCU VDD. This power scheme ensures that BM70 and MCU I/O voltages are compatible.

Figure 1-5 shows an example power scheme using a button cell battery. For BM71, a 10uF cap(X5R/X7R) is applied to `BAT_IN` pin. BM71BLES1FC2 need to connect BK_IN with VBAT.

FIGURE 1-4: BM70/BM71 TO MCU INTERFACE EXAMPLE – 3.3V LDO

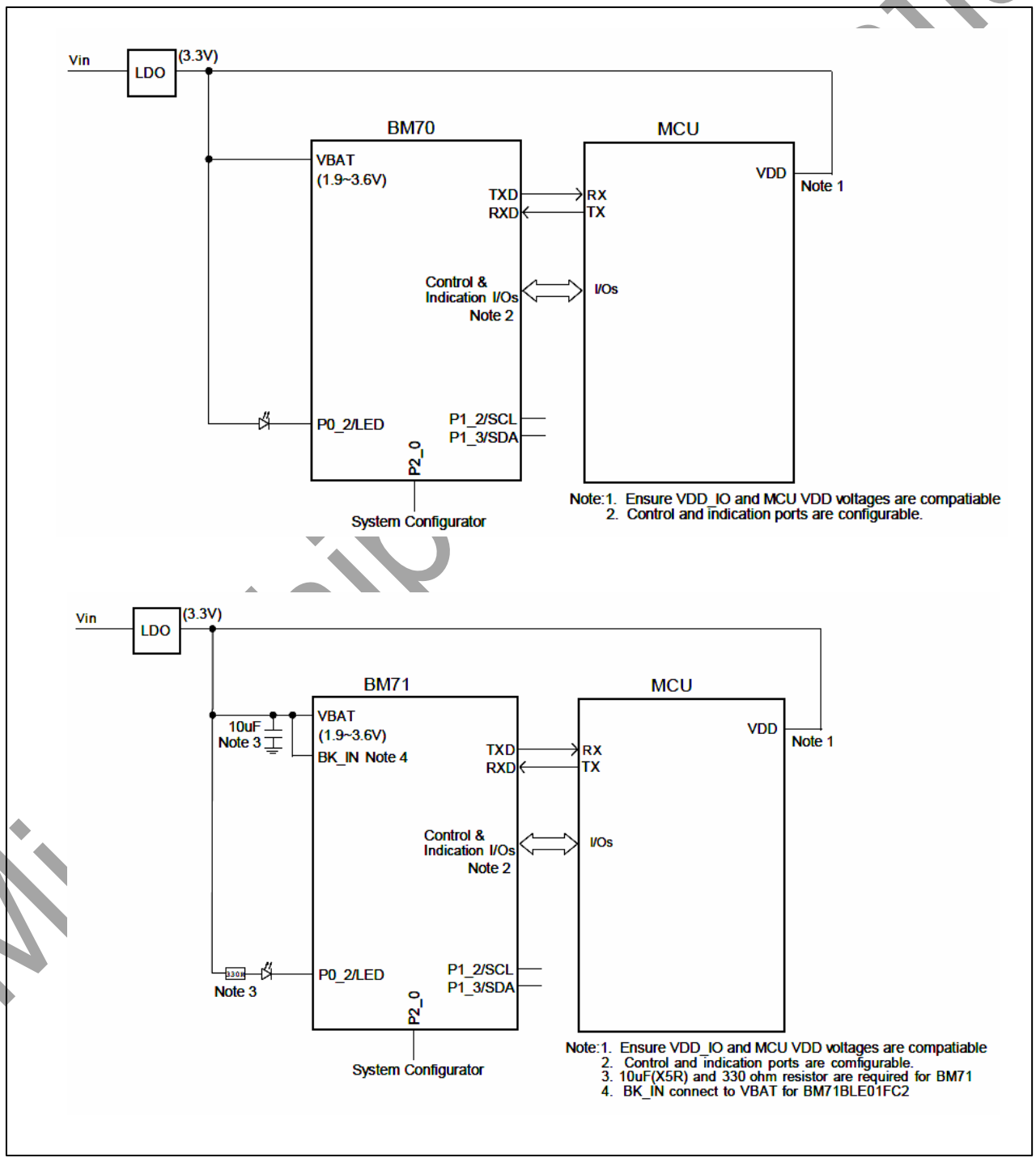
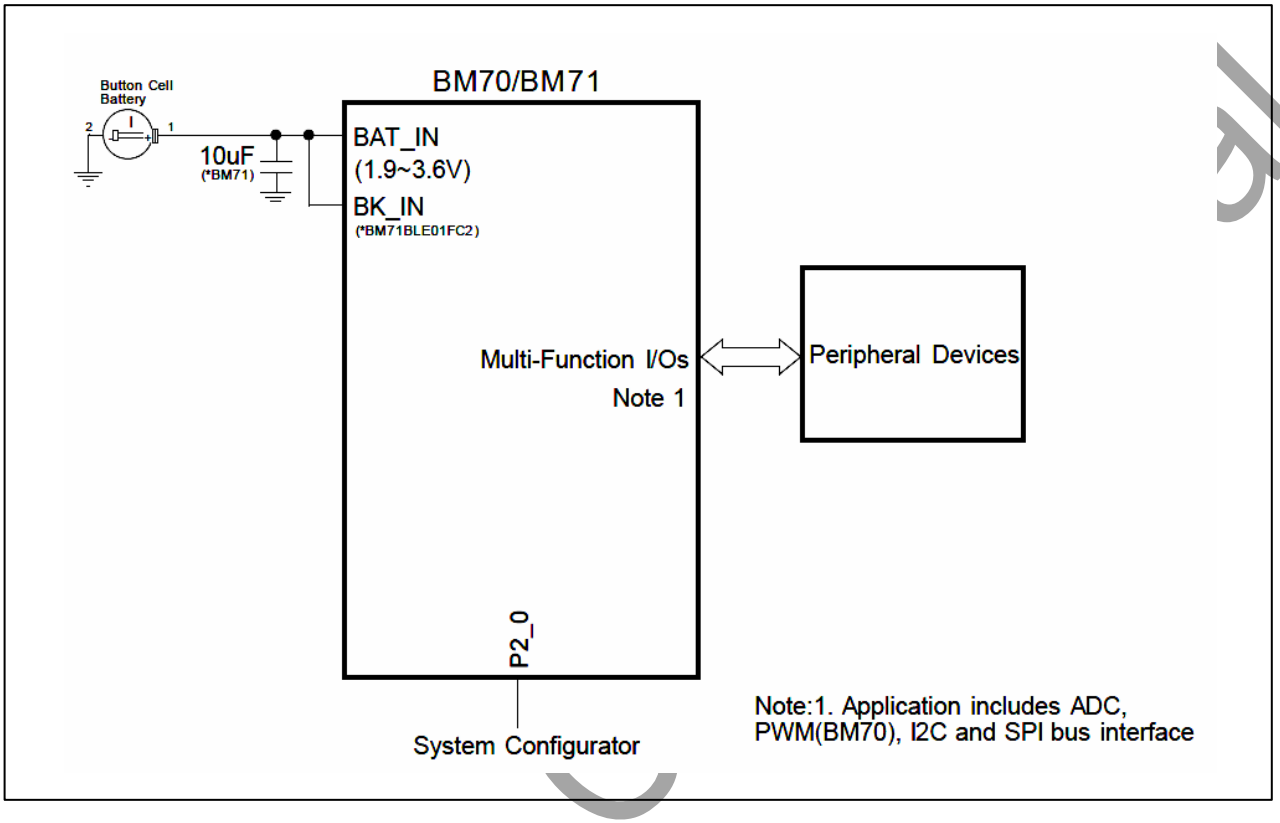


FIGURE 1-5: BM70 EMBEDDED APPLICATION EXAMPLE – Button Cell Battery



1.8 Mounting Details

BM70BLES1FC2

The BM70BLES1FC2 physical dimensions are shown in Figure 1-6, recommended host PCB footprint in Figure 1-7, and mounting suggestion in Figure 1-8. There should not be top copper layer near the test pin area shown in Figure 1-7. When laying out the host PCB, the areas under the antenna should not contain any top, inner layer, or bottom copper as shown in Figure 1-8. A low-impedance ground plane will ensure best radio performance (best range, lowest noise). Figure 1-8 shows a minimum ground plane area to the left and right of the module for best antenna performance. The ground plane can be extended beyond the minimum recommended as need for host PCB EMC noise reduction. For best range performance, keep all external metal away from the ceramic chip antenna at least 30 mm.

BM70BLE01FC2

The BM70BLE01FC2 physical dimensions are shown in Figure 1-9, recommended host PCB footprint in Figure 1-10, and mounting suggestion in Figure 1-11. It is highly recommended to layout the host PCB as suggested in Figure 1-11. A low-impedance ground plane will ensure best radio performance (best range, lowest noise). Pin 30 (BT_RF) is a 50 ohm connection to an external antenna connector, PCB trace antenna, or component (ceramic chip) antenna through a host PCB 50 ohm micro-strip trace. This trace can be extended to include passive parts for antenna attenuation padding, impedance matching, or to provide test posts. It is recommended that the micro-strip trace be as short as possible for minimum loss and best impedance matching. If the micro-strip trace is longer, it should be a 50 ohm impedance. Figure 1-11 shows an example connection to U.FL connector.

BM71BLES1FC2

The BM71BLES1FC2 physical dimensions are shown in Figure 1-12, recommended host PCB footprint in Figure 1-13, and mounting suggestion in Figure 1-14. There should not be top copper layer near the test pin area shown in Figure 1-13. When laying out the host PCB, the areas under the antenna should not contain any top, inner layer, or bottom copper as shown in Figure 1-14. A low-impedance ground plane will ensure best radio performance (best range, lowest noise). Figure 1-14 shows a space area around antenna section for best antenna performance. The ground plane can be extended beyond the minimum recommended as need for host PCB EMC noise reduction. For best range performance, keep all external metal away from the ceramic chip antenna at least 30 mm.

BM71BLE01FC2

The BM71BLE01FC2 physical dimensions are shown in Figure 1-15, recommended host PCB footprint in Figure 1-16, and mounting suggestion in Figure 1-17. It is highly recommended to layout the host PCB as suggested in Figure 1-17. A low-impedance ground plane will ensure best radio performance (best range, lowest noise). Pin 1 (BT_RF) is a 50 ohm connection to an external antenna connector, PCB trace antenna, or component (ceramic chip) antenna through a host PCB 50 ohm micro-strip trace. This trace can be extended to include passive parts for antenna attenuation padding, impedance matching, or to provide test posts. It is recommended that the micro-strip trace be as short as possible for minimum loss and best impedance matching. If the micro-strip trace is longer, it should be a 50 ohm impedance. Figure 1-17 shows an example connection to U.FL connector.

1.9 Soldering Recommendations

The BM70/BM71 wireless module was assembled using standard lead-free reflow profile IPC/JEDEC J-STD-020.

The module can be soldered to the host PCB using standard leaded and lead-free solder reflow profiles. To avoid damaging the module, the following recommendations are given:

- Microchip Technology Application Note AN233 Solder Reflow Recommendation (DS00233) provides solder reflow recommendations
- Do not exceed peak temperature (T_P) of 250 deg C
- Refer to the solder paste data sheet for specific reflow profile recommendations
- Use no-clean flux solder paste
- Do not wash as moisture can be trapped under the shield
- Use only one flow. If the PCB requires multiple flows, apply the module on the final flow.

FIGURE 1-6: BM70BLES1FC2 MODULE DIMENSIONS

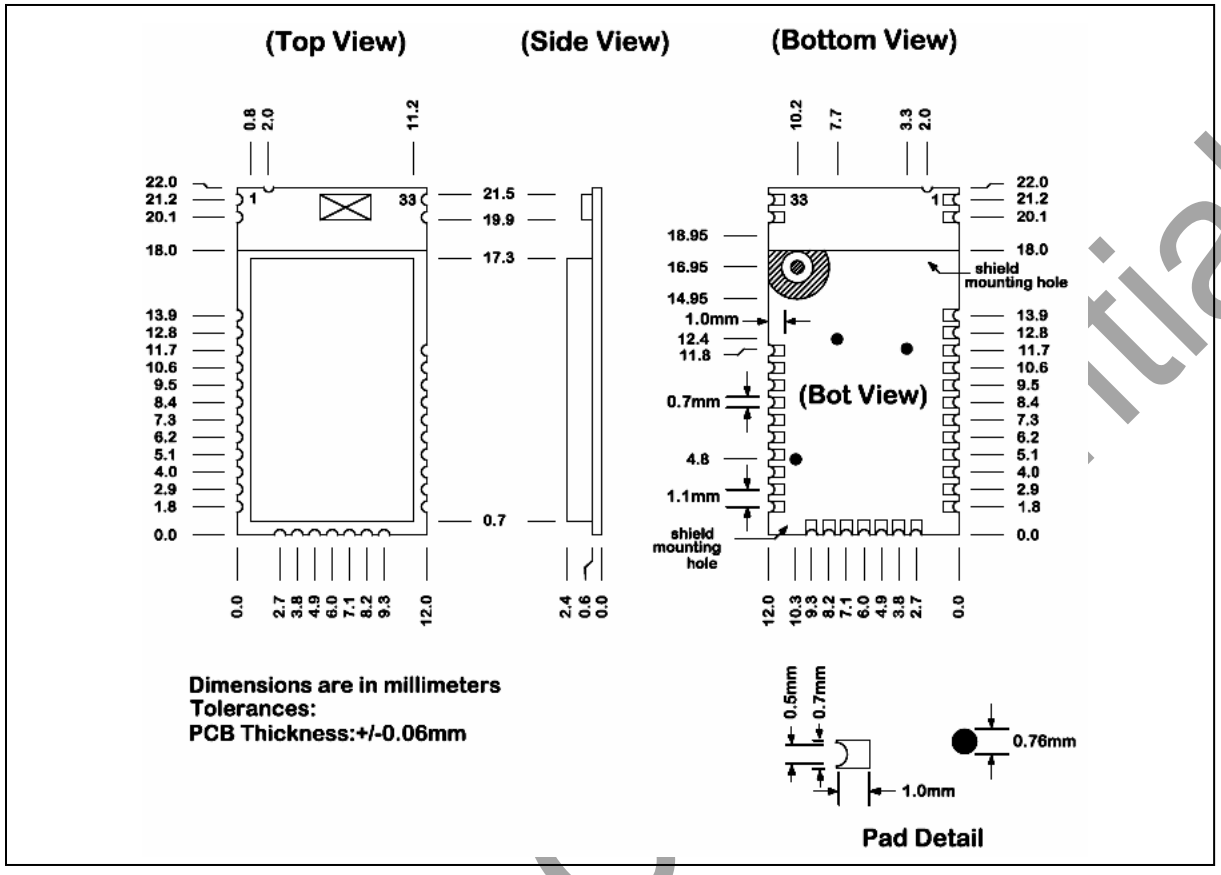


FIGURE 1-7: BM70BLES1FC2 RECOMMEDED PCB FOOTPRINT

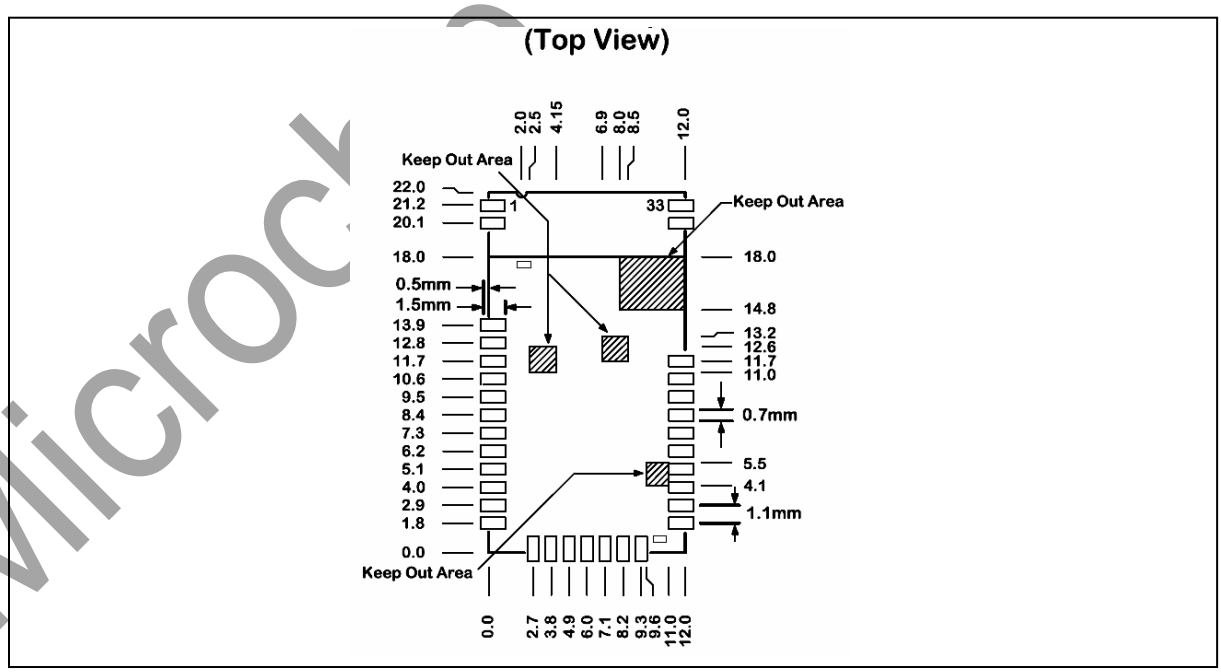


FIGURE 1-8: BM70BLE01FC2 HOST PCB MOUNTING SUGGESTION

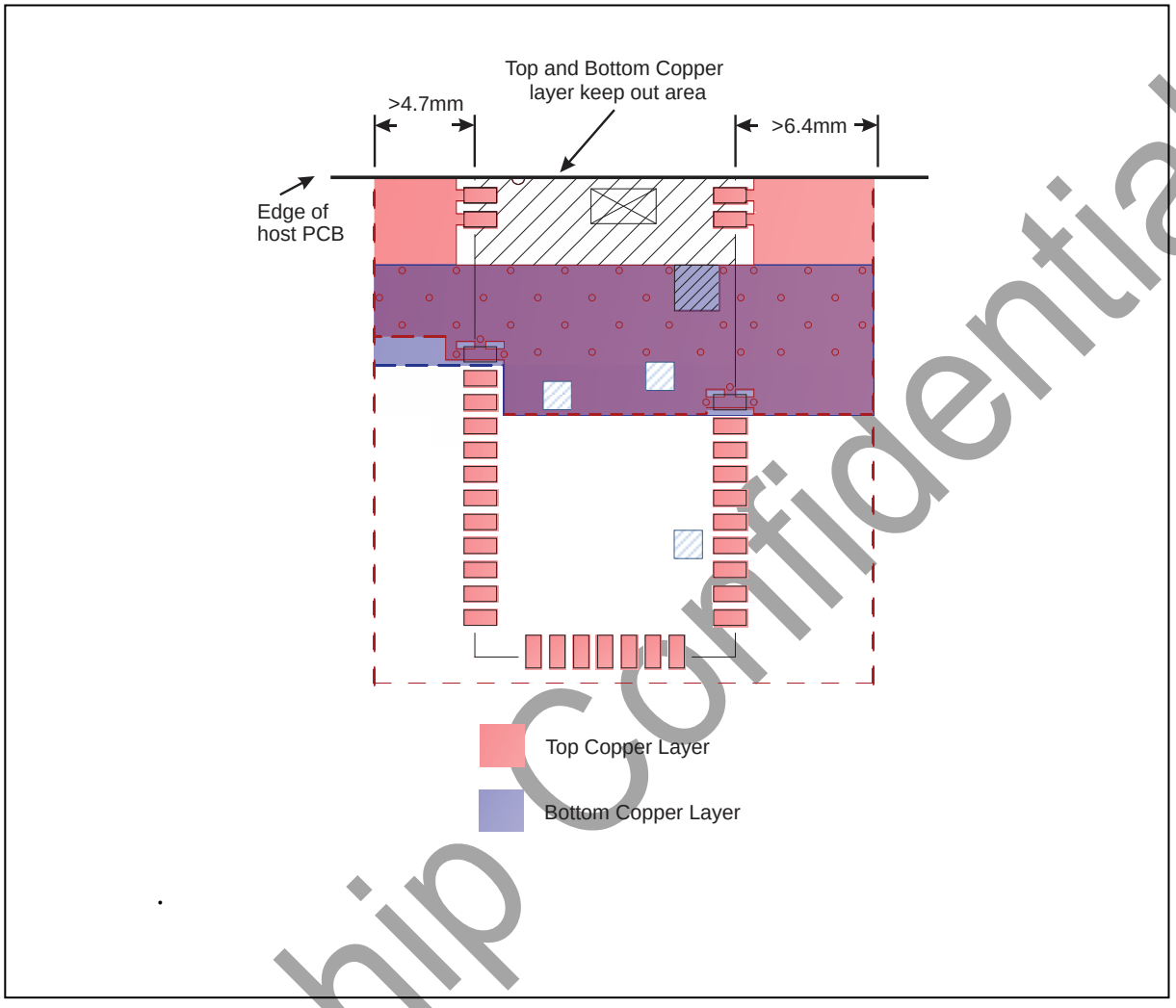


FIGURE 1-9: BM70BLE01FC2 MODULE DIMENSIONS

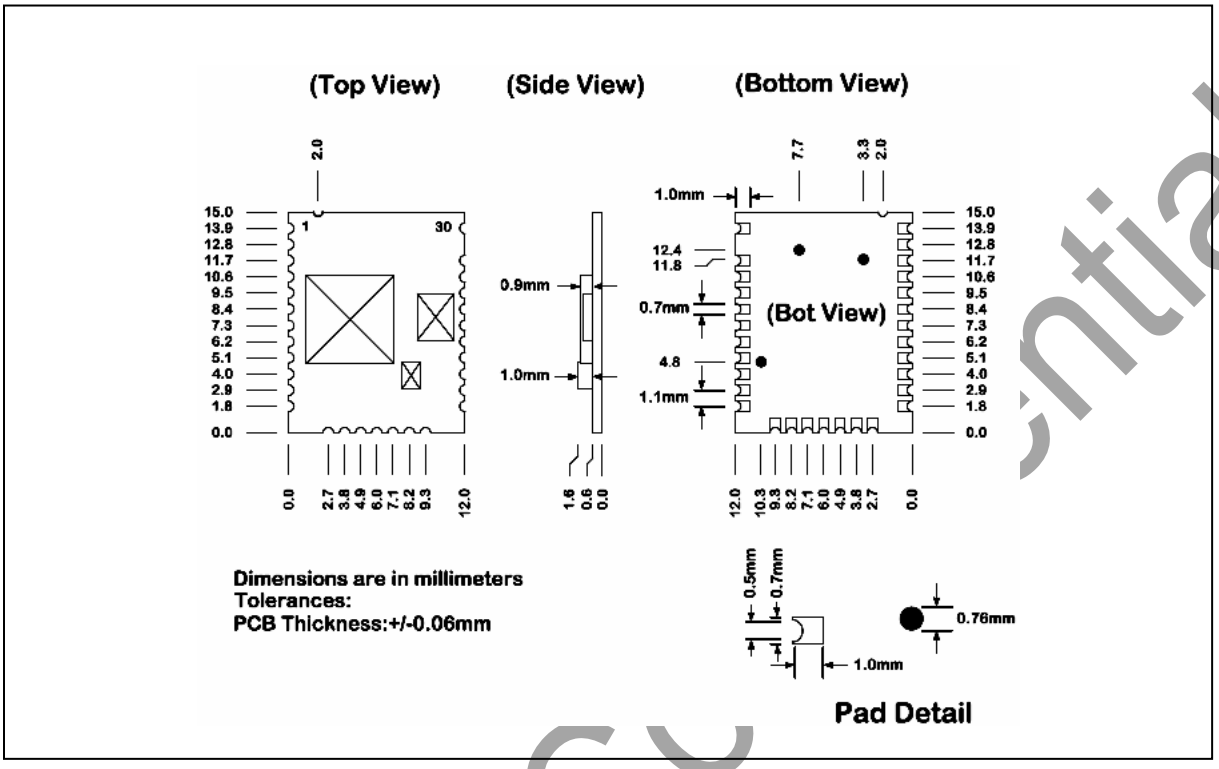


FIGURE 1-10: BM70BLE01FC2 RECOMMEDED PCB FOOTPRINT

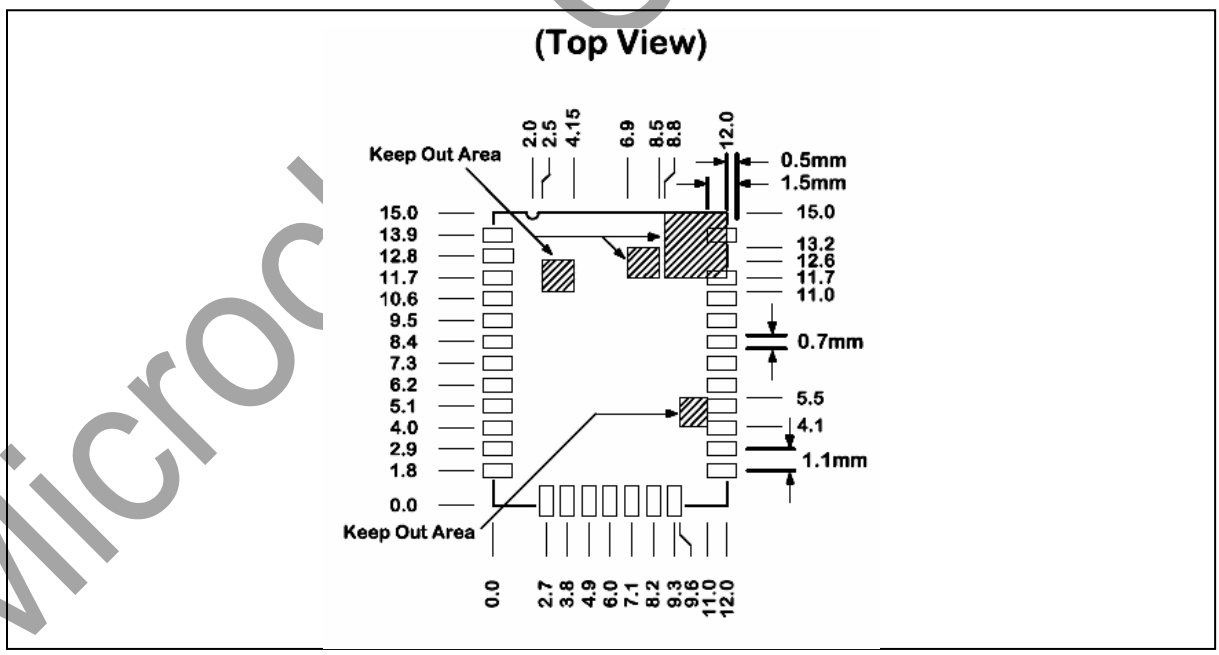
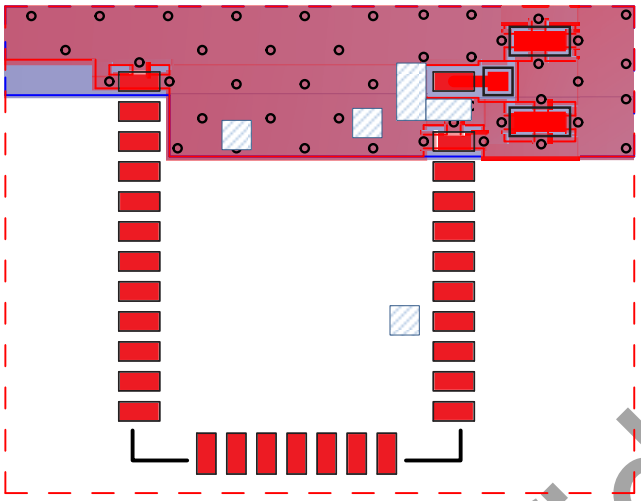


FIGURE 1-11: BM70BLE01FC2 HOST PCB MOUNTING SUGGESTION



Top Copper Layer

Bottom Copper Layer

Note: Keep out layer marked as ▨ is the test point position under module.

FIGURE 1-12: BM71BLES1FC2 MODULE DIMENSIONS

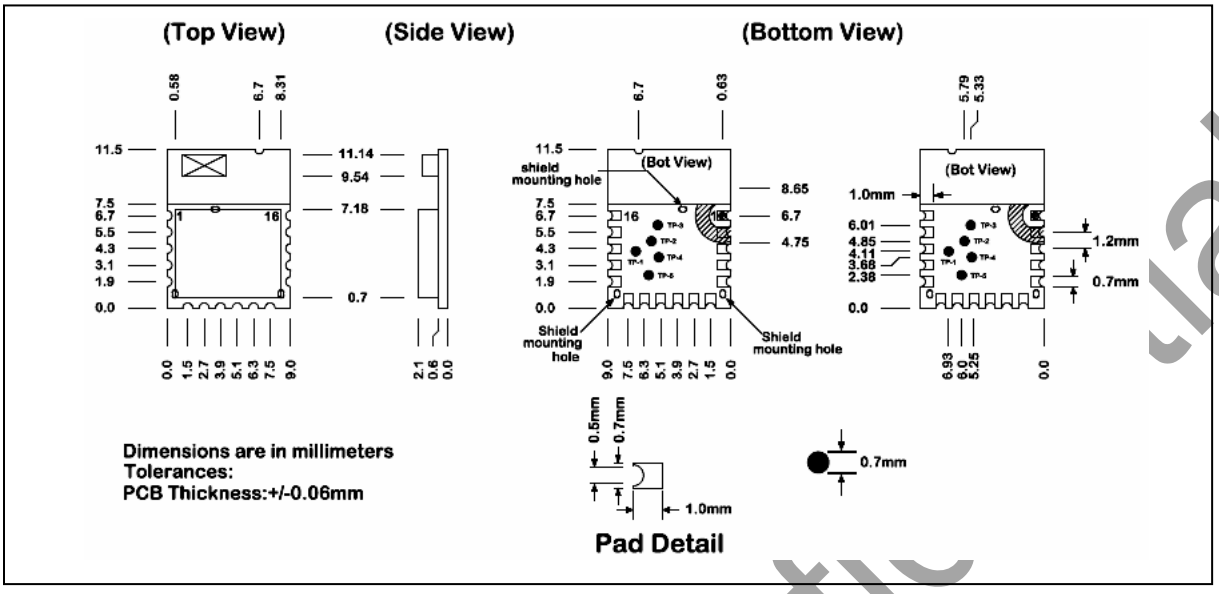


FIGURE 1-13: BM71BLES1FC2 RECOMMEDED PCB FOOTPRINT

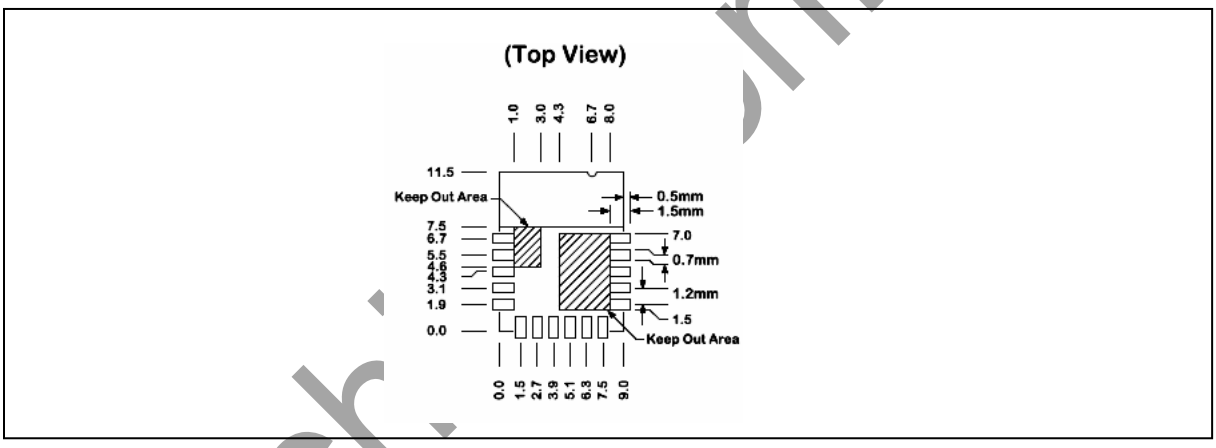


FIGURE 1-14: BM71BLES1FC2 HOST PCB MOUNTING SUGGESTION

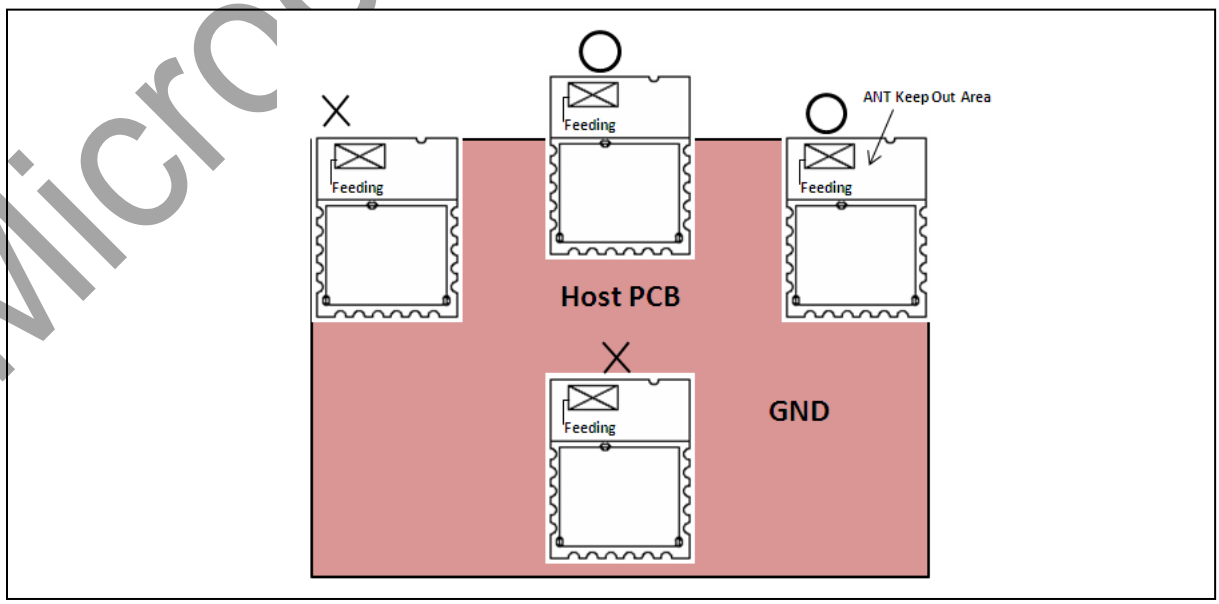


FIGURE 1-15: BM71BLE01FC2 MODULE DIMENSIONS

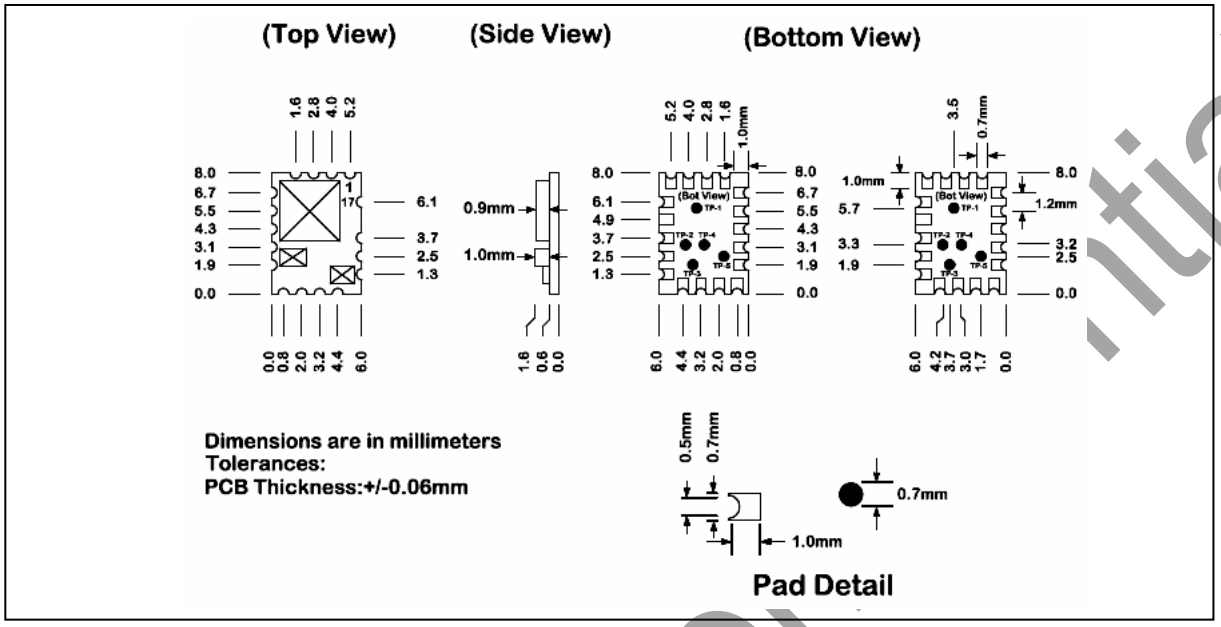


FIGURE 1-16: BM71BLE01FC2 RECOMMEDED PCB FOOTPRINT

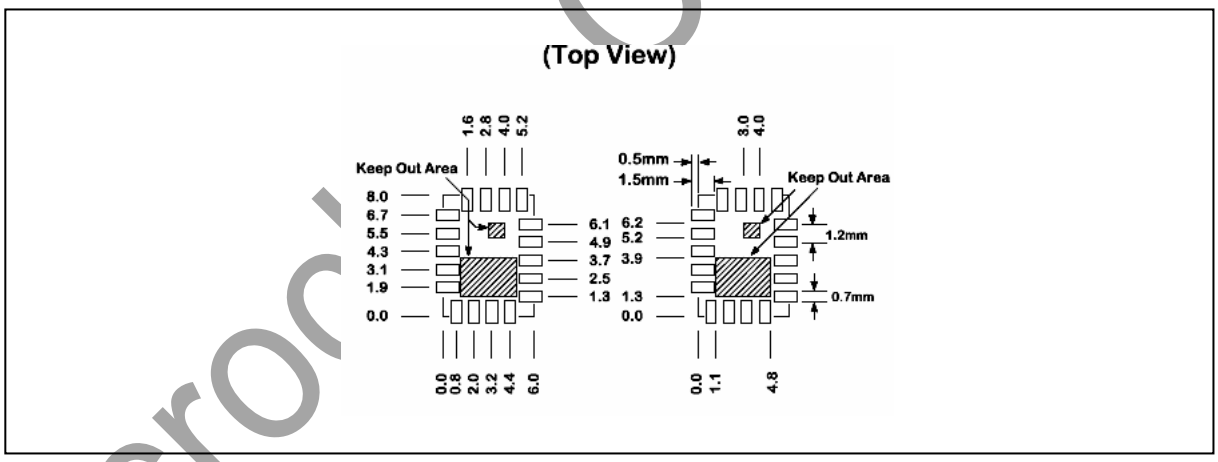
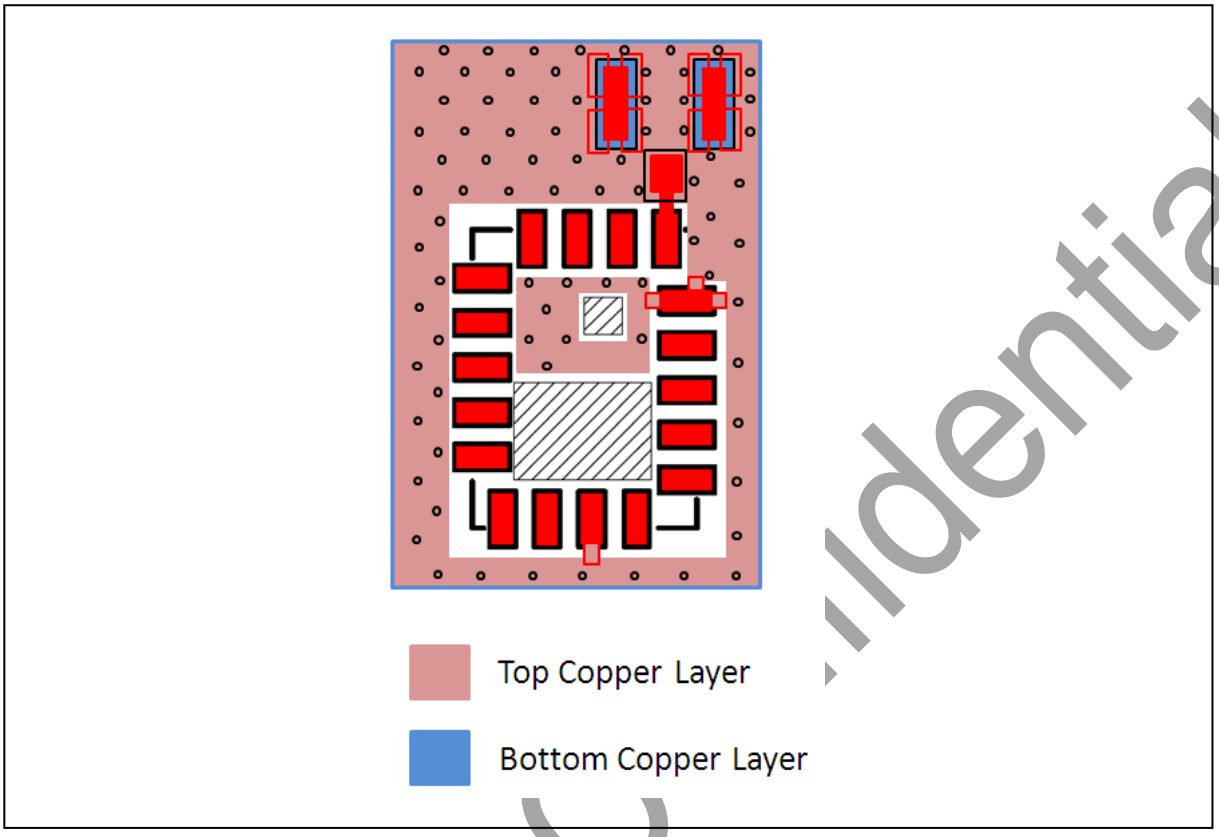


FIGURE 1-17: BM71BLE01FC2 HOST PCB MOUNTING SUGGESTION



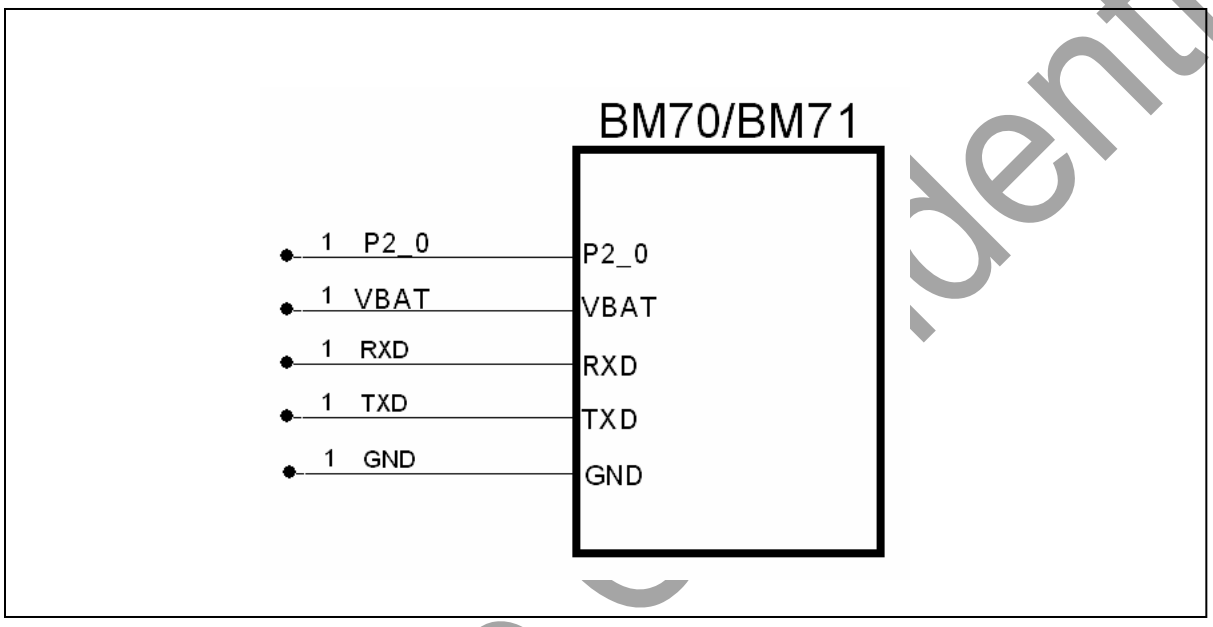
2.0 APPLICATION INFORMATION

2.1 External Configuration and Programming

The BM70 module can be configured and firmware programmed using an external configuration and programming tool. Figure 2-1 shows the connections between the module and test points, it is recommended to include these test points on the host PCB for development.

Configuration and firmware programming modes are entered according to the system configuration I/O pins (see Section 1.6).

FIGURE 2-1: EXTERNAL PROGRAMMING HEADER CONNECTIONS



2.2 Reference Circuit

Figure 2-2 ~ 2-5 show the BM70 and BM71 reference circuit. Figure In which UART, LED, GPIO, test interface and RF matching circuit are listed. GPIOs are configurable and the connection depends on user's application circuit. Power input range is 1.9V~3.6V. If battery is used, battery reverse protection circuit is suggested. The VDD_IO voltage is the same as power input. If LED display is used, be sure the power voltage > 3.0V to make it visual. RF antenna matching circuit in BM70BLE01FC2 also needs to be reserved to fine tune the antenna impedance matching.

FIGURE 2-2: BM70BLES1FC2 Reference Circuit

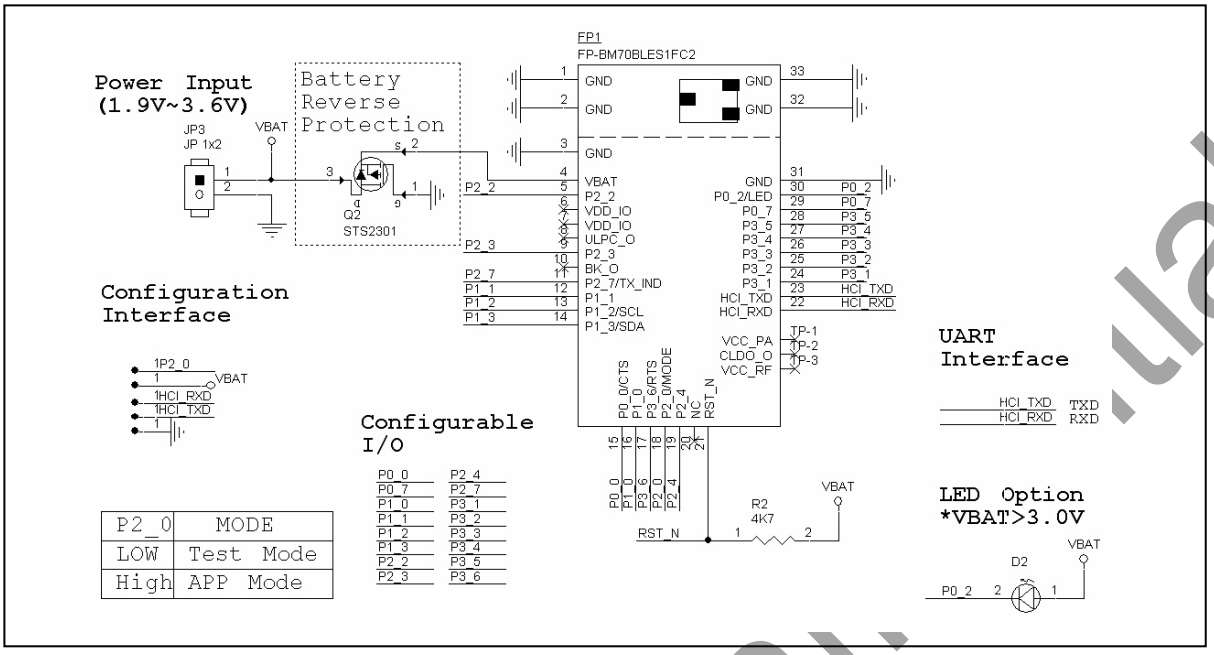


Figure 2-3 shows the BM70BLES1MC2 reference circuit, the RF antenna circuit is not included.

FIGURE 2-3: BM70BLE01FC2 Reference Circuit

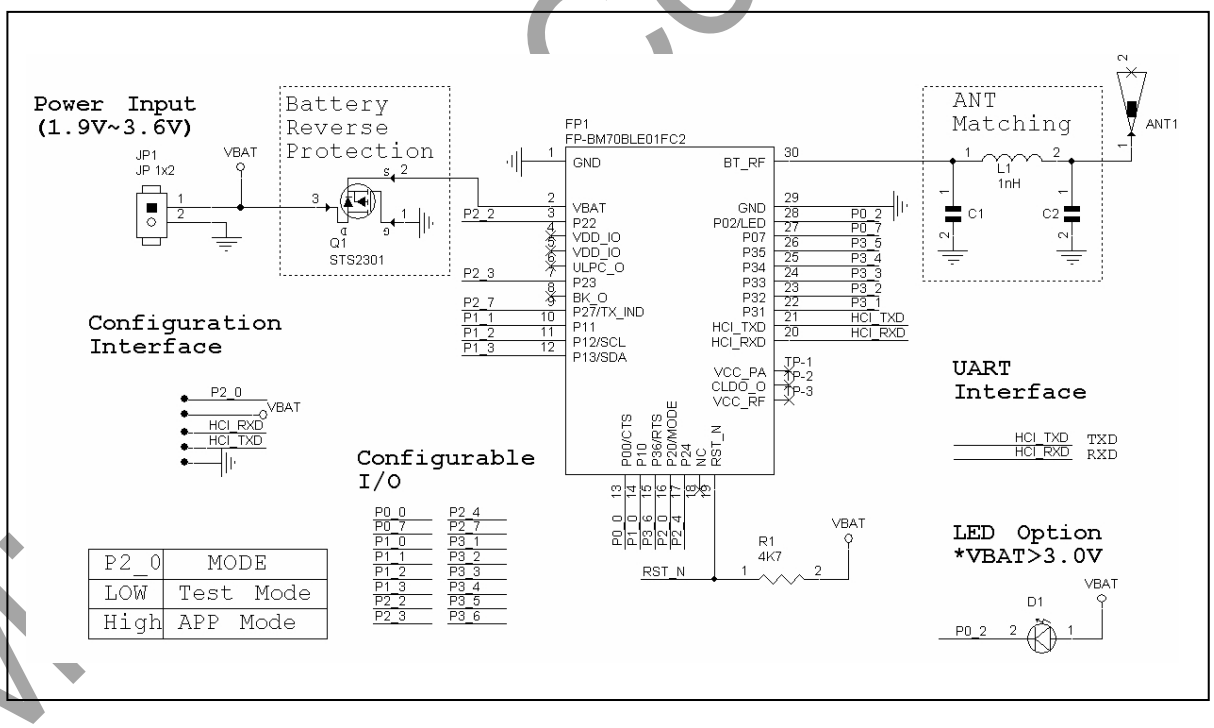


FIGURE 2-4: BM71BLE01FC2 Reference Circuit

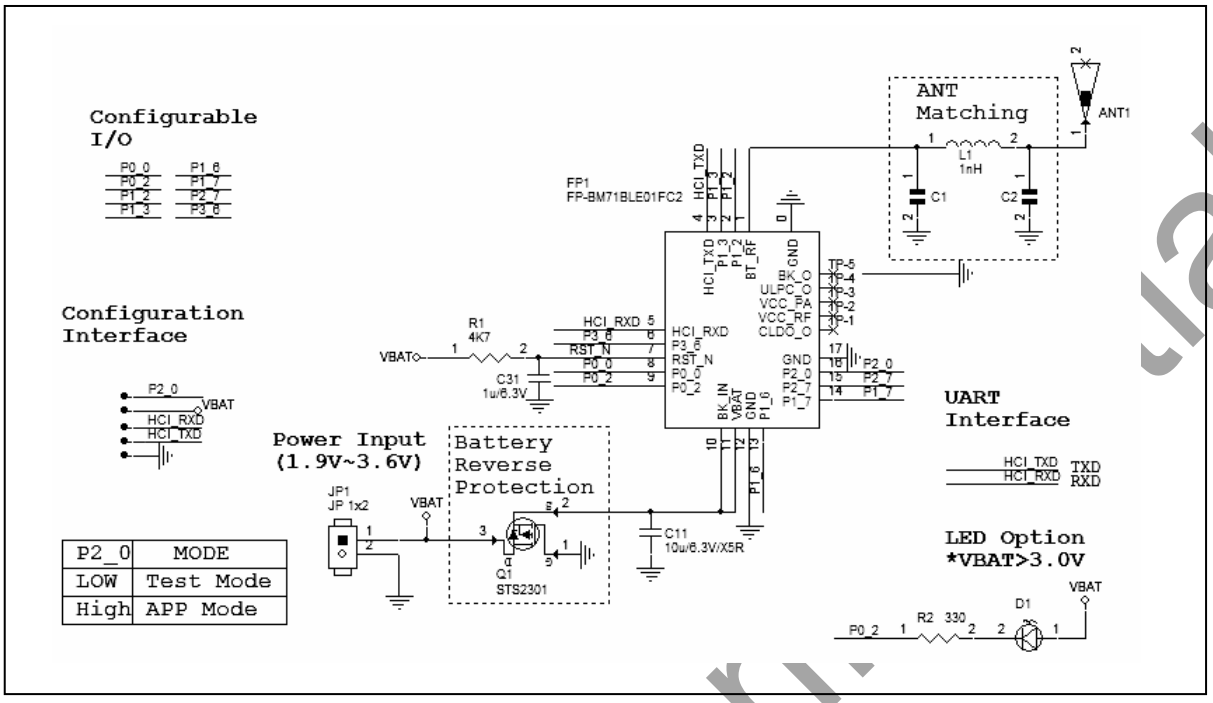
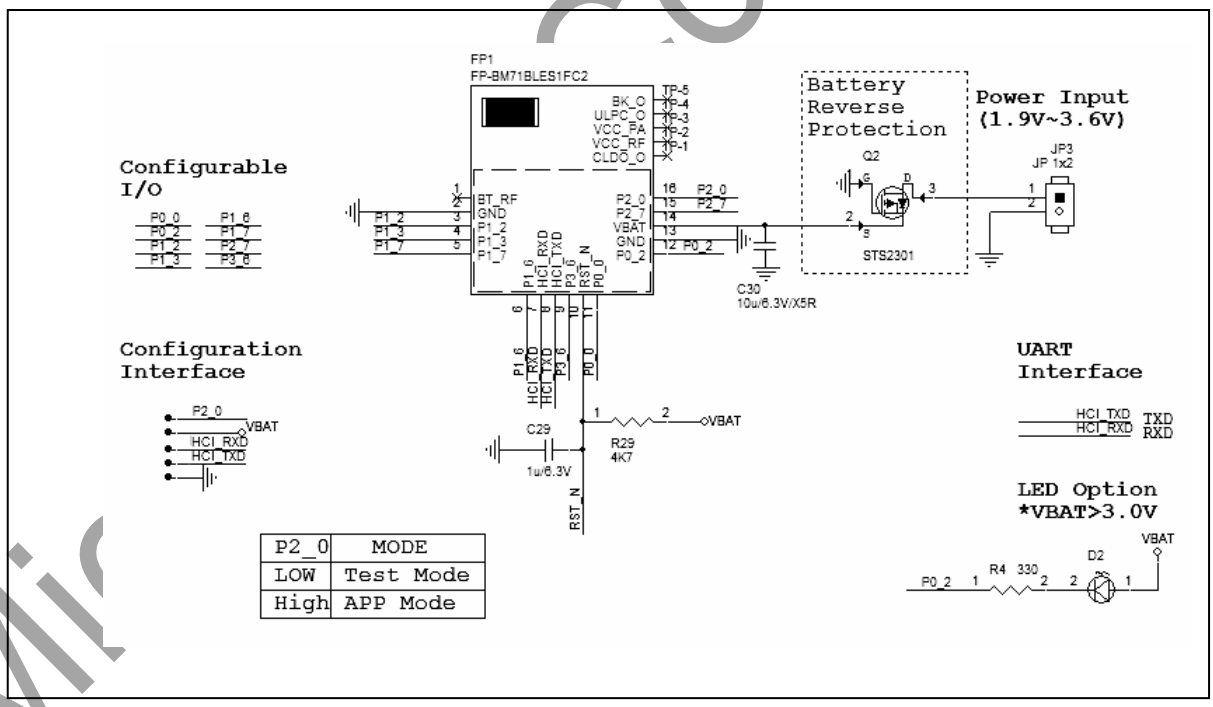


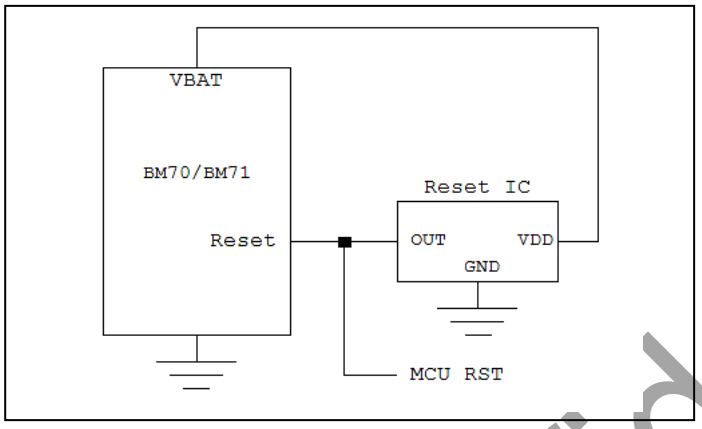
FIGURE 2-5: BM71BLES1FC2 Reference Circuit



2.2.1 Power Drop Protection

In order to prevent the BLE module disordering when power drop to low working voltage less than 1.9V, a reset chip with “Open Drain” type , delay time ≦ 10ms and triggered at 1.8V output voltage is recommended. Figure 2-7 shows the reset circuit block diagram.

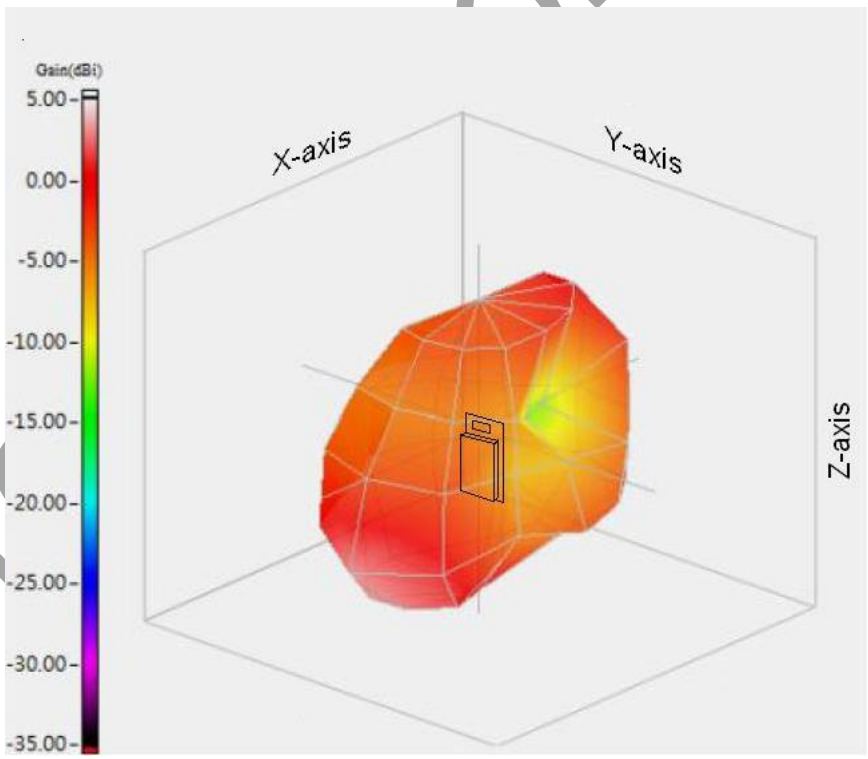
FIGURE 2-7: Optional Reset Circuit Block Diagram



2.3 BM70BLES1FC2/BM71BLES1FC2 Ceramic Chip Antenna

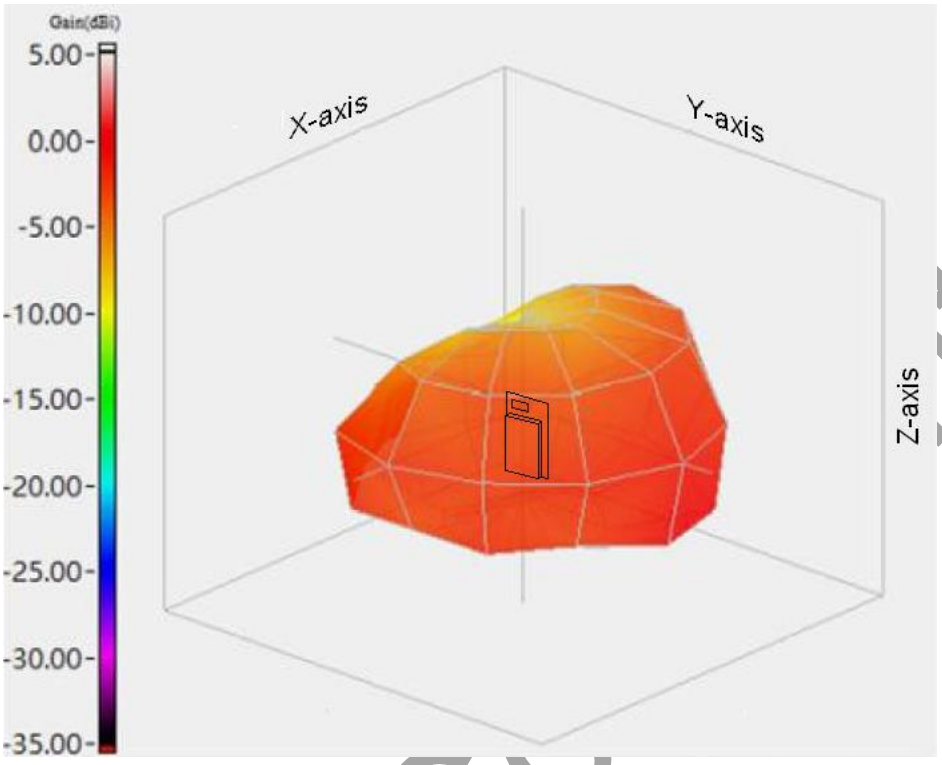
The BM70BLES1FC2 and BM71BLES1FC2 module contains an integral ceramic chip antenna. The antenna performance on the module is shown in Figure 2-6.

FIGURE 2-6: BM70BLES1FC2 ANTENNA RADIATION PATTERN



Frequency	2442 MHz
Max Gain	4.7dBi
Efficiency	56.9%

FIGURE 2-7: BM71BLES1FC2 ANTENNA RADIATION PATTERN

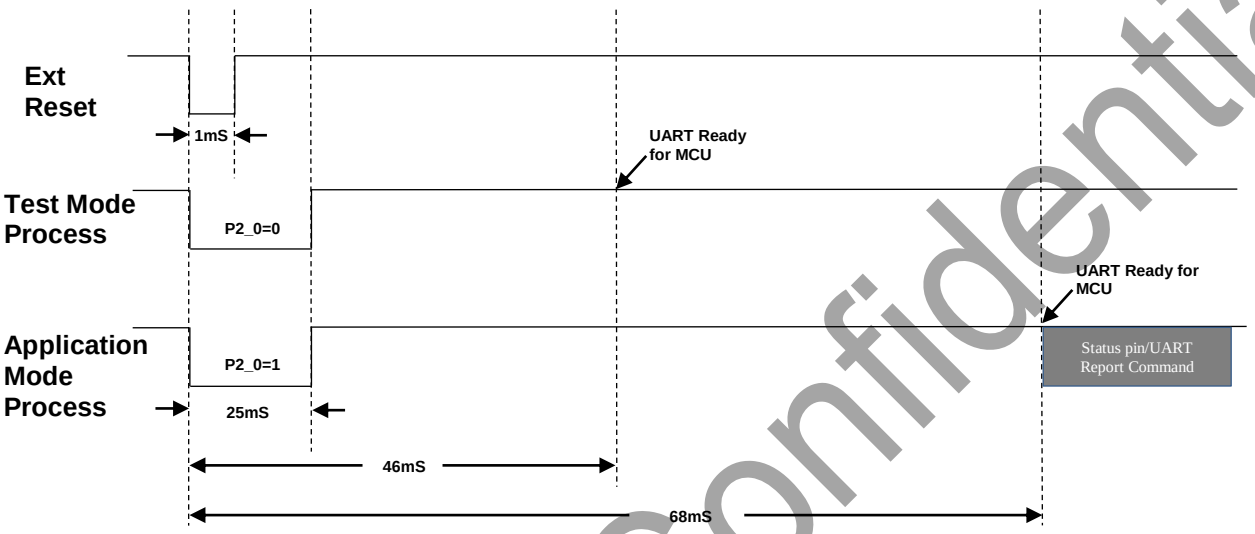


Frequency	2442 MHz
Max Gain	0.1dBi
Efficiency	42.7%

2.4 UART ready after Reset & Power On Timing

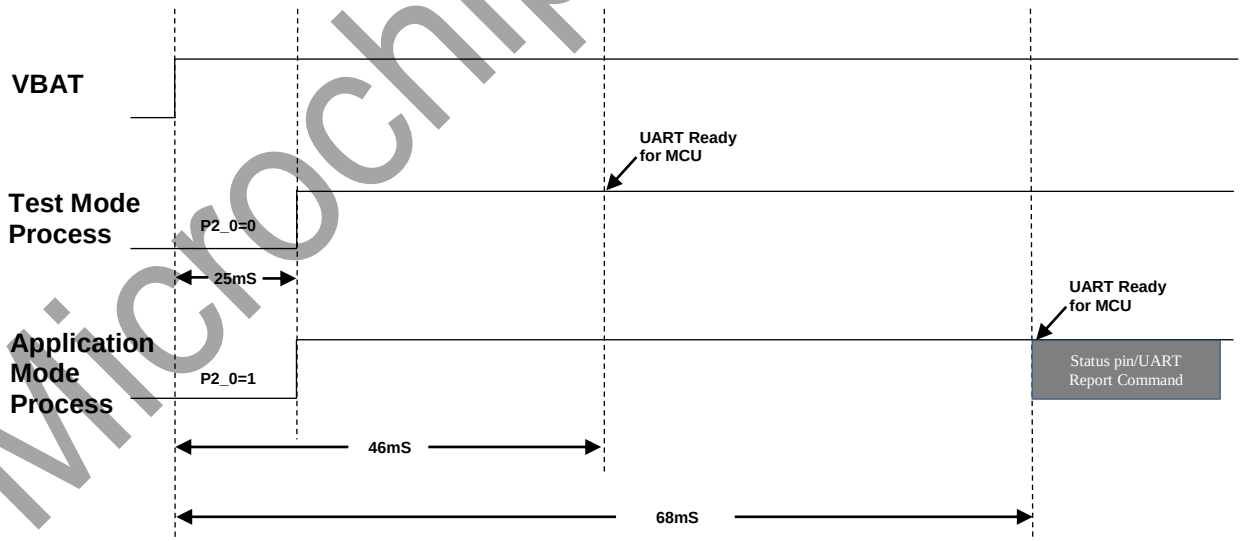
In MCU application, the timing period between reset/power on and BM70 UART ready need to be notified,. The timing diagram in Figure 2-2 illustrates the timing of BM70 UART port ready for test mode and application mode after reset. Figure 2-3 shows the timing of BM70 UART port ready for test mode and application mode after power on.
In application mode, when BM70 ready to talk to MCU after reset, it will have either status pin indication standby mode (see UI setting) or status report UART command to inform MCU that it is ready for communication.

FIGURE 2-2: Timing diagram of BM70 UART ready for test mode and application mode after reset



2.5 Power On Reset Timing

FIGURE 2-3: Timing diagram of BM70 UART ready for test mode and application mode after power on



2.6 Power Consumption

Figure 2-4 and 2-5 illustrate the TX/RX mode peak current consumption in connected mode. In both modes, the peak current of VBAT input is about 13mA.

FIGURE 2-4: Current consumption of RF TX in connected mode

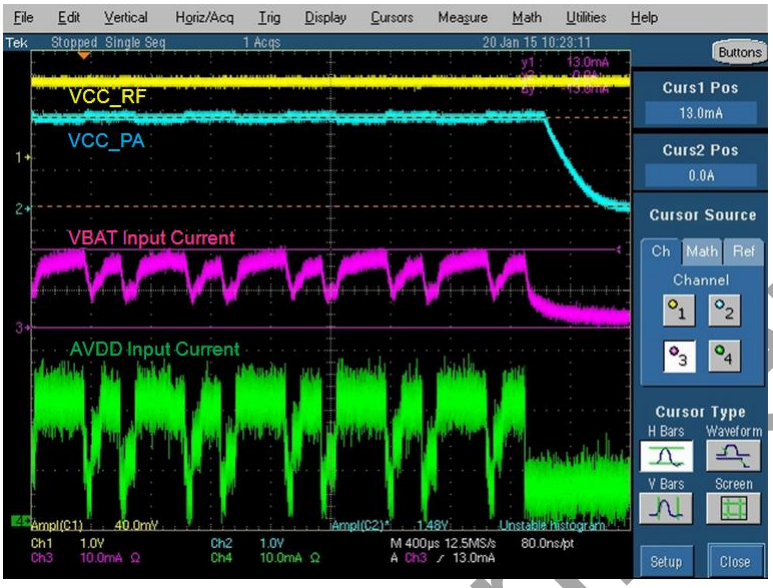
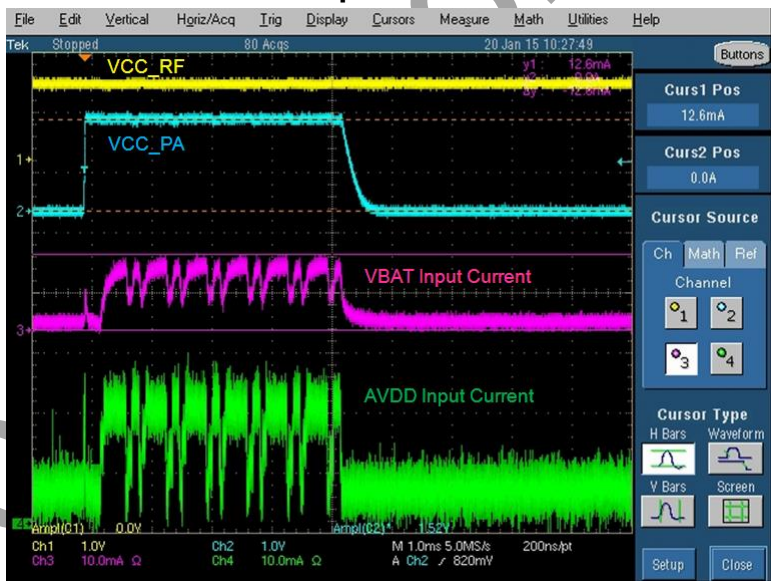


FIGURE 2-5: Current consumption of RF RX in connected mode



In BM70 BLEDK3 application, 4 basic modes of BLE device have defined in Table 1-6. A current consumption measurement example includes test condition and test environment setup is described in document “BM70 and BLEDK3 Application Note”. In the example the connected mode TX/RX data transfer has also be tested.

TABLE 1-6: Status Definition of BLEDK3 Application Example

Status	Description
Shutdown Mode	BLEDK3 is shutdown
Standby Mode	BLEDK3 sends advertising packets and wait for connection. BLEDK3 is under discoverable and connectable.
BLE Connected Mode	BLE link is established and CCCD of ISSC_Transparent_TX characteristic is disabled
Transparent Service Enabled Mode	BLE link is established and CCCD of ISSC_Transparent_TX characteristic is enabled

Note: CCCD stands for Client Characteristic Configuration, in GATT service characteristics.

3.0 REGULATORY APPROVAL

This section outlines the regulatory information for the BM70BLES1FC2 module for the following countries:

- United States
- Canada
- Europe
- Australia
- New Zealand
- Japan
- Korea
- Taiwan
- Other Regulatory Jurisdictions

3.1 United States

The BM70BLES1FC2 module has received Federal Communications Commission (FCC) CFR47 Telecommunications, Part 15 Subpart C “Intentional Radiators” modular approval in accordance with Part 15.212 Modular Transmitter approval. Modular approval allows the end user to integrate the BM70 module into a finished product without obtaining subsequent and separate FCC approvals for intentional radiation, provided no changes or modifications are made to the module circuitry. Changes or modifications could void the user’s authority to operate the equipment. The end user must comply with all of the instructions provided by the Grantee, which indicate installation and/or operating conditions necessary for compliance.

The finished product is required to comply with all applicable FCC equipment authorizations regulations, requirements and equipment functions not associated with the transmitter module portion. For example, compliance must be demonstrated to regulations for other transmitter components within the host product; to requirements for unintentional radiators (Part 15 Subpart B “Unintentional Radiators”), such as digital devices, computer peripherals, radio receivers, etc.; and to additional authorization requirements for the non- transmitter functions on the transmitter module (i.e., Verification, or Declaration of Conformity) (e.g., transmitter modules may also contain digital logic functions) as appropriate.

3.1.1 LABELING AND USER INFORMATION REQUIREMENTS

The BM70 module has been labeled with its own FCC ID number, and if the FCC ID is not visible when the module is installed inside another device, then the outside of the finished product into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording as follows:

Contains Transmitter Module FCC ID: BM70ABCDEFGH or
Contains FCC ID: BM70ABCDEFGH

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation

Contains Transmitter Module FCC ID: **BM70ABCDEFGH** or Contains FCC ID: **BM70ABCDEFGH**
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation

A user's manual for the finished product should include the following statement:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or

television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Additional information on labeling and user information requirements for Part 15 devices can be found in KDB Publication 784748 available at the FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB) http://apps.fcc.gov/oetcf/kdb/index.cfm.

RF EXPOSURE

All transmitters regulated by FCC must comply with RF exposure requirements. KDB 447498 General RF Exposure Guidance provides guidance in determining whether proposed or existing transmitting facilities, operations or devices comply with limits for human exposure to Radio Frequency (RF) fields adopted by the Federal Communications Commission (FCC).

From the FCC Grant: Output power listed is conducted. This grant is valid only when the module is sold to OEM integrators and must be installed by the OEM or OEM integrators. This transmitter is restricted for use with the specific antenna(s) tested in this application for Certification and must not be co- located or operating in conjunction with any other antenna or transmitters within a host device, except in accordance with FCC multi- transmitter product procedures.

HELPFUL WEB SITES

Federal Communications Commission (FCC): http://www.fcc.gov

FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB):

http://apps.fcc.gov/oetcf/kdb/index.cfm

3.2 Canada

The BM70BLES1FC2 module has been certified for use in Canada under Industry Canada (IC) Radio Standards Specification (RSS) RSS- 210 and RSS- Gen. Modular approval permits the installation of a module in a host device without the need to recertify the device.

3.2.1 LABELING AND USER INFORMATION REQUIREMENTS

Labeling Requirements for the Host Device (from Section 3.2.1, RSS- Gen, Issue 3, December 2010): The host device shall be properly labeled to identify the module within the host device.

The Industry Canada certification label of a module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labeled to display the Industry Canada certification number of the module, preceded by the words “Contains transmitter module”, or the word “Contains”, or similar wording expressing the same meaning, as follows:

Contains transmitter module IC: **12246A-BM70BLES1F2**

User Manual Notice for License- Exempt Radio Apparatus (from Section 7.1.3 RSS- Gen, Issue 3, December 2010): User manuals for license- exempt radio apparatus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both:

This device complies with Industry Canada license- exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

3.2.2 RF EXPOSURE

All transmitters regulated by IC must comply with RF exposure requirements listed in RSS- 102 - Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands).

(Get direct quote from Certificate and place here)

3.2.3 HELPFUL WEB SITES

Industry Canada: http://www.ic.gc.ca/

3.3 Europe

The BM70BLES1FC2 module is an R&TTE Directive assessed radio module that is CE marked and has been manufactured and tested with the intention of being integrated into a final product.

The BM70 module has been tested to R&TTE Directive 1999/5/EC Essential Requirements for Health and Safety (Article (3.1(a)), Electromagnetic Compatibility (EMC) (Article 3.1(b)), and Radio (Article 3.2) and are summarized in **Table 3- 1: European Compliance Testing**. A Notified Body Opinion has also been issued. All test reports are available on the BM70 product web page at http://www.microchip.com/bm70.

The R&TTE Compliance Association provides guidance on modular devices in document **Technical Guidance Note 01** available at http://www.rtteca.com/html/download_area.htm.

Note: To maintain conformance to the testing listed in **Table 3-1: European Compliance Testing**, the module shall be installed in accordance with the installation instructions in this data sheet and shall not be modified.

When integrating a radio module into a completed product the integrator becomes the manufacturer of the final product and is therefore responsible for demonstrating compliance of the final product with the essential requirements of the R&TTE Directive.

3.1.3 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the BM70 module must follow CE marking requirements. The R&TTE Compliance Association **Technical Guidance Note 01** provides guidance on final product CE marking.

3.1.4 ANTENNA REQUIREMENTS

From R&TTE Compliance Association document **Technical Guidance Note 01**:

> Provided the integrator installing an assessed radio module with an integral or specific antenna and installed in conformance with the radio module manufacturer's installation instructions requires no further evaluation under Article 3.2 of the R&TTE Directive and does not require further involvement of an R&TTE Directive Notified Body for the final product. [Section 2.2.4]

The European Compliance Testing listed in **Table 3- 1** was performed using the integral ceramic chip antenna.

TABLE 3- 1: EUROPEAN COMPLIANCE TESTING

Certification	Standards	Article	Laboratory	Report Number	Date
Safety	EN 60950-	(3.1(a))			
Health	EN 50371:2002-03				
EMC	EN 301 489-1 V1.8.1 (2008-04)	(3.1(b))			
	EN 301 489-17 V2.1.1 (2009-05)				
Radio	EN 300 328 V1.7.1 (2006-10)	(3.2)			
Notified Body Opinion					

3.3.3 HELPFUL WEB SITES

A document that can be used as a starting point in understanding the use of Short Range Devices (SRD) in Europe is the European Radio Communications Committee (ERC) Recommendation 70 - 03 E, which can be downloaded from the European Radio Communications Office (ERO) at: http://www.ero.dk/.

Additional helpful web sites are:

- Radio and Telecommunications Terminal Equipment (R&TTE):
  http://ec.europa.eu/enterprise/rtte/index_en.htm
- European Conference of Postal and Telecommunications Administrations (CEPT):
  http://www.cept.org
- European Telecommunications Standards Institute (ETSI):
  http://www.etsi.org
- European Radio Communications Office (ERO):
  http://www.ero.dk
- The Radio and Telecommunications Terminal Equipment Compliance Association (R&TTE CA):
  http://www.rtteca.com/

3.2 Australia

The Australia radio regulations do not provide a modular approval policy similar to the United States (FCC) and Canada (IC). However, BM70 module RF transmitter test reports can be used in part to demonstrate compliance in accordance with ACMA Radio communications “Short Range Devices” Standard 2004 (The Short Range Devices standard calls up the AS/NZS 4268:2008 industry standard). The BM70 module test reports can be used as part of the product certification and compliance folder. For more information on the RF transmitter test reports, contact Microchip Technology Australia sales office.

To meet overall Australian final product compliance, the developer must construct a compliance folder containing all relevant compliance test reports e.g. RF, EMC, electrical safety and DoC (Declaration of Conformity) etc. It is the responsibility of the integrator to know what is required in the compliance folder for ACMA compliance. All test reports are available on the BM70 product web page at http://www.microchip.com. For more information on Australia compliance, refer to the Australian Communications and Media Authority web site http://www.acma.gov.au/.

3.2.1 HELPFUL WEB SITES

The Australian Communications and Media Authority: www.acma.gov.au/.

3.3 New Zealand

The New Zealand radio regulations do not provide a modular approval policy similar to the United States (FCC) and Canada (IC). However, BM70 module RF transmitter test reports can be used in part to demonstrate compliance against the New Zealand “General User Radio License for Short Range Devices”. New Zealand Radio communications (Radio Standards) Notice 2010 calls up the AS / NZS 4268:2008 industry standard. The BM70 module test reports can be used as part of the product

certification and compliance folder. All test reports are available on the BM70 product web page at http://www.microchip.com/bm70. For more information on the RF transmitter test reports, contact Microchip Technology sales office.

Information on the New Zealand short range devices license can be found in the following web links:
http://www.rsm.govt.nz/cms/licensees/types-oflicence/general-user-licences/short-range-devices

and

http://www.rsm.govt.nz/cms/policy-and-planning/spectrum-policy-overview/legislation/gazette-notices/product-compliance/.

To meet overall New Zealand final product compliance, the developer must construct a compliance folder containing all relevant compliance test reports e.g. RF, EMC, electrical safety and DoC (Declaration of Conformity) etc. It is the responsibility of the developer to know what is required in the compliance folder for New Zealand Radio communications. For more information on New Zealand compliance, refer to the web site http://www.rsm.govt.nz/.

3.3.1 HELPFUL WEB SITES

Radio Spectrum Ministry of Economic Development: http://www.rsm.govt.nz/.

3.4 Japan

The BM70BLES1FC2 module has received type certification and is labeled with its own technical conformity mark and certification number as required to conform to the technical standards regulated by the Ministry of Internal Affairs and Communications (MIC) of Japan pursuant to the Radio Act of Japan.

Integration of this module into a final product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed. Additional testing may be required:

- If the host product is subject to electrical appliance safety (for example, powered from an AC mains), the host product may require Product Safety Electrical Appliance and Material (PSE) testing. The integrator should contact their conformance laboratory to determine if this testing is required.
- There is an voluntary Electromagnetic Compatibility (EMC) test for the host product administered by VCCI: http://www.vcci.jp/vcci_e/index.html

3.4.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the BM70 module must follow Japan marking requirements. The integrator of the module should refer to the labeling requirements for Japan available at the Ministry of Internal Affairs and Communications (MIC) website.

The BM70 module is labeled with its own technical conformity mark and certification number. The final product in which this module is being used must have a label referring to the type certified module inside:

Contains transmitter module with certificate number:

202-SMD069

3.4.2 HELPFUL WEB SITES

Ministry of Internal Affairs and Communications (MIC): http://www.tele.soumu.go.jp/e/index.htm Association of Radio Industries and Businesses (ARIB): http://www.arib.or.jp/english/

3.5 Korea

The BM70BLES1FC2 module has received certification of conformity in accordance with the Radio Waves Act. Integration of this module into a final product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed.

3.5.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the BM70 module must follow KC marking requirements.

The integrator of the module should refer to the labeling requirements for Korea available on the Korea Communications Commission (KCC) website.

The BM70 module is labeled with its own KC mark. The final product requires the KC mark and certificate number of the module:

3.5.2 HELPFUL WEB SITES

Korea Communications Commission (KCC): http://www.kcc.go.kr National Radio Research Agency (RRA): http://rra.go.kr

3.6 Taiwan

The BM70BLES1FC2 module has received compliance approval in accordance with the Telecommunications Act. Customers seeking to use the compliance approval in their product should contact Microchip Technology sales or distribution partners to obtain a Letter of Authority.

installation instructions are followed and no modifications of the module are allowed.

Integration of this module into a final product does not require additional radio certification provided

3.6.1 LABELING AND USER INFORMATION REQUIREMENTS

The BM70 module is labeled with its own NCC mark and certificate number as below:

The user's manual should contain below warning (for RF device) in traditional Chinese:

注意!

依據 低功率電波輻射性電機管理辦法
第十二條 經型式認證合格之低功率射頻電機，非經許可， 公司、商號或使用者均
不得擅自變更頻率、加大功率或變更原設計 之特性及功能。

第十四條 低功率射頻電機之使用不得影響飛航安全及干擾合法通信； 經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。 前項合法通信，指依電信規定作業之無線電信。 低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性

電機設備之干擾。

3.8.2 HELPFUL WEB SITES

National Communications Commission (NCC): http://www.ncc.gov.tw

3.7 Other Regulatory Jurisdictions

Should other regulatory jurisdiction certification be required by the customer, or the customer need to recertify the module for other reasons, a certification utility is available. For further regulatory Certification Utility and documentation, contact ISSC Technologies Corp.

4.0 ELECTRICAL CHARACTERISTICS

TABLE 4- 1: ENVIRONMENTAL CONDITIONS

Parameter	Value
Temperature Range (Operating)	-20℃ to +70℃
Temperature Range (Storage)	-65℃ to +150℃
Relative Humidity (Operating)	10% to 90%
Relative Humidity (Storage)	10% to 90%
Moisture Sensitivity Level	2

TABLE 4- 2: ELECTRICAL CHARACTERISTICS

Parameter	Min.	Typ.	Max.	Units
Supply Voltage (VDD)	1.9		3.6	V
I/O Supply Voltage (VDD_IO = VDD)	1.9		3.6	V
I/O Voltage Levels				
V_{IL} input logic levels low	VSS		0.3VDD	V
V_{IH} input logic levels high	0.7VDD		VDD	V
V_{OL} output logic levels low	VSS		0.2VDD	V
V_{OH} output logic levels high	0.8VDD		VDD	V
RESET				
$V_{TH,res}$ threshold voltage		1.6		V
Reset low duration	63			ns
Input and Tri-State Current with				
Pull-up Resistor	34	48	74	Kohm
Leakage current	-1		1	uA
Supply Current				
TX mode peak current @ VDD=3V, TX=0dBm, Buck Mode			13	mA
RX mode peak current @ VDD=3V, Buck Mode			13	mA
Link static current		60		uA
Standby current	1.9		2.9	uA
Power-Saving	1		1.7	uA
ADC (Analog to Digital Converter)				
Full scale (BAT_IN)	0	3.0	3.6	V
Full scale (AD0~AD15)	0		3.6	
Conversion time (ENOB 8bit)		131		uS
Conversion time (ENOB 10bit)		387		uS
Operating current			500	uA
PTS(precise temperature sensor)				
Detect range	-20		70	℃
Digital Output	1154		2613	
Resolution		11.5		bits/℃
Accuracy	-3		3	℃
Conversion time (ENOB 8-bit)		1.5		mS
Operating current			200	uA

5.0 ORDERING INFORMATION

TABLE 4-1: ORDERING INFORMATION

Part Number	Description
BM70BLE01FC2	Bluetooth® 4.2 BLE Single Mode, Class 2, Surface Mount module,external antenna, no shield. Size: 12x15mm
BM70BLES1FC2	Bluetooth® 4.2 BLE Single Mode, Class 2, Surface Mount module with antenna and shield. Size: 12x22mm
BM71BLE01FC2	Bluetooth® 4.2 BLE Single Mode, Class 2, Surface Mount module, external antenna, no shield. Size: 6x8mm
BM71BLES1FC2	Bluetooth® 4.2 BLE Single Mode, Class 2, Surface Mount module with antenna and shield. Size: 9x11.5mm

Note: The module can only be purchased through a Microchip representative.
Go to http://www.microchip.com/ for current pricing and a list of distributors carrying Microchip products.

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

Cleveland
Independence, OH
Tel: 216-447-0464
Fax: 216-447-0643

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

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

New York, NY
Tel: 631-435-6000

San Jose, CA
Tel: 408-735-9110

Canada - Toronto
Tel: 905-673-0699
Fax: 905-673-6509

ASIA/PACIFIC

Asia Pacific Office
Suites 3707-14, 37th Floor
Tower 6, The Gateway
Harbour City, Kowloon
Hong Kong
Tel: 852-2943-5100
Fax: 852-2401-3431

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

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

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

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

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

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

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

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

China - Shanghai
Tel: 86-21-5407-5533
Fax: 86-21-5407-5066

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

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

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

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

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

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

ASIA/PACIFIC

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

EUROPE

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

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

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

Germany - Dusseldorf
Tel: 49-2129-3766400

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

Germany - Pforzheim
Tel: 49-7231-424750

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

Italy - Venice
Tel: 39-049-7625286

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

Poland - Warsaw
Tel: 48-22-3325737

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

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

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