
MB2000L User Manual

PRODUCT	Bluetooth Module
MODEL NAME	MB2000L
TRADE MARK	MCSLOGIC

MCSLOGIC

Revision History

Version	Date	Revision Description
0.1	Aug, 2018	Initial release
1.0	Dec.2018	Electrical characteristic
1.1	19.Dec.2018	PCB size etc

1. Introduction

MCS Logic Bluetooth Module(MB2000L) is a fully integrated RF, Baseband controller, etc., a completed Bluetooth subsystem. It provides a UART interface, Analog/I2S/SPDIF audio output, MIC and functional GPIO. It is based on BES 2000L with specific interface design to meet Customer Products.

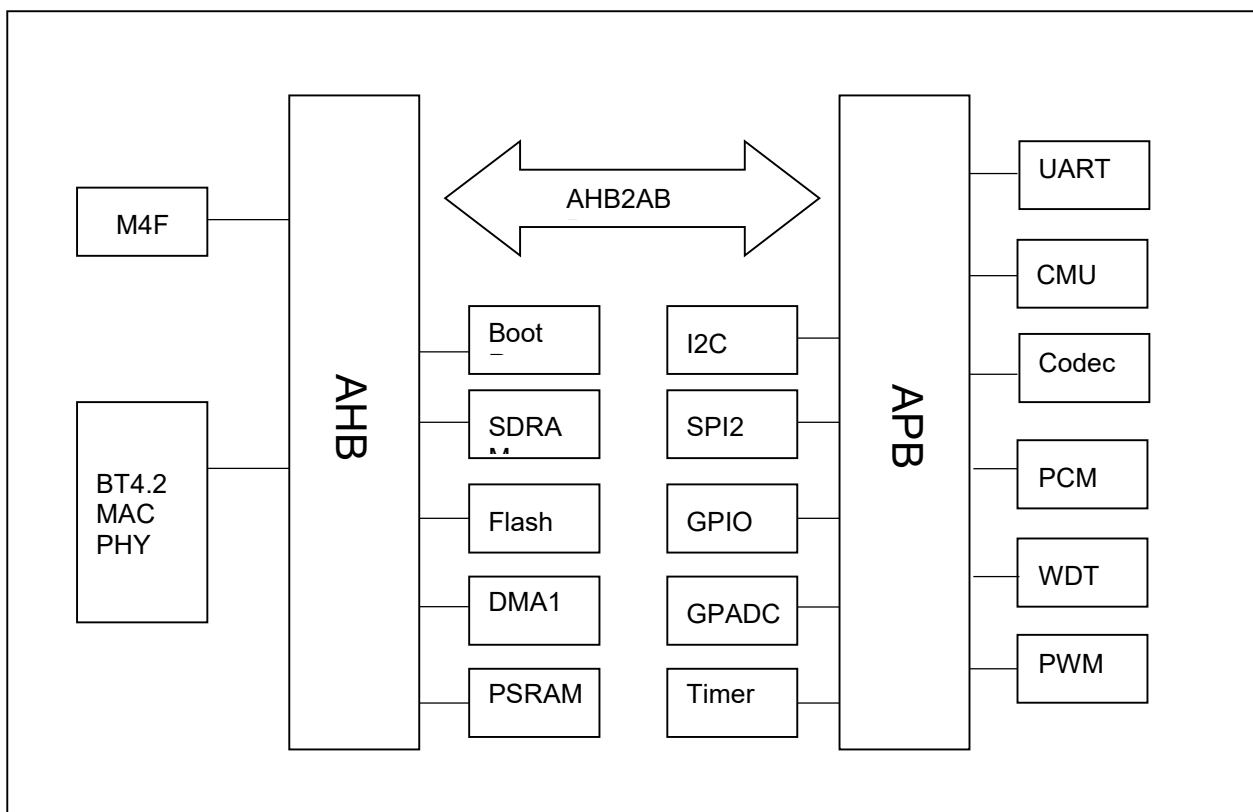
2. General Features

2.1 Module Features

- Operation Range (Class I)
 - Operating Temperature Range : -20°C ~ 80°C
 - Operating VDD Range : 3.1V ~ 4.2V
 - Output Power : 6dBm
 - Interfaces : UART, Analog/I2S/SPDIF Audio In/Out Functional I/O
 - Internal Antenna
 - Compatible with Bluetooth Specification 4.2 Dual mode
 - 24-bit Internal Stereo CODEC
 - 8Mbit flash on-chip.
 - ROHS Compliant
 - GFSK/8DPSK sf modulation, 79 channel
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2.2 Firmware Features

- Host Interface : UART
- Support Profile : A2DP (Sink, Source), AVRCP Controller, HFP, SPP
- Profile version : A2DP V1.3, AVRCP1.5, HFP1.5, SPP1.1
- SBC codec Support, AAC Codec Optional
- Firmware upgrade through Uart.



3. Pin Configuration

Symbol	Description
I	CMOS input
O	Output

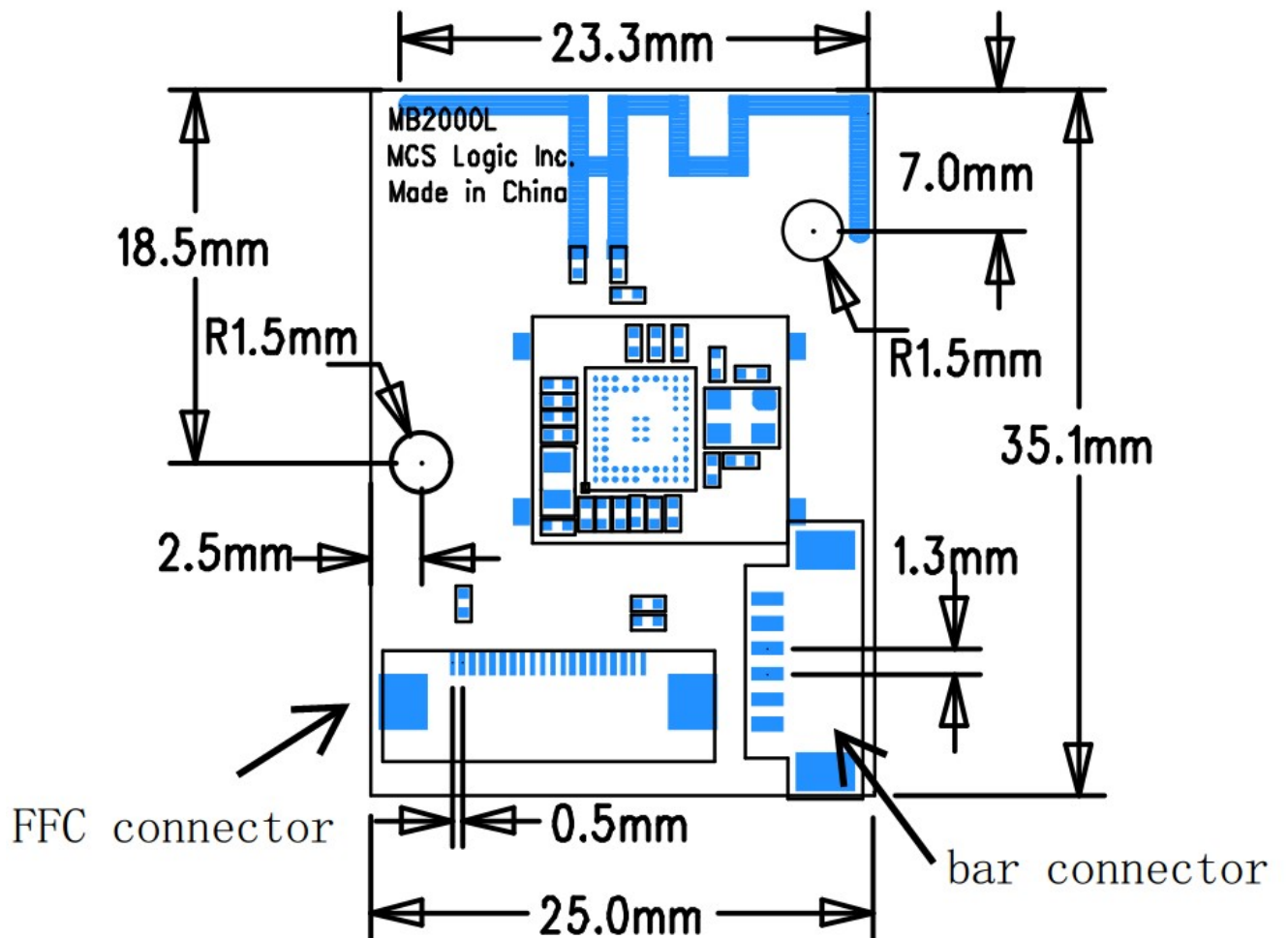
Pin descriptions for the MB2000L Module

N O	Pin Name	I/O	Description
1	GPIO_16	I/O	GPIO function port
2	NRESET	I	System Reset(Low Active)
3	UART_RX	I	UART Data Input active high
4	UART_TX	O	UART DataOutput active high
5	GND	I	DIGITAL Ground
6	MUTE(GPIO_17)	I/O	GPIO function port
7	I2S_SCK	O	I2S Bit clock
8	I2S_SD_OUT	O	I2S Data output
9	I2S_SD_IN	I	I2S Data input
10	I2S_WS	O	I2S LR clock
11	GND	I	DIGITAL Ground
12	AOUT_P_L	O	Analog audio positive left output
13	AOUT_N_L	O	Analogaudio negative left output
14	AOUT_P_R	O	Analog audio positive right output
15	AOUT_N_R	O	Analog audio negative right output
16	GND	I	DIGITAL Ground
17	SPDIF_OUT	O	optical output / upgrade TX
18	SPDIF_IN	I	optical input // upgrade RX
19	GND	I	DIGITAL Ground
20	VDD	I	VCC 3.3V

AUX in connector			
NO	Pin Name	I/O	Description
1	AUX_P_L	I	Analog audio positive left input
2	AUX_N_L	I	Analogaudio negative left input
3	AGND	O	Analog Ground
4	AUX_P_R	I	Analog audio positive right input

5	AUX_N_R	I	Analog audio negative right input
6	MIC_BIAS	O	Microphone bias

4. Dimension



5. Electrical CHARACTERISTICS

Table 5- 1 DC Electrical Specification (Recommended Operation Conditions)

SYMBOL	DESCRIPTION	MIN	TYP	MAX	UNIT
VDD	Supply Voltage from LDO	3.1	3.3	4.2	V
Tamb	Ambient Temperature	-20	27	80	°C
VIL	CMOS Low Level Input	0		0.3*VIO	V
VIH	CMOS High Level Input	0.7*VIO		VIO	V
VTH	CMOS Threshold Voltage		0.5*VIO		V

Notes: 1. VIO=3.0V

Table 5- 2 DC Electrical Specification (Absolute Maximum Ratings)

SYMBOL	DESCRIPTION	MIN	TYP	MAX	UNIT
Tamb	Ambient Temperature	-30		+80	°C
IIN	Input Current	-10		+10	mA
VIN	Input Voltage	-0.3		VIO+0.3	V
VIna	LNA Input Level			0	dBm

Notes: 1. VIO=3.0V

Table 5- 3Work Current (VDD 3.3V DCDC mode)

SYMBOL	DESCRIPTION	MIN	TYP	MAX	UNIT
Both scan	1.28s interval page and	/	450	/	uA
Sniff mode	500ms interval without scan Nsleep=4	/	250	/	uA
Play audio	SBC	/	17	/	mA
Telephone call	ESCO 2EV3 with one retransmitted	/	17	/	mA
Power off	Soft power off mode	/	7	/	uA

Table 5- 4Receiver Characteristics - Basic Data Rate (VDD = 3.3 V, TA = 27°C, unless otherwise specified)

SYMBOL &PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Sensitivity @0.1% BER		/	-92	/	dBm
Maximum received signal@0.1% BER		0	/	/	dBm
C/I co-channel		/	10	/	dB

Adjacent channel selectivity C/I	F=F0 + 1MHz	/	/	-4	dB
	F=F0 - 1MHz	/	/	-5	dB
	F=F0 + 2MHz	/	/	-23	dB
	F=F0 - 2MHz	/	/	-41	dB
	F=F0 + 3 MHz	/	/	-44	dB
	F=F0 - 3MHz	/	/	-44	dB
Adjacent channel selectivity C/I	F=Fimage	/	/	-23	dB
Out-of-band blocking performance	30MHz–2000MHz	-10	/	/	dBm
	2000MHz–2400MHz	-27	/	/	dBm
	2500MHz–3000MHz	-27	/	/	dBm
	3000MHz–12.5GHz	-10	/	/	dBm
Intermodulation		-35	/	/	dBm
Spurious output level		-150	/	/	dBm/Hz

Table 5- 5 Transmit Characteristics - Basic Data Rate(VDD = 3.3V, TA = 27 °C, unless otherwise specified)

SYMBOL & PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
General specifications					
Maximum RF transmit power		/	6	10	dBm
RF power control range		30	/	/	dB
20dB band width		/	0.9	/	MHz
Adjacent channel transmit power	F=F0 + 1MHz	/	-23	/	dBm
	F=F0 - 1MHz	/	-23	/	dBm
	F=F0 + 2MHz	/	-40	/	dBm
	F=F0 - 2MHz	/	-40	/	dBm
	F=F0 + 3MHz	/	-45	/	dBm
	F=F0 - 3MHz	/	-45	/	dBm
	F=F0 + >3MHz	/	/	-48	dBm
	F=F0 - >3MHz	/	/	-48	dBm
Δf1avg Maximum modulation		/	164	/	kHz
Δf2max Minimum modulation		/	145	/	kHz
Δf2avg/Δf1avg		0.8	/	/	/
ICFT		/	4	/	kHz
Drift rate		/	0.1	/	kHz/50 us
Drift (1 slot packet)		/	-2	/	kHz
Drift (5 slot packet)		/	-2	/	kHz

Table 5- 6 Receiver Characteristics - Enhanced Data Rate(VDD = 3.3 V, TA = 27°C, unless otherwise specified)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
$\pi/4$ DQPSK					
Sensitivity @0.01% BER		/	-93	/	dBm
Maximum received signal@0.1% BER		0	/	/	dBm
C/I co-channel		/	/	12	dB
Adjacent channel selectivity C/I	F=F0 + 1MHz	/	/	-1	dB
	F=F0 - 1MHz	/	/	-3	dB
	F=F0 + 2MHz	/	/	-23	dB
	F=F0 - 2MHz	/	/	-36	dB
	F=F0 + 3MHz	/	/	-44	dB
	F=F0 - 3MHz	/	/	-45	dB
Adjacent channel selectivity C/I	F=Fimage	/	/	-20	dB
8DPSK					
Sensitivity @0.01% BER		/	-81	/	dBm
Maximum received signal@0.1% BER		0	/	/	dBm
C/I c-channel		/	/	20	dB
Adjacent channel selectivity C/I	F=F0 + 1MHz	/	/	3	dB
	F=F0 - 1MHz	/	/	1	dB
	F=F0 + 2MHz	/	/	-18	dB
	F=F0 - 2MHz	/	/	-30	dB
	F=F0 + 3MHz	/	/	-35	dB
	F=F0 - 3MHz	/	/	-35	dB

Adjacent channel selectivity C/I	F=Fimage	/	/	-18	dB
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Table 5- 7 Transmit Characteristics - Enhanced Data Rate(VDD = 3.3 V, TA = 27°C, unless otherwise specified)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Maximum RF transmit		/	/	10	dBm
Relative transmit		/	-1.6	/	dB
$\pi/4$ DQPSK max w0		/	7.4	3	kHz
$\pi/4$ DQPSK max wi		/	6.7	20.8	kHz
$\pi/4$ DQPSK max wi +		/	2.4	32	kHz
8DPSK max w0		/	7.1	2.5	kHz
8DPSK max wi		/	4.4	26	kHz
8DPSK max wi + w0		/	2.7	32	kHz
$\pi/4$ DQPSK modulation accuracy	RMS DEVM	/	4.7	9.2	%
	99% DEVM	/	/	18.2	%
	Peak DEVM	/	8.8	23.3	%
8DPSK modulation accuracy	RMS DEVM	/	4.6	9.5	%
	99% DEVM	/	/	17.5	%
	Peak DEVM	/	11.3	20.4	%
In-band spurious emissions	F=F0 +1MHz	/	-25	/	dBm
	F=F0 - 1MHz	/	-25	/	dBm
	F=F0 +2MHz	/	-37	/	dBm
	F=F0 -2MHz	/	-37	/	dBm
	F=F0 + 3MHz	/	-42	/	dBm
	F=F0 - 3MHz	/	-42	/	dBm
	F=F0+/->3MHz	/	/	-47	dBm
EDR differential phase encoding		/	100	/	%

Table 5- 8 Codec – Digital to Analogue Converter

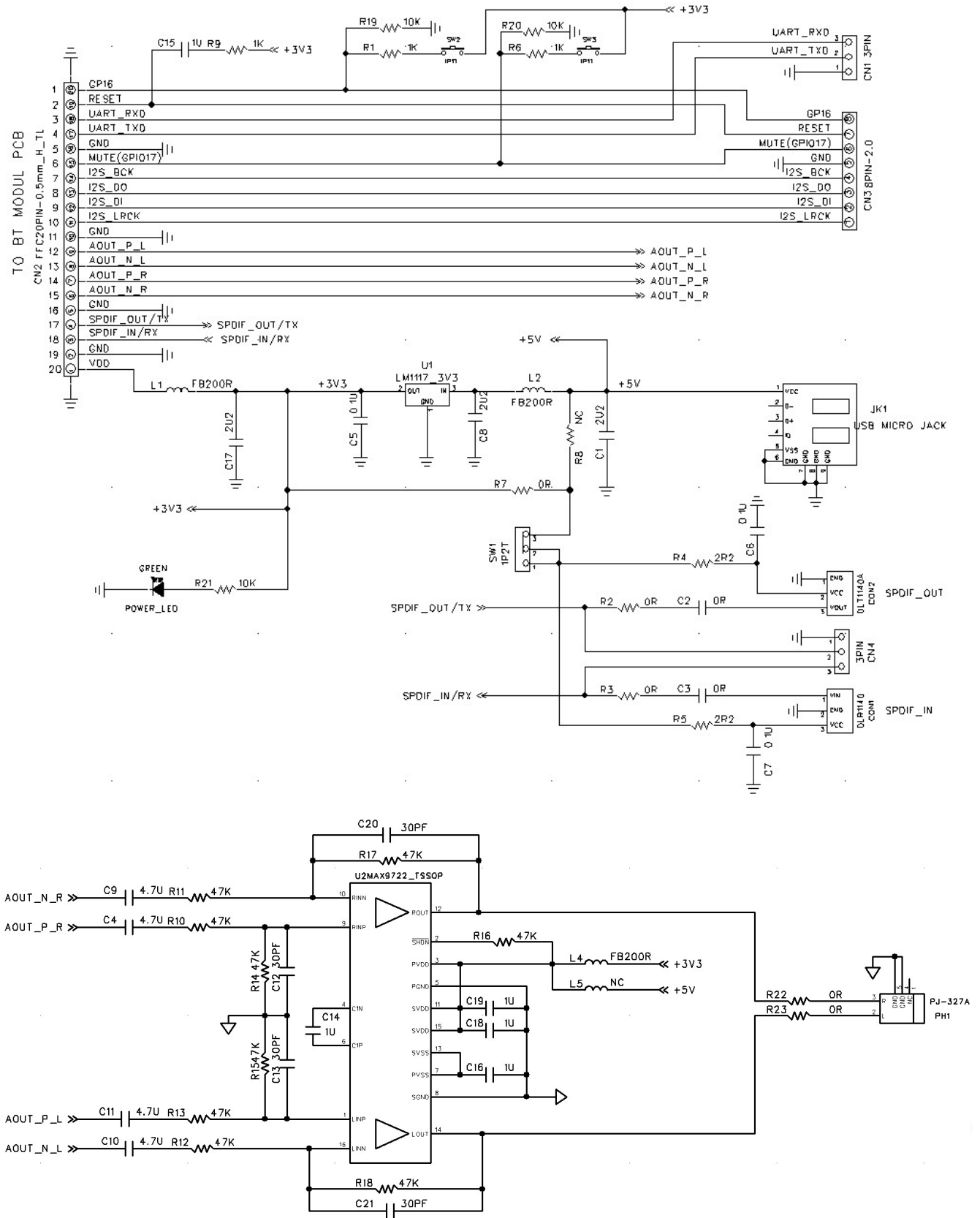
PARAMETER	CONDITIONS			MIN	TYP	MAX	UNIT
Resolution				/	/	24	Bits
Output Sample Rate, Fsample				8	/	192	kHz
SNR	fin=1kHz	Fsample	Load				
	B/W=20Hz~20kHz	48kHz	100kΩ	/	105	/	dB
	A-Weighted	48kHz	32Ω	/	105	/	dB
	700mvrmsoutput	48kHz	16Ω	/	105	/	dB
THD+N	fin=1kHz	Fsample	Load				
	B/W=20Hz~20KHz	8kHz	100kΩ	/	-84	-70	dB
	700mvrmsoutput	8kHz	32Ω	/	-84	-70	dB
		8kHz	16Ω	/	-84	-70	dB
		48kHz	100kΩ	/	-84	-70	dB
		48kHz	32Ω	/	-84	-70	dB
		48kHz	16Ω	/	-84	-70	dB
Digital Gain	Digital Gain Resolution = 1dB			-25	/	5	dB
Analogue Gain	Analogue Gain Resolution = 0.75dB			-18	/	5	dB
Output Voltage				/	/	700	mV rms
Stereo Separation (Crosstalk)				/	-80	/	dB

Notes: Ratio of output level with a 1-kHz full-scale input, to the output level playing an all-zero signal, measured A-weighted over a 20-Hz to 20-kHz bandwidth.

Table 5- 9 Codec - Analogue to Digital Converter

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNIT
Resolution			/	/	24	Bits
Output Sample Rate, Fsample			8	/	192	kHz
SNR	fin=1kHz	Fsample				
	B/W=20Hz~20kHz A-Weighted 1.4Vrms input	48kHz	/	96	/	dB
THD+N	fin=1kHzB/W=20Hz~20KHz 1.4Vrmsinput	Fsample				
		48kHz	/	-82	/	dB
Digital Gain	Digital Gain Resolution = 2dB		-12	/	16	dB
Analogue Gain	Analogue Gain Resolution = 0.75dB		0	/	41.25	dB

6. Application Circuit



7. Label information

8. Packing information

9. Administrative Regulations on Low Power Radio Waves Radiated Devices warning:

Article 12

Without permission granted by the NCC, any company, enterprise, or user is not allowed to change frequency, enhance transmitting power or alter original characteristic as well as performance to a approved low power radio-frequency devices.

Article 14

The low power radio-frequency devices shall not influence aircraft security and interfere legal communications; If found, the user shall cease operating immediately until no interference is achieved.

The said legal communications means radio communications is operated in compliance with the Telecommunications Act.

The low power radio-frequency devices must be susceptible with the interference from legal communications or ISM radio wave radiated devices.

Antenna :

Antenna type:PCB Antenna

Antenna gain:3.25dBi

FCC rules:

FCC part 15C 15.247

10. 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.

Any 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, 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.

We will retain control over the final installation of the modular such that compliance of the end product is assured. In such cases, an operating condition on the limit modular approval for the module must be only approved for use when installed in devices produced by a specific manufacturer. If any hardware modify or RF control software modify will be made by host manufacturer,C2PC or new certificate should be apply to get approval,if those change and modification made by host manufacturer not expressly approved by the party responsible for compliance ,then it is illegal.

FCC Radiation Exposure Statement

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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: 2ATGFMB2000L Or Contains FCC ID: 2ATGFMB2000L"

When the module is installed inside another device, the user manual of the host 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.

Note: 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.

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.

Any company of the host device which install this modular with limit modular approval should perform the test of radiated & conducted emission and spurious emission,etc. according to FCC part 15C : 15.247 and 15.209 & 15.207 ,15B Class B requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 & 15.207 ,15B Class B requirement , then the host can be sold legally.

11. IC Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(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.

Cet appareil contient des émetteurs / récepteurs exemptés de licence conformes aux RSS (RSS) d'Innovation, Sciences et Développement économique Canada. Le fonctionnement est soumis aux deux conditions suivantes :

- (1) Ce dispositif ne peut causer d'interférences ; et
- (2) Ce dispositif doit accepter toute interférence , y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

IC Radiation Exposure Statement

The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device.

This modular complies with IC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body. Cette modulaire doit être installé et utilisé à une distance minimum de 20 cm entre le radiateur et le corps de l'utilisateur.

If the IC 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 IC: 25108-BES2000L"

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

1. This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(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.
2. Cet appareil contient des émetteurs / récepteurs exemptés de licence conformes aux RSS (RSS) d'Innovation, Sciences et Développement économique Canada. Le fonctionnement est soumis aux deux conditions suivantes :
 - (1) Ce dispositif ne peut causer d'interférences ; et
 - (2) Ce dispositif doit accepter toute interférence , y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

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
