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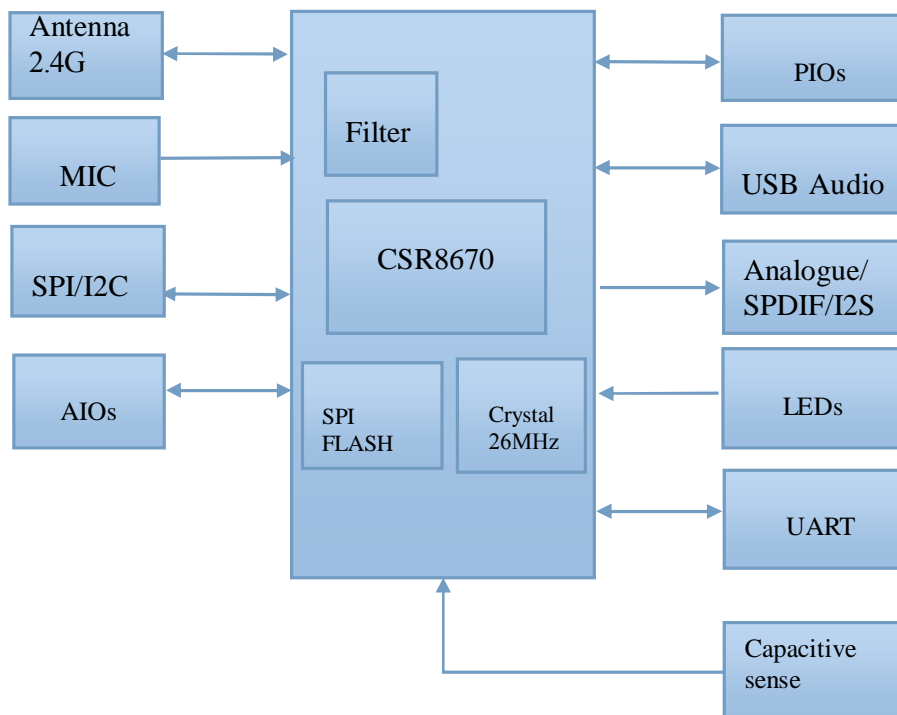
## 1. INTRODUCTION

The 8670 Bluetooth® module is a perfect consumer audio solution for wireless applications, such as wireless soundbars, wireless stereo speakers and headphones. It can be connected with any Bluetooth® devices in an operating range. It is slim and light so the designers can have better flexibilities for the product shapes.

The 8670 Bluetooth® module complies with Bluetooth® specification version 4.0. It supports HSP, HFP, A2DP, AVRCP, PBAP, MAP, SPP....profiles. It integrates an ultra-low-power DSP and application processor with embedded flash memory, a high-performance stereo codec, a power management subsystem, LED and LCD drivers and capacitive touch sensor inputs in a SOC IC. The dual-core architecture with flash memory enables manufacturers to easily differentiate their products with new features without extending development cycles. It integrates RF Baseband controller, antenna,... etc. and provides UART interface, programmable I/O, stereo speaker output, microphone input,... etc.

The detail information of 8670 Bluetooth® module is presented in this document below.

### 1.1 Block Diagram



## 1.2 Features

- ü Small overall dimension(22mm x 15mm x 2mm )
- ü Bluetooth Specification V4.0(Single Mode)
- ü Class1,Class 2and Class 3 support
- ü Physical connection as SMD type
- ü 16Mb internal flash memory(64-bit wide,45ns);optional support for 64Mb of external SPI flash
- ü Music Enhancements: SBC,MP3,AAC and AAC+,Faststream codec,atpX,5-band EQ,3D stereo separation and so on.
- ü Audio Interfaces: I2S,PCM and SPDIF
- ü Serial Interfaces: UART,USB 2.0,I2C and SPI
- ü 3 Hardware LED controllers (for RGB) and ability to drive LCD segment display directly
- ü Support for up to 6 capacitive touch sensor inputs
- ü Built-in RF combo filter, Integrated 26M Crystal.
- ü No radio signal interference, support for 802.11 co-existence

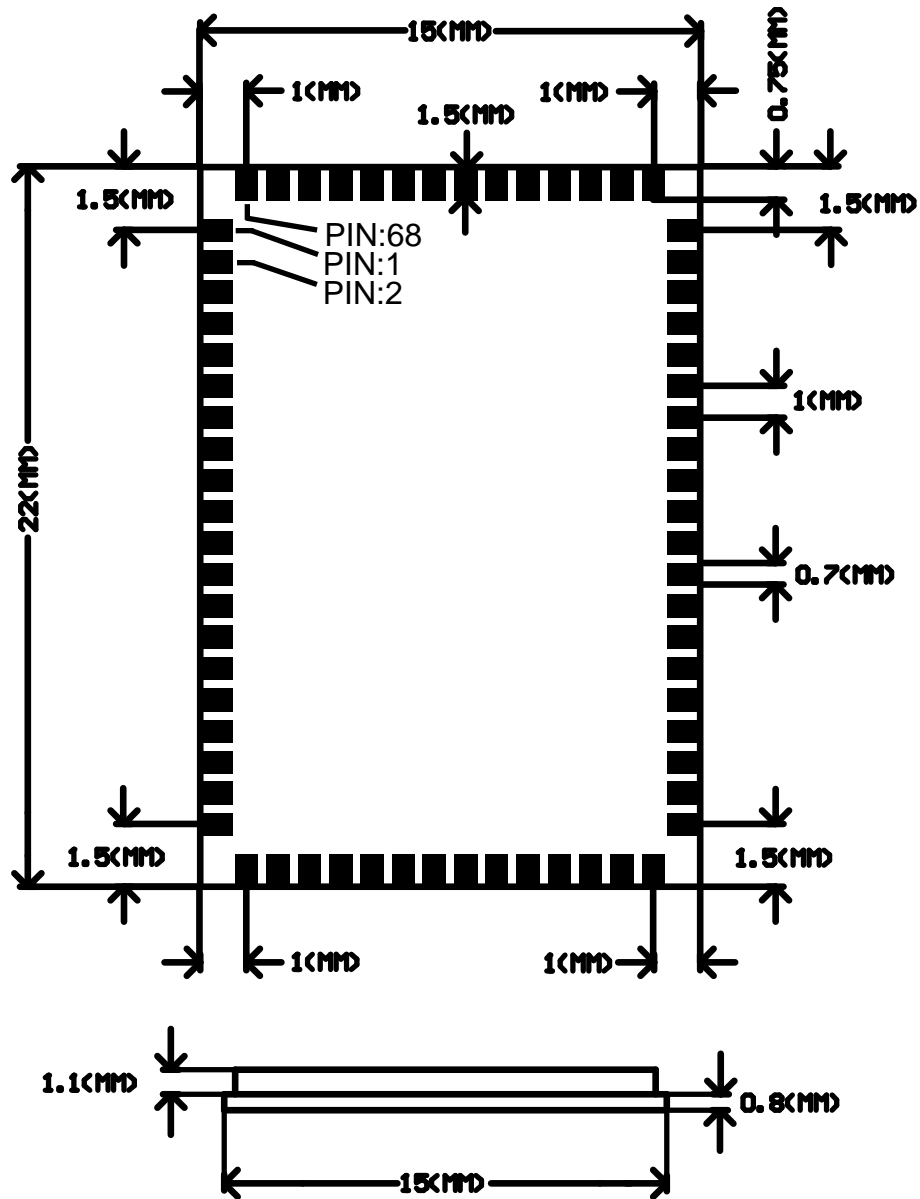
### 1.3 Application

- ü TVs
- ü Smart remote controllers
- ü Wired or wireless soundbars
- ü Wired or wireless speakers and headphones
- ü Wearable audio with sensors(health and well-bing applications)

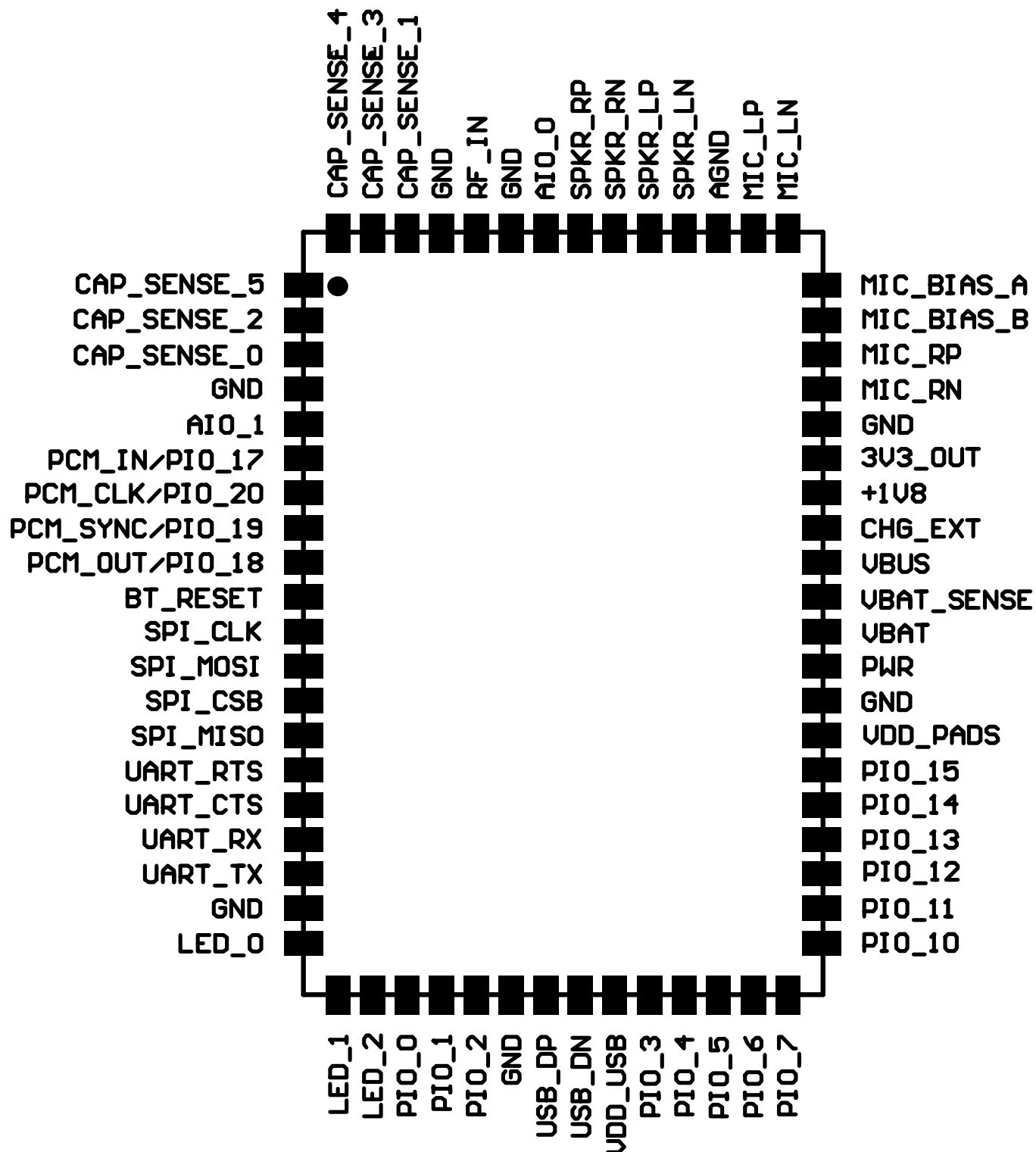
## 2. GENERAL SPECIFICATION

Bluetooth Specification	
Chip Set	CSR8670
Module ID	8670
BT Standard	Bluetooth® V4.0 specification
Sensitivity	-90dBm@0.1%BER
Frequency Band	2.402GHz~2.480GHz ISM Band
Baseband Crystal OSC	26MHz
Hopping	1600hops/sec, 1MHz channel space
RF Input Impedance	50 ohms
Environmental	RoHS Compliant

### 3. PHYSICAL CHARACTERISTIC



Note: Tolerance without mark default +/-0.05mm



### 3.1 Pin Description

Pin#	Pin Name	Pad Type	Description
1	CAP_SENSE_5	Analogue input	Capacitive touch sensor input
2	CAP_SENSE_2	Analogue input	Capacitive touch sensor input
3	CAP_SENSE_0	Analogue input	Capacitive touch sensor input
4	GND	Ground	Digital Ground
5	AIO_1	Bi-directional	Analogue programmable input / output line
6	PCM_IN/PIO_17	Bi-directional with weak pull_down	Synchronous data input.Alternative function PIO[17]
7	PCM_CLK/PIO_20	Bi-directional with weak pull_down	Synchronous data clock.Alternative function PIO[20]
8	PCM_SYNC/PIO_19	Bi-directional with weak pull_down	Synchronous data sync.Alternative function PIO[19]
9	PCM_OUT/PIO_18	Bi-directional with weak pull_down	Synchronous data output.Alternative function PIO[18]
10	BT_RESET	Input with strong pull-up	Reset if low.Input debounced so must be low for >5ms to cause a reset
11	SPI_CLK	Input with weak pull-down	SPI Clock
12	SPI_MOSI	Input with weak pull-down	SPI data input
13	SPI_CSB	Input with strong pull-up	Chip select for SPI,active low
14	SPI_MISO	Output with weak pull-down	SPI data output
15	UART_RTS	Bi-directional with weak pull_up	UART request to send,active low.Alternative function PIO[16]
16	SPI_CTS	Bi-directional with weak pull_down	UART clear to send,active low
17	UART_RX	Bi-directional with strong pull_up	UART data input
18	UART_TX	Bi-directional with weak pull_up	UART data output
19	GND	Ground	Digital Ground
20	LED_0	Open drain	LED driver Alternative function PO[29]
21	LED_1	Open drain	LED driver Alternative function PO[30]

22	LED_2	Open drain	LED driver Alternative function PO[31]
23	PIO_0	Bi-directional with weak pull_down	Programmable input/output line
24	PIO_1	Bi-directional with weak pull_down	Programmable input/output line
25	PIO_2	Bi-directional with weak pull_down	Programmable input/output line
26	GND	Ground	Digital Ground
27	USB_DP	Bi-directional	USB data plus with selectable internal 1.5kohm pull-up resistor
28	USB_DN	Bi-directional	USB data minus
29	VDD_USB	NC	Positive supply for USB ports
30	PIO_3	Bi-directional with weak pull_down	Programmable input/output line
31	PIO_4	Bi-directional with weak pull_down	Programmable input/output line
32	PIO_5	Bi-directional with weak pull_down	Programmable input/output line
33	PIO_6	Bi-directional with weak pull_down	Programmable input/output line
34	PIO_7	Bi-directional with weak pull_down	Programmable input/output line
35	PIO_10	Bi-directional with weak pull_down	Programmable input/output line
36	PIO_11	Bi-directional with weak pull_down	Programmable input/output line
37	PIO_12	Bi-directional with weak pull_down	Programmable input/output line
38	PIO_13	Bi-directional with weak pull_down	Programmable input/output line
39	PIO_14	Bi-directional with weak pull_down	Programmable input/output line
40	PIO_15	Bi-directional with weak pull_down	Programmable input/output line
41	VDD_PADS	Analogue in	positive supply input for digital input/output ports PIOx
42	GND	Ground	Digital Ground
43	PWR	Input enable	Regulator enable input. Can also be sensed as an input. Regulator enable and multifunction button. A high input (tolerant to VBAT) enables the on-chip regulators, which can then be latched on internally and the button used as a multifunction input.
44	VBAT	Power supply	Battery positive terminal

45	VBAT_SENSE	NC	Battery charger sense input
46	VBUS	Power supply	Alternative supply via bypass regulator for 1.8V and 1.35V switchmode power supply regulator inputs. Must be connected to the same potential as VOUT_3V3.
47	CHG_EXT	NC	External battery charger control
48	+1V8	Open drain output	LED driver
49	3V3_OUT	Analogue out	3.3V bypass linear regulator output
50	GND	Ground	Digital Ground
51	MIC_RN	Analogue in	Microphone input negative,right
52	MIC_RP	Analogue in	Microphone input positive,right
53	MIC_BIAS_B	Analogue out	Microphone bias B
54	MIC_BIAS_A	Analogue out	Microphone bias A
55	MIC_LN	Analogue in	Microphone input negative,left
56	MIC_LP	Analogue in	Microphone input positive,left
57	AGND	Ground	Analogue Ground
58	SPKR_LN	Analogue out	Speaker output negative,left
59	SPKR_LP	Analogue out	Speaker output positive,left
60	SPKR_RN	Analogue out	Speaker output negative,right
61	SPKR_RP	Analogue out	Speaker output positive,right
62	AIO_0	Bi-directional	Analogue programmable input / output line
63	GND	Ground	Analogue Ground
64	RF_IN	RF	Bluetooth 50ohm transmitter output/receiver input
65	GND	Ground	Analogue Ground
66	CAP_SENSE_1	Analogue input	Capacitive touch sensor input
67	CAP_SENSE_3	Analogue input	Capacitive touch sensor input
68	CAP_SENSE_4	Analogue input	Capacitive touch sensor input

#### 4. REFERENCE SCHEMATIC

Next page for detail.

## 5. PHYSICAL INTERFACE

### 5.1 Programmable I/O ports

- n The module provide 11 lines of programmable bidirectional I/O, Can configurate to different function by firmware.

### 5.2 Analogue I/O ports

- n The module has a analogue port AIO\_0, typically connections to thermistor for battery pack temperature measurements during charger control.

### 5.3 LED driver

- n The module provide 3 synchronized PWM LED driver for RGB leds. Can controlled by firmware. The driver are open-drain outputs, and the LEDs must pull up to positive supply. Refer to the section 4.1

### 5.4 Audio interfaces

Audio interface as following features:

Stereo or dual mono analogue audio output through  
SPK\_LP, SPK\_LN, SPK\_RP, SPK\_RN.

- n Stereo and mono analogue input through MIC\_LN, MIC\_LP, MIC\_RN, MIC\_RP.

The module is designed for different output, if a single-ended audio output is required, use an external differential to single-ended converter.

### 5.5 Microphone input

The module contains an independent low-noise microphone bias generator. The microphone bias generator is recommended for biasing electret condenser microphone. section 4.1 is a basing circuit for microphone with a sensitivity between -40~-60db.

### 5.6 Digital microphone inputs

The CSR8670 interfaces to 6 digital MEMS microphones. Figure x shows that 4 of the inputs have dedicated codec channels and 2 are multiplexed with the high-quality ADC channels.

### 5.7 Line input

If the pre-amplifier audio input gain is set at a low gain level it acts as an audio line level amplifier. In this line input mode the input impedance varies from 6kohm to 30kohm, depending on the volume setting.

### 5.8 PCM interface

The audio PCM interface on the 8670 supports:

- n On-chip routing to Kalimba DSP
- n Continuous transmission and reception of PCM encoded audio data over Bluetooth.
- n PCM interface master, generating PCM\_SYNC and PCM\_CLK.
- n PCM interface slave, accepting externally generated PCM\_SYNC and PCM\_CLK.

The PCM configuration options are enabled by setting the PS Key PSKEY\_PCM\_CONFIG32.

## 5.9 Digital audio interface(I2S)

The digital audio interface supports the industry standard formats for I2S, left-justified or right-justified. The interface shares the same pins as the PCM interface, which means each audio bus is mutually exclusive in its usage. Table as below lists these alternative functions

PCM Interface	I2S Interface
PCM_OUT	SD_OUT
PCM_IN	SD_IN
PCM_SYNC	WS
PCM_CLK	SCK

## 5.10 Reset

n The module is reset from several sources:

- Reset# pin
- Power on reset
- Software configured watch-dog

The Reset pin is an active low reset and is internally filtered using the internal low frequency clock oscillator. Recommended the low period >10ms.

RAM data not available after cold reset.

## 5.11 RF interface

The module integrates a balun filter. A 50ohms load is needed.

## 5.12 Battery charger

### 5.12.1 battery charger hardware operating modes

The battery charger hardware is controlled by VM, it has 5 modes:

- Disabled
- Trickle charger
- Fast charger
- Standby: fully charged or float charge
- Error: charging input voltage, VCHG is too low.

### 5.12.2 External charge mode

The external mode is for charging higher capacity batteries using an external bass device. The current is controlled by sinking a varying current into the CHG\_EXT pin, and the current is determined by measuring the voltage drop across a resistor. The max current up to 700mA.

## 5.13 Serial interfaces

### 5.13.1 UART

This is a standard UART interface for communicating with other serial devices. The UART interface provides a simple mechanism for communicating with other serial devices using the RS232 protocol.

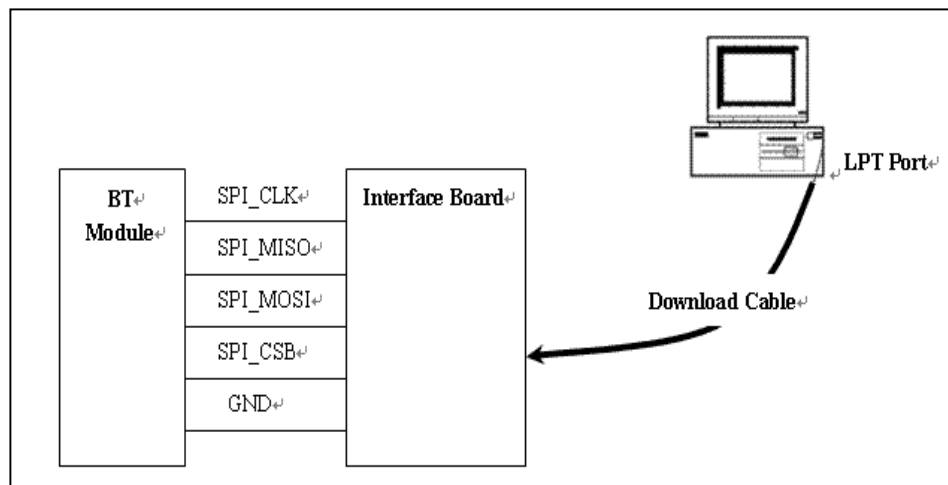
When the module is connected to another digital device, UART\_RX and UART\_TX transfer data between the two devices. The remaining two signals, UART\_CTS and UART\_RTS, can be used to implement RS232 hardware flow control where both are active low indicators.

**Note: The serial port interface(UART)can be used for system debugging.Don't support to use command set for profile function application by UART,such as HFP/A2DP/AVRCP and so on.These profiles function application can be contolled only by PIO,such as pairing/connect/answer/play/pause/next/previous function application and so on.**

### 5.13.2 SPI

The synchronous serial port interface (SPI) can be used for system debugging. It can also be used for in-system programming for the flash memory within the module. SPI interface uses the SPI\_MOSI, SPI\_MISO, SPI\_CSB and SPI\_CLK pins. Testing points for the SPI interface are reserved on board in case that the firmware shall be updated during manufacture.

The module operates as a slave and thus SPI\_MISO is an output of the module. SPI\_MISO is not in high-impedance state when SPI\_CSB is pulled high. Instead, the module outputs 0 if the processor is running and 1 if it is stopped. Thus the module should NOT be connected in a multi-slave arrangement by simple parallel connection of slave SPI\_MISO lines.



## 6. ELECTRICAL CHARACTERISTIC

### 6.1 Absolute maximum ratings

Rating	Min	Max	Unit
Storage temperature	-40	105	°C
Supply Voltage			
VBAT	2.8	4.25	V
VBUS	-0.4	5.75	V
VBAT_SENSE	-0.4	4.20	V
PWR	-0.4	4.40	V

### 6.2 Recommended operating conditions

Rating	Min	Typ	Max	Unit
Operating temperature range	-40		85	°C
Supply Voltage				
VBAT	2.8	3.30	4.25	V
VBUS	4.75	5.00	5.75	V
VBAT_SENSE	0	3.70	4.30	V
PWR	0	3.30	4.25	V

### 6.3 PIO Recommended operating conditions

Input Voltage	Min	Typ	Max	Unit
PIOx	1.70	1.80	3.6	V
AIOx	1.30	1.35	1.40	V
LED[0:2]	1.10	3.30	4.25	V
Output	Min	Typ	Max	Unit
PIOx	1.70	1.80		V
LED[0:2]	0	0		V

Output current with 3.3v supply	Min	Typ	Max	Unit
PIOx(Total output)			5.0	mA

Current with 3.3V Input and Tristate	Min	Typ	Max	Unit
Strong pull up	-150	-40	-10	uA
Strong pull down	10	40	150	uA
Weak pull up	-5	-1.0	-0.33	uA
Weak pull down	0.33	1.0	5.0	uA

## 6.4 Battery charger

Fast Charge mode	Min	Typ	Max	Unit
Charge current during constant charge mode	194	200	206	mA
Standby mode	100	-	150	mA

## 6.5 External charge mode

	Min	Typ	Max	Unit
Fast Charge current during constant charge mode	200	-	500	mA
Control current into CHG_EXT	0	-	20	mA

## 6.6 Power consumption

Operating Condition		Average Current	Unit
Slave	SCO connection with pocket type HV3	9.2	mA
	eSCO connection with pocket type 2EV3	7.3	mA
	eSCO connection with pocket type 3EV3	6.7	mA
	Stereo with high quality SBC decode	10.2	mA
	Stereo with high quality Aptx decode	14.9	mA
Master	SCO connection with pocket type HV3	10.2	mA
	eSCO connection with pocket type EV3	6.8	mA
	eSCO connection with pocket type 2EV3	6.2	mA
	Stereo with high quality SBC decode	15.2	mA

**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, 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.

**FCC Radiation Exposure Statement**

This device has been evaluated and shown compliant with the FCC RF Exposure limits under fixed exposure conditions (antennas are greater than 20cm from a person's body) when installed in certain specific OEM configurations.

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. Due to missing shielding the module is strictly limited to integration by the Grantee himself or his dedicated OEM integrator under control of the Grantee. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

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: 2ALGQ-BTM870B Or Contains FCC ID: 2ALGQ-BTM870B"

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

**IMPORTANT NOTE:**

This device is intended only for OEM integrators under the following conditions:

(1) According to FCC Part 15 Subpart C Section 15.212, the radio elements of the modular transmitter must have their own shielding. However, due to there is no shielding for this BT module, this module is granted as a Limited Modular Approval.

(2) This module has been designed to operate with PCB antenna having a maximum gain of 1.2dBi.

(3) Integration is typically strictly restricted to Grantee himself or dedicated OEM integrators under control of the Grantee.

The module will be responsible to satisfy SAR/RF Exposure requirements, when the module integrated into any (portable, mobile, fixed) host device.

This module is intended for OEM integrator only and the OEM integrators and instructed to ensure that the end user has no manual instructions to remove or install the device.

The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.

The module has no shielding and tested stand alone. This module is tested and approved as Limited modular approval with stand alone configuration, any OEM incorporated this radio module into any system are require additional testing and evaluation.

The module is only certified with the installed antenna. Any change of the antenna will void the certification.