WT2003H Serial
MP3 Chip Specification

Version: V1.02

Note :

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1. Introduction

WT2003HX is a powerful and high-quality MP3 chip upgraded from the MP3 chip of WT2003S to meet the market demand. It uses a high-performance 32-bit processor with a maximum frequency of 120MHz. It has the characteristics of low cost, fast response speed, low power consumption, high reliability, strong versatility and so on, and can meet customers' requirements from various aspects. Support standard asynchronous serial communication, flexible control mode. Support SPI-Flash as memory. With file index playback, spot insertion, single loop, all loop, 32-level adjustable volume and stereo output. Mass storage, up to 128M Flash disk. At present, there are three packaged chips, WT2003HX-16S, WT2003HX-24SS and WT2003HP8-32N (4*4MM smaller), which can better adapt to different application product fields.

2. Characteristics

- MP3 control: standard UART communication interface, the default baud rate is 9600, which supports setting baud rate through serial port command; Support SPI-Flash, TF card and U disk as memory. With the functions of file index play, spot insertion, single loop, all tracks loop, random play, etc. Level 32 has adjustable volume, and can support 128Mbit Flash, 32G TF card and 32G U disk at the maximum.
- Power-on does not play by default; With BUSY status indication, BUSY is usually low level, and it is high level when playing;
- Support switching audio output mode, sample default SPK output, for DAC output, please refer to audio output switching instruction (B6);
- Support voice high-quality audio format, MP3 and Wav formats, (audio code rate supports 8kbps~320kbps) and beautiful sound;
- Operating voltage: 2.4-5.2V；;
- Built-in 0.5w class D power amplifier;
- Two 16-bit asynchronous divider timers;
- Audio stream, IIS supports master and slave modes;
- An infrared remote control decoder;
- 16bit high precision ADC；;
- 16bit high precision DAC；;
- High-power IO drive capability, up to 64mA； direct drive;
- Support SD card /U disk offline upgrade program.

3. Model Choosing

For samples: please select the corresponding chip model and function code according to the selection table below, and contact our business personnel.

表 1 选型表

Function Code	Chip Model	Default Output	PC Mode	SPI Flash	TF Card	USB Drive
A01	WT2003H4-16S	PWM	Support	Maximum support of 128Mbit	Not support	Maximum support of 32G
	WT2003H4-24SS			Maximum support of 128Mbit	Maximum support of 32G	
	WT2003HP8-32N			Maximum support of 128Mbit	Maximum support of 32G	
A02	WT2003H4-16S			Not support	Maximum support of 32G	

4. Pin

WT2003H series chips are packaged with SOP16, TSSOP24 and QFN32, which are suitable for various applications. , its pin diagram and pin definition are as follows:

4.1. SOP16



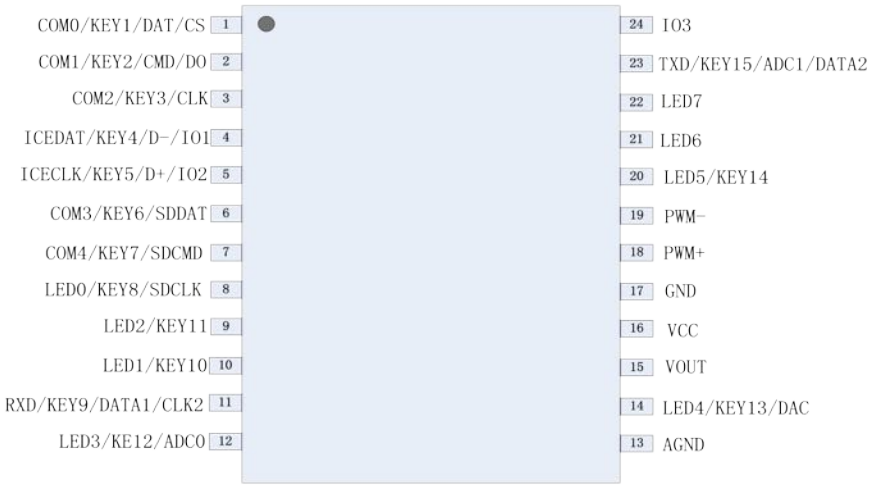
WT2003HX-16S

Pin	Name	Type	Description

1	COM0/KEY1/DAT/CS	I/O	0/ key 1/SD_DAT/SPI Flash chip selection
2	COM1/KEY2/CMD/DO	I/O	1/ key 2/SD_CMD/SPI Flash data
3	COM2/KEY3/CLK	I/O	2 bits/key 3/SD_CLK/SPI Flash clock
4	ICEDAT/KEY4/D-/IO1	I/O	Download port/button 4/D-/IO port
5	ICECLK/KEY5/D+/IO2	I/O	Download port/button 5/D+/IO port
6	RXD/KEY9/DATA1/CL2K	I/O	RXD/ key 9/ one-line serial port data input/two-line serial port clock signal input
7	LED3/KEY12/ADC0	I/O	Segment 3/ key 12/ADC channel 0
8	AGND	G	Analog ground
9	LED4/KEY13/DAC	I/O	Section 4/ key 13/DAC output
10	VOUT	P	Connect the external memory power supply port (106 capacitors must be connected to the ground)
11	VCC	P	Input power (106 capacitors must be connected to ground)
12	GND	G	Digital land
13	PWM+	O	Horn terminal
14	PWM-	O	Horn terminal
15	KEY14/LED5	I/O	Key 14/ Segment 5/Busy busy signal output
16	TXD/KEY15/ADC1/DATA2	I/O	TXD/ key 15/ADC channel 1/ two-wire serial port

Note:
COM (bit)-IO port can be extended to be used as digital tube bit selection;
LED (segment)-IO port can be extended to be used as digital tube segment selection;
Key-IO port can be extended to be used as a key.

4.2. TSSOP24



WT2003HX-24SS

Pin	Name	Type	Description
1	COM0/KEY1/DAT/CS	I/O	0/ key 1/SD_DAT/SPI Flash chip selection
2	COM1/KEY2/CMD/DO	I/O	1/ key 2/SD_CMD/SPI Flash data
3	COM2/KEY3/CLK	I/O	2 bits/key 3/SD_CLK/SPI Flash clock
4	ICEDAT/KEY4/D-/IO1	I/O	Download port/button 4/D-/IO port
5	ICECLK/KEY5/D+/IO2	I/O	Download port/button 5/D+/IO port
6	COM3/KEY6/SDDAT	I/O	Bit 3/ key 6/SD card data
7	COM4/KEY7/SDCMD	I/O	4/ key 7/SD card selection
8	LED0/KEY8/SDCLK	I/O	0/ key 8/SD card clock
9	LED2/KEY11	I/O	2/ key 11
10	LED1/KEY10	I/O	1/ key 10
11	RXD/KEY9/DATA1/CL2K	I/O	RXD/ key 9/ one-line serial port data input/two-line serial port clock signal input
12	LED3/KE12/ADC0	I/O	Segment 3/ key 12/ADC channel 0
13	AGND	G	Analog ground
14	LED4/KEY13/DAC	I/O	Section 4/ key 13/DAC output
15	VOUT	I/O	Connect the external memory power supply port (106 capacitors must be connected to the ground)
16	VCC	P	Input power (106 capacitors must be connected to ground)
17	GND	G	Digital land
18	PWM+	I/O	Horn terminal
19	PWM-	I/O	Horn terminal
20	LED5/KEY14	I/O	Segment code 5/ key 14/Busy busy signal output

21	LED6	I/O	Section 6
22	LED7	I/O	Section 7
23	TXD/KEY15/ADC1/DATA2	I/O	TXD/ key 15/ADC channel 1/ two-wire serial port data input
24	IO3	I/O	IO port

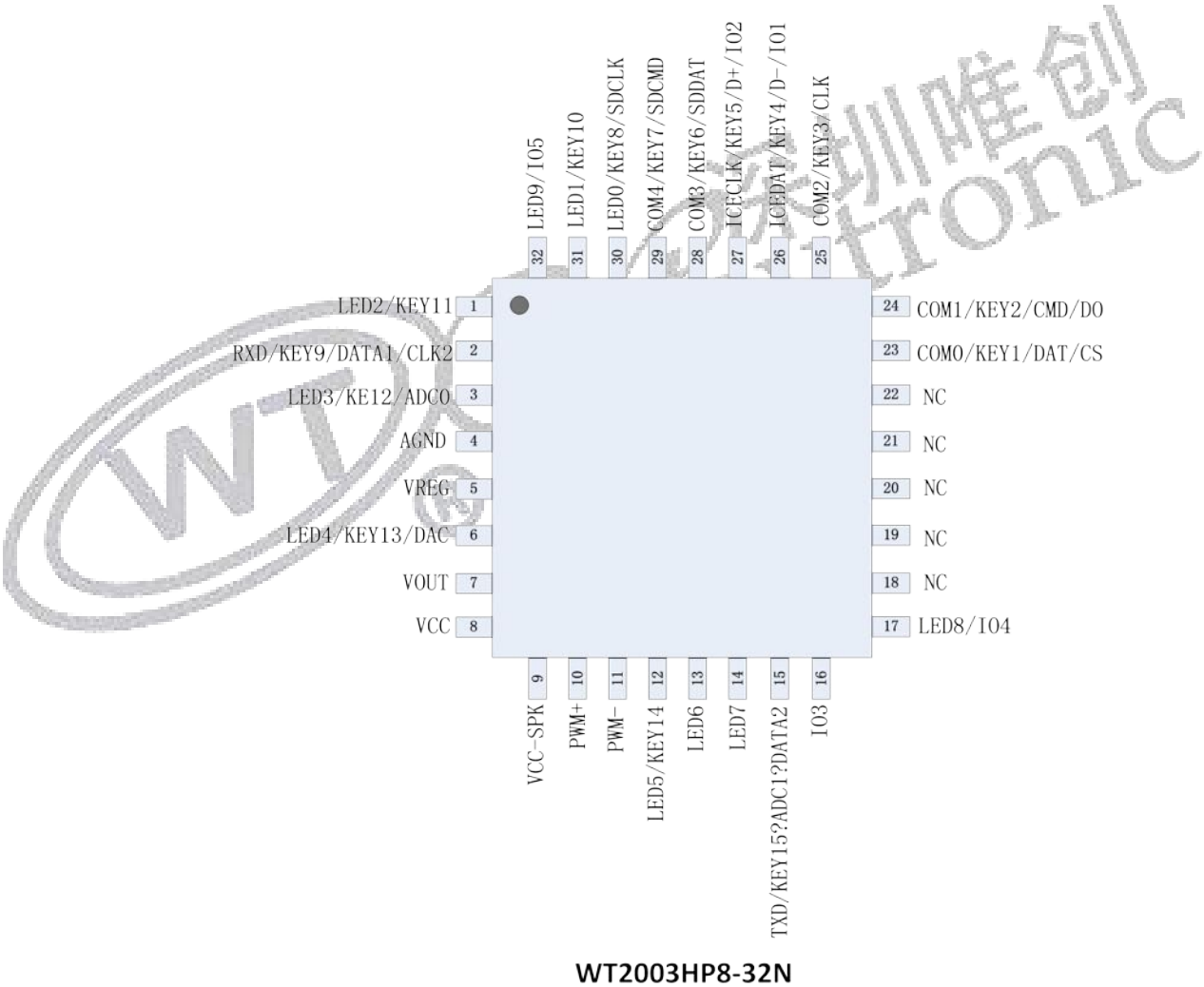
Note:

COM (bit)-IO port can be extended to be used as digital tube bit selection;

LED (segment)-IO port can be extended to be used as digital tube segment selection;

Key-IO port can be extended to be used as a key.

4.3. QFN32



WT2003HP8-32N

Pin	Name	Type	Description
1	LED2/KEY11	I/O	段 2/按键 11
2	RXD/KEY9/DATA1/CL2K	I/O	2/ key 11
3	LED3/KE12/ADC0	I/O	RXD/ key 9/ one-line serial port data input/two-line serial port clock signal input
4	AGND	G	Segment 3/ key /ADC channel 0
5	VREG	P	Analog ground
6	LED4/KEY13/DAC	O	Coupling pin, (105 capacitors must be connected to ground)
7	VOUT	P	Section 4/ key 13/DAC output
8	VCC	P	Connect the external memory power supply port (106 capacitors must be connected to the ground)
9	VCC-SPK	P	Input power (106 capacitors must be connected to ground)
10	PWM+	O	Internal power amplifier power input
11	PWM-	O	Horn terminal
12	LED5/KEY14	I/O	Horn terminal
13	LED6	I/O	Segment code 5/ key 14/Busy busy signal output
14	LED7	I/O	Section 6
15	TXD/KEY15/ADC1/DATA2	I/O	Section 7
16	IO3	I/O	TXD/ key 15/ADC channel 1/ two-wire serial port data input
17	LED8/IO4	I/O	IO port
18	NC	I/O	Section 8/IO port
19	NC	I/O	Empty foot
20	NC	I/O	Empty foot
21	NC	I/O	Empty foot
22	NC	I/O	Empty foot
23	COM0/KEY1/DAT/CS	I/O	Empty foot
24	COM1/KEY2/CMD/DO	I/O	0/ key 1/SD_DAT/SPI Flash chip selection
25	COM2/KEY3/CLK	I/O	1/ key 2/SD_CMD/SPI Flash data
26	ICEDAT/KEY4/D-/IO1	I/O	2 bits/key 3/SD_CLK/SPI Flash clock
27	ICECLK/KEY5/D+/IO2	I/O	Download port/button 4/D-/IO port
28	COM3/KEY6/SDDAT	I/O	Download port/button 5/D+/IO port
29	COM4/KEY7/SDCMD	I/O	Bit 3/ key 6/SD card data
30	LED0/KEY8/SDCLK	I/O	4/ key 7/SD card selection
31	LED1/KEY10	I/O	0/ key 8/SD card clock

32	LED9/IO5	I/O	1/ key 10

Note:
COM (bit)-IO port can be extended to be used as digital tube bit selection;
LED (segment)-IO port can be extended to be used as digital tube segment selection;
Key-IO port can be extended to be used as a key.

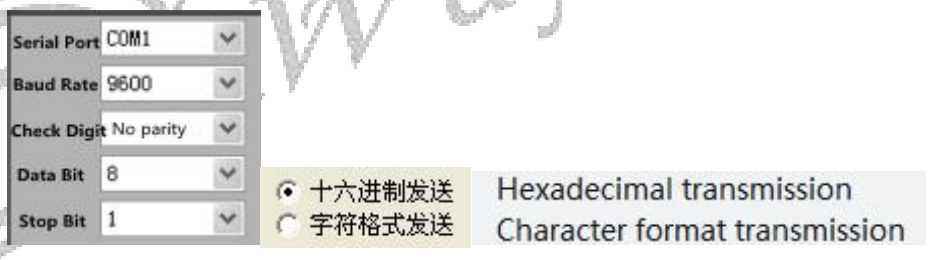
5. Control Mode

5.1. UART Control Mode

Standard UART communication interface, the default baud rate is 9600

5.1.1. Protocol command format

Standard UART asynchronous serial interface, which belongs to 3.3V TTL level interface. The format of communication data is: start bit: 1 bit; Data bits: 8 bits; Parity bit: none; Stop bit: 1 bit. To use the computer serial port debugging assistant, it is necessary to set the serial port parameters correctly, as shown in the figure:



start code	Length	Command code	Parameter	Accumulation and verification	Ending code
0X7E	As follows	As follows	As follows	As follows	0XEF

Note: "Length" refers to the length+command code+parameter+checksum, and "accumulation and checksum" refers to the low byte of the accumulated sum of length+command code+parameter.

Note: FLash voice play can realize instructions such as Flash index play, insertion, etc.

Table 2 Communication control instructions

CMD Detailed Explanation	Relevant Functions	Parameter	Unsupported Function Codes and Chip Models

A0	Specify FLASH index playback (full disk)	File index	(A02+WT2003H4-16S) does not support the Flash function.
A1	Specify the Flash root file name	Track information	
A2	Specify TF card root index playback	File index	(A01+WT2003H4-16S) does not support TF card function
A3	Specify TF card file name to play.	Track information	
A4	Specify index play in TF card folder	File index	
A5	Specify TF card folder-file name playback	Track information	
A6	Specify the root directory index play of U disk.	Track information	
A7	Specify USB disk file name to play.	Track information	
A8	Specify index play in U disk folder.	File index	
A9	Specify USB flash drive folder-file name play	Track information	
AA	Play pause command	without	
AB	Stop command	without	
AC	Next song command	without	
AD	Last song command	without	
AE	Volume control command	Volume level	
AF	Specify the playback mode.	cyclical pattern	
B1	insert in a radio or TV programme	Track information	
B6 00	Audio output mode is switched to SPK.	B6 XX	
B6 01	Audio output mode is switched to DAC.	B6 XX	

Table 3 Communication inquiry command

CMD Detailed	Relevant Functions	Parameter	Unsupported Function Codes and Chip Models

Explanation			
C0	Query the current software version.	C0 XX XX XX XX	
C1	Query the currently set volume.	C1 XX	
C2	Read the current working state	C2 XX	
C3	Query the total number of music files in Flash	C3 XX XX	(A02+WT2003H4-16S) does not support the Flash function.
C5	Query the total number of music files in TF card	C5 XX XX	(A01+WT2003H4-16S) does not support TF card function
C6	Query TF card specified folder-total number of music files	C6 XX XX	
C7	Query the total number of music files in U disk	C7 XX XX	
C8	Query the specified folder of U disk-total number of music files	C8 XX XX	
C9	Query the current playing file address.	C9 XX XX	
CA	Query the current peripheral connection status.	CA XX	
CB	Query the currently playing song name.	CB XX .. （8 Bytes）	

5.1.2. Write operation instructions

5.1.2.1. Write operation instruction return code format

start code	Length	Command code	Parameter	Accumulation and verification	Ending code
0X7E	As follows	As follows	As follows	As follows	0XEF

Note: After each write command is executed, the result code corresponding to the command is returned according to the communication protocol format.

Result code:→: 00 means: OK mode is executed;

→: 01 means: Flash commend is wrong, do not executed;

→: 02 means: EMP does not have this file;

→: 05 means: The equipment is not online;

5.1.2.2. Specify Flash root index play (A0)

This command indexes the files in Flash to play, and the files are sorted according to the index order.

Start code	Length	Command	Track high position	Track low position	Check code	Ending code
7E	05	A0	00	01	XX	EF

Example: send→◇7E 05 A0 00 01 A6 EF □

receive←◆7E 04 A0 00 A4 EF

Description of low/high position of track: hexadecimal means that if the 300th voice is 0x012C, then the high position of track is 0x01 and the low position of track is 0x2C.

The 67th voice is 0x43, so the high bit of the track is 0x00 and the low bit of the track is 0x43.

Note: A02+WT2003H4-16S firmware does not support this instruction.

5.1.2.3. Specify the audio file name to play in the root directory of Flash (A1)

This command can specify the audio file name in Flash to play (the file name is fixed at 4 characters and does not support Chinese)

Start code	Length	Command	File Name				Check code	Ending code
7E	0A	A1	'30'	'30'	'30'	'31'	XX	EF

Among them, "30, 30, 30 and 31" are ASCII codes of 0001 respectively, only the file name is ASCII code value, and other data are hexadecimal values; The above instruction indicates that the audio file named "0001" in the specified root directory is played, as an example:

Note: The file name does not support Chinese. If the file name exceeds 4 characters, you will not be able to specify the file name to play.

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

receive←◆7E 04 A1 00 A5 EF

Note: A02+WT2003H4-16S firmware does not support this instruction.

5.1.2.4. Specify TF card root index to play (A2)

This command indexes the files in TF card to play. Affected by the order of file storage, the files are sorted according to the index order.

Start code	Length	Command	Track high position	Track low position	Check code	Ending code
7E	05	A2	00	01	XX	EF

The index order of files is arranged according to the chronological order in which files are copied to TF card.

Example: send→◇7E 05 A2 00 01 A8 EF □

receive←◆7E 04 A2 00 A6 EF

Description of low/high position of track: hexadecimal means that if the 300th voice is 0x012C, then the high position of track is 0x01 and the low position of track is 0x2C;

The 67th voice is 0x43, so the high bit of the track is 0x00 and the low bit of the track is 0x43.

Note: A01+WT2003H4-16S firmware does not support this instruction.

5.1.2.5. Specify the audio file name to play in the root directory of TF card (A3)

This command can specify the file name in the root directory of TF card to play. (The file name is fixed with 4 characters and does not support Chinese)

Start code	Length	Command	File Name				Check code	Ending code
7E	0A	A3	'30'	'30'	'30'	'31'	XX	EF

Among them, "30, 30, 30 and 31" are ASCII codes of 0001 respectively, only the file name is ASCII code value, and other data are hexadecimal values; The above instruction indicates that the audio file named "0001.mp3" in the specified root directory is played as an example.

Example: send→◇7E 07 A3 30 30 30 31 6B EF □

receive←◆7E 04 A3 00 A7 EF

Note: A01+WT2003H4-16S firmware does not support this instruction.

5.1.2.6. Specify the audio index play in TF card folder (A4)

This command can specify that the audio in the folder under the root directory is played according to the index number. (The folder name is fixed with 5 characters and does not support Chinese)

Start code	length	command	Folder name (high-low)					File directory index (high-low)		Check code	Ending code
7E	0A	A4	'57'	'43'	'5A'	'59'	'31'	00	01	XX	EF

Among them, "57, 43, 5A, 59, 31" are the ASCII code values of the folder name "WCZY1" respectively, the first song is indexed and played in the "00 01" folder, the folder uses ASCII code values and other data are hexadecimal values; The above instruction indicates that the first audio file indexed in the folder will be played in the specified root directory.

Example: send→◇7E 0A A4 57 43 5A 59 31 00 01 2D EF □

receive←◆7E 04 A4 00 A8 EF

Note: A01+WT2003H4-16S firmware does not support this instruction.

5.1.2.7. Specify TF card folder-file name play (A5)

This command specifies the file name in the folder under the root directory to play. (The folder name is fixed with 5 characters and the file name is fixed with 4 characters, and Chinese is not supported)

Start code	length	Comm and	Folder Name					File Name				Check code	Ending code
7E	0C	A5	“57”	“43”	“5A”	“59”	“31”	“30”	“30”	“30 ”	“36”	XX	EF

Among them, "57, 43, 5A, 59, 31" are the ASCII code values of the folder name "WCZY1", and the file names "30, 30, 36" are 0006 ASCII codes, and the folder and file names are ASCII code values and other data are hexadecimal values; The above instruction indicates that the audio file named "0006.mp3" in the specified root directory is played as an example.

Example: send→◇7E 0C A5 57 43 5A 59 31 30 30 30 36 F5 EF □

receive←◆7E 04 A5 00 A9 EF

Note: A01+WT2003H4-16S firmware does not support this instruction.

5.1.2.8. Specify the root index of U disk to play (A6)

This command indexes the files in the USB flash drive to play. Affected by the order of file storage, the files are sorted according to the index order.

Start code	length	Command	Track high position	Track low position	Check code	Ending code
7E	05	A6	00	01	XX	EF

The order of file index is arranged according to the time sequence in which files are copied to the U disk.

Example: send→◇7E 05 A6 00 01 AC EF □

receive←◆7E 04 A6 00 AA EF

5.1.2.9. Specify the audio file name to play in the root directory of U disk (A7)

This command can specify the file name in the root directory for audio playback (the file name is fixed at 4 characters, and Chinese is not supported)

Start code	length	Comm and	File Name				Check code	Ending code
7E	0A	A7	‘30’	‘30’	‘30’	‘31’	XX	EF

Among them, "30, 30, 30 and 31" are ASCII codes of 0001 respectively, only the file name is ASCII code value, and other data are hexadecimal values; The above instruction indicates that the audio file named "0001.mp3" in the specified root directory is played as an example.

Example: send→◇7E 07 A7 30 30 30 31 6F EF □

receive←◆7E 04 A7 00 AB EF

5.1.2.10. Specify the audio index play in the U disk folder (A8)

This command can specify the audio index number in the folder under the root directory to play (the folder name is fixed with 5 characters and does not support Chinese)

Start code	length	Command	Folder name (high-low)					File directory index (high-low)		Check code	Ending code
7E	0A	A8	'57'	'43'	'5A'	'59'	'31'	00	01	XX	EF

Among them, "57, 43, 5A, 59, 31" are the ASCII code values of the folder name "WCZY1" respectively, the first song is indexed and played in the "00 01" folder, the folder uses ASCII code values and other data are hexadecimal values; The above instruction indicates that the first audio file of the index in the folder under the specified root directory is played.

Example: send→◇7E 0A A8 57 43 5A 59 31 00 01 31 EF □

receive←◆7E 04 A8 00 AC EF

5.1.2.11. In the specified USB flash drive folder-file name play (A9)

This command specifies the file name in the folder under the root directory to play. (The folder name is fixed with 5 characters and the file name is fixed with 4 characters, and Chinese is not supported)

Start code	length	Command	Folder Name					File Name				Check code	Ending code
7E	0A	A9	"57"	"43"	"5A"	"59"	"31"	"30"	"30"	"30 "	"36"	XX	EF

Among them, "57, 43, 5A, 59, 31" are the ASCII code values of the folder name "WCZY1", "30, 30, 36" are the ASCII codes of 006, and the file names and folders are ASCII code values, and other data are hexadecimal values; The above instruction indicates that the audio file named "0006.mp3" in the specified root directory is played as an example.

Example: send→◇7E 0C A9 57 43 5A 59 31 30 30 30 36 F9 EF □

receive←◆7E 04 A9 00 AD EF

5.1.2.12. Pause playback command (AA)

Start code	length	Command	Check code	Ending code
7E	03	AA	AD	EF

In the play state, if the instruction is sent, the play will be suspended; In the pause state, send this command, and then continue to play music from the pause.

Sending this instruction in stop state is invalid.

Example: send→◇7E 03 AA AD EF □

receive←◆7E 04 AA 00 AE EF

5.1.2.13. Stop order (AB)

Start code	length	Command	Check code	Ending code
7E	03	AB	AE	EF

Send this command to stop playing the currently playing music.

Example: send→◇7E 03 AB AE EF □

receive←◆7E 04 AB 00 AF EF

5.1.2.14. Next command (AC)

Start code	length	Command	Check code	Ending code
7E	03	AC	AF	EF

This command can trigger the next piece of music in the current playing directory. When the last piece of music is played, sending this command can trigger the first piece of music to be played.

Example: send→◇7E 03 AC AF EF □

receive←◆7E 04 AC 00 B0 EF

5.1.2.15. The last command (AD)

Start code	length	Command	Check code	Ending code
7E	03	AD	B0	EF

This command can trigger the playing of the last music in the current playing directory. When playing the first music, sending this command can trigger the playing of the last music.

Example: send→◇7E 03 AD B0 EF □

receive←◆7E 04 AD 00 B1 EF

5.1.2.16. Volume control command (AE).

There are 32 levels of volume, ranging from 0 to 31, of which 0 is mute and 1F is the maximum volume.

Start code	length	Command	Voice Volume Level	Check code	Ending code

7E	04	AE	1F	XX	EF

In the example, in order to send the maximum volume to level 31, this instruction can modify and adjust the volume in real time.

Example: send→◇7E 04 AE 1F D1 EF □

receive←◆7E 04 AE 00 B2 EF

5.1.2.17. Specify the playback mode (AF)

This instruction modifies the playback mode under the power-on condition, and will return to the default mode (no power-off memory) after power-off.

Start code	length	Command	Parameter	Check code	Ending code
7E	04	AF	00: No-loop single playback mode (default)	B3	EF
			01: Single loop playback mode	B4	
			02: All tracks loop playback mode	B5	
			03: Random mode	B6	

Example: send→◇7E 04 AF 01 B4 EF □

receive←◆7E 04 AF 00 B3 EF

5.1.2.18. Interruption instruction (B1)

This instruction can only be inserted in the play state, and it is invalid in the stop state.

Start code	length	Command	Mark Letter	Track high position	Track low position	Check code	Ending code
7E	06	B1	00	00	01	XX	EF

When sending this instruction, the currently playing track will be paused, and then the playing track specified in this instruction will be executed. When the playing is finished, the originally paused track will be played.

When the first insertion order is not finished, when the second insertion order is sent, the order is invalid. You can't insert the music again until the first one is finished.

Marking word: →00; Said: insert the designated index address in FLASH;

→01； Said: insert the designated index address in TF card;

→02； Said: insert the designated index address in the USB flash drive;

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

5.1.2.19. Switch the audio output mode (B6)

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

Start code	length	Command	Parameter	Check Code	End Code
7E	04	B6	00	BA	EF
			01	BB	

Parameter: 00 means SPK output and 01 means DAC output.

Note: The example instruction is to switch to DAC output based on the default SPK output.

Example: send→◇7E 04 B6 01 BB EF □

receive←◆7E 04 B6 00 BA EF

5.1.2.20. Query the current software version (C0)

This instruction is used for version confirmation, tracing query of version problems, precise positioning, etc.

Start code	length	Command	Check Code	End Code
7E	03	C0	C3	EF

Example: send→◇7E 03 C0 C3 EF □

receive←◆7E 18 C0 57 54 43 32 31 31 32 32 30 2D 36 34 2D 41 30 32 56 32 2E 30 32 72 EF

"57 54 43 32 31 32 30 2d36 34 2d41 30 32 56 32 2e30 32" is the query version number (hexadecimal display), and the conversion string is: WTC211220-64-A02V2.02, 211220 means December 20th, 2021, and 64-A02V2.02 is internal.

5.1.2.21. Query the currently set volume (C1)

This instruction is used to query the current playback volume. The example indicates that the current volume is "1f" level 31.

Start code	length	Command	Check Code	End Code
7E	03	C1	C4	EF

Example: send→◇7E 03 C1 C4 EF □

receive←◆7E 04 C1 1F E4 EF

5.1.2.22. Read the current working state (C2)

This instruction is used to inquire about the current playing state. The result code "02" in the example indicates that the stop "AB" instruction was sent to stop playing audio.

Start	length	Comman	Check	End Code

code		d	Code	
7E	03	C2	C5	EF

Result code:→: 01 means: played;
→: 02 means: paused;
→: 03 means: stopped;

Example: send→◇7E 03 C2 C5 EF □
receive←◆7E 04 C2 02 C8 EF

5.1.2.23. Inquire about the total number of music files in Flash (C3)

This command can query the number of all audio files in the Flash root directory.

Start code	length	Command	Check Code	End Code
7E	03	C3	C6	EF

Note:' 000b' in the example indicates that there are 11 audio pieces in the Flash card.
Example: send→◇7E 03 C3 C6 EF □
receive←◆7E 05 C3 00 0B D3 EF

Note: A02+WT2003H4-16S firmware does not support this instruction.

5.1.2.24. Inquire about the total number of music files in TF card (C5)

This command can query the number of all audio files in the TF card root directory (including the audio in the folder).

Start code	length	Command	Check Code	End Code
7E	03	C5	C8	EF

Note: In the example,' 000b' means that there are 11 audio tracks in the TF card.
Example: send→◇7E 03 C5 C8 EF □
receive←◆7E 05 C5 00 0B D5 EF

Note: A01+WT2003H4-16S firmware does not support this instruction.

5.1.2.25. Query the total number in the specified folder in TF card-music file (C6)

This command can query the total audio quantity in the folder under the root directory of TF card (the folder name is fixed with 5 characters, and Chinese is not supported)

Start code	length	Command	Folder name (high-low)					Check Code	End Code
7E	08	C6	'57'	'43'	'5A'	'59'	'31'	XX	EF

Among them, "57, 43, 5A, 59 and 31" are the ASCII code values of the folder name "WCZY1" respectively, and the result code is returned as two characters.

Example: "00 06" means that there are 6 songs in this "WCZY1" folder.

Example: send→◇7E 08 C6 57 43 5A 59 31 4C EF □
receive←◆7E 05 C6 00 06 D1 EF

Note: A01+WT2003H4-16S firmware does not support this instruction.

5.1.2.26. Check the total number of music files in the U disk (C7) (including the audio in the folder)

This command can query the number of all audio files in the root directory.

Start code	length	Command	Check Code	End Code
7E	03	C7	CA	EF

Note:' 000b' in the example indicates that there are 11 audio tracks in the USB flash drive.

Example: send→◇7E 03 C7 CA EF □
receive←◆7E 05 C7 00 0B D7 EF

5.1.2.27. Query the specified folder in the U disk-the total number of music files (C8)

This command can query the total audio quantity in the folder under the specified root directory (the folder name is fixed with 5 characters and does not support Chinese)

Start code	length	Command	Folder name (high-low)					Check Code	End Code
7E	08	C8	'57'	'43'	'5A'	'59'	'31'	XX	EF

Among them, "57, 43, 5A, 59 and 31" are the ASCII code values of the folder name "WCZY1" respectively, and the result code is returned as two characters.

Example: "00 06" means that there are 6 songs in this "WCZY1" folder.
Example: send→◇7E 08 C8 57 43 5A 59 31 4E EF □
receive←◆7E 05 C8 00 06 D3 EF

5.1.2.28. Query the address of the currently playing file (C9)

Start code	length	Command	Check Code	End Code

7E	03	C9	CC	EF

Note: Example "00 03" indicates that the current song is played to the address of the third song in the root directory.

Example: send→◇7E 03 C9 CC EF □

receive←◆7E 05 C9 00 03 D1 EF

5.1.2.29. Query the current peripheral connection status (CA)

Start code	length	Command	Check Code	End Code
7E	03	CA	CD	EF

When SD card and U disk are inserted or pulled out, WT2003HX will actively return data to prompt. The lower 4 bits of the return value indicate the existence status of PC connection (BIT3), U disk (BIT2), SD card (BIT1) and SPI-FLASH(BIT0) respectively, 0-exists, 1-does not exist.

Example: 0X01: No PC connection (BIT3=0), no U disk (BIT2=0), no SD card (BIT1=0), SPI-flash (bit 0 = 1);

0X07: No PC connection (BIT3=0), U disk (BIT2=1), SD card (BIT1=1) and SPI-FLASH(BIT0=1).

5.1.2.30. Query the song name (CB) of the currently playing song.

Start code	length	Command	Check Code	End Code
7E	03	CB	CE	EF

The data returned by the example is represented by ASCLL code, and the song "30 30 36 2e6d 70 33 20" is named as 0006.mp3

If the song name is less than 8 bytes, then the insufficient will be returned in 20H. (Does the song name have to be eight bytes or only eight bytes?)

Example: send→◇7E 03 CB CE EF □

receive←◆7E 0C CB 30 30 30 36 2E 6D 70 33 20 FB EF

5.1.3. Active feedback code

5.1.3.1. Peripheral storage connection status

Operating Code	Return Value

0XCA	XX

When the U disk is inserted or pulled out, it will actively return data to prompt; The lower 4 bits of the return value indicate the existence status of PC connection (BIT3), U disk (BIT2), SD card (BIT1) and SPI-FLASH(BIT0) respectively,

0-exists and 1-does not exist.

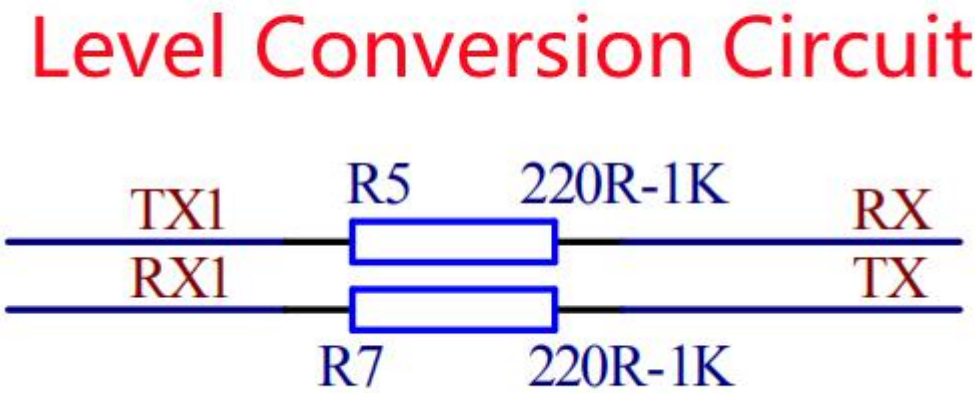
Example: 0X01: No PC connection (BIT3=0), no U disk (BIT2=0), no SD card (BIT1=0), SPI-flash (bit 0 = 1);

0X07: No PC connection (BIT3=0), U disk (BIT2=1), SD card (BIT1=1) and SPI-flash (Bit0 = 1);

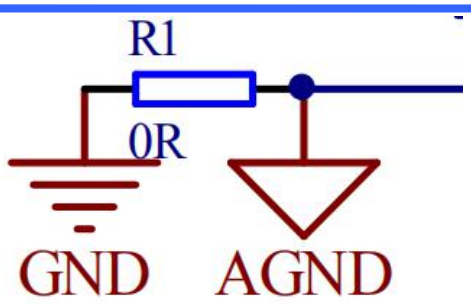
6. Matters needing attention in circuit design

(1) circuit reference design reference document "WT2003HX chip application circuit"

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



When AGND and GND are connected to the external power amplifier, they need to be isolated by 0R resistor, as shown in the following figure:



7. Electrical parameters

7.1. Absolute maximum rated parameter

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

7.2. 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

7.3. IO input/output electrical logic characteristics

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 Voltage	0.7* VOUT	_	VOUT+0.3	V	VOUT = 3.3V

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

7.4. 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	_

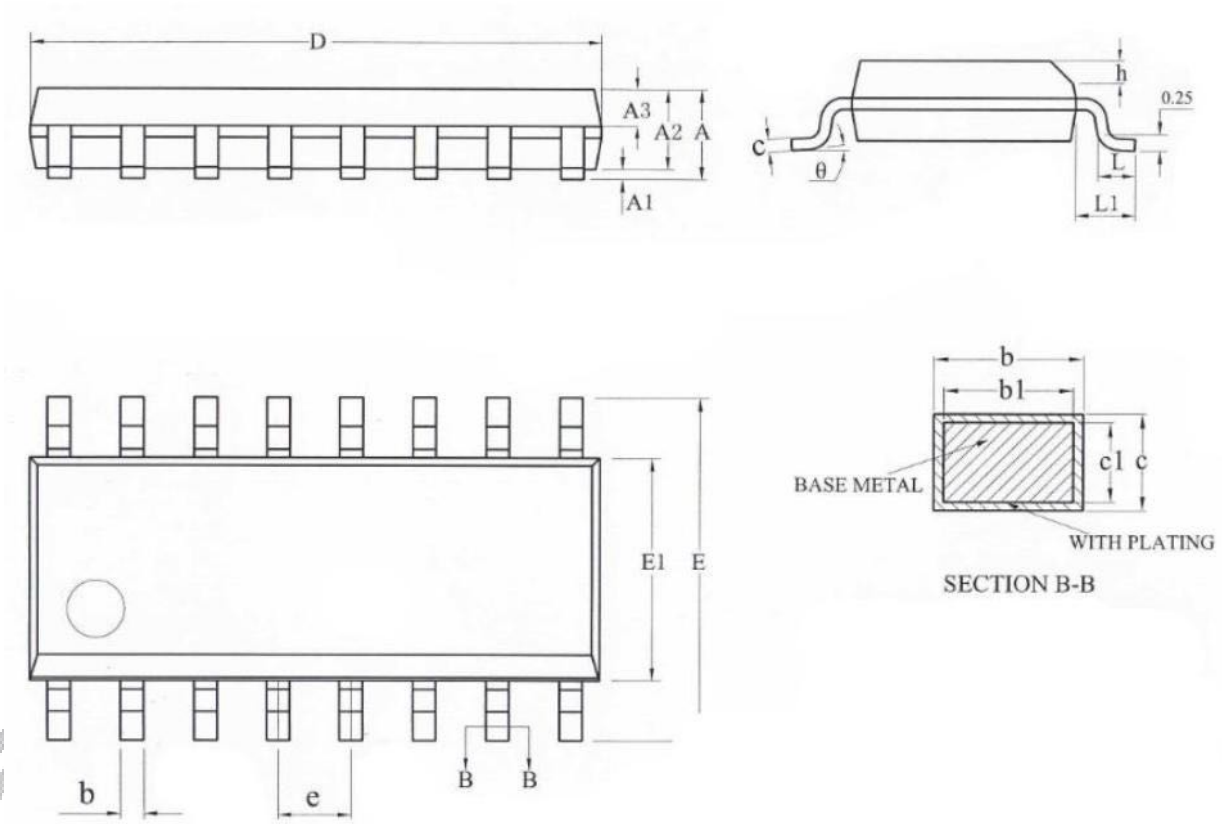
7.5. ADC characteristics

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

8. Package Information

8.1. SOP16 Package Size

Unit：mm

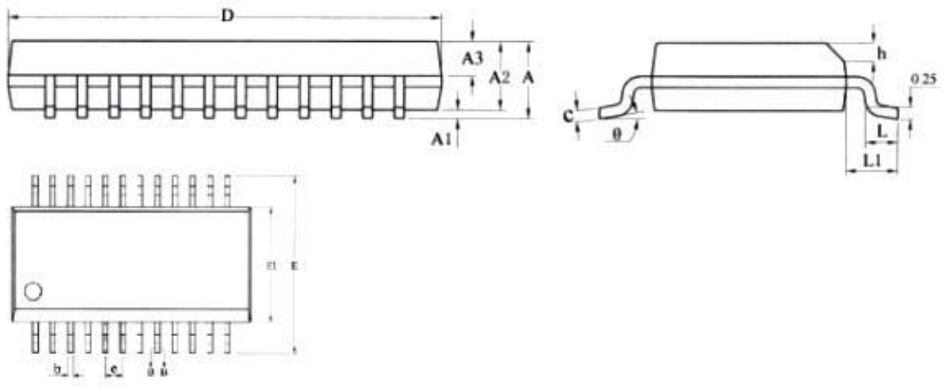


名称	最小值	典型值	最大值
A	-	-	1.75
A1	0.10	0.15	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	-	0.47
b1	0.38	0.41	0.44
c	0.20	-	0.24
c1	0.19	0.20	0.21
D	9.80	9.99	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
h	0.25	-	0.50
L	0.50	-	0.80

L1	1.05REF		
θ	0	-	8°

8.2. TSSOP24 Package Size

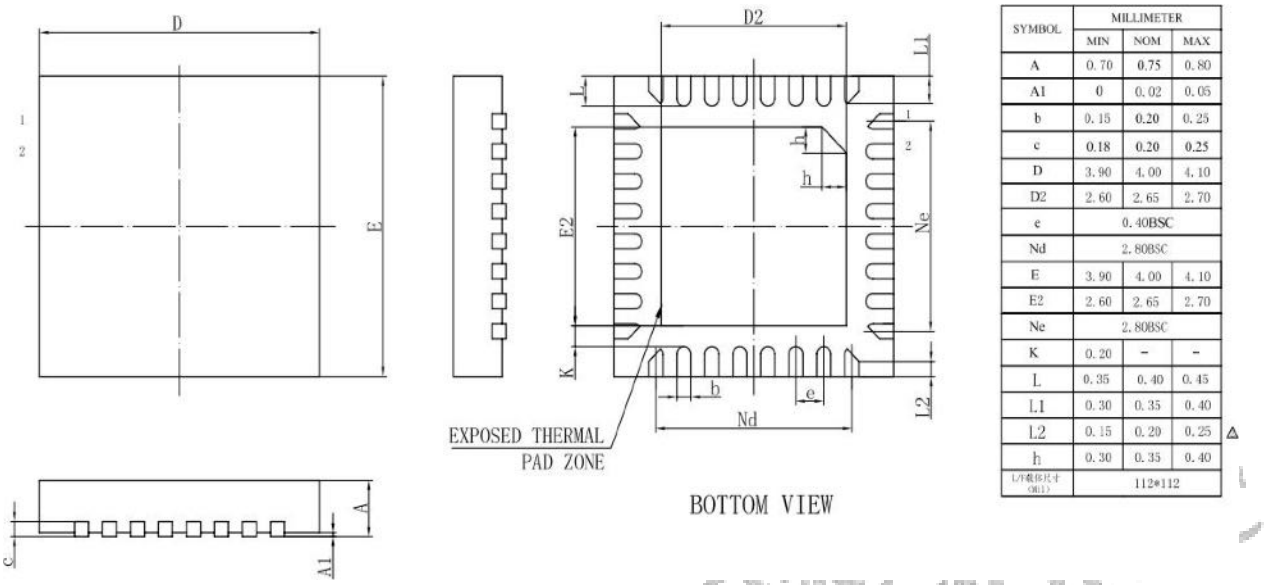
单位：mm



名称	最小值	典型值	最大值
A	-	-	1.75
A1	0.10	0.15	0.25
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.23	-	0.31
b1	0.22	0.25	0.28
c	0.20	-	0.24
c1	0.19	0.20	0.21
D	8.55	8.65	8.75
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	0.635BSC		
h	0.30	-	0.50
L	0.50	-	0.80
L1	1.05REF		
θ	0	-	8°

8.3. QFN32 Package Size

Unit：mm



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.15	0.20	0.25
c	0.18	0.20	0.25
D	3.90	4.00	4.10
D2	2.60	2.65	2.70
e	0.40BSC		
Nd	2.80BSC		
E	3.90	4.00	4.10
E2	2.60	2.65	2.70
Ne	2.80BSC		
K	0.20	-	-
L	0.35	0.40	0.45
L1	0.30	0.35	0.40
L2	0.15	0.20	0.25
h	0.30	0.35	0.40
载体尺寸(mil)	112*112		