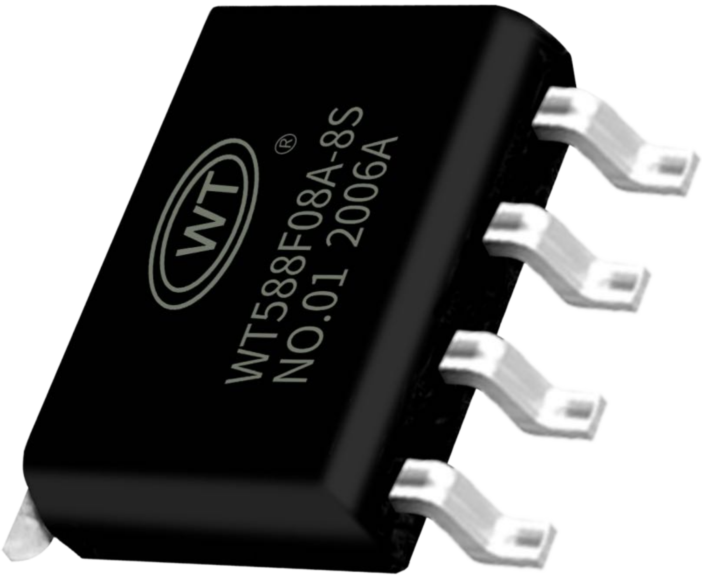
WT588F08A-8S
Voice Chip Specification

Version: V1.09



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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

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

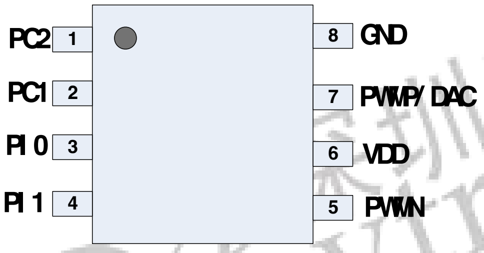
low levels) for 1 second, the chip enters sleep

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



WT588F08A-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	℃
Storage temperature	-50~100	℃

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

5. Electrical Characteristics

Parameters	Sign	Minimum	Typical Value	Maximum	Test Condition
Working voltage	VCC	2.0V		5.5V	
Oscillation frequency	Fbank0	4.096MHz±3%		8.192MHz±3%	
Oscillation frequency(BANK 7)	Fbank7		32.768MHz±3%		
RC oscillator frequency	Frc 1		65.536 MHz±3%		
Low power rc oscillator frequency	frc 2	32768hz-5%		32768hz 15%	
Working electrical 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-0.4V，PA select

					intensity drive option
IO leakage current	**IOL**		**-16 mA**		**Vout=0.4V PA select intensity drive option**
IO port pull-down resistance	**RPD**		**50K/220 K/1M/infinity Can choose configuration Default 1M internal pull-down resistance**		**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 18.4ms ({5ms+(0.1ms+0.3ms)*8}X2+2=18.4ms).

Detailed description can be seen below

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 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 interval between an address command byte is less than 10ms, it is recommended to use 2ms; the time interval between two address commands must be greater than 10ms.

6.3. One-line Audio and Command Code

Command Code	Function	Description
E0H....EFH	FFE0 is the minimum volume; FFEF is the maximum; 16-level volume is adjustable in total	Send this command to adjust the volume at the end of the 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 FFF2 loop command, it can be interrupted by the FFFE command, the ordinary address command, and the FFF3/FFF8 combined command, and becomes invalid; the playback command must be sent first, and then the loop playback command. Send FFF2 again to stop the current loop function
F3H	Code-linking play	FFF3H+Voice address A, FFF3H+Voice address B, FFF3H+Voice address C,... When playing address A, the following code will not be interrupted, after playing A, it will play B, then C.... The interval between FFF3 and the address should be less than 10ms, 5ms is recommended; while the delay between one set of coded addresses and the next set of addresses needs to be greater than 10ms, it is recommended to use 10ms ("FFF3+voice address" is a set of coded addresses), at most support 40-segment continuous code
FEH	Stop playing the current audio	Execute this command to stop playing the current voice.

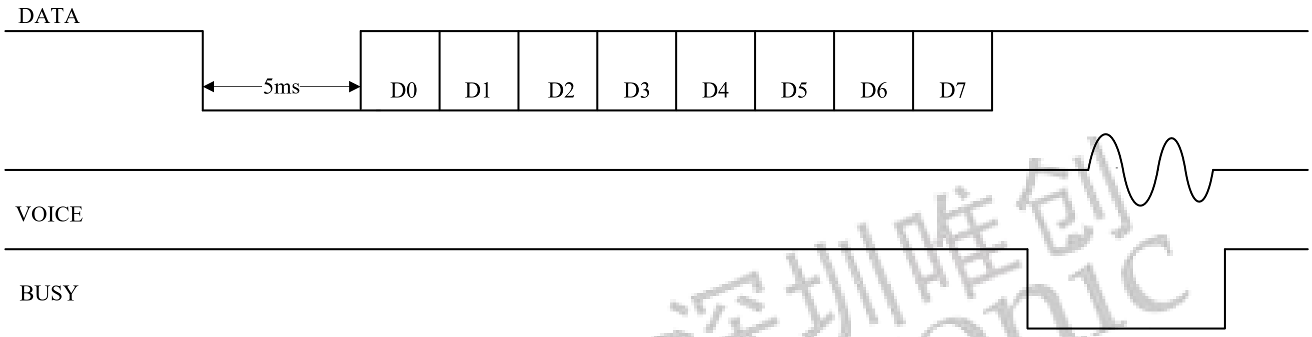
Note:

1. Without stopping the playback, if there is no command code FFF3H and only a voice address, the voice that is being played will be interrupted. The consecutive code commands must be used in conjunction with the address (for example: FFF3H+0000H+FFF3H+0001H). FFF3H can easily combine

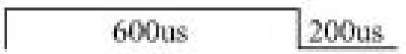
different voices, FFF3H+address A+FFF3H+address B, up to 40 groups of content can be combined; it can also complete the combined playback by judging the BUSY level when the voice is played and the change of the BUSY level at the end of the playback.

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 group of code-linked addresses after a delay of more than 10ms before sending the next group of code-linked addresses.

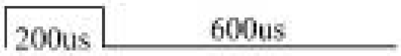
6.4. One-line serial port sequence diagram



First pull down the data line for 5ms (the time range is 5ms-20ms), then send 16-bit data, send the high byte first, then the low byte, send the low bit first, then the high bit, using the ratio of high level to low level To represent the value of each data bit.



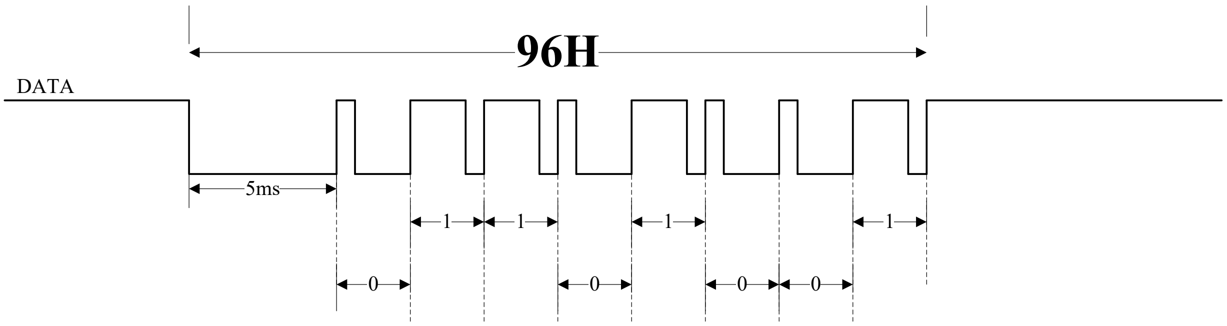
The ratio of high and low level is 3:1, represented by 1



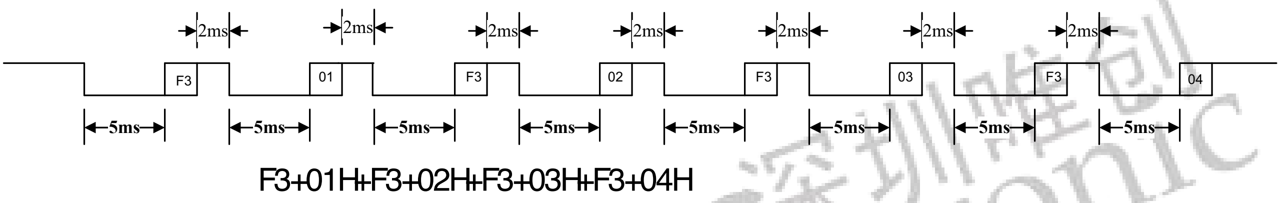
The ratio of high and low level is 1:3, represented by 0

Note: The high level must be in front and the low level in the back.
It is recommended to use 200us: 600us. Value range: 100us:300us ~ 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 sequence diagram is as follows:



Suppose we want the chip to play the voice content of address 01/02 in turn. That is, continuous code command playback, FFF3+0001+FFF3+0002. The corresponding timing can be as shown in the following figure:



Note:

1. Because the WT588F voice initialization time takes a long time, and it cannot respond to commands during the initialization period.
2. When continuous code is played, there needs to be a 2ms interval between bytes and a 5ms interval between instructions and addresses, and the delay between one group of consecutive code addresses and the next group of addresses needs to be greater than 10ms. With a delay of 10ms, you can refer to the figure above.
3. The chip IO port, the default 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 5ms before sending the command before sending the command.

7. Two-line Serial Port Communication

7.1. Pin Distribution

package	pin		
	PC2	PC1	PI0
SOP8/DIP8	Default to BUSY signal output port	CLK	DATA

7.2. Audio Address Corresponding Relation

Data(hexadecimal)	Function
00H	Play the 0th voice
01H	Play the 1th voice
02H	Play the 2th voice
…….	
03E5H	Play the 997th voice
03E6H	Play the 998th voice
03E7H	Play the 999th voice

Note: If you want to play the address voice, just send the address to automatically play the address voice, the interval between an address command byte is less than 10ms, it is recommended to use 2ms; the time interval between two address commands must be greater than 10ms.

7.3. Voice and Command Code Correspondence Table:

Command code	Function	Description
FFE0H.... FFEFH	FFE0 is the minimum volume; FFEF is the maximum; 16-level volume is adjustable in total.	Send this command to adjust the volume at the end of the voice playback, during playback or in standby mode.
FFF2H	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 FFF2 loop command, it can be interrupted by the FFFE command, the ordinary address command, and the FFF3/FFF8 combined command, and becomes invalid; the playback command must be sent first, and then the loop playback command. Send FFF2 again to stop the current loop function
FFF3H	Code-linking play	FFF3H+Voice address A, FFF3H+Voice address B, FFF3H+Voice address C,... When playing address A, the following code will not be interrupted, after playing A, it will play B, then C.... A 2ms delay is required between FFF3 and the address. The interval between one set of coded addresses and the next set of addresses must be greater than 2ms ("FFF3+Voice Address" is a set of coded addresses), and up to 40 segments of coded addresses are supported
FFFEH	Stop playing the current audio	Execute this command to stop playing the current voice.

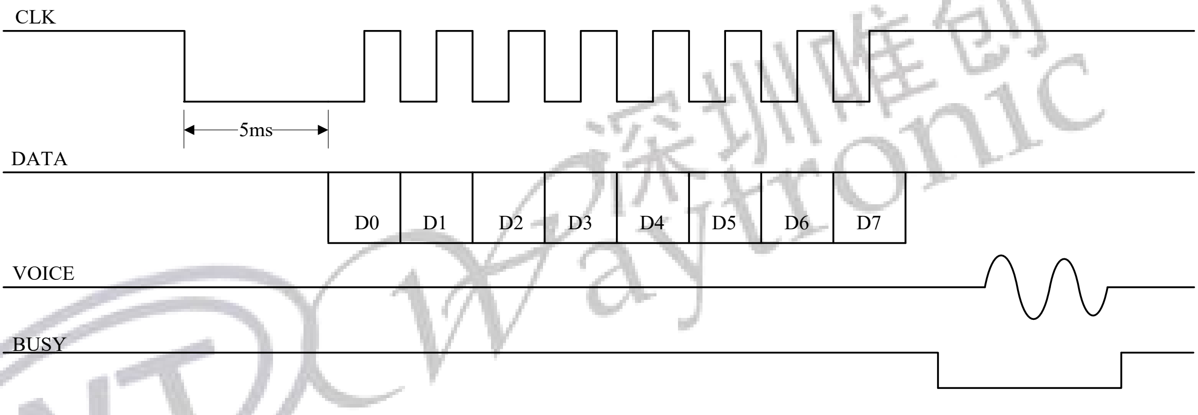
Note:

1. Without stopping the playback, if there is no command code FFF3H and only a voice address,

the voice that is being played will be interrupted. The consecutive code commands must be used in conjunction with the address (for example: FFF3H+0000H+FFF3H+0001H). FFF3H can easily combine different voices, FFF3H+address A+FFF3H+address B, up to 40 groups of content can be combined; 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.

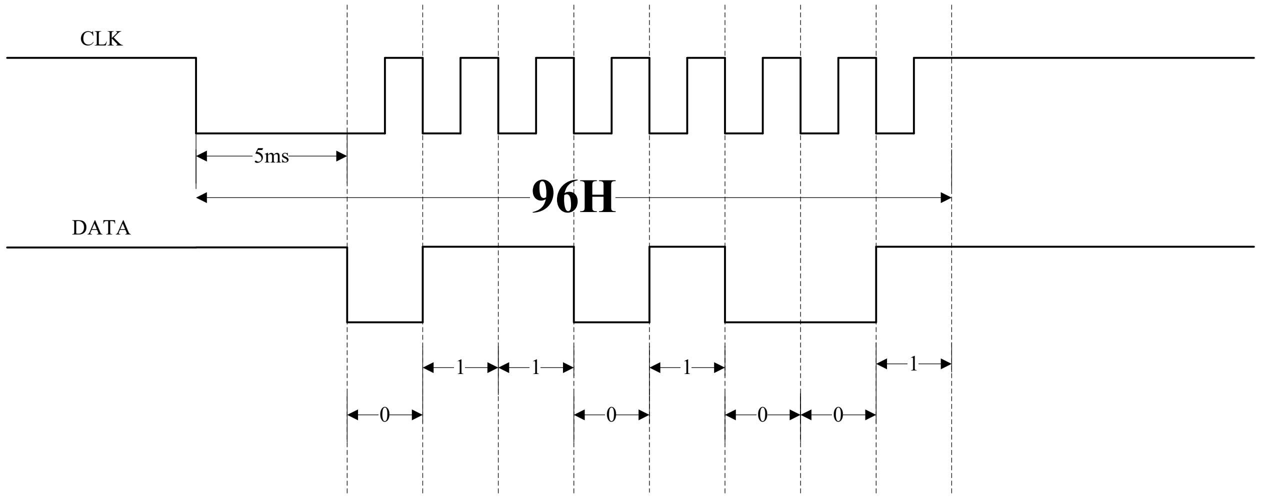
2. Because the WT588F voice initialization time takes a long time, and it cannot respond to commands during initialization, it is recommended that users use the code-linking function to send a group of code-linked addresses after a delay of 10ms before sending the next group of code-linked addresses.

7.4. Two-line serial port sequence diagram

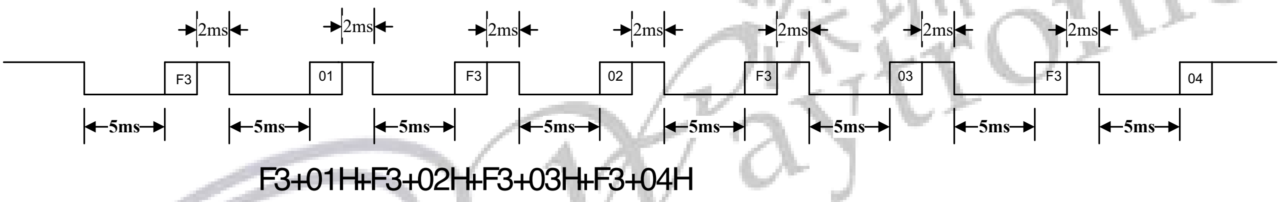


The two-wire serial port control mode is controlled by the chip clock CLK and data DATA. Before each byte of data is sent, the clock signal CLK is pulled down by 5ms to 20ms, and 5ms is recommended. The low bit of the received data is first, and the data is received on the rising edge of the clock. The clock cycle is between 200us and 3.2ms, and the recommended cycle is 300us. When sending data, the high byte is sent first, then the low byte, the low byte is sent first, and then the high byte is sent. 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/ in turn. That is, continuous code command playback, FFF3+0001+FFF3+0002. The corresponding timing can be as shown in the following figure:



Remarks:

1. Because the WT588F voice initialization time takes a long time, and it cannot respond to commands during the initialization period;
2. When continuous code is played, there needs to be a 2ms interval between bytes and bytes. The command needs to leave a 5ms interval between addresses, and the delay of one group of consecutive code addresses and the next group of addresses needs to be greater than 10ms. With a delay of 10ms, you can refer to the figure above;

Chip IO port, the default internal 1M pull-down. Therefore, when the customer is doing low-power sleep, the CLK and DATA can be pulled down after playback to prevent backflow; if the CLK is pulled low, the CLK must be pulled high for more than 5ms before sending the command before sending the command.

8. Program Example

8.1. One-line serial port control program (double-byte instruction)

```
/*-------------------------------------
;module name:Line_1A_WT588F(UI16 USER_DATA)
;function:Realize one-line serial communication function
; Input parameters:USER_DATA
11
;Output parameters:
; one_line_DATA //Data line
;-------------------------------------*/
#define UC8
unsigned char
#define UI16
unsigned int
#define one_line_DATA P1
void Line_1A_WT588F(UI16 USER_DATA)
{
UC8 i;
bit B_DATA;
UC8 num_temp=0;
UI16 ddata_temp ， pdata_temp;
ddata_temp = USER_DATA;
pdata_temp = ddata_temp& 0X00FF;
ddata_temp>>= 8;
pdata_temp<<= 8;
ddata_temp |= pdata_temp;//User data assignment
num_temp = 16;
one_line_DATA = 0;
Delay_10us(500);
//delay 5MS
B_DATA = (bit)(ddata_temp&0X0001);
for(i=0;i<num_temp;i++)
{
if(i==8)
{
one_line_DATA = 1;
Delay_10us(200);//delay 2MS
one_line_DATA = 0;
Delay_10us(500);
//delay 5MS
}
one_line_DATA = 1;
//Pull up the data transmission line, ready to transmit data
if(B_DATA==0)
{
/*Represents logic level 0*/
Delay_10us(20);
// delay 200us
one_line_DATA = 0;
Delay_10us(60);
// delay 600us
}
else
{ /*Represents logic level 1*/
Delay_10us(60);
// delay 600us
one_line_DATA = 0;
Delay_10us(20);
// delay 200us
}
ddata_temp = ddata_temp>>1;
B_DATA = (bit)(ddata_temp&0x0001);
}
one_line_DATA = 1;
}
```

8.2. One-line serial port control program（FFF3+0001+FFF3+0002）

```
/*-------------------------------------
;module name:List_1A_Play_WT588F()
;function:Realize one-line serial port serial code sending function
;Input parameters: DDATA is sending data
;Output parameters:
;-------------------------------------*/
Void List_1A_Play_WT588F( void )
{
Line_1A_WT588F( FF );
Delay_1ms(2);
//delay 2ms
Line_1A_WT588F( F3 );
Delay_1ms(5);
Line_1A_WT588F( 00);
Delay_1ms(2);
Line_1A_WT588F( 01 );
Delay_1ms(10);
Line_1A_WT588F( FF );
Delay_1ms(2);
Line_1A_WT588F( F3 );
Delay_1ms(5);
Line_1A_WT588F( 00 );
Delay_1ms(2);
Line_1A_WT588F( 02 );
}
```

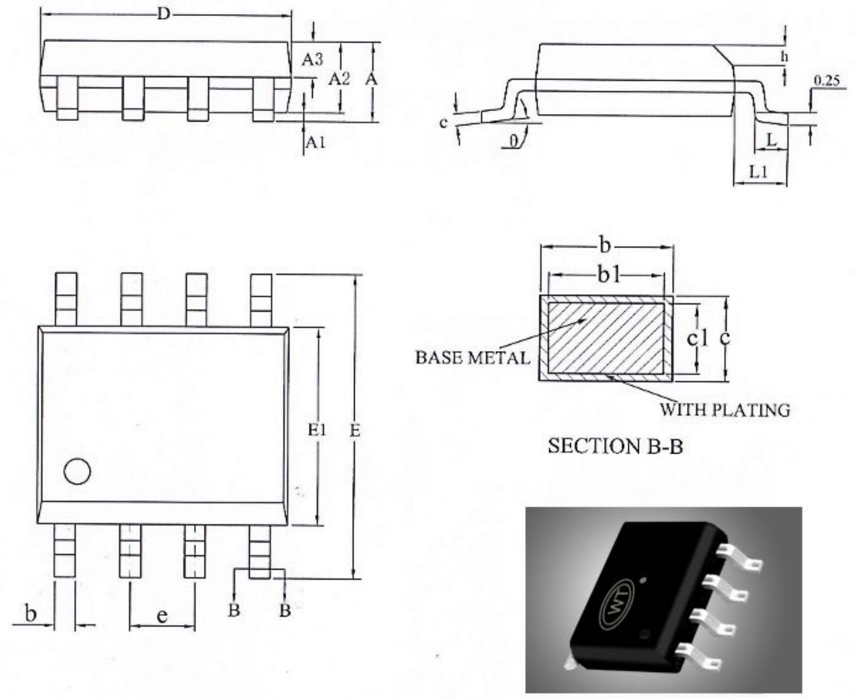
8.3. Two-wire serial port control program (double-byte instruction)

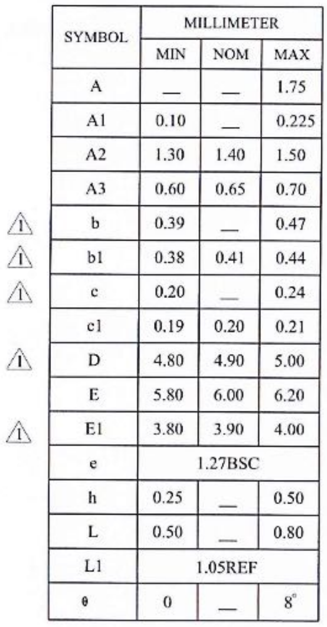
```
#define UC8
unsigned char
#define UI16
unsigned int
#define CLK_2A
P1
#define DATA_2A
P2
/*-------------------------------------
;module name:Line_2A_WT588F(UI16 USER_DATA)
;function:Realize the two-wire serial communication function
;Input parameters:
13
;Output parameters:
; CLK_2A
//Clock line
; DATA_2A //Data line
;-------------------------------------*/
void Line_2A_WT588F(UI16 USER_DATA)
{
UC8 i;
UC8 num_temp=0;
UI16 ddata_temp ， pdata_temp;
ddata_temp=USER_DATA;
pdata_temp = ddata_temp& 0X00FF;
ddata_temp >>= 8;
pdata_temp <<= 8;
ddata_temp |= pdata_temp;
num_temp =16;
CLK_2A
= 0;
//Clock line
Delay_10us(500);
//delay 5ms
for(j=0;j<num_temp;j++)
{
If(j==8)
{
CLK_2A = 1;
DATA_2A = 1;
Delay_N10us(200);
//delay 2ms
CLK_2A
= 0;
Delay_N10us(500); //delay 5ms
}
CLK_2A = 0;
DATA_2A = ddata_temp&0X0001;
Delay_N10us(20);
//delay 200us
CLK_2A
= 1;
Delay_N10us(20);
ddata_temp=ddata_temp>>1;
}
CLK_2A = 1;
DATA_2A = 1;
}
```

8.4. Two-wire serial control program(FFF3+0001+FFF3+0002)

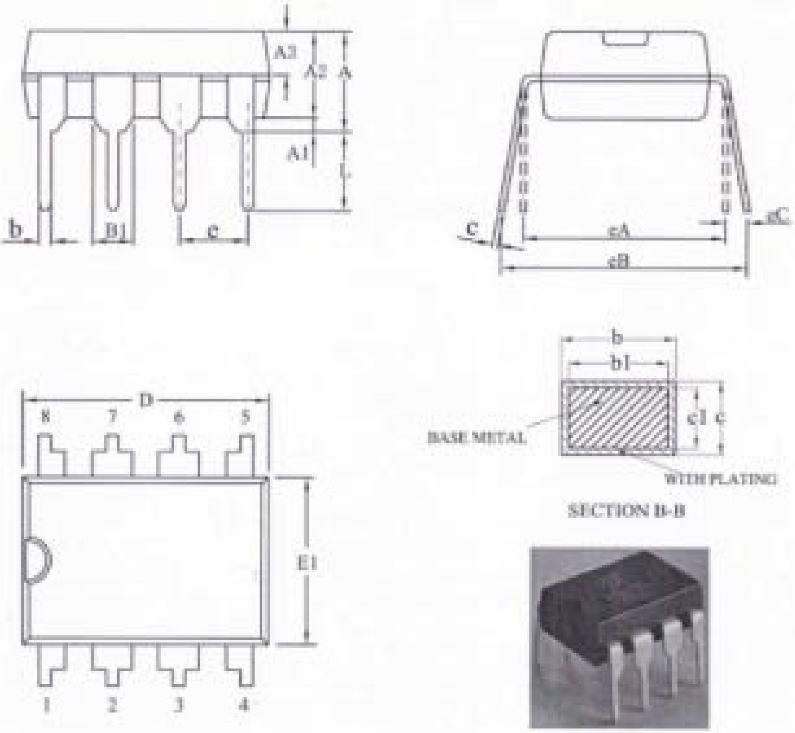
```
/*--------------------------------------
;module name:List_2A_Play_WT588F( )
;function:Realize the two-wire serial port link code sending function
;Input parameters: DDATA is sending data
;Output parameters:
;------------------------------------*/
Void List_2A_Play_WT588F( void )
{
Line_1A_WT588F( FF );
Delay_1ms(2);
//delay 2ms
Line_1A_WT588F( F3 );
Delay_1ms(5);
Line_1A_WT588F( 00);
Delay_1ms(2);
Line_1A_WT588F( 01 );
Delay_1ms(10);
Line_1A_WT588F( FF );
Delay_1ms(2);
Line_1A_WT588F( F3 );
Delay_1ms(5);
Line_1A_WT588F( 00 );
Delay_1ms(2);
Line_1A_WT588F( 02 );
}
```

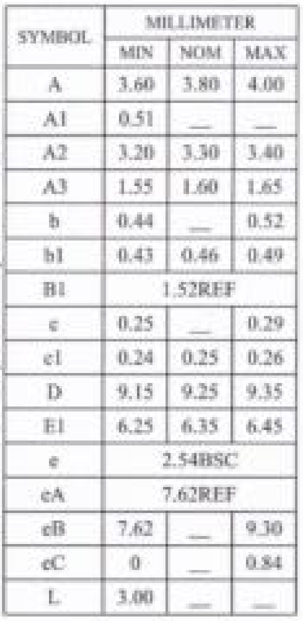
9. PIN Diagram





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°





SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	3.60	3.80	4.00
A1	0.51	__	__
A2	3.20	3.30	3.40
A3	1.55	1.60	1.65
b	0.44	__	0.52
b1	0.43	0.46	0.49
B1	1.52REF		
c	0.25	__	0.29
c1	0.24	0.25	0.26
D	9.15	9.25	9.35
E1	6.25	6.35	6.45
e	2.54BSC		
eA	7.62REF		
eB	7.62	__	9.30
eC	0	__	0.84
L	3.00	__	__