



BTA21

Bluetooth Module Data Sheet

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1. INTRODUCTION

The BTA21 Bluetooth® module is a perfect solution for enhanced audio applications, such as stereo headphones and high performance automobile handsfree. 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 BTA21 Bluetooth® module complies with Bluetooth® specification version 2.1. It supports HSP, HFP, A2DP, AVRCP, PBAP, OPP profiles. It integrates RF Baseband controller, antenna, etc. and provide UART interface, programmable I/O, stereo speaker output, microphone input, etc.

The detail information of BTA21 Bluetooth® module is presented in this document below.

1.1 Block Diagram

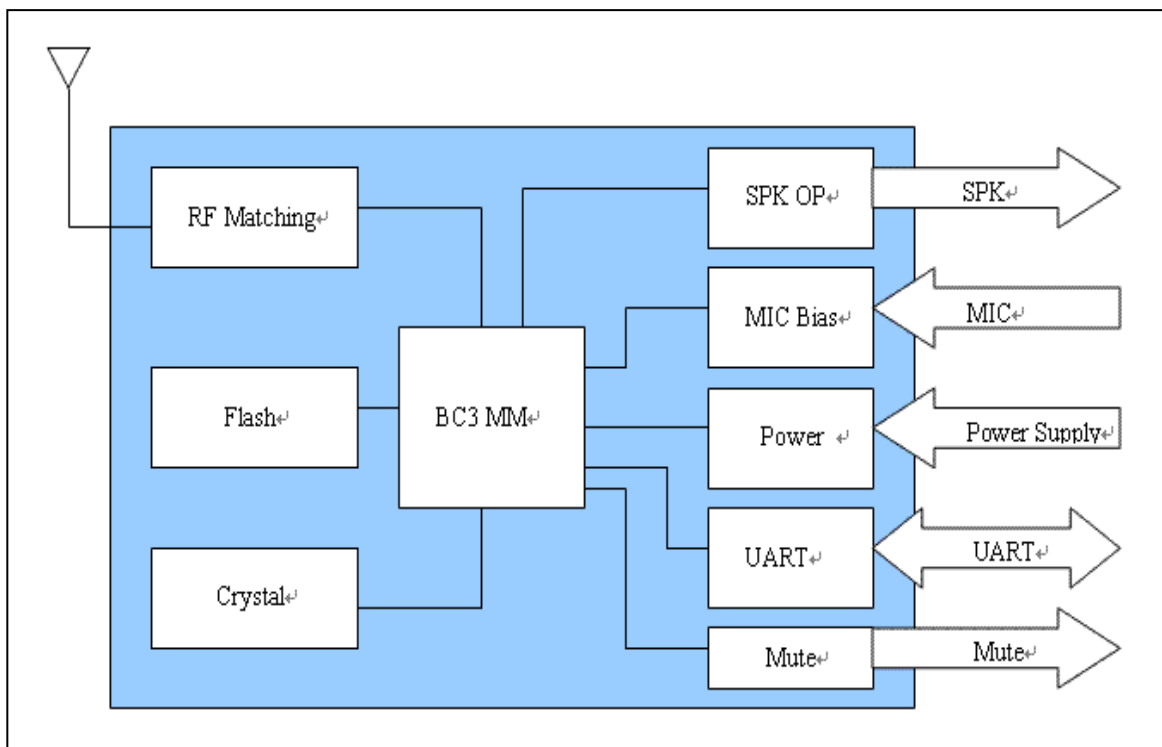


Figure 1



1.2 Features

- ✓ Small overall dimension(35mm x 25mm x 2mm)
- ✓ Bluetooth Specification V2.1
- ✓ Class 2 and Class 3 support
- ✓ Physical connection as SMD type
- ✓ DSP Co-Processor 16-bit Internal Stereo CODEC with -95dB SNR for DAC.
- ✓ High quality stereo audio (sample rate up to 44.1KHz)
- ✓ Built-in RF combo filter, Integrated 26M Crystal.
- ✓ Supports up to 8 Mbits on module flash memory.
- ✓ Support active inquire BT device and pairing.
- ✓ Support HSP, HFP, A2DP, AVRCP, OPP, SPP, PBAP, SYNC, PB-Sync for Nokia, PB-Sync For Samsung profile.
- ✓ Support active inquire BT device and pairing.
- ✓ Support customizable PIN code and device name.
- ✓ Support pairing up to 8 Bluetooth[®] device.
- ✓ Compatible with CSR cVc software echo cancellation solution.
- ✓ No radio signal interference, support for 802.11 co-existence
- ※ *Some features are optional for customization on demand.*



1.3 Application

- ✓ Automobile hands-free applications
- ✓ Hands-Free Car Kits for embedded Car audio systems
- ✓ Bluetooth Audio source gateway and data gateways for PND systems
- ✓ High Quality Stereo Bluetooth Headsets
- ✓ High Quality Mono Bluetooth Headsets
- ✓ Bluetooth Speakers



2. GENERAL SPECIFICATION

Bluetooth Specification	
Chip Set	CSR BC03-MultiMedia External
Module ID	BTA21
BT Standard	Bluetooth® V2.1 + EDR specification
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	• Microphone : Input (Differential) • Speaker : Output (Differential) • PCM : Output • UART : Tx/Rx • USB : DP/DN • PIOs • Antenna
Profile	HSP, HFP, A2DP, AVRCP, PBAP, detailed profiles depends on the firmware
Voice Processor	32MIPS Kalimba with cVc support
Power	
Supply Voltage	5.0V ~ 5.5V DC
Working Current	35mA typical, Depends on profiles
Standby Current	<1mA
Operating Environment	
Temperature	-40°C to +85°C
Humidity	10%~90% Non-Condensing
Environmental	RoHS Compliant

3. PHYSICAL CHARACTERISTIC

Dimension:

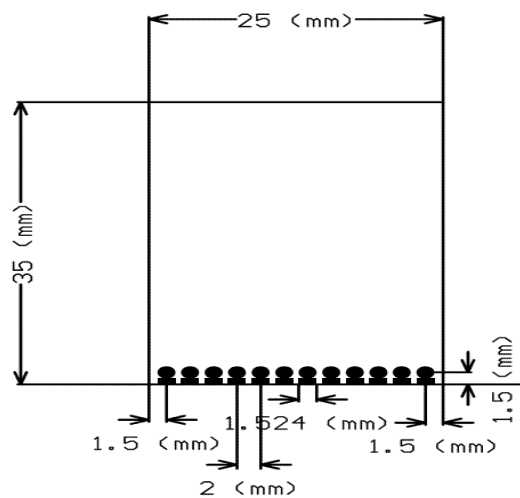


Figure 4

Top View:

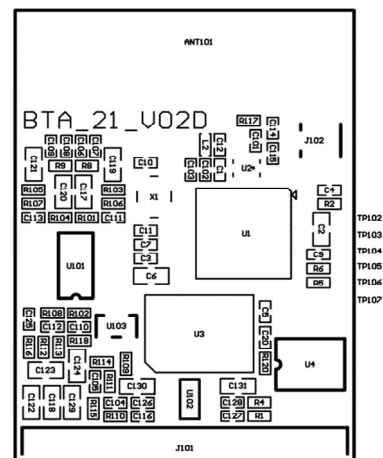


Figure 3

Pin Definition:

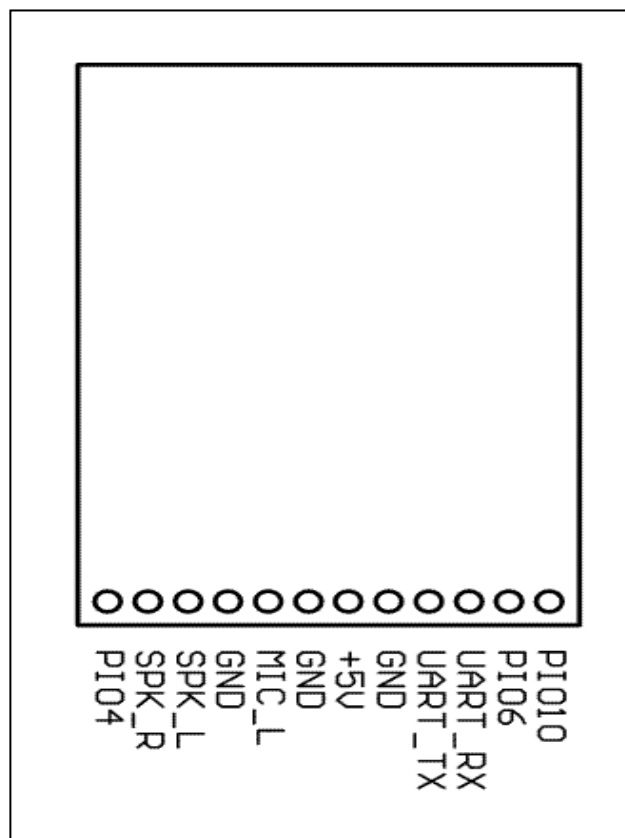


Figure 4



3.1 Pin Description

Pin	Name	I/O	Description
1	PIO[10]	I/O	programmable input/output
2	PIO[6]	I/O	programmable input/output
3	UART_RX	I	UART data input
4	UART_TX	O	UART data output
5	GND	-	Ground
6	+5V	I	Power supply
7	GND	-	Ground
8	MIC_L	I	Mic input
9	GND	-	Ground
10	SPK_L	O	Left channel audio out
11	SPK_R	O	Right channel audio out
12	PIO[4]	I/O	programmable input/output

4. PHYSICAL INTERFACE

4.1 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 20 μ s or less.

4.2 Audio Interfaces

Audio interface as following features:

- Mono analogue input for voice band and audio band
- Stereo and mono analogue output for voice band and audio band

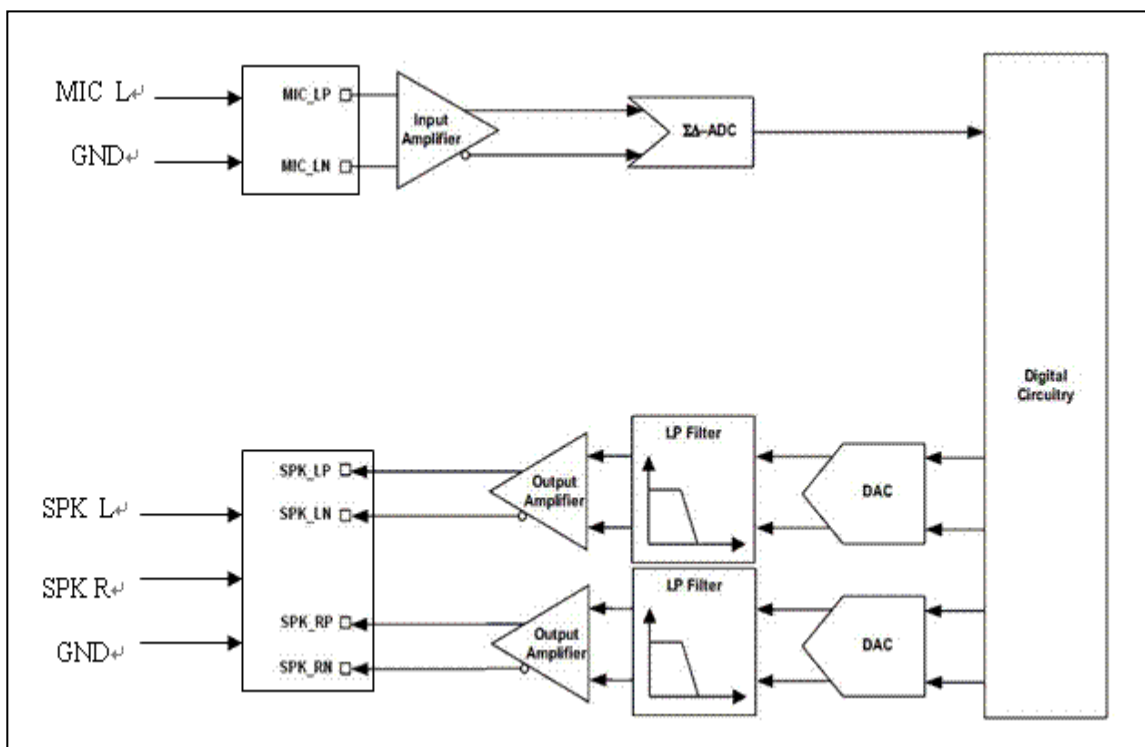


Figure 6

The stereo 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 uses a minimum of external components. The module features a differential stereo audio output interfaces.

4.2.1 ADC

The ADC consists of a second order Digma Delta converter as show in **Figure 6**.



4.2.2 ADC Sample Rate Selection and Warping

ADC supports the following sample rates: 8kHz, 11.025kHz, 16kHz, 22.05kHz, 24kHz, 32kHz, 44.1kHz.

One of the main concerns for stereo wireless music applications is the ability to keep sample rates for the CODECs at both ends of the wireless link in synchronization. A VM function adjusts the sample rate using a ‘warping’ function to tune the sample rate to the required value. The ADC warp function allows the sample rate to be changed by $\pm 3\%$, in steps of $1/2^{17}$, or 7.6ppm. The warp function preserves the signal quality – the distortion introduced when warping the sample rate is negligible.

4.2.3 ADC Gain

The ADC contains two gain stages for each channel, an analogue and a digital gain stage.

4.2.4 DAC

The DAC contains two second order Sigma Delta converters allowing two separate channels that are identical in functionality as show in **Figure 6**.

4.2.5 DAC Sample Rate Selection and Warping

Each DAC supports the following sample rates: 8kHz, 11.025kHz, 16kHz, 22.05kHz, 24kHz, 32kHz, 44.1kHz, 48kHz.

One of the main concerns for the DAC used in stereo wireless music applications is the ability to keep sample rates for the CODECs at both ends of the wireless link in synchronization. A VM function adjusts the sample rate using a ‘warping’ function to tune the sample rate to the required value. The ADC warp function allows the sample rate to be changed by $\pm 3\%$, in steps of $1/2^{17}$, or 7.6ppm. The warp function preserves the signal quality – the distortion introduced when warping the sample rate is negligible.

4.2.6 DAC Gain

The DAC contains two gain stages for each channel, a digital and an analogue gain stage.

4.2.7 Mono Operation

Mono operation is single channel operation of the stereo CODEC. The left channel represents the single mono channel for audio in and audio out. In mono operation the right channel is auxiliary mono channel that may be used in dual mono channel operation.



4.2.8 Audio Input Stage

The audio input stage of the module consists of a low noise input amplifier, which receives its analogue input signal from pins MIC_A_P and MIC_A_N to a second-order Σ - Δ ADC that outputs a 4Mbit/sec single-bit stream into the digital circuitry. The input can be configured to be either single ended or fully differential. It can be programmed for either microphone or line input and has a 3-bit digital gain setting of the input-amplifier in 3dB steps to optimize it for the use of different microphones.

4.2.9 Microphone Input

Check the reference design in **Figure 5** for the microphone input design.

4.2.10 Audio Output Stage

The output digital circuitry converts the signal from 16-bit per sample, linear PCM of variable sampling frequency to a 2Mbits/sec multi-bit stream, which is fed into the analogue output circuitry.

The output circuit comprises a digital to analogue converter with gain setting and output amplifier. Its class-AB output-stage is capable of driving a signal on both channels of up to 2V_{pk-pk} differential into a load of 16 Ω . The output is available as a differential signal between SPK_A_P and SPK_A_N for the left channel; and between SPK_B_P and SPK_B_N for the right channel. The output is capable of driving a speaker directly if its impedance is at least 8 Ω if only one channel is connected or an external regulator is used.

The gain of the output stage is controlled by a 3-bit programmable resistive divider, which sets the gain in steps of approximately 3dB.

The multi-bit stream from the digital circuitry is low pass filtered by a second order bi-quad filter with a pole at 20kHz. The signal is then amplified in the fully differential output stage, which has a gain bandwidth of typically 1MHz.

4.3 RF Interface

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

4.4 General Purpose Analog IO

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

4.5 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.



4.6 Serial Interfaces

4.6.1 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.

4.6.2 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.

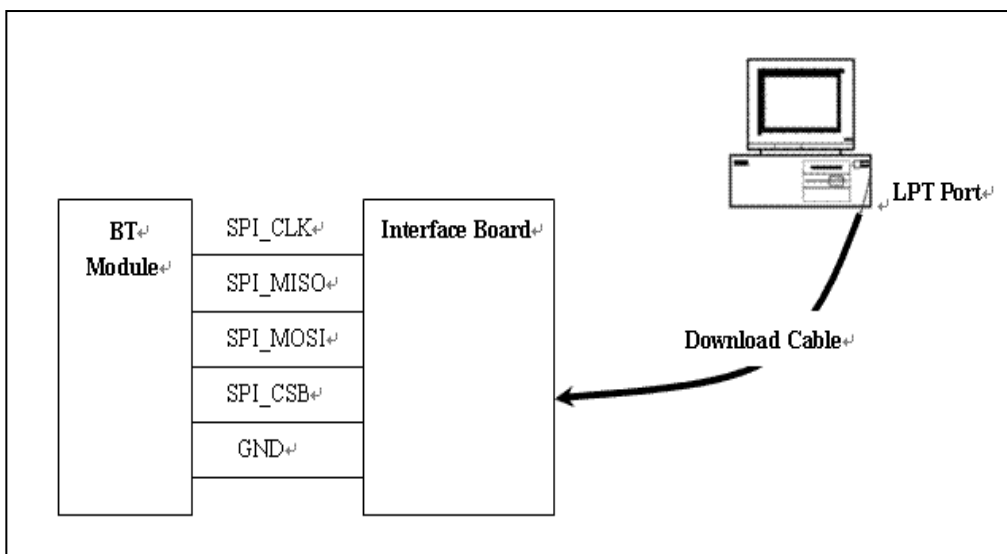


Figure 7



5. ELECTRICAL CHARACTERISTIC

5.1 Absolute Maximum Rating

Rating	Min	Max	Unit
Storage Temperature	-40	+150	°C
Operating Temperature	-40	+105	°C
PIO/AIO Voltage	-0.4	+3.6	V
+5V Voltage	-0.4	+5.5	V
Other Terminal Voltages except RF	-0.4	3V3+0.4	V

Table 1

5.2 Recommended Operating Conditions

Operating Condition	Min	Typical	Max	Unit
Operating Temperature Range	-40	--	+85	°C
+5V Voltage	+5	+5	+5.5	V

Table 2

5.3 Input/output Terminal Characteristics

5.3.1 Digital Terminals

Supply Voltage Levels	Min	Typical	Max	Unit
Input Voltage Levels				
V _{IL} input logic level low	-0.3	-	+0.25x5V	V
V _{IH} input logic level high	0.625x5V	-	5V+0.3	V
Output Voltage Levels				
V _{OL} output logic level low, I _{OL} = 4.0mA	-	-	0.125	V
V _{OH} output logic level high, I _{OH} = -4.0mA	0.75x5V	-	0.625x5V	V
Input and Tri-state Current				
I _i input leakage current at V _{in} =+3V3 or 0V	-100	0	100	nA
I _{oz} tri-state output leakage current at V _o =+3V3 or 0V	-100	0	100	nA
With strong pull-up	-100	-40	-10	μA
With strong pull-down	10	40	100	μA
With weak pull-up	-5	-1.0	-0.2	μA
With weak pull-down	0.	+1.	5.0	μA
I/O pad leakage current	-1	0	+1	μA
CI Input Capacitance	1.	-	5.0	pF



Resistive Strength				
Rpuw weak pull-up strength at +3V3-0.2V	500k	-	2M	Ω
Rpdw weak pull-up strength at 0.2V	500k	-	2M	Ω
Rpus strong pull-up strength at +3V3-0.2V	10k	-	50k	Ω
Rpds strong pull-up strength at 0.2V	10k	-	50k	Ω

Table 3

5.3.2 Internal CODEC - Analogue to Digital Converter

Parameter		Min	Typical	Max	Unit
Resolution		-	-	16	Bits
Input Sample Rate		8	-	44.1	kHz
Signal / Noise, $f_{in}=1\text{kHz}$, BW=20Hz->20kHz A-Weighted THD+N<1% 150mV Vpk-pk					
$F_{sample} = 8\text{kHz}$		-	82	-	dB
$F_{sample} = 11.025\text{kHz}$		-	81	-	dB
$F_{sample} = 16\text{kHz}$		-	80	-	dB
$F_{sample} = 22.05\text{kHz}$		-	79	-	dB
$F_{sample} = 32\text{kHz}$		-	79	-	dB
$F_{sample} = 44.1\text{kHz}$		-	78	-	dB
Digital Gain		-24	-	21.5	dB

Table 4

5.3.3 Internal CODEC - Digital to Analogue Converter

Parameter	Min	Typical	Max	Unit
Resolution	-	-	16	Bits
Output Sample Rate, F_{sample}	8	-	48	kHz
Signal / Noise, $f_{in}=1\text{kHz}$, BW=20Hz->20kHz A-Weighted THD+N<0.01% 0dBFS signal Load 100k Ω				
$F_{sample} = 8\text{kHz}$	-	95	-	dB
$F_{sample} = 11.025\text{kHz}$	-	95	-	dB
$F_{sample} = 16\text{kHz}$	-	95	-	dB
$F_{sample} = 22.05\text{kHz}$	-	95	-	dB
$F_{sample} = 32\text{kHz}$	-	95	-	dB
$F_{sample} = 44\text{kHz}$	-	95	-	dB
$F_{sample} = 48\text{kHz}$	-	95	-	dB
Digital Gain	-24	-	21.5	dB
Gain Resolution		1/32		dB

Table 5



5.3.4 Microphone Input

Microphone Input	Min	Typical	Max	Unit
Input full scale at maximum gain	-	4	-	mV rms
Input full scale at minimum gain(differential)	-	800	-	mV rms
Gain	-3	-	42	dB
Gain resolution	-	3	-	dB
Distortion at 1kHz	-	-	-74	dB
3dB Bandwidth	-	20		kHz
Input impedance	-	6		k Ω
THD+N(microphone input)@30mV rms input	-	0.04	-	%

Table 6

5.3.5 Speaker Output

Speaker Driver	Min	Typical	Max	Unit
Output voltage full scale swing (differential)	-	750	-	mV rms
THD+N 100k Ω load	-	-	0.01%	%
THD+N 16 Ω load	-	-	0.1%	%
SNR(Load=16 Ω , 0dBFS input relative to	-	95	-	dB

Table 7

5.4 Power consumptions

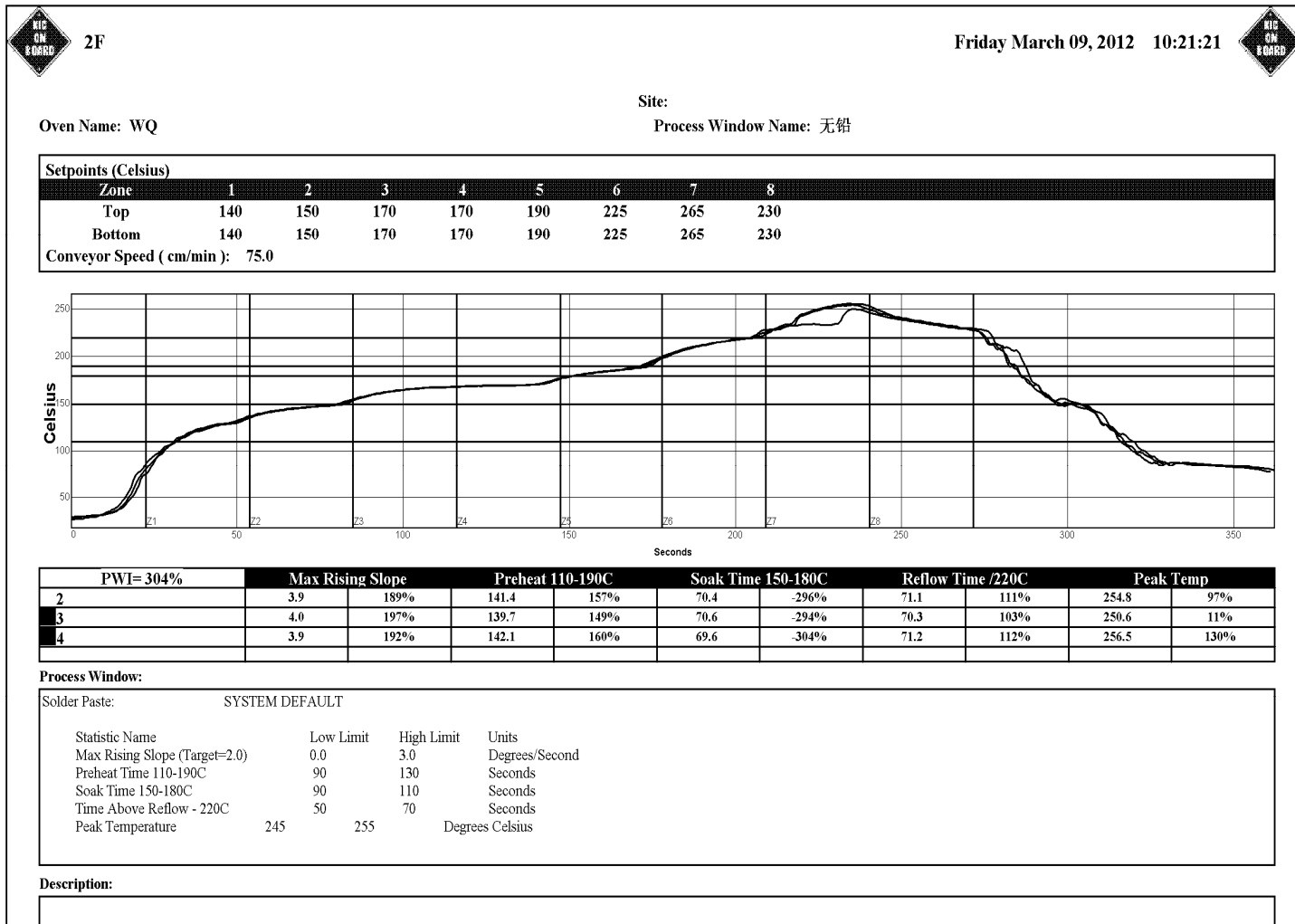
Operating Condition	Min	Typical	Max	Unit
Connected Idle (Sniff 1.28 secs)		0.19		mA
Connected with audio streaming	30	35	40	mA
Deep Sleep Idle mode		60		μ A

Table 8



6. RECOMMENDED TEMPERATURE REFLOW PROFILE

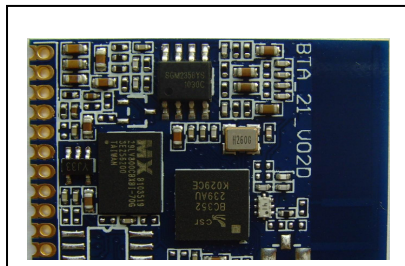
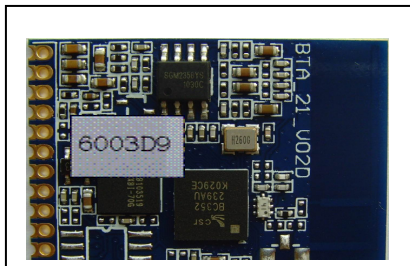
The soldering profile depends on various parameters necessitating a set up for each application. The data here is given only for guidance on solder reflow.



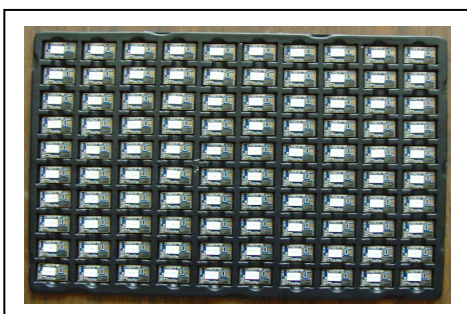


7. PACKAGING INFORMATION

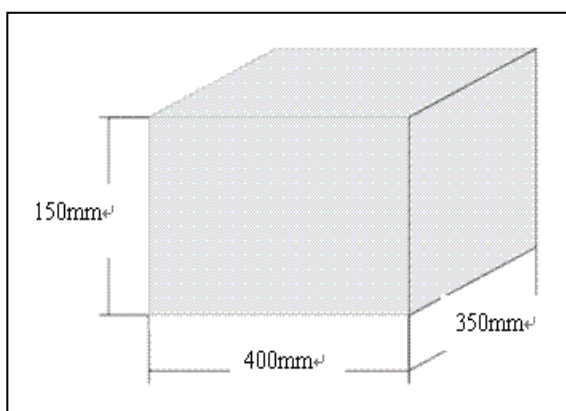
1. BLUETOOTH® Module: BTA21



2. Assembly



3. Dimension



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