Shenzhen Waytronic Electronics Co., Ltd

WT2003HM04 Module Specification

Version:V1.02

Note:

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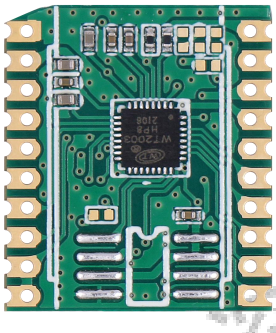
Catalogue

1. Product Introduction

WT2003HM04 is a powerful high-quality voice module with a high-performance 32-bit processor, capable of reaching a maximum frequency of 120MHz. It features low cost, low power consumption, high reliability, and strong versatility, with a built-in voice capacity of 900 seconds. The control methods are flexible: it supports UART Control Mode; it supports One-line Serial Port and Two-wire Serial Control Mode; it also supports button control mode (button control mode requires micro customization). Each control mode is fixed before leaving the factory, and samples need to be confirmed with our business personnel first.



2. Product Features

- UART Control Mode: Standard UART communication interface, default baud rate 9600; supports SPI-Flash as storage. Functions include file index playback, interstitial playback, single track loop, all track loop, random playback, etc. 32-level adjustable volume, maximum support for external 128Mbit Flash.
- Single Wire Serial Control Mode: Voice playback, stop, loop playback, and volume control can be controlled through the code transmission end; 8-level adjustable volume, supports SPI-Flash as storage: maximum support for external 128Mbit Flash.
- Two-wire Serial Control Mode: Voice playback, stop, loop playback, and volume control can be controlled through the code transmission end; 8-level adjustable volume, supports SPI-Flash as storage: maximum support for external 128Mbit Flash.
- Button Control Mode: Flexible trigger modes, can set any key as pulse repeat trigger, pulse non-repeat trigger, invalid key, level hold non-loop, level hold loop, non-hold loop, previous track non-loop, next track non-loop, previous track loop, next track loop, volume+, volume-, play/pause, stop, play/stop, etc., a total of 15 trigger modes, up to 10 keys can be used to trigger control output.
- Default no playback after power on; with BUSY status indication, BUSY is normally low level, high level during playback.
- Supports switching audio output modes, sample defaults to SPK output, for DAC output, please refer to the audio output switch command.

- Supports high-quality audio formats, supports MP3 and WAV formats, (audio bit rate supports 8kbps~320kbps) with beautiful sound.
- Operating voltage: 2.6-5.0V. The power supply ripple shall be controlled within 5%, and the peak voltage shall not exceed 5.5V. When applied to high-voltage products with stepped-down 5V power supply, it is recommended to add a 5V unidirectional TVS diode. Select a device with a junction capacitance (Cj) of approximately 10 pF, a trigger voltage lower than 7V, an IPP current higher than 25A, and the voltage corresponding to the IPP current shall be less than 11.5V.
- Built-in 0.5W D-class amplifier.
- Two 16-bit asynchronous divider timers.
- Digital audio stream, IIS supports host and slave modes.
- One infrared remote control decoder.
- 16-bit high-precision ADC and DAC.
- High-power IO driving capability, up to 64mA.
- Single-chip use (built-in capacity) requires pre-writing of built-in voice before leaving the factory.
- Supports UART update program and voice, it is recommended to reserve UART serial port when drawing board, please refer to the serial port upgrade document for upgrade.
- M04 module is not burned with the project, before shipment, it is necessary to confirm the burning project version, please refer to the following Selection Table for details.
- Supports SD card/U disk offline upgrade program, it is recommended to reserve interface when drawing board.
- **If the voice chip needs to be mounted with flash, it must use the flash provided by "Waytronic". If it is not used for special reasons, it must be handed over to our business, and it must be noted. (Because using flash from other companies without permission will cause it to not work).**

3. Selection Table

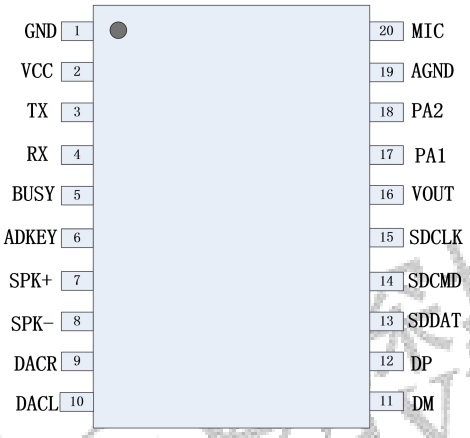
If samples are needed, please select the corresponding function code according to the following Selection Table and contact our business personnel:

Function Code	Communication Protocol	Default Output	Storage Method
A04	UART	PWM(When DAC output is needed, send audio switching command,UART communication reference: B6 command One-line and two-line reference: F400)	Internal Storage
A05	Single byte single wire		
A07	Single byte two-wire		
A15	Double byte		

	single wire		
A17	Double byte two-wire		

4. Pin Description

4.1. Pinout Diagram



WT2003HM04

Pin	Name	Type	Description
1	GND	G	GND: Ground
2	VCC	P	VBAT power input
3	TX	I/O	UART asynchronous serial data output
4	RX	I/O	UART asynchronous serial data input
5	BUSY	I/O	Busy signal (indicating playback status)
6	ADKEY	I/O	Button input (button function not enabled)
7	SPK+	I/O	Speaker terminal
8	SPK-	I/O	Speaker terminal
9	DACR	I/O	DAC right channel output
10	DACL	I/O	DAC left channel output
11	DM	I/O	USB DM
12	DP	I/O	USB DP
13	SDDAT	I/O	SD card data
14	SDCMD	I/O	SD card chip select
15	SDCLK	I/O	SD card clock
16	VOUT	I/O	3.3V power output

17	PA1	I/O	IO port
18	PA2	I/O	IO port
19	AGND	I/O	Analog ground
20	MIC	I/O	Microphone input positive pole

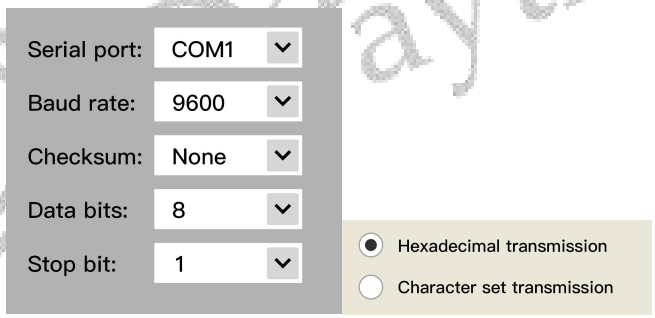
5. UART Control Mode

5.1. UART Control Mode

Standard UART communication interface, default baud rate 9600

5.1.1. Protocol Command Format

Standard UART asynchronous serial interface, operating at 3.3V TTL level. Communication data format is as follows: start bit: 1 bit; data bits: 8 bits; parity bit: none; stop bit: 1 bit. When using a computer serial port debugging assistant, it's necessary to correctly configure the serial port parameters, as shown in the image:



Start Code	Length	Command	Parameter	Checksum	End
0X7E	Look below	Look below	Look below	Look below	0XEF

Note: "Length" refers to the length of the command code, parameters, and checksum. "Checksum" refers to the lower byte of the sum of the length, command code, and parameters.

Note: Flash voice playback can achieve commands such as Flash index playback, combination playback, and interrupt playback.

Table 3: Communication Control Commands

CMD	Functions	Parameter
A0	Specified FLASH index playback (entire disk)	File index

A1	Specify Flash root Catalogue file name	Track information
AA	Play/pause command	None
AB	Stop command	None
AC	Next track command	None
AD	Previous track command	None
AE	Volume control command	Volume level
AF	Specify playback mode	Loop mode
B0	Combination playback	Track information
B1	Insert playback	Track information
B6 00	Switch audio output to SPK (speaker)	B6 XX
B6 01	Switch audio output to DAC	B6 XX
B8	Enter low power mode	B8 XX

Table 4: Communication Query Commands

CMD	Functions	Parameter
C0	Query current software version	C0 XX XX XX XX
C1	Query current set volume	C1 XX
C2	Read current operating status	C2 XX
C3	Query total number of music files in Flash	C3 XX XX
C9	Query current playback file address	C9 XX XX

5.1.2. Write Operation Instructions

5.1.2.1. Write Operation Return Code Format

Start Code	Length	Command	Result code	Checksum	End
0X7E	Look below	Look below	Look below	Look below	0XEF

Note: After executing each write command, return the corresponding Result code according to the Communication Protocol format for that command.

Result Codes::→: 00 indicates: OK, command executed successfully;

→: 01 indicates: Flash error, command not executed;

→: 02 indicates: File not found in EMP;

→: 05indicates: Device is offline.

5.1.2.2. Specify Flash Root Catalog Index Playback（A0）

This command indexes the files in Flash for playback, with file sorting according to the index order. The index order is preset before leaving the factory.

Start Code	Length	Command	Track High Byte	Track Low Byte	Checksum	End
7E	05	A0	00	01	XX	EF

Example:Sending→◇7E 05 A0 00 01 A6 EF □

Receiving←◆7E 04 A0 00 A4 EF

Track High/Low Description: Expressed in hexadecimal, for the 300th speech, represented as 0x012C, the track high byte is 0x01, and the track low byte is 0x2C. For the 67th speech, represented as 0x43, the track high byte is 0x00, and the track low byte is 0x43.

5.1.2.3. Specify Flash Root Catalog Filename Playback （A1）

This command allows specifying audio playback by filename in Flash (filename consists of 4 fixed characters, does not support Chinese).

Start Code	Length	Command	File name				Checksum	End
7E	0A	A1	'30'	'30'	'30'	'31'	XX	EF

In which, "30, 30, 30, 31" represent the ASCII code for 0001, only the filename adopts ASCII code values, while other data is hexadecimal values; the above command indicates specifying the audio file with the filename "0001" under the root Catalogue for playback as shown in the example.

Note: Chinese characters are not supported in filenames, and filenames exceeding 4 characters will not be able to be specified for playback.

Example:Sending→◇7E 07 A1 30 30 30 31 69 EF □

Receiving←◆7E 04 A1 00 A5 EF

5.1.2.4. Pause Playback Command（AA）

Start Code	Length	Command	Checksum	End
7E	03	AA	AD	EF

While in playback state, sending this command will pause the playback; while in pause state, sending this command will resume playing music from the pause position.

Sending this command while in the stop state is ineffective.

Example:Sending→◇7E 03 AA AD EF □

Receiving←◆7E 04 AA 00 AE EF

5.1.2.5. Stop Command (AB)

Start Code	Length	Command	Checksum	End

7E	03	AB	AE	EF

Sending this command stops the playback of the currently playing music.

Example:Sending→◇7E 03 AB AE EF □

Receiving←◆7E 04 AB 00 AF EF

5.1.2.6. Next Song Command (AC)

Start Code	Length	Command	Checksum	End
7E	03	AC	AF	EF

This command can trigger playing the next track under the current Catalogue. When playing the last track, sending this command can trigger playing the first track.

Example:Sending→◇7E 03 AC AF EF □

Receiving←◆7E 04 AC 00 B0 EF

5.1.2.7. Previous Song Command (AD)

Start Code	Length	Command	Checksum	End
7E	03	AD	B0	EF

This command can trigger playing the previous track under the current Catalogue. When playing the first track, sending this command can trigger playing the last track.

Example:Sending→◇7E 03 AD B0 EF □

Receiving←◆7E 04 AD 00 B1 EF

5.1.2.8. Volume Control Command (AE)

There are a total of 32 volume levels, ranging from 0 to 31, where 0 represents mute and 1F represents the maximum volume. (This command has power-off memory).

Start Code	Length	Command	Volume level	Checksum	End
7E	04	AE	1F	XX	EF

In the example, setting the volume to the maximum level 31 is achieved by sending the command. This command allows for real-time modification and adjustment of the volume.

Example:Sending→◇7E 04 AE 1F D1 EF □

Receiving←◆7E 04 AE 00 B2 EF

5.1.2.9. Specify Playback Mode (AF)

This command modifies the playback mode while the device is powered on, and defaults to the default mode after power loss.

Start Code	Length	Command	Parameter	Checksum	End
7E	04	AF	00:Single track non-looping playback mode (default)	B3	EF
			01:Single track looping playback mode	B4	
			02:All tracks looping playback mode	B5	
			03:Random playback mode	B6	

Example:Sending→◇7E 04 AF 01 B4 EF □

Receiving←◆7E 04 AF 00 B3 EF

5.1.2.10. Composite Playback Command (B0)

Start Code	Length	Command	Number of tracks	Track1	Track2	Track3	Checksum	End
7E	07	B0	03	01	03	02	XX	EF

Note: When receiving this command, the currently playing track is paused, and then the specified track indicated by this command is played. After playing the specified track, it automatically proceeds to play the subsequent tracks that need to be combined, until all tracks are played. It supports a maximum of 20 combined tracks.

When sending the second combined play command while the first one is not yet completed, the combined playback of tracks will restart according to the new combined instruction.

Number of tracks：→03；indicates that there are 3 tracks to be combined for playback.

Track1： →01；indicates that the first track to be combined is the first song stored in the memory.

Track2： →03；indicates that the first track to be combined is the first song stored in the memory.

Track3： →02；indicates that the third track to be combined is the second song stored in the memory.

In the example, "05" indicates a total of 5 combined songs, namely "01 01 0B 0A 02".

Example:Sending→◇7E 09 B0 05 01 01 0B 0A 02 D7 EF □

Receiving←◆7E 04 B0 00 B4 EF

5.1.2.11. Insert Playback Command (B1)

This command can only insert playback while in the playing state; it's ineffective to insert playback while in the

stopped state.

Start Code	Length	Command	Marker byte	Track High byte	Track Low byte	Checksum	End
7E	06	B1	00	00	01	XX	EF

When sending this command, the currently playing track is paused, and then the specified track indicated by this command is played. After playback is completed, the previously paused track resumes playback.

When the first insert playback command is not completed, sending the second insert playback command will be ineffective. You have to wait for the first insert playback music to finish before you can perform another insert playback.

Marker byte：→00；Indicates: Insert playback of specified index address in FLASH.

Example:Sending→◇7E 06 B1 02 00 07 C0 EF □

Receiving←◆7E 04 B1 00 B5 EF

5.1.2.12. Audio Output Mode Switching (B6)

After sending this command, switch to SPK output or DAC output. This function has power-off memory (default is SPK output).

Start Code	Length	Command	Parameter	Checksum	End
7E	04	B6	00	BA	EF
			01	BB	

Parameter：00 represents SPK output, and 01 represents DAC output.

Note: The example command switches from default SPK output to DAC output.

Example:Sending→◇7E 04 B6 01 BB EF □

Receiving←◆7E 04 B6 00 BA EF

5.1.2.13. Enter Low Power Mode (B8 00)

Sending this command puts the chip into low power sleep mode.

Start Code	Length	Command	Parameter	Checksum	End
7E	04	B8	00	BC	EF
			01	BD	

Command "00" consumes less than 2uA, with a wake up time of 100 milliseconds.
Command "01" consumes less than 30uA, with a wake up time of 2 milliseconds.

Note: The chip wakes up on the falling edge of the RXD pin. It is recommended to send 0x00 0x00 for wake up. The power consumption during sleep is related to the external Flash solution when used.

Example:Sending→◇7E 04 B8 00 BC EF □

Receiving←◆7E 04 B8 00 BC EF

5.1.2.14. Query Current Software Version (C0)

This command is used for version confirmation, tracing version issues, and precise positioning.

Start Code	Length	Command	Checksum	End
7E	03	C0	C3	EF

Example:Sending→◇7E 03 C0 C3 EF □

Receiving←◆7E 07 C0 21 09 28 70 89 EF

5.1.2.15. Query Current Set Volume (C1)

This command is used to query the current playback volume. The example indicates that the current volume is "1F", which corresponds to level 31.

Start ode	Length	Command	Checksum	End
7E	03	C1	C4	EF

Example:Sending→◇7E 03 C1 C4 EF □

Receiving←◆7E 04 C1 1F E4 EF

5.1.2.16. Read Current Operating Status (C2)

This command is used to query the current playback status. The example "02" indicates that during playback, the "AB" command was sent via Sending, which stopped the playback of audio.

Start Code	Length	Command	Checksum	End
7E	03	C2	C5	EF

Result code: →: 01 indicates: Playing

→: 02 indicates: Stopped

→: 03 indicates: Paused

Example:Sending→◇7E 03 C2 C5 EF □

Receiving←◆7E 04 C2 02 C8 EF

5.1.2.17. Query Total Number of Music Files in FLASH (C3)

Start Code	Length	Command	Checksum	End
7E	03	C3	C6	EF

Example query quantity is 11 audio tracks = "00 0B"

Example:Sending→◇7E 03 C3 C6 EF □

Receiving←◆7E 05 C3 00 0B D3 EF

5.1.2.18. Query Current Playback File Address (C9)

Start Code	Length	Command	Checksum	End
7E	03	C9	CC	EF

The returned address is represented by two bytes.

Note: Example "00 03" indicates the address position of the currently playing song, which is the third song under the root Catalogue.

Example:Sending→◇7E 03 C9 CC EF □

Receiving←◆7E 05 C9 00 03 D1 EF

5.2. Single Wire Serial Control Mode

In serial mode, an MCU can control the WT2003HM04 series voice module by sending data through the DATA line to achieve control objectives. This enables functionalities such as controlling voice playback, stopping, looping, etc.

5.2.1. Single Wire Voice Address Correspondence

Data (hexadecimal)	Function
00H	Play the 0th segment of speech
01H	Play the 1st segment of speech
02H	Play the 2nd segment of speech
…….	
DDH	Play the 221st segment of speech
DEH	Play the 222nd segment of speech
DFH	Play the 223rd segment of speech

Note: To play the speech at that address, simply send that address, and the speech at that address will be played automatically. The time interval between two address instructions should be greater than 4ms.

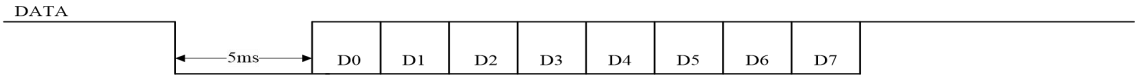
5.2.2. Single Wire Voice and Command Code Correspondence Table

Command	Function	Description
F0H	Automatically enter sleep mode (default upon power-up)	Executing this command, after the speech playback ends, the chip will automatically enter sleep mode after waiting for 5 seconds. Upon entering sleep mode, the chip wakes up on the falling edge of the DATA pin, and after waking up, there needs to be a 100ms

		interval before receiving commands effectively. This command has power-off memory and is effective when the chip is in the wake-up state.
F1H	Exit automatic sleep mode	Executing this command, after the speech playback ends, the chip will remain in standby mode. This command has power-off memory and is effective when the chip is in the wake-up state. (This command is applicable for both deep sleep and standby sleep.)
E0H....E7H	E0 is minimum volume, E7 is maximum volume, with a total of 8 volume levels	During speech playback, sending this command adjusts the volume when the speech ends or when the chip is in standby mode.
F2H	Loop playback of current speech	Executing this command enables looping playback of the current speech segment, and can be sent during speech playback or when speech is stopped. During execution of the F2 loop command, it can be interrupted by the FE command, ordinary address instructions, and becomes ineffective. It's necessary to send a playback command first before sending the loop playback command.
F3H	Continuous playback	F3H followed by speech addresses A, B, C, etc., while playing address A, subsequent codes are received without interruption, playing A, then B, then C... A delay of 2ms is required between F3 and the address.
FEH	Stop playback of current speech	Executing this command stops playback of the current speech segment.
F4H 00/01	Switch audio output mode	F4H 00 switches to DAC, F4H 01 switches to PWM. This setting is effective when the chip is in the wake-up state.
F4H 02	Deep sleep (within 3uA)	Deep sleep, effective when the chip is in the wake-up state. Default to deep sleep before leaving the factory.
F4H 03	Standby sleep (within 30uA)	Standby sleep, effective when the chip is in the wake-up state.

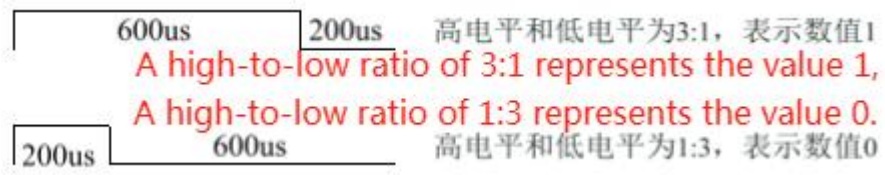
Note: Without Command F3H, only the speech address will interrupt the previously playing speech if it's not stopped. The continuous code instruction must be used with an address (e.g., F3H+00H+F3H+01H). F3H allows convenient combination of different speeches, such as F3H+Address A+F3H+Address B, with a maximum of 10 combinations. The first instruction in the group must be F3+address. Alternatively, combination playback can be achieved by detecting changes in the BUSY level during speech playback and at the end of speech playback.

5.2.3. Single Wire Serial Port Timing Diagram



Pull the data line low for 4~20ms, with 5ms recommended. Send 8 bits of data by first sending the Low byte,

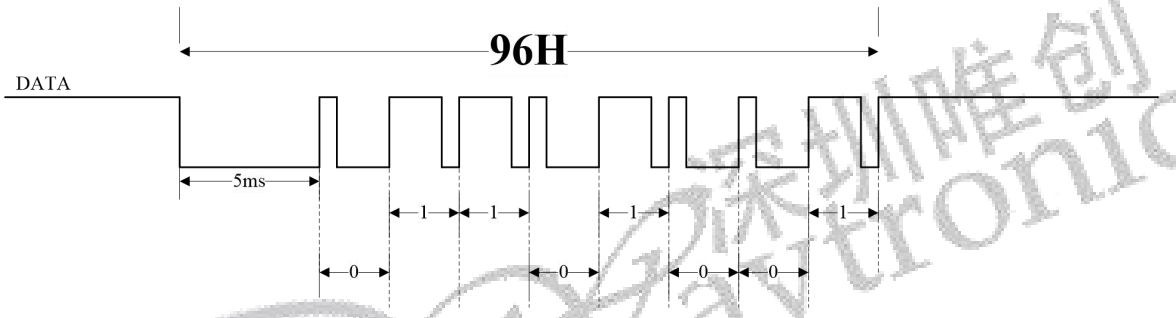
then sending the High byte. Use the ratio of high and low levels to represent the value of each data bit.



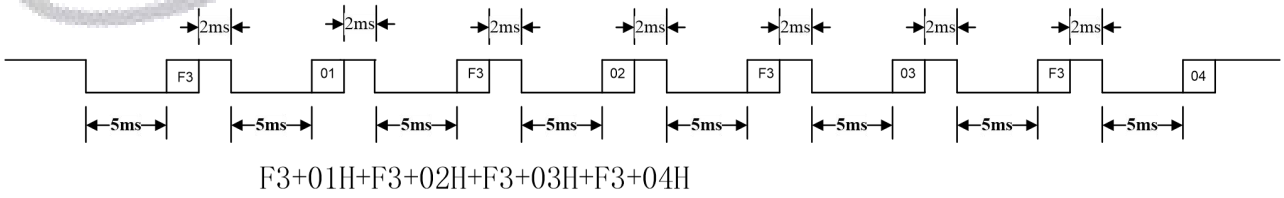
Note: High level must come before low level.

It is recommended to use 200us:600us or 400us:1200us (widening the level in certain situations can improve communication stability). The upper and lower limits of the range are referenced as 40us:120us ~ 400us:1200us. Pay attention to using the 3:1 and 1:3 level ratios to ensure communication stability.

If we want to send 96H, with the Low byte sent first followed by the High byte, the corresponding timing diagram is as follows:



If we want the chip to sequentially play the speech content at addresses 01/02/03/04, that is, continuous code instructions for playback, it would be F3+01+F3+02+F3+03+F3+04. The corresponding timing diagram can be shown as follows:



F3+01H+F3+02H+F3+03H+F3+04H

Note:When using the continuous code function, after sending one set of continuous code addresses, wait for 2ms before sending the next set of continuous code addresses. However, the interval between F3 and the address remains 2ms. In deep sleep mode, the chip must be awakened first. It is recommended to send the 0xFE command to wake up the chip, then wait for 100ms before sending the command. In standby sleep mode, you can directly send the speech address command for playback.

The default mode upon factory setting is deep sleep mode.

5.3. Two-wire Serial Control Mode

In two-wire serial mode, MCU can send data to the WT2003HM04 series voice module via CLK and DATA lines to achieve control objectives. It enables controlling voice playback, stopping, looping, etc.

5.3.1. Two-wire Voice Address Correspondence

Data (hexadecimal)	Function
00H	Play the 0th segment of speech
01H	Play the 1st segment of speech
02H	Play the 2nd segment of speech
…….	
DDH	Play the 221st segment of speech
DEH	Play the 222nd segment of speech
DFH	Play the 223rd segment of speech

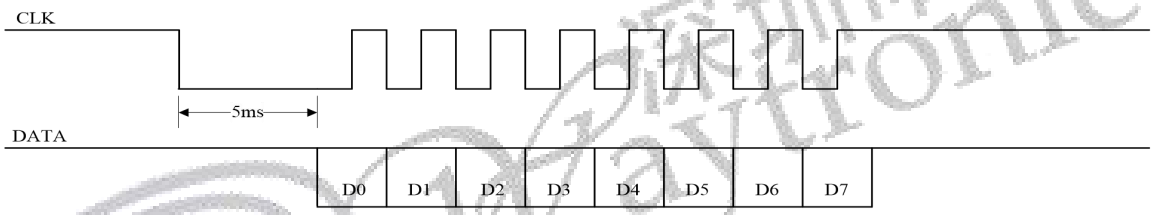
Note: To play the speech at that address, simply send that address, and the speech at that address will be played automatically. The time interval between two address instructions should be greater than 4ms.

5.3.2. Two-wire Voice and Command Code Correspondence Table

Command	Function	Description
F0H	Automatically enter sleep mode (this is the default state upon power-up)	Executing this command, after speech playback ends, the chip will automatically enter sleep mode after waiting for 5 seconds. Upon entering sleep mode, the chip wakes up on the falling edge of the CLK pin, and after waking up, there needs to be a 100ms interval before receiving commands effectively. This command has power-off memory and is effective when the chip is in the wake-up state.
F1H	Exit automatic sleep mode	Executing this command, after speech playback ends, the chip remains in standby mode. This command has power-off memory and is effective when the chip is in the wake-up state. (This command is applicable for both deep sleep and standby sleep.)
E0H....E7H	E0 represents the minimum volume while E7 represents the maximum volume, providing a total of 8 volume levels adjustment	During speech playback, or when the chip is in standby mode, sending this command adjusts the volume. It is effective when the chip is in the wake-up state.
F2H	Loop playback of the current speech	Executing this command enables looping playback of the current speech segment and can be sent during speech playback or when speech is stopped. During the execution of the F2 loop command, it can be interrupted by the FE command, ordinary address

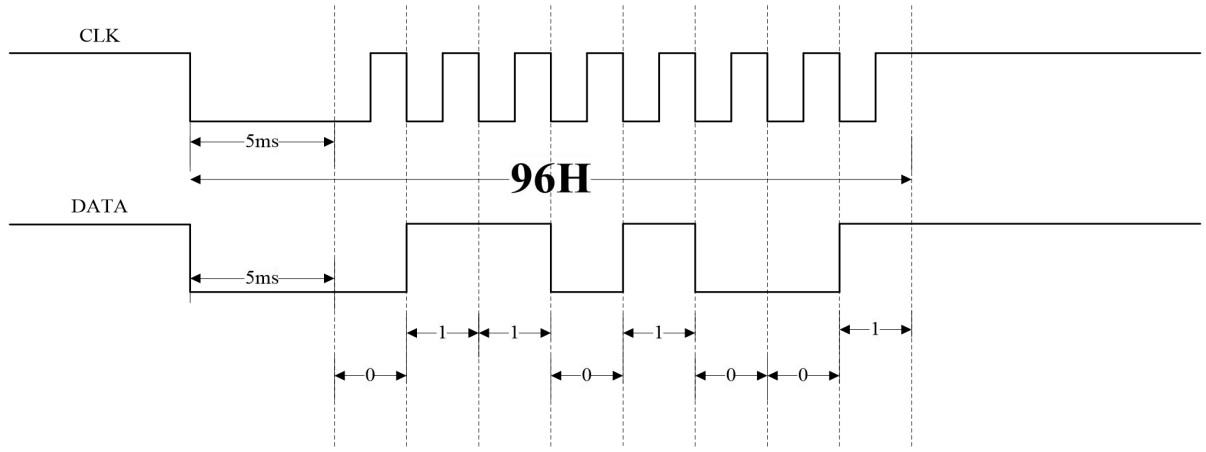
		instructions, and becomes ineffective. It is necessary to send a playback command first before sending the loop playback command. It is effective when the chip is in the wake-up state.
F3H	Continuous playback	F3H followed by speech addresses A, B, C, etc. When playing address A, subsequent codes are received without interruption, playing A, then B, then C... A delay of 2ms is required between F3 and the address. It is effective when the chip is in the wake-up state.
FEH	Stop playback of current speech	Executing this command stops playback of the current speech segment. It is effective when the chip is in the wake-up state.
F4	Switch audio output mode	F4 00 switches to DAC, F4 01 switches to PWM. It is effective when the chip is in the wake-up state.
F4H 02	Deep sleep (within 3uA)	Deep sleep, effective when the chip is in the wake-up state. Default to deep sleep before leaving the factory.
F4H 03	Standby sleep (within 30uA)	Standby sleep, effective when the chip is in the wake-up state.

5.3.3. Two-wire Serial Port Timing Diagram:

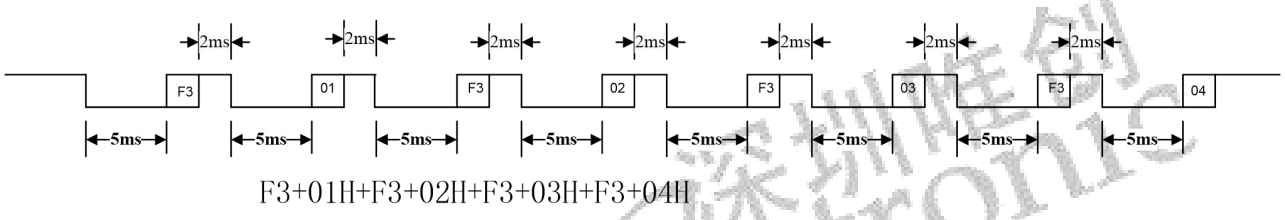


In the Two-wire Serial Control Mode, operations are controlled by the chip clock (CLK) and data (DATA) signals. Before sending each byte of data, the clock signal (CLK) is pulled low for 4ms to 20ms, with 5ms recommended to wake up the WT2003HM04 voice module. Data is received with the Low byte first, followed by the High byte, on the rising edge of the clock signal (CLK). The clock period ranges from 200us to 1ms, with a recommended duration of 300us for both high and low levels (meaning each clock cycle for sending one bit is 600us). When sending data, the Low byte is sent first, followed by the High byte. The data includes commands such as 00H to DFH for speech address instructions, E0H to E7H for volume adjustment commands, F2H for loop playback commands, and FEH for stop playback commands.

If we want to send 96H, the corresponding timing diagram is as follows:



If we want the chip to sequentially play the speech content at addresses 01/02/03/04, that is, continuous code instructions for playback, it would be F3+01+F3+02+F3+03+F3+04. The corresponding timing diagram can be shown as follows:



F3+01H+F3+02H+F3+03H+F3+04H

Note: When using the continuous code function, there should be a delay of 2ms after sending one set of continuous code addresses before sending the next set of continuous code addresses. However, the interval between F3 and the address remains 2ms.

In deep sleep mode, the chip must be awakened first. It is recommended to send the 0xFE command to wake up the chip, then wait for 100ms before sending other commands.

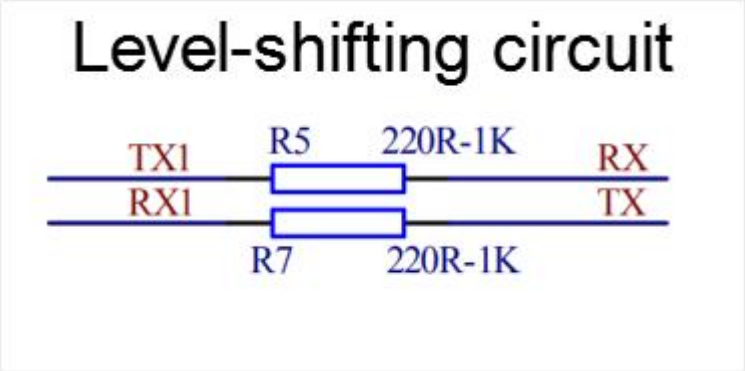
In standby sleep mode, you can directly send the speech address command for playback.

The default mode upon factory setting is deep sleep mode.

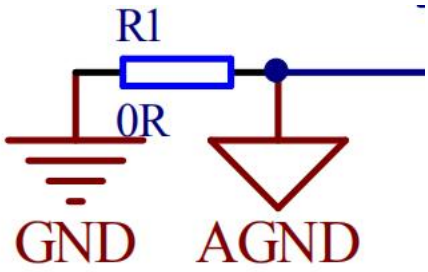
6. Circuit Design Considerations

（一）Circuit reference design reference document "WT2003HX Chip Application Circuit

（二）When the MCU voltage level does not match the voice chip voltage level, please add a level conversion circuit, as shown in the following diagram:



（三）When AGND and GND are connected to an external amplifier, a 0-ohm resistor should be added for isolation, as shown in the following diagram:

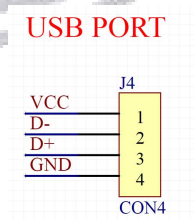


（四）It is recommended to expose all test points, including the burning port of the voice chip, on the PCB board. The benefits of doing so are:

1.Users can replace audio files in the Flash or TF card via the USB interface. If there are any special anomalies or mixed content, there is no need to remove the chip. Our company can assist directly in online voice program flashing.

2.After your company has stocked up, if the customer suddenly requests additional functions, we can also assist by providing upgrade programs for USB upgrades.

The update port is: USB interface.



7. Program Examples

7.1. Single Wire Serial Program Example

7.1.1. Single Wire Serial Control Program (Single Byte)

```
#define ui16 unsigned int
#define u8    unsigned char
sbit SL1_DATA=P0^1;
/*-------------------------------------
;Module Name:Line_1A_WT2003H(u8    SL1_DATA)
;Function:Implementing a One-Wire Serial Communication Function
;Input: s_data is the sending data
;Output:
;SL1_DATA is the data port.
;-------------------------------------*/
void Line_1A_WT2003H( u8 s_data)
{
u8 sl_data,i;
SL1_DATA=1;
delay_10us(200);    //delay2ms
SL1_DATA=0;
delay_10us(500);    //delay5ms
sl_data= s_data;
for(i=0;i<8;i++)
{
if(sl_data&0x01)
{
SL1_DATA=1;
delay_10us(120); //delay1200us
SL1_DATA=0;
delay_10us(40);    //delay400us
}
else
{
SL1_DATA=1;
delay_10us(40); //delay400us
SL1_DATA=0;
delay_10us(120); //delay1200us
}
sl_data = sl_data>>1;
```

```
}
SL1_DATA=1;
}
```

7.1.2. Single Wire Serial Program (Playback Fixed Address)

//reference

```
void List_1A_Play_REC_WT2003H( void )
{
Line_1A_WT2003H( 0xFE );       //Act as wake-up function, wake up the IC in advance.
Delay_1ms(200);
Line_1A_WT2003H( 0x02 );
}
```

7.1.3. Single Wire Serial Control Program (Continuous Playback: F3+01+F3+02+F3+03)

//When performing continuous playback, you can reference the following Sending codes.

```
/*-------------------------------------
;ModuleName:List_1A_Play_WT2003H()
;Function:Implementing a serial line sending function for continuous codes
;Input: DDATA represents the sending data.
;Output:
;-------------------------------------*/


void List_1A_Play_WT2003H( void )
{
Line_1A_WT2003H( 0xFE );       //Act as wake-up function, wake up the IC in advance.
Delay_1ms(200);
Line_1A_WT2003H( 0xF3 );
Delay_1ms(2);      //delay2ms
Line_1A_WT2003H(0x01 );
Delay_1ms(2);
Line_1A_WT2003H(0xF3);
```

```
Delay_1ms(2);
Line_1A_WT2003H( 0x02 );
Delay_1ms(2);
Line_1A_WT2003H( 0xF3 );
Delay_1ms(2);
Line_1A_WT2003H( 0x03 );
Delay_1ms(2);
}
```

7.2. Two-wire Serial Program Example

7.2.1. Two-wire Serial Control Program (Single Byte)

```
#define ui16 unsigned int
#define u8    unsigned char
sbit SL2_DATA=P0^1;
sbit SL2_CLK=P0^2;
/*---------------------------------------
;ModuleName:Line_2A_WT2003H(u8 s_data)
;Function:Implementing Dual Serial Port Communication Function
;Input Parameter: s_data represents the data being sent
;Output:
; SL2_CLK            //Clock line
; SL2_DATA    //Data line
;---------------------------------------*/
void Line_2A_WT2003H( u8 s_data)
{
      u8 txdata,i;
      txdata = s_data;
      SL2_DATA =1;
      SL2_CLK =1;
      delay_10us(500);
      SL2_CLK=0;
      delay_10us(500);

      for(i=0;i<8;i++)
      {
            SL2_CLK=0;
            if(txdata&0x01)
                  SL2_DATA=1;
            else
```

```
            SL2_DATA=0;

            delay_10us(30);
            SL2_CLK=1;
            delay_10us(30);
            txdata = txdata>>1;
        }

        SL2_DATA=1;
        SL2_CLK=1;
}
```

7.2.2. Two-wire Serial Program (Playback Fixed Address)

```
//reference
void List_2A_REC_WT2003H( void )
{
Line_2A_WT2003H( 0xFE);          //Act as wake-up function, wake up the IC in advance.
Delay_1ms(200);
Line_2A_WT2003H( 0xF5);          //Single-line recording starts.
Delay_1ms(5000);                          //Recording for 5 seconds.Line_2A_WT2003H( 0xFE);          //Stop
recording
Delay_1ms(100);
Line_2A_WT2003H( 0xF6);          //Play recording
}
```

7.2.3. Two-wire Serial Control Program (Continuous Playback: F3+01+F3+02+F3+03)

//At the fixed voice address When performing continuous playback, you can reference the following Sending codes.

```
void List_2A_Play_WT2003H( void )
{
Line_2A_WT2003H( 0xFE );       //Act as wake-up function, wake up the IC in advance.
Delay_1ms(200);
Line_2A_WT2003H( 0xF3 );
Delay_1ms(2);     //delay2ms
Line_2A_WT2003H(0x01 );
Delay_1ms(2);
Line_2A_WT2003H(0xF3);
```

```
Delay_1ms(2);
Line_2A_WT2003H( 0x02 );
Delay_1ms(2);
Line_2A_WT2003H( 0xF3 );
Delay_1ms(2);
Line_2A_WT2003H( 0x03 );
Delay_1ms(2); }
```

8. Electrical Parameters

8.1. Absolute Maximum Rated Parameters

Symbol	Parameter	Min	Max	Unit
Tamb	Ambient Temperature	-40	+85	°C
Tstg	Storage temperature	-65	+150	°C
VCC	Supply Voltage	-0.3	5.2	V
V_{Vout33}	3.3V IO Input Voltage	-0.3	3.6	V

8.2. PMU Characteristics

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VCC	Voltage Input	2.4	3.7	5.2	V	_
V_{VOUT}	Voltage output	2.4	3.0	3.4	V	VCC = 3.7V, 100mA loading
I_{VOUT}	Loading current	_	_	100	mA	VCC=3.7V

8.3. Electrical Logic Characteristics of I/O

IO intput characteristics						
Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
V_{IL}	Low-Level Input Voltage	-0.3	_	0.3* VOUT	V	VOUT = 3.3V
V_{IH}	High-Level Input	0.7*	_	VOUT+0.3	V	VOUT = 3.3V

	Voltage	VOUT				
IO output characteristics						
V_{OL}	Low-Level Output Voltage	_	_	0.33	V	VOUT = 3.3V
V_{OH}	High-Level Output Voltage	2.7	_	_	V	VOUT = 3.3V

8.4. Analog DAC Characteristics

Parameter	Min	Typ	Max	Unit	Test Conditions
Frequency Response	20	_	16K	Hz	1KHz/0dB 100kohm loading A-Weighted Filter
THD+N	_	-65	_	dB	
S/N	_	95	_	dB	
Output Swing	_	0.54	_	Vrms	
Dynamic Range	_	92	_	dB	1KHz/-60dB 100kohm loading With A-Weighted Filter
Output Resistance	_	8.3	_	K	_

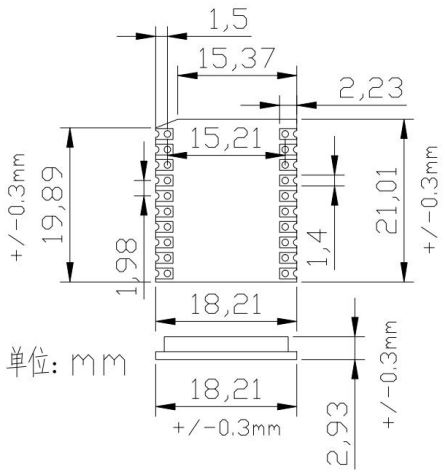
8.5. ADC Characteristics

Parameter	Min	Typ	Max	Unit	Test Conditions
Dynamic Range	_	75	_	dB	1KHz/210mVrms
S/N	_	79	_	dB	line mode :6dB with cap
THD+N	_	-70	_	dB	PGAIS=2

9. Module Dimensions

The module size is 21.01 * 18.21mm, with a pin pitch of 2.0mm. The dimensions are defined as shown in the diagram:

Unit：mm



10. Revision Version

Version	Date	Description
V1.00	2021-12-13	First version
V1.02	2024-12-11	Add power supply range description.