# BTM8670

## Bluetooth Module Data Sheet

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|---|---|
| Document Type: | Bluetooth Module Datasheet |
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# Revision History

| Date | Version | Description | Author |
|---|---|---|---|
| 2013-03-06 | V1.0 | ■ First Release | |
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# CONTENT

# 1. INTRODUCTION

The BTM8670 Bluetooth® module is a perfect consumer audio solution for wireless applications, such as wireless sound bars, 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 BTM8670 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 architect with flash memory enables manufactures to easily differentiate the products with new features without extending development cycles. It integrates RF Baseband controller, antenna,… etc. and provide UART interface, programmable I/O, stereo speaker output, microphone input,… etc.

The detail information of BTM8670 Bluetooth® module is presented in this document below.

## 1.1 Block Diagram

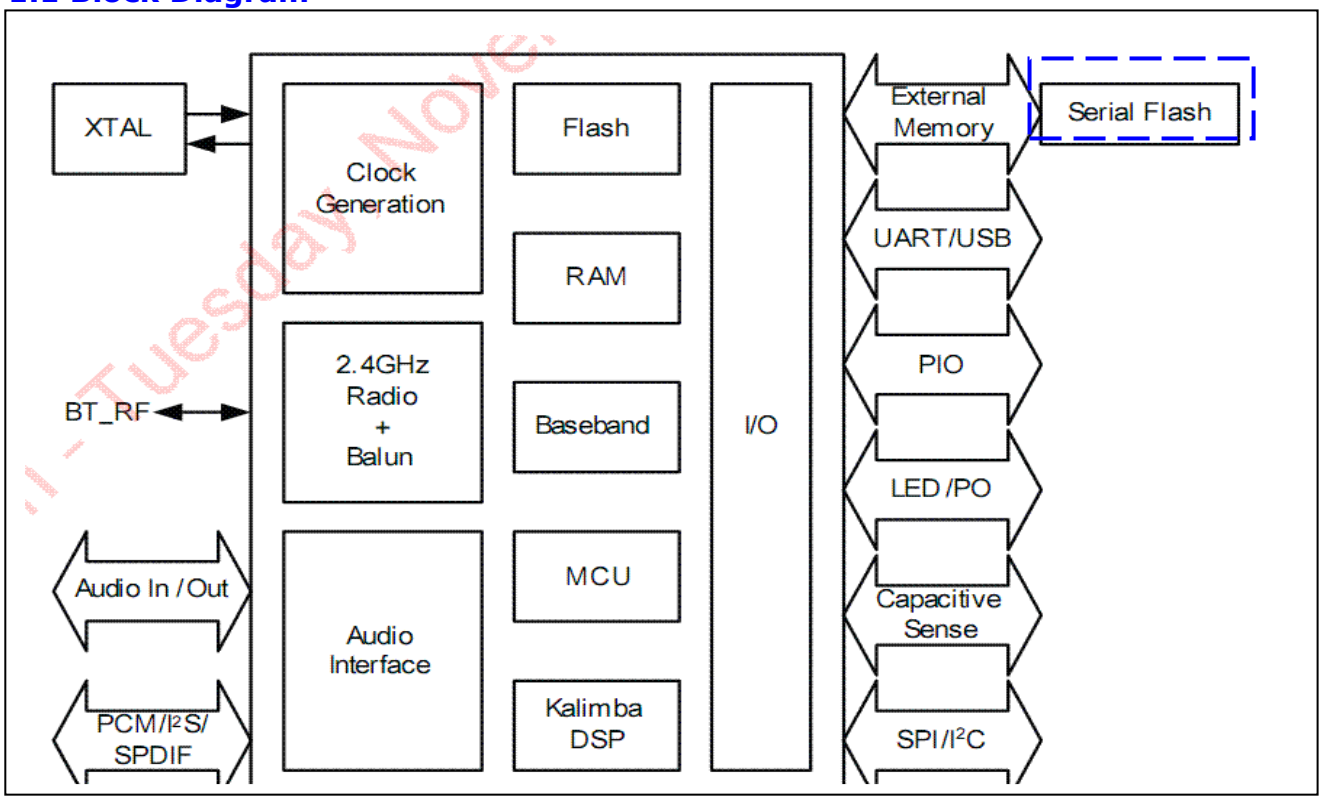



Figure 1

## 1.2 Features

- ✓ Small overall dimension(22mm x 15mm x 2mm )
- ✓ Bluetooth Specification V4.0(Dual Mode)
- ✓ Class1,Class 2and Class 3 support
- ✓ Physical connection as SMD type
- ✓ 80MHz RISC MCU and 80MIPS Kalimba DSP
- ✓ 16Mb internal flash memory(64-bit wide,45ns);optional support for 64Mb of external SPI flash
- ✓ Stereo codec with 2 channels ADC and up to 6 microphone inputs(include bias generators and digital microphone support)
- ✓ Support for CSR's latest CVC technology for narrow-band and wideband voice connections including wind noise reduction
- ✓ Music Enhancements: SBC,MP3,AAC and AAC+, Fast stream codec,atpX,5-band EQ,3D stereo separation and so on.
- ✓ Audio Interfaces: I2S,PCM and SPDIF
- ✓ Serial Interfaces: UART,USB 2.0,I2C and SPI
- ✓ Support HSP, HFP, A2DP, AVRCP,PBAP,MAP,SPP,iAP profile
- ✓ Multipoint support for HFP connection to 2 handsets for voice
- ✓ Multipoint support for A2DP connection to 2 A2DP source for music play back
- ✓ 3 Hardware LED controllers (for RGB) and ability to drive LCD segment display directly
- ✓ Support for up to 6 capacitive touch sensor inputs
- ✓ Built-in RF combo filter, Integrated 26M Crystal.
- ✓ No radio signal interference, support for 802.11 co-existence

※ ***Some features are optional for customization on demand.***

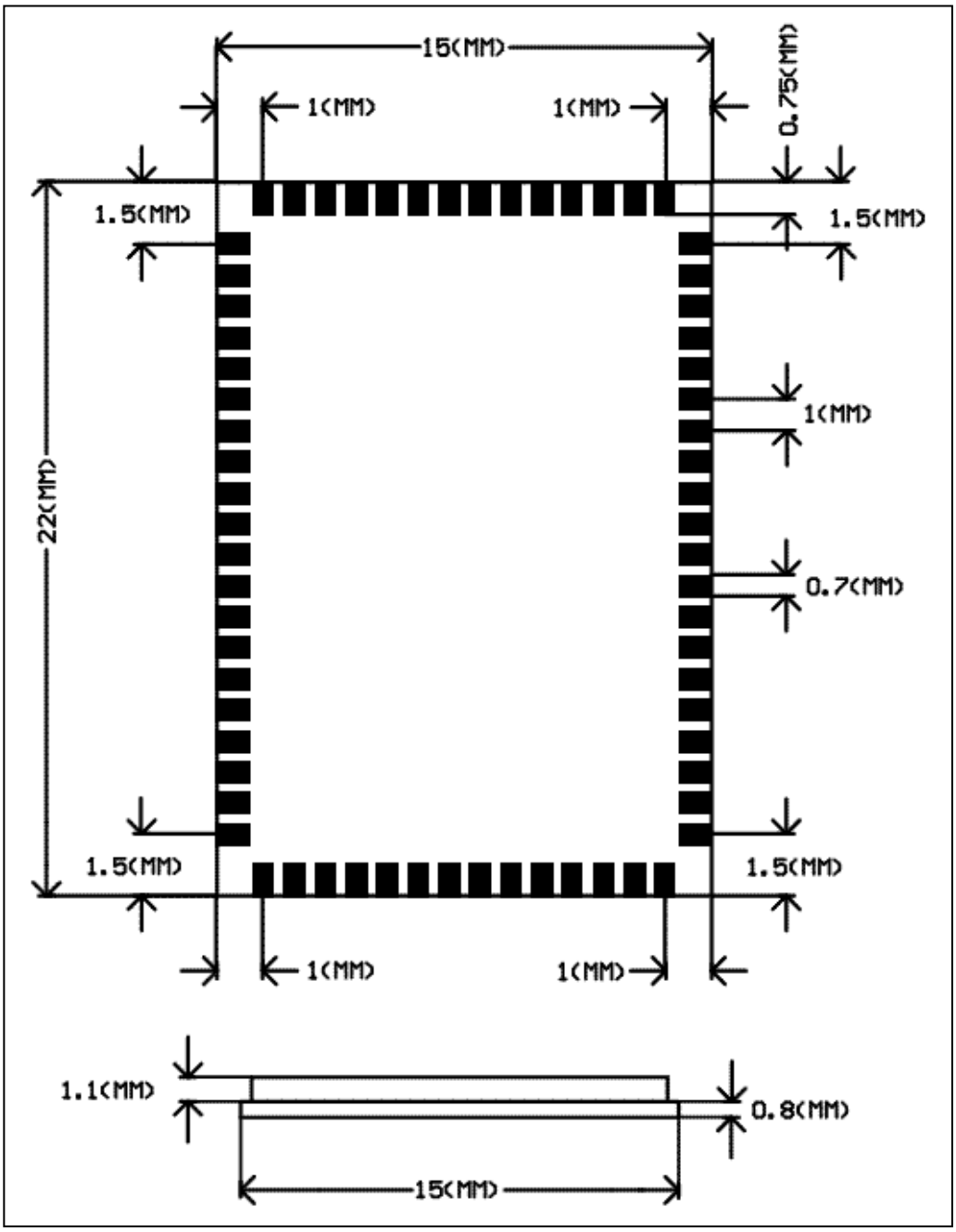
## 1.3 Application

- ✓ TVs
- ✓ Smart remote controllers
- ✓ Wired or wireless sound bars
- ✓ Wired or wireless speakers and headphones
- ✓ Wearable audio with sensors(health and well-being applications)

# 12. GENERAL SPECIFICATION

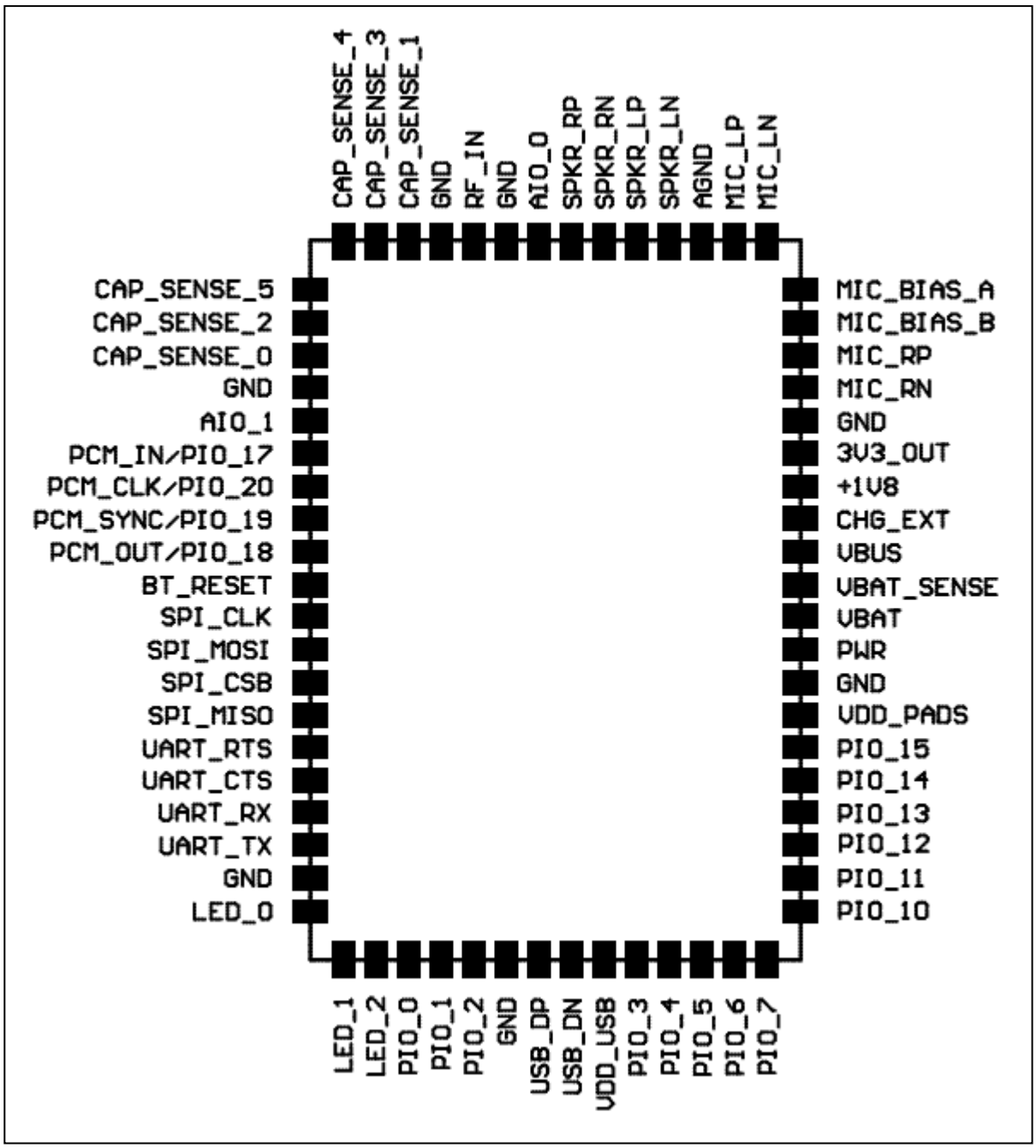
| **Bluetooth Specification** | |
|---|---|
| Chip Set | CSR8670 |
| Module ID | BTM8670 |
| BT Standard | Bluetooth® V4.0 specification |
| RF TX Output Power | 10dBm (Max) |
| Sensitivity | -90dBm@0.1%BER |
| Frequency Band | 2.402GHz~2.480GHz ISM Band |
| Baseband Crystal OSC | 26MHz |
| Hopping | 1600hops/sec, 1MHz channel space |
| RF Input Impedance | 50 ohms |
| Major Interface | • Microphone : Input (Differential)<br>• Speaker : Output (Differential)<br>• UART : Tx/Rx<br>• PIOs<br>• Antenna |
| Profile | HSP, HFP, A2DP, AVRCP,PBAP,MAP,SPP |
| Voice Processor | 80MIPS Kalimba with cVc support |
| **Power** | |
| Supply Voltage | 3.0V ~ 4.2V DC |
| Working Current | 15mA typical, Depends on profiles |
| Standby Current | <1mA |
| **Operating Environment** | |
| Temperature | -40ºC to +85ºC |
| 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 | 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 debouched 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<br>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 | NC | 1.7V to 3.6V positive supply input for digital input/output ports PIO[15:4] |

| | | | |
|---|---|---|---|
| 42 | GND | Ground | Digital Ground |
| 43 | PWR | Input enable | Regulator enable input.<br>Can also be sensed as an input.<br>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<br>Switch mode power supply regulator inputs.<br>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 | NC | 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. 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 20μs or less.

## 4.2 Audio Interfaces

The Audio interface circuit consists of:

- Stereo/dual-mono audio codec
- Dual analogue audio inputs
- Dual analogue audio outputs
- 6 digit MEMS microphone inputs
- A configurable PCM,I2S or SPDIF interface

As below shows the functional blocks of the interface. The codec supports stereo/dual-mono playback and recording of audio signals at multiple sample rates with a 16-bit resolution. The ADC and DAC of the codec each contain 2 independent high-quality channels. Any ADC or DAC channel runs at its own independent sample rate.

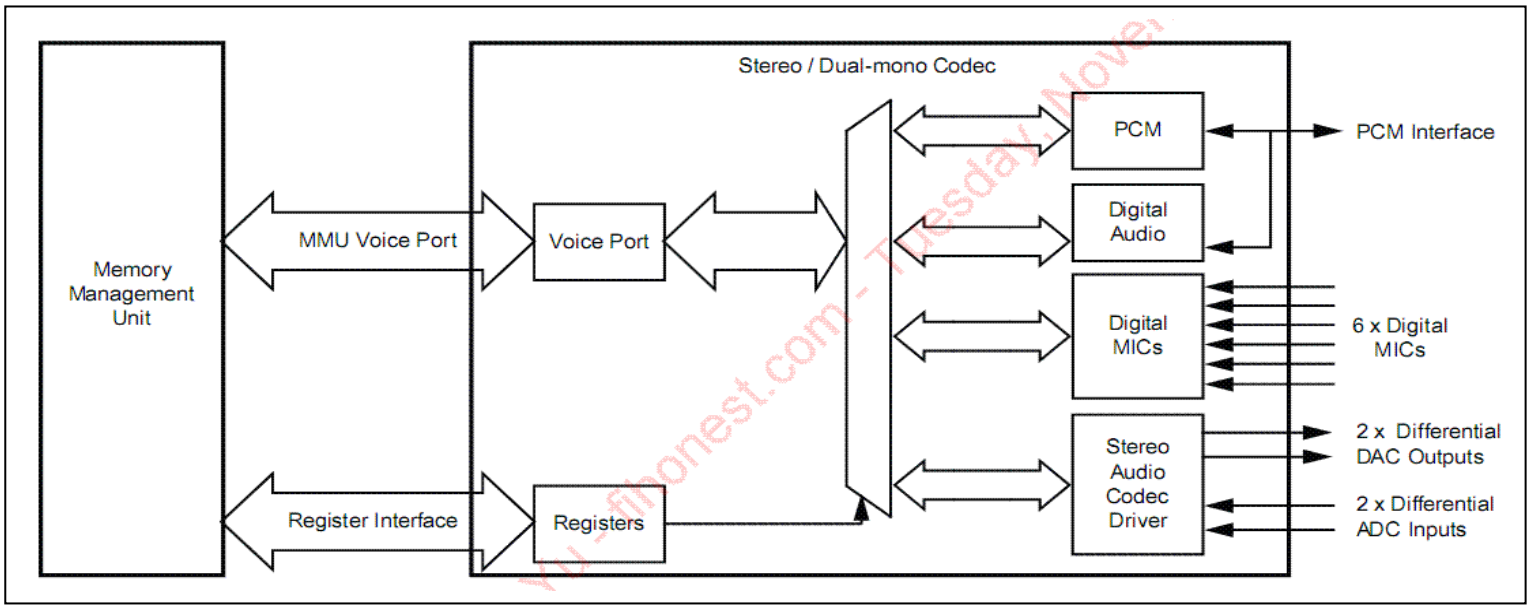



**Figure 4**

The interface for the digital audio bus shares the same pins as the PCM codec interface described in section as below which means each of the audio buses are mutually exclusive in the usage. As below lists these alternative functions.

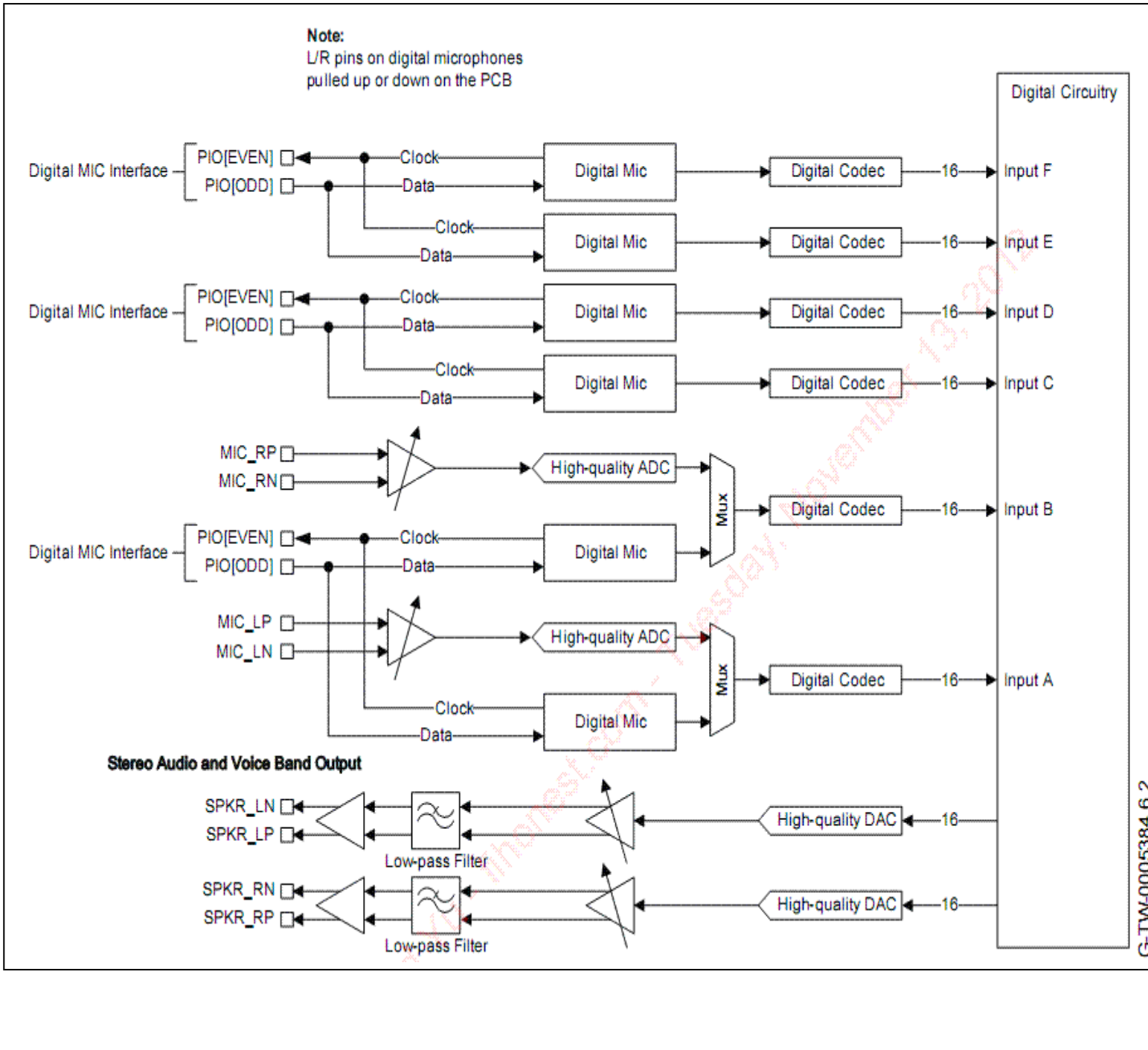
| PCM Interface | SPDIF Interface | I²S Interface |
|---|---|---|
| PCM_OUT | SPDIF_OUT | SD_OUT |
| PCM_IN | SPDIF_IN | SD_IN |
| PCM_SYNC | - | WS |
| PCM_CLK | - | SCK |

**Figure 5**

### 4.2.1 Audio Codec Interface

The main features of the interface are:

- Stereo and mono analogue input for voice band and audio band
- Stereo and mono analogue output for voice band and audio band
- Support for stereo digital audio bus standards such as I2S
- Support for IEC-60958 standard stereo digital audio bus standards, e.g. SPDIF and AES3(also known as AES/EBU)
- Support for PCM interfaces including PCM master codec that require an external system clock



### 4.2.2 ADC

Figure 3 shows the CSR8670 consists of 2 high-quality ADCs:

- Each ADC has a second-order Sigma-Delta converter
- Each ADC is a separate channel with identical functionality
- There are 2 gain stages for each channel,1 of which is an analogue gain stage and the other is a digital gain stages

### 4.2.3 ADC Sample Rate Selection

Each ADC supports the following pre-defined sample rates, although other rates are progrmmable,e.g.40kHz:

- 8kHz
- 11.025 kHz
- 16kHz
- 22.050kHz
- 24kHz
- 32 kHz
- 44.1kHz
- 48 kHz

### 4.2.4 ADC Digital Gain

A digital gain stage inside the ADC varies from -24dB to 21.5dB,see as below, there is also a fine gain interface with 9-bit gain setting allowing gain changes in 1/32 steps. The Firmware controls the audio input gain.

| Digital Gain Selection Value | ADC Digital Gain Setting (dB) | Digital Gain Selection Value | ADC Digital Gain Setting (dB) |
|---|---|---|---|
| 0 | 0 | 8 | -24 |
| 1 | 3.5 | 9 | -20.5 |
| 2 | 6 | 10 | -18 |
| 3 | 9.5 | 11 | -14.5 |
| 4 | 12 | 12 | -12 |
| 5 | 15.5 | 13 | -8.5 |
| 6 | 18 | 14 | -6 |
| 7 | 21.5 | 15 | -2.5 |

### 4.2.5 DAC

The DAC consists of:

- 2 fourth-order Sigma-Delta converters enabling 2 separate channels that are identical functionality, as figure x shows
- 2 gain stages for each channel, 1 of which is an analogue gain stage and the other is a digital gain stage

### 4.2.6 DAC Sample Rate Selection

- 8kHz
- 11.025kHz
- 16kHz
- 22.050kHz
- 32kHz
- 40kHz
- 44.1kHz
- 48kHz
- 96kHz

### 4.2.7 DAC Digital Gain

A digital gain stage inside the DAC varies from -24dB to 21.5dB,see as below, there is also a fine gain interface with 9-bit gain setting enabling gain changes in 1/32 steps. The overall gain control of the ADC is controlled by the firmware. Its setting is a combined function of the digital and analogue amplifier settings

| Digital Gain Selection Value | DAC Digital Gain Setting (dB) | Digital Gain Selection Value | DAC Digital Gain Setting (dB) |
|---|---|---|---|
| 0 | 0 | 8 | -24 |
| 1 | 3.5 | 9 | -20.5 |
| 2 | 6 | 10 | -18 |
| 3 | 9.5 | 11 | -14.5 |
| 4 | 12 | 12 | -12 |
| 5 | 15.5 | 13 | -8.5 |
| 6 | 18 | 14 | -6 |
| 7 | 21.5 | 15 | -2.5 |

### 4.2.8 DAC Analogue Gain

As below shows that the DAC analogue gain stage consists of 8 gain selection values that represent seven 3dB steps

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

| Analogue Gain Selection Value | DAC Analogue Gain Setting (dB) | Analogue Gain Selection Value | DAC Analogue Gain Setting (dB) |
|---|---|---|---|
| 7 | 0 | 3 | -12 |
| 6 | -3 | 2 | -15 |
| 5 | -6 | 1 | -18 |
| 4 | -9 | 0 | -21 |

### 4.2.9 IEC 60958 Interface

The IEC 60958 interface is a digital audio interface that uses bi-phase coding to minimize the DC content of the transmitted signal and enables the receiver to decode the clock information from the transmitted signal. The IEC 60958 specification is based on the 2 industry standards:

- AES3(also known as AES/EBU)
- Sony and Philips interface specification SPDIF

The interface is compatible with IEC 60958-1, IEC 60958-3 and IEC 60958-4

The SPDIF interface signals are SPDIF-IN and SPDIF-OUT and are shared on the PCM interface pin.

### 4.2.10 Microphone Input

BTM8670contains 2 independent low-noise microphone bias generators. The microphone bias generators are recommended for biasing electro condenser microphones. A biasing circuit for microphones with a sensitivity between about -40dB to -60dB(0dB=1V/Pa)

### 4.2.11 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.

### 4.2.12 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 impendence varies from 6kohm to 30kohm, depending on the volume setting.

### 4.2.13 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 16Ω. The output is available as a differential signal between SPK_R_RP and SPK_R_RN for the left channel; and between SPK_L_LP and SPK_L_LN for the right channel. The output is capable of driving a speaker directly if its impedance is at least 8Ω 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 PCM Interface

The audio PCM interface on the BTM8670 supports:

- On-chip routing to Kalimba DSP
- Continuous transmission and reception of PCM encoded audio data over Bluetooth.
- Processor overhead reduction through hardware support for continual transmission and reception of PCM data
- A bidirectional digital audio interface that routes directly into the baseband layer of the firmware .It does not pass through the HCI protocol layer.
- Hardware on the BTM8670 for sending data to and from a SCO connection.
- Up to 3 SCO connections on the PCM interface at any one time.
- PCM interface master, generating PCM_SYNC and PCM_CLK.
- PCM interface slave, accepting externally generated PCM_SYNC and PCM_CLK.
- Various clock formats including:
  Long Frame Sync
  Short Frame Sync
  GCI timing environments
- 13-bit or 16-bit linear, 8-bit u-law or A-law compander sample formats.
- Receives and transmits on any selection of 3 the first 4 slots following PCM_SYNC.

The PCM configuration options are enabled by setting the PS Key PSKEY_PCM_CONFIG32.

## 4.4 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 |

## 4.5 RF Interface

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

## 4.6 General Purpose Analog IO

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

## 4.7 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.

## 4.8 Serial Interfaces

### 4.8.1 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.**

### 4.8.2 I2C Interface

As this I2C interface is software-driven it is suited to relatively slow functions such as driving a dot matrix LCD, keyboard scanner or EEPROM. If it is not used, then PIO[7:6] are available to form a software-driven master I2C interface.

### 4.8.3 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.

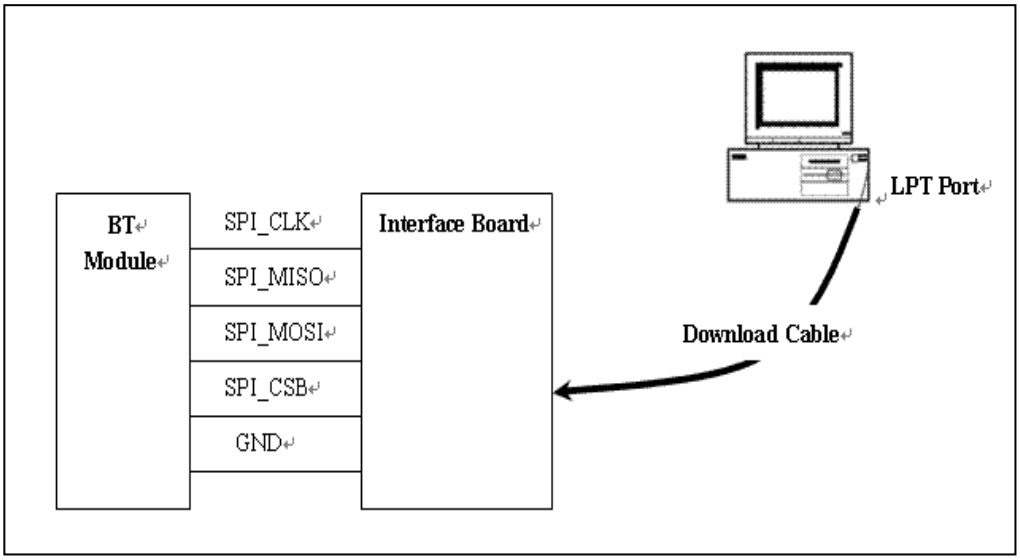



**Figure 6**

# 5. ELECTRICAL CHARACTERISTICS

## 5.1 Absolute Maximum Ratings

| Rating | | Min | Max | Unit |
|---|---|---|---|---|
| Storage temperature | | -40 | 105 | °C |
| Supply Voltage | | | | |
| 5V(USB VBUS) | VCHG | -0.4 | 5.75 | V |
| 3.3V | SMPS_3V3 | -0.4 | 3.60 | V |
| | VDD_USB | -0.4 | 3.60 | V |
| Battery | LED[2:0] | -0.4 | 4.40 | V |
| | SMP_VBAT | -0.4 | 4.40 | V |
| | | -0.4 | 5.75 | V |
| | | -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_PADS_3 | -0.4 | 3.60 | V |
| | SMPS_1V8_SENSE | -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**

## 5.2 Recommended Operating Conditions

| Rating | | Mi | Typ | Max | Uni |
|---|---|---|---|---|---|
| Operating temperature range | | -40 | 20 | 85 | °C |
| Supply Voltage | | | | | |
| | VCHG | 4.75 / 3.10 | 5.00 | 5.75 | V |
| 3.3V | SMPS_3V3 | 3.10 | 3.30 | 3.60 | V |
| | VDD_USB | 3.10 | 3.30 | 3.60 | V |
| Battery | LED[2:0] | 1.10 | 3.70 | 4.25 | V |
| | SMP_VBAT | 2.50 | 3.70 | 4.25 | |
| | VBAT_SENSE | 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_PADS_3 | 1.70 | 1.80 | 3.60 | |
| | SMPS_1V8_SENSE | 1.70 | 1.80 | 1.95. | V |
| 1.35V | SMPS_1V35_SENSE | 1.30 | 1.35 | 1.40 | V |
| | VDD_AUDIO | 1.30 | 1.35 | 1.40 | V |
| | VREGIN_DIG | 1.30 | 1.35 or 1.80 | 1.95 | V |

**Table 2**

## 5.3 Input/output Terminal Characteristics

### 5.3.1 Codec: Analogue to Digital Converter

| Analogue to Digital Converter | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Conditions | | Mi | Typ | Max | Uni |
| Resolution | - | | - | - | 16 | Bits |
| Input Sample Rate, | - | | 8 | - | 48 | kHz |
| SNR | $f_{in}$ = 1kHz B/W = 20Hz→$F_{sample}$/2 (20kHz max) A-Weighted | $F_{sample}$ | | | | |
| | | 8kHz | - | 93 | - | dB |
| | | 16kHz | - | 92 | - | dB |
| | | 32kHz | - | 92 | - | dB |
| | | 44.1kHz | - | 92 | - | dB |
| | | 48kHz | - | 92 | - | dB |
| THD+N | $f_{in}$ = 1kHz B/W = 20Hz→$F_{sample}$/2 (20kHz max) | $F_{sample}$ | | | | |
| | | 8kHz | - | 0.004 | - | % |
| | | 48kHz | - | 0.008 | - | % |
| 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 |
| Stereo separation(crosstalk) | | | - | -89 | - | dB |

**Table 3**

### 5.3.2 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 | $f_{in}$ = 1kHz<br>B/W = 20Hz→20kHz<br>A-Weighted<br>THD+N < 0.1% | $F_{sample}$ | Load | | | | |
| | | 48kHz | 100kΩ | - | 96 | - | dB |
| | | 48kHz | 32Ω | - | 96 | - | dB |
| | | 48kHz | 16Ω | - | 96 | - | dB |
| THD+N | $f_{in}$ = 1kHz<br>B/W = 20Hz→20kHz<br>0dBFS input | $F_{sample}$ | Load | | | | |
| | | 8kHz | 100kΩ | - | 0.002 | - | % |
| | | 8kHz | 32Ω | - | 0.002 | - | % |
| | | 8kHz | 16Ω | - | 0.003 | - | % |
| | | 48kHz | 100kΩ | - | 0.003 | - | % |
| | | 48kHz | 32Ω | - | 0.003 | - | % |
| | | 48kHz | 16Ω | - | 0.004 | - | % |
| Digital Gain | Digital Gain Resolution = 1/32 | | | -24 | - | 21.5 | dB |
| Analogue Gain | Analogue Gain Resolution = 3dB | | | -21 | - | 0 | dB |
| Stereo separation(crosstalk) | | | | - | -88- | - | dB |

**Table 4**

# 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.

2F Friday March 09, 2012 10:21:21

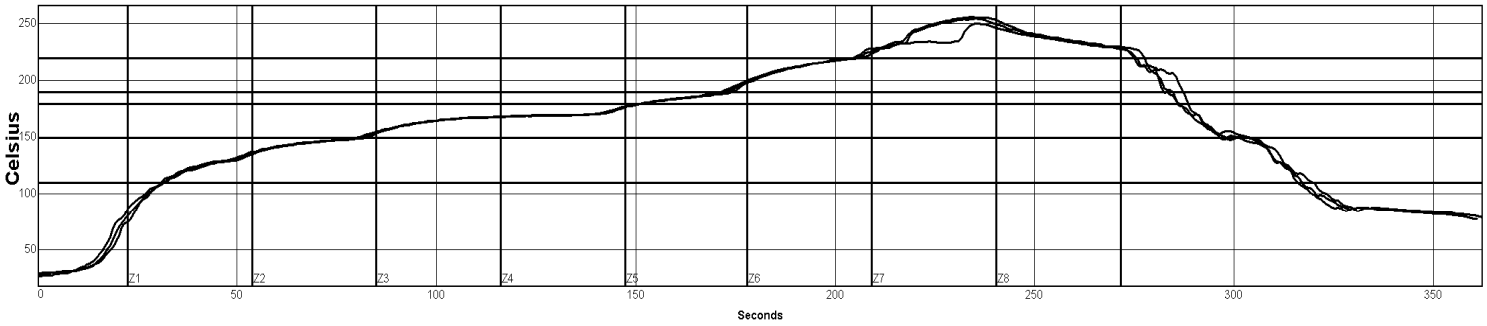
Site:

Oven Name: WQ Process Window Name: 无铅

Setpoints (Celsius)

| Zone | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Top | 140 | 150 | 170 | 170 | 190 | 225 | 265 | 230 |
| Bottom | 140 | 150 | 170 | 170 | 190 | 225 | 265 | 230 |

Conveyor Speed ( cm/min ): 75.0




| PWI= 304% | Max Rising Slope | | Preheat 110-190C | | Soak Time 150-180C | | Reflow Time /220C | | Peak Temp | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 3.9 | 189% | 141.4 | 157% | 70.4 | -296% | 71.1 | 111% | 254.8 | 97% |
| 3 | 4.0 | 197% | 139.7 | 149% | 70.6 | -294% | 70.3 | 103% | 250.6 | 11% |
| 4 | 3.9 | 192% | 142.1 | 160% | 69.6 | -304% | 71.2 | 112% | 256.5 | 130% |

Process Window:

Solder Paste: SYSTEM DEFAULT

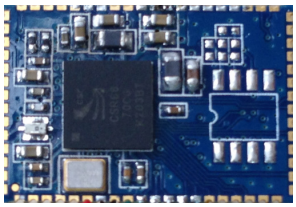
| Statistic Name | Low Limit | High Limit | Units |
|---|---|---|---|
| Max Rising Slope (Target=2.0) | 0.0 | 3.0 | Degrees/Second |
| Preheat Time 110-190C | 90 | 130 | Seconds |
| Soak Time 150-180C | 90 | 110 | Seconds |
| Time Above Reflow - 220C | 50 | 70 | Seconds |
| Peak Temperature | 245 | 255 | Degrees Celsius |

Description:

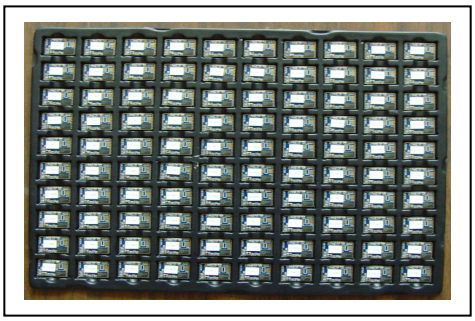
**Figure 7**

# 7. PACKAGING INFORMATION

1. BLUETOOTH® Module: BTM8670



2. Assembly



3. Dimension