

WTN6040F-8S

Voice Chip Specification

Version: V1.01

Note :

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1. Overview:

WTN6040F is a low-cost、high-performance CMOS voice IC.The biggest feature is that it can be programmed repeatedly.It can support a maximum voice length of 40seconds.The sampling rate is up to 32kHz.16-level volume control,and PWM output mode.The clock frequency of the IC is 13.10729($\pm 3\%$)MHz.The IC works in a wide voltage range from 1.8V to 5.5V.

2. Functions:

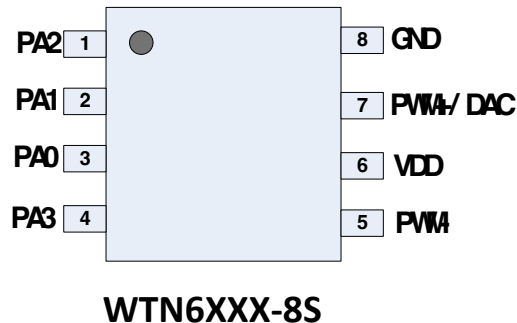
- (1) Operating voltage: 1.8V~5.5V
- (2) MCU working frequency: 13.1072MHz
- (3) Three reset conditions: a. Low voltage reset (LVR=1.7V); b. Power-off reset; c. Watchdog timer overflow
- (4) 12-bit PWM audio output, which can directly drive 8 Ω /0.5W speakers and buzzers
- (5) Built-in watchdog: a. It can be enabled/disabled through options; b. The period is 0.13s
- (6) Support one-line serial port and two-line serial port control (up to 224 segments of voice can be loaded, detailed explanation will be provided later)
- (7) Support BUSY status output (The BUSY pin of the standard program defaults to high level, and it is low level during voice playback. In addition, in the serial port control mode, the BUSY pin will have a level change only when the voice chip receives the correct voice address sequence)
- (8) The control mode and output mode of the chip have been set when the program is programmed, and cannot be changed again. When ordering the chip, you need to explain the application requirements with the salesman
- (9) Initialization is required to receive control commands normally, because WTN6 power-on requires a certain initialization time (about 100MS), and it cannot respond to commands during initialization

Note:

WTN6 chip first-line serial port control PWM output DEMO board playback effect plus communication timing demo video:

https://v.youku.com/v_show/id_XNDcwMzM4NzI1Ng==.html?spm=a2h0c.8166622.PhoneSokuUgc_1.dtitl
e

3. Pin Description



Pad Name	Pad No.	ATTR.	Description
PA2	1	I/O	Busy signal output
PA1	2	I/O	Two-wire serial port clock signal input terminal/One-wire serial port data signal input terminal/numerical pulse data signal input terminal
PA0	3	I/O	Two-wire data signal input/reset pin
PA3	4	I/O	Not yet used (NC)
PWM-	5	out	PWM output pin
VDD	6	Power	Power positive
PWM+/DAC	7	I/O	PWM, DAC output pin
GND	8	Power	Power negative

4. Limit Parameters:

Name	Range	unit
VDD~GND power voltage	-0.5~+6.0	V
Vin input voltage	-0.5 < Vin < VDD+0.5	V
Storage temperature	0~+75	°C
Operating temperature	-25~+85	°C

Note: These are the results of the samples tested in the laboratory. The chip can work normally at -40°C~+85°C.

5. DC Characteristics:

symbol	parameter	minima	typical value	maxima	unit	condition
VDD	operating voltage	1.8V	-	5.5	V	
Isb	stand-by current		4		uA	VDD=5V , MCU stop system clock shut down
			0.5		uA	VDD=5V , MCU stop system clock shut down
Iop	operating current		1.5		mA	13.1072MHz , PWM disabled
Vih	high voltage input		0.5VDD		V	
Vil	low voltage input		0.5VDD		V	
Voh	High voltage output	0.95VDD			V	No load
Vol	low voltage output			0.05VDD	V	
VDD	operating voltage	1.8V	-	5.5	V	
Isb	stand-by current		4		uA	VDD=5V , MCU stop system clock shut down
			0.5		uA	VDD=5V , MCU stop system clock shut down
Iop	operating current		1.5		mA	13.1072MHz , PWM disabled
Vih	high voltage input		0.5VDD		V	
Vil	low voltage input		0.5VDD		V	
Voh	High voltage output	0.95VDD			V	No load
Vol	low voltage output			0.05VDD	V	
IIK	input leakage current		0.1		uA	
Ioh	output drive current		4.19		mA	Vout=2.0V
			14.5		mA	
Iol	output sink current		-30		mA	
			-9.5		mA	
Rpd	pull-down		50K		Ohm	Vin=3.0V,the pull-down resistance is

	resistor		220K		Ohm	selected according to the needs
			1M		Ohm	
Vlvr	threshold voltage		2		V	

The above parameters are under the condition of VDD=3.0V and Ta=25℃

6. One-line Serial Communication

One-line serial port mode can use MCU to send data to WTN6 series voice chip through DATA line to control playback、stop、and loop, etc.

6.1. Pin Distribution:

paking	pin	
	PA1	PA2
SOP8	DATA	BUSY

6.2. Correspondence of First-line Voice Address:

Data (hexadecimal)	Functions
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 the address, you can automatically play the voice of the address as long as you send the address. The time interval between the two address instructions must be greater than 4ms.

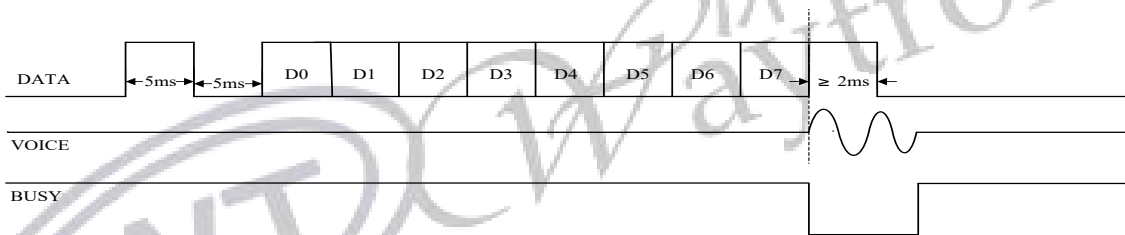
6.3. Correspondence Table of One-line Voice and Command Code

Command code	Functions	description
E0H...EFH	A total of 16 levels of volume adjustment, E0 volume is the smallest, EF volume is the largest	send this command to adjust the volume when the playback is over or in the standby state while playing sound

F2H	loop current sound	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.
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.
F8H	insert mute	F8H+mute time (10MS as the unit), mute is inserted after playing an address.
FEH	stop playing the current voice	execute this command to stop playing the current voice.

Note: Without stopping the playback, if there is no command code F3H or F8H, and only the voice address, the voice that was playing before will be interrupted. The code command must be used in conjunction with the address (for example: F3H+00H+F3H+01H) . F3H and F8H can easily combine different voices, F3H+address+F8H+10H (100ms), up to 10 groups of content can be combined, the first group of commands must be F3+address; it can also be judged by the BUSY level during voice playback and the end of playback BUSY level changes, complete combined playback

6.4. One-line Serial Port Timing Diagram:



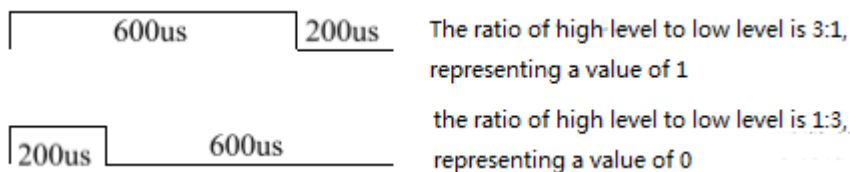
First pull the data line high for 5ms, then pull it low for 5ms, send 8-bit data, send the low bit first, then the high bit, use the ratio of high level to low level to represent the value of each data bit.

(If you want to go to sleep immediately, you only need to wait for more than 2ms after sending the command, and then pull DATA low).

Note:

WTN6040F can enter low power consumption mode only when PA1 (DATA pin) is low. Therefore, after the chip broadcast is completed or the command is sent, the PA1 pin is pulled low after waiting for 2MS, and the chip enters sleep low power consumption mode. (When PA1, PA0, PA3 are used as input ports, there are 1M pull-downs inside)

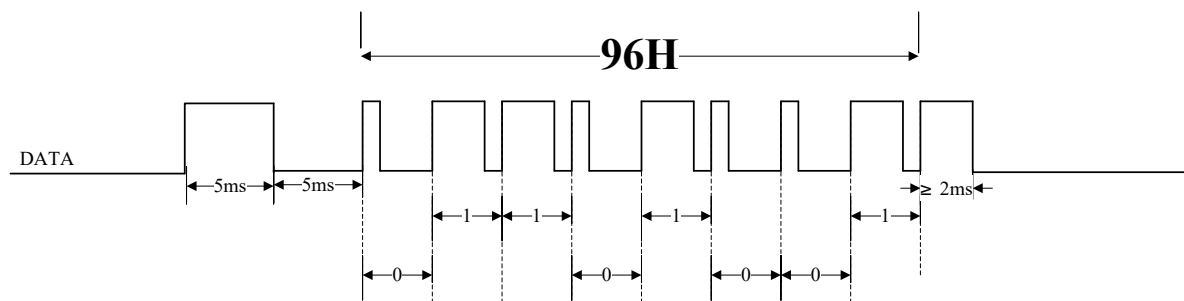
For WTN6040F, the wake-up time needs to be greater than 2ms (high pulse wake-up). Therefore, it is recommended to wait for 5ms after pulling it high, and then send the command when pulling it low.



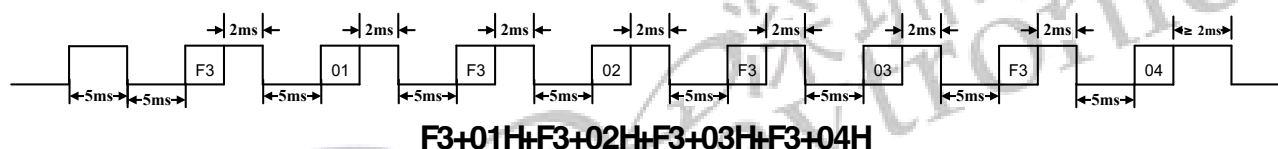
Note: high level first, low level behind

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 turn. 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:



Note:

It is recommended that users use the link code function, after sending a set of link code addresses, delay 2ms before sending the next set of code addresses, because WTN6 power-on requires a certain initialization time (about 100MS), and it cannot respond to commands during initialization. But the interval between F3 and the address is still 2ms;

Chip IO port, the default internal 1M pull-down. Therefore, when the customer is doing low-power sleep, the voice playback can pull down DATA to prevent backflow.

7. Two-wire Serial Communication:

7.1. Pin Distribution:

packing	pin		
	PA2	PA1	PA0
SOP8/DIP8	the default is BUSY signal output terminal	CLK	DATA

7.2. Voice Address Correspondence:

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

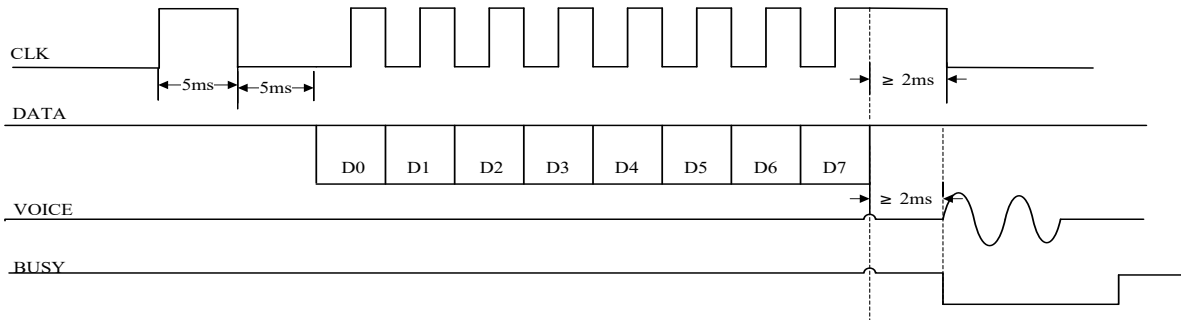
Note: If you want to play the voice of the address, you can automatically play the voice of the address as long as you send the address, and the time interval between the two address instructions must be greater than 4ms

7.3. Voice and Command Code Correspondence Table :

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 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
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.
F8H	Insert mute	F8H+mute time (10MS as the unit), mute is inserted after playing an address.
FEH	Stop playing the current voice	Execute this command to stop playing the current voice.

Note: In the case of stopping playback, if there is no command code F3H or F8H, and only a voice address, the voice that was playing before will be interrupted. The consecutive code commands must be used in conjunction with the address (for example: F3H+00H+F3H+01H). F3H and F8H can easily combine different voices, F3H+address+F8H+10H (100ms), up to 10 groups of content can be combined, the first group of instructions must be F3+address; it can also be judged by the BUSY level during voice playback and the end of playback The change of BUSY level completes the combined playback.

7.4. Two-wire Serial Port Timing Diagram:



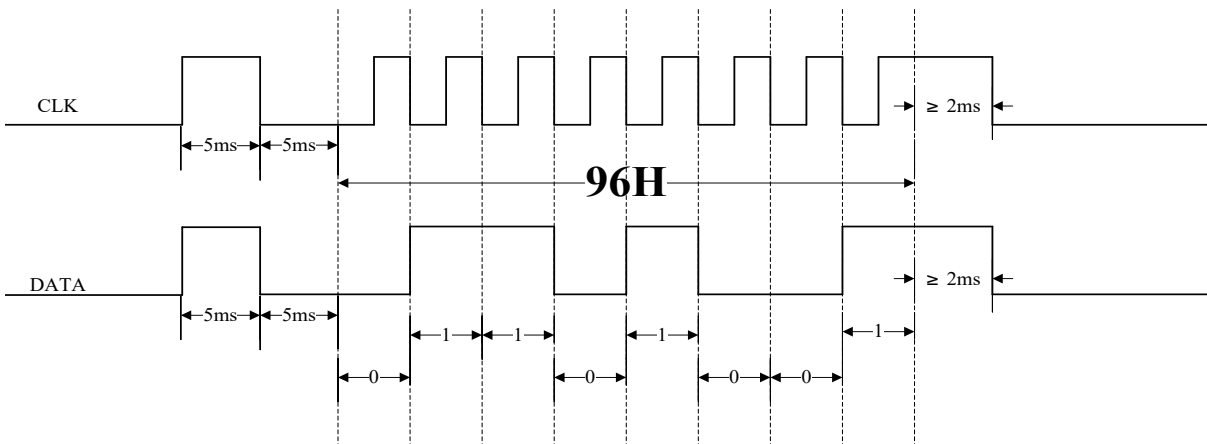
Note:

WTN6040F can enter low power consumption mode only when PA1 (CLK pin) is low. Therefore, the PA1 pin should be pulled low after the chip broadcast is completed or the command is sent. (When PA1, PA0, PA3 are used as input ports, there are 1M pull-downs inside)

WTN6040F wake-up time needs to be greater than 2ms (high pulse wake-up). Therefore, it is recommended to wait for 5ms after pulling it high, and then send the command when pulling it low.

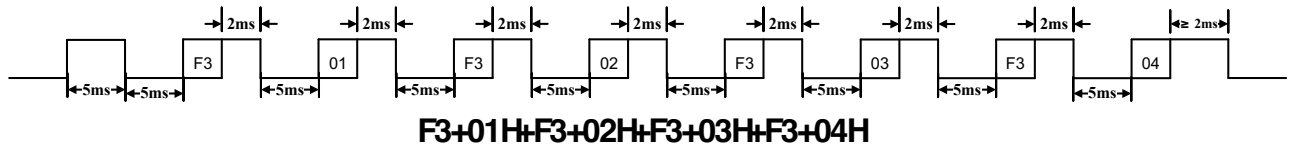
The two-wire serial port control mode is controlled by the chip clock CLK and data DATA. Before sending a byte of data, first pull CLK high for 5ms, then wait for 5ms after pulling it low (for chip wake-up and initialization), and then send 8 bits data. The low bit of the received data is first, and the data is received on the rising edge of the clock. The clock cycle is between 100us and 6.4ms, and it is recommended to use 300us for each high and low level duration (that is, the clock cycle for one bit transmission is 600us). 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 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:



Note:

It is recommended that users use the code-link function to send a group of code-linked addresses and then delay 2ms before sending the next group of code-linked addresses; but the interval between F3 and the address is still 2ms, because WTN6 power-on requires a certain initialization time (about 100MS)), and cannot respond to commands during initialization;

Chip IO port, the default internal 1M pull-down. Therefore, when the customer is doing low-power sleep, the voice playback can pull down CLK and DATA to prevent backflow.

8. Program Example:

8.1. One-line Serial Port Control Program:

```
#define UC8    unsigned char
#define P_DATA    P01
/*-----
; module name: Line_1A_WTN6(UC8  DDATA)
; funtion: Realize one-line serial communication function
; input parameter: DDATA is sending data
; output parameter:
; P_DATA    Data port
;-----*/
Void Line_1A_WTN6( 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);    //delay200us
    P_DATA = 0;
    Delay_N10us(60);    //delay600us
}
S_DATA = S_DATA>>1;
B_DATA = S_DATA&0X01;
}
P_DATA = 1;
}

```

8.2. Two-wire Serial Port Control Program

```

#define UC8    unsigned char
#define CLK_2A    P01
#define P_DATA_2A P00
/*-----
;module name:Line_2A_WTN6(UC8 DDATA)
;funtion: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_WTN6(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

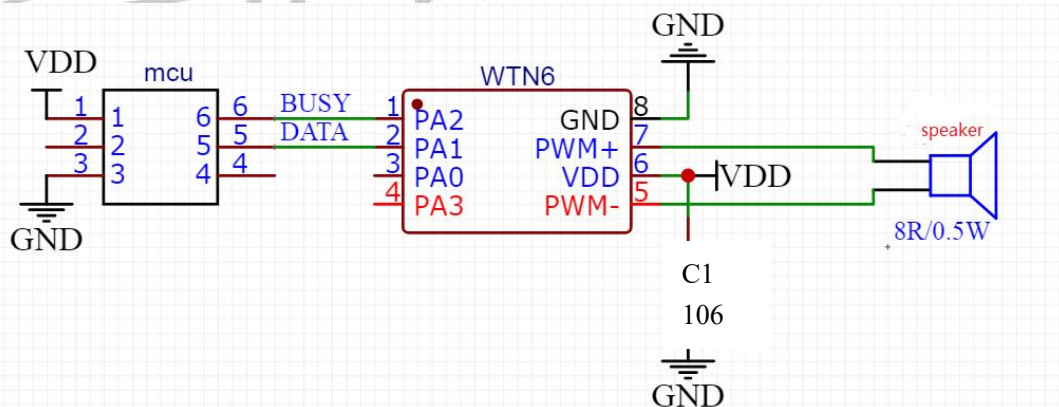
    Delay_N10us(30);                    //delay 300us
    CLK_2A          = 1;                //pull up
    Delay_N10us(30);                    //delay 300us

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

9. Application Circuit:

9.1. One-line Serial Port Circuit:

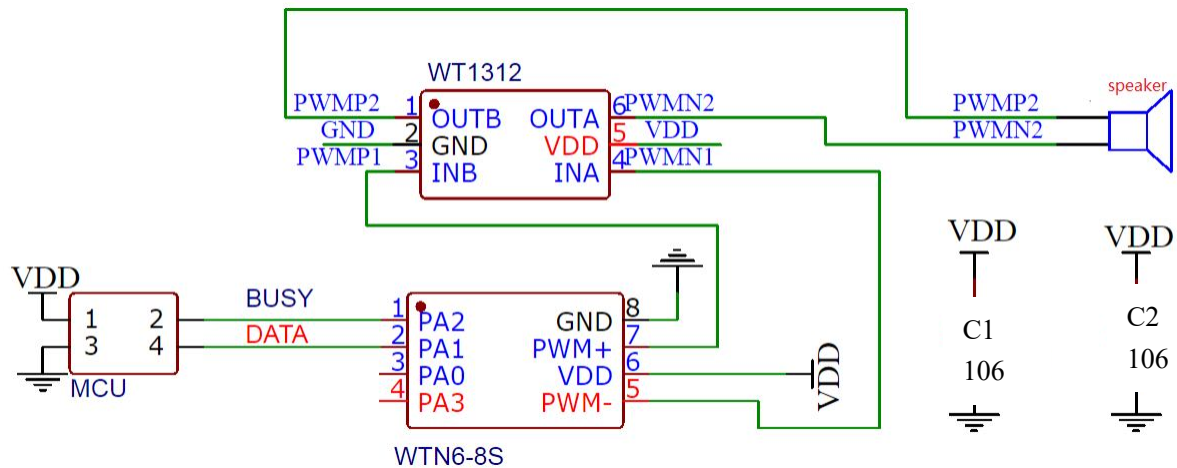
the working voltage range of the voice chip is 1.8V-5.5V, PWM output



Note:

1. When wiring the capacitor C1 as close as possible to the VDD pin of the WTN6040F chip to enhance the anti-interference ability of the voice chip. When C1=106, the ESD anti-interference ability is strengthened. When C1=104, the ESD anti-interference ability is relatively weak.
2. WTN6040F, high level cannot enter sleep. Therefore, products with low power consumption are needed. When the wave needs to play voice, set PA1 to low. (When PA1, PA0, PA3 are used as input ports, there are 1M pull-downs inside)

The working voltage range of the voice chip is 1.8V-5.5V, the working voltage range of the power amplifier chip is 1.8V-6.0V, and the output of the external PWM power amplifier



Note:

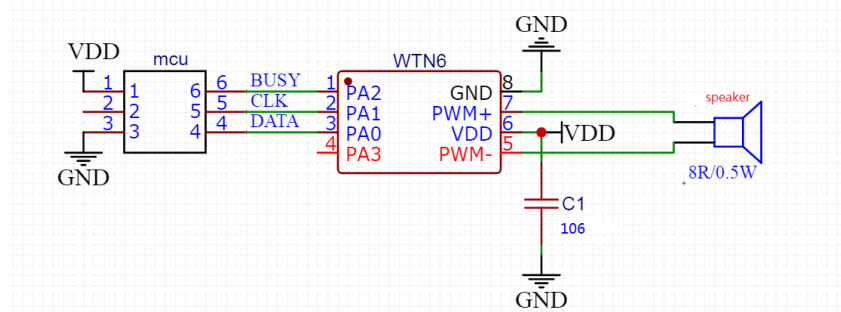
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2. WTN6040F, high level cannot enter sleep. Therefore, products with low power consumption are needed. When the wave needs to play voice, set PA1 to low. (When PA1, PA0, PA3 are used as input ports, there is a 1M pull-down inside)

9.2. Two-wire Serial Application Circuit

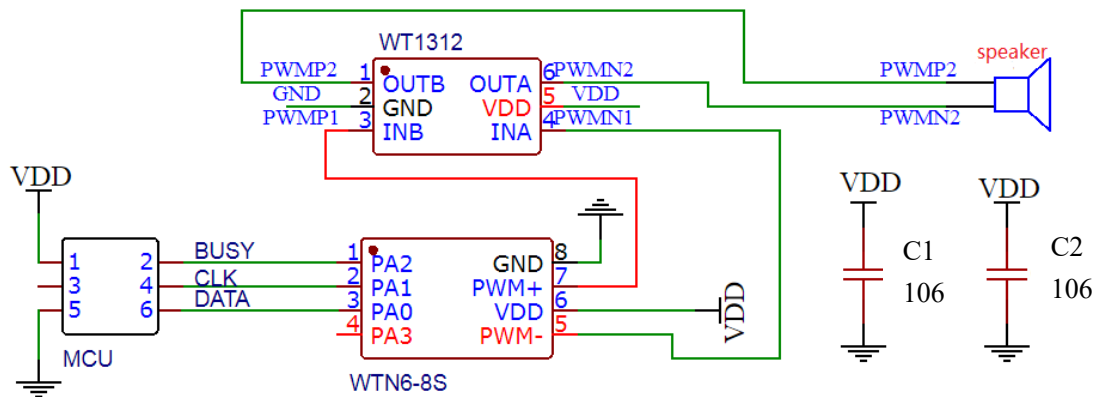
The working voltage range of the voice chip is 1.8V-5.5V, PWM output:



Note:

1. When wiring the capacitor C1 as close as possible to the VDD pin of the WTN6040F chip to enhance the anti-interference ability of the voice chip. When C1=106, the ESD anti-interference ability is strengthened. When C1=104, the ESD anti-interference ability is relatively weak.
2. WTN6040F, high level cannot enter sleep. Therefore, products with low power consumption are needed. When the wave needs to play voice, set PA1 to low. (When PA1, PA0, PA3 are used as input ports, there is a 1M pull-down inside)

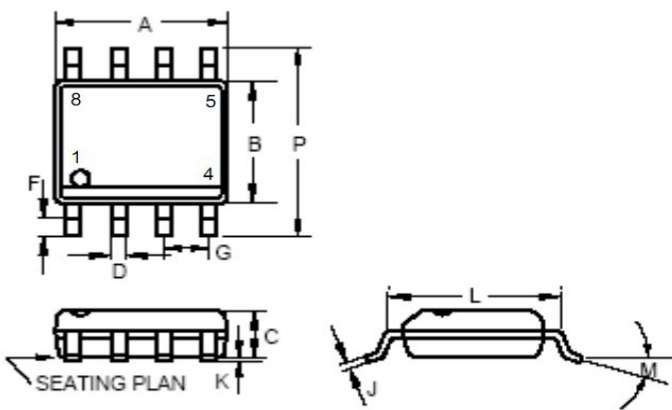
The working voltage range of the voice chip is 1.8V-5.5V, the working voltage range of the power amplifier chip is 1.8V-6.0V, and the output of the external PWM power amplifier



Note:

1. When wiring the capacitor C1 as close as possible to the VDD pin of the WTN6040F chip to enhance the anti-interference ability of the voice chip. When C1=106, the ESD anti-interference ability is strengthened. When C1=104, the ESD anti-interference ability is relatively weak.
 2. WTN6040F, high level cannot enter sleep. Therefore, products with low power consumption are needed. When the wave needs to play voice, set PA1 to low. (When PA1, PA0, PA3 are used as input ports, there is a 1M pull-down inside)
- The WT1312 power amplifier is a PWM power amplifier and can only be used in PWM output mode.

10. Package Pin Diagram:



Note: For 8-pin S.O.I.C., 100 units per tube.

	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.183	-	0.202	4.65	-	5.13
B	0.144	-	0.163	3.66	-	4.14
C	0.068	-	0.074	1.35	-	1.88
D	0.010	-	0.020	0.25	-	0.51
F	0.015	-	0.035	0.38	-	0.89
G	0.050 BSC			1.27 BSC		
J	0.007	-	0.010	0.19	-	0.25
K	0.005	-	0.010	0.13	-	0.25
L	0.189	-	0.205	4.80	-	5.21
M	-	-	8°	-	-	8°
P	0.228	-	0.244	5.79	-	6.20