HMBT01 Module specification

Hmbt01 is a Low-Power Embedded bt+ble dual protocol module. It consists of a highly integrated radio frequency chip ac6956c, a small number of peripheral devices and built-in audio storage flash.

catalogue

1 Product overview

HMBT01 contains v5.1+br+edr+ble Bluetooth chip ac6956c with 32-bit DSP supporting hardware floating-point units, with a maximum dominant frequency of 240mhz. The chip has built-in audio processing, audio codec, SRAM, flash and rich peripheral resources. The hmbt01 module contains a flash chip that stores audio.

HMBT01 is a dual Bluetooth module that integrates Bluetooth control and Bluetooth playback.

1.1 characteristic

- 32-bit DSP supports hardware Float Point Unit(FPU)
- Up to 240MHz programmable processor
- peripheral：
    - One full speed USB 2.0 OTG controller
    - Four multi-function 16-bit timers, support capture and PWM mode
    - Three 16-bit PWM generator for motor driving
    - Three full-duplex basic UART, UART0 and UART1 supports DMA mode
    - Two SPI interface supports host and device mode
    - One hardware IIC interface supports host and device mode
    - Built-in Cap Sense Key controller
    - 10-bit ADC for analog sampling
    - External wake up/interrupt on all GPIOs
- DSP Audio Processing
    - SBC, AAC Audio decodes supported for BT audio
    - mSBC voice codecs supported for BT phone
    - Supports MP2, MP3, WMA, APE, FLAC, AAC, MP4, M4A, WAV, AIF, AIFC audio decoding
    - Packet Loss Concealment (PLC) for voice processing
    - Acoustic echo cancellation/suppression (AEC,AES)
    - Single/Dual MIC Environmental Noise Cancellation (ENC)
    - Multi-band DRC limiter
    - 30-band EQ configuration for voice Effects
- Audio Codec
    - Two channels 16-bit DAC, SNR >= 95dB
    - Three channels 16-bit ADC , SNR >= 90dB
    - Sampling rates of 8KHz/11.025KHz/16KHz/22.05KHz/24KHz/ 32KHz/44.1KHz/48KHz are supported
    - One analog MIC amplifier, build-in MIC bias generator
    - Supports two PDM digital MIC inputs
    - three channels Stereo analog MUX

- Supports cap-less, single-ended, and differential mode at the DAC path
- Supports 16ohm and 32ohm Speaker loading

- Bluetooth
  - Compliant with Bluetooth V5.1+BR+EDR+BLE specification
  - Maximum output power -1.01dbm
  - On board PCB antenna, antenna gain -0.58 dBi

1.2 application fields

- Bluetooth stereo speaker
- Bluetooth mono speaker
- sleep aid white noise machine
- wireless Bluetooth controller

2 Version update instructions
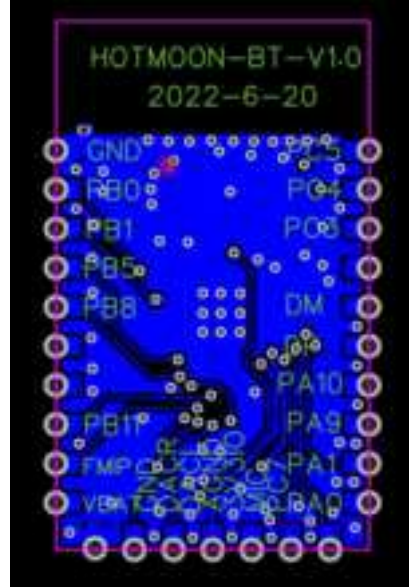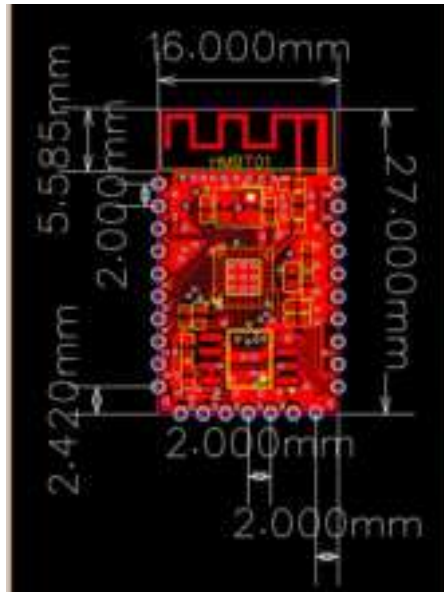
Update date	Update content	Updated version
July 18, 2022	New document	V1.0.0

3 Module interface

3.1 Size package

Hmbt01 has two rows of pins with a pin spacing of 2mm.
Size: 16mm (W) × 27mm (L) × 3.6mm (H)

3.2 Pin definition

Pin	Symbol	IO type	function
1	PC5	I/O	GPIO,SD1CLKA,,SPI1DOB,UART2RXD,IIC_SDA_B, ADC13,PWMCH5
2	PC4	I/O	GPIO,SD1CMDA,SPI1CLKB,UART2TXD,IIC_SCL_B, ADC10,PWMCH5H
3	PC3	I/O	GPIO,SD1DAT0A,SPI1DIB
4	no	no	no
5	USBDM	I/O	USBDM,UART1RXD,IIC_SDA_A
6	USBDP	I/O	USBDP,UART1TXD,IIC_SCL_A,ADC12
7	PA10	I/O	GPIO,SD0CLKA,ALNK0_LRCKB,ADC3,SPDIF_IN_B, TMR1,Touch9,UART2RXB,PWMCH4L
8	PA9	I/O	GPIO,SD0CMA,ALNK0_SCLKB,SPDIF_IN_A,Touch8, UART2TXB,PWMCH4H
9	PA1	I/O	GPIO,AMUX0R,Touch1,ADC0,UART1RXC,PWMCH0L
10	PA0	I/O	GPIO,AMUX0L,Touch0,CLKOUT0,UART1TXC,PWMCH0H
11	PC7	I/O	GPIO,MIC_BIAS
12	MIC	I	Microphone input channel
13	3V3IO	P	3.3VPower input and output
14	AGND	P	DAC reference resources
15	DACL	O	DAC Left channel
16	DACR	O	DAC Right channel
17	GND	P	Power ground
18	VBAT	P	Power supply
19	FMIP	I	FMinput

20	PB11	I/O	GPIO,SDPG,SPDIF_OUT
21	no	no	no
22	no	no	no
23	PB8	I/O	GPIO,AMUX1R,SPI2_DIA,ADC8,CLKOUT1
24	PB5	I/O	GPIO,PWM3,CAP1,UART0TXC,UART0RXC
25	PB1	I/O	GPIO,SPI1DOA
26	PB0	I/O	GPIO,SPI1CLKA,UART1TXA,PWMCH1H
27	GND	P	Power ground

Note: P refers to the power pin, i/o refers to the input and output pin, and I refers to the input pin

4 Electrical parameters

4.1 Absolute electrical parameters

parameter	describe	Min	Max	Unit
T_{stg}	Storage temperature	-65	+150	°C
VBAT	Supply Voltage	2.2	5.5	V
$V_{3.3IO}$	3.7V IO Input Voltage	-0.3	$V_{3.3IO}$+0.3	V

4.2 Working conditions

Parameter	describe	Min	Typ	Max	Unit
T_{amb}	Ambient Temperature	-20	-	+70	°C
VBAT	Supply Voltage	2.2	3.7	5.5	V
$V_{3.3IO}$	3.3V IO Output Voltage	-	3.3	$V_{3.3IO}$+0.3	V
V_{DACVDD}	DAC Voltage	-	2.7	-	V
$I_{L3.3}$	Loading current	-	-	150	mA
V_{IL}	Low-Level Input Voltage	-0.3	-	0.3* $V_{3.3IO}$	V
V_{IH}	High-Level Input Voltage	0.7*$V_{3.3IO}$	-	$V_{3.3IO}$+0.3	V
V_{OL}	Low-Level Output Voltage	-	-	0.33	V
V_{OH}	High-Level Output Voltage	2.7	-	-	V

4.3Internal Resistor Characteristics

Port	General Output	High Drive	Internal Pull-Up Resistor	Internal Pull-Down Resistor	Comment
PA0、PA1	8mA	24mA	10K	10K	1、PB1 default pull up

PA9、PA10 PB1、PB3 PB8~PB10 PC2~PC5						2、USBDM & USDBP default pull down
PB11	Output 0	8mA	24mA	10K	10K	3、PB0, PB2, PB5 can pull-up resistance to 5V
PC7	Output 1	8mA	64mA			4、internal pull-up/pull-down resistance	accuracy ±20%
PB0、PB2 PB5		8mA		10K	10K	
USBDP		4mA	-	1.5K	15K	5、PRx supply by RTCVDD
USBDM		4mA	-	180K	15K	

4.4 DAC

Parameter	Min	Typ	Max	Unit	Test Conditions
Frequency Response	20	-	20K	Hz	1KHz/0dB 10Kohm loading With A-Weighted Filter
THD+N	-	-75	-	dB	
S/N	-	95	-	dB	
Crosstalk	-	-90	-	dB	
Output Swing	-	1	-	Vrms	
Dynamic Range	-	90	-	dB	1KHz/-60dB 10Kohm loading With A-Weighted Filter
DAC Output Power	11	-	-	mW	32ohm loading

5 RF parameters

5.1 Transmitter

Parameter	Min	Typ	Max	Unit	Test Conditions
RF Power Control Range	-	-1.01	-	dBm	
20dB Bandwidth	-	1246	-	KHz	

Relative Power		-	-1	-	dB	25℃,VBAT=5V
Adjacent	+2MHz	-	-40	-	dBm	2441MH
Channel	-2MHz	-	-38	-	dBm	
Transmit	+3MHz	-	-44	-	dBm	
Power	-3MHz	-	-35	-	dBm	
π/4 DQPSK	DEVM RMS	-	6	-	%	
Modulation	DEVM 99%	-	10	-	%	
Accuracy	DEVM Peak	-	15	-	%	

5.2 Receiver

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity		-	-90	-	dBm	
Co-channel Interference Rejection		-	-13	-	dB	
Adjacent Channel Interference Rejection	+1MHz	-	+5	-	dB	25℃,VBAT=5V
	-1MHz	-	+2	-	dB	2441MH
	+2MHz	-	+37	-	dB	
	-2MHz	-	+36	-	dB	
	+3MHz	-	+40	-	dB	
	-3MHz	-	+35	-	dB	

6. OEM/Integrators Installation Manual

List of applicable FCC rules

This module has been tested and found to comply with part 15.247 requirements for Modular Approval.

Summarize the specific operational use conditions

This module can be applied in household electrical appliances as well as TV and IP camera. The input voltage to the module should be nominally 2.2-3.5 VDC ,typical value 3.7VDC and the ambient temperature of the module should not exceed 85℃.

Limited module procedures

N/A

Trace antenna designs

N/A

RF exposure considerations

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

Antennas

The module has one PCB antenna and the antenna gain is -0.58 dBi.

Label and compliance information

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: "Contains Transmitter Module FCC ID: 2A3V3HMNL-03" or "Contains FCC ID: 2A3V3HMNL-03".   The FCC ID can be used only when all FCC ID compliance requirements are met.

Information on test modes and additional testing requirements

a) The modular transmitter has been fully tested by the module grantee on the required number of
channels, modulation types, and modes, it should not be necessary for the host installer to re-test all the available transmitter modes or settings. It is recommended that the host product manufacturer, installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits (e.g., where a different antenna may be causing additional emissions).
b) The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product

(enclosure). This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.

c) If the investigation indicates a compliance concern the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to notcause interference. The operator of the host product will be obligated to stop operating the device until the interference have been corrected .

Additional testing, Part 15 Subpart B disclaimer

The final host / module combination need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part15 digital device. The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369. For host

products with certified modular transmitter, the frequency range of investigation of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the higher frequency range of investigation. When testing the host product, all the transmitters must be operating. The transmitters can be enabled by using publicly- available drivers and turned on, so the transmitters are active. In certain conditions it might be appropriate to use a technology-specific call box (test set) where accessory devices or drivers are not available. When testing for emissions from the unintentional radiator, the transmitter shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) and/or active scanning. In these cases, this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled.

Testing laboratories may need to add attenuation or filters depending on the signal strength of any active beacons (if applicable) from the enabled radio(s). See ANSI C63.4, ANSI C63.10 and ANSI C63.26 for further general testing details. The product under test is set into a link/association with a partnering WLAN device, as per the normal intended use of the product. To ease testing, the product under test is set to transmit at a high duty cycle, such as by sending a file or streaming some media content.

FCC statement

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.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.