BM70/71

Bluetooth® Low Energy (BLE) Module

Features

- Qualified for Bluetooth SIG v5.0 core specification
- Certified to FCC, ISED, MIC, KCC, NCC, and SRRC radio regulations
- Certified by European RED Assessed Radio module
- Compliant to RoHS
- Supports UART interface
- Supports transparent UART data service of BLE
- The BM70 module supports 3-channel pulse-width modulation (PWM) and the BM71 module supports 1-channel PWM
- Supports Precision Temperature Sensor (PTS) for ambient temperature detection
- Supports 12-bit ADC (ENOB=10 or 8 bits) for battery and voltage detection
- Provides 8-channel ADC for the BM70 module and 5-channel ADC for the BM71 module
- Features 18 general purpose I/O (GPIO) pins for the BM70 module and 9 GPIO pins for the BM71 module
- Features integrated 32 MHz crystal
- Small and compact surface mount module
- Castellated surface mount pads for easy and reliable host PCB mounting

RF Features

- ISM band 2.402 GHz to 2.480 GHz operation
- Channels: 0 to 39
- Receive Sensitivity: typical -90 dBm (LE)
- Transmit Power: 0 dBm (typical)
- Received Signal Strength Indication (RSSI) monitor with 1 dB resolution

MAC/Baseband/Higher Layer Features

- Secure AES128 encryption
- GAP, GATT, SMP, L2CAP and integrated public profile support
- To create custom GATT services, refer to the "*BM70/71 Bluetooth® Low Energy Module User's Guide*" (DS50002542) for details.
- Configurable role as peripheral/central, client/server

FIGURE 1: BM70 MODULE

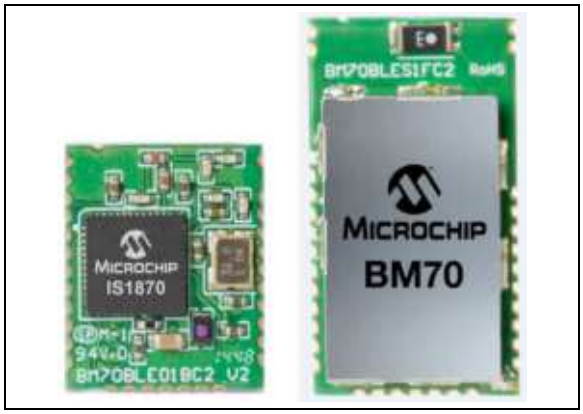
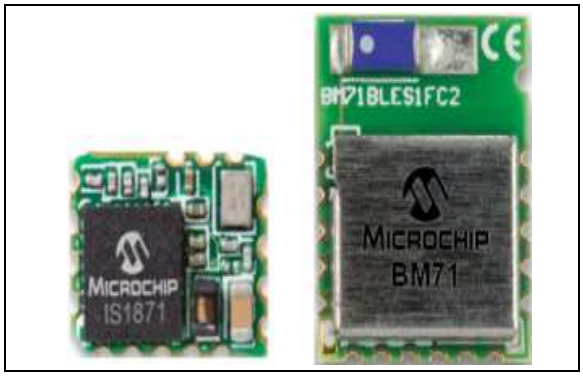


FIGURE 2: BM71 MODULE



Antenna

- Chip antenna (BM7xBLES1FC2) range based on open air measurement and phone-module connection:
  - BM70: up to 50m
  - BM71: up to 10m
- External antenna (BM7xBLE01FC2) connection through RF pad

Power Management

- Two low power modes supported, with wake up through GPIO or internal timer
- Average current: Tx=3.3 mA and Rx=3.2 mA with buck at 3.0V V_{BAT} input and 18.75 ms connection interval, when transmitting full data packets to achieve a data rate of approximately 8.6 kbps

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Operating Conditions

- Operating voltage range: 1.9V to 3.6V
- Operating temperature: -40ºC to +85ºC

Applications

- Internet of Things (IoT)
- Secure Payment
- Wearable Devices
- Home and Security
- Health and Fitness
- Beacons
- Industrial and Data Logger

General Description

The BM70/71 module offers BLE solutions for embedded applications. It conforms to the Bluetooth 5 core specification to enhance the throughput and security for the IoT applications. It also supports beacon technology to enhance the user experience for the IoT applications, and enables users to control the cloud and receive data without opening the application through a smartphone.

The BM70/71 module has an integrated Bluetooth stack and is available in different form factors to optimize space, cost, and RF performance. The power-optimized design minimizes the current consumption and extends battery life for portable and wearable applications.

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1.0 DEVICE OVERVIEW

The BM70/71 module is built around Microchip Technology IS1870/71 BLE Integrated Circuit (IC). The IS1870/71 IC includes an on board Bluetooth stack, a power management subsystem, a 2.4 GHz transceiver, and an RF power amplifier. The user can embed Bluetooth functionality into any product using the BM70/71 module.

The BM70/71 module enables the following features:

- Simple integration and programming
- Reduced development time
- Superior wireless module with a low-cost system
- Interoperability with Apple® iOS and Android™ OS
- A wide range of applications

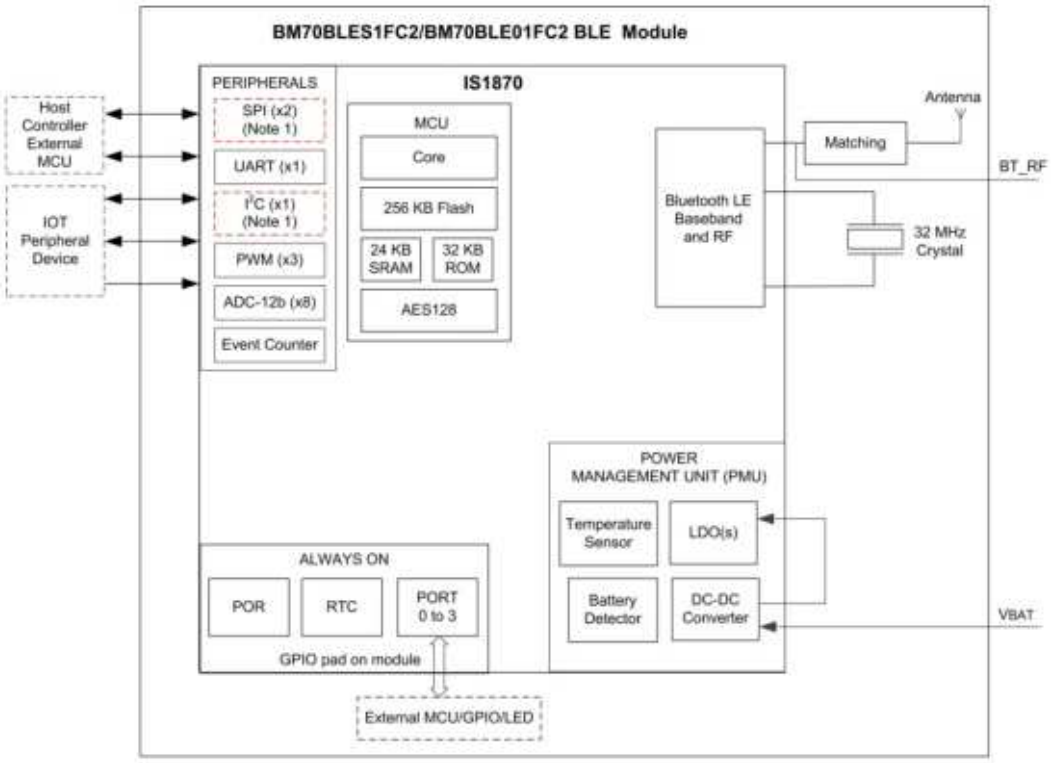
The BM70/71 module can independently maintain a low power wireless connection. Low power and flexible power management features maximize the lifetime of the BM70/71 module in battery-operated devices. A wide operating temperature range enables its applications in indoor and outdoor environments.

The BM70/71 module is a small, compact, and surface-mounted module with castellated pads for easy and reliable host PCB mounting. The relatively small form factor of the module is targeted for applications, such as wearable sports, fitness devices and so on.

1.1 Interface Description

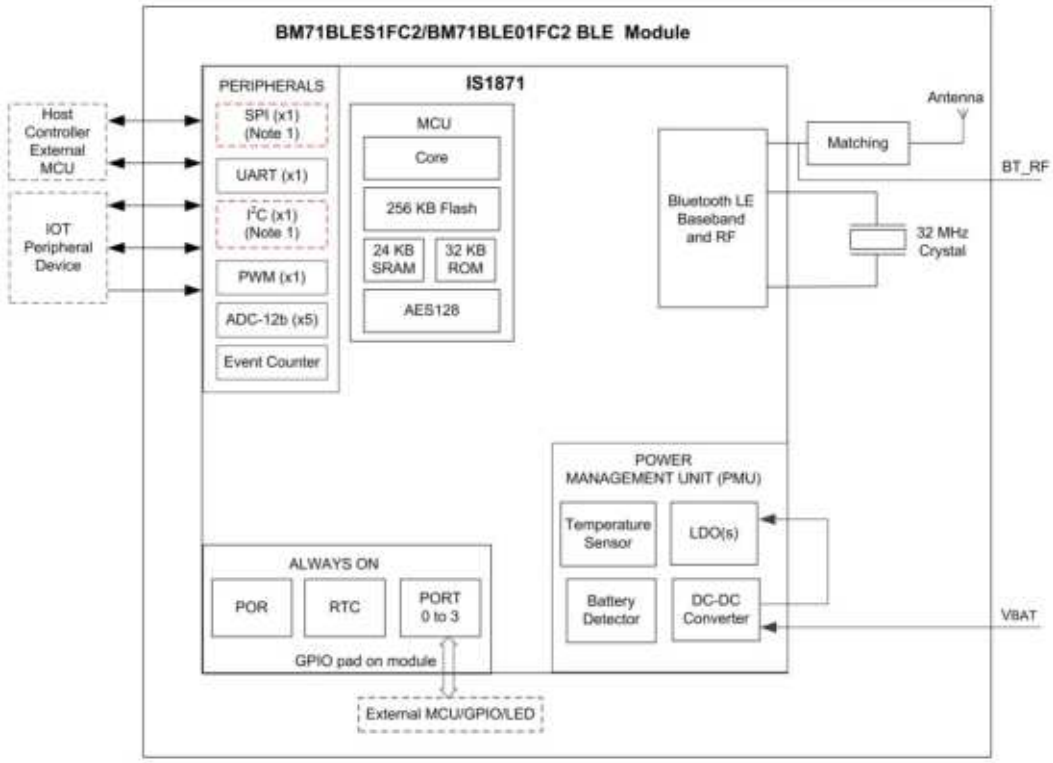
Figure 1-1 and Figure 1-2 illustrate an example of the BM70/71 module-based system.

FIGURE 1-1: BM70 MODULE BLOCK DIAGRAM



Note 1: SPI and I^2C peripherals of the IS1870/71 IC can be enabled on the BM70/71 module by changing the default firmware. For more details, contact a local Microchip representative.

FIGURE 1-2: BM71 MODULE BLOCK DIAGRAM



Note 1: SPI and I^2C peripherals of the IS1870/71 IC can be enabled on the BM70/71 module by changing the default firmware. For more details, contact a local Microchip representative.

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Figure 1-3 through Figure 1-6 illustrate the pin diagrams of the BM70/71 module.

FIGURE 1-3: BM70BLE01FC2 PIN DIAGRAM

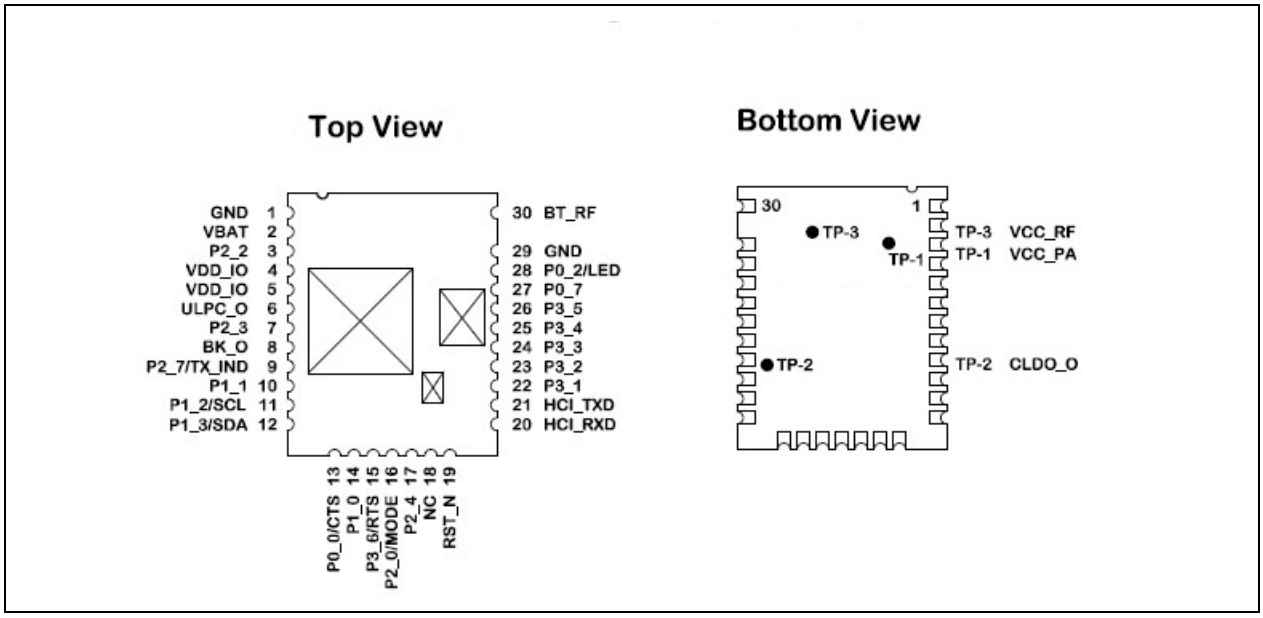


FIGURE 1-4: BM70BLES1FC2 PIN DIAGRAM

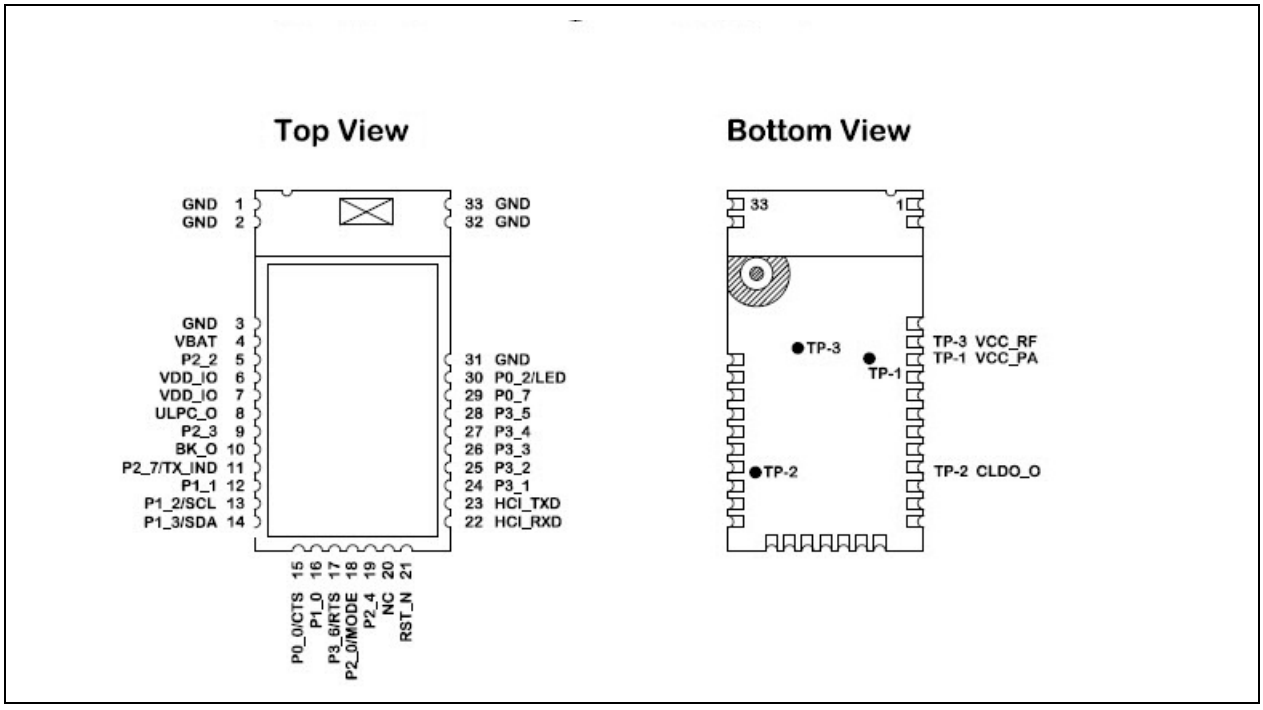


FIGURE 1-5: BM71BLE01FC2 PIN DIAGRAM

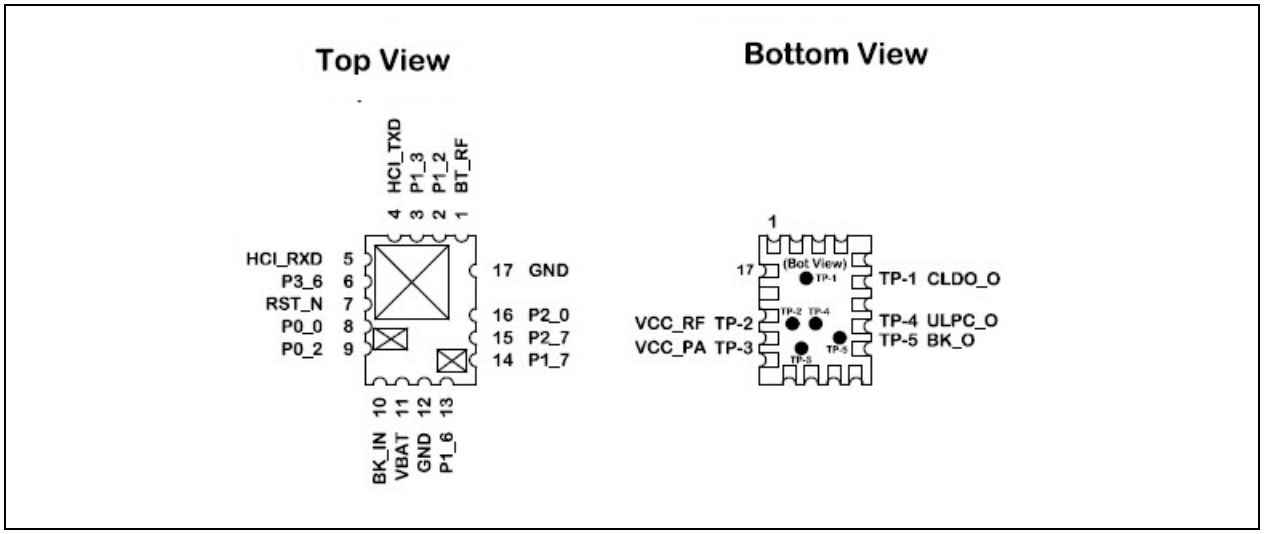
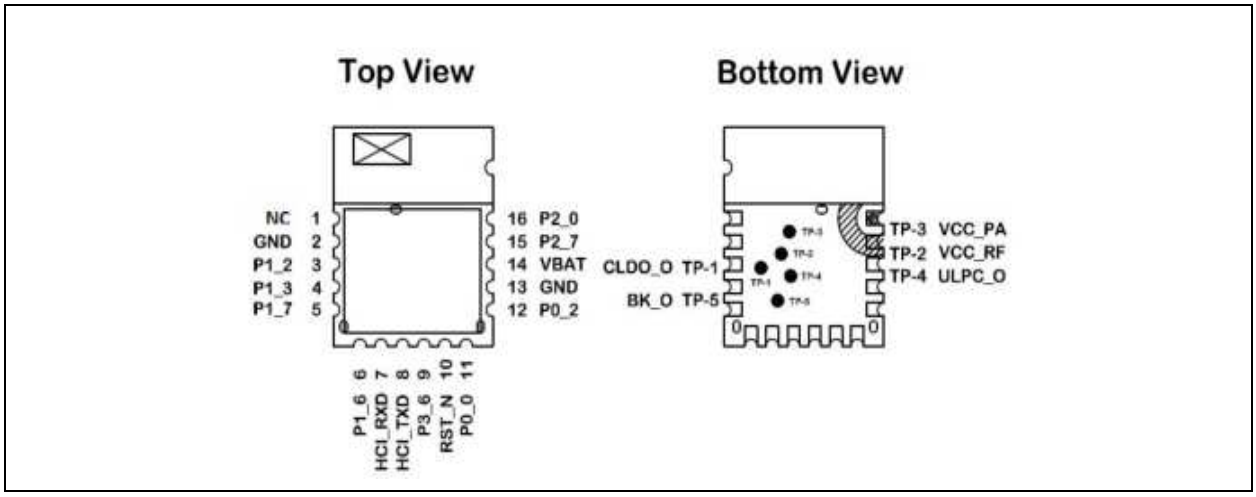


FIGURE 1-6: BM71BLES1FC2 PIN DIAGRAM



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Table 1-1 provides pin descriptions of the BM70/71 module.

TABLE 1-1: BM70/71 PIN DESCRIPTION

BM70BLE01FC2	BM70BLES1FC2	BM71BLE01FC2	BM71BLES1FC2	Pin Name	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. Voltage range: 1.9V to 3.6V
—	—	10	—	BK_IN	Power	Buck input. Voltage range: 1.9V to 3.6V
3	5	—	—	P2_2	DIO	GPIO, default pull-high input PWM1
4	6	—	—	VDD_IO	Power	I/O positive supply. Do not connect. Ensure VDD_IO and MCU I/O voltage are compatible
5	7	—	—	VDD_IO	Power	I/O positive supply. Do not connect. 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. Internal use only, do not connect to other devices
7	9	—	—	P2_3	DI	GPIO, default pull-high input PWM2
8	10	—	—	BK_O	Power	1.55V buck output. Internal use only, do not connect to other devices
—	—	13	6	P1_6	DIO	P1_6, when connected to the host MCU, set the MCU pin connected to P1_6 either high impedance or drive pin to low during firmware start-up (approximately 22 msec)
—	—	14	5	P1_7	DIO	P1_7
9	11	15	15	P2_7/TX_IND	DIO AI DO	GPIO: P2_7 ADC Input: AD14 TX_IND
10	12	—	—	P1_1	DIO AI	GPIO: P1_1 ADC Input: AD9
11	13	2	3	P1_2	DIO AI	GPIO, default pull-high input AD10
12	14	3	4	P1_3	DIO AI	GPIO, default pull-high input AD11
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	DI	System configuration, default pull-high input H: Application mode L: Test mode

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TABLE 1-1: BM70/71 PIN DESCRIPTION (CONTINUED)

BM70BLE01FC2	BM70BLES1FC2	BM71BLE01FC2	BM71BLES1FC2	Pin Name	Type	Description
17	19	—	—	P2_4	DIO	GPIO, default pull-high input
18	20	—	—	NC	—	No connection
Legend:	A = Analog			D = Digital		I = Input O = Output
19	21	7	10	RST_N	DI	Module Reset (active-low) (internal pull up)
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: P3_1
23	25	—	—	P3_2	DIO	GPIO: P3_2
24	26	—	—	P3_3	DIO	GPIO: P3_3
25	27	—	—	P3_4	DIO	GPIO: P3_4
26	28	—	—	P3_5	DIO DO	GPIO, default pull-high input LED1
27	29	—	—	P0_7	DIO AI	GPIO, default pull-high input AD7
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	—	BT_RF	AI	External antenna connection (50 Ohm) Only for BM70BLE01FC2 and BM71BLE01FC2 No connection for BM71BLES1FC2
—	33	—	—	GND	Power	Ground reference

Legend: A = Analog
D = Digital
I = Input
O = Output

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Table 1-2 provides the hardware features of the BM70/71 module.

Note:	I^2C and SPI are accessible using specific firmware versions that support these peripheral interfaces. Please refer to the BM70/71 product page on the Microchip web site for the latest firmware.

TABLE 1-2: BM70/71 MODULE HARDWARE FEATURES

Feature/ Modules	**BM70BLES1FC2**		**BM70BLE01FC2**		**BM71BLES1FC2**		**BM71BLE01FC2**	
Configuration	**Module H/W**	**Default IS1870 Firmware**	**Module H/W**	**Default IS1870 Firmware**	**Module H/W**	**Default IS1871 Firmware**	**Module H/W**	**Default IS1871 Firmware**
UART	1	1	1	1	1	1	1	1
GPIO (see **Note 2**)	18	13	18	13	9	4	9	4
12-bit ADC channels	8	6	8	6	5	3	5	3
PWM	3	2	3	2	1	0	1	0
Total pins	33	—	30	—	16	—	17	—
On board antenna with CAN	Yes	—	—	—	Yes	—	—	—
No Antenna	—	—	Yes	—	—	—	Yes	—
Government regulatory RF certified	Yes	—	—	—	Yes	—	—	—
Size (mm)	12x22x2.4	—	12x15x1.6	—	9x11.5x2.1	—	6x8x1.6	—

Note 1: The GPIO, ADC and PWM numbers used are based on disabling the LED indication and UART Hardware flow-control (RTS/CTS) functionality, see Table 1-1.

2: For a detailed explanation of GPIO, refer to the "*BM70/71 Bluetooth® Low Energy Module User's Guide*" (DS50002542).

Table 1-3 provides the details of the test pads used for the production test on the bottom of the BM70/71 module. See Figure 1-3 through Figure 1-6 for more details.

TABLE 1-3: TEST PADS DETAILS

BM70BLE 01FC2	BM70BLE S1FC2	BM71BLE 01FC2	BM71BLE S1FC2	Pin Name	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-1	CLDO_O	Power	1.2V CLDO output
TP-3	TP-3	TP-2	TP-2	VCC_RF	Power	1.28V RF LDO output
—	—	TP-4	TP-4	ULPC_O	Power	1.2V ULPC LDO output
—	—	TP-5	TP-5	BK_O	Power	1.55V buck output

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2.0 APPLICATION INFORMATION

2.1 Reference Schematics

Figure 2-1 through Figure 2-8 illustrate the BM70/71 module reference schematics for the various Stock Keeping Units (SKUs). The GPIOs are configurable, and the connection depends on the user's application circuit.

It is recommended to use an external Reset IC in all applications. An example of using this circuit with the MCP111-195 is illustrated in Figure 2-1, Figure 2-3, Figure 2-5, and Figure 2-7. This Reset IC prevents the Flash data corruption, when VBAT drops below 1.9V (this includes brown-out, power-down, and power-up conditions).

The RF antenna impedance matching circuit in Figure 2-3 and Figure 2-5 require users to implement by the selected antenna specification.

For battery-powered applications, it is recommended to use the following external circuits as illustrated in Figure 2-2, Figure 2-4, Figure 2-6, and Figure 2-8. The first circuit (left side) ensures that the LED indicator is bright enough in applications with VBAT > 3.0V. The second circuit (right side) provides protection from battery voltage reverse connection.

If a fixed voltage source is applied to VBAT (e.g. 3.3V), the soft start output is necessary to prevent the inrush voltage over 3.6V to damage the Flash.

FIGURE 2-1: BM70BLES1FC2 REFERENCE CIRCUIT

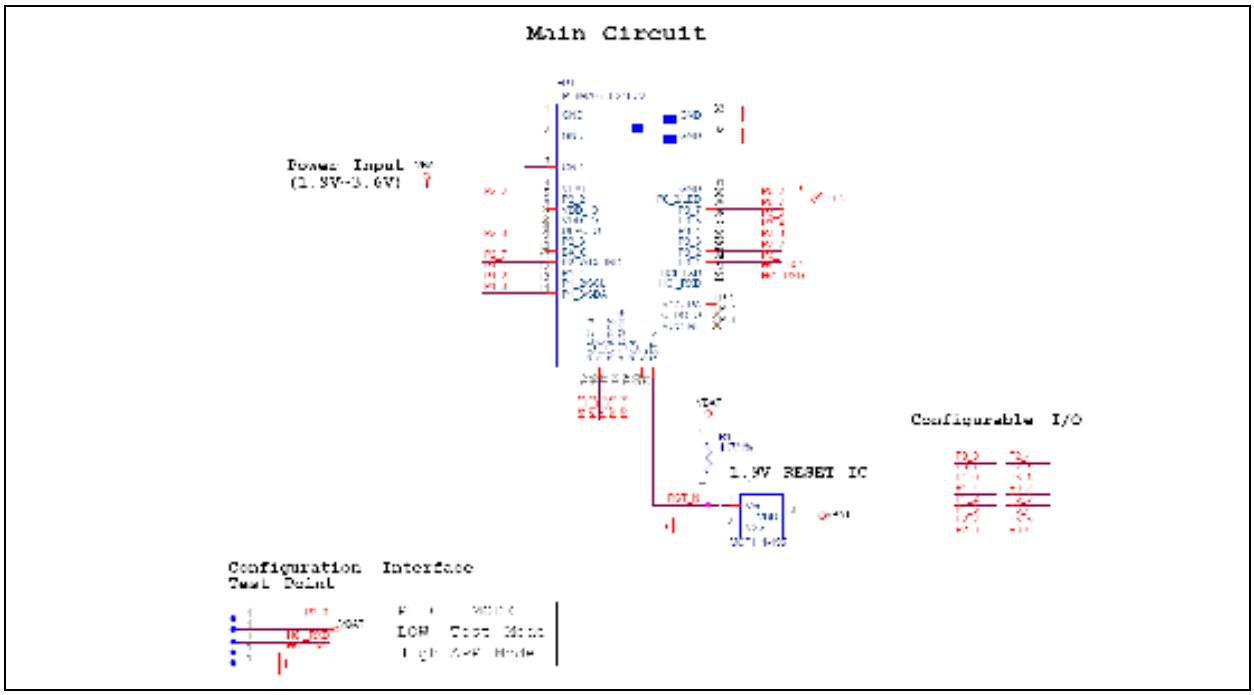


FIGURE 2-2: BM70BLES1FC2 REFERENCE CIRCUIT

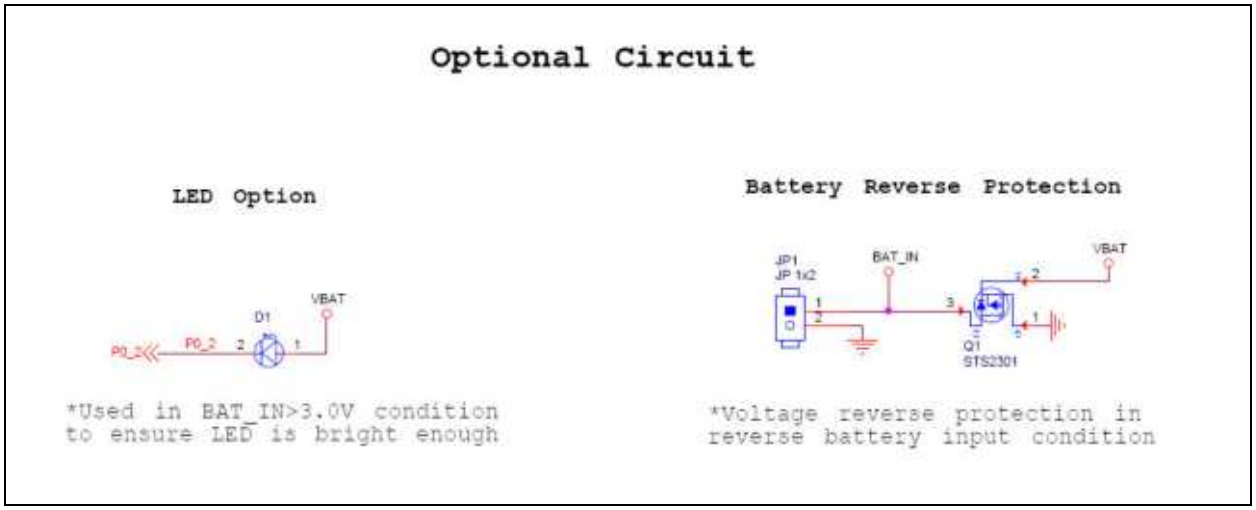
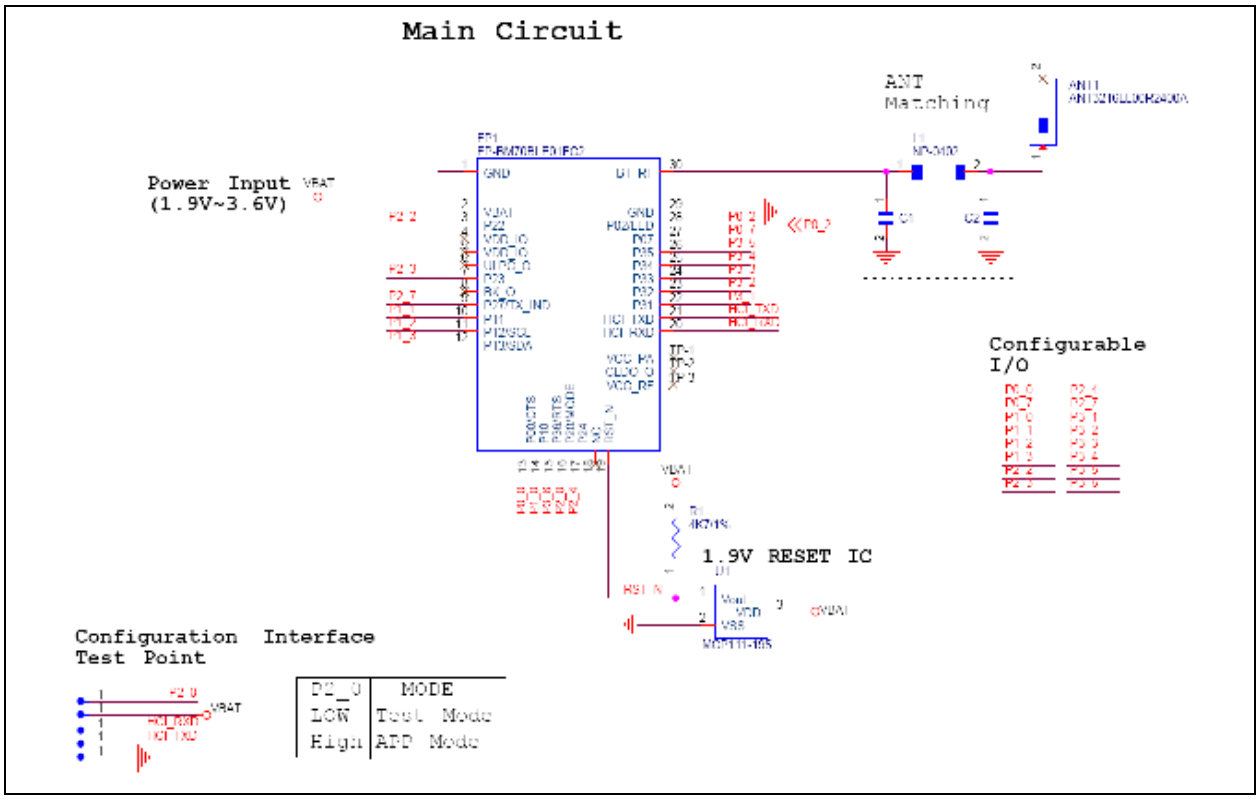


FIGURE 2-3: BM70BLE01FC2 REFERENCE CIRCUIT



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FIGURE 2-4: BM70BLE01FC2 REFERENCE CIRCUIT

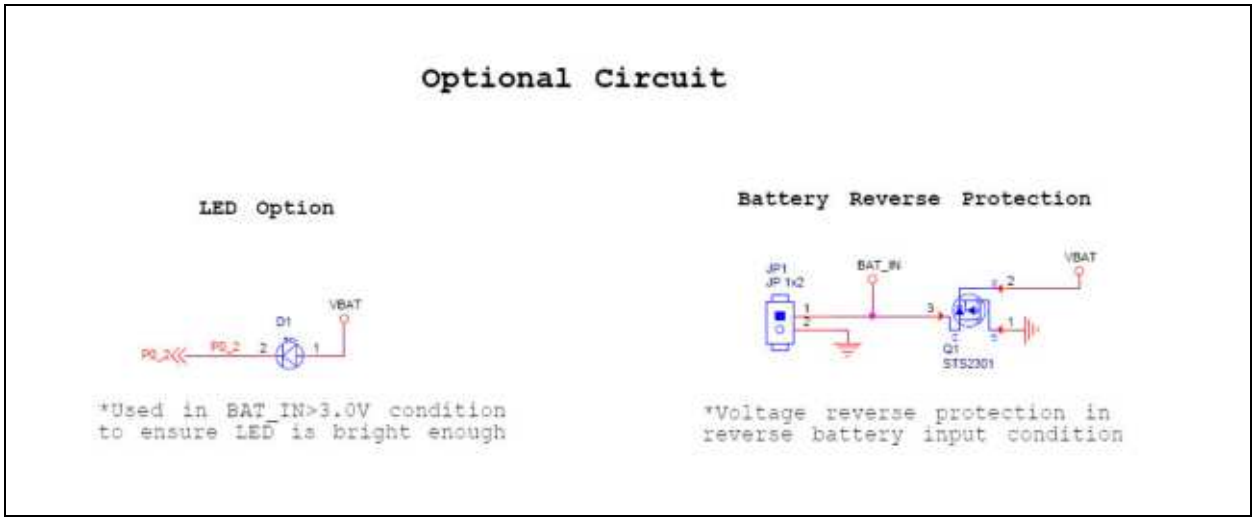
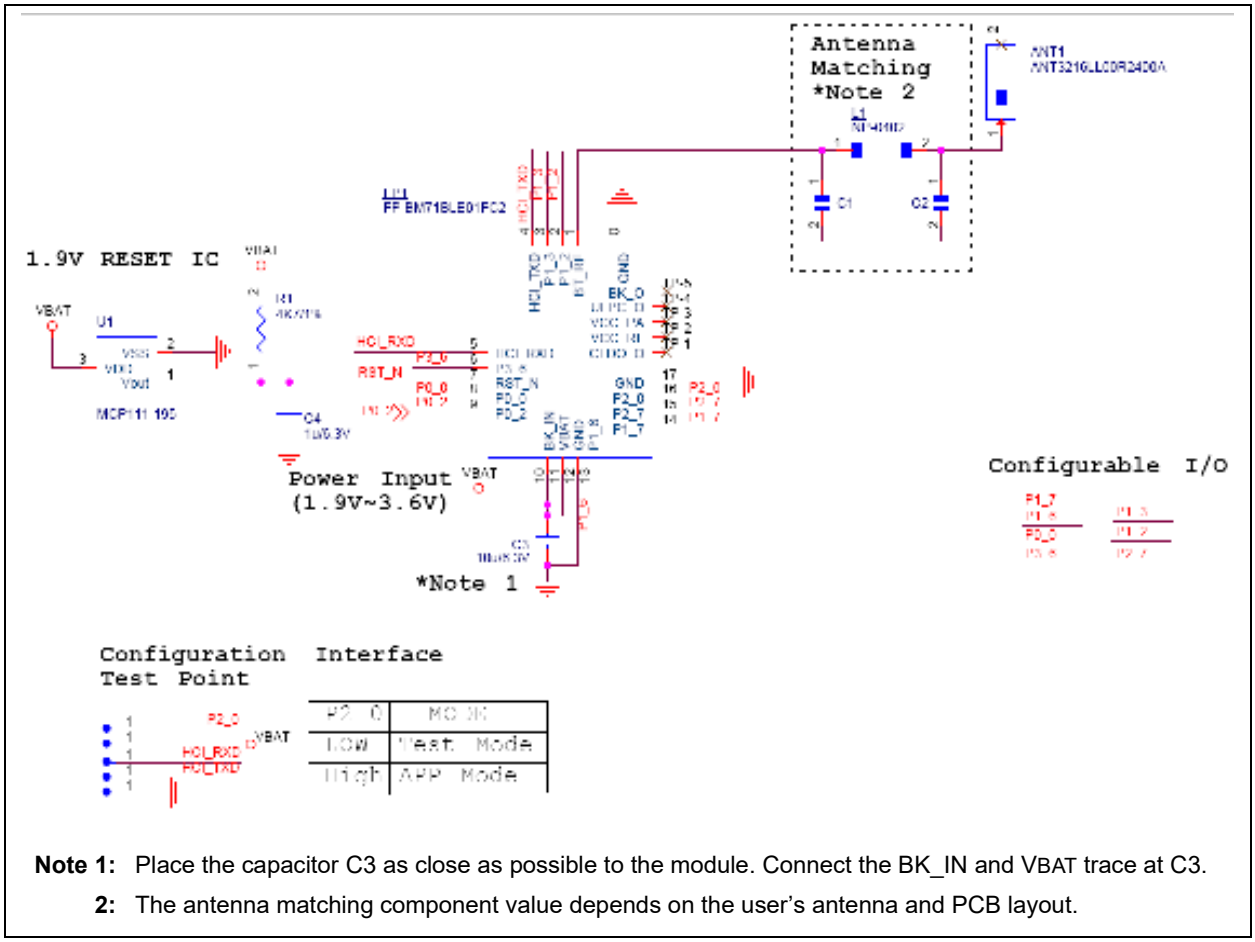


FIGURE 2-5: BM71BLE01FC2 REFERENCE CIRCUIT



Note 1: Place the capacitor C3 as close as possible to the module. Connect the BK_IN and VBAT trace at C3.

2: The antenna matching component value depends on the user's antenna and PCB layout.

FIGURE 2-6: BM71BLE01FC2 REFERENCE CIRCUIT

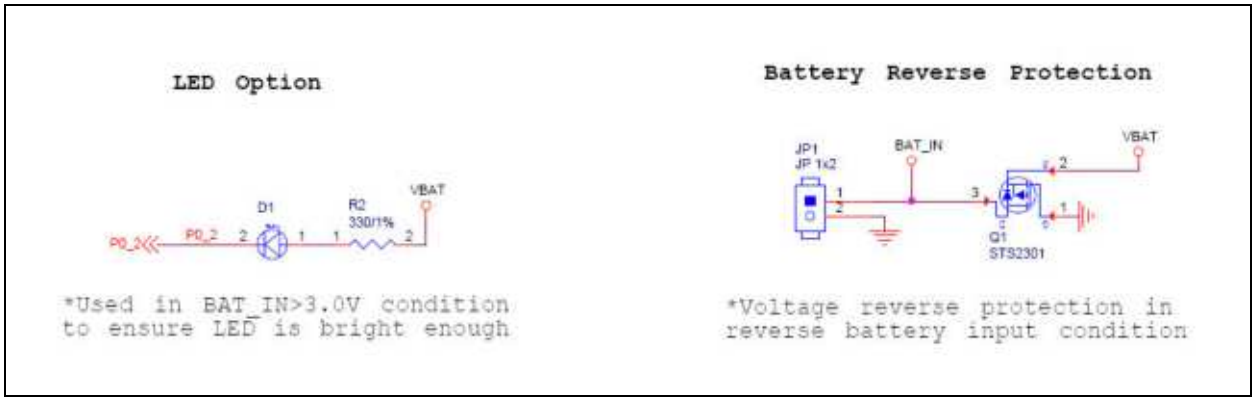
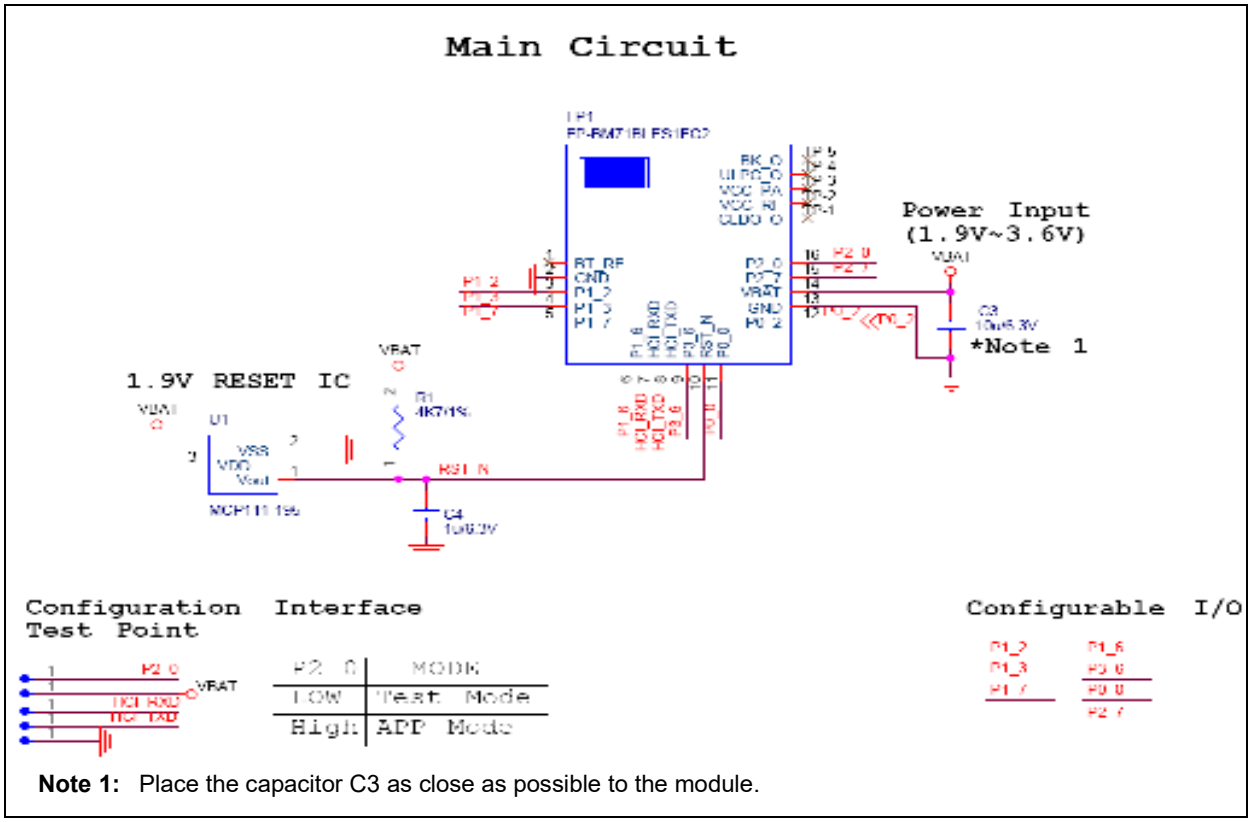


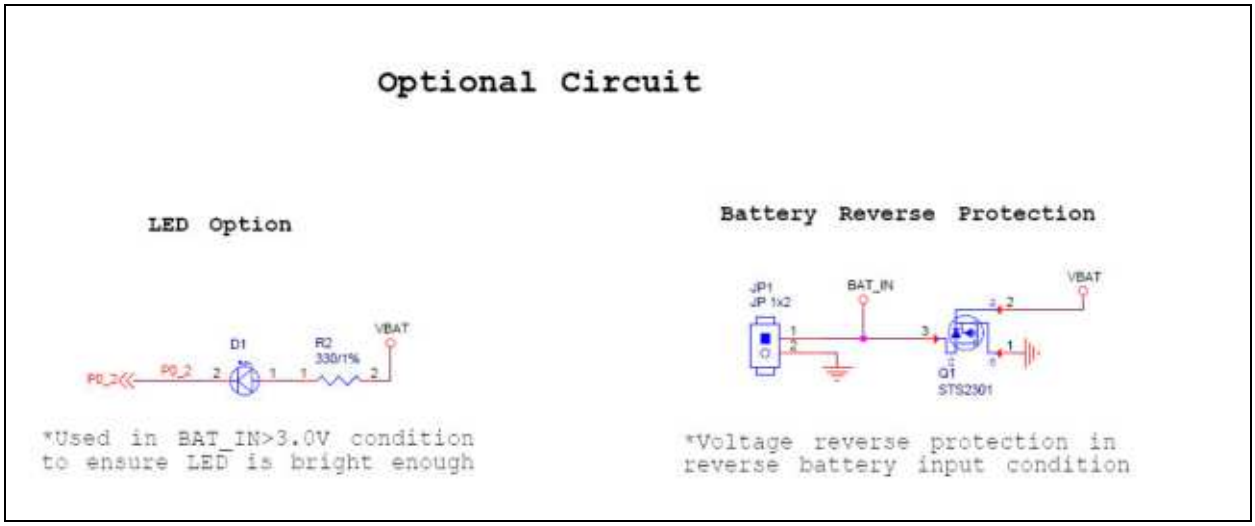
FIGURE 2-7: BM71BLES1FC2 REFERENCE CIRCUIT



Note 1: Place the capacitor C3 as close as possible to the module.

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FIGURE 2-8: BM71BLES1FC2 REFERENCE CIRCUIT - OPTIONAL

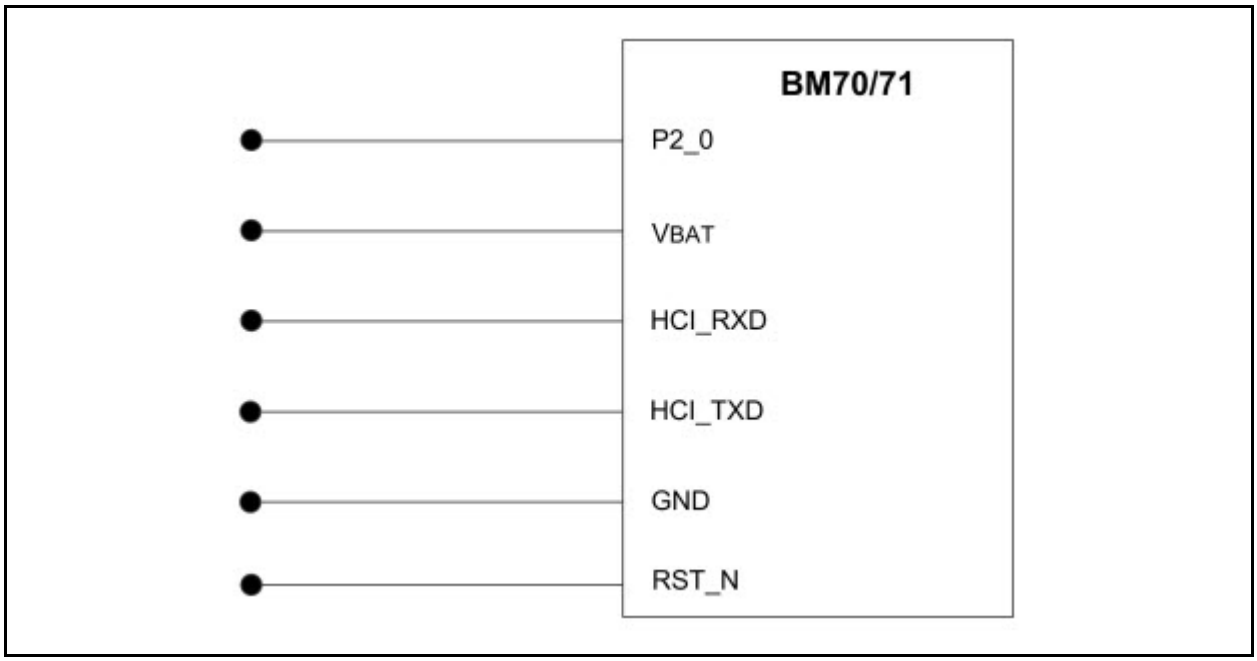


2.2 External Configuration and Programming

The BM70/71 module can be configured and programmed using an external configuration and programming tool. Figure 2-9 illustrates the minimum signals required for configuring and programming the module using host PCB.

Configuration and programming modes can be configured using the P2_0 pin. Refer to **3.4, System Configuration** for details.

FIGURE 2-9: EXTERNAL CONFIGURATION AND PROGRAMMING



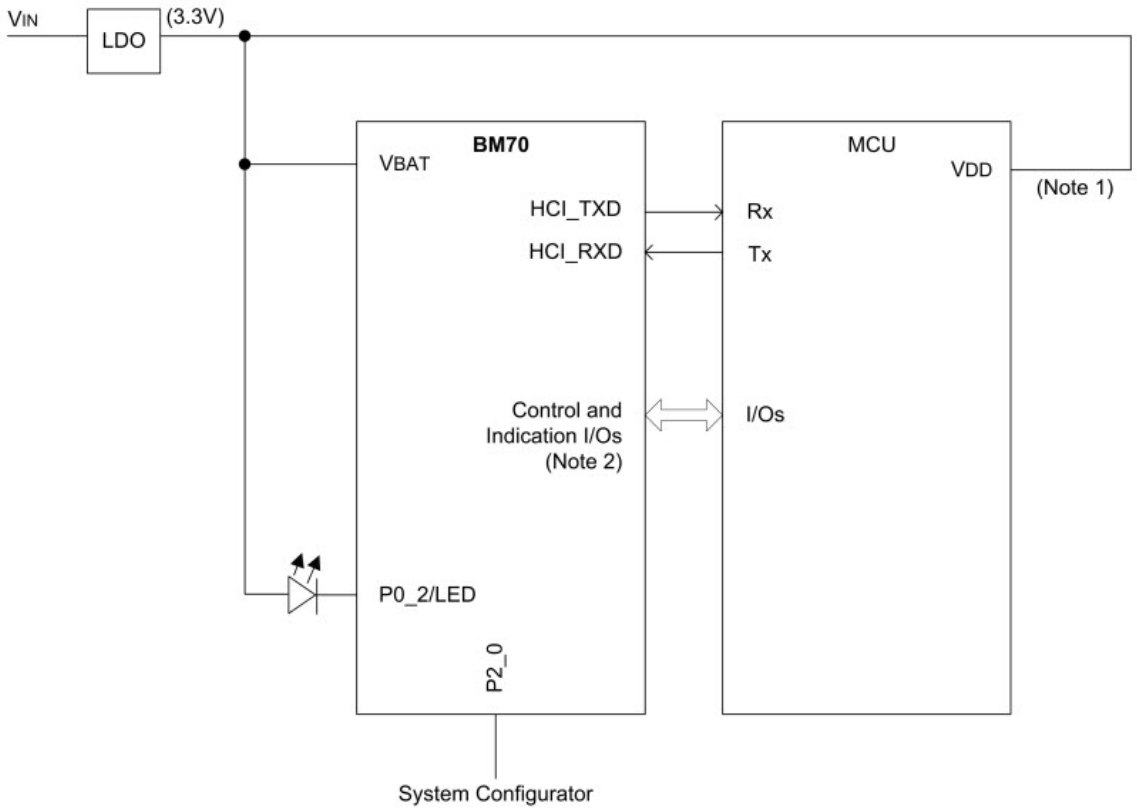
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2.3 Host MCU Interface

2.3.1 HOST MCU INTERFACE OVER UART

Figure 2-10 and Figure 2-11 illustrate the interfacing between the BM70/71 and host MCU using UART. UART uses Host Control Interface (HCI) to share the communication among the Host MCU and BM70/71 module. The interface also illustrates the power scheme using a 3.3V Low Drop Out (LDO) regulator that supplies 3.3V to the BM70/71 (BAT_IN) and MCU VDD. This power scheme ensures that the BM70/71 module and MCU I/O voltages are compatible.

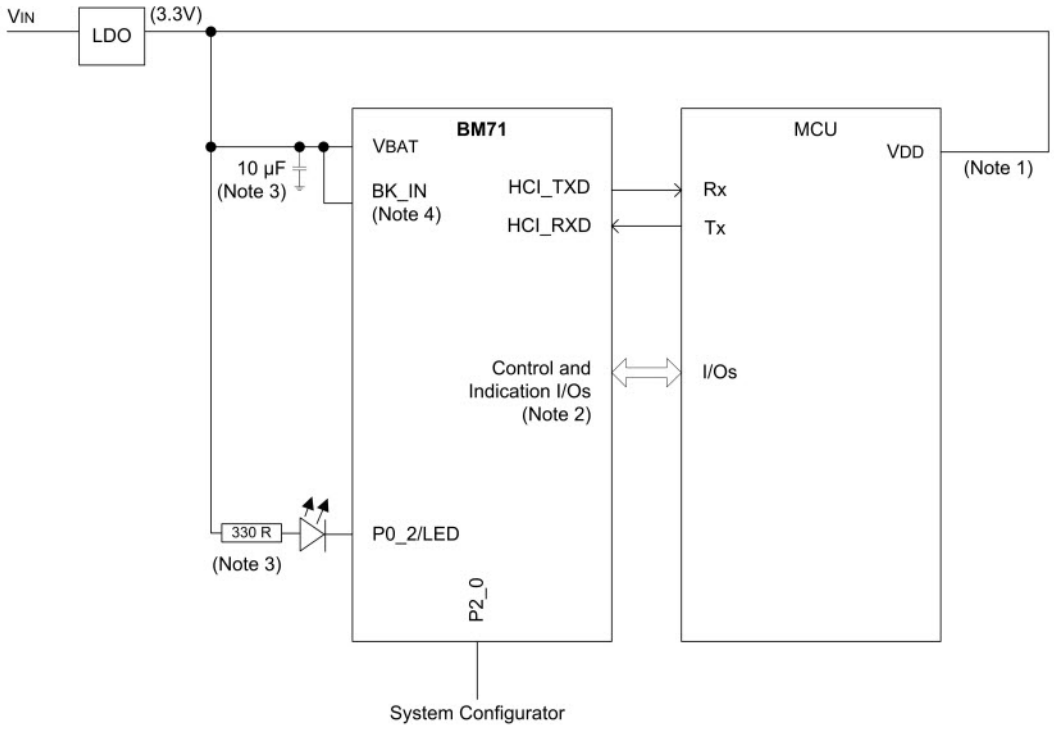
FIGURE 2-10: BM70 MODULE TO MCU INTERFACE



Note 1: Ensure that VBAT(=I/O Voltage) and MCU VDD voltages are compatible.

2: Control and indication ports are configurable.

FIGURE 2-11: BM71 MODULE TO MCU INTERFACE



Note 1: Ensure that V_{BAT}(=I/O Voltage) and MCU V_{DD} voltages are compatible.

2: Control and indication ports are configurable.

3: 10 µF (X5R) and 330 Ohm resistor are required for the BM71 module.

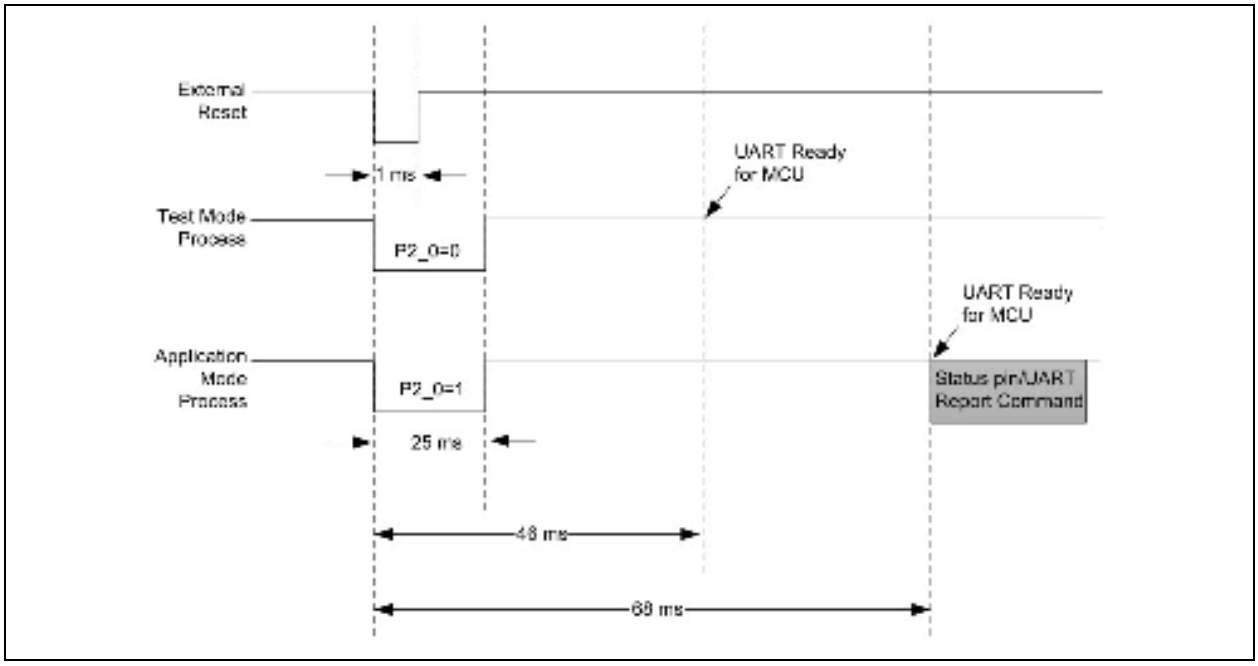
4: BK_IN connect to V_{BAT} for BM71BLE01FC2.

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2.3.2 UART READY AFTER EXTERNAL RESET

In MCU applications, the time between Reset and the BM70/71 module UART port ready for Test mode and Application mode, after an external Reset (RST_N) must be notified. Figure 2-12 illustrates the timing diagram of the BM70/71 module UART port ready for Test mode and Application mode after Reset.

FIGURE 2-12: TIMING DIAGRAM OF BM70/71 MODULE UART READY FOR TEST MODE AFTER RESET

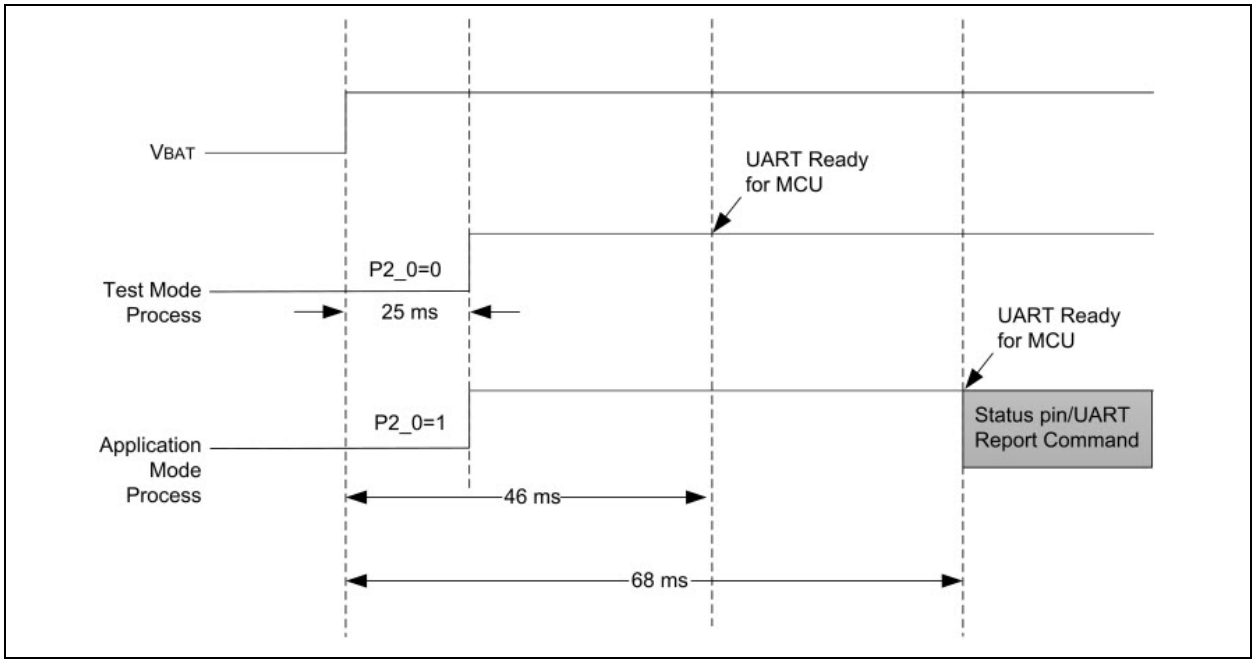


2.3.3 UART READY AFTER POWER-ON RESET

Figure 2-13 illustrates the timing diagram of the BM70 module UART port ready for Test mode and Application mode after Power-on Reset (POR).

In Application mode, when the BM70/71 module is ready to communicate with the host MCU after reset, the BM70/71 module may have internal status indicated by the status pins, or by a status report UART command. This status pin or status report UART command is sent to inform the MCU that the BM70/71 module is ready for communication.

FIGURE 2-13: TIMING DIAGRAM OF BM70 MODULE UART READY FOR TEST MODE AFTER POWER-ON

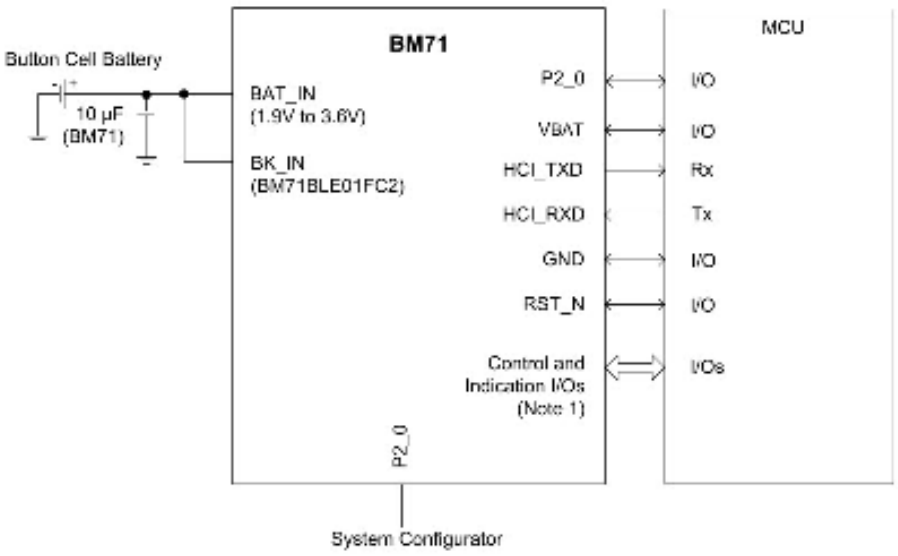


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2.4 Typical Hosted Configuration

Figure 2-14 illustrates the typical hosted configuration for the BM71 module. It also illustrates an application using a coin cell battery at VBAT input. For the BM71 module, a 10 µF capacitor (X5R/X7R) is applied to the BAT_IN pin. Only on the BM71 module, the BK_IN pin of the module must be connected to the BAT_IN pin.

FIGURE 2-14: BM71 MODULE TYPICAL HOSTED CONFIGURATION

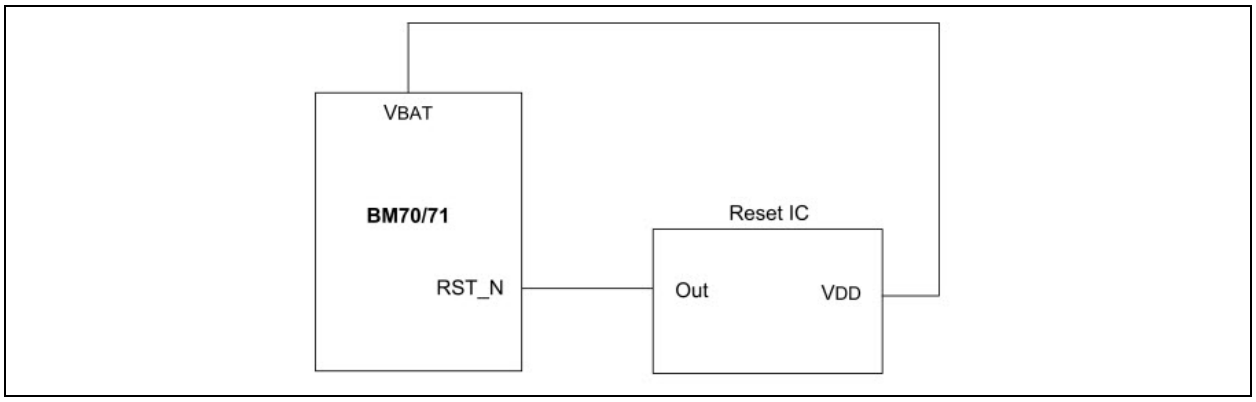


Note 1: Hardware functions can include ADC and PWM. Refer to "*BM70/71 Bluetooth® Low Energy Module User's Guide*" (DS50002542) for a full description of all possible configurable behavior and hardware.

2.5 Power-Drop Protection

To prevent the BM70/71 module from disruptions, when the voltage drops to less than 1.9V, an “Open Drain” Reset chip with a delay time of ≤ 10 ms that triggers Reset at 1.8V output voltage is recommended. Figure 2-15 illustrates the Reset circuit block diagram.

FIGURE 2-15: RESET CIRCUIT BLOCK DIAGRAM



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3.0 MODULE CONFIGURATION

The BM70/71 module features and services can be configured to fit a wide range of application requirements. Refer to the "*BM70/71 Bluetooth® Low Energy Module User's Guide"* (DS50002542) for details of all device behavior along with information on how to configure the IS8170/71 IC on the BM70/71 module. Refer to **3.1"UART Interface"** through **3.4"System Configuration"** that describe default behavior of the BM70/71 module, which can be easily changed.

3.1 UART Interface

The BM70/71 module UART pins, TXD and RXD, are connected to the UART pins of the host MCU. By default, the UART characteristics are set to a baud rate of 115200, with 8-bit data, 1 stop bit, no parity, and no hardware flow control. These characteristics are configurable; refer to the "*BM70/71 Bluetooth® Low Energy Module User's Guide"* (DS50002542) for the full description.

3.2 Control and Indication I/O Pins

The BM70/71 module I/O pins are configurable as either control or indication signal. The control signals are input to the BM70/71 module and the indication signals are output from the BM70/71 module. Table 3-1 and Table 3-2 provide default pin functions of the default firmware logic in the IS1870/71 IC on the BM70/71 module. For different BM70/71 module application requirements, the I/O pin assignment is configurable and can fit a wide range of application requirements. For additional information related to I/O pin assignment, refer to the "*BM70/71 Bluetooth® Low Energy Module User's Guide"* (DS50002542).

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

PINS	N/C(1)	LOW_BATTERY_IND(1)	RSSI_IND(1)	LINK_DROP(1)	UART_RX_IND(1)	PAIRING_KEY(1)	RF_ACTIVE_IND(1)	STATUS1_IND(1)	If hardware function is enabled, UART_RTS is fixed to this pin	If hardware function is enabled, UART_CTS is fixed to this pin	If hardware function is enabled, TX_IND is fixed to this pin	If hardware function is enabled, LED0 is fixed to this pin
P1_0												
P3_1			Default									
P3_2				Default								
P3_3					Default							
P3_4						Default						
P0_7		Default										
P1_1								Default				
P2_2	Default											
P2_4	Default											
P3_5	Default											
P3_6									Default			
P0_0										Default		
P2_7											Default	
P0_2												Default

Note 1: These signals are part of the remappable hardware functionality and can be input/output on different GPIO pins of the module. Refer to the "*BM70/71 Bluetooth® Low Energy Module User's Guide"* (DS50002542) for details.

TABLE 3-2: CONFIGURATION AND INDICATION I/O ASSIGNMENTS FOR BM71 MODULE

PINS	LOW_BATTERY_IND	RSSI_IND	LINK_DROP	UART_RX_IND	PAIRING_KEY	RF_ACTIVE_IND	STATUS1_IND	STATUS2_IND	If hardware function is enabled, UART_RTS is fixed to this pin	If hardware function is enabled, UART_CTS is fixed to this pin	If hardware function is enabled, TX_IND is fixed to this pin	If hardware function is enabled, LED0 is fixed to this pin
P1_6				Default								
P1_7					Default							
P1_2							Default					
P1_3								Default				
P3_6									Default			
P0_0										Default		
P2_7											Default	
P0_2												Default

3.3 Reset (RST_N)

The Reset input pin (RST_N) is used to reset the BM70/71 module with an active-low pulse with a minimum pulse width of 63 ns.

3.4 System Configuration

Table 3-3 provides the system configuration settings of the P2_0 pin that places the BM70/71 module into various operational modes. The P2_0 pin has an internal pull up.

TABLE 3-3: SYSTEM CONFIGURATION SETTINGS

P2_0	Operational Mode
High	Application mode
Low	Test mode (calibration of the IS1870/71 IC), Configuration mode (programming of configuration parameters for default firmware), Firmware Update mode (programming of internal flash memory of IS1870/71 IC).

Note: For more details and information on the use of these different modes, refer to the "*BM70/71 Bluetooth® Low Energy Module User's Guide*" (DS50002542).

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4.0 ANTENNA

4.1 Antenna Characteristics

4.1.1 BM70BLES1FC2 CERAMIC CHIP ANTENNA

The BM70BLES1FC2 module contains an inbuilt ceramic chip antenna. Figure 4-1 illustrates the antenna radiation pattern of the ceramic chip antenna on the BM70BLES1FC2 module.

FIGURE 4-1: BM70BLES1FC2 ANTENNA RADIATION PATTERN

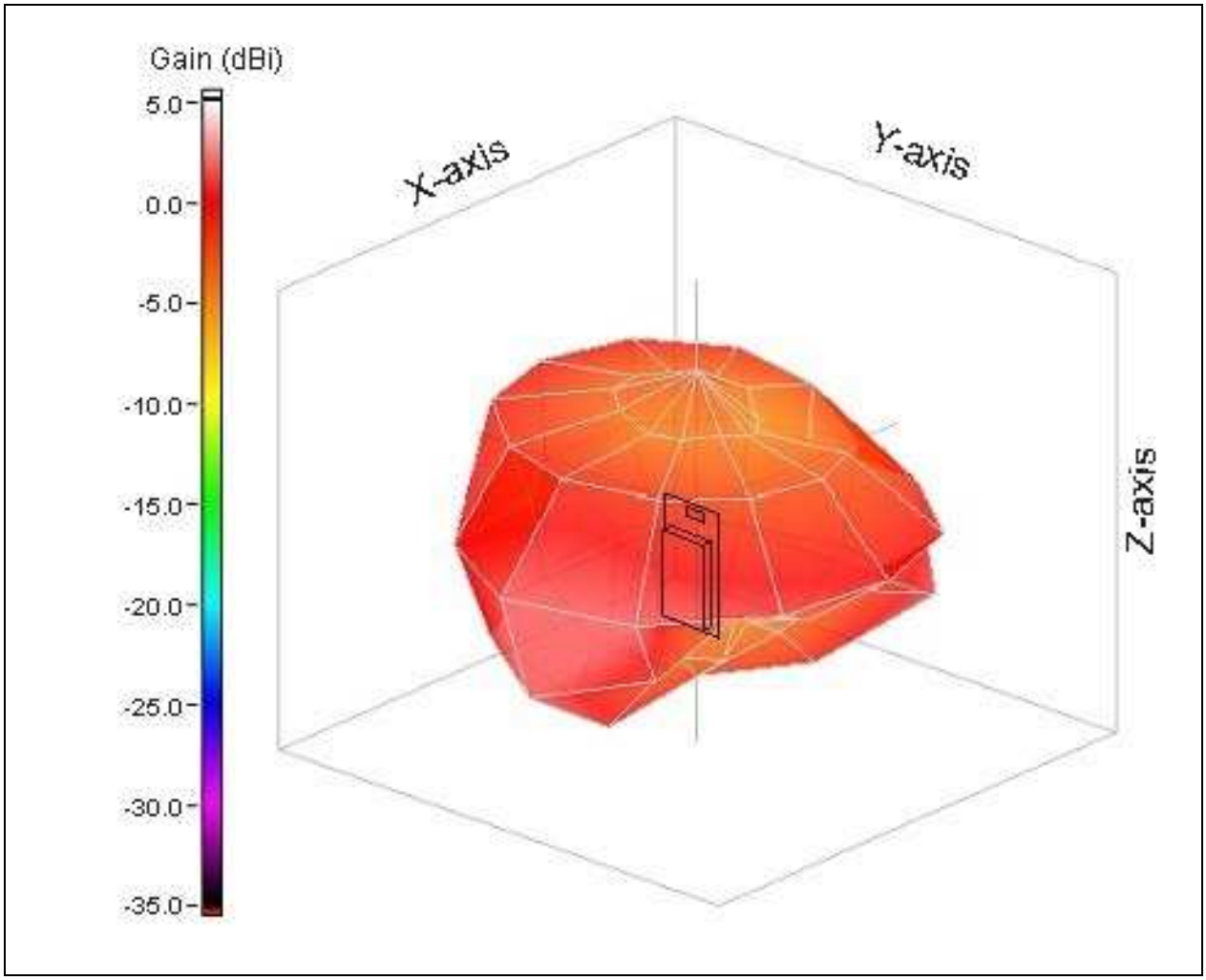


Table 4-1 provides the antenna radiation pattern details of the BM70BLES1FC2 module.

TABLE 4-1: BM70BLES1FC2 ANTENNA RADIATION PATTERN DETAILS

Parameter	Values
Frequency	2450 MHz
Peak Gain	1.63 dBi
Efficiency	71.55%

4.1.2 BM71BLES1FC2 CERAMIC CHIP ANTENNA

The BM71BLES1FC2 module contains an inbuilt ceramic chip antenna. Figure 4-2 illustrates the antenna radiation pattern of the ceramic chip antenna on the BM71BLES1FC2 module.

FIGURE 4-2: BM71BLES1FC2 ANTENNA RADIATION PATTERN

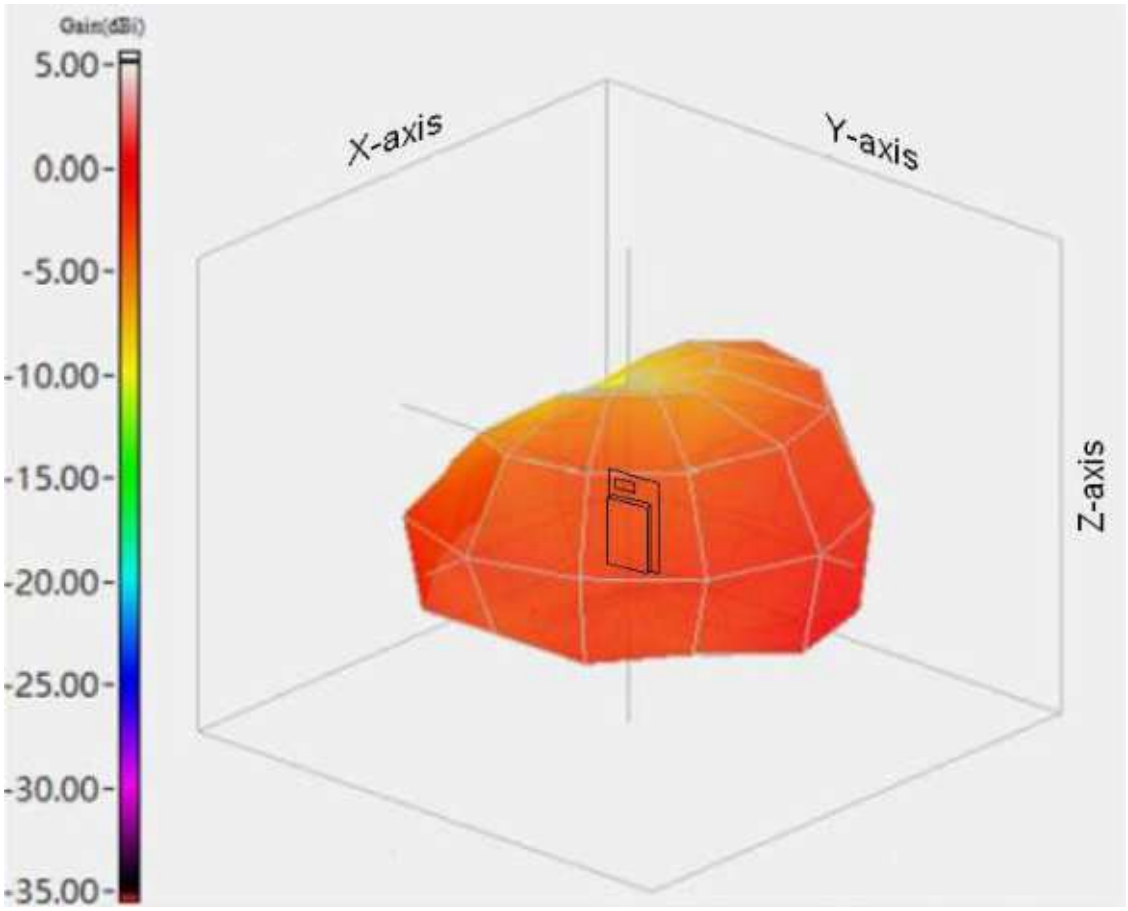


Table 4-2 provides the antenna radiation pattern details of the BM71BLES1FC2 module.

TABLE 4-2: BM71BLES1FC2 ANTENNA RADIATION PATTERN DETAILS

Parameter	Values
Frequency	2442 MHz
Peak Gain	0.1 dBi
Efficiency	42.7%

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4.2 Antenna Placement

For a Bluetooth wireless product, the antenna placement affects the whole system performance. The antenna requires free space to radiate the RF signals and it cannot be surrounded by the ground plane.

Figure 4-3 illustrates a typical example of good and poor antenna placement of the BM70BLES1FC2 module on the main application board with the ground plane.

FIGURE 4-3: BM70BLES1FC2 ANTENNA PLACEMENT EXAMPLES

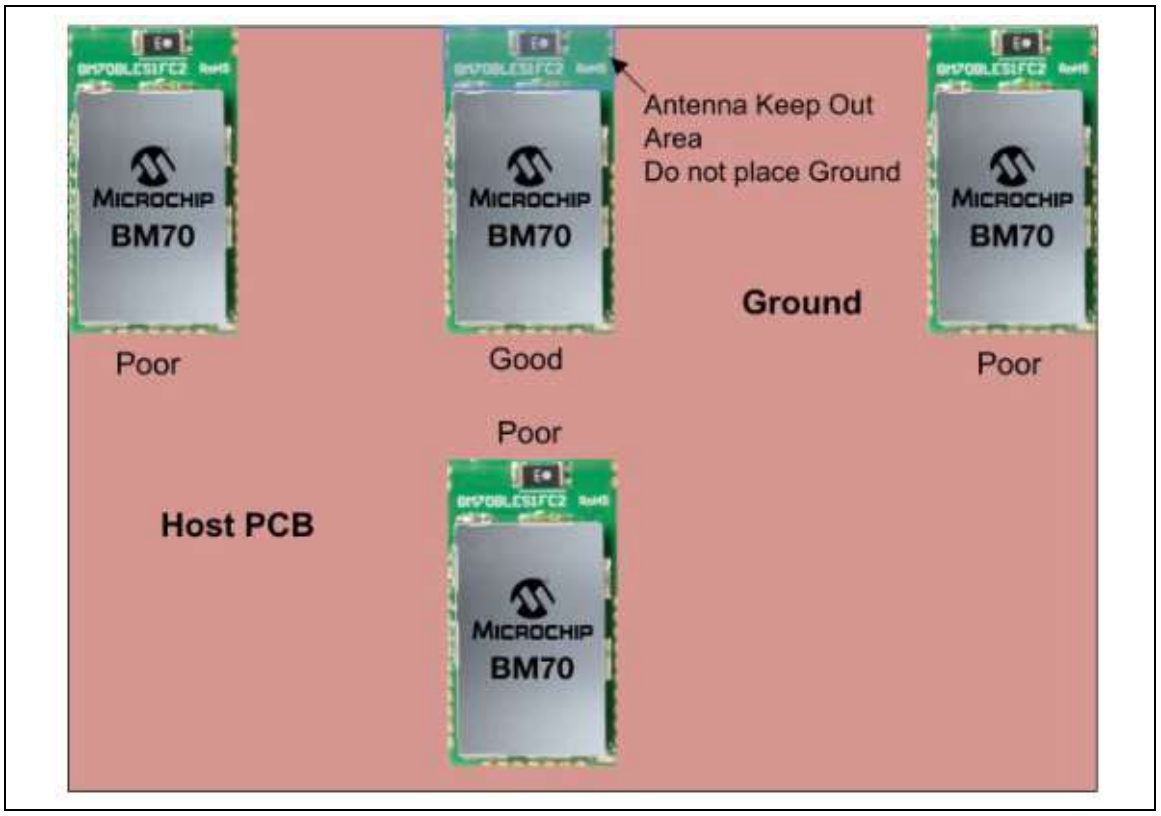
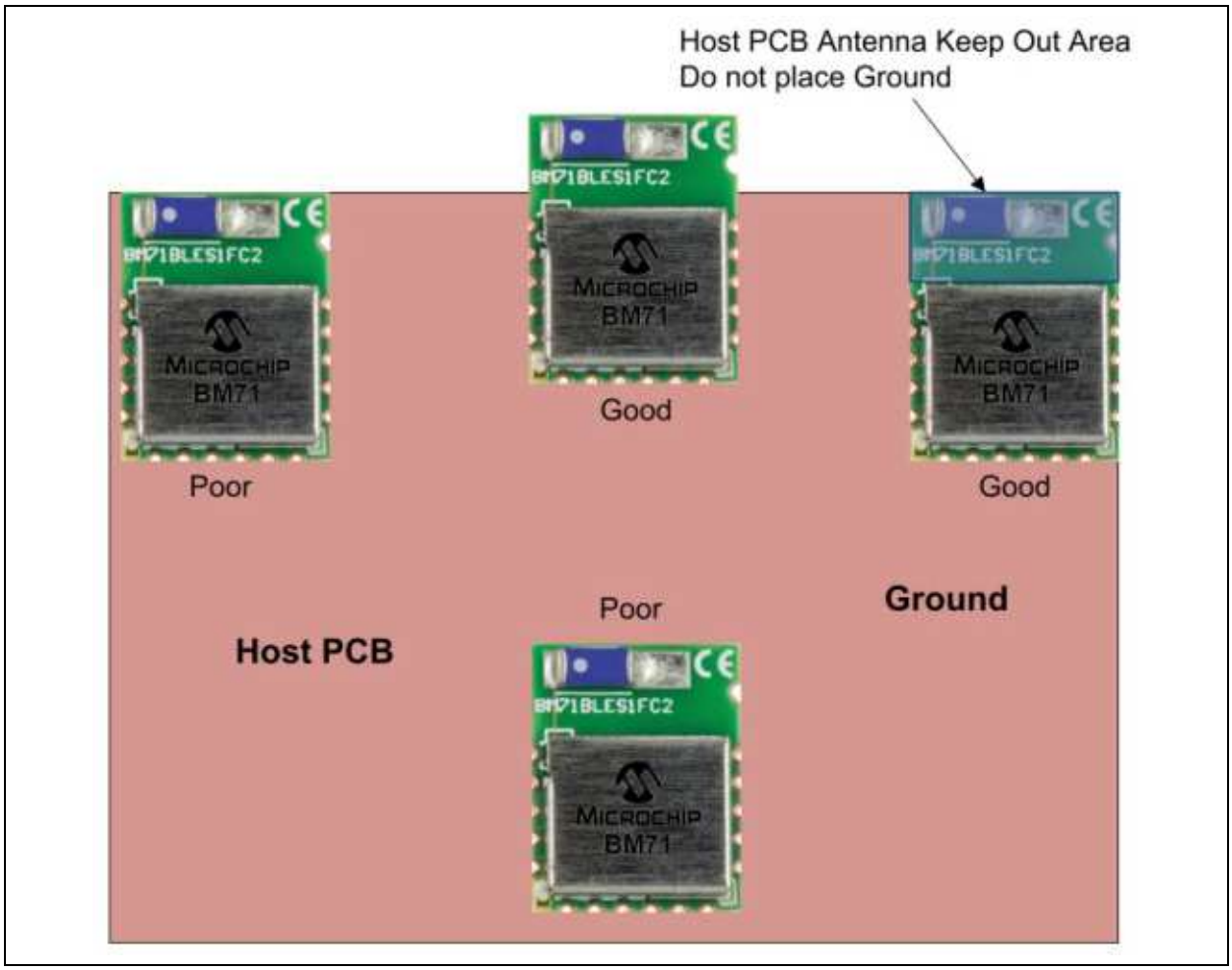


Figure 4-4 illustrates a typical example of good and poor antenna placement of the BM71BLES1FC2 module on the main application board with the ground plane.

FIGURE 4-4: BM71BLES1FC2 ANTENNA PLACEMENT EXAMPLES



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4.3 Antenna Considerations

Table 4-3 provides the part number and manufacturer details of the antenna used on the BM70BLES1FC2 module.

TABLE 4-3: BM70BLES1FC2 ANTENNA DETAILS

Description	Part Number	Manufacturer
ANT ANT3216A063R2400A PIFA 2.4 GHZ L3.2W1.6	ANT3216A063R2400A	YAGEO

Table 4-4 provides the part number and manufacturer details of the antenna used on the BM71BLES1FC2 module.

TABLE 4-4: BM71BLES1FC2 ANTENNA DETAILS

Description	Part Number	Manufacturer
ANT ANT3216LL00R2400A 2.4 GHZ L3.2W1.6	ANT3216LL00R2400A	YAGEO

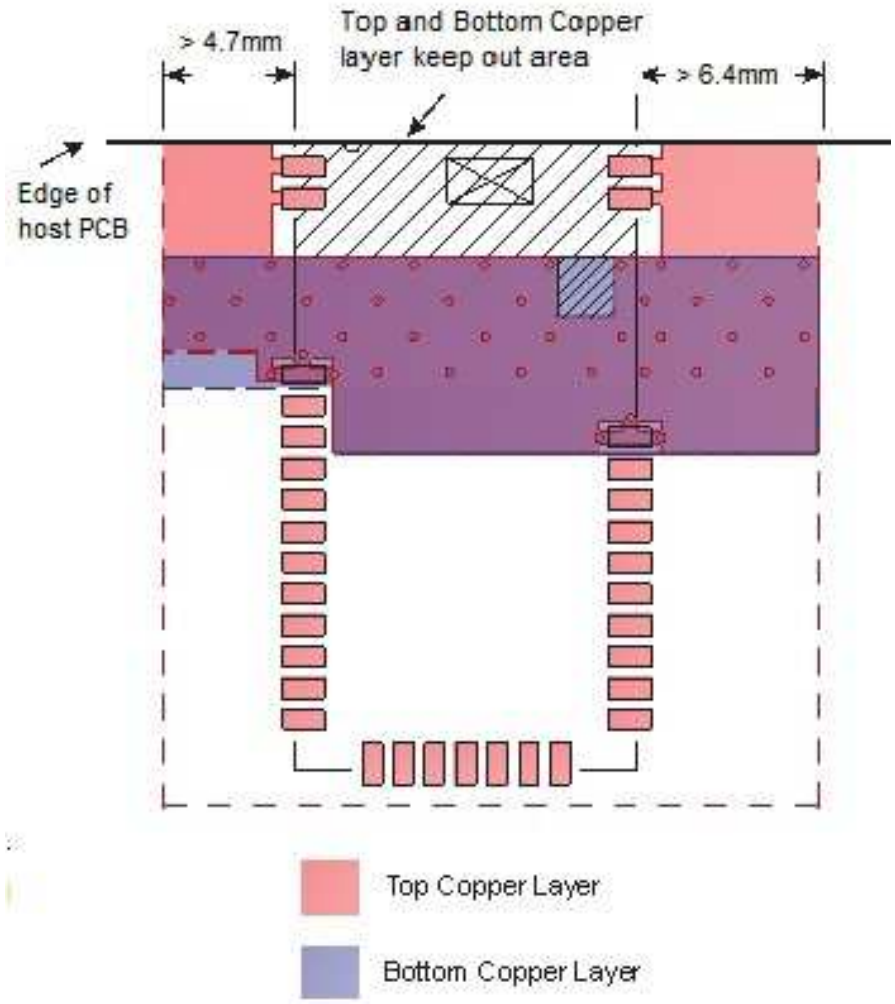
4.4 Host PCB Mounting Suggestion

4.4.1 BM70BLES1FC2 HOST PCB MOUNTING

Figure 4-5 illustrates the host PCB mounting suggestions for the BM70BLES1FC2 module, showing the minimum ground plane area to the left and right of the module for best antenna performance.

The area under the antenna must not contain any top, inner or bottom copper layer, while designing the host PCB. A low-impedance ground plane ensures the best radio performance (best range, low noise). The ground plane can be extended beyond the minimum recommended as required for the host PCB EMC noise reduction. For best range performance, keep all external metal away from the ceramic chip antenna by a minimum of 30 mm.

FIGURE 4-5: BM70BLES1FC2 HOST PCB MOUNTING SUGGESTION



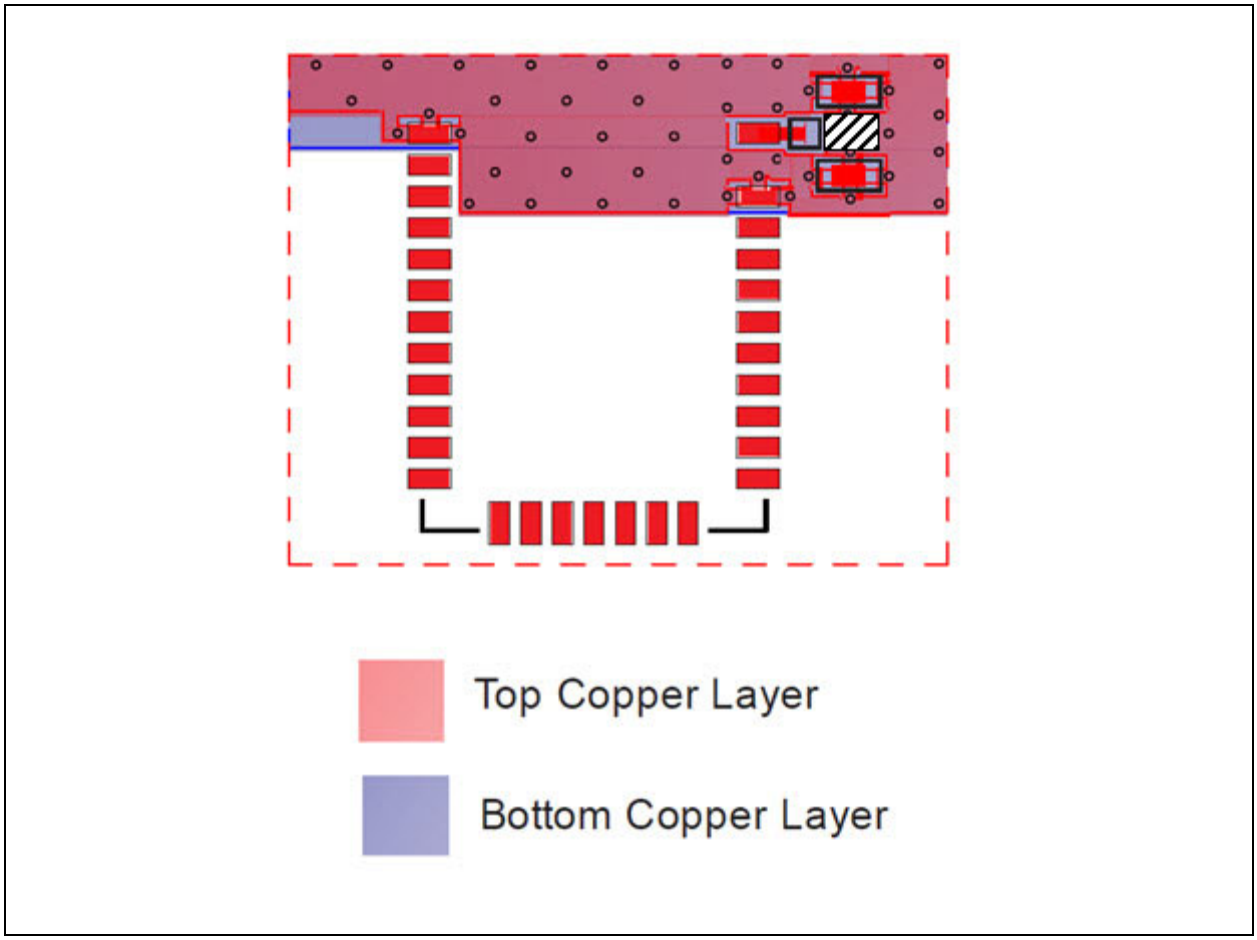
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4.4.2 BM70BLE01FC2 HOST PCB MOUNTING

Figure 4-6 illustrates the mounting suggestions for the BM70BLE01FC2 module and also shows a connection to UFL connector. A low-impedance ground plane will ensure the best radio performance (best range, low noise).

The pin 30 (BT_RF) is connected to an external antenna connector, a PCB trace antenna, or a component (ceramic chip) antenna through a host PCB 50 Ohm micro-strip trace. The micro-strip trace can be extended to include passive parts for antenna attenuation padding, impedance matching, or to provide test points. 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 must be a 50 Ohm controlled impedance.

FIGURE 4-6: BM70BLE01FC2 HOST PCB MOUNTING SUGGESTIONS

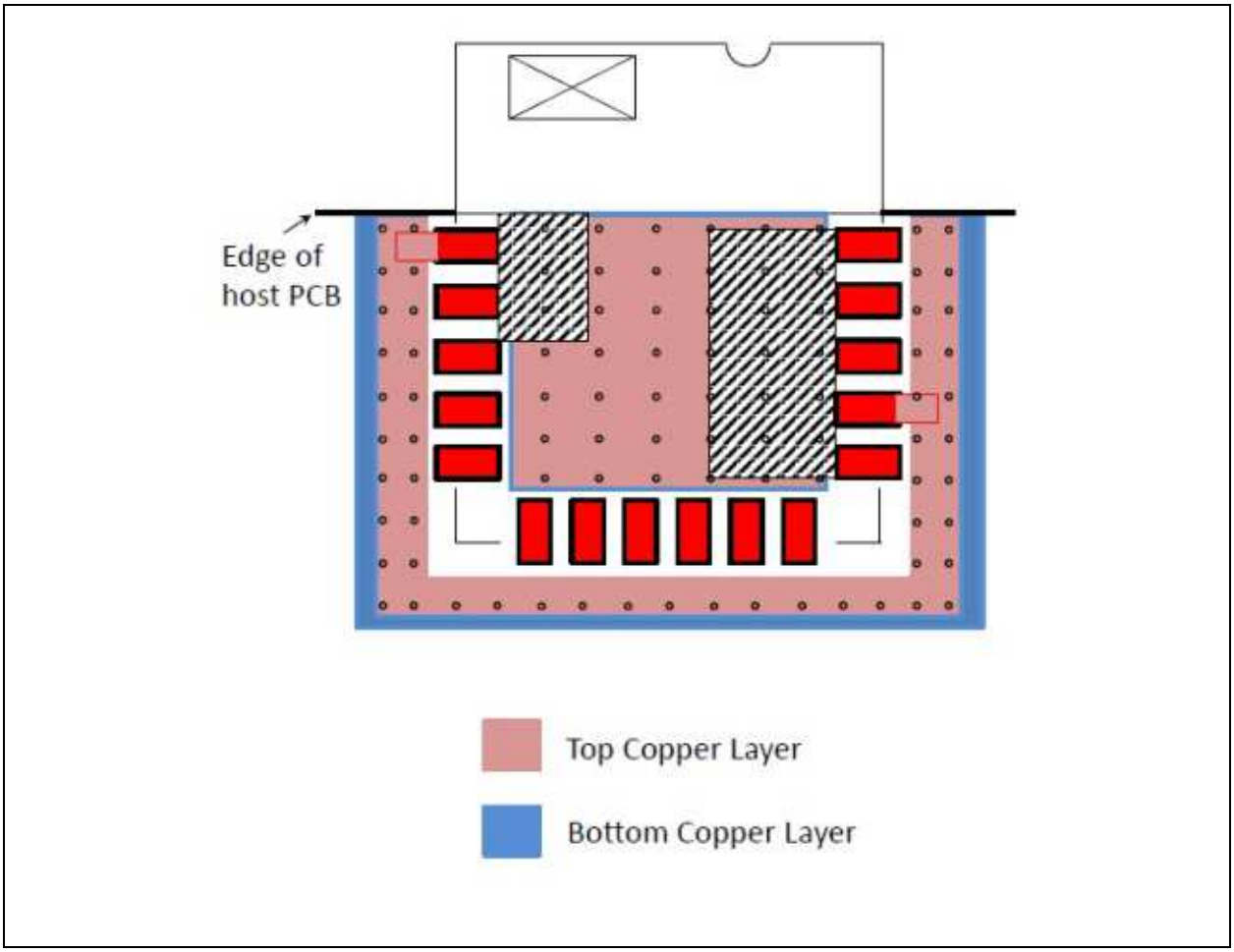


4.4.3 BM71BLES1FC2 HOST PCB MOUNTING

Figure 4-7 illustrates the mounting suggestions for the BM71BLES1FC2 module. It also shows the area around the antenna, required for the best antenna performance.

The area under the antenna must not contain any top, inner, or bottom copper layer while designing the host PCB. A low-impedance ground plane ensures the best radio performance (best range, low noise). The ground plane can be extended beyond the minimum recommended as required for the host PCB EMC noise reduction. For best range performance, keep all external metal away from the ceramic chip antenna by a minimum of 30 mm.

FIGURE 4-7: BM71BLES1FC2 HOST MOUNTING SUGGESTION



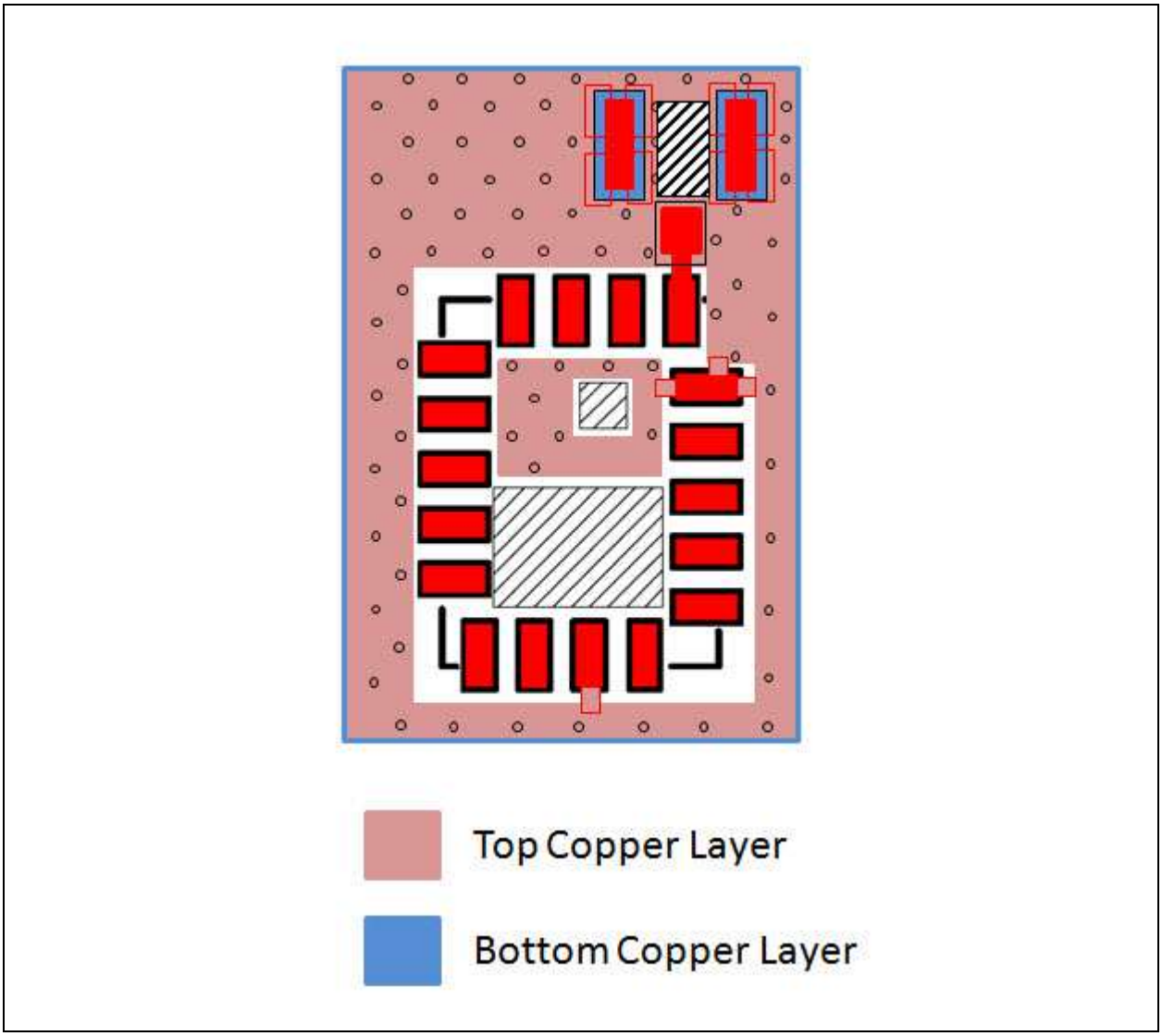
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4.4.4 BM71BLE01FC2 HOST PCB MOUNTING

Figure 4-8 illustrates the mounting suggestions for the BM71BLE01FC2 module. It also shows a connection to the UFL connector. A low-impedance ground plane ensures the best radio performance (best range, low noise).

The pin 1 (BT_RF) is connected to an external antenna connector, a PCB trace antenna, or a component (ceramic chip) antenna through a host PCB 50 Ohm micro-strip trace. The micro-strip trace can be extended to include passive parts for antenna attenuation padding, impedance matching, or to provide test points. 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 must be a 50 Ohm controlled impedance.

FIGURE 4-8: BM71BLE01FC2 HOST PCB MOUNTING SUGGESTION



NOTES:

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5.0 ELECTRICAL CHARACTERISTICS

This section provides an overview of the BM70/71 module electrical characteristics. Additional information will be provided in future revisions of this document as it becomes available.

Absolute Maximum Ratings

Ambient temperature under bias for modules parts ending with 0002.....-20°C to +70°C
Ambient temperature under bias for modules parts ending with 0B0x.....-40°C to +85°C
Storage temperature ..... -40°C to +125°C
Voltage on V_{DD} with respect to V_{SS} ..... -0.3V to +3.6V
Voltage of any digital pin .....-0.3V to V_{DD} + 0.3 ≤ 3.9
Maximum output current sink by any I/O pin.....12 mA
Maximum output current sourced by any I/O pin.....12 mA

Note: Stresses above those listed under **"Absolute Maximum Ratings"** may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions, above those indicated in the operation listings of this specification, is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Table 5-1 provides the recommended operating conditions of the BM70/71 module.

TABLE 5-1: RECOMMENDED OPERATING CONDITIONS

Symbol	Min.	Typ.	Max.
PMU			
VDD (VBAT, BK_IN, AVDD)	1.9V	3.0V	3.6V
RST_N	1.9V	3.0V	3.6V
Other I/O	1.9V	—	3.6V
GPIO			
V_{IH} (Input High Voltage)	0.7 VDD	—	VDD
V_{IL} (Input Low Voltage)	VSS	—	0.3 VDD
V_{OH} (Output High Voltage) (High drive, 12 mA)	0.8 VDD	—	VDD
V_{OL} (Output Low Voltage) (High drive, 12 mA)	VSS	—	0.2 VDD
Pull up resistance	34 kOhm	48 kOhm	74 kOhm
Pull down resistance	29 kOhm	47 kOhm	86 kOhm
Supply Current (see **Note 1**)			
Peak Tx mode current at VDD=3V, Tx=0 dBm, Buck mode	—	10 mA at +25°C	13 mA at +70°C/+85°C
Peak Rx mode current at VDD=3V, Buck mode	—	10 mA at +25°C	13 mA at +70°C/+85°C
"Reduced current consumption" low power mode current (see **Note 2**)	—	60 µA at +25°C	
"Shutdown" low power mode current (see **Note 2**)	1.0 µA	—	2.9 µA

Note 1: The current measurements are characterized across a sample of BM70/71 modules at room temperature (+25°C), unless otherwise noted.

2: For more details on "Reduced current consumption" or "Shutdown" low power modes, refer to the "*BM70/71 Bluetooth® Low Energy Module User's Guide"* (DS50002542).

Note: For more details on "Analog to Digital Converter (ADC) and Precision Temperature Sensor (PTS) specifications, refer to "*IS1870/71 Bluetooth® Low Energy SoC data sheet"* (DS60001371).

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Table 5-2 provides the RF specifications of the BM70/71 module.

TABLE 5-2: RF SPECIFICATIONS

Parameter		Min.	Typ.	Max.
Transmitter				
Frequency		2402 MHz	—	2480 MHz
Output Power		—	0 dBm	—
RF Power Control Range		-25 dBm	—	3 dBm
In-band Spurious (N±2)		—	-38.5 dBm	—
In-band Spurious (N±3)		—	-43.25 dBm	—
Modulation Characteristic - Frequency Deviation (see **Note 1**)		—	247 kHz	—
Receiver				
Frequency		2402 MHz	—	2480 MHz
Sensitivity Level (interference active)		—	-90 dBm	—
Interference Performance	Co-channel	—	17 dB	—
	Adjacent ± 1 MHz	—	0 dB	—
	Adjacent ± 2 MHz	—	-25 dB	—
	Adjacent >= ± 3 MHz	—	-32 dB	—
Inter-modulation Characteristic (n=3,4,5)		—	-37.5 dBm	—
Maximum Usable Level			0 dBm	

Note 1: Tested by transmitting known ‘00001111’b patterns.

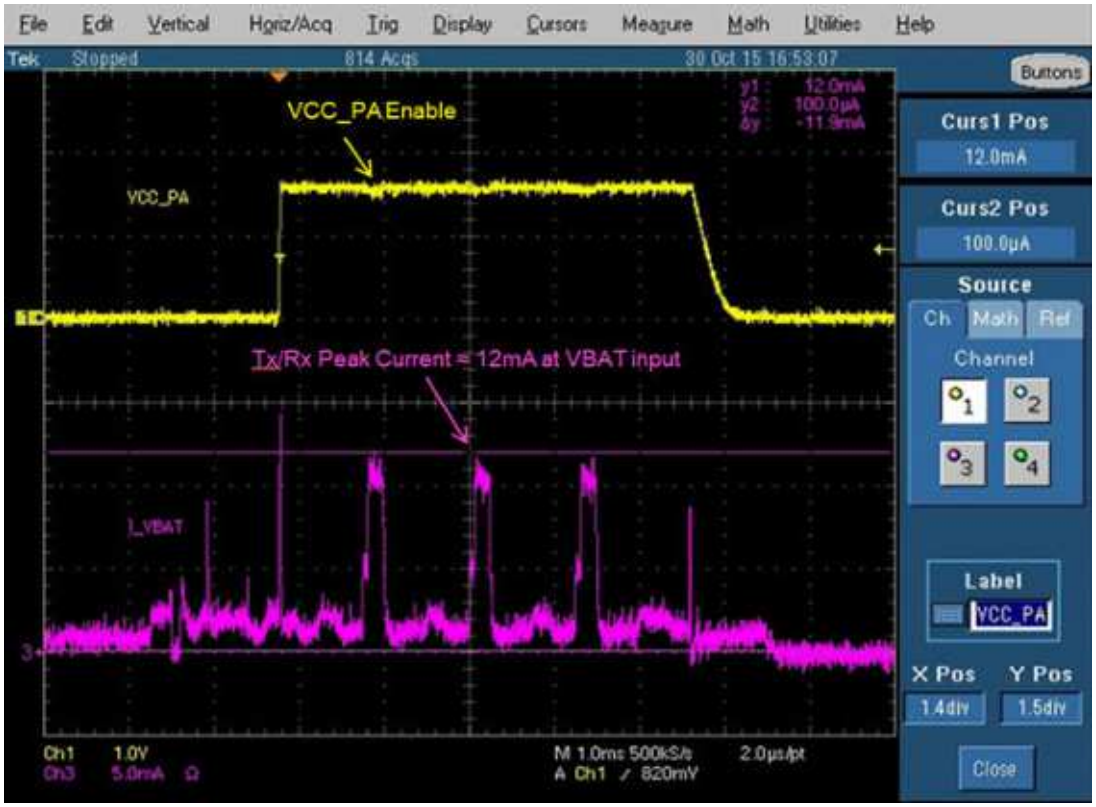
5.1 Current Consumption Details

5.1.1 Tx/Rx CURRENT CONSUMPTION DETAILS

Figure 5-1 illustrates the Tx/Rx peak current consumption of 12 mA during an advertising event. However, the average current consumption is only around 230 µA while advertising at an interval of approximately 100 ms, see Figure 5-2. This is due to the "Reduced Current Consumption" Low Power mode being enabled (configuration parameter - UART_RX_IND). Reducing the current draw to approximately 60 µA, while not actively transmitting the advertisings packets, refer to the "*BM70/71 Bluetooth® Low Energy Module User's Guide*" (DS50002542) for more details.

The overall average current consumption is measured with a 3.3V VBAT input, and is affected by the way the IS1870/71 IC on the BM70/71 module has been configured to operate. A low average current value can be achieved by choosing the minimum settings for the advertising interval and connection interval, which meet the data throughput requirements of the intended application. The lower or less frequent the interval time periods, the lower the overall average current to be drawn.

FIGURE 5-1: TX/RX PEAK CURRENT CONSUMPTION OF AN ADVERTISING EVENT



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Figure 5-2 illustrates the oscilloscope screen, captured when the auto operation and Low Power mode is active on the BM70/71 module. Refer to the "*BM70/71 Bluetooth® Low Energy Module User's Guide"* (DS50002542) for more details on the auto operation.

FIGURE 5-2: TX/RX AVERAGE CURRENT CONSUMPTION WHILE BM70/71 MODULE IS ADVERTISING



For additional information on the current consumption measurements, test conditions and test environment setup, refer to the "*BM70/71 Bluetooth® Low Energy Module User's Guide"* (DS50002542).This user guide provides detailed information about the behavior of the default internal logic of the IS1870/71 IC on the BM70/71 module.

Table 5-3 provides the average current consumption measurements for the BM70/71 module in Application mode.

TABLE 5-3: BM70/71 APPLICATION MODE CURRENT CONSUMPTION MEASUREMENTS

Test Mode	Interval [ms]	Average Current Consumption
Advertising (see **Note 1,2,3**)	20	1.061 mA
	50	505 µA
	100	298 µA
	500	113 µA
	1000	89 µA
Connected (see **Note 1,2,4**)	18.75	2.23 mA
	50	2.13 mA
	100	2.10 mA
	500	83 µA
	1000	80 µA

Note 1: These measurements are done at an operating temperature of +25°C at 3.3V and are characterized across a sample of BM70/71 modules.

2: These measurements are taken with version 1.06 firmware, loaded into the module with “Reduced Current Consumption” Low Power mode enabled. For more details on Low Power modes and current consumption configuration, refer to “*BM70/71 Bluetooth® Low Energy Module User's Guide*” (DS50002542).

3: The advertising packet data payload is approximately 15 bytes in length.

4: The amount of data being transmitted between two peer devices can affect the average current measured. The average current measurements are done with only the necessary Bluetooth packets being exchanged to keep the connection active at the stated interval.

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6.0 PHYSICAL DIMENSIONS

6.1 BM70BLES1FC2

Figure 6-1 illustrates the physical dimensions of the BM70BLES1FC2 module.

FIGURE 6-1: BM70BLES1FC2 MODULE DIMENSIONS

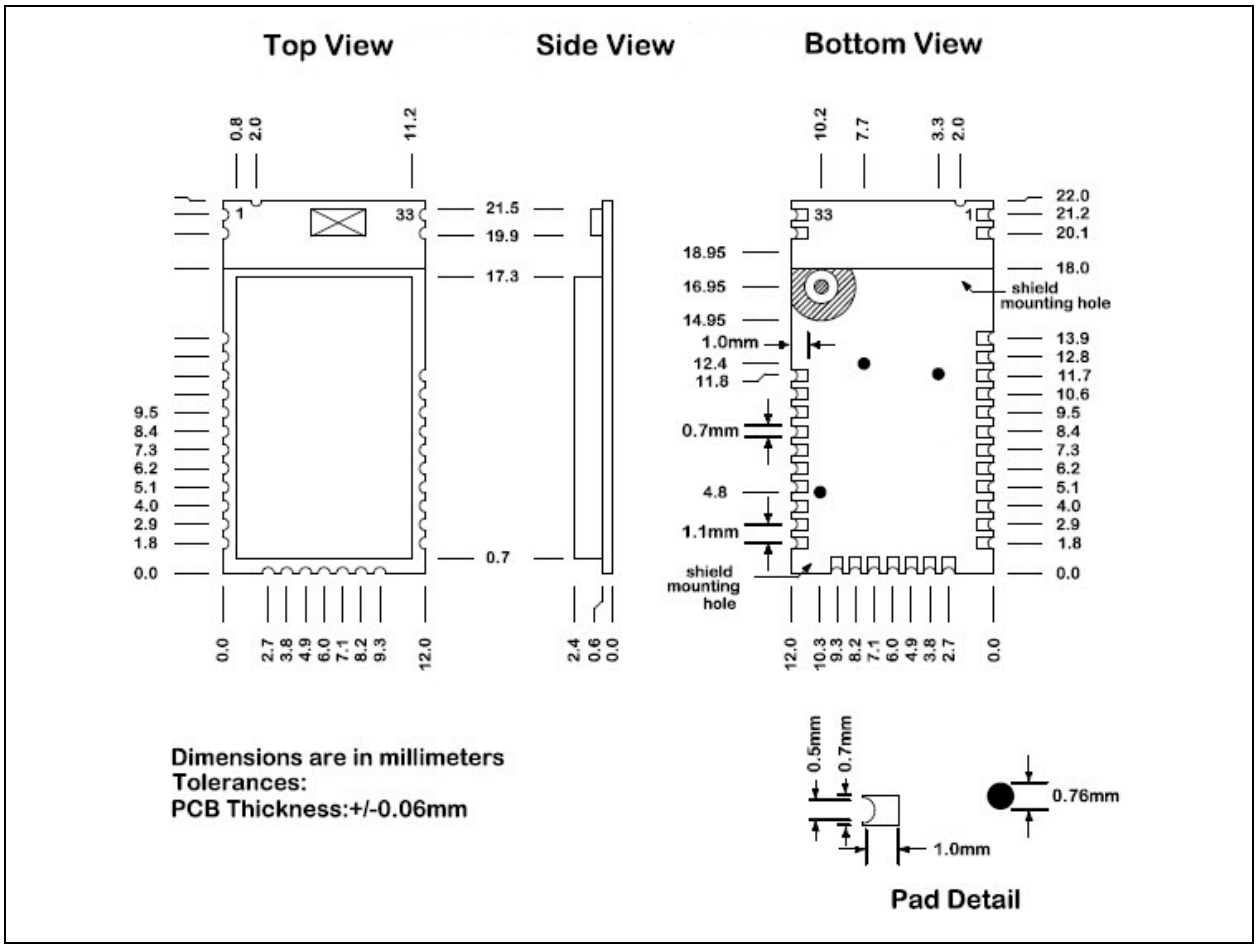
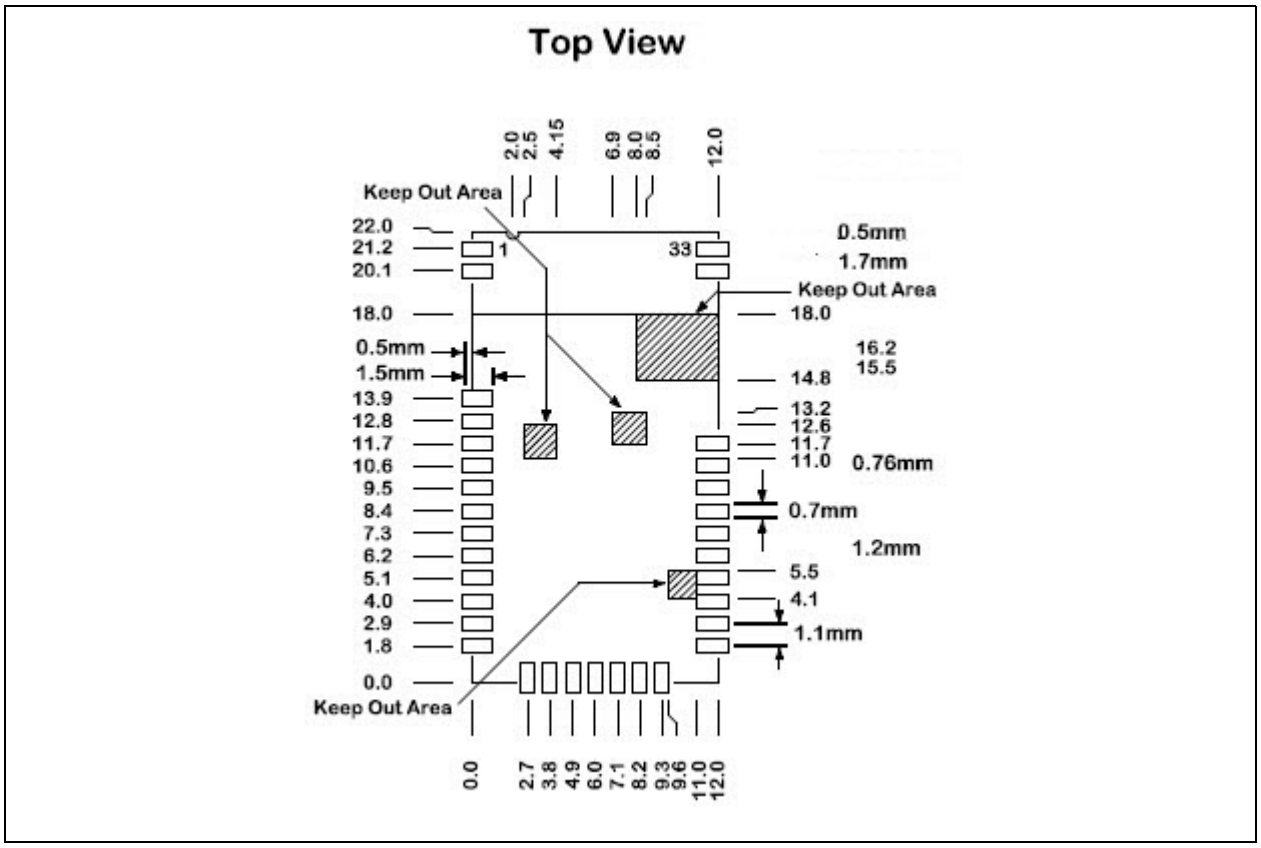


Figure 6-2 illustrates the recommended PCB footprint. Ensure that no top copper layer is near the test pin area.

FIGURE 6-2: BM70BLES1FC2 RECOMMENDED PCB FOOTPRINT



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6.2 BM70BLE01FC2

Figure 6-3 illustrates the physical dimensions of the BM70BLE01FC2 module.

FIGURE 6-3: BM70BLE01FC2 MODULE DIMENSIONS

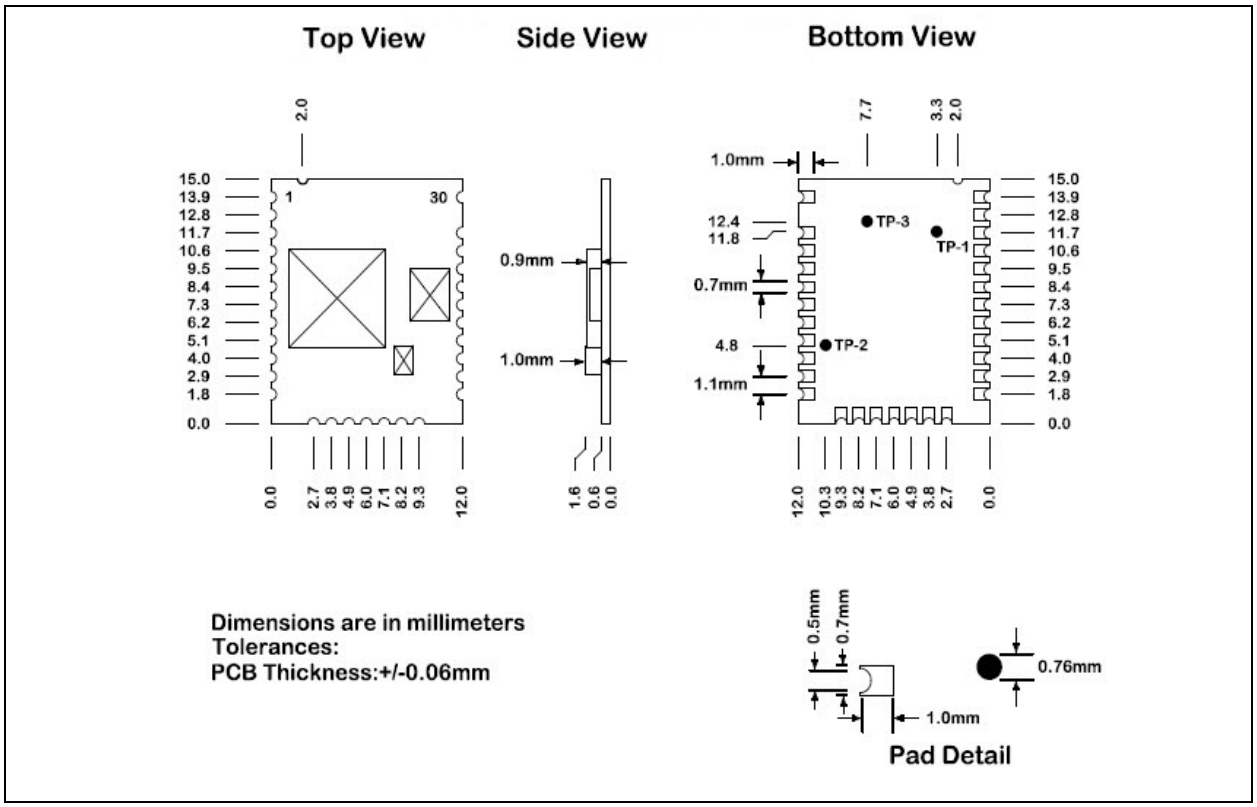
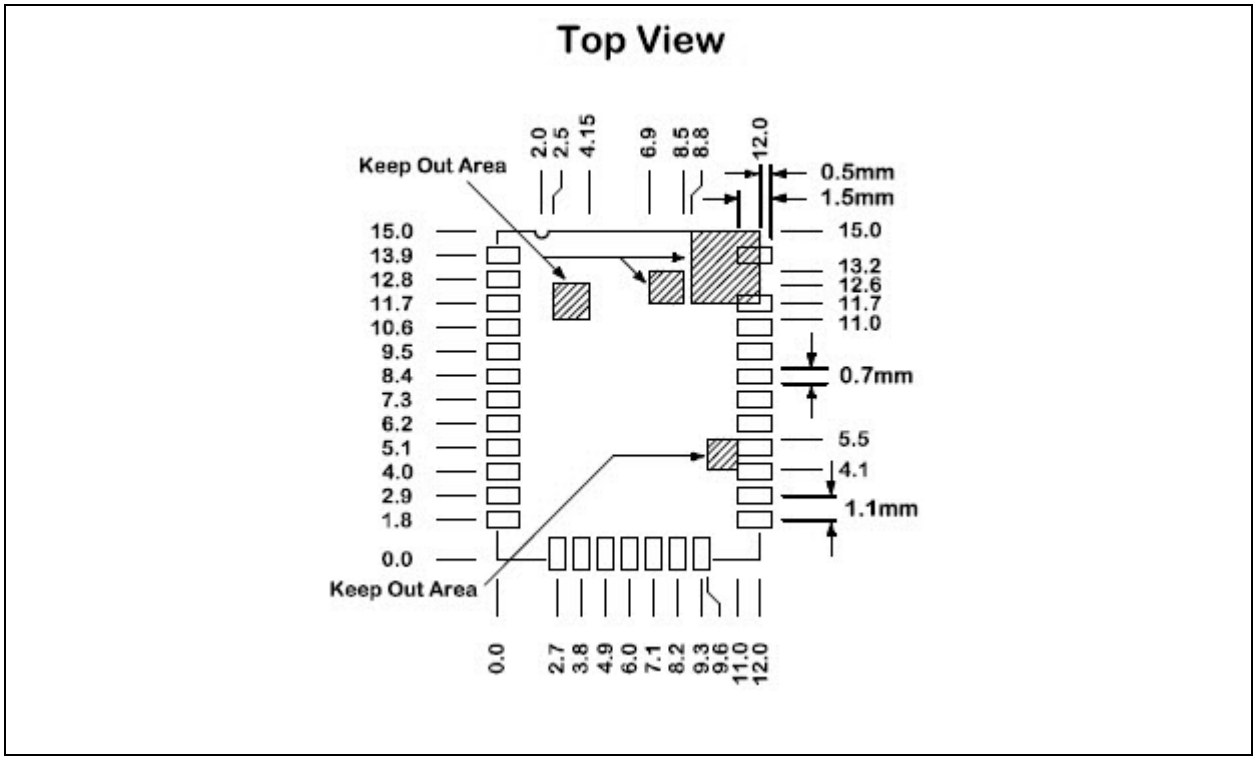


Figure 6-4 illustrates the recommended PCB footprint.

FIGURE 6-4: BM70BLE01FC2 RECOMMENDED PCB FOOT PRINT

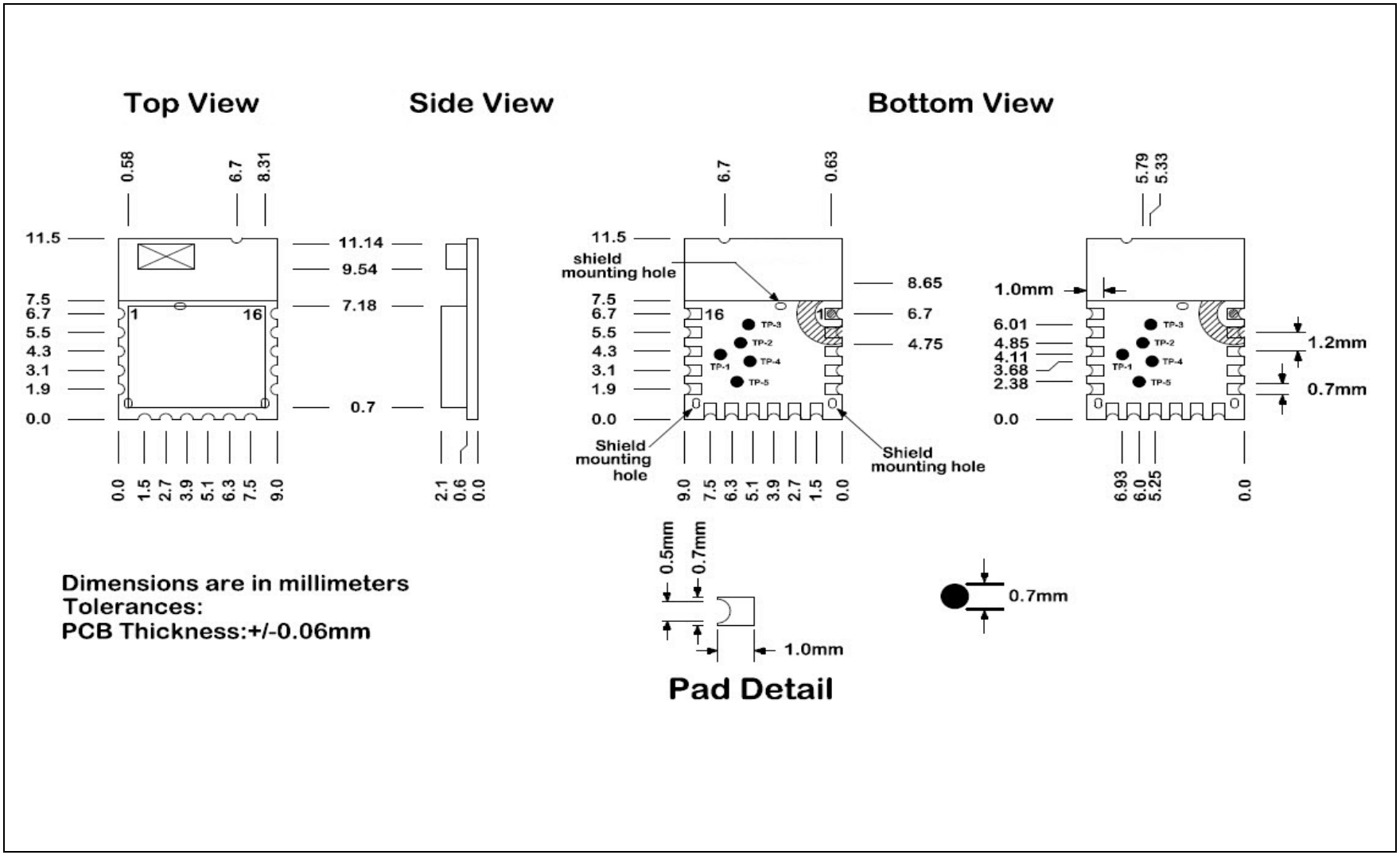


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6.3 BM71BLES1FC2

Figure 6-5 illustrates the physical dimensions of the BM71BLES1FC2 module.

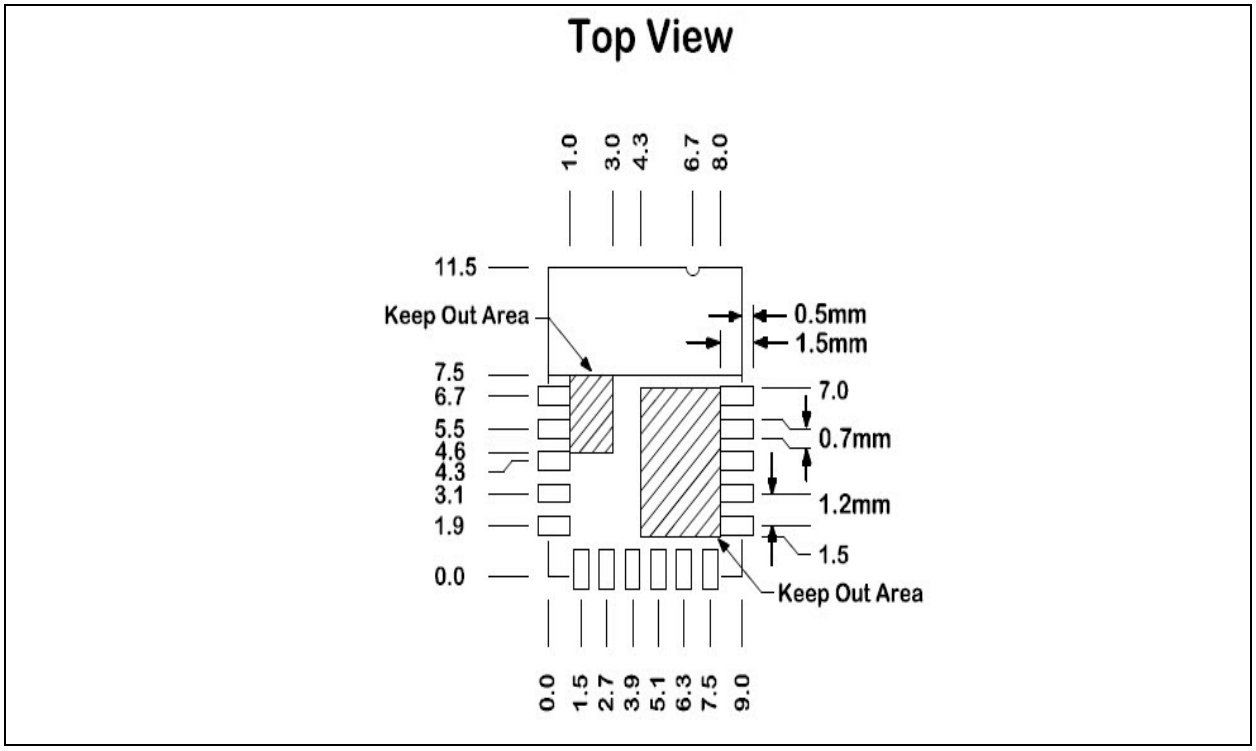
FIGURE 6-5: BM71BLES1FC2 MODULE DIMENSIONS



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Figure 6-6 illustrates the recommended PCB footprint. Ensure that no top copper layer is near the test pin area.

FIGURE 6-6: BM71BLES1FC2 RECOMMENDED PCB FOOTPRINT

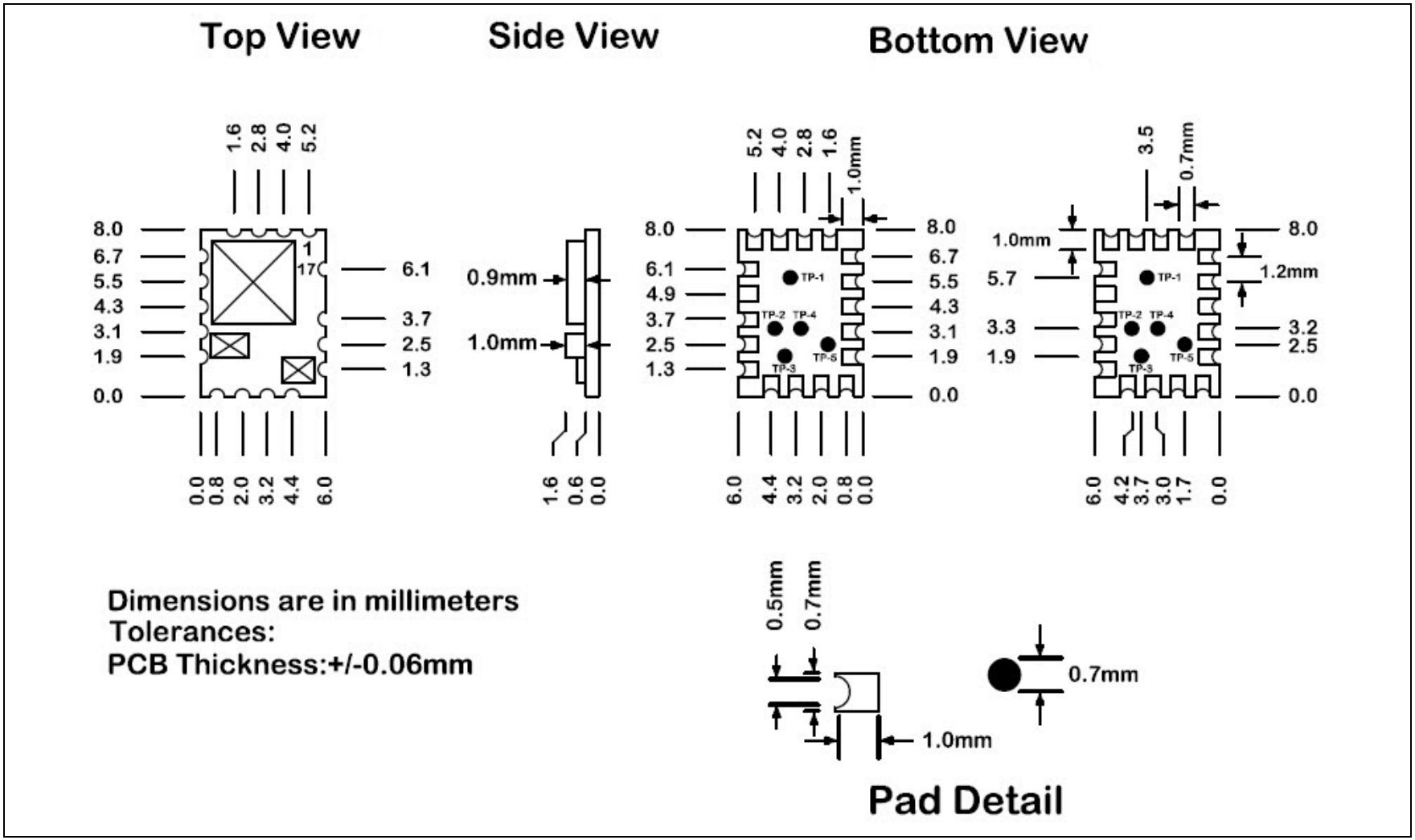


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6.4 BM71BLE01FC2

Figure 6-7 illustrates the physical dimensions of the BM71BLE01FC2 module.

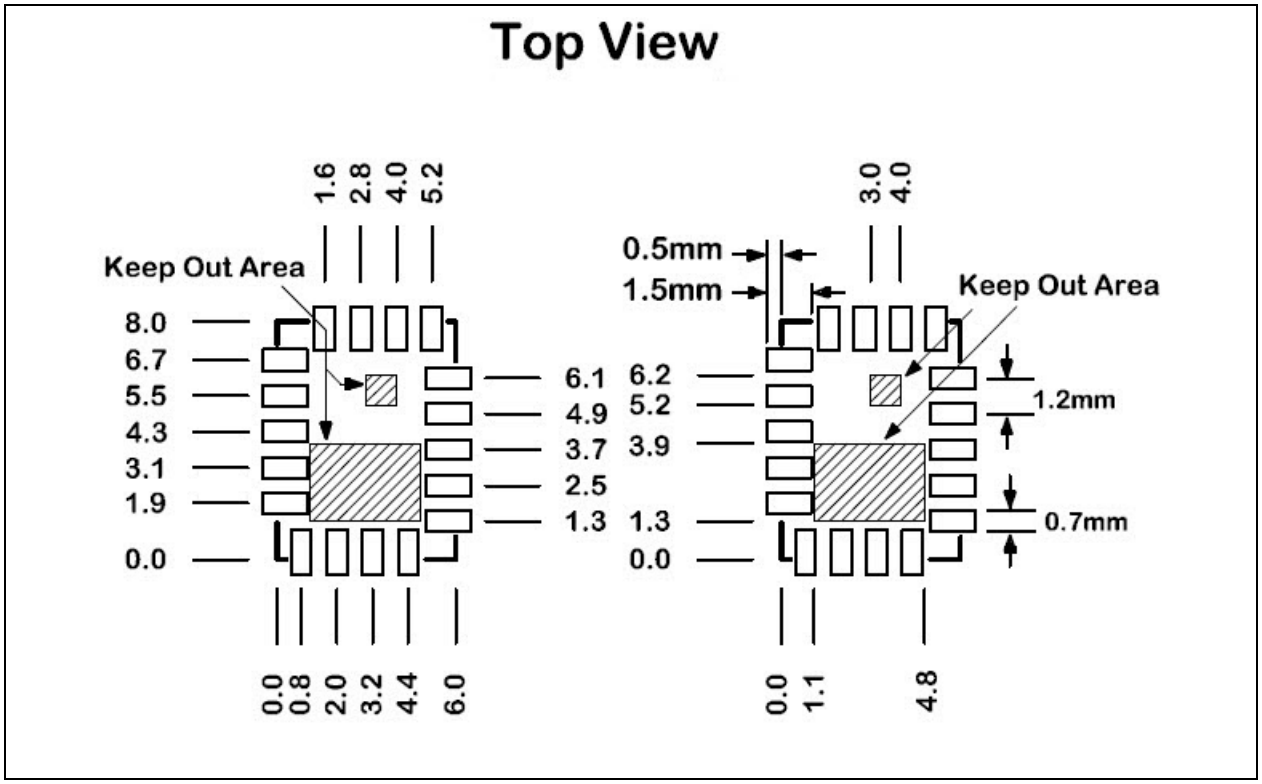
FIGURE 6-7: BM71BLE01FC2 MODULE DIMENSIONS



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Figure 6-8 illustrates the recommended PCB footprint.

FIGURE 6-8: BM71BLE01FC2 RECOMMENDED PCB FOOTPRINT



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7.0 SOLDERING RECOMMENDATIONS

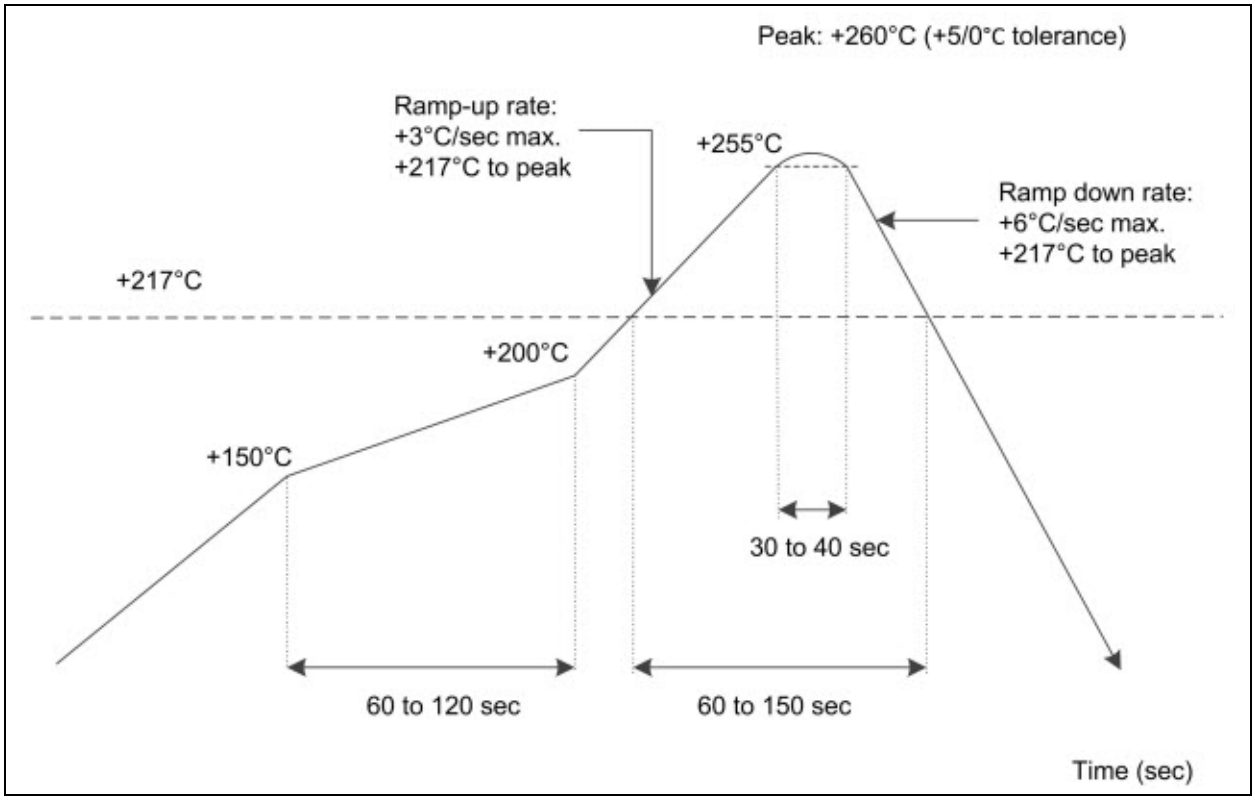
The BM70/71 module is assembled using a standard lead-free, reflow profile, IPC/JEDEC J-STD-020. The BM70/71 module can be soldered to the host PCB by using the standard lead or lead-free solder reflow profiles.

To avoid any damage to the BM70/71 module, follow these recommendations:

- Refer to the "*AN233 Solder Reflow Recommendation*" (DS00233) document for the soldering reflow recommendations
- Do not exceed the peak temperature (T_P) of +260°C
- Use no-clean flux solder paste
- Do not wash the BM70/71 module, as moisture can be trapped under the shield
- Use only one flow. If the PCB requires multiple flows, apply the BM70/71 module on the final flow

Figure 7-1 illustrates the reflow profile of the BM70/71 module.

FIGURE 7-1: REFLOW PROFILE



NOTES:

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8.0 ORDERING GUIDE

Table 8-1 provides the ordering information for the BM70/71 module.

TABLE 8-1: BM70/71 MODULE ORDERING INFORMATION

Module	Description	Operating Temperature Range	Firmware Version	Antenna	Shield	Pin #	Regulatory Certification	Regulatory Model No. (see **Note 3**)	Orderable Part Number (see **Note 1** and **2**)
BM70	Bluetooth BLE module, (12x15x1.6 mm)	-20°C to +70°C	V1.03	External	No	30	No	N/A	BM70BLE01FC2-0002AA
BM70	Bluetooth BLE module, (12x15x2.4 mm)	-20°C to +70°C	V1.03	On board	Yes	33	FCC, ISED, CE, MIC, KCC, NCC, SRRC	BM70BLES1FC2	BM70BLES1FC2-0002AA
BM71	Bluetooth BLE module, (6x8x1.6 mm)	-20°C to +70°C	V1.06	External	No	17	No	N/A	BM71BLE01FC2-0002AA
BM71	Bluetooth BLE module, (9x11.5x2.1 mm)	-20°C to +70°C	V1.06	On board	Yes	16	FCC, ISED, CE, MIC, KCC, NCC, SRRC	BM71BLES1FC2	BM71BLES1FC2-0002AA
BM70	Bluetooth BLE module, (12x15x1.6 mm)	-40°C to +85°C	V1.06	External	No	30	No	N/A	BM70BLE01FC2-0B03AA
BM70	Bluetooth BLE module, (12x15x2.4 mm)	-40°C to +85°C	V1.06	On board	Yes	33	FCC, ISED, CE, MIC, KCC, NCC, SRRC	BM70BLES1FC2	BM70BLES1FC2-0B03AA
BM71	Bluetooth BLE module, (6x8x1.6 mm)	-40°C to +85°C	V1.06	External	No	17	No	N/A	BM71BLE01FC2-0B02AA
BM71	Bluetooth BLE module, (9x11.5x2.1 mm)	-40°C to +85°C	V1.06	On board	Yes	16	FCC, ISED, CE, MIC, KCC, NCC, SRRC	BM71BLES1FC2	BM71BLES1FC2-0B02AA
BM70	Bluetooth BLE module, (12x15x2.4 mm)	-40°C to +85°C	V1.11	On board	Yes	33	FCC, ISED, CE, MIC, KCC, NCC, SRRC	BM70BLES1FC2	BM70BLES1FC2-0B04AA
BM71	Bluetooth BLE module, (9x11.5x2.1 mm)	-40°C to +85°C	V1.11	On board	Yes	16	FCC, ISED, CE, MIC, KCC, NCC, SRRC	BM71BLES1FC2	BM71BLES1FC2-0B04AA

Note 1: With the introduction of the IS187xSF-202 IC, the PC tools provided by Microchip which change/control Bluetooth operation have been revised. The correct tool version must be paired with the applicable module/IC part number.
All module parts ending with BM7xBLEX1FC2-0BxxAA must use the PC tools ending with 0BxxAA.
All module parts ending with BM7xBLEX1FC2-0002AA must use the PC tools ending with 0002AA.

2: The numbers listed under “Orderable Part Number” must be used when purchasing a specific module from Microchip.

3: “Regulatory Model No.” column represents the Model No. listed in Microchip's regulatory notices. The extensions used to order/buy a specific version of the module are listed in the “Orderable Part Number”.

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NOTES:

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APPENDIX A: CERTIFICATION NOTICES

The BM70 module (BM70BLES1FC2) has received the regulatory approval for the following countries:

- BT SIG/QDID:74246
- United States/FCC ID: A8TBM70ABCDEFGH
- Canada/ISED
  - IC: 12246A-BM70BLES1F2
  - HVIN: BM70BLES1F2
- Europe/CE
- Japan/MIC: 202-SMD069
- Korea/KCC: MSIP-CRM-mcp-BM70BLES1FC2
- Taiwan/NCC No: CCAN15LP0500T1
- China/SRRC: CMIIT ID: 2015DJ7135

The BM71 module (BM71BLES1FC2) has received the regulatory approval for the following countries:

- BT SIG/QDID:74246
- United States/FCC ID: A8TBM71S2
- Canada/ISED
  - IC: 12246A-BM71S2
  - HVIN: BM71BLES1FC2
- Europe/CE
- Japan/MIC: 005-101150
- Korea/KCC: MSIP-CRM-mcp-BM71BLES1FC2
- Taiwan/NCC No: CCAN16LP0010T5
- China/SRRC: CMIIT ID: 2016DJ2787

A.1 United States

The BM70/71 Module has received Federal Communications Commission (FCC) CFR47 Telecommunications, Part 15 Subpart C “Intentional Radiators” single-modular approval in accordance with Part 15.212 Modular Transmitter approval. Single-modular transmitter approval is defined as a complete RF transmission sub-assembly, designed to be incorporated into another device, that must demonstrate compliance with FCC rules and policies independent of any host. A transmitter with a modular grant can be installed in different end-use products (referred to as a host, host product, or host device) by the grantee or other equipment manufacturer, then the host product may not require additional testing or equipment authorization for the transmitter function provided by that specific module or limited module device.

The user must comply with all of the instructions provided by the Grantee, which indicate installation and/or operating conditions necessary for compliance.

The host product itself is required to comply with all other applicable FCC equipment authorizations, regulations, requirements and equipment functions that are not associated with the transmitter module portion. For example, compliance must be demonstrated: to regulations for other transmitter components within a host product; to requirements for unintentional radiators (Part 15 Subpart B), 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) as appropriate (e.g., Bluetooth and Wi-Fi transmitter modules may also contain digital logic functions).

A.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 should use the following wording:

For the BM70 module:

> Contains Transmitter Module
> FCC ID: A8TBM70ABCDEFGH
>
> or
>
> Contains FCC ID: A8TBM70ABCDEFGH
>
> **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**

Due to the limited size of the BM71, the FCC Identifier (FCC ID) is displayed in the datasheet only and it cannot be displayed on the module. Therefore, the FCC ID must be placed on 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:

For the BM71 module:

> Contains Transmitter Module FCC ID: A8TBM71S2
>
> or
>
> Contains FCC ID: A8TBM71S2
>
> **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**

The user's manual for the product must 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, which is available at the FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB) https://apps.fcc.gov/oetcf/kdb/index.cfm.

A.1.2 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. This module is approved for installation into mobile or/and portable host platforms

A.1.3 HELPFUL WEB SITES

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

FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB): https://apps.fcc.gov/oetcf/kdb/index.cfm.

A.2 Canada

The BM70/71 module has been certified for use in Canada under Innovation, Science and Economic Development Canada (ISED, formerly Industry Canada) Radio Standards Procedure (RSP) RSP-100, Radio Standards Specification (RSS) RSS-247 and RSS-Gen. Modular approval permits the installation of a module in a host device without the need to recertify the device.

A.2.1 LABELING AND USER INFORMATION REQUIREMENTS

Labeling Requirements for the Host product (from RSP-100-Issue 11, Section 3): The host product shall be properly labeled to identify the module within the host device.

On the BM71, due to the limited module size, the IC identifier is displayed in the data sheet only and it cannot be displayed on the module label.

The Innovation, Science and Economic Development 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 Innovation, Science and Economic Development Canada certification number of the module, preceded by the word “Contains”, or similar wording expressing the same meaning, as follows:

For the BM70 module:

> Contains IC: 12246A-BM70BLES1F2

For the BM71 module:

> Contains IC: 12246A-BM71S2

User Manual Notice for License-Exempt Radio Apparatus (from Section 8.4, RSS-Gen, Issue 4, November 2014): User manuals for license-exempt radio appara-

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tus 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's 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.

Guidelines on Transmitter Antenna for License Exempt Radio Apparatus:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain must be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

A.2.2 RF EXPOSURE

All transmitters regulated by the Innovation, Science and Economic Development Canada (ISED) must comply with RF exposure requirements listed in RSS-102 - Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands).

This transmitter is restricted for use with a specific antenna 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 Innovation, Science and Economic Development Canada multi-transmitter guidelines.

The installation of the transmitter must ensure compliance is demonstrated according to the ISED SAR procedures.

A.2.3 HELPFUL WEB SITES

Innovation, Science and Economic Development Canada (ISED): http://www.ic.gc.ca/

A.3 Europe

The BM70/71 module is an Radio Equipment Directive (RED) assessed radio module that is CE marked and has been manufactured and tested with the intention of being integrated into a final product.

The BM70/71 module has been tested to RED 2004/53/EC Essential Requirements for Health and Safety (Article (3.1(a)), Electromagnetic Compatibility (EMC) (Article 3.1(b)), and Radio (Article 3.2), which are summarized in the following European Compliance Testing tables.

The ETSI provides guidance on modular devices in the "*Guide to the application of harmonised standards covering Article 3.1(b) and Article 3.2 of the Directive 2014/53/EU RED to multi-radio and combined radio and non-radio equipment*" document available at http://www.etsi.org/deliver/etsi_eg/203300_203399/203367/01.01.01_60/eg_203367v010101p.pdf.

Note: To maintain conformance to the testing listed in Table A-1/Table A-2, 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 against the RED.

A.3.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the BM70/71 module must follow CE marking requirements.

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TABLE A-1: EUROPEAN COMPLIANCE TESTING (BM70 MODULE)

Certification	Standards	Article	Laboratory	Report Number	Date
Safety	EN60950-1:2006/A11:2009/A 1:2010/A12:2011/A2:2013	[3.1(a)]	TUV Rheinland Taiwan	10051261 003	2016-01-05
Health	EN300328 V1.9.1/ EN62479:2010			10053580 001	2015-12-10
EMC	EN301489-1 V1.9.2	[3.1(b)]		10051137 002	2016-01-08
	EN301489-17 V2.2.1				
	EN301489-1 V2.1.1 EN301489-17 V2.2.0			10051137 003	2017-05-26
	EN301489-17 V3.1.1 EN301489-17 V3.2.0				
Radio	EN300328 V1.9.1	(3.2)		10053580 001	2015-12-10
				50067510 001(1)	2017-10-04
	EN300328 V2.1.1			50067510 002	2017-05-26

Note 1: RF reports apply only to modules using the part IS1870SF-202.

TABLE A-2: EUROPEAN COMPLIANCE TESTING (BM71 MODULE)

Certification	Standards	Article	Laboratory	Report Number	Date
Safety	EN60950-1:2006/A11:2009/A 1:2010/A12:2011/A2:2013	[3.1(a)]	TUV Rheinland Taiwan	10053210 001	2016-01-07
Health	EN62479:2010			10053433 001	2015-12-29
EMC	EN301489-1 V1.9.2	[3.1(b)]		10052964 001	2015-10-22
	EN301489-17 V2.2.1				
	EN301489-1 V2.1.1 EN301489-1 V2.2.0			10052964 002	2017-05-26
	EN301489-17 V3.1.1 EN301489-17 V3.2.0				
Radio	EN300328 V1.9.1	(3.2)		10053433 001	2015-12-29
				50067509 001(1)	2017-04-10
	EN300328 V2.1.1			50067509 002	2017-05-26

Note 1: RF reports apply only to modules using the part IS1871SF-202.

A.3.2 CONFORMITY ASSESSMENT

From ETSI Guidance Note EG 203367, section 6.1 Non-radio products are combined with a radio product:

If the manufacturer of the combined equipment installs the radio product in a host non-radio product in equivalent assessment conditions (i.e. host equivalent to the one used for the assessment of the radio product) and according to the installation instructions for the radio product, then no additional assessment of the combined equipment against article 3.2 of the RED is required.

The European Compliance Testing listed in Table A-1 and Table A-2 are performed using the integral ceramic chip antenna.

A.3.2.1 SIMPLIFIED EU DECLARATION OF CONFORMITY

Hereby, Microchip Technology Inc. declares that the radio equipment type BM70/71 is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity, for this product, is available at: http://www.microchip.com/design-centers/wireless-connectivity

A.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

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can be downloaded from the European Radio Communications Committee (ECC) at: http://www.ecodocdb.dk/.

Additional helpful web sites are:

- Radio Equipment Directive (2014/53/EU): https://ec.europa.eu/growth/single-market/european-standards/harmonised-standards/red_en
- European Conference of Postal and Telecommunications Administrations (CEPT): http://www.cept.org
- European Telecommunications Standards Institute (ETSI): http://www.etsi.org
- The Radio Equipment Directive Compliance Association (REDCA): http://www.redca.eu/

A.4 Japan

The BM70/71 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.

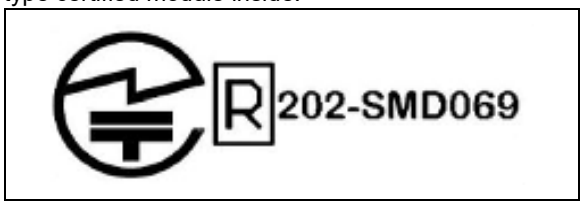
Integration of this module into a final product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed. Additional testing may be required:

- 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

A.4.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the BM70/71 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.

For the BM70 module, due to a limited module size, the technical conformity logo and ID is displayed in the data sheet and/or packaging and cannot be displayed on the module label. The final product in which this module is being used must have a label referring to the type certified module inside:



For the BM71 module, due to the limited module size, the technical conformity logo and ID are displayed in the data sheet only and cannot be displayed on the module label. The final product in which this module is being used must have a label referring to the type certified module inside:



A.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/

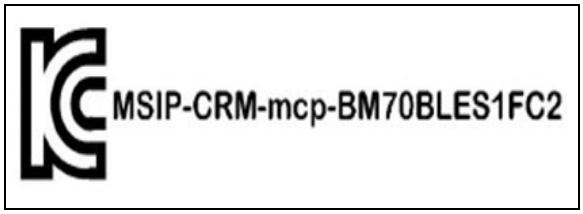
A.5 Korea

The BM70/71 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.

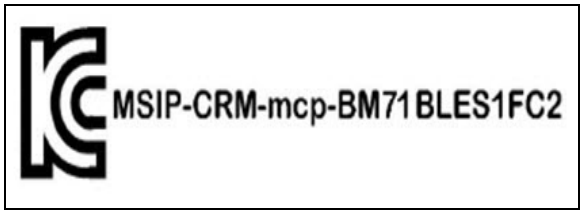
A.5.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the BM70/71 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:



On the BM71 module, due to the limited module size (9.0 mm x 11.5 mm) the KC mark and identifier is displayed in the data sheet only and cannot be displayed on the module label. The final product requires the KC mark and certificate number of the module:



A.5.2 HELPFUL WEB SITES

Korea Communications Commission (KCC):
http://www.kcc.go.kr

National Radio Research Agency (RRA):
http://rra.go.kr

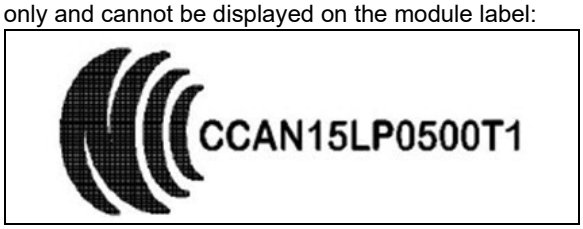
A.6 Taiwan

The BM70/71 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.

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.

A.6.1 LABELING AND USER INFORMATION REQUIREMENTS

For the BM70 module, due to the limited module size, the NCC mark and ID are displayed in the data sheet only and cannot be displayed on the module label:



On the BM71 module, due to the limited module size (9.0 mm x 11.5 mm) the NCC mark and identifier is displayed in the data sheet only and cannot be displayed on the module label.



The user's manual should contain following 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。

A.6.2 HELPFUL WEB SITES

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

A.7 China

The BM70/71 module has received certification of conformity in accordance with the China MIIT Notice 2014-01 of State Radio Regulation Committee (SRRC) certification scheme. 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.

A.7.1 LABELING AND USER INFORMATION REQUIREMENTS

The BM70 module is labeled with its own CMIIT ID as follows:



When Host system is using an approved Full Modular Approval (FMA) radio: The host must bear a label containing the statement “This device contains SRRC approved Radio module CMIIT ID: 2015DJ7135”.

On the BM71 module, due to the limited module size (9.0 mm x 11.5 mm) the CMIIT ID is displayed in the data sheet only and cannot be displayed on the module label:



When Host system is using an approved Full Modular Approval (FMA) radio: The host must bear a label containing the statement “This device contains SRRC approved Radio module CMIIT ID: 2016DJ2787”.

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A.8 Other Regulatory Information

- For information about other countries' jurisdictions not covered here, refer to the http://www.microchip.com/design-centers/wireless-connectivity.
- Should other regulatory jurisdiction certification be required by the customer, or the customer needs to recertify the module for other reasons, contact Microchip for the required utilities and documentation.

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NOTES:

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APPENDIX B: REVISION HISTORY

Revision A (October 2015)

This is the initial released version of the document.

Revision B (October 2015)

This revision includes the following changes as well as minor updates to text and formatting, which were incorporated throughout the document.

TABLE B-1: MAJOR SECTION UPDATES

Section	Update Description
"Features"	This section is updated with certification informations. The data from this section has been reformatted and distributed in other sections.
"MAC/Baseband/Higher Layer Features", • **"External antenna (BM7xBLE01FC2) connection through RF pad"**, **"Operating Conditions"**,and **FIGURE 2: "BM71 MODULE"**	These sections are newly added.
"General Description"	This section was previously placed in chapter 1 and has been moved here.
1.0 "Device Overview"	Table 1-2, Table 1-4, and Table 1-5 are added.
2.0 "Application Information"	This chapter contains information that was previously located in Appendix A and Electrical Characteristics.
8.0 "Ordering Guide"	Table 8-1 is updated with Y-axis information and certification information.
Appendix A: "Certification Notices"	This section is updated with images for the Certification Marking and their numbers. The regulatory information is updated to be the latest.
5.0 "Electrical Characteristics"	Table 5-3 is added

Revision C (November 2015)

Updated **Appendix A: "Certification Notices"**.

Revision D (March 2016)

This revision includes the following changes as well as minor updates to text and formatting incorporated throughout the document.

TABLE D-1: MAJOR SECTION UPDATES

Section	Update Description
1.1 "Interface Description"	This section is updated with a note. Updated Figure 1-1, Figure 1-2, Figure 1-6
2.1 "Reference Schematics"	Figure 2-1 through Figure 2-8, Figure 2-10, Figure 5-1, Figure 5-2, Figure 2-11, Figure 4-1 and Table 4-1, Table 8-1
"Absolute Maximum Ratings"	Updated this section.
5.1.1 "Tx/Rx current consumption details"	Updated this section with new content.
8.0 "Ordering Guide"	This section is updated with a note.
Appendix A: "Certification Notices"	Content has been updated

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Revision E (January 2017)

This revision includes the following changes as well as minor updates to text and formatting, which were incorporated throughout the document.

TABLE E-1: MAJOR SECTION UPDATES

Section	Update Description
"Features"	Updated this section.
"MAC/Baseband/Higher Layer Features"	Updated this section.
• "External antenna (BM7xBLE01FC2) connection through RF pad"	Updated the average current details.
"Operating Conditions"	Updated the operating temperature details.
1.0 "Device Overview"	Updated Figure 1-1, Figure 1-2, Table 1-1 and Table 1-2 Deleted Table 1-4
2.0 "Application Information"	Updated Figure 2-9 through Figure 2-11 and Figure 2-14
3.0 "Module Configuration"	Added Table 3-2 and updated this section.
4.3 "Antenna Considerations"	Added new section.
5.0 "Electrical Characteristics"	Updated ambient temperature details for part numbers ending with 0002 and 0B0x. Deleted Table 5-2. Updated Table 5-1, Table 5-3. Added Table 5-2
8.0 "Ordering Guide"	Updated Table 8-1
Appendix A: "Certification Notices"	Updated this section.

Revision F (May 2017)

This revision includes the following changes as well as minor updates to text and formatting were incorporated throughout the document.

TABLE F-1: MAJOR SECTION UPDATES

Section	Update Description
1.0 "Device Overview"	Updated Table 1-1, Figure 1-6
6.0 "Physical dimensions"	Updated Figure 6-5 and Figure 6-6
8.0 "Ordering Guide"	Added Regulatory model information in Table 8-1
Appendix A: "Certification Notices"	Added the report number of "Radio" certification and notes in Table A-1 and Table A-2

Revision G (January 2018)

This revision includes the following changes as well as minor updates to text and formatting were incorporated throughout the document.

TABLE G-1: MAJOR SECTION UPDATES

Section	Update Description
"Features"	Updated Canada certification information.
1.0 "Device Overview"	Updated the NOTE.
2.0 "Application Information"	Updated **2.1"Reference Schematics"**, Figure 2-1, Figure 2-3, Figure 2-5 and Figure 2-7.
8.0 "Ordering Guide"	Updated Table 8-1 with Canada regulatory certification information and deleted Microchip IC information.

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TABLE G-1: MAJOR SECTION UPDATES

Section	Update Description
Appendix A: "Certification Notices"	Updated the United States, Canada and Europe certification information. Updated KDB and ECC URL links.

Revision H (July 2018)

This revision includes the following changes as well as minor updates to text and formatting were incorporated throughout the document.

TABLE H-1: MAJOR SECTION UPDATES

Section	Update Description
Document	Updated Bluetooth Specification.
TABLE 8-1: "BM70/71 Module Ordering Information"	Updated Ordering Guide for New FW Version.
Appendix A: "Certification Notices"	Updated Regulatory Approval Section.

Revision J (January 2019)

This revision includes the following changes as well as minor updates to text and formatting were incorporated throughout the document.

TABLE I-1: MAJOR SECTION UPDATES

Section	Update Description
Antenna	Added Antenna range values.
TABLE 1-1: "BM70/71 PIN Description"	Updated P1_6 pin.

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ISBN: 978-1-5224-4097-0

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