WT588F02A-8S
Voice Chip Specification

Single Byte

CONTENT

1. Overview

WT588F02A-8S (with built-in 2M bit flash) is a 16-bit DSP voice chip newly developed by Shenzhen Waytronic Electronics Co., Ltd., with an internal oscillation of 32Mhz and 16-bit PWM decoding. Powerful functions make WT588F02A-8S a leader in the voice chip industry. At present, WT588F02A-8S, with higher sound quality, can support up to 170 seconds of voice content (if the customer does not require sound quality, it can store up to 320 seconds of voice content). WT588F02A-8S is different from traditional OTP chips. The biggest breakthrough is that customers can replace the internal voice content of the chip through the MCU or supporting downloader; and the chip has built-in hardware SPI, UART, IIC, comparator and other resources, which can customize various personalized functional products for customers.

2. Functions overview

1. 16-bit DSP voice chip, 32Mhz internal oscillation
2. Working voltage 2.0~5.5V
3. 16bit PWM/DAC output, can directly drive 8R 0.5W speakers
4. Support 6K~32Khz WAV files
5. Customers can replace the internal voice content of the chip through MCU or supporting downloader
6. Support one-line serial port, two-line serial port (UART and IIC communication will be developed)
7. Support up to 4 channels of 16K sampling rate mixing
8. Support up to 16-channel midi playback (8K sampling rate)
9. Support up to 1000 segments of addresses, addresses less than 224 segments are single-byte coded, and segments greater than or equal to 224 are double-byte coded
10. With hardware SPI interface, UART interface, IIC, built-in comparator and other interfaces. Various functions can be customized for customers
11. Chip built-in 220k byte storage space (not including main control program)
12. The chip main control program and flash data can be erased and re-programmed
13. The chip power-on initialization time is about 200ms
14. After the chip playing is over, and the IO port (DATA and CLK) maintains a stable level (both high and low levels) for 1 second, the chip enters sleep

Note：

1. The control method of the chip has been set when the program is programmed. When ordering the chip, it is necessary to explain the application requirements with the salesperson.

2. If you need a chip with lower standby power consumption, please contact our salesperson.

3. Description of PIN
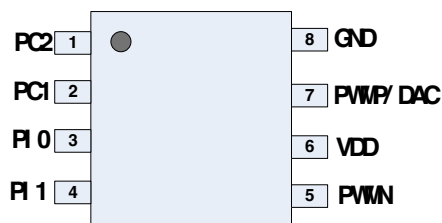
WT588F02A-8S

3.1. Pin Distribution Diagram

Pad Name	Pad No.	ATTR.	Description
PC2/BUSY	1	I/O	Busy signal output
PC1/DATA1/CLK2	2	I/O	Two-wire serial port clock signal input end/One-wire serial port data signal input end
PI0/DATA2	3	I/O	Two-wire serial data signal input terminal
PI1	4	I/O	Not yet used (NC)
PWMN	5	out	PWM output pin
VDD	6	Power	Power positive
PWMP	7	I/O	PWM output pin/DAC
GND	8	Power	Power negative

4. Limit Parameters

Mark	Range	Unit
VDD~GND power supply voltage	-0.5~+5.5	V
Vin input voltage	GND-0.3< Vin <VDD+0.5	V
Vout output voltage	GND < 0.3V ~ VDD+0.3	V
Top operating temperature	-20~ +85	°C
Storage temperature	-50~100	°C

Note:this is the result of the sample tested in the lab.The chips can work normally at -20~+85°C

---

5. Electrical Characteristics

Parameter	symbol	Lowest limit	Typical	Highest limit	Test condition
operating voltage	VCC	2.0V		5.5V	
oscillation frequency	Fbank0	4.096MHz±3%		8.192MHz±3%	
oscillation frequency(BANK 7)	Fbank7		32.768MHz±3%		
RCOscillator frequency	Frc 1		65.536 MHz±3%		
Low power rc oscillator frequency	frc 2	32768hz-5%		32768hz 15%	
Working current	IOP		5mA		No load
IO port logic level (H)	VIH	0.8 VCC			
IO port logic level (L)	VIL			0.2VCC	
	ILK			0.1 UA	
IO port output level (H)	VOH	0.95VCC			No load
IO port output level (L)	VOL			0.05V	No load
IO port drive current	IOH		16mA		VOUT=VCC-0.4 V, PA selects the intensity drive option
IO leakage current	IOL		-16 mA		Vout=0.4V PA select intensity drive option
IO port pull-down resistance	RPD		1.50K/220 K/1M/gigantic 2.Can be optionally configured 3.Default 1M internal pull-down		Pull down pin , PA

6. One-line Serial Communication

One-line serial port mode can use MCU to send data to WT588F series voice chip through DATA line to achieve the purpose of control. It can control voice playback, stop, loop, etc. One-line serial port control only needs one IO port, and the shortest time for an instruction is 8.2ms (5ms+(0.1ms+0.3ms)*8=8.2ms).

6.1. Pin Assignment

Package form	PIN	
	PC1	PC2
SOP8	DATA	BUSY

6.2. Correspondence of One-line Voice Address

data（Hexadecimal）	function
00H	Play the 0th voice
01H	Play the 1th voice
02H	Play the 3th 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 the address, just send the address to automatically play the voice of the address, and the time interval between the two address commands must be greater than 4ms.If the number of address segments is less than 224, the default is single-byte code transmission. The default is double-byte code transmission for more than or equal to 224 segments.

## 6.3. Correspondence Table of One-line Voice and Command Code

command code	Function	Description
E0H....EFH	E0 volume is the smallest, EF volume is the largest, a total of 16 levels of volume adjustment	Send this command to adjust the volume at the end of the voice playback, during playback 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. Send F2 again to stop the current cycle function
F3H	Play with code	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. However, a maximum of 40ms delay is required between a set of coded addresses and the next set of addresses ("F3+Voice Address" is a set of coded addresses), and a maximum of 40 codes can be realized.
FEH	Stop playing the current voice	Execute this command to stop playing the current voice.

Note：
1、When the playback is not stopped, if there is no command code F3H and only a voice address, the voice that is being played will be interrupted. The continuous code command must be used in conjunction with the address (for example: F3H+00H+F3H+01H). F3H can easily combine different voices. F3H+Address A+F3H+Address B can combine up to 40 groups of content; it can also complete the combined playback by judging the BUSY level when the voice is played and the change of the BUSY level at the end of the playback.

2、Because the WT588F voice initialization time takes a long time and cannot respond to commands during initialization, it is recommended that users use the code-linking function to send a group of coded addresses and then delay 2ms before sending the next group of coded addresses.

6.4. One-line Serial Port Timing Diagram
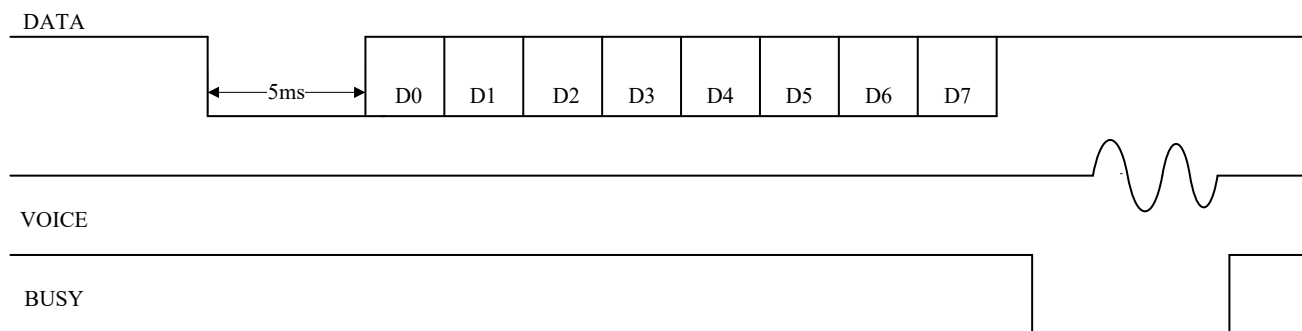
First pull the data line low for 5ms (the time range is 5ms-20ms), then send 8-bit data, send the low bit first, then the high bit, and use the ratio of high level to low level to represent the value of each data bit.

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

It is recommended to use 200us: 600us. Value range: 100us:120us ~ 400us:1200us. It is recommended to use 3:1 and 1:3 level ratios (the level ratio range is 3:1~5:1, 1:3~1:5) to ensure stable communication.

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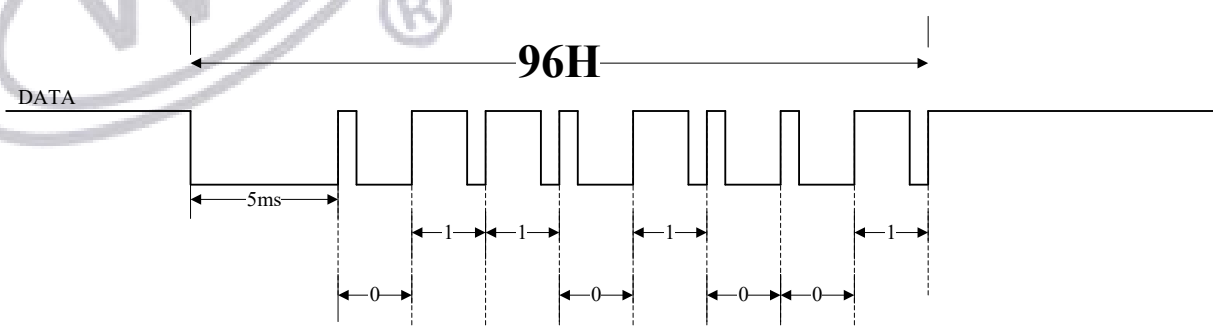
Suppose we want the chip to play the voice content of address 01/02/03/04 in sequence. That is to play with the code command, F3+01+F3+02+F3+03+F3+04. The corresponding timing can be as shown in the figure below:

F3+01H+F3+02H+F3+03H+F3+04H
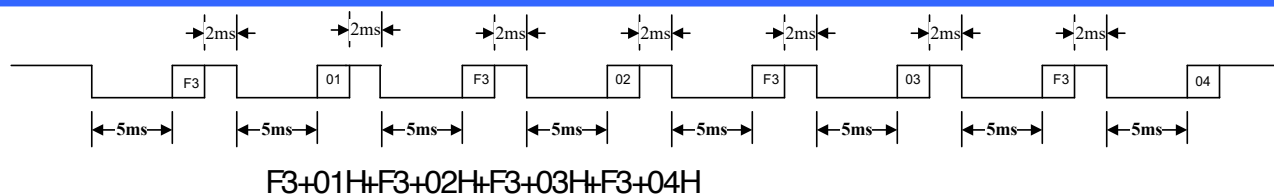
Note：

1、The power-on initialization time of the WT588F voice chip is about 200ms, and it cannot respond to commands during initialization.;

2、There should be an interval of 2ms between the F3 command and the address during continuous playback, please refer to the figure above；

3、The chip IO port defaults to internal 1M pull-down. Therefore, when the customer is doing low-power sleep, the DATA can be pulled low after playback to prevent backflow; if the DATA is pulled low, the DATA must be pulled high for more than 3ms before sending the command before sending the command。

7. Two-wire Serial Communication

7.1. Pin Distribution

packaging	pin		
	PC2	PC1	PI0
SOP8/DIP8	The default is BUSY signal output terminal	CLK	DATA

7.2. 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 address voice, just send the address to automatically play the address voice, the time interval between the two address instructions must be greater than 4ms.

The number of address segments is less than 244, and the default is single-byte code transmission, and the default is double-byte code transmission for more than 224 segments.

7.3. Voice and Command Code

Command code	function	description
E0H....EFH	E0 volume is the smallest, EF volume is the largest, a total of 16 levels of volume adjustment	Send this command to adjust the volume at the end of voice playback, during playback or in standby mode.
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. Send F2 again to stop the current cycle function
F3H	Play with code	F3H+Voice Address A, F3H+Voice Address B, F3H+Voice Address C,... When playing address A, the following code will not be interrupted, after playing A, play B, then play C.... A 2ms delay is required between F3 and the address. However, a maximum of 40ms delay is required between a set of coded addresses and the next set of addresses ("F3+Voice Address" is a set of coded addresses), and a maximum of 40 codes can be realized.
FEH	Stop playing current voice	Execute this command to stop playing the current voice.

Note：

1、When the playback is not stopped, if there is no command code F3H and only a voice address, the voice that is being played will be interrupted. The continuous code command must be used in conjunction with the address (for example: F3H+00H+F3H+01H). F3H can easily combine different voices. F3H+address A+F3H+address B can combine up to 40 groups of content; it can also complete the combined playback by judging the BUSY level when the voice is played and the change of the BUSY level at the end of the playback.

2、Because the WT588F voice initialization time takes a long time, and it cannot respond to commands during initialization, it is recommended that users use the code-linking function to send a set of code-linked addresses and then delay 2ms before sending the next set of code-linked addresses.

7.4. Two-serial Port Timing Diagram
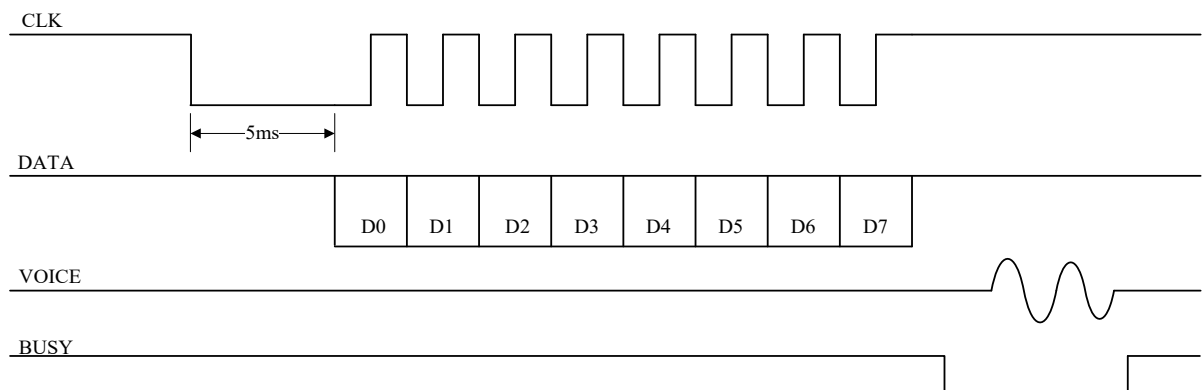
The two-wire serial port control mode is controlled by the chip clock CLK and data DATA. Before each byte of data is sent, the clock signal CLK is pulled down by 5ms to 20ms, and 5ms is recommended. The low bit of the received data is first, and the data is received on the rising edge of the clock. The clock cycle is between 200us and 3.2ms, and the recommended cycle is 300us. When sending data, send the low bit first, then the high bit. 00H～DFH in the data are voice address commands, E0H～EFH are volume adjustment commands, F2H is a loop playback command, and FEH is a stop playback command.

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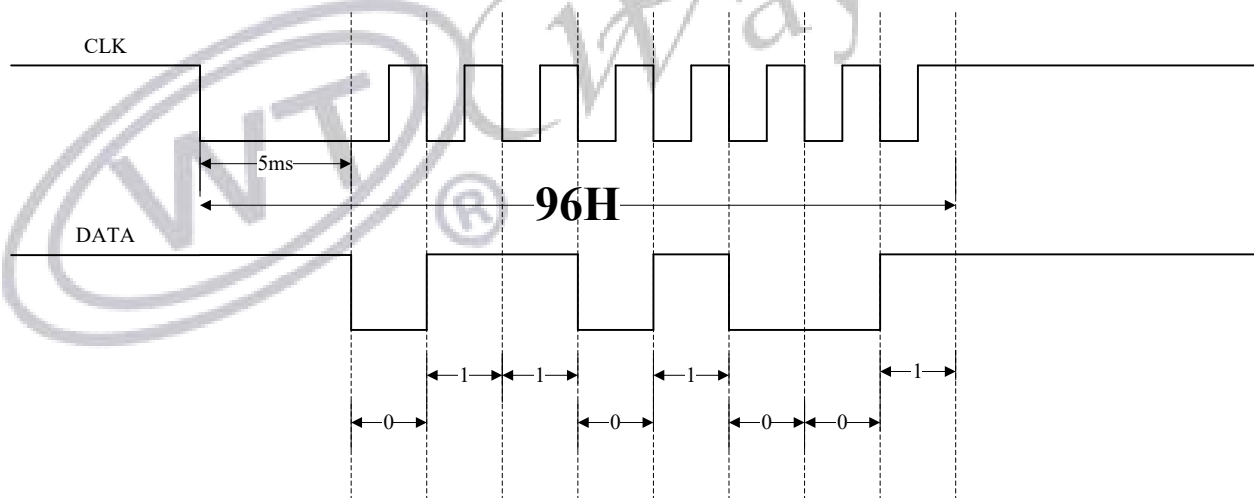
Suppose we want the chip to play the voice content of address 01/02/03/04 in sequence. That is, the continuous code command playback, F3+01+F3+02+F3+03+F3+04. The corresponding timing can be as shown in the following figure:

F3+01H+F3+02H+F3+03H+F3+04H
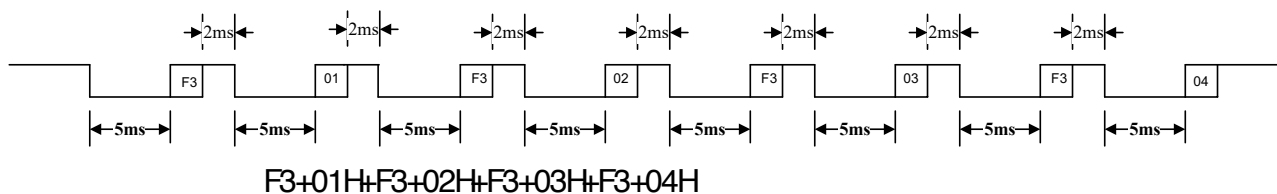
Note：

1、Because the power-on initialization time of the WT588F voice chip is about 200ms, it cannot respond to commands during initialization.

2、There should be an interval of 2ms between the F3 command and the address during continuous playback, please refer to the figure above.

3、The chip IO port defaults to internal 1M pull-down. Therefore, when the customer is doing low-power sleep, the DATA can be pulled down after playback to prevent backflow; if the DATA is pulled down, the DATA must be pulled up for more than 3ms before sending the command before sending the command.

8. Program Example

8.1. One-line Serial Port Control Program(Single Byte Instruction)

```
#define    UC8     unsigned char
#define    P_DATA P01
/*------------------------------------
;module name:Line_1A_WT588F(UC8  DDATA)
;function:realize one-line serial communication function
;input parameters: DDATA is sending data
;output parameters:
;P_DATA  DDATA is sending data
;-----------------------------------*/
Void Line_1A_WT588F( UC8  DDATA)
{
    UC8   S_DATA,j;
    bit      B_DATA;

    S_DATA =  DDATA;
    P_DATA = 0;
    Delay_1ms(5);       //delay 5ms
    B_DATA = S_DATA&0X01;

    for(j=0;j<8;j++)
    {
       if(B_DATA == 1)
       {
          P_DATA = 1;
          Delay_N10us(60);    //delay 600us
          P_DATA = 0;
          Delay_N10us(20);   //delay 200us
       }
```

```
        else
        {
            P_DATA = 1;
            Delay_N10us(20);  //delay 200us
            P_DATA = 0;
            Delay_N10us(60);   //delay 600us
        }
        S_DATA = S_DATA>>1;
        B_DATA = S_DATA&0X01;
    }
    P_DATA = 1;
}
```

8.2. One-line Serial Port Control Program（F3+01+F3+02+F3+03）

```
/*----------------------------------
;module name:List_1A_Play_WT588F()
;function:Realize one-line serial serial code sending function
;input parameters: DDATA is sending data
;output parameters:
;----------------------------------*/




Void List_1A_Play_WT588F( void )
{
    Line_1A_WT588F( F3 );
    Delay_1ms(2);        //delay 2ms
    Line_1A_WT588F( 01 );
    Delay_1ms(2);
    Line_1A_WT588F( F3);
    Delay_1ms(2);
    Line_1A_WT588F( 02 );
    Delay_1ms(2);
    Line_1A_WT588F( F3 );
    Delay_1ms(2);
    Line_1A_WT588F( 03 );
    Delay_1ms(2);
}
```

8.3. Two-line Serial Port Control Program(Single Byte Instruction)

```
#define   UC8        unsigned char
#define   CLK_2A        P01
#define   P_DATA_2A   P00


/*----------------------------------
;module name:Line_2A_WT588F(UC8 DDATA)
;function:realize the two-wire serial communication function
;input parameters:DDATA is sending data
;output parameters:
;  CLK_2A           //clock line
; P_DATA_2A  //data   line
;---------------------------------*/
Void   Line_2A_WT588F(UC8 DDATA)
{
    UC8   S_DATA,j;
     bit      B_DATA;
    CLK_2A     = 1;          //clock line
    P_DATA_2A = 1;                        //data   line

    S_DATA = DDATA;
     CLK_2A   = 0;
    Delay_1ms(5);        //delay 5ms
    B_DATA = S_DATA&0X01;

    for(j=0;j<8;j++)
    {
        CLK_2A              = 0;                 // pull down
        P_DATA_2A        = B_DATA;               //transmission data one bit

        Delay_N10us(30);           //delay 300us
        CLK_2A     = 1;            //pull up
        Delay_N10us(30);           //delay 300us

        S_DATA = S_DATA>>1;
        B_DATA = S_DATA&0X01;
    }
    P_DATA_2A     = 1;
    CLK_2A      = 1;
}
```

8.4. Two-wire Serial Port Control Program(F3+01+F3+02+F3+03)

```
/*----------------------------------
;module name:List_2A_Play_WT588F( )
;function:realize the two-wire serial port link code sending function
;input parameters: DDATA is sending data
;output parameters:
;--------------------------------*/

Void List_2A_Play_WT588F( void )
{
    Line_2A_WT588F( F3 );
    Delay_1ms(2);          //delay 2ms
    Line_2A_WT588F( 01 );
    Delay_1ms(2);
    Line_2A_WT588F( F3 );
    Delay_1ms(2);
    Line_2A_WT588F( 02 );
    Delay_1ms(2);
    Line_2A_WT588F( F3 );
    Delay_1ms(2);
    Line_2A_WT588F( 03 );
    Delay_1ms(2);
}
```

9. Package Pin Diagram
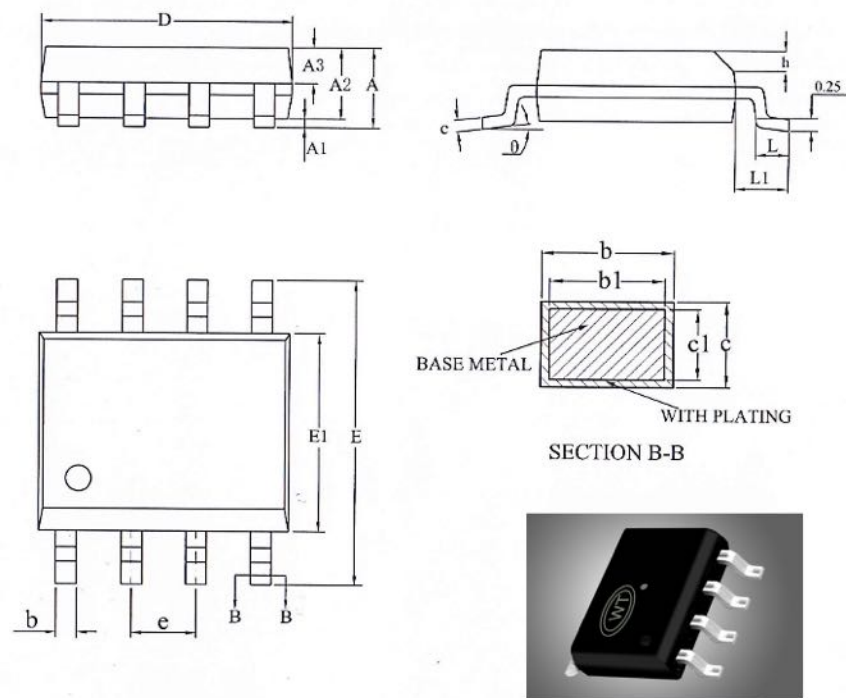
| SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.75
A1	0.10	—	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	—	0.47
b1	0.38	0.41	0.44
c	0.20	—	0.24
c1	0.19	0.20	0.21
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
h	0.25	—	0.50
L	0.50	—	0.80
L1	1.05REF		
θ	0	—	8°

BASE METAL

WITH PLATING

SECTION B-B

10.   Downloader

Save the bin file in the downloader, and connect the device through the online downloader to replace the voice. It can be used to replace the voice of production or client equipment. It is easy to use, fast, and simple to operate. It is suitable for devices that require frequent voice replacement.
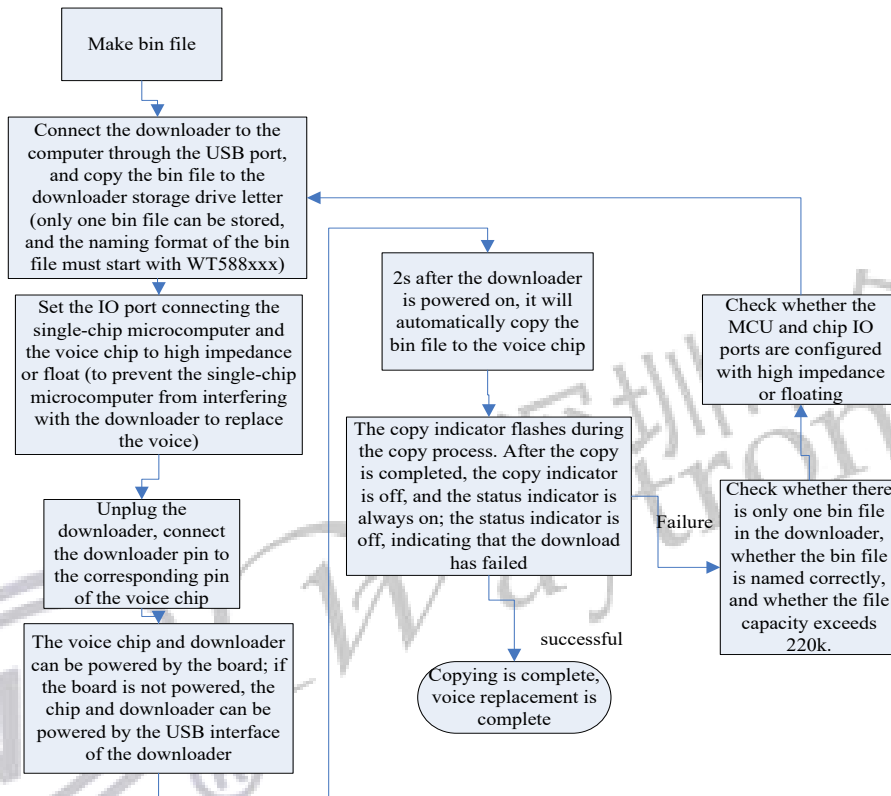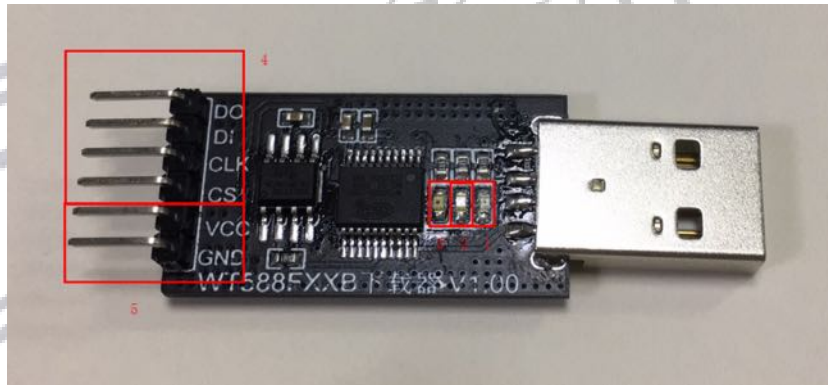

10.1. Schematic of Download
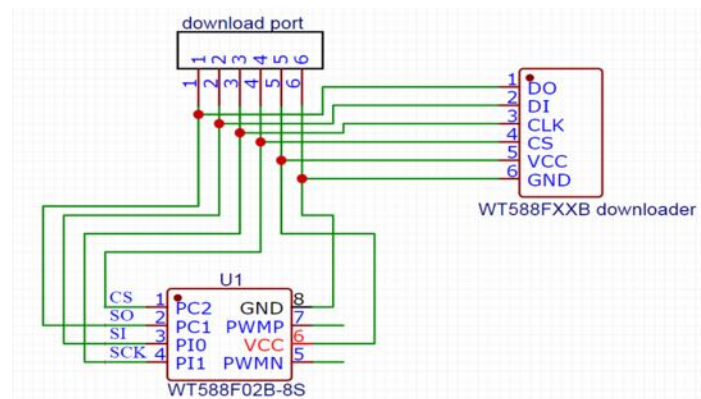
This chip only needs to connect 4 wires for programming. In order to be compatible with other chips and downloaders, 6 wires are connected here. CS and CLK are connected or not connected, which will not affect the programming

10.2. Downloader Instruction

（1）Make a bin file: After logging in to the host computer URL of the webpage, load the voice file to be played or use the text-to-audio function to load the voice and make the bin file. WT588bin file web page creation login URL: http://WT588f.waytronic.com:8083/user/register. For the steps of making the bin file, please refer to the "WT588F Web Host Computer Operating Instructions 2020-8-31", and the video explanation can be provided by contacting the salesperson.

（2）Store the bin file: Connect the USB to the computer, and a drive letter will appear (formatting for the first use). Save the bin file in the drive letter. The name of the bin file must start with WT588. After the Bin file is stored, disconnect the downloader from the computer.

（3）Connect the chip: Let the microcontroller release the voice chip, and set the IO port of the microcontroller connected to the voice chip as input or floating; connect the programming port of the downloader (that is, the 4 pins of box 4) to the corresponding IO port of the voice chip (DO-PC1, DI-PI0, CLK-PI1, CS-PC2, VCC-VCC, GND-GND), the customer can leave a download port on the board when

drawing the board, which is convenient for downloading and replacing the voice.

（4）Power supply to the downloader: 5 is the power supply pin. When the board has power supply, the downloader can be powered through the VCC and GND pins; when the board is not powered, it can be powered by USB (adapter or computer USB can be used for power supply, generally not recommended to use computer USB for power supply)) Supply power to the downloader and chip; if the board has a download port according to the above schematic diagram, you can directly plug the downloader into the download port for programming.

（5）Automatic download: 2s after the downloader is powered on, the downloader will automatically download the bin file to the voice chip

（6）Light indication：Power Indicator、Copy indicator、Status Indicator。

　　　The power indicator light is always on to indicate that the product is already in working condition。

　The copy indicator flashes during the copy process, and goes out after the copy is over.

　　The status indicator is usually off. If the copy is successful, the status indicator is always on, and if the copy fails, the status indicator is off.

　　　simple to operate, and is suitable for devices that require frequent voice replacement. (The online downloader has a video explanation, you can contact the salesperson to provide it.)