

Technical Description:

The Equipment Under Test (EUT) is a 2.4GHz Bluetooth speaker. The EUT can accept line in analog audio source. The Bluetooth portion is operating between 2402MHz and 2480MHz (79 channels with 1MHz channel spacing, adaptive frequency hopping). The EUT is powered by 3.7VDC (1 * 3.7VDC Lithium rechargeable battery) or powered by USB port. The USB interface of the EUT does not contain PC Connectivity which is for charging use only. When the EUT is switched ON in Bluetooth mode, the light will be flashing. The corresponding Bluetooth device would be searched and connected to the EUT before playing audio. After pairing, the light will stay lit.

2.4GHz Bluetooth Module:

Modulation Type: GFSK

Frequency Range: 2402MHz - 2480MHz, 1MHz channel spacing, 79 channels

Antenna Type: Integral, Internal (PCB Trace)

Antenna Gain: 0dBi

Nominal rated field strength: 86.0BμV/m at 3m

Maximum allowed field strength of production tolerance: +4dB / - 4dB

1. Bluetooth module F6188(U4):

- a. BK8000 (U1) acts as the Bluetooth transceiver.
- b. The 26MHz crystal (Y1) provides system clock for BK8000 (U1)
- c. 25Q40BT (U2) is the EEPROM for parameter setup for the Bluetooth module.

2. Audio portion:

- 1) 4871 (U3) is power amplifier driving 2 speakers.

3. Power Management portion:

- 1) U4 BT405 (U9) acts a DC/DC converters
- 2) DW01 (U5) and 8205S (U6) are battery protection ICs.



The Bluetooth module F-6X88 manual

一、Product overview:

Intelligent wireless audio data transmission products F-6X88 Bluetooth module for the independent development of our company, is the high price of stereo wireless transmission scheme of low cost, module uses chip to provide the high quality and compatibility for the module, the overall better performance. F-3008 Bluetooth module with free driving mode, customers only need to access the application module products, wireless transmission can quickly realize the music, enjoy wireless music.

二、Field of application:

This module is mainly used for music transmission in short distance, can be connected with mobile phone and personal computer, conveniently, the connection between PDA and other digital products, enjoy bluetooth wireless transmission of music.

※ Bluetooth audio

※ Bluetooth stereo headset

※ hands-free phone

The Bluetooth wireless audio transmission

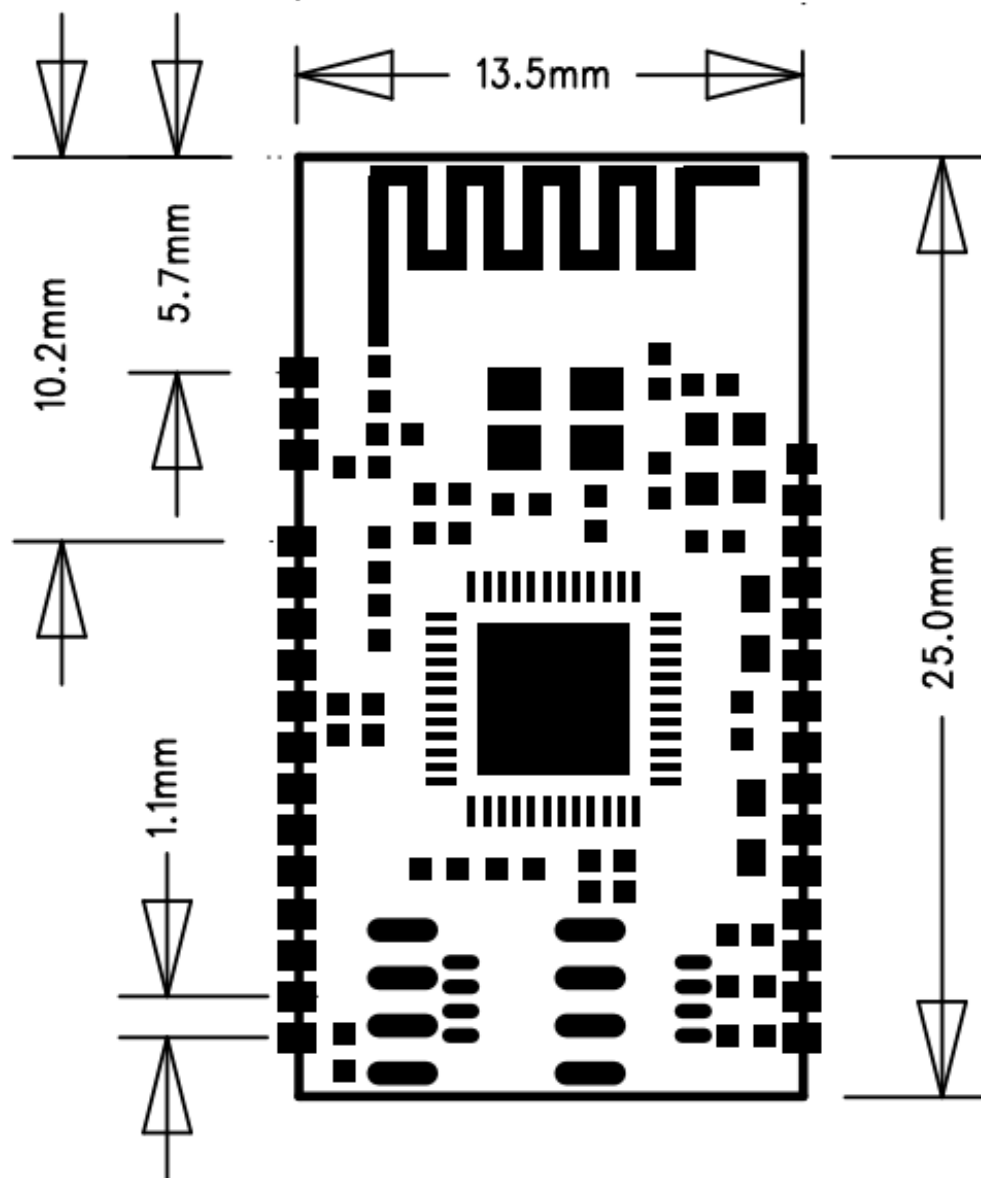
三、Performance parameters:

Model	F-6X88
Bluetooth specification	Bluetooth V2.1
supply voltage	DC2.8-4.2V
Support Bluetooth protocol	HFPV1.5, A2DPV1.2, AVRCPV1.0
working current	≤60mA
standby current	<500uA
temperature range	-40°C to +85°C



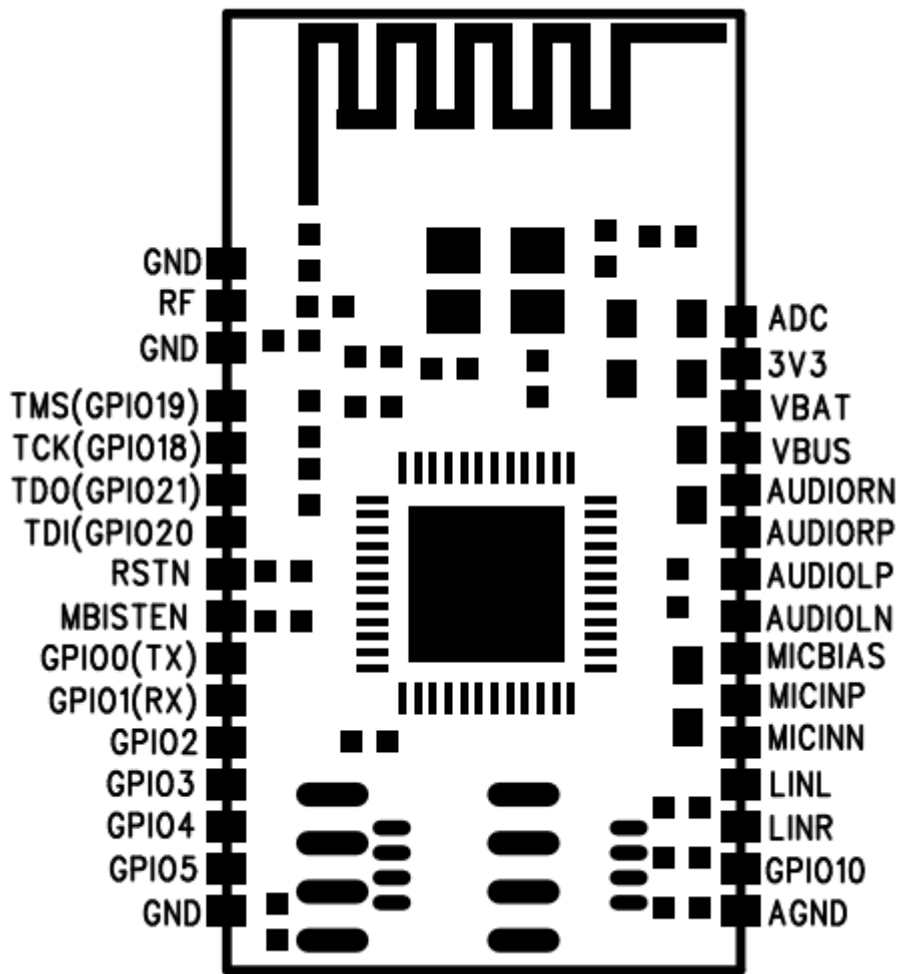
The wireless transmission range	<10 meter
Transmission power:	CLASS2, 4dbm
sensitivity:	-80dBm<0.1%BER
frequency range :	2.4GHz-2.480GHz
External Port:	I2C, SPI and UART interface
audio performance	SBCdecode
The audio Signal to Noise Ratio:	≥ 75 dB
Module size	25X13.5X1.8MM

五、The size graph of the module :





六、Module pin definition diagram



七、Pin description



Pin	Symb	I/O	Description
1	RF_GND	RF_GND	RF_GND
2	ANT	ANT	ANT PORT
3	RF_GND	RF_GND	RF_GND
4	TMS (GPIO19)	Digital I/O	JTAG pin
5	TCK (GPIO18)	Digital I/O	JTAG pin
6	TDO (GPIO21)	Digital I/O	JTAG pin
7	TDI (GPIO20)	Digital I/O	JTAG pin
8	RSTN	Digital I/O	JTAG pin / Reset pin-low active
9	MBISTEN	Digital I/O	Memory bit check
10	GPIO0 (TX)	Digital I/O	UART TX
11	GPIO1 (RX)	Digital I/O	UART RX
12	GPIO2	Digital I/O	GPIO2
13	GPIO3	Digital I/O	GPIO3
14	GPIO4	Digital I/O	GPIO4
15	GPIO5	Digital I/O	GPIO5
16	GND	GND	Ground connect battery negative
17	AGND	AGND	Ground connect battery negative
18	GPIO10	Digital I/O	GPIO10
19	LINR	AUX_INPUT	LINR
20	LINL	AUX_INPUT	LINL
21	MICINN	MIC-	MICINN
22	MICINP	MIC+	MICINP
23	MICBIAS	MICBIAS	MICBIAS
24	AUDIOLN	Audio output	Left channel audio output negative
25	AUDIOLP	Audio output	Left channel audio output positive
26	AUDIORP	Audio output	Right channel audio output positive
27	AUDIORN	Audio output	Right channel audio output negative
28	VBUS	Charge port	VBUS
29	VBAT	Power supply	Power supply
30	3V0	Power	3.0V output
31	ADC	Power	ADC input
32			



八、Connection circuit notice:

The F-6X88 module in the application process, please pay attention to avoid the influence of power amplifier, a boost circuit to avoid interference source module, module power supply circuit with high power circuit unit to form a series circuit, in order to improve the SNR

九、Notice:

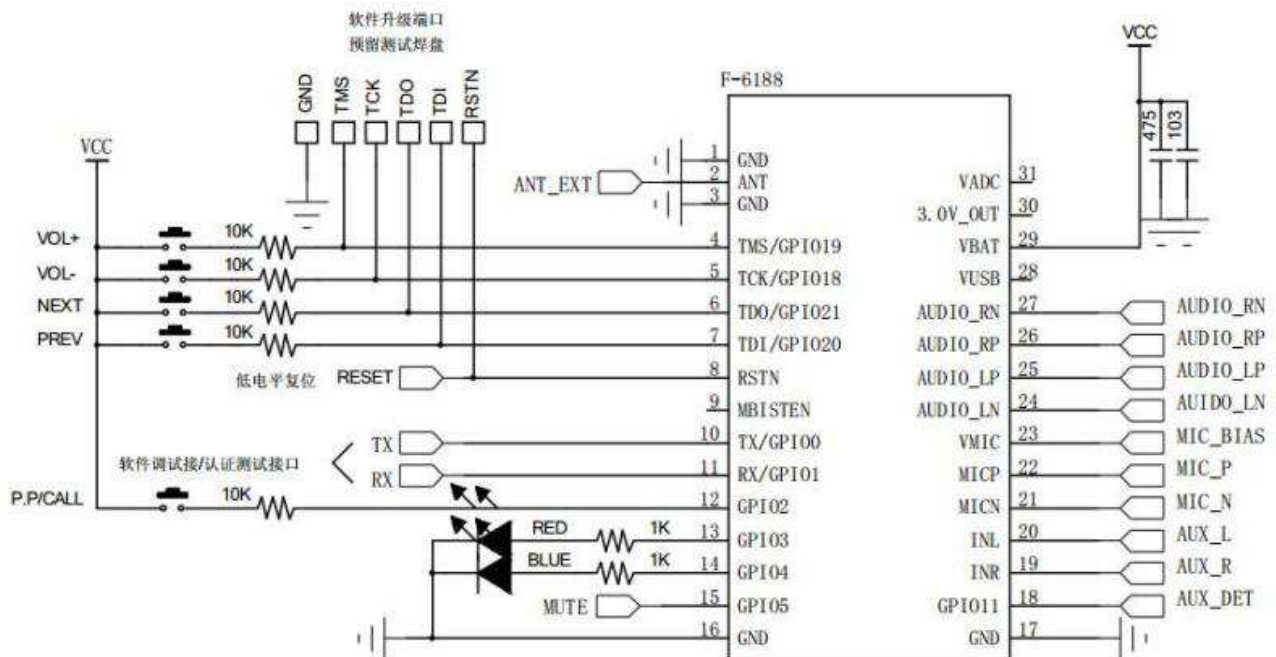
A. About the Bluetooth wireless application environment, wireless signal includes a Bluetooth application are influenced by the surrounding environment, such as

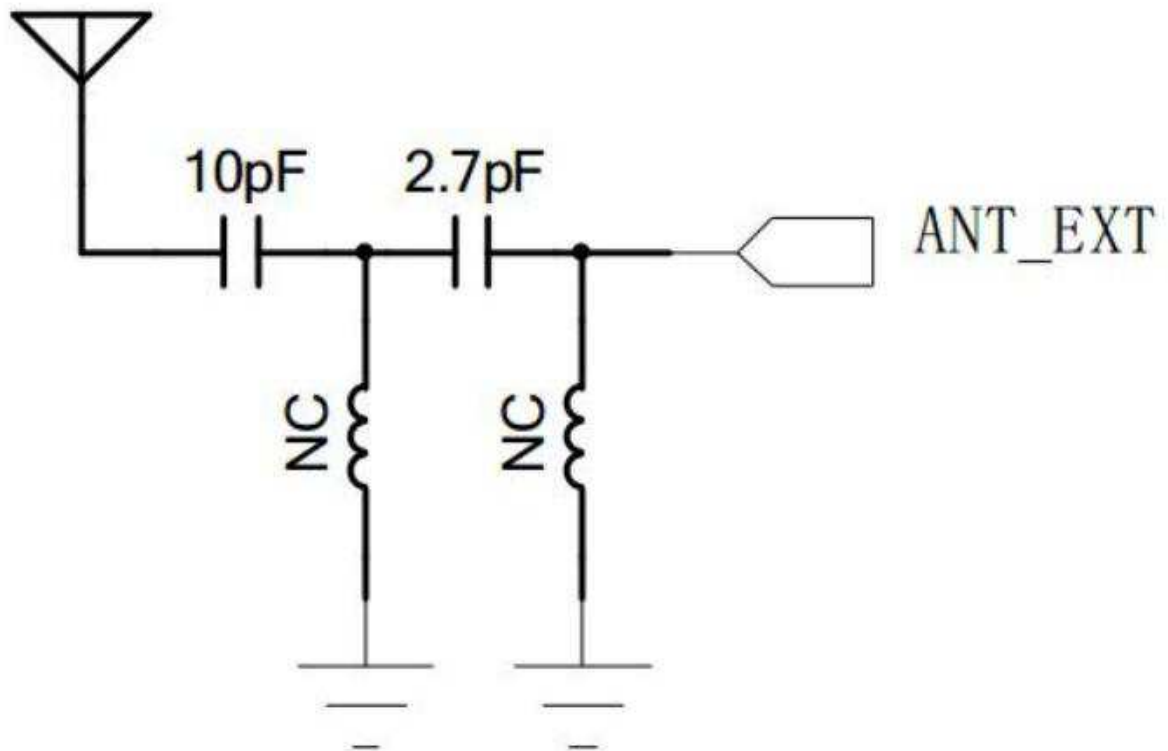
Wood, metal and other obstacles will be absorbed on the wireless signal, thus in the practical application, influence the distance of data transmission

B. Because Bluetooth module to complete the existing system, placed in the shell. Because of the metal shell on the radio frequency signal Is a shielding effect. It is recommended not to install in a metal shell.

C. PCB Layout: The antenna part of the Bluetooth module is the PCB antenna, the metal will weaken the function of antenna, while to the module layout, below the antenna module is prohibit paving and walk the line, if hollow out it is better

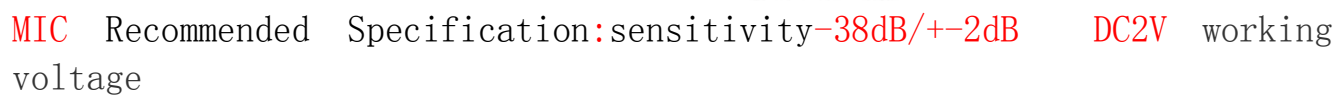
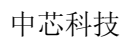
十、Application circuit:





Notice: The module has built-in antenna, external antenna as the need increases

MIC circuit:





BK8000 Bluetooth Audio SoC Datasheet

Preliminary Specification

Approvals

<i>Name</i>	<i>Date</i>	<i>Signature</i>

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Disclaimer: Descriptions of specific implementations are for illustrative purpose only, actual hardware implementation may differ.



Revision History

Rev.	Date	Author(s)	Remark
0.1	Dec/17/2013	WF	Initial release



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1. General Description

The BK8000 chip is a highly integrated single-chip Bluetooth audio device. It integrates the high-performance transceiver, rich features baseband processor, and Bluetooth audio profile. The BK8000 cache based architecture enables it is fully programmable with any application, that it may be used for control and multimedia hybrid application.

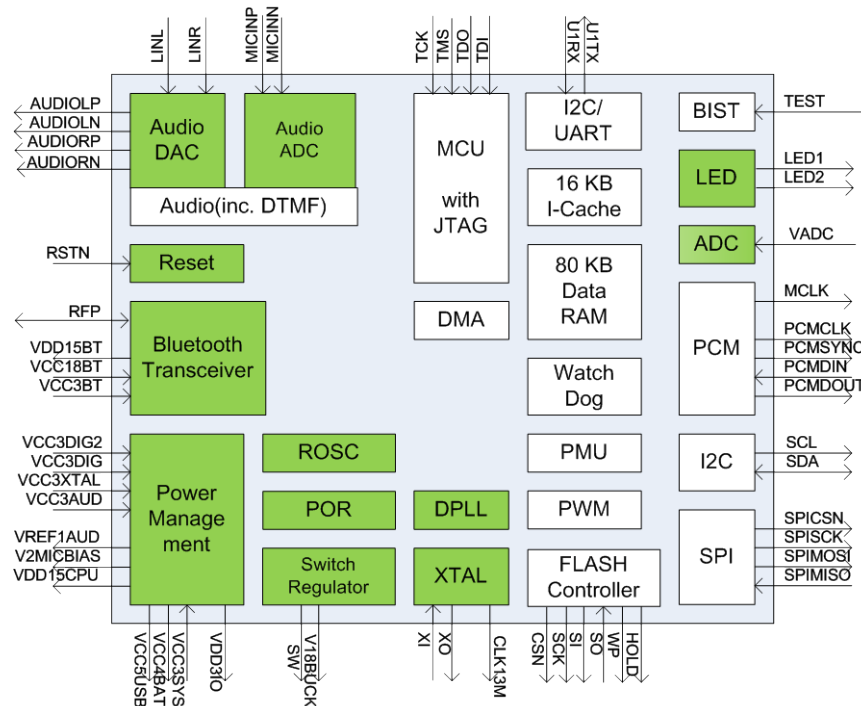
- -90 dBm sensitivity for 1 Mbps mode and 5 dBm transmit power
- A2DP v1.2, AVRCP v1.0 and HFP v1.5 profile
- Integrated 90 dB SNR stereo ADC and stereo DAC
- 19 GPIOs for the peripheral, debug and LED indicator
- Full duplex hands-free speakerphone
- QFN package with different size

1.1. Features

- Operation voltage from 2.8 V to 4.2 V
- Bluetooth 2.1 + EDR compliant

1.2. Applications

- Bluetooth stereo speaker
- Bluetooth stereo headset
- Bluetooth control and multimedia hybrid



2. Pin Definition

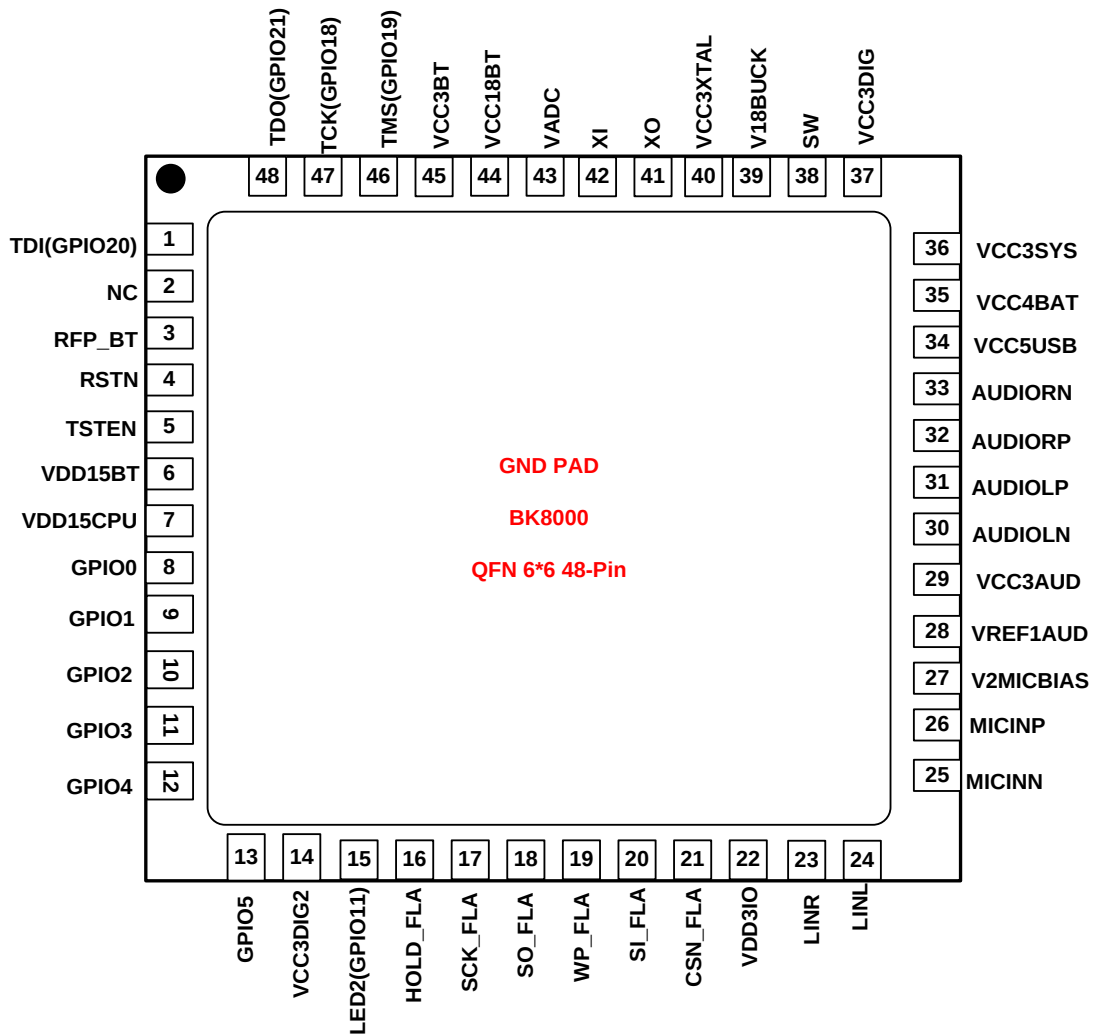


Figure 1 BK8000 QFN 6x6 Package

3. Functional Description

3.1. GPIO

The BK8000 has total 19 GPIOs, which can be configured as either input or output. Most of them have second function.

Table 1 GPIO Function Mapping

GPIO	Function Mapping
GPIO0	UART TXD or I2C2 SCL
GPIO1	UART RXD or I2C2 SDA
GPIO2	I2S Clock
GPIO3	I2S Symbol Clock
GPIO4	I2S Data Input
GPIO5	I2S Data Output
GPIO6	I2S Master Clock or SPI Enable
GPIO7	SPI Clock
GPIO8	SPI MOSI
GPIO9	SPI MISO
GPIO10	PWM0
GPIO11	PWM1
GPIO12	13 MHz Clock
GPIO13	I2C1 SCL
GPIO14	I2C1 SDA
GPIO18	JTAG_TCK
GPIO19	JTAG_TMS
GPIO20	JTAG_TDI
GPIO21	JTAG_TDO

All GPIO can be source to wake up MCU from shut down state. In shut down state, any level change on the set GPIO will trigger the wake up procedure.

3.2. PWM Timer and Watch Dog Timer

There are two sets of PWM timers. One fast set uses 1 MHz clock as main clock, and another slow set uses 32 kHz clock as main clock. Each set has three 16 bits counter with 4 bit pre-divider. First two timers in slow set can be used to LED duty cycle control.



The watch dog timer runs with 32 kHz clock, with period from 0.6 ms to 38 second.

3.3. Power Management

The BK8000 supports USB power supply that it can work without battery. When there is a USB power supply, it will charge the battery with automatically charge current control while provide power to the BK8000. The buck will give nearly half current reduction for digital power.

The BK8000 can enter into shut down mode when there is no active connection. The shut mode can be waked up by GPIO and USB charge.

3.4. MCU

The 16 bit RISC MCU has 16 KB I-Cache and DMA bus, to support efficient execution and frequently data exchange. The JTAG interface can be used to on-line debug, which can be also configured as GPIO.

Besides 26 MHz crystal, the MCU can run with internal 90 MHz DPLL clock, or 32 kHz ring oscillator clock, with programmable divided ratio.

3.5. I2C and UART Interface

There is one set of I2C interface and one set of UART interface for debug or external MCU control the BK8000. They share the two same GPIO0 and GPIO1.

3.6. I2S Interface

The 4-wires I2S interface can be used to interchange digital audio data with external audio CODEC. The BK8000 also provides the master clock through GPIO6.

Table 2 I2C Clock Frequency

Audio Sample Rate (KHz)	Audio Bit Clock (MHz)	I2S MCLK
8	4.096	16.384 MHz or 12.288 MHz



16	4.096	16.384 MHz or 12.288 MHz
44.1	5.6448	44.1 kHz * 256 = 11.29 MHz
48	6.144	48 kHz * 256 = 12.288 MHz

3.7. FM Receiver Control Interface

The FM receiver control interface consists of a two-wire I2C interface and a 13 MHz clock for FM receiver reference.

3.8. FLASH Access Interface

The BK8000 MCU is running with the external FLASH program memory and the internal instruction cache. The external FLASH can be also used to store user data such as key configuration and Bluetooth pairing information.

3.9. SPI

The 4-wires SPI supports high speed data communication, which can be used as interface to either external FLASH or LCD controller.

3.10. SAR ADC and LED

The SAR ADC has 10-bit resolution, and the two LED drivers support up to 10 mA current.

3.11. Audio Peripheral

There are one set of speech ADC with sample rate 8 kHz or 16 kHz. The DAC have two channels for stereo application, with sample rate 8 kHz, 16 kHz, 44.1 kHz or 48 kHz.

There is also a stereo line in interface, to allow external stereo input passing internal 31 dB programmable gain amplify to stereo output.

4. Electrical Characteristics

4.1. Absolute Maximum Ratings

Parameter	Description	MIN	TYP	MAX	Unit
VCCBAT	Battery regulator Supply voltage	-0.3	3.3	4.2	V
P _{RX}	RX input power	-	10	-	dBm
T _{STR}	Storage temperature range	-40	-	150	°C
VCCIO	IO interface voltage	-0.3	2.8	3.6	V

4.2. Recommended Operating Conditions

Parameter	Description	MIN	TYP	MAX	Unit
VCCBAT	Battery regulator Supply voltage	2.8	3.3	4.2	V
T _{OPR}	Operation temperature range	-20	-	80	°C
VCCIO	IO interface voltage	1.8	-	4.2	V

4.3. Typical Power Consumption

State	Description	MIN	TYP	MAX	Unit
Shut down	Software shut down, wake up from GPIO		30		uA
Idle-Sniff	Idle state at Sniff mode		200		uA
Active (A2DP)	3DH1		30		mA
Active (HFP)	HV1		25		mA

4.4. RF Characteristics

Parameter	Condition	MIN	TYP	MAX	Unit
Operate Frequency	2402~2480	2402		2480	MHz
RXSENS-1 Mbps	BER=0.001		-90		dBm
RXSENS-2 Mbps	BER=0.0001		-92		dBm
RXSENS-3 Mbps	BER=0.0001		-84		dBm
Maximum received signal	BER=0.001	0			dBm
Maximum RF transmit power			5		dBm
RF Power Control Range		30			dB

4.5. Audio Characteristics

Parameter	Condition	MIN	TYP	MAX	Unit
DAC Output Amplitude				1	Vrms



DAC output SNR	1 kHz sine wave		96		dB
DAC Sample Rate		8		48	kHz
ADC SNR	1 kHz sine wave		96		dB
ADC Sample Rate		8		16	kHz

5. Application Schematic

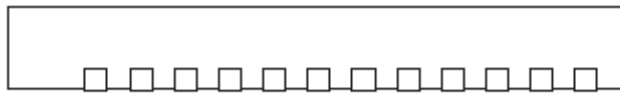
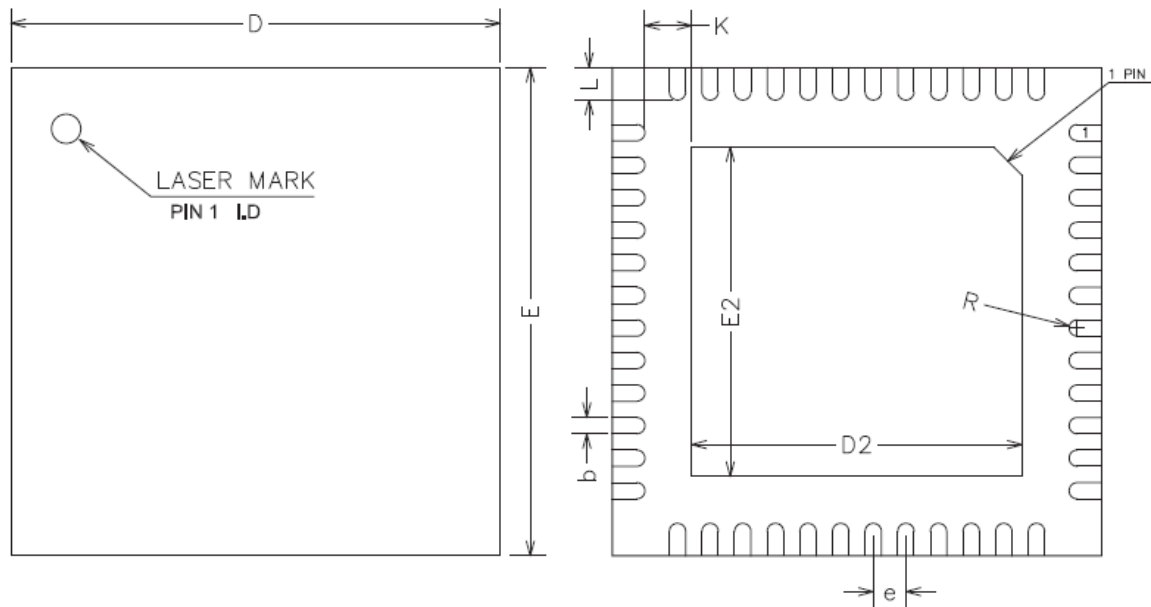
It will be provided with separate document.

6. About the Qualification

By carefully PCB layout, the BK8000 RF performance meets FCC, CE and BQB requirement. The Bluetooth protocol and profile provided by Beken are already qualified and listed in SIG website. If there is any end product listing requirement with the BK8000, please inquire Beken for the related QDID authorization.

7. Package Information

The BK8000 has package information below.



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
A3	0.20REF		
b	0.15	0.20	0.25
D	5.90	6.00	6.10
E	5.90	6.00	6.10
D2	3.95	4.05	4.15
E2	3.95	4.05	4.15
e	0.35	0.40	0.45
K	0.20	—	—
L	0.35	0.40	0.45
R	0.09	—	—

**8. Ordering Information**

Part number	Package	Packing	MOQ (ea)
BK8000Q	QFN 6mmx6mm 48-Pin	Tape Reel	10 k

Remark:

MOQ: Minimum Order Quantity