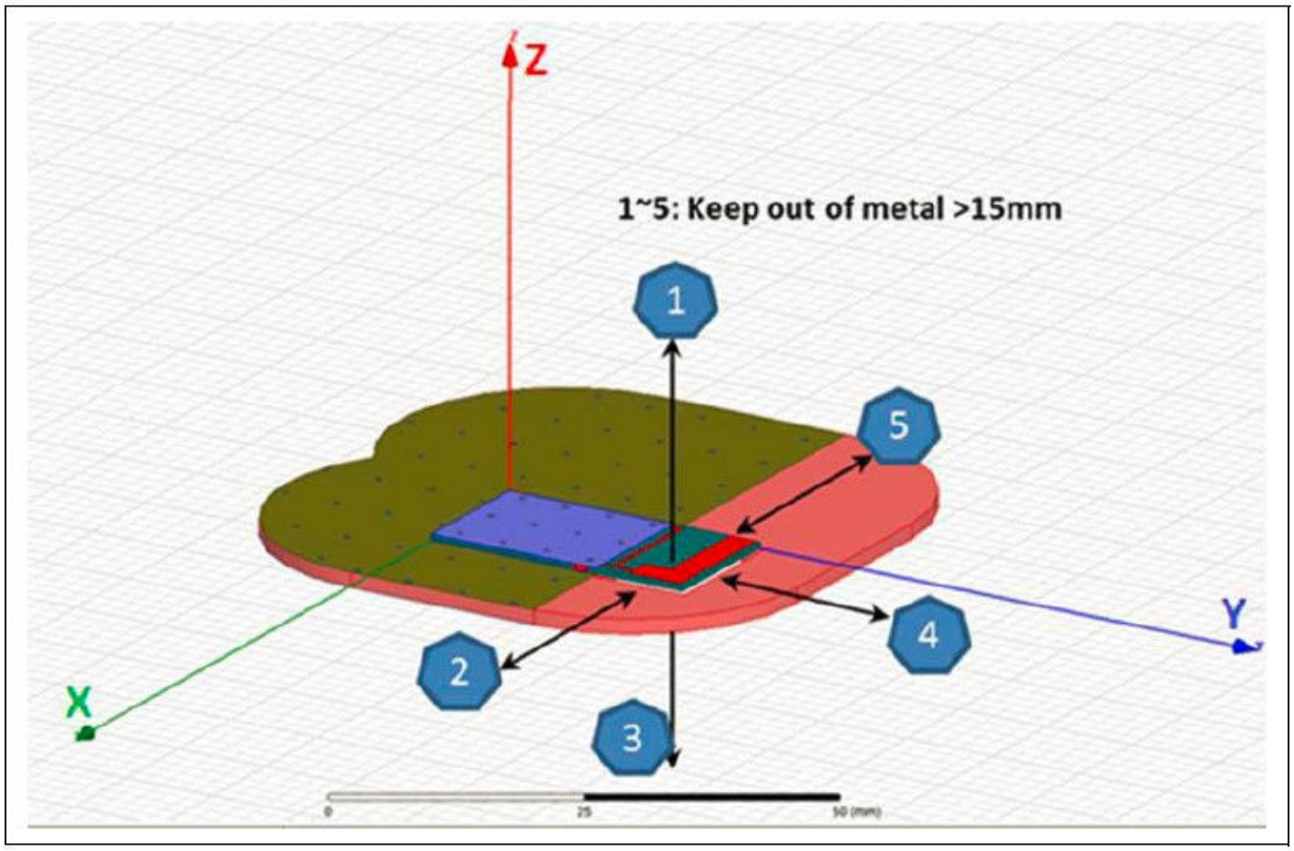
FIGURE 6-1: RECOMMENDED KEEPOUT AREA FOR PCB ANTENNA



6.2 Module Placement Guidelines

For a Bluetooth-enabled product, the antenna placement affects the overall performance of the system. The antenna requires free space to radiate RF signals and it must not be surrounded by the ground plane. Recommends that the areas underneath the antenna on the host PCB must not contain copper on top, inner, or bottom layers, as illustrated in Figure 6-1.

A low-impedance ground plane will ensure the best radio performance (best range, lowest noise). The ground plane can be extended beyond the minimum recommendation, as required for the main PCB EMC noise reduction.For the best range performance, keep all external metal at least 15 mm away from the on-board PCB trace antenna.

Figure 6-3 and Figure 6-4 illustrate examples of good and poor placement of the BM64 module on a host board with GND plane.

FIGURE 6-3: MODULE PLACEMENT GUIDELINES

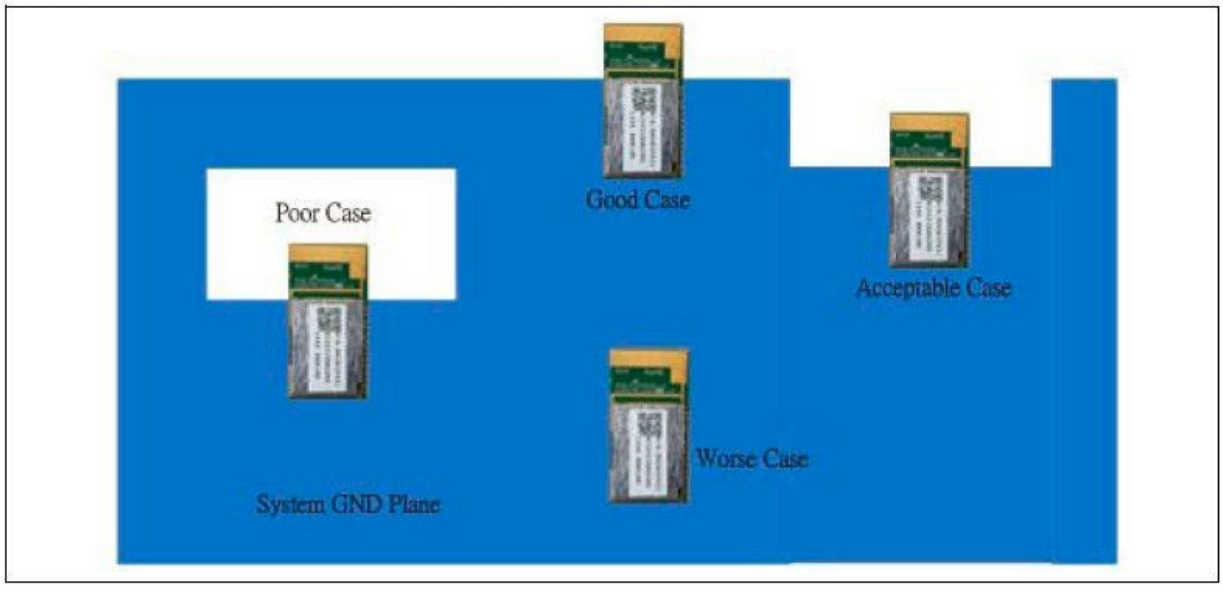
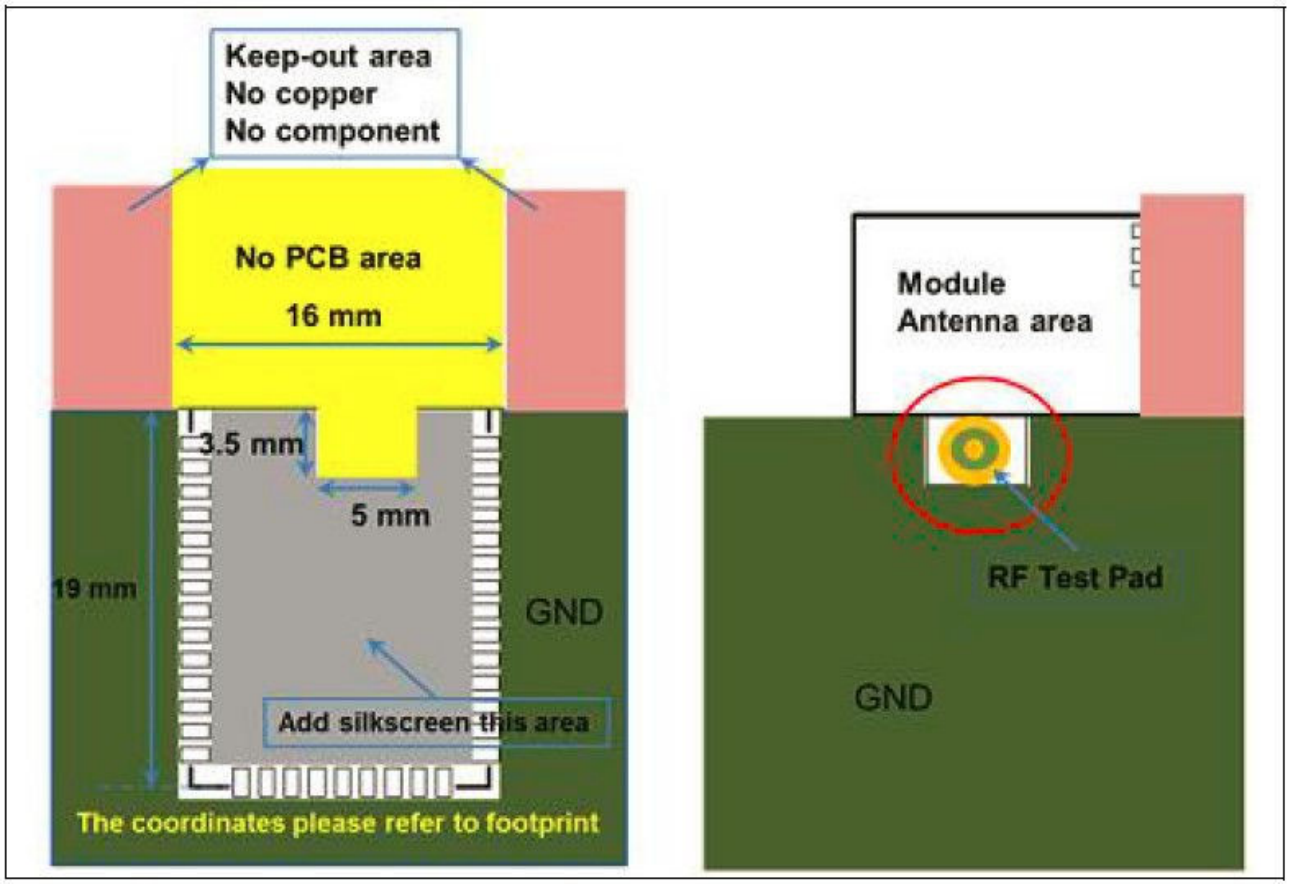


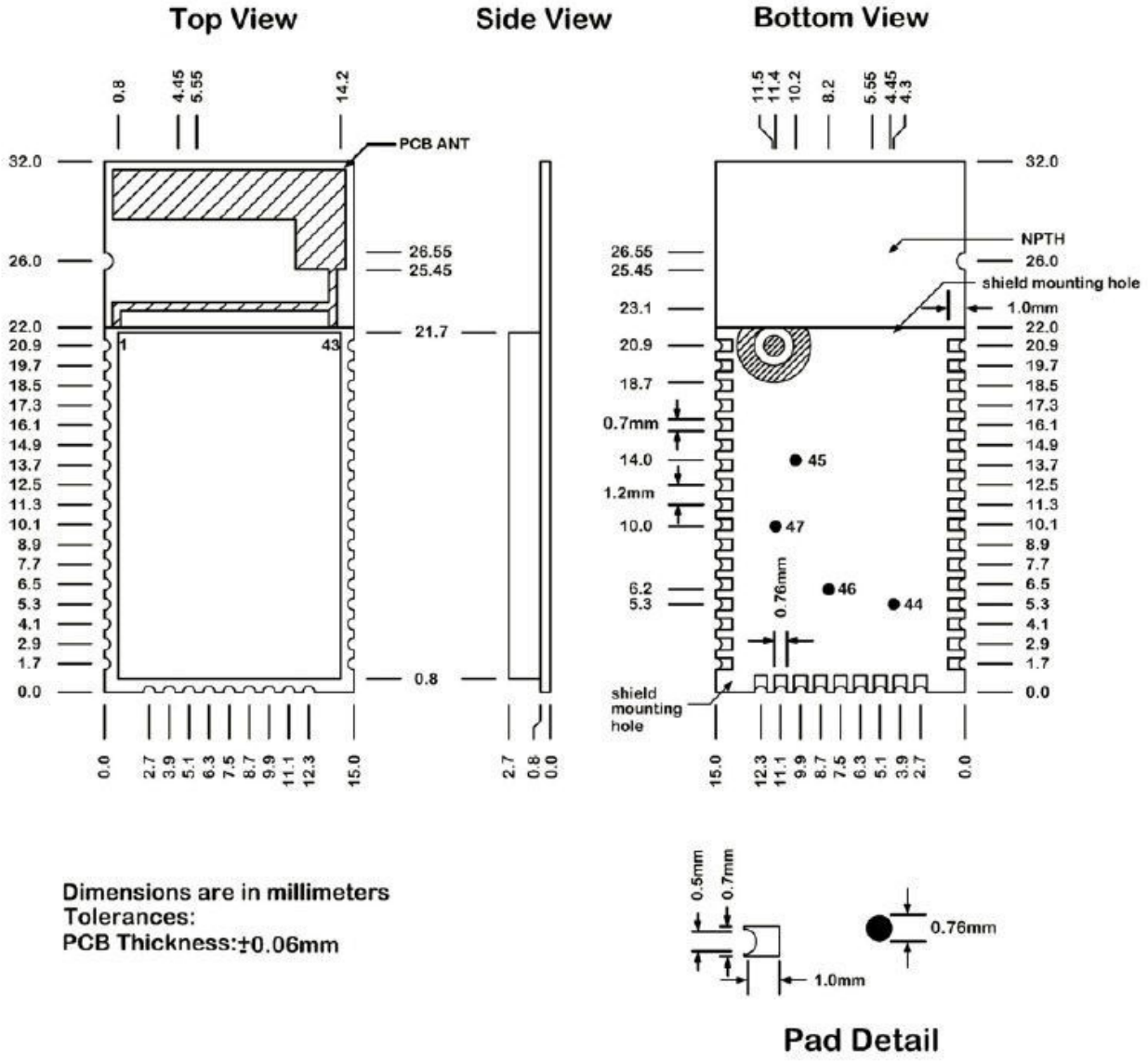
FIGURE 6-4: GND PLANE ON MAIN APPLICATION BOARD



7.0 PHYSICAL DIMENSIONS

Figure 7-2 illustrates the PCB dimension of the BM64 module.

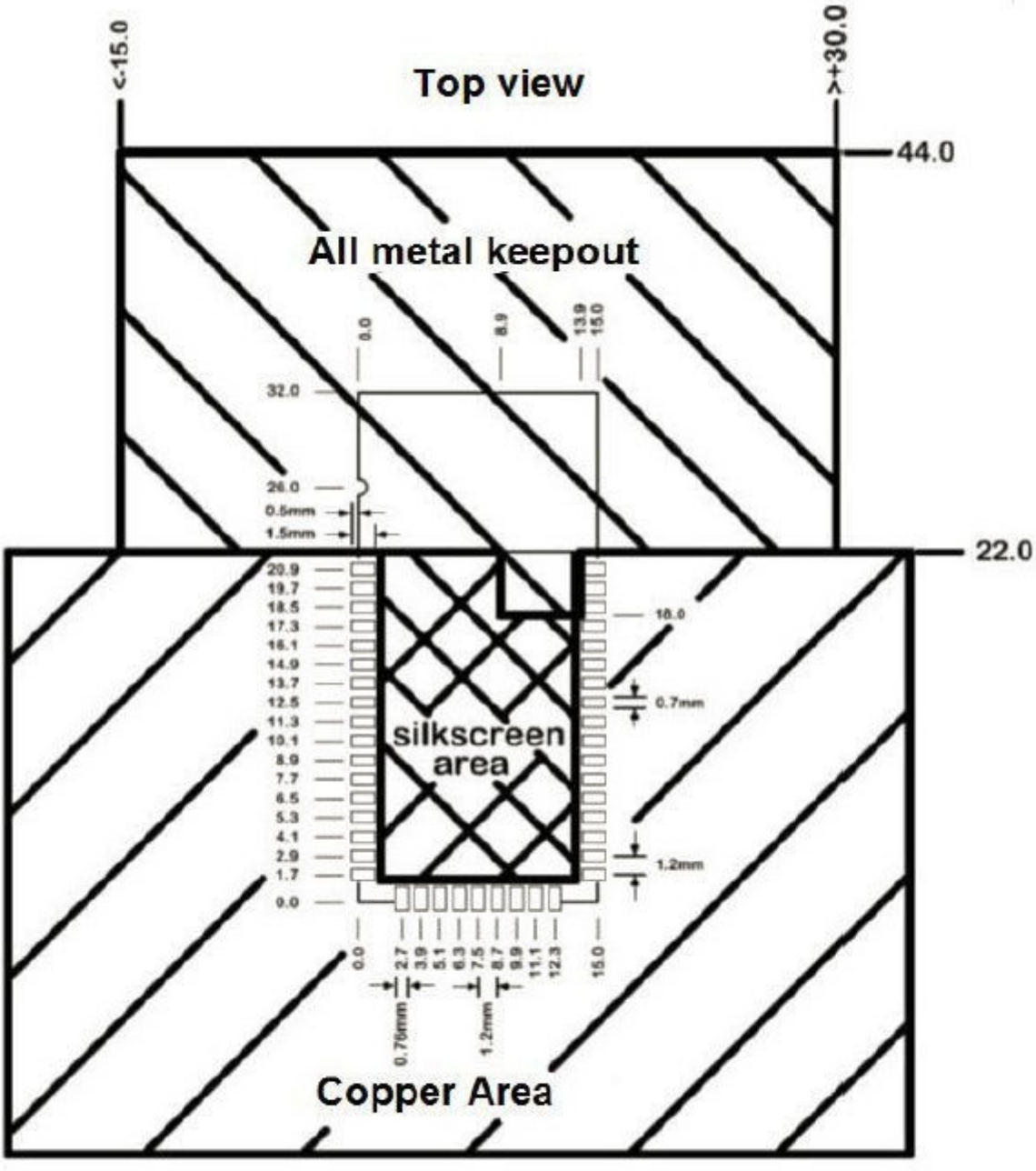
FIGURE 7-2: BM64 MODULE PCB DIMENSION



Note: PCB dimensions: X: 15.0 mm, Y: 32.0 mm and tolerances: 0.25 mm.

Figure 7-4 illustrates the recommended PCB footprint of the BM64 module.

FIGURE 7-4: RECOMMENDED BM64 MODULE PCB FOOTPRINT



Note 1: The keepout area is reserved to keep the RF test point away from GND plane.

2: All metal keepout is used to isolate the PCB antenna.

8.0 ELECTRICAL CHARACTERISTICS

This section provides an overview of the BM64 stereo audio module electrical characteristics. Additional information will be provided in future revisions of this document as it becomes available.

Absolute maximum ratings for the BM64 module are listed below. Exposure to these maximum rating conditions for extended periods may affect device reliability. Functional operation of the device at these or any other conditions, above the parameters indicated in the operation listings of this specification, is not implied.

8.1 Absolute Maximum Ratings

Ambient temperature under bias.....-20°C to +70°C

Storage temperature .....40°C to +125°C

Voltage on VDD with respect to VSS ..... -0.3V to +3.6V
Maximum output current sink by any I/O pin.....12 mA
Maximum output current sourced by any I/O pin.....12 mA

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

Table 8-1 through Table 8-9 provide the recommended operating conditions and the electrical specifications of the BM64 module.

TABLE 8-1: RECOMMENDED OPERATING CONDITION

Symbol	Parameter	Min.	Typical	Max.	Unit
BAT_IN	Input voltage for battery	3.2	3.8	4.2	V
ADAP_IN	Input voltage for adapter	4.5	5	5.5	V
TOPERATION	Operation temperature	-20	+25	+70	ºC

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

TABLE 8-2: I/O AND RESET LEVEL

Parameter	Min.	Typical	Max.	Unit
I/O supply voltage (VDD_IO)	3.0	3.3	3.6	V
I/O voltage levels				
V_{IL} input logic levels low	0	—	0.8	V
V_{IH} input logic levels high	2.0	—	3.6	V
V_{OL} output logic levels low	—	—	0.4	V
V_{OH} output logic levels high	2.4	—	—	V
RST_N				
Threshold voltage	—	1.6	—	V

Note: These parameters are characterized but not tested in manufacturing.

TABLE 8-3: 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	Headroom > 0.7V (ADAP_IN = 5V)	—	350	—	mA
	Headroom = 0.3V to 0.7V (ADAP_IN = 4.5V)	—	175(2)	—	mA
Trickle Charge Voltage Threshold		—	3	—	V
Battery Charge Termination Current, (% of Fast Charge Current)		—	10	—	%

Note 1: Headroom = VADAP_IN – VBAT

2: When VADAP_IN – VBAT > 2V, the maximum fast charge current is 175 mA for thermal protection.

3: These parameters are characterized but not tested in manufacturing.

TABLE 8-4: 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	µA
Shutdown Current	—	—	1	µA

Note 1: Test condition: BK_OUT = 1.8V with temperature +25°C.

2: These parameters are characterized but not tested in manufacturing.

TABLE 8-5: AUDIO CODEC ANALOG TO DIGITAL CONVERTER

T = 25°C, VDD = 2.8V, 1 kHz sine wave input, Bandwidth = 20 Hz to 20 kHz				
Parameter (Condition)	**Min.**	**Typical**	**Max.**	**Unit**
Resolution	—	—	16	Bit
Output Sample Rate	8	—	48	kHz
Signal to Noise Ratio **(Note 1)** (SNR at MIC or Line-in mode)	—	92	—	dB
Digital Gain	-54	—	4.85	dB
Digital Gain Resolution	—	2 to 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/rms
Input full-scale at minimum gain (differential)	—	800	—	mV/rms
3 dB bandwidth	—	20	—	kHz
Microphone mode (input impedance)	—	24	—	kOhm
THD+N (microphone input) at 30 mV/rms input	—	0.02	—	%

Note 1: f_{in} = 1 kHz, B/W = 20 Hz to 20 kHz, A-weighted, THD+N < 1%, 150 mV_{PP} input.

2: These parameters are characterized but not tested in manufacturing.

TABLE 8-6: AUDIO CODEC DIGITAL TO ANALOG CONVERTER

T = 25°C, VDD = 2.8V, 1 kHz sine wave input, Bandwidth = 20 Hz to 20 kHz					
Parameter (Condition)		**Min.**	**Typical**	**Max.**	**Unit**
Over-sampling rate		—	128	—	f_s
Resolution		16	—	20	Bit
Output Sample Rate		8	—	48	kHz
Signal to Noise Ratio **(Note 1)** (SNR at capless mode) for 48 kHz		—	98	—	dB
Signal to Noise Ratio **(Note 1)** (SNR at single-ended mode) for 48 kHz		—	98	—	dB
Digital Gain		-54	—	4.85	dB
Digital Gain Resolution		—	2 to 6	—	dB
Analog Gain		-28	—	3	dB
Analog Gain Resolution		—	1	—	dB
Output Voltage Full-scale Swing (AVDD = 2.8V)		495	742.5	—	mV/rms
Maximum Output Power (16 Ohm load)		—	34.5	—	mW
Maximum Output Power (32 Ohm load)		—	17.2	—	mW
Allowed Load	Resistive	—	16	O.C.	Ohm
	Capacitive	—	—	500	pF
THD+N (16 Ohm load) **(Note 2)**		—	0.05	—	%
Signal to Noise Ratio (SNR at 16 Ohm load) **(Note 3)**		—	98	—	dB

Note 1: fin = 1 kHz, B/W = 20 Hz to 20 kHz, A-weighted, THD+N < 0.01%, 0 dBFS signal, Load = 100 kOhm

2: fin = 1 kHz, B/W = 20 Hz to 20 kHz, A-weighted, -1 dBFS signal, Load =16 Ohm

3: fin = 1 kHz, B/W = 20 Hz to 20 kHz, A-weighted, THD+N < 0.05%, 0 dBFS signal, Load = 16 Ohm

4: These parameters are characterized but not tested in manufacturing.

TABLE 8-7: TRANSMITTER SECTION FOR BDR AND EDR

Parameter		**Min.**	**Typical**	**Max.**	**Bluetooth specification**	**Unit**
RF transmit power	Class 1	—	15.0(3)	—	< 20	dBm
	Class 2	—	2(3)	—	-6 to 4	dBm
EDR/BDR Relative transmit power		-4	-1.8	1	-4 to 1	dB

Note 1: The RF Tx power has modulation value.

2: The RF Transmit power is calibrated during the production using the MP tool software and MT8852 Bluetooth Test equipment.

3: Test condition: VCC_RF = 1.28V, temperature +25°C.

TABLE 8-8: RECEIVER SECTION FOR BDR AND EDR

	Modulation	**Min.**	**Typical**	**Max.**	**Bluetooth specification**	**Unit**
Sensitivity at 0.1% BER	GFSK	—	-89	—	≤-70	dBm
Sensitivity at 0.01% BER	π/4 DQPSK	—	-90	—	≤-70	dBm
	8 DPSK	—	-83	—	≤-70	dBm

Note 1: Test condition: VCC_RF = 1.28V with temperature +25°C.

2: These parameters are characterized but not tested in manufacturing.

8.2 Timing specifications

Figure 8-1 and Figure 8-2 illustrate the timing diagram of the BM64 module in I2S and PCM modes.

FIGURE 8-1: TIMING DIAGRAM FOR I²S MODES (MASTER/SLAVE)

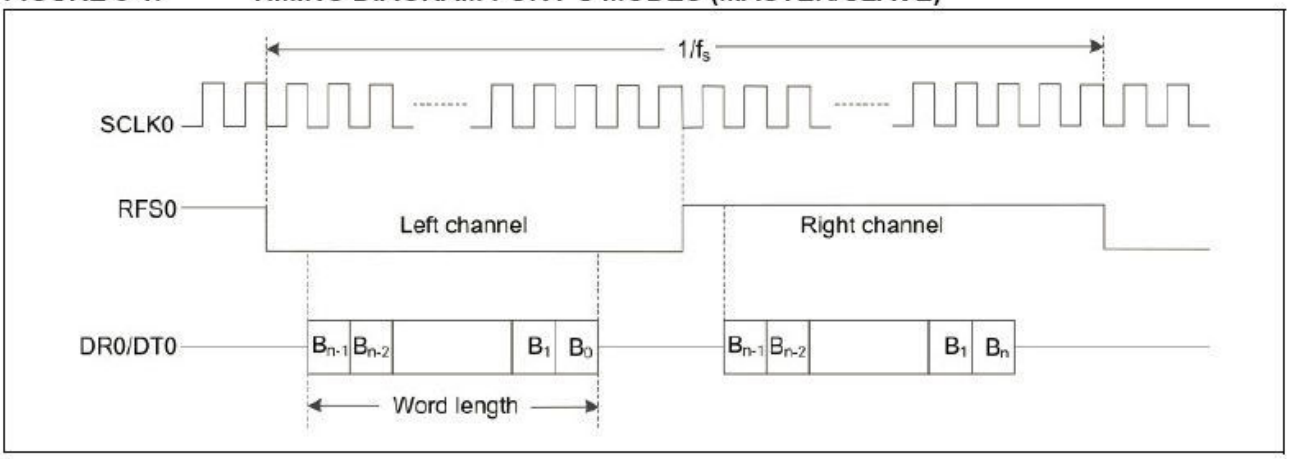
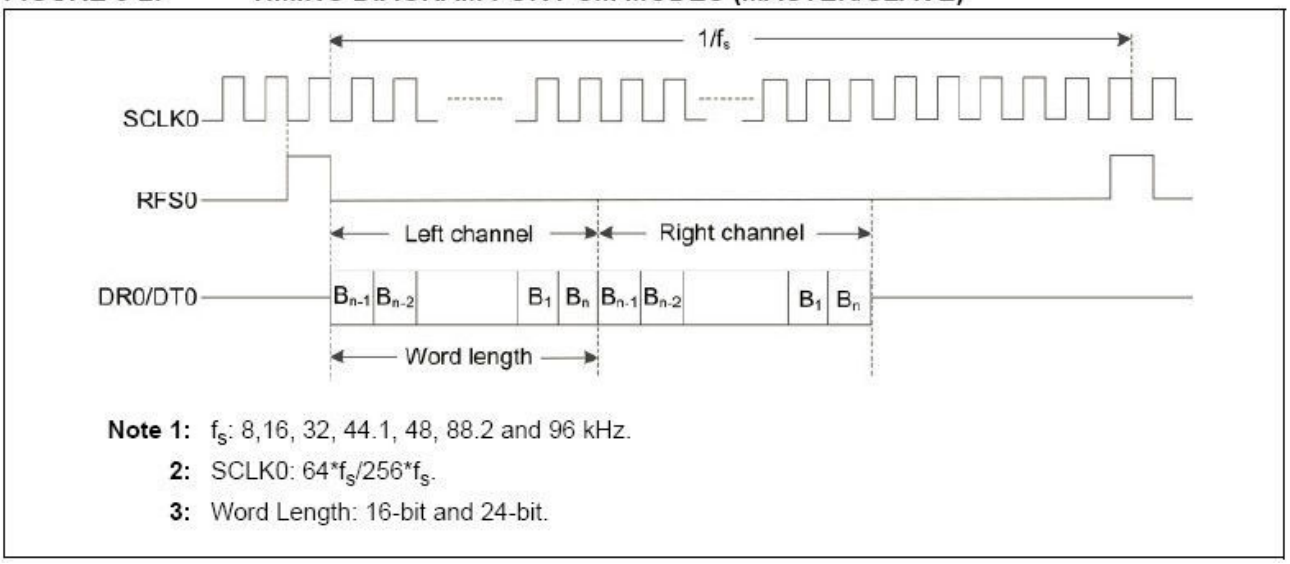


FIGURE 8-2: TIMING DIAGRAM FOR PCM MODES (MASTER/SLAVE)



Note 1: f_S: 8,16, 32, 44.1, 48, 88.2 and 96 kHz.

2: SCLK0: $64*f_S/256*f_S$.

3: Word Length: 16-bit and 24-bit.

Figure 8-3 illustrates the timing diagram of the audio interface.

FIGURE 8-3: AUDIO INTERFACE TIMING DIAGRAM

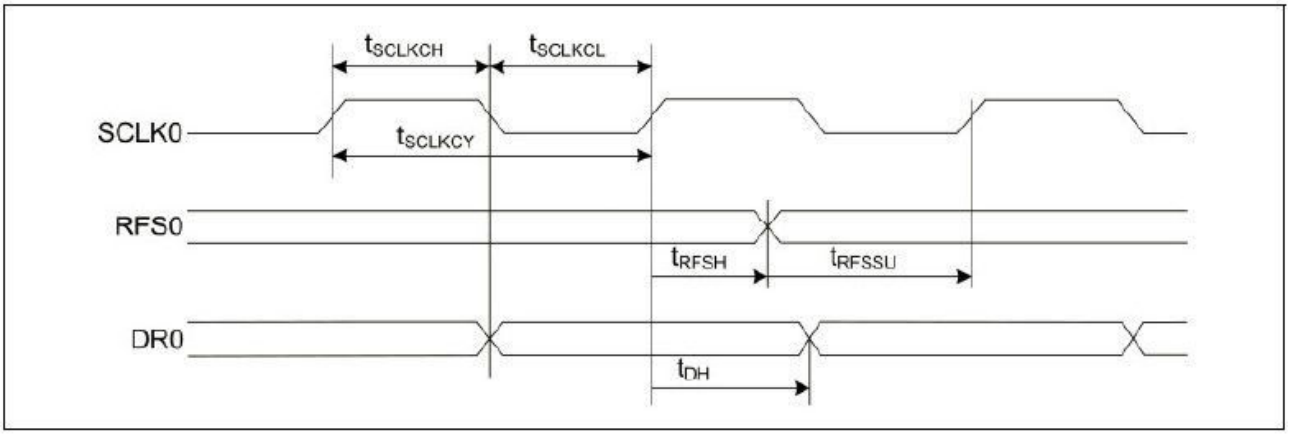


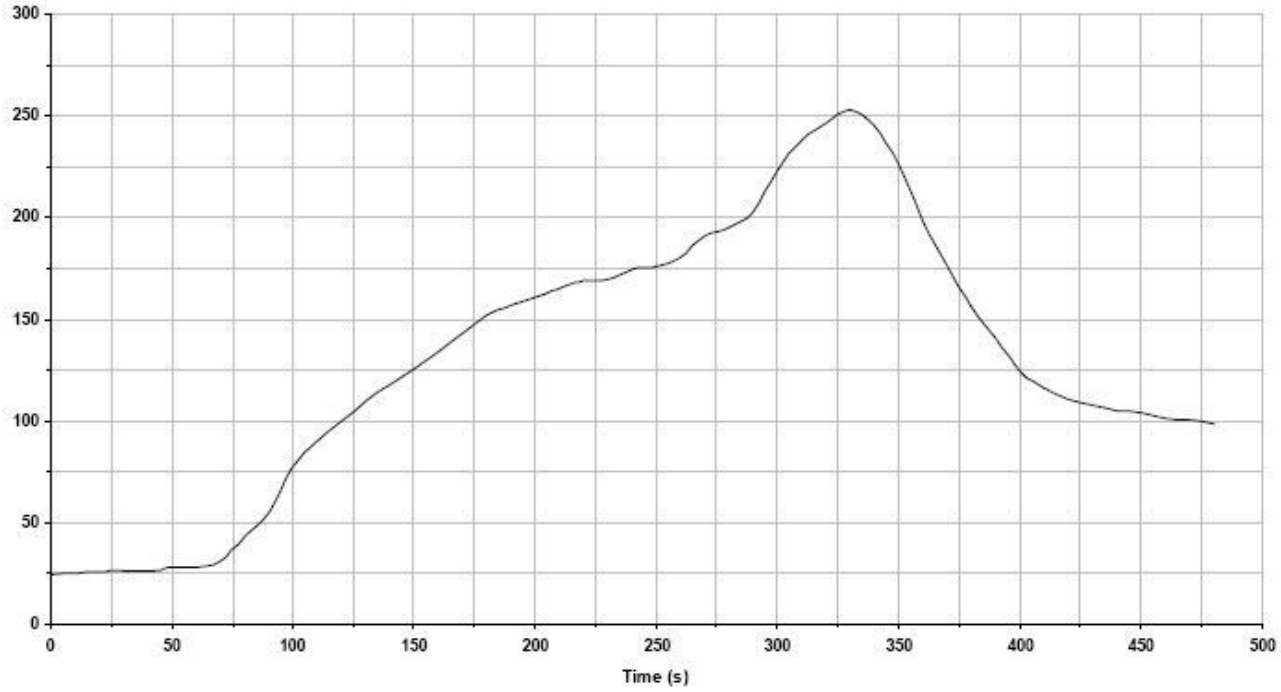
Table 8-10 provides the timing specifications of the audio interface.

TABLE 8-10: AUDIO INTERFACE TIMING SPECIFICATIONS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
SCLK0 duty ratio	d_{SCLK}	—	50	—	%
SCLK0 cycle time	t_{SCLKCY}	50	—	—	ns
SCLK0 pulse width high	t_{SCLKCH}	20	—	—	ns
SCLK0 pulse width low	t_{SCLKCL}	20	—	—	ns
RFS0 setup time to SCLK0 rising edge	t_{RFSSU}	10	—	—	ns
RFS0 hold time from SCLK0 rising edge	t_{RFSH}	10	—	—	ns
DR0 hold time from SCLK0 rising edge	t_{DH}	10	—	—	ns

Note: Test Conditions: Slave Mode, f_S = 48 kHz, 24-bit data and SLK0 period = 256 f_S.

9.0 Recommended Reflow Temperature Profile:



Key features of the profile:

-Initial Ramp=1-2.5℃/sec to 175℃ equilibrium
-Equilibrium time=60 to 80 seconds
-Ramp to Maximum temperature (250℃)=3℃/sec Max
-Time above liquidus temperature(217℃): 45 - 90 seconds
-Device absolute maximum reflow temperature: 250℃

Standard Packing Information

Module packing Box (Max 2880pcs module per box)

48pcs per tray, 10trays per ESD bag, vacuum packing sealed in ESD PE bag.

Maximum modules per ESD bag is 480pcs

Module packing bag dimension: 500.0mm x 390.0mm

Delivering carton box

To hold of module carton box for shipment (Max 2880pcs modules per box)

Delivery Carton Box dimension: 400.0mm x 290.0mm x 360.0mm (W x D x H)

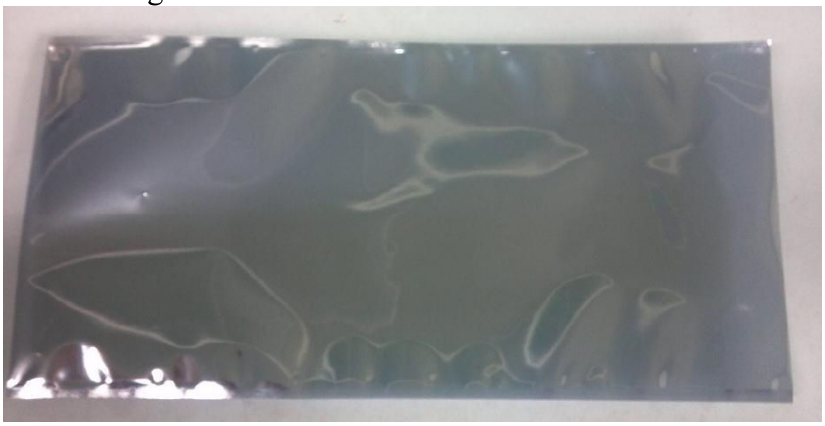
ESD tray dimension: 320.00mm x 150.00mm x 10mm(W x D x H)

ESD tray

ESD Lid dimension: 320.00mm x 150.00mm x 0.8mm(W x D x H)

ESD lid(cover on the tray)

ESD PE bag dimension: 500.00mm x 390.00mm



Vacuum packing (10trays per ESD bag)

Carton box dimension:400.0mm x 290.0mm x 360.0mm (W x D x H)

Carton box (6bags in per carton box)

Ordering Information

No	Items	Ordering Code	Description
1	BM64 Class1 module	BM64C1	Bluetooth output power Class1 BT4.2 Stereo Audio Module
2	BM64 Class2 module	BM64C2	Bluetooth output power Class2 BT4.2 Stereo Audio Module

Document History

Revision	Date	History
Draft V0.1	2017-05-2	First release
V0.2	2017-06-28	Modify PCB thickness.
V0.3	2017-07-05	Add packaging information

Contact Information
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R&D Office:
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Tel: 86-755-23353206
Fax: 86-755-23353151

China Factory:
No 192, Run Tang Ind., DanHu Community, FuCheng, LongHua District, Shenzhen, China
Tel: 86-755-28016180
Fax: 86-755-28016097
E-mail: sales6@sunitec-cn.com or manager@sunitec-cn.com
Http://www.sunitec-cn.com

FCC Statement

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.
Changes or modifications not expressly approved by the party responsible for compliance could void the user' s authority to operate the equipment.
NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursua nt to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful inte rference in a residential installation. This equipment generates uses and can radiate radio frequency energy a nd, if not installed and used in accordance with the instructions, may cause harmful interference to radio com munications. 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 turn ing 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.
- Reorient or relocate the receiving antenna.
- Reorient or relocate the receiving antenna.
-Consult the dealer or an experienced radio/TV technician for help important announcement

Important Note:

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
Country Code selection feature to be disabled for products marketed to the US/Canada.
This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2. The transmitter module may not be co-located with any other transmitter or antenna,

Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.
Any company of the host device which install this modular with limit modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C:15.247 and 15.209 requirement, only if the test result comply with FCC part 15.247 and 15.209 requirement, then the host can be sold legally.

End Product Labeling

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: Contains Transmitter Module FCC ID: 2AMX3BM64C1.

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.
The end user manual shall include all required regulatory information/warning as show in this manual.

The modular is not intended to be fielded serviceable as without shielding, host manufacturer must be considered shielding when integrating a module.

When the module is installed inside another device, the user manual of this device must contain below warning statements;

1. 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.
   (2) This device must accept any interference received, including interference that may cause undesired operation.
2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.