WT2000HX-16S
# Voice Chip Specification

Version: V1.09

CONTENT

1. Product Introduction

WT2000HX-16S is a powerful and high-quality recording chip that uses a high-performance 32-bit processor with a maximum frequency of 120MHz. With the characteristics of low cost, low power consumption, high reliability, and strong versatility, WT2000HX-16S is divided into two chips, WT2000H0-16S and WT2000H4-16S. WT2000H4-16S supports storing recording data in internal Flash, and supports up to 100S recording , It also supports external SPI Flash; WT2000H0-16S only supports external SPI Flash recording, and the maximum supports external 128Mbit Flash. Flexible control mode: support one-line serial communication and button control.

2. Functions

➢ Maximum can support external 128Mbit Flash;

➢ Control method: one-line serial port, (UART or button control can be customized);

➢ No playback by default when power on; with BUSY status indication, BUSY is high when recording or playing, and BUSY is low when stopping recording or not playing;

➢ Support high-quality recording, recording sampling supports 8K\12K\16K\20K\24K;

➢ Support voice decoding and playback of high-quality audio format, (8kbps~320kbps) with beautiful sound;

➢ Built-in 0.5W Class D power amplifier;

➢ The volume is adjustable, and the volume level is 8 levels;

➢ Two 16-bit asynchronous divider timers;

➢ Digital audio stream, IIS supports host and slave modes;

➢ An IIC controller;

➢ An infrared remote control decoder;

➢ 16 bit high precision ADC;

➢ 16 bit high precision DAC;

➢ High-power IO drive capability, which can directly drive up to 64mA.

➢ low levels) for 1 second, the chip enters sleep

3. Descriptions of PIN
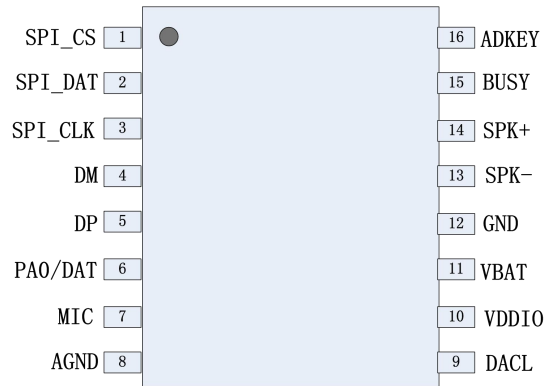
WT2000HX-16S

PIN	NAME	TYPE	Describtion
1	SPI_CS	I/O	SPI Flash Chip Select
2	SPI_DAT	I/O	SPI Flash data
3	SPI_CLK	I/O	SPI Flash CLK
4	DM	I/O	USB DM
5	DP	I/O	USB DP
6	PA0/DAT	I/O	IO PORT
		I/O	One-line serial port data pin
7	MIC	I/O	MIC RECORDING
8	AGND	G	Audio ground
9	DACL	O	DACLeft channel output
10	VDDIO	P	3.3VPower Output
11	VBAT	P	VBATpower input
12	GND	G	GND
13	SPK-	I/O	Speaker terminal
14	SPK+	I/O	Speaker terminal
15	BUSY	I/O	Busy signal (used to indicate playback
16	ADKEY	I/O	Key input

4. One-line Serial Communication

One-line serial port mode can use the MCU to send data to the WT2000HX-16S series voice chip through the DATA line to achieve the purpose of control. It can control voice playback, stop, loop, recording, etc.

4.1. Pin Assignment

package	pin	
	6	15
SOP16	DATA	BUSY

4.2. Correspondence of One-line Voice Address

Data (Hexadecimal)	Function
00H	Play the 0th voice
01H	Play the 1th voice
02H	Play the 2th voice
…….	
DDH	Play the 221th voice
DEH	Play the 222th voice
DFH	Play the 223th voice

Note: If you want to play the voice of this address, you can automatically play the voice of this address as long as you send the address, and the time interval between the two address commands must be greater than 4ms.

4.3. One-line Audio and Command Code

Command Code	Functions	Descriptions
F0H	Automatically enter sleep mode (default state after power-on)	After executing this command, after the voice playback is over, the chip will automatically enter sleep mode after waiting for 5S; after entering sleep, the chip wakes up on the falling edge of the DATA pin. After waking up, it takes an interval of 100ms to receive the command effectively; this command has power-down memory.

F1H	Exit automatically enter sleep mode	After executing this command, the chip will always be in the standby state after the voice playback ends; this command has power-down memory.
E0H....E7H	E0 has the smallest volume, E7 has the largest volume, a total of 8 levels of volume adjustment	In the voice playback, send this command to adjust the volume when the playback is over or in the standby state.
F2H	Loop current voice	Execute this command to play the current voice in a loop, and it can be sent when the voice is played/stopped. During the execution of the F2 loop command, it can be interrupted by the FE command, ordinary address command, and F3/F8 combined command, and becomes invalid; the playback command must be sent first, and then the loop playback command.
F5H+XXH	Recording section XX instructions	Recording section XX command: record a voice and store it in the recording area (currently only one recording is supported, and multiple recordings are not supported)
F6H+XXH	Play segment XX recording	F6H+XXH Play the XX section of the recording Play the voice content of the recording area
F3H	Continuous code playback	F3H+Voice Address A, F3H+Voice Address B, F3H+Voice Address C,... When playing address A, it will not interrupt after receiving the following code. After playing A, it will play B, and then play C.... A 2ms delay is required between F3 and the address
FEH	Stop playing the current voice/Stop the current recording	Execute this command to stop playing the current voice or stop the current recording
F4	Audio output mode switch	F4 00 switches to DAC, F4 01 switches to PWM

4.4. One-line Serial Port Sequence Diagram

The chip wakes up on the falling edge of the DATA pin, and it takes 100ms after wake-up to receive commands effectively; this command has power-down memory.
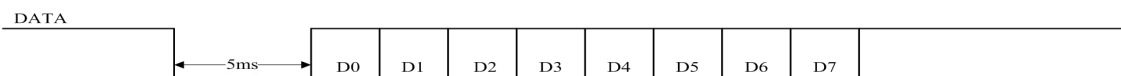

First pull the data line low for 4~20ms, recommended 5ms, send 8-bit data, send low bit first, then high bit, use the ratio of high level to low level to represent the value of each data bit

600us | 200us | The ratio of high and low level is 3:1, represented by 1

200us | 600us | The ratio of high and low level is 1:3, represented by 0

Note: The high level must be in front and the low level in the back

It is recommended to use 200us: 600us. Value range: 40us:120us ~ 400us:1200us. Pay attention to the use of 3:1 and 1:3 level ratios to ensure stable communication.

If we want to send 96H, then his corresponding timing diagram is as follows
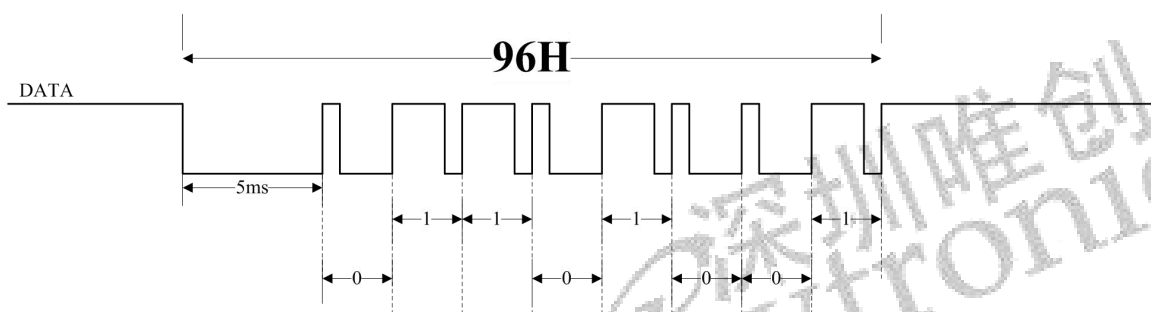
Suppose we want the chip to play the voice content of address 01/02/03/04 in sequence. That is, the continuous code command playback, F3+01+F3+02+F3+03+F3+04. The corresponding timing can be as shown in the following figure:

F3+01H+F3+02H+F3+03H+F3+04H
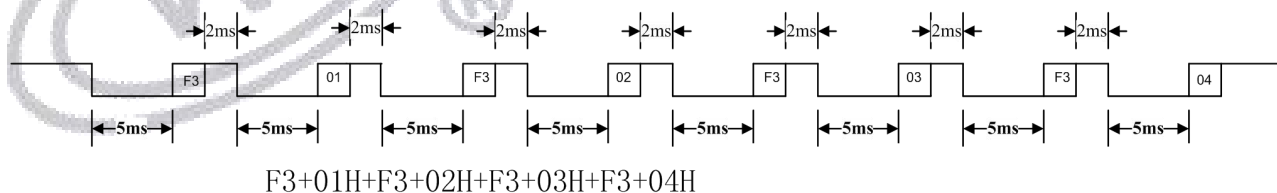
Note:

Because the WT2000HX-16S needs a certain amount of initialization time to power on, and it cannot respond to commands during initialization, it is recommended that users use the code-linking function to delay 2ms after sending a group of code-linked addresses before sending the next group of code-linked addresses; but F3 and F3 The interval between addresses is still 2ms;

After sleep, the chip is pulled up by default, and DATA is pulled high when the voice playback ends.

5. Button Function

5.1. Button Control Mode

KEY	OP	FUNCTION&OP
S1	Short press	Play fixed voice
S2	Short press	Play recording
S3	Short press	Volume+
S4	Long press	Long press to record
S5	Short press	Volume-

Note: Refer to the button circuit for the specific connection method, there will be a beep when the button is pressed.

6. SOP16 Package Circuit Design Reference
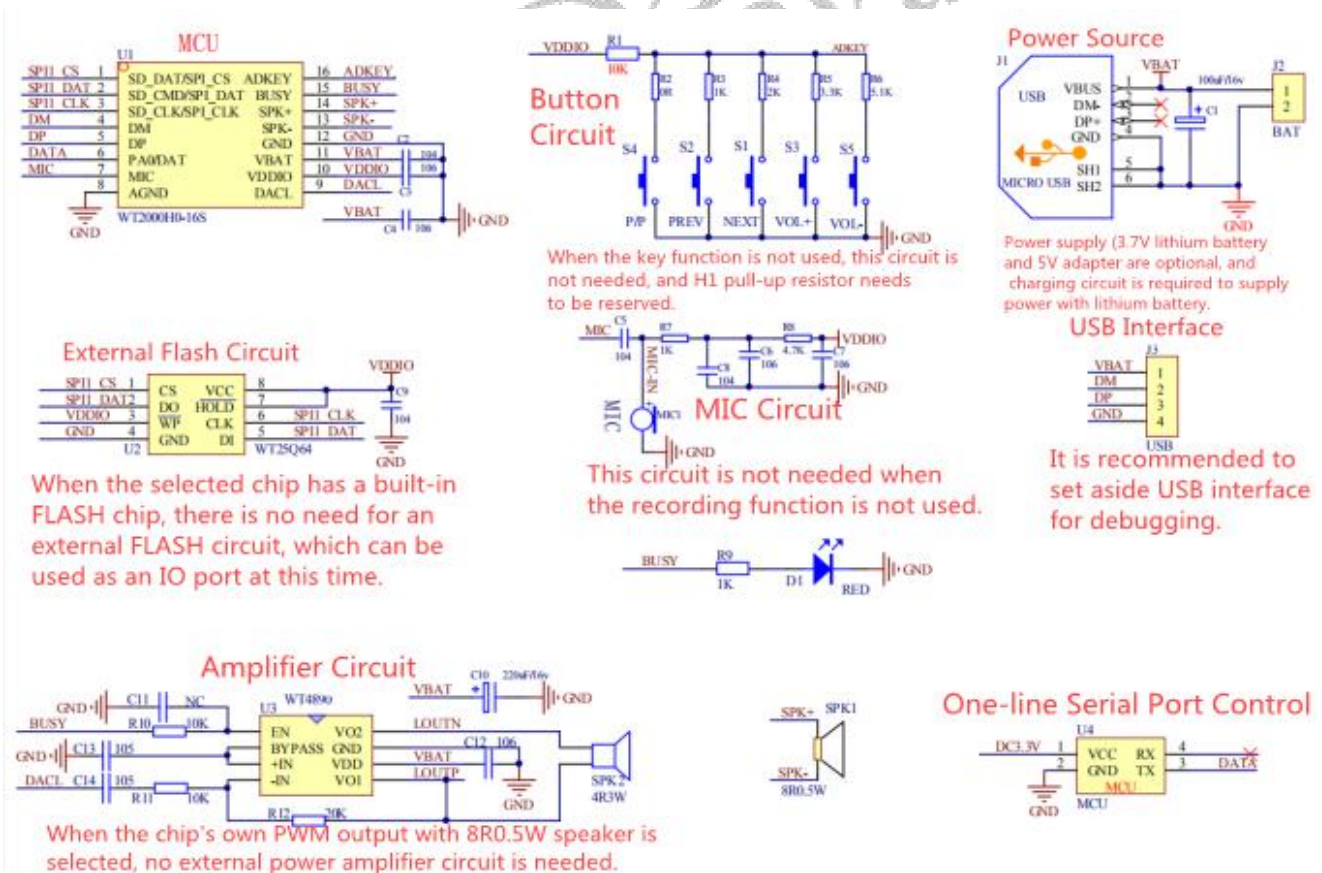
7. Electrical Parameters

7.1. Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Unit
Tamb	Ambient Temperature	-40	+85	°C
Tstg	Storage temperature	-65	+150	°C
VBAT	Supply Voltage	-0.3	5.5	V
$V_{VDDIO33}$	3.3V IO Input Voltage	-0.3	3.6	V

7.2. PMU Characteristics

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VBAT	Voltage Input	2.0	3.7	5.5	V	_
V_{VDDIO}	Voltage output	2.0	3.0	3.4	V	VBAT = 3.7V, 100mA loading
I_{VDDIO}	Loading current	_	_	100	mA	VBAT=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* VDDIO	V	VDDIO = 3.3V
V_{IH}	High-Level Input Voltage	0.7* VDDIO	_	VDDIO+0.3	V	VDDIO = 3.3V
IO output characteristics						
V_{OL}	Low-Level Output Voltage	_	_	0.33	V	VDDIO = 3.3V
V_{OH}	High-Level Output Voltage	2.7	_	_	V	VDDIO = 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. DAC 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

2. Package Information

unit：mm
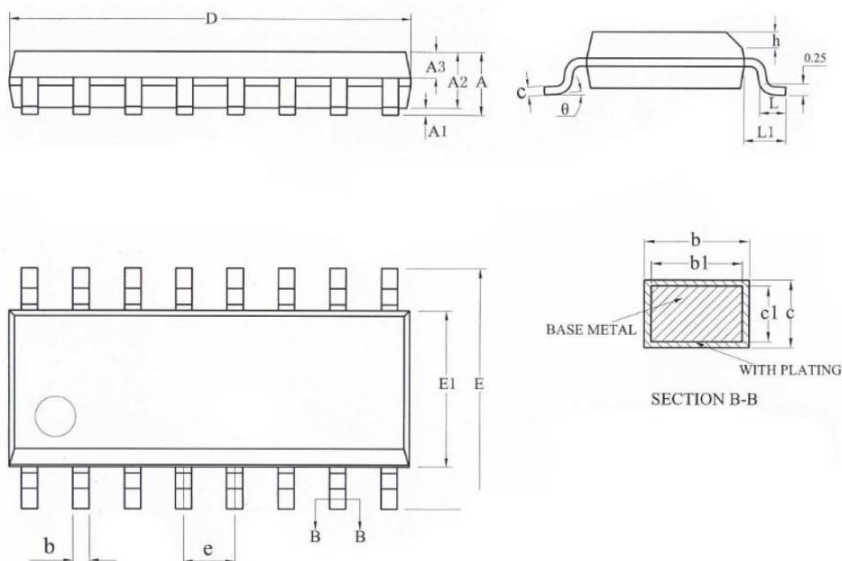
name	Minimum	Typical value	Max
A	-	-	1.75
A1	0.10	0.15	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	-	0.47
b1	0.38	0.41	0.44
c	0.20	-	0.24
c1	0.19	0.20	0.21
D	9.80	9.99	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
h	0.25	-	0.50
L	0.50	-	0.80
L1	1.05REF		
θ	0		8°