



Specification

Product name: Bluetooth module

Product model: F-6988

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Edit	Review	Approve

File include(C-CHIP) confidential documents, without permission, can not be disclosed



变更履历				
Version	Change Information	Page	Date	Editor
V2. 0	Initial issue	/	2018-03-06	WuDeLong
V2. 1	GPIO_5 is in tune with GPIO_15	/	2018-03-20	WuDeLong
V2. 2	GPIO_10 is in tune with GPIO_14 GPIO_5 is in tune with GPIO_9		2018-04-08	WuDeLong
V2. 3	Increase: Module packaging material height dimensions.		2018-04-24	WuDeLong
V2. 4	The 40th pin of the module is changed from GND to agnd		2018-05-24	Xiesanshun
V2. 5	Bluetooth version upgraded from 4.2 to 5.0		2018-06-25	Liuxiongchao

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一、Product overview:

F-6988 is the Bluetooth module for intelligent wireless audio transmission products designed by our company . F-6988 also is the low cost stereo audio Bluetooth solution with high performance. The main chip uses BEKEN BK3266 chip QFN40 packaging design. Without any driver, you can connect the module with your device to enjoy the high quality music easily and simple data transmission functions. It supports intelligent voice prompting and reporting number function, integrated TF card playback function and integrated mobile USB-disk playback function. It also supports internal LINE-IN

二、Application area:

F-6988 is used for Bluetooth audio transmission and it is convenience to connect with mobile phone, personal computer, PDA and other digital products with Bluetooth hardware to enjoy the music wirelessly. The major application are included

- ※Bluetooth speaker
- ※Bluetooth stereo headset
- ※Hands-free Phone
- ※Bluetooth speaker with data transmission
- ※Bluetooth data transmission application
- ※Support for mobile internet peripheral devices
- ※Bluetooth Smart Speaker

三、Features:

Bluetooth Profiles

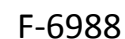
- ※ Bluetooth V4.2 specification support
- ※ 9 mA average current for A2DP
- ※ 0.8 uA deep sleep current



- ※ Bluetooth 4.2 classic and low energy
- ※ A2DP v1.3, AVRCP v1.6, HFP v1.7, HID v1.1, AVCTP v1.4, AVDTP v1.3, and SPP v1.2
- ※ True wireless stereo and two active link
- ※ Two wires UART download interface
- ※ 16 bits stereo ADC and DAC
- ※ Stereo line in and dual microphone
- ※ Five bands digital hardware equalizer
- ※ SPI, UART, I2C, SDIO and USB
- ※ Interface for external PA and LNA
- ※ Up to 220 mA battery charge controller

四、performance parameter:

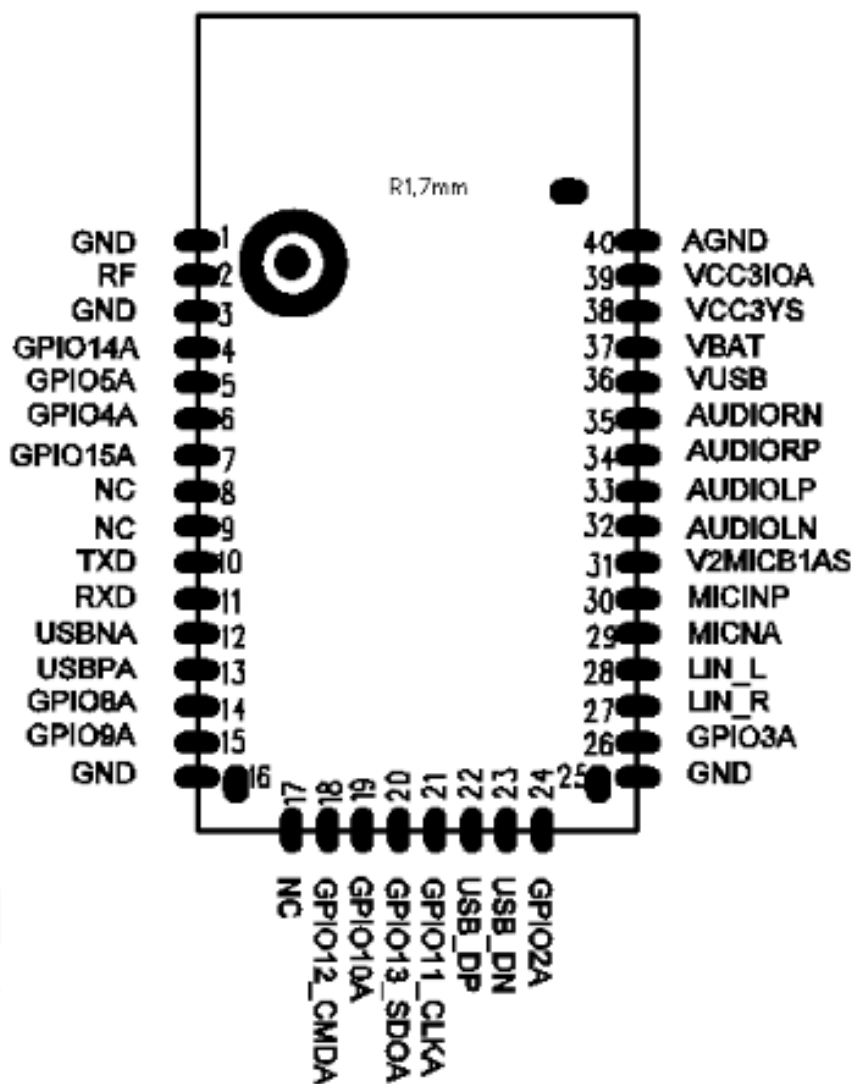
Model	F-6988
Bluetooth specification	Bluetooth V4.2
Service voltage	DC3.3-4.2V
Bluetooth Profile	A2DP v1.3, AVRCP v1.6, HFP v1.7, HID v1.1, AVCTP v1.4, AVDTP v1.3, and SPP v1.2
Supply voltage	≤20mA
Standby current	<500uA
Temperature range	-40°C to +80°C
The wireless transmission range	>10 (meter)
Transmission power	CLASS2, 4dbm
Sensitivity:	-81dBm<0.1%BER
Frequency range	2.402GHz-2.480GHz
The external interface	SPI, UART, I2C, GPIO,SDIO and USB
Audio performance	SBC (decode)
The audio signal to noise ratio	≥75dB
Module size	25 X 13.5 X 2mm



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七、Device pin out diagram :



八、Pin definition :

Pin	Symb	I/O	Description
1	GND	GND	RF_GND
2	RF	RF	RF_OUT / NC
3	GND	GND	RF_GND
4	GPIO14	Digital I/O	GPIO14, JTAG_TDO/PWM5/ADC7/PCM_DOUT
5	GPIO5	Digital I/O	GPIO5, SPI_MISO/I2C_SDA



6	GPIO4	Digital I/O	GPIO4,SPI_MISO/I2C_SCL
7	GPIO15	Digital I/O	GPIO14, Soft shut down and wake up(active high)
8	NC	NC	NC
9	NC	NC	NC
10	TXD	Digital I/O	GPIO0, UART_TXD/I2C_SCL, Download port
11	RXD	Digital I/O	GPIO1, UART_RXD/I2C_SDA, Download port
12	USB_DN/NC	Digital I/O	GPIO7, PWM1 / USBN./NC
13	USB_DP/NC	Digital I/O	GPIO6, PWM0 / USBP./NC
14	GPIO8_CMD/NC	Digital I/O	GPIO8, SD_CLK//SPI2_SCK
15	GPIO9_SDO/NC	Digital I/O	GPIO9, SD_CMD/TX_EN/SPI2_MOSI
16	GND	GND	Ground connect battery negative
17	NC	NC	NC
18	GPIO12_CMD	Digital I/O	GPIO12,JTAG_TMS/PWM3/PCM_CLK/SD_CMD/SPI2_MOSI
19	GPIO10	Digital I/O	GPIO10, SD_DATA0/RX_EN/SPI2_MISO
20	GPIO13_SDO	Digital I/O	GPIO13,JTAG_TDI/PWM4/ADC6/PCM_DIN/S D_DATA0/SPI2_MISO/NC
21	GPIO11_CLK	Digital I/O	GPIO11,JTAG_TCK/PWM2/ADC4/PCM_SYNC/SD_CLK //SPI2_SCK
22	USB_DP	Digital I/O	GPIO6, PWM0 / USBP
23	USB_DN	Digital I/O	GPIO7, PWM1 / USBN
24	GPIO12	Digital I/O	GPIO2,SPI_CSN/ADC1/IrDA/Capture Time
25	GND	GND	GND
26	GPIO3	Digital I/O	GPIO3,SPI_SCK/ADC2/CLKOUT
27	LINR	AUX_INPUT	LINR
28	LINL	AUX_INPUT	LINL
29	MICINA/NC	MIC/NC	Microphone input negative,/NC
30	MICINP	MIC+	Microphone input positive
31	V2MICB1AS	VMIC	Microphone reference voltage
32	AUDIOLN	Audio output	Audio left channel negative
33	AUDIOLP	Audio output	Audio left channel positive
34	AUDIORP	Audio output	Audio right channel positive
35	AUDIORN	Audio output	Audio right channel negative
36	VUSB	Power	VUSB (4.7-5.2V)
37	VBAT	Power supply	Power supply(3.3V-4.2V)
38	VCC3YS	Power	3.3V OUTPUT
39	VCC3IO	VCCSD	SD POWER
40	GND	GND	GND



九、Design notes:

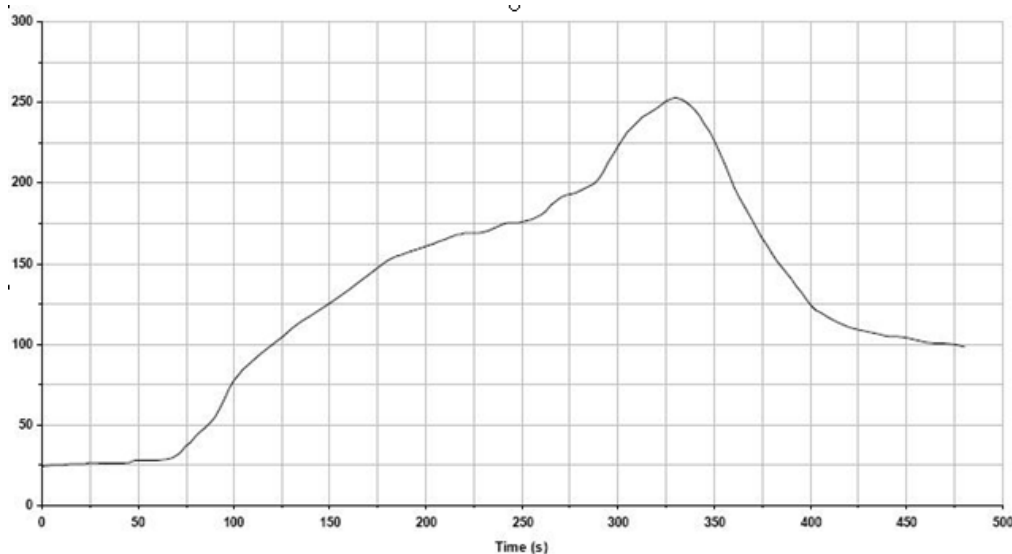
In order to better SNR, please pay attention to the hardware design of PA, DC booster, DC/DC circuit and the module power circuit to avoid influencing module.

十、Notes:

- A. The signal strength is depending on the environment of Bluetooth application, such as wood and metal will block the transmission signal to get the shorter transmission distance.
- B. Because of metal will block the signal transmission, it is recommend not to using the metal housing.
- C. PCB layout guideline: no any copper existed in the antenna area of the module is the PCB antenna, the metal will weaken the function of the antenna when the antenna module to the module board, following prohibited paving and walk the line.
- D. If the module antenna next to the battery、 metal, liquid crystal screen, loudspeaker, at least keep them away from antenna distance 15mm
- E. When layout the power supply line recommended star line, and to ensure that the Bluetooth module Power supply lines is better , and BT should be with the amplifier, power amplifier, MCU, separately, and the underside of the BT has no other interference.
- F. suggests the module antenna part floating on the floor, do not go around the antenna control line, power line, audio line, MIC interference lines;
- G. If the module antenna near the row seats, Because of metal will block the signal transmission, it is recommended to use professional high-gain antenna



十一、 Recommended reflow temperature:



Key features of the profile:

- Initial Ramp=1-2.5°C/sec to 175°C equilibrium
- Equilibrium time=60 to 80 seconds
- Ramp to Maximum temperature (250°C)=3°C/sec Max
- Time above liquidus temperature(217°C): 45 - 90 seconds
- Device absolute maximum reflow temperature: 250°C

十二、 Application schematic diagram:

Reference schematic diagram for reference purposes only!

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

FCC Part 15.247

2.3 Specific operational use conditions

This transmitter/module and its antenna(s) must not be co-located or operating in conjunction with any transmitter. This information also extends to the host manufacturer's instruction manual.

2.4 Limited module procedures

not applicable

2.5 Trace antenna designs

not applicable



2.6 RF exposure considerations

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This compliance to FCC radiation exposure limits for an uncontrolled environment, and minimum of 5mm separation between antenna and body.

The host product manufacturer would provide the above information to end users in their end-product manuals.

2.7 Antennas

PCB antenna; 0dBi; 2.402 GHz~2.480GHz

2.8 Label and compliance information

The end product must carry a physical label or shall use e-labeling followed KDB784748D01 and KDB 784748 stating "Contains Transmitter Module FCC ID: 2AG94-F6988".

2.9 Information on test modes and additional testing requirements

For more information on testing, please contact the manufacturer.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (FCC Part 15.247) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed when contains digital circuitry.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

General

Sections 2.2 through 2.10 of KDB 996369 D03 describe the items that must be provided in the integration instructions for host product manufacturers (e.g., OEM instruction manual) to use when integrating a module in a host product. Modular transmitter applicants should include information in their instructions for all these items indicating clearly when they are not applicable. For example, information on trace antenna designs could indicate "not applicable."

If the modular transmitter is only approved for use by the grantee in its own products and not intended for sale to third parties, the integration instructions may not be detailed but this must be declared in the filing. In that case, it is permitted to place the instructions in the theory-of-operation exhibit folder using long-term confidentiality. The applicant must include a statement in the filing that the module is not for sale and the user manual integration instructions are internal confidential manufacturing documents. The grant of certification for such a modular transmitter must be limited.

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.

2.3 Summarize the specific operational use conditions



Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

2.4 Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

- a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
- b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);
- c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;
- d) Appropriate parts by manufacturer and specifications;
- e) Test procedures for design verification; and
- f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that

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they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an “omni-directional antenna” is not considered to be a specific “antenna type”)).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

2.9 Information on test modes and additional testing requirements

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer's determination that a module as installed in a host complies with FCC requirements.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is **only** FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains

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unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

FCC Statements

(OEM) Integrator has to assure compliance of the entire end-product incl. the integrated RF Module. For 15 B (§15.107 and if applicable §15.109) compliance, the host manufacturer is required to show compliance with 15 while the module is installed and operating.

Furthermore the module should be transmitting and the evaluation should confirm that the module's intentional emissions (15C) are compliant (fundamental / out-of-band). Finally the integrator has to apply the appropriate equipment authorization (e.g. Verification) for the new host device per definition in §15.101.

Integrator is reminded to assure that these installation instructions will not be made available to the end-user of the final host device.

The final host device, into which this RF Module is integrated" has to be labeled with an auxiliary label stating the FCC ID of the RF Module, such as "Contains FCC ID: 2AG94-F6988

"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 to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment."

the Integrator will be responsible to satisfy SAR/ RF Exposure requirements, when the module integrated into the host device

Module statement

The single-modular transmitter is a self-contained, physically delineated, component for which compliance can be demonstrated independent of the host operating conditions, and which complies with all eight requirements of § 15.212(a)(1) as summarized below.

- 1) The radio elements have the radio frequency circuitry shielded.
- 2) The module has buffered modulation/data inputs to ensure that the device will comply with Part 15 requirements with any type of input signal.
- 3) The module contains power supply regulation on the module.
- 4) The module contains a permanently attached antenna.
- 5) The module demonstrates compliance in a stand-alone configuration.
- 6) The module is labeled with its permanently affixed FCC ID label.



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- 7) The module complies with all specific rules applicable to the transmitter, including all the conditions provided in the integration instructions by the grantee.
- 8) The module complies with RF exposure requirements.

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