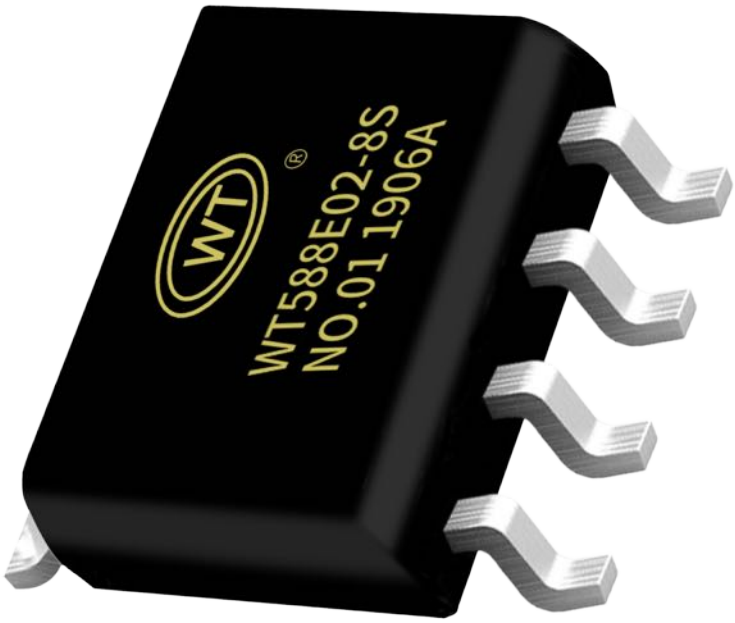
WT588E02B-8S
Voice chip specification

Version: V2.02



Note :

CONTENT

1. Product Introduction

update voice

1. Remote voice update: The bin file or T3Z file can be transferred to the MCU through WiFi or Bluetooth, and then the file can be updated to the chip by the MCU, which can realize the voice replacement of the client device
2. Online update: save the bin file to the online downloader, and connect the device through the online downloader to change the voice. The operation is convenient and fast, and it can be used for the voice replacement of the PCB board.

Storage method

1. There is 220K byte storage space inside the chip (not including the main control program)
2. The chip main control program and internal storage space can be repeatedly erased and written

Play mode

1. PWM output: 16-bit PWM pure audio output, which can directly drive 8 Ω /0.5W speakers and buzzers,
2. DAC output: 14-bit DAC audio output, can be connected to an external power amplifier
3. Support up to 4 channels 16K sampling rate mixing
4. Supports up to 16-channel midi playback (8K sampling rate);
5. Support seamless connection function (audio source needs to be processed, please contact the salesman)

(PWM and DAC output can be set by bin file)

Audio sampling rate

1. Voice sampling rate: support 6~32Khz;

Control method

1. One-line serial port control/two-line serial port control
2. Button function control (functions can be customized according to the actual situation)

(The main control program of serial port control and button control is different, please contact the salesman when placing an order)

Operation instruction

1. Volume adjustment instructions
2. Loop play instruction
3. Play fixed voice commands
4. Play pause command

Technical specifications

1. Power supply voltage DC2.0~5.5V
2. Working temperature -20~75 degrees
3. Humidity 5%~95%

Application scenarios

1. Devices that require change voice frequently
2. Outdoor equipment that needs to change the voice content

2. Overview

WT588E02B-8S is a 16-bit DSP voice chip newly developed by Shenzhen Waytronic Electronics Co., Ltd., internal oscillation 32Mhz, 16-bit PWM decoding. Powerful functions make WT588E02B-8S a leader in the voice chip industry.

At present, WT588E02B-8S can store up to 170 seconds of voice content with higher sound quality (if the customer has no requirements for sound quality, it can store up to 320 seconds of voice content).

3. Function Description

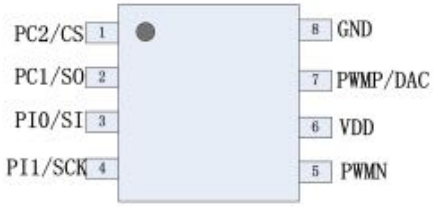
- 16-bit DSP voice chip, 32Mhz internal oscillation;
- Working voltage 2.0~5.5V;
- 16bit PWM/DAC output, can directly drive 8R 0.5W speakers;
- Support WAV files of 6K~32Khz;
- Customers can replace the internal voice content of the chip online through MCU or the supporting downloader;
- Support one-line serial port and two-line serial port (spi communication will come out one after another);
- Support up to 4 channels of 16K sampling rate mixing;
- Support up to 16 channels of midi playback (8K sampling rate);
- Support 224 segment addresses, which can be expanded with more requirements;
- With hardware SPI interface, UART interface, IIC, built-in comparator and other interfaces. Various
- functions can be customized for customers.
- There is 220K byte storage space inside the chip (not including the main control program).
- The chip main control program and built-in storage 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 ports (DATA and CLK) maintain a stable level (both high and
- low levels) for 1 second, the chip enters sleep

Selection attention:

1. The control mode and output mode of the chip can be set by the bin file, and the application requirements should be explained to the salesperson when ordering the chip.

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

4. PIN Description



WT588E02B-8S

5. Pin Distribution Diagram

Pad Name	Pad No.	ATTR.	Description
PC2/BUSY/CS	1	I/O	Output the busy signal/downloader programming port
PC1/DATA1/CLK2/SO	2	I/O	one-line serial port data signal input terminal/Two-line serial port clock signal input terminal/downloader programming port
PI0/DATA2/SI	3	I/O	two-line serial port data signal input terminal/downloader programming port
PI1/SCK	4	I/O	downloader programming port
PWMN	5	out	PWMoutput pin
VDD	6	Power	Positive electrode
PWMP	7	I/O	PWM output pin/DAC
GND	8	Power	Negative electrode

6. Limit Parameter

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 work temperature	-20~ +85	°C
Storage temperature	-50~100	°C

Remarks: As a result of the samples tested in the laboratory, the chip can work normally at -40℃~+85℃.

7. Electrical Characteristics

Parameters	sign	minimum	typical value	maximun	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 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

8. One-line Serial Communication

One-line serial port mode can use MCU to send data to WT588E 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). Detailed description can be seen below.

8.1. Pin Assignment

package	pin	
	PC1	PC2
SOP8	DATA	BUSY

8.2. One-line Audio Address Corresponding Relation

Data(hexadecimal)	Function
00H	Play the 0th voice
01H	The 1st audio play
02H	The 2nd audio play
.....	
DDH	The 221st audio play
DEH	The 222nd audio play
DFH	The 223rd audio play

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. The time interval between the two address commands must be greater than 4ms.

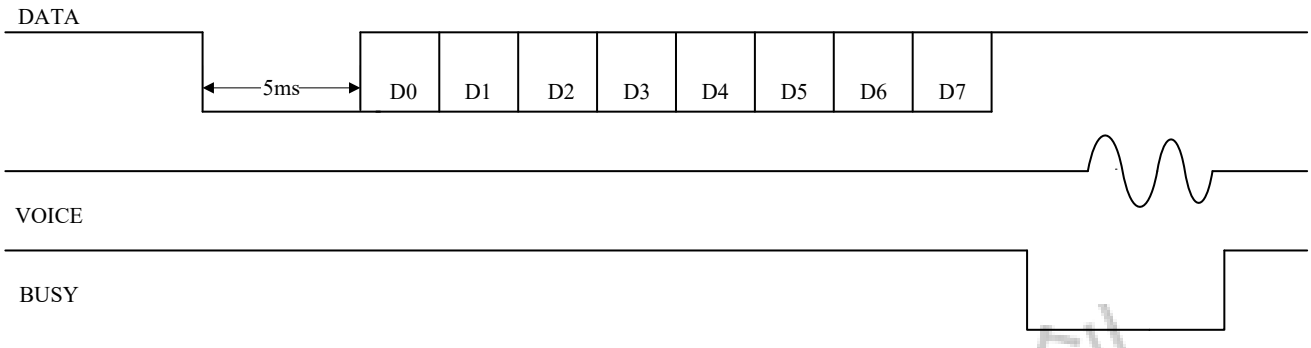
8.3. One-line Audio and Command Code

Command code	Function	Description
E0H....EFH	E0 is the minimum volume; EF 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	Repeat to play the current audio	Execute this command to play the current voice in a loop, and it can be sent while the voice is playing. During the execution of the F2 loop command, it can be interrupted by the FE command, the ordinary address command, and the 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	Code-linking play	F3H+Voice address A, F3H+Voice address B, F3H+Voice address C,... When playing address A, it does not interrupt when 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. The interval between one set of coded addresses and the next set of addresses must be greater than 2ms ("F3+Voice Address" is a set of coded addresses), and up to 40 segments of coded addresses can be realized.
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 F3H and only a voice address, the voice that is being played will be interrupted. The consecutive code commands must be used 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 WT588E 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 set of code-linked addresses and then delay 2ms before sending the next set of code-linked addresses.

8.4. One-line Serial Port Sequence Diagram



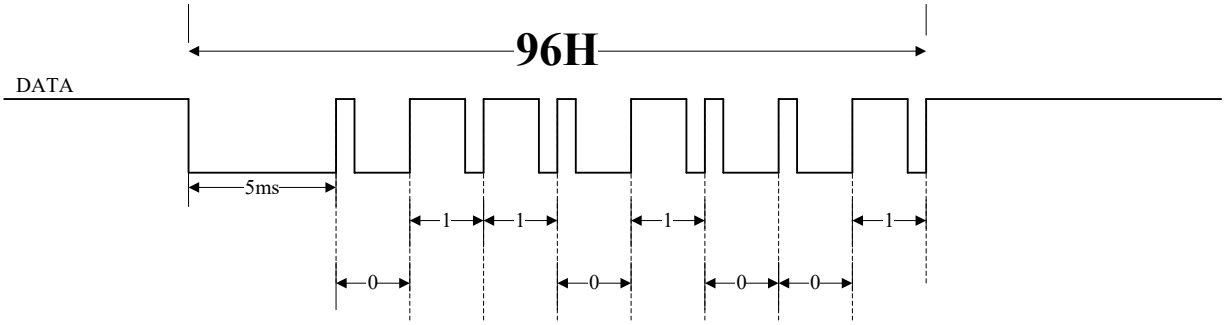
Pull data line low to 5ms(the time range is 5ms-20ms), then send 8-bit data, low bit first, then high bit.

Use the ratio of high level and low level to represent the value of each data bit.

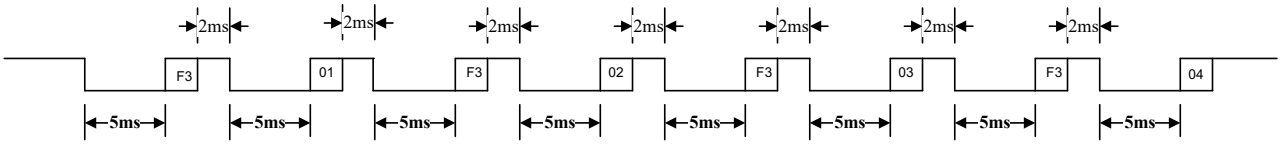
The ratio of high and low level is 3:1, represented by 1

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:



If we want the chip to play the voice content of address 01/02/03/04 in sequence. That is, the code-linking command playback, F3+01+F3+02+F3+03+F3+04. The corresponding sequence diagram can be shown as follows:



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 code-linking playback, please refer to the figure above.
3. Chip IO port, default 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.

9. Two-line Serial Port Communication

Two-line serial port mode can use MCU to send data to WT588E series voice chip through DATA line and CLK line to achieve the purpose of control. It can control voice playback, stop, loop, etc. The two-wire serial port control method has good anti-interference ability, and the shortest time of an instruction is 6.6ms (5ms+0.2ms*8=6.6ms). Detailed description can be seen below.

9.1. Pin Distribution

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

9.2. Audio Address Corresponding Relation

Data(hexadecimal)	Function
00H	Play the 0th voice
01H	The 1st audio play
02H	The 2nd audio play
.....	
DDH	The 221st audio play
DEH	The 222nd audio play
DFH	The 223rd audio play

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. The time interval between the two address commands must be greater than 4ms.

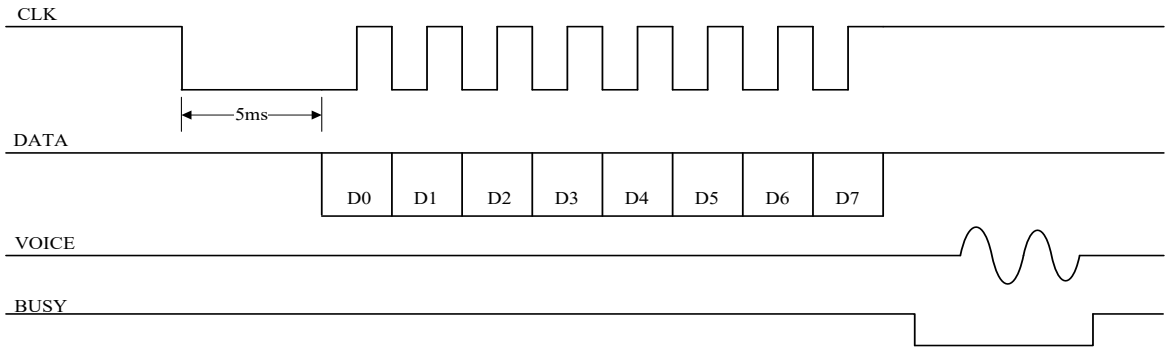
9.3. Two-line Audio and Command Code

Command code	Function	Description
E0H....EFH	E0 is the minimum volume; EF 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	Repeat to play the current audio	Execute this command to play the current voice in a loop, and it can be sent while the voice is playing. During the execution of the F2 loop command, it can be interrupted by the FE command, the ordinary address command, and the 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	Code-linking play	F3H+Voice address A, F3H+Voice address B, F3H+Voice address C,... When playing address A, it does not interrupt when 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. The interval between one set of coded addresses and the next set of addresses must be greater than 2ms ("F3+Voice Address" is a set of coded addresses), and up to 40 segments of coded addresses can be realized.
FEH	Stop playing the current audio	Execute this command to stop playing the current voice.

Note:

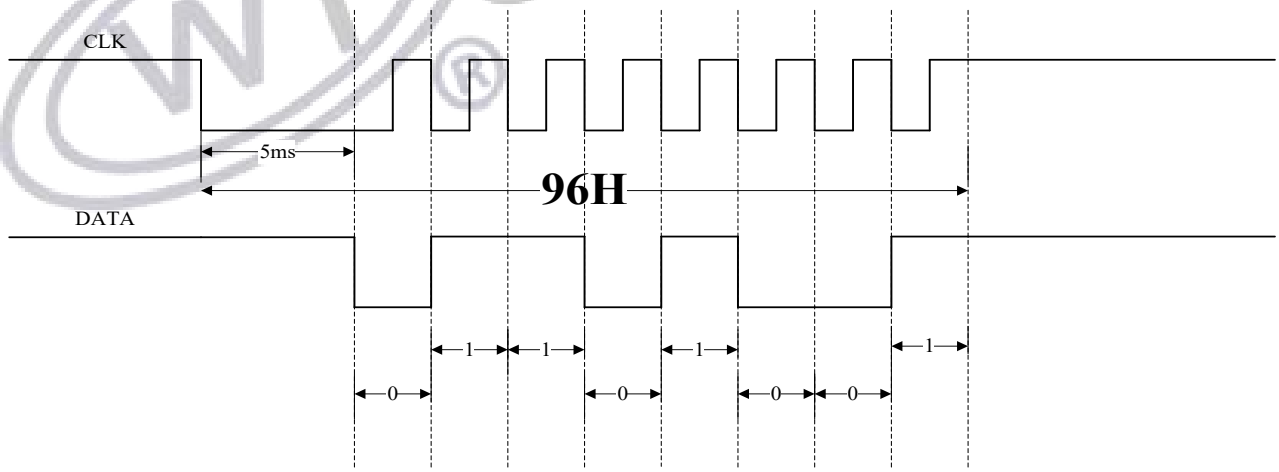
1. Without stopping the playback, if there is no command code F3H and only a voice address, the voice that is being played will be interrupted. The consecutive code commands must be used with the address (for example: F3H+00H+F3H+01H). F3H can easily combine different voices. F3H+address A+F3H+address 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 WT588E 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 set of code-linked addresses and then delay 2ms before sending the next set of code-linked addresses

9.4. Two-line Serial Port Sequence Diagram

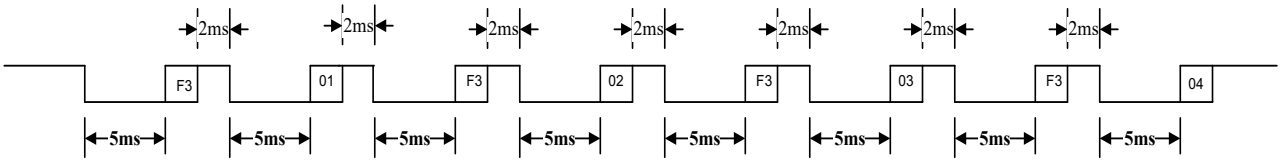


The two-line serial port control mode is controlled by the chip clock CLK and data DATA. Before each byte of data is sent, the clock signal CLK is pulled down 4ms to 20ms, and 5ms is recommended. Receive data low bit first, receive data on the rising edge of the clock. The clock cycle is between 200us 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:



If we want the chip to play the voice content of address 01/02/03/04 in sequence. That is, the code-linking command playback, F3+01+F3+02+F3+03+F3+04. The corresponding sequence diagram can be shown as follows:



F3+01H+F3+02H+F3+03H+F3+04H

Remark:

1. Since the WT588E voice chip power-on initialization time 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 code playback, please refer to the figure above;
3. Chip IO port, 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 3ms before sending the command before sending the command.

10. Program Example

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

```
#define UC8
unsigned char
#define P_DATA P01
/*-------------------------------------
; Module name: Line_1A_WT588E(UC8 DDATA)
;Function: Realize a serial port communication function
; Input parameters: DDATA is sending data
;Output parameters:
; P_DATA is the data port;-------------------------------------*/
Void Line_1A_WT588E( 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;
}
```

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

```
/*-------------------------------------
; Module name: List_1A_Play_WT588E()
; Function: Realize the function of sending one-line serial code-linking
; 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);
}
```

10.3. 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_WT588E(UC8 DDATA)
;Function: Realize two-line serial communication function
; Input parameters: DDATA is sending data
; Output parameters:
; CLK_2A //clock line
; P_DATA_2A //Data line;----------------------------------*/
Void Line_2A_WT588E(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;
```

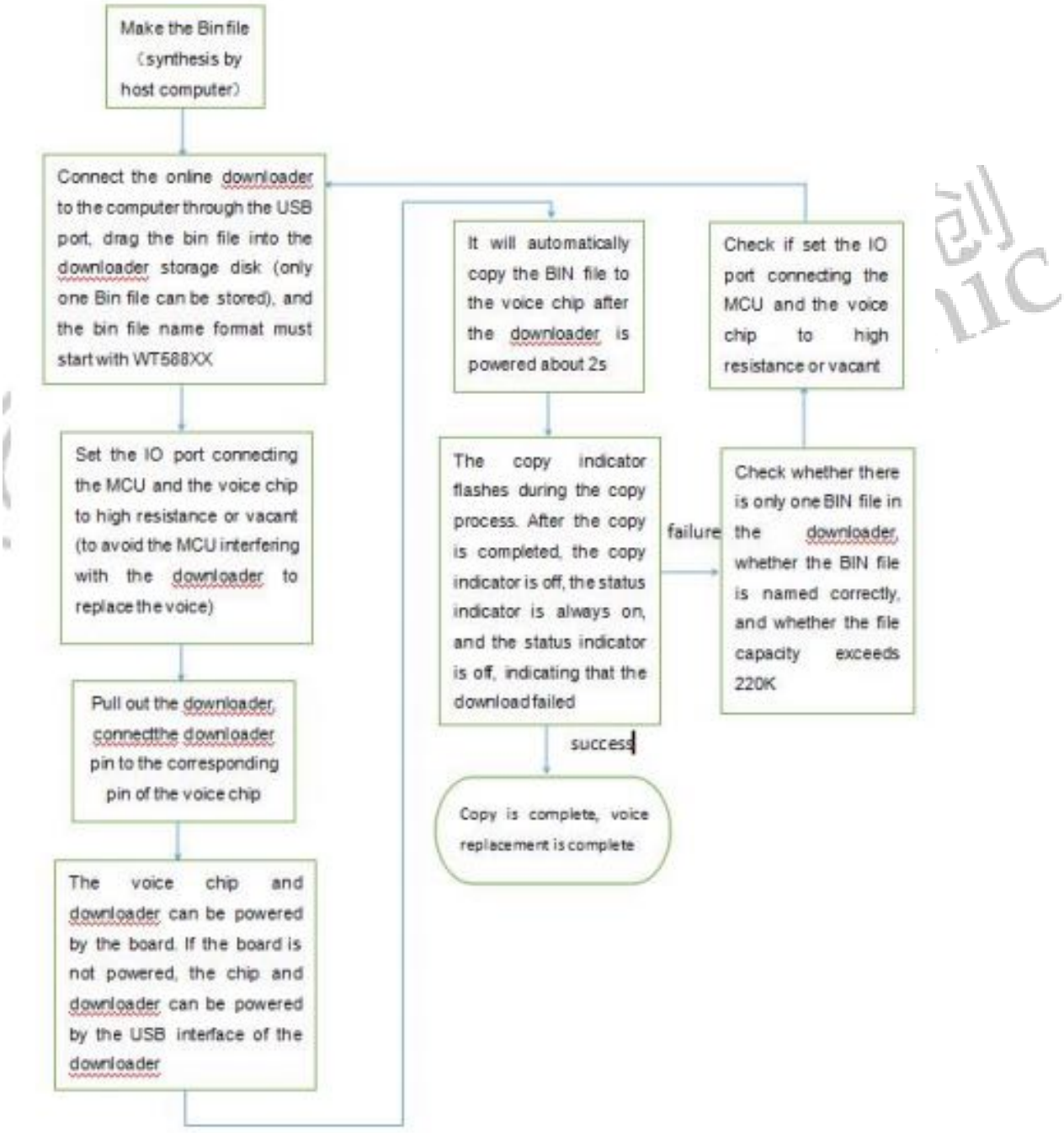
```
//Transmission data one bit
Delay_N10us(30);
//delay 300us
CLK_2A
= 1;
//pull-on
Delay_N10us(30);
//delay 300us
S_DATA = S_DATA>>1;
B_DATA = S_DATA&0X01;
}
P_DATA_2A
= 1;
CLK_2A
= 1;
}
```

10.4. Two-line Serial Port Control Program(F3+01+F3+02+F3+03)

```
/*-------------------------------------
; Module name: List_2A_Play_WT588E()
;Function: realize the function of sending two-line serial port with code-linking
; Input parameters: DDATA is sending data
;Output parameters:;----------------------------------*/
Void List_2A_Play_WT588E( void )
{
Line_2A_WT588E( F3 );
Delay_1ms(2);
//delay 2ms
Line_2A_WT588E( 01 );
Delay_1ms(2);
Line_2A_WT588E( F3 );
Delay_1ms(2);
Line_2A_WT588E( 02 );
Delay_1ms(2);
Line_2A_WT588E( F3 );
Delay_1ms(2);
Line_2A_WT588E( 03 );
Delay_1ms(2);
}
```

11. Online Downloader

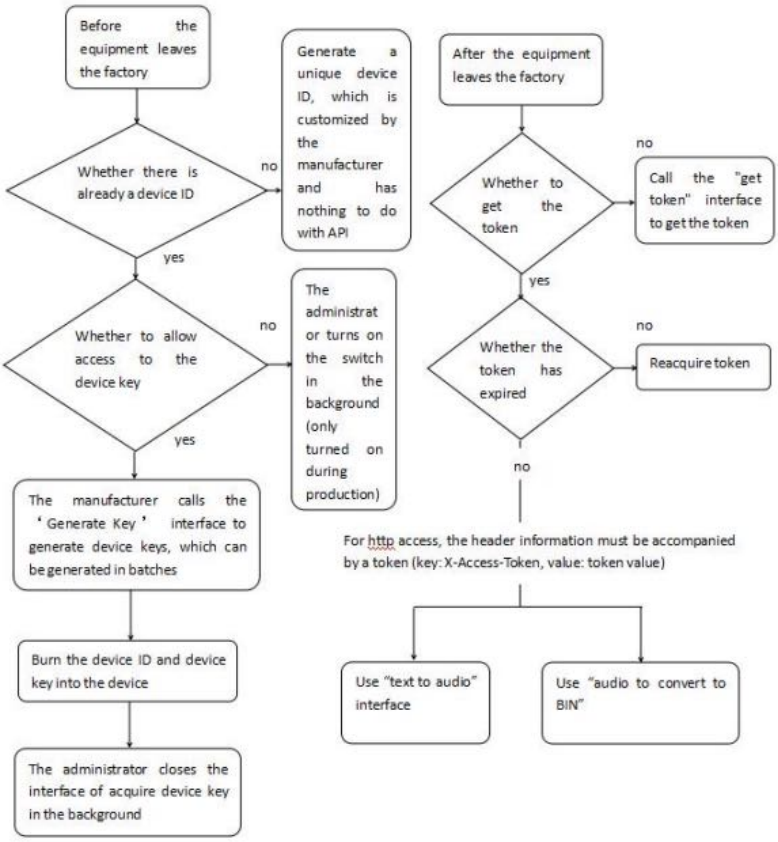
Save the bin file in the online downloader, and connect the device through the online downloader to replace the voice. It can be used for production or client device voice replacement. It is convenient, fast and simple to operate, and is suitable for devices that require frequent voice replacement. (The online downloader has a video explanation, you can contact the salesperson to provide it.)



11.1. Make the bin or the T3Z file

Make a bin file: After logging in to the host computer URL of the web page, load the voice file to be played or use the text-to-audio function to load the voice and make the bin file. WT588 web page creation customer login URL: http://WT588f.waytronic.com:8083/user/register. For the steps of making bin files, please refer to "WT588F Web Host Computer Operating Instructions 2020-8-31" or video explanations, which can be provided by contacting the salesperson.

Make T3Z files: access API interface, can load local voice or use text-to-speech function to generate voice files, convert voice files into bin files or T3Z files (can be used for single-segment voice modification), which can be used for single-segment voice or all voices Remote replacement. Interface URL: http://api.wt588f.waytronic.com:8083/doc.html?plus=1&cache=1, the following is the use process of API interface:



11.2. Bin File Transfer

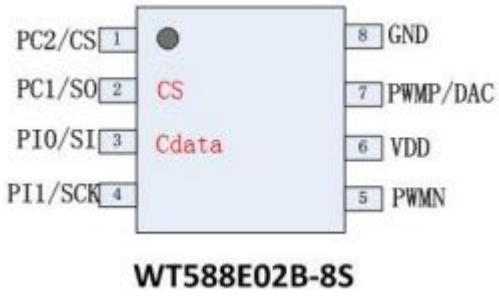
The finished bin file or T3Z file can be transmitted to the MCU by wifi, bluetooth or server.

11.3. WT Handshake Protocol Communication and Using

Used for handshake between the downloader and the WT588E02B chip

11.4. Pin Assignment

name	CS	Cdata
pin	PC1	PI0



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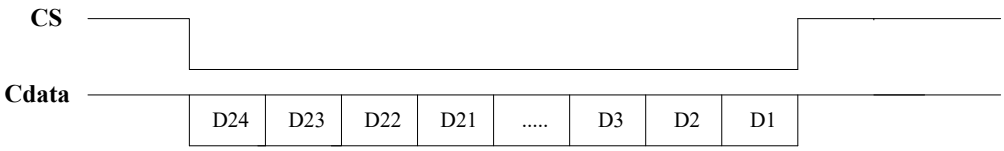
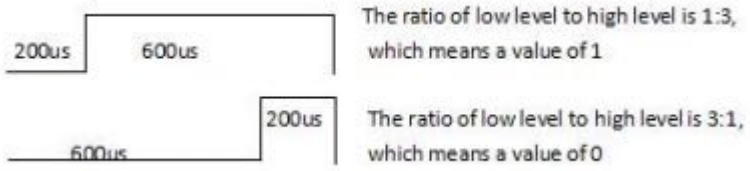
11.5. Command: directly send twenty-four digits of data (note: XX is hexadecimal)

command	function
7E A0 EF	Replace the internal content of all chips; 24bit
7E A0 xx EF	Replace the xxth internal voice ;32bit

11.6. WT handshake protocol specification. Take 24bit command as an example, the sending requirements are as follows, 32bit.

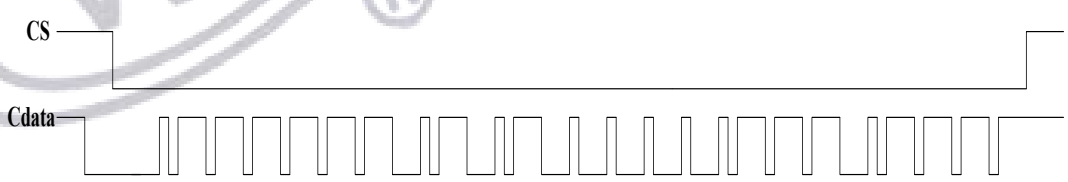


Note: After the handshake signal CS is pulled low, Cdata sends 24 bits of data again, sending the high bit first and then the low bit; the ratio of low to high level is used to represent the value of each bit of data.



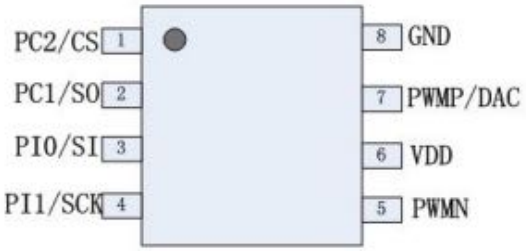
Note: The low level must be in front and the high level in the back.
It is recommended to use 200us: 600us. Value range: 40us:120us ~ 400us:1200us. Pay attention to the use of 3:1 and 1:3 level ratios to ensure stable communication.

11.7. The timing diagram example of sending 7E A0 EF is as follows



Note:
1. Before the CS signal is pulled low, the C data signal must be low, mainly to distinguish it from IIC communication.
2. The position where the CS line is pulled high at the end is the end position of the last bit high level timing.

12. Data Transmission



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Pin	Spi function definition
PC2	spi-cs
PC1	spi-so
PI0	spi-si
PI1	spi-clk

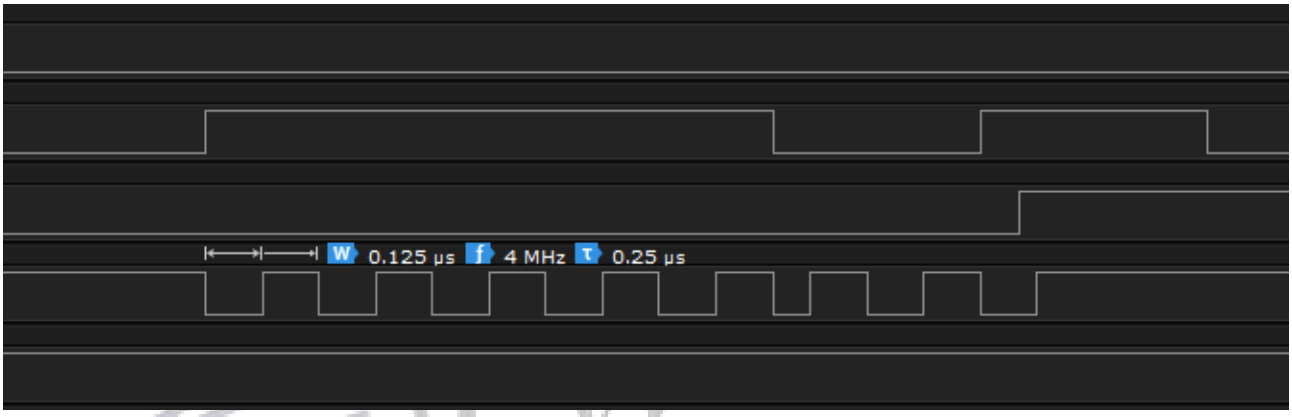
The data transmission between the voice chip and the MCU uses a customized spi protocol, in which the voice chip is the master and the MCU is the slave, but the cs is controlled by the MCU;

Specific way:

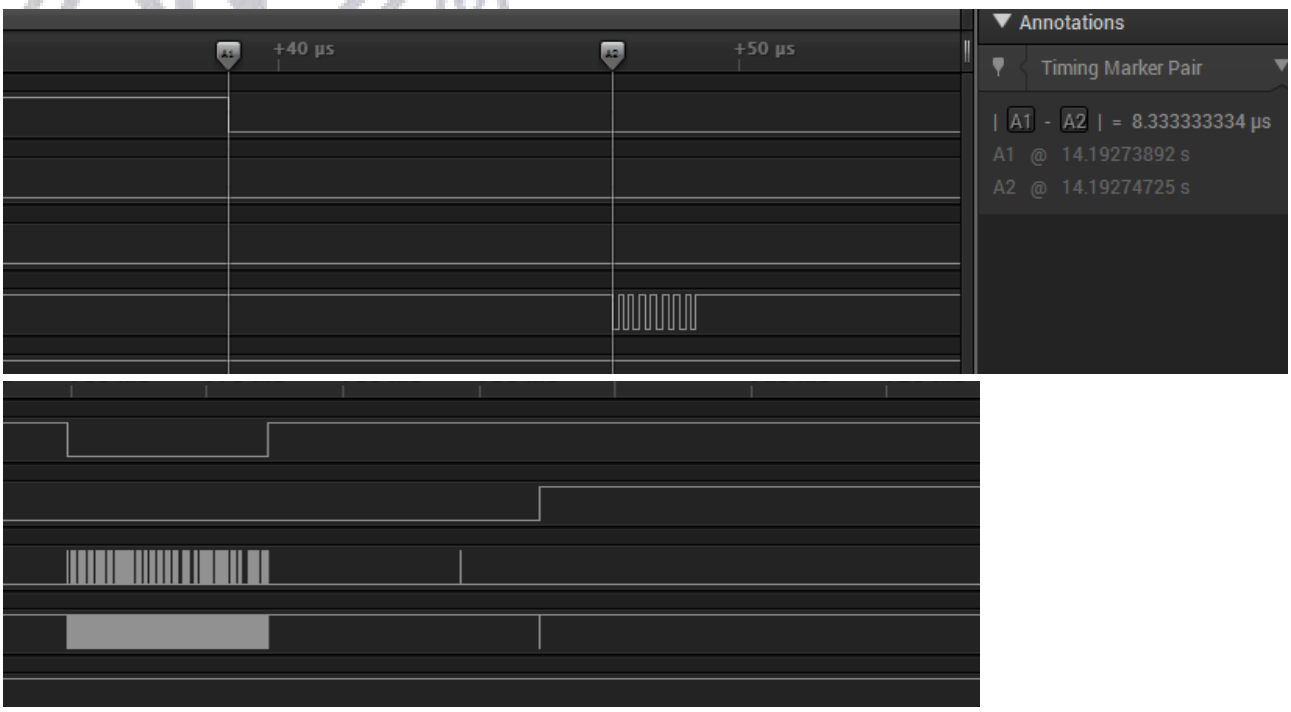
1. After the MCU enters the spi mode, pull down cs, the voice chip detects that cs is low, it will start to send the clk signal, the MCU sends the data to the voice chip according to the clk signal, and can pull up the cs signal when it needs to pause(Pull up for more than 256ms, communication ends)

2. When the MCU sends a byte of data to the voice chip through spi-so, the voice chip will return the last byte received to the MCU through spi-si (for example, the MCU sends the first byte 0x02 to the voice chip When sending the second byte to the voice chip, the voice chip will return 0x02 to the MCU. When the MCU sends the first byte, the chip will randomly return one byte of data), used to check whether the data is transmitted correctly, such as judging that the returned data is wrong , will stop communication.

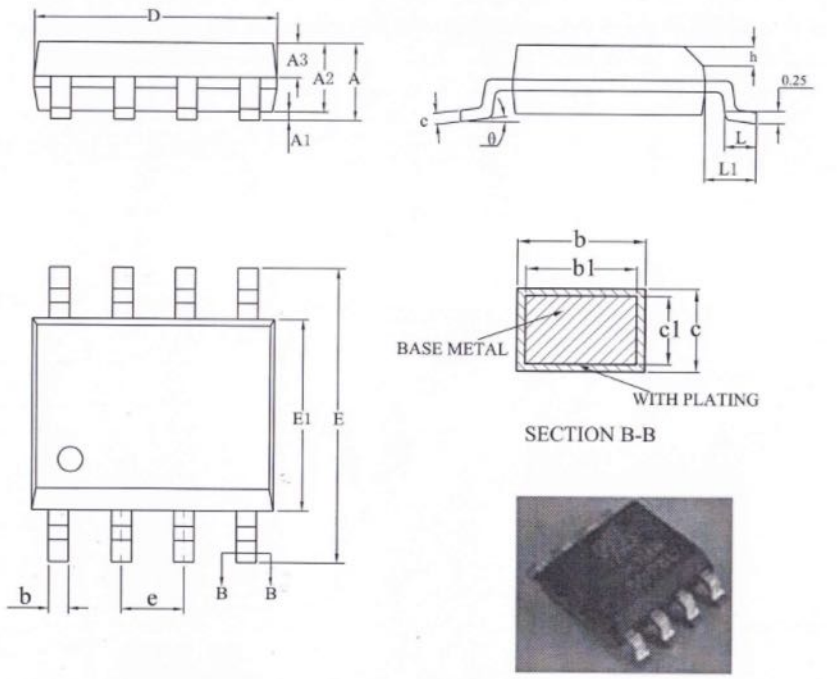
3. The MCU sends data in a double-byte manner each time, with an interval of 20-30us between bytes, and an interval of 40-50us between double bytes. If cs is not judged during double-byte data transmission, that is, if cs is pulled high, the MCU will still stop after sending the double-byte. The Clk clock cycle is 0.25us.



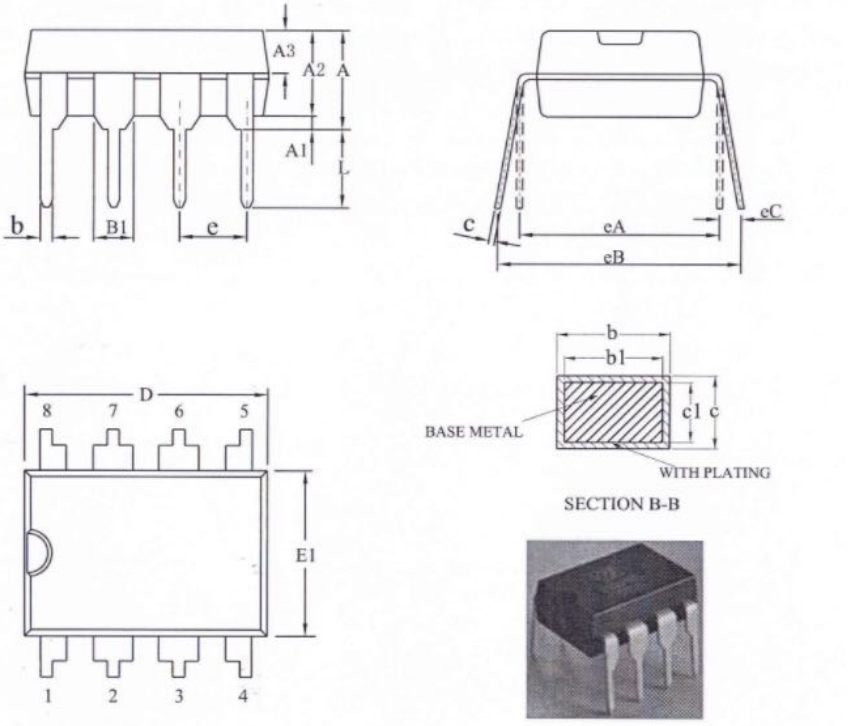
4. When the data transmission is completed, the MCU pulls cs higher than 256ms to end the communication



13. 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
1 b	0.39	—	0.47
1 b1	0.38	0.41	0.44
1 c	0.20	—	0.24
c1	0.19	0.20	0.21
1 D	4.80	4.90	5.00
E	5.80	6.00	6.20
1 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	—	—
5 A2	3.20	3.30	3.40
A3	1.55	1.60	1.65
6 1 b	0.44	—	0.52
6 5 2 b1	0.43	0.46	0.49
B1	1.52REF		
6 e	0.25	—	0.29
5 2 c1	0.24	0.25	0.26
6 D	9.15	9.25	9.35
6 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	—	—