



SYN6288E Chinese speech synthesis chip user manual

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V1.0	2021-06-08	The official release version, the package of SYN6288 is changed to LQFP32L, and the chip model is changed to SYN6288E; internal communication protocol, pin sequence, pin peripheral circuit are consistent with SYN6288.

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1. overview

SYN6288E Chinese speech synthesis chip is a mid-to-high-end speech synthesis chip with a more natural effect, based on the more cost-effective SYN6288 chip launched by Beijing Yuyin Tianxia Technology Co., Ltd. in early 2010. SYN6288E receives the text data to be synthesized through the asynchronous serial port (UART) communication method, and realizes the conversion from text to speech (or TTS speech).

In 2002, Yuyin Tianxia developed the first speech synthesis chip OSYNO6188 in China. The company's latest SYN6288E speech synthesis chip: LQFP32L chip package, simple hardware interface, low power consumption, clear and mellow timbre, high cost performance; in addition, SYN6288E

It is smarter and more accurate in recognizing text/numbers/strings, and the speech synthesis is more natural and intelligible. SYN6288E Speech Synthesis Effect

It is a Chinese speech synthesis chip that is really oriented to mid-to-high-end industry applications.

The birth of SYN6288E speech synthesis chip will promote the industry application of TTS speech synthesis technology to go deeper and wider!

1.1 Product application scope

- Vehicle information terminal voice broadcast, vehicle dispatching, vehicle navigation
- Bus station announcer, attendance machine
- Cell phone, fixed line
- Queue calling machine, cash register and charging machine
- Vending machines, information machines, POS machines
- Intelligent instrumentation, weather warning machines, intelligent transformers
- Intelligent toys, smart watches
- Electric bicycles
- Voice electronic books, color screen story books, voice electronic dictionaries, voice electronic guides
- News broadcast • Electronic map

1.2 Features

ÿSupport texts in GB2312, GBK, BIG5 and UNICODE internal code formats; **ÿClear** , natural and accurate Chinese speech synthesis effect; can synthesize any Chinese text, and support the synthesis of English letters; **ÿWith intelligent** text analysis and processing algorithms, can Correctly identify numbers, numbers, time and date, and commonly used symbols of weights and measures; **ÿHave** a strong ability to process polyphonic characters and Chinese surnames; **ÿSupport** a variety of text control marks to improve the accuracy of text processing; **ÿThe** amount of text synthesized each time up to 200 bytes;

- **Support** a variety of control commands, including: synthesis, stop, pause synthesis, continue synthesis, change baud rate, etc.;
- **Support** the sleep function, which can reduce power consumption in the sleep state; support multiple ways to query the working status of the chip;
- **Support** serial data communication interface, support three communication baud rates: 9600bps, 19200bps, 38400bps;
- **Support** 16-level volume adjustment; the foreground volume for playing text and the background volume for playing background music can be controlled separately;
- **The** speech speed of words can be adjusted by sending control marks, and it supports 6-level word speech speed adjustment;
- **Multiple** chord music, prompt sound effects and common voice prompt sounds for certain industries are solidified in the chip;
- **Internal** integration of 19 voice prompts, 23 chord prompts, and 15 background music;
- **Built-in** 10-bit push-pull (push-pull), independent power amplifier for digital-to-analog DAC output;
- **The** final product provides LQFP patch packaging form, the smallest in the industry;
- **All** indicators of the chip meet the application in harsh outdoor environments;

1.3 Product Function Description

• **Text** synthesis function

The chip supports the synthesis of any Chinese text, and can adopt four encoding methods of GB2312, GBK, BIG5 and Unicode. Chip support English

The synthesis of letters, when encountering English words, pronounce them alphabetically. The amount of text synthesized each time can reach 200 bytes.

• **Text** intelligent analysis and processing

The chip has the function of intelligent analysis and processing of text.

Fragments can be correctly identified and processed according to the built-in text matching rules.

For example: "2008-12-21" is read as "December 21, 2008", "10:36:28" is read as "Ten Thirty-Six: Twenty

Eight seconds", "28°C" is read as "twenty-eight degrees Celsius", and so on.

• **Ability** to process polyphonic characters and Chinese surnames

For texts with polyphonic characters, for example: "The top priority of the current work is to ensure the smooth progress of key projects in Chongqing despite all the difficulties.

OK, resolutely refuse to repeat construction", the chip can automatically analyze the text, distinguish the pronunciation of polyphonic characters in the text and synthesize the correct pronunciation.

• **16-level** digital volume control and 6-level word speed control

The chip can realize 16-level digital volume control, the volume is louder and wider. The foreground volume for playing text and the background volume for playing background music can be separated

Open control, more freedom.

• **Background** music can be selected during text broadcasting

15 pieces of background music are integrated in the chip, and background music can be selected during any broadcast.

• **Prompt** tone

The chip integrates 19 sound prompts, which can be used for information reminders, alarms and other functions in different occasions.

The chip integrates 23 polyphonic music, which can be used as polyphonic SMS prompt tone or polyphonic ringtone.



Support multiple control commands

Control commands include: synthesize text, stop synthesis, pause synthesis, resume synthesis, status query, enter Power Down mode, change communication Baud rate and other control commands. The controller sends control commands through the communication interface to control the chip.

Support multiple text control tags

The chip supports a variety of text control tags. Text control marks can be sent by sending "synthetic command", adjust the volume, set the number pronunciation, Set the speech rate of words, set whether to read punctuation, etc.

Query the working status of the chip

Support multiple ways to query the working status of the chip, including: query the status pin level, return automatically by reading the chip, send query command to get the return of the working status of the chip.

Support low power consumption mode

The chip supports Power Down mode. Use the control command to make the chip enter Power Down mode. Resetting the chip can make the chip from Power Down mode returns to normal working mode.

Support three communication baud rates

The communication baud rate supported by the chip: 9600bps, 19200bps, 38400bps.

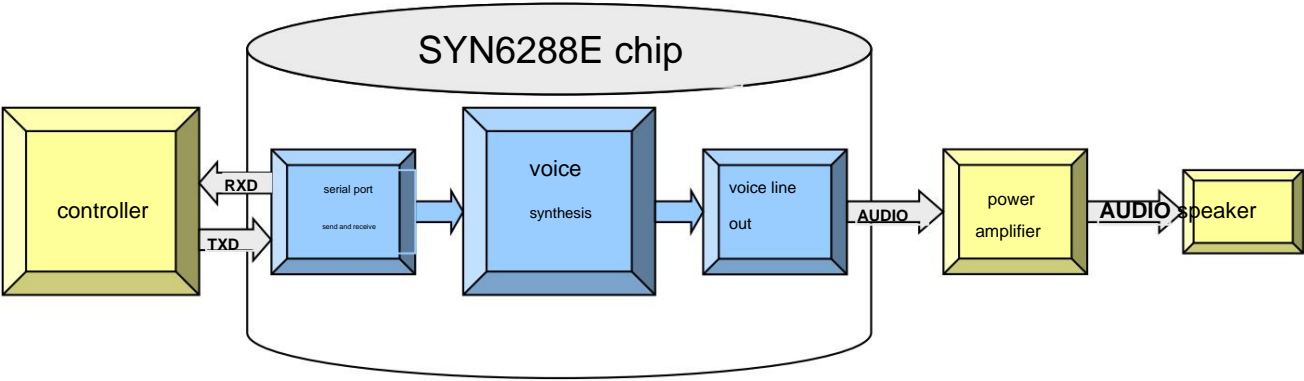
1.4 Synthetic effect

Naturalness	clarity	Correct rate	intelligibility
3.5	98%	96%	99%

1.5 System structure block diagram

The minimum system includes: controller module, SYN6288E speech synthesis chip, power amplifier module and speakers.

The main controller and the SYN6288E speech synthesis chip are connected through the UART interface, and the controller can communicate with the SYN6288E speech synthesis chip through the communication interface. The chip sends control commands and text, and the SYN6288E speech synthesis chip synthesizes the received text into a speech signal output, and the output signal is passed through the power After the amplifier is amplified, it is connected to the speaker for playback.

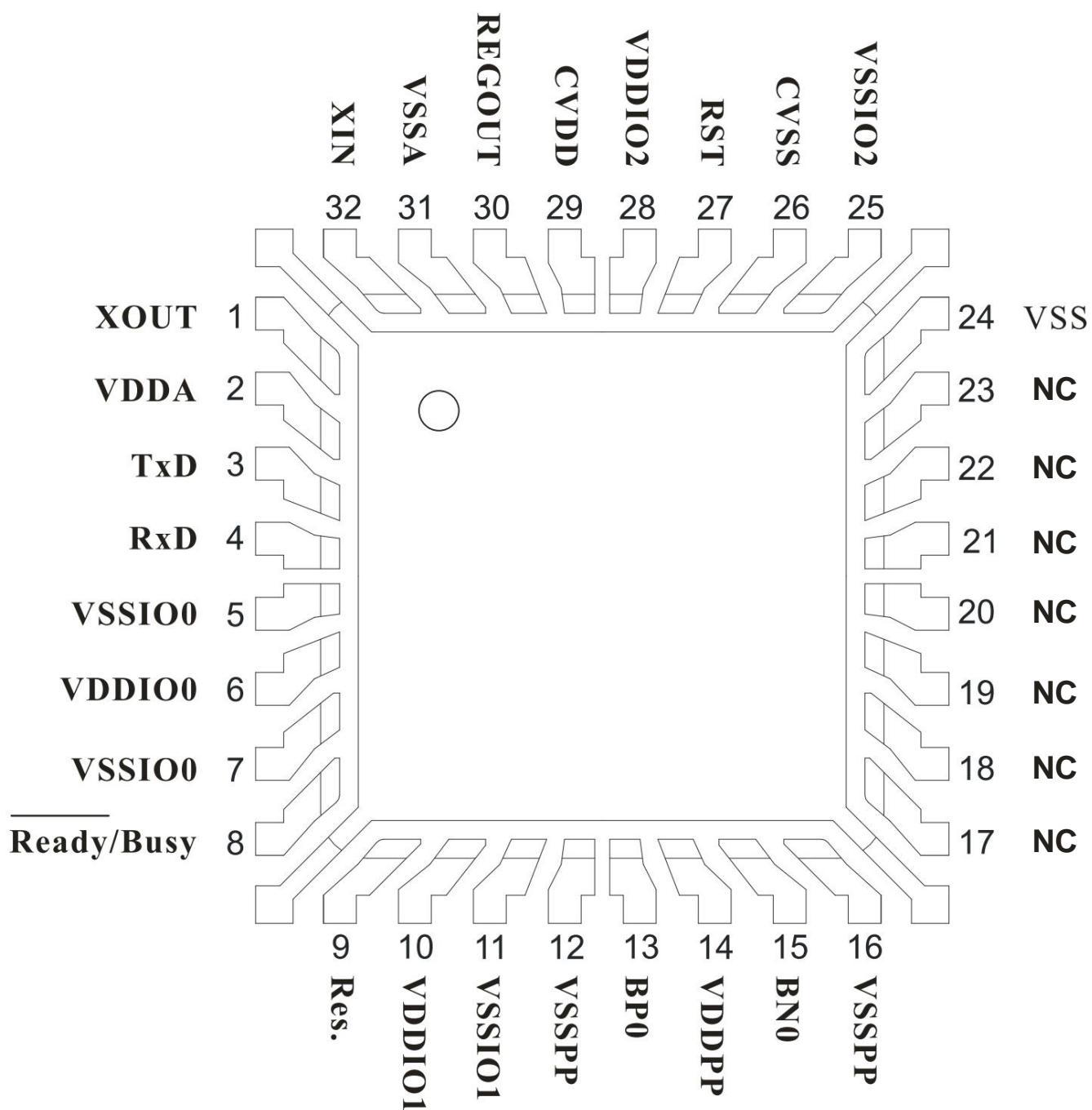


1.6 Ordering information

Chip model	Package information	
	package name	Package Description
SYN6288E	LQFP32L	32-pin chip 7mm X 7mm X 1.4mm

1.7 IC pin structure

1.7.1 Pin View



1.7.2 Pin definition

serial number	pin	illustrate	numbered pins	illustrate
1	XOUT	High speed crystal output	17	NC
2	VDDA	Positive pole of internal regulated power supply	18	NC
3	TxD	Serial data transmission, initial baud Rate 9600bps	19	NC
4	RxD	Serial data reception, initial baud Rate 9600bps	20	NC
5	VSSIO0	Negative pole of bus module 0 power supply		NC
6	VDDIO0 Bus Module 0	Power Positive		NC
7	VSSIO0	Negative pole of bus module 0 power supply		NC
8	Ready/Busy-STATUS pin	Low level indicates that CHIP is idle and can receive commands sent by the host computer orders and data; High level means CHIP is busy, positive Performing speech synthesis and broadcasting;		VSS
9	Res.	Res pin	25	VSSIO2 Bus module 2 power negative pole
10	VDDIO1 bus module 1	power supply positive	26	CVSS processor power negative
11	VSSIO1	Negative pole of bus module 1 power supply	27	RST
12	VSSPP	Speech output module power supply negative	28	VDDIO2 bus module 2 positive pole
13	BP0	Push DAC voice output 1	29	CVDD processor power supply positive
14	VDDPP voice output module	power supply positive	30	REGOUT voltage auto-regulation output
15	BN0	Push DAC voice output 2	31	VSSA Negative pole of internal regulated power supply
16	VSSPP	Speech output module power negative pole	32	XIN High speed crystal oscillator input



2. Chip control method

2.1 Control commands

The host computer sends commands to the SYN6288E chip in the format of command frames. The SYN6288E chip performs corresponding operations according to the command frame, and sends to the upper computer Returns the command operation result.

The SYN6288E chip provides a variety of control commands, the list is as follows:

command function	illustrate
Speech synthesis play command	Synthesize the text sent this time
Change communication baud rate command	Communication baud rate after change
stop compositing command	Stop the current compositing action
Pause compositing command	Pause an ongoing composition
restore compositing command	Continue compositing paused text
Chip status query command	Query the working status of the current chip: the host computer can check the status of the chip through the Inquiry command" to judge whether the TTS module is working normally, and to obtain the relevant According to the parameters, return 0x4E to indicate that the chip is still being synthesized, and return 0x4F to indicate Indicates that the chip is idle.
Command to enter Power Down mode	Make the chip enter Power Down mode from normal working mode, after reset recover

2.2 Chip Backhaul

After receiving the control command frame, the chip will send a 1-byte status feedback to the host computer, and the host computer can judge the current state of the chip according to the feedback. working status.

When the SYN6288E chip is successfully initialized, it will send a one-byte "initialization successful" return.

After receiving the command frame, the SYN6288E chip will judge whether the command frame is correct or not. If the command frame is correct, it will return

If the command frame is wrong, it will return a "receive failure" return.

When the SYN6288E chip receives the status query command, if the chip is in the working state of broadcasting, it will return "is broadcasting" back, if the chip

If the chip is in an idle state, a "chip idle" return is returned. After a frame of data is synthesized, the chip will automatically return a "chip idle" response.

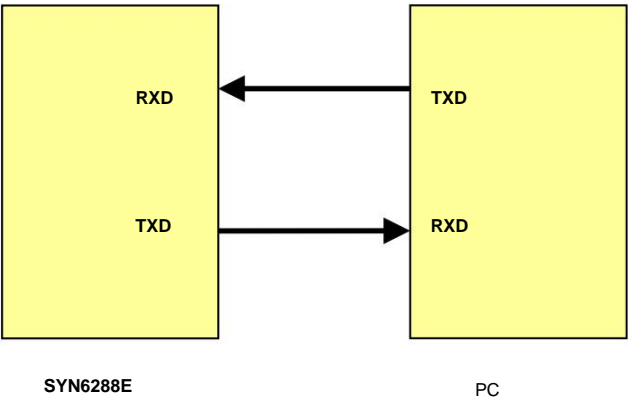
pass.

Return type name	return data	Triggering conditions
Init successful return	0x4A	The chip is initialized successfully
Received the correct command frame back	0x41	received successfully
0x45 is returned when an unrecognized command frame is received		Failed to receive
chip broadcast status return	0x4E	After receiving the "Status Query Command Frame", the chip is in the broadcasting state
Chip idle state feedback	0x4F	When a frame of data is synthesized, the chip enters the idle state and returns 0x4F; or After receiving the "Status Query Command Frame", the chip returns 0x4F when it is idle

3. communication method

3.1 Asynchronous serial communication (UART) interface

SYN6288E provides a set of full-duplex asynchronous serial communication (UART) interface to realize data transmission with microprocessor or PC. SYN6288E Use TxD, RxD and GND to realize serial communication. Among them, GND is used as the ground signal. SYN6288E chip supports UART interface communication mode, The commands and data sent by the host computer are received through the UART interface, and the maximum length of the data allowed to be sent is 206 bytes.



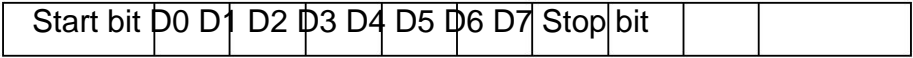
Please refer to 10.7 - "Series" for the specific circuit
Port Communication Reference Circuit" description

3.2 Communication transmission byte format

- 1. Initial baud rate: 9600 bps
- 2. Start bit: 1
- 3. Data bits: 8



- 4. Check digit: None
- 5. Stop bit: 1
- 6. Flow control: no



4. Communication frame definition and communication control

4.1 Command frame format

The chip supports the following command frame format: "frame header FD + data area length + data area" format. (maximum 206 bytes)

All commands and data sent by the host computer to the SYN6288E chip need to be encapsulated and transmitted in the form of "frame".

frame structure	Frame header (1 byte)	Data area length (2 bytes)	Data area (less than or equal to 203)			
			Command word (1 byte)	Command parameter (1 byte)	bytes Text to be sent (less than or equal to 200 bytes)	XOR check (1 byte)
data	0xFD	0XX 0XX	0XX	0XX	0XX . . .	0XX
illustrate	defined as sixteen Hexadecimal "0xFD"	high byte first low byte after	The length must be consistent with the previous "data area length"			

Note: The actual length of the data area (including command words, command parameters, text to be sent, XOR check) must be the same as the length of the data area defined after the frame header

Strictly consistent, otherwise the chip will report receiving failure.

4.2 Control commands supported by the chip

Data area (less than or equal to 203 bytes)							
Command word 1 byte		Command parameter				Text to be sent<=200 bytes	XOR check 1 byte
value	corresponding function	byte high 5 bits	corresponding function	1 byte byte low 3 bits	corresponding function		
0x01	Speech synthesis playback command	Value: 0	1. Value 0: said not to add	0	Set the text to: GB2312 encoding format	Two of the text to be synthesized binary content	
		Value: 1	Background music	1	Set the text to: GBK encoding format		
		Value: 2		2	Set the text to: BIG5 encoding format		
		Value: 3	2. Other values: Indicates the selected	3	Set the text to: UNICODE encoding format		
		...					
0x31	Set communication baud rate command (initial baud rate 9600bps)	0	no function	0	Set the communication baud rate: 9600bps		
				1	Set the communication baud rate: 19200bps		
				2	Set the communication baud rate: 38400bps		
0x02	stop synthesis command	no parameters				no text	
0x03	Pause synthesis command						
0x04	restore synthesis command						
0x21	Chip status query command						
0x88	Chip enters Power Down mode command						

The host computer can use the command words and command parameters in the data area to realize various functions of the speech synthesis chip.

4.3 Special instructions related to command frames

4.3.1 Sleep and wake-up instructions

• The chip will not sleep actively, it will sleep only after receiving the sleep command frame sent by the host computer.

• After the chip enters sleep mode, the host computer needs to wake up the chip first, and then send command frame data to the chip; (note: after waking up, an interval of 16 milliseconds before sending the command data)

• After sleep is awakened (for example, hardware wake-up or software wake-up), no valid command frame data sent by the host computer is received within 10 seconds (standby time) (speech synthesis play command, baud rate setting command, stop synthesis command, Suspend synthesis command, resume synthesis command, status query command), the chip will re-enter sleep (it will be regarded as interference wake-up and ignored). (Note: Only after the chip has entered dormancy, it will have 10 seconds to wake up from standby and go to sleep again)

4.3.2 Instructions for setting the baud rate

• The default initial baud rate is 9600bps; if the host computer needs to change the baud rate, it needs to be sent at an interval of 16 milliseconds after sending the set baud rate command frame

Send other command

frames. • If you want to change the baud rate, you have to resend the command frame for changing the baud rate

every time the system is reset. • After sending the command frame for changing the baud rate, pause for several hundred

milliseconds, and then change the baud rate of the host. • Both 9600bps and 19200bps baud rate communication transmissions are very stable (no matter

whether the chip is synthesizing broadcasting or idle) • Because the system time slice is close to the transmission time slice: the 38400bps baud rate communication transmission chip is very

stable when idle; When the chip is synthesizing and broadcasting, the upper computer is not very stable when sending data again, and the probability of successful reception and reception failure is about 50%. Remind the user: when the chip is synthesizing and broadcasting, if you use the 38400bps baud rate to send new data again (interrupt the current playback), you can send the "stop" command repeatedly to ensure that you receive the "successful reception" signal before sending a new one. data.

4.3.3 Other special instructions

• 1. In the same frame of data, the sending interval between each byte cannot exceed 8ms; the sending interval between frames must exceed 8ms.

• 2. When the SYN6288E chip is synthesizing text, if it receives another effective synthesis command frame, the chip will immediately stop the current

The text being synthesized is then synthesized to the newly received text.

• 3. The length of the text to be sent must be less than or equal to 200 bytes. If the actual sent length is greater than 200 bytes, the chip will report failure to receive. • 4. When the

user is continuously playing text content, after receiving the "chip idle" byte (ie 0x4F) after the previous frame of data has been played, it is best to delay about 1ms before sending the next frame

of data. • 5. When the user is playing text content

continuously (that is, the next frame of data will be sent immediately after the previous frame of data is played), it is recommended that the user

The data is framed at punctuation marks such as marks, question marks, exclamation marks, and semicolons. Because data transmission takes time, frames are divided at punctuation marks, coherent better, and can avoid the phenomenon that the phrase is cut off hard (for example, the word "bank", "silver" in the previous frame of data, "line" in the next frame data).

4.4 Example of command frame

4.4.1 Speech synthesis play command

frame structure	header	data area length	data area			
			command word	command parameter	text to send	XOR check
Data 0xFD	0x00 0x0B		0x01	0x00	Yuyin Tianxia 0xD3 0xEE 0xD2 0xF4 0xCC 0xEC 0xCF 0xC2	0xC1
Data frame 0xFD 0x00 0x0B 0x01 0x00 0xD3 0xEE 0xD2 0xF4 0xCC 0xEC 0xCF 0xC2 0xC1						
Description Play the text "Yuyin Tianxia" in the text encoding format "GB2312", without background music						
frame structure	header	data area length	data area			
			command word	command parameter	text to send	XOR check
Data 0xFD	0x00 0x0B		0x01	0x01	Yuyin Tianxia 0xD3 0xEE 0xD2 0xF4 0xCC 0xEC 0xCF 0xC2	0xC0
Data frame 0xFD 0x00 0x0B 0x01 0x01 0xD3 0xEE 0xD2 0xF4 0xCC 0xEC 0xCF 0xC2 0xC0						
Description Play the text "Yuyin Tianxia" in the text encoding format "GBK", without background music						
frame structure	header	data area length	Data area			
			command word	command parameter	to be sent text	XOR check
Data 0xFD	0x00 0x0B		0x01	0x02	Yuyintianxia 0xA6 0x74 0xAD 0xB5 0xA4 0xD1 0xA4 0x55	0xBB
Data frame 0xFD 0x00 0x0B 0x01 0x02 0xA6 0x74 0xAD 0xB5 0xA4 0xD1 0xA4 0x55 0xBB						
Description Play the text "Yuyin Tianxia" in the text encoding format of "BIG5", without background music						
frame structure	header	data area length	data area			
			command word	command parameter	Text to be sent	XOR check
Data 0xFD	0x00 0x0B		0x01	0x03	Yuyin Tianxia 0x8b 0xed 0x97 0xf3 0x59 0x29 0x4e 0x0b	0xC3
Data frame 0xFD 0x00 0x0B 0x01 0x03 0x8b 0xed 0x97 0xf3 0x59 0x29 0x4e 0x0b 0xC3						
Description Play the text "Yuyin Tianxia" whose text encoding format is "Unicode", without background music						

frame structure	header	data area length	data area			
			command word	command parameter	Text to be sent	XOR check
Data 0xFD	0x00 0x0B		0x01	0x09	Yuyin Tianxia 0xD3 0xEE 0xD2 0xF4 0xCC 0xEC 0xCF 0xC2	0xC8
Data frame	0xFD 0x00 0x0B 0x01 0x09 0xD3 0xEE 0xD2 0xF4 0xCC 0xEC 0xCF 0xC2 0xC8					
Explain that	when playing the text "Yuyin Tianxia" whose text encoding format is "GBK", the background music 1 will be played at the same time					
frame structure	header	data area length	data area			
			command word	command parameter	Text to be sent	XOR check
Data 0xFD	0x00 0x0B		0x01	0x79	Yuyin Tianxia 0xD3 0xEE 0xD2 0xF4 0xCC 0xEC 0xCF 0xC2	0xB8
Data frame	0xFD 0x00 0x0B 0x01 0x79 0xD3 0xEE 0xD2 0xF4 0xCC 0xEC 0xCF 0xC2 0xB8					
Explain that	when playing the text "Yuyin Tianxia" whose text encoding format is "GBK", the background music will be played at the same time 15					
frame structure	header	data area length	data area			
			command word	command parameter	text to send	XOR check
Data 0xFD	0x00 0x08		0x01	0x01	[v11] 0x5B 0x76 0x31 0x31 0x5D	0x85
Data frame	0xFD 0x00 0x08 0x01 0x01 0x5B 0x76 0x31 0x31 0x5D 0x85					
Description	Play the text "[v11]", the chip will recognize it as: set the volume to level 11					

4.4.2 Set baud rate command

Frame structure	frame header	data area length	data area			
			command word	command parameter	text to send	XOR check
data	0xFD	0x00 0x03	0x31	0x00		0xCF
Data frame	0xFD 0x00 0x03 0x31 0x00 0xCF					
illustrate	Set the baud rate: 9600bps					
Frame structure	frame header	data area length	Text to be			
			command word	command parameter	sent in the data area	XOR check
data	0xFD	0x00 0x03	0x31	0x01		0xCE
Data frame	0xFD 0x00 0x03 0x31 0x01 0xCE					
illustrate	Set the baud rate: 19200bps					

Frame structure	frame header data	data area length	data area			
			command word	command parameter	text to send	XOR check
data	0xFD	0x00 0x03	0x31	0x02		0xCD
Data frame	0xFD 0x00 0x03 0x31 0x02 0xCD					
illustrate	Set the baud rate: 38400bps					

4.4.3 Stop synthesis command

Frame structure	frame header data	data area length	data area			
			command word	command parameter	text to send	XOR check
data	0xFD	0x00 0x02	0x02			0xFD
Data frame	0xFD 0x00 0x02 0x02 0xFD					
illustrate	stop compositing command					

4.4.4 Pause synthesis command

Frame structure	frame header data	data area length	data area			
			command word	command parameter	text to send	XOR check
data	0xFD	0x00 0x02	0x03			0xFC
Data frame	0xFD 0x00 0x02 0x03 0xFC					
illustrate	Pause compositing command					

4.4.5 Restoring Synthesis Commands

Frame structure	frame header data	data area length	Text to be			
			command word	command parameter	sent in the data area	XOR check
data	0xFD	0x00 0x02	0x04			0xFB
Data frame	0xFD 0x00 0x02 0x04 0xFB					
illustrate	restore compositing command					

4.4.6 Chip status query command

Frame structure	frame header	data area length	data area			
			command word	command parameter	text to send	XOR check
data	0xFD	0x00 0x02	0x21			0xDE
Data frame	0xFD 0x00 0x02 0x21 0xDE					
illustrate	Use this command to judge whether the TTS module is working normally, and obtain the corresponding return parameters. Returning 0x4E indicates that the chip is still being synthesized. During broadcasting, return 0x4F to indicate that the chip is in an idle state.					

4.4.7 Chip enters Power Down mode command

Frame structure	frame header	data area length	Text to be			
			command word	command parameter	sent in the data area	XOR check
data	0xFD	0x00 0x02	0x88			0x77
Data frame	0xFD 0x00 0x02 0x88 0x77					
illustrate	Enter POWER DOWN state command, restore after reset					

5. Text Control Tags

5.1 List of text control tags

effect	Identity type	Control ID	Detailed description	chip default
Set foreground text playback volume (including display sound)	global [v?]		? is the volume value, value: 0~16 (where 0 is mute) ? When it is other unsigned integers, it will be treated as the maximum volume	[v10]
Set background music volume	global [m?]		value of 16. ? is the volume value, value: 0~16 (where 0 is mute) ? When it is other unsigned integer, it will be treated as the maximum	[m4]
Set word speed (for natural reading)	global	[t?]	volume value of 16. ? When it is other unsigned integers, it will be treated as the highest word speed value of 5 Level 0 is the slowest word speed, and level 5 is the fastest word speed. Note: For	[t4]

			Word-by-Word reading method does not support word speed adjustment	
Set up a number processing strategy	global	[n?]	? is 0, automatically judged ? When it is 1, the number is processed as a number ? is 2, the number is treated as a value ? When it is other unsigned integer, it will be treated as integer 0	[n0]
Set the pronunciation of "1" in the number globally	[y?]		? is 0, "1" is read as "unit" when combining numbers ? is 1, "1" is read as "one" when combining numbers ? When it is other unsigned integer, it will be treated as integer 0	[y0]
Set the prompt tone processing policy	global[x?]		? is 0, do not use prompt sound ? is 1, and the prompt tone is used by default ? When it is other unsigned integer, it will be treated as integer 0	[x1]
Set whether to read the punctuation	global [b?]		? is 0, do not read punctuation ? is 1, read punctuation ? When it is other unsigned integer, it will be treated as integer 0	[b0]
Set text reading method	global [o?]		? is 0, set to natural reading mode ? Set to 1, set to Word-By-Word mode ? When it is other unsigned integer, it will be treated as integer 0	[o0]
Restore default global compositing parameters		[d]	All following global flags reverted to default	
Force the next Chinese character to be pronounced by surname	Temporary [r]		The 1 Chinese character after this control mark is forced to be read as a surname (mainly used for polyphonic character surname processing), if there is no one Chinese character immediately, this control is invalid	
Force the last two Chinese characters to form a two-character word temporarily	[2]		The 2 Chinese characters after this control mark are forced to be read as "two-character words", if there is no Followed by 2 Chinese characters, this control is invalid	
The last three Chinese characters are mandatory to form a three-character word temporarily	[3]		The 3 Chinese characters after this control mark are forced to be read as "three-character words", if there is no Followed by 3 Chinese characters, this control is invalid	

Notice:

- 1) All control signs are half-width characters.
- 2) The control flag needs to be sent in the format of the speech synthesis command, and the special control mark is synthesized as text, that is, the synthesis command is "frame header + number Data area length + synthetic command word + text encoding format + special control mark text" format.
- 3) The control flag is a global control flag, that is, as long as it is used once, it will be sent to the chip without resetting the chip or powering off.
All text in will be under its control unless the corresponding [d] is used to restore the default setting.
- 4) When the chip is powered off or reset, the chip will return to all default values, and the original set flags will lose their effect and need to be reset.
- 5) Those that do not conform to the above recognizable "control marks" or are in the wrong format shall be treated as ordinary characters and numbers

Note: [d]

[v?] [m?] These 3 control marks cannot appear in the playback text at will (easy to understand ambiguity), only the following applications (other control control tags do not have this constraint)

ÿSent as a frame of data alone, at this time, it will affect the data starting from the next frame--suitable for separate change



ŷ1st frame: [v5] ŷ1st frame: Welcome Explanation: Set the foreground volume to level 5

Explanation: Play "Welcome" at 5 levels of foreground **volume**

ŷSent together with other control marks as a frame of data, at this time, it takes effect on the data starting from the next frame. Note: the control mark after the

The priority of the record is higher than the previous control flag--suitable for host computer initialization call

ŷFrame 1: [d][v5][m2][o0] Explanation: restore the default global variables first, then set the foreground volume to level 5, background

Level 2, read aloud in a natural way

ŷFrame 2: Welcome Explanation: Play "Welcome" at 5 levels of foreground volume and 2 levels of background volume

ŷ Put it at the beginning of the playing text and send it together with the playing text, at this time, it will take effect on the data at the beginning of this frame. -- fit and play text one

Send and change from

here ŷFrame 1: [v6][m2] Welcome to Speech Synthesis Chip Explanation: Starting from the data of this frame, press 6 levels of foreground volume 2

Level background volume playback: Play "Welcome to Speech Synthesis Chip" with 6 levels of foreground volume and 2 levels of background volume.

5.2 Example of using text control tags

5.2.1 Mark [v?] -- foreground playback volume

sample text	chip explained
[v6] Welcome to Speech Synthesis Chip	Starting from the data of this frame, it will be played according to the foreground volume of level 6: that is, it will be played according to level 6 foreground volume Play "Welcome to Speech Synthesis Chip" in large quantities, and the subsequent data frames will also Play at 6 levels of foreground volume.

5.2.2 Mark [m?]-Background music volume

sample text	The chip explains that
[m2] Welcome to Speech Synthesis Chip	starting from the data of this frame, it will be played at level 2 background volume: that is, it will be played at level 2 background volume Play "Welcome to Speech Synthesis Chip" in large quantities, and the subsequent data frames will also Play at level 2 background volume.

5.2.3 Mark [t?] --- word speed

sample text	The chip
Welcome to [t0] Beijing Yuyintianxia [t5] Speech Synthesis Chip	explanation will play "Welcome" at the default speed of 4 normal words, and then press 0 The slowest words play "Beijing Yuyin Tianxia" at the speed of speech, and then press level 5 for the fastest words Speech speed playback "speech synthesis chip"

5.2.4 token[n?] -- number processing strategy

sample text	The chip explains
[n0]234343545	the chip to judge automatically. Read as: two hundred and three thousand four hundred and thirty-four thousand three thousand five hundred and forty-five
[n1]234343545	The chip is forced to synthesize digital strings in the way of numbers. Read as: two three four three four three five four five
[n2]234343545	The chip is forced to synthesize digital strings in a numerical way. Read as: two hundred and three thousand four hundred and thirty-four thousand three thousand five hundred and forty-five

5.2.5 Mark [y?] -- the reading method of number 1

sample text	The chip explains
[y0]010-62986600	that the chip synthesizes the "1" in the text of the number according to the reading method of "unit". read: Zero one zero, six two nine eight six six zero zero
[y1]010-62986600	The chip synthesizes "1" in the text of the number according to the reading method of "one". read: Zero one zero, six two nine eight six six zero zero

Note: This flag is valid only when synthesizing number type text.

5.2.6 Mark [x?] -- beep strategy

sample text	The chip
[x0]ringa sounda	explanation is not processed according to the prompt tone, and it is directly read into English letters: ringa sounda
[x1]ringa sounda	Process according to the prompt tone: play the chord ringa, and then play the information prompt tone sounda

5.2.7 mark [b?] -- punctuation strategy

sample text	Chip
[b0] Welcome, come in!	interpretation punctuation marks are not read out, read as: "Welcome, please come in"
[b1] Welcome, come in!	Read out the punctuation marks as: "Welcome comma please enter exclamation Number"

5.2.8 Mark [o?] -- Text reading method

sample text	chip explained
[o0] Welcome to the Chinese speech synthesis chip developed by Yuyintianxia	read in a more natural way
[o1] Welcome to use the Chinese speech synthesis chip developed by Yuyintianxia to read aloud by Word By Word	

5.2.9 Mark [d] --- Restore default

sample text	The chip
[v11][n1]123, [y1]010-62986600, [r1]Qu Tianfang	explanation is read according to the 11-level volume: 123, 010, 6298660 Zero, song (qu3) Tian Fang
[d]123, 010-62986600, Qu Tianfang	All global control flags are restored to default! According to the default 8-level volume, it is read as: one hundred and twenty-three, zero one zero, six two nine eight Six Six Zero Zero, Qu (qu1) Tian Fang

5.2.10 Mark [r] -- pronunciation by last name

Example text	Chip explanation
Shan Xiaohu of the unit came over [r]	Shan Xiaohu: read as: dan1 xiao2 hu3
Shan Xiaohu of the unit came over	Shan Xiaohu: Pronounced as: shan4 xiao2 hu3

5.2.11 Marks [2] and [3]--mandatory word

Note: This chip can correctly segment phrases to more than 98%. Due to the complexity of Chinese semantics, it is impossible for any product to be 100% correct. answer

With this function, you can manually intervene to segment phrases, which can make the synthesis more natural to a certain extent.

The following are the unsegmented sentences that we specially screened out.

sample text	The chip
Beijing Dongzhimen Station has arrived	explains that the chip will be divided into: /Beijing East Zhi Gate Station To/ (sounds a bit unnatural)
Beijing[3] Dongzhimen Station has arrived	Manual intervention, split into: /Beijing Dongzhimen Station arrived/ (sounds more natural)



Entered Guangshun North Street	The chip will be divided into: /has entered Guang Shun Beijie/ (sounds a bit unnatural)
Has entered [2] Guangshun North Street	Manual intervention, split into: /has entered Guangshun Beidajie/ (sounds more natural)

5.2.12 Example of initialization synthesis

sample text	Chip explanation
The first frame data: [d][v8][m2][t5][y0][x1][o0]	first restores the default global variables, sets the foreground volume to level 8, and sets the background The volume is level 2, the phrase speed is set to level 5, and the synthetic number is set to "1" Pronounce it as "y", set the prompt sound, and set the natural reading method
Frame 2 data: Welcome to speech synthesis chip	Play "Welcome to Speech Synthesis Core" according to the variables set in the last frame of data piece"

6. Prompt sound effect

6.1 List of voice prompts

The chip provides 25 segments of sound prompts, which can be selected as information prompts according to the application occasion. The following list is the current chip

The name and sound type of the built-in prompt tone:

Voice prompt tone (19 songs in total)											
No.	Name	Sound Type		play time		No.	Name	Sound Type		play time	
1	sounda	error sound	soundb	1s		14	sound	alarm	2s		
2	card swiping	success	1s soundc	card		15	sound	alarm	1s		
3	swiping	success	1s			16	soundp	alarm	3s		
4	soundd	card swiping	success	1s			17	soundq	emergency alarm	1s	
5	sounde	card swiping	success	1s soundf			18	soundr	emergency alarm	4s	
6	laser sound	soundg	doorbell	1s			19	sounds	Cuckoo	1s	
7	sound			1s			20	soundt	Prompt tone	1s	
8	Soundh	doorbell	soundi	1s			soundu	Prompt tone	1s		
9	phone ringtone	2s soundj	phone ringtone				soundv	Prompt tone	1s		
10	1s						soundw	Prompt tone	1s		

11	soundk broadcast tone 2s soundl tone				soundx	Prompt tone 1s	
12	soundm tone		1s	25	soundy prompt tone 1s		
13			1s				

6.2 List of chord prompts

The chip provides 23 pieces of polyphonic music as prompts, which can be widely used in public information broadcasting occasions. The following list is the current

The name and playing length of the built-in tone of the chip.

Chord prompts (8 songs in total)					
serial number	name	Play time	sequence number	name	play time
1	msga	1s	5	msge	2s
2	msgb	1s	6	msgf	3s
3	msgc	1s	7	msgg	4s
4	msgd	1s	8	msgh	5s

Polyphonic ringtones (15 songs in total)					
Serial number	name	Playing time	Serial number	name	Playing time
1	ringa	60s	9	ringi	35s
2	ring b	70s	10	ringj	25s
3	ringc	27s	11	ring	18s
4	ring	65s	12	ringl	38s
5	the ring	60s	13	ring	60s
6	ring f	57s	14	ring	23s
7	ring	60s	15	ringo	5s
8	the ring	53s			

Polyphonic ringtones can be used not only as polyphonic ringtones, but also as material for background music

Note: There is no particularity in the use of the prompt tone, it is the same as the synthesis command for synthesizing ordinary text. However, it is important to note that the beep name

When there are English letters in the front or back, you need to use punctuation marks, spaces, carriage returns, etc. to separate them from other letters, so that the chip can automatically recognize them.

For example: send the text "sounda, hello!", sounda can synthesize the corresponding SMS prompt tone, but if the sent text

This "soundahello!", sounda can not synthesize the prompt sound, but directly read the letter "SOUNDA".

7. How the host computer calls the SYN6288E chip

7.1 Simple calling method

The simple call is for the case where the application is relatively simple. Users don't need to care about the working status of SYN6288E, only need to send text, SYN6288E

The received text will be synthesized into speech output.

In the case of simple calling, as long as the host computer establishes a serial communication connection with SYN6288E, it can send synthetic commands to realize text

The host computer does not need to ignore the feedback information and status output of SYN6288E, and SYN6288E will output the synthesized voice.

Tip: If the previous frame of text has not been synthesized, sending text to SYN6288E will interrupt the previous synthesis and execute a new synthesis.

7.2 Standard calling method

For general situations, the host computer needs to determine the working status of SYN6288E to more precisely control the work of the SYN6288E chip: for example, it is necessary to

Make sure that the next piece of text is synthesized after the last text is fully synthesized.

The application example is as follows: Suppose the text to be synthesized is 300 bytes, which exceeds the maximum text length that a command frame of the chip can hold (200 characters

Section), at this time, send text information to the chip twice. The procedure is as follows:

1. The upper computer first sends a text synthesis command frame to the chip, carrying text less than 200 bytes;
2. The upper computer waits for the SYN6288E chip to return the return message that the playback is complete, until it receives the chip return "0x4F", indicating that the previous text has been completed.

The synthesis is completed; or use the status pin of the query chip, send a query command, and confirm that the text of the previous frame has been synthesized through the queried information.

3. The host computer sends a text synthesis command frame to the SYN6288E chip again, and sends out the remaining 100 bytes of text information.

7.3 How to query the working status of the chip

The working status of SYN6288E can be queried through hardware and software.

Hardware method: By querying the level of the output pin Ready/Busy, the working status of the chip can be judged. When Ready/Busy is high level,

Indicates that the chip is in the state of synthesizing and playing text; when Ready/Busy is low, it indicates that the chip is in an idle state.

Software mode: Query the working status of the chip through the chip status query command frame. When the host computer sends a status query command frame to the chip,

The chip will immediately send the current chip status feedback to the host computer. The upper computer judges whether the current chip is empty according to the returned data of the chip status.

Idle state or broadcast state.

8. The coding system and scope of chip identification

SYN6288E supports the following 4 encoding systems: GB2312, GBK, BIG5, Unicode.

8.1 GB2312 coding system

recognition type	Identify code range	Remark
Half-width ASCII symbol area	0x00 --- 0x7F	
Full-width symbol area	0xA1A0 --- 0xA3FE	
Chinese character area	0xB0A1 --- 0xF7FE A total of 6768 Chinese characters	

8.2 GBK coding system

recognition type	Identify code range	Remark
Half-width ASCII symbol area	0x00 Full- --- 0x7F	
width symbol area	0xA1A0 --- 0xA3FE	
Chinese character area	0x8140 --- 0xA0FE 0xAA40 --- 0xFEFE	A total of 21003 Chinese characters

8.3 BIG5 coding system

Identification type	Identification code range	Half-width	Remark
ASCII symbol area	0x00	--- 0x7F	
Full-width symbol area	0xA140 --- 0xA3FE		
Chinese character area	0xA440 --- 0xF9FE	A total of 13060 Chinese characters	

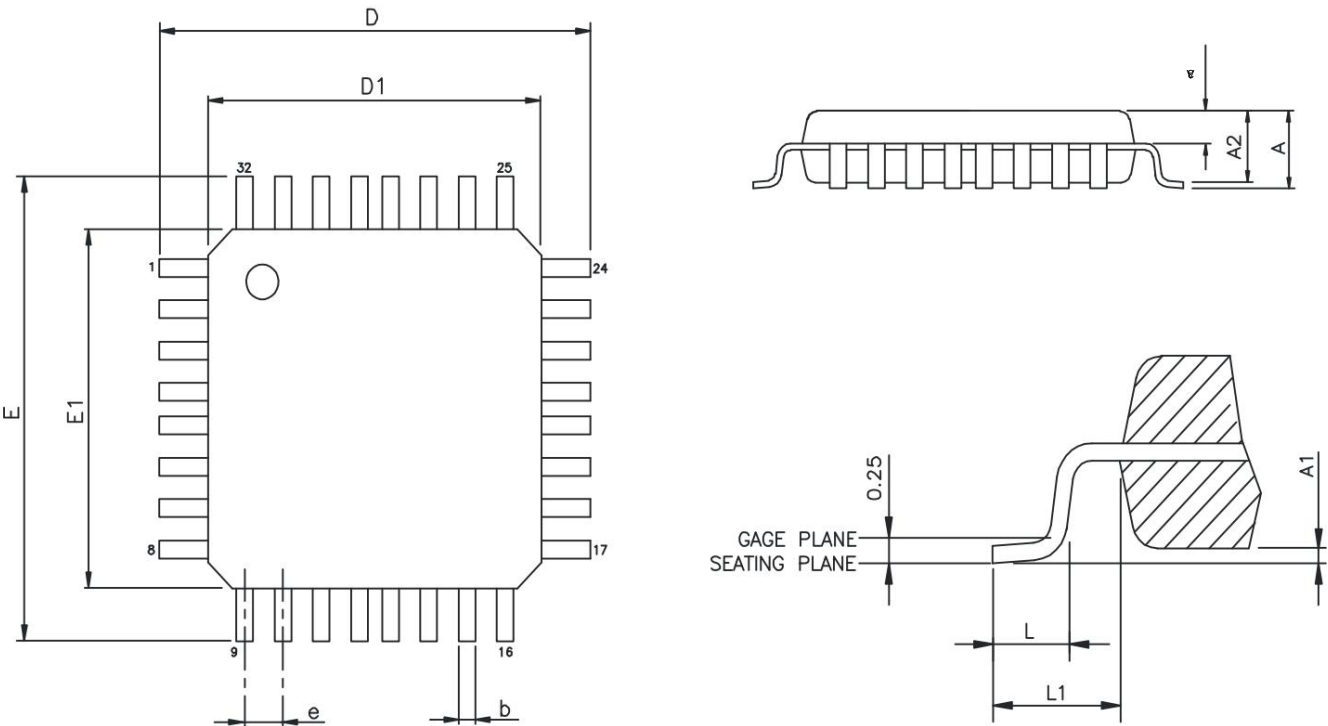
8.4 Unicode encoding system

recognition type	Identify code range	Remark
Full-width symbol area	0x00 area, 0x30 area, 0xFF area,	
Chinese character area	0x4E00 ---- 0x9FFF A total of 20902 Chinese characters	

Note: For the transmitted codes that are not recognizable, the silence will be silenced for tens of milliseconds.

9. Product Specifications

9.1 Encapsulating data



size label	Minimum (mm)	Maximum (mm)	size label	Minimum (mm)	Maximum (mm)
A	----	1.60	E	8.80	9.20
A1	0.05	0.15	E1	6.90	7.10
A2	1.35	1.45	e	0.80BSC	
A3	0.59	0.69	b	0.33	0.41
D	8.80	9.20	L	0.45	0.75
D1	6.90	7.10	L1	1.00 REF	

Chip package diagram

9.2 Limit parameters

project	Symbol	minimum value	maximum value	unit
voltage	VDD-V	-0.3	5.1	V
Input voltage	VIN	GND-0.3	VDD+0.3	V
Operating temperature	TOP	-35	85	°C
storage temperature	TSTG	-55	125	°C

Note: Exceeding the limit parameters listed in the table will result in incorrect operation or damage to the device.

9.3 Electrical Characteristics

project	symbol	the smallest value	Typical Value	Maximum	Unit	condition
Operating Voltage VDD 2.4			3.3	5.1V		
Standby current	ISBY	-	2.0	-	uA	VDD=3V, no load
Operating Current	IOPR-		10	- mA		VDD=3V, no load
Pull-Up resistor of TxD RPU -			800	-	KΩ	VDD=3V, no load
Input current of RxD	IIH	-	-	10.0uA		VDD=3V, VIN=3V
Drive current of TxD	IOD	-	4	- mA		VDD=3V, VO=2.4V
Sink Current of Status IOS		-	6	- mA		VDD=3V, VO=0.4V
Drive current of BP0	IOD		150	- mA		VDD=3V, BP0=1.5V
Sink Current of BP0	IOS		150	- mA		VDD=3V, BP0=1.5V
Drive current of BN0 IOD			150	- mA		VDD=3V, BN0=1.5V
Sink Current of BN0	IOS		150	- mA		VDD=3V, BN0=1.5V
Crystal Oscil. Freq FOSC -			16.0	- MHz		VDD=3V

9.4 Power Consumption When Playing Synthetic Sound

Test items	Test voltage: 3.0V typ		Test voltage 4.5V	
	max	typ	max	
Current when	0.2uA		1uA	
sleeping, current when working but	3.3 mA		4 mA	
not playing: volume level 1, playing text current:	50 mA		50 mA	
Volume 6 Play Text Current:	70 mA		80 mA	
Volume 10 Play Text Current:	130 mA		150 mA	
Volume 16 Play Text Current:	190 mA		280 mA	
Volume 1 Play Chord Current:	40 mA		40 mA	
Volume 6 Play Chord Current:	60 mA		70 mA	
Volume 10 Play Chord Current:	90 mA		100 mA	
Volume 16 levels playing chords Current:	140 mA		200 mA	

9.5 Normal working mode

When SYN6288E is in normal working mode, Ready/Busy indicates the working status of the chip. During speech synthesis or vocalization, Ready/Busy Output high level, indicating that it is working; when the synthesis is finished, Ready/Busy output low level to send data transmission to the upper computer (or microprocessor). Send the request until the end of the data transfer.

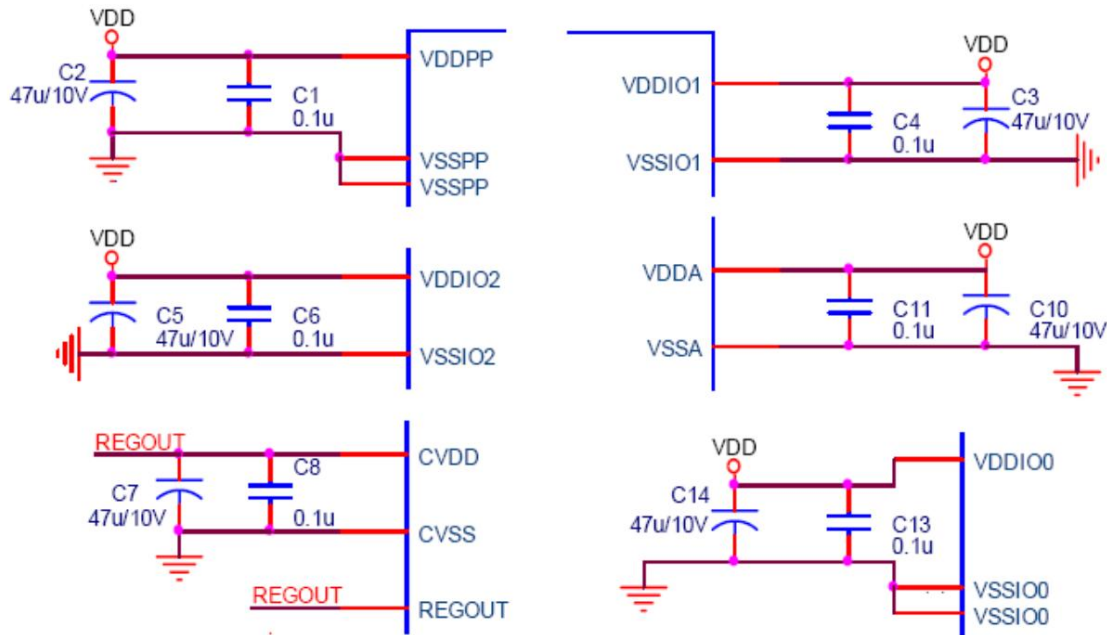
9.5 Sleep (Low Power Consumption) Operating Mode

SYN6288E will enter the sleep state after receiving the sleep command word from the main control system to save power consumption; and can receive any Italian command word to wake up the system.

Note: It takes about 16 milliseconds to enter the working state after waking up after hibernation.

10. reference circuit

10.1 Reference Circuit of Power Supply Module



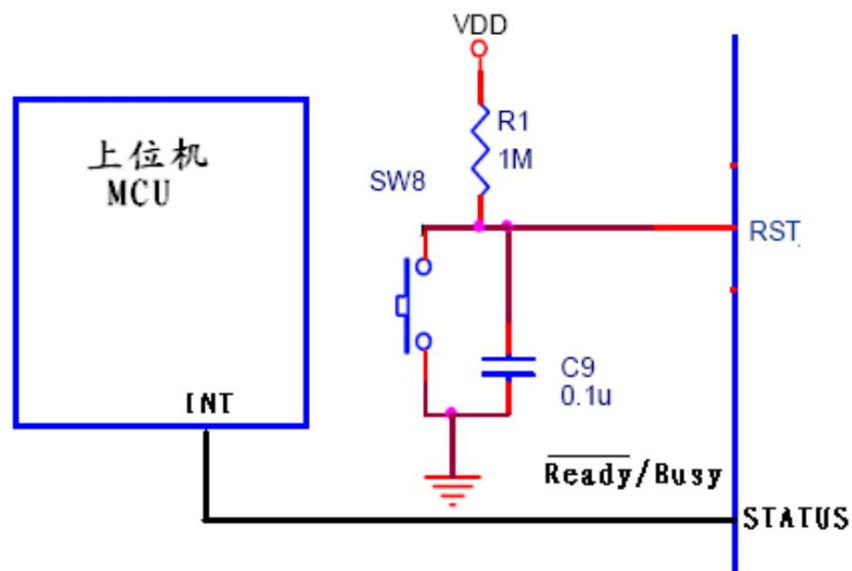
Remark 1: SYN6288E has 6 sets of external power supplies, and each set of power supplies uses a 47uF and a 0.1uF capacitor; if the user wants to save costs, **the user** can use a 0.1uF capacitor on each set of power supplies, and VDDPP, and VDDA **two sets of power supply, each with a 47uF capacitor**. Remark 2: The external power supply uses 3 batteries, or VDD = **3.3V~4.2V** Remark 3: Instructions for using the voltage automatic adjustment output REGOUT

SYN6288E provides a voltage automatic adjustment output REGOUT for the CVDD processor power module—that is, a linear voltage regulator. The output voltage of this **linear** voltage regulator is designed to be: $2.8V \pm 0.2V$. **Its characteristics are:**

Input external supply voltage: VDD **Output** current:
20mA **Output voltage:** 2.6V~3.0V

Remark 4: In view of the difference in the quality of power supplies on the market, it is recommended that users do not use critical limit voltages, such as: 5.0V power supply; it is recommended that the VDD value of the external **power** supply range from 3.3V to 4.2V, not higher than 4.5V or lower **at 3.0V**.

10.2 Reset circuit and status indication circuit



Note: Ready/Busy When the STATUS pin signal is low level, it means the chip is waiting to receive data. This pin can be used during system design

Connect to the interrupt input source of the MCU, generate a falling edge interrupt request to send data, to show that the upper computer MCU can send data to the speech synthesis chip.

10.3 Speaker output of SYN6288E

(1) In order to output sound in user application, SYN6288E built-in pusher

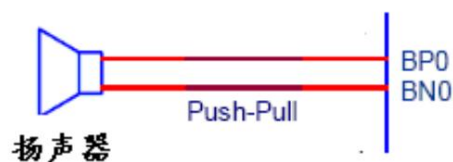
Pull-type (Push-Pull) DAC, can directly drive the speaker, into

Voice broadcast. And the built-in DAC circuit module of SYN6288E

block, using the VDDPP/VSSPP power supply module, the specific power supply

Please refer to Sections (10.1) and (10.2) for circuit description, and the power supply voltage value

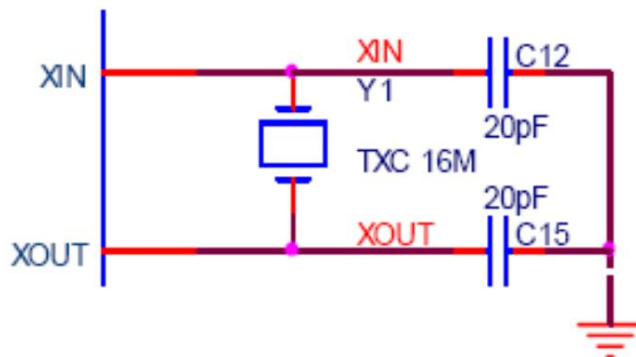
It can be powered independently of other power packs. (see picture on the right)



(2) Power amplifier reference circuit

See "Power Amplifier Reference Circuit V1.0.pdf"

10.4 SYN6288E external high-speed crystal oscillator



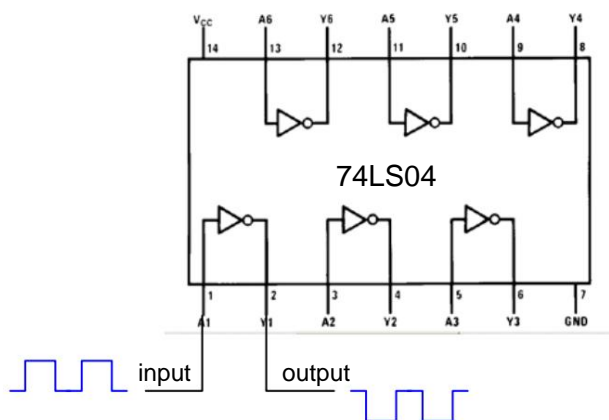
10.5 Serial communication inverter circuit

The serial communication data sent by the host computer to SYN6288E must be inverted data. The upper computer can choose one of the following two inverting methods:

Program code inversion method: use an inversion program in the software program of the host computer to send the data bit, start

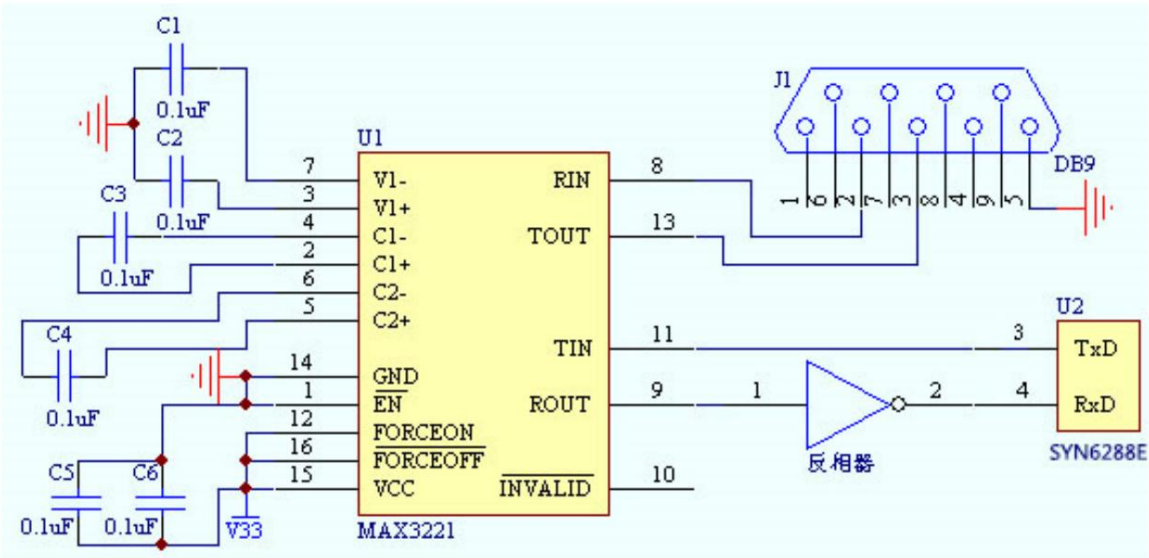
Bits and stop bits are reversed; start and stop bits are uncontrolled and cannot be reversed by program code.

Communication circuit hardware inverting method: add a hardware inverting circuit before the upper computer sends data to SYN6288E:

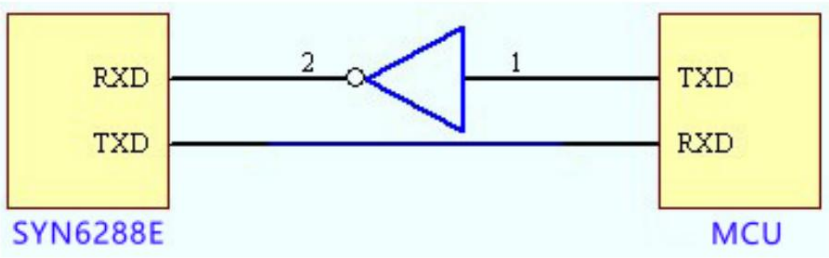


10.6 Reference circuit for serial communication

(a) The upper computer is the reference circuit of the PC

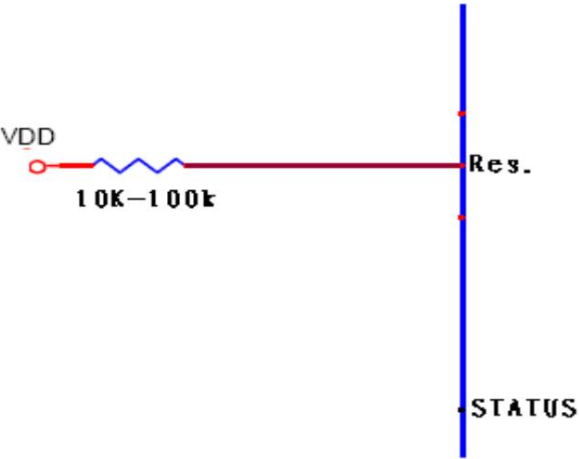


(b) The upper computer is the MCU reference circuit



Remarks: When the upper computer sends data to SYN6288E, an inverter must be added in the middle, and the section "Serial Communication Reverse Circuit" must be followed description in .

10.7 The correct connection of the Res pin (that is, the fifth pin)



Note: It can also be considered similar to the connection method of the reset pin RST, configuring a smaller capacitor (other groups of power supply configuration larger capacitors), so that

Before each power supply of SYN6288E is powered, the Res. pin can be set to high level! This can effectively prevent the sudden interference of the external power supply.

Note: The important thing is that when powering on, the system design should try to ensure that the power supply of each group of SYN6288E rises to the normal potential slower than Res to the normal potential.

11. Example program to send synthesized text

11.1 C language sample program

Next, take 51 single-chip microcomputer as the host computer as an example, use C51 language to realize a program example of text synthesis, assuming that the content of the text to be synthesized

The content is: "Welcome to Yuyin Tianxia SYN6288E Chinese Speech Synthesis Chip", the following is the program module for sending a frame of TTS text data.

```

#include <reg51.h> #include
<string.h>

void main(void) { /

*****text to be sent*****
char code text[ ] = {"Welcome to Yuyintianxia SYN6288E Chinese Speech Synthesis Chip"}; unsigned
char headOfFrame[5]; unsigned char length ;
unsigned char ecc = 0 ; unsigned int
i = 0; length = strlen(text) ; //Define checksum

//Need to send the length of the text

/*****Initialization of the serial port*****/ // At 11.0592MHz, set
= 0x20; SCON the baud rate to 9600bps, working mode 2 TL1 = 0xFA; TH1 = 0xFA; TMOD
= 0x50; PCON
= 0x80; EA = 0;
REN = 1 ; TI = 0; // Serial port working mode 1, allowing to receive
RI = 0; TR1 = 1;

//Transmit interrupt flag position
zero //Receive interrupt flag position
zero //Timer 1 is used as baud rate generation

/*****Sending process*****/ // Construct the frame header FD
0xFD ; // Construct the high byte of headOfFrame[0] =
headOfFrame[2] = length + 3; // the length of the data area headOfFrame[1] = 0x00 ;
Construct the low byte of the length of the data area headOfFrame[3] = 0x01; //construct the
command word: synthetic playback command headOfFrame[4] = 0x01; //construct the command
parameter: the encoding format is GBK

for(i = 0; i<5; i++) { //Send the constructed 5 header bytes sequentially

ecc=ecc^(headOfFrame[i]); //Exclusive OR check on the sent bytes
SBUF = headOfFrame[i]; while
(TI== 0) {} //Waiting for the send interrupt flag to
TI = 0; be set //Clear the send interrupt flag
}

for(i = 0; i<length; i++) { //Send the text data to be synthesized in sequence

ecc=ecc^(text[i]); // Exclusive OR check on the sent bytes
SBUF = text[i]; while
(TI== 0) {}
TI = 0;
}

SBUF=ecc; //Finally send the check byte
while (TI== 0) {}
TI=0; //
while(1);
}

```

11.2 Assembly language sample program

The following is an example of the assembly language used by the 51 single-chip microcomputer to control the upper computer, and demonstrates sending the text "Yuyin Tianxia" to the chip for synthesis.

The GBK code of "Yuyin Tianxia" is: "Yu": 0xd3ee "Sound": 0xd2f4 "Sky":
 0xccec "Down": 0xcfc2

```

;Crystal oscillator
11.0592MHz ecc EQU 40H ;Define checksum byte

ORG 0030H
TABLE: DB 0xD3,0xEE,0xD2,0xF4,0xCC,0xEC,0xCF,0xC2 ; GBK code of "Yuyin Tianxia"

ORG 0000H
LJMP MAIN

MAIN:
ORG 0200H
CLR EA ; Serial port initialization

MOV TMOD, #20H ; Timer 1 works in mode 2
MOV TH1, #0FAH ; load timer initial value, baud rate 9600
MOV TL1, #00H
SETB TR1 ;Start timer 1

MOV SCON, #50H ;Serial port working mode 1, allowing to receive
MOV PCON, #80H ; Baud rate doubled; send
CLR TI ; interrupt flag position zero
CLR RI Receive interrupt flag bit zero

MOV A, #0FDh ;Frame header
MOV ecc, A FD ;Assign initial value to XOR check
MOV SBUF, A unit;serial port send
JNB TI, $
CLR TI

MOV A, #00h ;High byte of data area length
XRL ecc, A
MOV SBUF, A
JNB TI, $
CLR TI

```

```

MOV A,#0Bh          ;Low byte of data area length
XRL ecc,A
MOV SBUF, A
JNB TI, $
CLR TI

MOV A,#01h          ;command word: synthetic playback command
XRL ecc,A
MOV SBUF, A
JNB TI, $
CLR TI

MOV A,#01h          ;Command parameters: encoding format is GBK
XRL ecc,A
MOV SBUF, A
JNB TI, $
CLR TI

MOV R7,#8            ;The total number of bytes of the text to
MOV R6,#0            be played;Sent byte count
MOV DPTR,#TABLE
LOOP: MOV A,R6
    MOVC A,@A+DPTR
    XRL ecc,A
    MOV SBUF, A      ;Play "Yuyin Tianxia"
    JNB TI, $
    CLR TI
    INC R6
    DJNZ R7, LOOP

MOV A,ecc            ; Send checksum byte
MOV SBUF, A
JNB TI, $
CLR TI

SJMP$

END

```

Notice:

1. After sending, the feedback signal from the chip can be received. If it is "41" and "4F", it means that the text has been received correctly and the synthesized broadcasting has been completed. It is idle; if it receives "45", it means that the text has not been received or synthesized correctly, and it needs to be resent or reset.
2. The Demo above mainly explains the protocol issues that need to be followed in the sending process; after sending the statement, a judgment program should be added to determine whether the sending is complete. The working status of the current chip can be judged by query or interrupt, and then the next data can be sent.

12. appendix

12.1 References

- MAX3221—3-V TO 5.5-V SINGLE-CHANNEL RS-232 LINE DRIVER/RECEIVER WITH +15-kV ESD PROTECTION
- "Inverter Integrated Circuit "SN74LS04/D—Hex Inverter" Device Manual"
- "SNAP01—Class AB Power Amplifier Device User Manual"
- "OSYNO 6188 Embedded Speech Synthesis Chip—User Manual"
- "SYN6288 Chinese Speech Synthesis Chip Data Manual V1.8"