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## Bluetooth® 4.1 Stereo Audio Module

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### Features:

- Complete, Fully Certified, Embedded 2.4 GHz Bluetooth® Version 4.1 Module
- Bluetooth Classic (BDR/EDR)
- Bluetooth SIG Certified
- Onboard embedded Bluetooth Stack
- Transparent UART mode for seamless serial data over UART interface
- Easy to configure with Windows GUI or direct by MCU
- Firmware can be field upgradable via UART
- Compact surface mount module: 29 x 15 x 2.5 mm<sup>3</sup>
- Castellated surface mount pads for easy and reliable host PCB mounting
- Environmentally friendly, RoHS compliant
- Perfect for Portable Battery Operated Devices
- Internal Battery Regulator Circuitry
- Worldwide regulatory certifications
- Audio-In / Out
  - BM23 support digital audio I<sup>2</sup>S format.
  - BM20 support analog audio output.

### Operational:

- Operating voltage: 3.0V to 4.2V
- Temperature range: -20°C to 70°C
- Simple, UART interface
- Integrated crystal, internal voltage regulator, and matching circuitry
- Multiple I/O pins for control and status

### RF/Analog:

- Frequency: 2.402 to 2.480 GHz
- Receive Sensitivity: -91 dBm (2Mbps EDR)
- Power Output: class 2 / +4dBm max.
- Connection Distance: >10m (free space and no interference)

### Audio processor

- Support 64 kb/s A-Law or  $\mu$ -Law PCM format, or CVSD (Continuous Variable Slope Delta Modulation) for SCO channel operation.
- Noise suppression
- Echo suppression
- SBC and optional AAC decoding
- Packet loss concealment
- Build-in four languages (Chinese/ English/

Spanish/ French) voice prompts and 20 events for each one (This function can be set up in "IS20XXS\_UI" tool.)

- Support SCMS-T

### Audio Codec

- 20 bit DAC and 16 bit ADC codec
- 98dB SNR DAC playback

### Peripherals

- Built-in Lithium-ion battery charger (up to 350mA)
- Integrate 3V, 1.8V configurable switching regulator and LDO
- Built-in ADC for battery monitor and voltage sense.
- A line-in port for external audio input
- Two LED drivers

### Flexible HCI interface

- High speed HCI-UART (Universal Asynchronous Receiver Transmitter) interface (up to 921600bps)

### MAC/Baseband/Higher Layer:

- Secure AES128 encryption
- Bluetooth profiles
  - HFP v1.6
  - HSP v1.1
  - A2DP v1.2
  - AVRCP v1.5
  - SPP v1.0
  - PBAP v1.0

### Antenna:

- Printed Antenna

### Compliance:

- Bluetooth SIG QDID: 58996
- Module certified for the United States (FCC) and Canada (IC), European Economic Area (CE), Korea (LTA), Taiwan (NCC) and Japan (MIC)

**Figure 1:**



**General Description:**

Stereo module is a fully-certified Bluetooth® Version 4.1 (BDR/EDR) module for designers who want to add Bluetooth® wireless audio and voice applications to their products.

This Bluetooth SIG certified module provides a complete wireless solution with Bluetooth stack, integrated antenna, and worldwide radio certifications in a compact surface mount package, 29x15x2.5 mm<sup>3</sup>.

This stereo module built-in Li-Ion charger and BM23 contain a digital audio interface. It supports HSP, HFP, SPP, A2DP, and AVRCP profiles. Both AAC and SBC codecs are supported for A2DP. Note that the customer must connect their own external analog CODEC/DSP/amplifier and MCU for audio output.

**Applications:**

- Bluetooth sound bar
- Bluetooth stereo speaker phone

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### Abbreviations List:

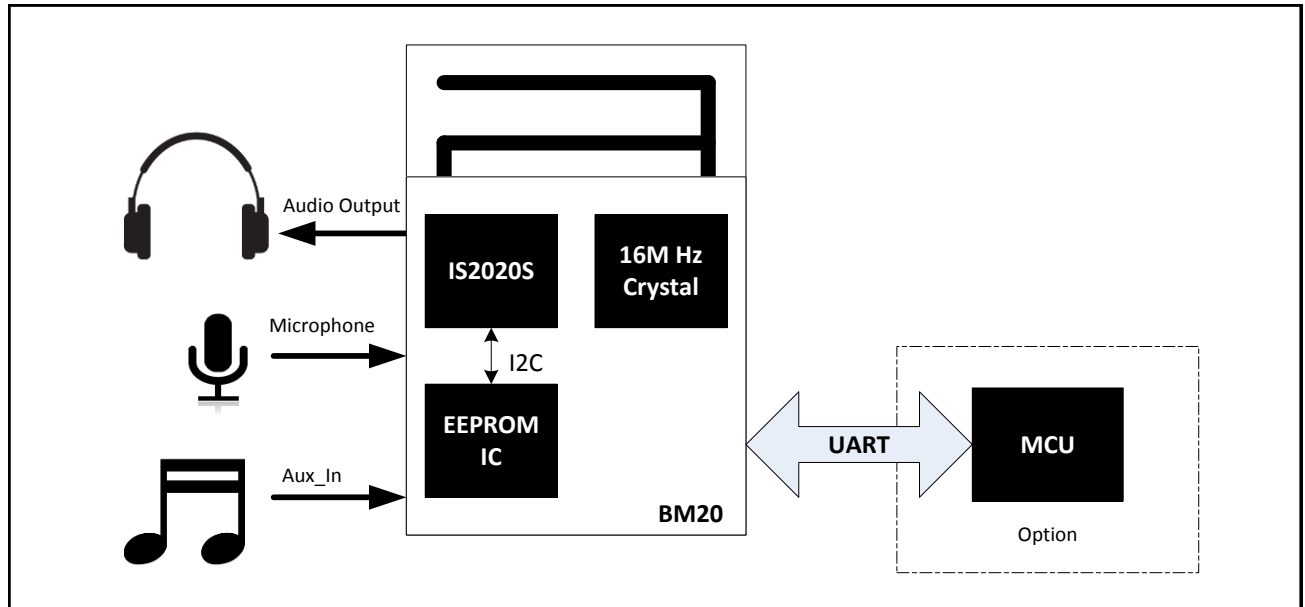
**HFP:** Hands-free Profile  
**AVRCP:** Audio Video Remote Control Profile  
**A2DP:** Advanced Audio Distribution Profile  
**PBAP:** Phone Book Access Profile  
**HSP:** Headset Profile  
**SPP:** Serial Port Profile

## 1.0 DEVICE OVERVIEW

The stereo module series include BM20 and BM23. The chip integrates Bluetooth 4.1 radio transceiver, PMU and DSP. Figure 1-1 and 1-2 shows the application block diagram.

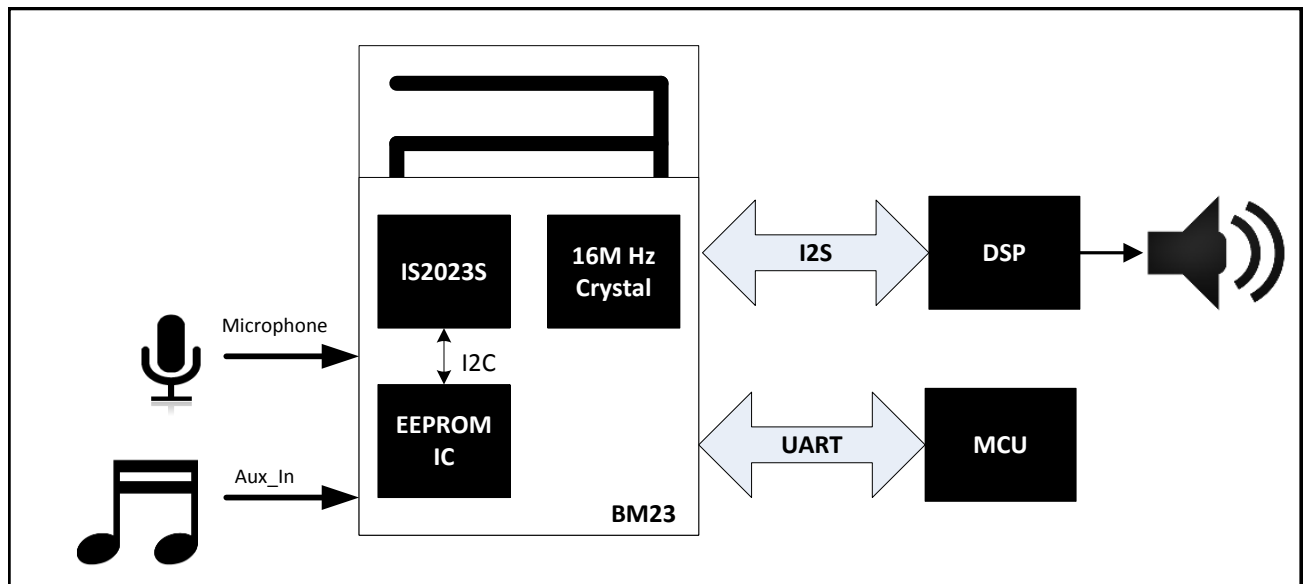
**FIGURE 1-1: BM20 Typical Application**

The following depicts an example of BM20 module operate as an independent system or connected to an MCU.



**FIGURE 1-2: BM23 Typical Application**

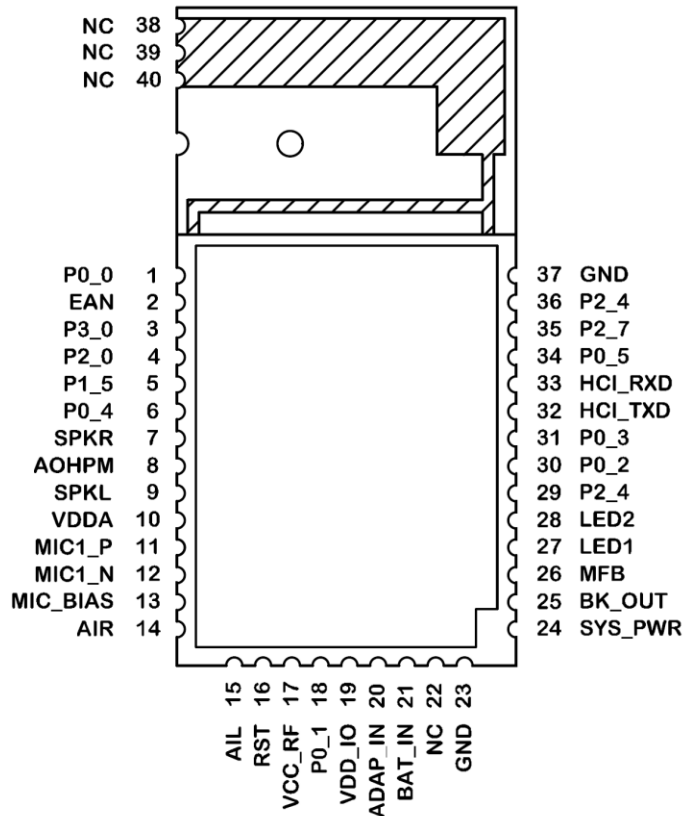
The following depicts an example of BM23 module connected to an MCU, external DSP/CODEC.



## 1.1 INTERFACE DESCRIPTION

BM20 pin diagram is shown in Figure 1-3. The pin descriptions are shown in Table 1-1

**FIGURE 1-3: BM20 PIN DIAGRAM**



**TABLE 1-1: BM20 PIN DESCRIPTION**

| Pin No. | Pin type | Name  | Description                                                                                                                                                       |
|---------|----------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | I/O      | P0_0  | IO pin, default pull-high input (Note 1)<br>1. Slide Switch Detector, active low.<br>2. UART TX_IND, active low.                                                  |
| 2       | I        | EAN   | Embedded ROM/External Flash enable<br>H: Embedded; L: External Flash                                                                                              |
| 3       | I        | P3_0  | IO pin, default pull-high input (Note 1)<br>Line-in Detector (default), active low.                                                                               |
| 4       | I        | P2_0  | IO pin, default pull-high input<br>System Configuration,<br>H: Application L: Baseband(IBDK Mode)                                                                 |
| 5       | I/O      | P1_5  | IO pin, default pull-high input (Note 1)<br>1. NFC detection pin, active low.<br>2. Out_Ind_0<br>3. Slide Switch Detector, active low.<br>4. Buzzer Signal Output |
| 6       | I/O      | P0_4  | IO pin, default pull-high input. (Note 1)<br>1. NFC detection pin, active low.<br>2. Out_Ind_0                                                                    |
| 7       | O        | SPKR  | R-channel analog headphone output                                                                                                                                 |
| 8       | O        | AOHPM | Headphone common mode output/sense input.                                                                                                                         |

# Stereo Module

| Pin No. | Pin type | Name     | Description                                                                                                                                                                                     |
|---------|----------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9       | O        | SPKL     | L-channel analog headphone output                                                                                                                                                               |
| 10      | P        | VDDA     | Positive power supply/reference voltage for CODEC, no need to add power to this pin.                                                                                                            |
| 11      | I        | MIC1_P   | Mic 1 mono differential analog positive input                                                                                                                                                   |
| 12      | I        | MIC1_N   | Mic 1 mono differential analog negative input                                                                                                                                                   |
| 13      | P        | MIC_BIAS | Electric microphone biasing voltage                                                                                                                                                             |
| 14      | I        | AIR      | R-channel single-ended analog inputs                                                                                                                                                            |
| 15      | I        | AIL      | L-channel single-ended analog inputs                                                                                                                                                            |
| 16      | I        | RST      | System Reset Pin, Low: reset                                                                                                                                                                    |
| 17      | P        | VCC_RF   | 1.28V RF LDO output, no need to add power to this pin.                                                                                                                                          |
| 18      | I/O      | P0_1     | IO pin, default pull-high input (Note 1)<br>1. FWD key when class 2 RF (default), active low.<br>2. Class1 TX Control signal of external RF T/R switch, active high.                            |
| 19      | P        | VDD_IO   | Power output , no need to add power to this pin                                                                                                                                                 |
| 20      | P        | ADAP_IN  | 5V Power adaptor input                                                                                                                                                                          |
| 21      | P        | BAT_IN   | 3.3V~4.2V Li-Ion battery input                                                                                                                                                                  |
| 22      | -        | NC       | No Connection                                                                                                                                                                                   |
| 23      | P        | GND      | Ground Pin                                                                                                                                                                                      |
| 24      | P        | SYS_PWR  | System Power Output<br>BAT mode: 3.3~4.2V<br>Adapter mode: 4.0V                                                                                                                                 |
| 25      | P        | BK_OUT   | 1.8V buck output, no need to add power to this pin                                                                                                                                              |
| 26      | I        | MFB      | 1. Power key when in off mode<br>2. UART_RX_IND: MCU use to wakeup BT (Note 1)                                                                                                                  |
| 27      | I        | LED1     | LED Driver 1                                                                                                                                                                                    |
| 28      | I        | LED2     | LED Driver 2                                                                                                                                                                                    |
| 29      | I        | P2_4     | IO pin, default pull-high input<br>System Configuration,<br>L: Boot Mode with P2_0 low combination                                                                                              |
| 30      | I        | P0_2     | IO pin, default pull-high input (Note 1)<br>Play/Pause key (default), active low.                                                                                                               |
| 31      | I/O      | P0_3     | IO pin, default pull-high input (Note 1)<br>1. REV key (default), active low.<br>2. Buzzer Signal Output<br>3. Out_Ind_1<br>4. Class1 RX Control signal of external RF T/R switch, active high. |
| 32      | O        | HCI_TXD  | HCI-UART TX data                                                                                                                                                                                |
| 33      | I        | HCI_RXD  | HCI-UART RX data                                                                                                                                                                                |
| 34      | I        | P0_5     | IO pin, default pull-high input (Note 1)<br>Volume down (default), active low.                                                                                                                  |
| 35      | I        | P2_7     | IO pin, default pull-high input (Note 1)<br>Volume up key (default), active low.                                                                                                                |

# Stereo Module

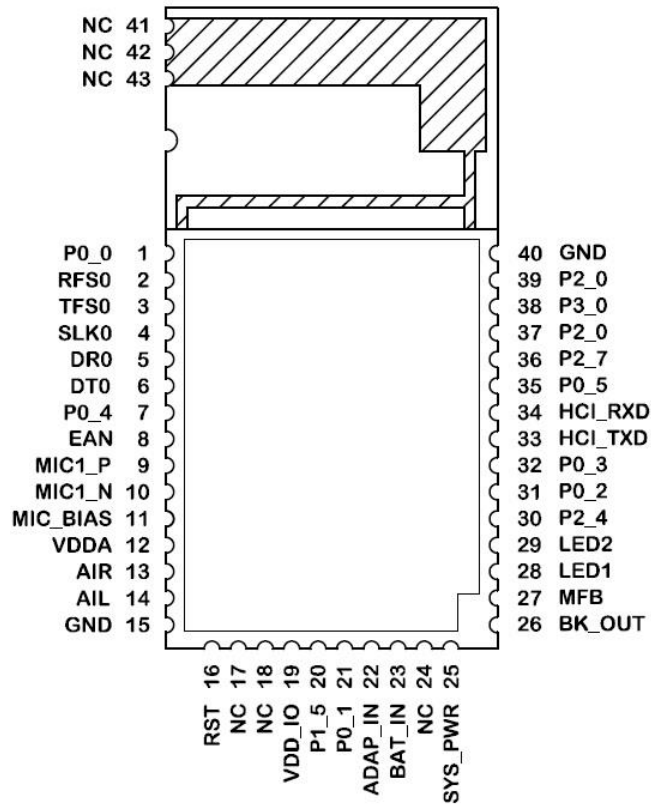
| Pin No. | Pin type | Name | Description                                                                                        |
|---------|----------|------|----------------------------------------------------------------------------------------------------|
| 36      | I        | P2_4 | IO pin, default pull-high input<br>System Configuration,<br>L: Boot Mode with P2_0 low combination |
| 37      | P        | GND  | Ground Pin                                                                                         |
| 38      | -        | NC   | No Connection                                                                                      |
| 39      | -        | NC   | No Connection                                                                                      |
| 40      | -        | NC   | No Connection                                                                                      |

\* I: signal input pin  
\* O: signal output pin  
\* I/O: signal input/output pin  
\* P: power pin

Note 1: These button or functions can be setup by “IS20XXS\_UI” tool.

BM23 pin diagram is shown in Figure 1-4. The pin descriptions are shown in Table 1-2

**FIGURE 1-4: BM23 PIN DIAGRAM**



**TABLE 1-2: BM23 PIN DESCRIPTION**

| Pin No. | Pin Type | Name     | Description                                                                       |
|---------|----------|----------|-----------------------------------------------------------------------------------|
| 1       | I/O      | P0_0     | IO pin, default pull-high input (Note 1)<br>UART TX_IND                           |
| 2       | I/O      | RFS0     | I <sup>2</sup> S interface: DAC Left/Right Clock                                  |
| 3       | I/O      | TFS0     | I <sup>2</sup> S interface: ADC Left/Right Clock                                  |
| 4       | I/O      | SLK0     | I <sup>2</sup> S interface: Bit Clock                                             |
| 5       | I        | DR0      | I <sup>2</sup> S interface: DAC Digital Left/Right Data                           |
| 6       | O        | DT0      | I <sup>2</sup> S interface: ADC Digital Left/Right Data                           |
| 7       | I/O      | P0_4     | IO pin, default pull-high input                                                   |
| 8       | I        | EAN      | Embedded ROM/External Flash enable<br>High: ROM mode;<br>Low: External Flash mode |
| 9       | I        | MIC1_P   | Mic 1 mono differential analog positive input                                     |
| 10      | I        | MIC1_N   | Mic 1 mono differential analog negative input                                     |
| 11      | P        | MIC_BIAS | Power output, microphone biasing voltage                                          |
| 12      | P        | VDDA     | Power output, reserve for external cap to fine tune audio frequency               |
| 13      | I        | AIR      | Stereo analog line in, R-channel                                                  |
| 14      | I        | AIL      | Stereo analog line in, L-channel                                                  |

# Stereo Module

| Pin No. | I/O | Name    | Description                                                                                        |
|---------|-----|---------|----------------------------------------------------------------------------------------------------|
| 15      | P   | GND     | Ground                                                                                             |
| 16      | I   | RST_N   | System Reset Pin, active when rising edge.                                                         |
| 17      | --  | NC      | --                                                                                                 |
| 18      | --  | NC      | --                                                                                                 |
| 19      | P   | VDDIO   | Power output, VDDIO pin, no need to add power to this pin                                          |
| 20      | I/O | P1_5    | IO pin, default pull-high input                                                                    |
| 21      | I/O | P0_1    | IO pin, default pull-high input                                                                    |
| 22      | P   | ADAP_IN | 5V power adaptor input                                                                             |
| 23      | P   | BAT_IN  | 3.3~4.2V Li-ion battery input                                                                      |
| 24      | --  | NC      | --                                                                                                 |
| 25      | P   | SYS_PWR | System Power Output<br>BAT mode: 3.3~4.2V<br>Adapter mode: 4.0V                                    |
| 26      | P   | BK_OUT  | Power output, 1v8 pin, no need to add power to this pin                                            |
| 27      | P   | MFB     | 1. Power key when in off mode<br>2. UART_RX_IND: MCU use to wakeup BT                              |
| 28      | P   | LED1    | LED Driver 1, 4mA max                                                                              |
| 29      | P   | LED2    | LED Driver 2, 4mA max                                                                              |
| 30      | I   | P2_4    | IO pin, default pull-high input<br>System Configuration,<br>L: Boot Mode with P2_0 low combination |
| 31      | I/O | P0_2    | IO pin, default pull-high input                                                                    |
| 32      | I/O | P0_3    | IO pin, default pull-high input                                                                    |
| 33      | O   | HCI_TXD | HCI-UART TX data                                                                                   |
| 34      | I   | HCI_RXD | HCI-UART RX data                                                                                   |
| 35      | I/O | P0_5    | IO pin, default pull-high input                                                                    |
| 36      | I/O | P2_7    | IO pin, default pull-high input                                                                    |
| 37      | I/O | P2_0    | IO pin, default pull-high input                                                                    |
| 38      | I/O | P3_0    | IO pin, default pull-high input                                                                    |
| 39      | I   | P2_0    | IO pin, default pull-high input<br>System Configuration,<br>H: Application L: Baseband(IBDK Mode)  |
| 40      | P   | GND     | Ground.                                                                                            |
| 41      | --  | NC      | --                                                                                                 |
| 42      | --  | NC      | --                                                                                                 |
| 43      | --  | NC      | --                                                                                                 |

\* I: signal input pin  
 \* O: signal output pin  
 \* I/O: signal input/output pin  
 \* P: power pin

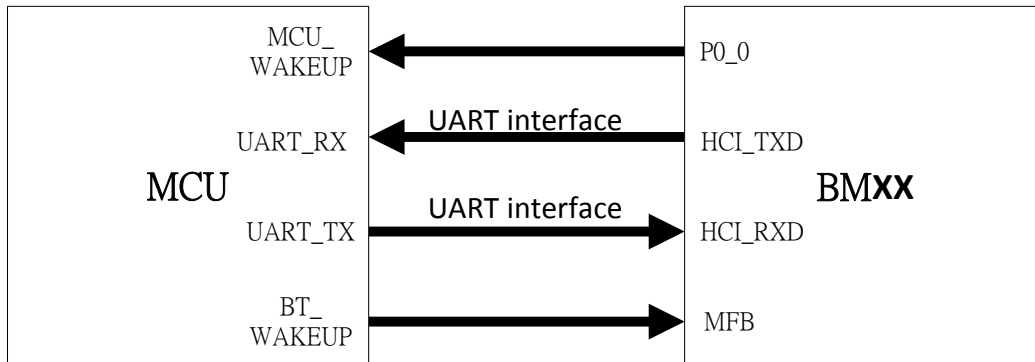
Note 1: These button or functions can be setup by “IS20XXS\_UI” tool.

## 2.0 APPLICATION INFORMATION

### 2.1 OPERATION WITH EXTERNAL MCU

Stereo module support UART command set to make an external MCU to control module. Here is the connection interface between BMXX and MCU.

**FIGURE 2-1: INTERFACE BETWEEN MCU AND BMXX MODULE**



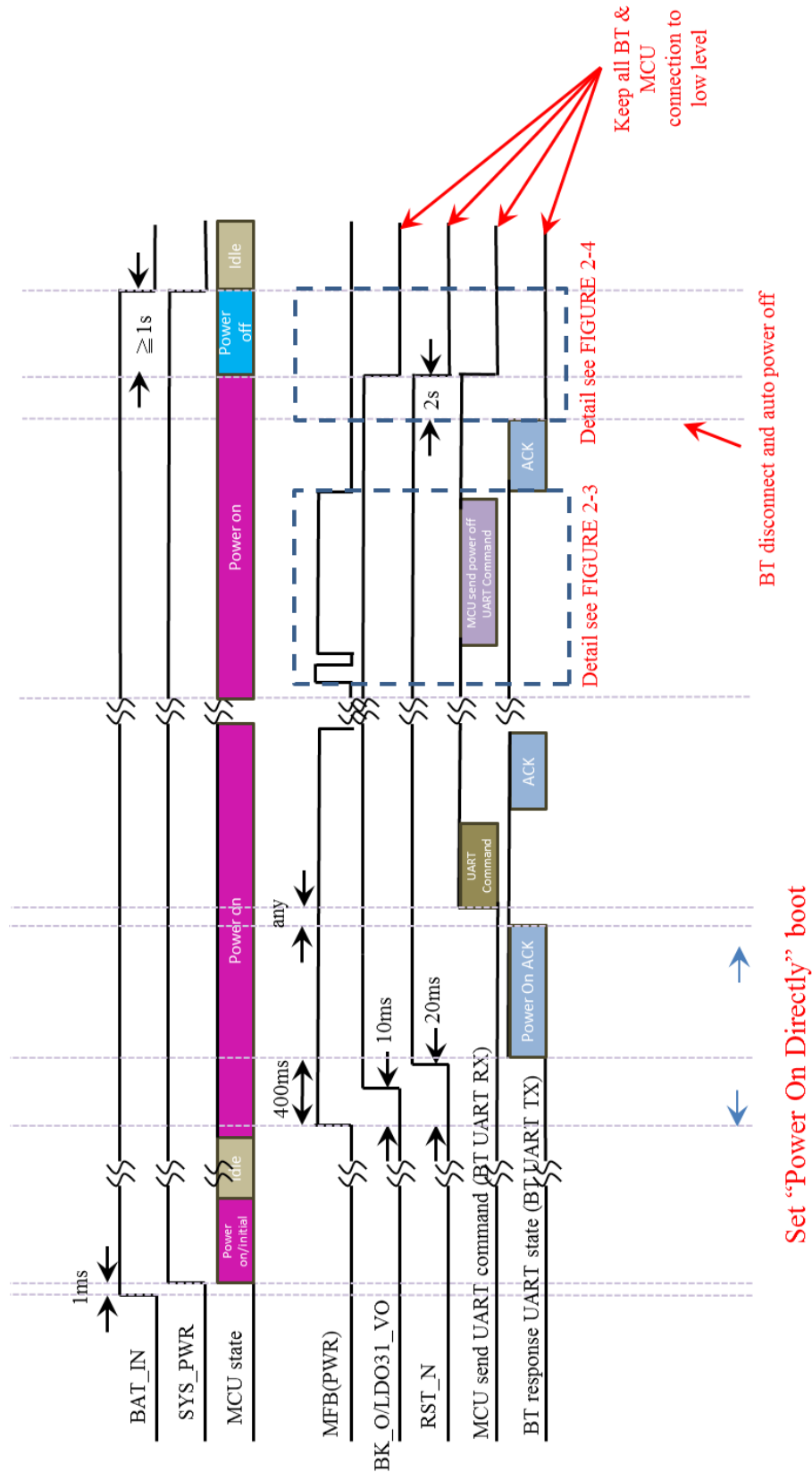
MCU can control module by UART interface and wakeup module by PWR pin. Stereo module provide wakeup MCU function by connect to P0\_0 pin of module.

“UART Command Set” document provide all function which module support and UI tool will help you to set up your system support UART command.

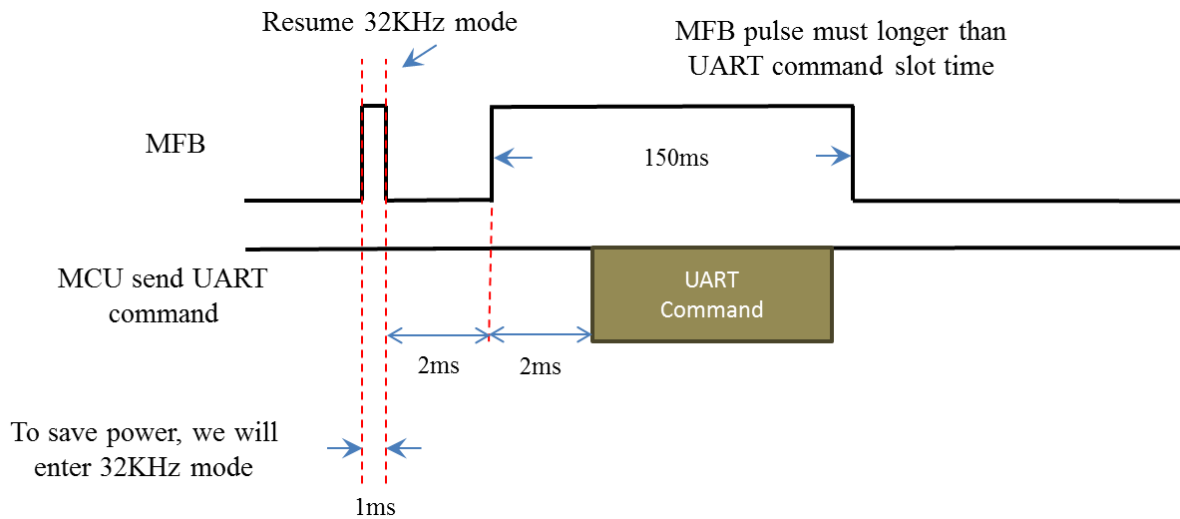
For more detail description, please reference “UART\_CommandSet\_v154” document and “IS20XXS\_UI” tool.

Here are some suggestions of UART control signal timing sequence:

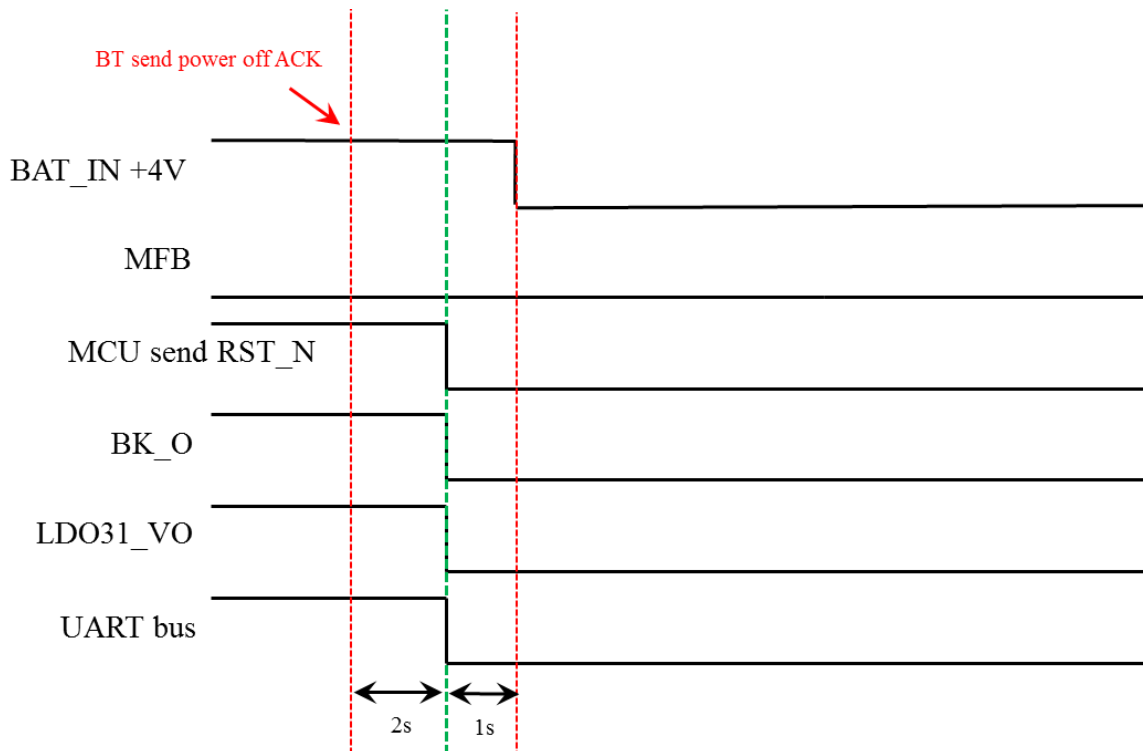
**FIGURE 2-2: POWER ON/OFF SEQUENCE**



**FIGURE 2-3: TIMING SEQUENCE OF RX INDICATION AFTER POWER ON**



**FIGURE 2-4: TIMING SEQUENCE OF POWER OFF**



EEPROM clock= 100KHz

For a byte write,  $0.01\text{ms} \times 32\text{clock} \times 2 = 640\text{us}$

If power drop faster than 640us, some issue may occurs, but the possibility is low

FIGURE 2-5: TIMING SEQUENCE OF POWER ON (NACK)

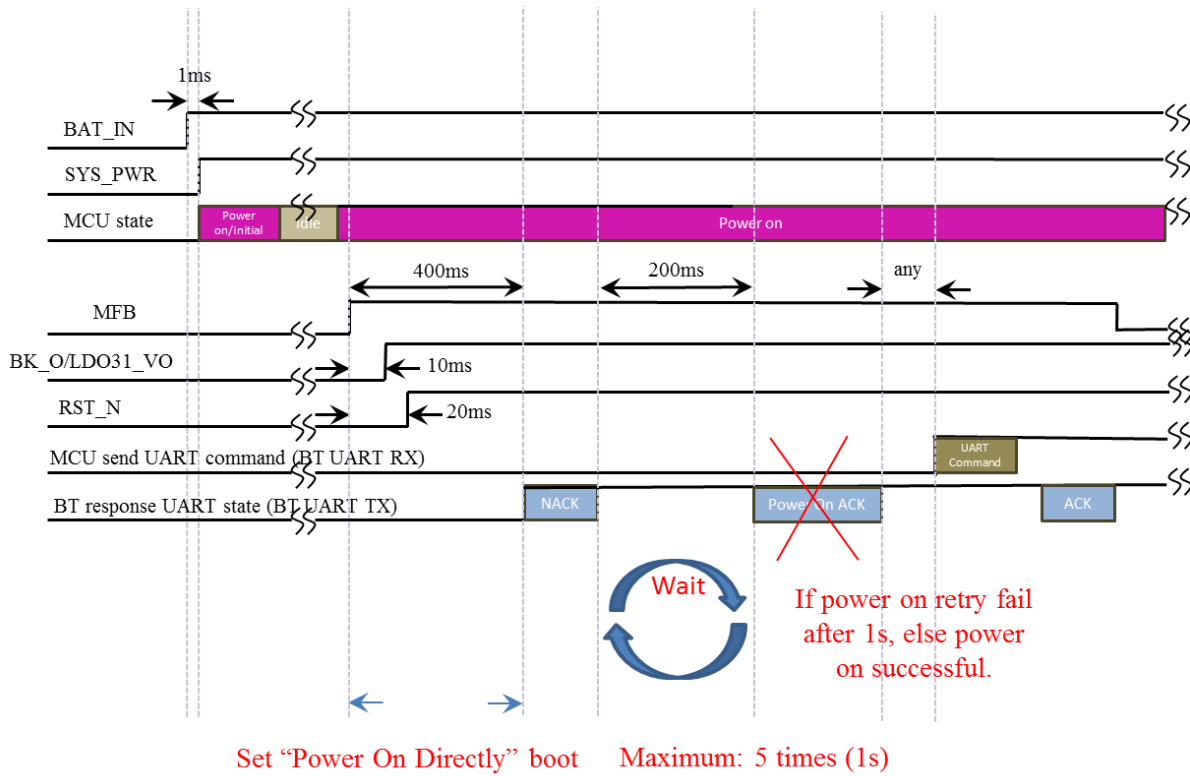
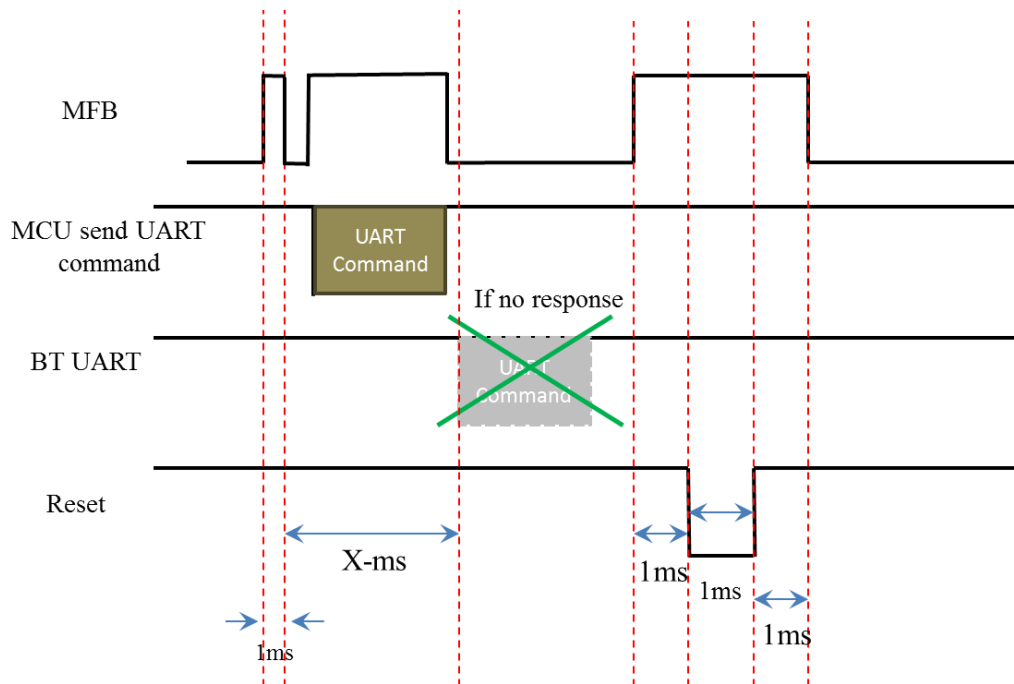
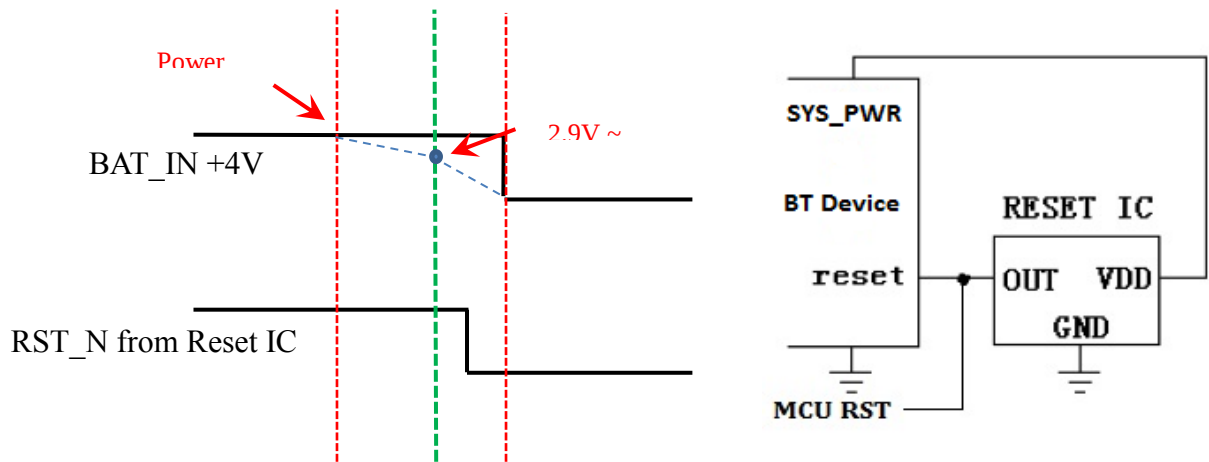


FIGURE 2-6: RESET TIMING SEQUENCE IF MODULE HANGS UP



If MCU send UART command, but BT does not response within X-ms,  
MCU will send a reset signal to BT to do hardware reset

FIGURE 2-7: TIMING SEQUENCE OF POWER DROP PROTECTION



If BT's BAT use adaptor translates voltage by LDO, we recommend use "Reset IC" to avoid power off suddenly. Rest IC spec output pin must be "Open Drain" 、delay time  $\leq 10\text{ms}$

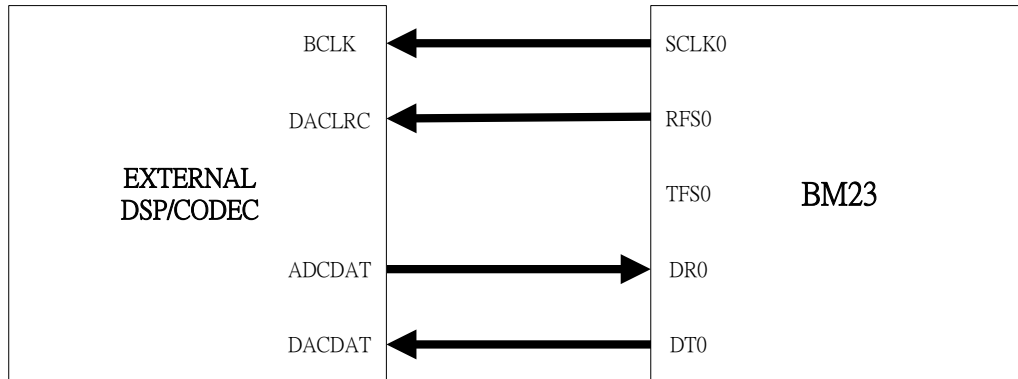
**Recommend part: TCM809SVNB713 or G691L263T73**

## 2.2 I<sup>2</sup>S Signal Application for BM23

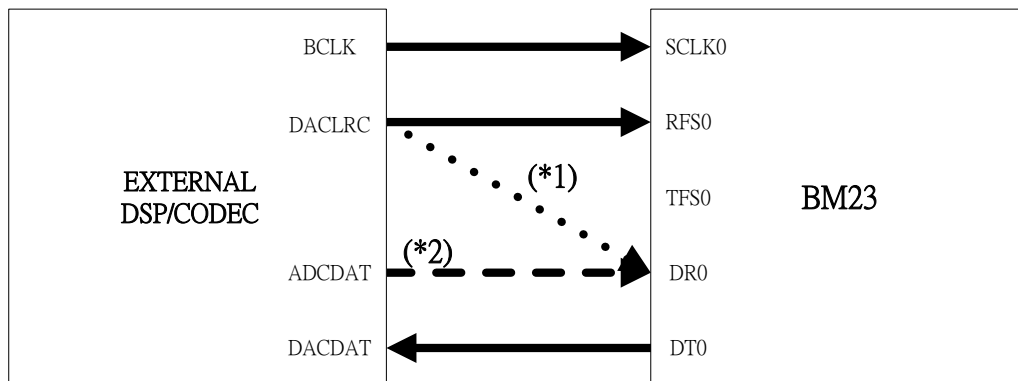
BM23 support I<sup>2</sup>S digital audio signal interface to connect your external CODEC/DSP. It provide 8k Hz, 44.1k Hz and 48k Hz sampling rate; it also support 16 bits and 24bits data format. The I<sup>2</sup>S setting can be set up by UI and DSP tools.

The external CODEC/DSP needs to be connected to SLK0, RFS0, TFS0, DR0, and DT0 (pins 4, 2, 3, 5, and 6 respectively). The I<sup>2</sup>S signal connection between BM23 and external DSP as below:

**FIGURE 2-9: MASTER MODE REFERENCE CONNECTION**



**FIGURE 2-10: SLAVE MODE REFERENCE CONNECTION**



Note 1: For 002 version chip or module, system should connect line 1 in slave mode figure.

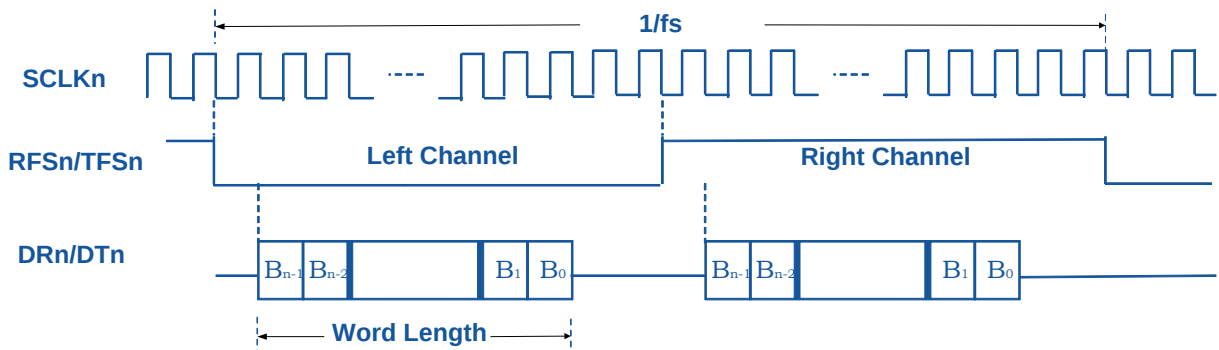
And, system not support ADC signal from external DSP/CODEC.

Note 2: For other version chip or module, system should connect line 2 in slave mode figure.

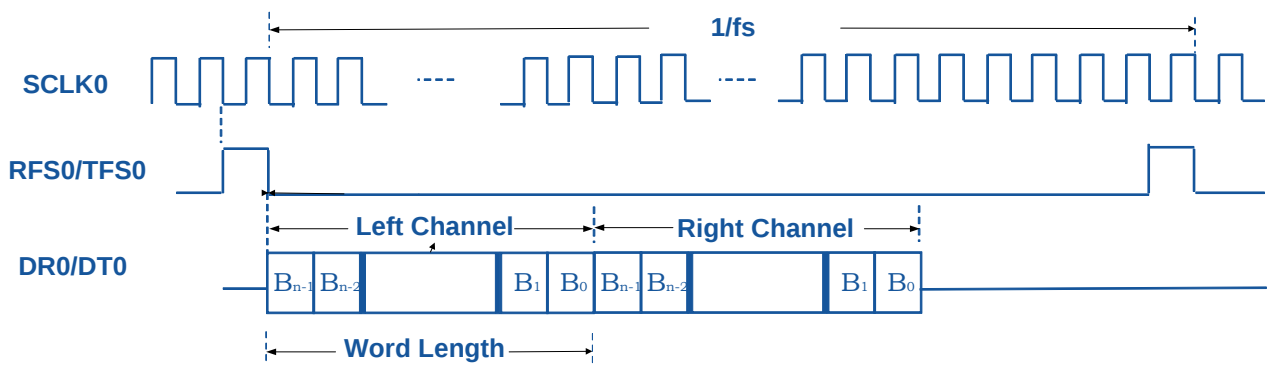
About “Mast” or “Slave” mode setting, you can use “DSP Configuration Tool” to set up system.

The clock and data timing as below:

**FIGURE 2-11: TIMING FOR I<sup>2</sup>S MODES (both master and slave)**



**FIGURE 2-12: TIMING FOR PCM MODES (both master and slave)**



## 2.3 RESET (RST\_N)

RST is module reset pin which is active LOW. To reset the module, the RST\_N must hold LOW for at least 63ns.

## 2.4 STATUS LED (LED1, LED2)

The status LED provide below status indication:

- Standby
- Inquiry
- Link
- Link Back
- Low Battery
- Page
- Battery Charging

Each status indication LED flashing sequence and brightness is configurable by UI tool.

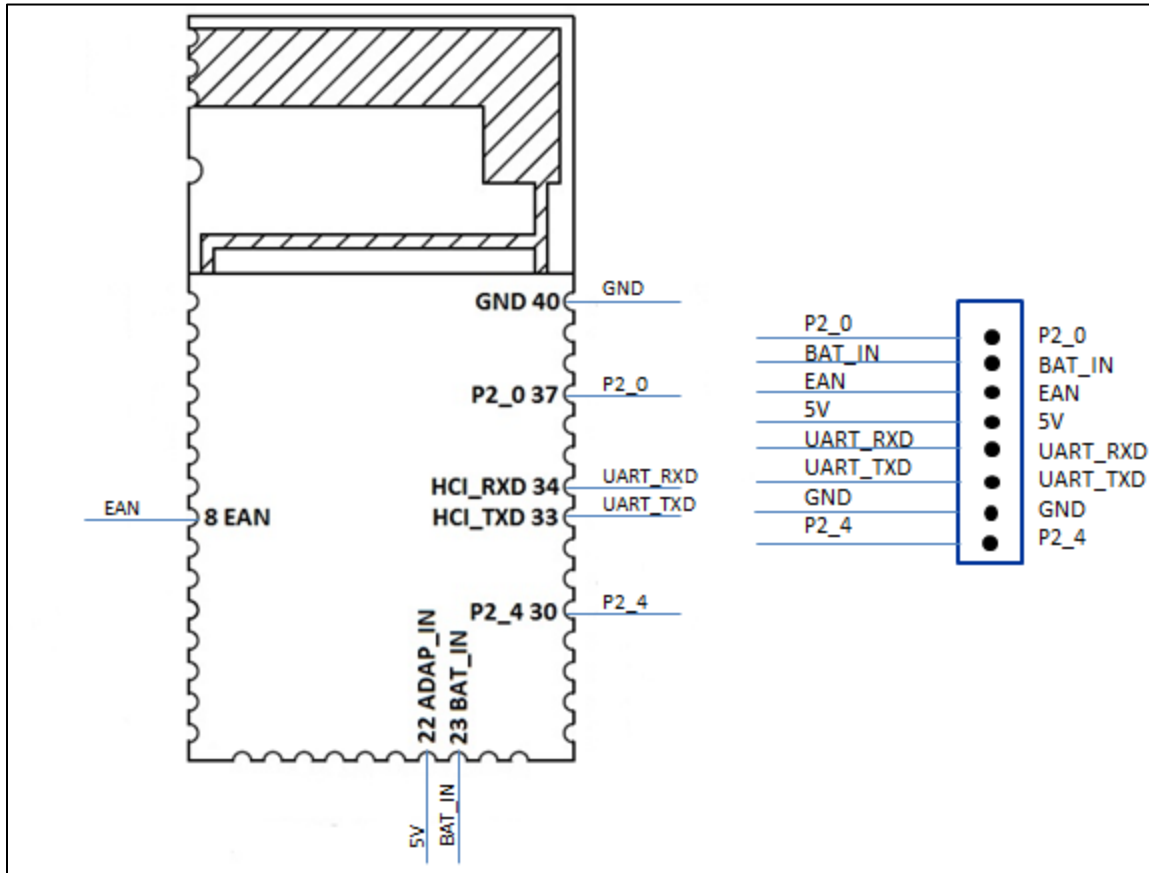
## 2.5 EXTERNAL CONFIGURATION

Stereo module can be configured and firmware programmed using an external configuration and programming tool available from Microchip. Figure 2-7 shows the configuration and firmware programming interface on BM23. It is recommended to include a pin header on the main PCB for development.

Configuration and firmware programming modes are entered accordingly to the system configuration I/O pins as shown in Table 2-1. Pin P20, P24 and EAN pin have internal pull-up.

**FIGURE 2-13: EXTERNAL PROGRAMMING HEADER CONNECTIONS**

(Here is the interface connect example of the BM23)



**TABLE 2-1: SYSTEM CONFIGURATION SETTINGS**

| P20  | P24  | EAN  | Operational Mode                                             |
|------|------|------|--------------------------------------------------------------|
| High | High | High | APP mode (Normal operation)                                  |
| Low  | High | High | Test mode (Write EEPROM)                                     |
| Low  | Low  | High | Write Flash (Firmware programming if flash build-in in chip) |

## 3.0 ELECTRICAL CHARACTERISTICS

**Table 3-1: ABSOLUTE MAXIMUM SPECIFICATION**

| Symbol                 | Parameter                 | Min | Max  | Unit |
|------------------------|---------------------------|-----|------|------|
| BAT_IN                 | Input voltage for battery | 0   | 4.3  | V    |
| ADAP_IN                | Input voltage for adaptor | 0   | 7.0  | V    |
| T <sub>STORE</sub>     | Storage temperature       | -65 | +150 | °C   |
| T <sub>OPERATION</sub> | Operation temperature     | -20 | +70  | °C   |

**Table 3-2: RECOMMENDED OPERATING CONDITION**

| Symbol                 | Parameter                 | Min | Typical | Max | Unit |
|------------------------|---------------------------|-----|---------|-----|------|
| BAT_IN                 | Input voltage for battery | 3   | 3.7     | 4.2 | V    |
| ADAP_IN                | Input voltage for adaptor | 4.5 | 5       | 5.5 | V    |
| T <sub>OPERATION</sub> | Operation temperature     | -20 | +25     | +70 | °C   |

Note:

Absolute and Recommended operating condition tables reflect typical usage for device.

**TABLE 3-3: I/O AND RESET LEVEL**

| Parameter                                | Min. | Typ. | Max. | Units |
|------------------------------------------|------|------|------|-------|
| I/O Supply Voltage (VDD_IO)              | 2.7  | 3.0  | 3.3  | V     |
| <b>I/O Voltage Levels</b>                |      |      |      |       |
| V <sub>IL</sub> input logic levels low   | -0.3 |      | 0.8  | V     |
| V <sub>IH</sub> input logic levels high  | 2.0  |      | 3.6  | V     |
| V <sub>OL</sub> output logic levels low  |      |      | 0.4  | V     |
| V <sub>OH</sub> output logic levels high | 2.4  |      |      | V     |
| <b>RESET</b>                             |      |      |      |       |
| V <sub>TH,RES</sub> threshold voltage    |      | 1.6  |      | V     |

Note:

(1) VDD\_IO voltage is programmable by EEPROM parameters.

(2) These parameters are characterized but not tested in manufacturing.

**Table 3-4: BATTERY CHARGER**

| Parameter                                                      |                                | Min | Typical | Max | Unit |
|----------------------------------------------------------------|--------------------------------|-----|---------|-----|------|
| ADAP_IN Input Voltage                                          |                                | 4.5 | 5.0     | 5.5 | V    |
| Supply current to charger only                                 |                                |     | 3       | 4.5 | mA   |
| Maximum Battery Fast Charge Current<br>Note: ENX2=0            | Headroom > 0.7V (ADAP_IN=5V)   | 170 | 200     | 240 | mA   |
|                                                                | Headroom = 0.3V (ADAP_IN=4.5V) | 160 | 180     | 240 | mA   |
| Maximum Battery Fast Charge Current<br>Note: ENX2=1            | Headroom > 0.7V (ADAP_IN=5V)   | 330 | 350     | 420 | mA   |
|                                                                | Headroom = 0.3V (ADAP_IN=4.5V) | 180 | 220     | 270 | mA   |
| Trickle Charge Voltage Threshold                               |                                |     | 3       |     | V    |
| Battery Charge Termination Current, (% of Fast Charge Current) |                                |     | 10      |     | %    |

Note:

- (1) Headroom =  $V_{ADAP\_IN} - V_{BAT}$
- (2) ENX2 is not allowed to be enabled when  $V_{ADAP\_IN} - V_{BAT} > 2V$
- (3) These parameters are characterized but not tested in manufacturing.

**Table 3-5: LED DRIVER**

| Parameter                     | Min | Typical | Max  | Unit    |
|-------------------------------|-----|---------|------|---------|
| Open-drain Voltage            |     |         | 3.6  | V       |
| Programmable Current Range    | 0   |         | 5.25 | mA      |
| Intensity Control             |     | 16      |      | step    |
| Current Step                  |     | 0.35    |      | mA      |
| Power Down Open-drain Current |     |         | 1    | $\mu A$ |
| Shutdown Current              |     |         | 1    | $\mu A$ |

Note:

- (1) Test condition: SAR\_VDD=1.8V, temperature=25 °C.
- (2) These parameters are characterized but not tested in manufacturing.

**Table 3-6: AUDIO CODEC ANALOGUE TO DIGITAL CONVERTER**

T= 25°C, V<sub>dd</sub>=3.0V, 1KHz sine wave input, Bandwidth = 20Hz~20KHz

| Parameter (Condition)                                              | Min. | Typ. | Max. | Unit      |
|--------------------------------------------------------------------|------|------|------|-----------|
| Resolution                                                         |      |      | 16   | Bits      |
| Output Sample Rate                                                 | 8    |      | 48   | KHz       |
| Signal to Noise Ratio <b>Note: 1</b><br>(SNR @MIC or Line-in mode) |      | 88   |      | dB        |
| Digital Gain                                                       | -54  |      | 4.85 | dB        |
| Digital Gain Resolution                                            |      | 2~6  |      | dB        |
| MIC Boost Gain                                                     |      | 20   |      | dB        |
| Analog Gain                                                        |      |      | 60   | dB        |
| Analog Gain Resolution                                             |      | 2.0  |      | dB        |
| Input full-scale at maximum gain (differential)                    |      | 4    |      | mV<br>rms |
| Input full-scale at minimum gain (differential)                    |      | 800  |      | mV<br>rms |
| 3dB bandwidth                                                      |      | 20   |      | KHz       |
| Microphone mode (input impedance)                                  |      | 24   |      | KΩ        |
| THD+N (microphone input) @30mVrms input                            |      | 0.02 |      | %         |

Note:

- (1) f<sub>in</sub>=1KHz, BW=20~20KHz, A-weighted, THD+N < 1%, 150mV<sub>pp</sub> input
- (2) These parameters are characterized but not tested in manufacturing.

# Stereo Module

**Table 3-7: AUDIO CODEC DIGITAL TO ANALOGUE CONVERTER**

| T= 25°C, V <sub>dd</sub> =3.0V, 1KHz sine wave input, Bandwidth = 20Hz~20KHz     |            |      |       |      |                |
|----------------------------------------------------------------------------------|------------|------|-------|------|----------------|
| Parameter (Condition)                                                            |            | Min. | Typ.  | Max. | Unit           |
| Over-sampling rate                                                               |            |      | 128   |      | f <sub>s</sub> |
| Resolution                                                                       |            | 16   |       | 20   | Bits           |
| Output Sample Rate                                                               |            | 8    |       | 48   | KHz            |
| Signal to Noise Ratio <small>Note: 1</small><br>(SNR @cap-less mode) for 48kHz   |            |      | 96    |      | dB             |
| Signal to Noise Ratio <small>Note: 1</small><br>(SNR @single-end mode) for 48kHz |            |      | 98    |      | dB             |
| Digital Gain                                                                     |            | -54  |       | 4.85 | dB             |
| Digital Gain Resolution                                                          |            |      | 2~6   |      | dB             |
| Analog Gain                                                                      |            | -28  |       | 3    | dB             |
| Analog Gain Resolution                                                           |            |      | 1     |      | dB             |
| Output Voltage Full-scale Swing (AVDD=2.8V) <small>Note:3</small>                |            |      | 742.5 |      | mV rms         |
| Maximum Output Power (16Ω load)                                                  |            |      | 34.5  |      | mW             |
| Maximum Output Power (32Ω load)                                                  |            |      | 17.2  |      | mW             |
| Allowed Load                                                                     | Resistive  | 8    | 16    | O.C. | Ω              |
|                                                                                  | Capacitive |      |       | 500  | pF             |
| THD+N (16Ω load)                                                                 |            |      |       | 0.05 | %              |
| Signal to Noise Ratio (SNR @ 16Ω load)                                           |            |      |       | 96   | dB             |

Note:

- (1) f<sub>in</sub>=1KHz, BW=20~20KHz, A-weighted, THD+N < 0.01%, 0dBFS signal, Load=100KΩ
- (2) These parameters are characterized but not tested in manufacturing.
- (3) V<sub>dd</sub>, AVDD are generated by internal LDO

**Table 3-8: TRANSMITTER SECTION FOR BDR AND EDR**

| Parameter                          | Min | Typ  | Max | Bluetooth specification | Unit |
|------------------------------------|-----|------|-----|-------------------------|------|
| Maximum RF transmit power          |     | 3.0  | 4.0 | -6 to 4                 | dBm  |
| EDR/BDR<br>Relative transmit power | -4  | -1.2 | 1   | -4 to 1                 | dB   |

Note:

The RF Transmit power is calibrated during production using MP Tool software and MT8852 Bluetooth Test equipment.

Test condition: VCC<sub>RF</sub>= 1.28V, temperature=25 °C.

**Table 3-9: RECEIVER SECTION FOR BDR AND EDR**

|                          | Modulation    | Min | Typ | Max | Bluetooth specification | Unit |
|--------------------------|---------------|-----|-----|-----|-------------------------|------|
| Sensitivity at 0.1% BER  | GFSK          |     | -90 |     | $\leq -70$              | dBm  |
| Sensitivity at 0.01% BER | $\pi/4$ DQPSK |     | -91 |     | $\leq -70$              | dBm  |
|                          | 8DPSK         |     | -82 |     | $\leq -70$              | dBm  |

Note:

- (1) Test condition: VCC\_RF= 1.28V, temperature=25 °C.
- (2) These parameters are characterized but not tested in manufacturing.

**Table 3-10: SYSTEM CURRENT CONSUMPTION OF ANALOG AUDIO OUTPUT**

| System Status                                        | Typ. | Max. | Unit |
|------------------------------------------------------|------|------|------|
| System Off Mode                                      | 2    | 5    | uA   |
| Standby Mode                                         | 0.8  |      | mA   |
| Linked Mode                                          | 0.4  |      | mA   |
| SCO Link                                             | 7.8  |      | mA   |
| A2DP Link ( $V_{p-p}=200\text{mV}$ ; 1k tone signal) | 10.7 |      | mA   |

Note: Use BM20 EVB as test platform.

Test condition: BAT\_IN= 3.8V, link with HTC EYE cell phone; distance between cell phone and EVB: 30cm.

**Table 3-11: SYSTEM CURRENT CONSUMPTION OF DIGITAL AUDIO OUTPUT(I<sup>2</sup>S)**

| System Status              | Typ. | Max. | Unit |
|----------------------------|------|------|------|
| System Off Mode            | 2    | 5    | uA   |
| Standby Mode               | 0.4  |      | mA   |
| Linked Mode                | 0.4  |      | mA   |
| SCO Link                   | 9.3  |      | mA   |
| A2DP Link (1k tone signal) | 11.7 |      | mA   |

Note: Use BM23 EVB as test platform

Test condition: BAT\_IN= 3.8V, link with HTC M8 cell phone; distance between cell phone and EVB: 30cm;  
I<sup>2</sup>S signal link with YAMAHA YDA174 EVB

## 4.0 PRINTED ANTENNA INFORMATION

### 4.1 MODULE RADIATION PATTERN

The stereo module contains a PCB printed antenna. The PCB printed antenna radiation pattern is shown in Figure 4-2.

FIGURE 4-1: ANTENNA KEEP OUT AREA EXAMPLES

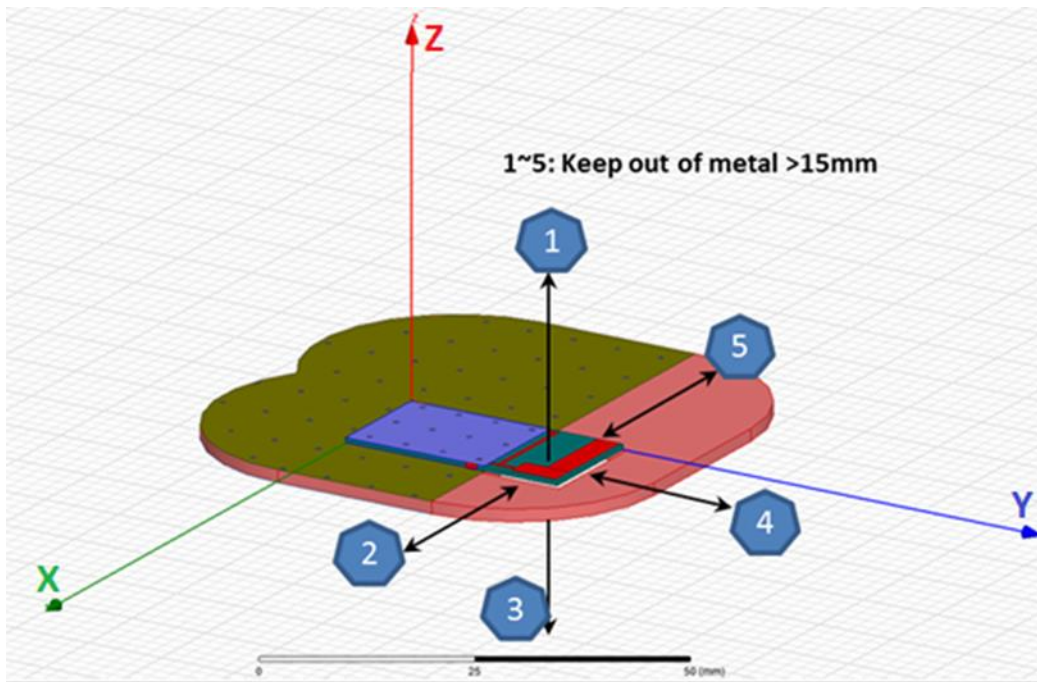
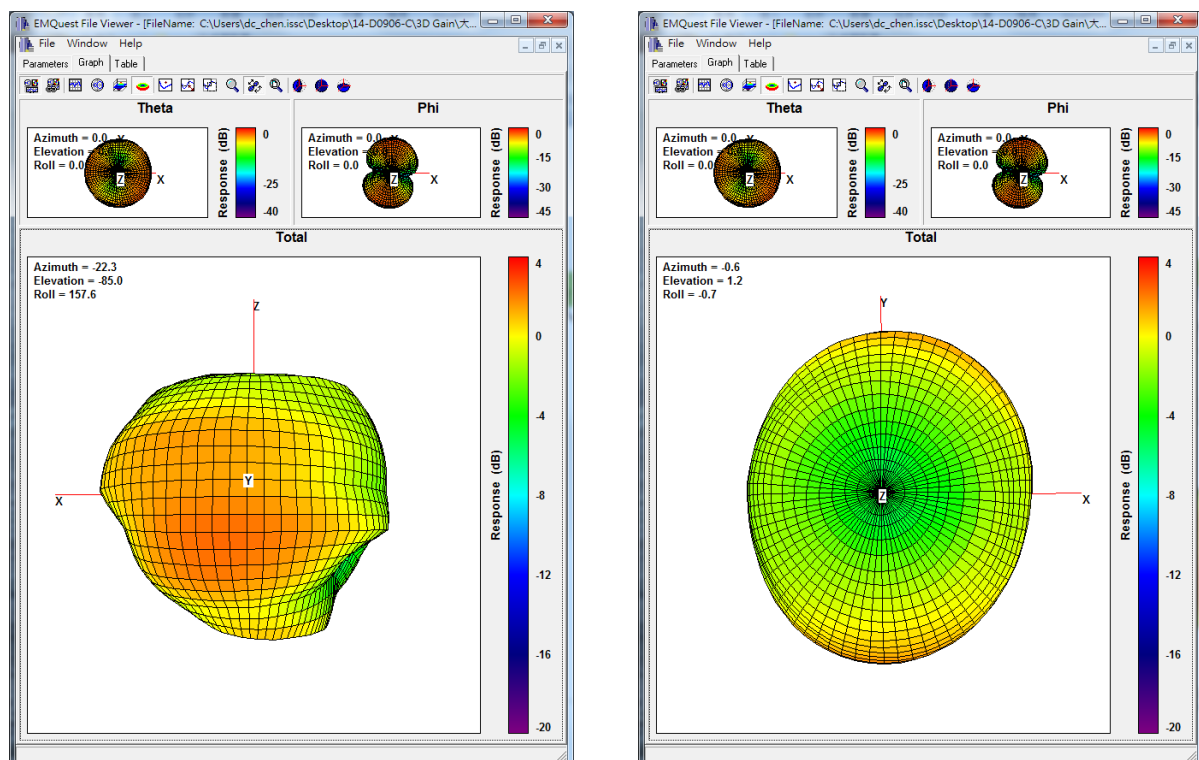


FIGURE 4-2: ANTENNA 3D RADIATION PATTERN @2441 MHz

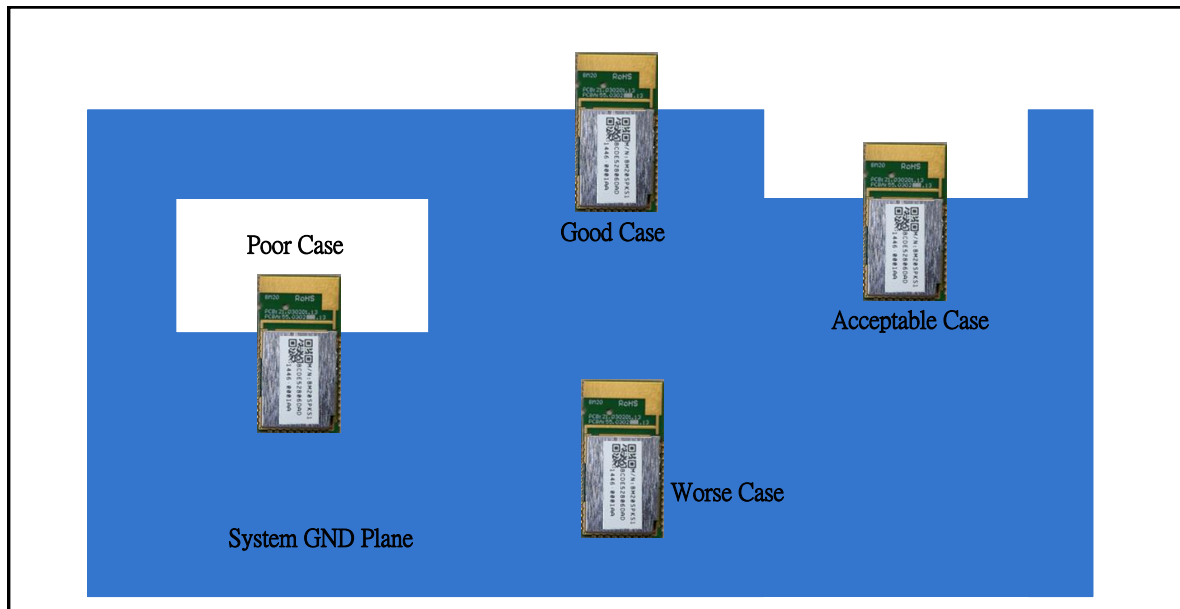


## 4.2 MODULE PLACEMENT RULE

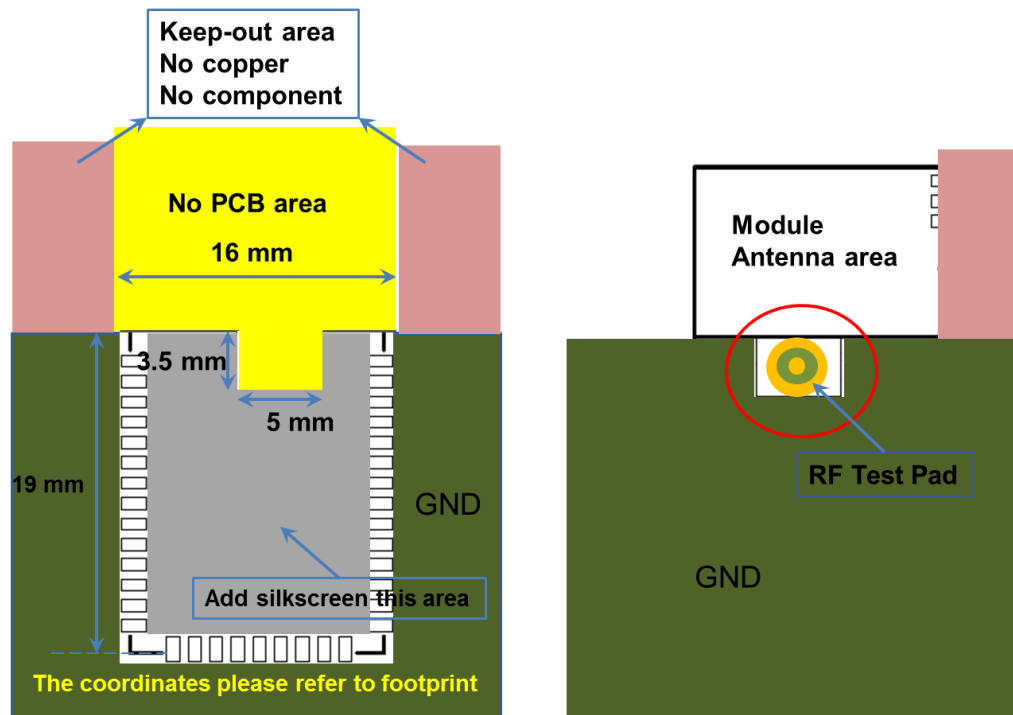
On the main PCB, the areas under the antenna should not contain any top, inner layer, or bottom copper as shown in Figure 4-1. A low-impedance ground plane will ensure the best radio performance (best range, lowest noise). The ground plane can be extended beyond the minimum recommended as need for the main PCB EMC noise reduction. For the best range performance, keep all external metal away from the ceramic chip antenna at least 15 mm.

Here are some examples of good and poor placement on a carrier board with GND plane.

**FIGURE 4-3: MODULE PLACEMENT EXAMPLES**

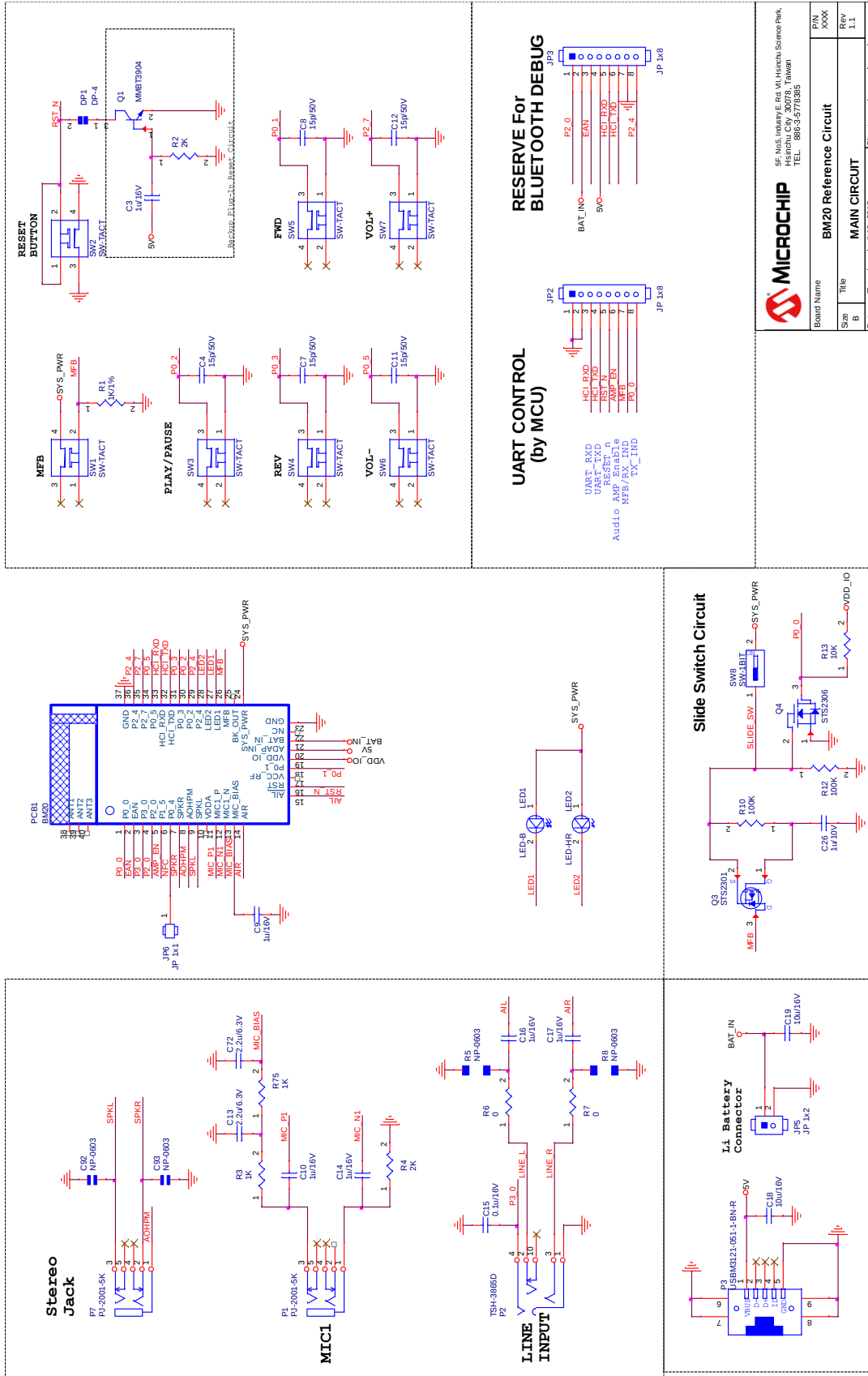


**FIGURE 4-4: GND PLANE ON MAIN APPLICATION BOARD**

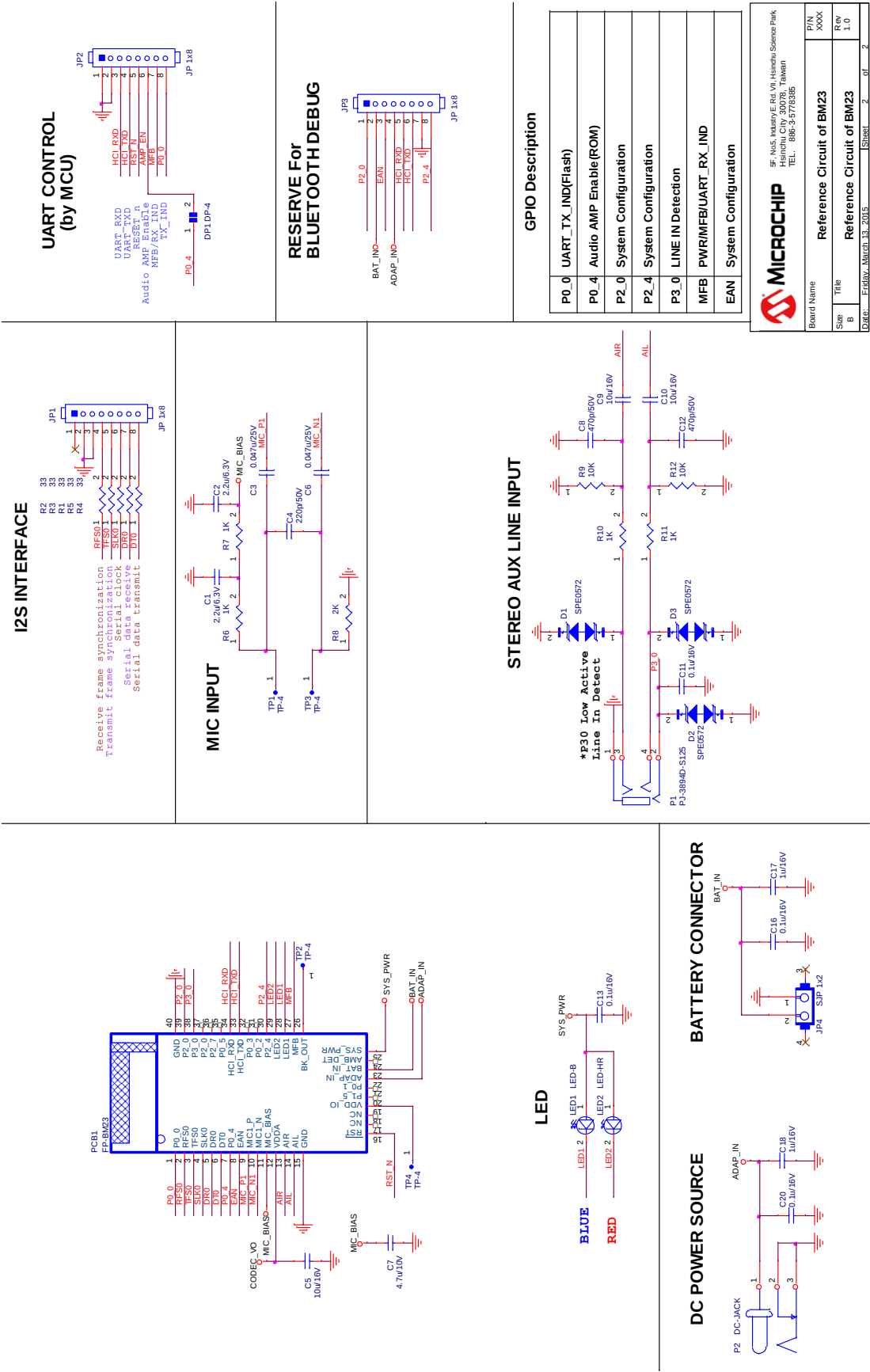


## 5.0 REFERENCE CIRCUIT

### 5.1 BM20 REFERENCE CIRCUIT



5.2 BM23 REFERENCE CIRCUIT



## 6.0 CERTIFICATION INFORMATION

### 6.1 BQTF INFORMATION

FIGURE 6-1: BM15/BM20/BM23/BM25 QDID Data

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| TPG Project                                                                                                                                                      | KleanWire IS2000 series (End Product)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------|--------------|--------------|-----|--------------|-----------|---------------------|--------------|----------------------------------------------------------------|---------------------|---------------------------|--------|---------------------|--------------|--------|---------------------|--------------|--------|---------------------|--------------|--------|---------------------|--------------|--------|---------------------|--------------|--------|---------------------|--------------|--------|---------------------|--------------|--------|---------------------|--------------|--------|---------------------|
| Member Company                                                                                                                                                   | ISSC Technologies Corp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Declaration ID                                                                                                                                                   | D023460                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| QD ID                                                                                                                                                            | 58996   <a href="#">Export ICS</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| PRD 1.0 ID (QP ID)                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Wi-Fi® Certification ID                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Subsetted Projects                                                                                                                                               | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Date Created</th> <th>Type</th> <th>ICS</th> </tr> </thead> <tbody> <tr><td>Jul 10, 2014</td><td>Main</td><td><a href="#">ICS</a></td></tr> <tr><td>Jul 13, 2014</td><td>Subset</td><td><a href="#">ICS</a></td></tr> <tr><td>Jul 14, 2014</td><td>Subset</td><td><a href="#">ICS</a></td></tr> <tr><td>Jul 14, 2014</td><td>Subset</td><td><a href="#">ICS</a></td></tr> <tr><td>Jul 14, 2014</td><td>Subset</td><td><a href="#">ICS</a></td></tr> <tr><td>Jul 14, 2014</td><td>Subset</td><td><a href="#">ICS</a></td></tr> <tr><td>Jul 14, 2014</td><td>Subset</td><td><a href="#">ICS</a></td></tr> <tr><td>Jul 14, 2014</td><td>Subset</td><td><a href="#">ICS</a></td></tr> <tr><td>Jul 14, 2014</td><td>Subset</td><td><a href="#">ICS</a></td></tr> <tr><td>Jul 14, 2014</td><td>Subset</td><td><a href="#">ICS</a></td></tr> <tr><td>Jul 14, 2014</td><td>Subset</td><td><a href="#">ICS</a></td></tr> </tbody> </table> |                     |                           | Date Created | Type         | ICS | Jul 10, 2014 | Main      | <a href="#">ICS</a> | Jul 13, 2014 | Subset                                                         | <a href="#">ICS</a> | Jul 14, 2014              | Subset | <a href="#">ICS</a> | Jul 14, 2014 | Subset | <a href="#">ICS</a> | Jul 14, 2014 | Subset | <a href="#">ICS</a> | Jul 14, 2014 | Subset | <a href="#">ICS</a> | Jul 14, 2014 | Subset | <a href="#">ICS</a> | Jul 14, 2014 | Subset | <a href="#">ICS</a> | Jul 14, 2014 | Subset | <a href="#">ICS</a> | Jul 14, 2014 | Subset | <a href="#">ICS</a> | Jul 14, 2014 | Subset | <a href="#">ICS</a> |
| Date Created                                                                                                                                                     | Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ICS                 |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Jul 10, 2014                                                                                                                                                     | Main                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <a href="#">ICS</a> |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Jul 13, 2014                                                                                                                                                     | Subset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <a href="#">ICS</a> |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Jul 14, 2014                                                                                                                                                     | Subset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <a href="#">ICS</a> |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Jul 14, 2014                                                                                                                                                     | Subset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <a href="#">ICS</a> |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Jul 14, 2014                                                                                                                                                     | Subset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <a href="#">ICS</a> |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Jul 14, 2014                                                                                                                                                     | Subset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <a href="#">ICS</a> |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Jul 14, 2014                                                                                                                                                     | Subset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <a href="#">ICS</a> |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
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| Jul 14, 2014                                                                                                                                                     | Subset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <a href="#">ICS</a> |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Jul 14, 2014                                                                                                                                                     | Subset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <a href="#">ICS</a> |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Design Name                                                                                                                                                      | ISSC BT4.1 KleanWire IS2000 series                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Design Model Number                                                                                                                                              | BM15SPKXY/ BM20SPKXY/ BM23SPKXY/ BM25SPKXY X=A~Z,0~9, Y=0~9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Hardware Version Number                                                                                                                                          | IS2000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Software Version Number                                                                                                                                          | IS2000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Qualification Assessment Date                                                                                                                                    | July/13/2014                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Listing Date                                                                                                                                                     | July/14/2014                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Design Description                                                                                                                                               | Bluetooth speaker/headset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Product Type                                                                                                                                                     | End Product                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Specification Name                                                                                                                                               | 4.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Product List                                                                                                                                                     | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Brand</th> <th>Model</th> <th>URL</th> <th>Description</th> <th>Subset ID</th> <th>Publish Date</th> </tr> </thead> <tbody> <tr> <td></td> <td>BM15SPKXY/ BM20SPKXY/ BM23SPKXY/ BM25SPKXY<br/>X=A~Z,0~9, Y=0~9</td> <td></td> <td>Bluetooth speaker/headset</td> <td></td> <td>Jul 14, 2014</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |                           | Brand        | Model        | URL | Description  | Subset ID | Publish Date        |              | BM15SPKXY/ BM20SPKXY/ BM23SPKXY/ BM25SPKXY<br>X=A~Z,0~9, Y=0~9 |                     | Bluetooth speaker/headset |        | Jul 14, 2014        |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Brand                                                                                                                                                            | Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | URL                 | Description               | Subset ID    | Publish Date |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
|                                                                                                                                                                  | BM15SPKXY/ BM20SPKXY/ BM23SPKXY/ BM25SPKXY<br>X=A~Z,0~9, Y=0~9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                     | Bluetooth speaker/headset |              | Jul 14, 2014 |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| <a href="#">Technical Data Sheet (RIN)</a> (not available)                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Listed By                                                                                                                                                        | <a href="#">mei feng Huang</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| BQE                                                                                                                                                              | <a href="#">Frankie Lin</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| Referenced QDID Profile Information                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |
| <div style="display: flex; align-items: center;"> <span style="color: orange; font-weight: bold; margin-right: 5px;">&gt;</span> <span>QDID: 58996</span> </div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                           |              |              |     |              |           |                     |              |                                                                |                     |                           |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |              |        |                     |

## 6.2 REGULATORY APPROVAL

BM23 has got these countries regulatory approval:

- United States; FCC ID: A8TBM23SPKXYC2A
- Canada; IC ID: 12246A-BM23SPKXYC2
- Europe
- Japan;   202-SMC067
- Korea; Certification No.: MSIP-CRM-S9S-BM23SPKXY
- Taiwan; NCC No.: CCAL15LP0270T3

BM20 has got these countries regulatory approval

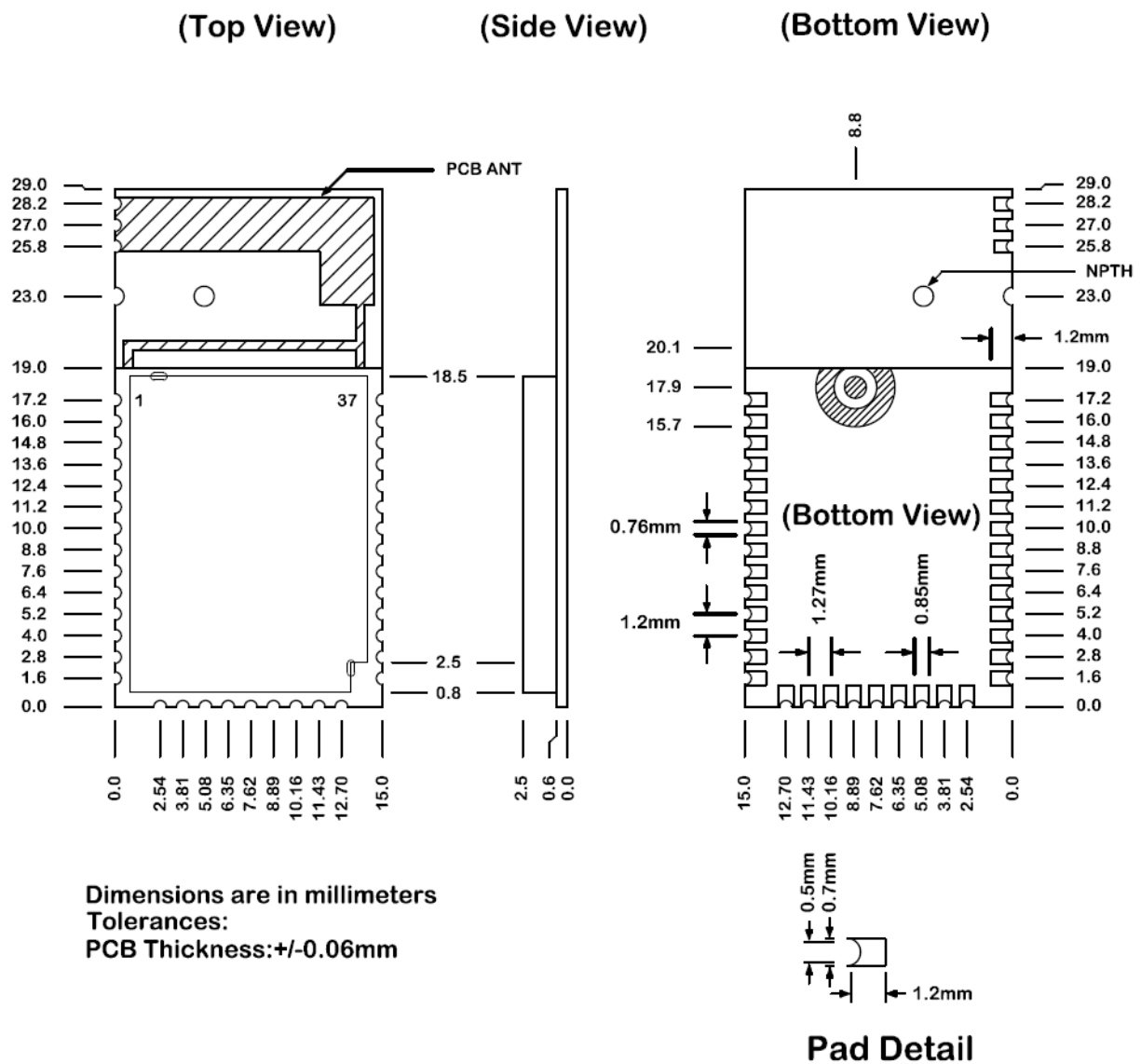
- CE: BM20SPKXYNBZ
- United States: FCC: A8TBM20SPKXYNBZ
- Canada: IC ID: 12246A-BM20SPKS1
- HVIN: BM20SPKS1
- Japan: 202-SMD048
- Korea KCC: MSP-CRM-mcp-BM20SPKS1NBC
- Taiwan NCC: CCAN15LP0460T2
- China SRRC: CMIIT ID: 2015DJ7134

For more information, please reference appendix.

## 7.0 MODULE OUTLINE AND REFLOW PROFILE

### 7.1 MODULE DIMENSION AND PCB FOOT PRINT

FIGURE 7-1: BM20 Outline Dimension



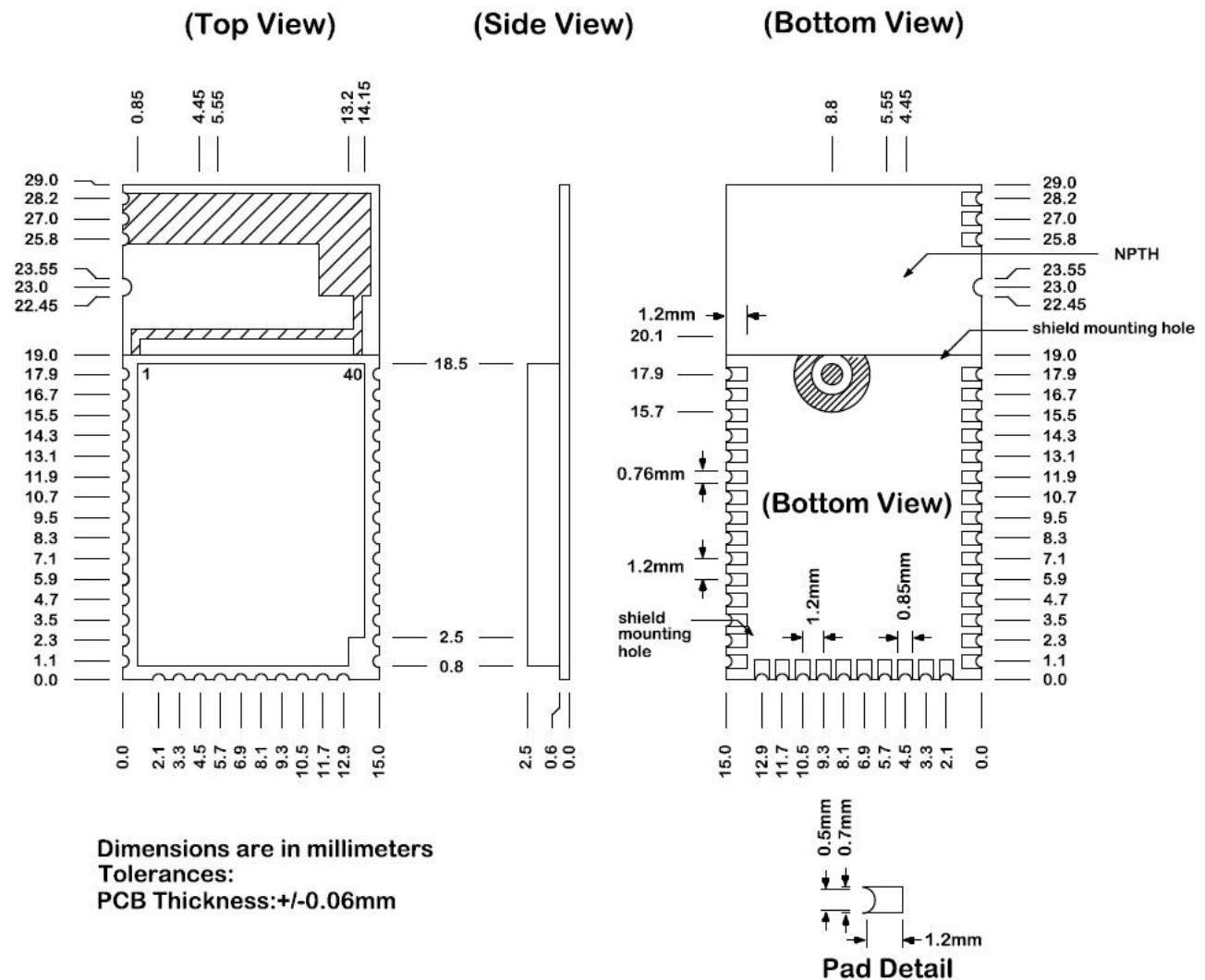
## PCB dimension:

X : 15.0 mm

Y : 29.0 mm

Tolerances: 0.25 mm

FIGURE 7-2: BM23 Outline Dimension



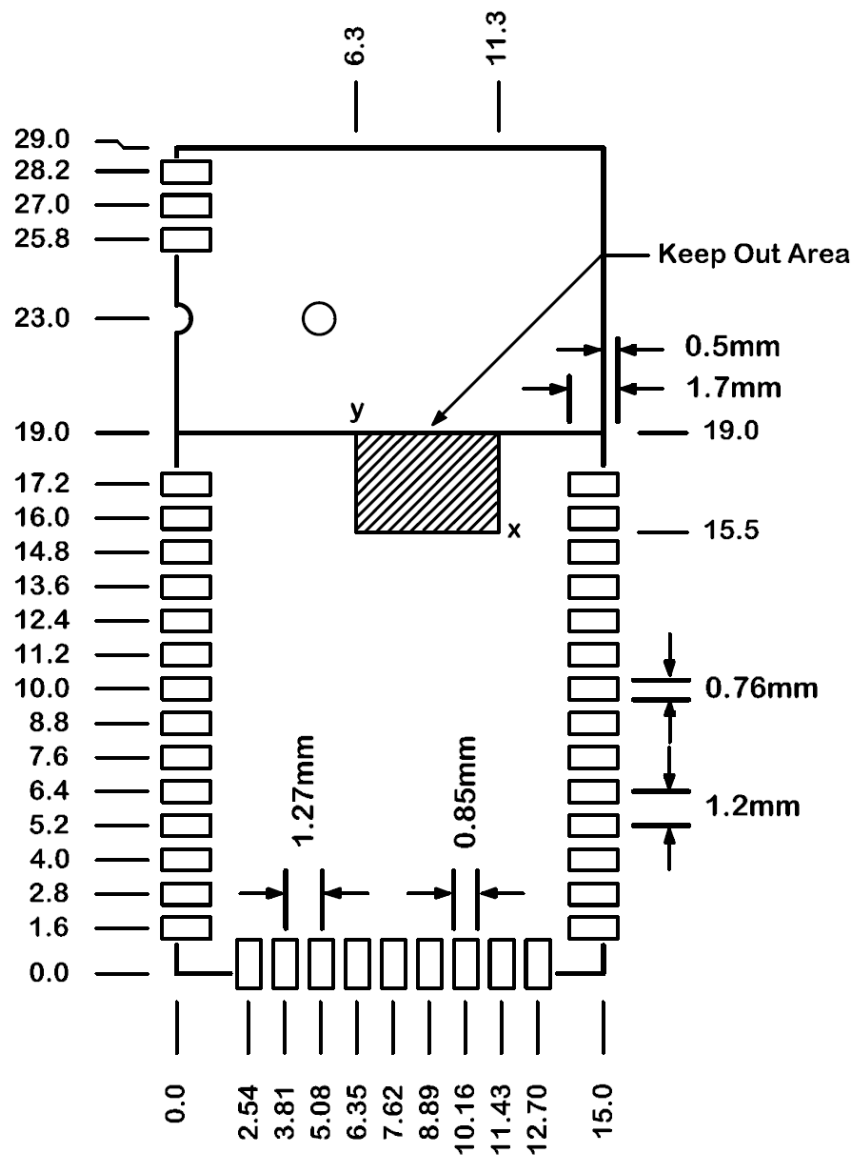
## PCB dimension:

X : 15.0 mm

Y : 29.0 mm

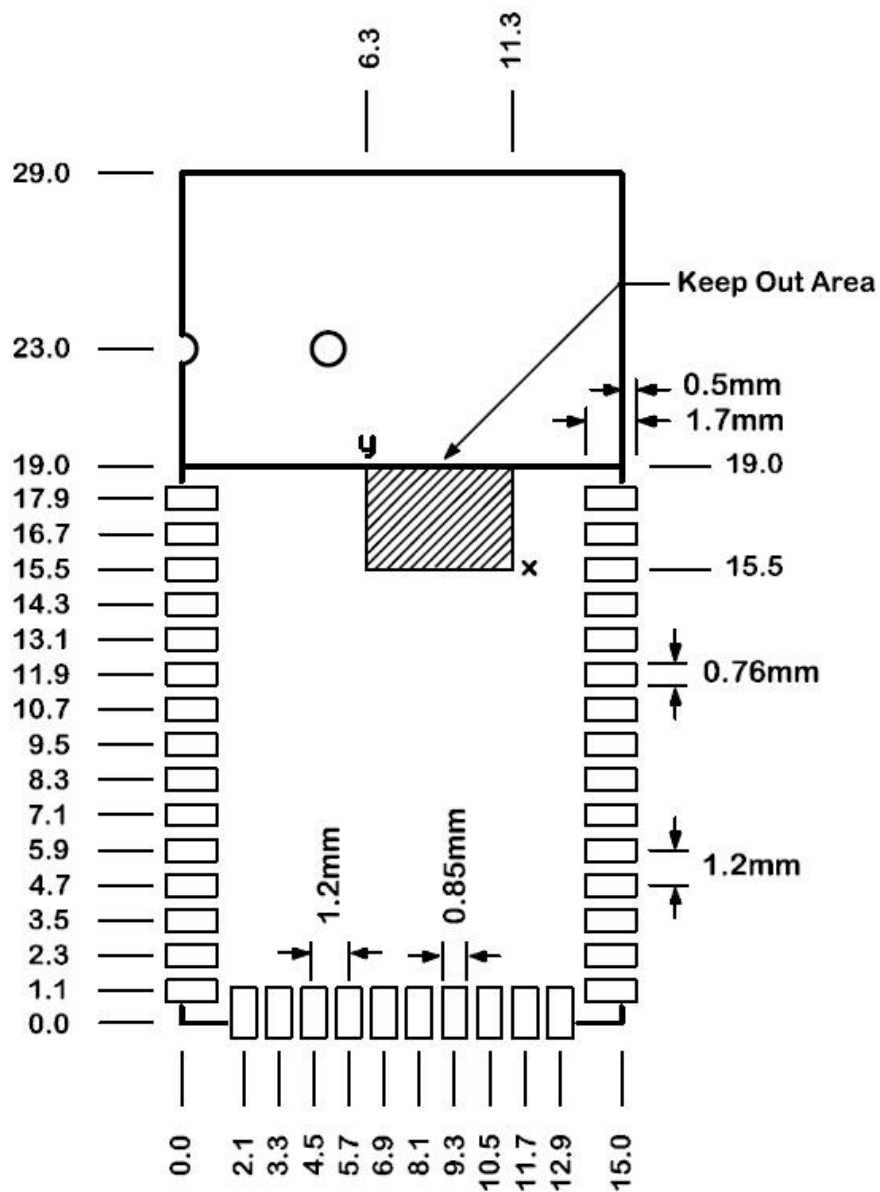
Tolerances: 0.25 mm

FIGURE 7-3: BM20 PCB FOOT PRINT



Note: The “Keep Out Area” is reserved for RF performance check.

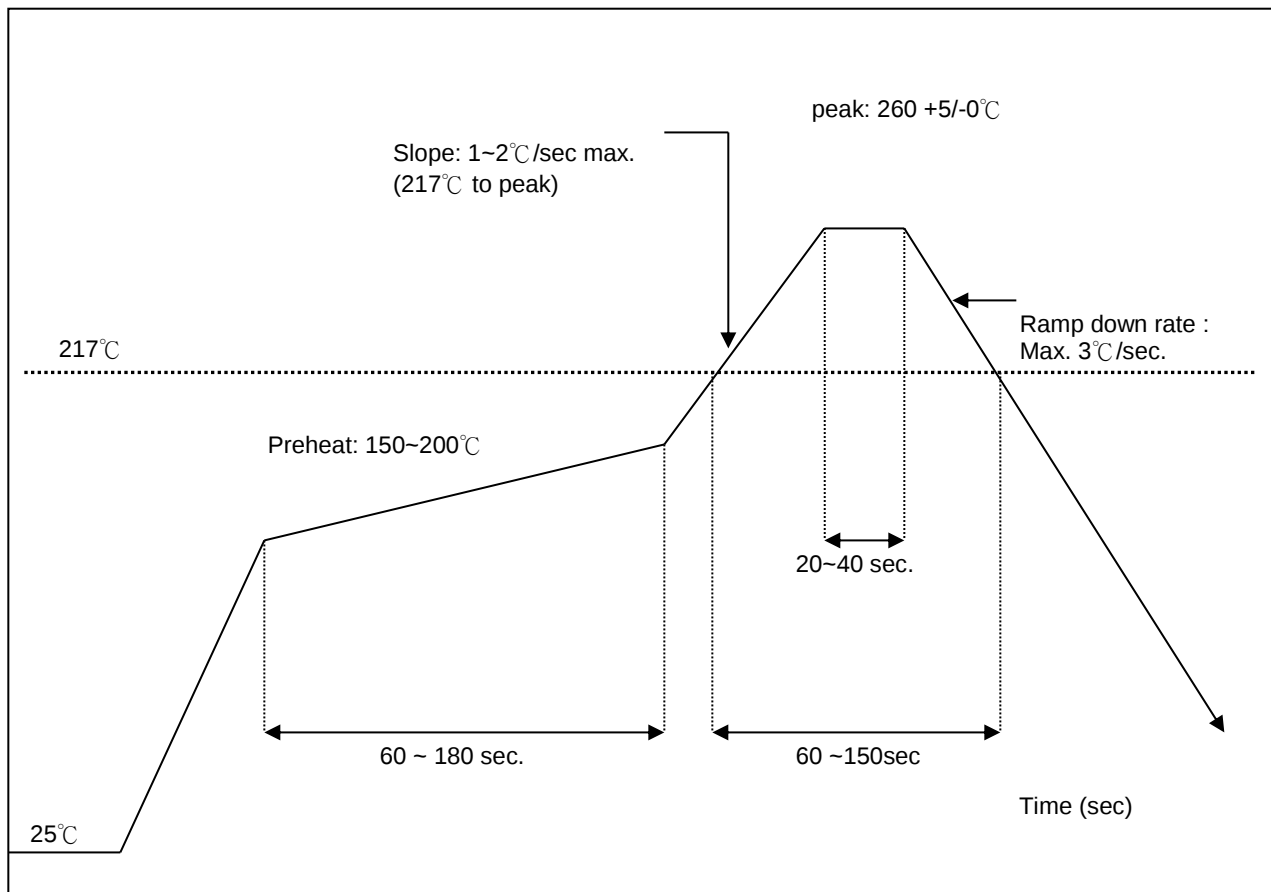
FIGURE 7-4: BM23 PCB FOOT PRINT



Note: The “Keep Out Area” is reserved for RF performance check.

## 7.2 REFLOW PROFILE

FIGURE 7-5: REFLOW PROFILE



### Soldering Recommendations

Stereo module was assembled using standard lead-free reflow profile IPC/JEDEC J-STD-020. The module can be soldered to the main PCB using standard leaded and lead-free solder reflow profiles. To avoid damaging of the module, the recommendations are listed as follows:

- Refer to Microchip Technology Application Note AN233 Solder Reflow Recommendation (DS00233) for the soldering reflow recommendations
- Do not exceed peak temperature (Tp) of 250 degree 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.

## 8.0 PACKAGING AND STORAGE INFORMATION

The module is packaged into trays (see following page) of sixty three (63) modules in a 7 x 9 format. These trays are then sealed into bags. Ten sealed bags are then placed in a box of 630 pieces with a dimension of 36 \* 16 \* 9.5 cm<sup>3</sup>.

The shelf life of each module in a sealed bag is 12 months at <40°C and <90% relative humidity.

After a bag is opened, devices that will be subjected to reflow solder or other high temperature processes must be mounted within 168 hours (7 days) at factory conditions of <30°C and <60% relative humidity.

## 8.1 ORDERING INFORMATION



**TABLE 5-1: Module Ordering Information**

| Part Number  | Description                                                                            |
|--------------|----------------------------------------------------------------------------------------|
| BM20SPKS1NBC | Bluetooth 4.1 BDR/EDR, Class 2 Surface Mount module with integrated antenna and shield |
| BM23SPKS1NB9 | Bluetooth 4.1 BDR/EDR, Class 2 Surface Mount module with integrated antenna and shield |

**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.

## A.1 United States

The 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 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.

### A.1.1 LABELING AND USER INFORMATION REQUIREMENTS

The 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:  
A8TBM23SPKXYC2A or  
Contains FCC ID: A8TBM23SPKXYC2A

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>.

### 3.1.2 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.

### 3.1.3 HELPFUL WEB SITES

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

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

## A.2 Canada

The BM23 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.

### A.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-BM23SPKXYC2 |
|----------------------------------------------------|

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. |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Transmitter Antenna (from Section 7.1.2 RSS-Gen, Issue 3, December 2010): User manuals for transmitters shall display the following notice in a conspicuous location:

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 should 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.

The above notice may be affixed to the device instead of displayed in the user manual.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

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.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi) and required impedance for each.

## A.2.2 OSURE

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).

## A.2.3 WEB SITES

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

## A.3 Europe

The BM23 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 BM23 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.

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](http://www.rtteca.com/html/download_area.htm).

**Note:** To maintain conformance to the testing listed in **Table A.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.

### A.3.1 ABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the BM23 module must follow CE marking requirements. The R&TTE Compliance Association **Technical Guidance Note 01** provides guidance on final product CE marking.

### A.3.2 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 A.3-1: EUROPEAN COMPLIANCE TESTING**

| Certificatio  | 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 |                                |          |            |               |      |

## 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 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](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/>

## A.4 Japan

The BM23 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.

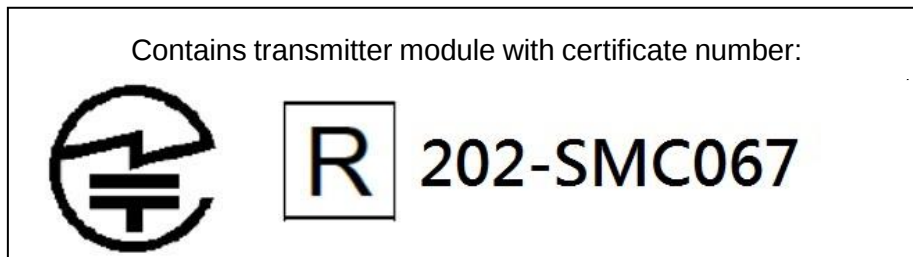
Integration of this module into a final product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed. Additional testing may be required:

- 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](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 BM23 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 BM23 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:



### 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 BM23 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.

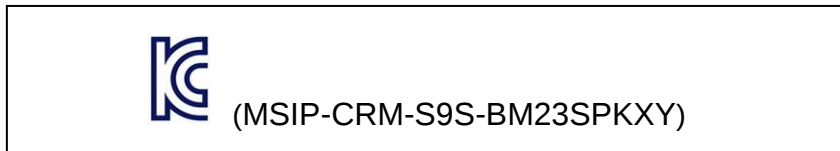
### A.5.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the BM23 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 BM23 module is labeled with its own KC mark. 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>

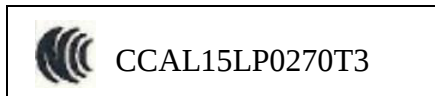
## A.6 Taiwan

The BM23 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

### A.6.1 LABELING AND USER INFORMATION REQUIREMENTS

The BM23 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。

### A.6.2 HELPFUL WEB SITES

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

## 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](http://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  
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#### India - Pune

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#### Japan - Osaka

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#### Japan - Tokyo

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#### Korea - Seoul

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