



BTM8610M

Bluetooth Module Data Sheet

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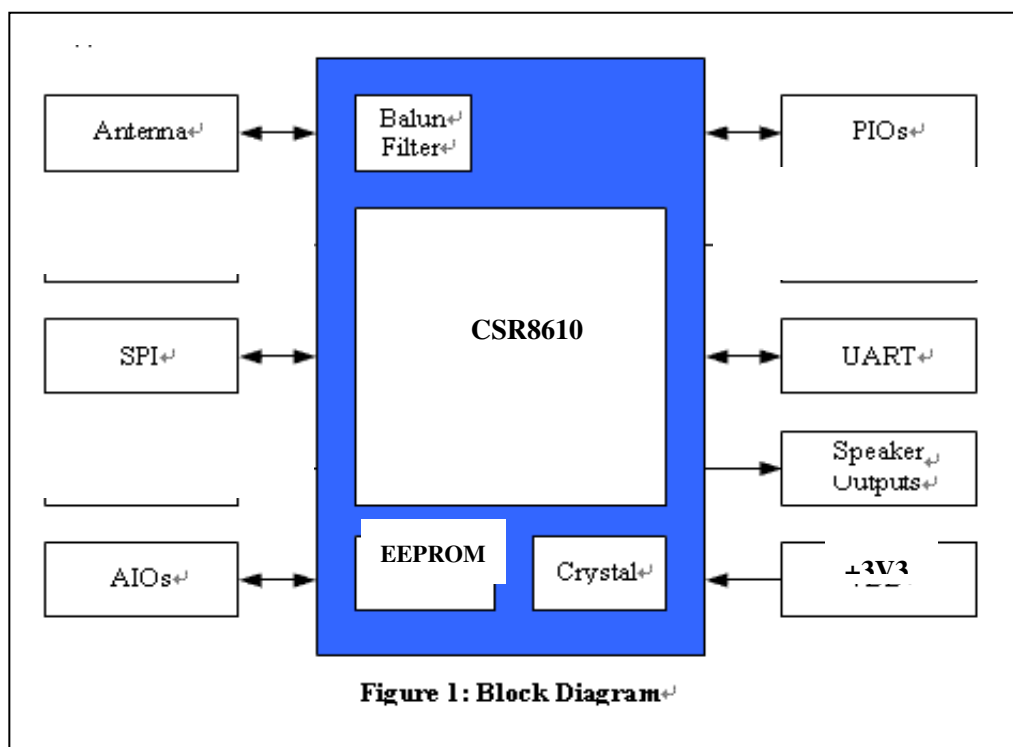
1. INTRODUCTION

The BTM8610M Bluetooth® module is a perfect solution for enhanced audio applications, such as headphones, mono headset. 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 BTM8610M Bluetooth® module complies with Bluetooth® specification version 4.0. It supports A2DP(mono),AVRCP,HFP,HSP profiles. It integrates RF Baseband controller, antenna,... etc. and programmable I/O, speaker output... etc.

The detail information of BTM8610M Bluetooth® module is presented in this document below.

1.1 Block Diagram





1.2 Features

- ✓ Small overall dimension(12mm x 15.4mm x 2mm)
- ✓ Bluetooth Specification V4.0
- ✓ Class 2 support
- ✓ Physical connection as SMD type
- ✓ Built-in RF combo filter, Integrated 26M Crystal.
- ✓ Support A2DP(mono),AVRCP,HFP,HSP profile.
- ✓ No radio signal interference, support for 802.11 co-existence
- ※ *Some features are optional for customization on demand.*

1.3 Application

- ✓ High Quality Mono Bluetooth Headset
- ✓ Hands-free car-kits
- ✓ Bluetooth Speakers(mono)

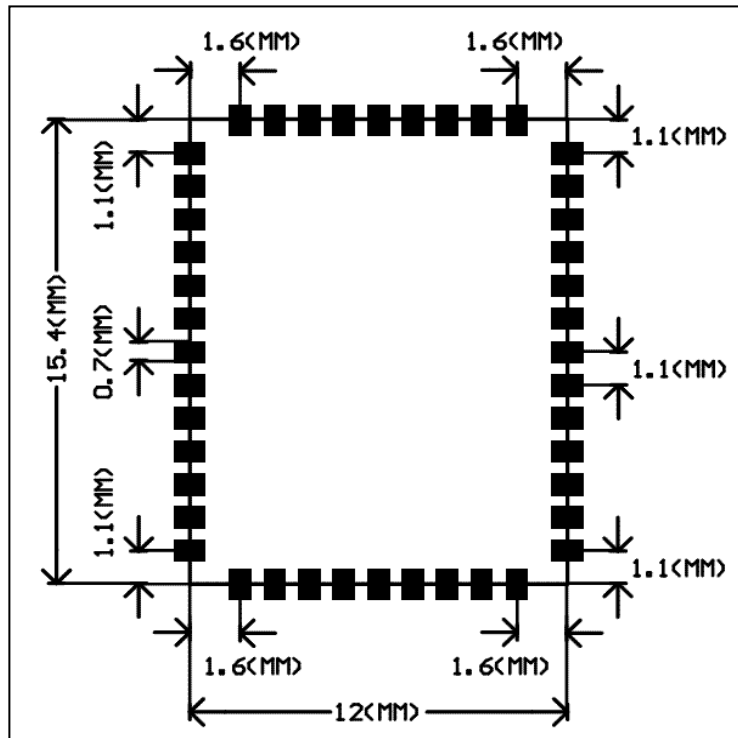


2. GENERAL SPECIFICATION

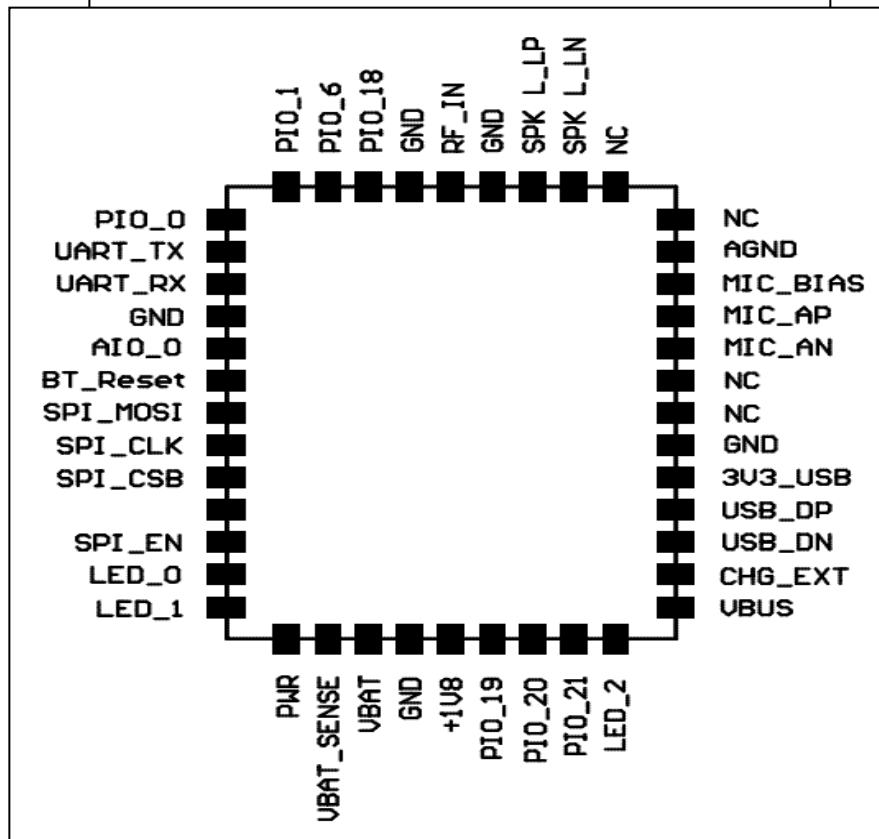
Bluetooth Specification	
Chip Set	CSR 8610 (ROM)
Module ID	BTM8610M
BT Standard	Bluetooth® V4.0
RF TX Output Power	4dBm (Class II)
Sensitivity	-86dBm@0.1%BER
Frequency Band	2.402GHz~2.480GHz ISM Band
Baseband Crystal OSC	26MHz
Hopping	1600hops/sec, 1MHz channel space
RF Input Impedance	50 ohms
Major Interface	<ul style="list-style-type: none">• Microphone : Input (Differential)• Speaker : Output (Differential)• PCM : Output• UART : Tx/Rx (for test)• PIOs• Antenna
Profile	A2DP,AVRCP,HFP,HSP
Voice Processor	80MIPS Kalimba with cVc support
Power	
Supply Voltage	3.3V ~ 4.2V DC
Working Current	30mA typical,Depends on profiles
Standby Current	<1mA
Operating Environment	
Temperature	-40C to +85
Humidity	10%~90% Non-Condensing
Environmental	RoHS Compliant



3. PHYSICAL CHARACTERISTIC



Dimension:
Figure 2



Pin Definition:
Figure 3



3.1 Pin Description

Pin#	Pin Name	Pad Type	Description
1	PIO_0	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
2	UART_TX	Bi-directional CMOS output, tri-state, with weak internal pull-up	UART data output
3	UART_RX	CMOS input with weak internal pull-down	UART clear to send active low
4	GND	Ground	Digital Ground
5	AIO_0	Bi-directional VDD/Low-voltage regulator output	Analogue programmable input/ output line circuitry and 1.5V regulated output (from internal low-voltage regulator)
6	BT_Rreset	CMOS input with weak internal pull-up	Active LOW reset
7	SPI_MOSI	CMOS input, with weak internal pull-down	SPI data input
8	SPI_CLK	Input with weak internal pull-down	SPI clock
9	SPI_CSB	Input with weak internal pull-up	Chip select for Serial Peripheral Interface (SPI),active low
10	SPI_MISO	CMOS output, tri-state, with weak internal pull-down	SPI data output
11	SPI_EN	Input with weak internal pull-up	Chip select for Serial Peripheral Interface (SPI),active low
12	LED_0	Open drain output	LED driver
13	LED_1	Open drain output	LED driver
14	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.
15	VBAT_SENSE	Battery charger sense input	Connect directly to the battery positive pin



16	VBAT	Power supply	Battery positive terminal
17	GND	Ground	Digital Ground
18	+1V8	Open drain output	LED driver
19	PIO_19	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
20	PIO_20	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
21	PIO_21	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
22	LED_2	Open drain output	LED driver
23	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.
24	CHG_EXT	External battery charger control	External battery charger transistor base control
25	USB_N	Bidirectional	USB data minus
26	USB_P	Bidirectional	USB data plus with selectable internal 1.5kohm pull-up resistor
27	3V3_USB	Power supply	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.
28	GND	Ground	Digital Ground
29	NC	NC	NC
30	NC	NC	NC
31	MIC_AN	Analogue	Microphone input negative, left
32	MIC_AP	Analogue	Microphone input positive, left
33	MIC_BIAS	Analogue	Microphone bias



34	AGND	Ground	Analogue Ground
35	NC	NC	NC
36	NC	NC	NC
37	SPKL_LN	Analogue out	Speaker output negative
38	SPKL_LP	Analogue out	Speaker output positive
39	GND	Ground	Digital Ground
40	RF_IN	RF	Bluetooth 50ohm transmitter output/receiver input
41	GND	Ground	Digital Ground
42	PIO_18	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
43	PIO_6	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
44	PIO_1	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line



4. REFERENCE SCHEMATIC

4.1

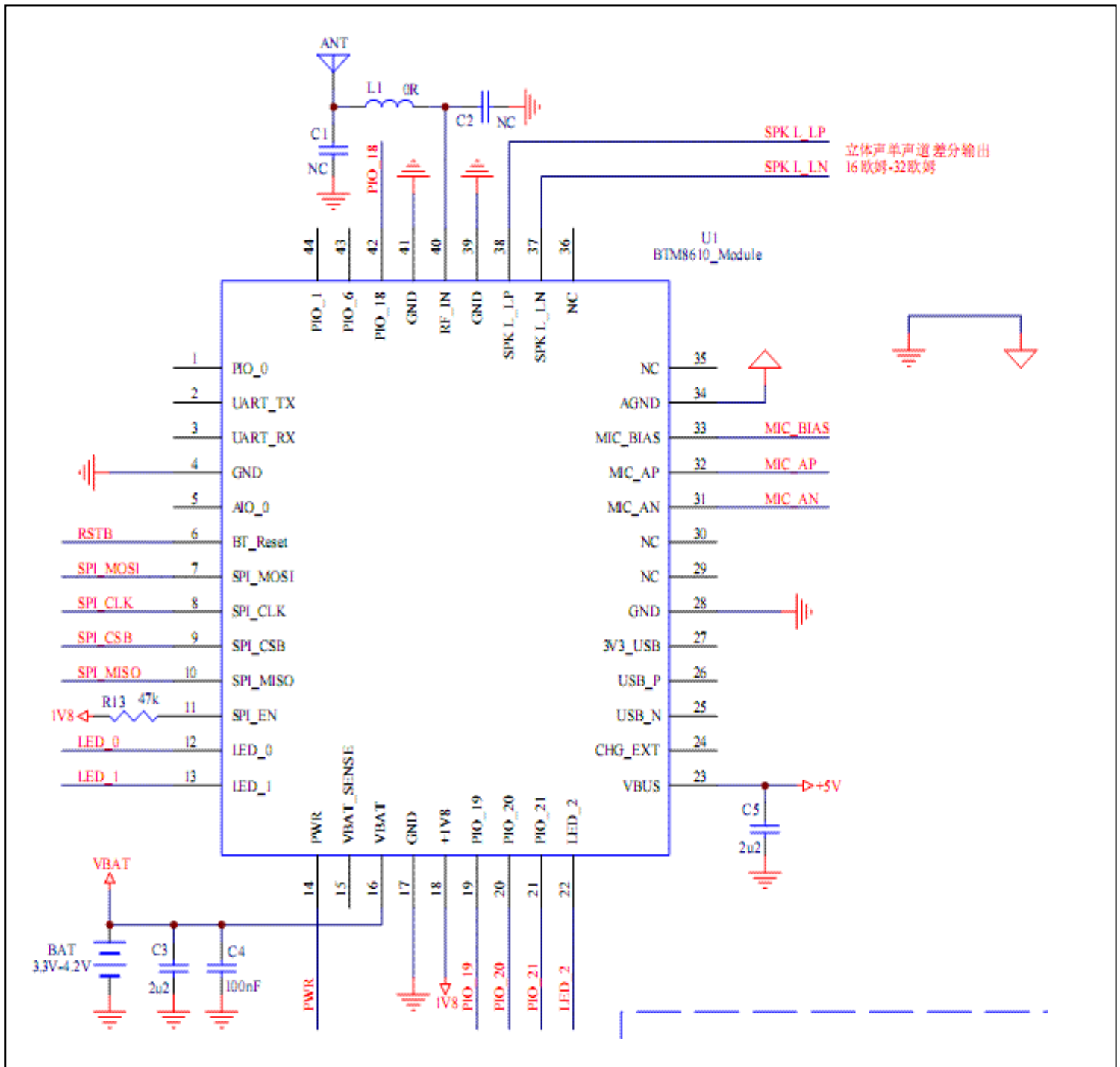


Figure 3



4.2

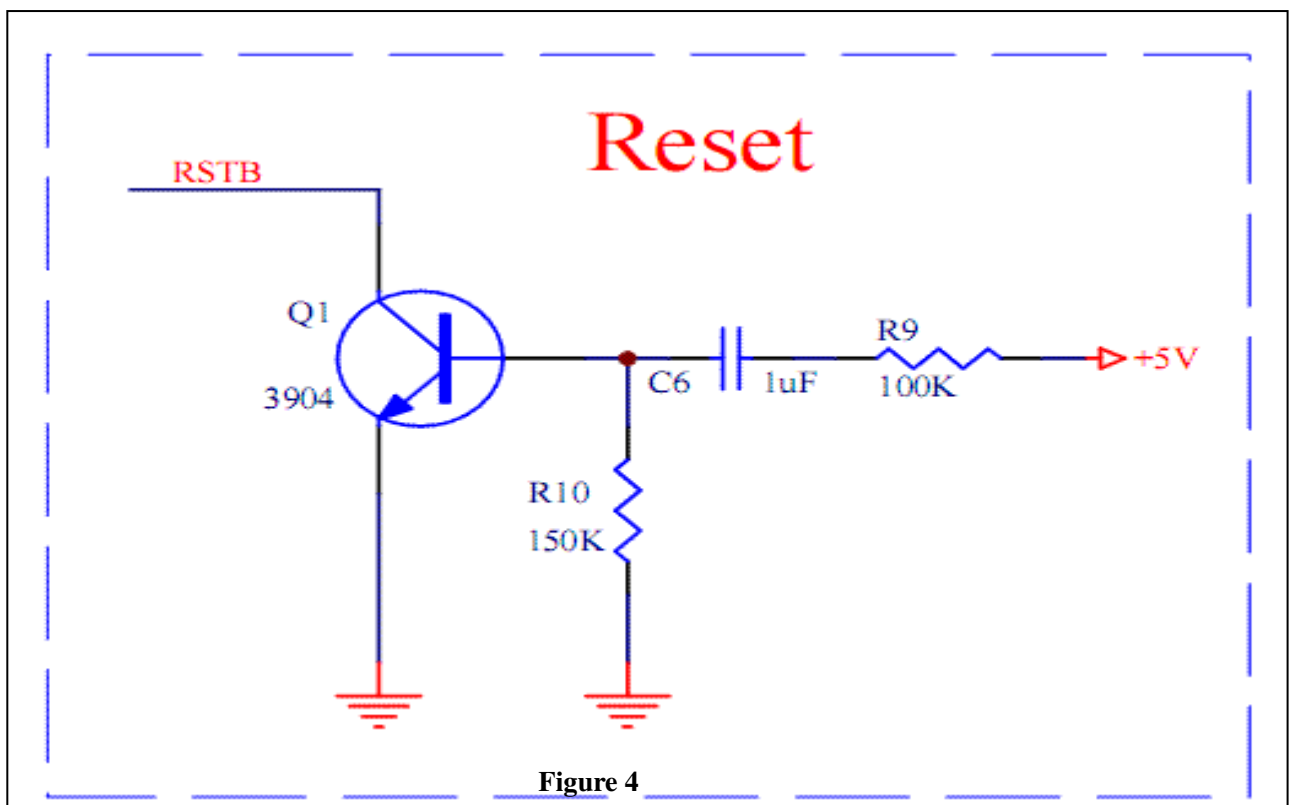
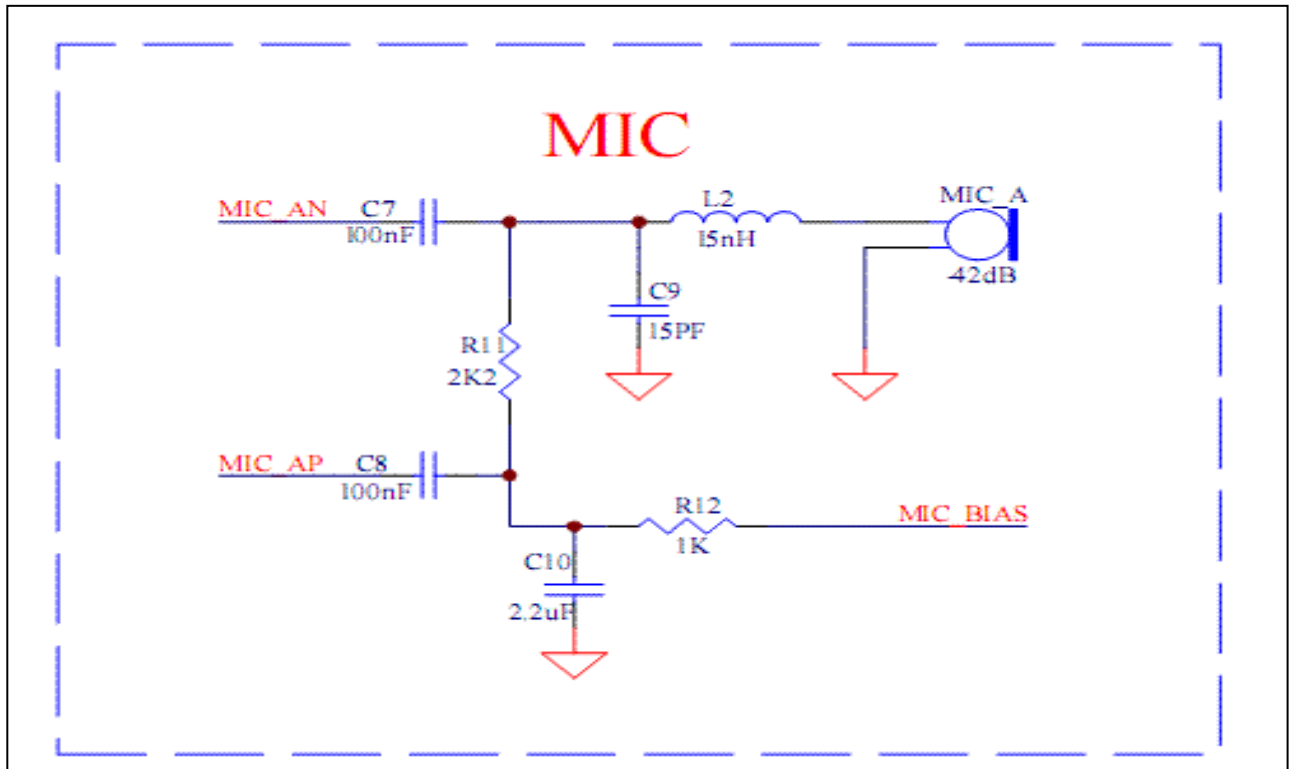


Figure 4



4.3

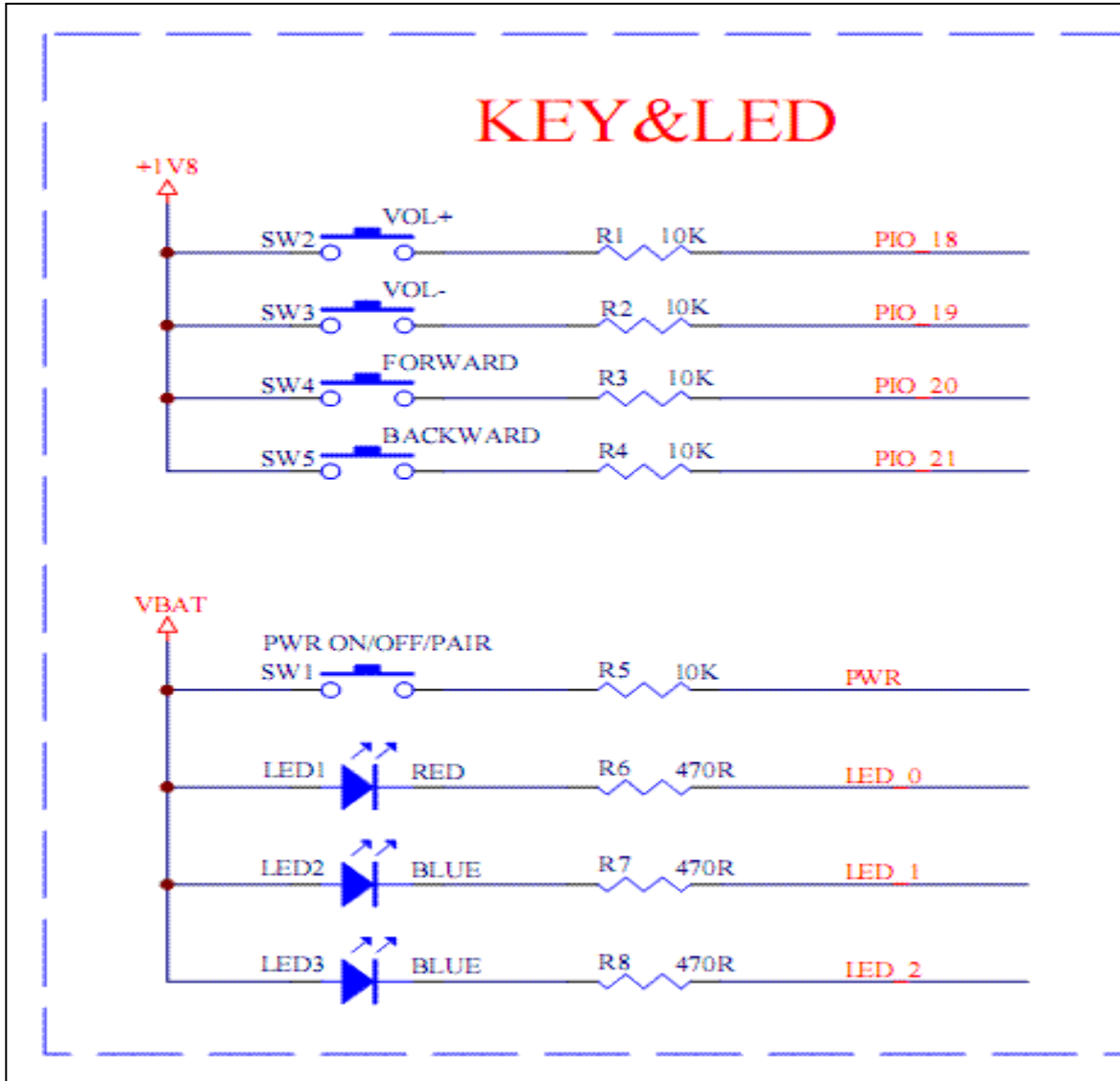


Figure 5



Figure 6



5. PHYSICAL INTERFACE

5.1 Power Supply

The transient response of the regulator is important. If the power rails of the module are supplied from an external voltage source, the transient response of any regulator used should be 20µs or less.

5.2 Audio Interfaces

Audio interface as following features:

- Mono analogue input for voice band and audio band
- Mono analogue output for voice band and audio band
- Support for digital audio bus standards such as I²S
- Support for PCM interfaces including PCM master codecs that require an external system clock

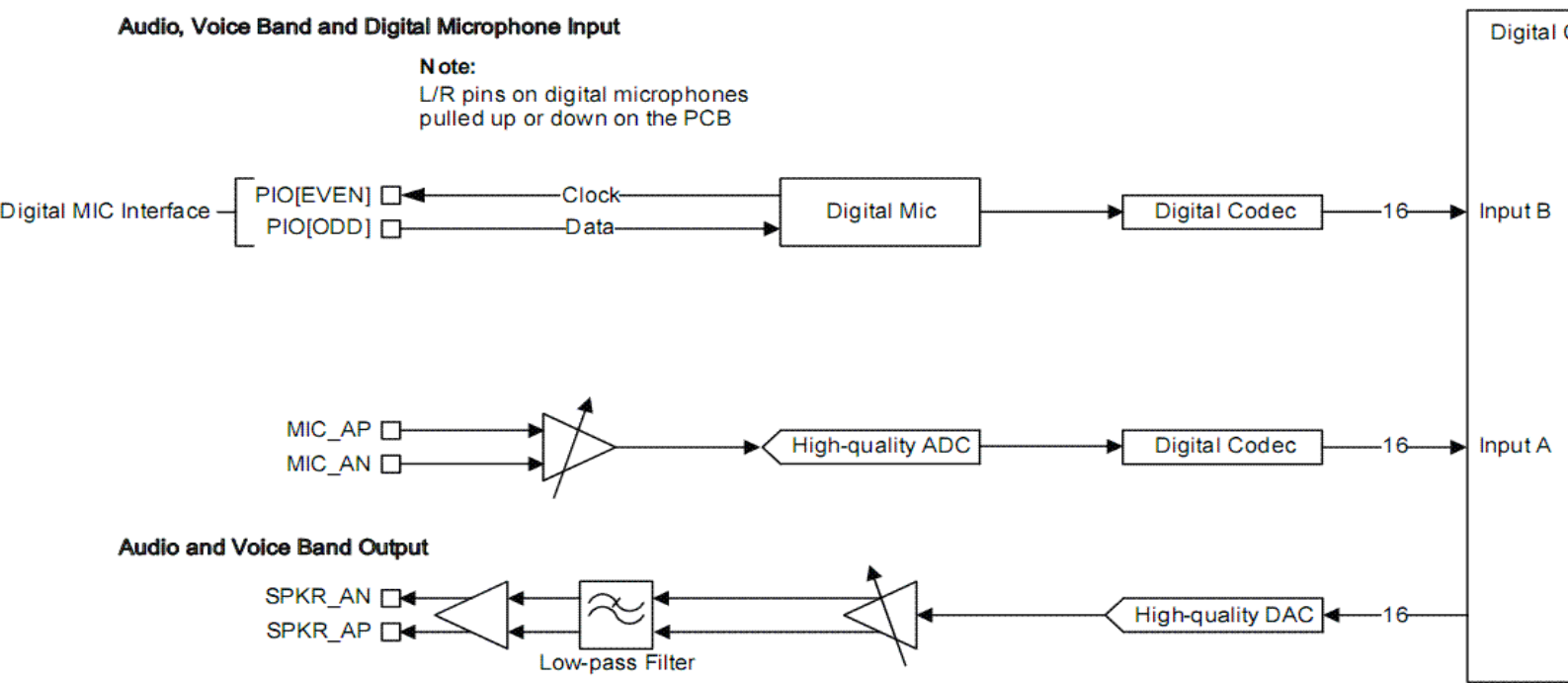


Figure 7

The CSR8610 BGA audio codec uses a fully differential architecture in the analogue signal path, which results in low noise sensitivity and good power supply rejection while effectively doubling the signal amplitude. It operates from a dual power supply, VDD_AUDIO for the audio circuits and VDD_AUDIO_DRV for the audio driver circuits.

5.2.1 ADC

- The ADC has a second-order Sigma-Delta converter.



- There are 2 gain stages for the ADC, 1 of which is an analogue gain stage and the other is a digital gain stage.

5.2.2 ADC Pre-amplifier and ADC Analogue Gain

CSR8610 BGA has an analogue gain stage based on an ADC pre-amplifier and ADC analogue amplifier:

- The ADC pre-amplifier has 4 gain settings: 0dB, 9dB, 21dB and 30dB
- The ADC analogue amplifier gain is -3dB to 12dB in 3dB steps
- The overall analogue gain for the pre-amplifier and analogue amplifier is -3dB to 42dB in 3dB steps.
- Us a low gain levels for an audio line level amplifier

5.2.3 ADC Gain

A digital gain stage inside the ADC varies from -24dB to 21.5dB, see Table 9.2. There is also a fine gain interface

with a 9-bit gain setting allowing gain changes in 1/32 steps, for more information contact

CSR. The firmware controls the audio input gain.

5.2.4 DAC

The DAC consists of:

- 1 fourth-order Sigma-Delta converter, see Figure 9.2
- 2 gain stages, 1 of which is an analogue gain stage and the other is a digital gain stage

5.2.5 DAC Gain

A digital gain stage inside the DAC varies from -24dB to 21.5dB, see Table 9.3. There is also a fine gain interface

with a 9-bit gain setting enabling gain changes in 1/32 steps, for more information contact CSR.

The overall gain control of the DAC is controlled by the firmware. Its setting is a combined function of the digital and analogue amplifier settings.

5.2.6 Microphone Input

CSR8610 BGA contains an independent low-noise microphone bias generator. The microphone bias generator is recommended for biasing electret condensor microphones.

5.2.7 Audio Output Stage

The output stage digital circuitry converts the signal from 16-bit per sample, linear PCM of variable sampling frequency to bit stream, which is fed into the analogue output circuitry.



The analogue output circuit comprises a DAC, a buffer with gain-setting, a low-pass filter and a class AB output stage amplifier. Figure 9.6 shows that the output is available as a differential signal between SPKR_AN and SPKR_AP.

5.3 RF Interface

The module integrates a balun filter. The user can connect a 50ohms antenna directly to the RF port.

5.4 General Purpose Analog IO

The general purpose analog IOs can be configured as ADC inputs by software. Do not connect them if not use.

5.5 General Purpose Digital IO

There are nine general purpose digital IOs defined in the module. All these GPIOs can be configured by software to realize various functions, such as button controls, LED displays or interrupt signals to host controller, etc. Do not connect them if not use.

5.6 Serial Interfaces

5.6.1 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 controlled only by PIO, such as pairing/connect/answer/play/pause/next/previous function application and so on.

5.6.2 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.

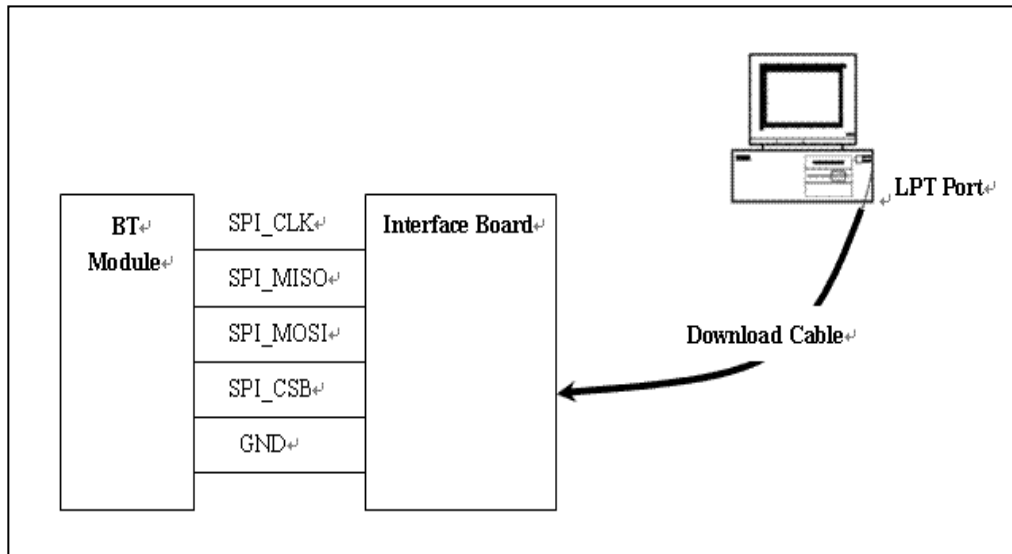


Figure 8



6. ELECTRICAL CHARACTERISTIC

Note:

For all I/O terminal characteristics:

- Current drawn into a pin is defined as positive; current supplied out of a pin is defined as negative.

6.1 Absolute Maximum Rating

Rating		Mi	Max	Uni
Storage temperature		-40	105	°C
Supply Voltage				
Charger	VCHG	-0.4	5.75 / 6.50 ^(a)	V
LEDs	LED[2:0]	-0.4	4.40	V
Battery	VBAT_SENSE	-0.4	4.20	V
	VREGENABLE	-0.4	4.40	V
1.8V	VDD_AUDIO_DRV	-0.4	1.95	V
	VDD_AUX_1V8	-0.4	1.95	V
	VDD_PADS_1	-0.4	3.60	V
	VDD_PADS_2	-0.4	3.60	V
	VDD_AUX_1V8	-0.4	1.95	V
1.35V	SMPS_1V35_SENSE	-0.4	1.45	V
	VDD_AUDIO	-0.4	1.45	V
	VREGIN_DIG	-0.4	1.95	V
Other terminal voltages		VSS - 0.4	VDD + 0.4	V

Table 1



6.2 Recommended Operating Conditions

Rating		Mi	Typ	Max	Uni
Operating temperature range		-40	20	85	°C
Supply Voltage					
Charger	VCHG	4.75 / 3.10(a)	5.00	5.75 / 6.50(b)	V
LEDs	LED[2:0]	1.10	3.70	4.30	V
Battery	VBAT_SENSE	0	3.70	4.30	V
	VREGENABLE	0	3.70	4.25	V
1.8V	VDD_AUDIO_DRV	1.70	1.80	1.95	V
	VDD_AUX_1V8	1.70	1.80	1.95	V
	VDD_PADS_1	1.70	1.80	3.60	V
	VDD_PADS_2	1.70	1.80	3.60	V
	VDD_AUX_1V8	1.25	1.80	1.95	V
1.35V	SMPS_1V35_SENSE	1.30	1.35	1.45	V
	VDD_AUDIO	1.30	1.35	1.45	V
	VREGIN_DIG	1.30	1.35 or 1.80(c)	1.95	V

6.3 Input/output Terminal Characteristics Table 2

6.3.1 Codec: Analogue to Digital Converter

Analogue to Digital Converter					
Parameter	Conditions	Mi	Typ	Max	Uni
Resolution	-	-	-	16	Bits
Input Sample Rate,	-	8	-	48	kHz
	F_{sample}				
	8kHz	-	93.5	-	dB
	16kHz	-	92.5	-	dB
	32kHz	-	91.4	-	dB



		44.1kHz	-	90.4	-	dB
		48kHz	-	89.6	-	dB
THD+N	$f_{in} = 1\text{kHz}$ $B/W = 20\text{Hz} \rightarrow F_{\text{sample}}/2$ (20kHz max)	F_{sample}				
		8kHz	-	0.0041	-	%
		48kHz	-	0.0072	-	%
Digital gain	Digital gain resolution = 1/32		-24	-	21.5	dB
Analogue gain	Pre-amplifier setting = 0dB, 9dB, 21dB or 30dB Analogue setting = -3dB to 12dB in 3dB Steps		-3	-	42	dB

Table 3

6.3.2 Codec: Digital to Analogue Converter

Digital to Analogue Converter							
Parameter	Conditions		Mi	Typ	Max	Uni	
Resolution	-		-	-	16	Bits	
Output Sample Rate, F_{sample}	-		8	-	96	kHz	
SNR	$f_{in} = 1\text{kHz}$ $B/W = 20\text{Hz} \rightarrow 20\text{kHz}$ A-Weighted $THD+N \leq 0.1\%$	F_{sample}	Load				
		48kHz	100k Ω	-	95.6	-	dB
		48kHz	32 Ω	-	95.8	-	dB
		48kHz	16 Ω	-	95.6	-	dB
THD+N	$f_{in} = 1\text{kHz}$ $B/W = 20\text{Hz} \rightarrow 20\text{kHz}$ 0dBFS input	F_{sample}	Load				
		8kHz	100k Ω	-	0.0025	-	%
		8kHz	32 Ω	-	0.0056	-	%
		8kHz	16 Ω	-	0.0108	-	%
		48kHz	100k Ω	-	0.0027	-	%
		48kHz	32 Ω	-	0.0067	-	%
		48kHz	16 Ω	-	0.0122	-	%
Digital Gain	Digital Gain Resolution = 1/32		-24	-	21.5	dB	
Analogue Gain	Analogue Gain Resolution = 3dB		-21	-	0	dB	
Output voltage full- scale swing	-		-	-	778	mV rms	

Table 4



7. RECOMMENDED TEMPERATURE REFLOW PROFILE

The soldering profile depends on various parameters necessitating a set up for each application. The data here is given only for guidance on solder reflow.

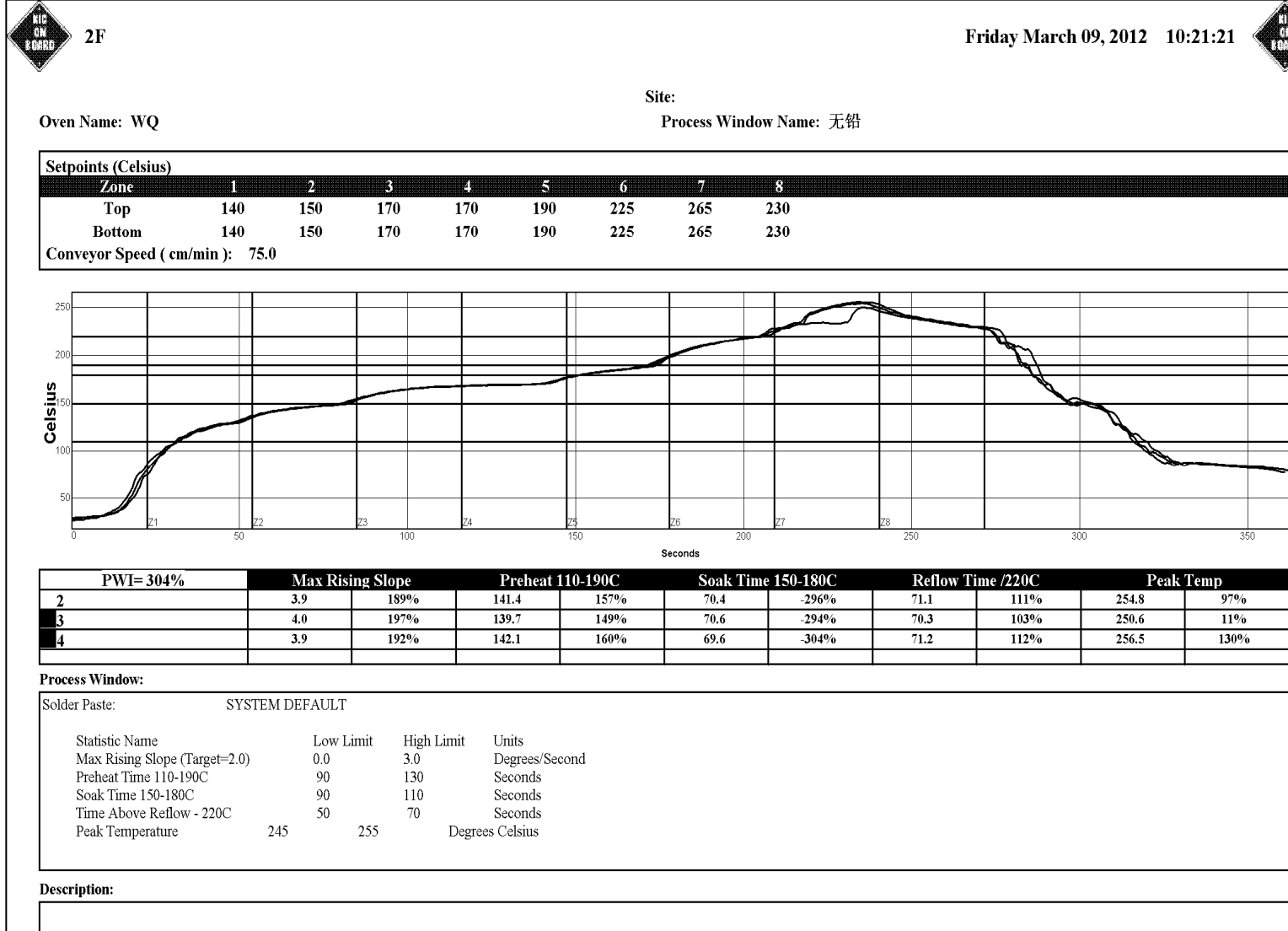
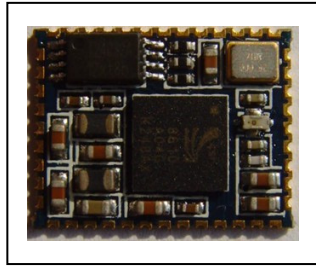


Figure 9

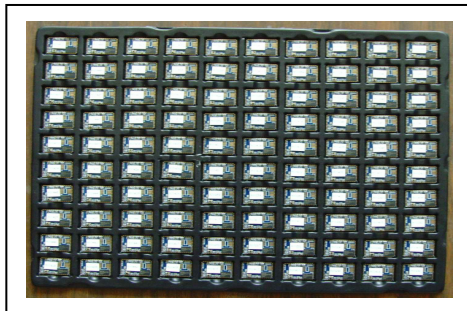


8. PACKAGING INFORMATION

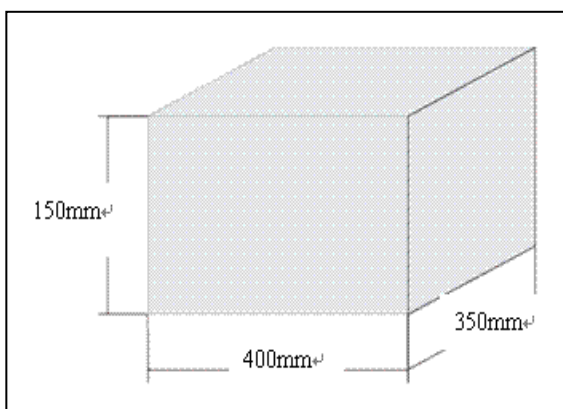
1. BLUETOOTH® Module: BTM8610M



2. Assembly



3. Dimension



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